

BLACKMER POWER PUMPS
 INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS
ML4 SERIES
MODELS: MLX4A, MLX4A-CS; MLN4A, MLN4A-CS; MLG4A
OBSOLETE MODELS: MLX4, MLX4-CS; MLN4, MLN4-CS; MLG4

966909
INSTRUCTIONS AND PARTS LIST NO. 185/S
 Section 100
 Effective January 1993
 Replaces September 1990

Discontinued Models: Parts Availability May be Limited.

WARNING

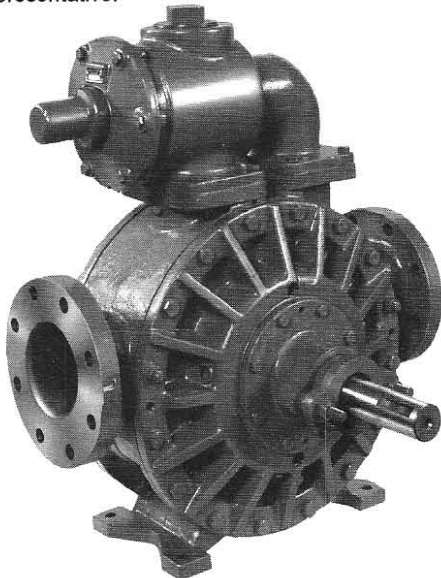
THIS PRODUCT MUST ONLY BE INSTALLED IN SYSTEMS WHICH HAVE BEEN DESIGNED BY THOSE QUALIFIED TO ENGINEER SUCH SYSTEMS. THE SYSTEM MUST BE IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS AND SAFETY CODES AND WARN OF ANY HAZARDS UNIQUE TO THE PARTICULAR SYSTEM.

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

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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.



blackmer		SER. NO.
		<input type="text"/>
	I.D. NO.	<input type="text"/>
		<input type="text"/>
M O D.		<input type="text"/>
GRAND RAPIDS, MICH. MADE IN U.S.A.		

SERIAL NUMBER _____
 I.D. NUMBER _____
 MODEL _____

Figure 1 - Pump Identification Tag

II. INSTALLATION

CLEANING PRECAUTIONS

Foreign matter entering the pump can cause extensive damage. The suction tank and piping should be cleaned and flushed before installing the pump.

LOCATION AND PIPING

Pump life and performance can be significantly reduced when installed in an improperly designed system. Before starting the layout and installation of the piping system, consider the following suggestions:

1. Locate the pump as near as possible to the source of supply to avoid excessive inlet pipe friction.
2. The inlet line should be at least as large as the intake port on the pump. It should slope downward to the pump, and should not contain any upward loops. Eliminate restrictions such as sharp bends, globe valves, unnecessary elbows, and undersized strainers.
3. It is recommended a strainer be installed in the inlet line to protect the pump from foreign matter. The strainer should be located at least 24" (0.6m) from the pump, and have a net open area of at least four times the area of the intake piping. Strainers must be cleaned regularly to avoid pump starvation.
4. The intake system must not contain any air leaks. If practical, this should be verified by applying air pressure to the system.
5. Expansion joints, placed at least 36" (0.9m) from the pump, will compensate for expansion and contraction of the pipes.
6. The use of a check valve or foot valve at the supply tank is generally not recommended with a self-priming, positive displacement pump. If this type of valve is to be used, it should be located near the pump on the discharge side.

MOUNTING THE PUMPING UNIT

A solid foundation reduces noise and vibration, and will improve pump performance. On permanent installations it is recommended the pumping unit be secured by anchor bolts as shown in Figure 2. This arrangement allows for slight shifting of position to accommodate alignment with the mounting holes in the base plate.

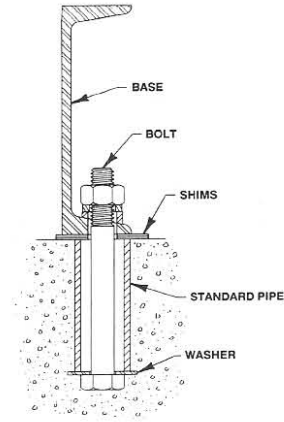


Figure 2 - Pipe Type Anchor Bolt Box

For new foundations, it is suggested that the anchor bolts be set in concrete. When pumps are to be located on existing concrete floors, holes should be drilled into the concrete to hold the anchor bolts.

When installing units built on channel or structural steel type bases, use care to avoid twisting the base 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.

III. OPERATION

PRE-START UP CHECK LIST

1. Check the alignment of the pipes to the pump. Pipes should be supported so that they do not spring away or drop down when pump flanges or union joints are disconnected.
2. Alignment is critical to good pump performance and is frequently disturbed during shipment, handling or installation. Before operating the pump, check the alignment of the driver, gear reducer, and the pump (see Figure 3).

To check for parallel alignment, the use of a dial indicator is preferred. If a dial indicator is not available, use a straight edge. Turn both shafts by hand, checking the reading through one complete revolution. Maximum offset should be less than .005" (127mm).

To check for angular alignment, insert a feeler gauge between the coupling halves. Check the spacing in 45 degree increments around the coupling (four check points). Maximum variation should not exceed .005" (.127mm) **NOTE:** After the pump has been in operation for a week or two, completely recheck alignment.

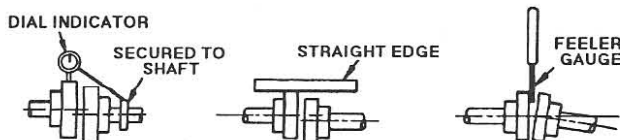


Figure 3 - Alignment Check

3. Couplings with rubber inserts do not require lubrication. All other couplings are pre-lubricated at the factory, but require frequent lubrication to prevent excessive wear.

4. Blackmer helical gear reducers are shipped from the factory without oil in the gearcase. Fill with the grade of oil indicated on the reducer tag. For more specific instructions on Blackmer gear reducers, refer to Parts Lists 186/B1 through 186/B8.
5. Check the entire pumping system to verify that the proper inlet and discharge valves are fully open, and that the drain valves and other auxiliary valves are closed.
6. Install vacuum and pressure gauges on the pump in the threaded connections provided. These can be used to check actual suction and discharge conditions after pump start-up.
7. Check the wiring of the motor, and briefly turn on the power to make sure that the pump rotates in the direction of the rotation arrow.

START UP PROCEDURE

NOTE: If there is a problem concerning any of the following items, or if the pump is abnormally noisy, see "General Pump Troubleshooting" for possible causes.

1. Start the motor. Priming should occur within one minute.
2. Check the vacuum and pressure gauges to see if the pump is operating within the expected conditions.
3. Check for leakage from the piping and equipment.
4. Check for overheating of the pump, reducer, and motor.
5. If possible, check the flow rate.
6. Check the pressure setting of the relief valve by briefly closing a valve in the discharge line and reading the pressure gauge. This pressure should be 20 psi (138 kPa) higher than the maximum operating pressure. **CAUTION:** Do not run the pump for more than 10 - 15 seconds with the discharge valve completely closed. If adjustments need to be made, refer to "Relief Valve Setting & Adjustment."

RUNNING THE 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

1. To flush the pump, run the pump with the discharge valve open and the intake valve closed. Bleed air into the pump through the intake gauge plug hole. Pump air for 30 second intervals to clean out most of the pumpage. If complete drainage of the pump is desired, drain holes are provided in both heads, and in the pump casing.
2. Run cleaning fluid through the pump for one minute to clean out the remainder of the original pumpage. It is recommended to keep the pump full of cleaning fluid until the pump is used again. **NOTE:** The cleaning fluid must be compatible with the vanes and O-rings if the fluid is to be left in the pump for an extended period of time.
3. Clear out the cleaning fluid using the same procedure as in step one.

PUMP ROTATION

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

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

TO REVERSE PUMP ROTATION

ML4A Series pumps have double-ended shafts, allowing the pump to be driven from either end. Rotation is changed by reversing the position of the pump assembly. To do so, rotate the pump 180 degrees so that the opposite shaft becomes the driven shaft.

RELIEF VALVE

WARNING

INTERNAL BYPASSING OF LIQUID ELEVATES LIQUID TEMPERATURE. INTERNAL BYPASS VALVE SHOULD ONLY BE USED FOR BRIEF PERIODS AND AT DIFFERENTIAL PRESSURES BELOW 125 PSI. FOR EXTENDED PERIODS OR HIGHER PRESSURES, INTERNAL BYPASS PORT MUST BE PLUGGED AND THE LIQUID RETURNED BACK TO THE SOURCE.

The ML4A Series pump is offered with an optional relief valve assembly which is bolted onto the pump casing. The valve may be used as an internal relief valve, or as an external bypass, piped back to the storage tank (see Figure 4). Its purpose is to protect the pump or pumping system from excessive pressure. The valve is not meant to be used for prolonged recirculation.

Blackmer relief valves are designed for satisfactory operation with a partially closed discharge line on most types of installations. This allows for reduction of 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.

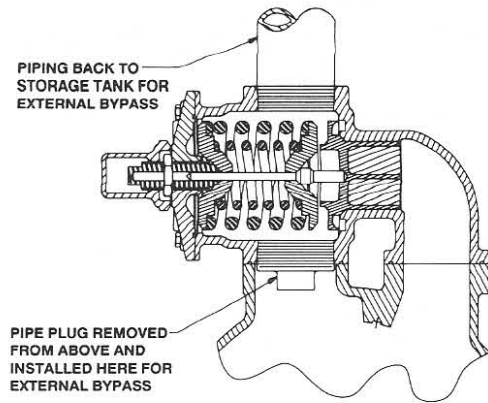


Figure 4 - Relief Valve

RELIEF VALVE SETTING & ADJUSTMENT

The relief valve should normally be set 20 psi (138 kPa) higher than the operating pressure.

1. **To increase the pressure setting**, remove the relief valve cap, loosen the locknut, and turn the adjusting screw inward, or clockwise.
2. **To reduce the pressure setting**, remove the relief valve cap, loosen the locknut, and turn the adjusting screw outward, or counterclockwise.

DO NOT ATTEMPT TO USE RELIEF VALVE SPRINGS OUTSIDE OF THEIR APPROPRIATE SETTING RANGE. Refer to the Parts Lists for various spring ranges.

MANUAL BYPASS VALVE

WARNING

EXCESSIVE DISCHARGE PRESSURE CAN RESULT IN DAMAGE TO THE PUMP OR PERSONAL INJURY. IN ORDER TO CONTROL SYSTEM PRESSURE A BYPASS VALVE OR OTHER PRESSURE LIMITING DEVICE MUST BE INSTALLED IN THE DISCHARGE PUMPING SYSTEM.

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. For example:

1. When handling very viscous liquids excessive pressure may develop when starting the pump. To avoid possible damage to the pump, open the bypass valve before starting. After the pressure stabilizes and the pump is running smoothly, close the valve slowly.
2. 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. See other causes of noise and vibration in the "General Pump Troubleshooting" Section.

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

OPTIONAL JACKETED HEADS

Hot oil or steam can be circulated through jacketed heads by connections at the 1/2" NPT pipe plugs directly above and below the shaft for heating highly viscous liquids, or to "thaw out" liquids which have congealed in the pumping chamber and packing area. Maximum recommended steam pressure is 150 psi (1034 kPa).

Make sure heat is applied early enough to sufficiently thin the liquid before starting the pump. Liquids that congeal in the relief valve chamber will make the valve inoperative. Insulation of the pump with sufficient heat to the jackets will usually thin the liquid in the relief valve chamber. However, precautions should be taken to ensure the valve has free movement. It is advisable to start the pump with an open discharge.

IV. MAINTENANCE and PARTS LISTS

A. PUMP MODELS: MLX4A, MLX4A-CS

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

Before work is started on the pump, make sure the pressure is relieved, and the liquid is drained. During disassembly, be careful of sharp edges on worn or damaged parts.

LUBRICATION

Pump bearings should be lubricated every one to twelve weeks, depending on the application, and operating conditions.

1. Use Amoco - Amolith All Weather Grease, or an equivalent grease compatible with the pump elastomers and the application.
2. Remove the grease relief fitting from the bearing cover.
3. Apply grease with a hand gun until grease begins to escape from the grease relief fitting port.
4. Replace the grease relief fitting.

Excessive greasing can cause grease to be pushed between the mechanical seal faces causing seal failure. It is normal for some grease to escape from the tell-tale hole under the bearing for a short period of time after lubrication. If this condition persists, it may be an indication that an excessive amount of grease was used, or that the mechanical seal is leaking.

Blackmer gear reducers are shipped from the factory without oil in the gearcase. Fill with the grade of oil indicated on the reducer tag. The oil should be changed after the first 48 hours of use, and approximately every 500 hours of use thereafter.

