BLACKMER LIQUEFIED GAS PUMPS

FOR LP-GAS AND NH3 SERVICE

INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

MODELS: LGRL1.25, LGRLF1.25A, LGL1.25, LGLF1.25A, LGL1.5

960409
INSTRUCTIONS NO. 501-B00
Page 1 of 8

Section	500
Effective	June 2001
Replaces	585/C Nov 1988

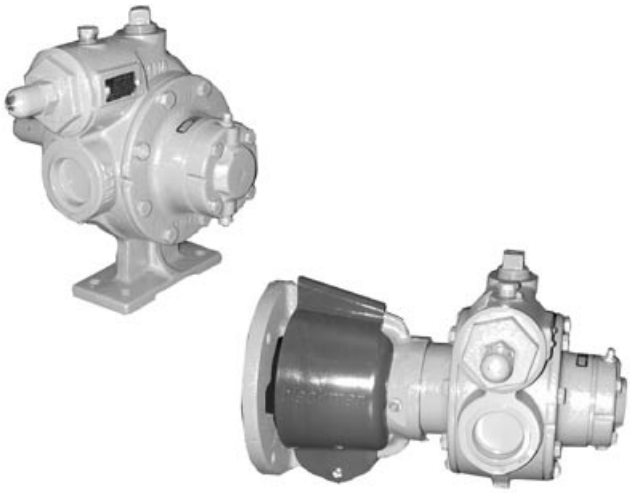


TABLE OF CONTENTS *Page*

NOTE: Numbers in parentheses following individual parts indicate reference numbers on the corresponding Blackmer Parts List.

SAFETY DATA

This is a SAFETY ALERT SYMBOL.
When you see this symbol on the product, or in the manual, look for one of the following signal words and be alert to the potential for personal injury, death or major property damage.

⚠ DANGER

Warns of hazards that WILL cause serious personal injury, death or major property damage.

⚠WARNING

Warns of hazards that CAN cause serious personal injury, death or major property damage.

⚠ CAUTION

Warns of hazards that CAN cause personal injury or property damage.

NOTICE:

Indicates special instructions which are very important and must be followed.

NOTICE:

Blackmer liquefied gas pumps MUST only be installed in systems which have been designed by qualified engineering personnel. The system MUST conform to all applicable local and national regulations and safety standards.

This manual is intended to assist in the installation and operation of the Blackmer liquefied gas pumps, and MUST be kept with the pump.

Blackmer liquefied gas pump service shall be performed by qualified technicians ONLY. Service shall conform to all applicable local and national regulations and safety standards.

Thoroughly review this manual, all instructions and hazard warnings, BEFORE performing any work on the Blackmer liquefied gas pumps.

Maintain ALL system and Blackmer liquefied gas pump operation and hazard warning decals.

SAFETY DATA

⚠WARNING

Hazardous voltage. Can shock, burn or cause death.

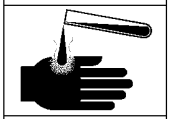
FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.

⚠WARNING

Hazardous pressure can cause personal injury or property damage.

DISCONNECTING FLUID OR PRESSURE CONTAINMENT COMPONENTS DURING PUMP OPERATION CAN CAUSE SERIOUS PERSONAL INJURY, DEATH OR MAJOR PROPERTY DAMAGE.

⚠WARNING



Hazardous or toxic fluids can cause serious injury.

IF PUMPING HAZARDOUS FLUIDS SYSTEM MUST BE FLUSHED AND DECONTAMINATED, INSIDE AND OUT, PRIOR TO PERFORMING SERVICE OR MAINTENANCE.

⚠WARNING

Hazardous machinery can cause serious personal injury.

FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

⚠WARNING

Hazardous pressure can cause personal injury or property damage.

DO NOT ATTEMPT TO OPEN THE PUMP UNTIL YOU HAVE BLED OFF THE PRESSURE. ON SYSTEMS WITH METERS, THE DIFFERENTIAL VALVE WILL KEEP LIQUID UNDER PRESSURE IN THE PUMP, METER AND PIPING EVEN WHEN THE HOSE IS EMPTIED.

