These models are obsolete. Parts availability will be limited.

BLACKMER POWER PUMPS ML4 SERIES

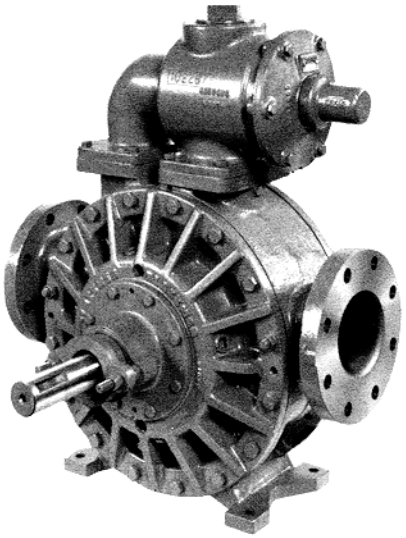
Discontinued Oct. 1990

966904

INSTRUCTIONS AND PARTS LIST NO. 185/ZS

Section	100
Effective	May 1988
Replaces	New

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS WITH PARTS LISTS



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WARNING

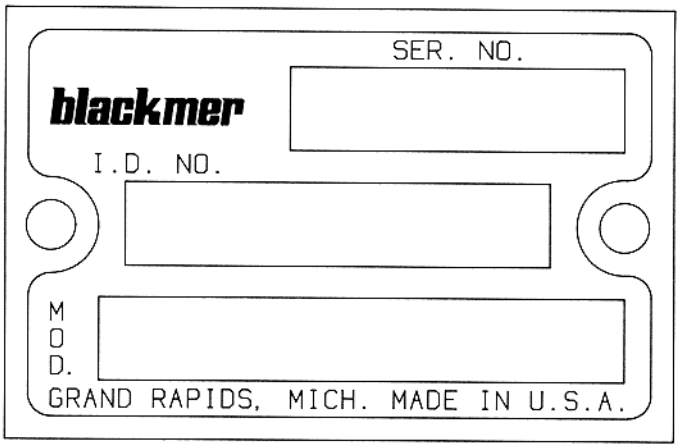
THIS PRODUCT MUST ONLY BE INSTALLED IN SYSTEMS WHICH HAVE BEEN DESIGNED BY THOSE QUALIFIED TO ENGINEER SUCH SYSTEMS. THE SYSTEM MUST BE IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS AND SAFETY CODES AND WARN OF ANY HAZARDS UNIQUE TO THE PARTICULAR SYSTEM.

MAINTENANCE

MAINTENANCE AND TROUBLE SHOOTING MUST BE DONE BY AN INDIVIDUAL EXPERIENCED WITH PUMP MAINTENANCE AND THE TYPE OF SYSTEM INVOLVED.

I. PUMP IDENTIFICATION

A pump identification tag, containing the pump serial number, I.D. number, and model designation, is attached to each pump (see Figure 1). It is recommended that the data from this tag be recorded and filed for future reference. If replacement parts are needed, or if information pertaining to the pump is required, this data must be furnished to a Blackmer Representative.



SERIAL NUMBER _____

I.D. NUMBER _____

MODEL _____

Figure 1 — Pump Identification Tag

DISCONTINUED MODELS

II. INSTALLATION AND OPERATION

LOCATION

Locate the pump as near the source of supply as possible to reduce detrimental inlet pipe friction. A solid foundation reduces vibration and noise and improves the pump performance. On permanent installations it is recommended that the pumping units be securely bolted to a concrete foundation.

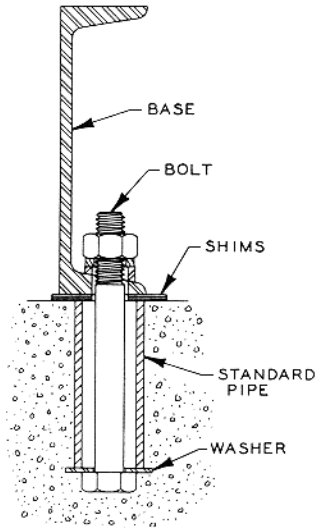


Figure 2

When new pump foundations are to be cast in concrete, it is suggested that anchor bolts of the type shown in Fig. 2 be set into the concrete.

This type of anchor bolt allows for slight shifting of position to better line up with the mounting holes in the base plate. When pumps are to be located on existing concrete floors, holes should be drilled into the concrete and foundation bolts anchored therein.

When installing units built on channel or structural steel type bases, care should be taken that the base is not twisted out of shape when anchor bolts are tightened. Shims should be used under the edges of the base prior to tightening of the anchor bolts to prevent distortion.

RELIEF VALVE

The ML4 Series Pump is offered with an optional relief valve assembly which is bolted onto the pump body. The valve may be used as an internal relief valve, or as an external bypass, piped back to the storage tank (see Figure 3). Its purpose is to protect the pump or pumping system from excessive pressure. The valve is not meant to be used for prolonged recirculation.

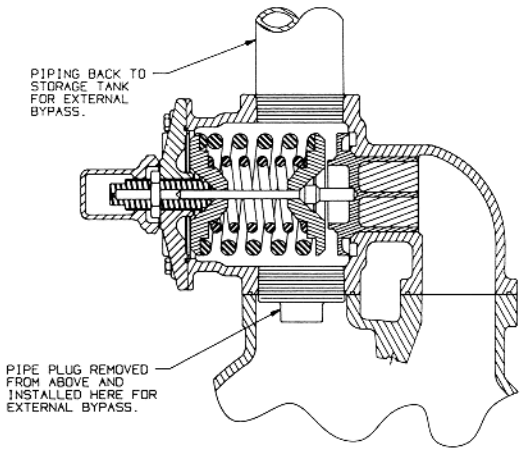


Figure 3 — Relief Valve

Blackmer relief valves are designed for satisfactory operation with a **partially** closed discharge line on most types of installations. This allows reduction of the flow from the discharge piping without slowing down the speed of the pump (for a limited time).

When pumping highly volatile liquids under a high suction lift, and cavitation or starving of the pump exists, partial closing of the discharge valve will result in excessive noise in the relief valve. Plumbing the relief valve so flow is directed back to the storage tank is recommended when operating under these conditions.

The relief valve setting should be 20 psi (138 kPa) higher than the operating pressure. To increase the pressure setting, remove the relief valve cap, loosen the locknut, and turn the adjusting screw inward, or clockwise. To reduce the pressure setting, turn the adjusting screw outward, or counterclockwise. **Do not attempt to use springs outside of their appropriate setting range.** (See Parts List for spring ranges.)

To check the pressure setting of the relief valve, install a pressure gauge at the gauge hole on the discharge side of the pump near the relief valve, then check its reading with a valve completely closed in the discharge line. **CAUTION: Do not run the pump with the valve completely closed for more than 10–15 seconds.**

MANUAL BYPASS VALVE

A bypass line from the pump discharge to the pump suction, with a manual shut-off valve, is recommended when handling volatile liquids, viscous liquids at a high lift, or when delivering to piping too small to take the full flow from the pump.

With a 4″ size pump, a 2″ manual bypass valve and recirculating line is recommended.

When handling very viscous liquids, excessive pressure may develop when starting. To avoid possible damage to the pump, open the valve before starting. After the pressure stabilizes and the pump is running smoothly, close the valve slowly.

When liquids are pumped under a high suction lift, cavitation may result, causing the pump to become very noisy and begin vibrating. By cracking the manual bypass valve open, and permitting some of the liquid to recirculate, the noise and vibration can be reduced to an acceptable level.

If pump noise and vibration cannot be controlled with the manual bypass valve, look for other causes of noise under the "General Pump Troubleshooting" Section.

PIPING

Some pump systems deliver at a rate below the designated capacity of the pump because the system was improperly piped. Before installing any piping, a complete piping diagram should be made, and pipe friction, suction lift, discharge head, vacuum, and total pressure on the pump should be computed for the specific liquid being handled, and the desired flow rate. Without these computations, it is almost impossible to determine beforehand whether a pumping installation will work properly.

Restrictions in the pipe line, such as elbows, sharp bends, globe valves, certain restrictive-type plug valves and undersized strainers, should be avoided. Use gate or ball valves, not globe valves. **The inlet line should be at least as large as the intake port, and as straight as practical.** It should slope downward to the pump, never upward or with upstanding loops. Use pipe of adequate size and strength that has been thoroughly flushed prior to being connected to the pump. Debris in the piping sys-

tem can seriously damage, and ultimately ruin, the pump. Expansion joints, placed at a minimum of 3 feet (0.91 meters) from the pump, will compensate for expansion and contraction.

It is very important that there be no air leaks in the intake line. If practical to do so, apply air pressure to the completed pipe line to check for leaks.

The use of check valves or foot valves in the supply tank is generally not recommended with a self-priming, positive displacement pump, and can often cause considerable trouble. If a valve in the discharge line is closed while the pump is operating, it forces liquid to recirculate through the pressure relief valve causing the liquid to heat up and expand. A check valve in the suction line prevents the expanding liquid from returning to the supply tank, causing a build-up of pressure on the pump and in the piping system. The result can be excessive leakage at the pump or at the pipe joints. If a check valve is required, locate it near the pump on the discharge side only.

STRAINER

A strainer is recommended to protect the pump from damage by foreign particles. Generally, the strainer should be installed in the inlet line, and should have a set open area of at least four times the area size of the pump intake pipe. For more specific applications, refer to the manufacturer recommendation for proper installation and sizing of the strainer. The strainer should be inspected and cleaned at regular intervals.

ALIGNMENT

Spacer couplings are recommended for ease of repair and service.

The alignment of the motor, the gear reducer and the pump is often disturbed in transit, and must be checked before the unit is put into operation.

On units where flexible couplings are used, the coupling cover should be removed and a straight edge laid across the two hubs of the coupling, as shown in Fig. 4. The maximum offset should be less than .015″ (0.38mm).

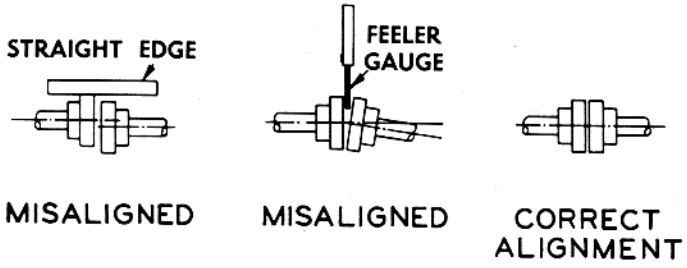


Figure 4

With a feeler gauge, or piece of flat steel of proper thickness, check the angular misalignment of the coupling halves. Check in four places at 90 degree increments about the periphery of the coupling. Maximum variation in this spacing should not exceed .020″ (0.50mm).

Check the alignment of the pipes to the pump to avoid strains which might later cause misalignment. To check, unbolt flanges or break union joints. Pipes should not spring away or drop down. **After the pump has been in operation for a week or two, completely recheck the alignment** (see Figure 5).

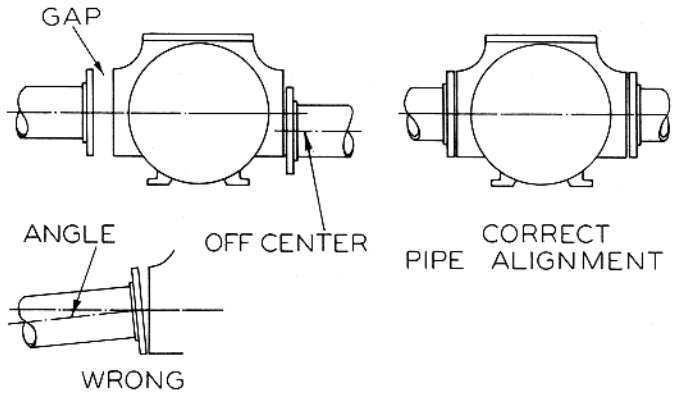


Figure 5 — Pipe to Pump Alignment

PUMP PERFORMANCE CHECK

It is usually desirable to make a running check of a pumping system before putting it into operation. The main points to check include: general operation of the system, leakage from piping and equipment, direction of pump rotation, proper pump speed, noise level of the pump, pumping rate, and shut-off pressure.

Whenever a new pump is first started, it should be watched carefully for several hours and checked for signs of malfunction.

If the pump is abnormally noisy, follow the checking procedures outlined under the "General Pump Troubleshooting" Section.

ROTATION

A right-hand pump rotates clockwise with the intake on the right side, when viewed from the driven end.

RUNNING PUMP IN REVERSE

It is sometimes desirable to reverse the pump for draining a line. The pump is satisfactory for this type of operation, if a separate pressure relief valve is provided to protect the pump from excessive pressures. When pumping backwards against a possible closed valve, operation in reverse may cause an increase in noise and vibration. Reversed pump pressures should not exceed 100 psi (689 kPa).

