BLACKMER LIQUEFIED GAS PUMPS FOR LP-GAS AND NH3 SERVICE

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

MODELS: LGL2, TLGLD2, LGL3, TLGLD3 LGL2C, TLGLD2C, LGL3C, TLGLD3C DISCONTINUED MODELS

960415
INSTRUCTIONS NO. 585/ZD

Section	500
Effective	September 1983
Replaces	May 1981

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

	LGL2	LGL3
Nominal Capacity (GPM) (60 PSI) at Ambient Temperature of:	650 RPM	980 RPM
80° F.	64	205
32° F.	51	165
	Models	
For Motor Drive	LGL2,	LGL3
For Truck Mounting	TLGLD2,	TLGL3
Pump Weight	90	150 lb.
Maximum Pump Speed (RPM)	650	980
Maximum Differential Pressure (PSI)	100	100
Minimum Relief Valve Pressure (PSI)	125	125
Torque Required (Ft.-Lb.):		
At 75 PSI	36	72
At 100 PSI	48	89

These pumps are listed by Underwriters' Laboratories, Inc. for liquefied-petroleum gas and NH3, with a vapor pressure of not more than 200 PSI at 100° F., at a differential pressure not over 125 PSI.

STRAINER

The pump should be protected from foreign matter by the installation of a strainer in the intake line. A 40 mesh screen is recommended. It will prevent .010" and larger pieces of weld splatter, slag, etc. from entering the pump.

RELIEF VALVE & BYPASS VALVE

The built-in spring loaded valve is to prevent damage to the pump or piping system from excess pressure and should not be used for recirculation. A separate bypass valve is required by Underwriters' Laboratories, Inc. in 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 relief valve. 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.

For conventional PTO (150 ft. lb. torque) the separate bypass should not be set higher than 75 psi. For a heavy-duty PTO, the setting can be up to 100 psi.

The Blackmer Model BV2 separate bypass valve can be mounted as shown in Fig. 1 for bulk plant installation.

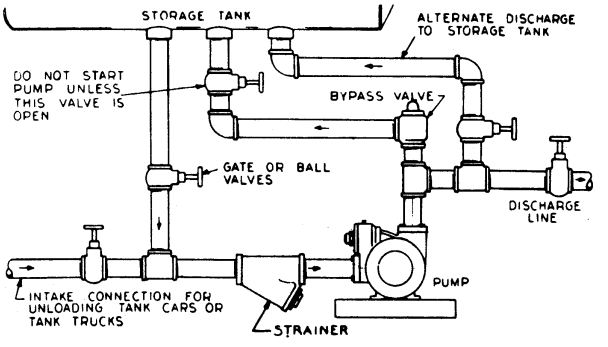

Fig. 1

INSTALLATION AND OPERATION—MOTOR DRIVEN PUMPS

LOCATION

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. 2 be set into the concrete.

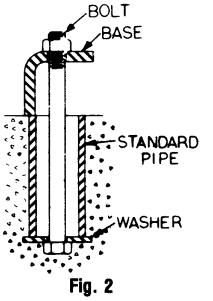

Fig. 2

KI Pumps & Systems, Inc., 206 Enterprise Road, P.O. Box 180287, Delafield, WI 53018-1768
TEL (888) 547 8678 FAX (262) 547 8678 info@kipumps.com www.blackmerpumps.com

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.

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 restricted type plug valves and undersize strainers. Use pipe of adequate size and strength that has been thoroughly flushed before connecting to the pump. Less restrictive gate or ball valves should also be used. Flexible connectors used near the pump will compensate for expansion, contraction and will provide a more vibration free operation.

Unions and valves in the piping near the pump will facilitate maintenance. On the intake side, locate the nearest fitting at least six inches from the pump to permit the removal of the pressure control cover.

CAUTION

PUMP WITH WELDED CONNECTIONS.

The pump contains three non-metallic "O" ring seals that will be damaged if welding is done without removing pump unit and flange "O" rings.

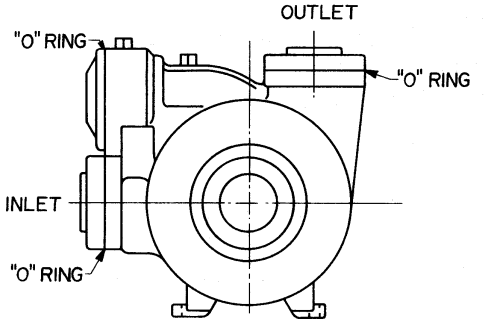

Fig. 3

One "O" ring is under the inlet flange, one "O" ring is under the outlet flange and one "O" ring is under the pressure relief valve flange.

