



Installation, Operation and Maintenance Manual

MODEL VPF

VERTICAL MIXED FLOW PUMP

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Safety Page

1. Safety Precautions

- This manual contains useful instructions with regard to safety and the drawings necessary for putting into service, maintenance, inspection, and checking of correct operation. Be sure to completely read this Operation Manual and other attached documents before installation, operation, maintenance or inspection of this pump and to use this pump properly. Read all about the knowledge, safety information and precautions concerning the equipment prior to using it.
- In this Manual, precautions have been classified into "DANGER", "WARNING", "CAUTION", and "NOTICE".



DANGER

This indicates an urgent and dangerous situation that could result in a personal serious injury or loss of life unless it is avoided. This will be used only for an extremely dangerous situation.



WARNING

This indicates a dangerous situation that may result in a serious injury or loss of life unless it is avoided.



CAUTION

This indicates a dangerous situation that may result in a slight injury or an injury of intermediate degree unless it is avoided.

NOTICE

This indicates a message related to the safety of persons or the protection of equipments (loss of property)

- Even an item indicated by "NOTICE" has the possibility of causing a serious result depending on the situation. You have to strictly observe the precautionary messages since they all explain important matters.
- General safety precautions for this product will be explained after the next paragraph and should be observed, together with the above.

2. Exemption Clauses

We are unable to take the responsibility for any incongruence created due to inobservance of the items described in the Operation Manual.



3. General Safety Precautions

1. Precautions for using the product

- 1) Persons appointed to the pumps installation, operation and maintenance shall be well trained and shall have a close knowledge of safety rules. During operations, unauthorized persons shall keep away from the work area.
- 2) Rotating parts are present in the equipment when in operation. No person shall come close to the rotating portion of the pump during operation, in order to avoid being caught by the machine.
- 3) Persons shall wear appropriate protective equipments, like hard hat, safety footwear and others, in the work area, regardless of whether or not the pumps are in operation.

2. Precautions for maintenance and inspection

- 1) Our hope concerning the modification of the functions
If you want to change the functions of the main body and auxiliary equipment, please give us an order for this change.
- 2) Our hope concerning the replacement of parts
If you replace consumable parts or the like during maintenance and inspection, please use our genuine parts.
- 3) Confirmation of working environment
 - a) Arrange the area around the pump in orderly fashion by taking unnecessary objects away from the pump prior to the start of operation. Also, check the ambient situation (temperature, state of ventilation, brightness, etc.) and confirm that there is no safety problem.
 - b) Check whether the tools required for the work are all available and are all in good condition.
- 4) Prevention of accidents
 - a) When carrying the parts by a crane, no one shall stay below the suspended load.
 - b) When handling the parts by hand, be careful not to get your hands caught between two parts.
 - c) When lifting a large part, use a chain block or the like, and gradually raise the load while keeping it horizontal.
If a load is moved while it is unbalanced and slanted, then the suspended load may collapse, resulting in injuries or damaged parts.
 - d) For the prevention of electric shock, cables and the like should be removed only after interrupting all the electric systems, and after connecting them to the ground line to release the electric charge.



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3. Actions to be taken after problems have occurred

If problem have occurred, please inform DMW Corporation of the following items:

- 1) Information contained on pump name plate (Production No., Type, Total Heads, Discharge, Number of Revolutions, Year & Month of Production, etc.)
- 2) Situation of the pump (please inform DMW Corporation of the situation of ther pump in detail, including the state of the pump before and after the occurrence).



