

**Installation, Operation &
Maintenance Manual**
Self-Priming Centrifugal
Solids Handling Pumps

T-100ZZB-14-75 SERIES



IMPORTANT! - Read all instructions in this manual before operating or servicing a pump.


Before installation, read the following instructions carefully. Failure to follow instruction and safety information could cause serious bodily injury, death and/or property damage. Each Barmesa product is carefully inspected to insure proper performance. Closely following these instructions will eliminate potential operating problems, assuring years of trouble-free service.

⚠ DANGER "Danger" indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠ WARNING "Warning" indicates an imminently hazardous situation which, if not avoided, MAY result in death or serious injury.


⚠ CAUTION "Caution" indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.


IMPORTANT! - Barmesa Pumps is not responsible for losses, injury or death resulting from failure to observe these safety precautions, misuse, abuse or misapplication of pumps or equipment.

 **ALL RETURNED PRODUCTS MUST BE CLEANED, SANITIZED, OR DECONTAMINATED PRIOR TO SHIPMENT, TO INSURE EMPLOYEES WILL NOT BE EXPOSED TO HEALTH HAZARDS IN HANDLING SAID MATERIAL. ALL APPLICABLE LAWS AND REGULATIONS SHALL APPLY.**

⚠ WARNING Installation, wiring, and junction connections must be in accordance with the National Electric Code and all applicable state and local codes. Requirements may vary depending on usage and location.

⚠ WARNING Installation and servicing is to be conducted by qualified personnel only.

 Keep clear of suction and discharge openings. Do not insert fingers in pump with power connected; the rotating cutter and/or impeller can cause serious injury.

 Always wear eye protection when working on pumps. Do not wear loose clothing that may become entangled in moving parts.

⚠ DANGER Pumps build up heat and pressure during operation. Allow time for pumps to cool before handling or servicing the pump or any accessory items associated with or near the pump.

⚠ DANGER Risk of electric shock. To reduce risk of electric shock, always disconnect pump from power source before handling any aspect of the pumping system. **Lock out power and tag.**

⚠ WARNING Do not use these pumps in water over 104° F. Do not exceed manufacturers recommended maximum performance, as this could cause the motor to overheat.

⚠ DANGER Operation against a closed discharge valve will cause premature bearing and seal failure. Heat build up on self-priming and end suction pumps may cause dangerous pressures. A high temperature switch or pressure relief valve is recommended to be installed in pump case.

⚠ WARNING Carefully read instruction manuals supplied with motor or engine before operating or servicing.

⚠ CAUTION Pump speed and operating conditions must be within performance range.

⚠ DANGER **DO NOT** pump hazardous material. These pumps are NOT to be installed in locations classified as hazardous in accordance with the National Electric Code, ANSI/NFPA 70.

⚠ CAUTION **DO NOT** run pump backwards. Make sure that rotation is correct before operating pump.

⚠ WARNING Use proper lifting equipment with adequate capacity to prevent personnel injuries or equipment damage.

⚠ WARNING Before servicing close the suction and discharge valves, vent pump slowly and drain.

⚠ CAUTION Never operate these pumps unless there is liquid in the pump casing. The pump will not prime when dry. Extended operation of a dry pump will destroy the seal.

IMPORTANT! - Prior to installation, record Model Number, Serial, Amps, Voltage, Phase and HP from pump name plate for the future reference.

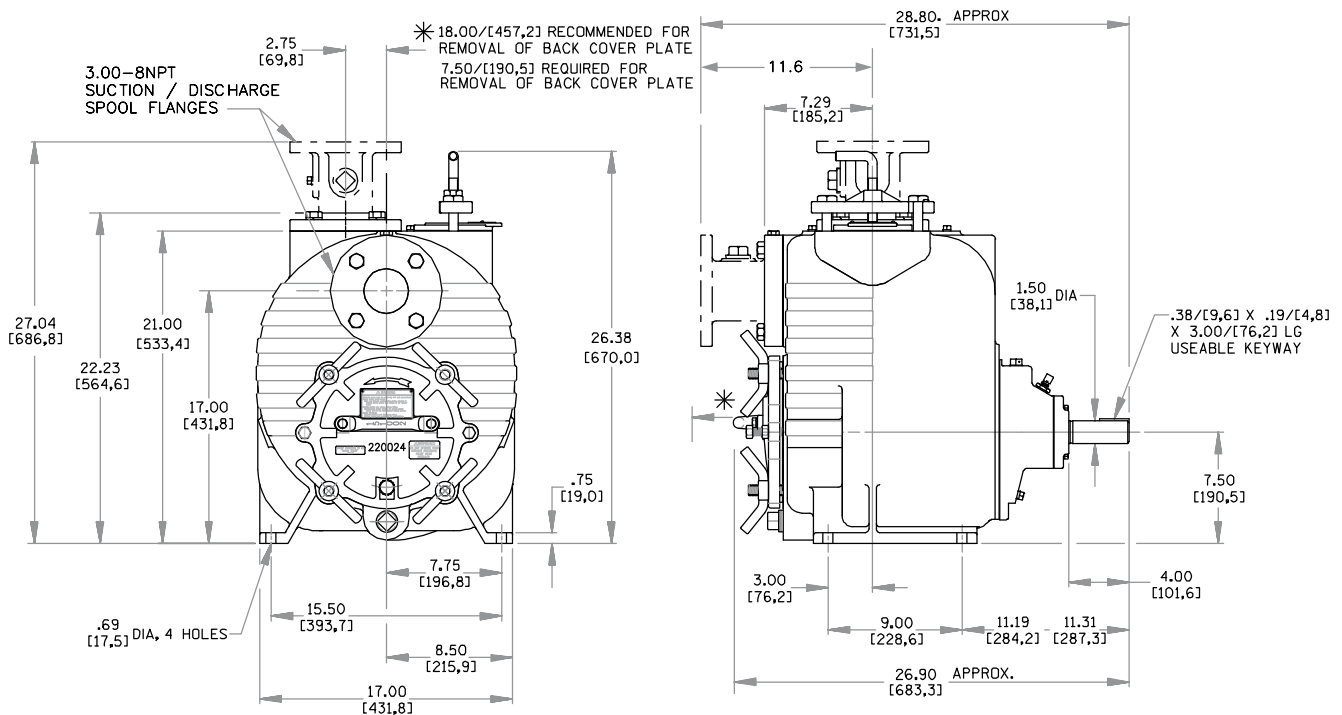
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Serial: _____

PHASE: _____ HP: _____

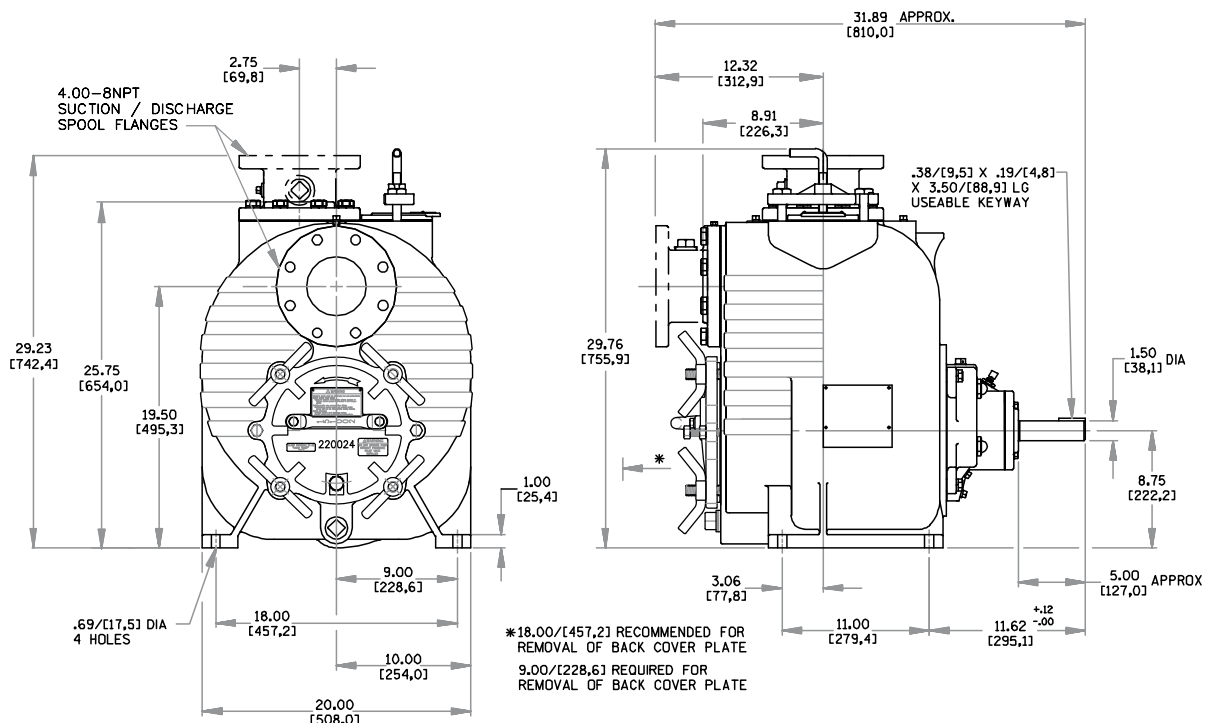
► T-80ZZB

| | |
|---|--|
| DISCHARGE: | 3" x 3" NPT, 125 lbs., female flange. |
| SPHERICAL SLD HNDLG: | 2½" |
| LIQUID TEMPERATURE: | 160°F (71°C) |
| CASING: | Cast iron ASTM A-48 class 30. Maximum operating pressure 87 psi (600 KPa). |
| IMPELLER: | 2 vane, open. Ductile iron no. 65-45-12. |
| SHAFT: | Alloy steel no. 4140. |
| SHAFT SLEEVE: | 316 series stainless steel. |
| WEAR PLATE: | Carbon steel no. 1015. Replaceable. |
| COVER PLATE: | Cast iron ASTM A-48 class 30, weight 30 lbs. Removable/adjustable. |
| FLAP VALVE: | Neoprene with steel reinforcing. |
| BEARING HOUSING: | Cast iron ASTM A-48 class 30. |
| SEAL PLATE: | Cast iron ASTM A-48 class 30. |
| BEARING - PUMP END: | Open single ball, radial load. |
| BEARING - DRIVE END: | Open double ball, thrust load. |
| SEAL CAVITY AND BEARING LUBRICATION: | SAE no. 30 non detergent oil, pump includes oil level sight gauges. |
| GASKETS: | Buna-N, compressed synthetic fibers, PTFE, vegetable fiber, cork and rubber. |
| O-RINGS: | Buna-N. |
| HARDWARE: | Standard plated steel. |
| PAINT: | Air dry enamel, water based. |
| PRESSURE RELIEF VALVE: | Brass. |
| SEAL: | Type 21, mechanical, oil lubricated, double floating, self aligning. Silicon carbide rotating and stationary faces, fluorocarbon elastomers (Viton® or equivalent). 316 stainless steel cage and spring. |
| OPTIONAL EQUIPMENT: | Flexible coupled assy, with base OSHA guard and electric motor. |



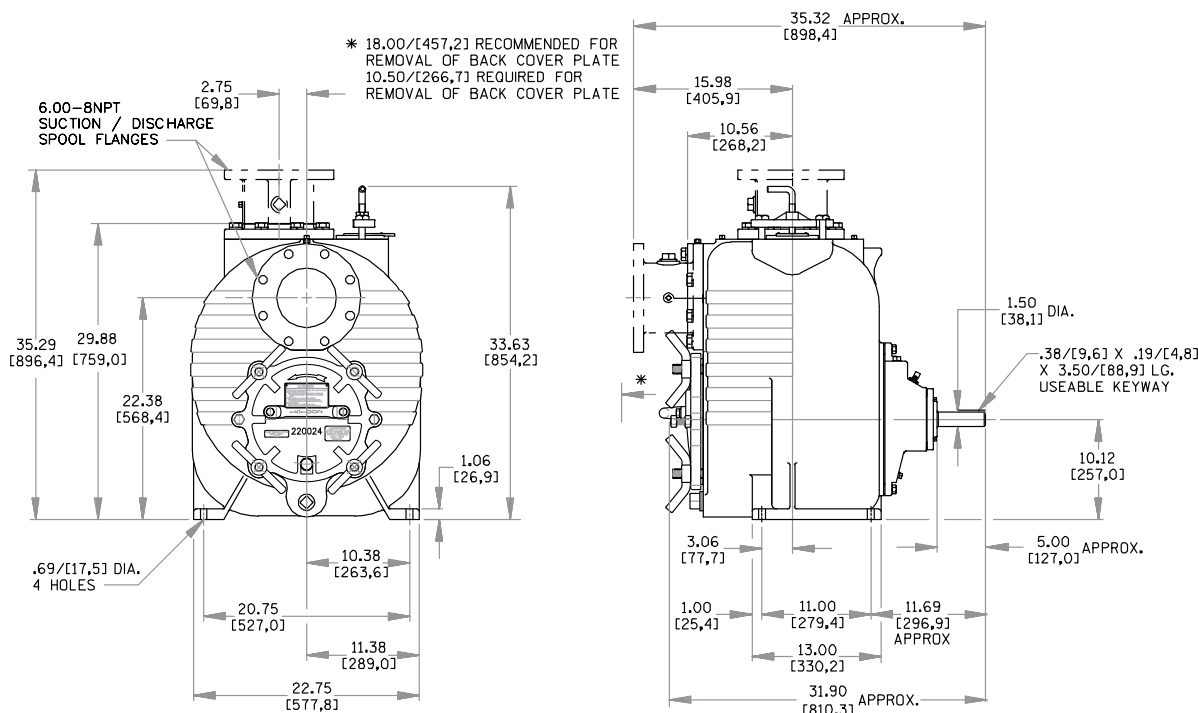
T-100ZZB-14-75

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| DISCHARGE: | 4" x 4" NPT, 125 lbs., female flange. |
| SPHERICAL SLD HNDLG: | 3" |
| LIQUID TEMPERATURE: | 160°F (71°C) |
| CASING: | Cast iron ASTM A-48 class 30. Maximum operating pressure 86 psi (593 KPa). |
| IMPELLER: | 2 vane, open. Ductile iron no. 65-45-12. |
| SHAFT: | Alloy steel no. 4140. |
| SHAFT SLEEVE: | 316 series stainless steel. |
| WEAR PLATE: | Carbon steel no. 1015. Replaceable. |
| COVER PLATE: | Cast iron ASTM A-48 class 30, weight 30 lbs. Removable/adjustable. |
| FLAP VALVE: | Neoprene with steel reinforcing. |
| BEARING HOUSING: | Cast iron ASTM A-48 class 30. |
| SEAL PLATE: | Cast iron ASTM A-48 class 30. |
| BEARING - PUMP END: | Open single ball, radial load. |
| BEARING - DRIVE END: | Open double ball, thrust load. |
| SEAL CAVITY AND BEARING LUBRICATION: | SAE no. 30 non detergent oil, pump includes oil level sight gauges. |
| GASKETS: | Buna-N, compressed synthetic fibers, PTFE, vegetable fiber, cork and rubber. |
| O-RINGS: | Buna-N. |
| HARDWARE: | Standard plated steel. |
| PAINT: | Air dry enamel, water based. |
| PRESSURE RELIEF VALVE: | Brass. |
| SEAL: | Type 21, mechanical, oil lubricated, double floating, self aligning. Silicon carbide rotating and stationary faces, fluorocarbon elastomers (Viton® or equivalent). 316 stainless steel cage and spring. |
| OPTIONAL EQUIPMENT: | Flexible coupled assy, with base OSHA guard and electric motor. |



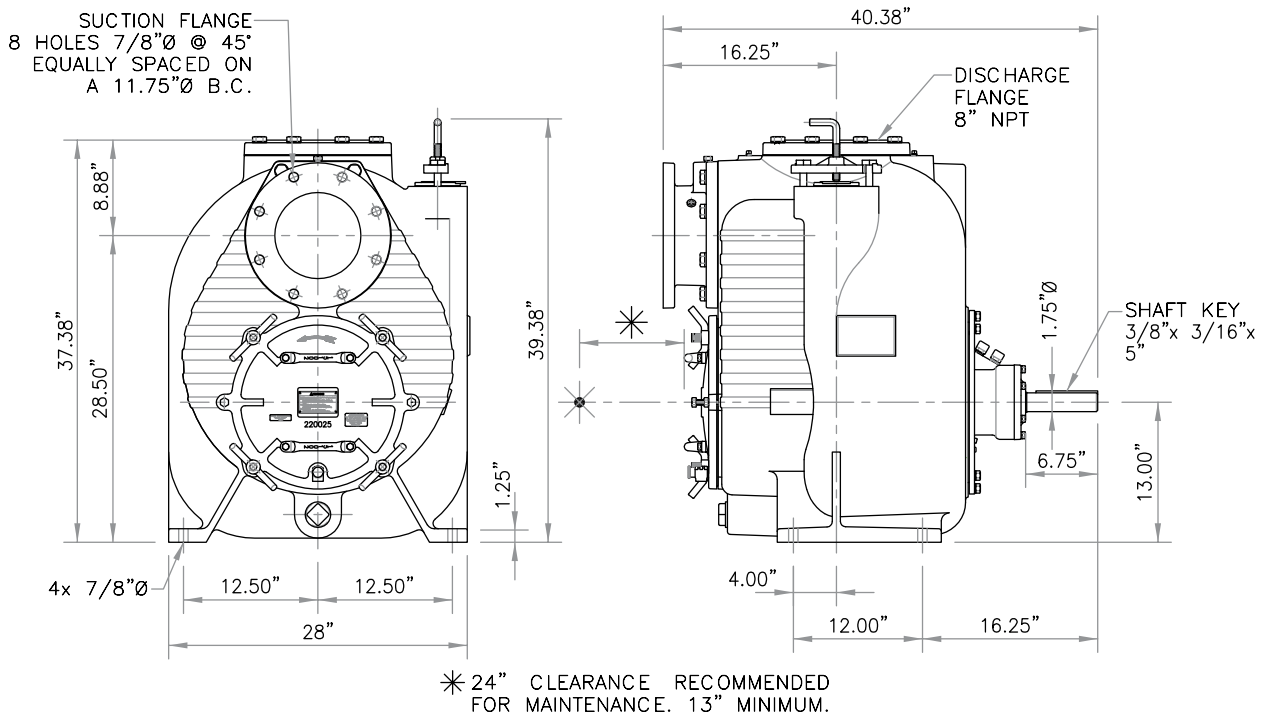
T-150ZZB-14-75

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| DISCHARGE: | 6" x 6" NPT, 125 lbs., female flange. |
| SPHERICAL SLD HNDLG: | 3" |
| LIQUID TEMPERATURE: | 160°F (71°C) |
| CASING: | Cast iron ASTM A-48 class 30. Maximum operating pressure 79 psi (545 KPa). |
| IMPELLER: | 2 vane, open. Ductile iron no. 65-45-12. |
| SHAFT: | Alloy steel no. 4140. |
| SHAFT SLEEVE: | 316 series stainless steel. |
| WEAR PLATE: | Carbon steel no. 1015. Replaceable. |
| COVER PLATE: | Cast iron ASTM A-48 class 30, weight 30 lbs. Removable/adjustable. |
| FLAP VALVE: | Neoprene with steel reinforcing. |
| BEARING HOUSING: | Cast iron ASTM A-48 class 30. |
| SEAL PLATE: | Cast iron ASTM A-48 class 30. |
| BEARING - PUMP END: | Open single ball, radial load. |
| BEARING - DRIVE END: | Open double ball, thrust load. |
| SEAL CAVITY AND BEARING LUBRICATION: | SAE no. 30 non detergent oil, pump includes oil level sight gauges. |
| GASKETS: | Buna-N, compressed synthetic fibers, PTFE, vegetable fiber, cork and rubber. |
| O-RINGS: | Buna-N. |
| HARDWARE: | Standard plated steel. |
| PAINT: | Air dry enamel, water based. |
| PRESSURE RELIEF VALVE: | Brass. |
| SEAL: | Type 21, mechanical, oil lubricated, double floating, self aligning. Silicon carbide rotating and stationary faces, fluorocarbon elastomers (Viton® or equivalent). 316 stainless steel cage and spring. |
| OPTIONAL EQUIPMENT: | Flexible coupled assy, with base OSHA guard and electric motor. |



T-200ZZB-14-75

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| DISCHARGE: | 8" x 8" NPT, 125 lbs., female flange. |
| SPHERICAL SLD HNDLG: | 3" |
| LIQUID TEMPERATURE: | 160°F (71°C) |
| CASING: | Cast iron ASTM A-48 class 30. Maximum operating pressure 86 psi (593 KPa). |
| IMPELLER: | 2 vane, open. Ductile iron no. 65-45-12. |
| SHAFT: | Alloy steel no. 4140. |
| SHAFT SLEEVE: | 316 series stainless steel. |
| WEAR PLATE: | Carbon steel no. 1015. Replaceable. |
| COVER PLATE: | Cast iron ASTM A-48 class 30, weight 30 lbs. Removable/adjustable. |
| FLAP VALVE: | Neoprene with steel reinforcing. |
| BEARING HOUSING: | Cast iron ASTM A-48 class 30. |
| SEAL PLATE: | Cast iron ASTM A-48 class 30. |
| BEARING - PUMP END: | Open single ball, radial load. |
| BEARING - DRIVE END: | Open double ball, thrust load. |
| SEAL CAVITY AND BEARING LUBRICATION: | SAE no. 30 non detergent oil, pump includes oil level sight gauges. |
| GASKETS: | Buna-N, compressed synthetic fibers, PTFE, vegetable fiber, cork and rubber. |
| O-RINGS: | Buna-N. |
| HARDWARE: | Standard plated steel. |
| PAINT: | Air dry enamel, water based. |
| PRESSURE RELIEF VALVE: | Brass. |
| SEAL: | Type 21, mechanical, oil lubricated, double floating, self aligning. Silicon carbide rotating and stationary faces, fluorocarbon elastomers (Viton® or equivalent). 316 stainless steel cage and spring. |
| OPTIONAL EQUIPMENT: | Flexible coupled assy, with base OSHA guard and electric motor. |



► Receiving inspection

Upon receiving the pump, it should be inspected for damage or shortages. If damage has occurred, file a claim immediately with the company that delivered the pump. If the manual is removed from the packaging, do not lose or misplace.

► Storage

Any product that is stored for a period longer than six (6) months from the date of purchase should be bench tested prior to installation. A bench test consists of, checking the impeller to assure it is free turning and a run test to assure the motor (and switch if provided) operate properly.

► Controls

Manual models require a separate approved pump control device or panel for automatic operation. Be sure the electrical specification of the control selected properly match the electrical specifications of the pump.

► Installation

These instructions cover general installations requirements of the pump. The pump is designed to handle mild industrial corrosives, mud or slurries containing large entrained solids.

There are two different applications for these pumps, first is static lift, which is most common, where the pump is position above the level of liquid to be pumped. The second is a flooded suction, where the liquid to the pump is under pressure. Mounting, line configuration and priming will be different for each application.

The pressure supplied to the pump is critical to the performance and safety, limit incoming pressure to 50% of the maximum permissible operating pressure as shown on the pump performance curve. For PSI multiply TDH in feet by 0.4335.

