PULSA® Series

DIAPHRAGM METERING PUMPS

Installation Operation Maintenance Instruction

Bulletin No. 340

Pulsafeeder

Manufacturers of Process Pumps and Systems:
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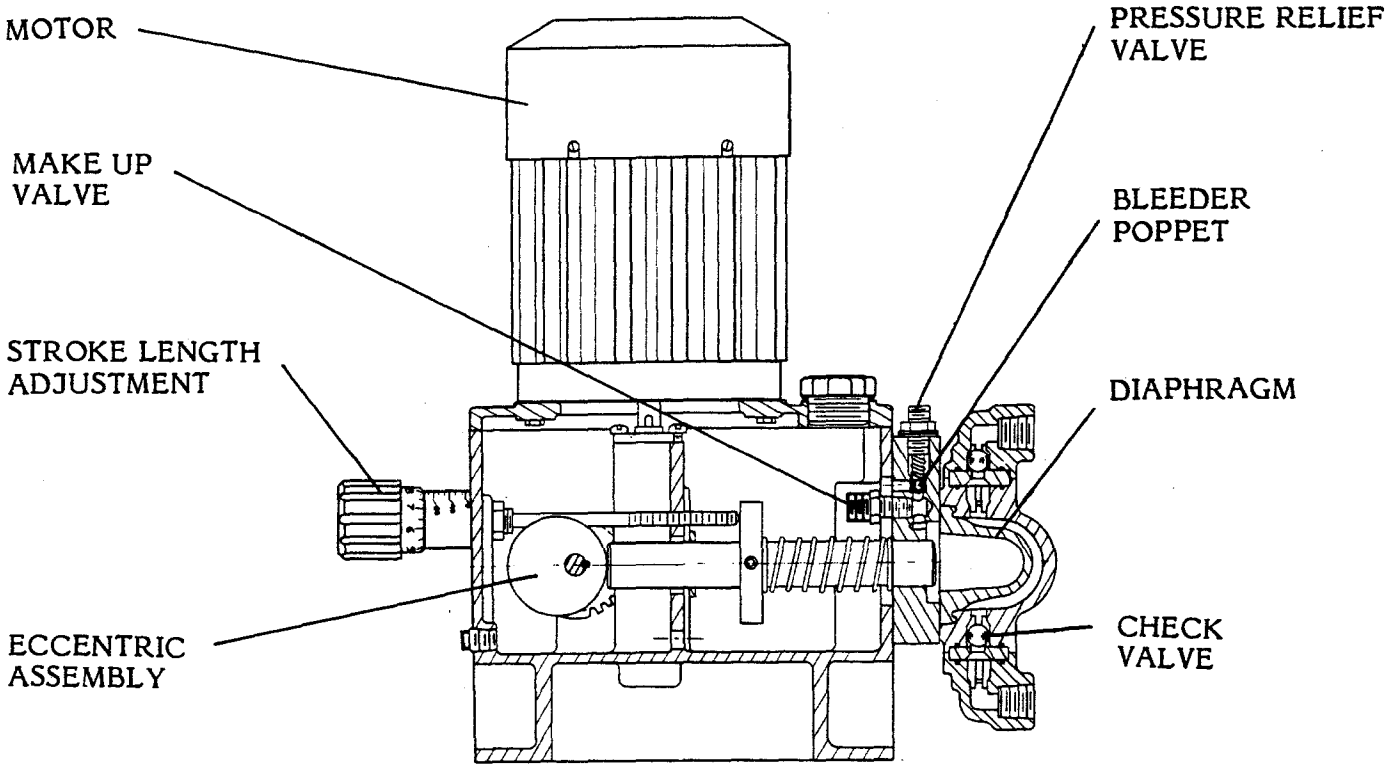

FIGURE 1

HOW IT WORKS

Figure 1

The motor drives a wormshaft at constant speed. Through wormgear reduction and eccentric, a reciprocating power stroke is transferred to a piston. The length of piston stroke determines pump capacity and can be adjusted manually to provide pumping range from 0-100% of rating. This piston does not pump chemicals, but an exceptionally stable oil having excellent lubricating and hydraulic qualities. The forward movement of the piston pressurizes hydraulic fluid which expands the elastomer diaphragm in direct relation to piston travel. As the diaphragm expands, the chemical is forced from the reagent head and out the discharge check valve. When the piston starts to return, hydraulic pressure is released and the diaphragm returns to normal shape and draws in new chemical. Any oil leakage past the piston, however slight, is replaced by the make-up valve which permits flow of replacement oil from the oil reservoir.

