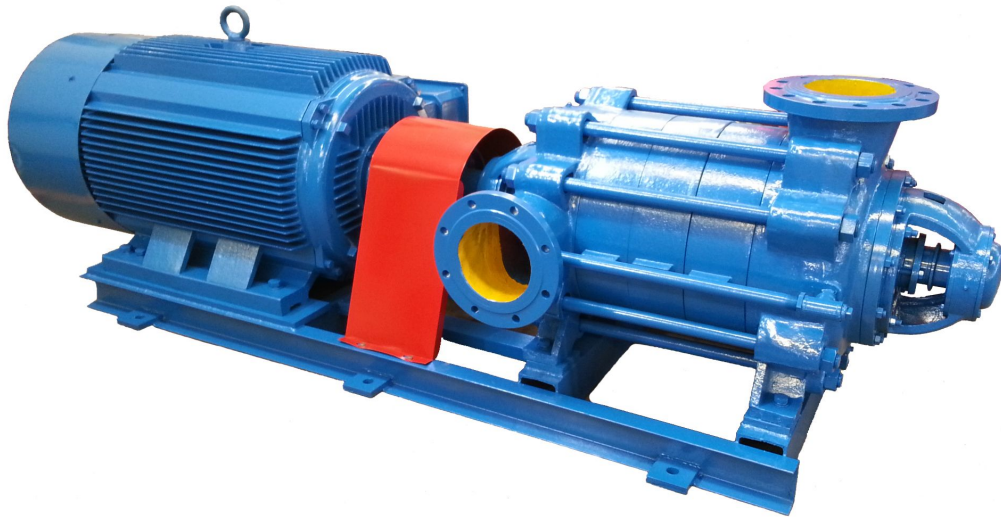


D, DM, DF, DG, DY Type Horizontal Multistage Centrifugal Pump



Production Manual

SHANGHAI PACIFIC PUMP MANUFACTURE (GROUP) CO.,LTD

WARNING !

Please carefully read the manuals of this product and the relevant corollary ones before use and follow the safe operation provisions therein during installation, use and repair.

Do not let the pump work for a long time with a small or zero flow, otherwise the vibration with the pump unit and even vaporization with the liquid being pumped would be caused, leaving personal injury and equipment damage.

As the pump is a rotating equipment, so the power must be cut off before to install or repair the pump unit in order to avoid personal injury.

Before use of the pump, check if the cable is broken, bent and well grounded and, during work, never let your hand in or remove the protective cover in order to avoid personal injury. Do not start the pump after turning on the power until its moving direction being checked correct by spot-pressing the switch button.

As of the corollary motor used in the coal mine, the one in YB2 series is ok, but can not be used for the mining surface, for which the one in YBK series is workable. Those in Y series can not be used inside of mines.

Mount a clutch protective cover for the sake of personal safety.

To prevent both pump and motor shafts from being against with each other to cause breakdown and even the motor's burning-out after the pump starts moving, first pull the pump shaft outward towards the pump clutch to the utmost extent before adjusting the interval between the two clutches pf both pump and motor and then adjust it according to the requirement set forth in the manual.

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Description of Selecting Pump

(1) Pump performance see sheet of performance data. The data in sheet is test performance at 1 atmosphere & normal temperature & clean water, when the medium is high viscosity, the performance should be transformed.

(2) The pump type, data and gravity, temperature, viscosity, corrosive feature etc must be stated in the order.

(3) If the required data is different from the data in sheet of performance data, our company also can design according to your requirements.

1. Product Introduction

The serial pump is multi-stage section centrifugal pump, the excellent hydraulic models are high-efficiency, energy-saving, and have wide performance range, operating safety & steady, low noise, long life and installing & repairing is very convenient etc. It can deliver heat water, oil, corrosive or wearable medium by changing the material, seal or adding cooling system.

Type D pump can deliver water without solid particle or the liquid which the chemical and physical feature are similar with water and temperature is $\leq 80^{\circ}\text{C}$, it is suitable for delivering water in mine and urban water project etc.

Type DG pump can deliver clean water without solid particle or the liquid which the chemical and physical feature are similar with water, and temperature is $\leq 105^{\circ}\text{C}$, it is suitable for delivering boiler feed water or heat water.

Type DM pump can deliver the neutral mineral water which solid particles percent $\leq 1.5\%$ (solid Dia. $< 0.5\text{mm}$) and other similar sewage, the temperature of the liquid is $\leq 80^{\circ}\text{C}$. It is suitable for steel works, mines, cities projects etc.

