# PULSA Series®

DIAPHRAGM METERING PUMPS

## INSTALLATION
## OPERATION
## MAINTENANCE
## INSTRUCTION

## BULLETIN No. 680C

PULSAFEEDER
A Unit of IDEX Corporation

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Controls and Systems

ENGINEERED PUMP OPERATIONS
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## How it Works:

*Figure 1*

A standard foot mounted motor drives a wormshaft at constant speed. Through wormgear reduction and eccentric, a reciprocating power stroke is transferred to a plunger. The length of plunger stroke determines pump capacity and can be adjusted manually to provide pumping range from 0-100% of rating. However, this plunger does not pump chemicals, but an exceptionally stable oil* having excellent lubricating qualities. This makes a perfect pumping medium.

*A special property petroleum oil tradenamed "PULSAlube" is generally used as hydraulic fluid. Continual reference to "oil" as hydraulic medium implies its general use rather than its use of necessity. Check with your representative or the factory if substitute oils must be used.*

**Hydracone Diaphragm**
*Figure 2*

The HYDRACONE elastomer diaphragm Figure No. 2 isolates product pumped from the plunger and pump mechanism.

Several elastomers are offered including Viton* and Hypalon* which provide a satisfactory chemical resistance for a wide variety of corrosive fluids.

The forward movement of the plunger pressurizes the hydraulic fluid which expands the elastomer HYDRACONE diaphragm in direct relation to plunger travel. As diaphragm expands, chemical is forced from reagent head and out discharge check valve. When plunger starts to return, the hydraulic pressure is released and HYDRACONE returns to normal shape. This diaphragm return, which is not affected by inlet pressure conditions, draws in new chemical under high suction lift.

**Products of E.I. DuPont*

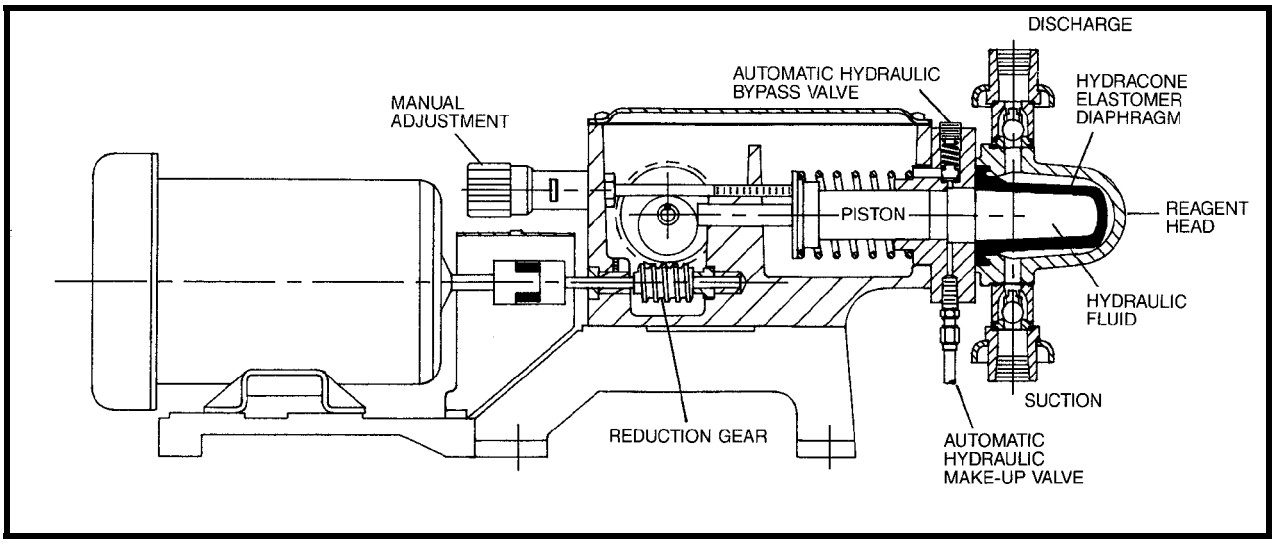



Figure 1.

Any leakage past the plunger, 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 plunger thus creating a vacuum ahead of the plunger during the suction stroke of the pump. The make-up valves are factory set.

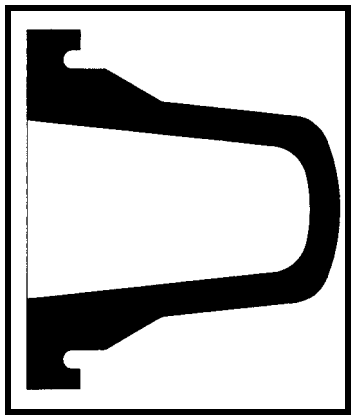


Figure 2.