⚠CAUTION

Hazardous pressure can cause personal injury or property damage.

FAILURE TO RELIEVE SYSTEM PRESSURE PRIOR TO PERFORMING PUMP SERVICE OR MAINTENANCE CAN CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

PUMP DATA

TECHNICAL DATA

Maximum Pump Speed	1750 RPM
Maximum Temperature	240°F (115°C)
Maximum Differential Pressure	150 psi (10.3 bar)
Maximum Working Pressure (Inlet Pressure + Differential Pressure)	350 psi (24.1 bar)

NOTE: These pumps are listed by Underwriters' Laboratories for liquefied petroleum gas and NH3 service.

INITIAL START UP INFORMATION

Model No. _____

Serial No. _____

Date of Installation: _____

Inlet Gauge Reading: _____

Discharge Gauge Reading: _____

Flow Rate: _____

INSTALLATION

NOTICE:

BLACKMER LP-GAS PUMPS MUST ONLY BE INSTALLED IN SYSTEMS DESIGNED BY QUALIFIED ENGINEERING PERSONNEL. SYSTEM DESIGN MUST CONFORM WITH ALL APPLICABLE REGULATIONS AND CODES AND PROVIDE WARNING OF ALL SYSTEM HAZARDS.

NOTICE:

THIS PUMP SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF NFPA 58 AND ALL APPLICABLE LOCAL, STATE AND NATIONAL REGULATIONS.

⚠WARNING

Hazardous voltage. Can shock, burn or cause death.

- **⚠ Install, ground and wire to local and National Electrical Code requirements.**
- **⚠ Install an all-leg disconnect switch near the unit motor.**
- **⚠ Disconnect and lockout electrical power before installation or service.**
- **⚠ Electrical supply MUST match motor nameplate specifications.**
- **⚠ Motors equipped with thermal protection automatically disconnect motor electrical circuit when overload exists. Motor can start unexpectedly and without warning.**

INSTALLATION

PRE-INSTALLATION CLEANING

Foreign matter entering the pump WILL cause extensive damage. The supply tank and intake piping MUST be cleaned and flushed prior to pump installation and operation.

LOCATION AND PIPING

An improperly designed piping system or improper unit installation WILL significantly reduce pump performance and life. Blackmer recommends the following piping system layout and unit installation.

1. To minimize intake losses, locate the pump as close as possible to the source of supply.
2. Intake piping and fittings MUST be at least as large in diameter as the pump intake connection.
3. Minimize the number of intake line fittings (valves, elbows, etc.) and piping turns or bends. The nearest fitting on the intake line must be at least 6" from the pump to permit access to the pump relief valve . (See Figure 3)
4. An intake strainer must be installed 5 - 10 pipe diameters from the pump intake. The strainer should have a net open area of at least four times the area of the intake pipe. Strainers must be cleaned regularly to avoid pump starvation and cavitation.
5. Intake and discharge piping MUST be free of all leaks.
6. To facilitate piping expansion and contraction, expansion joints should be placed 3 feet (0.9m) from the pump intake and discharge.
7. ALL piping and fittings MUST be properly supported to prevent any piping loads from being placed on the pump.
8. Install pressure gauges in the NPT ports provided in the pump casing to check pump at start up.
9. The use of a vapor return line will increase delivery by preventing back pressure from building up at the receiving tank and reducing pressure in the supply tank.
10. Whenever possible, keep liquefied gas systems full of liquid, even when idle. This will keep the O-rings from changing shape, shrinking or super cooling. Evaporation of liquefied gas leaves an abrasive powder on the surface which can cause wear to the pump, meter, and seals.

PUMP MOUNTING

Permanently mount the unit by securing the base plate with adequately sized anchor bolts to a level concrete floor following recommended industry standards (See Figure 1). A solid foundation will reduce system noise and vibration, and will improve pump performance. Refer to ANSI/HI standards or a suitable pump handbook for information on typical pump mounting and foundations. Check coupling alignment after pump and base assembly is secured to the foundation.