REPLACING VANES ONLY

1. Remove the head assembly and all other parts on the outboard (non-driven) side of the pump according to steps 1 through 9 of the "Pump Disassembly" Section.
2. Turn the shaft by hand until a vane (14) comes to the top (12 o'clock) position of the rotor.
3. Remove and replace the vane, making sure to install the vane with the rounded edge outward to contact the liner.
4. Rotate the shaft until the next rotor slot is in the top position, and replace the vane.
5. Continue this procedure until all new vanes are in place.
6. Reassemble the pump as instructed in "Pump Assembly."

PUMP DISASSEMBLY

NOTE: The numbers in parentheses following individual parts indicate reference numbers on the coinciding Parts List.

1. Remove the bearing cover capscrews (28) and slide the bearing cover (27) from the shaft, being careful not to cut the inserted grease seal (104) on the shaft keyway.
2. Remove the bearing preload wave spring (24C).
3. Bend up the lockwasher tang (24B) engaged in the locknut (24A), and turn the locknut counterclockwise to remove it from the shaft. Slide the lockwasher off the shaft.

5. Make sure the shaft is free of any dirt, nicks or burrs which may cause seal O-ring damage when removing the hub assembly and rotating seal face.
6. Remove the hub capscrews (21D). To disengage the hub assembly from the head, two jack screw holes are provided in the rim of the hub. Slide the hub assembly off the shaft with the bearing, stationary seat, and stationary O-ring still intact. Once the hub assembly has been removed from the head, the bearing and stationary seat can be removed from the hub.
 - a. Slide the bearing (24) out of the bearing cavity.
 - b. Using a blunt instrument, push or gently tap the backside (non-polished side) of the stationary seat (153A) to remove it from the seal recess. Place a cloth under the seal to avoid damage. Be careful not to contact the polished surface of the seal face during removal.
7. With the use of wire hooks, carefully pull the rotating seal assembly (jacket, seal face & O-ring) (153B & 153E) out of the head and off the shaft. Holes in the seal jacket will facilitate the removal.
8. Remove the head capscrews (21) and head stud nuts (21C). Two jack screw holes are provided in the rim of the head to facilitate removal.
9. Remove the head (20 or 20A) from the casing, being careful not to nick or scrape the shaft.
10. The disc (71) will come off with the head assembly and is attached with four (4) countersunk, allen-head machine screws (71A) and lockwashers (71B).
11. In order to remove the rotor and shaft assembly without damaging the mechanical seal, it is advisable to remove the second hub assembly and mechanical seal components from the opposite side of the pump. Follow steps 1 through 7.
12. From the open side of the pump, grasp the rotor in the 3 and 9 o'clock positions, and gently pull the rotor and shaft (13) out of the head assembly remaining on the casing. **CAUTION:** Use care to avoid injury—the rotor and shaft is heavy and may have sharp edges.
13. The remaining head assembly can now be easily removed. Follow steps 8 through 10.
14. Depending on the pump application, the liner (41) can be removed in two ways:
 - a. If the pumpage is a clean, non-corrosive liquid, with low viscosity, the liner can usually be withdrawn from the casing by prying with two 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. Use a block under the bar, against the rotor, to bring the liner the rest of the way out (see Figure 5).

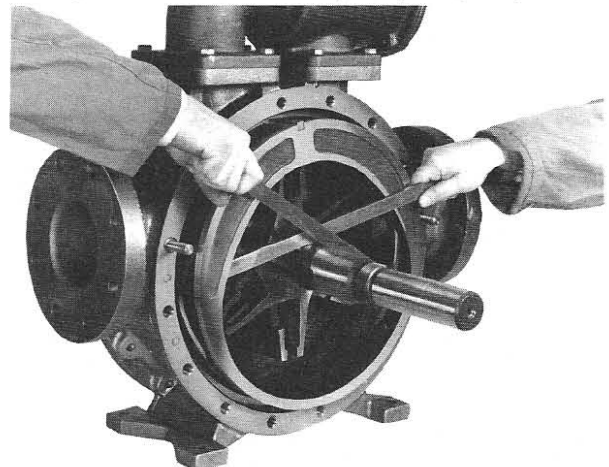


Figure 5 - Liner Removal

MAINTENANCE: MLX4A, MLX4A-CS

- b. 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 the casing, rather than pried out. To do so, use a brass or hard wood drift and a hammer and tap around the diameter of the liner until it is driven out of the casing.

PARTS REPLACEMENT

1. If any of the O-rings have been removed or disturbed during disassembly, it is recommended they be replaced with new O-rings. **NOTE:** Teflon O-rings should be heated in hot water to aid installation.
2. Excessive or continuous leakage from the tell-tale hole in the bearing cover may be an indication of a damaged mechanical seal. If a mechanical seal has been leaking, it is recommended the entire seal be replaced. Refer to "General Pump Troubleshooting" for possible causes of seal leakage.

PUMP ASSEMBLY

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

1. LINER

The liner has a close fit with the casing, and care should be taken to avoid finger injury during installation.

- a. Align and start the liner (41) and liner key (74) together into the pump casing. The word "INTAKE," which is cast into the liner, must be towards the intake side of the pump. **NOTE:** The intake port is marked with an inward facing arrow.
- b. Lightly tap the outer edge of the liner with a plastic or lead hammer to fully insert it into the casing.

2. DISC

Before the disc is attached to the head, check to make sure both surfaces are clean and smooth. Gently file away any protruding burrs or rough spots.

- a. Place a disc (71) on the head (20 or 20A) with the counterbored screw holes facing up.
- b. Position the disc so that when the head is mounted with the drain hole and V-notch down, the word "INTAKE" on the disc will be towards the intake side of the pump. The two disc holes should be in the 2 and 4 o'clock positions if the inlet is on the right (see Figure 6).
- c. Install the four (4) lockwashers (71B), tangs outward, and machine screws (71A) to attach the disc to the head.

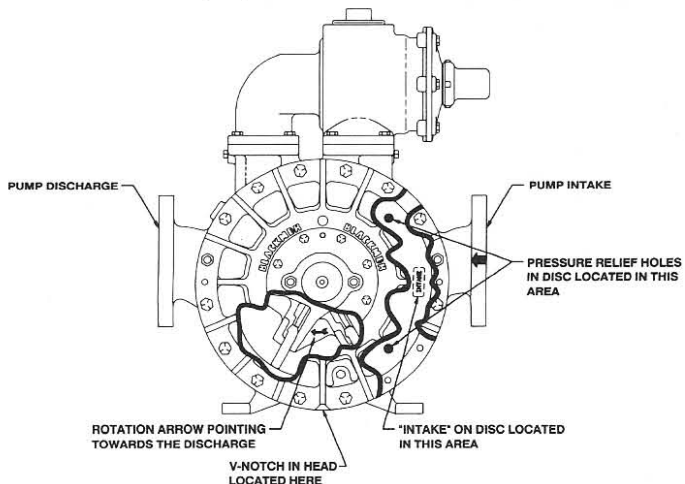


Figure 6

3. HEAD ASSEMBLY

- a. To mount the head assembly to the casing, first install the head O-ring (72) in the groove formed where the disc meets the head.
 - b. Grease the chamfer on the pump casing where the head O-ring will need to slide into position.
 - c. Place the head assembly (20 or 20A) on the studs, with the V-notch and drain hole facing down (towards the bottom of the pump).
 - d. Check to make sure the word "INTAKE" on the disc is towards the intake side of the pump when the head is mounted.
 - e. Install and tighten the two (2) nuts (21C) on the head studs.
 - f. Install and tighten the head capscrews (21) uniformly, making sure the head O-ring slides into place without damage.
4. At this point it is necessary to attach one hub (20C) and bearing (24) to the mounted head without the O-rings or mechanical seal components. Install and snug up the hub capscrews. **NOTE:** 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.**

5. ROTOR AND SHAFT

It is necessary to install the bottom vanes and the push rods in the rotor while inserting the rotor and shaft into the pump casing.

- a. Partially install the rotor and shaft into the open side of the pump and through the bore of the installed head. Be careful not to damage the disc face with the shaft end. **NOTE: When installing the rotor and shaft, the rotation arrow on the rotor must point in the direction of pump rotation—towards the discharge side of the pump when the arrow is positioned directly below the shaft.** (Refer back to Figure 6.)
- b. 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 (77) are inserted (see Figure 7).
- c. The rotor and shaft, with the three bottom vanes installed, can now be fully inserted into the casing.
- d. Install the remaining vanes in the top positions of the rotor.

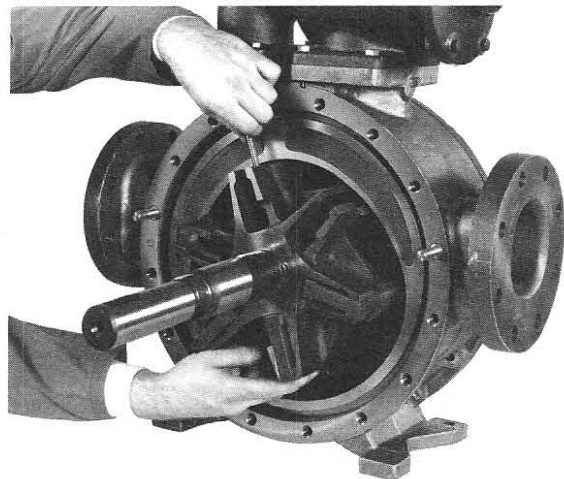


Figure 7

6. In order to lift and square the rotor against the previously installed head, it is necessary to install the bearing, bearing spacer, and the locknut on the mounted head and hub assembly. This will position the rotor, and aid in installing the second head assembly.
 - a. Grease the bearing (24) and place it into the bearing housing in the hub.
 - b. Slide the bearing spacer (24D) and locknut (24A) onto the shaft and snug up the locknut by hand.

MAINTENANCE: MLX4A, MLX4A-CS

7. Follow steps 2 and 3 to install the remaining head assembly (including the head, head O-ring, and disc). Remember to grease the entire casing chamfer to help slide the head O-ring into place.

8. MECHANICAL SEAL

Rotating Assembly

- a. Make sure the shaft is free of burrs that might cut or nick the O-rings. Put a light film of grease on the shaft between the rotor and the shaft threads to facilitate seal installation.
- b. Slide the mechanical seal rotating assembly (153B & 153E) over the shaft with the drive tangs of the jacket towards the rotor, and the polished face outward.
- c. Rotate the jacket assembly to engage the drive tangs into the rotor slots. **IMPORTANT:** Failure to engage the drive tangs of the jacket assembly will cause seal damage when the hub is attached.
- d. Clean the rotating seal face with a clean tissue and alcohol.

Stationary Seat

- a. Put a light coating of grease in the seal recess of the hub.
- b. Align the locating pin in the stationary seat (153A) with the slot in the bottom of the hub recess.
- c. Insert the stationary seat (153A) and O-ring (153D) into the seal recess with the polished face outward.
- d. Clean the polished face of the stationary seat with tissue paper and alcohol.

NOTE: Apply a light grease or suitable lubricant on bronze seal faces during assembly.

9. HUB ASSEMBLY

- a. Before installing the second hub assembly, grease the three (3) head chamfers.
- b. Install the hub O-rings (72A & 72B), and slide the hub onto the shaft with the V-notch of the hub towards the bottom of the pump. Use extreme care to avoid damage to the seal face.
- c. Install and hand tighten the two (2) hub capscrews (21D) to pull the hub into place.

10. BEARING AND BEARING SPACER

- a. Hand pack the bearing with grease. Use Standard Oil Company - Amolith All Weather Grease, or an equivalent grease compatible with the pump elastomers and the application.
- b. Insert the greased bearing (24) into the bearing housing of the hub. Tap the outer edge of the bearing to ensure that it is properly seated.
- c. Slide the bearing spacer (24D) onto the shaft.

11. Return to the first head assembly and remove and reassemble the hub, this time including the mechanical seal and O-rings (see step 8 for mechanical seal instructions). 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.

12. LOCKNUT ADJUSTMENT

The purpose of the bearing locknuts and lockwashers is to center and maintain the pump rotor between the discs. Overtightening the locknuts can cause bearing failure or a broken lockwasher tang "A" (see Figure 8). Loose locknuts will allow the rotor to shift against the discs, causing excessive wear.

