BLACKMER LIQUEFIED GAS PUMPS FOR LP-GAS AND NH3 SERVICE

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

MODELS: LG4C, TLGFD4, TLGLF4

DISCONTINUED MODELS

960430
INSTRUCTIONS NO. 585/ZG

Section	500
Effective	August 1982
Replaces	April 1980

GENERAL INFORMATION

SAFETY RULES

It is recommended that NFPA Pamphlet 58 be consulted for Safety Rules. Consult local and state regulations also.

WARNING DANGER

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.

PUMP DATA

LG4C, TLGFD4, TLGLF4

Nominal Capacity (GPM) (650 RPM – 50 PSI) at Ambient Temperature of:	
80°F.	255
32°F.	205
Maximum Pump Speed (RPM)	650
Maximum Differential Pressure (PSI)	100
Relief Valve Pressure (PSI)	125
Maximum Temperature	240°F.
Pump Weight (LBS.)	190 & 215
Torque Required (FT.-LB.)	192

These pumps are listed by Underwriters' Laboratories, Inc. for liquified-petroleum gas and NH3.

INSTALLATION AND OPERATION—MOTOR DRIVEN PUMPS

LOCATION LG4C

Locate the pump as near the source of supply as possible to reduce pipe friction. A good foundation reduces vibration and noise and improves the pump performance. On permanent installations, it is recommended that the pumping units be securely bolted to a concrete foundation. When new pump foundations are to be cast in concrete, it is suggested that anchor bolts of the type shown in Fig. 1 be set into the concrete.

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

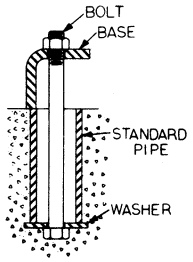


Fig. 1

RELIEF VALVE & BYPASS VALVE

The built-in spring loaded relief valve is to prevent damage to the pump or pumping system from excess pressure and should not be used for recirculation. A separate bypass valve is required by Underwriters' Laboratories, Inc. piped from the pump discharge system back to the supply tank. The setting on the separate bypass valve should be at least 25 psi less than the 125 psi relief valve setting. Do not pipe the bypass valve back to the intake line. The valve and piping should be of adequate size to accommodate the full flow from the pump when the discharge line is closed and pump running at its **normal maximum speed.**

The Blackmer Model BV2 separate bypass valve can be mounted as shown in Fig. 2 for bulk plant installation.

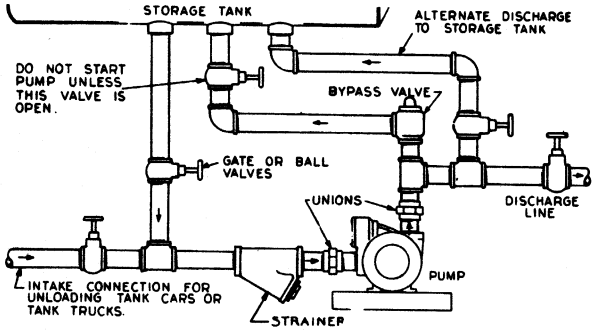


Fig. 2

STRAINER

Flanged internal valves, when used in supply tank outlets, are equipped with screens. Secondary strainers are then not necessary.

When strainers are installed they should be of a size equal to or larger than the intake pipe. The screen or perforated basket should have opening size of .020" or smaller.

PIPING

Many pump systems deliver at a rate below the designated capacity of the pump because the system was improperly piped. Restrictions in the pipe line should be avoided, such as elbows, sharp bends, globe valves, certain restrictive-type plug valves and undersize strainers. Use gate or ball valves, not globe valves. The inlet line should slope downward to the pump, never upward. Use pipe of adequate size and strength that has been thoroughly flushed before connecting to the pump. Flexible connectors used near the pump will compensate for expansion contraction and will provide a more vibration-free operation.

On the intake side, locate the nearest fitting at least six inches from the pump to permit the removal of the relief valve cover.

When the unit is first started, rotation should be checked with the direction arrow on the pump. The dicharge pressure should be compared to the supply pressure with a closed discharge. If the differential is over 100 psi, the separate bypass valve setting should be reduced.