4. Important Warning Items



WARNING

- Do not lift the whole body of the pump by a suspension lug of the discharge elbow. Doing so may result in death or a serious injury, if the equipment falls due to a break in the suspension lug or the like.
(2.1 Caution during assembly)
- If the pump stops during operation due to power interruption, first turn off the circuit breaker to avoid automatic start-up as a result of a sudden power recovery. Then, take necessary measures.
(3.4 Caution during operation)
- Never touch the rotating element until the rotation of the shaft has completely stopped. Otherwise, there is a possibility of being caught and injured by the rotating element.
(3.5 Caution before pump stop)
- The pumps usually equip protective devices like coupling guard. Never uninstall them.
- When the pumps with instruments, like vibration sensor, are used in hazardous location, safety barrier relays must be equipped between monitor and transducer. Check safety barrier relays equipped in electrical circuit.
- Material of pumps are usually safe ones. However check that materials comply with local regulations in reference to attached MSDS (Material Safety Data Sheets).
- Design temperature of lifting liquid of model VPF is from 0 to 60 degrees Celsius. Check the individual specification of the pump on attached pump data sheet and confirm that ambient conditions are in accordance with the pump specification.
- Maximum allowable load of the pumps from downstream pipings is shown in the attached general arrangement drawing. Check the load from pipings before pump installation.
- Requirement for electrical connection to the pump motors is shown in the attached Requirement for Electrical Connection to Motors. Check and confirm electrical system before pump installation



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CAUTION

- Be sure to read the Operation Manual before using the pump.
- The pump must be run only in its normal rotating direction. Otherwise, the equipment is liable to be damaged. Refer to the Pump Outline drawing for the rotating direction.
(3.2 Caution during initial operation)
- Never touch the rotating element when adjusting gland packing during pump operation.(3.4 Caution during operation)
- If you require repairs or function changes for the pump, please give us an order for the repair or change. If customers repair or change the functions by themselves, we can take no responsibility for the results.
(4.5 Disassembly and inspection)
- Please use our genuine parts as replacement parts. If parts other than our genuine parts are used, the pump performance may become unsatisfactory or an unexpected situation may even result in some cases. Also, we can take no responsibility for any problems created because our genuine parts were not used. (4.7 Spare parts)



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NOTICE

- Work should be started after performing curing work to prevent dropping of nails, bolts or small steel pieces into a suction sump or inside of the pump during the work. Otherwise, the pump and auxiliary equipment are liable to be damaged by suction.
(2.1 Cautions during assembly)
- Be careful not to break the submerged bearing by hitting it on the shaft end of the main shaft or the edge of the sleeve.
(2.1 Cautions during assembly)
- Avoid eccentricity by applying an excessive load to a discharge elbow during flange coupling with the piping at the discharge side. Otherwise, it may cause vibration, a damaged bearing, or bending of the main shaft.
(2.1 Cautions during assembly)
- If the levelness during the initial setting of pump base exceeds 5/100 mm against every 1meter, then it is likely to cause vibration. In this case, the pump bases should be set again. Also, if the allowable value shown in Table 2-1 is exceeded during disassembly and inspection, it is necessary to review whether the pump can be reassembled or not. Please inform us of the necessity of the review.
(2.3 Levelness of pump bases)
- Apply fresh water to synthetic rubber bearings when inserting the lower shaft into these bearings. Without water application, rubber may be seized and burnt, resulting in more serious damage.
(2.4 Assembly of pump)
- If any damage to the paint coat is recognized after disassembly, then touch-up painting is required. If nothing is done, then corrosion or the like may occur. (2.9 Disassembly, 4.5 Disassembly and inspection)
- At the time of reassembly, sealing parts such as sheet packing, O-rings and the like should be replaced with new ones. Reuse of sealing parts may cause a leak and thus should be avoided.
(2.9 Disassembly, 4.5 Disassembly and inspection)



Safety Page

NOTICE

- If shut-off operations are carried out for more than 5 minutes, the liquid temperature in the pump will rise. If a high temperature occurs, then a discharge bowl or the like may be deformed thereby damaging the pump.
(3.3 Caution during starting)
- Be careful not to tighten the gland too much. Excessive tightening of the gland may cause burning or wearing of the sleeve.
(3.4 Caution during operation)
- If the pump is operated for a long time below the minimum allowable operating water level, then air suction may occur and vibration and damage to the impeller may be caused, by which the life of the pump may be adversely affected.
(3.4 Caution during operation)
- Confirm the kind of oil on the name plate and lubricate. Lubrication with a different kind of oil is liable to damage the bearing.
(4.2 Maintenance of thrust bearing)
- Re-filling of lubricant must be performed through a filter.
(4.2 Maintenance of thrust bearing)
- It should be noted that the supplement of a large amount of grease may generate heat due to agitation.
(4.2 Maintenance of thrust bearing)



Chapter 1 Introduction

1.1 Pump construction

This manual is intended for the user of the fan (blower) to thoroughly understand their correct usage. The vertical mixed flow pump has a main part in which comprises an outer casing portion and a rotating portion. Recommended lubricants, fluids, chemical

1) Outer casing portion

This is comprised of a suction bell, a discharge bowl, a discharge elbow and a stuffing box which may be a part of a discharge elbow (refer to the attached pump general arrangement drawing).

