Varley Double Helical Gear Pumps
Installation, Operating and Maintenance Instructions

Most pump problems occur at start up!

These notes have been prepared to help you prevent problems as well as deal with them.

All Varley pumps are covered by a one year warranty against defects in manufacture, the commencement date of the warranty being the date of despatch of the unit from our factory. The warranty also covers damage sustained in transit, provided both carrier and ourselves receive written notification of any damage within three days.

Notes for the Guidance of Installers

1 The pump should be installed first and the pipework built away from the pump. This should avoid strain being imposed upon the pump by poorly aligned pipework. Such strain may result in rapid seal leakage, bearing failures or broken pipe ports.
On pumps which have threaded ports, care should be taken to see that the pipe does not bottom into the port, or the threads will be damaged and the port broken. Support the pipe to prevent strain due to its weight being imposed upon the pump.

2 Determining the suction port: Provided that the build of the pump has not been altered after despatch from our factory the correct direction of rotation is indicated by an arrow on the pump front cover. This same arrow has marked upon it the suction port position (namely the tail of the arrow) and discharge port (the head of the arrow). In any case, a positive check may be obtained by observing the domed protrusion on the side of the non drive end cover of the pump – the suction port is always on the same side of the pump as that protrusion (see diagram 4).

3 Ensure that on suction pipework there is no possibility of any leakage which could result in air being drawn in to the pump.

4 Filter: A full-flow filter should be fitted on the suction side of the pump. If this is not provided, check to see whether or not one is to be fitted. In cases where the fluid to be pumped is guaranteed to be free from foreign matter, no filter need be fitted but it is desirable to insert a piece of fine gauze between flanges in the pipe-work so that weld slag, thread cuttings, sand, etc. will be trapped by the gauze and prevented from entering the unit. This gauze should be removed once the pipe-work system is perfectly clean.

Start Up

Before start-up it is wise to check the following points:

1 Check that the pump shaft turns freely. If the pump is jammed solid, it is likely that already some foreign matter has been introduced into the pump and the gears are jammed. This must be rectified immediately.

2 If the pump will turn, but is rather stiff, it is likely that the pump is gland packed and the packing has dried out somewhat on the shaft. In this case, slacken-off the two setscrews a couple of turns and continue to turn by hand until the pump frees.
N.B. *The pump should not spin freely, but should have a very slight resistance to movement with a gland packed unit. If it is still stiff after adjusting set screws, lightly tap the pump with a soft hammer in case the material parts have been forced together during installation*

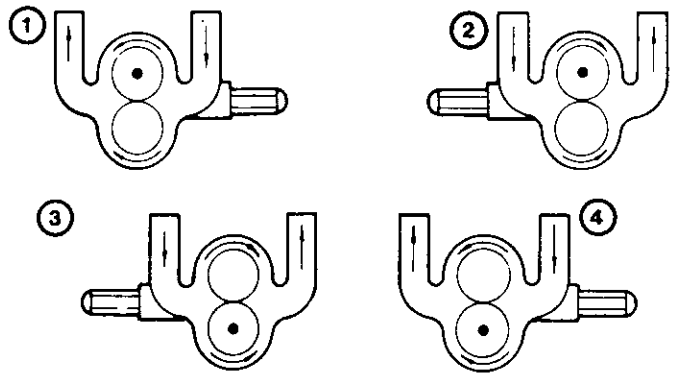
3 Although Varley pumps are self priming, it is much easier and safer, on an initial start, to hand-prime the pump with a thin lubricating oil. This guarantees that all parts are well 'wetted' and will result in rapid pick-up of fluid being pumped. (Obviously this procedure is unnecessary where the pump is beneath the level of the liquid in the tank).

4 A gland-packed pump may leak along the shaft on initial start-up, but it is wise to allow a short time of running in this condition for it to bed-in before any effort is made to adjust the gland. Adjustment should then be carried out until there is just an occasional drip of liquid from the gland area, adjustment should be done carefully over a period of hours taking each nut down evenly a little at a time.

On some units, and especially on warm oil units, a slight leak may develop across the pump end cover joints. Should this occur, all the nuts on the end covers of the pump should be checked for tightness.

5 All units have had their relief valves set to the pressure specified on our order acknowledgement, but should this set pressure prove to be unsuitable on site, it can be varied by screwing the relief valve setting-screw on the non-drive end cover of the pump in or out depending on whether the pressure needs to be increased or decreased. If the

Diagram 4



SKETCH SHOWING POSITION OF DOMED SEALING NUT ON BY-PASS RELATIVE TO PORTS

1 Top Drive A/CW Rotation
2 Top Drive C/W Rotation
3 Bottom Drive A/CW Rotation
4 Bottom Drive C/W Rotation

correct pressure cannot be set an alternative spring, available from our Spares Department, may be required.