Weld piping to inlet and outlet flanges and reinstall the three "O" rings.

When the unit is first started, rotation should be checked with the direction arrow on the pump. The discharge 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 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, 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. 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

Where flexible couplings are used, the coupling cover should be removed and a straight edge laid across the two hubs of the coupling as shown in **Fig. 4**. The maximum offset should be less than .015".

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 at 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.

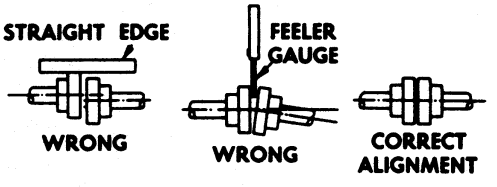

Fig. 4

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 valves in the bypass return line must be open. After the pump is started, check the direction of the arrow on the pump head.

OPERATIONAL CHECK

The relief valve and separate bypass valve setting 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 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.

INSTALLATION AND OPERATION—TRUCK PUMPS

LOCATION

When locating the pump on the tank, safety should be the first consideration.

Locate the pump so that the suction line will be as short and straight as possible. Long suction lines lessen the capacity of a pump.

A large vapor return line should be used in all transport loading and unloading. Without such a line, the back pressure built up in the receiving tank, along with the vacuum in the supply tank, would noticeably reduce the flow rate and could cause constant bypassing. A 1½" or 2" (depending on length) vapor return hose and piping is recommended.

The outlet valve selected for the tank must give the desired flow rate without starving the pump.

PUMP ROTATION

An engine-wise rotation of the power take-off requires a right-hand pump for direct drive; anti-engine-wise a left-hand pump. When viewed from the shaft end, a right-hand pump turns clockwise, a left-hand pump counter-clockwise. Be sure your pump rotates in the same direction as the power take-off. The pump rotation is indicated by an arrow on the pump head. It should never be run in the reverse direction.

DRIVE

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

It is extremely important to install a proper drive line to avoid excessive wear, vibration and noise.

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. 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.

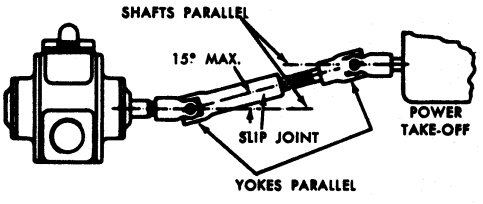

Fig. 5

PUMP SPEED

The higher the operating speed of the pump, the shorter the life of wearing parts. High pump speed may also cause continuous partial recirculation through the internal relief valve which will further shorten vane life. The operator should acquaint himself with these factors and, when making a 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.
   (b) Discharge Pressure Operated - Keep discharge line valve closed. When pump is started it will build up enough pressure to open the tank outlet valve. NOTE: This type of valve usually requires about 20 PSI differential pressure to open and about 15 PSI differential pressure to keep it open. 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 never exceed recommended maximum.
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. The differential pressure should be between 125 psi and 160 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.

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.

MAINTENANCE

LUBRICATION

Pump bearings should be lubricated every three months. When the pump is installed for propane or butane service, use a light, ball-bearing type of grease. For extreme low temperature service in northern climates, the pump should be lubricated with a low temperature grease. Listed below are some of the low temperature greases which can be used for this service:

Shell Oil Company – B & B No. 70919
Mobil Oil Company – Grease No. 22
Standard Oil Co. – Supermil Grease No. 42901
Exxon – Beacon 325

Apply grease with a hand pressure gun until it appears at the grease relief fitting.

It is normal for some grease to escape from the tell-tale holes under the bearing covers for a short period after lubrication. If this condition persists, the head must be removed and the mechanical seal replaced.

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

DISASSEMBLY

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

The size 2 pumps have dirt shields on the shafts; the double-end shaft models have one on each shaft. These shields will slide off the shaft with the bearing cover after removing the bearing cover capscrews.