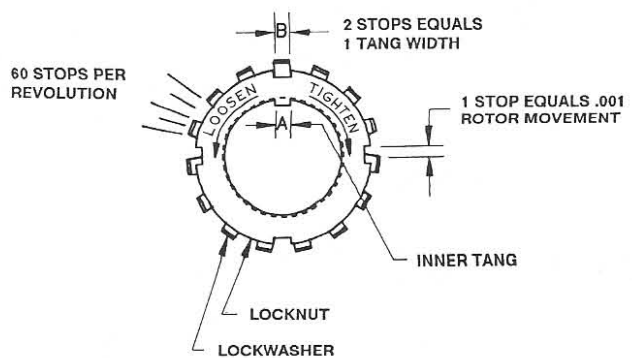


Figure 8 - Locknut Assembly

- a. Install the lockwashers (24B) with the tangs facing outward, and the locknuts (24A) with the tapered face inward. Be sure the inner tang "A" does not slip out of the tang slot in the shaft threads. Bend the tang toward the slot if necessary.
- b. Tap the outer edge of the bearings on both ends. Using a spanner wrench, tighten both locknuts to be sure that the bearings are bottomed in the head recess. **CAUTION:** Overtightening the locknuts will bend or shear the inner tang.
- c. Loosen both locknuts one complete turn.
- d. Tighten one locknut until a slight rotor drag is felt when turning the shaft by hand.
- e. Back off the nut the width of one lockwasher tang "B" (see Figure 8), or two stops. Secure the locknut by bending the closest aligned lockwasher tang into the locknut slot. The pump should now turn freely when rotated by hand.
- f. Tighten the other locknut by hand until it is snug against the bearing and the bearing is firmly seated in the head recess. With a spanner wrench, tighten the nut the width of one lockwasher tang "B," or two stops. 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.
- g. 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 should be alternately loosened one stop, or 0.001" (0.025mm), at a time until the washer can be moved. Start with the last adjusted nut.

13. GREASE SEAL

If the grease seal (104) 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 cavity of the bearing cover so that the lip of the seal will face inward (towards the pump) when the cover is attached.

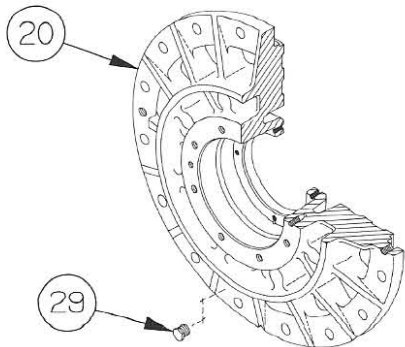
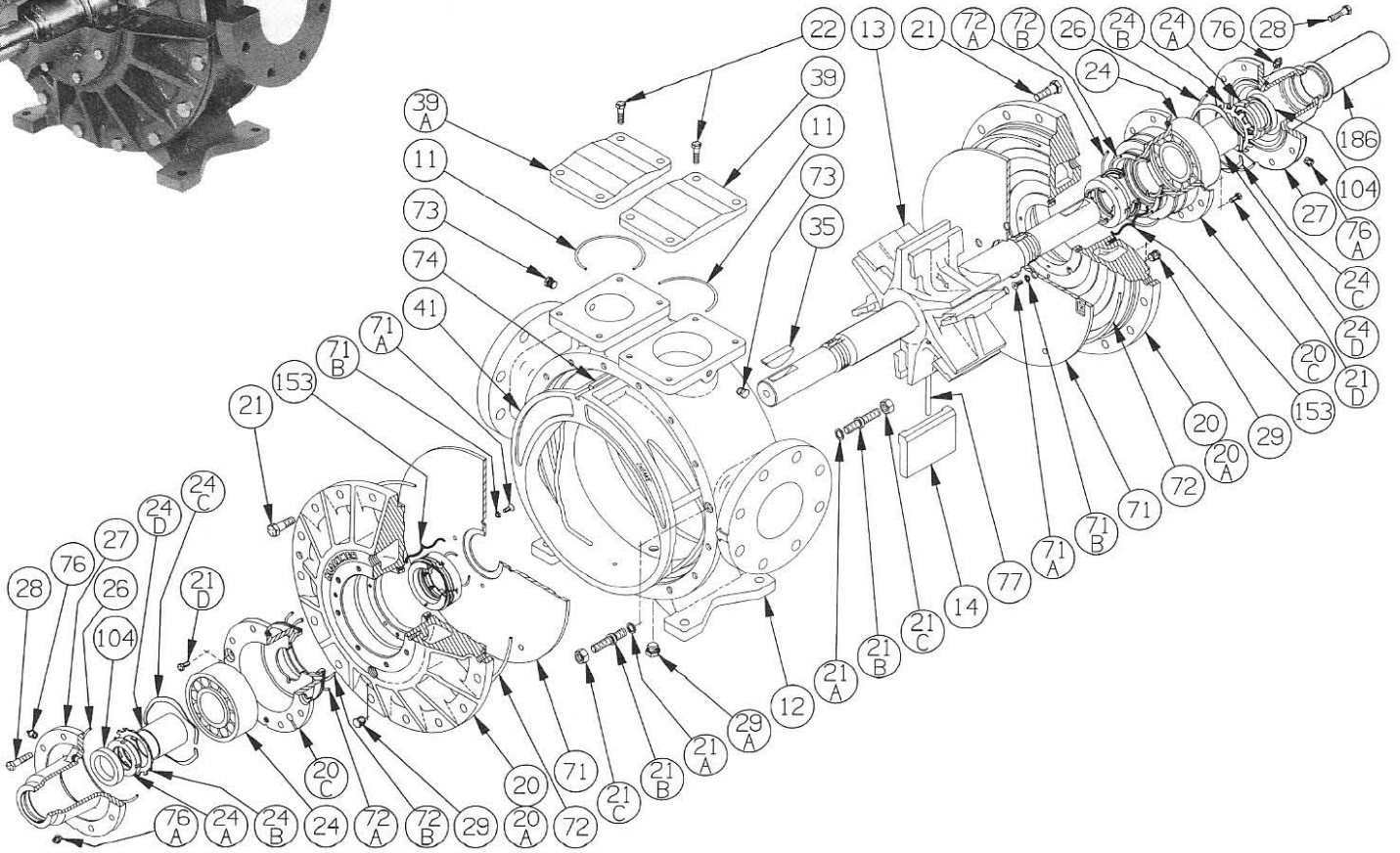
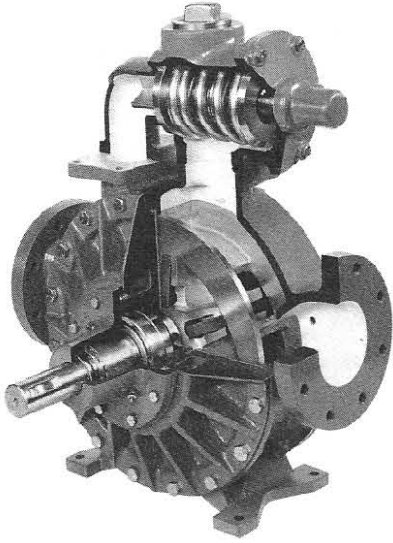
16. BEARING COVER

Place the bearing preload wave spring (24C) against the outer bearing race. Install a bearing cover O-ring (26) into the groove in the bearing cover (27) and slide the cover over the shaft with the V-notch down. Install and tighten the bearing cover capscrews (28).

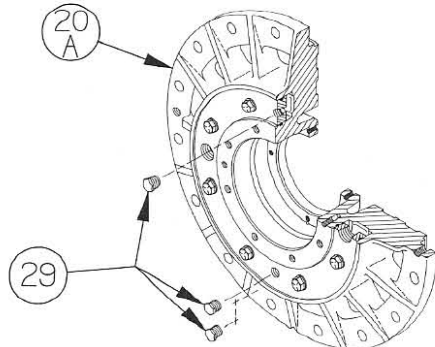
CAUTION: The pump **MUST NOT** be operated without the bearing covers bolted into place.

NOTES

PARTS LIST: MLX4A, MLX4A-CS



CAST STEEL HEAD



CAST STEEL JACKETED HEAD

PARTS LIST: MLX4A, MLX4A-CS

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.	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	27	Bearing Cover	2	046900	046904
	O-Ring - Blanking Plate/Valve (Viton)		701991	701991	28	Capscrews - Bearing Cover & Hub	16	920369	920369
	O-Ring - Blanking Plate/Valve (Teflon)		702066	702066	29	Drain Plug - Head	2 - 3	908198	908198
12	Casing - Raised Face Flanges	1	.....	016902	29A	Drain Plug - Casing	1	908207	908207
	Casing - Flat Face Flanges		016900	.....	35	Key - Shaft	1	909136	909136
13	Rotor & Shaft (Std.) (Includes Ref. Nos. 24A & 24B)	1	266905	266905	39	Blanking Plate (Inlet)	1	496900	496902
	Rotor & Shaft (Chrome Oxide Shaft) (Includes Ref. Nos. 24A & 24B)		266906	266906	39A	Blanking Plate (Discharge)	1	496901	496904
14	Vane - Maxvane (Std.)	6	096200	096200	41	Liner (Std.)	1	186915	186915
	Vane - EC Maxvane		096201	096201		Liner (Hardened)		186916	186916
	Vane - Laminate		096960	096960		Lower Displacement Liner ¹		186917	186917
	Vane - EC Laminate		096961	096961		Lower Displacement Liner (Hardened)		186918	186918
	Vane - Ductile Iron		096962	096962	71	Disc (Std.)	2	066902	066902
	Vane - EC Ductile Iron		096963	096963		Disc (Hardened)		066903	066903
	Vane - Bronze		096966	096966	71A	Machine Screw - Disc	8	920007	920007
	Vane- EC Bronze		096967	096967	71B	Lockwasher - Disc	8	909622	909622
	Vane - Hardened Ductile Iron		096964	096964	72	O-Ring - Head (Buna-N) (Std.)	2	702050	702050
	Vane - EC Hardened Ductile Iron		096965	096965		O-Ring - Head (Viton)		702058	702058
20	Head (Std.)	2	036918	037002	72A	O-Ring - Head (Teflon)	2	702069	702069
20A	Jacketed Head	2	036919	037003		O-Ring (Large) - Hub (Buna-N) (Std.)	2	702057	702057
20C	Hub	2	036952	036956		O-Ring (Large) - Hub (Viton)	2	702059	702059
21	Capscrews - Head	28	920510	920510	72B	O-Ring (Large) - Hub (Teflon)	2	702068	702068
21A	Gasket - Head Stud	4	701981	701981		O-Ring (Small) - Hub (Buna-N) (Std.)	2	702027	702027
21B	Stud - Head	4	921569	921569		O-Ring (Small) - Hub (Viton)	2	702060	702060
21C	Nut - Head Stud	4	922850	922850	73	O-Ring (Small) - Hub (Teflon)	2	702065	702065
21D	Capscrews - Hub	4	920128	920128		Gage Plug	2	908198	908198
22	Capscrews - Blanking Plate/Valve	8	920457	920457	74	Key - Liner	1	186902	186902
24	Roller Bearing	2	903252	903252	76	Grease Fitting	2	317815	317815
24A	Locknut - Bearing	2	903543	903543	76A	Grease Relief Fitting	2	701992	701992
24B	Lockwasher - Bearing	2	903544	903544	77	Push Rod (Std.)	3	126901	126901
24C	Wave Spring - Bearing	2	903546	903546		Push Rod (Lower Displacement) ¹		126902	126902
24D	Spacer - Bearing	2	903547	903547	104	Grease Seal	2	331907	331907
26	O-Ring - Bearing Cover (Buna-N) (Std.)	2	702061	702061	186	Shaft Protector	1	346902	346902
	O-Ring - Bearing Cover (Viton)		702062	702062	Conversion Kit - MLX to MLN	896903	.....	
	O-Ring - Bearing Cover (Teflon)		702067	702067	Conversion Kit - MLX to MLG	896904	.....	

EC = Extra-Clearance

¹High Pressure Option (to 225 psi).

Note: 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.

INTERCHANGEABILITY WITH OBSOLETE MLX4, MLX4-CS

MLX4A, MLX4A-CS	Interchangeability with MLX4, MLX4-CS
PART NAME	REFERENCE
Rotor & Shaft	a
Liner	b
Vanes	c
Push Rods	d
Heads	c
Discs	c

REFERENCE:

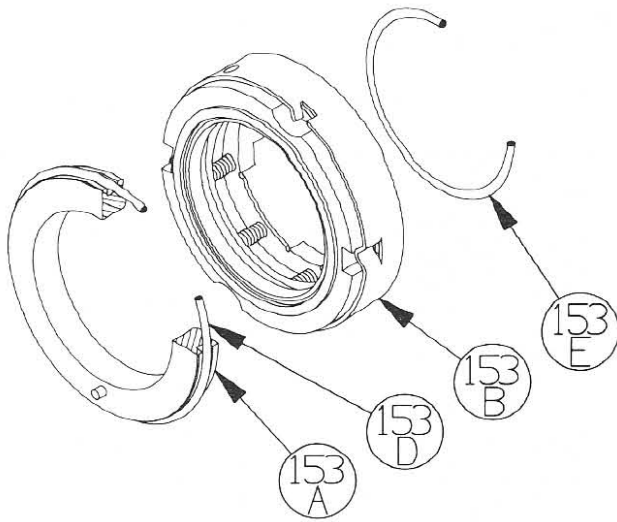
a = Interchangeable but requires new vanes.

b = Interchangeable but requires new push rods.

c = Interchangeable.

d = Interchangeable but requires new liner (consult factory).