The suction bell is for forming the suction opening for the pump and was so designed as to effectively guide the lifted liquid to the impeller.

The discharge bowl is a diffuser type. The pressure is increased while guiding the flow from the impeller in the axial direction.

A discharge elbow works to guide the flow of lifted liquid from a discharge bowl to piping at the discharge side. A stuffing box is a shaft seal device provided at a through shaft passage for the discharge elbow.

Also, the total weight of the outer casing portion is transferred to a pump base through the discharge elbow.

2) Rotating portion

This is comprised of a connecting shaft, a shaft coupling, a main shaft and an impeller.

The motor, connecting shaft and main shaft are connected by shaft couplings, and an impeller gives lift and centrifugal force to the lifted liquid by rotation, thereby performing pumping action.

At the portion where the main shaft slides with the submerged bearing and the shaft seal device, a sleeve is provided and the wear of the main shaft itself is prevented.

Also, the weight of the rotating element and a hydraulic thrust, (axial thrust) in axial

Direction due to a water pressure difference at the inlet and outlet of the impeller during operation are supported by the thrust bearing of the pump.



Chapter 2 Assembly and disassembly

2.1 Cautions during assembly

NOTICE

- Work should be started after performing curing work to prevent dropping of nails, bolts or small steel pieces into a suction sump or inside of the pump during the work.
Otherwise, the pump and auxiliary equipment are liable to be damaged by suction.
- Be careful not to break the submerged bearing by hitting it on the shaft end of the main shaft or the edge of the sleeve.
- Avoid eccentricity by applying an excessive load to a discharge elbow during flange coupling with the piping at the discharge side. Otherwise, it may cause vibration, a damaged bearing, or bending of the main shaft.
- Some long parts of the pumps, like column pipes, involve a risk of over-turning. Keep them laid down in storage until just before assembling work.

- 1) Special assembly and disassembly tools have been designed specially for the pumps and furnished as accessories for the assembly, disassembly and inspection of the pump. Be sure to use these after looking at the list of assembly and disassembly tools attached. Maximum lifted weight at assembly and disassembly work is shown in attached general arrangement drawing.



WARNING

- Do not lift the whole body of the pump by a suspension lug of the discharge elbow. Doing so may result in death or a serious injury, if the equipment falls due to a break in the suspension lug or the like.

- 2) The Parts must be lifted with the wire, which has sufficient strength.
- 3) For lifting up or lowering, carefully consider the wire position and proper protection for wire to prevent the product being damaged.
- 4) Do not remove protection tape around the threaded portion at the end of the main shaft.
- 5) Carefully handle the main shaft so as to prevent its bending by an excessive load applied.
- 6) When installing the impeller and coupling into the main shaft, carefully give a whirl-stop by folding and bending the lock plate, set screw or using another methods.



Chapter 2 Assembly and disassembly

- 7) Protect the mating face, fitting portion and sliding portion of each part so they are not damaged.
- 8) Assemble the column pipes in the correct order referring their serial numbers.
Serial numbers are stamped on the outer periphery of the column pipe flanges.
- 9) Wipe clean all the flange surfaces and other contact surfaces and then start assembling.
- 10) For tightening flanges or shaft joints, be sure to assemble while aligning the match marks on the outer periphery of the flanges.
- 11) Tightening of bolts must be performed using the specified torque.^(*1)
- 12) Be sure to apply sealant to the mating faces fitting portions of the parts and prevention material for screw loosening, in accordance with attached "Sealant Application Manual".
- 13) Recommended lubricants, fluids, chemicals must be prepared and filled in prescribed portions, in accordance with attached "Recommended Lubricants, Fluids, Chemicals & Consumption Schedule (Lubricants Oil List)".
- 14) Be sure to perform painting work after assembly to mating faces of painted parts.

