

SUBMERSIBLE

# MOTOPUMP Manual

INSTALLATION / OPERATION / MAINTENANCE





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Dear customer,

We thank you for choosing VANSAN Submersible Pump and wish you have good use of it.

VANSAN Submersible Pumps are certified under ISO 9001:2015 and manufactured with TS11146 Submersible Pump standards.

Read this manual very carefully before you install the pump in the well.

Please keep this manual to get use of it also in the future.

## General Information of Pump

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Submersible pumps are multi-stage centrifugal pumps that are designed as their submersible electric motors work under the water. Motor bearings are lubricated with the water that is filled inside the submersible electric motor and cooling operation for the bearings is provided by the water in the well that's flowing around the body of motor. Submersible Pumps are used for pumping the water that is not much corrosive.

## Preparation for Installation

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Before the installation, motopump should be checked if it has been damaged during the shipment or not.

The things that should be checked before the installation are listed below;

- Check if there is any fracture or cut on the pump, motor and power cables and do not start the installation until damaged area is repaired.
- Make sure that insulation resistance is not lower than 200M  $\Omega$  (megaohm) by testing it with a 500 V Megger Tester. The table below shows the condition of motors and power cables according to the insulation resistance data that's measured.

## Preparation for Installation

Condition of the Motor and Power Cables	Megaohm Value (MΩ)
A new motor (which is not in well) or a used motor which can be reinstalled in well	200.0
A new motor in well	2.0
A motor in good condition in well	0.5 - 2.0
Damaged motor (It is not a must to take the pump out of the well, it can continue working)	0.02 - 0.5
Damaged motor and power cables (The pump has to be taken out of the well, power cables and motor have to be repaired or replaced. The motor can continue working in this condition but it will not work for long time)	0.01 - 0.02
Broken motor (The pump has to be taken out of the well, power cables have to be repaired or the motor has to be replaced)	0 - 0.01

The table above is prepared for the motors at 25°C. At higher temperatures, insulation resistance will be lower.



During the installation, the lips of the power cables have to be protected against water and moisture.

## Use of Check Valves

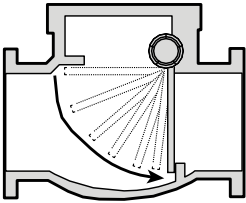
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At the discharge case of VANSAN submersible pumps, there is a water type check valve.

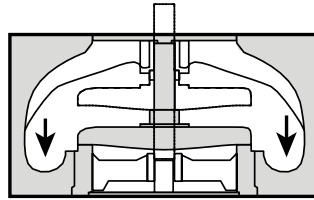
During the installation of the pump, a check valve must be placed after the discharge valve too. When the pump stops, this check valve prevents the water at the pipe line to flow backward and damage the pump. It also provides the long pipe line to remain filled.

Swing type check valves are not acceptable and should never be used with submersible motors/pumps. Swing type check valves have a slower reaction time which can cause water hammer. Wafer type VANSAN silent check valves close quickly when flow velocity is equal to zero before the backspin starts and helps to eliminate water hammer due to having short return path and spring pressure.

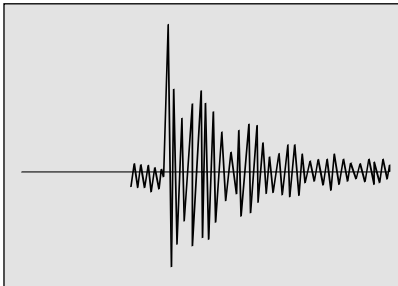
## Use of Check Valves



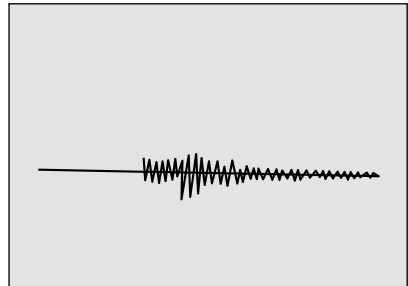
At typical swing type check valves, the valve gets closed by moving along the 90° path after the backward flow starts.



At VANSAN silent check valves, valve is activated by the spring and it gets closed silently before the backward flow starts when the flow velocity is equal to zero.



Water hammer oscillogram at normal check valves.



Water hammer oscillogram at VANSAN silent check valves under the same conditions.



## Power Cable Selection

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Power cable that will be used should be appropriate to work under the water. For power cable selection, you can either use the table below or get in touch with VANSAN to ask for help for this occasion.



Unless the power cable is selected as water-proof and appropriate to be used under the water, the submersible pump is out of warranty.

Selection of power cable depends on the motor's power and the length of cable. Table below shows the maximum cable lengths that can be used depending on the motor power and cable size.

Power cable length of the motor is 1 x 5 m for DOL 2 x 5 m for Wye-Delta.