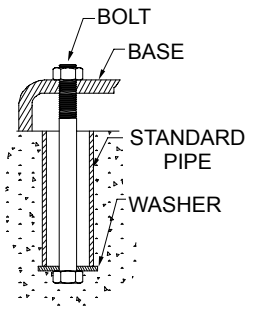


Figure 1

COUPLING ALIGNMENT

The pump must be directly coupled to a gear and/or driver with a flexible coupling.

Both angular and parallel coupling alignment MUST be maintained between the pump, gear, motor, etc. in accordance with manufacturer's instructions. See Figure 2.

1. 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" (125 microns).
2. To check for angular alignment, insert a feeler gauge between the coupling halves. Check the spacing in 90 degree increments around the coupling (four check points). Maximum variation should not exceed .005" (125 microns).

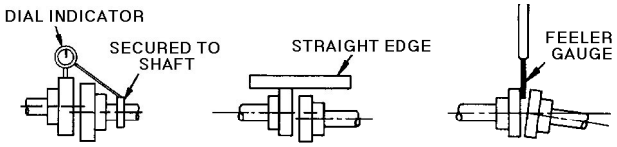


Figure 2 - Alignment Check

INTERNAL PUMP RELIEF VALVE AND EXTERNAL BYPASS VALVE

NOTICE:

THE PUMP INTERNAL RELIEF VALVE IS DESIGNED TO PROTECT THE PUMP FROM EXCESSIVE PRESSURE AND MUST NOT BE USED AS A SYSTEM PRESSURE CONTROL VALVE.

For ALL liquefied gas applications, install an external bypass valve, and any necessary piping, back to the storage tank. DO NOT pipe the bypass valve back to the intake line. The setting on the external bypass valve should be at least 25 psi (1.7 bar) lower than the internal pump relief valve setting. Refer to "Relief Valve Setting & Adjustment" section. The valve and piping must be of adequate size to accommodate the full flow from the pump when the discharge line is closed.

A Blackmer Model BV bypass valve can be mounted as shown in Figure 3 for bulk plant installation. Refer to Blackmer Bypass Valve Installation and Maintenance Instructions for bypass valve settings and adjustments.

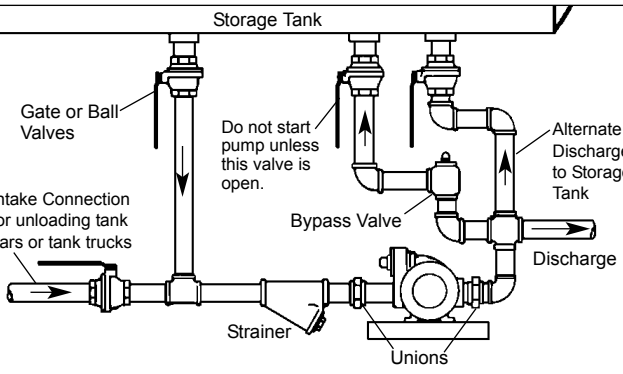


Figure 3- Bypass Valve Mounting

OPERATION

PUMP ROTATION

NOTICE:

CONFIRM CORRECT PUMP ROTATION BY CHECKING THE PUMP ROTATION ARROWS RESPECTIVE TO PUMP DRIVER ROTATION.

TO CHANGE PUMP ROTATION

To reverse pump rotation, remove both bearing covers (27, 27A) and locknuts/lockwashers (24A, 24B). Remove the outboard head (20) and reverse the rotor and shaft (13). The vanes (14) must also be reversed so that the relief grooves face in the direction of rotation. Refer to “Pump Disassembly” and “Pump Assembly” sections of this manual for parts removal and replacement instructions.

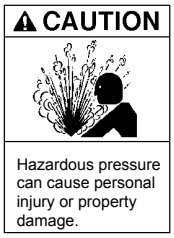
PRE-START UP CHECK LIST

1. Inspect complete piping system and supports to ensure that no piping loads are being placed on the pump.
2. Install pressure gauges in the 1/4" NPT intake and discharge ports located on the pump casing to check pump performance after start-up.
3. Ensure all valves and fittings in piping system are in the start-up or operating positions.
4. Jog the pump motor to verify proper pump rotation.