(*1) Refer to the included Tightening Torque Control Enumeration.



Chapter 2 Assembly and disassembly

2.2 Receiving, handling and storage

2.2.1 Receiving

The pumps shall be thoroughly inspected when received to check for any damage which may have occurred during transportation. Any damage shall be promptly reported to DMW.

2.2.2 Handling

The pumps are disassembled after pump running test at the factory and are shipped in some packages separately.

Make sure that load capacity of lifting devices is appropriate to the mass indicated on the package.

2.2.3 Storage

If the pumps are not put into service immediately, do not remove the anti-corrosion compound and make sure they are stored in a clean and dry location.



2.3 Levelness of pump base

When setting the pump base, confirm that the pump base is level by using a level.
(Reconfirm also during disassembly and inspection of the pump.)

NOTICE

- If the levelness during the initial setting of pump base exceeds 5/100 mm against every 1meter, then it is likely to cause vibration. In this case, the pump bases should be set again.
During disassembly and inspection, it is necessary to review whether the pump can be reassembled or not.
Please inform us of the necessity of the review



2.4 Assembly of pump

- 1) Put the suction bell on a assembly-disassembly tool .
Fix the impeller to a shaft and put it on a suction bell.
At this time, adhere the impeller closely to the suction bell so as to make the lower shaft selfstanding.

NOTICE

- Apply fresh water to synthetic rubber when inserting the lower shaft into these bearings. Without water application, rubber may be seized and burnt, resulting in more serious damage

- 2) Slowly lower an assembly of the discharge bowl with the rubber bearing, and the column pipe and bearing spider through the lower shaft, and assemble the suction bell and discharge bowl. .
- 3) Slightly lift the pump portion assembled up to now and remove the assembly-disassembly tool.
Lower it from the pump base opening to inside of the sump and receive the flange or the temporary seat of the column pipe by means of assembly-disassembly tool.
In similar way, Assemble the column pipe and column pipe hunger after the assembling the shaft and the intermediate shaft coupling.
- 4) Assemble the discharge elbow with the stuffing box. However, assemble the gland packing and packing gland after centering.
Assemble the thrust bearing unit and the flexible disc coupling at pump side.
- 5) Assemble the driver pedestal.
Assemble the motor to the driver pedestal.
Also, insert in advance the flexible disc coupling at motor side into a motor shaft end.



2.5 Confirmation of assembly

After assembling the pump, confirm by the following procedure that the rotating element, such as the impeller and main shaft, are not in abnormal contact with the stationary portions, such as the discharge bowl and shaft bearing.

- 1) Attach an eye bolt to the top of the main shaft, and lift the rotating element of the pump with a chain block.
- 2) Slightly lift the rotating element with a chain block until they are slightly floated and slowly turn the shaft coupling by hand and check its turning condition.
- 3) Next, carefully lift the rotating element until the impeller hits the discharge bowl and the main shaft becomes unmovable, and check the moving situation of the main shaft and measure the stroke of all of the rotating element.
- 4) Slowly lower the rotating element and adhere them closely to the casing liner in the case of VPFO type, and adhere the suction bell to the impeller in the case of VPFC type. The assembly is good if there is no abnormal condition observed



2.6 Centering

After confirmation of the pump assembly, mount a driver and perform the centering work.

- 1) Attach a dial gauge to the flexible disc coupling on the driver side, turn the pump shaft slowly by hand, measure the outer diameter of the flexible disc coupling on the pump side, and move and adjust the driver so as to drop the value within the specified allowable range.
- 2) Measure the face-to-face dimension of the shaft coupling using a clearance gauge and confirm that its face-to-face dimension (parallelism) is within the allowable specified value. If the face-to-face dimension deviates from the allowable value, then slightly lift up the rotating element, then slowly lower it and repeat the steps again from (1).



2.7 Disassembly

For disassembly and inspection or repairs, the pump should be disassembled in the reverse order of the assembly procedure. For disassembly, take precautions for the following items in addition to the precautions for the assembly.

