BLACKMER TRUCK PUMPS

INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

MODELS: TXLW2, TXLW3

These models are obsolete.
Parts availability will be limited.

963912
INSTRUCTIONS NO. 285/J

Section	200
Effective	June 1995
Replaces	May 1992

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.

PUMP DATA

Maximum Pump Speed	350 RPM
Maximum Temperature	300°F (149°C)
Maximum Differential Pressure	150 psi (1034 kPa)
Maximum Working Pressure (Inlet Pressure + Differential Pressure)	350 psi (2413 kPa)

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INSTALLATION

CLEANING PRECAUTIONS

Foreign matter entering the pump can cause extensive damage. The suction tank 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 pumping 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. When locating the pump, safety should be the first consideration. Other considerations include length of drive line, accessibility for maintenance, and convenience of connections.
3. A strainer should be installed in the inlet line to protect the pump from foreign matter. The strainer should have a net open area of at least four times the area of the intake piping. Clean the strainer 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. The discharge line and fittings must be large enough to minimize the pressure drop in the system. The lower the friction loss, the higher the flow rate.
6. Flexible pipe connections should be used for all high temperature liquid applications. The flexible connections will compensate for expansion and contraction of the pipes resulting from temperature changes.

TRUCK MOUNTING

The pump will operate satisfactorily in any position. It can be bolted to the frame or on a saddle hung below the frame. It must be securely fastened in a firm support. Thorough draining of the pump may be accomplished when the pump is mounted with the feet down, or with the suction flange up.

PUMP DRIVE

The pump may be driven by a power take-off through universal joints. When using universal joints, a splined slip joint must be used on the connecting jack shaft to prevent end thrust on the the pump shaft. If end thrust does develop, the use of an optional shaft support bearing is recommended.

It is very important to install a proper drive line to avoid excessive wear, vibration, and noise (see Figure 1).

A few general guidelines to follow:

1. Avoid square slip joints.
2. Use the least number of jack shafts as is practical.
3. Use an even number of universal joints.
4. The pump shaft and power take-off shaft should be parallel in all respects. It is recommended that an angular level measuring device be used to ensure the PTO and pump shaft are parallel to each other. If necessary, the pump can be shimmed to correct any misalignment. The PTO shaft coming off the transmission does not need to be perfectly horizontal as long as the pump is shimmed to have its shaft parallel in all respects.
5. The yoke of the universals at both ends of the jack shaft should be parallel.
6. The maximum recommended angle between the jack shaft and pump shaft is 15 degrees.

Failure to follow any of these guidelines may result in a gallop or uneven turning of the pump rotor, which will in turn cause a surging vibration to the liquid stream and piping system.

INSTALLATION

NOTE: The pump may also be driven hydraulically. Hydraulic motors should be well supported with their shafts parallel to the pump shaft in all respects. Standard ninety degree (90°) angle brackets, conforming to hydraulic motor mounting dimensions, are available from commercial sources.

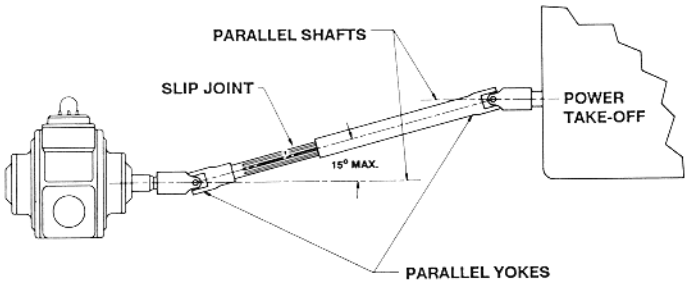

Figure 1 - Pump Drive

PUMP ROTATION

To determine pump rotation:

If the intake port and relief valve are on the right, with the drive end of the shaft pointing towards the observer, the pump is right-hand (clockwise rotation).

If the intake port and relief valve are on the left, with the drive end of the shaft pointing towards the observer, the pump is left-hand (counterclockwise rotation).

NOTE: The pump must be installed to operate in the same direction of rotation as the power take-off. For instance, when looking directly into the power take-off shaft, a counterclockwise or left-hand rotation of the power take-off requires a clockwise or right-hand pump.