## Power Cable Selection

D.O.L. Maximum Lengths Of Cable											
Motor Rating (kW)	Cable Size (mm <sup>2</sup> )										
	3x1,5	3x2,5	3x4	3x6	3x10	3x16	3x25	3x35	3x50	3x70	3x95
5,5	65	108	172	258	431	689	1077	1507	2153	3014	4091
7,5	48	80	129	193	322	515	805	1127	1610	2254	3059
10	38	64	102	153	156	409	639	894	1278	1789	2428
12,5		52	83	125	209	334	522	730	1043	1461	1982
15		45	72	109	181	289	452	633	904	1266	1718
17,5			61	92	153	245	383	536	765	1071	1454
20			52	79	131	210	327	458	655	917	1244
25					106	170	266	372	531	744	1009
30					90	145	226	316	452	633	859
35					76	122	190	266	380	532	722
40					67	107	168	235	336	470	639
50						89	139	195	279	390	529
60							115	160	229	321	435
70								139	198	278	377
75								131	187	262	356
80								120	172	241	326
90									154	215	292
100									137	192	261
110									127	178	242
125										157	213
150											182
175											155
200											
210											

## Power Cable Selection

Y/Δ Maximum Lengths of Cable											
Motor Rating (kW)	Cable Size (mm <sup>2</sup> )										
	3x1,5	3x2,5	3x4	3x6	3x10	3x16	3x25	3x35	3x50	3x70	3x95
5,5	97	161	258	388	646	1033	1615	2261	3230	4521	6136
7,5	72	121	193	290	483	773	1027	1690	2415	3381	4588
10	57	96	153	230	383	613	958	1342	1916	2683	3641
12,5	47	78	125	188	313	501	783	1096	1565	2191	2974
15	41	68	109	163	271	434	678	949	1356	1899	2577
17,5	34	57	92	138	230	367	574	803	1148	1607	2181
20	29	49	79	118	196	314	491	688	982	1375	1867
25		40	64	96	159	255	398	558	797	1115	1514
30			54	81	136	217	339	475	678	949	1288
35			46	68	114	182	285	399	570	798	1083
40				60	101	161	252	352	503	705	956
50					84	134	209	293	418	585	794
60					69	110	172	241	344	481	653
70					59	95	149	208	297	416	565
75						90	141	197	281	394	534
80						82	129	180	258	361	490
90						74	115	162	231	323	423
100							103	144	206	289	392
110							95	134	191	267	363
125								118	168	235	319
150								101	144	201	273
175									123	172	233
200										152	207
210										145	196

## Filling the Water of the Motor

VANSAN Submersible motors are already filled with water-antifreeze mix. In consequence of potential evaporation while transport and storage, it is necessary to control the water-level inside the motor. ATTENTION! Before operation control the water level inside the motor if necessary fill the motor with clean water

1- Position the motor horizontally. Remove the screw (1) of filling hole and the screw (2) of the emptying hole. Pour the clean water into the motor making sure that there will be no air left inside. Replace the screw (1) of filling hole. (Fig. 1A)

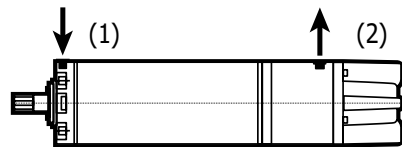
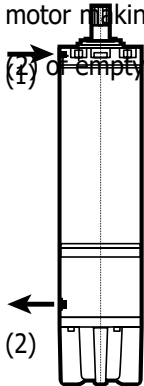


Fig. 1A

2- Position the motor vertically. Complete the missing water from the (1) screw of filling hole. Wait around 2-3 minutes. So there will be no air left into the motor. If there is still some water missing, fill it completely again and close the screw. (Fig. 1B)

Fig. 1B



Running the motor without water can cause serious failures to it. It damages the axial bearing of the motor. Failures caused by running the motor without water are out of WARRANTY.

## Cooling the Motor

Most important factor of submersible motors long service life is that the motor has to be cooled well. (Fig. 2)

Required flow velocity around the motor is given in the table below for motors being cooled well enough.

If the motor will be installed in an open body of water (i.e pool) or diameter of the well is much bigger than the diameter of the motor, Flow Inducer Sleeve must be used to provide the flow velocities that are given in the table above, around the motor.

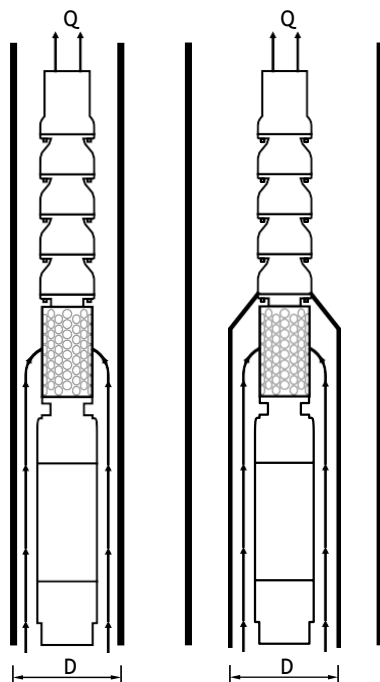


Fig. 2

Motor Type	Motor Rating	Minimum Water Flow
6" Rewindable	4 kW - 18.5 kW 22 kW - 30.5 kW	0.2 m/s 0.5 m/s
8" Rewindable	22 kW - 37 kW 60 kW - 93 kW	0.2 m/s 0.5 m/s
7" Rewindable	22 kW - 55 kW	0.5 m/s
10" Rewindable	81 kW - 185 kW	0.5 m/s

## Cooling the Motor

Required flow inducer sleeve's inside diameter that depends on the flow rate is given below as a diagram. For example, if a pump that has a 15 kW motor will be working at 27 m<sup>3</sup>/h flow rate, minimum inside diameter of the flow inducer sleeve should be selected as 26 cm.