NOTICE

- If any damage to the paint coat is recognized after disassembly, then touch-up painting is required. If nothing is done, then corrosion or the like may occur.
- At the time of reassembly, sealing parts such as sheet packing, O-rings and the like should be replaced with new ones. Reuse of sealing parts may cause a leak and thus should be avoided.

- 1) Confirm the match marks during disassembly. If it is hard to see them, perform marking again and then start the disassembly
- 2) Small parts such as bolts and nuts should be classified and stored in proper containers to prevent them from becoming lost.
- 3) After disassembling the main shaft, wrap protection tape around the threaded portion at the shaft end and do not remove the tape until reassembly.
- 4) Do not remove the submerged bearing except for replacement. Also, normally do not disassemble the impeller from lower shaft.
- 5) Pay due attention to the storage of disassembled parts and never lose them.



Chapter 3 Operation

3.1 Items to be confirmed before operation

After the initial delivery or after the disassembly and inspection, confirm the following items before operation:

- 1) Confirmation of the execution of the sequence check
- 2) Confirmation of the execution of flushing of piping
- 3) Confirmation of assembly conditions
 - a) Tightening conditions of each connecting bolt for pump, driver and discharge piping
 - b) Execution of the lifting up the rotating element
 - c) Execution of the adjustment of coupling distance
 - d) Execution of centering (Par. 2•6)
 - e) Confirmation of the lubricant oil for thrust bearing

3.2 Cautions during initial operation

Problems of the pump frequently tends to occur in an early stage of pump operation, so the pump should be handled after fully understanding this Operation Manual. In the event of the occurrence of problems, stop the pump immediately.



CAUTION

- The pump must be run only in its normal rotating direction. Otherwise, the equipment is liable to be damaged. Refer to the Pump Outline Drawing for the rotating direction.

- 1) Initially perform inching when starting the pump, and increase the speed up to the rated speed after confirming that the following items are normal.
 - a) Rotating state and turn down of the main shaft are smooth.
 - b) There should be no abnormal sound at the thrust bearing portion of the driver.
 - c) There should be no odor.
 - d) There should be no abnormal vibration.
- 2) Always pay attention to the temperature change in the thrust bearing of the pump. Particularly, confirm that there is no sudden temperature rise within 30 minutes after starting.
- 3) Confirm that the discharge pressure of the pump is always stable during operation.



Chapter 3 Operation

3.3 Caution during starting

- 1) Inspection around driver
 - a) Confirm that an adequate amount of grease or lubricating oil is in the bearing. In the case of forced lubrication, confirm that normal pressure is being kept for the lubricating oil.
(In this pump, forced lubrication is N/A)
 - b) Confirm the amount of flow of cooling water.
(In this pump, cooling water is N/A)
 - c) Inspect other requirements.
- 2) Start the pump by fully closing the discharge valve.
- 3) When the rated number of revolutions is reached and the discharge pressure has increased after starting, gradually open the discharge valve.
- 4) Do not start the pump when the suction water level is lower than the specified water level.



3.4 Caution during operation



WARNING

- If the pump stops during operation due to power interruption, first turn off the circuit breaker to avoid automatic start-up as a result of a sudden power recovery. Then, take necessary measures.

1) Thrust bearing of pump

- a) Temperature of bearing shall be managed when measured at the outer surface of the bearing housing .
- b) Temperature of bearing shall be managed when measured near the bearing .
- c) When the bearing is cooled, confirm that the temperature and discharge of cooling water have normal values .

2) Shaft seal part



CAUTION

- When adjusting gland packing during pump operation, use a long lug wrench and never touch the rotating element.

NOTICE

- Be careful not to tighten the gland too much. Excessive tightening of the gland may cause burning or wearing of the sleeve.

Some water staying near the bottom of the gland drain tray of the stuffing box is appropriate.

3) Sound

If a large amount of air or foreign matter is sucked in, abnormal sound may be generated and vibration may occur.

4) Vibration

The vibration reference value shown in Fig. 5-1 should be used as the standard allowable vibration value. Also, even though the value is within allowable vibration value, there may be a possibility of a certain anomaly if a sudden increase or fluctuation in vibration occurs, and this must be carefully checked thereafter.



