



Operation Manual

In-Line Vertical Pump PI

WDM Water Systems

PI Operation Manual

FOREWORD

These units are vertical process pumps of the overhung configuration and identified by WDM Pumps as PI.

It is recommended that the services of a WDM Pumps installation technician be employed for the installation and initial starting of the pump. Such service will help to ensure the user that the equipment is properly installed, and will provide an excellent opportunity for the plant operator to receive useful tips and guidelines relative to the unit. The tools and/or equipment referenced in this manual are not supplied by WDM Pumps unless specifically ordered. This pump design can be serviced with standard maintenance tools.

Instructions in this manual are written for trained, experienced technicians who are familiar with the basic principles and tools involved in the installation, care and service of a pump and who, as part of their trade education have acquired the ability to interpret and follow the detailed specifications required for such installation, care, and service. Successful operation of the unit is dependent on careful study of the manual and a well-planned maintenance program.

A complete reading of this manual by personnel in contact with the pump is essential to safety. Incorrect installation, operation or maintenance can result in personal injury or death to personnel and damage to the pump and plant.

Before performing any service function be certain that the unit is separate from its power source or that the power source is locked out to prevent any form of energy from entering the equipment.

Contact with hot surfaces of the pump can cause severe burns. Care must be taken where such surfaces are exposed. Care must also be taken to prevent ignition of flammable fluids or other material.

Information in this manual is believed to be reliable, but it is not guaranteed by WDM Pumps as to its completeness or accuracy.

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1. SECTION ONE - PRODUCT DESCRIPTION

These operating instructions contain important information about the installation, operation and service of the unit. It is therefore imperative that the installing engineer and the responsible specialist/operating personnel read and understand these operating instructions before installation and commencement of operation.

This manual must always be available in the operational area of the machine/plant.

Please contact a WDM Pumps dealer should problems arise. The pump may only be opened by a WDM Pumps approved technician during the guarantee period.

In case of queries, please have your project number and type designation of the pump available. You can find both of these on the first page of these operating instructions or on the rating plate fixed to the pump.

When ordering spare parts we would further request that you give the description of the required parts, together with their part numbers and identity numbers. You can find these on the sectional drawing and spare part list enclosed.

1.1 Introduction

WDM Pumps of type PI are In-Line Vertical pumps, vertically (radially) split case, centerline supported with an overhung impeller.

The PI is a single stage, single suction pump. For these pumps, rotation is clockwise as viewed from the motor (coupling) end. These pumps have a top Pull-Out which simplifies maintenance. The complete rotor assembly is easily removed for inspection without disturbing the pump's piping. When performing maintenance to the mechanical seal, it is not necessary to remove the complete top assembly, as this pump has a split coupling that allows easy removal and access to the mechanical seal without removing the motor (driver) or adapter.

The PI pump has a carbon made bushing for pump shaft alignment.

The following information is included in the nameplate of your pump unit:

- Serial number
- RPM
- Head

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1.2 PUMP CASE, IMPELLER, AND ADAPTER

1.2.1 Pump Case

Developed in cast iron, it is radially split with four bosses for cooling purposes, venting valve to extract air from the system, and manometers inspection.

1.2.2 Impeller

Single-suction, closed-cast impeller, in one piece, dynamically balanced with balancing holes near the hub, designed to meet high performance during the pumps life.

1.2.3 Adapter

The adapter connects the vertical motor with the case to transmit the power to the impeller through the shafts (motor and pump) and the split coupling. This part has with two lifting ears that allow an easier carry and handle. The bracket has a drainer plug, which avoids accumulation of condensed water inside the pump.

1.3 SEAL CHAMBER

The PI pump has an outside balanced mechanical seal option, inside unbalanced mechanical seal option, as well as packaging option. Mechanical seal (stationary part) holder with cooling system.

2. SECTION TWO - SAFETY

This operation manual gives basic instructions that should be observed during installation, operation and maintenance of the pump. It is therefore imperative that this manual be read by the responsible personnel/operator prior to assembly and commissioning.

It must always be kept available at the installation site. Not only are the general safety instructions contained under this SECTION TWO - SAFETY that must be observed but also the specific information provided in other sections.

2.1 IDENTIFICATION OF SAFETY INSTRUCTIONS IN THE OPERATING MANUAL

Safety instructions given in this manual whose non-compliance would affect personal and equipment safety are identified by the following symbol.



Where electrical safety is involved, the following symbol is shown.



ATTENTION

The **ATTENTION** symbol is inserted in safety instructions whenever non-compliance might endanger the machine or its function.

It is imperative that signs affixed to the machine are observed and kept legible, for example:

- arrow indicating the direction of rotation
- symbols indicating fluid connections

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2.2 QUALIFICATION AND TRAINING OF OPERATING PERSONNEL

The personnel responsible for operation, maintenance, inspection and assembly must be adequately qualified. The responsibilities and supervision of the personnel must be exactly defined by the plant operator. If the staff does not have the necessary knowledge, they must be trained and instructed. Training may be performed by a WDM Pumps representative on behalf of the plant operator. Moreover, the plant operator is to make sure that the contents of the operating manual are fully understood by the personnel.

2.3 HAZARDS IN THE EVENT OF NON-COMPLIANCE WITH THE SAFETY INSTRUCTIONS

Non-compliance with the safety instructions may produce a risk to the personnel as well as to the environment and the unit and results in loss of any right to claim damages.


Non-compliance may involve the following hazards:


- Risk of injury or death.
- Failure of important functions of the machine/plant.
- Exposure of people to electrical, mechanical, chemical, and thermal hazards.
- Endangering or damaging the environment due to hazardous substances being released.


2.4 COMPLIANCE WITH REGULATIONS PERTAINING TO SAFETY AT WORK

When operating the pump, the safety instructions contained in this manual, the relevant national accident prevention regulations, local and federal health and safety regulations, quality system requirements, and any other service and safety instructions issued by the plant operator must be observed

2.5 SAFETY INSTRUCTIONS RELEVANT FOR OPERATION

 If hot or cold machine components involve hazards, they must be guarded against accidental contact (attach warning signs).

 Any leakage of hazardous fluids must be drained away to prevent any risk to persons or the environment. Statutory regulations are to be complied with.

 Hazards resulting from electricity must be prevented.

2.6 SAFETY INSTRUCTIONS RELEVANT FOR MAINTENANCE, INSPECTION AND ASSEMBLY WORK

It is the plant operator's responsibility to ensure that all maintenance, inspection and assembly work is performed by authorized and qualified personnel who have adequately familiarized themselves with the subject in matter by studying this manual in detail.

Any work on the machine shall only be performed when it is at a standstill. To shut off the machine it is imperative to follow the procedure for shutting down the machine as described in SECTION 5.4-STOPPING.

Pumps and pump units that convey hazardous materials must be decontaminated before any maintenance work is performed.

On completion of work all safety and protective facilities must be re-installed and made operative again.

Prior to restarting the machine, follow the instructions listed under *SECTION 5.2-STARTUP*.

2.7 UNAUTHORIZED ALTERATIONS AND SPARE PARTS

Modifications may be made to the machine only after consultation with a WDM Pumps representative.

Using spare parts and accessories authorized by WDM Pumps is in the interest of safety. The use of parts not authorized by the dealer exempt the manufacturer from any liability, voiding the warranty.

2.8 UNAUTHORIZED MODES OF OPERATION

The reliability of the machine is guaranteed if and only if it is used in the intended manner, in accordance with the statutes of this manual. The limit values specified in the data sheet must never be exceeded under any circumstance.

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3. SECTION THREE - TRANSPORT & STORAGE

3.1 SHIPPING ARRANGEMENTS

A wooden skid is furnished for support and ease of transportation. Other required items (e.g. hardware, spare parts, etc.) are boxed or secured to the skid.

3.2 UNLOADING AND CHECKING EQUIPMENT

The following steps should be completed for all pumps when received.

1. Handle all equipment carefully.
2. Remove unit only by properly supporting the wooden shipping skid.
3. After unloading, inspect the pump, check the shipment against the packing list, and report damages or shortages immediately to freight carrier and to the designated WDM Pumps representative.

3.3 TRANSPORT



To avoid damage, the unit must be transported and handled with care. It should be gently lowered onto an even surface. Pay attention to and identify the signs marking the points of equilibrium and fastening places for ropes, or the openings for forklift trucks.



Observe the plant's safety precautions when lifting heavy components.



Since the unit is shipped horizontally, it must first be placed vertically to remove it from the pallet. To do such operation, use the lifting lug on the motor (driver), to tilt the unit until it is in vertical position. To prevent the pallet from moving, secure it before starting this operation. Once the pump is in vertical position and correctly supported, the rope or chain is placed under the driver and through the adapter. Both techniques are illustrated in Figure 3.1.



On some pumps, it may be necessary to remove the coupling guard before placing the rope or chain under the driver and through the adapter. After moving the pump, and before start-up, the coupling guard must be placed back in place.

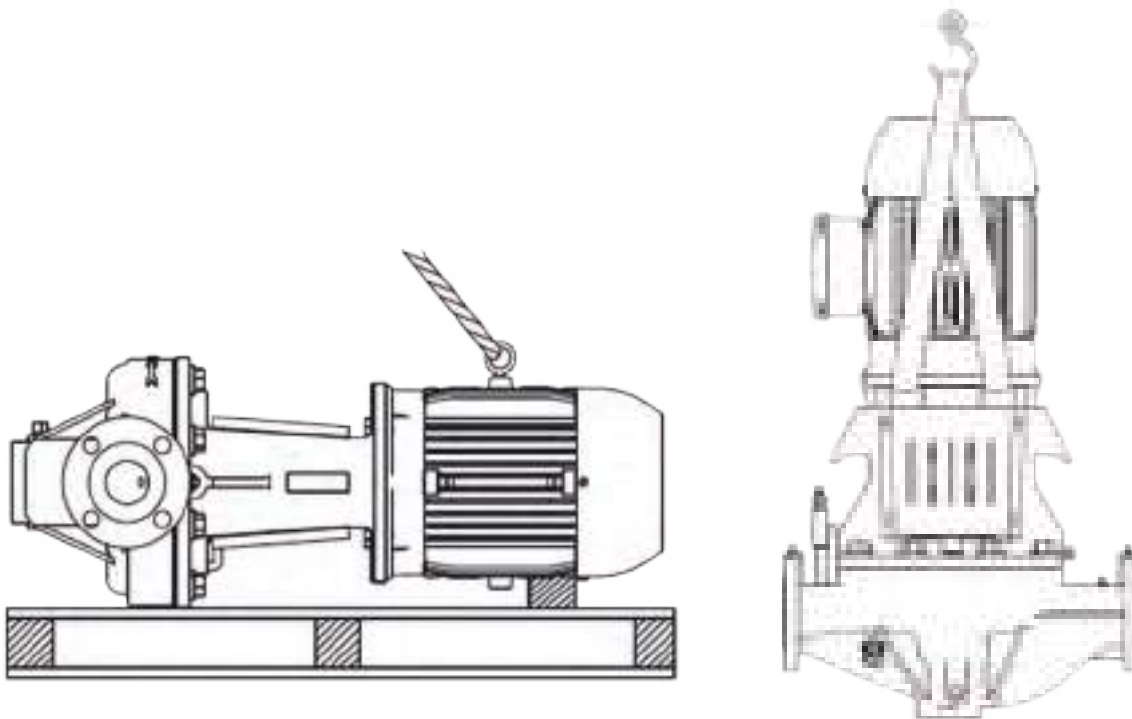


Figure 3.1. Correct Position of the lifting ropes or chains. On the left, to tilt the unit to a vertical position; on the right, to lift the unit.

3.4 STORING

If the pump is not installed immediately (within one month after shipping date), it should be safely stored prior to installation in a dry location free of dirt and grit. Furthermore, the pump unit (pump, driver, etc.) should not be subject to sudden temperature changes or vibrations.

Observe the following steps:

1. Remove pump from shipping crate, but do not damage the crate because the unit is to be reboxed.
2. Remove all instruments and mechanical seal; store them safely.
3. Plug the instrument taps.
4. Thoroughly dry the pump with hot air.
5. Any painted surface damaged in shipment should be repainted or sprayed with oil.
6. Keep the pump moisture-free by the following two means:
 - a. Spray the pump case with acid-free, moisture-free, protective oil or kerosene.
 - b. Place desiccant or humidor bags inside the suction and discharge areas of the pump.