Clearance

The chart shows the recommended clearance for servicing the pumps.

| Pump Size | In Front of Back Cover | Min. Cover removal |
|-----------|------------------------|--------------------|
| 4" | 18" | 11" |
| 6" | 18" | 11" |
| 8" | 24" | 13" |

Foundation

The pump foundation should be sufficiently substantial to form a level, rigid support for the combined weight of the pump and driver and maintain alignment of the installed unit.

Foundation bolts, of the proper size, should be imbedded in the concrete. A pipe sleeve, about 2½" diameters larger than the bolt, should be used to allow for final positioning of the bolts. See Figure 1.

Mounting

Mount pump and driver on a common base plate with coupling, must be aligned. Preliminary alignment is necessary after the complete unit has been leveled on the foundation, and again, after the unit is piped, and rechecked periodically as outlined in the following paragraphs. Position unit on foundation and level the base plate, using rectangular metal blocks and shims, or wedges having a small taper as shown in Figure 1.

A gap of ¾" to 1½" should be allowed between the base plate and foundation for grouting. Adjust the metal supports or wedges until the shafts of the pump and driver are level.

Grouting

Grouting compensates for unevenness in the foundation and prevents vibration and shifting after mounting is complete. Build a form around the base plate to contain the grout, and sprinkle area with water to obtain a good bond. The base should be completely filled with a good quality, non-shrinking grout. The usual mixture for grouting is one part Portland cement and two parts sand with sufficient water to flow freely. It is also desirable to grout the leveling pieces, shims or wedges in place. Foundation bolts should be fully tightened when grout has hardened, usually about 48 hours after pouring.

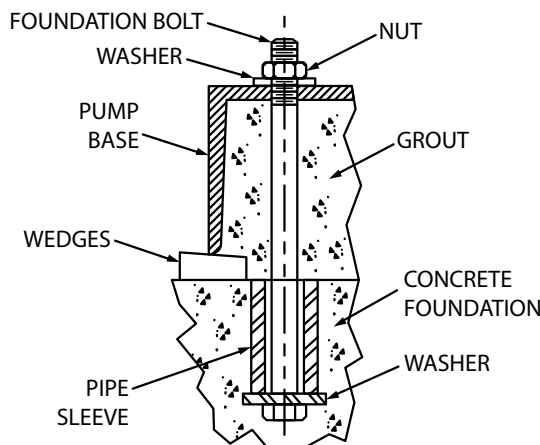


Figure 1

Usually, it is advisable to increase the size of both the suction and discharge pipes at the pump nozzles to have minimum acceptable friction loss, suction pipe should never be smaller in diameter than the pump suction nozzle. When suction pipe is of larger diameter than the pump suction nozzle, an eccentric reducer is required to eliminate possible air or vapor pockets at the pump suction inlet.

Piping

The pump suction and discharge connections are not intended to indicate the required suction and discharge pipe sizes. The pipe diameter must be selected according to the requirements of the pumping system and recommended friction losses for the liquid being pumped.

Both suction and discharge pipes must be supported independently near the pump, so that when piping is connected to the pump, no strain will be transmitted to the pump. Piping should be arranged with as few bends as possible, and, preferably, with long radius elbow whenever possible.

► Material

Either pipe or hose may be used, however, the material must be compatible with the liquid being pumped. If hose is used in suction lines, it must be rigid-wall, reinforced type to prevent collapse under suction. Using piping couplings in suction lines is NOT recommended.

Suction Piping

A horizontal suction line must have a gradual rise to the pump. Any high point in the suction pipe can become filled with air and prevent proper operation of the pump and may cause loss of prime. The pipe and fittings must be free of all air leaks.

Maximum performance is obtained when suction line and pump size are matched. The velocities of 8 to 11 feet per second are obtained when the suction line is sized to the pump suction. This tends to keep solids in suspension and suction line cleaner.

The use of oversized suction line will increase priming time and could cause clogging at the reducers.

► Suction Line in Sump

If a single suction line is installed in a sump, it should be positioned away from the wall of the sump at a distance equal to 1.5 times the diameter of the suction line.

If there is a liquid flow from an open pipe into the sump, the flow should be kept away from the suction inlet because the inflow will carry air down into the sump, and air entering the suction line will reduce pump efficiency.

If it is necessary to position inflow close to the suction inlet, install a baffle between the inflow and the suction inlet at a distance 1.5 times the diameter of the suction pipe. The baffle will allow entrained air to escape from the liquid before it is drawn into the suction inlet.

If two suction lines are installed in a single sump, the flow paths may interact, reducing the efficiency of one or both pumps. To avoid this, position the suction inlets so they are separated by a distance equal to at least 3 times the diameter of the suction pipe.

Gauges

Pumps are usually drilled and tapped for discharge pressure and vacuum suction gauges. If gauges are required and pumps are not tapped, drill and tap the discharge and suction lines not less than 18 inches from the discharge and suction ports and install in the lines. Do not mount any closer as this may cause inaccurate readings.

► Strainer

If a strainer is used, make sure the total area of the openings in the strainer is at least three to four times the cross section of the suction line, the openings should not permit passage of solids larger than the solids handling capability of the pump.

| | |
|----------------|---------------|
| SH3-U | 2-1/2" Solids |
| SH4, 6 and 8-U | 3" Solids |

► Discharge Piping

On the 3" model a 3/4" air bleed line should be used in order to reduce the priming time to a minimum. This is mandatory on force main installations.

An air-bleed valve (by others) may be placed in this line, but not necessary. A clear plastic line is excellent, allowing the operator to detect any clogging.

There are two ways of returning the airbleed line to the pit.

1. A line discharging above the liquid level. This condition is most accepted, but has the disadvantage of losing its prime if the suction check valve is held open by debris. This is generally not a problem if pump is ran at 1600 rpm or higher.

2. A line discharging below the liquid level. This condition works best at slower speeds where considerable debris is encountered. However, the pipe should not project more than one foot below the low liquid level. The pump will not lose prime, if there are no leaks in the systems.

CAUTION *The air-bleed line that is returned to the pit MUST be secured against being drawn into the pump suction inlet.*

The air bleed return line to the pit must be separated from the suction pipe as far as possible in order to eliminate churning air into the sump liquid.

DANGER *DO NOT leave manual shut off valve (if installed in air bleed line), closed during operation. A closed valve may cause a pump which has lost prime to continue to operate without reaching prime, causing dangerous overheating and possible explosive rupture of the pump casing.*

Standard designs require the installation of a check valve and a gate valve. The check valve should be installed in the horizontal position to avoid deposits between the disc and the body and should have a spring loaded are or an externally weighted arm. The gate valve is used when cleaning or repairing the check valve and should be down stream from the check valve.

Alignment

For a trouble free operation, the alignment of the pump and power source is critical. The driver and pump shafts, of either a flex coupled or v-belt driven system, must be aligned with and parallel to each other. Check pump and piping after installed and before operation.

Flex-Coupled

Check the coupling faces, as well as the suction and discharge flanges of the pump for horizontal or vertical position by means of a level. Correct the positions, if necessary, by adjusting the supports or wedges under the base plate, as required.

NOTE: A flexible coupling should not be used to compensate for misalignment of the pump and driver shafts. The purpose of the flexible coupling is to compensate for temperature changes and to permit end movement of the shafts without interference with each other, while transmitting power from the driver to the pump.

CAUTION *Remove and lock out power to driver.*

Field alignment

The faces of the coupling halves should be spaced far enough apart so that they cannot strike each other when the driver rotor is moved toward the pump. The necessary tools for checking the alignment of a flexible coupling are a straight edge and a taper gauge or a set of feeler gauges.

NOTE: In most cases where extreme accuracy is necessary, a dial indicator or laser alignment tool may be required to align coupling.

Angular alignment check is made by inserting a taper gauge or feelers between the coupling faces at 90 degree intervals around the coupling.

The unit will be in angular alignment when the coupling faces are exactly the same distance apart at all points. (See Figure 2).

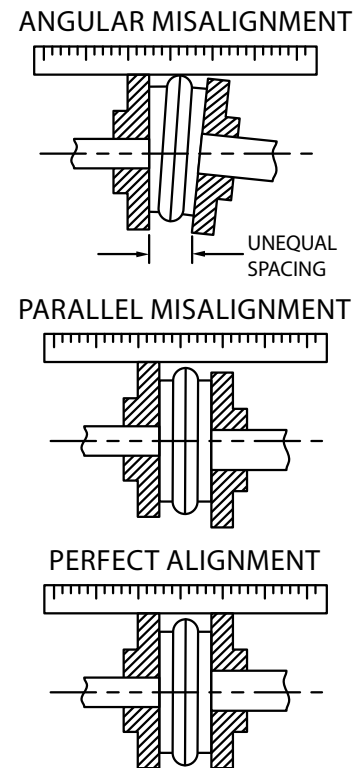


Figure 2

Parallel alignment check is made by placing a straight edge across both coupling rims at the top, bottom and at both sides. The unit will be in parallel alignment when the straight edge rests evenly on the coupling rim at all positions. Allowance may be necessary for temperature changes and for coupling halves that are not of the same outside diameter. Care must be taken to have the straight edge parallel to the axis of the shafts. Correction for Angular and Parallel Misalignment is made by adjusting the shims under the driver. After each change, it is necessary to recheck the alignment of the coupling halves, as adjustment in one direction may disturb adjustments already made in another direction.

The permissible amount of coupling misalignment will vary with the type of pump and driver, but should be limited to approximately 0.002" per inch of shaft diameter when final adjustment is made.

When the units are lined up cold, it is necessary to make allowance for the vertical rise of the driver caused by heating when in operation. When the preliminary alignment has been completed the foundation, bolts should be tightened evenly, but not too firmly.

⚠ DANGER *Coupling or belt guards must be used to avoid serious injury to operating personnel.*

▶ V-Belt Driven

Be sure the pulleys are properly aligned and the power source and pump are parallel. If the drive system uses multiple belt, make sure they are of a matched set.

Belts must be adjusted in accordance with the belt manufactures instructions. If belts are too loose, slippage will occur. If belts are too tight, there will be excessive power loss and possible bearing failure. Belts and pulleys should be properly selected for the desired conditions.

▶ Belt Tensioning

New belt drives should be checked after 5, 20 and 50 hours of operation and re-tension as required. Then check and re-tension monthly or at least in 500 hour intervals.

The ideal belt tension is the lowest tension at which the belt will not slip under peak load. **DO NOT** over-tension belts, as this will shorten belt life as well as bearing life.

Under-tensioning will cause belt slippage. Belt slippage can be caused by dirt, grease, oil and other foreign materials.

▶ Wiring

For electric motor drives, connect power supply to conform with national and local codes. Line voltage and wire capacity must match the ratings stamped on the motor nameplate.

▶ Rotation

Before starting the pump, check the required direction of rotation of the pump. The proper direction is indicated by a direction arrow on the pump casing. Separate the coupling halves, then start motor to see that it rotates in the direction required by the pump.

If it does not, reverse any two main leads of the 3-phase wiring to the motor. The coupling halves can be reconnected and the pump primed for starting.

Pre-Operation

The following important items should be checked as pump is started and placed in operation.

- Pump and driver securely bolted.
- Coupling properly aligned.
- Piping completed.
- Correct pump rotation.
- Pump shaft turns freely.
- Discharge valve closed.
- Suction valve open (if used).

- Coupling Guard installed
- Pump fully primed
- Pump and driver properly lubricated.

Only after these items have been checked should the pump be started.

▶ Lubrication

Check the eyeglass (86-Bearings) and (87-Seal) on end of bearing housing (65) for proper amount of ISO VG1000 or SAE 30 non-detergent oil.

▶ Priming

Before starting the pump, the casing and suction line must be filled with liquid through fill cover (49), and air vented through the vent pipe plugs. The pump must not be run until it is completely filled with liquid, because of danger of injuring some of the parts of the pump which depend upon liquid for lubrication. The discharge gate valve should be closed during priming. Be sure the mechanical seal and power frame are supplied with the proper lubrication.

⚠ CAUTION *Never operate pump unless there is liquid in the pump casing. The pump will not prime when dry. Extended operation of a dry pump will destroy the seal.*

▶ Priming by Suction Pressure

When operating with suction pressure (flooded suction), remove the pipe plug at the top of the casing and when pump is filled with liquid, replace plug.

▶ Priming with foot valve and strainer

A foot valve and strainer may be installed on the lower end of the suction pipe to keep pump filled with liquid.

SHAFTS NOT PARALLEL

SHAFTS NOT IN LINE

SHAFTS PARALLEL AND SHEAVES IN LINE

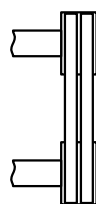
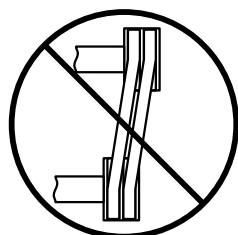
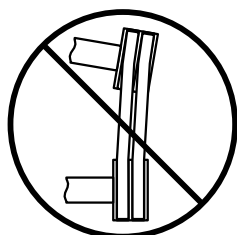


Figure 2b

Incorporate filler pipe in discharge pipe between pump and check valve. Remove pipe plug at top of casing, then fill suction pipe and pump with liquid. When pump is full of liquid, replace plug and close filler pipe.

CAUTION When a foot valve and strainer are installed on the suction pipe, a spring loaded type check valve **MUST** be installed next to the pump in the discharge piping to prevent pump rupture from water hammer shock.

Priming by means of primer pump or ejector, attached to the pump, will also remove air from suction pipe and pump casing. When pump is filled with liquid, start motor and slowly open discharge gate valve.

► **Starting the Pump**

Consult the operating manual for the power source before starting the power source.

On initial start up, the gate valve in the discharge piping should be closed and slowly opened after pump is up to speed and pressure developed.

WARNING ***DO NOT operate pump for any appreciable length of time against a closed discharge valve, as this may heat trapped liquid excessively and damage the pump or seal.***

► **Overheating**

The operating temperature of these pump is 160 °F max. Do not operate above this temperature. Closed valves in the suction and discharge line can cause the overheating.

DANGER ***Operating against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode.***

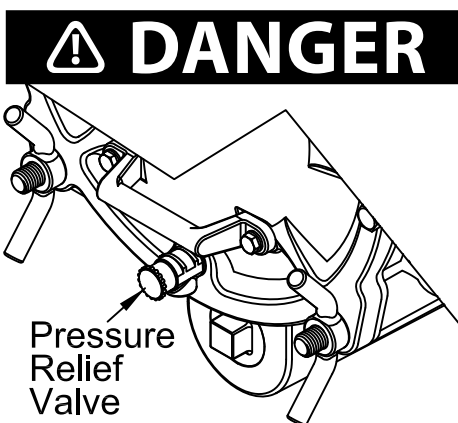


Figure 3

The pump is equipped with a pressure relief valve to safeguard against rupture or explosion due to heat. The valve will open if casing vapor pressure reaches a critical point (see Figure 3).

DANGER ***Stop the pump if overheating occurs, and allow to cool before servicing. DO NOT remove any covers, plates, gauges, fittings or pressure relief valve from the pump. Liquid within the pump can reach boiling temperatures and pressure in the pump can cause ejection of parts and liquid. AFTER the pump cools the pump can be drained and serviced.***

► **Bearing Temperature**

Normally bearings run at higher than ambient temperatures because of heat generated by friction. Normal bearing temperatures up to 160 °F and can operate up to 180 °F safely.

Check bearing temperatures with a contact-type thermometer against the housing. Record this temperature for future use. A sudden bearing temperature increase is a warning that the bearings are at the point of failing to operate properly. Check lubricant for proper viscosity at correct level. Shaft misalignment can cause overheating.

► **Strainer Check**

If a strainer is installed, be sure to check and clean regularly or when the pump flow rate begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings to detect strainer blockage.

Never introduce air or steam pressure into the pump casing or piping to remove a blockage. This could result in personal injury or equipment damage. If back flushing is necessary, liquid pressure must be limited to 50% of the maximum permissible operating pressure shown on the performance curve.

► **Pump Vacuum Check**

With pump inoperative, install a vacuum gauge in the system. Block the suction line and start the pump. At operating speed the pump should pull a vacuum of 20 inches or more of mercury.

Open the suction line and read the vacuum gauge with the pump primed and operation speed. Shut off pump, the vacuum gauge reading will immediately drop proportionate to static suction lift, and should then stabilize. If reading falls rapidly after stabilization, an air leak exists. Check the vacuum gauge installation before checking for the source of the leak.

► Stopping the Pump

Never stop the flow suddenly. If the pumped liquid is stopped abruptly, damaging shock waves can be transmitted to the pump and piping system. Close all connecting valves slowly.

Reduce the throttle speed slowly on engine driven pumps and allow the engine to briefly idle before stopping.

If the application involves a high discharge head, gradually close the discharge-throttling valve before stopping the pump. Lock out and disconnect the power source after stopping the pump.



Do not operate the pump against a closed discharge throttling valve for long periods of time. Components could deteriorate, liquid could come to a boil and build pressure, causing pump casing to rupture or explode.

► Cold Weather Preservation

Drain the pump to prevent freezing and flush out any solids with a hose. Operate the pump for approximately one minute to remove any remaining liquid.

► Preventive Maintenance

The following is a general recommendation for preventive maintenance. Regardless of the application, following a routine preventive maintenance program will help assure trouble-free performance and long life from your pump.

A first inspection of parts for NEW applications should be approx. 250 hours. This will give you some insight of the wear rate for your application.

On a Daily Bases:

- Check the general conditions, such as temperature, vibrations, unusual noises, cracks, leaks, loose hardware, etc.
- Check pump performance and record gauge readings (if equipped), speed and flow. Changes in gauge readings can indicate problems that can be corrected before damage or failure occurs.

On a Weekly Bases:

- Check Bearing and Mechanical Seal lubrication.

On a Monthly Bases:

- Check V-Belts or coupling.

Every Six Months:

- Check front Impeller/Wear and rear impeller/Seal plate clearance.

Once a Year:

- Inspect and clean the Check Valve Assembly. Check the valve flapper (38) that it may be torn or deteriorated with use. Deposits may also build up between the rubber and the seat.
- Check pump and driver alignment.
- Check to see if there is any shaft deflection.
- Check Bearings and Bearing Housing.
- Replace bearing lubrication.

If the impeller (61) is removed for any reason and the mechanical seal is in good condition, **DO NOT** disturb the seal as this will cause the seal to leak and require replacing.

If the mechanical seal (62) ever needs replacing, check the following parts for wear or deterioration; casing (1), seal plate (81), impeller (61), shaft (71), o-rings (15), (19), (89) and (93).

► Lubrication

Bearings - On the rear of the pedestal check the oil level through the sight glass (86). The level should be up to the center of the sight glass. In order for both bearings to be lubricated properly, the pump must be level. If the oil is low, remove vent plug (66) and add ISO VG1000 or SAE 30, non-detergent oil.

Inspect and clean if required vent plug before replacing it on pedestal. It is recommended that this oil be changed at least once a year.

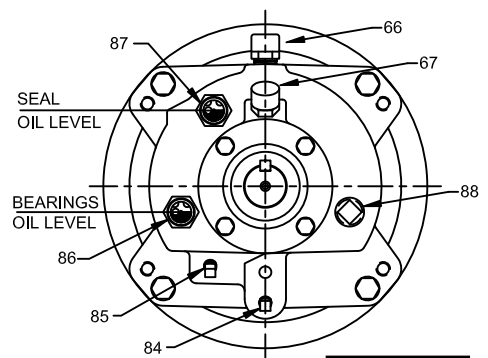


Figure 4

Seal cavity - Check the oil level through the sight glass (87). The level should be up to the center of the sight glass.

If low, remove vent plug (67) and add ISO VG1000 or SAE 30 non-detergent oil. Inspect and clean if required before replacing it on pedestal. It is recommended that this oil be changed at least once a year.

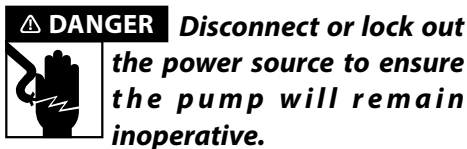
► Service and Repair

Disassembly - The following is for the pump end only, for power source repair, see manual supplied with the power source.

Many repairs can be done by draining the pump and removing the back cover. The piping and power source must be disconnected if major repairs are needed.

► Pre-Service Check List

Before servicing pump, please observe the following:



Technician must be qualified to service this equipment.

Read this manual carefully and follow all instructions and safety information, both in this manual and tags on the pump.

Allow pump to cool. Check temperature before opening or removing any covers, plates or plugs.

Close all valves in suction and discharge lines and slowly vent pump. Drain the pump. Use caution, liquid could be hot.

Use appropriate lifting equipment to prevent personnel injuries or damage to equipment.

See Figures 9, 10, 11 or 12, depending on pump model for the following.

► Back Cover and Wear Plate

Remove pump casing drain plug (20) and drain the pump. Clean and reinstall the drain plug. Remove the hand nuts (32) and pull the back cover and wear plate assembly from pump casing (1).

Inspect the wear plate (14), and replace if worn. Remove conical screw (16), lockwasher (17) and hex nut (18) to remove wear plate (14). Inspect back cover o-rings (15) and (19) and replace if damaged.

► Suction Check Valve

To service or replace check valve assembly (38), remove pin (41) and reach through the back cover opening and pull complete assembly from suction flange (40). Check valve is available as a repair part and not sold as individual parts.

See Figures 9A, 10A, 11A or 12A, depending on pump model for the following.

► Rotating Assembly

Remove power source to provide clearance for rotating assembly. Suction and discharge piping does not need to be removed.

Remove the cavity drain plug (84) and drain the seal lubricant. Clean and reinstall the seal cavity drain plug (84). Loosen impeller (61) while rotating assembly is still in the pump casing.

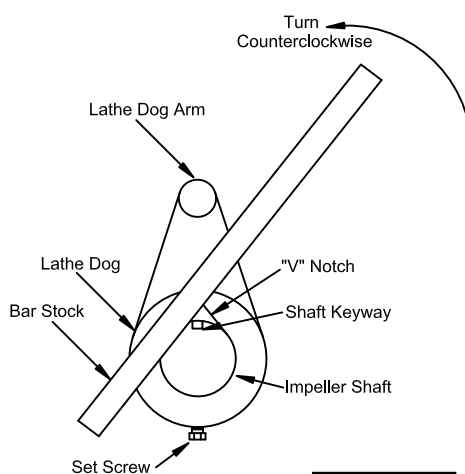


Figure 5

Wedge a block of wood between the vanes of the impeller and the pump casing and then remove socket head screw (83) and washer (82).

On the drive end of shaft (71) place a lathe dog with the "V" notch positioned over the shaft keyway.

With the impeller (61) blocked use a long piece of bar stock to pry against the arm of the lathe dog in a counterclockwise direction (while facing the drive end of pump). Do not damage the shaft or keyway. Once impeller breaks loose, remove wood block and lathe dog. (See Figure 5).

⚠ IMPORTANT! - Do not remove impeller until rotating assembly has been removed from pump casing.

(See Figures 9, 10, 11 or 12, depending on pump model).

(12) from casing. Pull rotating assembly away from the pump casing. Take note of the amount and thickness of shims (13/94), See Figures 9A, 10A, 11A or 12A, for reassembly.