Chapter 3 Operation

5) Discharge pressure and current value

If the discharge pressure fluctuates abnormally or decreases extremely, the suction side may become clogged with a solid object or air may be sucked in. Also, if the sliding portion is clogged with foreign matters and is becoming burnt, then the current value fluctuates abnormally in some cases.

6) Suction water level

NOTICE

- If the pump is operated for a long time below the minimum allowable operating water level, then air suction may occur and vibration and damage to the impeller may be caused, by which the life of the pump may be adversely affected.

Be sure to operate the pump above the lowest water level .

7) Leakage

Be careful of leakage from the piping system.

8) Handling pressure gauge (compound gauge)

Close the main valve when the gauge is not being read. If the pressure fluctuates all the time, the life of pressure gauge (compound gauge) is liable to be shortened.

9) Record of noise

Record of noise at factory running test is attached.

3.5 Caution before pump stop



WARNING

- Never touch the rotating element until the rotation of the shaft has completely stopped. Otherwise, there is a possibility of being caught and injured by the rotating element.

- 1) Generally fully close the discharge valve and stop the pump.



Chapter 4 Maintenance and control

Effective, appropriate maintenance and control during pump operation will create smooth operation of pump functions and extension of the life of the pump.

4.1 Operation log

After starting use of the pump, it is recommended that the operating situation, inspection items and other information are recorded in the operation log

1) Items to be recorded

- Time of start
- Time of stop
- Duration of operation
- Cumulative time
- Inspection time
- Suction water level
- Discharge water level
- Discharge pressure
- Vibration
- Noise
- Bearing temperature
- Shaft seal part
- Cooling water
- Lubricating oil
- Current
- Voltage
- Others

2) Changes in the operation log records may provide hints of a potential problem; therefore, the log is useful for preventive control by clarifying the causes.

3) If there is no great difference from the records made immediately after installation, even after operation for a long time period, it can be said that there is almost no internal wear or damage.

4.2 Maintenance of thrust bearing

The general maintenance procedure is :

NOTICE

- Confirm the kind of oil on the name plate and lubricate. Lubrication with a different kind of oil is liable to damage the bearing.
- Re-filling of lubricant must be performed through a filter.

1) The time period for replacing the lubricating oil varies depending upon the operating time of the pump and environmental conditions.

However, if the color of the oil has changed to black or if the oil has an abnormal odor, it should be replaced regardless of the number of days.



Chapter 4 Maintenance and control

NOTICE

- It should be noted that the supplement of a large amount of grease may generate heat due to agitation.

- 2) When lubricating using grease, fill the bearing box with grease to the level of 1/3 to 1/2 as a standard.
- 3) If abnormal sound occurs during use or vibration or abnormal heat generation is recognized during use, the bearing must be replaced regardless of the operation time.

4.3 Maintenance of shaft seal part

(1) Maintenance of gland packing

a) Daily inspection

- 1) Check if heat is generated due to excessive tightening or uneven tightening of gland.
- 2) Some water staying near the bottom of the gland drain tray of the stuffing box is appropriate. This state of tightening will prevent heating and prevent wear.

b) Taking out gland packing

- 1) Use a tool with a cork screw attached to the tip, and screw it into the gland packing, then pull out the gland packing.
- 2) Clean the stuffing box and packing gland. At that time, also clean the water sealing hole and piping.
- 3) Inspect the wear of the sleeve and, if the wear is significant, replace it with a new one.

c) Adjustment of gland packing

- 1) Use the specified gland packing only.
- 2) For other than ring moldings, the dimensions should be adjusted as shown below.
- 3) For cutting a gland packing, firmly wind the gland packing around a round bar having the same diameter as the shaft while adapting the packing to the bar, then cut to obtain the correct dimensions.
- 4) No opening at the cut end.



Chapter 4 Maintenance and control

d) Loading of gland packing

- 1) When opening the gland packing, open it while twisting the cut ends. If it is opened straight, the opposite side may be deformed or damaged.
- 2) At the time of loading, shift the cut ends by 90° and 180°. Load it by fully pushing the end of the handle of a hammer one ring at a time.
- 3) After loading, tighten a packing gland attaching bolt with a wrench, loosen the attaching bolt again, and then tighten by hand only this time.