Whenever possible, keep liquified gas systems full of liquid, even when idle. This will keep the "O" rings from changing shape, shrinking or super-cooling. Evaporation of liquified gas leaves an abrasive powder on the surface which can cause wear to the pump, seals, meter, etc. If the system does not function properly, refer to the section on "Pump Troubles and Their Cures."

Use a vapor return line if possible, a 1½" or 2" line is recommended (depending on length). This will speed up delivery since a vapor line prevents back-pressure from building up at the receiving tank and a vacuum from forming in the supply tank. In laying out the system, read the section on "Pump Troubles" for suggested ways to eliminate difficulties before they develop.

ALIGNMENT

Coupling alignment on stationary units should be checked after anchor bolts are tightened.

Where flexible couplings are used, the coupling cover should be removed and a straight edge laid across the two hubs of the coupling as shown in Fig. 3. The maximum offset should be less than .015".

With a feeler gage or piece of flat steel of proper thickness, check the space between the two coupling halves. Insert a gage at a point on the coupling and a 90° increments about the coupling. The space should not vary more than .020". Misalignment is not desirable. If it does exist, it must not exceed the above limits.

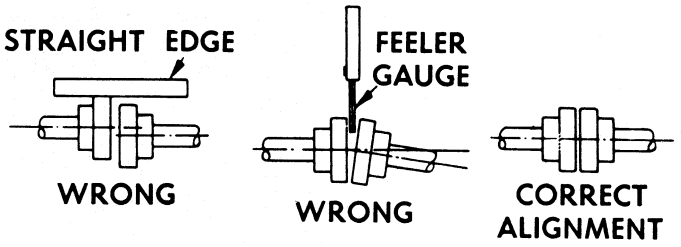


Fig. 3

OPERATIONAL CHECK

The installation should be checked before being put into operation. Install a pressure gage in the gage hole nearest the discharge port provided on the pump casing before starting. Check all valves. The valve in the bypass return line must be open. After the pump is started, check the direction of shaft rotation to be sure it matches the direction of the arrow on the pump head.

The relief valve and separate bypass valve settings should be checked as described under Steps 8, 9, and 10 of Truck Pump "Operation Check". The separate bypass valve on motor driven units is frequently set to protect the motor. If the pump is not delivering the expected flow rate, the separate bypass valve (or pump relief valve) may be set too low and thus remain partially open. Remember that relief valves normally begin to bypass about 5 to 15 psi below their setting.

TO REVERSE PUMP ROTATION (LG4C ONLY)

Remove bearing covers from both heads and the head from the shaft side. Reverse the rotor-and-shaft so that the shaft protrudes through the head still on the cylinder. The vanes must be reversed, in the slots so that the pressure relief grooves face in the direction of rotation. The rounded or wearing edge of the vanes must be outward to contact the bore of the cylinder. See "Maintenance Instructions" for removal and replacement of heads and rotors.

INSTALLATION AND OPERATION TRUCK PUMPS

LOCATION TLGFD4, TLGLF4

When locating the pump on the tank, safety should be the first consideration. Length of the drive line, accessibility for maintenance, and convenience of connections are other considerations.

PUMP ROTATION

The double ended shaft allows the pump to be driven from either end. The pump's direction of rotation is indicated by an arrow on the pump head and it should never be run in the reverse direction. If the arrow has been removed or painted over, use the following:

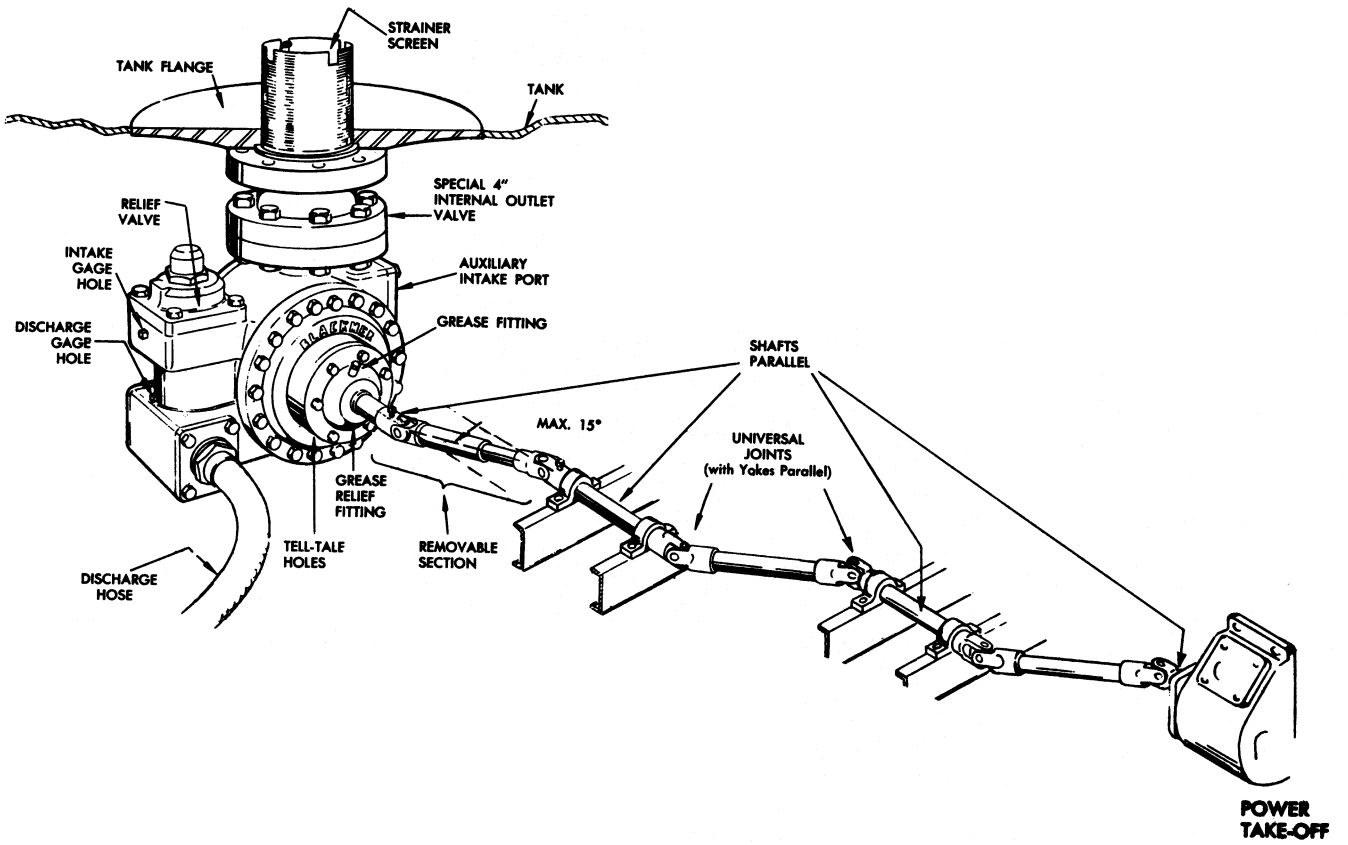
As viewed from drive end, and discharge ports to the left, pump rotation is clockwise.

As viewed from drive end, and discharge ports to the right, pump rotation is counterclockwise.

DRIVE

The pump may be driven by a power take-off from the transmission through universal joints or by a hydraulic motor. Additional pump shaft support is not necessary.

TYPICAL TRANSPORT PUMP DRIVE



It is extremely important to install a proper drive line to avoid excessive wear, vibration and noise. The drive line illustrated was designed for tractor/semi-trailer units with the pump mounted on the semi-trailer.

A few general rules to follow:

1. Use the least practical number of jackshafts (intermediate shafts).
2. Use an even number of universal joints.
3. The pump shaft and every other (alternate) jackshaft must be parallel to power take-off in both vertical and horizontal planes. The other shafts do not have to be parallel with anything.
4. Do not exceed 15° at any joint.
5. When unloading – align tractor with trailer.
6. A four-inch pump requires more torque than the capacity of ordinary universal joints and power take-offs commonly used on smaller pumps.
7. An improperly designed drive line can result in a gallop or uneven turning of pump rotor which will impart a surging vibration to the liquid stream and piping system.

PUMP SPEED

There are two separate and important considerations in setting the pump and engine speeds:

1. The pump speed should never exceed 650 RPM.
2. The pump and engine speed may have to be reduced when delivering through restricted lines in order to prevent bypassing.

The higher the operating speed of the pump, the shorter the life of wearing parts.

