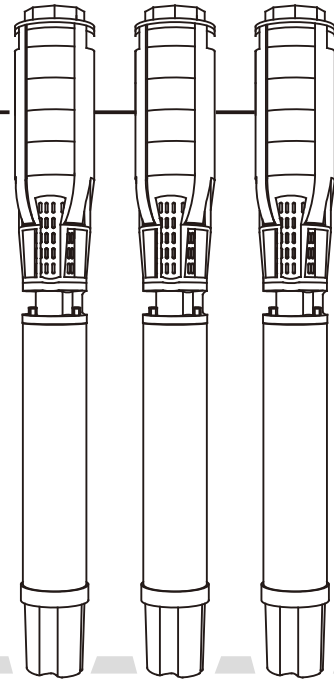


## OPERATION INSTRUCTIONS

Cast Stainless Steel  
Submersible Pump

**VP/FVP/HVP/VPN/VS  
VN/VL Series**

ENG 



Please check the following points before installation.

- The product is meeting with the specifications ordered.
- Defective or damages, if any.
- All related accessories and tools are ready.
- These instructions contain fundamental information and precautionary notes.
- Please read the manual thoroughly prior to installation of unit for proper operation.
- Keep these instructions near location of operation for easy access.
- Any failure or accidents caused by erroneous installation and/or wrong operation. Non-compliance with the instructions will not be warranted.

---

## General

The pumps have been developed in accordance with state-of-art technology. They are manufactured with utmost care and subject to continuous quality control. These instructions are intended to facilitate familiarity with the pumps and its designated use. The manual contains important information for reliable, proper and efficient operation. Compliance with the operating instruction is of vital important to ensure reliability and a long service life of the pump and to avoid any risks.

## Safety

These instructions contain fundamental information, which must be complied with during installation, operation and maintenance. Therefore the manual must be read and understood both by the installing personnel and the responsible trained personnel/operators prior to installation and commissioning, and it must always be kept close to the location of the unit for easy access. Marking of Safety sign in the instructions. The safety instructions contained in this manual non-compliance of which might cause hazards to person are specially marked with the common hazard sign, namely,



( Safety Mark )

Non-compliance with Safety instructions. Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the machine itself. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claim for damages.

In particular, non-compliance can, for example, result in; Failure of important machine / unit functions,

- Failure of prescribed maintenance and servicing practices,
- Hazard to persons by electrical, mechanical and chemical effects.

## Safety awareness

It is imperative to comply with the safety instructions contained in this manual, the relevant national and safety regulations and operator's own internal work, operation and safety regulations.

## Safety instructions for maintenance, inspection and installation work

The operator is responsible for ensuring that all maintenance, inspection and installation work be performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual. Working on machine must be carried out only during standstill. The shutdown procedure described in the manual for taking the machine out of service must be adhered to without fail. Pump handling media injurious to health must be decontaminated. Immediately following completion of work, all safety-related and protective devices must be re-installed and/or re-activated.

## Unauthorized modification and manufacture of spare parts

Modification or alterations of the machine are only permitted after consulted with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for consequential damage.



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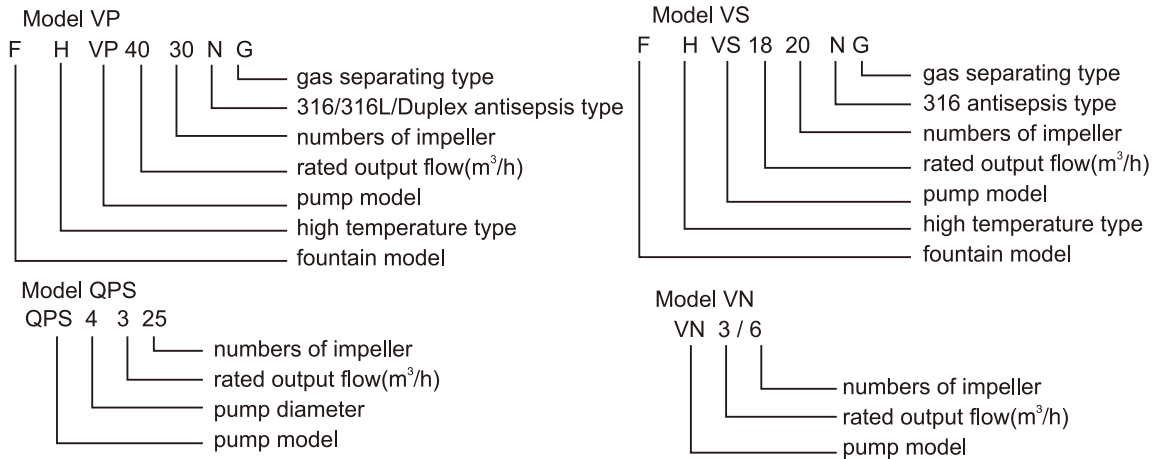
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## 1 General

Directions of Pump Rotation are diversified according to Pump Model. Observing from the delivery side, Models VP/VS/VN/FVP/HVP/VPN rotate counterclockwise, the pumps are coupled directly to submersible motor. Model VN rotates clockwise and has an internal motor, thus coupling to other motor is not needed.

### 1.1 Pump Identification Code



Model QPS, VP and VS are suitable for fresh water pumping and Model HVP and HVS are suitable for hot spring water application. Model HVPG and HVSG are assembled with gas separation system to protect gas lock in gas contained well point. Model FVP is suitable for fountain application 316/316L/Duplex antisepsis type for VPN.

### 2.2 Applications

Recommended Pumps Models are QPS, VP and VS for fresh water, HVP and HVS for hot spring, HVPG and HVSG for gas contained well. In addition to fresh water and hot spring application, Model VS and VP are also recommended for application of seawater and amelioration of organic-solvent-tainted soil and pumping high acid water VPN.