TO REVERSE PUMP ROTATION

To reverse pump rotation, the locknuts, lockwashers, and bearing covers must be removed from both heads. The head assembly and disc must then be removed from the driven end of the pump, and the rotor and shaft reversed, so that the driven end of the shaft protrudes through the head still on the casing. The vanes must also be reversed so that the relief grooves face the direction of rotation. The rounded or wearing edges of the vanes must be outward to contact the bore of the liner. See "Maintenance" for removal and replacement of the pump parts.

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. 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.
3. 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.
4. Connect the hose to the receiving tank.
5. 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 with 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 the pump speed. Overspeeding can cause the pump to overheat. Refer to "Pump Speed."
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 15 - 20 psi (103 - 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 and Adjustment."

PUMP SPEED

The truck operator should acquaint himself with the proper engine speed for the best operation of the pump. If the proper take-off has been used, a medium idling speed, which can be gauged by the sound of the engine, should produce approximately the rated capacity of the pump. PTO and hydraulically driven units should contain control elements which prevent excessive pump speeds regardless of engine idle speed.

If the delivery is appreciably more than the pump rating, the engine should be operated slower. If the delivery is appreciably less than rated, check for possible causes listed under "General Pump Troubleshooting."

RUNNING THE PUMP IN REVERSE

It is sometimes desirable to run the pump in reverse to drain a line. The pump is satisfactory for this type of operation, but the flow rate will decrease, depending on the system conditions and the pump speed. When running the pump in reverse, a separate relief valve is recommended in order to protect the pump from excessive pressures.

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 or through the larger auxiliary fitting on the intake line. Pump air for 30 second intervals to clean out most of the pumpage.
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 vane material if the fluid is to be left in the pump for an extended period of time.
3. Flush out the cleaning fluid using the same procedure as in step 1.

RELIEF VALVE

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

The purpose of the relief valve is to protect the pump or pumping system from excessive pressure. The valve is not meant to be used for prolonged recirculation.

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. A separate bypass valve, piped back to the storage tank, is recommended when operating under these conditions.

RELIEF VALVE SETTING AND ADJUSTMENT

The relief valve pressure setting is marked on a metal tag attached to the valve cover. Generally, the relief valve should be set at least 15 - 20 psi (103 - 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.

Refer to Parts List 285/J1 for various spring pressure ranges.

MAINTENANCE

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

IMPORTANT: Before work is started on the pump, make sure that 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 eight weeks, depending on the operating duty and the system conditions.

Recommended Grease: *Amoco® - Amolith All Weather Grease*, or equivalent.

Greasing Procedure:

1. Remove the grease relief fittings (76A) from the bearing covers (27 and 27A).
2. Apply grease with a hand gun until grease begins to escape from the grease relief fitting port.
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 on pumps equipped with mechanical seals can cause seal failure.

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 7 of the "Pump Disassembly" Section.
2. Turn the shaft by hand until a vane 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 relief grooves facing in the direction of rotation, and with the rounded edge outward to contact the liner (see Figure 2).

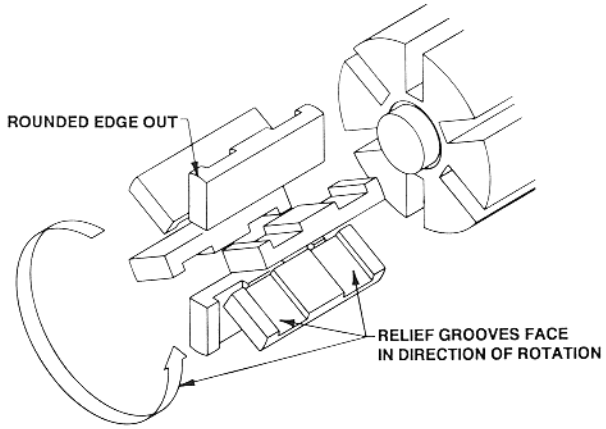

Figure 2 - Vane Replacement

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. This method of vane replacement ensures that the push rods do not fall out of their slots and jam the pump.