► Rotating Assembly Tool

An assembly tool may be constructed using 1/2 NPT steel or malleable iron, Tee, qty. 2 pieces approx. 6" long and one piece approx. 14" long (See Figure 6).

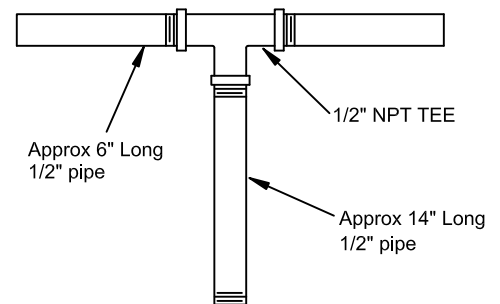


Figure 6

See Figures 9A, 10A, 11A or 12A, depending on pump model for the following.

Remove air vent (66) from bearing housing (65) and screw the 14" long piece into the air vent hole. Assemble the Tee onto the pipe and the two 6" pieces into the Tee. Remove bearing housing o-ring (93).

► Impeller Removal

Unscrew impeller (61) from shaft (71) being careful that the tension on the shaft seal spring will be released as impeller is removed. Inspect and replace impeller if worn or cracked.

Note quantity and thickness of shims (90) for reassembly.

► Seal Removal

Remove the shaft sleeve (91) and rotating portion of seal (62) off of shaft (71) as a unit. To remove stationary, first remove capscrew (79) and lockwasher (80) from seal plate (81). Position seal plate (81) on a flat surface and using a seal tool or wooden dowel, press stationary out from back side of seal plate. Remove o-ring (89) from shaft sleeve.

Go to "**Seal Installation**", if no further disassembly is required.

► Shaft & Bearing Removal

Normally, under proper maintenance, the bearing housing should not require disassembly. Disassemble the shaft and bearings ONLY when they show signs of wear or damage.



IMPORTANT! - *Field disassembly of shaft and bearings should not be done in the field, but done in the shop by qualified personnel.*

Remove drain plug (85) from bearing housing (65) and drain the lubricant. Clean and reinstall the drain plug.

Remove capscrew (74) and lockwasher (75) and slide bearing cap (69) and oil seal (72) off of shaft (71). Remove bearing cap gasket (76) and press oil seal (72) from bearing cap (69).

With a block of wood against the impeller end of shaft (71), tap the shaft with bearings, from the bearing housing (65). Pry or press oil seals (77) and (78) from bearing housing.

Clean and inspect bearings (64) and (68) without removing from shaft, as not to damage bearings. It is recommended that the bearings be replaced when shaft and bearings are removed.

With a soft cloth soaked in cleaning solvent, clean the bearing housing, shaft and all components **EXCEPT** the bearings. Replace any parts worn or damaged.



IMPORTANT! - *Field disassembly of shaft and bearings should not be done in the field, but done in the shop by qualified personnel.*

WARNING Use solvent in well ventilated area free from sparks and flames. Wear the correct protective clothing as solvents may be toxic and flammable.

Thoroughly clean bearings in fresh solvent and dry with filtered compressed air, then coat with light oil. Keep bearings free of all dirt and foreign material. **DO NOT** spin bearings dry as this may scratch the balls or races and cause premature failure.

Inspect the bearing balls by rotating the bearing checking for roughness or binding. If balls are discolored or rough when rotated, replace the bearings.

The bearing tolerances provide a tight press fit onto the shaft and a snug slip fit into the bearing housing.

If proper fit is not achieved, replace the bearings, shaft or bearing housing. If bearing replacement is required, remove snap ring (73) and use a bearing puller to remove the bearings from the shaft.

► Shaft & Bearing Reassembly

Inspect shaft for nicks, scratches, distortions or thread damage on the impeller end. Clean up small nicks and burrs with a fine file or emery cloth. Replace shaft if defective.

Position the inboard oil seal (77) in the bearing housing bore with the lip positioned toward the threaded end of shaft. Press the oil seal into the housing until the face is flush with the counterbored surface toward the inside of the housing.

Position the outboard oil seal (78) in the bearing housing bore with the lip positioned toward the keyed end of shaft. Press the oil seal into the housing until the face is flush with the counterbored surface toward the outside of the housing.



IMPORTANT! - *The shielded side of bearing (64) must be toward the impeller end of the shaft. The outboard bearing (68) must be positioned with the retaining ring on the O.D. of the bearing toward the drive end of the shaft.*

An electric oven, hot oil bath, induction heater or hot plate may be used to heat the bearings for ease of installing onto shaft. Bearings should never be heated with direct flame or directly on a hot plate.

Note: If a hot oil bath is used to heat the bearings, both the oil and container must be absolutely clean. Filter oil thoroughly if it has been previously used.

After the bearings have been installed and allowed to cool, check to ensure that they have not moved away from the shaft shoulders in shrinking. If the bearings have moved, use a suitable sized sleeve and press the bearings into position against the shaft shoulders. A sleeve or an arbor press can be used to install the bearings if heating the bearings is not practical.

Press only on the inner race when installing the bearings onto the shaft. Never press or hit against the outer race, balls or cage. Install snap ring (73) onto shaft to secure the outboard bearing.

Slide the shaft with bearings into the bearing housing by pushing against the bearing's outer race (Never hit the balls or ball cage), until the snap ring on the outboard bearing seats against the bearing housing.

Press the outboard oil seal (72) into the bearing cap (69) with the lip positioned toward the key end of shaft. Replace the bearing cap gasket (76) and secure the bearing cap with capscrew (74) and lockwasher (75). Be careful not to damage the oil seal lip on the shaft keyway.

Lubricate the bearing housing as indicated in the "Lubrication" section.

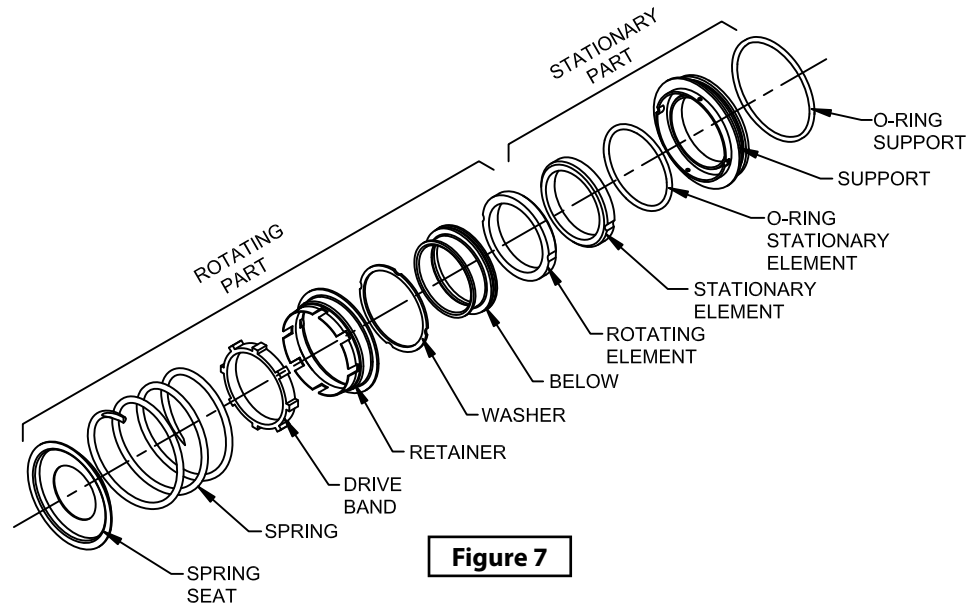


Figure 7

► Seal Installation

See Figures 9A, 10A, 11A, 12A, 7, or 8A and 8B, depending on pump model for the following.

With a cloth soaked in fresh cleaning solvent, clean the seal cavity and shaft. Inspect and remove any dirt, nicks and burrs in the stationary seat bore in the seal plate (81). The bore must be completely clean before installing the seal.

A new seal assembly should be installed any time the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

Remove the new seal and inspect the precision finished faces to ensure that they are free of any foreign matter. To ease installation of the seal, lubricate the shaft sleeve (91), bellows and stationary o-ring (89) with water or a small amount of oil, and apply a drop of light lubricating oil on the precision finished faces.

If seal plate (81) was removed, install seal plate gasket (63) and position seal plate (81) over shaft (71) and secure to bearing housing (65) with capscrew (79) and lockwasher (80).

To prevent damaging the shaft sleeve the o-ring over a piece of tubing 1¼" I.D. x 1½" O.D. x 2" long.

Slide the tube over the shaft threads, then slide the o-ring off the tube and onto the shaft. Remove the tube and continue sliding the o-ring down the shaft until seated against the shaft shoulder.

When installing a new cartridge seal assembly, remove the seal from container and remove the mylar storage tabs from between the seal faces.

Sub assemble the stationary element into the stationary seat. Lubricate the external stationary seat o-ring with light oil and press the subassembly squarely into the seal plate (81) until the o-ring engages the bore in the seal plate.

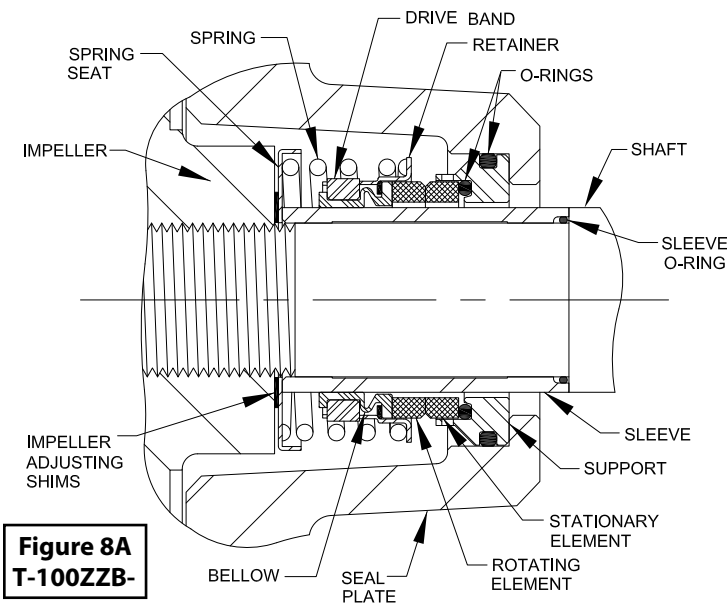


Figure 8A
T-100ZZB-

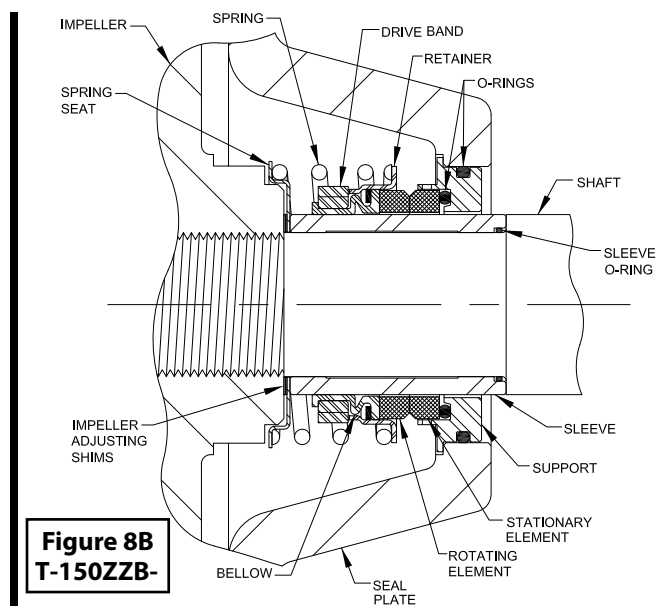


Figure 8B
T-150ZZB-

Sub assemble the rotating element into the retainer and bellows. Slide this subassembly onto the shaft sleeve until the face of the rotating element is just flush with the chamfered end of the sleeve. Slide the assembled seal and sleeve onto the shaft until the seal faces contact. Continue to push the sleeve through the seal until the chamfered end seats firmly against the shaft shoulder. Install the spring and spring seat against the spring. On the SH6 and SH8 pumps, be sure the spring seat fits squarely over the step on the back of the impeller.

► **Impeller Installation**

Inspect the impeller and replace if cracked or badly worn. Clean shaft threads and impeller threads before reassembly.

Place the correct thickness impeller adjusting shims (90), that was previously removed, onto the shaft. Apply Anti-Seize or equal to the shaft threads and screw the impeller (61) onto the shaft (71) until tight. **DO NOT** force the impeller onto the shaft. Back the impeller off at the first sign of binding. Make sure the shaft and impeller threads are clean and free of dirt.

The seal spring should seat over the shoulder on the back side of impeller.

See chart "A" for impeller and seal plate clearance. Measure this clearance and add and remove impeller adjusting shims as needed.

| Chart "A" | |
|----------------------------------|-------------------|
| Impeller to Seal Plate Clearance | |
| 3, 4, 6 & 8 | .025 to .040 inch |

This clearance can be measured by reaching through the priming port with a feeler gauge if the rotating assembly has been installed in the pump casing.

Before installing the impeller capscrew and washer, install the Rotating Assembly (2), See Figure 9, 10, 11 or 12. The rotating assembly must be installed in the pump casing before the impeller capscrew can be torqued down.

Install rotating assembly in pump casing (1), coat the threads of capscrew (83) with Anti-Seize or equal and install the impeller washer (82) and capscrew (83). Torque capscrew (83) to 90 ft. lbs.



IMPORTANT! - If the pump has been completely disassembled, reassemble the suction check valve and back cover assembly at this time. The back cover assembly must be in place to adjust the impeller face clearance.

► **Rotating Assembly Installation**

Install the intermediate o-ring (93) and seal plate o-ring (92) on SH4 & 8, and lubricate the o-rings with light grease. Use the installation tool, and carefully ease the rotating assembly into the pump casing. Do not damage the o-rings.

Install the rotating assembly adjusting screw sets (13/94) using the same thickness as previously removed. Secure the rotating assembly (2) to pump casing (1) with capscrew (11) and lockwasher (12). **Do Not** completely tighten capscrew until the back cover (21) has been set.

| Chart "B" | |
|----------------------------------|-------------------|
| Impeller to Wear Plate Clearance | |
| 3, 4, 6 & 8 | .010 to .020 inch |

See chart "B" for impeller and wear plate clearance. This clearance is accomplished by loosening the jam nut (28) and turning the jack screws (27) an equal amount until the impeller scrapes against the wear plate when the shaft is turned. After the impeller scrapes, adjust to approximately 0.015".

An alternate method of adjusting, is to reach through the suction port with a feeler gauge and measure the gap.

► Suction Check Valve Installation

See Figures 9, 10, 11 or 12 depending on pump model for the following.

Inspect the check valve assembly (38), and replace if badly worn. The assembly must be replaced as a complete unit. See parts list for check valve kit.

Reach through the back cover opening with check valve (38) and position the adaptor in the mounting slot in the suction flange (40). Align the adaptor with the flange hole, and secure the assembly with the check valve pin (41).

Note: If the suction or discharge flanges were removed, replace the gaskets by applying Permatex Aviation #3 Form-A-Gasket or equal to the mating surfaces and secure the flanges to the appropriate hardware.

► Back Cover Installation

See Figures 9, 10, 11 or 12, depending on pump model for the following.

If wear plate (14) was removed, carefully center it on the back cover (21) and secure with conical screw (16), lockwasher (17) and hex nut (18). The wear plate must be concentric to prevent binding when back cover is installed.

Replace the back cover o-ring (19) and lubricate with #2 grease. Clean the contacting surfaces in the pump casing that might interfere or prevent a good seal with the back cover. Place the back cover assembly into the pump casing, being sure the wear plate does not bind against the impeller.

Replace the back cover o-ring (19) and lubricate with #2 grease. Clean the contacting surfaces in the pump casing that might interfere or prevent a good seal with the back cover. Place the back cover assembly into the pump casing, being sure the wear plate does not bind against the impeller.

Apply Anti-Seize or grease on the shoulder of the back cover or any contact surfaces on the pump casing to aid in future disassembly and to reduce rust and build-up of scale.

Tighten the hand nuts (32) evenly to secure the back cover assembly. Do Not over-tighten, they should be just tight enough to ensure a good seal at the shoulder of the back cover. Be sure the wear plate does not bind against the casing.

► Pressure Relief Valve Installation

See Figures 9, 10, 11 or 12 depending on pump model for the following.

To provide additional safety for the pump and operator, the back cover is equipped with a pressure relief valve (24).

When ever the pump is overhauled, it is recommended that the pressure relief be replaced. Always use OEM replacement parts. Remove the valve periodically for cleaning and inspection. To reinstall, apply Teflon pipe sealant or equal to the threads on relief valve. Position the discharge port downward when reinstalled.

► Final Assembly

Place key (70) into shaft (71) and reconnect the power source. Install any guards used over rotating members.

⚠ DANGER DO NOT operate pump without guards in place. Exposed rotating parts can cause sever injury to personnel.

Install the suction and discharge lines and open all valves. All piping connections should be tight and properly supported and secure.

Remove fill cover assembly (47) and fill the pump casing with clean liquid. Reinstall cover and tighten. See Pre-Operation section for priming the pump.

► Lubrication - Seal Assembly

See Figures 9A, 10A, 11A or 12A, depending on pump model for the following.

Before operating the pump, remove vent plug (66) and fill the seal cavity with approximately 40 ounces of SAE 30 non-detergent oil or ISO VG1000 to the middle of the sight gauge (87). Clean and reinstall the vent plug (66). Oil should be maintained at the middle of the gauge.

► Lubrication - Bearings

Check the oil level regularly through sight gauge (86) and maintain at the middle of the gauge. When lubrication is required, add SAE 30 non-detergent oil or ISO VG1000 through the hole for air vent (67). Do not over-fill, as this can cause overheating of bearings and result in bearing failure.

Under normal conditions, drain the bearing housing yearly and refill with approx. 10 oz of clean oil.

Change more frequent when operated continuously or in a rapid temperature change environment.

Monitor the bearing oil regularly for rust or moisture condensation especially in areas of variable temperature changes.

► Locating Trouble

To aid in locating problems, it is recommended the following be installed.

- a) Install a vacuum gauge on the suction side of the pump.
- b) Install a low-pressure gauge on the discharge side of the pump.

Use a small valve for attaching the gauges and keep them shut off when not in use. If left to flutter with pulsations a vacuum gauge will develop a crack in the internal tube causing it to leak unknowingly and give priming problems.

By using the vacuum and pressure gauges, you should be able to locate most problems that will occur. Air leaks on the suction side are the most common problems encountered in selfpriming pumps.

It may be necessary to connect a pressure water supply to the drain hole of the pump and hydrostatically test it if all checks fail to identify the location of the leak. Keeping the water pressure low, 5 to 10 lb is ideal. Higher pressures may not show an o-ring leak.

If the above shows no leaks, remove bolts from the the suction flange and insert a solid steel backing plate and tighten the flange.

If with the pump running the vacuum gauge reads as much or more than during normal operation, then the problem is most likely in the suction pipe or sump area. Don't overlook the possibility of air entering the suction line, air that could be coming from the air bubbler control pipe (if used).



⚠ DANGER *Allow pump to cool before servicing. DO NOT remove any covers, plates, gauges, relief valve or fittings from the pump. Liquid within the pump can reach boiling temperatures and pressure in the pump can cause ejection of parts and liquid. AFTER the pump cools, close the suction and discharge valves, vent the pump, then it can be drained and serviced.*

⚠ WARNING *Always wear eye protection when working on pumps. Do not wear loose clothing that may become entangled in moving parts.*



⚠ DANGER *Risk of electric shock. Always disconnect the pump from the power source before handling inspections or repairs.*

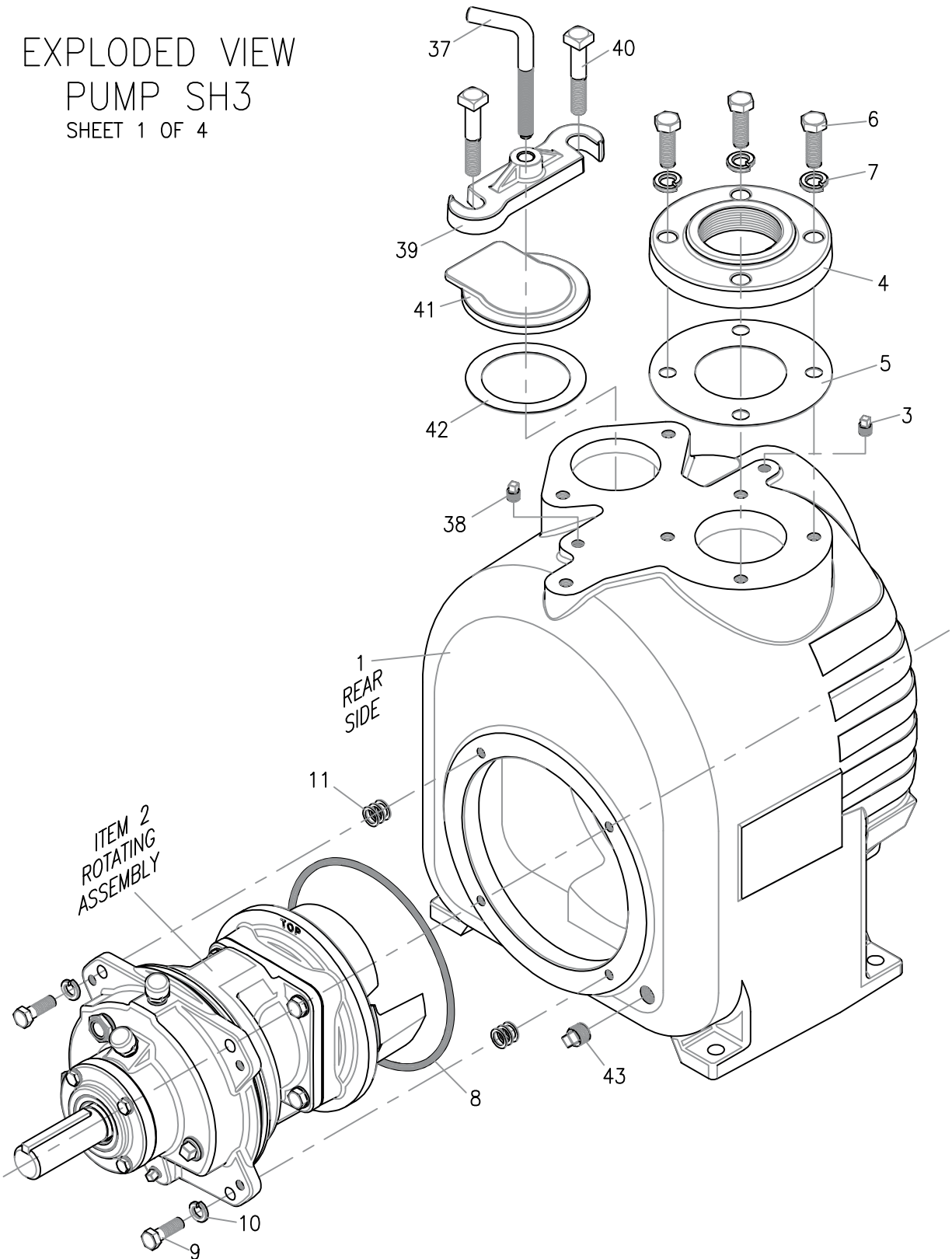
| Symptom | Possible Cause (s) | Corrective Action |
|--|---|---|
| Pump will not prime | <ol style="list-style-type: none"> 1. Pump body not filled with water 2. Air leak in suction line 3. Suction check valve clogged or damaged 4. Leaking or worn seal or pump gasket 5. Suction check valve or foot valve clogged or binding 6. Suction lift or discharge head too high 7. Clogged strainer or foot-valve | <ol style="list-style-type: none"> 1. Fill pump body with water. 2. Repair or replace suction line 3. Clean or replace check valve 4. Check pump vacuum. Replace leaking or worn seal or gasket 5. Clean valve 6. Check piping installation and install bypass line if needed. See "Installation" 7. Clean or replace |
| Pump stops or fails to deliver rated low or pressure | <ol style="list-style-type: none"> 1. Air leak in suction line 2. Leaking or worn seal or pump gasket 3. Suction intake not submerged at proper level or sump too small 4. Impeller or other wearing parts worn or damaged 5. Clogged strainer or pump 6. Impeller clogged 7. Suction lift or discharge head too high 8. Pump speed too slow 9. Wrong direction of rotation 10. Incorrect impeller diameter | <ol style="list-style-type: none"> 1. Repair or replace suction line 2. Check pump vacuum. Replace leaking or worn seal or gasket 3. Check installation and correct submergence as needed 4. Replace worn or damaged parts. Check that impeller is properly centered and rotates freely 5. Unclog or replace 6. Clean impeller of debris 7. Check piping installation and install bypass line if needed. See "Installation" 8. Check driver output, check belts or couplings for slippage 9. Correct rotation 10. Check system requirements |