Note, if pump is equipped with obsolete liner (p/n 186900 or 186911), obsolete push rods (p/n 126900) must be used.



MLX4 MECHANICAL SEAL - STANDARD

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

MLX4 MECHANICAL SEAL - OPTIONAL

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

MLX4 MECHANICAL SEAL - OPTIONAL

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

MLX4 MECHANICAL SEAL - OPTIONAL

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 Bronze Seal Face	2	337001
153D	O-Ring - Stationary (Buna-N)	2	701934
153E	O-Ring - Rotating (Buna-N)	2	701933

MLX4 MECHANICAL SEAL - OPTIONAL

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 Bronze Seal Face	2	337001
153D	O-Ring - Stationary (Viton)	2	701921
153E	O-Ring - Rotating (Viton)	2	701967

MLX4 MECHANICAL SEAL - OPTIONAL

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 Bronze Seal Face	2	337001
153D	O-Ring - Stationary (Teflon)	2	702056
153E	O-Ring - Rotating (Teflon)	2	702055

MLX4 MECHANICAL SEAL - OPTIONAL

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

MLX4 MECHANICAL SEAL - OPTIONAL

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 Ceramic Seal Face	2	337002
153D	O-Ring - Stationary (Viton)	2	701921
153E	O-Ring - Rotating (Viton)	2	701967

MLX4 MECHANICAL SEAL - OPTIONAL

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 Ceramic Seal Face	2	337002
153D	O-Ring - Stationary (Teflon)	2	702056
153E	O-Ring - Rotating (Teflon)	2	702055

MLX4 MECHANICAL SEAL - OPTIONAL

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

MLX4 MECHANICAL SEAL - OPTIONAL

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

MLX4 MECHANICAL SEAL - OPTIONAL

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

MAINTENANCE

B. PUMP MODELS: MLN4A, MLN4A-CS

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

LUBRICATION

Sleeve bearings (bushings) are lubricated by the liquid being pumped. Additional lubrication is not required.

Blackmer gear reducers are shipped from the factory without oil in the gearcase. Fill with the grade of oil indicated on the reducer tag. The oil should be changed after the first 48 hours of use, and approximately every 500 hours of use thereafter.

REPLACING VANES ONLY

1. Remove the head assembly and all other parts on the outboard (non-driven) side of the pump (see "Pump Disassembly").
2. Turn the shaft by hand until a vane (14) comes to the top (12 o'clock) position of the rotor.
3. Remove and replace the vane, making sure to install the vane with the rounded edge outward to contact the liner.
4. Rotate the shaft until the next rotor slot is in the top position, and replace the vane.
5. Continue this procedure until all new vanes are in place.
6. Reassemble the pump as instructed in "Pump Assembly."

PUMP DISASSEMBLY

Before work is started on the pump, make sure the pressure is relieved, and the liquid is drained. During disassembly, be careful of sharp edges on worn or damaged parts.

NOTE: The numbers in parentheses following individual parts indicate reference numbers on the coinciding Parts List.

1. On the outboard (non-driven) side of the pump, remove the hub capscrews (21D). To disengage the outboard hub assembly (20C) from the head, two jack screw holes are provided in the rim of the hub. Slide the hub assembly off the shaft with the shaft cover still intact. **NOTE:** The sleeve bearing (24) is press fit into the hub and should not be removed unless replacement is necessary (see "Sleeve Bearings").
 2. Remove the two (2) shaft cover capscrews (28) to release the shaft cover (27) and O-ring (26) from the hub assembly.
 3. On the opposite (inboard) end of the pump, clean the pump shaft thoroughly, making sure the shaft is free of nicks, burrs, or paint that might damage the packing or mechanical seal when the inboard hub is removed.
- #### 4. PUMPS EQUIPPED WITH PACKING
- a. Back off the packing removal nuts (18A) to reduce packing friction.
 - b. Remove the inboard hub capscrews (21D). Two jack screw holes are provided in the rim of the inboard hub to facilitate removal.
 - c. Slide the packing follower (75) and hub assembly (20C) together off the shaft.
 - d. Remove the packing follower removal nuts (18) and pull the follower out of the hub assembly.
 - e. The packing rings (19) and packing washer (58) can be pulled from the inboard hub with the use of a corkscrew tool or screw-driver.

NOTE: The sleeve bearing is press fit into the hub assembly and should not be removed unless replacement is necessary (see "Sleeve Bearings").

5. PUMPS EQUIPPED WITH A MECHANICAL SEAL

On pumps equipped with a **Blackmer Mechanical seal**, a seal follower is used in place of the packing follower, and a seal housing is used to hold the stationary seat of the the mechanical seal in place.

- a. Remove the two seal follower capscrews (16) to release the seal follower (126) from the housing.
- b. Pull the mechanical seal housing (153F) from the hub. The stationary seat and its O-ring (153A & 153D) will come off with the housing and can be pried loose with the fingers.
- c. Pull the rotating half of the seal (seal jacket, rotating face, and rotating O-ring) (153C, 153B, 153E) from the shaft as a complete unit.
- d. Remove the hub capscrews (21D). To disengage the hub assembly from the head, two jack screw holes are provided in the rim of the hub. Slide the hub assembly off the shaft.

NOTE: On pumps equipped with a **commercial mechanical seal**, loosen all setscrews before removing the hub assembly. For further instructions on the disassembly and assembly of commercial mechanical seals, refer to the separate literature accompanying the mechanical seal.

6. Remove the head capscrews (21) and head stud nuts (21C). Two jack screw holes are provided in the rim of the head to facilitate removal.
7. Remove the head (20 or 20A) from the casing, being careful not to nick or scrape the shaft.
8. The disc (71) will come off with the head assembly and is attached with four (4) countersunk, allen-head machine screws (71A) and lockwashers (71B).
9. From the open side of the pump, grasp the rotor in the 3 and 9 o'clock positions, and gently pull the rotor and shaft (13) out of the head assembly remaining on the casing. **CAUTION:** Use care to avoid injury—the rotor and shaft is heavy and may have sharp edges.
10. The remaining head assembly can now be easily removed. Follow steps 6 through 8.
11. Depending on the pump application, the liner (41) can be removed in two ways:
 - a. If the pumpage is a clean, non-corrosive liquid, with low viscosity, the liner can usually be withdrawn from the casing by prying with two 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. Use a block under the bar, against the rotor, to bring the liner the rest of the way out (see Figure 5).

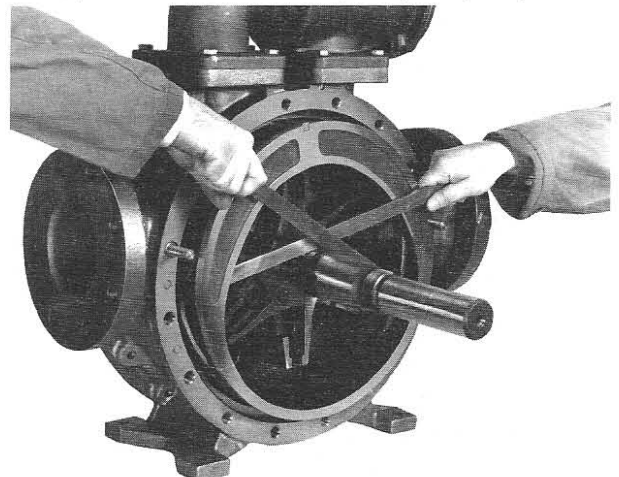


Figure 5 - Liner Removal

MAINTENANCE: MLN4A, MLN4A-CS

- b. 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 the casing, rather than pried out. To do so, use a brass or hard wood drift and a hammer and tap around the diameter of the liner until it is driven out of the casing.

PARTS REPLACEMENT

1. If any of the O-rings have been removed or disturbed during disassembly, it is recommended they be replaced with new O-rings. **NOTE:** Teflon O-rings should be heated in hot water to aid installation.
2. Excessive or continuous leakage around the pump shaft may be an indication of a damaged mechanical seal, worn packing, or a damaged or worn sleeve bearing.
 - a. If a mechanical seal has been leaking, it is recommended the entire seal be replaced. Refer to "General Pump Troubleshooting" for possible causes of seal leakage.
 - b. If the packing is leaking excessively refer to "Packing Adjustment." If this does not solve the problem, a complete new set of packing rings should be installed.
 - c. If the pump shaft indicates an excessive amount of radial "play," the sleeve bearing in the hub should be replaced.

PUMP ASSEMBLY

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

1. LINER

The liner has a close fit with the casing, and care should be taken to avoid finger injury during installation.

- a. Align and start the liner (41) and liner key (74) together into the pump casing. The word "INTAKE," which is cast into the liner, must be towards the intake side of the pump. **NOTE:** The intake port is marked with an inward facing arrow.
- b. Lightly tap the outer edge of the liner with a plastic or lead hammer to fully insert it into the casing.

2. DISC

Before the disc is attached to the head, check to make sure both surfaces are clean and smooth. Gently file away any protruding burrs or rough spots.

- a. Place a disc (71) on the head (20 or 20A) with the counter-bored screw holes facing up.

- b. Position the disc so that when the head is mounted with the drain hole and V-notch down, the word "INTAKE" on the disc will be towards the intake side of the pump. The two disc holes should be in the 2 and 4 o'clock positions if the inlet is on the right (see Figure 6).
- c. Install the four (4) lockwashers (71B), tangs outward, and machine screws (71A) to attach the disc to the head.

3. HEAD ASSEMBLY

- a. To mount the head assembly to the casing, first install the head O-ring (72) in the groove formed where the disc meets the head.
- b. Grease the entire chamfer on the pump casing where the head O-ring will need to slide into position.
- c. Place the head assembly (20 or 20A) on the studs, with the V-notch and drain hole facing down (towards the bottom of the pump).
- d. Check to make sure the word "INTAKE" on the disc is towards the intake side of the pump when the head is mounted.
- e. Install and tighten the two (2) nuts (21C) on the head studs.
- f. Install and tighten the head capscrews (21) uniformly, making sure the head O-ring slides into place without damage.

4. SLEEVE 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.

- a. To aid installation, heat the hub in an oven at 200°F (93°C) before installing the bearing.
- b. Place the bearing in the bearing bore on the inside face of the hub with the tapered end inward.
- c. Using an arbor press, press the bearing into the hub in one continuous motion, until it is flush with (or slightly below) the inside face of the hub. Starting and stopping the pressing motion may result in a cracked bearing.

5. HUB ASSEMBLY

- a. Before attaching the hub assembly to the mounted head, grease the three (3) head chamfers.
- b. Install the hub O-rings (72A & 72B), and slide the hub onto the shaft with the V-notch of the hub towards the bottom of the pump.
- c. Install and tighten the two (2) hub capscrews (21D) to pull the hub into place. **BEGIN WORKING ON THE OPPOSITE SIDE OF THE PUMP.**

6. ROTOR AND SHAFT

It is necessary to install the bottom vanes and the push rods in the rotor while inserting the rotor and shaft into the pump casing.

- a. Partially install the rotor and shaft into the open side of the pump and through the bore of the installed head. Be careful not to damage the disc face with the shaft end. **NOTE:** When installing the rotor and shaft, the rotation arrow on the rotor must point in the direction of pump rotation – towards the discharge side of the pump when the arrow is positioned directly below the shaft. (Refer back to Figure 6.)
- b. 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 (77) are inserted (see Figure 7).
- c. The rotor and shaft, with the three bottom vanes installed, can now be fully inserted into the casing.
- d. Install the remaining vanes in the top positions of the rotor.

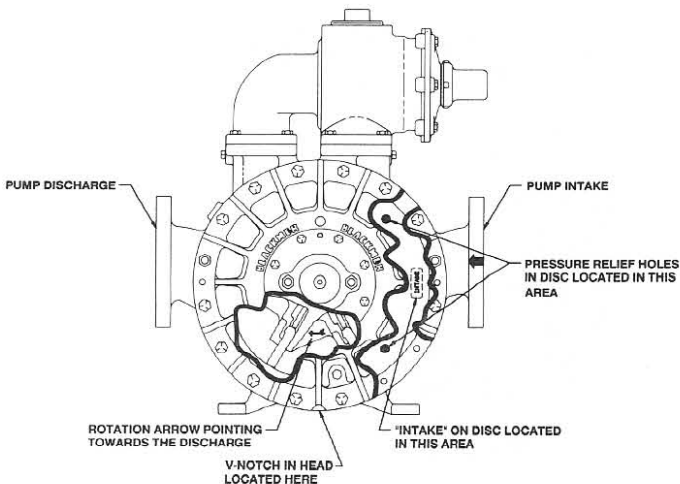


Figure 6

MAINTENANCE: MLN4A, MLN4A-CS

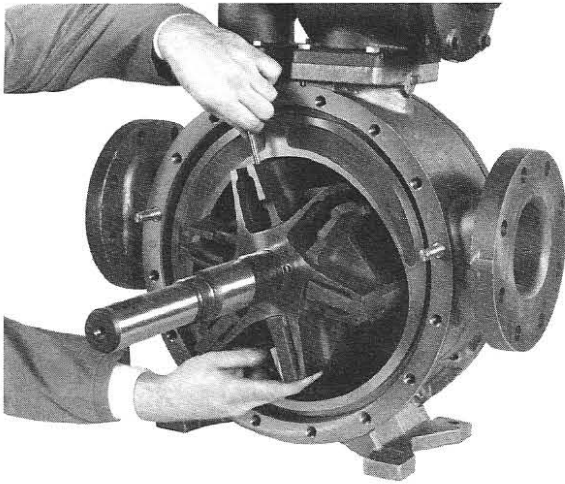


Figure 7

7. Follow steps 2 through 5 to install the remaining head and hub assemblies. Remember to grease the casing chamfer and the three (3) head chamfers.