High pump speed may cause continuous partial recirculation through the internal relief valve which will shorten vane life. The operator should acquaint himself with these factors and when making the delivery, set the engine to operate the pump at proper speed. The use of a tachometer is recommended. If the differential pressure on the pump is then over 100 psi, the speed should be lowered since part of the product will be recirculating through the bypass or relief valve.

OPERATIONAL CHECK

The following steps should be taken to check out a new system when it is placed in operation:

1. Install a pressure gage on the discharge side of the pump. (The difference between pump discharge pressure and the supply tank pressure is called the "Differential Pressure" in the following instructions.)
2. Connect the hose to the receiving tank.
3. Open the shut-off valve in the bypass return line.
4. If the tank outlet valve is:
   (a) **Lever Operated — Pull control knob all the way out. Manually check the lever under the truck to see that it is in a completely open position.**

WARNING: If control wire is not connected properly, the valve will not be completely open, resulting in pump cavitation, which can cause rapid pump wear.

   (b) **Discharge Pressure Operated — Keep discharge line valve closed. When the pump is started it will build up enough pressure to keep open the tank outlet valve. If the piping is quite large it may be necessary to restrict the discharge line shut-off valve in order to maintain sufficient pressure to keep the tank outlet valve open.**

5. Start the pump.
6. Check pump rotation with the arrow on the pump.
7. Check pump speed (it should not exceed 650 RPM).

8. With discharge valve closed, check the differential pressure across the pump. It should not exceed the pressure setting of the separate bypass valve.
9. With discharge valve still closed, momentarily close the manual shut-off valve in the bypass return line to check the pump relief valve setting. The differential pressure should be approximately 125 psi.
10. The separate bypass valve must always be set lower than the relief valve. If the valves work properly, the pump should now be ready to operate.

Note that the normal operating pressure should be at least 5-15 psi less than the separate bypass setting. Pump speeds which result in higher pressures (nearing the valve setting) mean that liquid is being recirculated uselessly. Slow the engine down thereby eliminating needless wear on the equipment.

To increase the pressure setting, remove the cap from the adjusting screw, loosen the lock-nut, and turn the adjusting screw clockwise, or inward. To reduce the pressure setting, turn the screw counter-clockwise, or outward.

Whenever possible, keep liquiefied gas systems full of liquid, even when idle. This will keep the "O" rings from changing shape, shrinking or super-cooling.

MAINTENANCE

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

LUBRICATION

Pump bearings should be lubricated every three months.
Use Standard Oil - Amolith All Weather Grease.

With a hand gun apply grease slowly to the grease fittings on both bearing covers until excess grease begins to come from the grease relief fittings. It is normal for some grease to escape from the tell-tale holes under the bearing housing for a short time after lubrication.

On motor driven units, oil in the gear case should be maintained to the oil level plug and changed every 6 months.

DISASSEMBLY

Before work is started on a pump, it must be drained and the gas pressure relieved.

Remove the bearing cover capscrews and slide the bearing cover off the shaft. The grease seal will come off with the bearing cover.

These pumps are protected from "end thrust" by a lockwasher and locknut installed outside the bearing on each end of the shaft. Remove the bearing locknut after bending up the engaged lockwasher tang. Check for burrs or roughness that could damage the mechanical seal "O" ring when the head is removed.

The head assembly, consisting of head, bearing, mechanical seal, head "O" ring and disc, can now be removed by removing the head capscrews and prying the head loose with a screwdriver. The bearing and seal are slip-fit on the shaft and the assembly will slide off readily if the shaft is clean and smooth.

Dismantle head assembly by removing the four machine screws holding the disc in place. The head "O" ring and rotating half of the mechanical seal are "free". The stationary half of the seal can be pushed from its recess with a screwdriver or other blunt instrument. The bearing can be pushed from the opposite side in the same manner. Clean all parts thoroughly and protect the "O" rings and seal faces from damage.

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

If the liner of a TLGLF4 pump, is worn or badly damaged, it should be replaced. Using a brass or hard wood drift, with a hammer, tap the liner around its outside diameter, to drive it out of the casing.

ASSEMBLY

Before assembling, clean each part thoroughly. Wash out bearing and seal recesses.