Fault Finding and Correction

1 **Failure to Prime**

i Check that all valves are in open position

ii Check for leaks in suction line and seal

iii Check that the by-pass valve is not blocked in the open position – clean if necessary.

iv Check that the filter is not blocked – change or clean if necessary.

2 **Reduction in Flow Rate**

i Check that the by-pass valve is closed – clean and reset as required.

ii Check that there are no leaks on the pump or in the system.

iii Check that any regulating valve in the discharge line is set correctly.

3 **Noisy Running**

i Check suction line and filter for blockages.

ii Strip the pump down and look for damaged parts or foreign matter.

4 **Pump has seized and will not turn.**

i Dismantle and clean.

ii Replace damaged parts.

Service and Maintenance

Peerless Pump has a separate Service and Spares Department which will undertake field work and manages the Repair Section at our works. The Spares Department will be pleased to help you identify spare parts and supply replacements.

For those who wish to carry out their own maintenance, we give below some notes on servicing the units:

Dismantling

Remove pump from the bracket, or baseplate and proceed as follows:

1 Withdraw the coupling half from the pump shaft (first slackening the grub screw)

2 Carefully remove the key from its keyway.

3 Examine the shaft extension and keyway for cleanliness and carefully remove any burrs.

4 Remove setscrews (or nuts) and washers securing the front cover to the pump body. Break the joint by lightly tapping the cover with a soft hammer and withdraw the cover.

5 Detach rear cover in the same fashion as for the front cover removal.

6 If fitted, withdraw the spacing collar from the mainshaft at the front cover end and detach the shaft locating washer at the rear cover end.

7 Remove circlips and withdraw the bearing housings complete with bearings from each end of the shafts.

In the case of pump Size 1 to Size 20, the housings will part from the rotor end faces sufficiently to allow the insertions of extractor plates – these can be supplied – for drawing the bearing inner races off the shafts.

In the case of pumps size 35 and above the bearing housings complete with bearing outer races and rollers will slide freely off the shafts leaving the inner races still in position.

8 After the removal of the circlips the inner races can be removed from the shafts with the aid of a screw type extractor.

9 Do not attempt to press shaft through the rotors on any of the pump sizes. Rotors are permanently secured to the shafts and they must be considered as one unit.

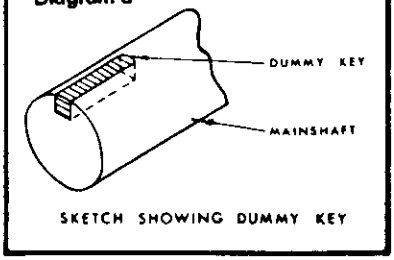
10 Remove the outer races of the bearings from their housings.

11 On a gland-packed pump, fully unscrew the gland adjustment setscrews and remove the gland retainer and gland. Remove all the old packing and then clean and smooth the bore using a fine emery cloth or a small soft wire brush.

12 By-Pass Valve
Remove dome nut and release locknut. Screw out the setting screw, making sure the number of turns are counted. Remove the setting screw housing, spring and valve.

In the case of a mechanical seal:
The mechanical seal rotating element should be removed from the pump before the rotating assembly is pressed out. In removing this seal, it is advisable to use a dummy-shaft key to prevent the seal ring being cut when it passes over the keyway (see diagram 5).

Diagram 5



SKETCH SHOWING DUMMY KEY

The seal collet should be removed by opening up the slot and sliding it off the shaft. The static seal face is in the front cover; this should not be removed unless the seal is being replaced.

Inspection

Examine all parts for wear and damage and clean up or replace with new parts as necessary. It is unwise to rebuild a pump with worn components.

Reassembly

N.B. *It is advisable to use new bearings when a pump is being overhauled.*

1 Carefully press the outer races of the roller bearings into the bearing housings.

2 Fit the rotor keys into the grooves in the main and idler shafts.

3 Push the gears along the shaft into their correct positions.

4 Carefully press the bearing housing and bearing assemblies on to the shaft, ensuring that they are square to the shaft. Note that in this case the load should be placed on the inner race of the bearing.

5 Where supplied, refit the circlips into the grooves in the shafts. Check to see that the rotor turns freely in its bearings.

6 Match the mainshaft assembly and the idlershaft assembly together and place them in the body from the rear towards the front of the pump.

7 Very carefully insert the assembly into the body ensuring square entry and that both assemblies are entering the pump together. Ensure the pressing is done on the outer race to prevent damage to rotors and bearing housings.

8 The assembly is correct when the housings are flush to the body. Fit locating washer and spacing collar, when provided, replace front and rear cover gaskets and fit the covers.