8. PACKING AND PACKING FOLLOWER

When necessary to repack, 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.

- a. Insert the packing washer (58) into the stuffing box of the inboard hub.
- b. Insert each the packing rings (19) separately into the stuffing box, using the packing follower (75) to properly seat each ring after placement. Be sure to stagger the split joints approximately 180 degrees apart so that they are not overlapping or near the joint of the preceding ring.
- c. After the packing rings are in place, install and tighten the two packing follower removal nuts (18A) against the hub.
- d. Place the packing follower (75) snugly against the packing. Install the two packing follower stud nuts (18) and **tighten lightly**.

NOTE: Adjustment to the packing follower should be made while pumping liquid (see "Packing Adjustment").

9. PACKING ADJUSTMENT

It is important that the packing be properly adjusted to prevent overheating.

- a. While the liquid is being pumped, uniformly tighten the packing follower stud nuts (18) a very small amount at a time.

- b. Check the stuffing box temperature several minutes after each adjustment for signs of overheating.
- c. Adjust the nuts until leakage is controlled, and no excess heat develops. **NOTE:** Some leakage is desirable to lubricate the packing, but in some cases is unacceptable, depending on the application.

10. BLACKMER MECHANICAL SEAL (if equipped)

Rotating Assembly

- a. On the **inboard end** (driven end) of the pump, make sure the shaft is free of burrs that might cut or nick the O-rings. Use a fine emory cloth to remove burrs and smooth the shaft keyway edges. Put a light film of grease on the shaft and O-ring chamfers to facilitate seal installation.
- b. Slide the rotating half of the mechanical seal, including the seal jacket, the rotating face and rotating O-ring (153C, 153B & 153E) over the shaft with the drive tangs of the jacket towards the rotor, and the polished face outward.
- c. Rotate the jacket assembly to engage the drive tangs in the keyway of the shaft threads.
- d. Clean the rotating seal face with a clean tissue and alcohol.

Stationary Seat

- a. Lightly grease the stationary seat cavity in the seal housing (153F).
- b. Insert the stationary seat and O-ring (153A & 153D) into the seal housing with the polished face inward (locating pin outward). Be careful not to contaminate the seal face with grease. Use a tissue paper and alcohol to clean the seal face if necessary.
- c. Lightly grease the inboard hub cavity, and insert the seal housing.
- d. Place the seal follower (126) against the housing, making sure to engage the locating pin of the stationary seat with the hole in the follower.
- e. Install and tighten the seal follower capscrews (16).

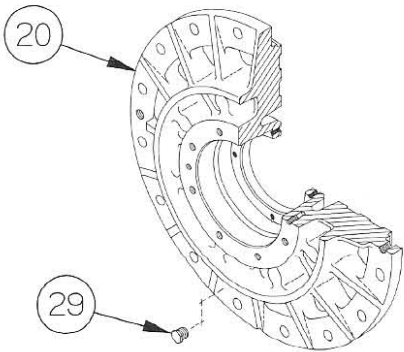
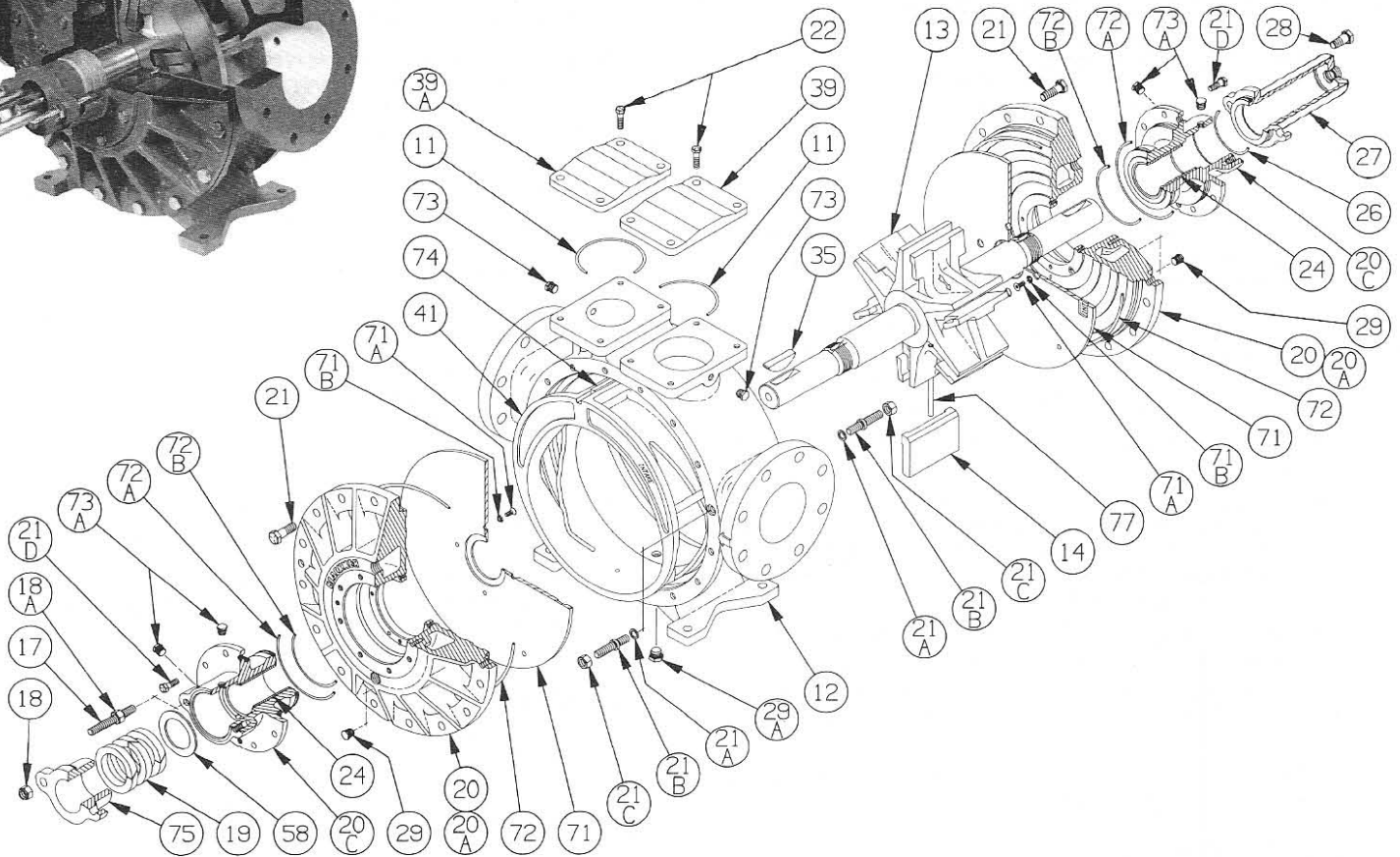
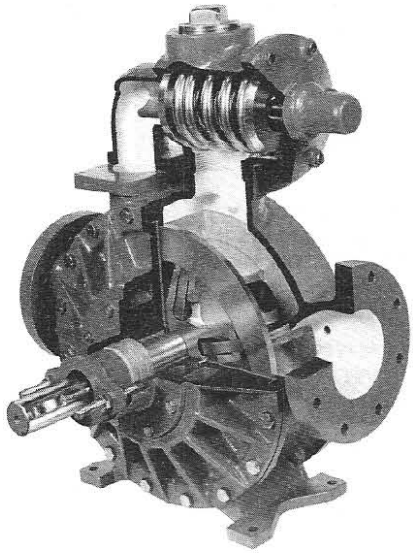
11. COMMERCIAL MECHANICAL SEAL

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

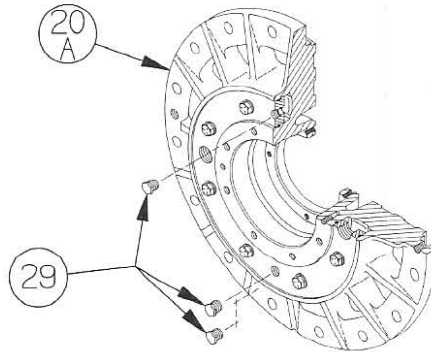
12. SHAFT COVER

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

PARTS LIST: MLN4A, MLN4A-CS



CAST STEEL HEAD



CAST STEEL JACKETED HEAD

PARTS LIST: MLN4A, MLN4A-CS

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.	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	26	O-Ring - Shaft Cover (Teflon)	1	702064	702064
	O-Ring - Blanking Plate/Valve (Viton)		701991	701991	27	Shaft Cover (Outboard)	1	046902	046912
	O-Ring - Blanking Plate/Valve (Teflon)		702066	702066	28	Capscrews - Shaft Cover	2	920495	920495
12	Casing - Raised Face Flanges	1	.....	016902	29	Drain Plug - Head	2	908198	908198
	Casing - Flat Face Flanges		016900	.....	29A	Drain Plug - Casing	1	908207	908207
13	Rotor & Shaft (Std.)	1	266905	266905	35	Key - Shaft	1	909136	909136
	Rotor & Shaft (Chrome Oxide Shaft)		266906	266906	39	Blanking Plate (Inlet)	1	496900	496902
14	Vane - Maxvane (Std.)	6	096200	096200	39A	Blanking Plate (Discharge)	1	496901	496904
	Vane - EC Maxvane		096201	096201	41	Liner (Std.)	1	186915	186915
	Vane - Laminate		096960	096960		Liner (Hardened)		186916	186916
	Vane - EC Laminate		096961	096961		Lower Displacement Liner		186917	186917
	Vane - Ductile Iron		096962	096962		Lower Displacement Liner (Hardened)		186918	186918
	Vane - EC Ductile Iron		096963	096963	58	Packing Washer	1	356905	356905
	Vane - Bronze		096966	096966	71	Disc (Std.)	2	066902	066902
	Vane - EC Bronze		096967	096967		Disc (Hardened)		066903	066903
	Vane - Hardened Ductile Iron		096964	096964	71A	Machine Screw - Disc	8	920007	920007
	Vane - EC Hardened Ductile Iron		096965	096965	71B	Lockwasher - Disc	8	909622	909622
17	Packing Follower Stud	2	921580	921580	72	O-Ring - Head (Buna-N) (Std.)	2	702050	702050
18	Locknut - Stud	2	922420	922420		O-Ring - Head (Viton)		702058	702058
18A	Removal Nut - Packing Follower	2	922850	922850		O-Ring - Head (Teflon)		702069	702069
19	Packing Set (Std.)	1	326900	326900	72A	O-Ring (Large) - Hub (Buna-N) (Std.)	2	702057	702057
20	Head (Std.)	2	036918	037002		O-Ring (Large) - Hub (Viton)		702059	702059
20A	Jacketed Head	2	036919	037003		O-Ring (Large) - Hub (Teflon)		702068	702068
20C	Hub & Bushing Assembly (Carbon)	2	036950	036954		72B		O-Ring (Small) - Hub (Buna-N) (Std.)	2	702027	702027
	Hub & Bushing Assembly (Bronze)		036953	036955	O-Ring (Small) - Hub (Viton)		702060	702060	
21	Capscrews - Head	28	920510	920510		O-Ring (Small) - Hub (Teflon)		702065	702065
21A	Gasket - Head Stud	4	701981	701981	73	Gage Plug	2	908198	908198
21B	Stud - Head	4	921569	921569	73A	Plug - Hub	4	908198	908198
21C	Nut - Head Stud	4	922850	922850	74	Key - Liner	1	186902	186902
21D	Capscrews - Hub	16	920331	920331	75	Packing Follower	1	146905	146906
22	Capscrews - Blanking Plate/Valve	8	920457	920457	77	Push Rod (Std.)	3	126901	126901
24	Sleeve Bearing (Carbon)	2	166900	166900		Push Rod (Lower Displacement)		126902	126902
	Sleeve Bearing (Bronze)		166901	166901		Conversion Kit - MLN to MLX		896902	.....
26	O-Ring - Shaft Cover (Buna-N)(Std.)	1	701939	701939		Conversion Kit - MLN to MLG		896904	.....
	O-Ring - Shaft Cover (Viton)		711930	711930					

EC = Extra-Clearance

Note: 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.