Replacement is automatic because the oil loss allows the diaphragm to get out of phase with the piston thus creating a vacuum ahead of the piston during the suction stroke of the pump.

Any excess pressure buildup within the hydraulic chamber or reagent head, due to accidental valve closure or line stoppage is relieved through the automatic pressure relief valve. It expels oil under excess pressure ahead of the piston back into the oil reservoir thus terminating the pumping action and protecting the pump mechanism. Instrumentation sensitive to high instantaneous pressures developed while the relief valve is operating may require a separate relief valve in the process line. Relief valves are factory set at maximum nameplate pressure.

INSTALLATION TIPS

Check the Shipment

A standard shipment includes the pump, oil, instruction and parts list packet. Unpack carefully and make sure all parts are received. Check voltage of electric motor against the service to be used.

Motor Rotation

Correct pump rotation is obtained when the motor is turning clockwise when viewed from the top. Directional arrows are provided on the pump cover showing correct motor rotation. If the pump is operated in the wrong direction for long periods of time internal damage to the pump will result.

Locating the Pump

The pump is designed to operate under indoor atmospheric conditions unless the optional weatherproofed motor is supplied. Check the motor supplied before installing in a severe outdoor environment. The pump will not meter fluids at temperatures below 40°F (4°C) or above 150°F (65°C) without damage to the diaphragm.

1) Pump must be level within 1/8" for good valve operation.
2) In most cases the pump can be operated without bolting down. When bolting down use 1/4" screws and bolt only to a smooth surface.

Flooded Suction Desirable:

Installation will be simpler to operate if the liquid will flow to the pump by gravity. Wherever possible, the pump should be located below the level of storage vessel.

Discharge Pressure:

All models are designed for continuous service at the rated discharge pressure. To maintain metering control and prevent liquid "flow thru", it is necessary that discharge pressure be at least 15 PSI above suction pressure. When pumping downhill a back pressure valve should be placed in the discharge line.

Piping Suggestions:

The size and length of inlet piping is critical for good pump operation. Inlet pipe sizing charts are provided to help in choosing inlet piping.

If piping is used instead of tubing, care should be taken to support and brace the piping so that it does not put excessive stress on the reagent head. For some installations it is helpful if shut-off valves and unions are used on both the suction and discharge lines. This allows easier inspection of the check valves and cleaning of the reagent head assembly when maintenance is performed.

The use of a pipeline strainer in the suction line between suction shut off valve and pump suction valve is recommended. 100 mesh screen is preferred.

Flush Piping System:

All lines should be flushed with a clean liquid or air before connecting up to the pump, to carry out pipe scale or other foreign material. Make sure flushing liquid is compatible with the chemical to be pumped.

START UP

Filling the Oil Reservoir:

Every metering pump is tested for rated capacity at maximum pressure capability of the pressure relief valve before shipment. For shipping purposes the reservoir oil has been removed. Sufficient fresh oil is included with the shipment for refilling the oil reservoir. Remove the oil fill cap and fill the reservoir until the oil level is above the make-up valve yet no higher than the threads in the oil fill hole. One quart fills the gearbox to the minimum level. The oil is compounded to serve as both gear lubricant and hydraulic transfer fluid. Check with the vendor if substitute oils are going to be used. DO NOT RUN PUMP WITHOUT OIL.