FLUSHING THE PUMP

Liquids which solidify when cold or which might otherwise damage the pump after prolonged contact, or would contaminate other loads, should be flushed out.

Drain the pump and lines by pumping air. Then pump a flushing liquid to suitably clean the pump. **On pumps equipped with a relief valve,** close the discharge line for 10 to 15 seconds (maximum) while pumping. This should be done several times to flush out the relief valve.

If complete drainage of the pump is desired, drain holes are provided in both heads and in the casing.

CLEANING PRECAUTIONS

New tanks require careful cleaning to remove weld splatter, slag, scale, and other foreign matter before filling with liquid. Suction pipes from the tank to the pump should be flushed before being attached to the pump. **Foreign matter entering the pump can cause extensive damage.**

III. MAINTENANCE
A. PUMP MODEL MLX4

MAINTENANCE AND TROUBLE SHOOTING MUST BE DONE BY AN INDIVIDUAL EXPERIENCED WITH PUMP MAINTENANCE AND THE TYPE OF SYSTEM INVOLVED.

LUBRICATION

Pump Bearings should be lubricated in the range of every one week to every three months, depending on the application, and the operating conditions.

Use: Standard Oil — Amolith All Weather Grease, or an equivalent grease which is compatible with the elastomers and the application.

CAUTION: Excessive greasing pressure can cause grease to be pushed between the mechanical seal faces causing failure.

It is recommended that you remove the grease relief fitting, and with a hand gun apply grease slowly to the grease fittings on both bearing covers until grease begins to come from the grease relief fitting port. It is normal for some grease to escape from the tell-tale holes in the hub for a short period of time after lubrication.

Before starting the pump, put oil in the gear reducer. Couplings with rubber inserts do not require lubrication. Other types of couplings are pre-lubricated at the factory, but require frequent lubrication to prevent excessive wear.

PUMP DISASSEMBLY

Before work is started on the pump, be sure the liquid is drained and the pressure relieved.

Remove the bearing cover capscrews, and slide the bearing cover from the shaft, being careful not to cut the inserted grease seal on the shaft keyway. Remove the bearing preload wave spring.

The MLX4 pumps are protected from "end-thrust" by a lockwasher and locknut installed outside the bearing on each end of the shaft. To remove the bearing locknut, bend up the engaged lockwasher tang and rotate the nut counterclockwise.

Slide the bearing spacer from the shaft. Make sure the shaft is free of burrs that may cut or nick the mechanical seal O-ring when the hub assembly is removed.

Remove the hub capscrews. To disengage the hub assembly from the head, two (2) jack screw holes are provided in the rim of the hub. The bearing, the stationary seat, and the stationary O-ring will slide off the shaft along with the hub. With the use of wire hooks (holes in the seal jacket will facilitate the removal), the rest of the mechanical seal, consisting of the seal jacket, the rotating face, and the rotating O-ring, can then be removed from the shaft as a complete unit. **NOTE:** Applying plastic electrical tape over the shaft keyway and threads will protect the seal O-rings from possible damage.

Remove the head capscrews and nuts. Two jack screw holes are also provided in the rim of the head for easy removal. Remove the head from the casing, being careful not to nick or scrape the shaft.

The disc will come off with the head and is attached with four (4) countersunk allen head set screws and lockwashers.

Inspect the edges of the vanes that contact the liner for gouges, ridges, or tears. Remove and replace the vanes if damaged (see "Replacing Vanes").

Removal of the push rods usually requires the removal of the rotor and shaft, but if the pump is removed from the system, the push rods may be removed through the intake or discharge port.

When it is necessary to remove the rotor and shaft assembly, it is advisable that the second hub assembly and mechanical seal components be removed also. This is recommended to avoid mechanical seal damage.

If the pumpage is a clean, non-corrosive liquid, with low viscosity, the liner can usually be withdrawn from the casing by prying with 2 bars. Insert the tips of the bars into the port openings on either side of the liner, and partially remove the liner by prying against the rotor. Using a block under the bar, against the rotor will assist in bringing the liner the rest of the way out (see Figure 6).

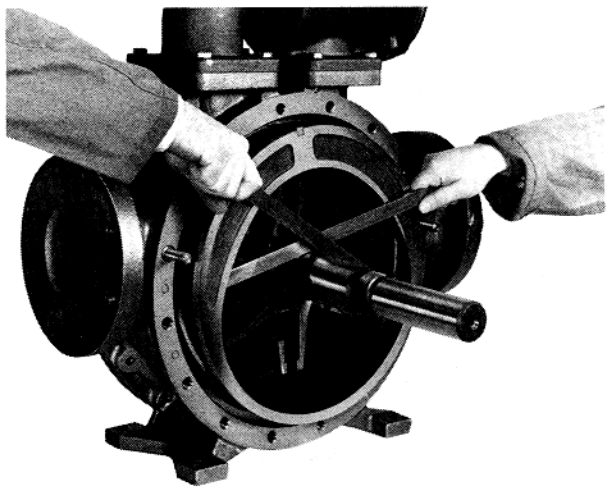


Figure 6 — Liner Removal

If the pumpage is corrosive, contains a large concentration of particulate matter, or is high viscosity, the liner will most likely have to be driven out of the casing, rather than pried out. To do so, it will be necessary to remove the rotor and shaft and the second head assembly. The liner can then be driven out of the casing with the use of a hammer and a block of wood positioned against the end of the liner.

REPLACING VANES

Vanes can usually be removed or replaced by removing only one head, and sliding them in or out of the rotor end. With pin-lock vanes, it is easiest to remove and replace the vane when it is in the bottom of its slot in the rotor. To achieve this, simply turn the shaft by hand until a vane comes to the 12 o'clock (top) position, remove and replace the vane, then rotate to the next slot. Repeat this procedure until all new vanes are in place. When installing the vanes, make sure the rounded or wearing edge of the vane is outward to contact the liner.

NOTE: For replacement of other pump parts, refer to the separate subheadings in the following "PUMP ASSEMBLY" Section.

PUMP ASSEMBLY

Before reassembling the pump, clean each part thoroughly. Wash out seal and bearing recesses and remove any burrs from the rotor or liner with a file. It is also very important that the discs and heads be free of any burrs, dirt or foreign particles which could cause the pump to jam.

NOTE: If any of the O-rings have been removed or "disturbed" during service, it is recommended they be replaced with new. When installing, be sure to inspect the O-ring grooves and remove any burrs or dirt to ensure proper sealing.

Assuming both heads have been removed, the following instructions are necessary for proper reassembly:

LINER

Slide the liner into the pump casing with the aid of a small rubber mallet if necessary. The liner has a very close diametrical fit with the casing, and care should be taken to avoid finger injury during installation. The keyway in the top of the liner should line up with the notch in the top of the casing. The cast word "INTAKE" located on the side of the liner should be closest to the intake side of the pump. (**NOTE:** The inlet port is marked with an inward facing arrow.) It is easiest to insert the liner key while installing the liner.

DISC

Before the disc is attached to the head, check again to make sure both surfaces are clean and smooth. Gently file away any protruding burrs or rough spots. Place the disc, with the countersunk screw holes facing up, on the head. The disc should be positioned such that **when the head is mounted** the word "INTAKE" on the disc will be toward the intake side of the pump, and the two disc holes on either side of the word "INTAKE" will be in the 2 and 4 o'clock positions, if the inlet is on the right. The head drain hole and V-notch should be at the bottom of the pump when the head is properly mounted (see Figure 7).

Install the four (4) lockwashers (tangs outward) and allen head set screws to hold the disc in place.

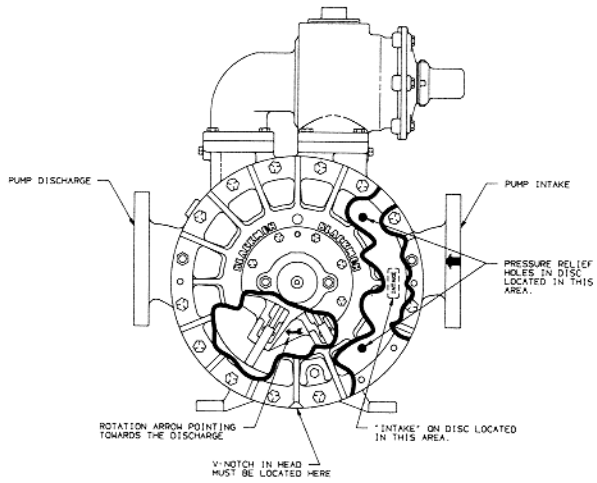


Figure 7

HEAD ASSEMBLY

To mount the head assembly, first install the head O-ring in the groove formed where the disc meets the head. Grease the chamfer on the pump casing where the head O-ring will need to slide into position. Place the head assembly on the studs, with the V-notch and the drain hole facing down.

Check to make sure the word "INTAKE" on the disc is towards the intake side of the pump, when the head is mounted. Install and tighten the two (2) nuts on the head studs, then install and tighten all head capscrews uniformly, making sure the head O-ring slides into place without damage.

ASSEMBLY TIP

At this point it is necessary to attach the hub to the mounted head without the O-rings, mechanical seal components, or bearing. Install and snug up the two hub capscrews. This step is intended as an assembly aid and is essential to help guide the rotor and shaft into place without damaging the mechanical seal. The remaining parts of the hub will be installed later. **BEGIN WORKING ON THE OPPOSITE SIDE OF THE PUMP.**

ROTOR AND SHAFT

If the pump is removed from the system, tip the subassembly so it is resting on the hub, with the cavity opening upward.

With the rotor shaft axis vertical, and the insertion end down, install the three (3) push rods, and carefully insert the rotor shaft through the bearing bore, making sure that the shaft does not strike and damage the disc face.

If the pump is connected to the system, it will be necessary to install the three bottom vanes and the pushrods while installing the rotor and shaft. To do so, partially install the rotor shaft through the bearing bore, being careful not to damage the disc face. Part of the rotor should remain outside of the casing such that the three bottom vanes (rounded edge outward) can be inserted into the rotor slots and held in place while all three push rods are inserted (see Figure 8). The rotor and shaft, with the three (3) bottom vanes installed, should then be **fully** inserted into the casing. The remaining vanes can then be installed in the top positions of the rotor. (See "Vanes" for proper installation.)

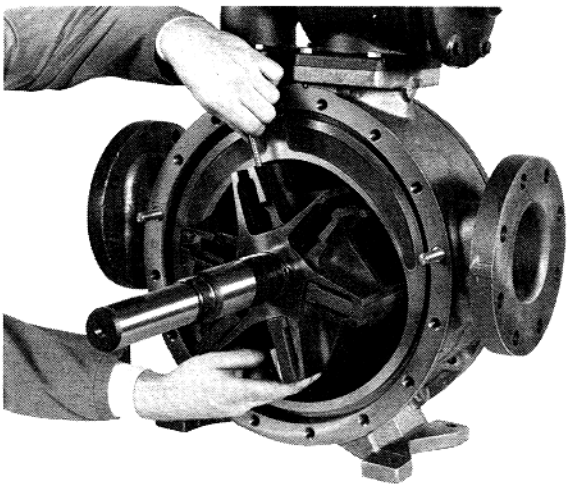


Figure 8

NOTE: When installing the rotor and shaft, the rotation arrow on the rotor must point towards the discharge side of the pump when the arrow is positioned below the shaft. (Refer back to Figure 7.)

VANES

If the rotor and shaft is installed in the casing, the pin-lock vanes can only be installed at the 12 o'clock (top) position. Insert the vanes into the slots in the rotor with the rounded edge outward to contact the liner. If the pump is tipped on its side, it may be necessary to move the push rods with the use of a screwdriver to assist in vane installation.

ASSEMBLY TIP

In order to lift and square the rotor against the previously installed head, it will now be necessary to install the bearing, the bearing spacer, and the locknut to the mounted head assembly. This will position the rotor, and aid in installing the second head assembly.

First, grease the bearing and place it into the bearing housing in the hub, then slide the bearing spacer and locknut onto the shaft and snug up the locknut by hand.

SECOND HEAD ASSEMBLY

Once the vanes are installed and the rotor and shaft is situated, the second head assembly, consisting of the disc, head O-ring, and head, should be installed in the same manner as previously instructed. Once again make sure to grease the casing chamfer to help slide the head O-ring into place.

MECHANICAL SEAL

If the mechanical seal has been leaking, it is advisable to replace the entire seal, including the stationary seat and its O-ring.

Before installing the mechanical seal, make sure the shaft is clean and free from burrs which might cut or nick the O-rings. A very light coating of oil or light grease on the shaft and on the O-ring chamfers in the head will help the parts slide into place.

NOTE: Teflon O-rings should be heated in hot water during installation.