INTERCHANGEABILITY WITH OBSOLETE MLN4, MLN4-CS

MLN4A, MLN4A-CS	Interchangeability with MLN4, MLN4-CS
PART NAME	REFERENCE
Rotor & Shaft	a
Liner	b
Vanes	c
Push Rods	d
Heads	c
Discs	c

REFERENCE:

a = Interchangeable but requires new vanes.

b = Interchangeable but requires new push rods.

c = Interchangeable.

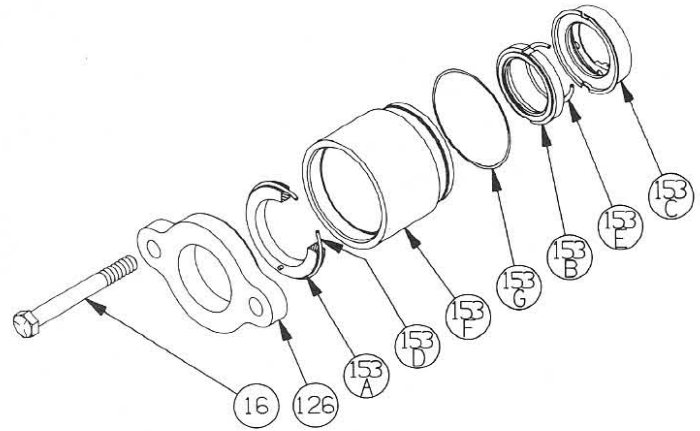
d = Interchangeable but requires new liner (consult factory).

Note, if pump is equipped with obsolete liner (p/n 186900 or 186911), obsolete push rods (p/n 126900) must be used.

MLN4 BLACKMER MECHANICAL SEAL - OPTIONAL

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
153	Mechanical Seal Assembly	1	337019	337019
153A	Stationary Seat (Hardened Steel)	1	332005	332005
153B	Seal Face (Carbon)	1	331867	331867
153C	Jacket Assembly	1	331886	331886
153D	O-Ring - Stationary (Buna-N)	1	701934	701934
153E	O-Ring - Rotating (Buna-N)	1	711912	711912
153F	Seal Housing	1	336987*	336987*
153G	O-Ring - Seal Housing (Buna-N)	1	701900	701900
126	Seal Follower	1	146902*	146912*
16	Capscrews - Seal Follower	2	920569*	920569*

*Parts not included in Mechanical Seal Assembly



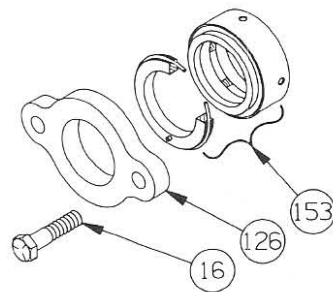
MLN4 BLACKMER MECHANICAL SEAL - OPTIONAL

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
153	Mechanical Seal Assembly	1	337020	337020
153A	Stationary Seat (Hardened Steel)	1	332005	332005
153B	Seal Face (Carbon)	1	331867	331867
153C	Jacket Assembly	1	331886	331886
153D	O-Ring - Stationary (Viton)	1	701921	701921
153E	O-Ring - Rotating (Viton)	1	711962	711962
153F	Seal Housing	1	336987*	336987*
153G	O-Ring - Seal Housing (Viton)	1	701901	701901
126	Seal Follower	1	146902*	146912*
16	Capscrews - Seal Follower	2	920569*	920569*

*Parts not included in Mechanical Seal Assembly

MLN4 COMMERCIAL MECHANICAL SEAL - OPTIONAL

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
153	Single Mechanical Seal Asy. Crane Type 9 (59U)	1	337022	337022
126	Seal Follower	1	146902	146912
16	Capscrews - Seal Follower	2	920495	920495

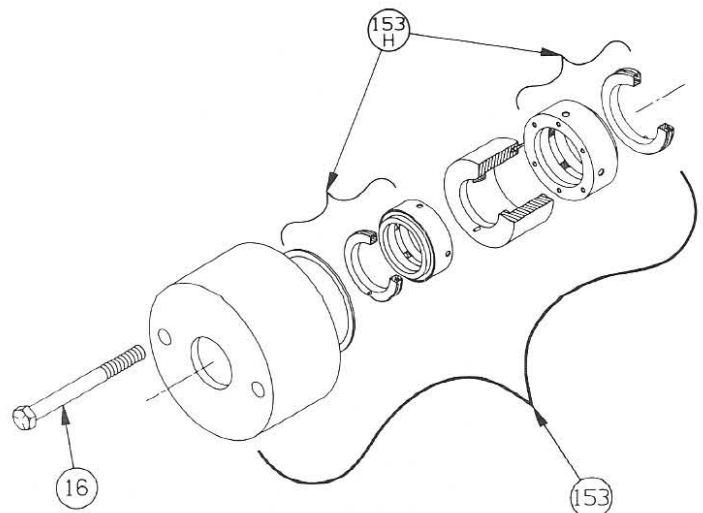


MLN4 COMMERCIAL MECHANICAL SEAL - OPTIONAL

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
153	Single Mechanical Seal Asy. Crane Type 8 (58U) (Viton O-Rings)	1	337023	337023
126	Seal Follower	1	146902	146912
16	Capscrews - Seal Follower	2	920495	920495

MLN4 COMMERCIAL MECHANICAL SEAL - OPTIONAL

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
153	Double Mechanical Seal Asy. Crane Type 9 (59U)	1	337025	337025
153H	Double Mechanical Seal Asy. (less seal follower & spacer)	1	337034	337034
16	Capscrews - Seal Follower	2	920569	920569



MLN4 COMMERCIAL MECHANICAL SEAL - OPTIONAL

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
153	Double Mechanical Seal Asy. Crane Type 8 (58U) (Viton O-Rings)	1	337024	337024
153H	Double Mechanical Seal Asy. (less seal follower & spacer)	1	337033	337033
16	Capscrews - Seal Follower	2	920569	920569

MAINTENANCE

C. PUMP MODEL: MLG4A

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

LUBRICATION

New pump bearings take approximately 2 to 6 hours to be "run-in" or "conditioned." The higher the pressure, the longer the time required. Make sure 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 MLG pump models. Many greases will cake up and prevent the proper flow of lubricant when used in automatic lubricators. The following greases are proven in this service. These greases can also be used for high temperature service:

**AMOCO RYCON PREMIUM HT
LUBRIPLATE NO. 930-AA
MOBILPLEX EP NO. 1**

The maximum 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.

REPLACING VANES ONLY

1. Remove the head assembly and all other parts on the outboard (non-driven) side of the pump (see "Pump Disassembly").
2. Turn the shaft by hand until a vane (14) comes to the top (12 o'clock) position of the rotor.
3. Remove and replace the vane, making sure to install the vane with the rounded edge outward to contact the liner.
4. Rotate the shaft until the next rotor slot is in the top position, and replace the vane.
5. Continue this procedure until all new vanes are in place.
6. Reassemble the pump as instructed in "Pump Assembly."

PUMP DISASSEMBLY

Before work is started on the pump, make sure the pressure is relieved, and the liquid is drained. During disassembly, be careful of sharp edges on worn or damaged parts.

NOTE: The numbers in parentheses following individual parts indicate reference numbers on the coinciding Parts List.

1. Clean the pump shaft thoroughly on both ends, making sure it is free of nicks and burrs.
2. On the outboard end of the pump, back off the gland removal nuts (18A) and remove the gland stud nuts (18).
3. Slide the gland and automatic lubricator assembly (75 & 76) from the hub. **NOTE:** The gland bearing is press fit and machined in the gland, and should not be removed. If bearing replacement is necessary, the entire gland assembly must be replaced.
4. The packing rings (19) and packing washer (58) can be pulled from the stuffing box with the use of a corkscrew tool or screwdriver. Be careful not to scratch the shaft.

5. Remove the gland assembly and packing from the opposite (in-board) hub.
6. Remove the hub capscrews (21D). To disengage the hub assembly (20C) from the head, two jack screw holes are provided in the rim of the hub. Slide the hub assembly off the shaft.
7. Remove the head capscrews (21) and head stud nuts (21C). Two jack screw holes are provided in the rim of the head to facilitate removal.
8. Remove the head (20 or 20A) from the casing, being careful not to nick or scrape the shaft.
9. The disc (71) will come off with the head assembly and is attached with four (4) countersunk, allen-head machine screws (71A) and lockwashers (71B).
10. From the open side of the pump, grasp the rotor in the 3 and 9 o'clock positions, and gently pull the rotor and shaft (13) out of the head assembly remaining on the casing. **CAUTION:** Use care to avoid injury—the rotor and shaft is heavy and may have sharp edges.
11. The remaining head and hub assemblies can now be easily removed. Follow steps 6 through 8.
12. Depending on the pump application, the liner (41) can be removed in two ways:
 - a. If the pumpage is a clean, non-corrosive liquid, with low viscosity, the liner can usually be withdrawn from the casing by prying with two 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. Use a block under the bar, against the rotor, to bring the liner the rest of the way out (see Figure 5).
 - b. 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 the casing, rather than pried out. To do so, use a brass or hard wood drift and a hammer and tap around the diameter of the liner until it is driven out of the casing.

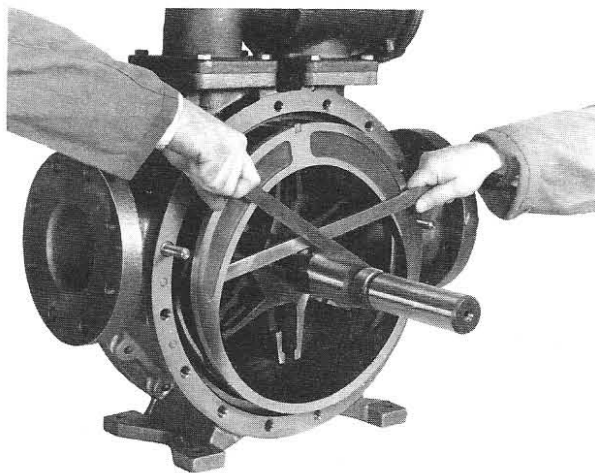


Figure 5 - Liner Removal

MAINTENANCE: MLG4A

PARTS REPLACEMENT

1. If any of the O-rings have been removed or disturbed during disassembly, it is recommended they be replaced with new O-rings. **NOTE:** Teflon O-rings should be heated in hot water to aid installation.
2. If the packing is leaking excessively refer to "Packing Adjustment." If this does not solve the problem, a complete new set of packing rings should be installed.

PUMP ASSEMBLY

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

1. LINER

The liner has a close fit with the casing, and care should be taken to avoid finger injury during installation.

- a. Align and start the liner (41) and liner key (74) together into the pump casing. The word "INTAKE," which is cast into the liner, must be towards the intake side of the pump. **NOTE:** The intake port is marked with an inward facing arrow.
- b. Lightly tap the outer edge of the liner with a plastic or lead hammer to fully insert it into the casing.

2. DISC

Before the disc is attached to the head, check to make sure both surfaces are clean and smooth. Gently file away any protruding burrs or rough spots.

- a. Place a disc (71) on the head (20 or 20A) with the counter-bored screw holes facing up.
- b. Position the disc so that when the head is mounted with the drain hole and V-notch down, the word "INTAKE" on the disc will be towards the intake side of the pump. The two disc holes should be in the 2 and 4 o'clock positions if the inlet is on the right (see Figure 6).
- c. Install the four (4) lockwashers (71B), tangs outward, and machine screws (71A) to attach the disc to the head.

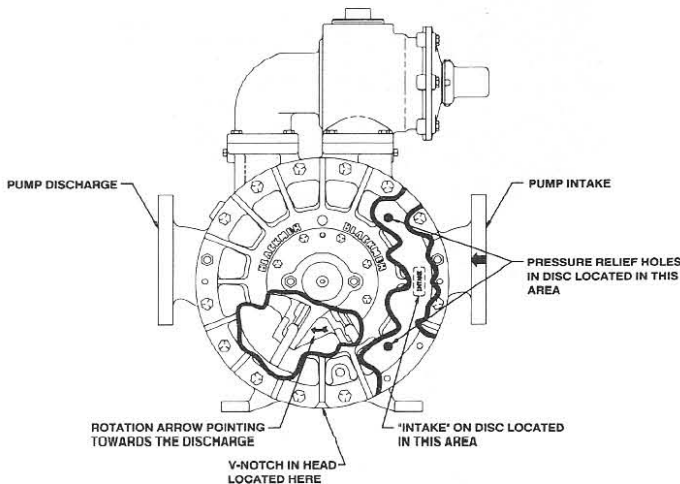


Figure 6

3. HEAD ASSEMBLY

- a. To mount the head assembly to the casing, first install the head O-ring (72) in the groove formed where the disc meets the head.
- b. Grease the chamfer on the pump casing where the head O-ring will need to slide into position.
- c. Place the head assembly (20 or 20A) on the studs, with the V-notch and drain hole facing down (towards the bottom of the pump).
- d. Check to make sure the word "INTAKE" on the disc is towards the intake side of the pump when the head is mounted.
- e. Install and tighten the two (2) nuts (21C) on the head studs.
- f. Install and tighten the head capscrews (21) uniformly, making sure the head O-ring slides into place without damage.