Priming Process Head:

1) Before starting pump, open the suction line and discharge line shut off valves.
2) If the piping system design and the storage tank are such that the product flows by gravity to the pump, no priming is required. If the discharge line is under pressure, air will be trapped in the process head and it will be necessary to remove the discharge pressure to enable the pump to prime itself.
3) If the pump must handle a suction lift, it may be necessary to manually prime the reagent head. Remove the discharge valve by unscrewing the two valve cap bolts and then lifting the valve out. Fill the head with process fluid, or a compatible liquid, then replace the valve in the same position and retighten the valve cap bolts to 10-15 in. lb. torque.
4) Start the pump and increase the control setting to full stroke.
5) Make a brief check to assure that the pump is producing the approximate rated flow at the full stroke setting. Calibration should not be attempted on any model until is has run at least one hour to assure the pump hydraulic and reagent head systems have stabilized.

The hydraulic oil system is primed at the factory but may lose partial prime during shipment and storage or if the hydraulic system has inadvertently been relieved due to starting up with restricted suction or discharge conditions. Loss of prime will cause erratic operation and insufficient flow. If these problems are encountered after priming the process head, follow Step 9 of the Priming Procedure on page 5 noting the number of turns the pressure relief valve screw is backed out. If this does not solve the problem, follow Steps 4 through 10 of the Priming Procedure.

To Adjust Flow Rate:

The pump is provided with a micrometer knob adjustment for changing length of stroke while in operation or idle. Turn adjustment knob clockwise to increase flow and counterclockwise to decrease flow. The adjustment knob is read directly in percent of flow. These indications can be converted to volumetric or weight units by calibration conversion charts.

Calibration:

All pumps must be calibrated under actual operating conditions for the operator to know the proper adjustment for particular outputs. A typical displacement chart is shown in Figure 2. Note that output is linear in respect to micrometer settings.

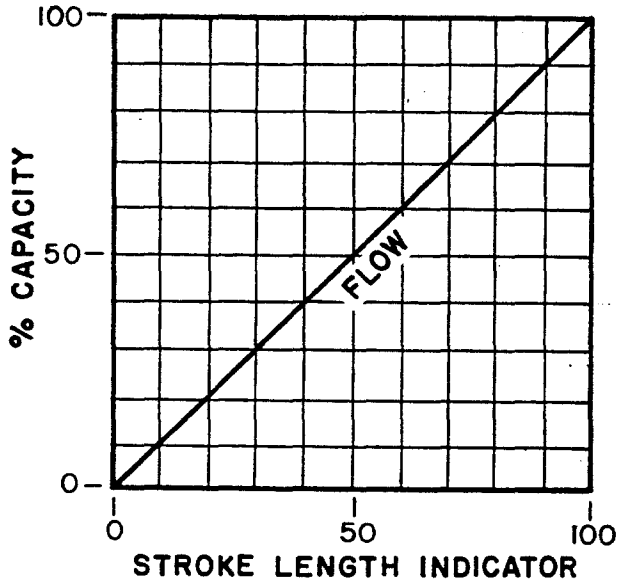

FIGURE 2

OPERATION AND MAINTENANCE

Diaphragm Inspection:

The diaphragm can be damaged by the following:

1) Chemical attack.
2) Mechanical damage from trash or abrasives.
3) High temperature - above 150°F (65°C).
4) Low temperature - below 40°F (4°C).

Service conditions will determine life and dictate the replacement schedule.

Diaphragms which are punctured or show evidence of tearing or abrasion at the sealing edge should be replaced. If diaphragm shows evidence of hardening so as to be non-flexible it should be replaced.