The maximum sand content of the water must not exceed 300g/m<sup>3</sup>, and size of sands must be smaller than 0.1~0.5mm. A larger sand content will reduce the life of the pump and increase the risk of blocking problem.

## 2 Standard Specifications

See sample for details of Models QPS/VP/VS/VN/FVP.

## 3 Delivery and Storage

### 3.1 Delivery

These submersible pumps are supplied from the factory in proper packing in which they should remain until they are to be installed.

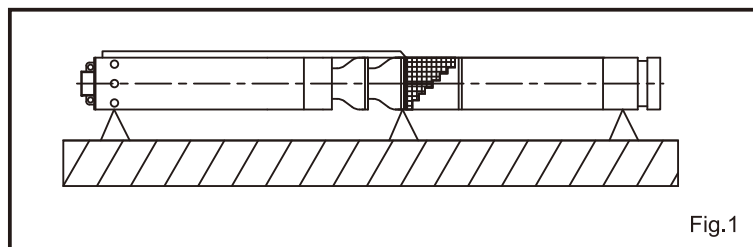
During unpacking and prior to installation, care must be taken when handling the pump to ensure that misalignment does not occur due to bending. The pump should not be exposed to unnecessary impact and shocks.

## 3 Delivery and Storage

### 3.2 Storage

When to store the pump not using to be spare or lifting up from the well, following cares must be taken.

- Storage temperature:  $-20\text{ }^{\circ}\text{C} \sim +60\text{ }^{\circ}\text{C}$
- Drain water away from the pump and dry it up well, but do not drain the water from the motor.
- Give taping on tip of all cables to protect from getting wet.
- Do not store in the place being exposed to direct sunlight, high temperature, high humidity and possible to get frozen.
- Put cover to avoid damage on the pump and cables.
- Once the pump is unpacked, it should be stored, adequately supported, or vertically to prevent misalignment of the pump. During the storage horizontally, the pump is to be supported as shown in fig.1.



When to handling the pump horizontally, the pump part and the motor part are to be lifted simultaneously.

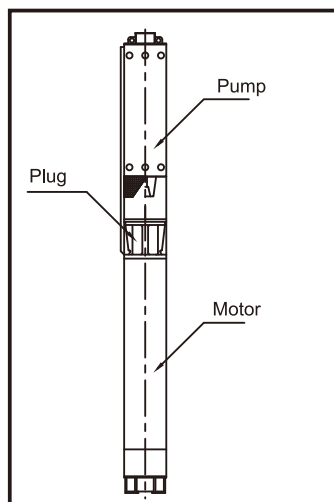
Note that the center of gravity will vary depending on Pump type.

## 4 Installation and Maintenance

### 4.1 Check out Filling Liquid

Please do not open a plug. Moreover, please do not put in liquid. See fig. 2.

Stop it absolutely because it causes a motor trouble.



### 4.2 Check out Pump unit

Try to rotate the shaft at coupling part by hand to see if the shaft rotate freely.

In case the coupling is covered by a strainer, uncover it first. After checked, put the strainer back and screw it firmly.

If it is difficult to rotate the shaft by hand, use any adequate tool like a screwdriver.

All pumps are well tested at the factory before delivery. Adjustment at the field is not needed.

Only in case that the pump is stored a long time without running, need to make thorough check-out before installation.

### 4.3 Positional Requirements



If the pump is to be installed in a position where it is accessible, the coupling must be suitably isolated from human touch. The pump can for instance be built in a flow sleeve.

Please be sure to install a pump perpendicularly. For horizontal installation, Please consult us. (See Fig. 3)

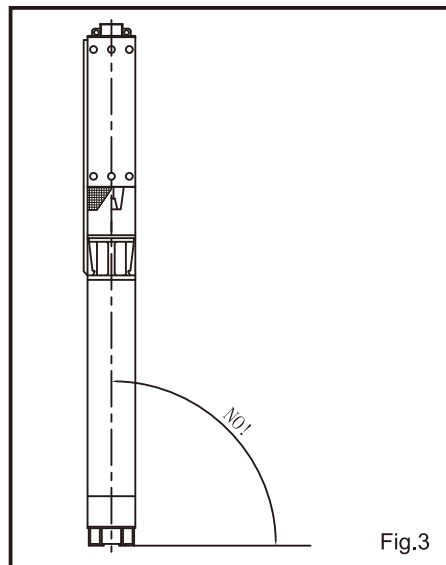


Fig.3

During operation the suction motor adapter of the pump must be always be completely submerged in the liquid. In special conditions, it maybe necessary to submerge the pump even deeper, depending on the operation conditions of the actual pump and the NPSH value.

### 4.4 Maximum Diameter of Pump

Please refer to sample for the maximum diameter of the pumps.

It is recommended to check the inside diameter of the well before install pumps.