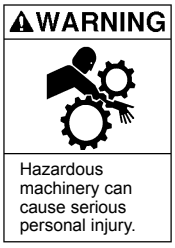
START UP PROCEDURES

NOTICE:

CONSULT THE "GENERAL PUMP TROUBLESHOOTING" SECTION OF THIS MANUAL IF DIFFICULTIES DURING START UP ARE EXPERIENCED.



OPERATING PUMP AGAINST A CLOSED VALVE CAN CAUSE SYSTEM COMPONENT FAILURE, PERSONAL INJURY AND PROPERTY DAMAGE.



OPERATION WITHOUT GUARDS IN PLACE CAN CAUSE SERIOUS PERSONAL INJURY, PROPERTY DAMAGE OR DEATH.

1. Start the motor. Priming should occur within one minute.
2. Check the pressure gauges to ensure the system is operating within expected parameters. Record the gauge readings in the "Initial Start Up Information" section of this manual for future reference.
3. Inspect piping, fittings, and associated system equipment for leaks, noise, vibration and overheating.
4. Check the flow rate to ensure the pump is operating within the expected parameters. Record flow rate in the “Initial Start Up” section of this manual.
5. Close the discharge valve and check the differential pressure across the pump. It should not exceed the pressure setting of the external bypass valve.
6. With the discharge valve still closed, momentarily close the manual shut-off valve in the bypass return line to check the pump relief valve. The pressure should be at least 25 psi (1.7 bar) higher than the maximum system operating pressure or the system pressure control valve setting. If adjustments need to be made, refer to “Relief Valve Setting and Adjustment” section of this manual.
7. The external bypass valve must always be set at least 25 psi (1.7 bar) lower than the internal pump relief valve. NOTE: The normal operating pressure should be at least 5 - 15 psi (0.3 -1.0 bar) less than the external bypass setting. Pump speeds which result in higher pressures (nearing the valve setting) forces the liquid to be recirculated, creating excessive wear on the pump and equipment.

RELIEF VALVE SETTING AND ADJUSTMENT

The factory relief valve pressure setting is marked on a metal tag attached to the valve cover. It is recommended the relief valve be set at least 25 psi (1.7 bar) higher than the maximum system operating pressure or the system pressure control valve setting.

INCORRECT SETTINGS OF THE PRESSURE RELIEF VALVE CAN CAUSE SYSTEM COMPONENT FAILURE, PERSONAL INJURY AND PROPERTY DAMAGE.

Relief Valve Adjustment Procedure:

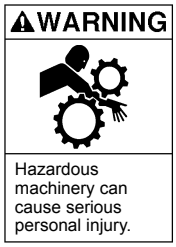
1. **To INCREASE the pressure setting**, remove the relief valve cap (1), loosen the locknut (3), and turn the adjusting screw (2) inward, or CLOCKWISE.
2. **To DECREASE the pressure setting**, remove the relief valve cap (1), loosen the locknut (3), and turn the adjusting screw (2) outward, or COUNTERCLOCKWISE.

Refer to corresponding Blackmer Pump Parts List for relief valve spring pressure ranges.

MAINTENANCE

NOTICE:

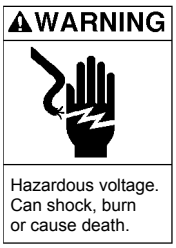
MAINTENANCE SHALL BE PERFORMED BY QUALIFIED TECHNICIANS ONLY, FOLLOWING THE APPROPRIATE PROCEDURES AND WARNINGS AS PRESENTED IN THIS MANUAL.



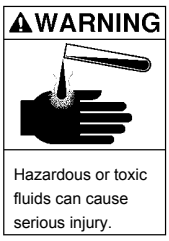
FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

MAINTENANCE

DO NOT ATTEMPT TO OPEN THE PUMP UNTIL YOU HAVE BLED OFF THE PRESSURE. ON SYSTEMS WITH METERS, THE DIFFERENTIAL VALVE WILL KEEP LIQUID UNDER PRESSURE IN THE PUMP, METER AND PIPING EVEN WHEN THE HOSE IS EMPTIED.



FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.



IF PUMPING HAZARDOUS FLUIDS SYSTEM MUST BE FLUSHED AND DECONTAMINATED, INSIDE AND OUT PRIOR TO PERFORMING SERVICE OR MAINTENANCE.