4. HUB ASSEMBLY

- a. Before attaching the hub assembly (20C) to the mounted head, grease the outer (largest) head chamfer.
- b. Install the hub O-ring (72A), and slide the hub onto the shaft with the V-notch of the hub towards the bottom of the pump.
- c. Install and tighten the two (2) hub capscrews (21D) to pull the hub into place. **BEGIN WORKING ON THE OPPOSITE SIDE OF THE PUMP.**

5. ROTOR AND SHAFT

It is necessary to install the bottom vanes and the push rods in the rotor while inserting the rotor and shaft into the pump casing.

- a. Partially install the rotor and shaft into the open side of the pump and through the bore of the installed head. Be careful not to damage the disc face with the shaft end. **NOTE:** When installing the rotor and shaft, the rotation arrow on the rotor must point in the direction of pump rotation—towards the discharge side of the pump when the arrow is positioned directly below the shaft. (Refer back to Figure 6.)
- b. 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 (77) are inserted (see Figure 7).
- c. The rotor and shaft, with the three bottom vanes installed, can now be fully inserted into the casing.
- d. Install the remaining vanes in the top positions of the rotor.

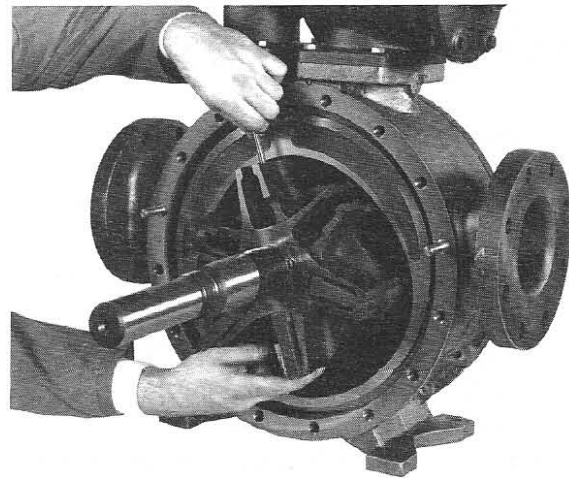


Figure 7

MAINTENANCE: MLG4A

6. Follow steps 2 through 4 to install the remaining head and hub assemblies. Remember to grease the casing chamfer and the outer (largest) head chamfer.

7. PACKING AND GLAND ASSEMBLY

When necessary to repack, 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. Follow this procedure for both the inboard and outboard stuffing boxes:

- a. Insert each of the packing rings (19) separately into the stuffing box, using the gland (75) to properly seat each ring after placement. Be sure to stagger the split joints approximately 180 degrees apart so that they are not overlapping or near the joint of the preceding ring.
- b. Insert the packing washer (58) into the stuffing box against the packing.
- c. After the packing washer and rings are in place, install and tighten the two gland removal nuts (18A) against the hub.
- d. Place the gland (75) snugly against the packing with the drain groove downward.
- e. Install the two gland stud nuts (18) and **tighten lightly**.
NOTE: If working on the outboard stuffing box, install the shaft protector (186) against the gland assembly before installing and tightening the stud nuts.

NOTE: Adjustment to the gland and packing should be made while pumping liquid (see "Packing Adjustment").

9. PACKING ADJUSTMENT

It is important that the packing be properly adjusted to prevent overheating.

- a. While the liquid is being pumped, uniformly tighten the gland stud nuts (18) a very small amount at a time.
- b. Check the stuffing box temperature several minutes after each adjustment for signs of overheating.
- c. Adjust the nuts until leakage is controlled, and no excess heat develops. **NOTE:** Some leakage is desirable to lubricate the packing, but in some cases is unacceptable, depending on the application.

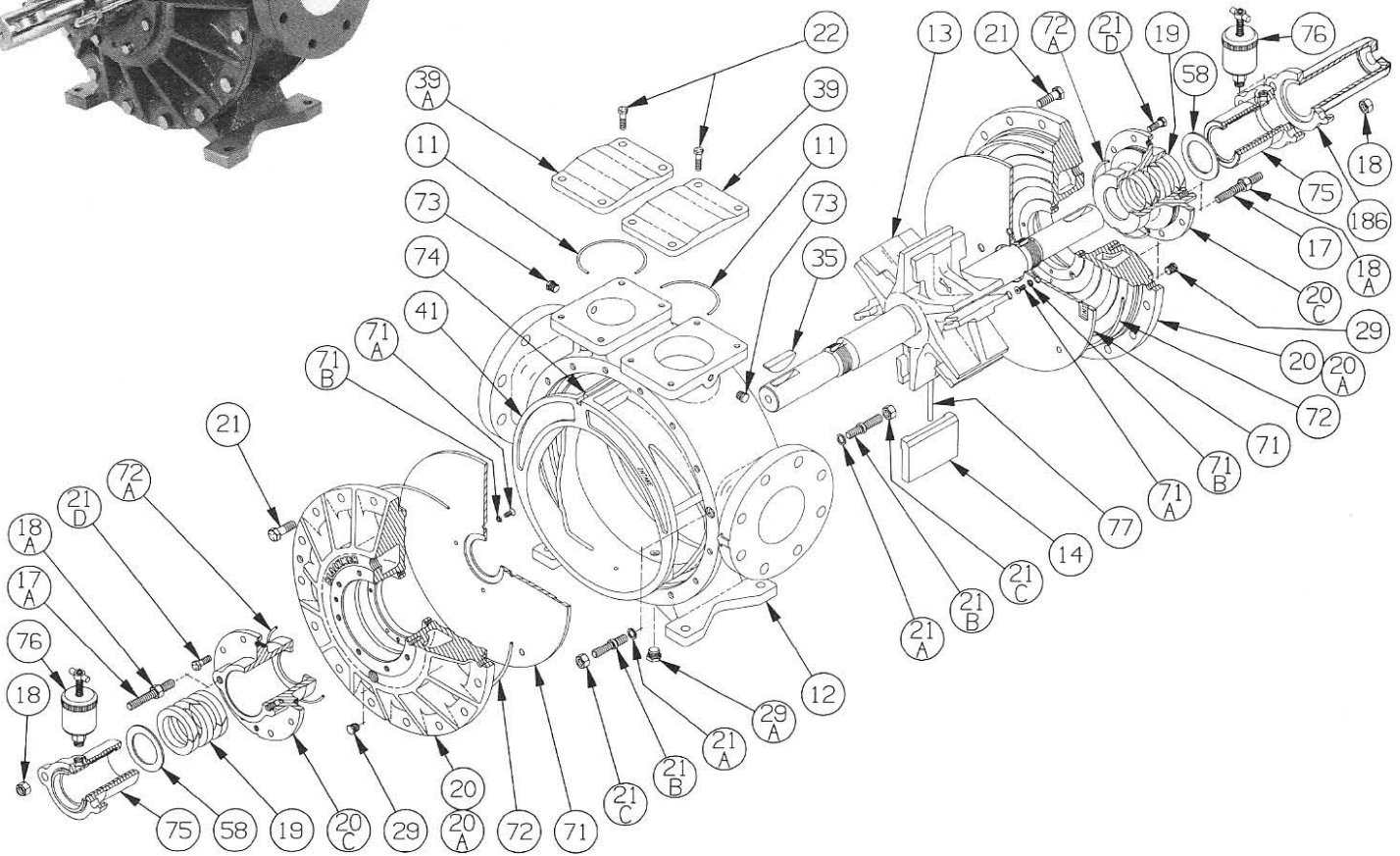
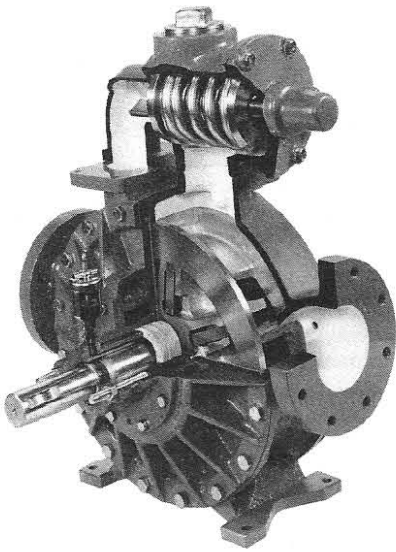
10. AUTOMATIC LUBRICATOR

Refer to "Lubrication" for the recommended grease. To fill the automatic (spring-loaded) lubricator:

- a. Back the wing nut all of the way out until it is touching the zerk fitting.
- b. 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.

NOTE: To maintain proper flow of lubrication to the bearing, adjust the 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.

PARTS LIST: MLG4A



PARTS LIST: MLG4A

REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	
11	O-Ring - Blanking Plate/Valve (Buna-N)(Std.)	2	701918	29	Drain Plug - Head	2	908198	
	O-Ring - Blanking Plate/Valve (Viton)		701991	29A	Drain Plug - Casing	1	908207	
	O-Ring - Blanking Plate/Valve (Teflon)		702066	35	Key - Shaft	1	909136	
12	Casing - Flat Face Flanges	1	016900	39	Blanking Plate (Inlet)	1	496900	
13	Rotor & Shaft (Std.)	1	266905	39A	Blanking Plate (Discharge)	1	496901	
	Rotor & Shaft (Chrome Oxide Shaft)		266906		Liner (Std.)	1	186915	
14	Vane - Maxvane (Std.)	6	096200	41	Liner (Hardened)		1	186916
	Vane - EC Maxvane		096201		Lower Displacement Liner		1	186917
	Vane - Laminate		096960		Lower Displacement Liner (Hardened)	1	186918	
	Vane - EC Laminate		096961	58	Packing Washer	2	356905	
	Vane - Ductile Iron		096962	71	Disc (Std.)	2	066902	
	Vane - EC Ductile Iron		096963		Disc (Hardened)	2	066903	
	Vane - Bronze		096966	71A	Machine Screw - Disc	8	920007	
	Vane- EC Bronze		096967	71B	Lockwasher - Disc	8	909622	
	Vane - Hardened Ductile Iron		096964		O-Ring - Head (Buna-N) (Std.)	2	702050	
	Vane - EC Hardened Ductile Iron		096965	72	O-Ring - Head (Viton)		702058	
					O-Ring - Head (Teflon)		702069	
17	Gland Stud (Outboard)	2	921586		O-Ring - Hub (Buna-N) (Std.)	2	702057	
17A	Gland Stud (Inboard)	2	921561		O-Ring - Hub (Viton)		702059	
18	Locknut - Stud	4	922420	72A	O-Ring - Hub (Teflon)		702068	
18A	Removal Nut - Gland	4	922850					
19	Packing Set (Std.)	2	326900	73	Gage Plug	2	908198	
20	Head (Std.)	2	036918	74	Key - Liner	1	186902	
20A	Jacketed Head	2	036919	75	Gland & Bearing Assembly	2	146900	
20C	Hub	2	036957	76	Automatic Lubricator	2	317885	
21	Capscrews - Head	28	920510	77	Push Rod (Std.)	3	126901	
21A	Gasket - Head Stud	4	701981		Push Rod (Lower Displacement)		126902	
21B	Stud - Head	4	921569	186	Shaft Protector	1	346901	
21C	Nut - Head Stud	4	922850		Conversion Kit - MLG to MLX		896902	
21D	Capscrews - Hub	16	920331		Conversion Kit - MLG to MLN		896903	
22	Capscrews - Blanking Plate/Valve	8	920457					

EC = Extra-Clearance

Note: 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.

INTERCHANGEABILITY WITH OBSOLETE MLG4

MLG4A	Interchangeability with MLG4
PART NAME	REFERENCE
Rotor & Shaft	a
Liner	b
Vanes	c
Push Rods	d
Heads	c
Discs	c
Hubs	c

REFERENCE:

a = Interchangeable but requires new vanes.