**4.5 Minimum Speed of Peripheral Current**

To avoid the motor failure due to insufficient cooling, make the pumping volume higher than parameters shown in the table below.

| Motor maker | Size     | Speed of peripheral current | Well dia. ( mm ) |            |             |              |              |              |
|-------------|----------|-----------------------------|------------------|------------|-------------|--------------|--------------|--------------|
|             |          |                             | 4"(100)          | 5"(125)    | 6"(150)     | 8"(200)      | 10"(250)     | 12"(300)     |
| Hitachi     | M6       | 0.15m/sec                   |                  |            | 45.3(31.7)  | 225.2(157.6) | 454.6(318.2) | 739.6(517.7) |
|             | M9       | 0.50m/sec                   |                  |            |             |              | 947.1(663.0) | 1897.1(1328) |
| U-flo       | M4       | 0.10m/sec                   | 12.6(8.8)        | 53.1(37.2) | 100.1(70.1) | 220.0(154.0) | 373.0(261.1) |              |
|             | M6       | 0.10m/sec                   |                  |            | 33.9(23.8)  | 153.9(107.7) | 306.8(214.8) | 496.8(347.8) |
| Franklin    | M8       | 0.10m/sec                   |                  |            |             | 68.8(48.2)   | 221.7(155.2) | 411.7(288.2) |
|             | M4       | 0.076m/sec                  | 9.6(6.7)         | 40.5(28.3) | 76.3(53.4)  | 167.7(117.4) | 284.2(198.9) |              |
|             | M6       | 0.154m/sec                  |                  |            | 54.6(38.2)  | 237.3(166.1) | 470.4(329.3) | 760.0(532.0) |
|             | M8-75kW  | 0.154m/sec                  |                  |            |             | 55.6(38.9)   | 288.7(202.1) | 578.2(404.8) |
|             | M8 95kW- | 0.154m/sec                  |                  |            |             |              | 268.8(188.2) | 558.4(390.9) |

In case that the pumping volume is less than the volume shown in the table, equip the unit with a flow sleeve. The numerical value in is the amount of pumping at the time of attaching a sleeve.

The pumping volume is calculated by the inside diameter of carbon steel pipe which served as well diameter.

**4.6 Check up Electric Supply**

- Voltage during operation is to be set within  $\pm 5\%$  of the rated voltage.

**4.7 Discharge diameter, capacity and the smallest submerging depth**

The amount of standard pumping and the minimum submerging depth for every discharge caliber are shown in a lower table.

| Discharge diameter(A) | Capacity (m3/min) |             | Minimum submerging depth (m) |
|-----------------------|-------------------|-------------|------------------------------|
|                       | 50Hz              | 60Hz        |                              |
| 25                    | 0.045以下           | 0.050以下     | 0.4                          |
| 32                    | 0.04-0.08         | 0.045-0.090 | 0.4                          |
| 40                    | 0.07-0.14         | 0.08-0.16   | 0.5                          |
| 50                    | 0.11-0.22         | 0.12-0.25   | 0.7                          |
| 65                    | 0.20-0.40         | 0.22-0.45   | 0.9                          |
| 80                    | 0.36-0.71         | 0.40-0.80   | 1.2                          |
| 100                   | 0.63-1.25         | 0.71-1.40   | 1.6                          |
| 125                   | 1.00-2.00         | 1.12-2.24   | 2.5                          |
| 150                   | 1.60-3.15         | 1.80-3.55   | 3.6                          |





Before starting any work on the pump / motor, make sure that the electric supply has been switched off and that it cannot be accidentally switched on.

Clear up the well prior to installing the pump.

If the pump is installed without cleaning well, it will possibly cause the quick wear of pump.

Be careful not to drop any tools or bolts into the well.

Dropped objects will become obstacles to hinder lifting up the pump from the well.

Installation is to be carried out carefully, safely and surely.

### 5.1 Preparation of Installation

Need to prepare all necessities in advance for sure and safety installation.

- Flat and ample space enables to carry out installation safely.
- A crane tough enough against the load to lower the unit down into the well.
- Strong enough wire ropes and shackles.
- Strong enough riser pipe clamps
- Full set of necessary tools.

### 5.2 Handling Cables

Handle cables very carefully. If cables are damaged, it may possibly cause electric shock and fire.

- Do not put anything on cables. Do not put cables between any objects.
- Do not give unnecessary force or shock on cables.
- Be careful not to damage cables rubbed in the well.

### 5.3 Measuring Insulation Resistance

Measure the insulation resistance prior to installation.

Insulation level over 100M $\Omega$  is to be normal standard for brand-new.

Measure the insulation level again after installed. If measured below 50M $\Omega$ , consult with your distributor about it.

### 5.4 Riser Pipe

Riser Pipe is to be fastened to the discharge head of the pump(Flange type).

In case of a threaded joint type Riser Pipe, clean out the thread part and fit it together to ensure that they do not work loose due to torque reaction caused by the starting and stopping of the pump.

Check if the thread is not damaged and the socket is firmly fastened.

In case of a flange type Riser Pipe, clean up dust or any substances on the contact surfaces. Put packing between contacts and fasten them together by bolts tightly.

Use a special tool in the case of FRP. Be careful not to damage.

For Models VS/QPS/VN, tighten the fixing screw on the discharge head of the pump after screwed the Riser Pipe into the Pump. If the screwing is not tight enough, the leakage may possibly occur.



### 5.5 Cable Fitting

Fix the cable on Riser Pipe by cable bands at intervals of 3m each at maximum. In case of a 3m long Riser Pipe, fix the cable at the position over and below the joints. For a 5.5m long Riser Pipe and FRP, fix the cable at the position over and below the joints and the middle of Pipe additionally.

### 5.6 Lowering the pump

Measure the diameter of the well prior to lower the pump.

Lower the pump carefully into the well, taking care not to damage the cable.

Pulling the cable of electrode and water sensor too strong may cause snapping of a wire.

Be careful when deviating and falling down.