DISCONNECTING FLUID OR PRESSURE CONTAINMENT COMPONENTS DURING PUMP OPERATION CAN CAUSE SERIOUS PERSONAL INJURY, DEATH OR MAJOR PROPERTY DAMAGE.

LUBRICATION

Ball bearings must be lubricated every three months at a minimum. More frequent lubrication may be required, depending on the application and the operating conditions.

Recommended Grease:

Exxon® - RONNEX MP Grease;

Mobil® MOBILITH AW-2 (64353-6) Grease, or equivalent Lithium grease.

Greasing Procedure:

1. Remove the grease relief fittings (76A) from the bearing covers (27, 27A).
2. SLOWLY apply grease with a hand gun until grease begins to escape from the grease relief fitting port. Discard excess grease in accordance with the proper codes and regulations.
3. Replace the grease relief fittings (76A).

DO NOT overgrease pump bearings. While it is normal for some grease to escape from the grease tell-tale hole after lubrication, excessive grease can cause mechanical seal failure. The tell-tale hole is located in the head between the bearing and the seal.

VANE REPLACEMENT

NOTICE:

MAINTENANCE SHALL BE PERFORMED BY QUALIFIED TECHNICIANS ONLY, FOLLOWING THE APPROPRIATE PROCEDURES AND WARNINGS AS PRESENTED IN THIS MANUAL.

1. Drain and relieve pressure from the pump and system as required.
2. Remove the head assembly from the **outboard** (non-driven) side of the pump according to steps 4 - 9 in the "Pump Disassembly" section of this manual.
3. Turn the shaft by hand until a vane (14) comes to the top (12 o'clock) position of the rotor. Remove the vane.
4. Install a new vane (14), ensuring that the rounded edge is UP, and the relief grooves are facing towards the direction of rotation. See Figure 4.
4. Repeat steps 3 and 4 until all vanes have been replaced. **NOTE:** The standard rotor & shaft has eight vanes and no push rods. The optional rotor & shaft has four vanes and two push rods.
6. Reassemble the pump according to the "Pump Assembly." section of this manual.

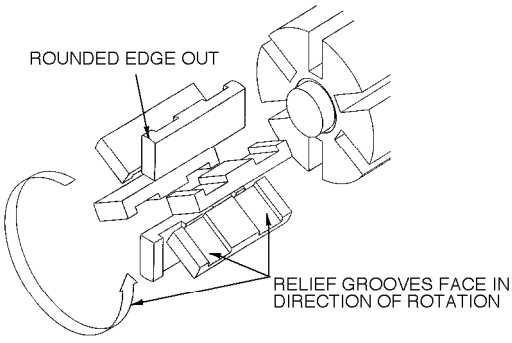


Figure 4 - Vane Installation

PUMP DISASSEMBLY

1. Drain and relieve pressure from the pump and system as required.
2. Starting on the **inboard** (driven) end of the pump, clean the pump shaft thoroughly, making sure the shaft is free of nicks and burrs. This will prevent damage to the mechanical seal when the inboard head assembly is removed.
3. Remove the inboard bearing cover capscrews (28) and slide the inboard bearing cover (27) and gasket (26) off the shaft. Discard the bearing cover gasket.

   NOTE: On flange mounted pumps, a bracket mount (108) takes the place of the inboard bearing cover. To disassemble, take apart the coupling (34) and remove the mounting screws (28A). The bracket and gasket (26) can then be removed from the head (20).
4. Remove the outboard bearing cover capscrews (28) and slide the outboard bearing cover (27A) and gasket (26) off the shaft. Discard the bearing cover gasket.