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ATTENTION

Attach red tags with a “Remove Moisture Absorbent Material Bags Prior to Installing” to warn about the presence of this desiccant material.

7. Cover all the openings with plywood or metal covers. Recheck the condition of these covers every month and replace as necessary.
8. If the pump’s external parts have protective coatings, periodically inspect and renew the coating as required.
9. Rotate the shaft 1 ¼ revolutions every week.

ATTENTION

The client must keep a record of the weekly rotation of the shaft. Failure to document and present these records as evidence will void the warranty.

10. Check the packaging for damage every month.
11. Ensure pump flange covers remain in place.
12. Return the unit to the shipping crate.
13. When the pump is to be installed, remove all the protective coatings and desiccant or drain all oils.

One month before installation, a WDM Pumps representative should be employed to conduct a final inspection.

To properly store the motor (driver) for periods longer than one month, follow these steps:

1. Store the motor in a clean, dry area, or cover it with a loose tarp (the tarp must be loose in order to prevent condensation).
2. Exercise precautions to avoid transit or nesting of rodents, snakes, birds, and insects.
3. Inspect and, if necessary, recoat the rust preventive coating of external machined surfaces.
4. Fill with lubricant the grease-lubricated cavities of the motor, but first remove the drain plug and fill the cavity until the grease starts to purge.

ATTENTION

Follow the instruction manual of the driver manufacturer to ensure the lubrication is performed properly.

5. Upon receipt, considering that the oil-lubricated drivers are not shipped oil-filled, fill the reservoir to maximum level with properly selected oil with rust and corrosion inhibitors.

ATTENTION

Always drain the oil before moving the pump, to avoid any damages, and refill the motor on its new location.

6. Rotate the shaft of the motor once a month.

7. Some form of heating must be used to prevent condensation. This heating should maintain the winding temperature at a minimum of 9 °F (5 °C) above the surrounding ambient temperature. There are three options:

- If space heaters are supplied, they should be energized.
- If none are available, single phase or “trickle” heating may be utilized by energizing one phase of the motor’s windings with a low voltage, producing heat in the winding conductor.

ATTENTION

Request the required voltage and transformer capacity from the driver manufacturer.

- A third option is to use an auxiliary heat source and keep the windings warm by either convection or blowing warm dry air into the motor.

ATTENTION

Be careful not to overheat, since keeping the temperature of the motor frame 9 °F (5 °C) above the surrounding ambient temperature is sufficient.

After the storing period, follow the next steps as start-up preparations:

1. Motor should be thoroughly inspected and cleaned to restore to an “As Shipped” condition.
2. Motors, which have been subjected to vibration, must be disassembled and each bearing inspected for damage.
3. Oil and/or grease must be completely changed using lubricants and methods recommended on the motor’s lubrication plate, in the “LUBRICATION” section of the driver manufacturer’s manual.
4. If storage has exceeded one year, the motor manufacturer’s Quality Assurance Department must be contacted prior to equipment start-up for any special recommendations.

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3.5 CONSERVATION

All exposed, machined, working surfaces (flanges, seals, surfaces supporting the motor), shaft ends, and the like have been cleaned and treated with anticorrosive agents. After being cleaned, all parts inside the pump housing have been sprayed with anticorrosive agents.

The period of protection offered by these conservation measures is approximately 18 months if stored in a dry place. If stored under unfavorable climatic conditions, this protective period may be considerably reduced. Should the anticorrosive layer become damaged, it can be repaired by repainting or respraying.



Anticorrosive layers inside the pump housing must be removed with process neutral solvents before commencing pump operation.



When removing the protective coating with a neutral solvent, follow the safety instructions of the solvent manufacturer carefully.

ATTENTION

The anticorrosive layer applied to the exposed parts does not need to be removed before putting the pump into operation.

4. SECTION FOUR - PIPING



These units are furnished for a specific service condition. Any change in the hydraulic system may affect the pump performance adversely.



The connection of the piping must be carried out with utmost care; otherwise, the pumping medium can escape during operation, which can seriously endanger the operating personnel.



In a new installation, great care should be taken to prevent dirt, scale, welding beads, and other items from entering the pump. The suction system should be thoroughly flushed before installing the suction strainer and suction piping.

ATTENTION

Suction and discharge piping should be of ample size, be installed in direct runs with minimum bends.

ATTENTION

Short radius elbows shall be avoided near the suction nozzle. If an elbow is necessary, it should be of the long radius type.

ATTENTION

Suction and discharge piping configurations should be in accordance with the Hydraulic Institute Standards.

ATTENTION

Suction and discharge piping, fittings, and valves must be adequately supported and anchored close to the pump flanges to eliminate strains imposed on the pump casing, prevent excessive nozzle loads, maintain pump/driver alignment, and avoid pipe-induced vibration.

4.1 PIPING THE SYSTEM

1. Check whether the piping is loosely laid, so that no strain is placed on the pump.



Piping layout and installation shall provide adequate maintenance and operation accessibility. Field installed auxiliary equipment shall not interfere with removal of the machine or driver.

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2. Remove the covers of the pump flanges.
3. Check whether the seals are correctly mounted.
4. Install a check valve and a gate valve in the discharge pipe. When the pump is stopped, the check valve will protect the pump against excessive back-flow pressure and will prevent the pump from running backward.

ATTENTION

The check valve should be installed between the gate valve and discharge flange in order to permit its inspection.

5. A spool piece should be installed in suction line so that the suction strainer may be installed and removed with a pressure gauge between the strainer and pump.
6. The suction strainer should be installed between 5 to 20 pipe diameters upstream from the suction flange.
7. Cone type strainers (otherwise known as “witches – hat” strainers) should be mounted as recommended by the Hydraulic Institute, with the cone pointing upstream away from the pump, into the oncoming flow. As the strainer gradually gathers particles from the liquid and blocks up, this direction will result in the lowest turbulence impact onto the liquid flow entering the pump.

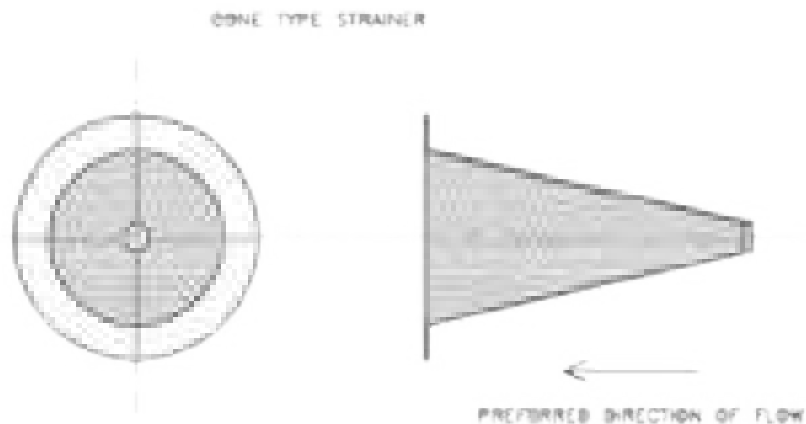


Figure 4.1. Correct mounting of a cone type strainer.

8. Pump and pipe flanges must be parallel; they should mate together without effort, and with the bolt holes properly in line.

9. Proceed in the same way with the discharge pipe.



Make sure that there are isolation block valves at the pump for each type of auxiliary piping.



Consider a slope in the suction piping to avoid high points.



In horizontal suction lines, reducers should be eccentric (with the flat side of the reducer on top).



No obstruction within at least five pipe diameters of the suction flange should be fitted.



Do not install unsupported piping on the pump.



Make sure electrical connections do not impose any stress on the pump unit.

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5. SECTION FIVE - OPERATION

5.1 PRIMING

The most common method used for warming a pump, or maintaining a standby pump in a warm condition, is the use of a warming line and orifice, thus circulating the hot pumpage through the idle pump.

ATTENTION

It is recommended that the pump be warmed at the rate of 100 °F (55 °C) rise per hour for normal warming, or 268 °F (149 °C) rise per hour for emergency warming.

ATTENTION

It is recommended that the idle pump temperature be maintained within 36 °F (20 °C) of the system operating temperature.

Circulation can be easily accomplished by guiding a small amount of flow from the discharge side of the system beyond the check valve via a multiple breakdown orifice into the bottom of the pump case. The hot liquid will then pass through the case and out the suction and return to some low pressure point in the system. In many cases, the pump drain line is used for the warming connection.

Note: Many variations are possible and one that is compatible with the customer's particular installation should be considered.

5.2 STARTUP



Every time before the pump is started up the safety devices must be mounted and fastened.



In order to avoid risks of injury or damage, all pump units must be equipped with emergency-stop devices.



For operation of electrical drives, control systems and their cable routes, the safety instructions issued by their manufacturers must be observed.


The startup procedure is as follows:

1. Before starting the pump, check the security of all bolting, piping, and wiring.
2. Check all gauges, valves and instruments for proper working order.
3. Check all equipment for proper rotation.
4. Verify that the discharge valve is closed.
5. Open the suction valve.
6. Open discharge valve and allow pump to fill with fluid. Since the pump is not self-venting, the venting valve located in the discharge side must be opened, to allow any trapped air to vent when the pump is filling with fluid. Once the air has come out and fluid leaves through the venting valve, close the venting valve.
7. Keep the valves open approximately 60 seconds to ensure that pump is completely full of fluid.
8. Close discharge valve.
9. Start, and IMMEDIATELY STOP, the driver and observe the rotation of the shaft.
10. Correct rotation should be in direction of rotation arrow.

ATTENTION

If shaft rotation is incorrect, consult driver manufacturer's instructions in order to change rotation.

11. Priming accomplished and correct shaft rotation established, the pump is ready for continued operation.
12. Ensure the discharge valve is open to approximately $\frac{1}{4}$ fully open.
13. Start driver again, and completely open the discharge valve IMMEDIATELY when the operating speed has been reached.

 **Danger:** Do not allow discharge valve to remain closed for any length of time. Pumped fluid temperature will rise excessively causing damage to pump.

5.3 OPERATING CHECK

During the initial operating hours, the pump should be monitored constantly. It is thus possible to detect irregularities immediately and to take appropriate measures for their elimination (See SECTION NINE - TROUBLESHOOTING CHART).

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To monitor flow, pressure, and temperature, regular visual inspection and monitoring is advisable and/or necessary during operation.

WDM Pumps recommends checking the pump constantly at regular intervals in order to detect problems early, in case they arise.

The operational check routine must include minimum the following points:



Beware of freely rotating parts, when the pump is in operation there is a high risk of injury.

- Check at regular intervals that the safety equipment is sound and is arranged and fastened according to the regulations, and energized where applicable.
- Check the security of all bolting, piping, and wiring.
- Check all gauges, valves and instruments for proper working order.
- Check all equipment for correct rotation.
- Check that the pumping unit is running quietly and without vibrating.



Unusual or too loud noises point towards a possible fault.

- Monitor the power consumption of the drive motor. Low or excessive power consumption indicates a possible fault.
- Check the sealing system:
 - a. Refer to the seal manufacturer for his estimate of maximum acceptable leakage rate, as this will depend on application, design, location and the sealed liquid characteristics.
 - b. If leakage is excessive, switch the pump off as quickly as possible, isolate the pump by closing the discharge and suction valves or using some other approved method designated as safe for your system, and check the rotating seal ring and the stationary seal ring.

ATTENTION

If the sealing system of the mechanical seal fails, the pump must be taken out of operation immediately.



The pump may only be operated under the minimum operating range for short periods. The minimum pump flow is given in the characteristic line.

5.4 STOPPING

1. Throttle pump discharge to minimum flow.



Warning: do not close suction valve, this will cause the pump to run dry.

2. Turn the power off to the driver.
3. Close the pump discharge valve
4. Observe the run - down of the pump until full stop.



If the rotor is jerky or suddenly stops, there is a danger that the rotor has become blocked. The pump must be opened and all running clearances checked.

5. Close the suction valve when the pump shaft stops rotating as the pump must be isolated before examination and made safe.



Do not close the suction valve until the pump has come to a full stop, as it may cause the pump to run dry.

6. Ensure the drive motor cannot be unintentionally turned on.
7. Ensure the shut-off devices in the suction and pressure pipes cannot be unintentionally opened.
8. Drain the pump and the auxiliary piping.