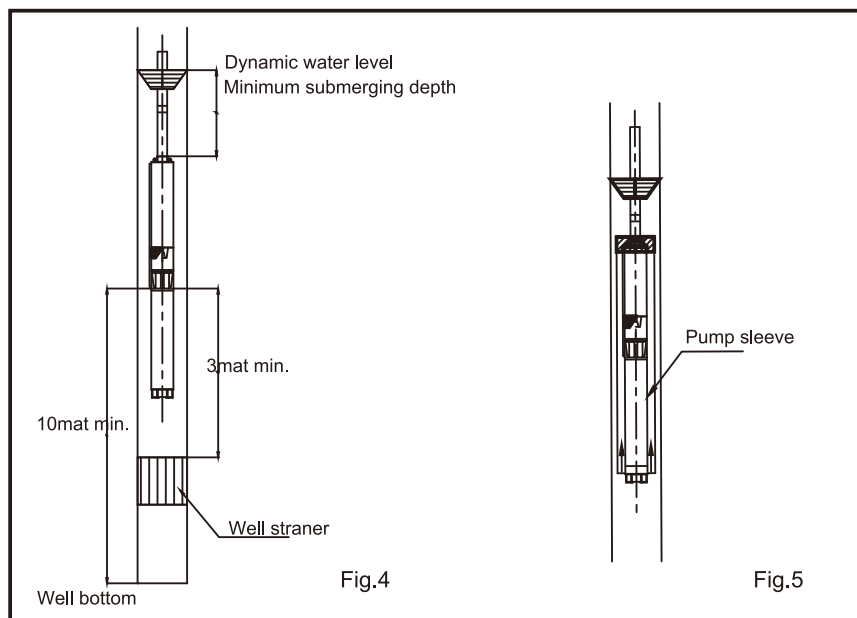
### 5.7 Installation Position

Make the position where the pump is set up more than minimum diving depth. (Refer to 4.7 Discharge diameter, capacity and minimum submerging depth)

Do not take the position below the well strainer or nearby.

The level of intake part is to be positioned at least 3m over from the well strainer and up more than 10m from the well bottom. (See fig. 4)

When necessary speed of peripheral water current cannot be obtained or cannot avoid the installation position near the well strainer, equip a flow sleeve with the unit. (See fig. 5)



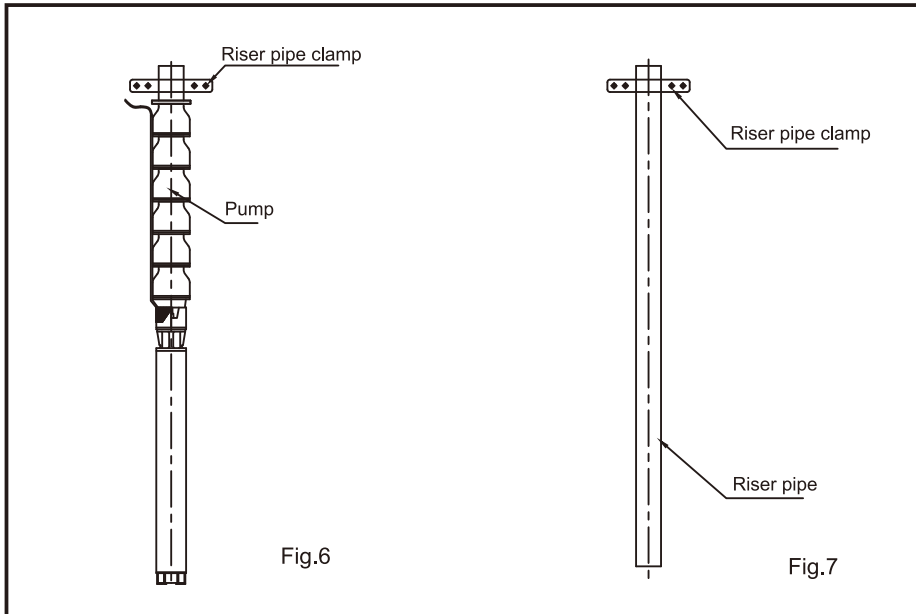
**5.8 Installation Manual**

Install the unit safely and surely following the procedure shown below:

- ① Pipe clamp is installed in short pipe connected with discharge head of the pump, or riser pipe. (See fig.6)

And fit another set of clamps to the first section of Riser Pipe beforehand. (See fig.7)

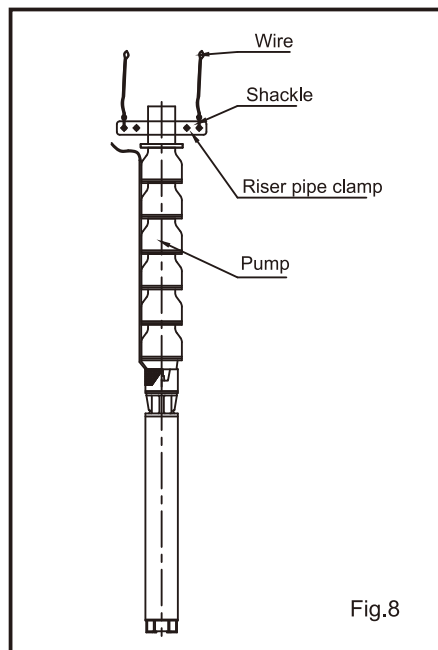
Fasten bolts / nuts of Riser Pipe clamp firmly.



- ② Put a shackle through the wire rope and fit it to the Riser Pipe clamp. (See fig.8)

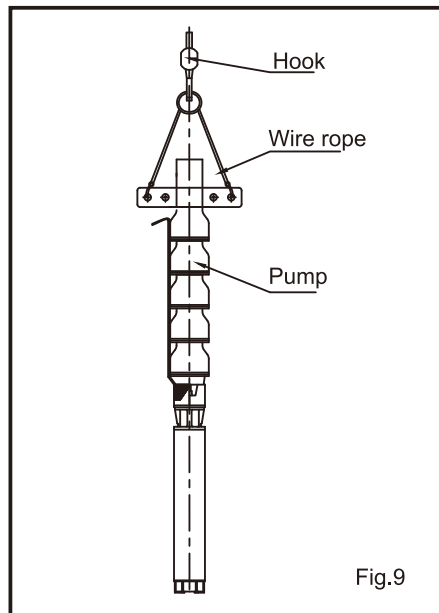
In case there are two sets of wire rope and shackles, fit one set also to the first section of Riser Pipe.