Carefully slide the rotating half of the seal down the shaft, and engage the driving tangs of the seal jacket with the notches in the rotor. Make sure the polished face of the seal is outward. It is very important that the seal face is free of all traces of dirt, dust or grease. A clean tissue paper and alcohol can be used to clean the seal face. (**NOTE:** Apply a light oil or a suitable lubricant on bronze seal faces during assembly.)

Next, insert the stationary seat of the seal into the mechanical seal cavity of the hub and engage the locating pin of the seat with the slot in the hub. Again, the polished face must be outward and free of all traces of oil or dirt.

HUB ASSEMBLY

Before installing the second hub assembly, be sure to grease the three (3) head chamfers. Slide the hub, with the O-rings installed, onto the shaft with the V-notch of the hub towards the bottom of the pump. Extreme care should be taken to avoid damage to the seal face. To pull the hub into place, install and tighten the two (2) hub capscrews.

BEARING AND BEARING SPACER

Insert the greased bearing into the bearing housing in the hub. Tap the outer race of the bearing to ensure that it is properly seated in the hub. Slide the bearing spacer onto the shaft.

Return to the first head assembly and remove and reassemble the hub, this time including the mechanical seal and O-rings. (See "Mechanical Seal" Section for instruction.) Lightly grease the shaft and the head chamfers before installing the assembly to enable the O-rings to slide into place without damage. Reinstall the bearing spacer.

LOCKNUT ADJUSTMENT

The pump must be free turning with all head and hub capscrews tight before making an adjustment on the locknuts.

The purpose of the locknut adjustment is to center, and maintain the pump rotor between the heads. It is very important that the bearing locknuts be installed properly. Overtightening locknuts will cause bearing failure and/or a broken lockwasher inner tang "A" (see Fig. 9). Loose locknuts will allow the rotor to shift, causing wear on the discs.

The following is the proper method of installation:

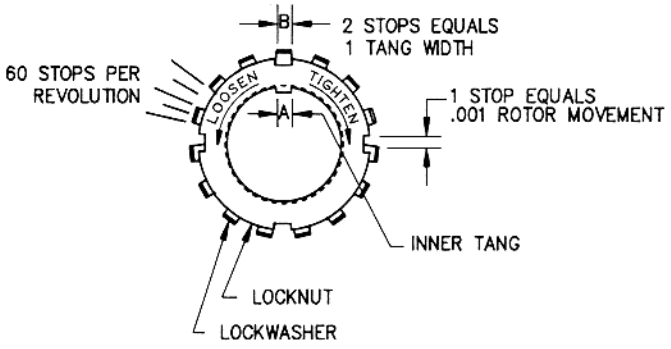


Figure 9 — Locknut Assembly

The MLX4 pump has threaded locknuts with reference marks about the periphery (similar to a vernier scale), which indicate axial movement of 0.001 of an inch (0.025mm) when rotated one stop.

1. Install the lockwashers with the tangs facing outward, and the locknuts with the tapered face inward. Be sure the inner tang "A" (see Fig. 9) of the lockwasher does not slip out of the tang keyway. Bend the tang toward the keyway if necessary.

2. Using a spanner wrench, tighten both locknuts to be sure that the bearings are bottomed in the hub recess. CAUTION: Over-tightening will bend or shear the inner tang, and can damage the bearing.

3. Loosen both locknuts one complete turn.

4. With one locknut loose tighten the other locknut until a slight rotor drag is felt when turning the shaft by hand.

5. Back off the nut the width of one lockwasher tang "B" (see Fig. 9) or two stops, if necessary. Secure the locknut by bending the closest aligned lockwasher tang into the locknut slot. Make sure the pump turns freely when rotated by hand.

6. Tighten the other locknut by hand until it is snug against the bearing, and the bearing is firmly seated in the hub recess. With a spanner wrench, tighten the nut the width of one lockwasher tang "B" (see Fig. 9), or 2 stops, if necessary. Secure the locknut by bending the aligned lockwasher tang into the groove in the locknut. The pump should continue to turn as freely as before adjustment.

7. A check of adjustment may be made by grasping the nut and washer with finger pressure and rotating back and forth. If this cannot be done, one or both nuts are too tight, and the nuts alternately should be loosened one stop, or 0.001" (0.025mm) at a time until the washer can be moved, starting with the last adjusted nut.

NOTE: A properly adjusted pump will always allow the shaft to turn freely under a no load condition. A pump which does not turn freely should not be installed in any system.

GREASE SEAL

If the grease seal has been removed from the bearing cover, it must be replaced prior to attaching the cover to the pump. Apply a small amount of grease to the outside diameter of the grease seal, and push it into the bearing cover cavity with the lip of the seal facing upwards. Thus, when the bearing cover is attached to the pump, the lip of the seal will face inward.

BEARING COVERS

Place the bearing preload wave spring against the outer bearing race. Install a bearing cover O-ring into the groove in the bearing cover, and slide the bearing cover onto the shaft with the V-notch down. Install and tighten all bearing cover capscrews. (Bearing cover capscrews also secure the hub in place.)

CAUTION: The pump MUST NOT be operated without the bearing covers bolted into place.

B. PUMP MODEL MLN4

MAINTENANCE AND TROUBLE SHOOTING MUST BE DONE BY AN INDIVIDUAL EXPERIENCED WITH PUMP MAINTENANCE AND THE TYPE OF SYSTEM INVOLVED.

LUBRICATION

Before starting the pump, put oil in the gear reducer. Couplings with rubber inserts do not require lubrication. Other types of couplings are pre-lubricated at the factory, but require frequent lubrication to prevent excessive wear.

PUMP DISASSEMBLY

Before work is started on the pump, be sure the liquid is drained and the pressure relieved.

To remove the **OUTBOARD HUB** assembly and shaft cover as a unit, first remove the hub capscrews. Two (2) jack screw holes are provided in the rim of the hub to facilitate removal. The shaft cover and sleeve bearing will come off with the hub. Removal of the two (2) shaft cover capscrews will release the shaft cover and its O-ring from the hub. The bearing is press fit into the hub and should not be removed unless replacement is necessary (see "Bearings").

Before removing the inboard hub assembly, clean the pump shaft thoroughly, and remove any burrs, nicks, or paint that might damage the packing, or mechanical seal O-rings, if so fitted.

To remove the **INBOARD HUB** assembly, on pumps equipped with **PACKING,** first back off the packing removal nuts to reduce packing friction. Next, remove the hub capscrews. Two jack screw holes are also provided in the rim of the inboard hub to facilitate removal. Slide the packing follower and hub assembly from the shaft.

The inboard hub assembly on a packed pump consists of 3 packing rings, a pack washer, and a sleeve bearing. After removing the packing follower, the packing rings can be pulled out with the use of a cork screw tool or a screwdriver. As in the outboard head, the bearing is press fit into the hub and should not be removed unless replacement is necessary.

On pumps equipped with a **BLACKMER MECHANICAL SEAL,** it is recommended that the inboard hub be left in place until the mechanical seal components have been removed. This is necessary to avoid damage to the seal faces and O-rings. On these pumps, a seal follower is used in place of the packing follower, and a mechanical seal housing is used to hold the stationary seat of the mechanical seal in place. **NOTE:** Applying plastic electrical tape over the shaft keyway will help protect the seal O-rings from damage.

To remove the mechanical seal, first remove the two (2) follower capscrews to release the seal follower from the housing. Next, remove the mechanical seal housing from the hub. The stationary seat and its O-ring will come off with the mechanical seal housing, and can be pried loose with the fingers. The rotating half of the seal, consisting of the seal jacket, the rotating face and the rotating O-ring, can then be removed from the shaft as a complete unit.

On pumps equipped with a **COMMERCIAL MECHANICAL SEAL,** refer to the separate literature accompanying the mechanical seal for instruction.

After the seal components are removed, the inboard hub assembly can safely be removed. Remove the hub capscrews and disengage the hub from the head with the aid of the two jack screw holes provided.

To remove the head assembly, remove the head capscrews and nuts. Two jack screw holes are also provided in the rim of the head for easy removal. Slide the head from the casing, being careful not to nick or scrape the shaft.

The disc will come off with the head and is attached with four (4) countersunk allen head set screws and lockwashers.

Inspect the edges of the vanes that contact the liner for gouges, ridges, or tears. Remove and replace the vanes if damaged (see "Replacing Vanes").

Removal of the push rods usually requires removal of the rotor and shaft, but if the pump is removed from the system, push rods may be removed through the intake or discharge port. Use care to avoid finger injury.

If the pumpage is a clean, non-corrosive liquid, with low viscosity, the liner can usually be withdrawn from the casing by prying with 2 bars. Insert the tips of the bars into the port openings on either side of the liner, and partially remove the liner by prying against the rotor. Using a block under the bar, against the rotor will assist in bringing the liner the rest of the way out (see Figure 6).

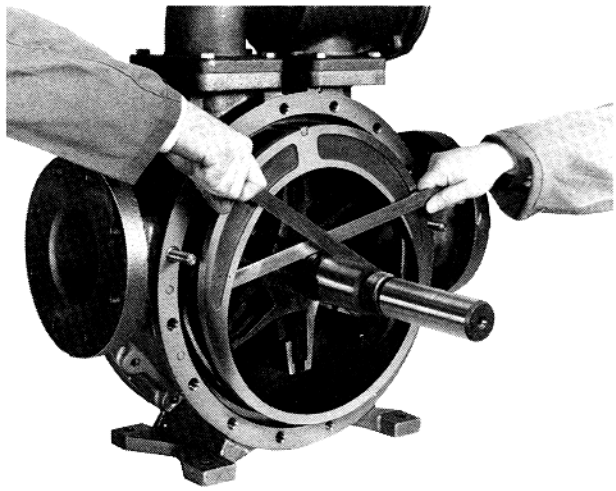


Figure 6 — Liner Removal

If the pumpage is corrosive, contains a large concentration of particulate matter, or is high viscosity, the liner will most likely have to be driven out of the casing, rather than pried out. To do so, it will be necessary to remove the rotor and shaft and the second head assembly. The liner can then be driven out of the casing with the use of a hammer and a block of wood positioned against the end of the liner.

REPLACING VANES

Vanes can usually be removed or replaced by removing only one head, and sliding them in or out of the rotor end. With pin-lock vanes, it is easiest to remove and replace the vane when it is seated in the bottom of its slot in the rotor. To achieve this, simply turn the shaft by hand until a vane comes to the 12 o'clock (top) position, remove and replace the vane, then rotate to the next slot. Repeat this procedure until all new vanes are in place. When installing the vanes, make sure the rounded or wearing edge of the vane is outward to contact the liner.

NOTE: For replacement of other pump parts, refer to the separate subheadings in the following "PUMP ASSEMBLY" Section.

PUMP ASSEMBLY

Before reassembling the pump, clean each part thoroughly. Wash out the stuffing box and remove any burrs from the rotor or liner with a file. It is also very important that the discs and heads be free of any burrs, dirt or foreign particles which could cause the pump to jam.

NOTE: If any of the O-rings have been removed or "disturbed" during service, it is recommended they be replaced with new. When installing, be sure to inspect the O-ring grooves and remove any burrs or dirt to ensure proper sealing.

Assuming both heads have been removed, the following instructions are necessary for proper reassembly:

LINER

Slide the liner into the pump casing with the aid of a small rubber mallet if necessary. The liner has a very close diametrical fit with the casing, and care should be taken to avoid finger injury during installation. The keyway in the top of the liner should line up with the keyway in the top of the casing. The cast word "INTAKE" located on the side of the liner should be closest to the intake side of the pump. (**NOTE:** The inlet port is marked with an inward facing arrow.) The liner key is usually easiest to insert while installing the liner.

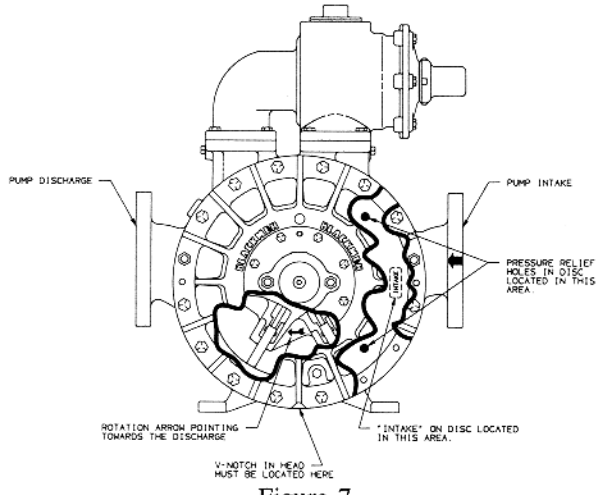


Figure 7

DISC

Before the disc is attached to the head, check again to make sure both surfaces are clean and smooth. Gently file away any protruding burrs or rough spots. Place the disc, with the countersunk screw holes facing up, on the head. The disc should be positioned such that **when the head is mounted,** the word "INTAKE" on the disc will be towards the intake side of the pump, and the two disc holes on either side of the word "INTAKE" will be in the 2 and 4 o'clock positions, when the inlet is on the right. The head drain hole and V-notch should face the bottom of the pump when the head is installed (see Figure 7).