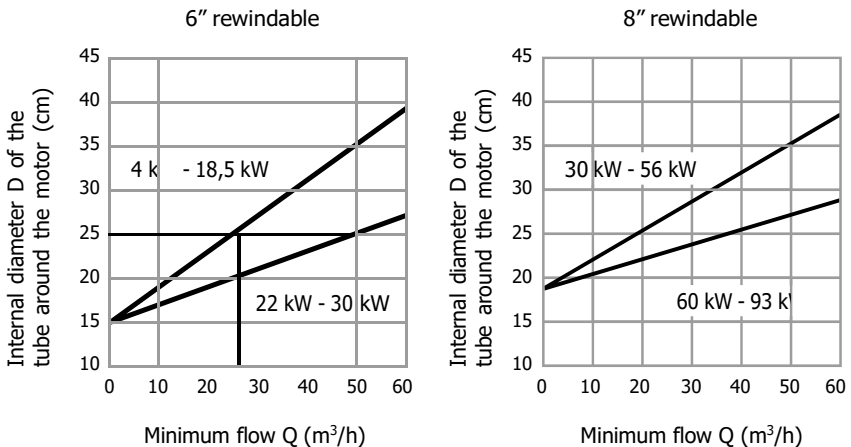


Figure 3 shows a typical flow inducer sleeve construction. Sleeve is fixed to the body of the pump with the stainless steel worm gear clamps. Sleeve is centered with 3 bolts from the bottom casting part of the motor's body. When the material of the sleeve is selected, a corrosion resistant material (i.e. PVC) should be used.

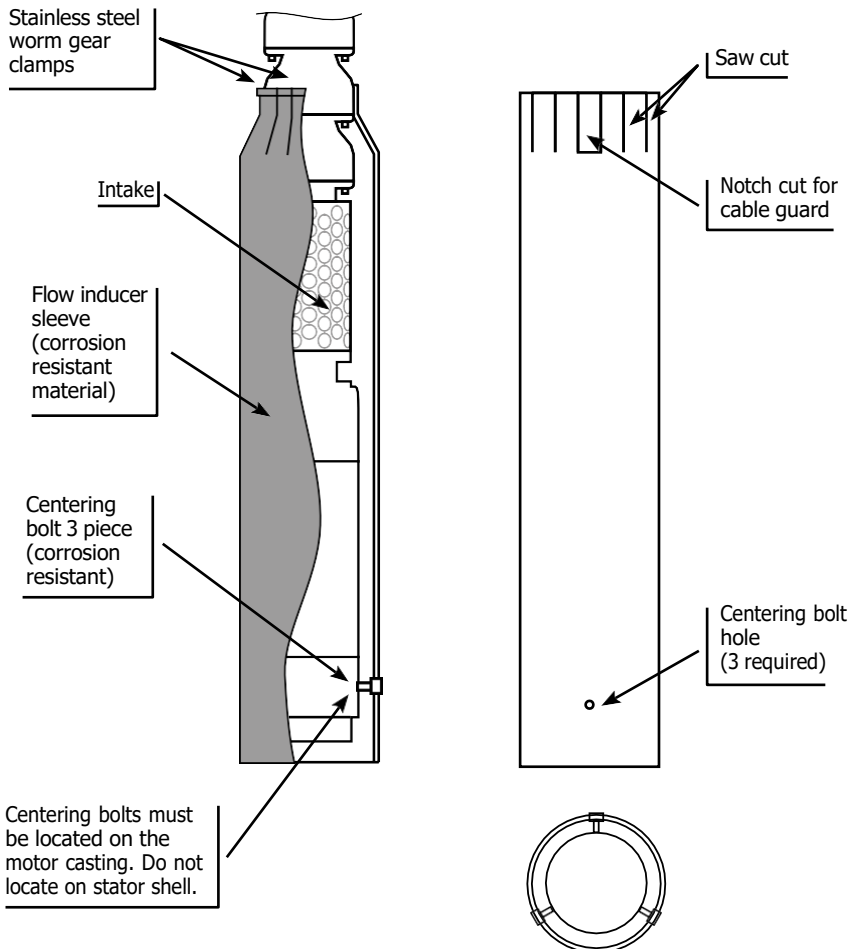


Fig. 3

Cooling the Motor

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Submersible pump motors are designed to work at 50°C water temperature. If the water's temperature is higher than 50°C , a more powerful motor must be used more than the power that pump will absorb. Required motor power can be found in the table below.

Water Temperature (°C)	The power that can be absorbed from the motor compared to its name plate (%)	
	6" motors	8" motors
50°C	95%	90%



## Installation of the Pump

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When the submersible pumps are installed to the well, they are connected to discharge flange with column pipes. For that reason column pipes and the couplings that connect the column pipes to each other are the parts that carry the pump. Extra attention and care is needed when the pipes are connected to each other.

For the open body of water applications (i.e. pools), bottom part of the pump should be at least 30 cm higher than the bottom of the pool or the well and also flow inducer sleeve should be used outside of the motor for cooling it. (Fig. 3)



Submersible pumps can only work safely up to 50 g/m<sup>3</sup> amount of sand. If the amount of sand in the water is more than 50 g/m<sup>3</sup>, bearings of submersible pump will failure in short time because of wearing out. Failures that might be caused by the excessive amount of sand are out of WARRANTY.

If the pump installation will not be done by the VANSAN distributors installation crews, people who will do the installation have to be professionals and experienced in this topic.

## Installation of the Pump

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Required equipments for the pump installation are listed below.

- 1) Three-legged table
- 2) 2 pipe clamps that match with the column pipe's diameter
- 3) A hoist that will be able to carry the weight of the pump and column pipes that will be lowered to the well
- 4) A steel sling that will be able to carry the weight of the pump and column pipes
- 5) 2 chain pipe wrenches
- 6) Enough amount of the plastic cable clamp to fit the power cables to column pipes (Power cables must be fitted to the column pipe in every 3 m)

In order to do the electrical controls and connect the panel safely, clamp-on ammeter and meger tester are needed.