| Symptom | Possible Cause (s) | Corrective Action |
|-----------------------------------|--|---|
| Pump requires too much power | <ol style="list-style-type: none"> 1. Pump speed too high 2. Discharge head too low 3. Liquid specific gravity or viscosity greater than expected 4. Impeller oversized for system requirements 5. Electrical defects 6. Wrong direction of rotation | <ol style="list-style-type: none"> 1. Check driver output, check that sheaves or couplings are sized correctly 2. Adjust discharge valve 3. Change to higher horse power motor 4. Replace with smaller impeller 5. Check power supply and motor 6. Correct rotation |
| Pump Clogs Frequently | <ol style="list-style-type: none"> 1. Discharge flow too slow 2. Suction check valve or foot valve clogged or binding | <ol style="list-style-type: none"> 1. Open discharge valve fully to increase flow rate and run engine at maximum governed speed 2. Clean valve |
| Excessive noise | <ol style="list-style-type: none"> 1. Cavitation in pump 2. Pumping entrained air 3. Pump, drive or base not securely mounted 4. Impeller clogged or damaged 5. Suction and discharge lines not properly supported 6. Pump and motor misaligned 7. Pump bearings worn 8. Motor bearings worn or fan rubs housing | <ol style="list-style-type: none"> 1. Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory 2. Locate and eliminate source of air bubble 3. Secure mounting hardware 4. Clean out debris, replace damaged parts 5. Check piping installation for proper support 6. Align 7. Replace bearings 8. Repair or replace |
| | <ol style="list-style-type: none"> 1. Bearing temperature is high, but within limits 2. Low or incorrect lubricant 3. Drive misaligned 5. Bearing (s) frozen | <ol style="list-style-type: none"> 1. Check bearing temperature regularly to monitor any increase 2. Check for proper type and level of lubricant 3. Align drive pr B 5. Disassemble pump and check bearing (s) |
| Excessive pump vibration | <ol style="list-style-type: none"> 1. Cavitation at pump suction due to insufficient NPSHA 2. Impeller imbalance due to wear or corrosion 3. Pump shaft bent 4. Base plate loose on foundation or insufficient strength to support the load | <ol style="list-style-type: none"> 1. Alter installation to reduce NPSHR 2. Check for Impeller balance or replace 3. Replace 4. Secure mounting hardware or reinforce |
| Pump works for a while then quits | <ol style="list-style-type: none"> 1. Obstruction in pump or piping 2. Air or gas in liquid 3. Incomplete priming | <ol style="list-style-type: none"> 1. Clean out pump or piping 2. Locate and eliminate source of air bubble 3. Fill pump body with water, See "Priming" |

NOTE: Barmesa Pumps assumes no responsibility for damage or injury due to disassembly in the field. Disassembly of the pumps or supplied accessories other than at Barmesa Pumps or its authorized service centers, automatically voids warranty.

Figure 9a

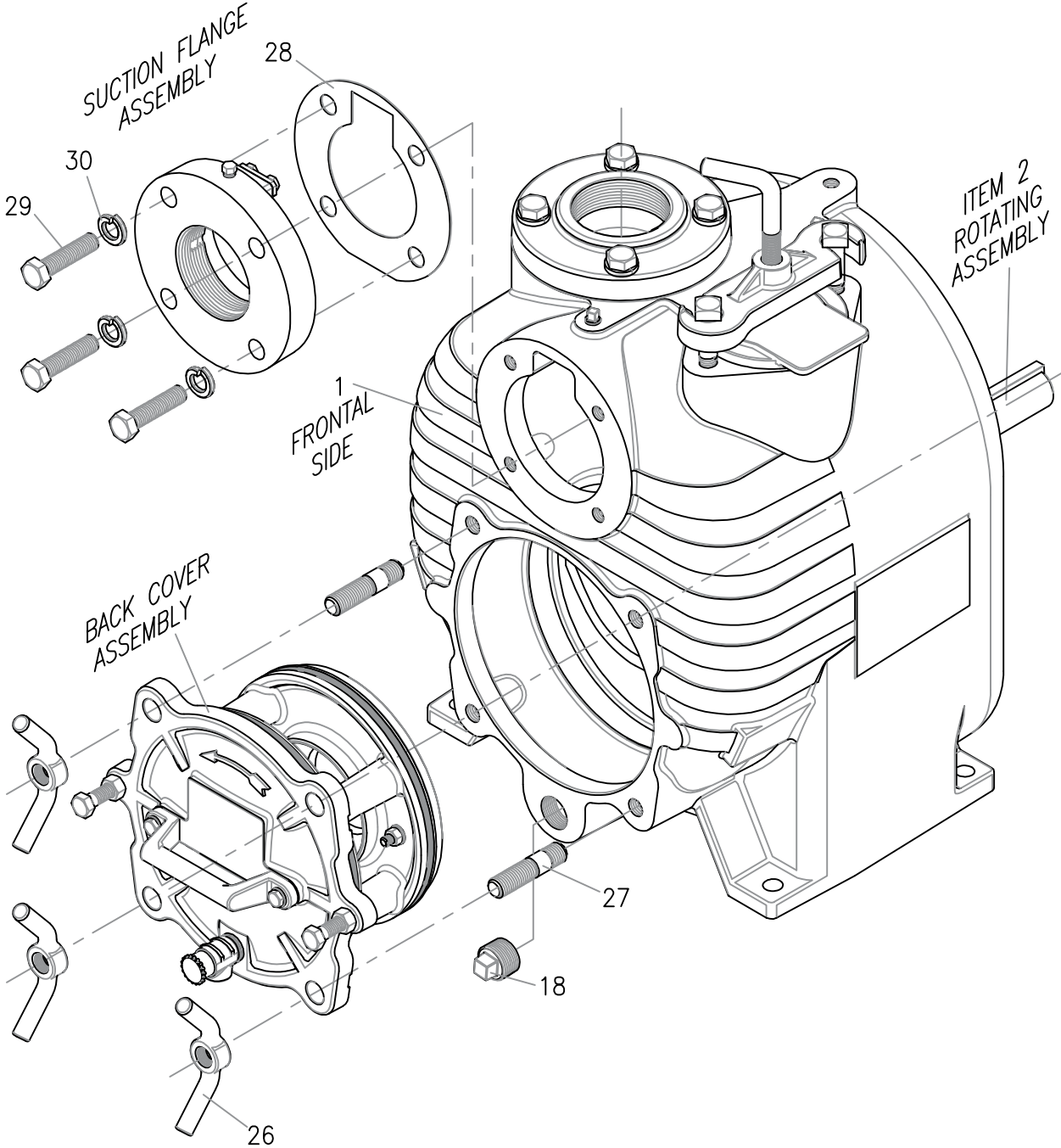
EXPLODED VIEW
PUMP SH3
SHEET 1 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 9b

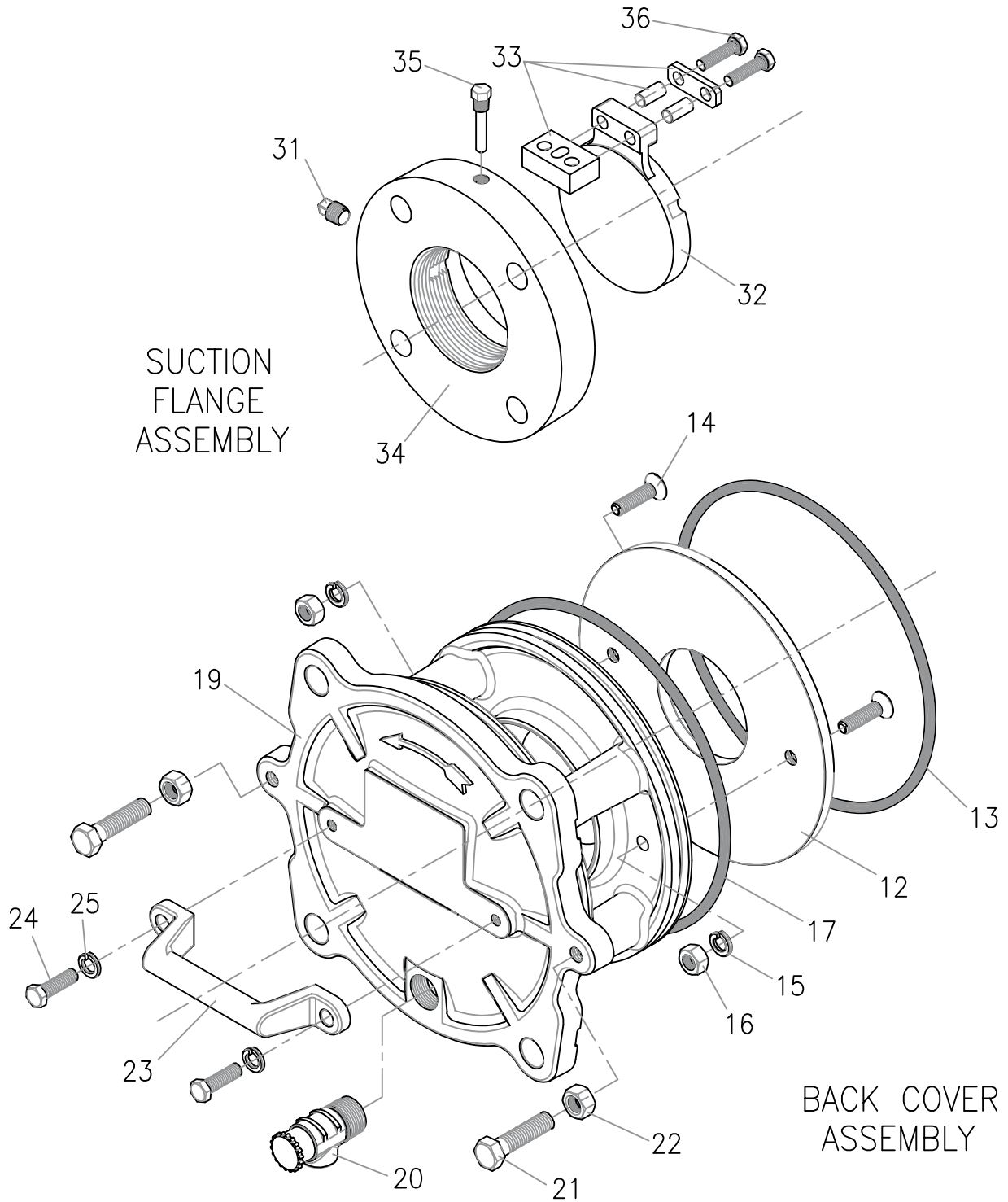
EXPLODED VIEW
PUMP SH3
SHEET 2 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 9c

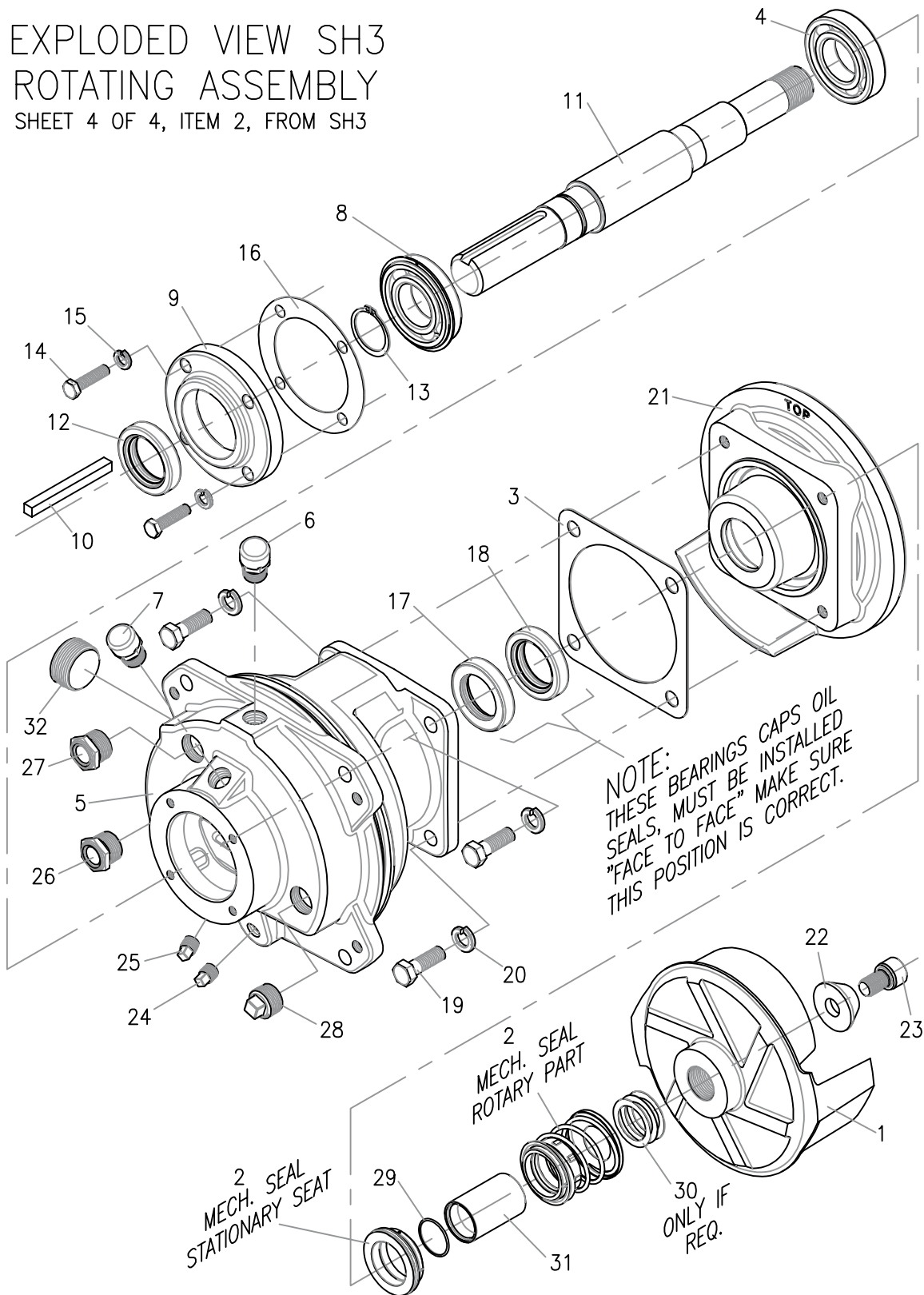
EXPLODED VIEWS
PUMP SH3
SHEET 3 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

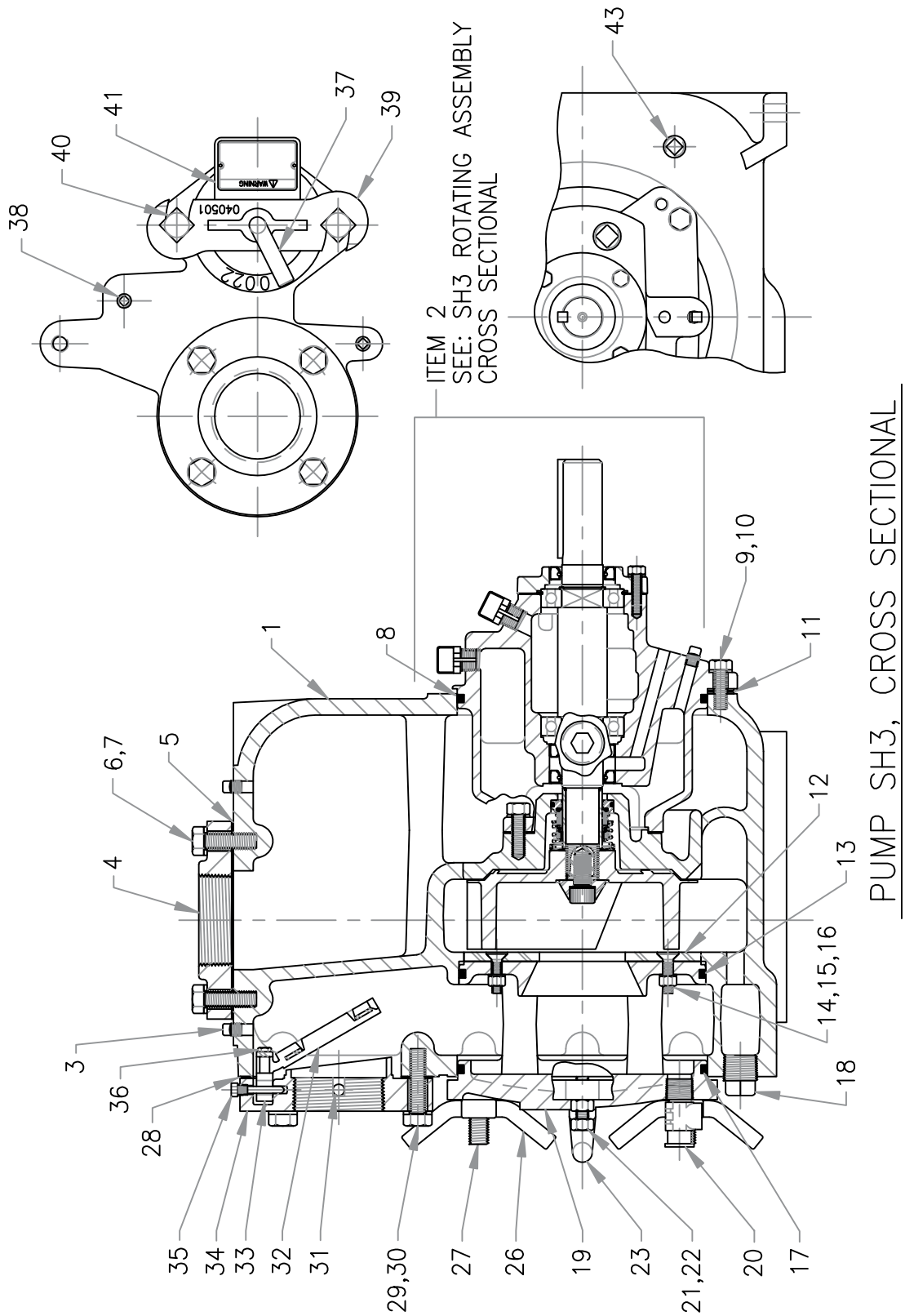
Figure 9d

EXPLODED VIEW SH3
ROTATING ASSEMBLY
SHEET 4 OF 4, ITEM 2, FROM SH3



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 9e

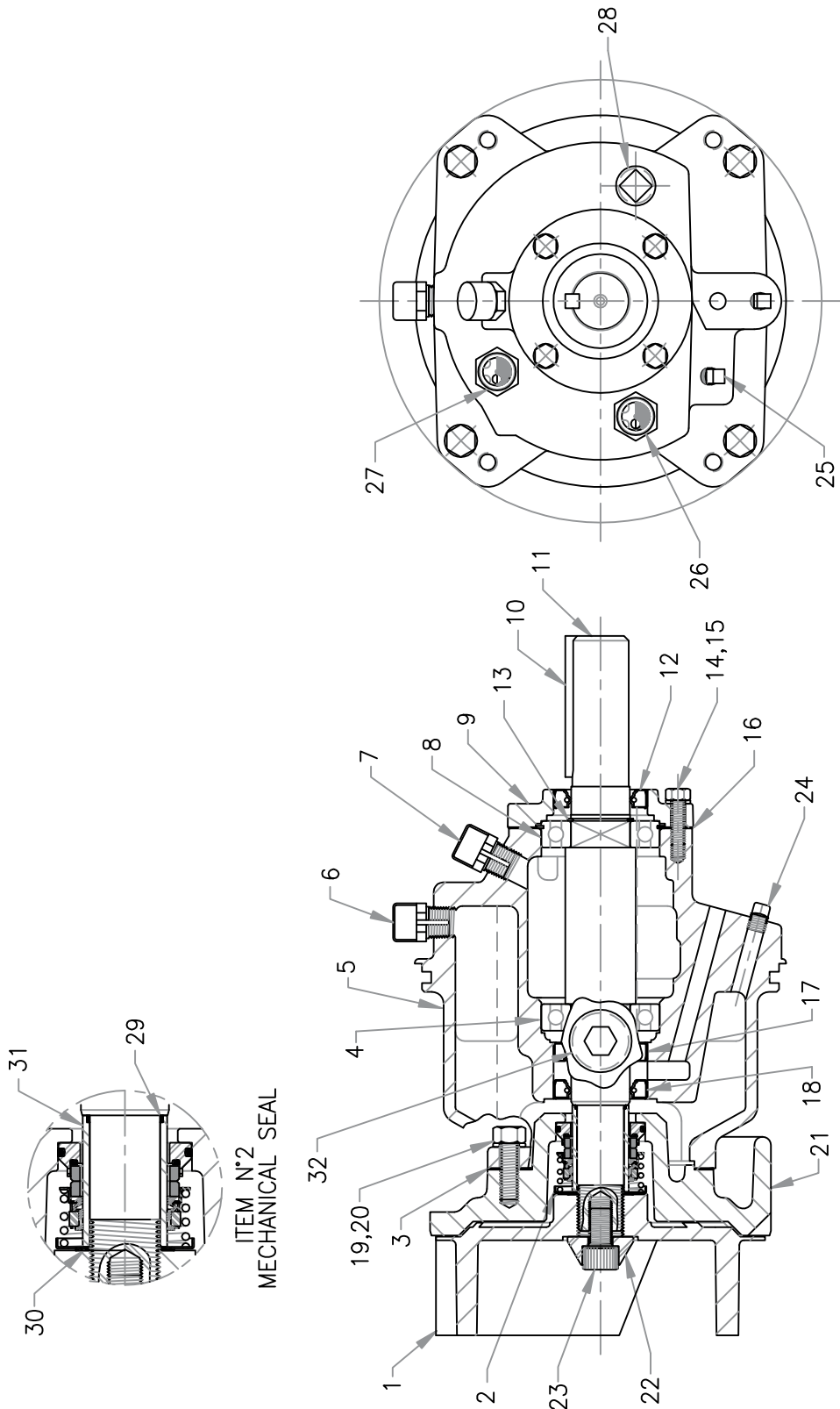


For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

| PART LIST | | | |
|-----------|------|--|----------|
| ITEM | QTY. | DESCRIPTION | PART No. |
| 1 | 1 | PUMP CASING | 03090078 |
| 2 | 1 | REPAIR ROTATING ASSY. (SEE: SH3 ROTATING ASSEMBLY PART LIST) | |
| 3 | 1 | PIPE PLUG | 93010143 |
| 4 | 1 | DISCHARGE FLANGE | 03060004 |
| 5 | 1 | DISCHARGE FLANGE GASKET | 92010155 |
| 6 | 4 | HEX HEAD CAPSCREW | 91010283 |
| 7 | 4 | LOCKWASHER | 91010015 |
| 8 | 1 | O-RING, ROTATING ASSEMBLY | 92010045 |
| 9 | 4 | HEX HEAD CAPSCREW | 91010263 |
| 10 | 4 | LOCKWASHER | 91010014 |
| 11 | 12 | ROTATING ASSEMBLY ADJ SHIM | 91010057 |
| 12 | 1 | WEAR PLATE ASSY | 30400856 |
| 13 | 1 | BACK COVER O-RING | 92010044 |
| 14 | 2 | CONICAL SCREW | 91010402 |
| 15 | 2 | LOCKWASHER | 91010061 |
| 16 | 2 | HEX NUT | 91010433 |
| 17 | 1 | BACK COVER O-RING | 92010045 |
| 18 | 1 | CASING DRAIN PLUG | 93010141 |
| 19 | 1 | BACK COVER PLATE | 03220024 |
| 20 | 1 | PRESS RELIEF VALVE | 31200021 |
| 21 | 2 | JACK BOLT – BACK COVER | 91010264 |
| | | | |
| 23 | 1 | COVER PLATE HANDLE | 03151002 |
| 24 | 2 | HEX HEAD CAPSCREW | 91010244 |
| 25 | 2 | LOCKWASHER | 91010012 |
| 26 | 4 | HAND NUT | 03230002 |
| 27 | 4 | STUD | 91010321 |
| 28 | 1 | SUCTION FLANGE GASKET | 92010180 |
| 29 | 4 | HEX HEAD CAPSCREW | 91010284 |
| 30 | 4 | LOCKWASHER | 91010015 |
| 31 | 1 | PIPE PLUG | 93010143 |
| 32 | 1 | SUCTION CHECK VALVE | 92010226 |
| 33 | 1 | SUPPORT | 30400893 |
| 34 | 1 | SUCTION FLANGE | 03050017 |
| 35 | 1 | CHECK VALVE PIN | 30400865 |
| 36 | 2 | HEX HEAD CAPSCREW | 91010223 |
| 37 | 1 | CLAMP BAR SCREW | 30400911 |
| 38 | 1 | PIPE PLUG | 93010143 |
| 39 | 1 | CLAMP BAR | 03040501 |
| 40 | 2 | MACHINE BOLT | 91010401 |
| 41 | 1 | FILL COVER PLATE | 03220022 |
| 42 | 1 | COVER GASKET | 92010124 |
| 43 | 1 | PIPE PLUG | 93010142 |