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.
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 DISASSEMBLY

NOTE: The numbers in parentheses following individual parts indicate reference numbers on Parts List 285/J1.

1. Remove the bearing cover capscrews (28) and slide the inboard bearing cover (27A) and bearing cover gasket (26) off the shaft.
2. 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.
3. Make sure the shaft is free of any dirt, nicks or burrs which may cause seal damage when removing the head assembly and rotating seal face.
4. Remove the head capscrews (21), then carefully pry the head (20) away from the casing with the use of two large screw drivers. The head O-ring (72) should come off with the head assembly.
5. Slide the head assembly off the shaft with the bearing and the mechanical seal stationary seat still intact. Once the head has been removed from the casing, the bearing and stationary seat can then be removed from the head.
   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.
6. Carefully pull the rotating seal assembly (jacket, seal face, & O-ring) (153C, 153B & 153E) off the shaft.
7. Remove the disc (71).
8. Remove the bearing cover, gasket, locknut, and lockwasher from the opposite side of the pump, per steps 1 and 2. Remove all dirt and burrs from the shaft.

9. From the open side of the pump, gently pull the rotor and shaft (13) out of the head assembly remaining on the casing. While one hand is pulling the shaft, the other hand should be cupped underneath the rotor to prevent the vanes and push rods from falling out.

10. The remaining head assembly, seal components, and disc can now be easily removed. However, make sure that the rotating seal face (153B) and the disc do not drop and become damaged when removing the head. If possible, laying the pump flat with the head facing upward allows for the easiest disassembly.

11. Remove the liner (41) by tapping around the outside diameter of the liner with a brass or hard wood drift and a hammer until it is driven out of the casing.

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.

1. LINER

a. On 2-inch pump models, apply grease to the liner key groove in the pump casing to hold the key (74) in place during liner insertion. Install the key in the groove. On 3-inch pump models, install the key in the liner keyway on the top of the liner.

b. Align the liner keyway with the pump casing keyway and start the liner into the casing with the word "INTAKE" on the liner towards the intake port of the casing. Uniformly tap the outer edge of the liner with a rubber mallet to fully insert it into the casing. Use care to avoid finger injury during installation.

2. Place a disc (71) on the outboard (non-driven) side of the casing with the seal cavity facing outward. **NOTE:** While installing the outboard disc, the relief valve and intake port should be towards the left for clockwise (right-hand) rotation, or towards the right for counter-clockwise (left-hand) rotation.

3. Without installing the head O-ring or mechanical seal components, attach the outboard head, with the bearing, to the casing. Insert two head capscrews (21) 180 degrees apart, and hand-tighten.

   This head will be used to hold and align the rotor and shaft while the inboard side of the pump is assembled. The head will later be removed, and the outboard parts properly installed.

4. VANES AND PUSH RODS

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

   a. Insert vanes (14) into the bottom three rotor slots with the relief grooves facing the direction of rotor rotation, and with the rounded edges facing outward. (Refer back to Figure 2.)

   b. Hold the vanes in place while inserting the push rods (77) as shown in Figure 3.

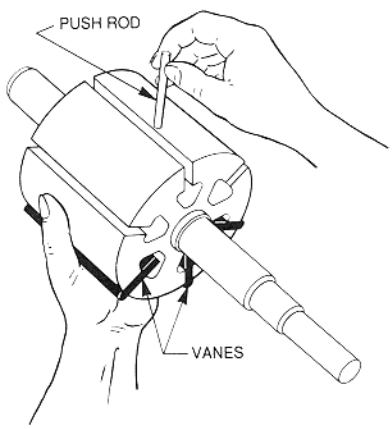

Figure 3 - Push Rod Installation

5. ROTOR & SHAFT

   a. While holding the vanes in place, carefully slide the **non-driven** end (shorter end) of the pump shaft through the disc and head on the casing.

   b. Install the three remaining vanes into the slots in the top of the rotor. Make sure the rounded edges of the vanes face outward, and the relief grooves face in the direction of rotation.