It is very important that electrical works are done by the professionals for the safety during the installation and starting the pump.

## Delivery and Unpacking

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Pumps, that are ready to be delivered, are dyed and accessories are attached on them after they are tested . Unless pump length is too long, pump and motor are delivered as coupled or else they are delivered separately.



VANSAN Submersible Pumps are packed in wooden box to make it ready for delivery. Coupling of the pump and motor must be done by people who have been certificated at VANSAN seminars. Installation of the pump is also suggested to be done by people who have been certificated at VANSAN seminars.

Controls of the pump and motor should be done in order to detect there is any damage on them happened during the delivery and handling and if so, it must be reported.

When the submersible pump is delivered to the place to be installed, it should be unpacked carefully from the box. The box must be opened very carefully not to damage pump, motor and the power cables.

## Delivery and Unpacking

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If there is any fracture on the pump or any damage on the motor, installation has to be stopped and you should get in touch with VANSAN distributor. Otherwise, failures that might be caused because of starting the pump in these conditions are out of WARRANTY.

It should be checked on the pump and motor name plates if the product satisfies the pump specifications in its order or else the installation must not be started.

## Connection of Power Cables

Connection of the power cable that will be used along the well and until the control panel with the power cable on the motor must be done very carefully and by the professionals only. Unless the insulation after the connection is well done, short circuit might happen when the connection area is in the water.

Insulation of each cable should be stripped only as far as necessary to provide room for a stake type connector. Each individual joint should be taped with rubber electrical tape, using two layers by wrapping tightly for eliminating airspaces as much as possible.

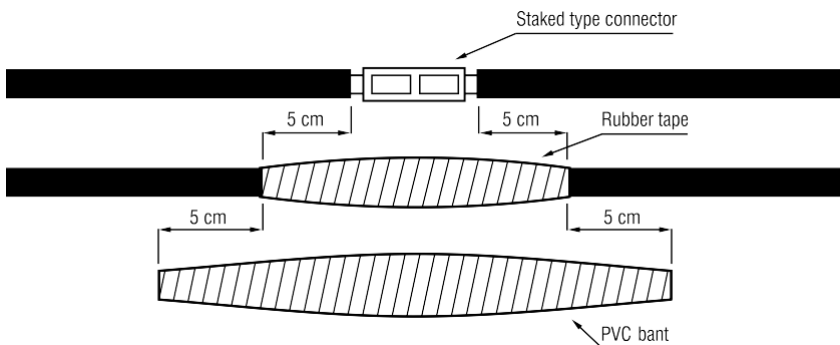


Fig. 4

Total thickness of tape should be no less than the thickness of the cable insulation in order to prevent the smashing of the cables when the pump is lowered in the well.

## Installation of the Pump to the Well

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Firstly, three legged table should be set on the well. The most important thing to be taken into consideration is that the hanging place must be on the same axis with the axis of the well. Then, the pump should be brought to the well head and riser pipe should be fitted to the pump to be able to hang the pump. Additional power cable's insulation is checked by inserting it into water. Insulation value should be no less than 2 megaohm. If the insulation value is less than 2 megaohm, power cable should be separated from the connection point and motor's power cable is controlled by Meger Tester.

If the insulation value is less than 2 megaohm as the result of the test, installation should be stopped and you should get in touch with the VANSAN distributors. If there is no problem as the result of the test of the motor, power cable's connection must be done more carefully this time. Insulation value should be checked again after the power cables are connected to each other.



Water level of the submersible motor must be checked. Failures that will be caused by starting the motor without water are out of WARRANTY. (Look at the part 'Filling the Water of the Motor')

After the water level is checked, motor and pump are started to be lowered in the well. The pump is lowered until the distance between discharge of the pump and the ground is 1 meter. U shaped clamp is fitted between the discharge case and the last intermediate bowl and pump is lowered until the clamp is fully in touch with the ground. Riser pipe is unfixed and it is fitted to the column pipe's coupling. After column pipe is lifted up with hoist, it is positioned vertically and it is put on the pump's discharge case. Before the pipe is fitted, threaded joints should be cleaned with wire brush and also be greased. Greasing process will be helpful in installation and disassembly of the pump. This process should be repeated in each pipe addition. When the column pipe is fitted, it should be tightened with 2 chain pipe wrenches.

Electrodes are used to prevent the pump working when there is no water left. It must be used in every submersible pump installation. When it is not used, the risk of working without water is told to be accepted. One of the electrodes should be placed 30 cm above the pump discharge and the other one should be placed to the calculated height (assuming that number of the motor start-stop value will not be higher than the given values) depending on the water level decrease velocity in the well. Practically, the distance between the upper and lower electrode should be 3 meters. The lower electrode shows that water level is too low and the upper electrode shows that water in the well is at a level that pump can work safely. The liquid level relay on the control panel either lets the pump work or stops it depending on the information that comes from the electrodes.

Upper and lower electrodes should be fixed to the column pipe with the power cables during the installation.

Pump should be lowered in the well carefully to avoid damaging the power cables or level control electrodes.

Power cables should be fixed to the column pipes in every 3 meters. During this process, soft plastic clamps should be used not to damage the power cables. Also soft rubber pieces should be put between the power cable and the pipe to prevent the iron pipe damaging the power cables.



During lowering the pump in the well, it should be controlled with a megger tester periodically to see if there is any leakage or rupture at the power cables. If there is any problem, pump should be lifted up and then damaged area should be located. Thus, the damaged part can be either repaired or the power cable can be replaced if needed.