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 9f



SH3 ROTATING ASSEMBLY, CROSS SECTIONAL

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

| PART LIST | | | |
|-----------|------|-------------------------------|----------|
| ITEM | QTY. | DESCRIPTION | PART No. |
| 1 | 1 | IMPELLER | 03140074 |
| 2 | 1 | MECHANICAL SEAL (SEE NOTE: 1) | 31030401 |
| 3 | 1 | SEAL PLATE GASKET | 92010173 |
| 4 | 1 | INBOARD BALL BEARING | 31020035 |
| 5 | 1 | BEARING HOUSING | 03040024 |
| 6 | 1 | AIR VENT | 80062501 |
| 7 | 1 | AIR VENT | 80062501 |
| 8 | 1 | OUTBOARD BEARING | 31020036 |
| 9 | 1 | BEARING CAP | 03170016 |
| 10 | 1 | SHAFT KEY | 30400634 |
| 11 | 1 | IMPELLER SHAFT | 30400751 |
| 12 | 1 | BEARING CAP OIL SEAL | 31150010 |
| 13 | 1 | BEARING SNAP RING | 31010016 |
| 14 | 4 | HEX HEAD CAPSCREW | 91010244 |
| 15 | 4 | LOCKWASHER | 91010012 |
| 16 | 1 | BEARING CAP GASKET | 92010163 |
| | | | |
| 18 | 1 | INBOARD OIL SEAL | 31150010 |
| 19 | 4 | HEX HEAD CAPSCREW | 91010263 |
| 20 | 4 | LOCKWASHER | 91010014 |
| 21 | 1 | SEAL PLATE | 03180026 |
| 22 | 1 | IMPELLER WASHER | 30400425 |
| 23 | 1 | SOCKET HEAD CAPSCREW | 91010395 |
| 24 | 1 | SEAL CAVITY DRAIN PLUG | 93010143 |
| 25 | 1 | BEARING HOUSING DRAIN PLUG | 93010143 |
| 26 | 1 | SIGHT GAUGE | 31120012 |
| 27 | 1 | SIGHT GAUGE | 31120012 |
| 28 | 1 | PLUG | 93010148 |
| 29 | 1 | SEAL SLEEVE O-RING | 92010035 |
| 30 | 3 | IMPELLER ADJ SHIM SET | 91010134 |
| 31 | 1 | SEAL SLEEVE | 30400826 |
| 32 | 1 | DRY SEAL PLUG | 93010114 |

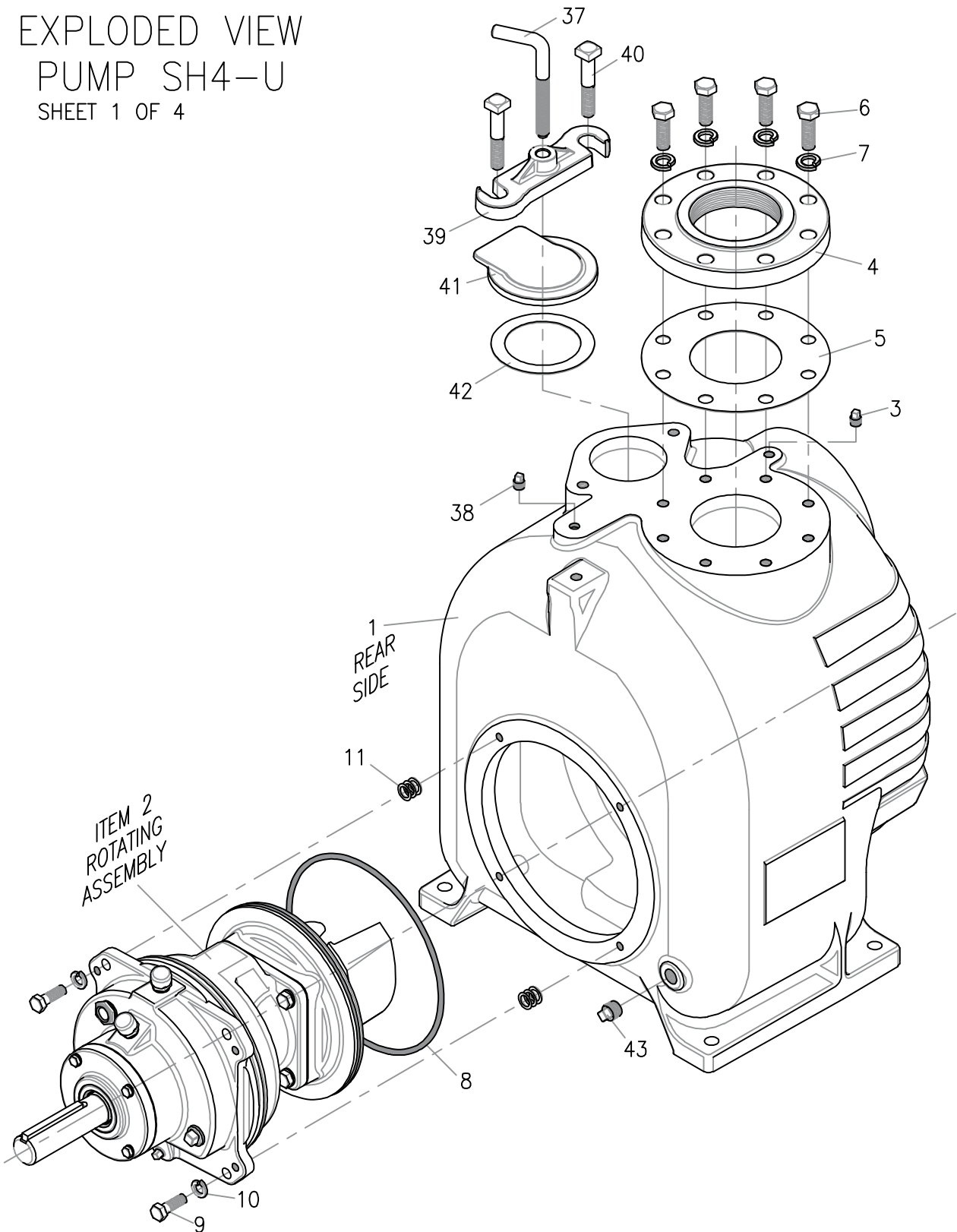
NOTE:

1.- THE MECHANICAL SEAL, IS AVAILABLE IN TUNGSTEN FACES;
IN THIS CASE THE PART NUMBER IS # 31030402.

For Repair Part Please supply: Model Number and Serial as shown on
Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 10a

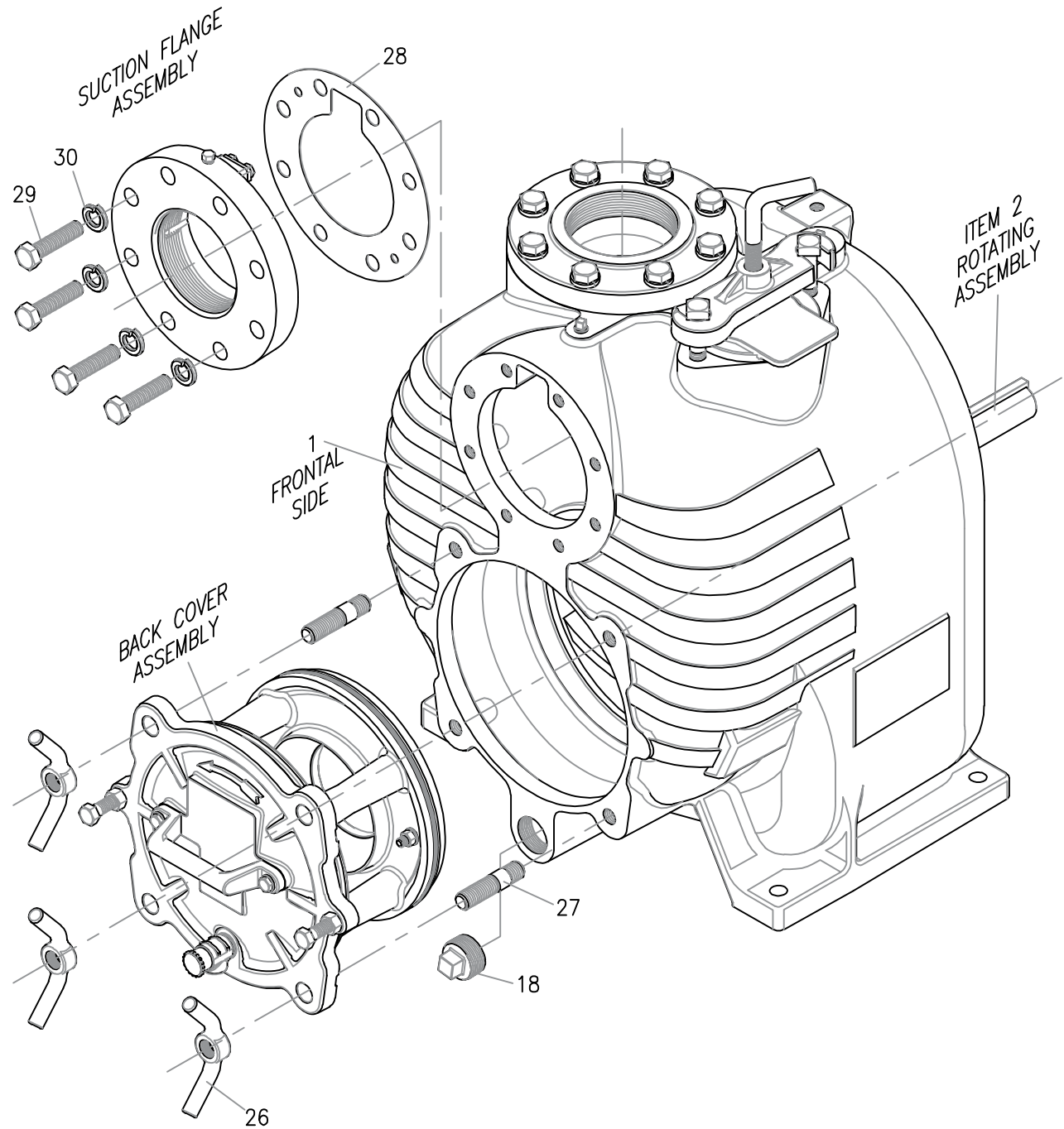
EXPLODED VIEW
PUMP SH4-U
SHEET 1 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 10b

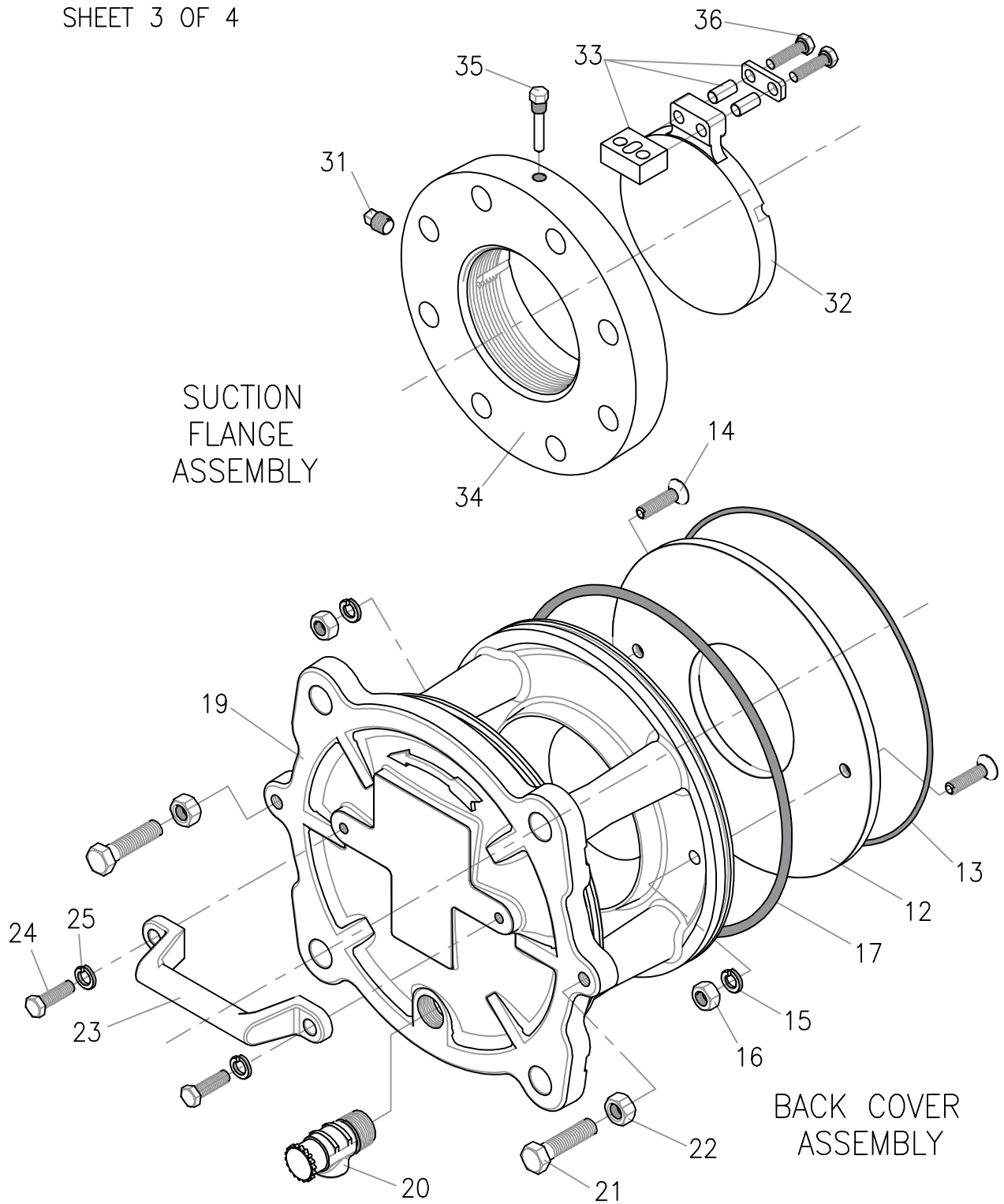
EXPLODED VIEW
PUMP SH4-U
SHEET 2 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 10c

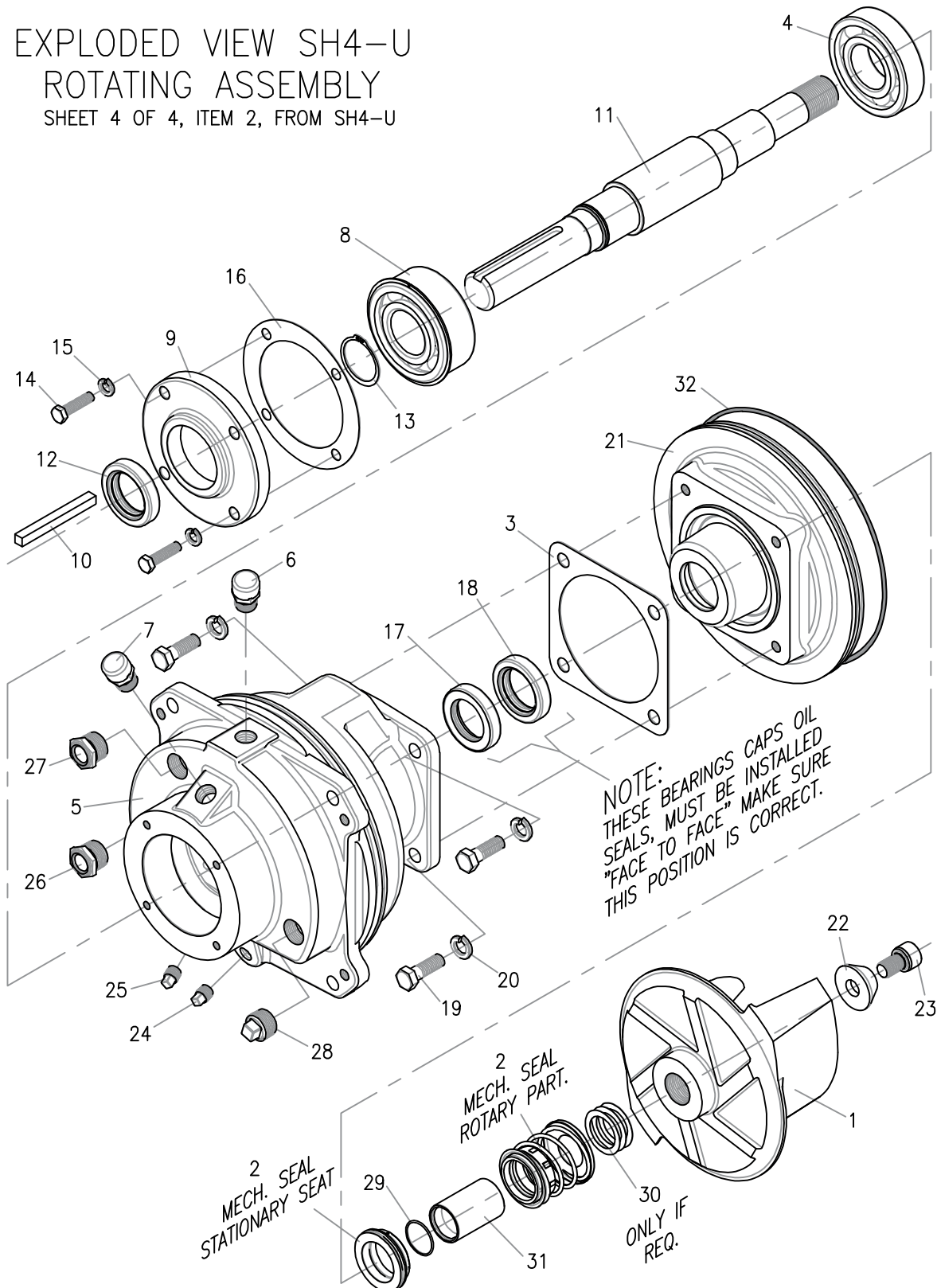
EXPLODED VIEWS
PUMP SH4-U
SHEET 3 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