6. DISC

   Install the remaining disc (71) on the inboard side of the pump with the seal cavity facing outward. The disc relief hole should be positioned 45 degrees between the bottom of the pump and the intake port (see Figure 4).

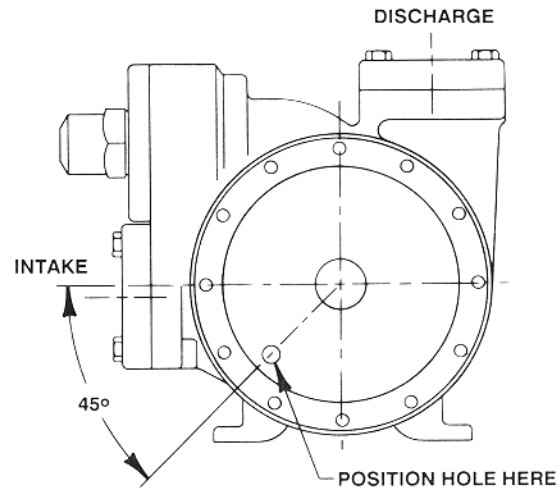

Figure 4 - Disc Relief Hole Location

7. MECHANICAL SEAL

   Rotating Assembly

   a. Put a light film of clear oil on the shaft between the rotor and the shaft threads to facilitate seal installation.

   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.

   c. Rotate the jacket assembly to engage the drive tangs into the rotor slots.

   d. Align and Install the rotating seal face and its O-ring (153B & 153E) into the seal jacket assembly with the polished face outward.

   e. Clean the rotating seal face with a clean tissue and alcohol.

   Stationary Seat

   a. Put a light coating of oil in the seal recess of the head.

   b. Align the pin in the stationary seat (153A) with either slot in the bottom of the head 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.

8. HEAD O-RING

   The head O-ring (72) is slightly smaller in diameter than the O-ring groove in the head. Before installation, clean the O-ring groove. To install, lay the bottom part of the O-ring into the bottom part of the groove, and slide the thumbs over the O-ring in opposite directions while stretching it ahead with the fingers, as shown in Figure 5.

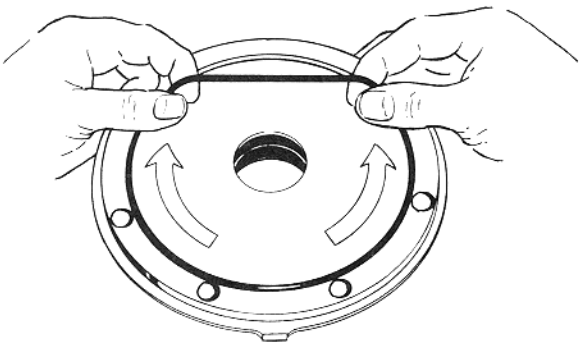

Figure 5 - Head O-Ring Installation

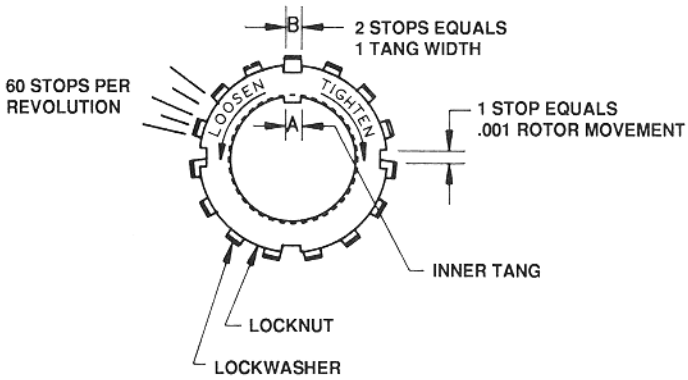

Figure 6 - Locknut Assembly

9. **HEAD ASSEMBLY**

   a. Install the head assembly (20) over the shaft, being careful to avoid any contact between the end of the shaft and the polished face of the stationary seat.

   b. Rotate the head so that the drain hole, located at the back of the bearing cavity, faces down when the pump is mounted for operation.

   c. Install and partially tighten the four head capscrews (21) 90 degrees apart. The remaining head capscrews will be installed later.