When the pump is lowered to the expected depth, well discharge flange and the elbow are installed. If a special well discharge flange, that is produced by VANSAN, is used, power and electrode cables should be passing through the holes on the flange.

## Connection of the Submersible Pump to the Control Panel

After the installation of the submersible pump in the well, power cables that are coming out of the pump should be connected to the electrical control panel. This process should be done by only a professional electrician.



Electrical control panel should be protected from the water and moisture. The most important thing that should be taken into consideration is that the power cables should not be smash or bended.

Connections to the electrical control panel should be done depending on the schematic instructions that are taped inside the electrical control panel's cover. Liquid level electrodes should be also connected depending on the instructions.

Before the connection between electrical control panel and the main system of electricity, it should be checked with a circuit - tester to be sure there is no electricity in the control panel.

Before the connection of the electrical control panel is done, power cable's insulation should be controlled by a Meger Tester.

## Equipments of Control Panel

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- 1) Main contact breaker is used to cut off the power that comes to the control panel.
- 2) Thermal relay is used to protect the motor when it absorbs excessive current.
- 3) Fuse is used to protect the line if there is any short circuits at the power cables or the motor.
- 4) Control key
- 5) Liquid level control relay is used to control the water level and prevent the pump working without water by the help of the liquid level electrodes that are installed in the well. When the water is at required level, it starts the pump again automatically.
- 6) Liquid level electrodes are connected with cables to the liquid level control relay.
- 7) Phase protection relay is used to stop the pump if there is any problem at one of the phases.
- 8) Ammeter is used to show the current that motor absorbs.
- 9) Voltmeter is used to measure the working voltage.

There should be warning lamps on the control panel to warn the user at the unexpected occasions. Control panels should be insured against the short circuit. Moreover, their insulation should be well done and also it should be protected from moisture, dust and water.

## Starting the Pump

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Before starting the pump, it must be checked that all controls during the preparation and all warnings are taken into consideration.



Before starting the pump, voltage of the system should be measured. This value shouldn't be less than 5% and higher than 10% of the nominal value for the three phases. If there are more differences at the voltages than the given amounts, it should not be started until the required voltage is provided for the motor.

Thermal relay on the control panel should be set up depending on the ampere value on the nameplate of the motor. Thermal relay should be set up 58% of the motor's nameplate value on the Y/ $\Delta$  motors.

For submersible motor pumps working with frequency converter, adjustment and programming of the frequency converter should be done as showed by the attached frequency converter operating instructions, minimum rpm of the submersible motor pumps is 30 Hz, start/stop ramp for the motor pumps should keep short (2-3 sec. max. lower frequency and revolutions and high start/stop ramp can be damage the motor and the bearings. For correct adjustment to the motor revolutions and start/stop ramp, see frequency converter operating instructions, adjustments and programming to the device should be done only by electrically qualified personnel, non-observance is risk of damage to device and motor and pump, risk of electrical Shock!



Failures caused by running the motor pumps by incorrect adjustment to the device and by non-observance to the instructions, are out of WARRANTY.

Before starting the pump, the valve on the line should be positioned as half open. Manometer should be installed between the pump and the valve to measure the pressure.

Then pump can be started. Pump's discharge pressure can be read from manometer. Manometer gives the information about the direction of rotation because if the pump is rotating in the wrong direction, it cannot reach the real pressure value level. When the gate valve is closed, motor should be started to rotate in the both directions for a few seconds to read the values from the manometer. Right rotation direction is the one that the higher pressure is read from the manometer.

If the pressure value is decreasing steadily during the pump works although gate valve position is same, it shows that there is a problem. In this occasion, water level in the well might get lower or there might be hole or leakage on the pipes on the pressure line or in the well.

Pumps should never be allowed to work at the position that is absorbing more current than their nominal values. If the current that motor absorbs is higher than its nominal value on the nameplate of it, the valve should be closed until this value gets the nominal value lower.

Starting the Pump

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6" submersible type electric motors are allowed to have 20 start - stop maximum in one hour. 8" - 10"

submersible type electric motors are allowed to have 10 start - stop maximum in one hour. Exceeding this values and starting the motor more often will damage the motor and the failures that will be caused as a result of this situation are of WARRANTY.

After finding the right rotation direction of the pump, it should be allowed to work at a closer gate valve position for a while.

The amount of sand that comes out of the well should be checked periodically. VANSAN 4" Submersible Pumps and VANSAN 6" - 7" - 8" - 10" Submersible Pumps are resistant to 50 m<sup>3</sup>/h respectively. If the amount of sand is higher than these values, pump will be worn out more than normal and the failures that will be caused because of these occasions are out of WARRANTY. If the amount of the sand is higher, then the suggestions should be asked from the companies that dig wells.

Before having the pump work automatically, settings of the thermal relay should be checked. One of the fuses should be taken out and motor should be run on two phases for this control. In this occasion, thermal relay should stop the pump in around 30 - 40 seconds. This trial should be repeated for all three phases and each time motor starter should be allowed to cool down for 3 and 10 minutes for 6" and 8" - 10" motors respectively. After this control, pump should be allowed to work automatically.

## Maintenance and Storage

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Lifetime of the submersible pumps is defined as 10 years. Best way to take care of your submersible pump is to have it controlled periodically.

After start using the pump, a maintenance card should be opened to the pump. Pump's voltage, current, flow rate and pressure values should be saved periodically in every 3 months. By comparing these values between each other and with the nominal values, pump's condition can be understood. As soon as there are sudden deviations or steadily decrease / increase in these values, you should call competent distributor.