If the outside temperature is below 32 °F (0 °C), all cooling chambers must be emptied, and all seal system cooling coils must be drained.

5.5 SHORT-TERM SHUTDOWN

If the pump was switched off correctly and has not suddenly come to a halt, it may be re-started without the need to take any special measures.

If the pump comes to a sudden halt, or if the pump was switched off because of a possible danger, it must be checked for damage.

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5.6 LONG-TERM SHUTDOWN

1. Follow the stopping procedure described in SECTION 5.4 – STOPPING.
2. While the unit is idle:
 - a. If the plant is in an operational state, warm up and start the unit at monthly intervals (see *SECTION 5.2 - STARTUP* for details).
 - b. If the plant is not in an operational state, turn the unit over by hand a couple of times at monthly intervals, ensuring the shaft is not returned to the same position, to allow the shaft to rest in a different position every time.
3. If there is danger of freezing, drain the pump and all the auxiliary piping.

6. SECTION SIX – MAINTENANCE

To perform the maintenance of the PI pump, no special (custom made) tools are needed.



Before initiating maintenance procedures disconnect all power sources to the equipment and discharge any parts which may retain an electric charge. Use proper locks to avoid accidental start-up of the pump system. Failure to comply may result in severe personal injury.



When performing the maintenance of the pump, use the safety equipment appropriate for the pumped fluid, materials, and location of the equipment, such as gloves, safety glasses, harnesses and other equipment regarded as mandatory by the plant's safety instructions.

6.1 DISASSEMBLY

Depending on the extent of the required disassembly, follow the next steps to disassemble your PI pump.

1. Stop the pump. See *SECTION 5.4 - STOPPING*.
2. Drain all possible fluids from the pump case.
3. Disconnect any auxiliary piping and wiring that could interfere with disassembly.
4. When disassembling the pump, match mark, tag or otherwise identify all parts, and provide separate containers for small parts. Refer to the pump sectional drawing included in *SECTION EIGHT - PARTS INFORMATION* for proper identification of parts.
5. Remove the coupling guard, first loosen the screws and remove them, then remove both coupling guards.
6. Remove coupling as follows:
 - a. Unscrew the bolts from both parts of the coupling.
 - b. Remove the washers from both parts of the coupling.
 - c. Draw out of the shaft both parts of the coupling.
7. Loosen the setscrews on the mechanical seal.
8. Remove keys from the motor and the shaft.

Note: For maintenance on Outside Balanced Mechanical Seal only, skip step 9 and proceed to step 10 (a – h) as motor removal is not required.

9. Unscrew the motor (driver) from the adapter and remove it.

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ATTENTION

The use of a crane with a chain or sling to lift the motor (driver) is suggested.

10. Exercise care and remove mechanical seal as follows:
 - a. Loosen and remove the shaft screw from the upper part of the coupling side.
 - b. Remove the washer from the shaft.
 - c. Remove the rotating part of the mechanical seal, with its setscrews.
 - d. Remove the adapter's screws and washers.
 - e. Draw out the adapter from the shaft.
 - f. Remove the gasket that was used with the adapter.
 - g. Draw out the stationary part of the mechanical seal.
 - h. Remove the gasket that was used with the stationary part of the mechanical seal.

Note: If no further maintenance beyond that of Outside Balanced Mechanical Seal is required, proceed to Section 6.3 Reassembly, step 12.

11. Unscrew the adapter from the casing. First, remove the screws and washers and then remove the adapter.
12. Remove the gasket from the adapter.
13. Remove the bushing from the adapter.
14. Exercise care and remove the shaft-impeller assembly from the casing.



Avoid bumping the impeller with the sidewalls of the casing.

15. To remove the impeller, first remove the impeller screw, lockwasher and finally the key.

ATTENTION

Do not heat the impeller.



Impeller nut is a right hand thread.

6.2 INSPECTION AND CLEANING

1. Thoroughly clean all parts with kerosene or equivalent and dry all parts with compressed air or a clean, lint free cloth.
2. Inspect all components for corrosion, erosion, pitting, and scoring. If required, replace with WDM Pumps O.E.M. genuine replacement parts.
 - a. Visually check all individual parts for any damage.
 - b. Check the casing for wear.
 - c. Check the impeller for wear.
 - d. Check the radial clearance for wear.
 - e. Check all auxiliary piping.
 - f. Check for sealing elements.
 - g. Check the bushing.
 - h. Check for transmission elements of the coupling.

6.3 REASSEMBLY

6.3.1 PI Mechanical Seal Option

Please follow the steps detailed on this section to reassemble the PI Mechanical Seal pump. To reassemble the PI Packing pump refer to *SECTION 6.3.2* – PI Packing Option.

Reassemble as follows:



Observe the plant's safety precautions when lifting heavy components. Request help when moving or positioning them.

ATTENTION

Mounting of bearings should be carried out in a dry, dust free area away from metal working or other machines producing shavings and dust to avoid contamination of bearings.

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ATTENTION

The bearings should remain in their original packaging. Once they are to be assembled onto the shaft, they must be removed from their packaging, and the preservative in the outside diameter and the bore must be wiped out.

ATTENTION

Bearings should be demagnetized before mounting them, to avoid contamination.

ATTENTION

During assembly, all threads must be protected with an anti-seize agent.

1. Insert the shaft key in the keyway on the impeller side of the shaft.

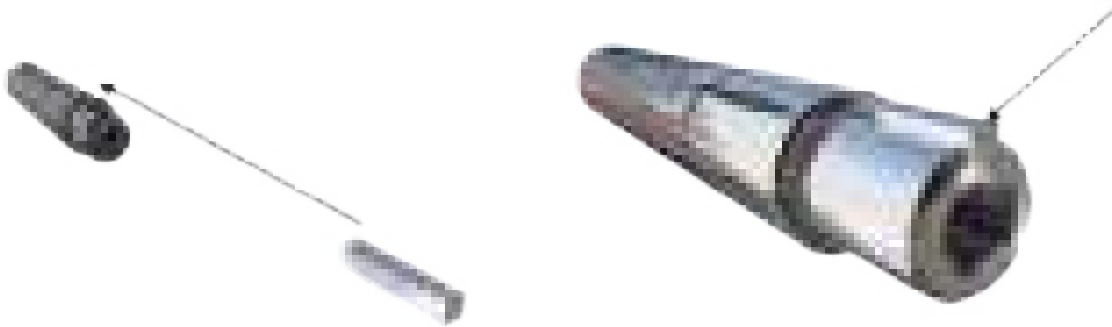


Figure 6.1 Inserting the shaft key in the keyway on the impeller side of the shaft.

ATTENTION

In case that the pump is PI Fire or Close Coupled, the shaft must be assembled with a shaft sleeve.

2. If applicable, insert the shaft sleeve into the shaft. Make sure that the sleeve enters completely.

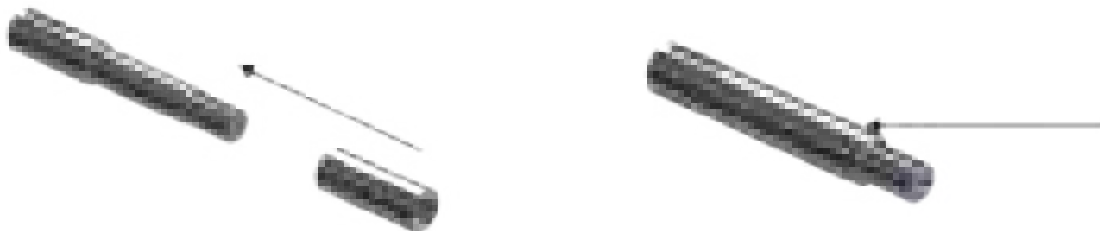


Figure 6.2 Inserting the shaft sleeve into the shaft.

3. Introduce the shaft inside the impeller until it reaches the step on the shaft.



Figure 6.3 Introducing the shaft inside the impeller until it reaches the step on the shaft.

4. Place the impeller lockwasher into the shaft's impeller side.



Figure 6.4 Placing the impeller lockwasher into the shaft's impeller side.

PI Operation Manual

5. Tighten the impeller screw into the shaft's impeller side.

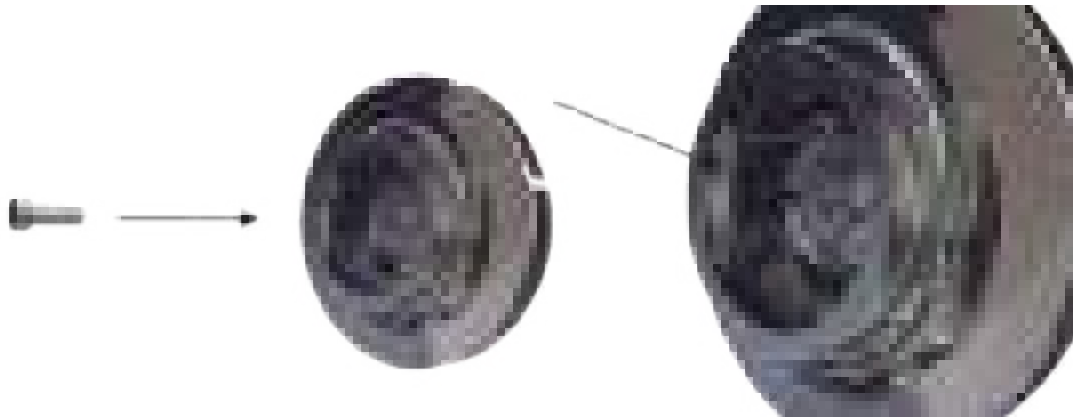


Figure 6.5 Tightening the impeller screw into the shaft's impeller side.

6. Placing the impeller-shaft assembly in the casing.

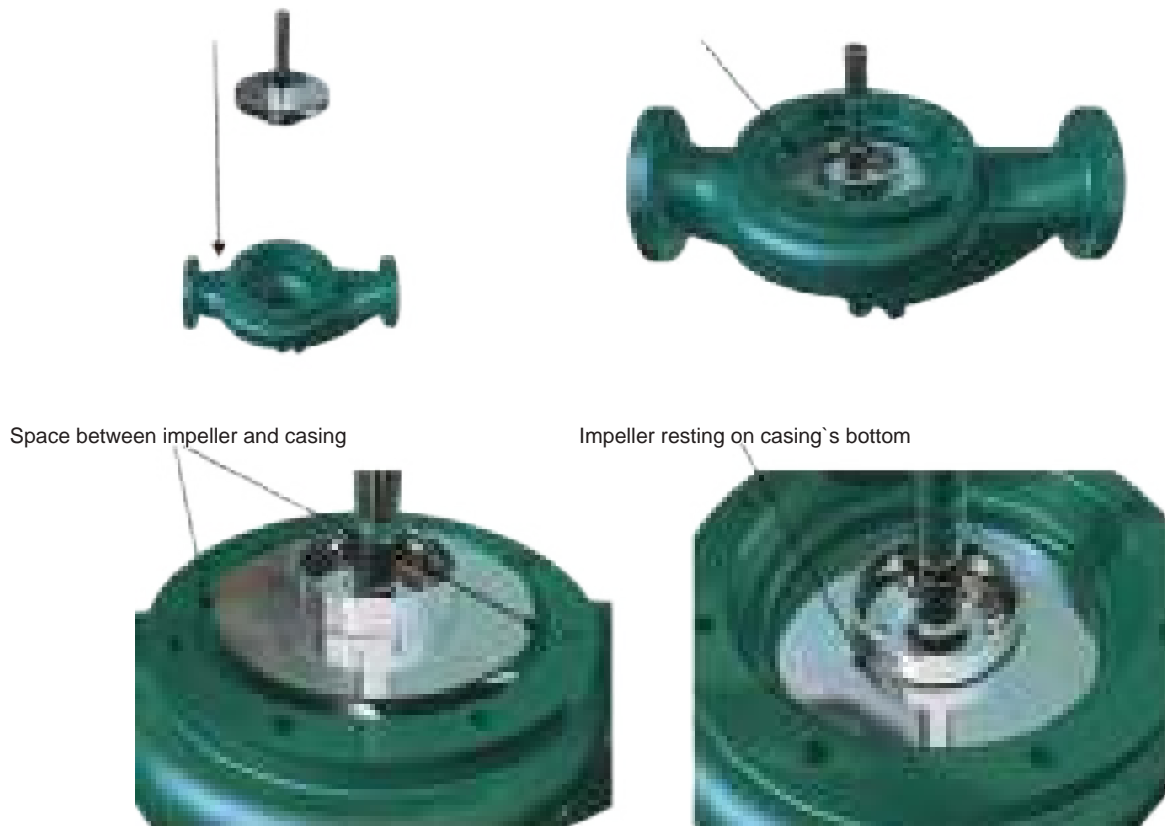


Figure 6.6 Placing the impeller-shaft assembly in the casing.