5. To remove locknuts and lockwashers (24A and 24B):
   a. Bend up the engaged lockwasher tang and rotate the locknut counterclockwise to remove it from the shaft
   b. Slide the lockwasher (24B) off the shaft. Inspect the lockwasher for damage and replace as required.
   c. Repeat steps a and b on the opposite shaft end.
6. Remove the head capscrews (21). Each head (20) has a threaded jackscrew hole to facilitate removal. Insert a capscrew (21) into the jackscrew hole to easily remove head from the casing (12). **NOTE: It is a good practice to attach pump heads to the same ends they were removed from.**
7. Slide the head (20) off the shaft. The bearing (24), mechanical seal stationary seat and stationary O-ring (153A & 153D) will come off with the head assembly.
   a. Pull the bearing (24) from the housing in the head.
   b. To remove the mechanical seal stationary seat (153A), use the blunt end of a screw driver to gently push the backside of the stationary seat from the head. Place a cloth under the seal to avoid damage. Be careful not to contact the polished face of the seal during removal. Remove and discard mechanical seal stationary O-ring.
8. Carefully pull the rotating seal assembly, consisting of seal jacket (153C), rotating seal face and rotating O-ring (153B & 153E) from the shaft. Remove and discard the rotating O-ring (153E).
9. Carefully remove the disc (71) and head O-ring (72).
10. Pull the rotor and shaft (13) from the casing (12). While one hand is pulling the shaft, the other hand should be cupped underneath the rotor to prevent the vanes (14) from falling out. Carefully set the rotor and shaft (13) aside for future vane replacement and reassembly.
11. Lay the pump flat with the remaining head facing upward to remove the head assembly, mechanical seal, and disc from the outboard side of the pump, as instructed in steps 6 - 9 above.
12. If necessary, remove the liner (41) by tapping around the outside diameter of the liner with a hard wood drift and a hammer until it is driven from the casing (12).

PUMP ASSEMBLY

Before reassembling the pump, inspect all component parts for wear or damage, and replace as required. Wash out the bearing/seal recess of the head and remove any burrs or nicks from the rotor and shaft. Remove any burrs from the liner.

Reassemble the OUTBOARD side of the pump first:

1. Align the liner keyway with the setscrew (74) that extends down into the pump casing (12) and start the liner (41) into the casing. The word “INTAKE” cast on the liner must face the intake port of the pump casing. Uniformly tap the outer edge of the liner with a rubber mallet to fully insert into the casing.
2. Place the disc (71) against the liner (41) with the seal cavity outward and disc relief hole located as shown in Figure 5.
3. Without installing the head O-ring (72) or mechanical seal components, temporarily attach the outboard head (20) and bearing (24) to the casing (12). Install and hand-tighten two head capscrews (21), 180 degrees apart. This head will be used to hold and align the rotor and shaft (13) while the inboard side of the pump is assembled. **NOTE: It is a good practice to attach pump heads to the same ends they were removed from.**
4. Before installing the rotor & shaft assembly (13), the direction of pump rotation must be determined as follows:

   If the pump is to be **right-hand** with **clockwise** rotation, the intake port and the relief valve must be on the **right** with the drive end of the shaft pointing towards the observer.

   If the pump is to be **left-hand** with **counterclockwise** rotation, the intake port and the relief valve must be on the **left** with the drive end of the shaft pointing towards the observer.
5. Remove the vanes (14) and push rods (77) (if equipped) from the rotor and shaft assembly (13). Inspect for wear and damage, and replace as follows:
   a. Insert the vanes (14) into the bottom rotor slots with the relief grooves facing in the direction of pump rotation, and with the rounded edges outward. See Figure 4.

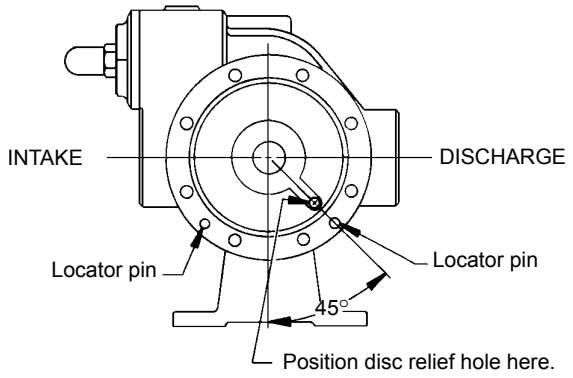


Figure 5 - Disc Relief Hole Location

   b. If the pump is equipped with an optional four-vane rotor and shaft (13A), hold the two bottom vanes (14) in place while inserting the two push rods (77).
   c. After the bottom vanes (14) (and push rods, (77) if equipped) are installed, carefully insert the non-driven end of rotor and shaft into the casing (12).
   d. Install all remaining vanes (14) into the top positions of the rotor.
6. Install the disc (71) on the inboard side of the pump with the seal cavity facing outward and the disc relief hole located as shown in Figure 5.
7. Install a new head O-ring (72) in the groove between the disc (71) and the casing(12).