Any excess pressure buildup within the hydraulic chamber or reagent head due to accidental valve closure or line stoppage is relieved through the automatic hydraulic bypass valve. It blows off oil under excess pressure ahead of the plunger back into the oil reservoir thus terminating the pumping action and protecting the pump mechanism. Hydraulic bypass valves are factory set at full design pressure unless specified differently by purchaser.

**Pressure Relief Valve**

A separate process relief valve should be installed in the process piping to protect piping and sensitive process equipment.

**Plastic Reagent Head**
3/8" Dia. Piston Design

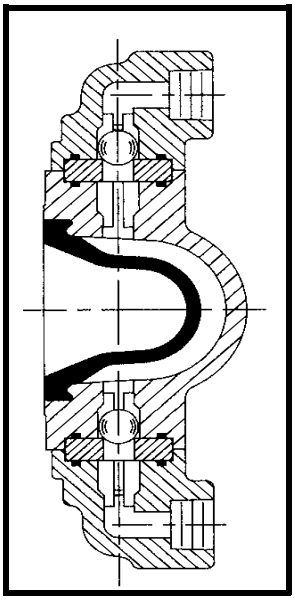


Figure 5.

**Metal Reagent Head**
⅜″ Through 1.125″ Dia. Piston Design

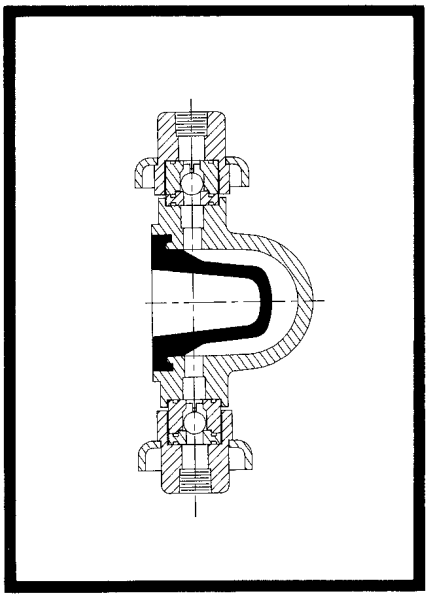


Figure 3.

**Metal Reagent Head**
1.250″ Through 1.500″ Dia. Piston Design

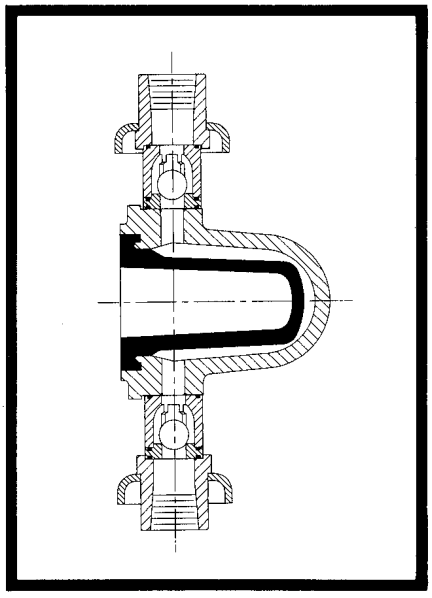


Figure 4.

**Plastic Reagent Head**
½″ Through 1.500″ Dia. Piston Design

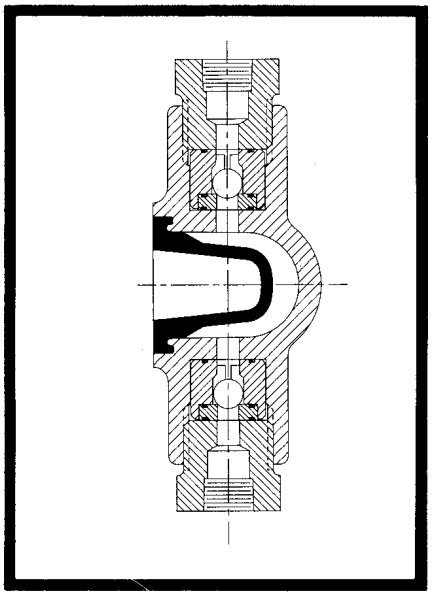


Figure 6.

# Installation Tips

**Check The Shipment**

A standard PULSA Series shipment includes the pump, PULSAlube oil, wrenches, instruction and parts list packet and replacement parts if ordered. Unpack carefully, check packing list and make sure all parts are received. Check voltage of electric motor against the service to be used.