N.B. *The gland should be repacked before the front cover is replaced on the pump since this will centralise the cover on the body.*

9 After tightening down the covers check that the mainshaft turns freely: if it does not it is probable that the bearing housings have closed up on the rotors. It is possible, by lightly tapping the body with a hide hammer, to ease them off.

10 By-pass Valve
Assembly of by-pass should be effected in reverse order to the dismantling.

Note on repacking the gland
The gland should be repacked using only moulded rings supplied by Peerless Pump Ltd and they should be used in the following order:

lead ring
three fibre rings
lead ring

Make sure that the ring joints are staggered to prevent a leakage path for the liquid. Then refit the gland retainer, and screw in the setscrews until the shaft has just the slightest resistance to movement, (though it should still be quite free to turn).

Note on assembly of mechanical seal

Again, the mechanical seal should be assembled using a dummy key in the coupling keyway.

The stationary carbon ring should be carefully pressed into the recess in the front cover, care being taken to see that the carbon is pressed in squarely.

N.B. *Great care must be taken to see that the carbon is not chipped or cracked during this operation (the carbon is a brittle component).*
It is wise to lightly smear the rotating face with clean lubricating oil before assembly of the front cover.

It should be possible to reassemble a pump satisfactorily, provided normal fitting skill is exercised. However, the skill of fitting the seal in the front cover is made easy by the use of special tools which are available from Peerless Pump Ltd should you require them.

Points to be borne in mind when designing the installation.

1 Location of the pumps
Wherever possible the pump should be located close to the supply tank. This avoids the necessity for long suction pipe runs which can often be troublesome. This is because no pump can literally 'suck', it normally requires atmospheric pressure to 'push' liquid to the pump.

Varley gear pumps when correctly selected and installed are relatively quiet, although where they are running in isolation with little or no other background noise, they can be heard (e.g. a pump sited under a bedroom will be inaudible during the day, but can be a cause of complaint at night). It is wise to locate the unit away from any such area.

2 Sizing of pipework
Resistance to flow is reduced as pipework size is increased, and consequently requires less motive power. We, therefore, do not apply a limitation to the maximum discharge pipework that can be employed. It should be noted, however, that at no time should this be less than the port size of the pump.

N.B. *Care must be taken when choosing the diameter of suction pipework when the pump is operating under suction lift.*
Should the diameter be too large, the pump will spend much of its time, on start up, evacuating the large volume of air in the pipe, and we strongly recommend the pipe size be kept to the same size as that of the suction port.

3 Noise
Noise may be airborne, structure-borne, pipe-borne, or fluid-borne. The siting of the unit will take care if airborne noise and steps should be taken to mount the unit on a noise/vibration absorbing base if structure-borne noise could be a serious problem.

Most fluid and pipe-borne noise results from numerous changes of direction causing turbulent flow of the fluid and vibration of the pipework. The number of bends should, therefore be kept to a minimum. This form of noise is frequently the most troublesome as pipework often runs through a building and the noise is distributed throughout.

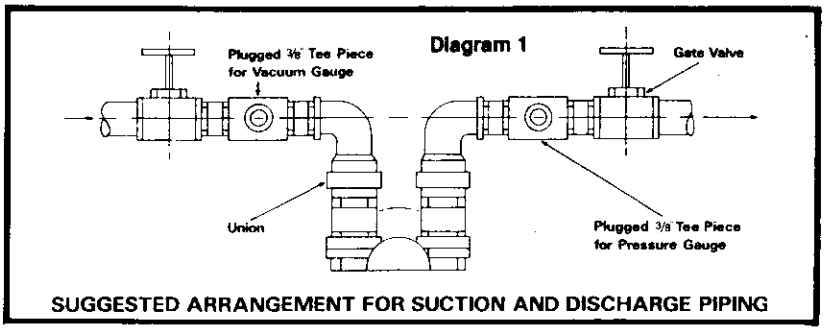
The pipework should also be firmly clipped to the wall, with some anti-vibration material between clip and pipe. When pipework is not near a wall it must be firmly supported.

4 Suction lifts
It has already been mentioned that pumps should be mounted as closely as possible to the tank. Where this is impossible, the imposition of a suction lift on the pump is often necessary. In such cases, it is essential that the pipework be free from all air leaks. Therefore, joints should be kept to a minimum. Even though the pump unit is self-priming a foot valve should still be fitted to the suction line in the tank. Without this the pump is called upon to prime the total length of the line at each start-up which means longer periods of dry running before the fluid reaches the pumps and rapid wear can occur.