4.4 Maintenance of auxiliary equipment

- 1) Instruments such as a pressure gauge and compound gauge tend to make distortion due to a sudden pressure fluctuation during start-up or stop; also, the needles vibrate due to pressure pulsation when sending water and distortion is liable to occur after a long period of time. Therefore, the main valve should be opened only when reading pressure values.
- 2) Flow relays, motor-operated valves and the like installed on conduits for auxiliary equipment for automatic operation must operate reliably and perfectly; and particularly the sensors having contact points for warning should be checked for their operation daily or during weekly inspection, so as to avoid imperfect contacts or erroneous operation under abnormal conditions.



4.5 Disassembly and inspection



CAUTION

- If you require repairs or function changes for the pump, please give us an order for the repair or change. If customers repair or change the functions by themselves, we can take no responsibility for the results.

The purpose of disassembly and inspection is preventive maintenance. Portions that cannot be inspected by daily inspection are checked. Each part is checked for wear and corrosion and should be repaired or replaced with sparepart. Also, in carrying out the disassembly and inspection, you should request us to dispatch our supervisor for carrying out the work in accordance with his instructions.

1) Time of execution

- a) The time for disassembly and inspection varies depending on the operating frequency and usage conditions of the pump, but as a standard, execution should be at an interval of 2 to 3 years.
- b) Execution time after the second execution should be determined by referring to the results of the preceding inspection.

2) Preparation before work

- a) Preparation for required tools
- b) Confirmation of spare parts

3) Disassembly work

This should be carried out in accordance with 2•9 "Disassembly."

4) Inspection items

- a) Impeller
 - Inspect the degree of wear and corrosion.
 - Verify that there is no damage at the end face of the outer periphery of the impeller.
 - Inspect for cracks using the Dye Penetrant Test.
- b) Main shaft
 - Inspect situation of corrosion.



Chapter 4 Maintenance and control

c) Shaft seal part

- If the amount of wear on the outer diameter exceeds the following values, it is time for replacement.

d) Bearing sleeve

- Presence or absence of uneven wear
- If the clearance between the shaft bearing has extended to more than specified value, it should be replaced. Also, if there are no recessed or projected portions due to wear on the sleeve, priority should be given to the replacement of the shaft bearing.

e) Shaft bearing

- Presence or absence of uneven wear
- When the clearance between the bearing sleeve has extended to more than specified value, it should be replaced.

NOTICE

- If any damage to the paint coat is recognized after disassembly, then touch-up painting is required. If nothing is done, then corrosion or the like may occur.
- At the time of reassembly, sealing parts such as sheet packing, O-rings and the like should be replaced with new ones. Reuse of sealing parts may cause a leak and thus should be avoided.

g) After inspection and cleaning, be sure to perform replacement of the O-rings and gaskets and repair painting.

4) After disassembly and inspection

Organize the records and replenish the spare parts.



4.6 Maintenance during stopping for a long time period

- 1) After stopping pump operation for a long period, maintenance operations for about 30 minutes should be performed at least once a month.
- 2) If there is more than one pump, operation time and operation frequency should be evenly distributed without providing standby machines, to avoid the long-term stopping of pumps.

4.7 Spare parts



CAUTION

- Please use our genuine parts as replacement parts. If parts other than our genuine parts are used, the pump performance may become unsatisfactory or an unexpected situation may even result in some cases. Also, we can take no responsibility for any problems created because our genuine parts were not used.

Kinds and quantities of spare parts vary depending on the use and operating conditions of the pump. Generally, shaft bearings, sleeves, O-rings and gaskets should be kept on hand. If a shaft bearing has been delivered as a spare part, it is packed for long-term storage and so should be stored as it is in an indoor area free from direct sun light. Also, O-rings and gaskets should be stored in the same place. Delivered spare parts list (if available) and recommended spare parts list are attached.



Chapter 5 Trouble shooting

As the cause of the problems, various factors are affecting each other in a complicated manner in some cases. If an problems occur, its main causes must be determined first, then adequate measures should be taken. The items described below are general causes of and measures to be taken in response to problems. These causes sometimes occur as a result of various causes compounded. In such cases, please contact DMW Corporation and give us the details of the trouble.