**Locating the 680C Pumps:**

PULSA 680C pumps are designed to operated under indoor atmospheric conditions. It is desirable to provide a hood or covering for outdoor service. Alternate oil or external heating must be arranged if ambient temperatures will be below 40°F (4.4°C). Fluid temperatures entering the pump must be 40°F (4.4°C) or greater. Check with factory if concerned with the suitability of the operating environment.

1. Check level of pump. Shim where necessary.

2. Securely bolt to foundation. Do not distort base.

*NOTE: Most 680 models will operate without bolting down. However, it is important to have a solid and level foundation so that a minimum of vibration is evident. Continual vibration can loosen gaskets and pipe connections.*

3. Check motor alignment and reagent head and valve bolt tightness before operation. Follow bolt torque readings carefully.

**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 680 models are designed for continuous service at the rated discharge pressure. To prevent liquid flow through, it is necessary that discharge pressure be at least 5 psi above suction pressure. When pumping downhill a back pressure valve should be placed in the discharge line.

**Piping:**

Pipe size and length are critical to proper operation of any metering pump. A restricted discharge or starved suction condition spells immediate failure to any metering pump installation. A separate brochure entitled "Designing a Successful Metering Pump Installation" is provided to assist Engineers responsible for piping system design. Copies are available upon request (Technical Sheet 304). Inlet piping must be at least equal in size to pump inlet connection.

Figure A shows the preferred piping configuration for a good metering pump installation. A good piping installation addresses present and future requirements of the metering system. Plan for shut off valves and unions or flanges installed on both suction and discharge lines. This allows inspection of the check valves without draining long runs of pipe. Install a tee in the suction and discharge piping between the pump and the shut off valves. This permits easy installation of a calibration tube for calibration of the pump at start up or any future date. A tee in the discharge piping is a must on a good installation because it permits ease of mounting a pressure gauge to check discharge pressure at the pump and setting the hydraulic bypass valve during start up and future maintenance functions. To prevent strain on the pump fittings use pipe straps and braces. Do not allow the weight of the piping to be supported by a pipe union, the valve fitting or other portion of the pump head or leaks will occur. An air leak at a union or other fitting in the suction piping can severely affect metering accuracy and is extremely difficult to detect. In assembly of piping, use pipe thread tape or a compound compatible with the product handled. If rigid piping is used we suggest bolting the pump to its foundation.

**Use Strainers:**

Pump check valves are susceptible to dirt and other contaminants and any accumulation can cause malfunction. Be sure to use a pipeline strainer in the suction line between the suction shut off valve and the pump suction valve, 100 mesh screen is preferred.

**Flush Piping System:**
Whether new or old piping is used, all lines should be flushed with a clean liquid or air before connecting the pump to carry out pipe scale or other foreign material. Make sure flushing liquid is compatible with the chemical to be pumped.

**Metal Reagent Head Models:**

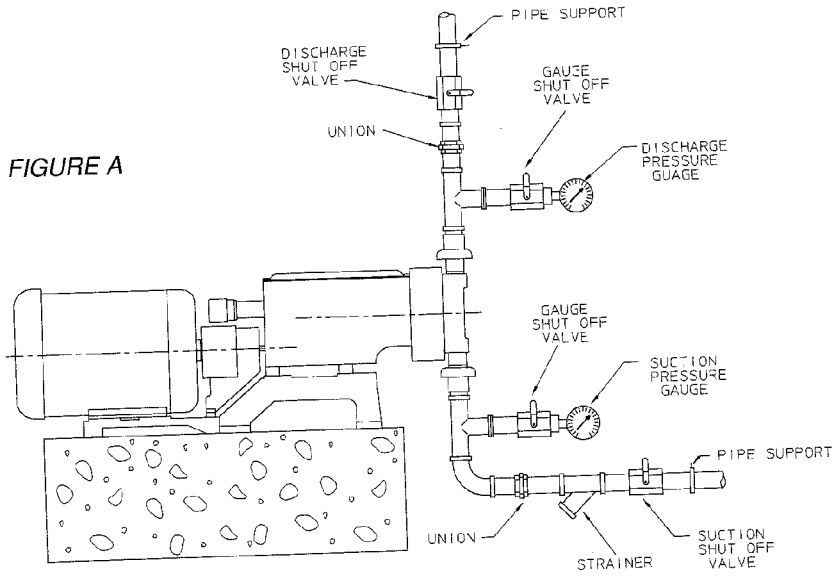
The metal reagent head assembly is provided in several alloys. Piping of similar alloy should be selected. Dissimilar materials can cause galvanic corrosion.