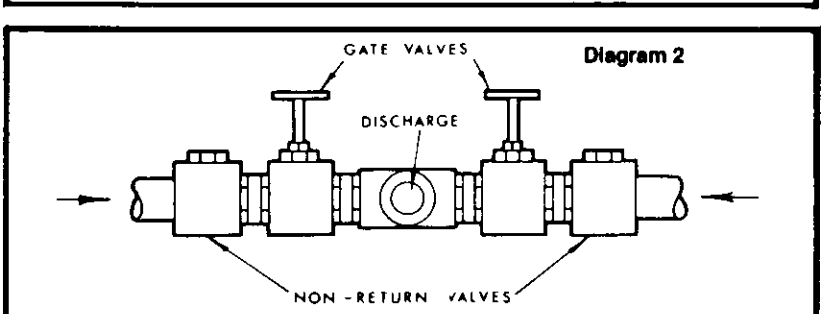
5 Filter
New pumps rely on the maintenance of fine working clearances for efficient operation, so if there is any possibility of foreign matter finding its way into the tank and thence to the pump, a full-flow suction filter must be installed to ensure long life.

6 Valving
Isolating valves should always be provided on either side of the pump to avoid the messy task of clearing lines before removal of the pump for maintenance. (see diagram (1) for suggested layout).

Where two units pump the same line (especially on an automatic standby system), non return valves should be fitted in the discharge from each unit to prevent back-flow of the liquid through the stationary pump. A satisfactory valving arrangement is shown in diagram (2).



SUGGESTED ARRANGEMENT FOR SUCTION AND DISCHARGE PIPING



SUGGESTED PIPING ARRANGEMENT FOR TWO PUMPS HAVING COMMON DISCHARGE.

7 Effect of fluid viscosity
Very careful attention must be paid to the pipework layout when viscous fluids are being pumped. Suction lifts should be avoided if possible and all pipework runs kept as short as possible to avoid large pipework losses. Particular care must be taken when heat is required to bring the viscosity to an acceptable level. At start-up the liquid is often cold, resulting in a severe overloading of the pump and possibly a motor failure. If there is the possibility of cold starts, you should let us know and we can take it into account when specifying the unit.

8 By-pass valve
The by-pass valves fitted to pumps of our manufacture are intended entirely as pressure relief valves to protect the pump and system against over-pressure should blockage occur in the discharge pipework, or should the imposed load rise too high. It should not, therefore, be used as a pressure regulating valve in normal circumstances (and it will not normally give adequate regulation if any attempt is made to use it in this way).

A system should not be designed using a return-to-inlet by-pass valve if the discharge is to be kept closed for long periods since the fluid will then circulate around the pump and cause overheating. In this case the alternative return-to-tank system should be utilised. To avoid aeration of oil, the return line back to tank should be installed as far away as possible from suction line, the entry of this line into the tank must go below the oil level at all times (see diagram (3)).

Notes for the guidance of designers and draughtsmen
Because the pumping unit is relatively simple and inexpensive, its siting is sometimes given little thought. It is in fact the 'heart' of an installation and, therefore, the sizing and location are worthy of careful attention.

Motors
Motors are normally trouble-free as long as they are kept in clean dry conditions. Where greasing points are fitted they should be given one shot of grease every few months running – but not more than one shot.

Filters
Filters should be cleaned regularly.

Pump storage
It sometimes happens that a unit must be obtained well before the plant is to be put into operation. If it should become necessary to store a pump, or to leave it on site for a lengthy period before operation, the following precautions should be taken.

1 On a gland-packed pumps loosen off the gland retainer setscrews.

2 Liberally coat the pump shaft, coupling and motor shaft with a protective oil.

3 Ensure that the motor windings are kept dry either by storing in warm, dry, clean conditions or install heaters in the motor.

4 Fill the pump body with a corrosion-inhibiting oil and, where the pump is in storage, seal off pump ports. About once a month give the pump shaft a couple of turns to prevent any standing corrosion effects.

Recommended spares

We are frequently asked to provide a list of recommended spares for units of our manufacture. To assist the user to assess his requirements we break our recommendation into two headings – namely, 'normal' usage spares (those normally required to be replaced during the overhaul of a unit which has been maintained and operated correctly) and 'strategic' breakdown spares (those spares which should be held against breakdown when the unit is of strategic importance to the operation of a system).

We give below our normal recommendation for a spares holding:

1 – set gaskets
1 – set gland-packing or mechanical seals
1 – set bearings and housings

Strategic breakdown spares
All those for normal repair, plus the following:

One complete set of internals, namely: –

shafts
rotors
keys
bearing housings
one by-pass valve

Obviously, if there are many pumps of the same type operating in a system, it would be wise to hold spare pumps, together with sets of normal usage spares.

Diagram 3

TYPICAL PIPEWORK LAYOUT