	Cause	Emergency measures	Permanent measures
No starting possible	Start-up conditions are not complete.	Confirm each condition. If a machine is defective, create a short-circuit and temporarily start. Confirm if individual start is possible.	Inspect and repair the equipment and circuits.
	A protection circuit is operating.	Check if the trouble has been resolved.	Inspect the circuit.
	Driver is defective.		Repair the driver.
	Foreign matter is caught in rotating element.	Stop once and restart.	Disassemble and clean.
	Bearing is burnt.		Replace bearing.
Pumping Impossible or pump discharge reduced	Foreign matters are caught by the impeller.	Stop once and restart.	Disassemble and clean.
	Impeller is damaged.	Stop once and restart.	Replace impeller.
	Increased suction lift due to dropped water level.	Wait in the same state until the suction water level rises.	Check if there is any ground settlement.
	Actual head and head loss are higher than expected.		Reexamine the actual head and line loss.
	Liner ring worn.		Replace liner ring.
	Air is being sucked from gland.	Tighten the gland packing additionally.	Replace gland packing.
Overload	Excessive number of revolutions.		Adjust power supply.
	Excessive or insufficient water quantity.	Adjust the opening of the discharge valve.	
	Operation other than the specified points.	Adjust the opening of the discharge valve.	Reexamine specified points.
	Mud or foreign matter mixed in.	Stop once and restart.	Clean suction pit and take measures for preventing foreign matter.
	Excessive tightening of gland packing.	Loosen packing gland once and then gradually tighten.	Tighten packing gland carefully and uniformly.
	Deviated shaft center.		Perform centering.
	Damaged bearing.		Replace bearing.
	Contact at rotating portions.	Disassemble and correct.	Replace contacted parts.



Chapter 5 Trouble shooting

Temperature rise at gland portion	Excessive tightening of gland packing.	Loosen packing gland once and then gradually tighten.	Tighten packing gland carefully and uniformly.
	Faulty insertion of packing.		Take out packing and put it back again.
	Amount of sealing water is not adequate.	Adjust by sealing water valve.	Supply prescribed amount of water.
	Sealing water pressure is not adequate.	Adjust by sealing water valve.	Reexamine supply pressure.
	Mounting position for mechanical seal is not correct.		Perform resetting.
Heat from bearing	Lubricating oil is all gone.	Provide adequate amount of lubricating oil.	
	Excessive amount of lubricating oil.		
	Deteriorated lubricating oil.		Replace lubricating oil.
	Shortage of cooling water.		Increase the rate of supply of cooling water.
	Lubricating oil is not proper.		Replace it with proper one.
	Foreign matter mixed in.	Clean.	Replace lubricating oil.
	Run-out of main shaft.		Disassemble and replace.
	Defective bearing such as backlash.		Replace bearing.
Vibration and noise	Damaged bearing.		
	Deviated shaft center.		Perform centering.
	Main shaft is bent.		Correct or replace main shaft.
	Faulty centering.		Perform centering again.
	Damaged bearing.		Replace bearing.
	Pump base is not level.	Adjust to make level using shims. (Verify this adjustment with us.)	Resetting pump base.
	Foreign matter is clogging pipes.		Remove foreign matter.
	Rotating element contacting.	Disassemble and correct.	Replace contacting parts.
	Piping is vibrating.	Support it.	
	Air is being sucked in.	Raise suction water level.	Raise suction water level.
Prevent the occurrence of vortex.		Install vortex splitter.	
Foundation is not perfect.		Increase the strength of foundation.	



Chapter 6 Service

Contact the supplier you purchased the product from or our company if repair or inspection services are necessary for your pump. In the presence of any abnormalities in your pump or motor, stop its operation immediately and carry out troubleshooting procedure. (Refer to Chapter 5 "Trouble shooting.")

In the case of malfunctions, please report to the supplier the items listed on the pump's nameplate (particularly, our serial number and type) and the state of malfunctions (abnormalities).

Any other information would also be helpful, if available.