An Eyebolt of shackle is to be fastened firmly.



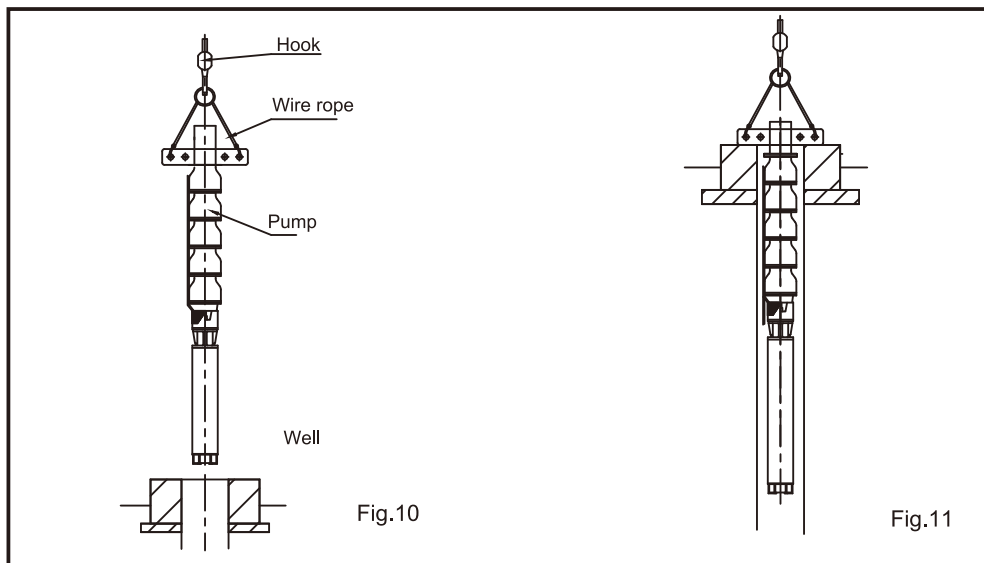
③ Hang the wire rope on the hook of a crane and pull up the pump. (See fig. 9)

At that time take care that the extra force will not be given to the rope and the rope does not touch any obstacles. Hanging the rope on the hook is to be handled very carefully.



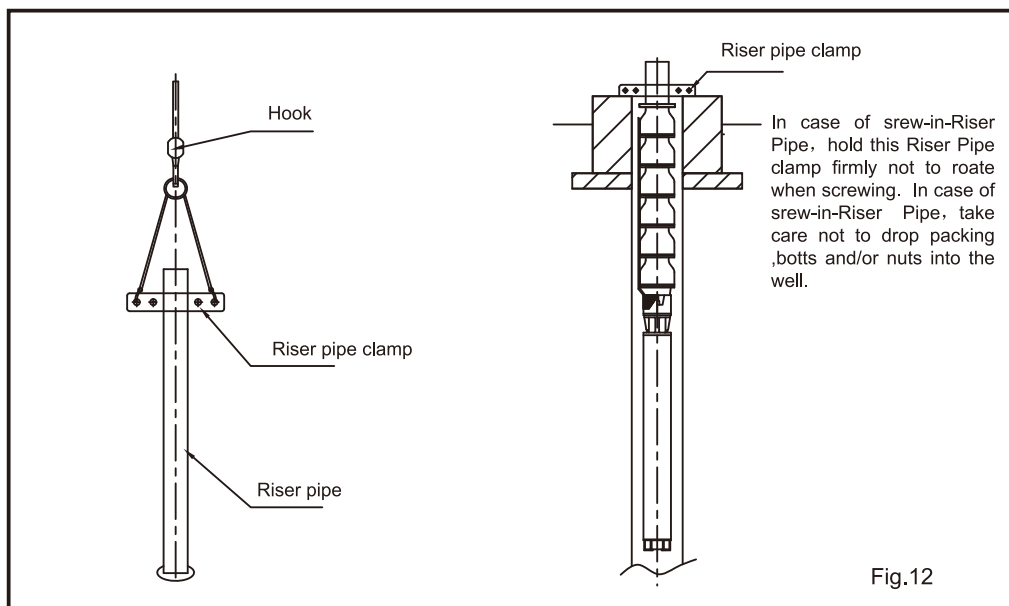
④ Lower the pump into the well. (See fig. 10 and 11)

Be careful the wire is not caught between the well and Riser Pipe clamp.



⑤ When complete lowering down, loose the hanging rope and unhook the rope from the hook of a crane. Then remove the shackle from the Riser Pipe clamp looking out not to drop it into the well. Fit the removed wire rope and shackle to the first section of Riser Pipe. (If there are two sets of wire rope and shackle, fit one set to the second section of Riser Pipe.) Steps can be referred to fig. 8 in point ②

⑥ Hang the wire rope fitted to Riser Pipe, to be connected, on the hook of a crane and pull up the unit. And connect to the pump installed already in the well. (See fig. 12) In case of a screw-in type Riser Pipe, take care that the socket, unscrewed by chance through rotating Riser Pipe, drops down into the well. Moreover, connect Riser Pipe to the pump straight and firm using proper tool.