There is no problem about making the submersible pumps wait without starting it. However, it must be worked once in a month to prevent possible jamming in the pump.



While storing outside the well, water of the motor should be emptied.

Control panel of submersible pump should be cleaned from dust and moisture by monthly periods. In every 6 months, equipments and cable connections of the control panel should be checked and loosen ones should be tightened.

## Possible Troubles and Corrective Actions

Pump Runs But Gives No Water or Runs at Reduced Capacity	
The discharge valve is closed.	Open the valve.
Wrong direction of rotation. (only at three phase motors)	Power cable's two phase should be replaced.
Too low water level in borehole.	Increase the installation depth of the pump and close the valve to decrease flow rate.
Selected pump is not suitable for this application.	Pull out the pump and install a suitable pump for the application.
Leakage or blockage in the pipework.	Check and repair pipework.
The inlet strainer is choked up.	Pull out the pump and clean the strainer.
The pump or check valve is blocked partly or completely.	Pull out the pump, check and clean or replace the pump and valve.
Pump runs on at a lower rotational speed.	Check the voltages or if there is anything abnormal with one of the phases.
There is leakage at the installation.	Check the entire installation and repair it if that exists.
Pump shaft or coupling is worn out.	Pull out the pump and check it.



## Possible Troubles and Corrective Actions

Pump's Discharge Pressure is not Enough	
Too low water level in borehole.	Increase the installation depth of the pump and close the valve to decrease flow rate.
Pressure switch is set up wrong or failed.	Check if pressure switch is working properly and set up right.
There is leakage at the installation.	Check the entire installation and repair it if that exists.
Pump is worn out.	Pull out the pump and replace worn out parts and get in touch with the service.
Pump impeller's is choked up.	Pull out the pump and check it.

Thermal Protection System is Running	
Motor absorbs excessive amount of current. Pump is jammed.	Stop the motor quickly and get in touch with the service. Pull out the pump and send it to the service.
Motor is broken.	Pull out the pump and check if motor has any failures and send it to the service.
Settings of thermal relay or selection of relay is wrong.	Check the thermal relay and its settings.
Motor runs on two phases.	Check power phases. fuses and cable connections.

## Possible Troubles and Corrective Actions

Frequent Starts and Stops	
Liquid level electrodes are too close to each other.	Distance between two electrodes must be at least 3 meters. Lower electrode should be installed 30 cm up from pump discharge.

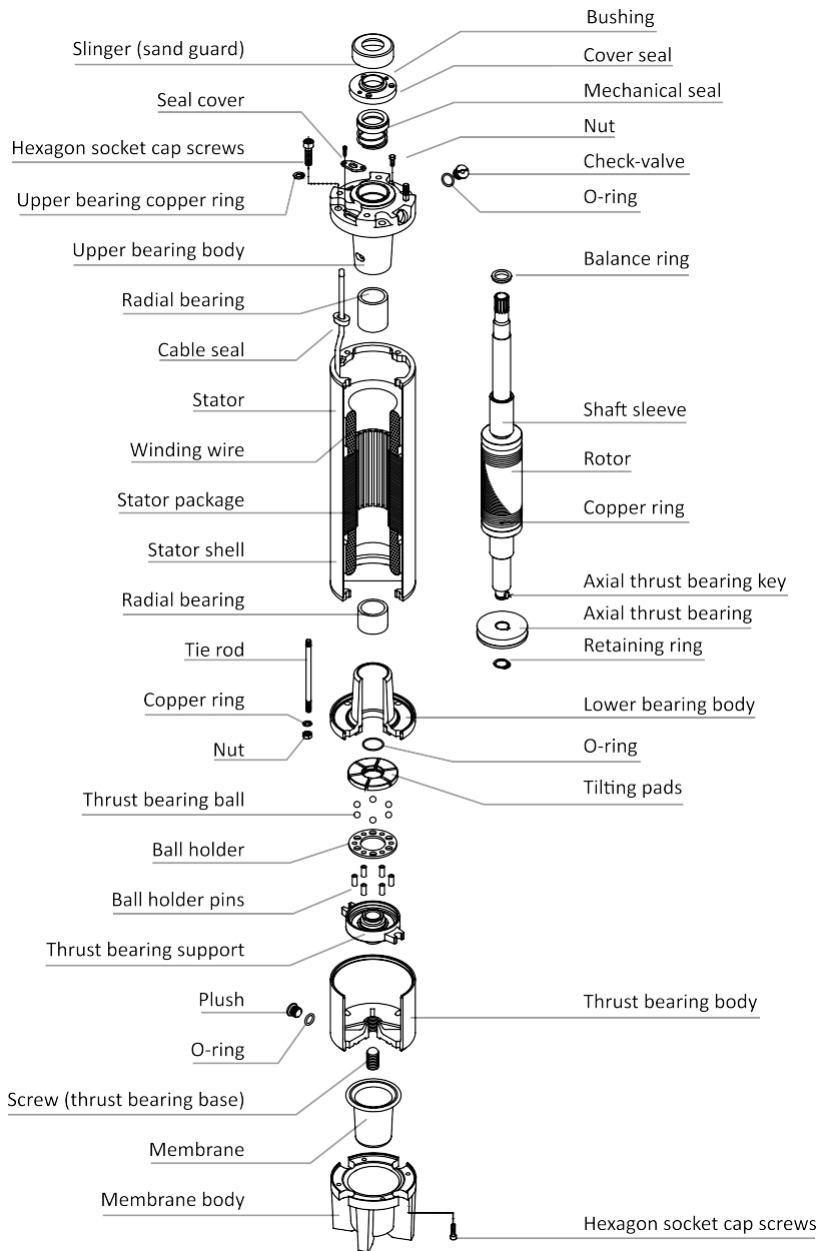
Pump Runs Noisy and Vibrating	
Pump equipments are partly/completely blocked.	Pull out the pump and have it repaired.
There is excessive amount of air or gas in the water of the well.	Fluid must be processed to have air or gas out of it.
Motor's axial thrust bearing is broken.	Pull out the pump and replace the axial thrust bearing of motor.
Selected pump is not suitable for this application.	Pull out the pump and install a suitable pump for the application.
Pump's bearings are worn out.	Replace the pump's bearings.
Fixing of the installation is weak.	Check the installation.
Duty point is out of pump's characteristic curve.	Close the valve to decrease the flow rate to make the pump to work at duty point.