7. Using a hydraulic press, insert the bushing in the central bore of the adapter, making sure it is well positioned in the bottom of the adapter.

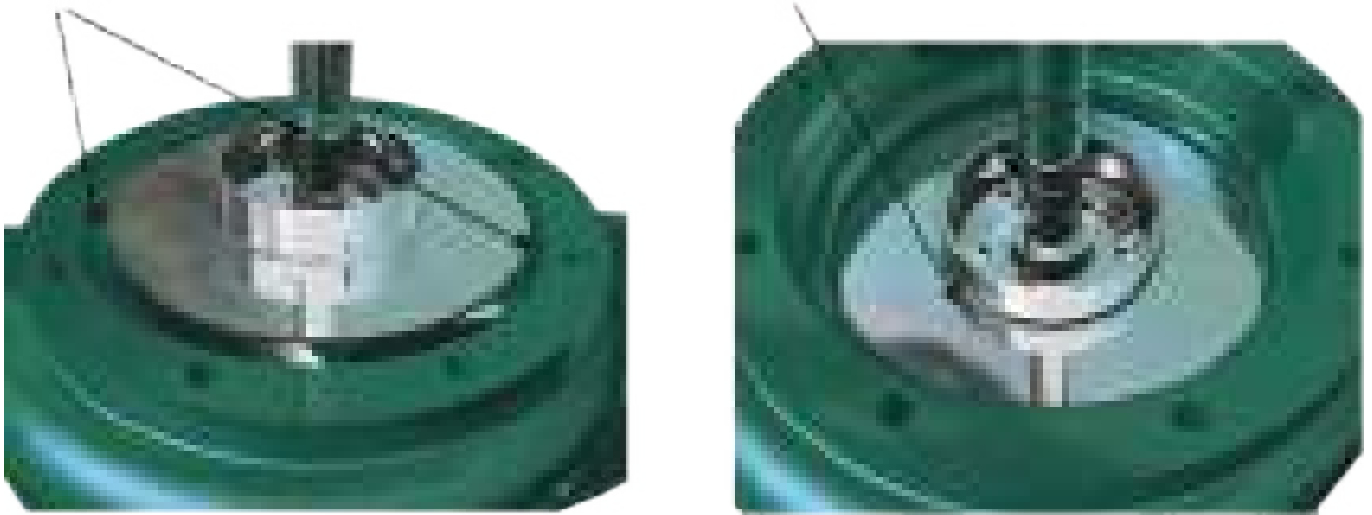


Figure 6.7 Inserting the bushing in the central bore of the adapter.

ATTENTION Do not force the insertion of the carbon bushing beyond the limit with the hydraulic press, as the bushing may be broken.

8. Place the corresponding gasket in the adapter; make sure to match the holes in the adapter. It is recommended to grease the gasket once in place, in order to accomplish the next reassembly step.



Figure 6.8 Placing the corresponding gasket over the adapter.

9. Position the adapter in the casing, the shaft must pass through the central bore. Make sure that the adapter's ears are aligned with the suction side and the screw holes match.



Figure 6.9 Positioning the adapter in the casing.

ATTENTION

The ears of the adapter are aligned with the suction and discharge flanges, with the drain on the adapter specifically aligned with the suction side. This arrangement will allow the correct installation of the mechanical seal.

10. Place the corresponding washers on the adapter matching the screwholes.



Figure 6.10 Placing the corresponding washers on the adapter matching the screwholes.

11. Fasten the corresponding screws on the adapter.

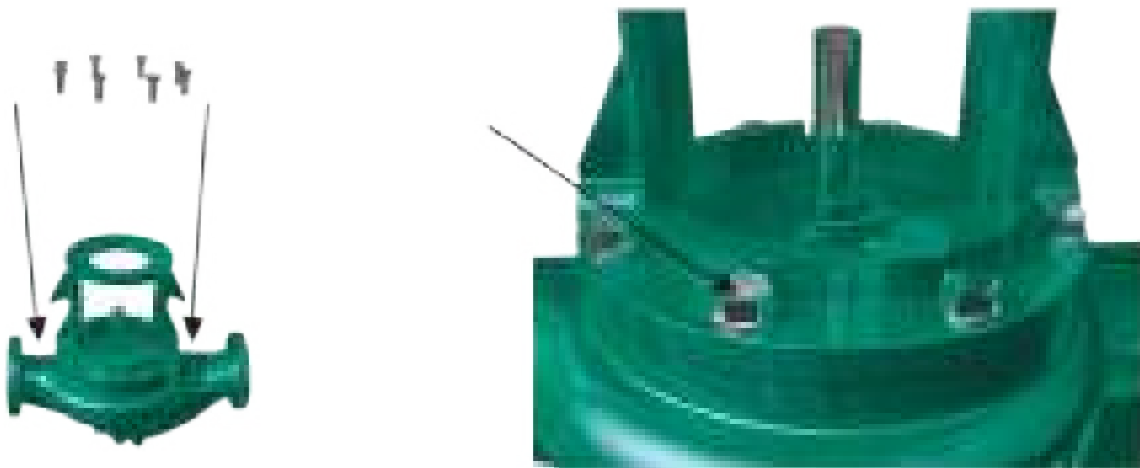


Figure 6.11 Fastening the corresponding screws on the adapter.

12. Insert the corresponding gasket of the mechanical seal into the shaft. Make sure the gasket is well positioned in the bottom of the adapter.



Figure 6.12 Inserting the gasket of the mechanical seal into the shaft.

13. Place the stationary part of the mechanical seal over the gasket.

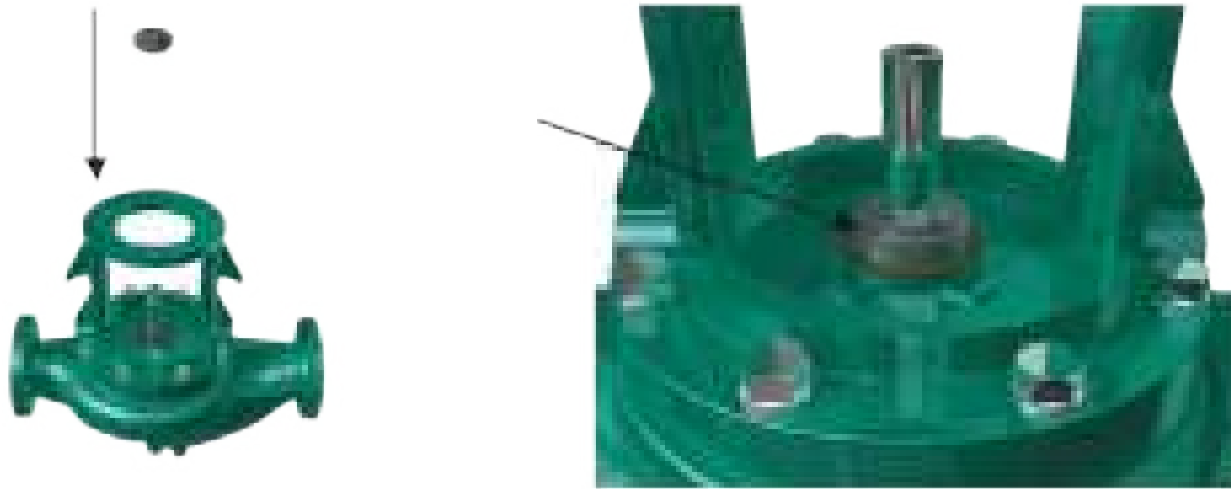


Figure 6.13 Placing the stationary part of the mechanical seal over the gasket.

ATTENTION

The holes in the stationary part of the mechanical seal should be aligned perpendicular (90°) to the suction and discharge flanges. This orientation will allow the flushing to match directly with these holes on either side.

14. Insert the corresponding gasket over the stationary part of the mechanical seal.

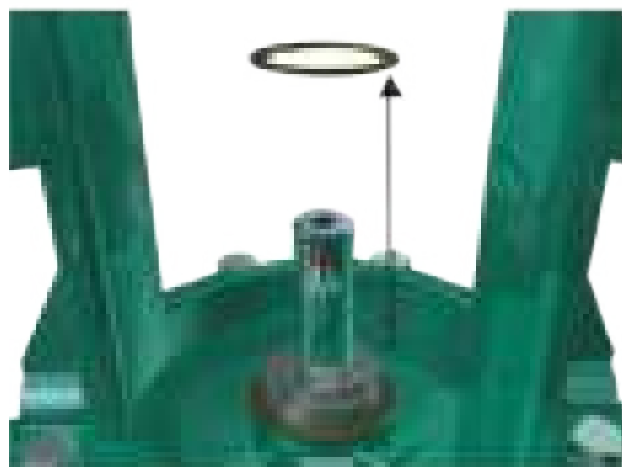


Figure 6.14 Inserting the corresponding gasket over the stationary part of the mechanical seal.

15. Introduce the mechanical seal head in the shaft. Make sure that the mechanical seal is well positioned.

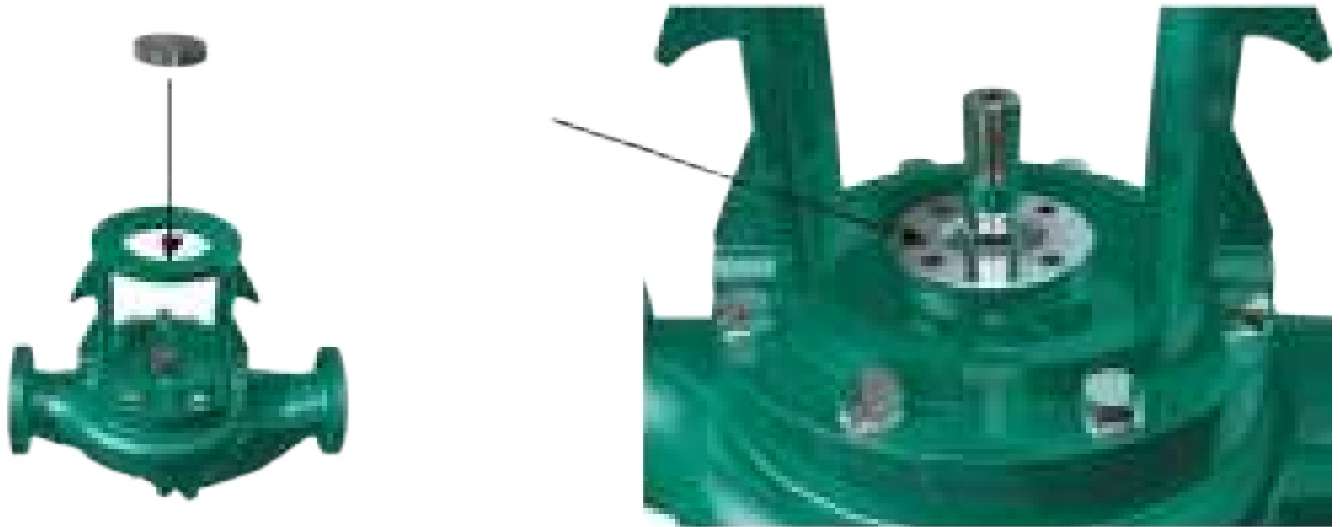


Figure 6.15 Introducing the mechanical seal head in the shaft.

16. Place the corresponding washers on the adapter matching the screwholes.

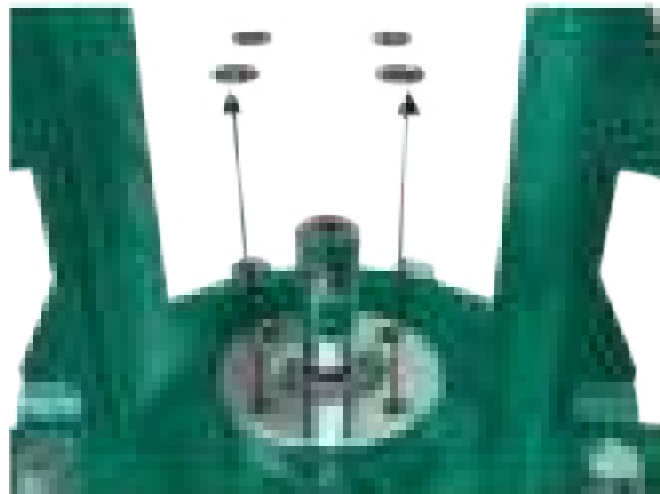


Figure 6.16 Placing the corresponding washers on the adapter matching the screwholes.