Type DF pump can deliver the corrosive liquid without solid particle, which temperature is from -20°C - 150°C

Type DY pump deliver oil or oil products without solid grain, viscosity $\leq 120^{\circ}\text{C}$, range of temperature is from -20°C - 150°C .

Inlet pressure of pumps is less than 0.6MPa.

Performance Range

Capacity Q: 3.75 - 840 m³/h

Head H: 19 - 680 m

The Description of Pump Type

D(DG, DM, DF, DY)450-60*4

D - Multi-stage horizontal centrifugal pump

DM - Multi-stage wearable centrifugal pump

DF - Multi-stage anti-corrosive centrifugal pump

DY - Multi-stage centrifugal oil pump

450- The flow is 450m³/h at design point

- 60 - The single stage head is 60m at design point
- 4 - The number stage is 4 stages

125D25*5

- 125 - Inlet dia. is 125mm
- D - Multi-stage horizontal centrifugal pump
- 25 - The single stage head is 25m at design point
- 5 - The number of stage is 5 stages

2. Structure Specification

Type D, DG, DM, DF, DY pump is consist of stator, rotor, bearing, shaft seal:

(1) Stator: The main parts are suction casing, stage casing, discharge casing and diffuser, they are screw up by poles, to become a working house. The suction direction of type D pump is horizontal, the discharge direction is upward; the discharge and suction direction of type DG pump are both upward; the discharge direction of type DM, DF, DY pump are upward, and the suction direction is horizontal usually, also can be made upward as user's requirement.

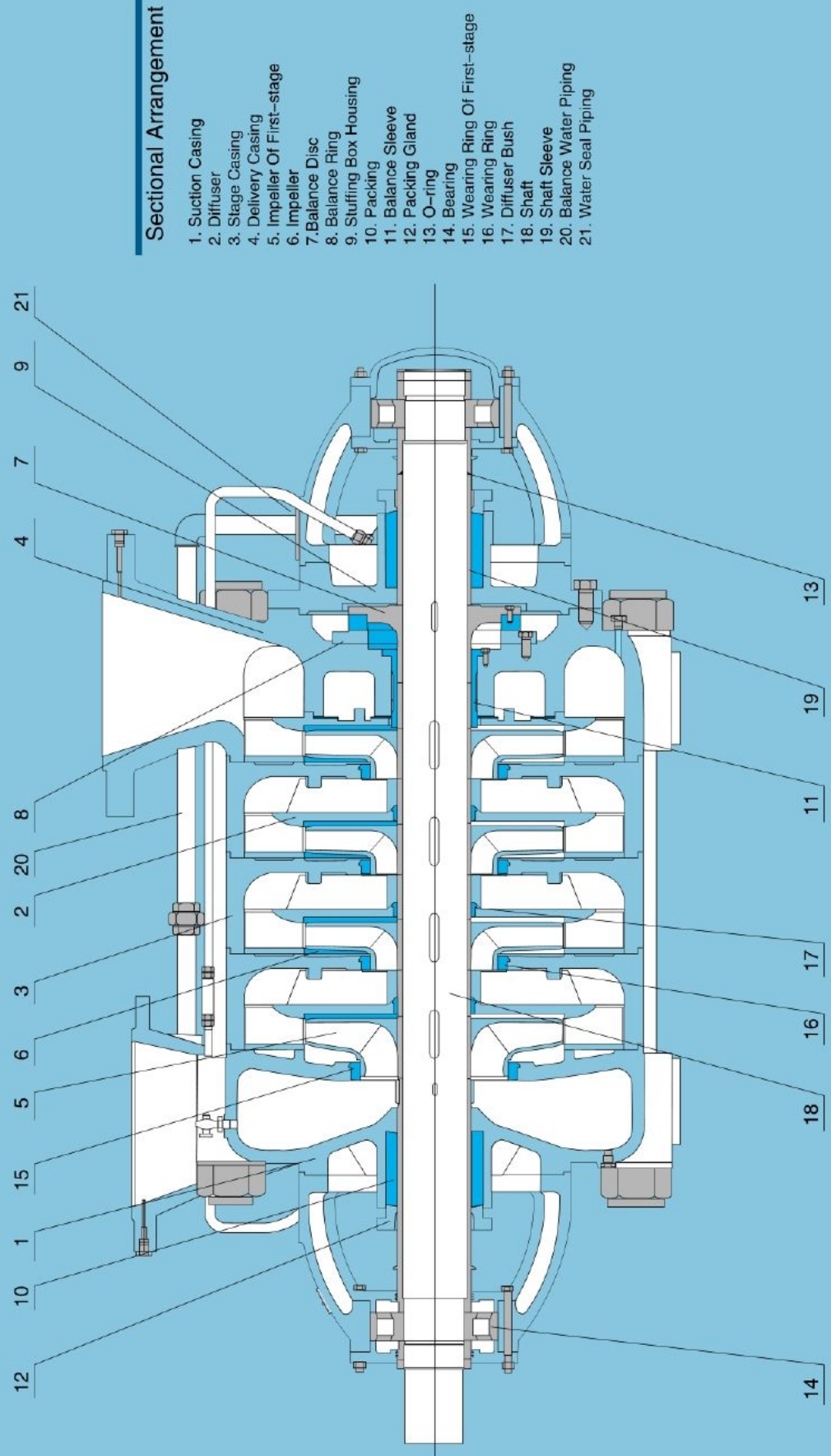
(2) Rotor: It is consist of shaft, impellers, balance disc and shaft sleeve etc. Shaft supplied power to impeller; The axial force is balanced by balance disc; The sleeve mounted on shaft to protect shaft.