The TLGLF4 liner has a very close diametral fit with the casing and care must be used to avoid finger injury during assembly. With the casing resting on one of the head flanges, align the key slots and have the liner intake slots towards the casing intake flange. Start the liner into the casing and start the key into the matching grooves. Lightly tap the uppermost surface of the liner, with a plastic hammer, around its circumference. The liner will enter the casing either in a series of small steps or drop in suddenly. Tap the key into position, and stand the casing up.

Wipe each "O" ring and around the recess in the head. Place the stationary seat and its "O" ring in the recess so that the pin on the seat engages either slot in the bottom of the recess. The polished face will be in view. Insert the rotating "O" ring in the seal face and place the polished face against the polished face of the stationary seat. With the drive tangs, of the seal jacket assembly up, align the drive notches and place the seal jacket over the seal face.

Place the disc in its recess in the head with the disc hole on the intake side of the pump and the "Blackmer" name in an

upright position. Replace and tighten firmly the machine screws and lockwashers. The driving tangs of the rotating seal should protrude through the center hole. With the "Blackmer" name in the 12 o'clock position, the tell-tale hole will be beneath the shaft.

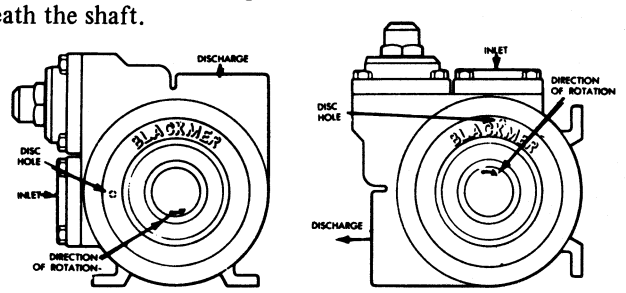


Fig. 4

The head "O" ring should be replaced if it is swollen, nicked, or cut. It is normally smaller in diameter than the "O" ring groove. To install, lay the ring flat on the head and start on one side of the groove.

Slide the thumbs over the "O" ring in opposite directions, stretching ahead with the fingers as shown in Fig. 5. If rolled into the groove, the "O" ring can be rolled out again.

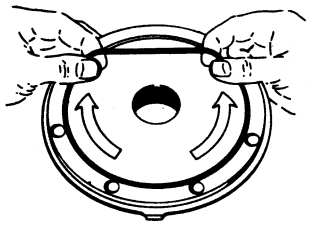


Fig. 5

Place the bearing in its head cavity or recess, with the grease shield to the inside, so the balls are visible.

Install one head as shown in Fig. 4. The "Blackmer" name should be at the top, the disc hole adjacent to the inlet and the tell-tale hole at the bottom. Secure the head to cylinder by installing and tightening the head capscrews. Tip this subassembly so it is now resting on the head bearing cover flange and the cylinder cavity opens upward. Determine pump direction of rotation.

Remove any burrs or rough spots on the rotor shaft, that will damage seal "O" rings. Put a light coating of oil on the rotor shaft and that is to be pushed through the seal assembly "O" ring in the installed head. With the rotor shaft axis vertical and the insertion end down, install the three (3) push rods, and carefully insert the rotor shaft through the seal "O" ring. Turn the rotor and shaft assembly to engage the seal driver tangs.

Install the vanes with the grooves facing the direction of rotation, the rounded edge of the vanes outward and the wear plates on each vane closest to the rotor shaft axis. It may be necessary to move the push rods, with a screwdriver, to install the vanes. Use care not to move the push rods too far as jamming can result.

Install the lockwasher and locknut on the threaded end of the inserted rotor shaft. With a spanner wrench, tighten the bearing locknut very tight. Lightly tap the outer race of the bearing to make sure it is seated and retighten the locknut.

Lightly oil the rotor shaft from the rotor out to the threads. Install the second head and carefully work the seal "O" ring over the shaft threads. Rotate the head to engage seal driver tangs, get the same locations of "Blackmer," disc hole, and tell-tale hole as the first head. Start four (4) head capscrews. Install the lockwasher and bearing locknut. Use a spanner wrench to tighten the bearing locknut very tight. Install and secure all head capscrews.

Loosen both bearing locknuts and rotate the rotor shaft. The rotor must turn, with a light uniform seal drag, in both directions. Oil or grease on the seal surfaces will greatly increase the seal drag.