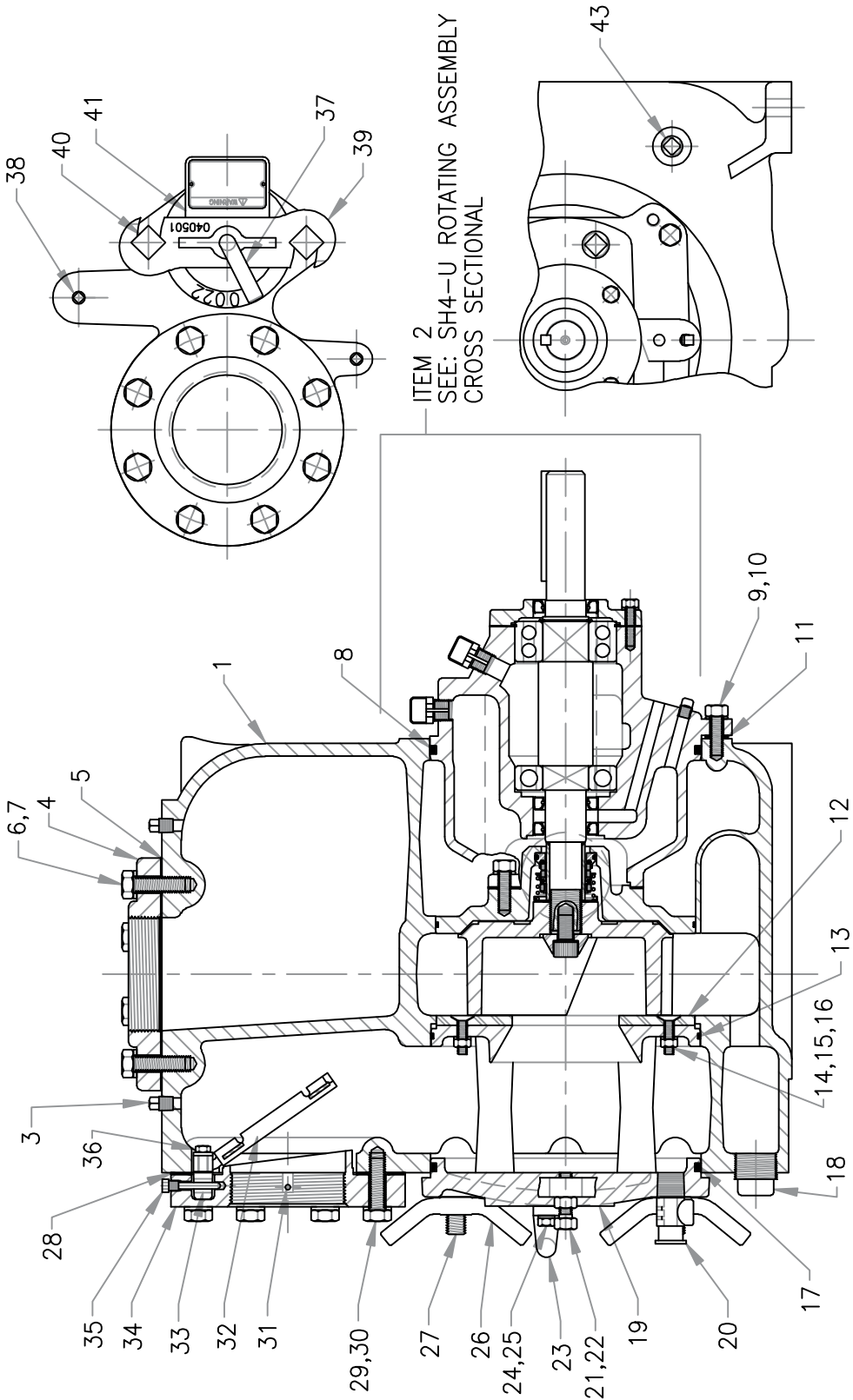
Figure 10d

EXPLODED VIEW SH4-U
ROTATING ASSEMBLY
SHEET 4 OF 4, ITEM 2, FROM SH4-U



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 10e



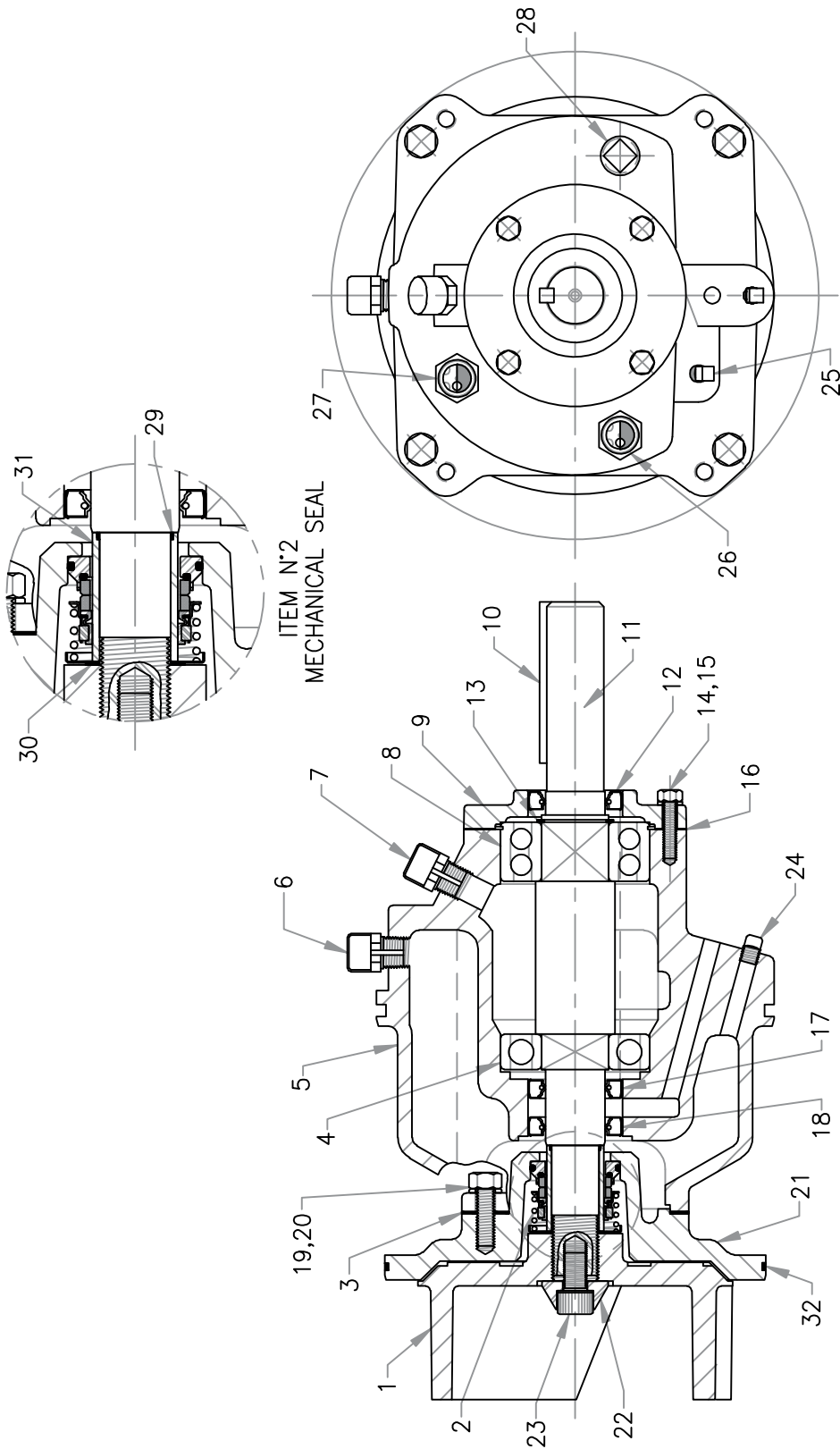
PUMP SH4-U, CROSS SECTIONAL

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

| PART LIST | | | |
|-----------|------|--|----------|
| ITEM | QTY. | DESCRIPTION | PART No. |
| 1 | 1 | PUMP CASING | 03090077 |
| 2 | 1 | REPAIR ROTATING ASSY. (SEE: SH4 ROTATING ASSEMBLY PART LIST) | |
| 3 | 1 | PIPE PLUG | 93010143 |
| 4 | 1 | DISCHARGE FLANGE | 03060006 |
| 5 | 1 | DISCHARGE FLANGE GASKET | 92010156 |
| 6 | 8 | HEX HEAD CAPSCREW | 91010283 |
| 7 | 8 | LOCKWASHER | 91010015 |
| 8 | 1 | O-RING, ROTATING ASSEMBLY | 92010046 |
| 9 | 4 | HEX HEAD CAPSCREW | 91010263 |
| 10 | 4 | LOCKWASHER | 91010014 |
| 11 | 12 | ROTATING ASSEMBLY ADJ SHIM SET | 91010057 |
| 12 | 1 | WEAR PLATE ASSY | 30400857 |
| 13 | 1 | BACK COVER O-RING | 92010033 |
| 14 | 2 | CONICAL SCREW | 91010402 |
| 15 | 2 | LOCKWASHER | 91010061 |
| 16 | 2 | HEX NUT | 91010433 |
| 17 | 1 | BACK COVER O-RING | 92010046 |
| 18 | 1 | CASING DRAIN PLUG | 93010146 |
| 19 | 1 | BACK COVER PLATE | 03220023 |
| 20 | 1 | PRESS RELIEF VALVE | 31200021 |
| 21 | 2 | JACK BOLT – BACK COVER | 92010264 |
| | | | |
| 23 | 1 | COVER PLATE HANDLE | 03151002 |
| 24 | 2 | HEX HEAD CAPSCREW | 91010244 |
| 25 | 2 | LOCKWASHER | 91010012 |
| 26 | 4 | HAND NUT | 03230002 |
| 27 | 4 | STUD | 91010321 |
| 28 | 1 | SUCTION FLANGE GASKET | 92010179 |
| 29 | 8 | HEX HEAD CAPSCREW | 91010284 |
| 30 | 8 | LOCKWASHER | 91010015 |
| 31 | 1 | PIPE PLUG | 93010143 |
| 32 | 1 | SUCTION CHECK VALVE | 92010224 |
| 33 | 1 | SUPPORT | 30400891 |
| 34 | 1 | SUCTION FLANGE | 03050016 |
| 35 | 1 | CHECK VALVE PIN | 30400866 |
| 36 | 2 | HEX HEAD CAPSCREW | 91010224 |
| 37 | 1 | CLAMP BAR SCREW | 30400911 |
| 38 | 1 | PIPE PLUG | 93010143 |
| 39 | 1 | CLAMP BAR | 03040501 |
| 40 | 2 | MACHINE BOLT | 91010401 |
| 41 | 1 | FILL COVER PLATE | 03220022 |
| 42 | 1 | COVER GASKET | 92010124 |
| 43 | 1 | PIPE PLUG | 93010142 |

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 10f



SH4-U ROTATING ASSEMBLY, CROSS SECTIONAL

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

| PART LIST | | | |
|-----------|------|-------------------------------|----------|
| ITEM | QTY. | DESCRIPTION | PART No. |
| 1 | 1 | IMPELLER | 03140073 |
| 2 | 1 | MECHANICAL SEAL (SEE NOTE: 1) | 31030401 |
| 3 | 1 | SEAL PLATE GASKET | 92010173 |
| 4 | 1 | INBOARD BALL BEARING | 31020032 |
| 5 | 1 | BEARING HOUSING | 03040023 |
| 6 | 1 | AIR VENT | 80062501 |
| 7 | 1 | AIR VENT | 80062501 |
| 8 | 1 | OUTBOARD BEARING | 31020031 |
| 9 | 1 | BEARING CAP | 03170014 |
| 10 | 1 | SHAFT KEY | 30400634 |
| 11 | 1 | IMPELLER SHAFT | 30400753 |
| 12 | 1 | BEARING CAP OIL SEAL | 31150010 |
| 13 | 1 | BEARING SNAP RING | 31010015 |
| 14 | 4 | HEX HEAD CAPSCREW | 91010244 |
| 15 | 4 | LOCKWASHER | 91010012 |
| 16 | 1 | BEARING CAP GASKET | 92010164 |
| | | | |
| 18 | 1 | INBOARD OIL SEAL | 31150010 |
| 19 | 4 | HEX HEAD CAPSCREW | 91010263 |
| 20 | 4 | LOCKWASHER | 91010014 |
| 21 | 1 | SEAL PLATE | 03180025 |
| 22 | 1 | IMPELLER WASHER | 30400425 |
| 23 | 1 | SOCKET HEAD CAPSCREW | 91010395 |
| 24 | 1 | SEAL CAVITY DRAIN PLUG | 93010143 |
| 25 | 1 | BEARING HOUSING DRAIN PLUG | 93010143 |
| 26 | 1 | SIGHT GAUGE | 31120012 |
| 27 | 1 | SIGHT GAUGE | 31120012 |
| 28 | 1 | PIPE PLUG | 93010148 |
| 29 | 1 | SEAL SLEEVE O-RING | 92010035 |
| 30 | 3 | IMPELLER ADJ SHIM SET | 91010134 |
| 31 | 1 | SEAL SLEEVE | 30400826 |
| 32 | 1 | SEAL PLATE O-RING | 92010033 |

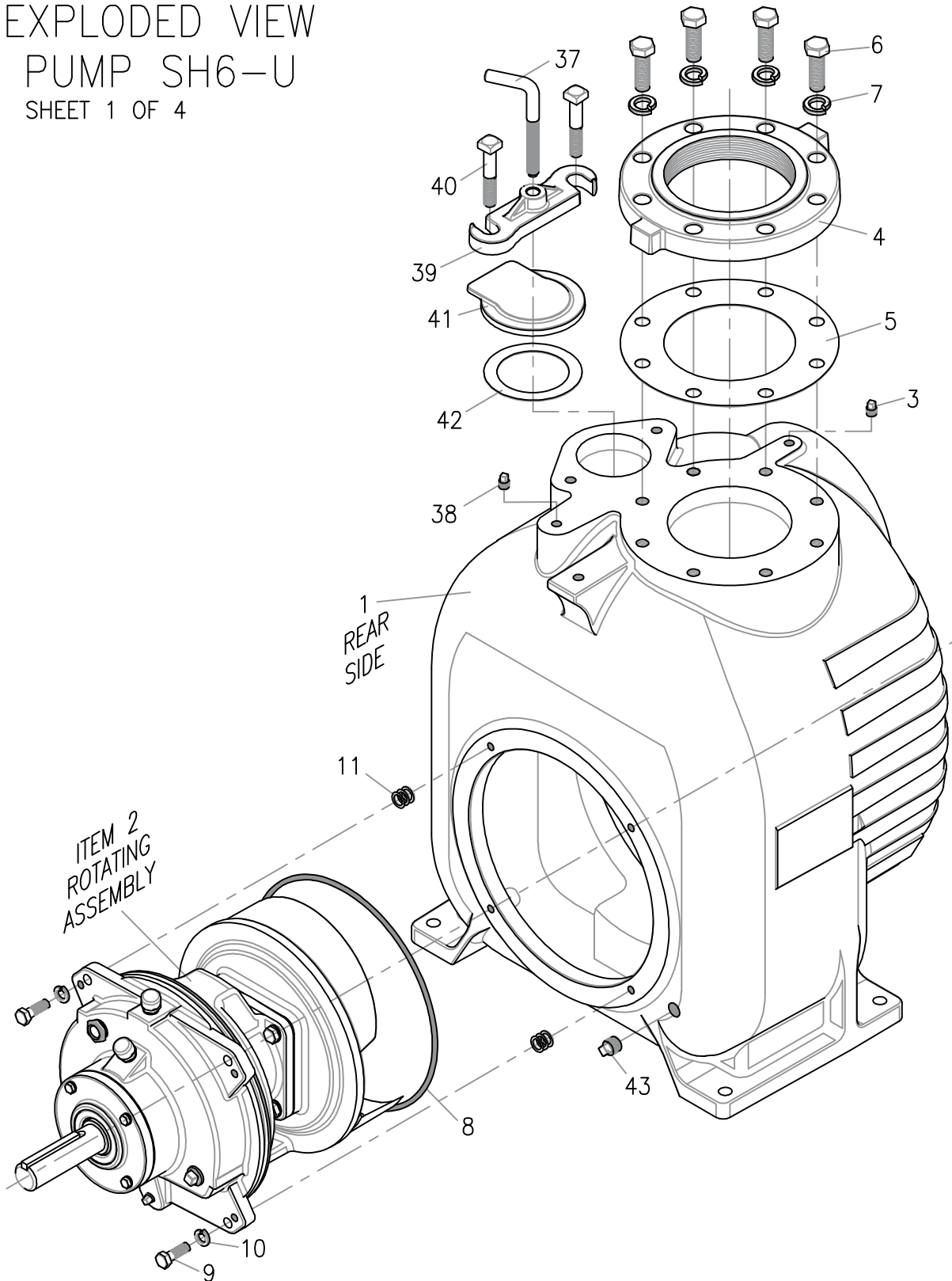
NOTE:

1.- THE MECHANICAL SEAL, IS AVAILABLE IN TUNGSTEN FACES;
IN THIS CASE THE PART NUMBER IS # 31030402.

For Repair Part Please supply: Model Number and Serial as shown on
Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 11a

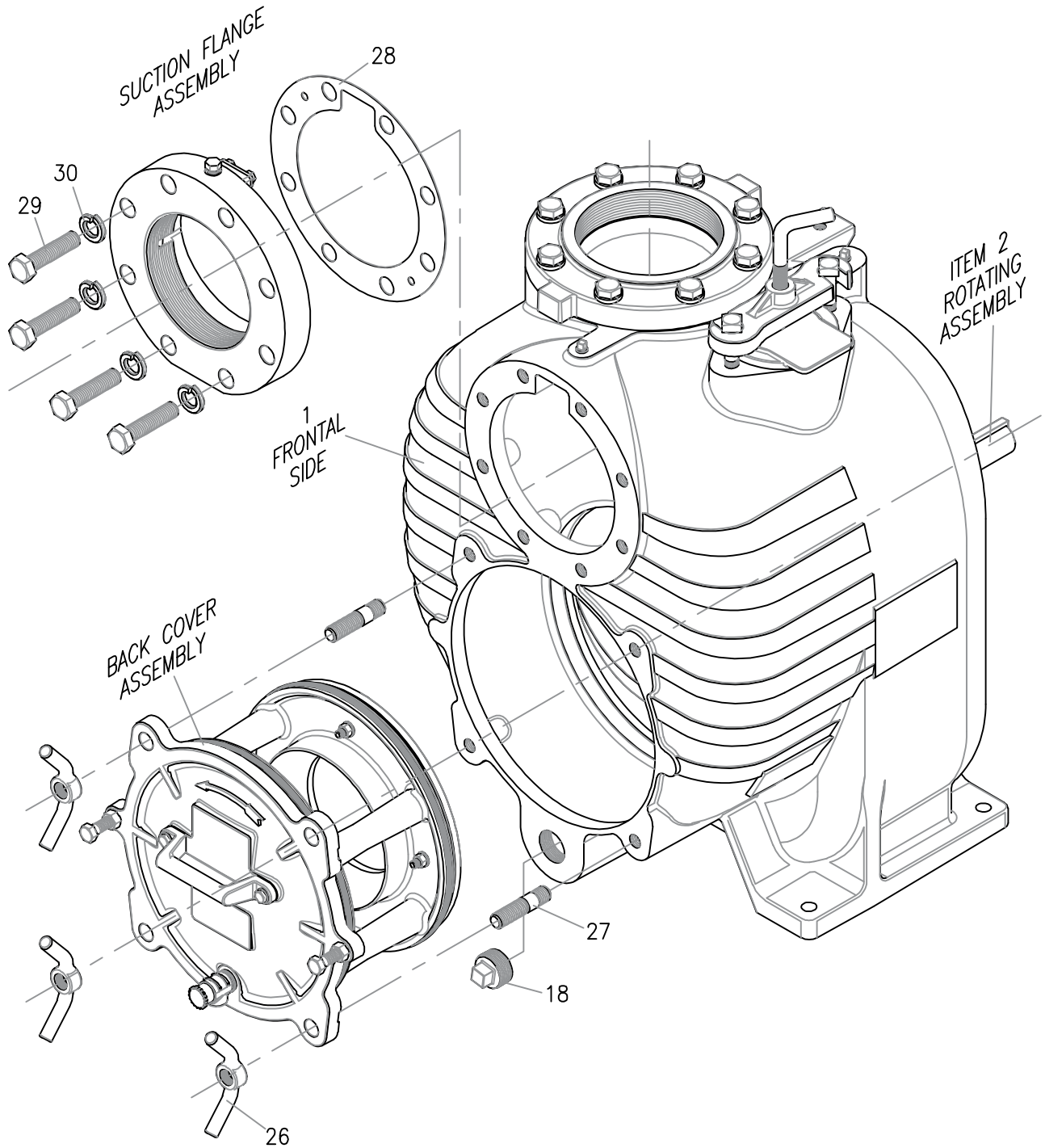
EXPLODED VIEW
PUMP SH6-U
SHEET 1 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 11b

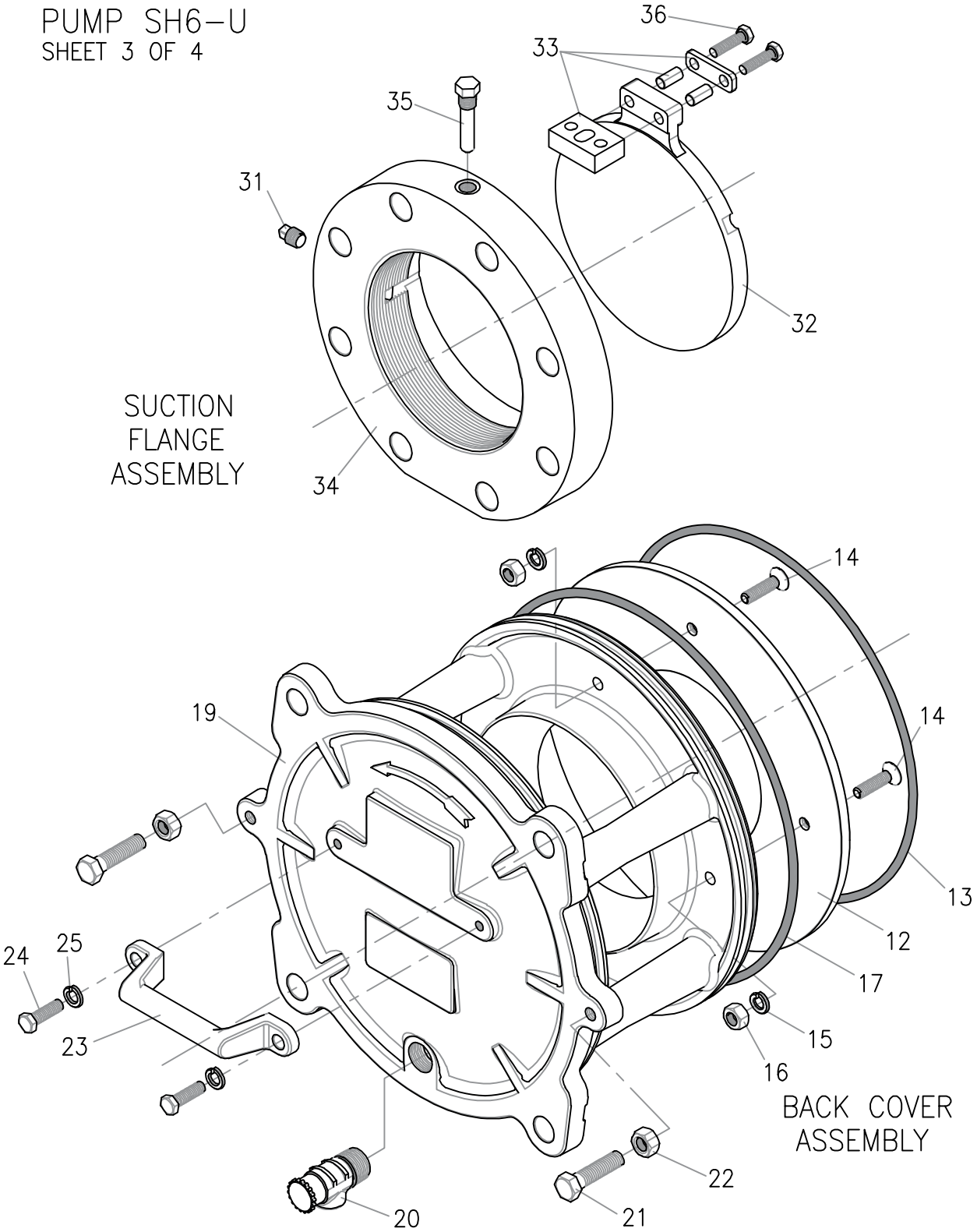
EXPLODED VIEW
PUMP SH6-U
SHEET 2 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 11c