Do not backweld piping to the valve housings without first removing the valve housings from the pump as excessive heat can damage the reagent head and other parts. Tie bars must be positioned on the valve housing *before* welding.

**Plastic Reagent Head Models:**

Care must be exercised when making connections on plastic reagent head models. Excessive tightening can distort or break the plastic materials. Tubing should be rated for the highest discharge pressure expected. DO NOT USE METAL PIPING.

*FIGURE A*



# Start-Up Inspection

Every 680C metering pump is tested for correct capacity at maximum pressure capability of the hydraulic bypass valve before shipment. The diaphragm cavity is fully primed and remains so for shipment. For shipping purposes the gear and hydraulic reservoir oil have been removed. Sufficient fresh PULSAlube oil is included with the shipment for refilling the gear and hydraulic reservoirs.

# Warning

1. Do not run pump without oil.
2. Do not remove main gear box cover while pump is running.
3. Do not run pump with coupling guard removed.
4. Do not put hands or fingers in gear box or reservoir when pump is running.

**Filling Gear and Oil Reservoirs:**

Remove the pump cover and fill both reservoirs with PULSAlube oil to the top of the gear box partition. Do not overfill. PULSAlube oil is compounded to serve as both gear lubricant and hydraulic transfer fluid. Check with factory if substitute oils must be used.

The cover assembly incorporates a free acting diaphragm to allow breathing of the reservoir and at the same time seal the reservoir from the atmosphere. Be sure the diaphragm is properly positioned when replacing the cover so that it will seal on the gear box.

**Final Inspection:**

Because of the pump's small size and light weight it sometimes receives severe handling during shipment. Though physical damage may not occur, it is always possible for parts to move slightly in adjustment. This situation might occur with motor or pneumatic control alignment. A quick visual check should be made to assure that motor and control shafts have not shifted severely out of alignment or damage could occur from starting the motor. If unusual vibration should occur after start up realign the motor and coupling.

**Start-up:**

Since the hydraulic oil system is primed at the factory, priming the process system is all that should be necessary to produce flow. If the hydraulic system has inadvertently been dumped due to starting up with restricted suction or discharge conditions, repriming procedures under the maintenance section may have to be followed before pump calibration can begin.

**Priming Process Head:**

1. 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 however, 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 tie bar 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 tie bar bolts.
4. The pump is now ready for start-up.
5. Start the pump and increase the control setting to full stroke.
6. Make a brief check to assure that the pump is producing the approximate flow desired at the full stroke setting. Calibration should not be attempted on any model until it has run at least one hour to assure the pump hydraulic and reagent head systems have stabilized.

If the pump does not produce the approximate flow desired at the full stroke setting refer to the Trouble Shooting Section for possible causes and refer to Priming Procedure under the Operation and Maintenance Section.

**To Adjust Flow Rate;**
*Figure B.*

The 680C PULSA pumps are provided with a micrometer knob adjustment for changing length of stroke while in operation or idle. NOTE: The external auto locking knob must be fully disengaged prior to adjustment. When adjustment is complete the lock will automatically engage to prevent drifting of the stroke setting. Turn adjustment knob clockwise to increase flow and counterclockwise to decrease flow. The adjustment knob is read directly in percent of stroke length. These indications can be converted to volumetric or weight units by calibration conversion charts.

**Calibration:**

All pumps are tested on water at room temperature with 7 foot flooded head at full rated pressure. Any curves supplied by Pulsafeeder would be representative of this test and can only be used as a guideline.

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 C. Note that output is linear with respect to micrometer settings but that increase in discharge pressure decreases output slightly and describes the line parallel to that at atmospheric pressure.

This is caused by compression of hydraulic oil and valve inefficiencies. Capacity at atmospheric pressure will be nearly that of calculated displacement. As the discharge pressure increases there will be a corresponding decrease in capacity at a rate of approximately 1% per 100 psi increase.