Bearings are locked to the shaft and serve as thrust bearings to position the rotor in the casing. It is necessary to remove the lock collars before the head can be removed. Remove the bearing cover and loosen the set screw in the locking collar. Insert a punch in the drilled hole in the collar and tap firmly with a hammer, driving the collar in the direction opposite the pump rotation. When loosened, slide the collars off the shaft. Remove the head capscrews and slide the head assembly off the shaft. Shaft must be free of burrs and rough spots to avoid damage to seals.

The stationary seat of the seal and its "O" ring will come off the shaft as part of the head assembly. The remaining parts will slide off the hsaft as a unit. If the seal has been leaking, it is advisable to replace the entire seal, including the stationary seat and its "O" ring. It is important to keep all parts of the seal clean. Before installing a new seal, remove all burrs and rough spots from the shaft with fine emery.

The outside diameter of the liner is machined undersize so that it is slip-fit into the pump body.

To remove the liner, remove one of the pump heads, insert the tip of a large screwdriver or metal bar into a port opening and pry against the rotor. A block between the bar and rotor will assist in bringing the liner all the way out.

NOTE: Place wooden wedges in vane slots to hold push rods in place.

If the liner cannot be removed in this manner, remove the remaining head, place a block of wood or piece of brass against the end of the liner and drive it out with a hammer.

ASSEMBLY

Before inserting a new liner, clean the pump casing thoroughly. Remove any burrs from the new liner with a file.

Replace the liner key (Ref. 74). All liners are marked "Intake" on one side of the key seat. The liner must be inserted with this marking on the intake side of the pump. The "hole pattern" is the discharge porting. If installed backwards, the liner will restrict the port openings, and cause noise and loss of capacity.

If the rotor and shaft have been removed, it will be necessary to install the bottom three vanes and the push rods before re-installing. This will prevent the push rods from falling down against the inner surface of the liner. The vanes must be held in place while making the installation. To install the remaining three vanes, turn the shaft by hand until an empty slot comes to the 12 o'clock position, insert a vane, and move to the next slot.

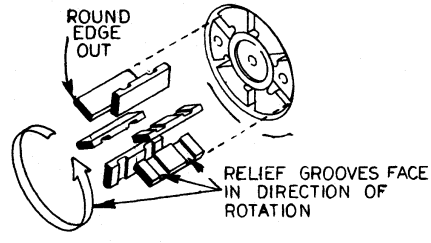

Fig. 6

Vanes must be installed with the rounded, or wearing edge, outward to contact the surface of the liner. The relief grooves in the vanes must face the leading, or pressure side.

Install the disc with the seal recess toward the outside. Position the relief hole as shown in **Fig. 7.**

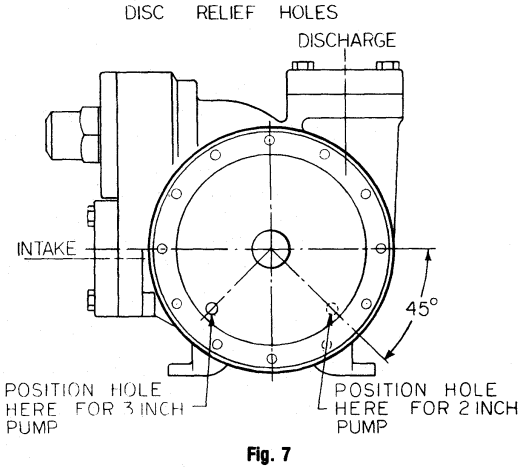

Fig. 7

Before installing the mechanical seal, remove all burrs and rough spots from the shaft which might cut or nick the rubber

"O" rings. A small amount of oil applied to the shaft will help slide the parts in place.

Place the rotating half of the seal on the shaft and engage the two driving prongs on the seal jacket with the notches in the shaft shoulder. The polished face of the carbon should be outward and the "O" ring inward. Wipe all traces of dirt and dust from the face of the carbon. Place the stationary seat in the recess in the head with the polished face outward and the drivepin engaged in the slot in the head.

Place the bearing in the recess in the head. Avoid striking the seal face against the end of the shaft when installing head on shaft. Tighten head capscrews on both heads before locking bearings to shaft.

Install the bearing lock-collar on the shaft with the recess inward to engage the shoulder on the bearing. Push the lock-collar and bearing inward while turning the lock-collar by hand in the direction the shaft will turn when pumping. The bearing must be seated firmly against the back wall of the recess when the collar is tightened.