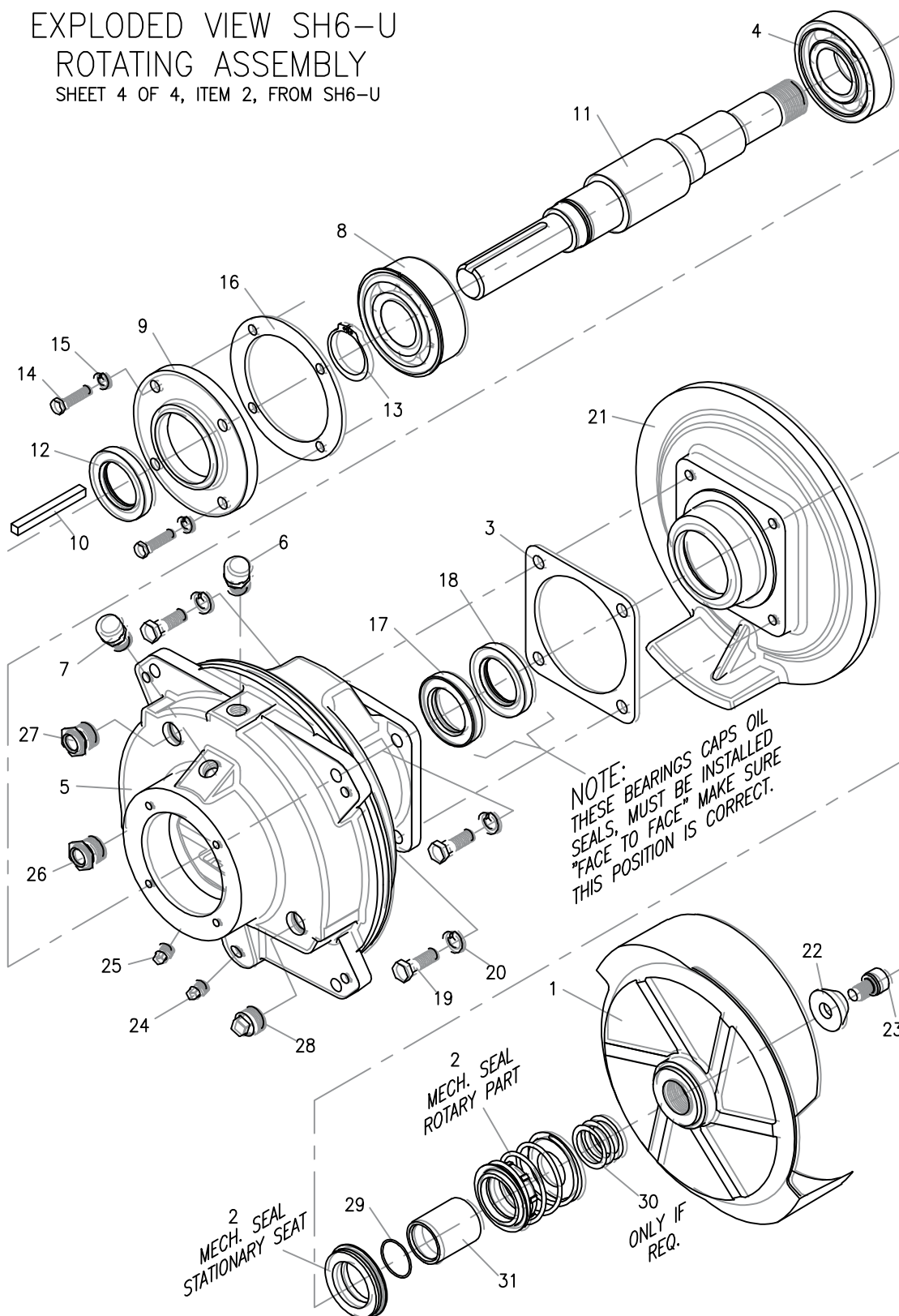
EXPLODED VIEW
PUMP SH6-U
SHEET 3 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

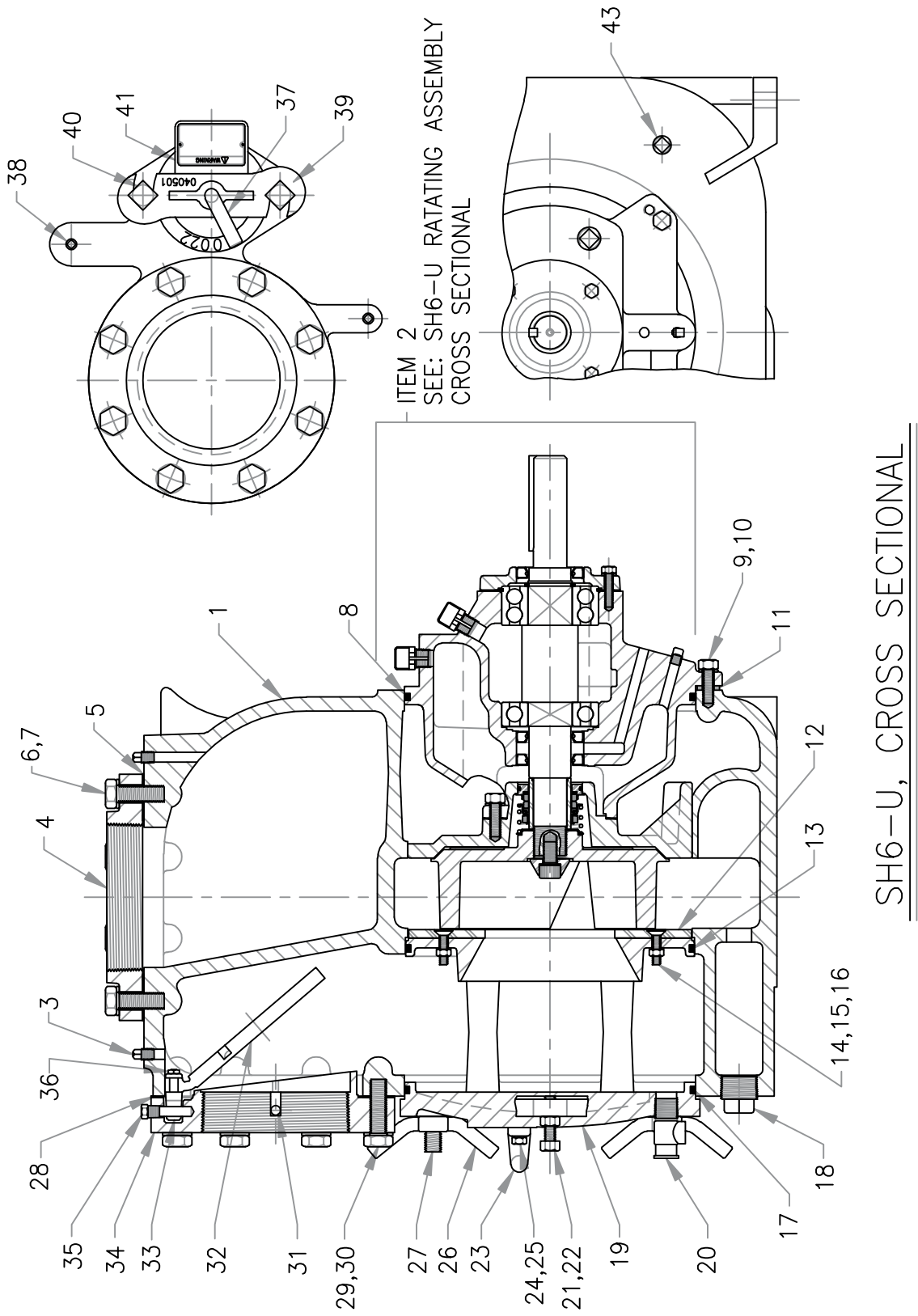
Figure 11d

EXPLODED VIEW SH6-U
ROTATING ASSEMBLY
SHEET 4 OF 4, ITEM 2, FROM SH6-U



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 11e



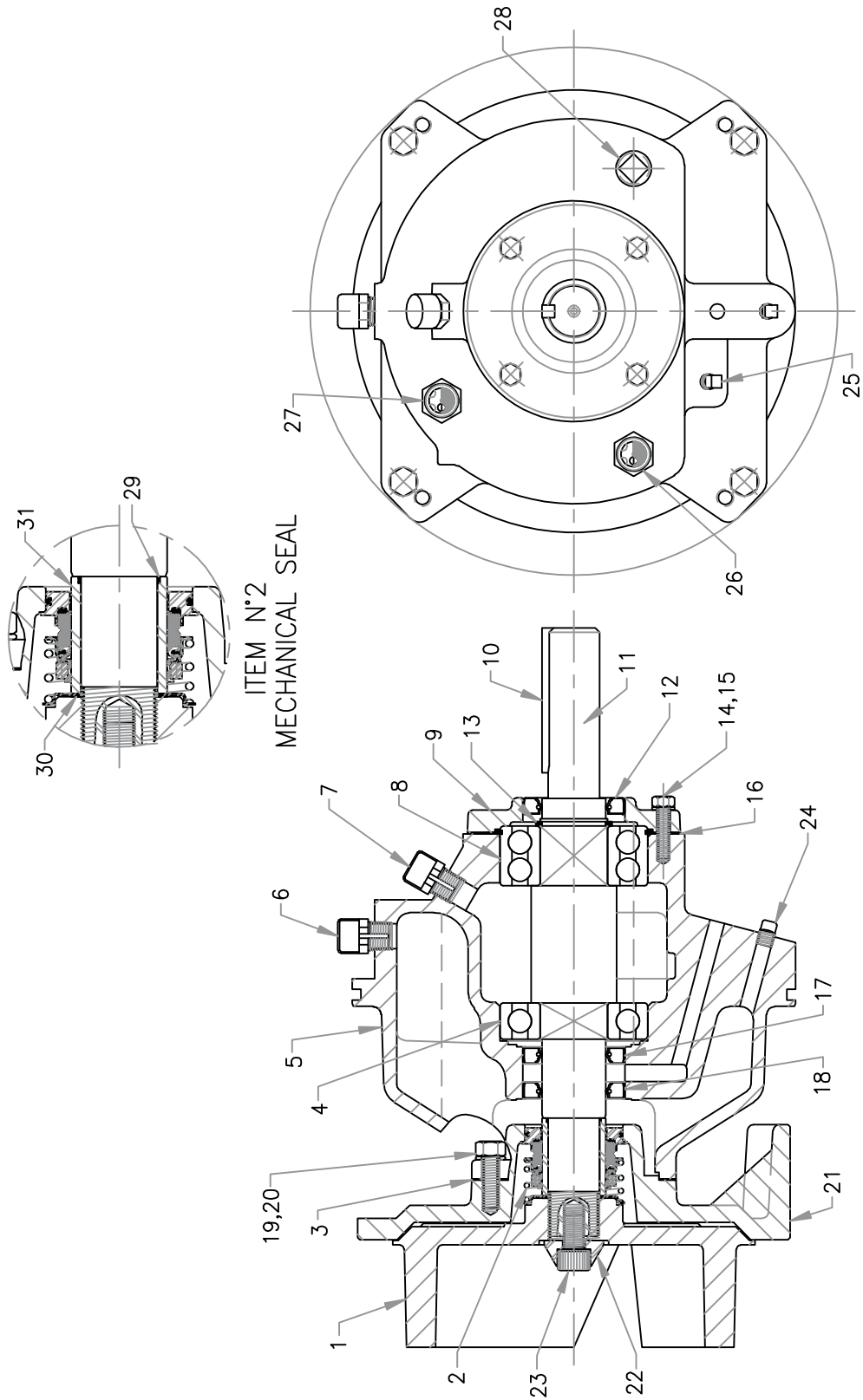
SH6-U, CROSS SECTIONAL

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

| PART LIST | | | |
|-----------|------|--|----------|
| ITEM | QTY. | DESCRIPTION | PART No. |
| 1 | 1 | PUMP CASING | 03090076 |
| 2 | 1 | REPAIR ROTATING ASSY. (SEE: SH6 ROTATING ASSEMBLY PART LIST) | |
| 3 | 1 | PIPE PLUG | 93010143 |
| 4 | 1 | DISCHARGE FLANGE | 03060008 |
| 5 | 1 | DISCHARGE FLANGE GASKET | 92010159 |
| 6 | 8 | HEX HEAD CAPSCREW | 91010292 |
| 7 | 8 | LOCKWASHER | 91010016 |
| 8 | 1 | O-RING, ROTATING ASSEMBLY | 92010047 |
| 9 | 4 | HEX HEAD CAPSCREW | 91010263 |
| 10 | 4 | LOCKWASHER | 91010014 |
| 11 | 12 | ROTATING ASSEMBLY ADJ SHIM SET | 91010057 |
| 12 | 1 | WEAR PLATE ASSY | 30400855 |
| 13 | 1 | BACK COVER O-RING | 92010048 |
| 14 | 4 | CONICAL SCREW | 91010402 |
| 15 | 4 | LOCKWASHER | 91010061 |
| 16 | 4 | HEX NUT | 91010433 |
| 17 | 1 | BACK COVER O-RING | 92010047 |
| 18 | 1 | CASING DRAIN PLUG | 93010146 |
| 19 | 1 | BACK COVER PLATE ASSY. | 03220021 |
| 20 | 1 | PRESS RELIEF VALVE | 31200021 |
| 21 | 2 | JACK BOLT – BACK COVER | 91010264 |
| 22 | 2 | JAM NUT – BACK COVER | 91010415 |
| 23 | 1 | COVER PLATE HANDLE | 03151002 |
| 24 | 2 | HEX HEAD CAPSCREW | 91010244 |
| 25 | 2 | LOCKWASHER | 91010012 |
| 26 | 4 | HAND NUT | 03230002 |
| 27 | 4 | STUD | 91010321 |
| 28 | 1 | SUCTION FLANGE GASKET | 92010178 |
| 29 | 8 | HEX HEAD CAPSCREW | 91010293 |
| 30 | 8 | LOCKWASHER | 91010016 |
| 31 | 1 | PIPE PLUG | 93010143 |
| 32 | 1 | SUCTION CHECK VALVE | 92010225 |
| 33 | 1 | SUPPORT | 30400890 |
| 34 | 1 | SUCTION FLANGE | 03050015 |
| 35 | 1 | CHECK VALVE PIN | 30400867 |
| 36 | 2 | HEX HEAD CAPSCREW | 91010224 |
| 37 | 1 | CLAMP BAR SCREW | 30400911 |
| 38 | 1 | PIPE PLUG | 93010143 |
| 39 | 1 | CLAMP BAR | 03040501 |
| 40 | 2 | MACHINE BOLT | 91010401 |
| 41 | 1 | FILL COVER PLATE | 03220022 |
| 42 | 1 | COVER GASKET | 92010124 |
| 43 | 1 | PIPE PLUG | 93010142 |

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 11f



SH6-U ROTATING ASSEMBLY, CROSS SECTIONAL

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

| PART LIST | | | |
|-----------|------|-------------------------------|----------|
| ITEM | QTY. | DESCRIPTION | PART No. |
| 1 | 1 | IMPELLER | 03140072 |
| 2 | 1 | MECHANICAL SEAL (SEE NOTE: 1) | 31030403 |
| 3 | 1 | SEAL PLATE GASKET | 92010173 |
| 4 | 1 | INBOARD BALL BEARING | 31020030 |
| 5 | 1 | BEARING HOUSING | 03040022 |
| 6 | 1 | AIR VENT | 80062501 |
| 7 | 1 | AIR VENT | 80062501 |
| 8 | 1 | OUTBOARD BEARING | 31020029 |
| 9 | 1 | BEARING CAP | 03170013 |
| 10 | 1 | SHAFT KEY | 30400634 |
| 11 | 1 | IMPELLER SHAFT | 30400755 |
| 12 | 1 | BEARING CAP OIL SEAL | 31150009 |
| 13 | 1 | BEARING SNAP RING | 31010013 |
| 14 | 4 | HEX HEAD CAPSCREW | 91010244 |
| 15 | 4 | LOCKWASHER | 91010012 |
| 16 | 1 | BEARING CAP GASKET | 92010166 |
| | | | |
| 18 | 1 | INBOARD OIL SEAL | 31150009 |
| 19 | 4 | HEX HEAD CAPSCREW | 91010263 |
| 20 | 4 | LOCKWASHER | 91010014 |
| 21 | 1 | SEAL PLATE | 03180024 |
| 22 | 1 | IMPELLER WASHER | 30400425 |
| 23 | 1 | SOCKET HEAD CAPSCREW | 91010395 |
| 24 | 1 | SEAL CAVITY DRAIN PLUG | 93010143 |
| 25 | 1 | BEARING HOUSING DRAIN PLUG | 93010143 |
| 26 | 1 | SIGHT GAUGE | 31120012 |
| 27 | 1 | SIGHT GAUGE | 31120012 |
| 28 | 1 | PIPE PLUG | 93010148 |
| 29 | 1 | SEAL SLEEVE O-RING | 92010036 |
| 30 | 3 | IMPELLER ADJ SHIM SET | 30400401 |
| 31 | 1 | SEAL SLEEVE | 30400825 |

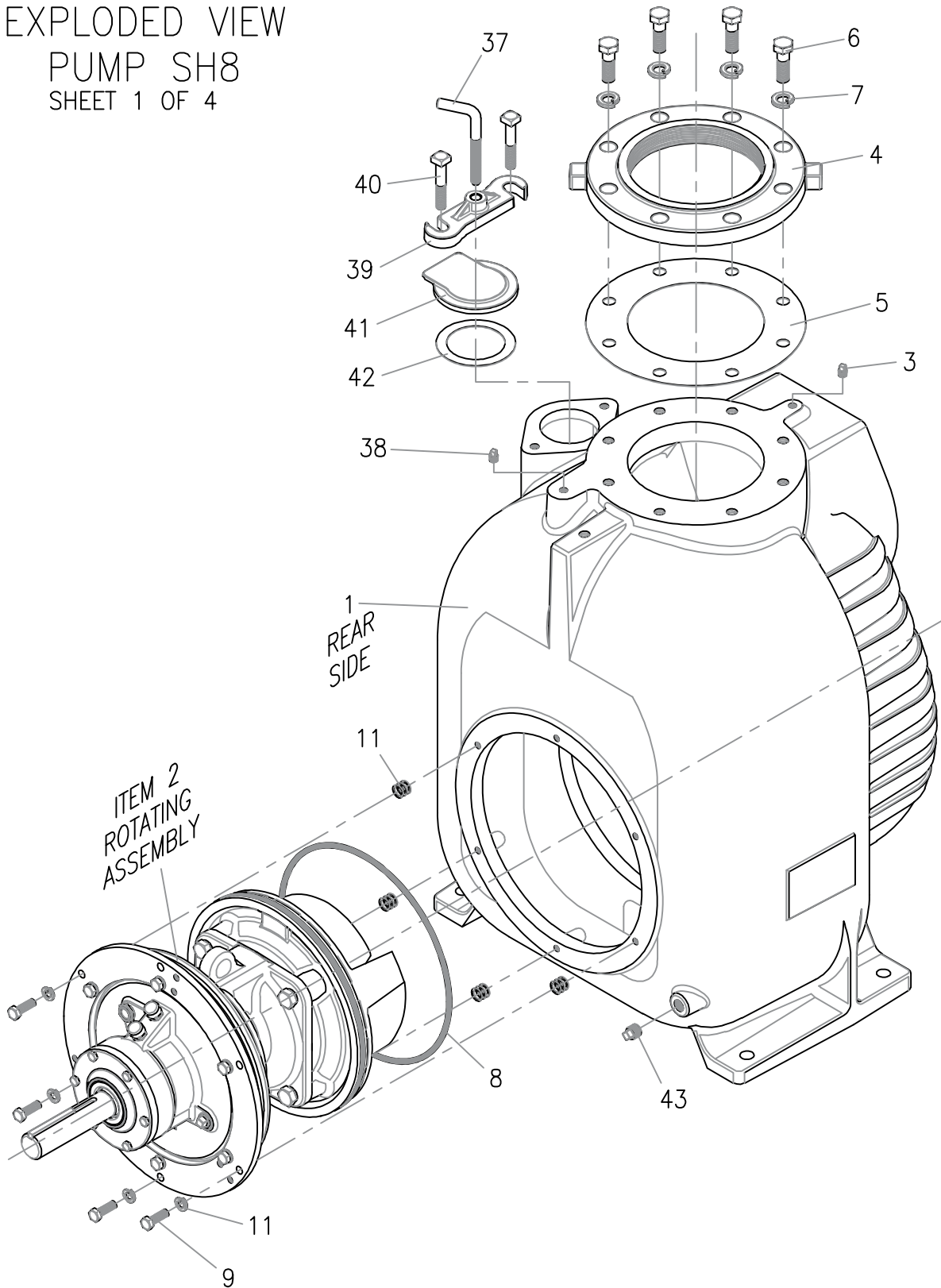
NOTE:

1.- THE MECHANICAL SEAL, IS AVAILABLE IN TUNGSTEN FACES;
IN THIS CASE THE PART NUMBER IS # 31030404.