⑦ When completed the connection of the pump and Riser Pipe, pull them up slightly as they are (within 10cm up.). Then remove the Riser Pipe clamp fitted to the pump (lower end). The electrode is set up with a wide tape etc. more than minimum submerging depth. (Refer to 4.7 Discharge diameter, capacity and minimum submerging depth) Then fit the cable to the position over and below the joint of Riser Pipe by cable band. (If a Riser Pipe is 4m, 5.5m or 9m long, fit the cable also at the middle part of Riser Pipe.) (See fig. 13)

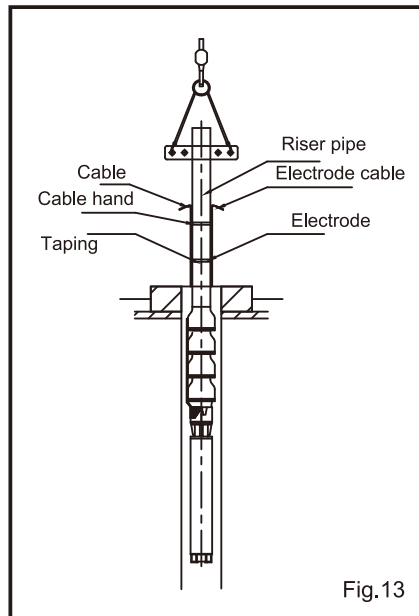


Fig.13

⑧ Continue the connection and fitting of the Riser Pipe, cable and electrode cable following steps explained above.

⑨ When connection of all Riser Pipes is completed, connect an elbow discharge pipe to Riser Pipe next.

First fix eyebolts to holes of the elbow discharge pipe and connect the wire rope there. Hang the wire rope on the hook of a crane and pull the unit up. Then connect the elbow pipe to Riser Pipe following the same steps of Riser Pipe connection. Set the cable through the elbow discharge pipe and lift the unit up slowly.

Finally, fit the cable to the Riser Pipe and the discharge pipe to complete the installation. (See fig.14 and 15)

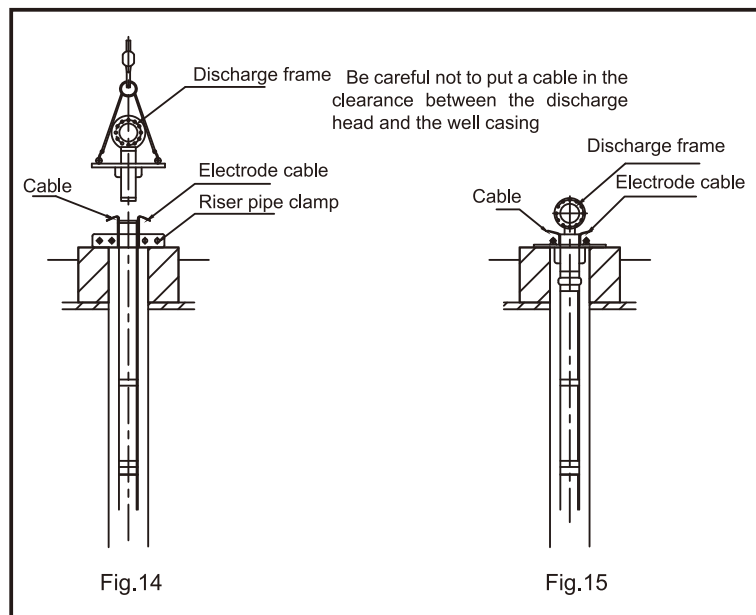


Fig.14

Fig.15

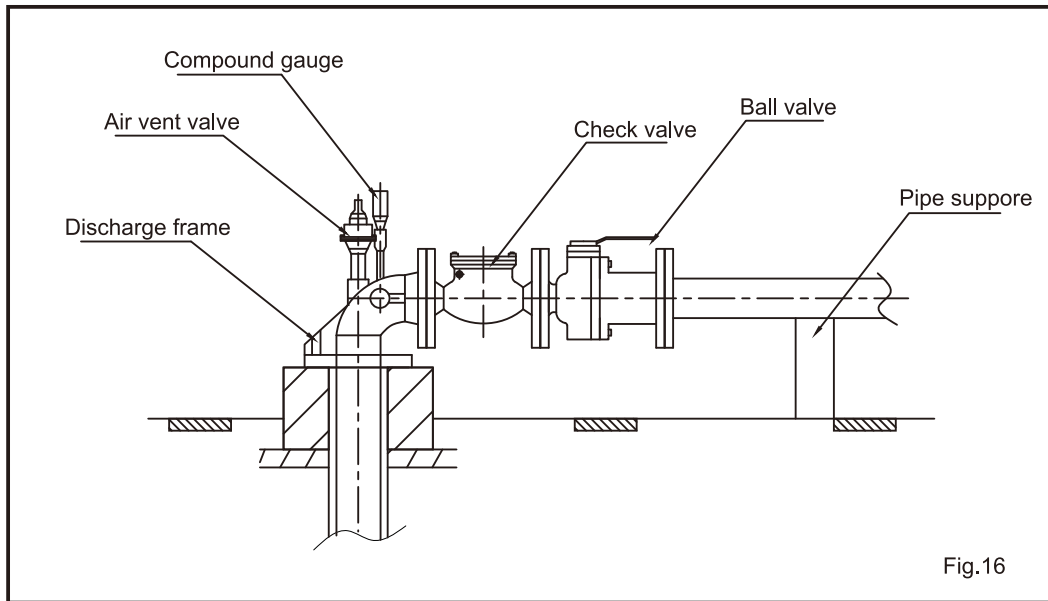


### 5.9 Setting Surface Unit

For assembling the surface unit, do not forget to place packing and fix bolts firmly not come to loose.