PI Operation Manual

17. Fasten the corresponding screws on the seal gland.



Figure 6.17 Fastening the corresponding screws on the seal gland.

ATTENTION

The NPT hole in the mechanical seal head should be aligned at 90° from the suction and discharge flanges, that is, perpendicular to the suction and discharge flanges, pointing towards either side of the pump. This will simplify the connection of the flushing line to the mechanical seal head.

18. Place the rotating part of the mechanical seal. Do not tighten the setscrews.

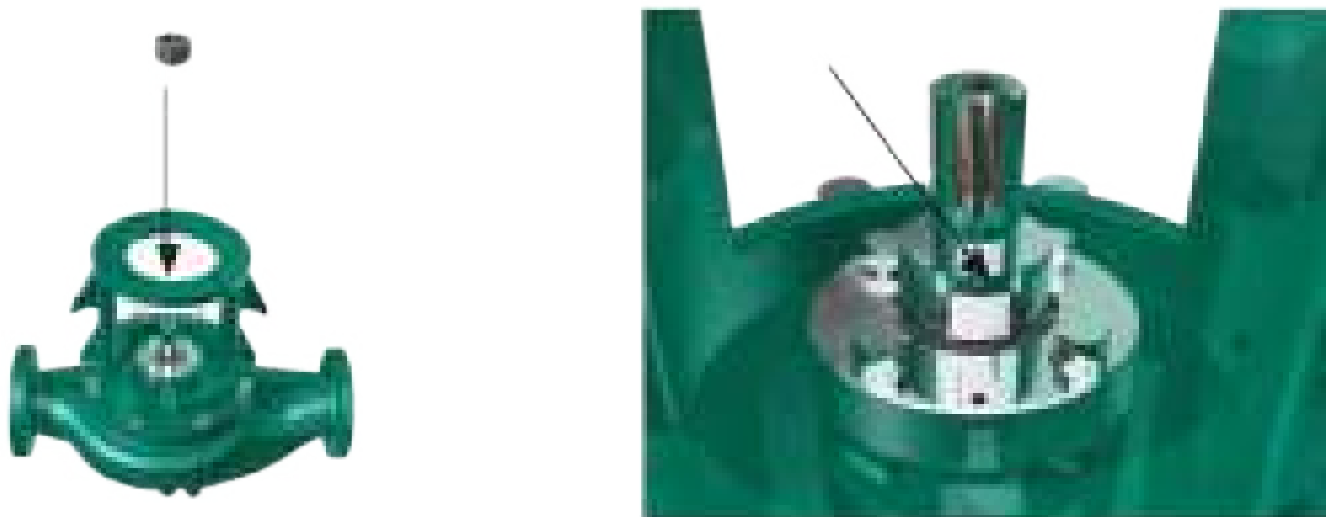


Figure 6.18 Placing the rotating part of the mechanical seal.

19. Place the lockwasher on the shaft, making sure that the screwholes match.

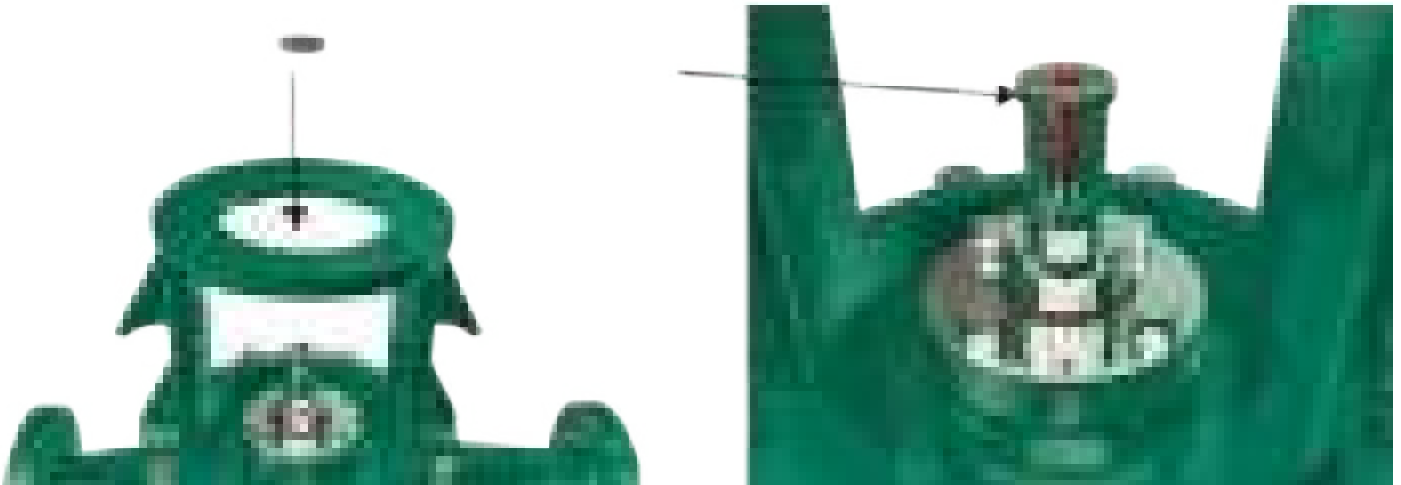


Figure 6.19 Placing the lockwasher on the shaft.

20. Tighten the shaft screw on the upper end of the shaft.

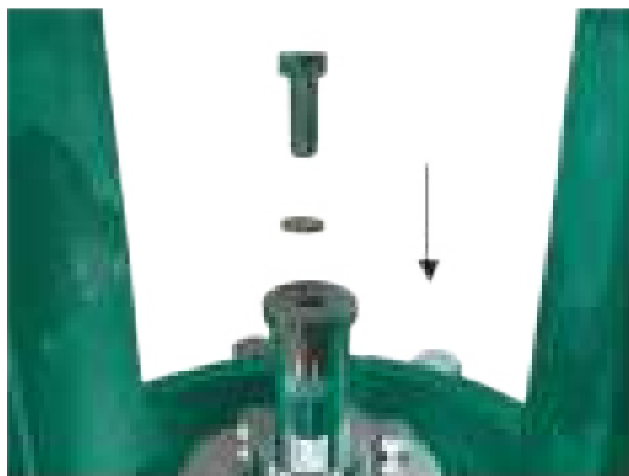


Figure 6.20 Tightening the shaft screw on the upper end of the shaft.

ATTENTION

Manually rotate the shaft to make sure it moves without any obstruction.

PI Operation Manual

21. Position the motor vertically and place it over the upper face of the adapter with the shaft of the motor facing downwards.



Figure 6.21 Positioning the motor in the adapter.

22. Place and tighten the motor screws. Tighten the screws crosswise to ensure a uniform assembly.

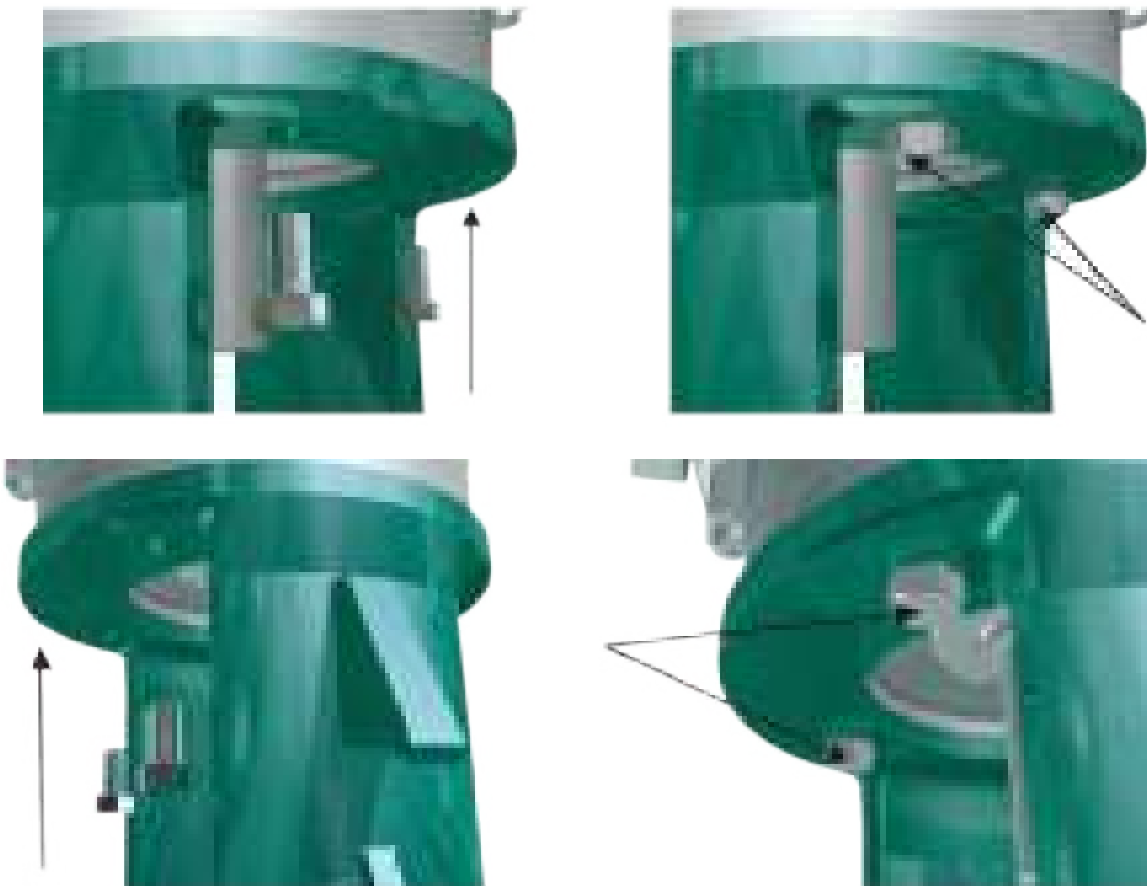


Figure 6.22 Placing and tighten the motor screws.

23. Insert the motor shaft key into its groove.

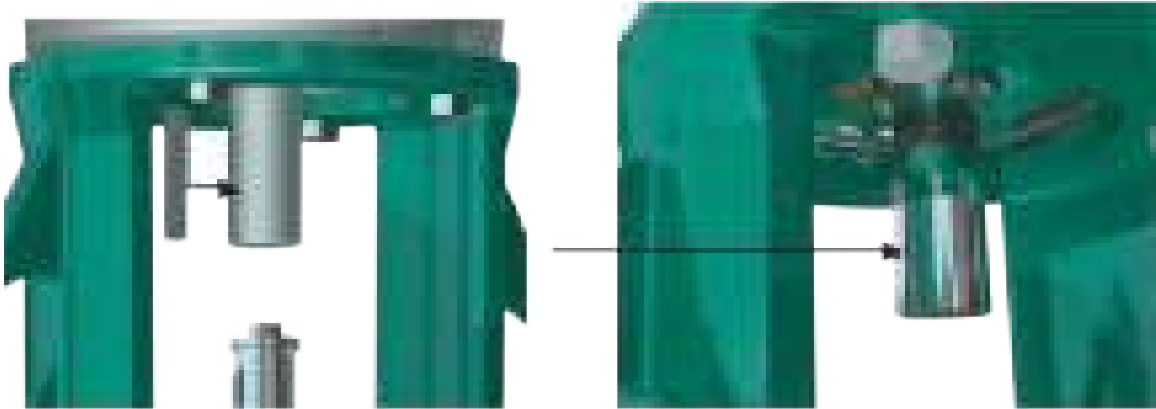


Figure 6.23 Inserting the motor shaft key into its groove.