For Repair Part Please supply: Model Number and Serial as shown on
Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 12a

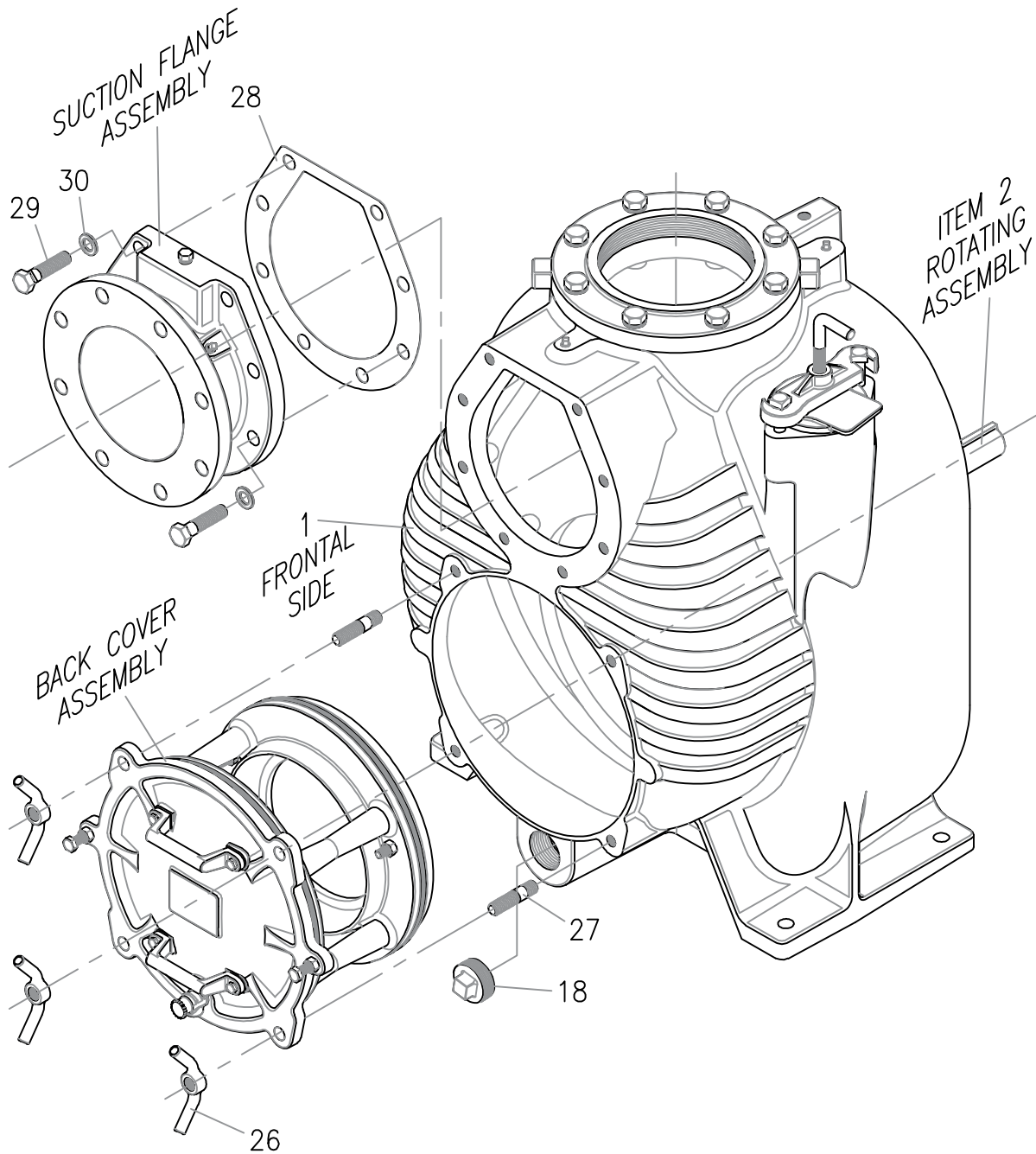
EXPLODED VIEW
PUMP SH8
SHEET 1 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 12b

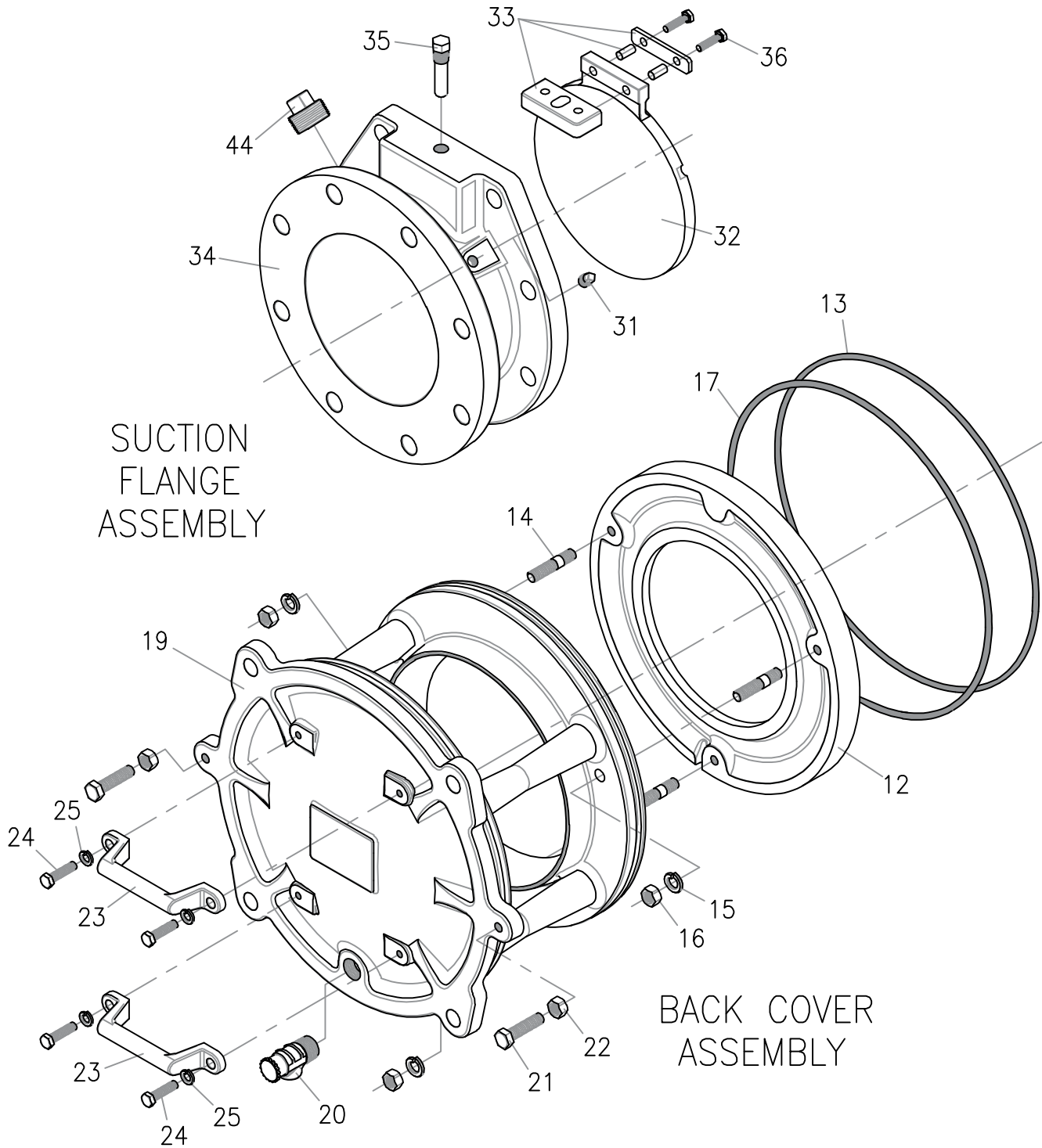
EXPLODED VIEW
PUMP SH8
SHEET 2 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 12c

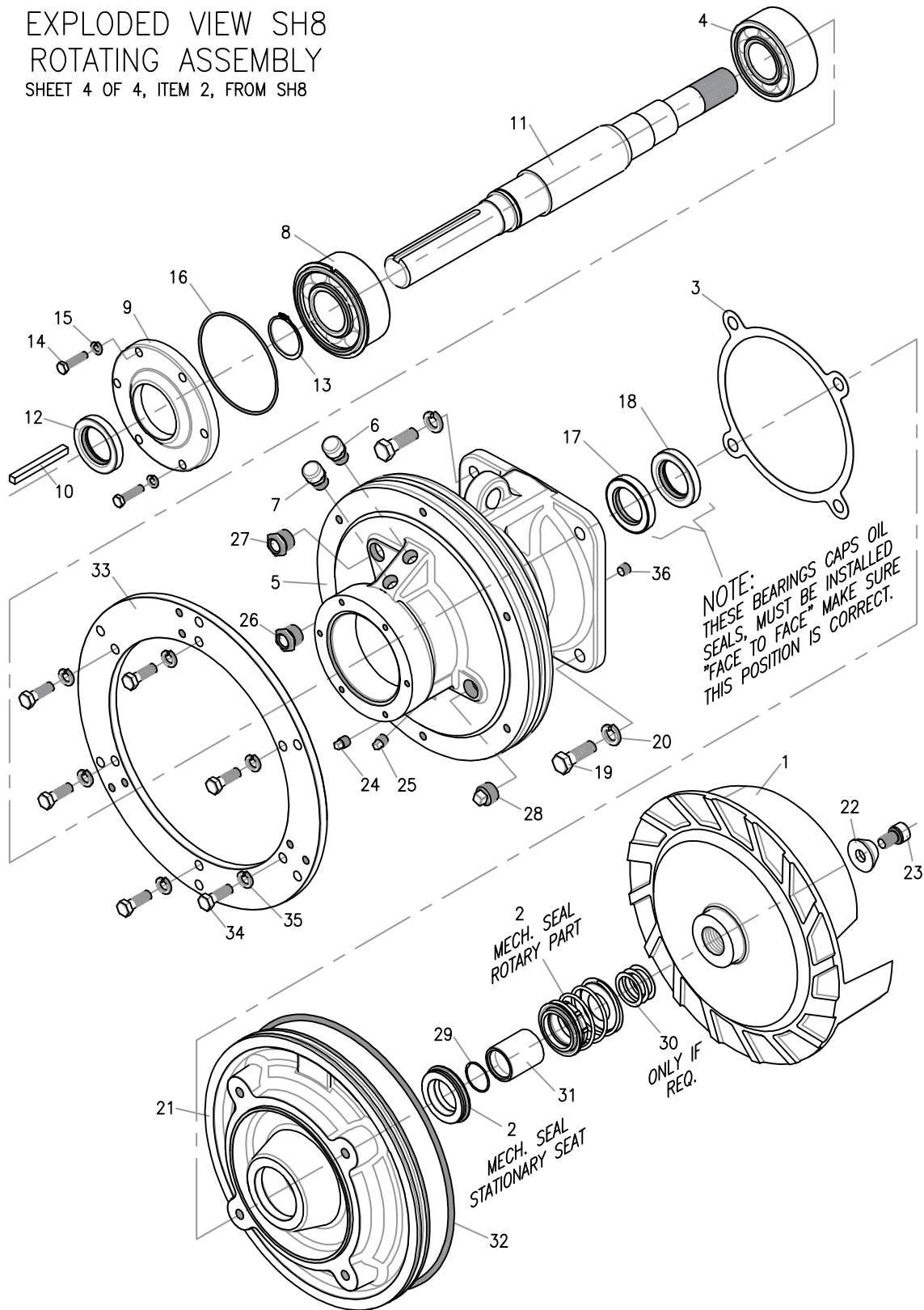
EXPLODED VIEWS
PUMP SH8
SHEET 3 OF 4



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

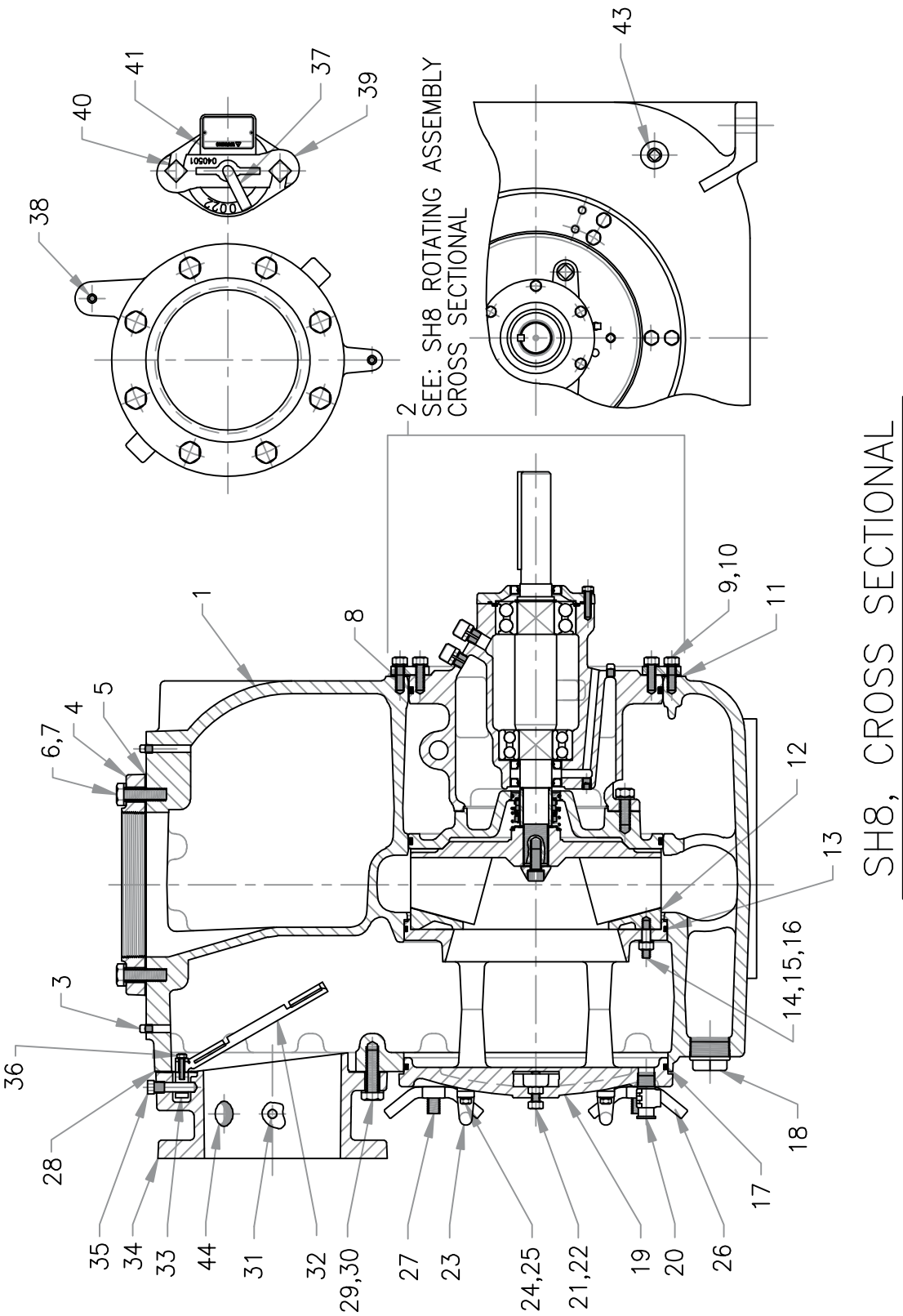
Figure 12d

EXPLODED VIEW SH8
ROTATING ASSEMBLY
SHEET 4 OF 4, ITEM 2, FROM SH8



For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 12e

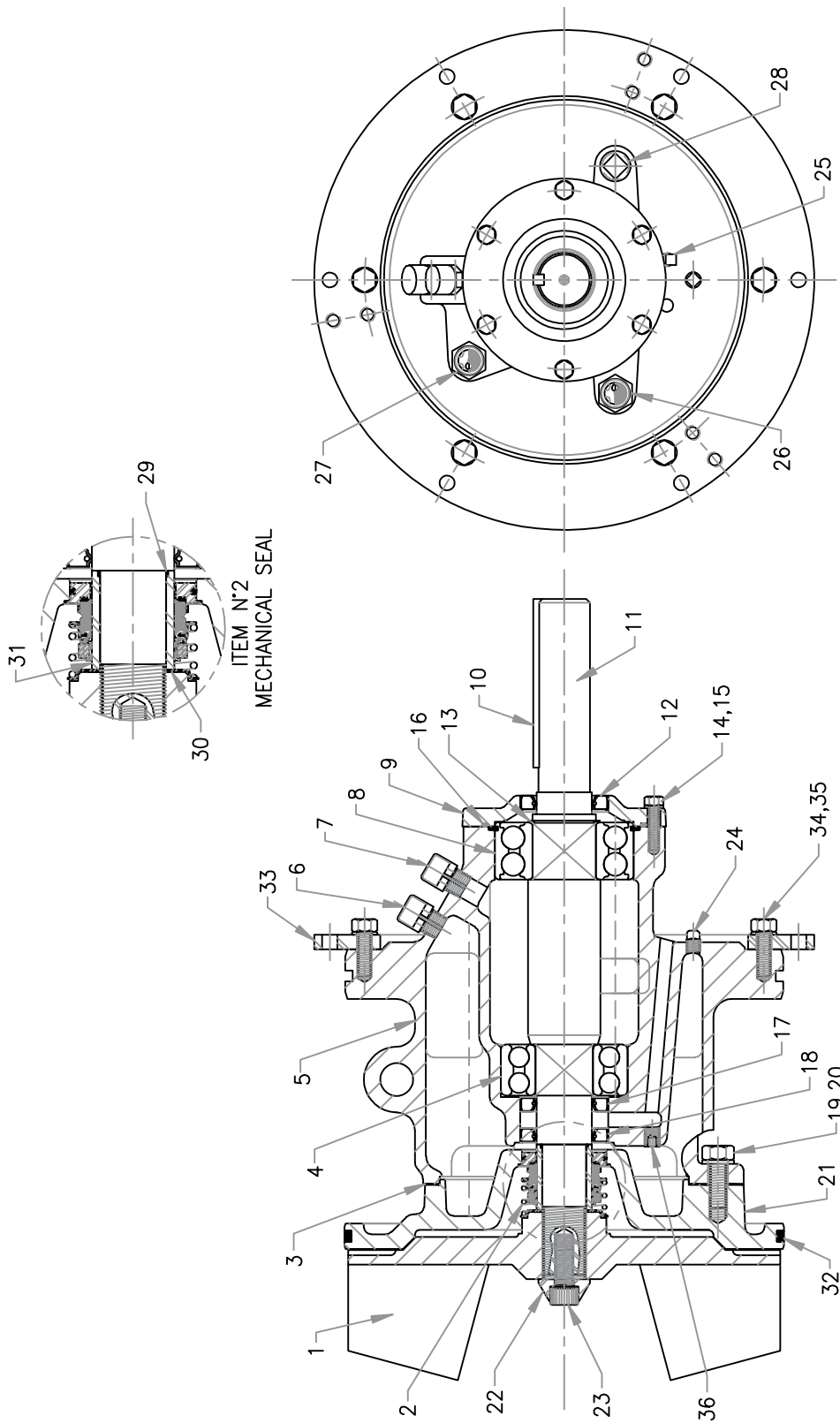


For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

| PART LIST | | | |
|-----------|------|---|----------|
| ITEM | QTY. | DESCRIPTION | PART No. |
| 1 | 1 | PUMP CASING | 03090082 |
| 2 | 1 | REPAIR ROTATING ASSY (SEE: SH8 ROTATING ASSEMBLY PART LIST) | |
| 3 | 1 | PIPE PLUG | 93010143 |
| 4 | 1 | DISCHARGE FLANGE | 03060009 |
| 5 | 1 | DISCHARGE FLANGE GASKET | 92010160 |
| 6 | 8 | HEX HEAD CAPSCREW | 91010292 |
| 7 | 8 | LOCKWASHER | 91010015 |
| 8 | 1 | O-RING, ROTATING ASSEMBLY | 92010065 |
| 9 | 6 | HEX HEAD CAPSCREW | 91010263 |
| 10 | 6 | LOCKWASHER | 91010014 |
| 11 | 18 | ROTATING ASSEMBLY ADJ SHIM SET | 91010057 |
| 12 | 1 | WEAR PLATE ASSY | 03190011 |
| 13 | 1 | BACK COVER O-RING | 92010066 |
| 14 | 3 | WEAR PLATE STUD | 91010311 |
| 15 | 3 | LOCKWASHER | 91010014 |
| 16 | 3 | HEX NUT | 91010415 |
| 17 | 1 | BACK COVER O-RING | 92010068 |
| 18 | 1 | CASING DRAIN PLUG | 93010147 |
| 19 | 1 | BACK COVER PLATE | 03220025 |
| 20 | 1 | PRESS RELIEF VALVE | 31200021 |
| 21 | 2 | JACK BOLT – BACK COVER | 91010264 |
| | | | |
| 23 | 2 | COVER PLATE HANDLE | 03151002 |
| 24 | 4 | HEX HEAD CAPSCREWN | 91010244 |
| 25 | 4 | LOCKWASHER | 91010012 |
| 26 | 4 | HAND NUT | 03230002 |
| 27 | 4 | STUD | 91010321 |
| 28 | 1 | SUCTION FLANGE GASKET | 92010181 |
| 29 | 8 | HEX HEAD CAPSCREW | 91010293 |
| 30 | 8 | LOCKWASHER | 91010016 |
| 31 | 1 | PIPE PLUG | 93010143 |
| 32 | 1 | SUCTION CHECK VALVE | 92010227 |
| 33 | 1 | SUPPORT | 30400895 |
| 34 | 1 | SUCTION FLANGE | 03050018 |
| 35 | 1 | CHECK VALVE PIN | 30400868 |
| 36 | 2 | HEX HEAD CAPSCREW | 91010223 |
| 37 | 1 | CLAMP BAR SCREW | 30400911 |
| 38 | 1 | PIPE PLUG | 93010143 |
| 39 | 1 | CLAMP BAR | 03040501 |
| 40 | 2 | MACHINE BOLT | 91010401 |
| 41 | 1 | FILL COVER PLATE | 03220022 |
| 42 | 1 | COVER GASKET | 92010124 |
| 43 | 1 | PIPE PLUG | 93010142 |
| 44 | 1 | PIPE PLUG | 93010146 |

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

Figure 12f



SH8 ROTATING ASSEMBLY, CROSS SECTIONAL

For Repair Part Please supply: Model Number and Serial as shown on Name Plate, and Part Description and Part Number as shown on Parts List.

| PART LIST | | | |
|-----------|------|-------------------------------|----------|
| ITEM | QTY. | DESCRIPTION | PART No. |
| 1 | 1 | IMPELLER | 03140075 |
| 2 | 1 | MECHANICAL SEAL (SEE NOTE: 1) | 31030403 |
| 3 | 1 | SEAL PLATE GASKET | 92010182 |
| 4 | 1 | INBOARD BALL BEARING | 31020038 |
| 5 | 1 | BEARING HOUSING | 03040025 |
| 6 | 1 | AIR VENT | 80062501 |
| 7 | 1 | AIR VENT | 80062501 |
| 8 | 1 | OUTBOARD BEARING | 31020037 |
| 9 | 1 | BEARING CAP | 03170017 |
| 10 | 1 | SHAFT KEY | 30400634 |
| 11 | 1 | IMPELLER SHAFT | 30400756 |
| 12 | 1 | BEARING CAP OIL SEAL | 31150009 |
| 13 | 1 | BEARING SNAP RING | 31010005 |
| 14 | 6 | HEX HEAD CAPSCREW | 91010244 |
| 15 | 6 | LOCKWASHER | 91010012 |
| 16 | 1 | BEARING CAP O-RING | 92010067 |
| 17 | 1 | BEARING CAP OIL SEAL | 31150009 |
| 18 | 1 | BEARING CAP OIL SEAL | 31150009 |
| | | | |
| 20 | 4 | LOCKWASHER | 91010015 |
| 21 | 1 | SEAL PLATE | 03180027 |
| 22 | 1 | IMPELLER WASHER | 30400425 |
| 23 | 1 | SOCKET HEAD CAPSCREW | 91010395 |
| 24 | 1 | SEAL CAVITY DRAIN PLUG | 93010143 |
| 25 | 1 | BEARING HOUSING DRAIN PLUG | 93010143 |
| 26 | 1 | SIGHT GAUGE | 31120012 |
| 27 | 1 | SIGHT GAUGE | 31120012 |
| 28 | 1 | PIPE PLUG | 93010148 |
| 29 | 1 | SEAL SLEEVE O-RING | 92010036 |
| 30 | 3 | IMPELLER ADJ SHIM SET | 30400401 |
| 31 | 1 | SEAL SLEEVE | 30400825 |
| 32 | 1 | SEAL PLATE O-RING | 92010065 |
| 33 | 1 | BEARING HOUSING ADAPTER | 30400121 |
| 34 | 6 | HEX HEAD CAPSCREW | 91010263 |
| 35 | 6 | LOCKWASHER | 91010014 |
| 36 | 1 | DRY SEAL PLUG | 93010113 |

NOTE:

1.- THE MECHANICAL SEAL, IS AVAILABLE IN TUNGSTEN FACES;
IN THIS CASE THE PART NUMBER IS # 31030404.

For Repair Part Please supply: Model Number and Serial as shown on
Name Plate, and Part Description and Part Number as shown on Parts List.