## Possible Troubles and Corrective Actions

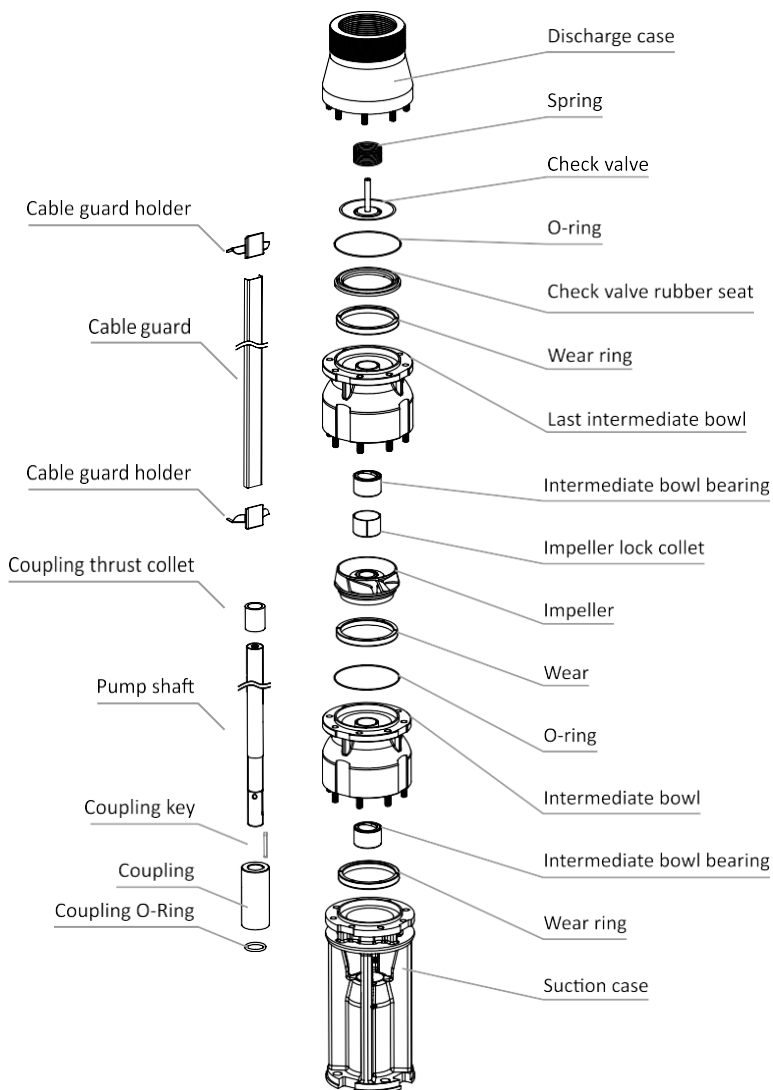
Pump Does not Run	
No electricity supply.	Contact the electricity supply authorities.
The fuses are blown.	Replace the blown fuses with the new ones.
The dry-running protection has cut off the electricity supply to the pump, due to low water level.	Check the water level.

Control Panel Runs Noisy	
Contactors' circuits are worn out.	Check the circuits of the contactor, have them repaired or replaced.