8. **MECHANICAL SEAL INSTALLATION**

Rotating Assembly -

a. Apply a small amount of motor oil on the shaft between the shaft threads and the rotor.

b. Slide the seal jacket assembly (153C) over the shaft and into the disc cavity with the drive tangs of the jacket towards the rotor. Rotate the jacket assembly to engage the drive tangs in the rotor slots.

c. Install a new rotating O-ring (153E) in the rotating seal face (153B). Align and insert the rotating assembly into the the seal jacket with the polished face outward. Clean the polished face with a clean tissue and alcohol.

Stationary Seat -

a. Apply a small amount of motor oil in the seal recess of the head (20).

b. Install a new stationary O-ring (153D) in the stationary seat (153A). Clean the polished face with a clean tissue and alcohol. Align the pin in the stationary seat with the slot in the head recess and push the seat fully into the seal recess with the polished face outward.

9. Carefully install the inboard head assembly (20) over the shaft. Do not contact the end of the shaft with the polished face of the stationary seat. Center the head on the pump casing (12). Install and uniformly tighten four head capscrews (21) 90° apart, torquing to 30 lbs ft (47 Nm). **NOTE: It is a good practice to attach pump heads to the same ends they were removed from.**

10. Hand pack the ball bearing (24) with grease. Refer to the "Lubrication" section for the recommended grease.

11. Install the bearing (24) into the head recess. The bearing balls should face outward, with the grease shield inward. The bearing must be fully and squarely seated in the head (20).

12. Turn the pump casing around and remove the outboard head (20) previously installed.

13. Install the outboard head (20), mechanical seal (153) and bearing (24) as instructed in steps 6 through 11.

14. Rotate the shaft by hand to engage the mechanical seal drive tangs, and to test for binding or tight spots. If the rotor does not turn freely, lightly tap the rims of the heads (20) with a soft faced mallet until the correct position is found. Install all of the remaining head capscrews (21) for each head and uniformly torque to 30 lbs ft (47 Nm).

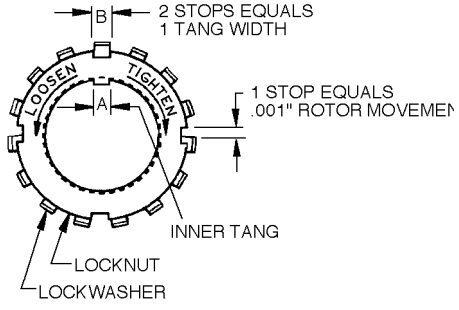


Figure 6 - Locknut Adjustment

16. **LOCKNUT ADJUSTMENT**

It is important that the bearing locknuts (24A) and lockwashers (24B) be installed and adjusted properly. Overtightening locknuts can cause bearing failure or a broken lockwasher tang. Loose locknuts will allow the rotor to shift against the discs (71), causing wear. See Figure 6.

a. On both ends of the pump shaft, install a lockwasher (24B) with the tangs facing outward, followed by a locknut (24A) with the tapered end inward. Ensure the inner tang "A" of the lockwasher is located in the slot in the shaft threads, bending it slightly, if necessary.

b. Tighten both locknuts (24B) to ensure that the bearings (24) are bottomed in the head recess. DO NOT overtighten and bend or shear the lockwasher inner tang.

c. Loosen both locknuts (24A) one complete turn.

d. Tighten one locknut (24A) 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". Secure the nut by bending the closest aligned lockwasher tang into the slot in the locknut. The pump should turn freely when rotated by hand.

f. Tighten the opposite locknut (24A) by hand until it is snug against the bearing (24). Then, using a spanner wrench, tighten the nut the width of one lockwasher tang. Tighten just past the desired tang, then back off the nut to align the tang with the locknut slot. Secure the nut by bending the aligned lockwasher tang into the slot in the locknut. The pump should continue to turn freely when rotated by hand.

g. To check adjustment, grasp the nut and washer with fingers and rotate back and forth. If this cannot be done, one or both locknuts are too tight and should be alternately loosened one stop at a time (.001" - 25 microns). Begin by loosening the locknut (24A) adjusted last.