To Prime The Hydraulic System:

1) Reassemble diaphragm and reagent head, tightening all bolts securely and evenly to 10-15 in. lb. torque.
2) Reassemble valve housing, valves, seats and seat "o"rings. Take care in inserting "o"rings that they are properly placed. Tighten all bolts to 10-15 in. lb. torque.
3) Fill gearbox to the required level with the recommended oil.
4) Set stroke length adjustment to the maximum stroke setting.
5) Loosen the hex jam nut securing the pressure relief valve adjustment screw located on the top of the pump head. Remove the adjustment screw. Do not re-position the washer on the screw. The washer will remain in its original position on the screw if not disturbed.
6) When repriming a pump that already has some oil in the hydraulic chamber it usually only requires that you place a finger over the valve cavity and run the pump for 10-20 seconds. If you are priming a pump that has been taken apart and re-assembled you must remove the relief valve parts from the pump head. A magnetized screwdriver is very helpful when doing this. Then follow the procedure of running the pump for 10-20 seconds after which, re-install the valve parts and spring in the same order they were taken out.
7) Stop the pump and replace the pressure relief valve screw, using the position of the sealing washer on the screw as a guide to approximately restore the original factory pressure adjustment. When the washer contacts the top face of the pump head, tighten the hex jam nut.
8) If a more accurate setting on the pressure relief valve is required see "Pressure Relief Valve." Approximately a 1/2 turn more after process pressure setting has been reached will seat the valve. The relief valve can be set higher if desired but do not exceed MAXIMUM OPERATING PRESSURE indicated on the nameplate.
9) Operate the pump until it reaches rated capacity (15-20 minutes). If it takes longer, loosen the relief valve screw until oil starts to leak around the threads. Do not totally remove the screw while the pump is running. Turn the screw back in slightly until the leaking stops and run for 10-20 seconds. Re-tighten adjustment screw and check pump capacity.
10) If the pump still does not reach capacity refer to the "TROUBLE-SHOOTING SECTION."

Check Valves:

Operating experience on thouands of installations has indicated that many metering pump troubles have to do with check valves. Problems usually stem from (a) an accumulation of trash between the valve and seat, (b) corrosion which damages seating surfaces, (c) erosion from high velocity flow, or (d) normal physical damage after extended service.

A valve seat, to function correctly, must have a polished, narrow seating surface. If the valve or valve seats do not show signs of wear, clean and reinstall. If they show signs of wear, replace both.

Hydraulic Make-Up Valve:

Hydraulic make-up valves are designed to maintain the correct volume of oil in the hydraulic system between the piston and the diaphragm. Since the valve operates only occasionally and with very little movement it is not considered a normal replacement item in a service schedule. If the valve is replaced because of corrosion or fouling, be sure tape or sealant is used on the pipe threads to assure an air tight seal.

Pressure Relief Valve:

The relief valve is factory set to the "Relief Valve Setting" if specified on the specification data sheet or at maximum pump pressure, indicated on the pump nameplate. To adjust to a lower relief pressure, turn counter-clockwise. To check the pressure setting it is necessary to install a gauge in the discharge line between the pump and a shut off valve. With the pump operating at maximum stroke a gradual closing of the shut off valve will cause the relief valve to reach its cracking pressure which will be observed on the gauge. When the relief valve is set for maximum pump operating pressure (shown on nameplate), cracking pressure is slightly above maximum operating pressure so that it does not weep during normal pump operation. "Dead head" pressure can be considerably higher than cracking pressure so the internal relief valve should not necessarily be considered a safety valve for the protection of sensitive process piping and instrumentation. It is unusual for a pressure relief valve to operate during normal pump operation. The following conditions will cause pressure relief valve operation:

1). Excessive pressure buildup in the process which the pump is injecting into.
2) A plugged discharge line or someone shutting off a valve in the discharge line while the pump is operating.
3) Restricted flow to the pump causing the make-up valve to operate.
4) If an inlet strainer is plugged, or someone closes an inlet valve thereby restricting flow of fluid to the pump.
5) Undersized (restrictive) piping or tubing must be avoided (see inlet pipe sizing charts).

Any unusual condition in the system which prevents free movement of the diaphragm will cause a recirculating condition between the make-up valve and the pressure relief valve. Continuous oil recirculation against the pressure relief valve will eventually aerate the oil plus introduce unnecessary load conditions within the pump mechanism.

Lubricating Instructions:

The oil is a custom blend with additives for lubrication and hydraulic transfer service. (For emergency requirements, a list of acceptable commercial oils is available). A periodic six month check should be made for oil level and possible contamination. Replace oil yearly or at more frequent intervals if oil appears contaminated.