24. Insert the impeller shaft key into its groove.

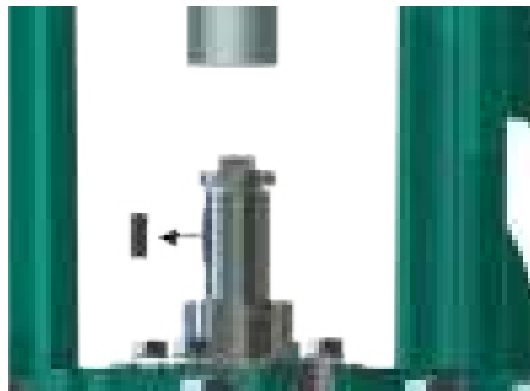


Figure 6.24 Inserting the impeller shaft key into its groove.

25. Insert the half of the coupling that has the keyways in its interior and adjust it to the motor and impeller shafts. Make sure to match the keyways of the coupling.

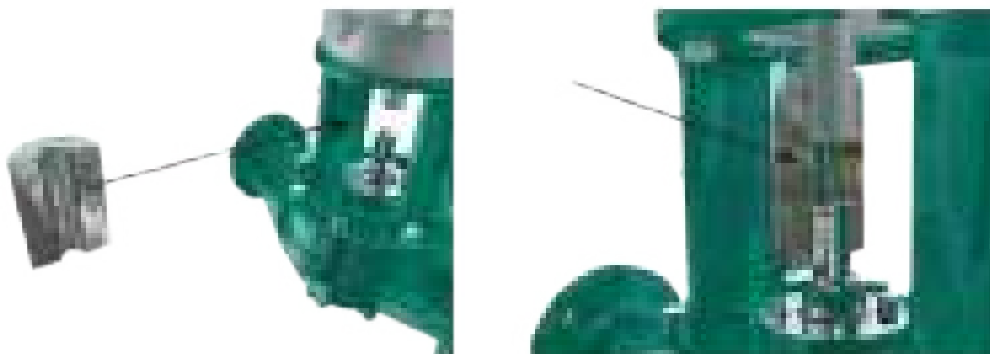


Figure 6.25 Inserting one-half of the coupling and adjust it to the motor and impeller shafts.

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ATTENTION

A lever (eg., a bar) should be used to lift the rotor, supported in the adapter and pressing against the bottom face of the half coupling, in order to hold it in its position once the rotor has been correctly matched in the half coupling, while performing the next steps.

26. Place the second half of the coupling in the shaft.

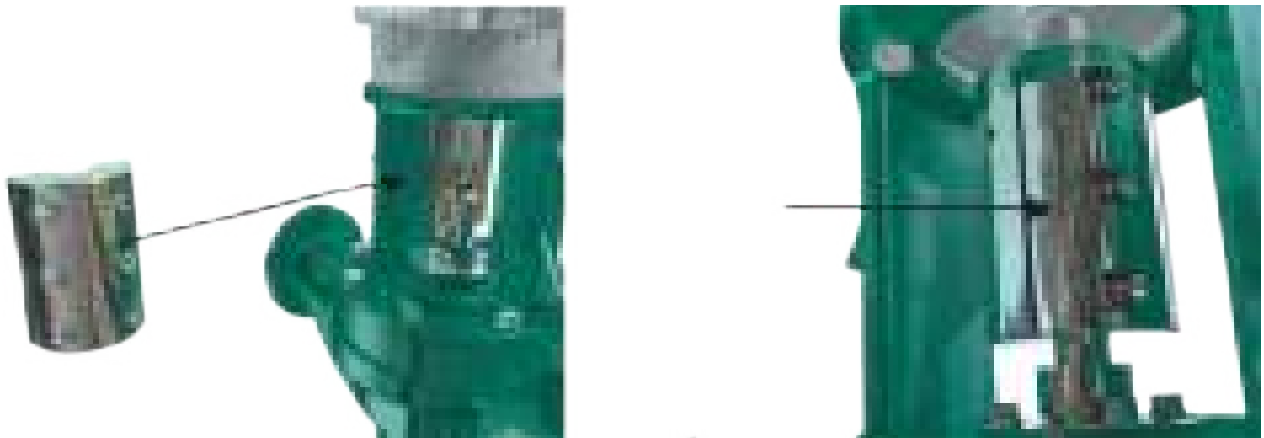


Figure 6.26 Placing the second half of the coupling in the shaft.

27. Place the lockwasher on both couple halves, making sure that the screwholes match.

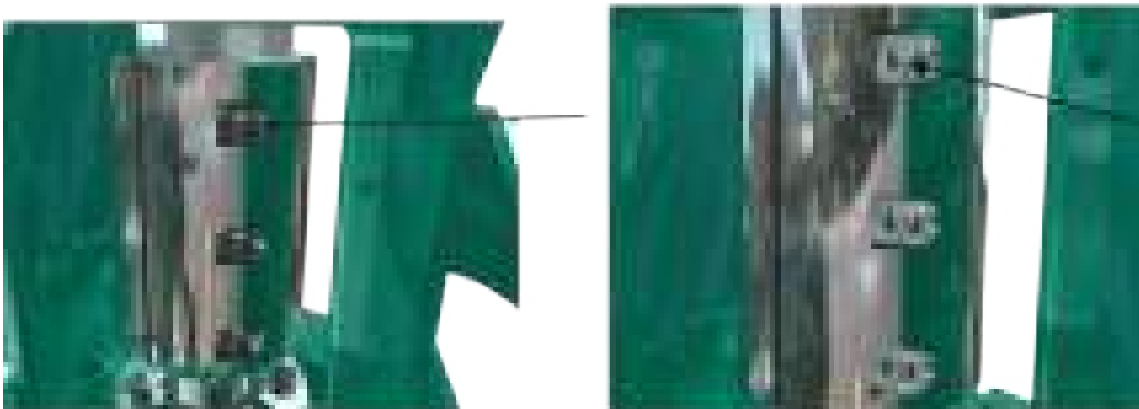


Figure 6.27 Placing the lockwasher on both couple halves.

28. Place and tighten the coupling screws. Tighten the screws crosswise to ensure a uniform assembly.



Figure 6.28 Placing and tightening the coupling screws.

ATTENTION Inspection point: Rotate the rotor by hand to verify that the coupling has been installed correctly. If not, disassemble the coupling and repeat the last six steps.

29. Tighten the setscrews of the rotating part of the mechanical seal. To ensure future effective performance of the mechanical seal press down the rotating part while tightening the setscrews.

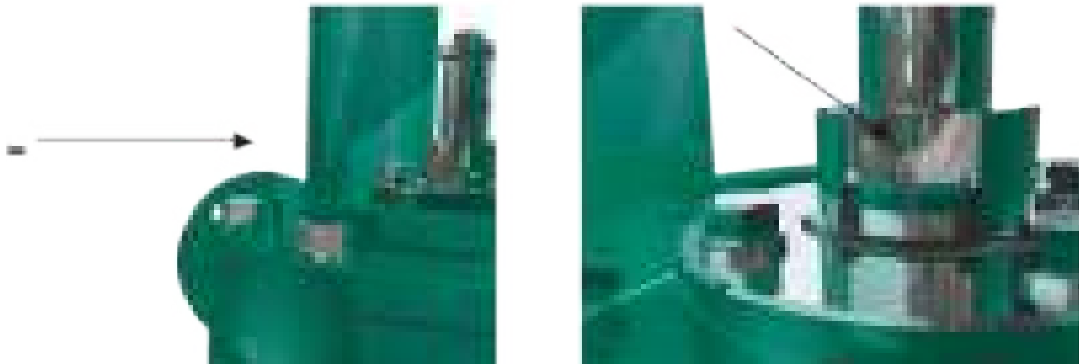


Figure 6.29 Tightening the setscrews of the rotating part of the mechanical seal.

30. Insert the tubing connector in the seal pipe.



Figure 6.30 Inserting the tubing connector in the seal pipe.

PI Operation Manual

31. Insert the vent valve into the tubing connector.



Figure 6.31 Inserting the vent valve into the tubing connector.

32. Insert the vent assembly into its corresponding position on the casing.

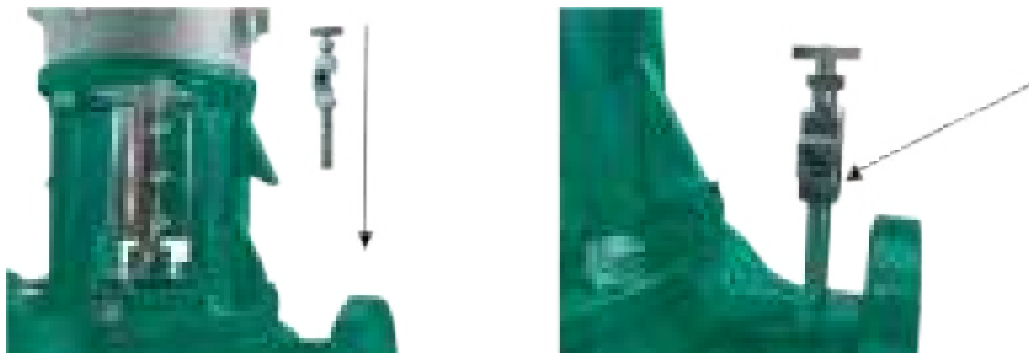


Figure 6.32 Inserting the vent assembly into its corresponding position on the casing.

33. Connect the valve and venting hose to the mechanical seal for its lubrication.

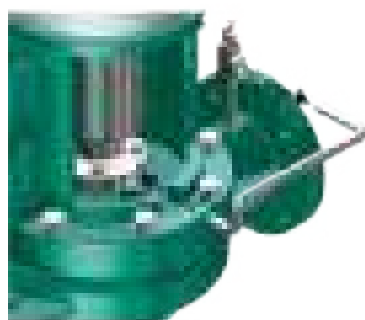


Figure 6.33 Connecting the valve and venting hose to the mechanical seal.

34. Install the coupling guard over the adapter.

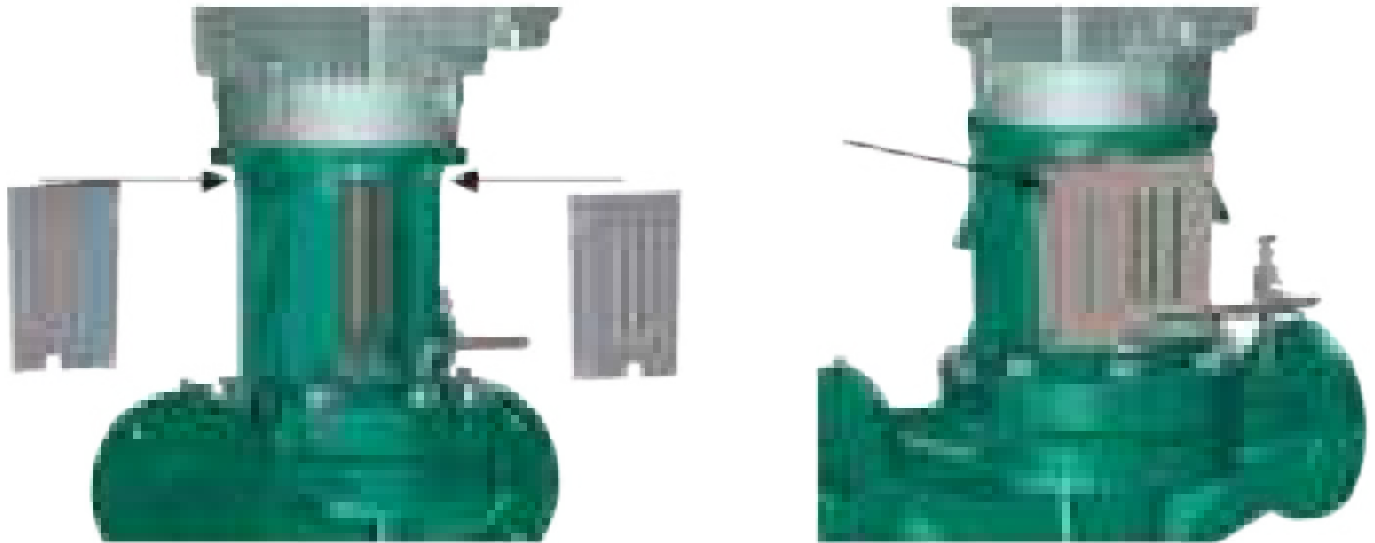


Figure 6.34 Installing the coupling guard over the adapter.