(3) Bearing parts: It is consist of bearing body, bearing and bearing cover etc. The bearing of type 85-67, 155-67, 600-60 pump is sliding bearing, lubricated by diluted oil, the other pump bearing is rolling bearing, lubricated by grease.

(4) Shaft seal: It is usually adopted soft packing seal, consist of sealing house on suction casing, packing, blocking water ring, the sealing house have some pressure water, to cool, lubricate and seal pump. Type D pump pressure water come from pump itself, type DG, DM, DF, DY pump pressure water is come from pump itself or outer water. Type DG, DF, DM, DY pump usually adopt mechanical seal.

(5) Drive: The pummp is driven directly by motor through elastic coupling. The rotaton of pump is clockwise looking from motor to pump.

Sectional Arrangement Figure for Type D、DG、DM、DF、DY Pump



Sectional Arrangement

1. Suction Casing
2. Diffuser
3. Stage Casing
4. Delivery Casing
5. Impeller Of First-stage
6. Impeller
7. Balance Disc
8. Balance Ring
9. Stuffing Box Housing
10. Packing
11. Balance Sleeve
12. Packing Gland
13. O-ring
14. Bearing
15. Wearing Ring Of First-stage
16. Wearing Ring
17. Diffuser Bush
18. Shaft
19. Shaft Sleeve
20. Balance Water Piping
21. Water Seal Piping

3. Assembly and Detection of Pump

The assembly quality of the pump will result in a notable affection to the performance and the running stability of it and can not be guaranteed unless the technical requirements in the drawings are strictly followed in the assembly, such as on the alignment between the centers of the impeller's outlet and the guide vane's inlet, the uniform values of the sealing intervals of both rotor and stator portions etc.

(1) Rotor

It takes two bearings are the support and measure the circle jumping values of the oraling of the impeller, the impeller's baffling sleeve (or rear navel), the balancing baffling sleeve and the muff, respectively, and the jumping value of the balancing disk's end-face, which should conform the requirements in the figure of the jointed parts of rotor (Fig. 2)

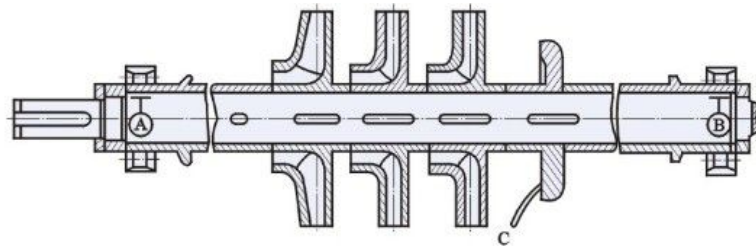


Fig. 2

For the nominal radial intervals of the seal rings of both pump casing and impeller, upon the table below:

Nominal size(mm)	30-90	>90-120	>120-180	>180-250	>250-500	>500-800	>800-1250	>1205
Diameter interval(mm)	0.3-0.4	0.4-0.5	0.5-0.6	0.6-0.7	0.7-0.85	0.85-1.2	1.2-1.6	1.6-2

For the allowed radial jumping error of each part of the assembled rotor, upon the table below:

Part	Nominal Diameter	≤50	>50-120	>120-260	>260-500	>500-800
Seal ring of impeller(A-B)		0.08	0.10	0.10	0.12	0.15
End-face jumping of disk C(A-B)		0.05	0.05	0.06	0.08	0.08

(2) Stator

Measure the axial serial amount of the rotor and the end-face jumping value of the balancing ring(s) sleeve, which should conform the requirements in the overall assembly drawing.