Under sustained conditions of high humidity or if water is present, the oil can become emulsified and take on a yellowish color. Change the oil immediately if this occurs and examine the make-up valve and other parts for corrosion. A suction pump similar to a grease gun is useful for removing oil from chambers, or it may be drained from the drain plug located near the adjustment knob.

PUMP SPECIFICATIONS

Maximum Pressure: See Nameplate
Maximum Flow: See Nameplate
Metering Accuracy: ± 1% Of Full Flow
Pump Size: 12" Long x 6" Wide x 13" High
Weight: 21.5 Lbs.
Inlet and Outlet Connections 1/4 NPT
Torque Specifications:
- Reagent Head Screw 10-15 in. lb.
- Valve Cap Screws 10-15 in. lb.
- Pump Head Screws 33-38 in.lb.
- Bearing Plate Screws 25-30 in. lb.

Stroke Rate 175 Strokes/Minute
Oil Capacity: Minimum of 1 Quart
Operating Temperature Range:
40-150 °F 4-65°C
Suction Lift: 20 Feet of Water (6 PSIA)
Maximum Viscosity: 500 cps

TROUBLESHOOTING

Experience drawn from thousands of installations has shown that there are three outstanding areas which contribute to the bulk of operating problems. First and foremost is installation conditions. Improper location and supply, inadequate or restrictive piping to and from the pump, unsupported piping, lack of strainer in suction piping.

The second major area is check valves. The check valve is the heart of any pump and sees more severe service than any other part of the pump. Opening and closing 175 times per minute the valve not only receives a mechanical hammering but receives it under high velocity, corrosive, erosive and sometimes extreme temperature conditions. Foreign particles, unlevel mounting, defective seals and improper torqueing all too often aggravate even the simplest application.

The third area is simple lack of a routine service policy. Routine service will catch or avoid simple operating problems which can develop into a crisis if left unattended.

The following is a brief troubleshooting guide to help identify and cure any operating problems you might experience.

DIFFICULTY	PROBABLE CAUSE	REMEDY
PUMP DOES NOT START	1) Faulty power source	Check power source
NO DELIVERY	1) Motor not running	Check power source
	2) Supply tank empty	Fill with liquid
	3) Lines clogged	Clean and flush
	4) Ball check valves held open with solids	Clean--inspect
	5) Prime lost	Reprime, check for leak
	6) Hydraulic system under primed	Refer to "Repriming Hydraulic System"
	7) Check valves installed upside down	See check valve illustrations
LOW DELIVERY	1) Check valves worn or dirty	Clean, replace if damaged
	2) Pressure relief valve opening each stroke	Refer to "Pressure Relief Valve"
	3) Stroke adjustment incorrect	Adjust stroke
	4) Hydraulic system underprimed	Refer to "Prime the Hydraulic System"
DELIVERY GRADUALLY DROPS	1) Check valve leakage	Clean, replace if damaged
	2) Leak in suction line	Locate and correct
	3) Fouled pressure relief or make-up valve	Refer to "Operation and Maintenance"
DELIVERY ERRATIC	1) Leak in suction line	Locate and correct
	2) Fouled check valves	Clean, replace if necessary
DELIVERY HIGHER THAN RATED	1) Suction pressure higher than discharge pressure	Install back pressure valve
	2) Back pressure valve set too low	Increase setting
PUMP LOSES OIL	1) Diaphragm ruptured	Replace
	2) Cover gasket leaks	Replace or tighten cover screws
	3) Pump head gasket leaks	Replace or tighten pump head bolts
NOISY GEARING, KNOCKING	1) Operating at partial stroke	No action necessary, some knocking is normal
	2) Worn gears	Replace gears
	3) Pressure relief valve set too high	Readjust -see "Pressure Relief Valve"
MOTOR OVERHEATS	1) Pump overloaded	Check operating conditions against pump design
	2) Faulty motor	Check no load amps

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