16. Inspect the grease seal (104) for wear or damage and replace as required. Grease the outside diameter of the grease seal and push it into the inboard bearing cover (27) or bracket mount (108) with the lip of the seal inward (towards the pump).

17. Attach a new bearing cover gasket (26) and the inboard bearing cover (27) to the inboard head (20). Install the outboard bearing cover (27A) and a new gasket to the outboard head. Make sure the grease fittings (76) on the bearing covers are accessible. Install and torque the bearing cover capscrews (28) to 30 lbs ft (47 Nm).

18. On flange mounted pumps, the bracket mount takes the place of the inboard bearing cover (27). To attach the bracket mount to the head, install a new bearing cover gasket (26) and the four mounting screws (28A).

19. Reinstall coupling, shaft key, and coupling guards.

20. Refer to “Pre-Start Up Check List” and “Start Up Procedures” sections of this manual prior to restarting pump operation.

GENERAL PUMP TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE
Pump Not Priming	1. Pump not wetted. 2. Worn vanes. 3. Suction valve closed. 4. Strainer clogged. 5. Suction line or valves clogged or too restrictive. 6. Pump vapor-locked. 7. Pump speed too low for priming. 8. Relief valve partially open, worn or not seating properly.
Reduced Capacity	1. Pump speed too low. 2. Suction valves not fully open. 3. Excessive restriction in the suction line (i.e.: undersized piping, too many elbows & fittings, clogged strainer, etc.). 4. Damaged or worn parts (vanes, discs, liner or rotor). 5. Excessive restriction in discharge line causing partial flow through the relief valve. 6. Relief Valve worn, set too low, or not seating properly. 7. External Bypass Valve set too high. 8. Operating without a vapor return line. 9. Vanes installed incorrectly (see "Vane Replacement"). 10. Liner installed backwards.
Noise	1. Excessive pressure drop in suction line due to: a. Undersized or restricted fittings in the suction line. b. Pump speed too fast. c. Pump too far from fluid source. 2. Running the pump for extended periods with a closed discharge line. 3. Pump not securely mounted. 4. Misalignment of pump, reducer or motor. 5. Bearings worn or damaged. 6. Vibration from improperly anchored piping. 7. Bent shaft, or drive coupling misaligned. 8. Excessively worn rotor. 9. Malfunctioning valve in the system. 10. Relief valve setting too low. 11. Liner installed backwards. 12. Damaged vanes (see following category).
Damaged Vanes	1. Foreign objects entering the pump. 2. Running the pump dry for extended periods of time. 3. Cavitation. 4. Excessive heat. 5. Worn or bent push rods, or worn push rod holes (four-vane rotor & shaft only). 6. Hydraulic hammer - pressure spikes. 7. Vanes installed incorrectly (see"Vane Replacement"). 8. Incompatibility with the liquids pumped.
Broken Shaft	1. Foreign objects entering the pump. 2. Relief valve not opening. 3. Hydraulic hammer - pressure spikes. 4. Pump/driver misalignment. 5. Excessively worn vanes or vane slots.
Mechanical Seal Leakage	1. O-rings not compatible with the liquids pumped. 2. O-rings nicked, cut or twisted. 3. Shaft at seal area damaged, worn or dirty. 4. Ball bearings overgreased. 5. Excessive cavitation. 6. Mechanical seal faces cracked, scratched, pitted or dirty.

blackmer

PEOPLE PROVIDING FLOW TECHNOLOGY WORLDWIDE

1809 Century Avenue, Grand Rapids, Michigan 49509-1595, U.S.A.
Telephone: (616) 241-1611 • Fax: (616) 241-3752
E-mail: blackmer@blackmer.com • Internet Address: www.blackmer.com

A DOVER RESOURCES COMPANY