Install the four (4) lockwashers (tangs outward) and allen head set screws to hold the disc in place.

HEAD ASSEMBLY

To mount the head assembly, first install the head O-ring in the groove formed where the disc meets the head. Grease the chamfer on the pump casing where the head O-ring will need to slide into position. Place the head assembly on the studs, with the V-notch and the drain hole facing down.

Check to make sure the word "INTAKE" on the disc is towards the intake side of the pump, when the head is mounted. Install and tighten the two (2) nuts on the studs, then install and tighten all head capscrews uniformly, making sure the head O-ring slides into place without damage.

BEARINGS

If the sleeve bearing has been removed from the hub, a new bearing must be installed prior to attaching the hub assembly to the head. The bearings are press fit into the hubs, and must be replaced with an arbor press as they are apt to crack if hammered into place. Note, the bearings are tapered slightly on one end to facilitate installation. Heating the hub in an oven at 200 to 250 °F (93 to 121 °C) before installation will prevent damage to the bearing.

The bearing must be pressed into place from the inside face of the hub, with the tapered end of the bearing inward (towards the hub). **Press the bearing into the hub in one continuous motion** until it is in proper position (flush with or slightly below the inside face of hub). Starting and stopping the pressing motion may result in a cracked bearing.

OUTBOARD HUB ASSEMBLY

It is easier to install the outboard hub assembly first, if both hubs have been removed. Before installing the hub assembly, be sure to grease the three (3) head chamfers to enable the hub O-rings to slide into place. Place the hub (with O-rings installed) into the head with the V-notch of the hub towards the bottom of the pump. To pull the hub into place, install and uniformly tighten the hub capscrews. **BEGIN WORKING ON THE OPPOSITE SIDE OF THE PUMP.**

ROTOR AND SHAFT

If the pump is removed from the system, tip the pump subassembly so it is resting on the outboard hub, with the cavity opening upward.

With the rotor shaft axis vertical, and the outboard end down, install the three (3) push rods, and carefully insert the rotor shaft assembly through the disc bore, making sure that the shaft does not strike and damage the disc face.

If the pump is connected to the system, it will be necessary to install the three bottom vanes and the push rods while installing

the rotor and shaft. To do so, partially install the rotor shaft through the disc bore, being careful not to damage the disc face. Part of the rotor should remain outside of the casing such that the three bottom vanes (rounded edge outward) can be inserted into the rotor slots and held in place while all three push rods are inserted (see Figure 8). The rotor and shaft, with the three (3) bottom vanes installed, should then be **fully** inserted into the casing. Install the remaining vanes in the top positions. (See "Vanes" for proper installation.)

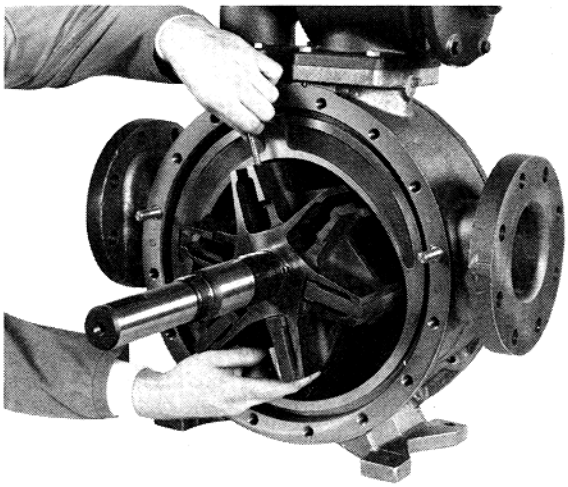


Figure 8

NOTE: When installing the rotor and shaft, the rotation arrow on the rotor must point towards the discharge side of the pump when the arrow is positioned below the shaft. (Refer back to Figure 7.)

VANES

If the rotor and shaft is installed in the casing, the pin-lock vanes can be installed only at the 12 o'clock (top) position. Slide the vanes into the slots in the rotor with the rounded edge outward to contact the liner. If the pump is tipped on its side, it may be necessary to move the push rods with the use of a screwdriver to assist in vane installation.

SECOND HEAD ASSEMBLY

Once the vanes are installed, the second head assembly, consisting of the disc, head O-ring, and head, should be installed in the same manner as previously instructed. Again, make sure to grease the casing chamfer to enable the head O-ring to slide into place without damage.

INBOARD HUB ASSEMBLY

Before installing the inboard hub assembly, be sure to grease the three (3) head chamfers where the hub O-rings will need to slide into place. Slide the inboard hub, with the O-rings installed, onto the shaft with the V-notch of the hub towards the bottom of the pump. Install and uniformly tighten the hub capscrews to pull the hub into place.

PACKING AND PACKING FOLLOWER

When necessary to re-pack, use a full set of new packing rings. Packing is furnished in sets with the correct number of rings. Never add new rings to an old set of packing.

Insert the packing washer into the stuffing box in the hub, then insert each of the three (3) packing rings separately into the stuffing box. Use the packing follower to properly seat each ring after placement, and be sure to stagger the split joints so that they are not overlapping or near the joint of the preceding ring.

After the packing rings are in place, and the two (2) packing follower removal nuts are tightened against the hub, place the packing follower snugly against the packing. Install the two (2) packing follower stud nuts, and tighten lightly. Adjustment should be made to the packing follower while pumping liquid (see "Packing Adjustment").

PACKING ADJUSTMENT

It is important that the packing be properly adjusted to prevent overheating. While the liquid is being pumped, uniformly tighten the packing follower stud nuts a very small amount at a time, then check the stuffing box temperature several minutes after each adjustment for signs of overheating. The nuts should be adjusted until leakage is controlled, provided no excess heat is developed. **NOTE:** Some leakage is acceptable, and in some cases is desirable, depending upon the application.

BLACKMER MECHANICAL SEAL

On pumps equipped with a Blackmer Mechanical Seal, if the seal has been leaking, it is advisable to replace the entire seal, including the stationary seat and its O-ring.

Before installing the mechanical seal, make sure the shaft is clean and free from burrs which might cut or nick the O-rings. A very light coating of oil or light grease on the shaft and on the O-ring chamfers will help the parts slide into place.

Carefully slide the rotating half of the seal (consisting of the seal jacket, the springs, the rotating face, and the rotating O-ring) down the shaft and engage the driving tangs of the seal jacket with the keyways in the shaft threads. Make sure the polished face of the seal is outward. **NOTE:** It is very important that both seal faces be free of all traces of dirt, dust, or grease. A clean tissue and alcohol should be used to clean the seal faces.

Next, lightly grease the cavity in the mechanical seal housing where the stationary seat fits. Insert the stationary seat and its O-ring into the mechanical seal housing with the polished face inward, towards the cavity, so that the locating pin of the seat is outward.

Install the seal housing into the lightly greased hub cavity, being careful not to contaminate either seal face. Place the seal follower against the seal housing, making sure to engage the locating pin of the stationary seat with the hole in the seal follower. Install and tighten the two (2) capscrews to hold the follower in place.

COMMERCIAL MECHANICAL SEAL

On pumps equipped with a commercial mechanical seal, refer to the separate literature accompanying the mechanical seal for instruction.

SHAFT COVER

Install the shaft cover O-ring into the groove in the shaft cover. Lubricate the chamfer on the **outboard** hub and slide the shaft cover over the shaft, and against the hub. Install and tighten the two (2) shaft cover capscrews.

C. PUMP MODEL MLG4

MAINTENANCE AND TROUBLE SHOOTING MUST BE DONE BY AN INDIVIDUAL EXPERIENCED WITH PUMP MAINTENANCE AND THE TYPE OF SYSTEM INVOLVED.

LUBRICATION

New pump bearings usually take approximately 2 to 6 hours to be "run-in" or "conditioned." The higher the pressure, the longer the time required. Make sure that there is an adequate supply of grease to the bearings. Frequent inspection of a new pump should be made for signs of malfunction of the bearings or packing. Once the bearings are conditioned, they will run at a stable temperature, depending on the temperature of the liquid.

Automatic (spring-loaded) lubricators are standard on the MLG4 pumps. Many greases will cake-up, and prevent the proper flow of the lubricant when used in automatic lubricators. The following greases are proven in this service. These greases can also be used for high temperature service.

LUBRIPLATE NO. 930-AA
MOBILPLEX EP NO. 1

The maximum recommended temperature of the liquids being pumped is 400 °F (204 °C), which is higher than the melting point of many greases. Whenever the temperature of the liquid is higher than the melting point of the grease, cooling water must be circulated through jacketed heads.

PUMP DISASSEMBLY

Before work is started on the pump, be sure the liquid is drained and the pressure relieved.

To remove the packing follower and bearing assembly, first remove the two (2) packing follower stud nuts (and the shaft protector, if working on the outboard assembly) then back off the two (2) packing follower removal nuts to reduce packing friction. The packing follower and bearing assembly, with the attached automatic lubricator, can then be disengaged from the hub and slid from the shaft.

The gland bearings are press fit and machined in the packing follower, and should not be removed. If bearing replacement is necessary, the entire packing follower assembly must be replaced.

After removing the packing follower and bearing assembly, the packing rings can be pulled from the stuffing box with the use of a cork screw tool or a screwdriver.

To remove the hub assembly, remove the hub capscrews. Two (2) jack screw holes are provided in the rim of the hub to facilitate removal. The packing washer will slide off with the hub.

Dismount the head assembly by removing the head capscrews and nuts. Two jack screw holes are also provided in the rim of the head for easy removal. Slide the head from the casing, being careful not to nick or scrape the shaft.

The disc will come off with the head, and is attached with four (4) countersunk allen head set screws and lockwashers.

Inspect the edges of the vanes that contact the liner for gouges, ridges, or tears. Remove and replace the vanes if damaged (see "Replacing Vanes").

Removal of push rods usually requires removal of the rotor and shaft, but if the pump is removed from the system, push rods may be removed through the intake or discharge port. Use care to avoid finger injury.

If the pumpage is a clean, non-corrosive liquid, with low viscosity, the liner can usually be withdrawn from the casing by prying with 2 bars. Insert the tips of the bars into the port openings on either side of the liner, and partially remove the liner by prying against the rotor. Using a block under the bar, against the rotor will assist in bringing the liner the rest of the way out (see Figure 6).

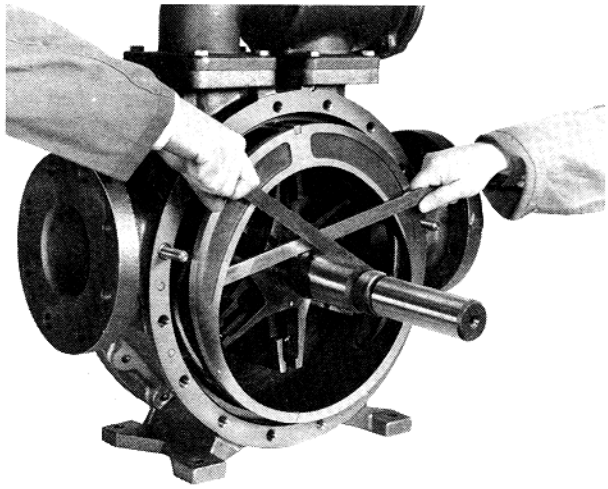


Figure 6 — Liner Removal

If the pumpage is corrosive, contains a large concentration of particulate matter, or is high viscosity, the liner will most likely have to be driven out of the casing, rather than pried out. To do so, it will be necessary to remove the rotor and shaft and the second head assembly. The liner can then be driven out of the casing with the use of a hammer and a block of wood positioned against the end of the liner.

REPLACING VANES

Vanes can usually be removed or replaced by removing only one head, and sliding them in or out of the rotor end. With pin-lock vanes, it is easiest to remove and replace the vane when it is seated in the bottom of its slot in the rotor. To achieve this, simply turn the shaft by hand until a vane comes to the 12 o'clock (top) position, remove and replace the vane, then rotate to the next slot. Repeat this procedure until all new vanes are in place. When installing the vanes, make sure the rounded or wearing edge of the vane is outward to contact the liner.

NOTE: For replacement of other pump parts, refer to the separate subheadings in the following "PUMP ASSEMBLY" Section.

PUMP ASSEMBLY

Before reassembling the pump, clean each part thoroughly. Wash out the stuffing box and remove any burrs from the rotor or liner with a file. It is also very important that the discs and heads be free of any burrs, dirt or foreign particles which could cause the pump to jam.