Standard equipment for the surface unit is shown in fig. 16

When to install long delivery pipes, use pipe supports for stable piping.



## 6 Electrical Connection



Before starting work on the pump, make sure that electricity supply is switched off and that it cannot be accidentally switched on.

**The electrical connection should be carried out by an authorized electrician in accordance with local regulations.**

Incorrect connection may cause an electric shock and fire.



The motor must be earthed and connected to external main switch.

### 6.1 Dealing with Cable

- Do not store exposing to direct sunlight.
- Do not use in coiled condition to avoid temperature rise.
- Keep being well ventilated.

**6.2 Power Supply and Control Panel**

- During operation set voltage  $\pm 5\%$  of the rated voltage and set disproportion within  $\pm 3\%$ .
- Control Panel is to be designed suitable for submersible pump.
- Protection relay is current limit type or 2E,3E which does not start by the maximum amperage at start-up but works to protect the motor sensing amperage over and phase error during operation.

**6.3 Cable Connection**

Check the power supply is switched off and then draw the cable from the well point into Control Panel. Following the circuit indication provided on Control Panel, connect the cable, electrode cable and others to the terminal board respectively and correctly. Standard sequences are shown in fig.17 and 18.

Fig.17 Sequence for direct-on-line start

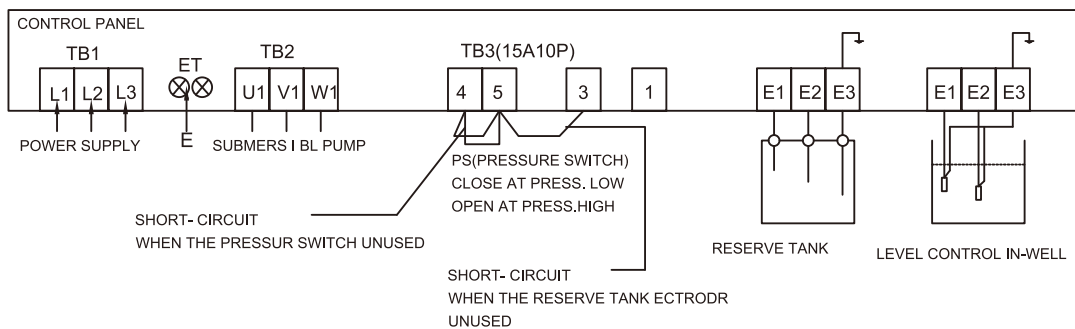
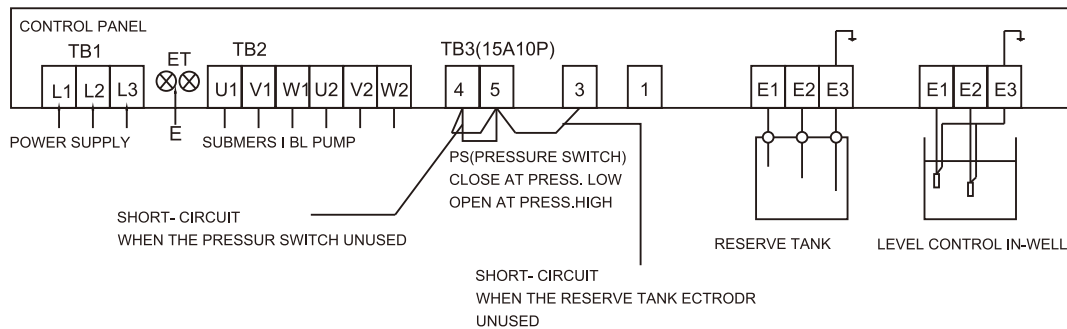


Fig.18 Sequence for star-delta start



**7.1 Check up Insulation Resistance**

Measure Insulation Resistance between the cable and the well (discharge frame), and confirm parameters indicating over the following levels.

- Right after installed over 50MΩ
- Pump operative value after a long time running over 1 MΩ

**7.2 Control Panel Functions**

The main functions included in the control board are shown in a lower table.

| Control method                  | Purpose   | Function   |
|---------------------------------|---|--|
| Short-circuit breaker           | Protect from fire and an electric shock when an electric leak happened                      | Shut off the electric supply automatically when sensed an electric leak.                               |
| Motor relay                     | Protect motor   | Shut off electric supply, automatically when sensed over load, phase error and reverse phase.          |
| Electrode bar type float switch | Protect motor from failure caused by low water level of well or control water level in tank | Control pump running according to water level in the well and tank.                                    |
| Arrester                        | Protect Control Panel from lightning damage   | Disperse excessive current from lightning to ground.   |
| Inching-prevent timer           | Prevent unusual on/off start when machine error or failure happened                         | In case of automatic operation, suspend start-up of pump running for a while.                          |
| 24 hours timer                  | Control running time a day  | In case of automatic operation, time of pump running will be limited according to the time programmed. |

**7.3 Alarms**

Alarm starts to sound and the alarm lamp on Panel front cover starts to blink as well when any trouble happened with the pump and power source.

Push the stop button to stop warning alarm.

When trouble happened, stop alarming sound pushing the stop button first and check up which alarm lamp is blinking. After settled the problem in order, push the reset button on the front cover to restart the pump running.

Restart the running without settlement on the problem may cause the failure on other machine or function. Be sure to settle the trouble first before to restart.



#### 7.4 Function check

To avoid trouble happening, watch out functional faults and lamps out of order in Control Panel customarily. For that, recommend to do daily check-up as shown below.

- For a Control Panel with lamp test function, push the lamp test button and see if all lamps are working in order. Lamps not working are to be replaced immediately.
- Push test button of short-circuit breaker and check if it will work in order.
- Push the test button of motor relay, and see if it will function normally.