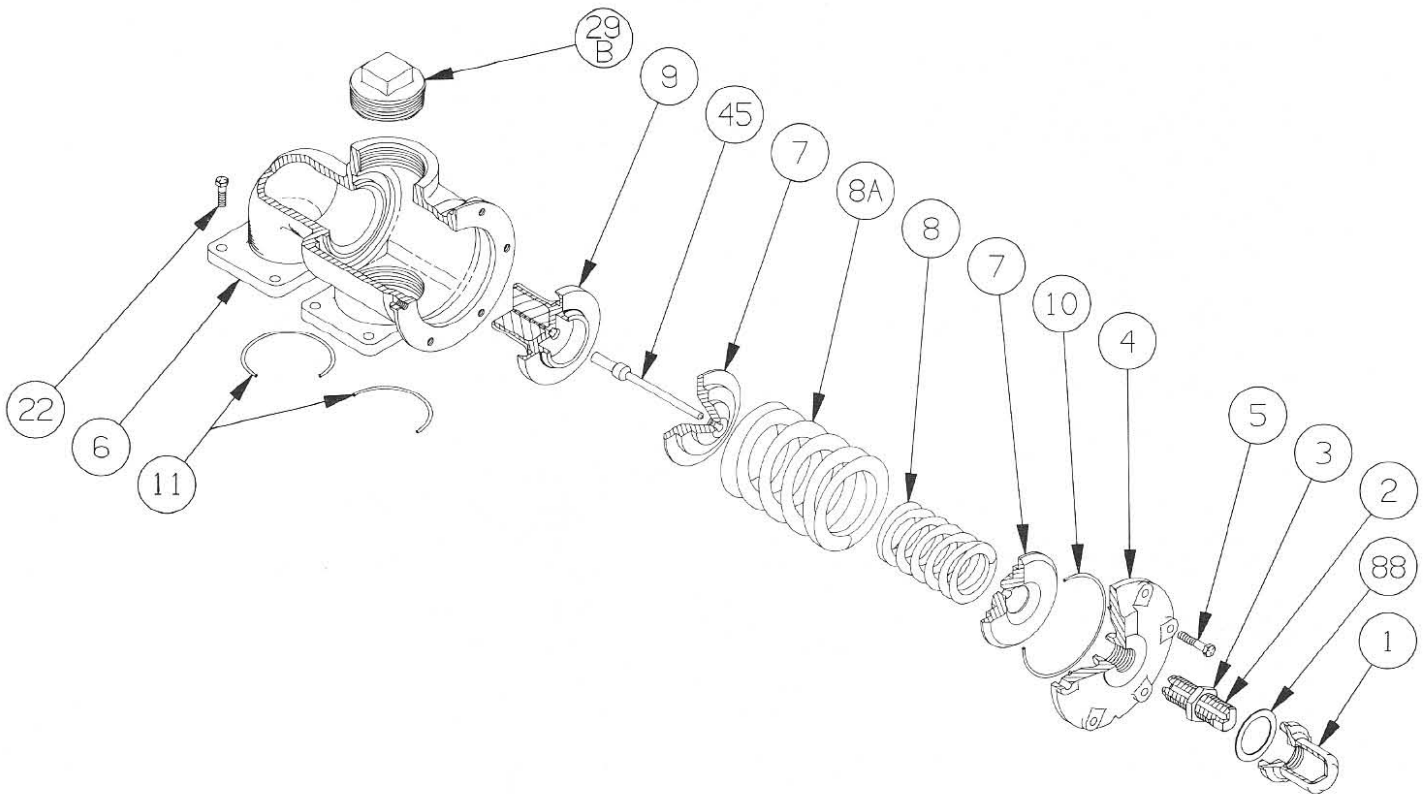
b = Interchangeable but requires new push rods.

c = Interchangeable.

d = Interchangeable but requires new liner (consult factory).

Note, if pump is equipped with obsolete liner (p/n 186900 or 186911), obsolete push rods (p/n 126900) must be used.

V. OPTIONAL RELIEF VALVE PARTS LIST



REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.	REF. NO.	PART NAME	PARTS PER PUMP	DUCTILE IRON PART NO.	CAST STEEL PART NO.
1	Cap - Relief Valve (R/V)	1	417710	416904	10	O-Ring - R/V Cover (Buna-N)	1	702057	702057
2	Adjusting Screw - R/V	1	437205	437205		O-Ring - R/V Cover (Viton)		702059	702059
3	Jam Nut - R/V	1	436655	436655		O-Ring - R/V Cover (Teflon)		702068	702068
4	Cover - R/V	1	416900	416902	11	O-Ring - Blanking Plate/Valve (Buna-N) (Std.)	2	701918	701918
5	Capscrew - R/V Cover	6	920351	920351		O-Ring - Blanking Plate/Valve (Viton)		701991	701991
6	Body - R/V	1	406900	406902		O-Ring - Blanking Plate/Valve (Teflon)		702066	702066
7	Spring Guide - R/V	2	426900	426900	22	Capscrews - Plate/Valve	8	920457	920457
8	Spring - R/V (45 - 75 psi)	1	476900	476900	29B	Bypass Plug (3" NPT)	1	908226	908226
8A	Spring - R/V (76 - 125 psi)	1	476901	476901	45	Spring Guide Rod	1	426901	426901
8 & 8A	Springs - R/V (126 - 200 psi)	*1 ea.	476900 476901	476900 476901	88	Gasket - R/V Cap	1	536652	536652
9	Valve - R/V	1	456315	456315					

* Use springs p/n 476900 and p/n 476901 nested together.

VI. MODEL CONVERSION INSTRUCTIONS/KITS

The ML4A Series is designed as a "modular" pump, with the various models being "interchangeable" by substituting the hub assemblies. For example, an MLX Model (external roller bearings) can be converted to either an MLN Model (internal sleeve bearings), or a MLG Model (external gland bearings with automatic lubricators), and vice versa.

To convert from one pump model to another, use the conversion kits listed in the table below. For instructions on the disassembly and assembly of the different hub assemblies, refer to the respective Maintenance Sections on pages 4 through 19.

REF. NO.	DESCRIPTION OF PARTS	MLX4 CONVERSION KIT No. 896902 TO CONVERT FROM AN MLN or MLG to an MLX		MLN4 CONVERSION KIT No. 896903 TO CONVERT FROM AN MLX or MLG to an MLN		MLG4 CONVERSION KIT No. 896904 TO CONVERT FROM AN MLX or MLN to an MLG	
		Qty.	Part No.	Qty.	Part No.	Qty.	Part No.
17	Packing Follower/Gland Stud	.....	.....	2	921580	2	921586
17A	Gland Stud (Inboard)	.....	.....	.....	.....	2	921561
18	Stud Locknut	.....	.....	2	922420*	4	922420*
18A	Packing Follower/Gland Removal Nut	.....	.....	2	922850*	4	922850*
19	Packing	.....	.....	1	326900*	2	326900*
20C	Hub/Hub & Bush. Asy.	2	036952	2	036950	2	036957
21D	Capscrews - Hub	4	920128	16	920331*	16	920331*
24	Roller Bearing	2	903252	.....	.....	.....	.....
24A	Locknut - Bearing	2	903543	.....	.....	.....	.....
24B	Lockwasher - Bearing	2	903544	.....	.....	.....	.....
24C	Wave Spring - Bearing	2	903546	.....	.....	.....	.....
24D	Spacer - Bearing	2	903547	.....	.....	.....	.....
26	O-Ring - Bearing/Shaft Cover (Buna-N)	2	702061	1	701939	.....	.....
27	Bearing/Shaft Cover	2	046900	1	046902	.....	.....
28	Capscrews - Bearing/Shaft Cover	16	920369	2	920495	.....	.....
58	Packing Washer	.....	.....	1	356905*	2	356905*
72A	O-Ring (Large) - Hub (Buna-N)	2	702057	2	702057	2	702057
72B	O-Ring (Small) - Hub (Buna-N)	2	702027	2	702027	.....	.....
73A	Plug - Hub	.....	.....	4	908198	.....	.....
75	Packing Follower/Gland	.....	.....	1	146905	2	146900
76	Grease Fitting	2	317815	.....	.....	.....	.....
	Automatic Lubricator	.....	.....	.....	.....	2	317885
76A	Grease Relief Fitting	2	701992	.....	.....	.....	.....
104	Grease Seal	2	331907	.....	.....	.....	.....
186	Shaft Protector	1	346900	.....	.....	1	346901
153	Mechanical Seal (SNCN)	2	337007	.....	.....	.....	.....

*When converting from an MLN to an MLG (or vice versa) these parts do not need to be substituted.

NOTE: For more complete information on parts, installation and operation, please refer to the individual sections for each pump model.

VII. GENERAL PUMP TROUBLESHOOTING

LEAKAGE

Location

Between the head & casing

MLX Models - From the tell-tale hole in the hub, or where the hub meets the head.

MLN Models - From the seal housing or around the shaft.

MLN & MLG Models - From the stuffing box in the hub.

Probable Cause/Corrective Action

Damaged head O-ring: Inspect and replace if necessary.

Burrs/dirt in head O-ring groove or casing: File and clean when necessary.

New Mechanical Seals: New seals may leak slightly at start up, but should seal up shortly thereafter.

Damaged mechanical seals: Check for damaged O-rings or cracked, scratched or worn seal faces.

Damaged hub O-rings: Inspect and replace if necessary.

Damaged Mechanical Seal: See Above.

Damaged shaft surface: Check the surface of the shaft in the seal area for damage. File any small burrs or ridges. If damage is severe, replace rotor & shaft.

Packing: Adjust the packing. If this does not solve the problem, replace the packing with a complete new set.

NOTE: On pumps equipped with packing, some leakage is necessary, and in some cases is desirable, depending on the application.

ESCAPING GREASE

Location

MLX Models - Around the pump shaft.

MLG Models - From the automatic lubricator (grease cup)

Probable Cause/Corrective Action

Damaged grease seal: Remove the bearing cover and inspect the grease seal for damage. Replace if necessary.

Automatic lubricator adjusted incorrectly: Adjust the flow control screw at the bottom of the lubricator (see "Automatic Lubricator").

SHAFT BINDING

Probable Cause

Burrs, dirt or foreign particles on the heads or discs.

MLX Models - Improper locknut adjustment.

MLN & MLG Models - Excessively tight packing.

MLX & MLN Models - Contaminated mechanical seal faces.

MLX & MLN Models - Mechanical seal drive tangs not engaged.

Corrective Action

During assembly, both heads and discs must be clean and smooth. File any burrs or rough spots, and wipe the discs with a clean cloth and alcohol to remove any dirt or foreign particles.

Locknuts must be adjusted properly to center the rotor and shaft between the heads. Refer to "Locknut Adjustment." on page 6.

Refer to "Packing Adjustment" on page 13 or 19.

Any trace of grease or dirt on the seal faces will prevent the faces from mating properly, causing the rotor and shaft to bind or turn hard. Use a tissue paper & alcohol to clean the seal faces.

NOTE: Apply a light oil or suitable lubricant to bronze seal faces only.

The driving tangs of the seal jacket must be engaged in the slots in the rotor (MLX Models), or in the keyways of the shaft threads (MLN Models).

OTHER POSSIBLE CAUSES OF SHAFT BINDING:

- Foreign particles on rotor, liner or vanes.
- Damaged vanes or rotor.
- Bent push rods.
- Liquids that "set up" when inactive.

GENERAL PUMP TROUBLESHOOTING

OVERHEATING

Location

Pump equipped with internal relief valve

MLN & MLG Models - Stuffing box of hub.

Probable Cause/Corrective Action

Continual, full bypassing of the liquid: The relief valve should be adjusted such that the pump will not bypass during normal operation.

WARNING: Internal bypassing of liquid elevates the liquid temperature. The internal bypass valve should only be used for brief periods and at differential pressures below 125 psi.

For extended periods of higher pressures, the internal bypass port must be plugged and the liquid returned back to the source.

Packing: Packing should never be tightened without checking afterward for overheating. 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 page 3).
- Plugged discharge line.
- Closed valve.

EXCESSIVE NOISE AND VIBRATION

Probable Cause

Cavitation, or vaporization of the liquid resulting from excessive vacuum on the pump due to starved suction.

Entrained air or vapors in the pump.

Rotor & Shaft installed backwards.

Pump speeds exceed the recommended maximum.

Continual or long term bypassing of liquid through relief valve.

Corrective Action

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.

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.

The rotation arrow on the rotor should point towards the discharge port when the arrow is located beneath the shaft. (See Figure 6 on page 5.)

Check the recommended RPM for your specific application.

Check for restriction in the discharge line, or an improper relief valve adjustment (see "Relief Valve" on page 3).

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.

GENERAL PUMP TROUBLESHOOTING

LOW DELIVERY RATE

Probable Cause

Relief valve setting too low, causing the liquid to bypass.

A dirty strainer.

Corrective Action

The relief valve setting should be 20 psi (138 kPa) higher than the differential pressure.

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

Probable Cause

- 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.

NOTES

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