(3) At the end of assembly, move the rotor with hand to check if there's frictional sound, non-flexible movement etc. Abnormal condition inside of the pump.

4. Installation of Pump

1. Preparations before erection:

- (1) The pump's basis must be enough strong, the mass of which should be approximately 3-5 times that of the unit.
- (2) Check both pump and motor to see if there is any loss of the pump's parts and any damages during transportation.
- (3) Make ready the tools and lifting machinery.

2. Sequence of erection:

- (1) Place steel pad and wedge under the foundation. Hook the four angles of the foundation with the lifting hooks to lift it on the ground and then slowly place it on the position with each bolt hole aimed at.
- (2) Level up the foundation, tighten the foot bolts and pour slurry onto the foot.
- (3) Adjust equipments. There should be an interval between both pump and clutch of the motor and the axes of both pump and motor should be coincided. For the two clutches, the evenness of the end-face intervals of both can be measured with a feeler, the allowed tolerance of which is 0.06mm, and the intervals between the rulers, which are used to measure in every direction along with the circumferences of both, on the surfaces of both excircles have an allowed tolerance of 0.08mm, use the adjusting pad to adjust in case of unconformity.
- (4) Link both inlet and outlet pipelines and both vacuumometer and piezometer at both inlet and outlet sections. Pump transport and handling

Attention:

The total weight of the delivered goods is recorded in the delivered descriptive file.



3.1 The transport and mobile

Strictly follow the general regulations of engineering and the rules of preventing accident from happening. Do appoint qualified supervisors to supervise all transportation and handle tasks. Check the transportation facility so as to make sure of it available with a qualified carrying weight. Make it sure for the heavy load to be safe without displacement during the transportation.

Never let any person go through or stand under the heavy load being lifted.

3.2 Lifting equipment

The lifting equipment shall have a proper type and lifting capacity. Only such a method that has been approved safe in the process of heavy equipments can be used. In the selection of a proper lifter, the weight of all the operations carried out by it (lifting arm, locking chains, hanging hooks etc.) and the lifting equipment shall be considered into the total weight of the portion to be processed. The lifting equipment shall be capable of safely lifting the heaviest object.

Attention:

In the case without the pointed lifting equipment, the operator shall use the lifting equipment which is normally workable, safe and has a proper loading capacity.

3.3 Lifting

3.3.1 Lifting rope

Make it sure to use a lifting rope suitable for the load and it is not allowed for the rope to damage the load and to damage itself either.

Make it sure for the safe working load of the selected rope to be enough for the decided lifting method.

Make it sure for the selected rope to be in a good state and the damaged rope shall be replaced at once.

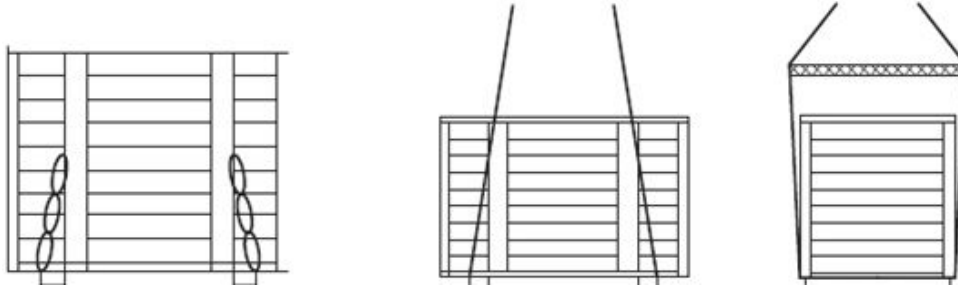
Make it sure for the load to be steady in the lifting process and for the rope to be connected to the pointed lifting point.

3.3.2 Rope connected object/binding the crate

Please follow the warning notice on the crate to perform correct rope binding and selection of the lifting equipment so as to guarantee steady lifting.