10. **BEARING**

   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. Install the bearing (24) into the head, and tap the outer edge of the bearing to ensure that it is properly seated.

11. Remove the outboard head, and position the disc (71) according to step 6.

12. Follow steps 7 through 10 for the outboard side of the pump. Remember to only install and partially tighten four head capscrews, 90 degrees apart.

13. **HEAD ALIGNMENT**

   a. Rotate the shaft by hand to test for binding or tight spots. If the rotor does not turn freely, lightly tap the rims of the heads with a lead hammer until the correct position is found.

   b. Install and partially tighten the remaining capscrews for each head.

   c. Fully tighten all of the head capscrews, alternating between one side of the head and the other. Frequently check that the shaft still turns freely. If tight, loosen the capscrews and repeat procedure. If the shaft continues to bind, check for grease or dirt on the mechanical seal faces.

14. **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 6). Loose locknuts will allow the rotor to shift against the discs, causing excessive wear.

   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 6), 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 loosened alternately one stop, or 0.001" (0.025mm), at a time until the washer can be moved, starting with the last adjusted nut.

15. **GREASE SEAL**

   If the grease seal (104) has been removed from the inboard bearing cover (27A) 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).

16. **BEARING COVER**

   Install a bearing cover gasket (26) and the inboard bearing cover (27A) on the inboard pump head. Install a bearing cover gasket and the outboard bearing cover (27) on the outboard pump head. Insert and tighten the bearing cover capscrews (28). Make sure the bearing covers are centered on the shaft, with the grease fittings (76) accessible.

GENERAL PUMP TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE
Pump Not Priming	1. Pump not wetted. 2. Worn Vanes. 3. Air leaks in the suction line. 4. Suction valve closed. 5. Suction line or valves clogged or too restrictive. 6. Wrong rotation on motor. 7. Broken drive train. 8. Pump vapor locked. 9. Pump speed too slow for priming.
Reduced Capacity	1. Suction valves not fully open. 2. Air leaks in the suction line. 3. Excessive restriction in the suction line (i.e.: undersized piping, too may elbows & fittings, etc.). 4. Damaged or worn parts (refer to "Parts Replacement"). 5. Rotor & shaft installed backwards. 6. Excessive restriction in the discharge line causing partial flow through the relief valve. 7. Relief valve worn, set too low, or not seating properly.
Noise	1. Excessive vacuum on the pump due to: a. Undersized piping or restrictive fittings in the suction line. b. Pump speed too fast for the viscosity being handled. c. Pump too far from the fluid source. 2. Running the pump for extended periods with a closed discharge line. 3. Misalignment of the pump, reducer, or motor. 4. Bearings worn or damaged. 5. Vibration from improperly anchored piping. 6. Baseplate not securely mounted. 7. Bent shaft. 8. Excessively worn rotor or liner. 9. Malfunctioning valve in the system. 10. Damaged vanes (see the following category).
Damaged Vanes	1. Incompatibility with the liquids being pumped. 2. Foreign objects entering the pump. 3. Running the pump dry for extended periods. 4. Cavitation. 5. Viscosity too high for the vanes and/or the pump speed. 6. Excessive heat. 7. Worn or bent push rods, or worn push rod holes. 8. Settled or solidified material in the pump at start-up. 9. Hydraulic hammer - pressure spikes.
Broken Shaft	1. Foreign objects entering the pump. 2. Pump speed too fast for high viscosity fluid. 3. Relief valve not opening. 4. Hydraulic hammer - pressure spikes. 5. Pump-driver misalignment. 6. Excessively worn vanes, vane slots, or liner. 7. Settled or solidified material in the pump at start-up.

GENERAL PUMP TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE
Mechanical Seal Leakage	1. Seal faces cracked, scratched, nicked, dirty, or worn. 2. O-rings not compatible with the liquids being pumped. 3. Shaft at seal area damaged, worn, or dirty. 4. Seal faces pitted due to corrosion or cavitation. 5. Bearings overgreased, forcing grease between the mechanical seal faces. 6. O-Rings nicked, cut, or twisted.

NOTES

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