Tighten the bearing locknut, on the driver end, until a slight drag increase is noted. Next, tighten the bearing locknut, on the outboard end, until the increased drag is eliminated. Find, align, and stake the closest lockwasher tang into the slot on the locknut. Repeat this operation for the locknut on the opposite end of the rotor shaft.

Apply a small amount of grease to the lip of the grease seal and install with the lip outward. Attach bearing cover gasket and bearing cover on each end.

REPLACING VANES

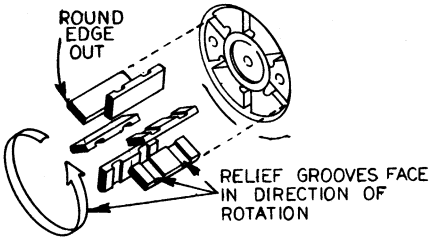


Fig. 6

Vanes can be replaced by removing only one head and it is advisable to remove the head opposite the drive end for this purpose. Turn the rotor by hand until the vanes appear at the 11 and 1 o'clock positions. Remove these two vanes and install new ones. The rounded or wearing edge of the vane must be outward to contact the cylinder and the relief grooves must face towards the leading or pressure side. Repeat this operation until all new vanes are in place.

PUMP TROUBLES AND THEIR CURES

LOSS OF DELIVERY

Probable causes:

1. A closed valve in the pipe line.
2. Cavitation caused by circulation of liquid through the relief valve. This might happen if the separate bypass valve is too small, or if the piping to the valve is too small.
3. Lack of a vapor return will cause high discharge pressure and a vacuum in the supply tank and resulting recirculation. If a vapor line is being used, it should be at least 1½" preferably 2". Where such a line is not permitted, vapor space filling (spray) valves should be used to keep pressure down to a reasonable level. Capacity without a vapor return line will be less than when one is used.
4. Reversed pump rotation. Check the rotation of the pump with the arrow on the casing.
5. Restriction in the suction line, caused by valves or too long of a suction line. Locate a pump as close to the supply as possible. It is easier for a pump to push liquid

through a discharge pipe than pull it through a suction pipe because of the tendency of these liquids to vaporize when the pressure drops.

6. Excessively worn vanes, discs, and rotor ends will increase pump slippage. One or more vanes installed backward may reduce capacity.
7. Cold weather will increase the size of vapor bubbles in in the inlet line thereby displacing a larger amount of liquid in the system.

LEAKAGE

Leakage will appear at the tell-tale holes under the bearing housing on the pump head. If leakage becomes excessive, the entire mechanical seal assembly should be replaced. If leakage appears from between the pump cylinder and the head, the head should be removed and its "O" ring inspected for cuts and nicks. If the "O" ring is damaged, it should be replaced.

EXCESSIVE WEAR OR DAMAGED PARTS

Excessive wear and damaged pump parts are most often the result of exceeding the speed limitations.

Overspeeding not only causes the wearing of all parts to accelerate rapidly but also, by increasing the discharge pressure, may cause the pump relief valve to open.

Vane wear and push rod penetration are usually caused by excessive vapors entering the pump (called cavitation) or by abrasives in the liquid. Cavitation causes the vanes to "bounce" violently and sometimes is accompanied by noise and vibration.

Cavitation is caused either by recirculation through the built-in relief valve on the pump, or by a restricted inlet. The inlet can be restricted by a dirty strainer screen, or by the internal tank valve being partially open.

All the above conditions are aggravated if the pump is running too fast and trying to deliver liquid faster than the piping can handle it.

A worn relief valve indicates a high setting on the separate bypass valve.

Corrosion of pump parts can be caused by calcium chloride brine carried over from dehydrators. Corrosion may damage internal parts and weaken the entire system. Corrective action should be taken immediately to eliminate the cause. Worn or scored discs and rotor ends are usually caused by improper replacement of the bearing locknuts.

Unless the locknuts are drawn up evenly as previously instructed in "Assembly", end-play will permit rotor and disc contact.

NOISE AND VIBRATION

Noise and vibration are usually the result of cavitation (see causes above). It may also be caused by vanes installed backwards (see Replacing Vanes), or by an improperly designed drive line which may impart a surging vibration to the pumping system.

Recirculation through the pump relief valve can also cause noise. Check setting of separate bypass valve.