Using a punch and hammer, lock the collar to the shaft as shown in **Fig. 8** driving the collar the direction of the shaft rotation. Rotate the shaft by hand to make sure it turns freely. If it binds or does not turn freely, loosen the bearing lock collars and the head capscrews and tap the edges of the heads with a lead hammer while rotating the shaft by hand. Retighten the head capscrews and lock collar set screws.

Replace the bearing cover and its gasket.

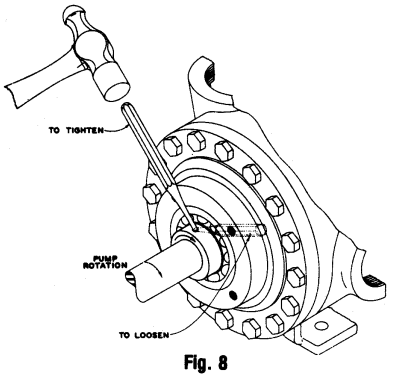

Fig. 8

Model LGL2 has a dirt shield at the inboard bearing cover; Model TLGLD2 has one on each bearing cover. Grease the end of the bearing cover. Slide the dirt shield on the end of the shaft and push it firmly against the end of the bearing cover. If necessary, use a blunt instrument to slide the dirt shield over the shaft.

TO REVERSE PUMP ROTATION

Remove bearing covers and locknuts 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 "Disassembly and Assembly" for removal and replacement of heads and rotor.

PUMP TROUBLES AND THEIR CURES

VANE WEAR

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.

Intake piping should be at least 2" on the LGL2 & TLGLD2 and at least 3" on the LGL3A and TLGL3A. For longer runs the next size larger piping should be used.

Cavitation can be caused by circulation of liquid through the built-in relief valve on the pump, or through the separate by-pass valve improperly piped back into the intake pipe. This can also happen if the pump valve operates at a lower differential pressure than the separate by-pass valve, even though the separate by-pass valve discharges into the supply tank. Check the setting of the separate by-pass valve. Cavitation is also caused by restricted intake piping, small or defective excess flow valve, plugged or too fine a strainer basket, and the use of globe valves instead of ball-type or gate-type valves.

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

One or more vanes installed backwards will cause noise and loss of capacity.

DAMAGED PUMP PARTS

Worn or scored discs can be caused by improper adjustment of the locknuts.

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 of corrosion.

LEAKAGE

Mechanical seals can be damaged and begin leaking from using the wrong grease, greasing with a high pressure gun, dirt or abrasive particles entering between the seal faces, cut or otherwise damaged "O" rings.

Leakage may 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 gasket inspected for cuts and nicks. If the gasket is damaged, it should be replaced.

ROTOR AND DISC WEAR

Worn universal joints or a slip-joint that does not slip under load are the two most common causes for excessive end thrust

on the pump shaft. This will cause the rotor to wear into the pump discs.

The most effective slip-joint is a well lubricated close fitting splined slip-joint. These commercially manufactured slip-joints will move axially under a high torque (rotating load). Worn, dry or dirty slip-joints especially the square "home-made" type will slip axially when the pump is not running, but when under load with the pump running the slip-joint becomes rigid. This can result in severe end thrust and wear to the pump.

NOISE AND VIBRATION

The most frequent cause is recirculation through the pump relief valve, caused by malfunction of the separate bypass or high bypass setting.

Another cause is excessive cavitation from a restricted intake, dirty strainer, small excess flow valve, too long or too small intake pipe.

Other possible causes – one or more vanes installed backwards, universal joints out of phase.

LOSS OF CAPACITY

The most probable causes are: restricted valve in pipe line; restricted excess-flow valve at tank outlet; cavitation; pump rotating backward; worn vane, disc, liner or rotor; pump located too far from storage tank (see paragraph on Location under "Motor Driven Pumps").

Cavitation and vapor binding may be caused by circulation of liquid through the relief valve. This will happen if the separate relief valve is set too high, is too small, or if the piping on the valve is too small. It can also be caused by overheating the pump or piping from hot sunshine or being located near a hot exhaust pipe.

If the excess-flow valve closes, it is an indication of trying to deliver too fast. The pump speed should be reduced.

Capacity without a vapor return line will be less than when a vapor return line is used.