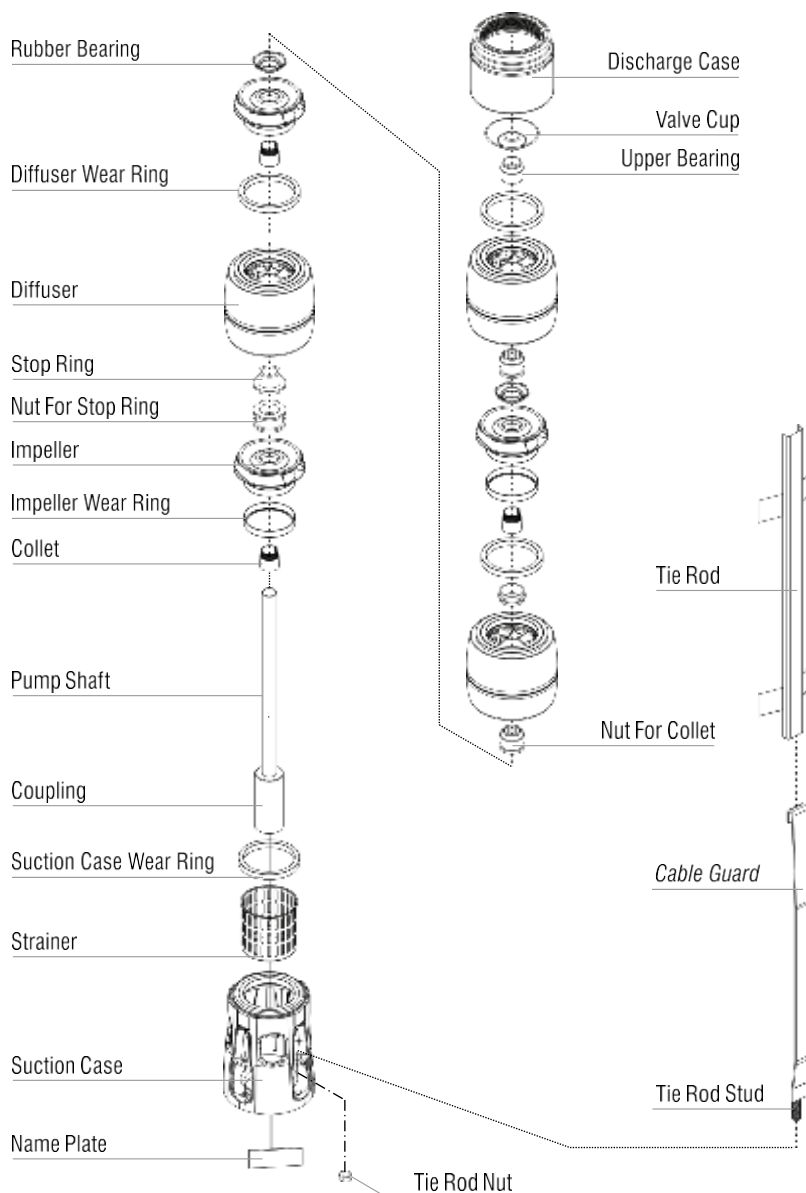
## Submersible Motor Part List



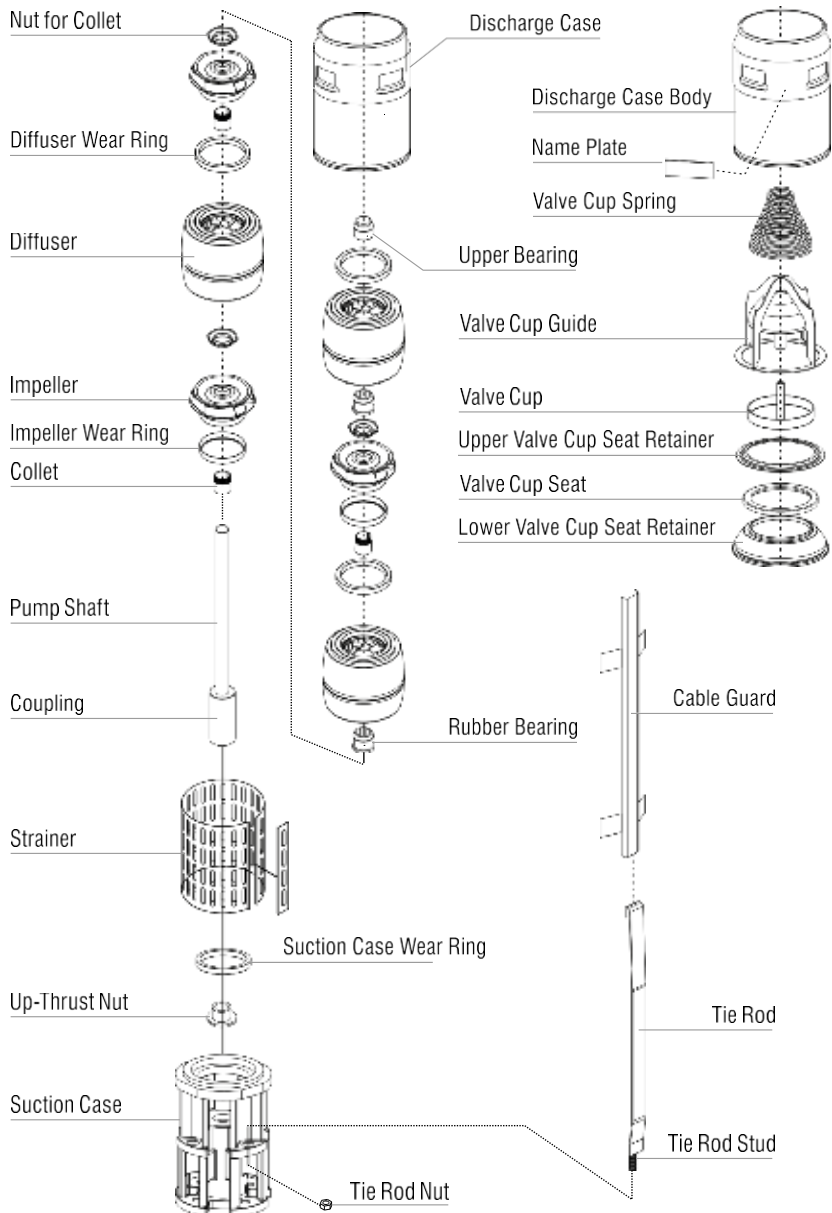
## Cast Iron Pump Part List



## Stainless Steel Pump Part List (6 inch)



## Stainless Steel Pump Part List (7-8-10 inch)



10035 Sk. No:10 A.O.S.B. 35620 - Cigli, Izmir / TURKEY  
T: +90 (232) 376 76 50 • F: +90 (232) 328 01 68  
[www.vansan.com.tr](http://www.vansan.com.tr) • [vansan@vansan.com.tr](mailto:vansan@vansan.com.tr)