NOTE: If any of the O-rings have been removed or "disturbed" during service, it is recommended they be replaced with new. When installing, be sure to inspect the O-ring grooves and remove any burrs or dirt to ensure proper sealing.

Assuming both heads have been removed, the following instructions are necessary for proper reassembly:

LINER

Slide the liner into the pump casing with the aid of a small rubber mallet if necessary. The liner has a very close diametrical fit with the casing and care should be taken to avoid finger injury during installation. The keyway in the top of the liner should line up with the keyway in the top of the casing. The cast word "INTAKE," located on the side of the liner should be closest to the intake side of the pump. (**NOTE:** The inlet port is marked with an inward facing arrow.) The liner key is usually easiest to insert while the liner is being installed.

DISC

Before attaching the disc to the head, check again to make sure both surfaces are clean and smooth. Gently file away any protruding burrs or rough spots. Place the disc, with the countersunk screw holes facing up, on the head. The disc should be positioned such that **when the head is mounted,** the word "INTAKE" on the disc will be towards the intake side of the pump, and the two disc holes on either side of the word "INTAKE" will be in the 2 and 4 o'clock positions when the inlet is on the right. The head drain hole and V-notch should face the bottom of the pump when the head is installed (see Figure 7).

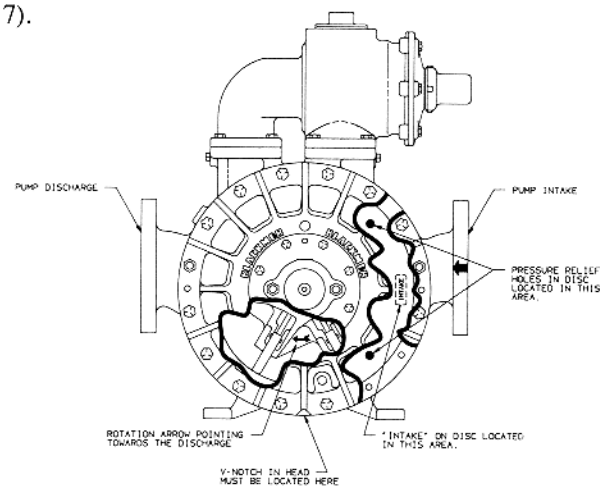


Figure 7

Install the four (4) lockwashers (tangs outward) and allen head set screws to hold the disc in place.

HEAD ASSEMBLY

To mount the head assembly, first install the head O-ring in the groove formed where the disc meets the head. Grease the chamfer on the pump casing where the head O-ring will need to slide into position. Place the head assembly on the studs with the V-notch and the drain hole facing down.

Check to make sure the word "INTAKE" on the disc is towards the intake side of the pump when the head is mounted. Install and tighten the two (2) nuts on the studs, then install and tighten all head capscrews uniformly, making sure that the head O-ring slides into place without damage.

HUB ASSEMBLY

Before installing the hub assembly, be sure to grease the three (3) head chamfers to enable the hub O-rings to slide into place. Place the hub (with O-rings installed) into the head, with the V-notch of the hub towards the bottom of the pump. To pull the hub into place, install and uniformly tighten the hub capscrews. **BEGIN WORKING ON THE OPPOSITE SIDE OF THE PUMP.**

ROTOR AND SHAFT

If the pump is removed from the system, tip the pump subassembly so it is resting on the assembled hub, with the cavity opening upward.

With the rotor shaft axis vertical, and the insertion end down, install the three (3) push rods, and carefully insert the rotor and shaft assembly through the disc bore, making sure that the shaft does not strike and damage the disc face.

If the pump is connected to the system, it will be necessary to install the three bottom vanes and the push rods while installing the rotor and shaft. To do so, partially install the rotor shaft through the disc bore, being careful not to damage the disc face. Part of the rotor should remain outside of the casing such that the three bottom vanes (rounded edge outward) can be inserted into the rotor slots and held in place while all three push rods are inserted (see Figure 8). The rotor and shaft, with the three (3) bottom vanes installed, should then be **fully** inserted into the casing. Install the remaining vanes in the top positions. (See "Vanes" for proper installation.)

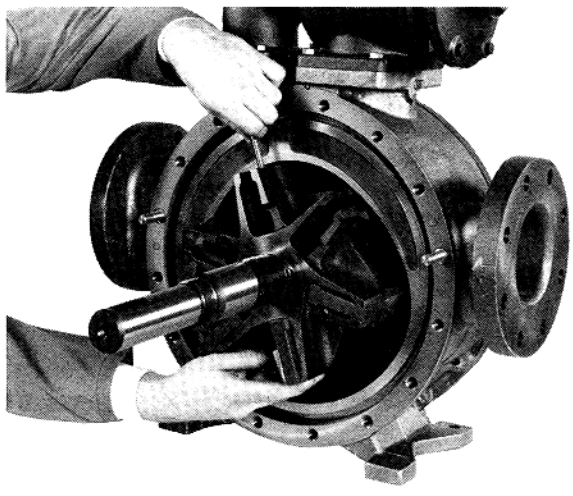


Figure 8

NOTE: When installing the rotor and shaft, the rotation arrow on the rotor must point towards the discharge side of the pump when the arrow is positioned below the shaft. (Refer back to Figure 7.)

VANES

If the rotor and shaft is installed in the casing, the pin-lock vanes can only be installed at the 12 o'clock (top) position. Slide the vanes into the slots in the rotor with the rounded edge outward to contact the liner. If the pump is tipped on its side, it may be necessary to move the push rods with the use of a screwdriver to assist in vane installation.

SECOND HEAD ASSEMBLY

Once the vanes are installed, the second head assembly, consisting of the disc, head O-ring, and head, should be installed in the same manner as previously instructed. Once again, make sure to grease the casing chamfer to enable the head O-ring to slide into place without damage.

SECOND HUB ASSEMBLY

Before installing the second hub assembly, be sure to grease the three (3) head chamfers where the hub O-rings will need to slide into place. Slide the hub, with the O-rings installed, onto the shaft with the V-notch of the hub towards the bottom of the pump. Install and uniformly tighten the hub capscrews, to pull the hub into place.

PACKING AND PACKING FOLLOWER ASSEMBLY

When necessary to re-pack, use a full set of new packing rings. Packing is furnished in sets with the correct number of rings. Never add new rings to an old set of packing.

Insert the packing washer into the stuffing box in the hub, then insert each of the three (3) packing rings separately into the stuffing box. Use the packing follower assembly to properly seat each ring after placement, and be sure to stagger the split joints so that they are not overlapping or near the joint of the preceding ring.

After the packing rings are in place, and the two (2) packing follower removal nuts are tightened against the hub, place the packing follower and bearing assembly snugly against the packing with the drain groove downward. Install the two (2) packing follower stud nuts and tighten lightly. Adjustment should be made to the packing follower assembly while pumping liquid (see "Packing Adjustment").

SHAFT PROTECTOR

The shaft protector should be added to the packing follower assembly on the outboard end. The two packing follower stud nuts (lightly tightened) will hold the shaft protector, and the packing follower in place.

PACKING ADJUSTMENT

It is important that the packing be properly adjusted to prevent overheating. While the liquid is being pumped, uniformly tighten the packing follower stud nuts a very small amount at a time, then check the stuffing box temperature several minutes after each adjustment for signs of overheating. The nuts should be adjusted until leakage is controlled, provided no excess heat is developed. Note, some leakage is acceptable, and in some cases is desirable, depending upon the application.

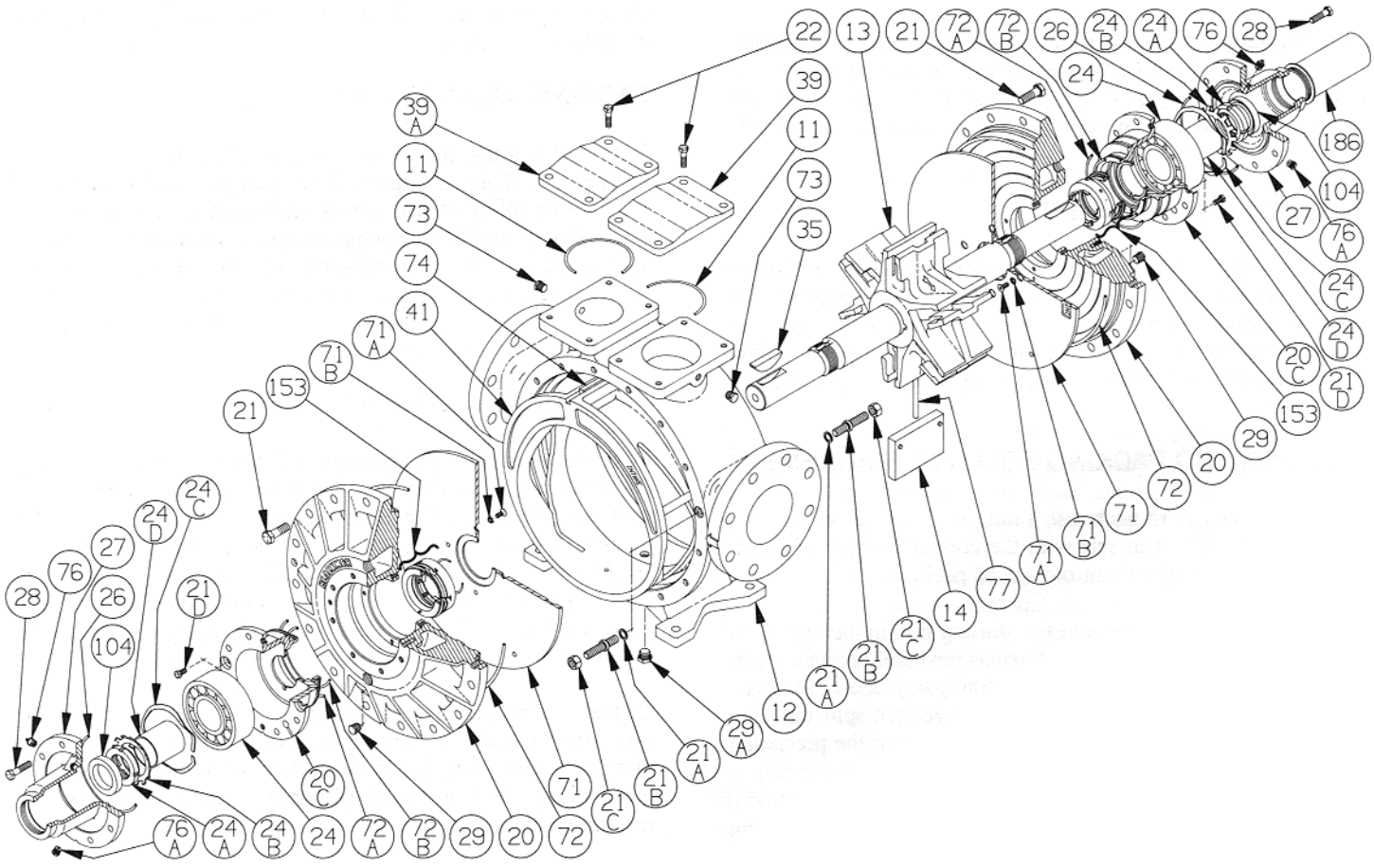
AUTOMATIC LUBRICATOR

To fill the automatic (spring-loaded) lubricator, first back the wing nut all the way out until it is touching the zerk fitting. Then, with a grease gun, add grease through the zerk fitting until the grease cup is full. The stem with the zerk fitting should now be all the way up. If the cup is to be filled by hand, a wing nut is provided to compress the cap spring during reinstallation. This wing nut must be backed off to the zerk fitting when running the pump.

To maintain proper flow of lubrication to the bearing, adjust the flow control screw at the bottom of the grease cup. For maximum flow, the screw should be vertical; for minimum flow, the screw should be horizontal. (Refer to "Lubrication" for the recommended grease.)