35. Tighten the coupling guard screws in position.

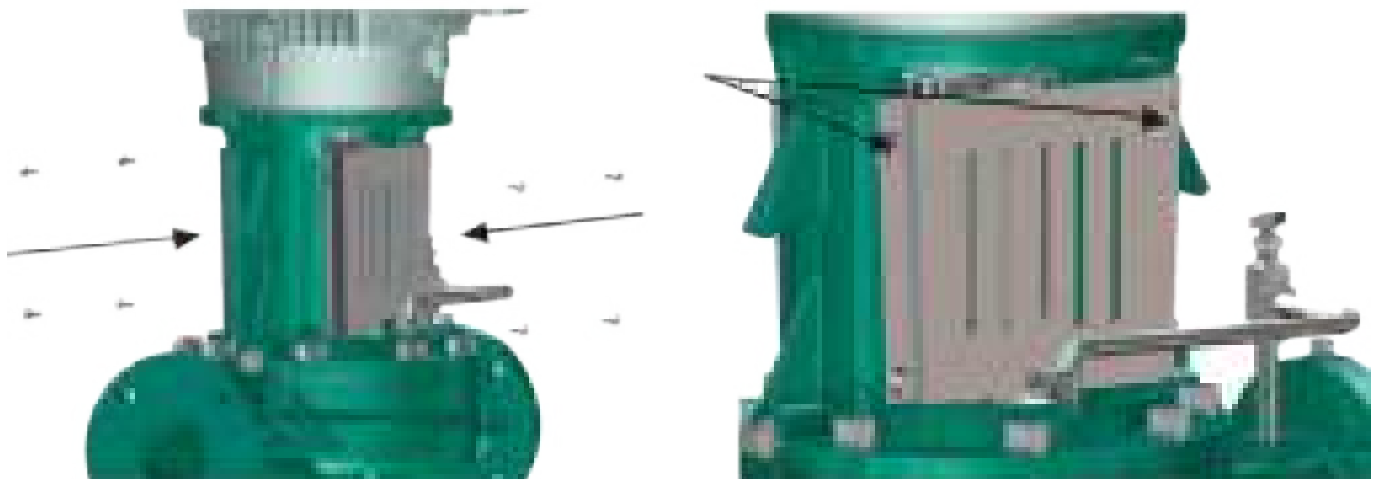


Figure 6.35 Tightening the coupling guard screws in position.

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36. At this point, the pump has been completely assembled.



Figure 6.36 Assembled pump.

6.3.2 PI Packing Option

The PI Packing Option pump shares reassembly steps 1 through 11, and 19 to 36, with the PI Mechanical Seal Option pump. Please follow the aforementioned steps from the PI Mechanical Seal Option pump reassembly procedure found in SECTION 6.3.1 - PI Mechanical Seal Option when reassembling the PI Packing Option pump.

Intermediate steps to reassemble the PI Packing Option pump, steps 13 to 18 for the driven side are the following:

13. Insert two strips of packing in the packing chamber rolled to the sleeve.

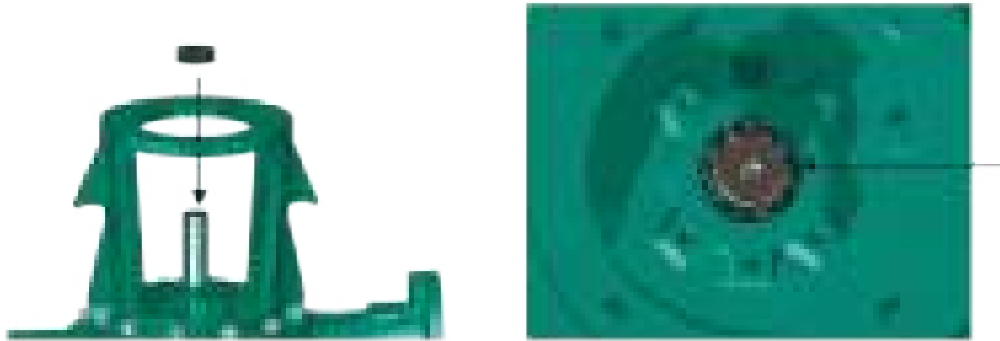


Figure 6.37 Inserting two strips of packing in the packing chamber rolled to the sleeve.

ATTENTION

The joining faces of each strip must not be aligned to ensure a proper assembly and function.

14. Assemble and insert the lantern ring into the shaft until it touches the packing.



Figure 6.38 Assembling and inserting the lantern ring into the shaft until it touches the packing.

PI Operation Manual

15. Place two strips of packing in the packing chamber. Make sure the packing is touching the lantern ring.

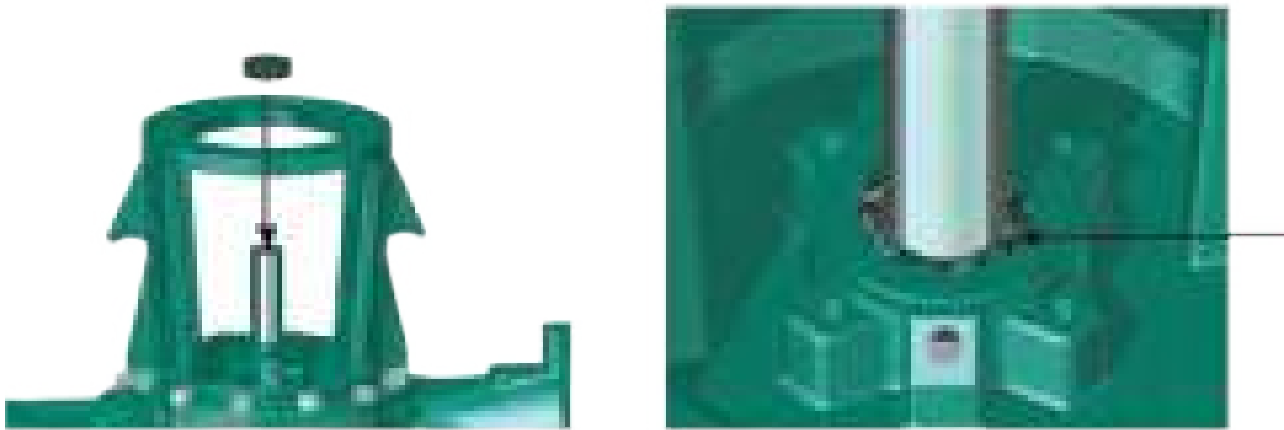


Figure 6.39 Placing two strips of packing in the packing chamber.

ATTENTION

The joining faces of each strip must not be aligned to ensure a proper assembly and function.

16. Insert the two corresponding studs into the adapter. The studs must be screwed until they stop.

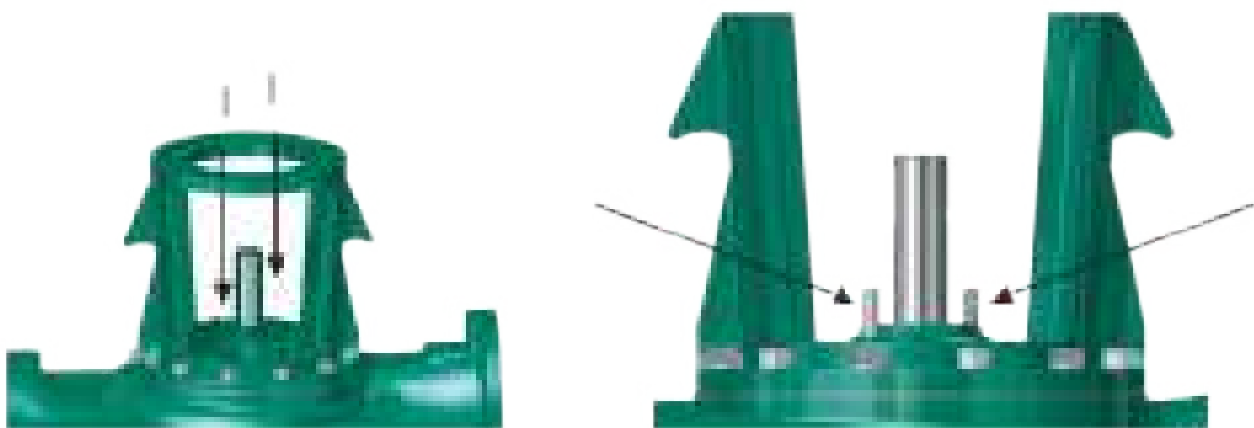


Figure 6.40 Inserting the two corresponding studs into the adapter.

17. Assemble and insert the packing gland onto the shaft.

a) Assemble the two equal pieces of the packing gland.

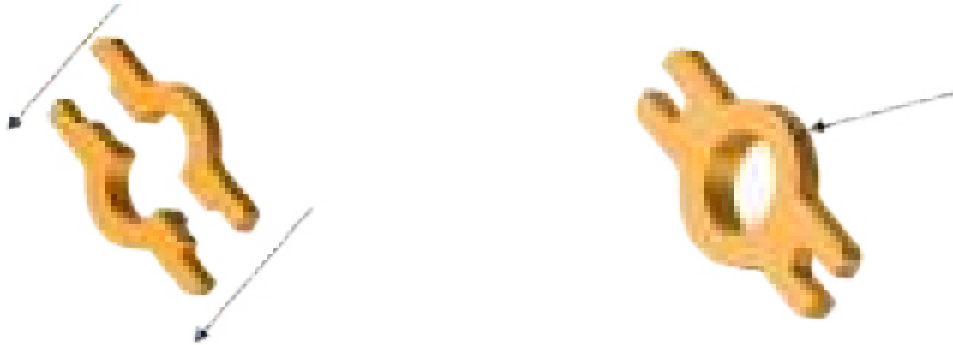


Figure 6.41 Assembling the two equal pieces of the packing gland.

b) Insert two screw bolts into the split packing gland. The head of both bolts should be in the same side.



Figure 6.42 Inserting two screw bolts into the split packing gland.

c) Place the two corresponding nuts into the screw bolts.

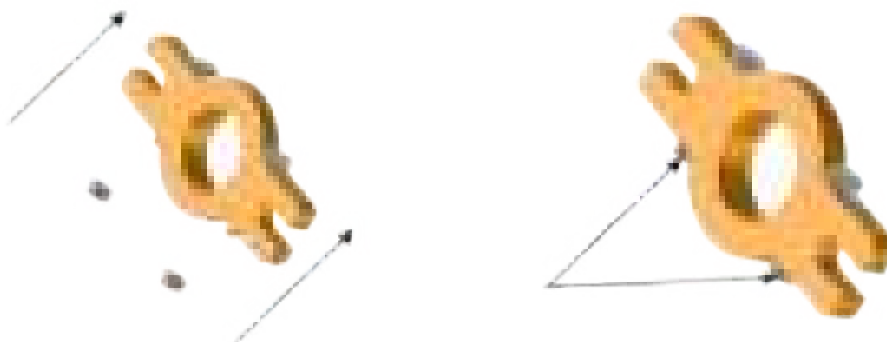


Figure 6.43 Placing the two corresponding nuts into the screw bolts.

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- d) Insert the packing gland onto the shaft. Make sure that the studs and the packing gland match with each other.

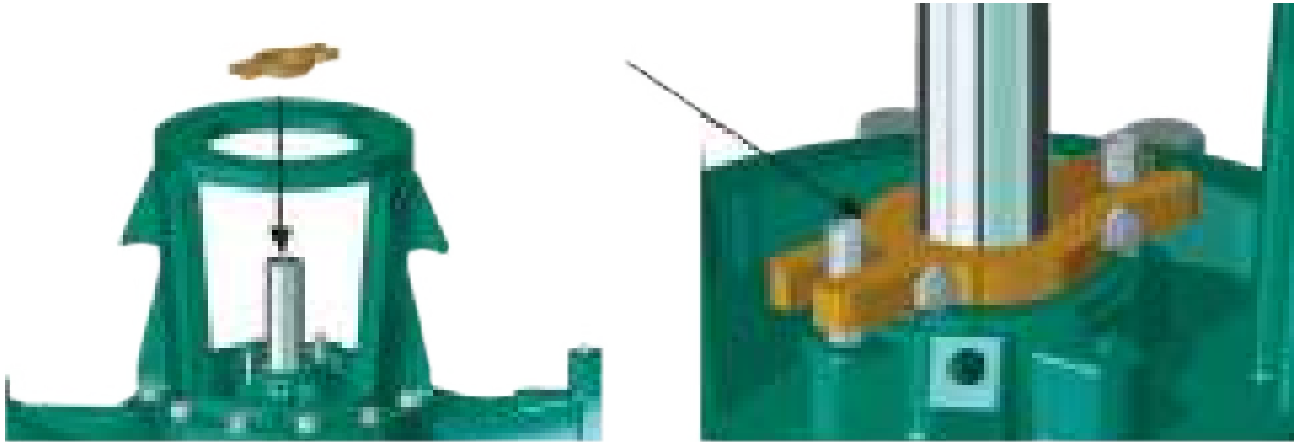


Figure 6.44 Inserting the packing gland into the shaft.