The lower-left figure shows an example of the crate mark, used to indicate the correct position of the rope. Similar to the outside mark, the crate shall be kept at the same direction.

The two figures on the right side present the recommended method for lifting the crate. An isolator shall be used on the upper of the crate to protect both sides of it from getting compressed by the rope.



3.3.3 Lifting the pump apparatus or the main part of the equipment

- a. A safe lifting equipment of a proper loading capacity.
- b. Both weight and size of the lifting equipment shall be taken into consideration sufficiently for the lifting steps.
- c. When to handle the pump, the hanging hooks of the lifter shall be placed under the foundation and a fork lifter can also be used. It is not allowed to place the hooks in the bolt holes of the pump and the prime mover or on the bearing bodies of the pump, much less on the pump shaft.
- d. Pay attention to the carrying capacity of the lifting equipment in the arrangement of the lifting rope and other lifting equipments, and the position of center of gravity as well so as to maintain the leveled lifting. It is necessary to be careful in the lifting so as to avoid destroying the fittings or other assemblies and to pay attention to avoiding collision between the pump parts and especially the damage on the processed fitting surface of the shaft at the pump coupling.
- e. For the sake of changing the arrangement for installation or storage, supports of an enough quantity shall be provided to prevent them from bending, when slide blocks or crossbars are used to support the equipment.
- f. Do not pile up the equipment.
- g. Never let foreign matters or dust into both pump and motor during the handling.



The fixing method for lifting the pump apparatus or the main parts of the equipment shall be that appointed or approved. As of other lifting points, such as the lift-ring bolt on the casing, they are designed only to lift individual parts and unable to lift the overall equipment. It is not allowed to wrap the lifting rope around the pipeline, instrument etc. devices in the assemblies lifting.

4. Unpack and check

Unpack and check, when the pump arrives at the user's place, if there are pump parts lost or damaged during the transportation and, if so, send a statement to the transportation department and the pump manufacturer at once.

5. Temporary storage

When the pump needs to be stored for a period of time before installation, it still needs to be packed and shall be placed on a dry, rainproof, dust-proof proper ground, with its vomit and suck-in ports covered to prevent foreign matters from getting in. The pump shaft, bearing and other precisely processed parts shall be prevented against wetting and coated with protective oil layer.

5. Start, Run and Stop of Pump



Turn the pump once per two weeks and make sure of the turning flexible.

The connection of the power supply to both motor and control equipment can be implemented by the special technicians.



Carefully read the manual of the electric equipment manufacturer, the national standard of the electric device and the related norms of law of the local power supplier.

Both pump and related equipments shall be grounded strictly.

Start:

- (1) Check if the oil level of the bearing is normal before start in case of the thinned oil lubrication.
- (2) Check if the rotary direction of the motor is correct before start.
- (3) Before start, first move the pump's clutch with hand to see if the moving part of it is flexible and, in case of a sliding bearing, move the pump 5-10 minutes or fill 10-20ml oil into the oil hole on the upper to have the bearing uniformly lubricated.
- (4) Before starting the pump, check if the pull bar is tightened.
- (5) Check if all meters, instruments and valves are normal.
- (6) Before start, pour water into the pump or extract the air inside of it and close the gate valve on the outlet pipeline and the piezometer's plug, then get through the circulated cooling water pipeline of the sliding bearing.

(7) after start, open the piezometer's plug and the vacuumometer's as well, and gradually open the gate valve to wait till the pointer of the piezometer pointing at the desired position.

Run:


1) Pay attention to the temperature of the pump's bearing after it is started, the average temperature rise should not be over 30°C and the maximum one 75 °C. Often fill oil during its running.

(3) 10-20 drops per minute is taken as the normal leakage of water for the stuffing room, otherwise, the stuffing gland has to be adjusted. Periodically check the clutch.


(4) Stop running at once in case of a failure during it and carry out service according to the troubleshooting table.


Stop:

Slowly close both gate valve and piezometer's plug on the outlet pipeline and the plug of the vacuumometer on the inlet one, then cut off the power of the motor and, finally, stop the circulated cooling water of the sliding bearing.

 **Warning:** Idle running is forbidden!

6. Maintenance and Service

 Prior to stopping the pump for repair, please do cut off the power! And present "This equipment is in repair" on the switch of the main power!

 For the sake of safety, set a proper obstruction around the working area and never let any persons irrelevant to the work in, especially in the place where the pump apparatus are moved away.