IV. PARTS LISTS

A. PUMP MODELS: MLX4, MLX4-CS



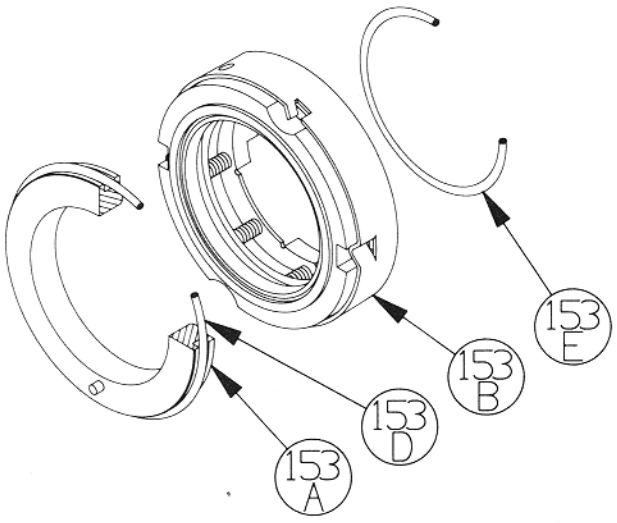
PUMP MODELS: MLX4, MLX4-CS

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
11	O-Ring - Blanking Plate/Valve (Buna-N) (Std.)	2	701918	701918
	O-Ring - Blanking Plate/Valve (Viton)		701991	701991
	O-Ring - Blanking Plate/Valve (Teflon)		702066	702066
12	Casing	1	016900	016902
13	Rotor & Shaft (Std.) (Includes Ref. No. 24A & 24B)	1	266900	266900
	Rotor & Shaft (Chrome Oxide Shaft) (Includes Ref. No. 24A & 24B)		266903	266903
14	Vane - Maxvane (Std.)	6	096932	096932
	Vane - EC Maxvane		096933	096933
	Vane - Laminate		096921	096921
	Vane - Ductile Iron		096928	096928
	Vane - Hardened Ductile Iron		096903	096903
	Vane - Bronze		096925	096925
	Vane - EC Laminate		096923	096923
	Vane - EC Hardened Ductile Iron		096907	096907
	Vane - EC Bronze		096927	096927
20	Head (Std.)	2	036900	036902
20A	Head - Jacketed	2	036901	
20C	Hub	2	036952*	036956*
21	Capscrews - Head	28	920510	920510
21A	Gasket - Head Stud	4	701981	701981
21B	Stud - Head	4	921569	921569
21C	Nut - Head Stud	4	922850	922850
21D	Capscrews - Hub	4	920128*	920128*
22	Capscrews - Plate/Valve	8	920457	920457
24	Bearing - Roller	2	903252*	903252*
24A	Locknut - Bearing	2	903543*	903543*
24B	Lockwasher - Bearing	2	903544*	903544*
24C	Wave Spring - Bearing	2	903546*	903546*
24D	Spacer - Bearing	2	903547*	903547*

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
26	O-Ring - Bearing Cover (Buna-N) (Std.)	2	702061*	702061*
	O-Ring - Bearing Cover (Viton)		702062*	702062*
	O-Ring - Bearing Cover (Teflon)		702067*	702067*
27	Cover - Bearing	2	046900*	046904*
28	Capscrews - Bearing Cover & Hub	16	920369*	920369*
29	Drain Plug - Head	2	908195	908195
29A	Drain Plug - Casing	1	908207	908207
35	Key - Shaft	1	909136	909136
39	Plate - Blanking (Inlet)	1	496900	496902
39A	Plate - Blanking (Discharge)	1	496901	496904
41	Liner (Std.)	1	186900	186900
	Liner (Hardened)		186911	186911
71	Disc (Std.)	2	066900	066900
	Disc (Hardened)		066901	066901
71A	Machine Screw - Disc	8	920007	920007
71B	Lockwasher - Disc	8	909622	909622
72	O-Ring - Head (Buna-N) (Std.)	2	702050	702050
	O-Ring - Head (Viton)		702058	702058
72A	O-Ring (Large) - Hub (Buna-N) (Std.)	2	702057	702057
	O-Ring (Large) - Hub (Viton)		702059	702059
	O-Ring (Large) - Hub (Teflon)		702068	702068
72B	O-Ring (Small) - Hub (Buna-N) (Std.)	2	702027	702027
	O-Ring (Small) - Hub (Viton)		702060	702060
	O-Ring (Small) - Hub (Teflon)		702065	702065
73	Plug - Gage	2	908195	908195
74	Liner - Key	1	186902	186902
76	Fitting - Grease	2	317815*	317815*
76A	Fitting - Grease Relief	2	701992*	701992*
77	Push Rod	3	126900	126900
104	Seal - Grease	2	331907*	331907*
186	Protector - Shaft	1	346900*	346900*

*To convert from one pump model to another, these parts must be substituted.

When ordering parts, it is important to include the pump Serial Number, I.D. Number, and Model Designation. Refer to "Pump Identification" on page 1.



MECHANICAL SEAL - STANDARD - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337007
153A	Stationary Seat - Hardened Steel	2	336992
153B	Rotating Assembly With Carbon Seal Face	2	337000
153D	O-Ring - Stationary (Buna-N)	2	701934
153E	O-Ring - Rotating (Buna-N)	2	701933

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337008
153A	Stationary Seat - Hardened Steel	2	336992
153B	Rotating Assembly With Carbon Seal Face	2	337000
153D	O-Ring - Stationary (Viton)	2	701921
153E	O-Ring - Rotating (Viton)	2	701967

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337009
153A	Stationary Seat - Hardened Steel	2	336992
153B	Rotating Assembly With Carbon Seal Face	2	337000
153D	O-Ring - Stationary (Teflon)	2	702056
153E	O-Ring - Rotating (Teflon)	2	702055

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337010
153A	Stationary Seat - Hardened Steel	2	336992
153B	Rotating Assembly With Carbon Seal Face	2	337001
153D	O-Ring - Stationary (Buna-N)	2	701934
153E	O-Ring - Rotating (Buna-N)	2	701933

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337011
153A	Stationary Seat - Hardened Steel	2	336992
153B	Rotating Assembly With Carbon Seal Face	2	337001
153D	O-Ring - Stationary (Viton)	2	701921
153E	O-Ring - Rotating (Viton)	2	701967

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337012
153A	Stationary Seat - Hardened Steel	2	336992
153B	Rotating Assembly With Carbon Seal Face	2	337001
153D	O-Ring - Stationary (Teflon)	2	702056
153E	O-Ring - Rotating (Teflon)	2	702055

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337013
153A	Stationary Seat - Ceramic	2	336995
153B	Rotating Assembly With Ceramic Seal Face	2	337002
153D	O-Ring - Stationary (Buna-N)	2	701934
153E	O-Ring - Rotating (Buna-N)	2	701933

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337014
153A	Stationary Seat - Ceramic	2	336995
153B	Rotating Assembly With Carbon Seal Face	2	337002
153D	O-Ring - Stationary (Viton)	2	701921
153E	O-Ring - Rotating (Viton)	2	701967

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337015
153A	Stationary Seat - Ceramic	2	336995
153B	Rotating Assembly With Carbon Seal Face	2	337002
153D	O-Ring - Stationary (Teflon)	2	702056
153E	O-Ring - Rotating (Teflon)	2	702055

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337016
153A	Stationary Seat - Ceramic	2	336995
153B	Rotating Assembly With Carbon Seal Face	2	337000
153D	O-Ring - Stationary (Buna-N)	2	701934
153E	O-Ring - Rotating (Buna-N)	2	701933

MECHANICAL SEAL - OPTIONAL - MLX4

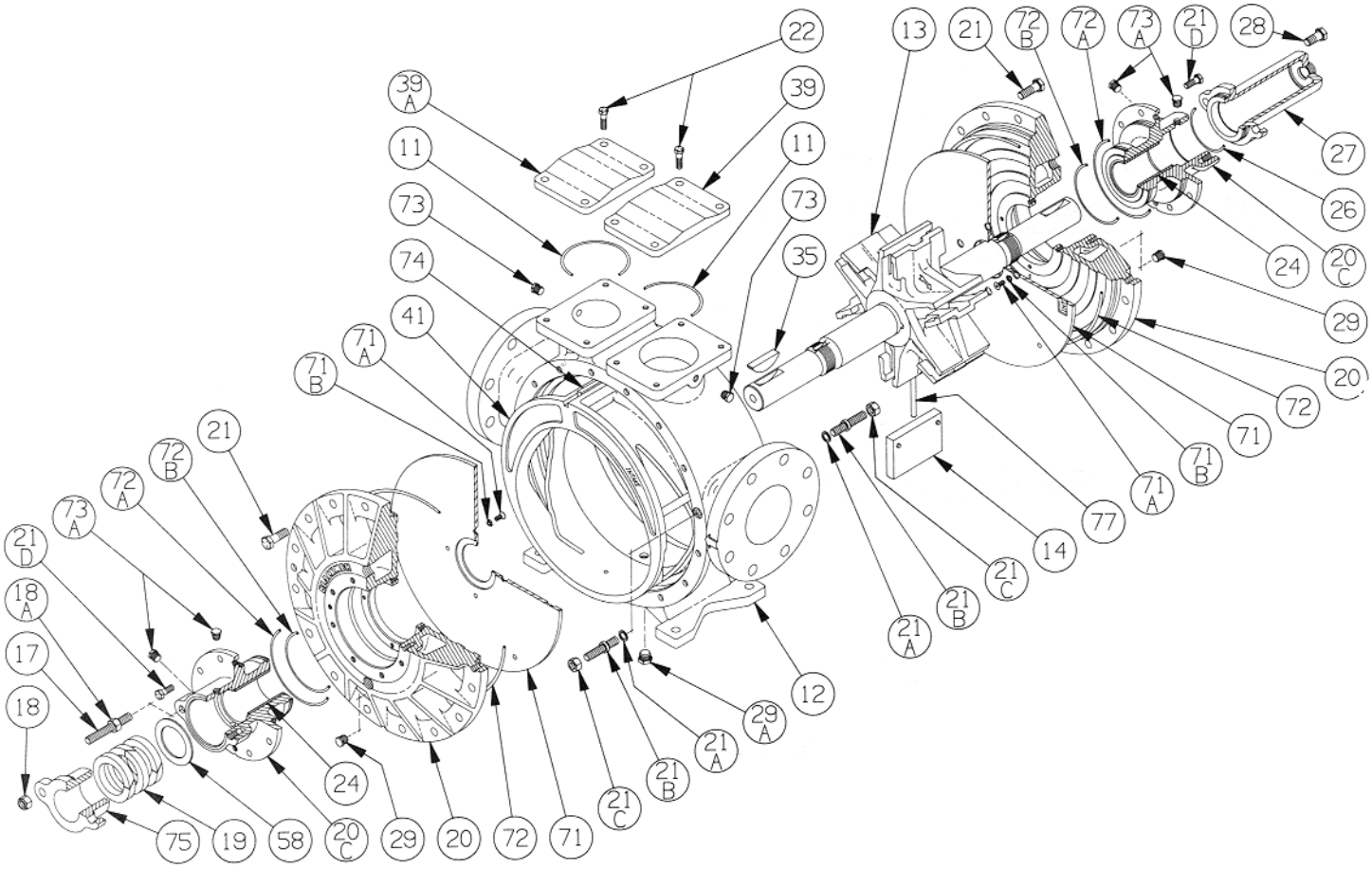
REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337017
153A	Stationary Seat - Ceramic	2	336995
153B	Rotating Assembly With Carbon Seal Face	2	337000
153D	O-Ring - Stationary (Viton)	2	701921
153E	O-Ring - Rotating (Viton)	2	701967

MECHANICAL SEAL - OPTIONAL - MLX4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	2	337018
153A	Stationary Seat - Ceramic	2	336995
153B	Rotating Assembly With Carbon Seal Face	2	337000
153D	O-Ring - Stationary (Teflon)	2	702056
153E	O-Ring - Rotating (Teflon)	2	702055

NOTES

B. PUMP MODELS: MLN4, MLN4-CS



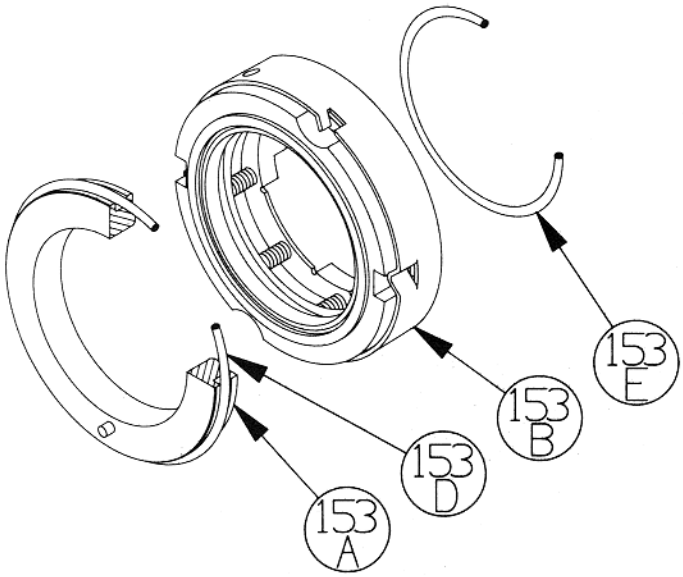
PUMP MODELS: MLN4, MLN4-CS

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
11	O-Ring - Blanking Plate/Valve (Buna-N) (Std.)	2	701918	701918
	O-Ring - Blanking Plate/Valve (Viton)		701991	701991
	O-Ring - Blanking Plate/Valve (Teflon)		702066	702066
12	Casing	1	016900	016902
13	Rotor & Shaft (Std.)	1	266900	266900
	Rotor & Shaft (Chrome Oxide Shaft)		266903	266903
14	Vane - Maxvane (Std.)	6	096932	096932
	Vane - EC Maxvane		096933	096933
	Vane - Laminate		096921	096921
	Vane - Ductile Iron		096928	096928
	Vane - Hardened Ductile Iron		096903	096903
	Vane - Bronze		096925	096925
	Vane - EC Laminate		096923	096923
	Vane - EC Hardened Ductile Iron		096907	096907
	Vane - EC Bronze		096927	096927
17	Stud - Packing Follower	2	921580*	921580*
18	Locknut - Stud	2	922420*	922420*
18A	Nut - Packing Follower Removal	2	922850*	922850*
19	Packing Set (Std.)	1	326900*	326900*
20	Head (Std.)	2	036900	036902
20A	Head - Jacketed	2	036901	
20C	Hub & Bushing Assembly (Carbon)	2	036950*	036954*
	Hub & Bushing Assembly (Bronze)		036953*	036955*
21	Capscrews - Head	28	920510	920510
21A	Gasket - Head Stud	4	701981	701981
21B	Stud - Head	4	921569	921569
21C	Nut - Head Stud	4	922850	922850
21D	Capscrews - Hub	16	920331*	920331*
22	Capscrews - Plate/Valve	8	920457	920457
24	Bearing - Sleeve (Carbon)	2	166900*	166900*
	Bearing - Sleeve (Bronze)		166901*	166901*