#### 7.5 Check Direction of Rotation

- ① Start running by opening the sluice valve at about one thirds of full opening.
- ② Open the sluice valve full and measure pressure and amperage.
- ③ Stop running and interchange two of the phase connection.
- ④ Start running again and repeat the step of point ② once more.
- ⑤ Stop running and compare the measured data at point ② and ④.

The connection gives higher pressure and lower amperage is correct connection.

| Check points        | Correct rotation | Incorrect rotation |
|---------------------|------------------|--------------------|
| Pressure            | Higher           | Lower              |
| Amperage            | Low              | High               |
| Vibration and noise | Less             | More               |

#### 7.6 Test Running

Start running and open the sluice valve at one thirds of full opening. Open the sluice valve gradually, watching the pressure gauge and keep continuous running near the level of designated total head.

Watch the proceeding carefully, because the problem like sand block is likely to happen right after the start-up.

#### 7.7 Operational check

- Check if the amperage is indicating close to the test data and below the rated amperage. If the amperage is high due to low voltage electric supply and other reason, amperage over up to 5% over the rated amperage is to be accepted.
- Check if any unusual vibration and noise are occurred.
- Take pumped water into a clear vessel and check the level of sand content. If the level of sand content is high, close the sluice valve slightly to reduce pumping volume.

#### 7.8 Check Total Head at shutoff

Open the sluice valve full and check if the total head (parameter at pressure gauge + dynamic water level) and amperage are close to the test data.



**7.9 Operation Manual**

Regular running is to be operated following procedures shown below after performed the functional checks instructed in point 7.4.

At automatic operation, normal running will be kept on providing any trouble not happened. So only manual operation is instructed here below.

Switch of changing operation is set to manual.

① For a Control Panel functioned to indicate voltage level, check voltage at each point of R-S, S-T and T-R touching the change switch respectively.

Even for a Control Panel without function to change voltage indication, checking voltage is imperatively needed.

When voltage is fluctuating more than  $\pm 5\%$  than the rated voltage, adjust the level to normal level before start running.

② In case of a Control Panel functioned to indicate different amperage, set the change switch off.

If not setting the change switch off, it may cause the damage on an ammeter due to the electric current at time of start.

③ Push the start button to start running the Pump.

④ In case of a Control Panel functioned to indicate different amperage, check the ampere respectively at R, S and T.

When any ampere shown exceeds the rated amperage, check up if there are any problems happened or not.

⑤ Take pumped water in a clear vessel and inspect sand or any foreign substances contained.

Since high content of sand may wear impellers and bearings to reduce the life of the pump, improve the installed conditions changing the position of the pump installed once or equipping a sleeve with the pump.

⑥ Push the stop button to quit running.

Stop and start are to be done following the instruction on start/stop frequency shown in the table of point 7.10.

**7.10 Start / Stop Frequency**

Standard of Start / Stop Frequency is shown in the table below.

| Motor output      | Frequency                           |
|-------------------|-------------------------------------|
| 7.5kW & less      | Less than 25 times an hour          |
| 11kW ~ 22kW       | Less than 20 times an hour          |
| 30kW ~ 55kW       | Less than 20 times an hour          |
| 55kW & over       | Less than 20 times an hour          |
| Starting interval | More than 3 min. after stopped once |

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## 8 Regular Maintenance

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For precious systems, the maintenance check is to be performed in a shorter cycle than the frequency recommended in the table below.

### 8.1 Pumping Volume check Once a week

In case that a flow meter is not equipped, check total head at shut-off and see the parameter is close to the test data or not.

### 8.2 Amperage check Once a week

Measure the amperage and check if it is close to the test data.

### 8.3 Vibration and Noise check Once a week

Check if there are any unusual vibrations and noise occurred during operation.

### 8.4 Insulation Resistance check Once a week

Measure the Insulation Resistance value once a month.

Insulation Resistance value capable to run the pump is  $1M\Omega$ . In case of showing a sharp drop in the gauge even at a bigger value, carry out the measuring in a shorter cycle.

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## 9 Periodical Maintenance

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If there are any unusual symptoms shown, try to get a professional inspection and service.

For precious systems, lift up the unit for check and inspection one year after the installation. Fix up the time of next inspection and service according to the status of the unit.

For overhaul service, need to send back the unit to the factory. Consult with your distributor to get the service.

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## 10 Troubles Shooting

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Whenever any inconveniences happened, report the trouble to your distributor.

Possible causes and solutions of troubles are indicated in the table below. Inspection works are to be performed by authorized and qualified specialists who are thoroughly familiar with the manual.



| Phenomenon                      | Possible pump problems                          | Solutions   |
|---------------------------------|---|---|
| No water delivered              | Well water level too low                        | Wait until well water level is restored, or if possible, lower pump further |
| Insufficient flow rate          | Suction screen clogged                          | Pull out and clean it   |
| Insufficient pressure           | Discharge valve closed or blocked               | Find and replace defective valve  |
|                                 | Pump silted up                                  | Pull out and clean it   |
| Starts and stops too frequently | Wrong direction of rotation                     | Carry out instruction as per 4.2  |
|                                 | Pump capacity exceeds well capacity             | Replace pump with one of lower capacity                                     |
|                                 | Leaks in system                                 | Locate leaks and repair   |
|                                 | Worn pump                                       | Pull out and overhaul it  |
| Excessive current flow          | Pressure switch or level control improperly set | Adjust setting  |
|                                 | Tank too small                                  | Replace tank with larger one  |
|                                 | Cable and motor defective insulation            | Pull out and overhaul or exchange   |
|                                 | Mechanical friction                             | Pull out and overhaul it  |