After installation or maintenance, check all the fixing and connecting bolts for safety.

1. Maintenance:

(1) Check if the pump's foundation, pump and motor are tightened.

(2) Check the status of the lead-wires of the meters and if the pipeline leaks or is loose.

Replace the lubricating oil of the bearing. Periodically check the performance and running status of the pump and make a detailed record, carry out service at once if case of a problem.

2. Assembly and removal:

1) Preparations before removal:

- (1) Drain the liquid inside of the pump out.
- (2) Remove the attached pipelines affecting the removal.
- 2) Steps of removal:
 - (1) Screw out the bolt on the bearing gland on the outlet side and the link-nuts among the outlet section, stuffing content and bearing body to remove the latter. Screw out the screws on the bearing gland, dust-proof disk and bearing cover in case of the sliding bearing to remove the gland, cover and both upper and lower liners, then screw out the nuts among the bearing body, stuffing content and outlet section on the outlet side to remove the former.
 - (2) Screw out the round nut on the shaft, remove the bearing's inner ring, bearing gland and baffle sleeve in turn, then remove the stuffing content (including the stuffing gland stuffing ring, stuffing etc.).
 - (3) Remove the O-ring of seal, muff, balancing disk and pin in turn, then remove the outlet section (including the final-stage guide vane and balancing sleeve)
 - (4) Remove the final-stage impeller and pin, then the middle section (including the guide vane). Go on removing the impellers, middle sections and guide vanes of the left each stage with the same way till the first-stage impeller's removal.
 - (5) Screw out the link-nuts between the inlet section and the bearing body and the bolt on the bearing gland, then remove the bearing part (before this, first remove the pump's clutch).
 - (6) Take the shaft out of the inlet section and screw out the fixing nuts on it, then remove the bearing's inner ring, O-ring of seal, muff, baffle sleeve etc. in turn.

The removal has been basically finished at that time, however, there are some parts still connected with each other then, which are convenient to be removed generally just by screwing out the link-nut or bolt.

To assemble it is to take the reversed sequences to remove in general, when to assemble the sliding bearing, both liner and shaft should be paired and scraped and it is required there are over 7 points per square inch on the liner, the interval between the liner and the upper shaft should be 0.15-0.18mm and of the single side on sides 0.075-0.09mm.

7. Failures and Troubleshooting

Failure	Causes	Troubleshooting
1. Pump not suck in, pointers of pressure gauge and vacuum meter severely jumping	Water injected into the pump insufficient, air leaks from wter inlet pipe, meter etc.	Inject water inot pump, tighten the leaking places
2. Pump not suck water, high vacuum shown on vacuum meter	Foot valve not opened or blocked up, too big resistance with water sucking pipe, too high suck-in height	Correct or replace foot valve, clean or replace water sucking pipe, lower the height.
3. Pressure available at pump outlet viewing from pressure gauge while no water out of pump	Too big resistance with water outlet pipe, wrong rotating direction, impeller blocked up, or pump damaged, insufficient r.p.m	Check or shorten outlet pipe, check motor, remove the pipe union, clean or replace impeller, raise r.p.m
4. Insufficient flow	Pump blocked up, too much friction with seal ring, insufficient r.p.m	Clean pump and pipe, replace seal ring, raise r.p.m
5. Too big power the pump consumes	Too tightly pressed packing gland, packing room heated, impeller worn out, water supply quantity of the pump increases	Loosen packing gland or replace packing, replace impeller, increase resistance with outlet pipe to reduce the flow
6. Abnormal sound inside of pump, no water into pump	Too big flow, too big resistance inside of water sucking pipe, too high water sucking height, air gets in the water sucking place, too high temperature of the liquid being transported	Increase the resistance inside of water outlet pipe to reduce the flow, check water-sucking pipe and foot valve, lower the height, tighten the air leaking places.
7. Pump vibrtes	Axes of pump and motor not on one central line, dirt or water gets into the bearing	Align the two central lines, clean bearing, replace lubricating grease
8. Bearing overheated	Lubricating grease dried or dirty, axes of pump and motor not on one central line	Check or clean bearing, replace lubricating grease, align central lines
9. Balancing water stops, balancing room heated, motor's power increased	Pump runs under a big flow and low head, grinding occurs between balancing disk and board	Close outlet valve to the designed working condition, remove balancing disk for repairing.

Our company reserves the right of improving the product design and changes it without notice.



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