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
26	O-Ring - Shaft Cover (Buna-N) (Std.)	1	701939*	701939*
	O-Ring - Shaft Cover (Viton)		711930*	711930*
	O-Ring - Shaft Cover (Teflon)		702064*	702064*
27	Cover - Outboard Shaft	1	046902*	046911*
28	Capscrews - Shaft Cover	2	920495*	920495*
29	Drain Plug - Head	2	908195	908195
29A	Drain Plug - Casing	1	908207	908207
35	Key - Shaft	1	909136	909136
39	Plate - Blanking (Inlet)	1	496900	496902
39A	Plate - Blanking (Discharge)	1	496901	496904
41	Liner (Std.)	1	186900	186900
	Liner (Hardened)		186911	186911
58	Packing Washer	1	356905*	356905*
71	Disc (Std.)	2	066900	066900
	Disc (Hardened)		066901	066901
71A	Machine Screw - Disc	8	920007	920007
71B	Lockwasher - Disc	8	909622	909622
72	O-Ring - Head (Buna-N) (Std.)	2	702050	702050
	O-Ring - Head (Viton)		702058	702058
72A	O-Ring (Large) - Hub (Buna-N) (Std.)	2	702057	702057
	O-Ring (Large) - Hub (Viton)		702059	702059
	O-Ring (Large) - Hub (Teflon)		702068	702068
72B	O-Ring (Small) - Hub (Buna-N) (Std.)	2	702027	702027
	O-Ring (Small) - Hub (Viton)		702060	702060
	O-Ring (Small) - Hub (Teflon)		702065	702065
73	Plug - Gage	2	908195	908195
73A	Plug - Hub	4	908195*	908195*
74	Key - Liner	1	186902	186902
75	Packing Follower	1	146905*	146906*
77	Push Rod	3	126900	126900

*To convert from one pump model to another, these parts must be substituted. **NOTE:** When converting from an N model to a G model (or vice versa), Reference Numbers 17, 18, 18A, 19, 21D & 58 do not need to be substituted.

When ordering parts, it is important to include the pump Serial Number, I.D. Number, and Model Designation. Refer to "Pump Identification" on page 1.



BLACKMER MECHANICAL SEAL - OPTIONAL - MLN4

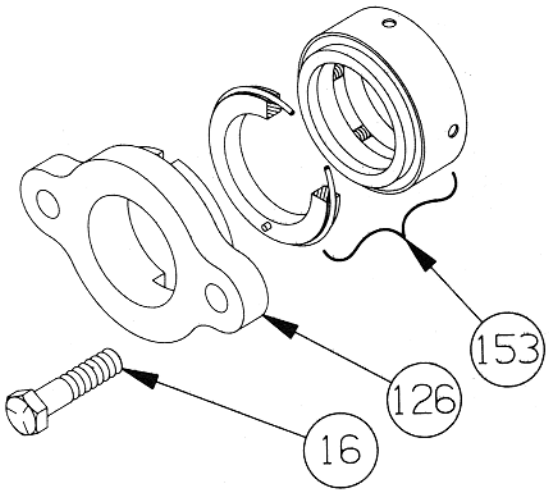
REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	1	337019
153A	Seat - Stationary (Hardened Steel)	1	332005
153B	Face - Seal (Carbon)	1	331867
153C	Jacket Assembly - Seal	1	331886
153D	O-Ring - Stationary (Buna-N)	1	701934
153E	O-Ring - Rotating (Buna-N)	1	711912
153F	Housing - Seal	1	336987*
153G	O-Ring - Seal Housing	1	701900
126	Follower - Seal	1	146902*
16	Capscrews - Seal Follower	2	920591*

*Parts not included in Mechanical Seal Assembly.

BLACKMER MECHANICAL SEAL - OPTIONAL - MLN4

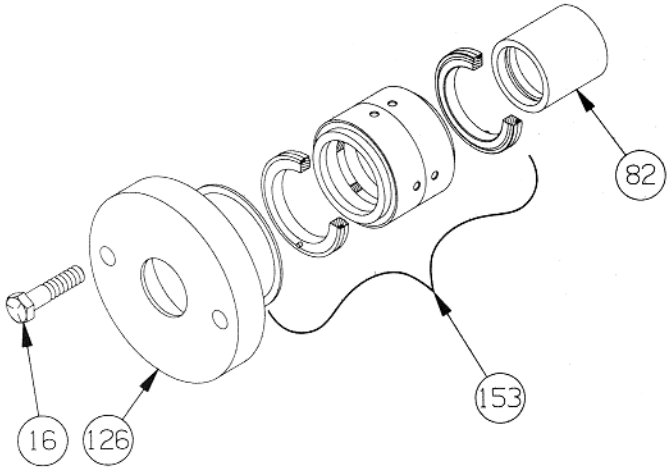
REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Mechanical Seal Assembly	1	337020
153A	Seat - Stationary (Hardened Steel)	1	332005
153B	Face - Seal (Carbon)	1	331867
153C	Jacket Assembly - Seal	1	331886
153D	O-Ring - Stationary (Viton)	1	701921
153E	O-Ring - Rotating (Viton)	1	701962
153F	Housing - Seal	1	336987*
153G	O-Ring - Seal Housing	1	701901
126	Follower - Seal	1	146902*
16	Capscrews - Seal Follower	2	920591*

*Parts not included in Mechanical Seal Assembly.



COMMERCIAL MECHANICAL SEAL - OPTIONAL - MLN4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Single Mechanical Seal Assembly **Crane Type 9** (59U)	1	337022
126	Follower - Seal	1	146907
16	Capscrews - Seal Follower	2	920495

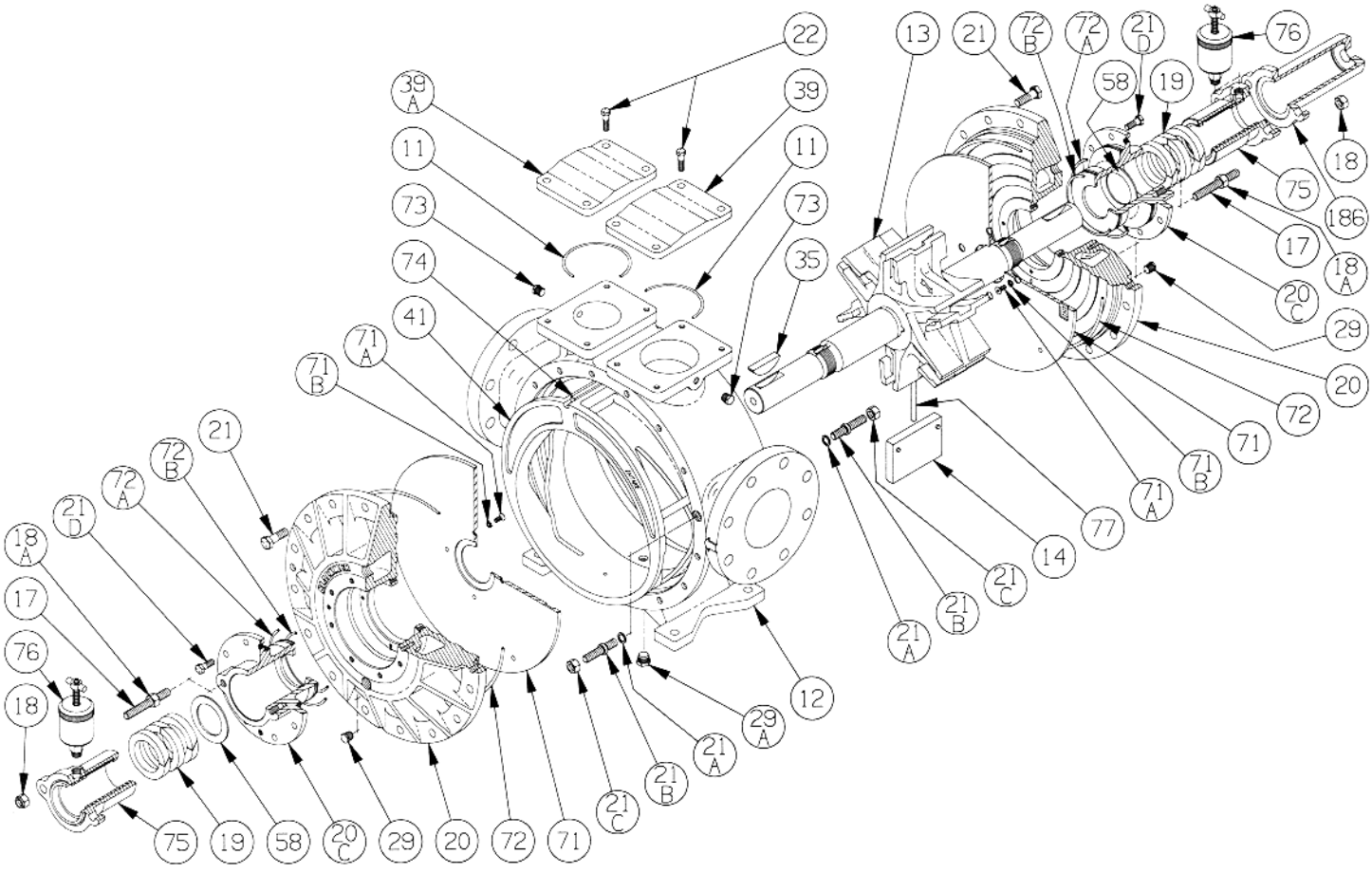


COMMERCIAL MECHANICAL SEAL - OPTIONAL - MLN4

REF. NO.	PART NAME	PARTS PER PUMP	PART NO.
153	Double Mechanical Seal Assembly **Crane Type 9** (59U)	1	337025
126	Follower - Seal	1	146908
82	Sleeve & O-Ring Assembly	1	336988
16	Capscrews - Seal Follower	2	