18. Place the corresponding nuts in their position.

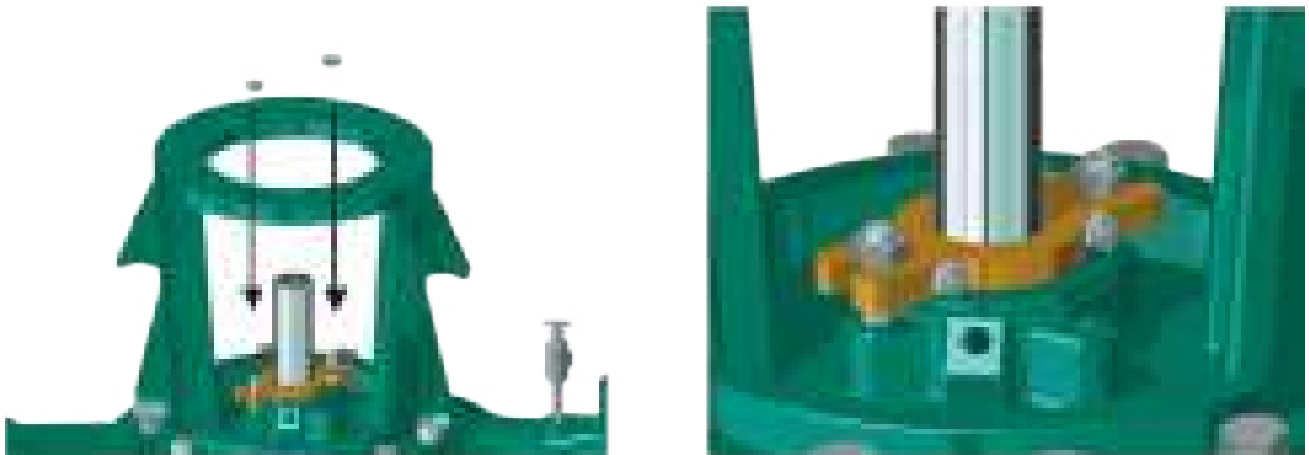


Figure 6.45 Placing the corresponding nuts in their position.

ATTENTION

The nuts must be screwed by hand, not using a wrench. This for the proper function of the packing seal.

After finishing these steps, refer to SECTION 6.3.1 PI Mechanical Seal Option, STEP 19.

7. SECTION SEVEN - SPARE PARTS

The recommended quantity of spare parts to meet regular conditions of constant operation over a period of two years are given in the list below:

Spare parts	Number of identical pumps (including reserve pumps)						
	2	3	4	5	6 and 7	8 and 9	10 and more
	Quantity of spare parts						
Impeller	1	1	1	2	2	3	30%
Shaft with key	1	1	1	2	2	3	30%
O-rings (one of each size)	2	3	6	8	8	10	150%
Repair kit for mechanical seal	1	1	2	2	2	3	30%

The spare parts should be available from the time of first operation.

Spare parts taken out and used must be replaced as soon as possible.

Please give the following details when ordering:

- Order No. of the pump
- Type of pump and size
- Identity number from the list of spare parts
- Part number from the sectional drawing
- Quantity

Material Storage of spare parts

- Store the spare parts in their original packaging.
- Store in a dry place, preferably at a constant temperature.
- Check the spare parts and the state of the packaging every 6 months for signs of corrosion.
- Repair any damage or sign of corrosion with anticorrosive agents.

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8. SECTION EIGHT - PARTS INFORMATION

Pump PI			
Item	Description	Item	Description
101	Pump Casing	909	Setscrew
211	Pump Shaft	912	Drain Plug
230	Impeller	913	Plug
400	Casing Gasket	914	Socket head Cap Screw (Coupling)
471	Seal Cover	400.01	Mechanical Seal Gasket (Top)
472	Rotating Seal Face	400.02	Mechanical Seal Gasket (Bottom)
475	Stationary Seal Face	900.01	Hexagonal Head Cap Screw (Case)
540	Bushing	900.02	Hexagonal Head Cap Screw (Gland)
594	Motor Adapter	900.03	Hexagonal Head Cap Screw (Motor)
681	Coupling Guard	900.04	Hexagonal Head Cap Screw (Shaft)
703	Sealing Tubing	931.01	Lockwasher (Case)
710	Seal Pipe	931.02	Lockwasher (Gland)
740	Flex Hose	931.03	Lockwasher (Shaft)
741	Vent Valve	940.01	Key (Coupling)
819	Motor (Driver) Shaft	940.02	Key (Impeller)
861	Split Coupling	940.03	Key (Motor)

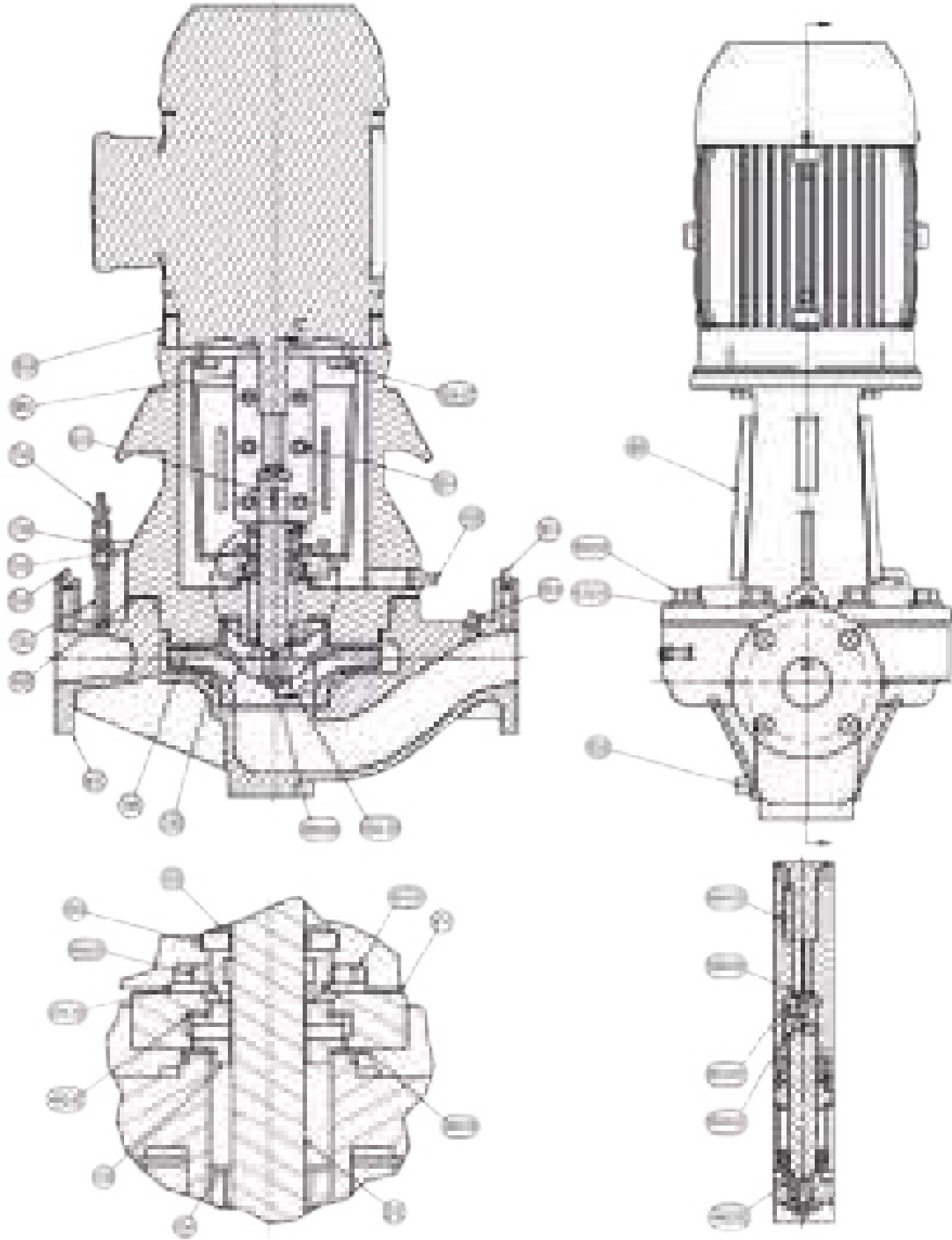


Figure 8.1 Sectional Drawing

PI Operation Manual

9. SECTION NINE - TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSES	SUGGESTED SOLUTION
<p>PUMP DOES NOT DELIVER LIQUID</p>	<ul style="list-style-type: none"> a. Inner pump parts are worn. b. Density or viscosity of pumped fluid is not same as designed. c. The motor voltage is incorrect. d. Motor runs only in two phase mode. e. Pump not primed. f. Speed too low. g. Feed pipe or impeller plugged. h. Clogged suction. i. Damaged impeller. j. Wrong rotation. k. Pump or piping are not properly vented. l. Formation of air pockets in the piping. m. The counter pressure of the system is greater than the design point of the pump. n. NPSHa too low. 	<ul style="list-style-type: none"> a. Change worn parts. b. Consult a WDM Pumps dealer. c. Apply correct voltage to the motor. d. Check the cables, connections and fuses. e. Prime pump. f. Check driver input. g. Clean pipe and impeller. h. Clean out suction line. i. Replace impeller. j. Check driver rotation. k. Vent or top up. l. Install vent valve or lay piping elsewhere. m. Open discharge valve as wide as necessary to reach the operating point. n. Check the fluid level in the feed container. Open suction valve completely. Lay suction pipe elsewhere as friction losses are too great. Check for a possible filter in the feed pipe.

TROUBLE	PROBABLE CAUSES	SUGGESTED SOLUTION
<p style="text-align: center;">CAPACITY OR DISCHARGE PRESSURE LOW</p>	<ul style="list-style-type: none"> a. Air leaks into suction. b. Speed too low. c. Clogged suction. d. Clogged impeller. e. Damaged impeller. f. Wrong rotation. g. Feed pipe or impeller plugged. h. Formation of air pockets in the piping. i. Inner pump parts are worn. j. Density or viscosity of pumped fluid is not same as designed. k. The motor voltage is incorrect. l. Motor connected only in two-phase mode. m. NPSHa too low. 	<ul style="list-style-type: none"> a. Check suction line for leaks. b. Check driver and its power source. c. Clean out suction line. d. Clean impeller. e. Replace impeller. f. Check motor (driver) rotation. g. Clean pipe and impeller. h. Install vent valve or lay piping elsewhere. i. Change worn parts. j. Consult a WDM Pumps dealer. k. Apply correct voltage to the motor. l. Check the cables, connections and fuses. m. Check the fluid level in the feed container. Open suction valve completely. Lay suction pipe elsewhere as friction losses are too great. Check for a possible filter in the feed pipe.
<p style="text-align: center;">DRIVER OVERLOAD</p>	<ul style="list-style-type: none"> a. Density or viscosity of pumped fluid is not same as designed. b. Speed too high. c. Pump is under tension. d. The motor voltage is incorrect. e. Motor connected only in two-phase mode. f. System head lower than rating. 	<ul style="list-style-type: none"> a. Consult a WDM Pumps dealer. b. Decrease driver speed. c. Check the piping for tension free connections. d. Apply correct voltage to the motor. e. Check the cables, connections and fuses. f. Check suction and discharge pressure.

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Our customers rely on our world-class team of experienced WDM Pumps engineers, technicians, and product application specialists.

WDM offers pump products and related equipment for a wide variety of industries, including industrial, agricultural, and construction. The WDM Pumps product line includes self priming, flexible coupled, close coupled, diesel and gasoline driven centrifugal pumps, in addition to submersible solids handling products.

WDM Pumps plants are strategically located throughout the Americas in the United States, Colombia, Mexico, Panama, Argentina, and Guatemala.



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