NOTES

C. PUMP MODEL: MLG4



PUMP MODEL: MLG4

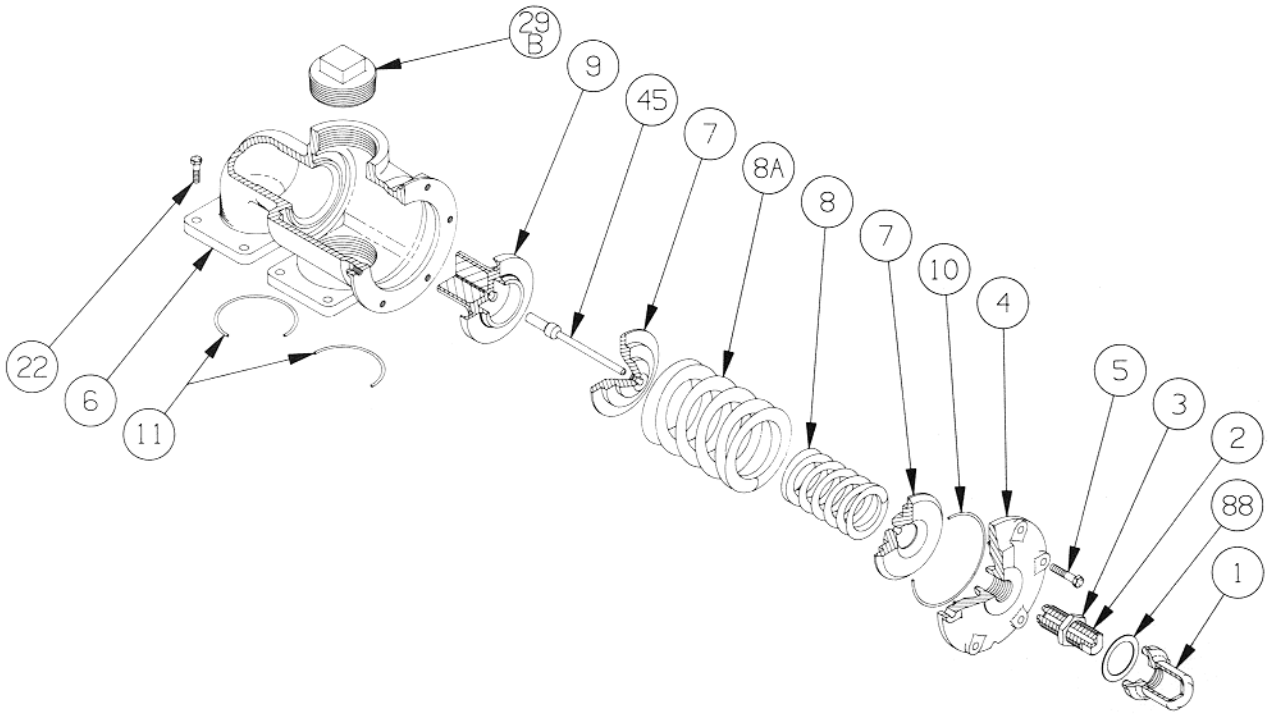
REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.
11	O-Ring - Blanking Plate/Valve (Buna-N) (Std.)	2	701918
	O-Ring - Blanking Plate/Valve (Viton)		701991
	O-Ring - Blanking Plate/Valve (Teflon)		702066
12	Casing	1	016900
13	Rotor & Shaft (Std.)	1	266900
	Rotor & Shaft (Chrome Oxide Shaft)		266903
14	Vane - Maxvane (Std.)	6	096932
	Vane - EC Maxvane		096933
	Vane - Laminate		096921
	Vane - Ductile Iron		096928
	Vane - Hardened Ductile Iron		096903
	Vane - Bronze		096925
	Vane - EC Laminate		096923
	Vane - EC Hardened Ductile Iron		096907
	Vane - EC Bronze		096927
17	Stud - Packing Follower	4	921580*
18	Locknut - Stud	4	922420*
18A	Nut - Pack. Follower Removal	4	922850*
19	Packing Set (Std.)	2	326900*
20	Head (Std.)	2	036900
20A	Head - Jacketed	2	036901
20C	Hub	2	O36951*
21	Capscrews - Head	28	920510
21A	Gasket - Head Stud	4	701981
21B	Stud - Head	4	921569
21C	Nut - Head Stud	4	922850
21D	Capscrews - Hub	16	920331*

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.
22	Capscrews - Plate/Valve	8	920457
29	Drain Plug - Head	2	908195
29A	Drain Plug - Casing	1	908207
35	Key - Shaft	1	909136
39	Plate - Blanking (Inlet)	1	496900
39A	Plate - Blanking (Discharge)	1	496901
41	Liner (Std.)	1	186900
	Liner (Hardened)		186911
58	Packing Washer	2	356905*
71	Disc (Std.)	2	066900
	Disc (Hardened)		066901
71A	Machine Screw - Disc	8	920007
71B	Lockwasher - Disc	8	909622
72	O-Ring - Head (Buna-N) (Std.)	2	702050
	O-Ring - Head (Viton)		702058
72A	O-Ring (Large) - Hub (Buna-N) (Std.)	2	702057
	O-Ring (Large) - Hub (Viton)		702059
	O-Ring (Large) - Hub (Teflon)		702068
72B	O-Ring (Small) - Hub (Buna-N) (Std.)	2	702027
	O-Ring (Small) - Hub (Viton)		702060
	O-Ring (Small) - Hub (Teflon)		702065
73	Plug - Gage	2	908195
74	Key - Liner	1	186902
75	Packing Follower & Bearing Assembly	2	146900*
76	Automatic Lubricator	2	317885*
77	Push Rod	3	126900
186	Protector - Shaft	1	346901*

*To convert from one pump model to another, these parts must be substituted. **NOTE:** When converting from an N model to a G model (or vice versa), Reference Numbers 17, 18, 18A, 19, 21D & 58 do not need to be substituted.

When ordering parts, it is important to include the pump Serial Number, I.D. Number, and Model Designation. Refer to "Pump Identification" on page 1.

D. RELIEF VALVE



OPTIONAL RELIEF VALVE - ML4 SERIES PUMPS

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
1	Cap - Relief Valve	1	417710	416904
2	Screw - R/V Adjusting	1	437205	437205
3	Nut - R/V Jam	1	436655	436655
4	Cover - Relief Valve	1	416900	416902
5	Capscrew - R/V Cover	6	920351	920351
6	Body - R/V	1	406900	406902
7	Guide - R/V Spring	1	426900	426900
8	Spring - Valve (45-75 PSI)	1	476900	476900
8A	Spring - Valve (76-125 PSI)	1	476901	476901
8 & 8A	Springs - Valve (126-200 PSI)	*1 ea.	476900 476901	476900 476901

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
9	Valve - R/V	1	456315	456315
10	O-Ring - R/V Cover (Buna-N)	1	702057	702057
	O-Ring - R/V Cover (Viton)		702059	702059
	O-Ring - R/V Cover (Teflon)		702068	702068
11	O-Ring - Blkg. Plate/Valve (Buna-N)	2	701918	701918
	O-Ring - Blkg. Plate/Valve (Viton)		701991	701991
	O-Ring - Blkg. Plate/Valve (Teflon)		702066	702066
22	Capscrews - Plate/Valve	8	920457	920457
29B	Plug - By-Pass (3" NPT)	1	908226	908226
45	Guide Rod - Spring	1	426901	426901
88	Gasket - R/V Cap	1	536652	536652

*Use Springs 476900 & 476901 nested together.

V. MODEL CONVERSION INSTRUCTIONS

The ML4 Series is designed as a "modular" pump, with the various models being "interchangeable" by substituting the hub assemblies. For example, an X Model (external roller bearings) can be converted to either an N Model (internal sleeve bearings) or a G Model (external gland bearings with automatic lubricators), and vice versa.

When converting from one model type to another, all parts from the hubs outward must be substituted. Refer to the individual parts lists to determine which parts — as indicated by an asterisk (*) — are needed to convert the pump. For instructions regarding the disassembly and assembly of the different hub assemblies, refer to the respective Maintenance Sections, on pages 4, through 11.

VI. GENERAL PUMP TROUBLESHOOTING

LEAKAGE

Location	Possible Cause/Corrective Action
Between the head & casing.	**Damaged head O-ring:** Remove the head and inspect the head O-ring for damage. Replace when necessary.
	Burrs/dirt in O-ring groove or casing: Inspect the O-ring groove and casing for burrs or dirt, which may inhibit proper sealing. File and clean when necessary.
X Models: From the tell-tale hole in the hub, or where the hub meets the head.	**New mechanical seals:** New seals may leak slightly at start up, but should seal up shortly thereafter.
	Damaged mechanical seals: Check for a damaged O-ring, or a scratched/chipped seal face. Replace when necessary.
	Damaged hub O-rings: Inspect both O-rings in the hub for damage. Replace when necessary.
N Models: From the seal housing or around the shaft.	**Damaged mechanical seal:** See above.
	Damaged shaft surface: Check the surface of the shaft in the seal area for damage. File away any small burrs or ridges. If damage is severe, replace the entire rotor and shaft.
N & G Models: From the stuffing box in the hub.	**Packing:** Adjust the packing. If this does not solve the problem, replace the packing with a complete, new set. **NOTE:** Some leakage is necessary, and in some cases is desirable, depending upon the application.

ESCAPING GREASE

Location	Possible Cause/Corrective Action
X Models: From the grease relief fitting in the bearing cover, and the tell-tale hole in the hub.	**Normal greasing:** On all pumps, after greasing it is normal for some grease to work out of the grease relief fittings and the tell-tale holes.
X Models: Around the pump shaft.	**Damaged grease seal:** Remove the bearing cover and inspect the grease seal for damage. Replace when necessary, making sure the seal is properly greased before reinstalling.
G Models: From the automatic lubricator (grease cup).	**Automatic lubricator adjusted incorrectly:** Adjust the flow control screw at the bottom of the automatic lubricator. For maximum flow, the screw should be vertical. For minimum flow, the screw should be horizontal.

SHAFT BINDING

Possible Cause	Corrective Action
Burrs, dirt, or foreign particles on the heads or discs.	During assembly, both the heads and discs must be clean and smooth. File away any burrs or rough spots from the head or disc faces, and wipe the discs with alcohol and a clean cloth to remove any dirt or foreign particles.
X Models: Improper locknut adjustment.	Locknuts must be properly adjusted to center the rotor and shaft between the heads. Refer to "Locknut Adjustment" on page 6.
N & G Models: Excessively tight packing.	Refer to the "Packing Adjustment" on page 10 or 13.

VI. GENERAL PUMP TROUBLESHOOTING

SHAFT BINDING

Possible Cause	Corrective Action
X & N Models: Contaminated mechanical seal faces.	Any trace of grease or dirt on either seal face will prevent the faces from mating properly, consequently causing the rotor and shaft to bind or turn hard. Use a tissue paper and alcohol to clean the seal faces. Apply a light oil or a suitable lubricant to bronze seal faces **only.**
X & N Models: Mechanical Seal driving tangs not engaged.	The driving tangs of the seal jacket must be engaged in the slots in the rotor (X Models), or in the keyways of the shaft threads (N Models).

Other Possible Causes of Shaft Binding:
—Foreign particles on rotor, liner, or vanes.
—Damaged vanes or rotor.
—Bent push rods.
—Liquids which "set up" when inactive.

OVERHEATING

Location	Possible Cause/Corrective Action
Pump equipped with internal relief valve.	**Continual, full bypassing of the liquid:** The valve should be adjusted such that the pump will not bypass during normal operation. If continual or long term bypassing is necessary, it is recommended the internal bypass port be plugged, and the liquid piped back to the tank.
N & G Models: Stuffing box of hub.	**Packing:** Packing should never be tightened without checking afterward for overheating. Also, if packing is old or worn, it will overheat and should be replaced.

Other Possible Causes of Overheating:
—Improper relief valve adjustment (see "Relief Valve" on pg. 2).
—Plugged discharge line.
—Closed valve.

EXCESSIVE NOISE AND VIBRATION

Possible Cause	Corrective Action
Cavitation, or vaporization of the liquid resulting from excessive vacuum on the pump due to starved suction.	Check for: • Inlet piping too long or too small in diameter. • Strainer plugged or dirty. • Undersized or restrictive fittings, such as globe valves, or partially closed valves. • Excessive amount of elbows. • Suction lift too great. • Pump speed too high for the viscosity of the liquid being pumped.

EXCESSIVE NOISE AND VIBRATION

Possible Cause	Corrective Action
Entrained air or vapors in the pump.	Check pipe joints for leakage of air. Sometimes when recirculating liquid in a tank, the returning liquid falling through the air carries air down into the tank, which eventually gets back into the pump, causing noise and vibration.
Rotor & Shaft installed backwards.	The rotation arrow on the rotor should point towards the discharge port when the arrow is located beneath the shaft. Refer to Figure 7 on page 5.
Pump speeds exceed the recommended maximum.	Check the recommended RPM for your specific application.
Continual or long term bypassing of liquid through the relief valve.	Check for a restriction in the discharge line, or an improper relief valve adjustment (see "Relief Valve" on page 2)

Other Possible Causes of Noise and Vibration:
—Excessively worn vanes, liner, or discs.
—Worn Bearings.
—Loose or improperly installed piping.
—Misalignment of pump and driver.
—Pump base not properly mounted.

LOW DELIVERY RATE

Possible Cause	Corrective Action
A low relief valve setting, causing the liquid to bypass.	The relief valve setting should be 20 psi (138 kPa) higher than the differential pressure.
A dirty strainer.	The strainer should be cleaned regularly.

Other Possible Causes of a Low Delivery Rate:
—Restriction in the suction line.
—Resistance in the discharge line.
—Air leaks in the suction line.
—Damaged or worn pump parts.
—Pump Speed too low or too high.
—Rotor & Shaft installed backwards.
—Relief valve leaking.
—Relief valve sticking open, or not properly seating.

POOR OR NO PRIMING

Possible Causes:
—Air leaks in the suction line.
—Restriction in the suction line.
—Damaged or worn pump parts.
—Too much lift for the vapor pressure of the fluid.
—A dirty or clogged strainer.

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