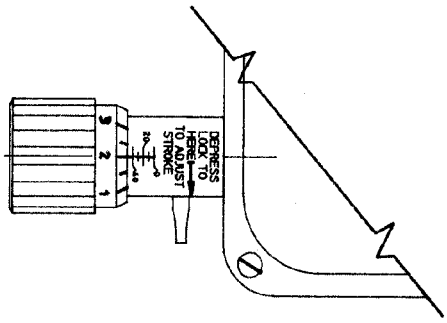



**Figure B**

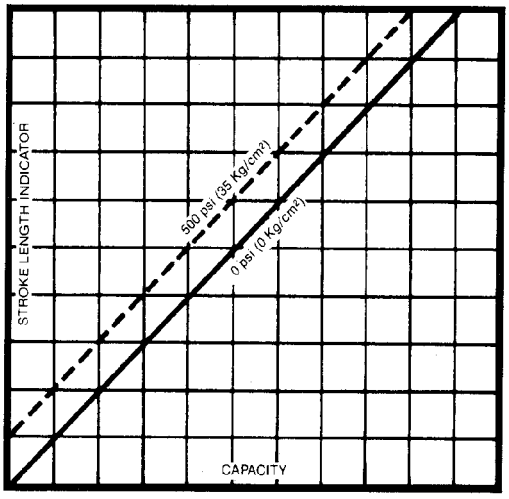



*FIGURE C.*

Figures D and E show two typical piping arrangements for performing pump calibration. It is desirable to calibrate from the suction side of the pump so the pump will be operating under actual or comparable discharge conditions.

Check the capacity several times at three different stroke length settings and record them on linear graph paper. For all stable conditions, these points should describe a straight line.

PULSA pumps supplied with automatic controls, either pneumatic or electronic, are accompanied by separate instructions on output adjustment and calibration.

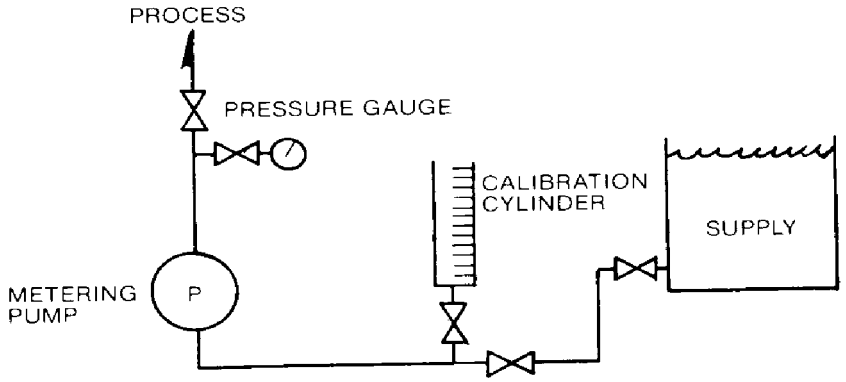



*FIGURE D*

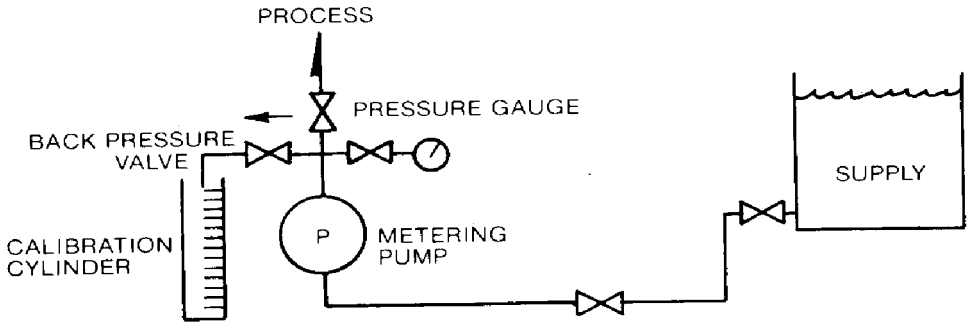



*FIGURE E*

# Operation and Maintenance

The preceding instructions have assisted you in proper installation and start-up of your 680C pump. The following sections are arranged to assist in maintaining proper pump operation and trouble shooting any problems that might develop during start-up or thereafter.

Accurate records in the early stages of pump operation will reveal the type and amount of maintenance that will be required. A preventative maintenance program based on these records will insure trouble free operation. It is not possible in these instructions to forecast the life of such parts as the diaphragm, check valves and other parts in contact with the product you are handling. Corrosion rates and conditions of operation affect the useful life of these materials so an individual metering pump must be gauged according to particular service conditions.

**HYDRACONE Diaphragm Inspection**

The HYDRACONE diaphragm is an elastomeric material which stretches on each displacement of the plunger. It can be damaged by the following:

1. Chemical attack.
2. Mechanical damage from trash or abrasives.
3. High temperature (Maximum 180°F, 2.2°C).
4. Low temperature (below 40°F, 4.4°C).
5. Suction pressure in excess of 20 psig.

Service conditions will determine life of the HYDRACONE and dictate the replacement schedule.

**To Inspect HYDRACONE Diaphragm**

1. Remove all pressure from the piping system.
2. Lock out motor.
3. Close the inlet and outlet shut-off valves.
4. Break the union or flanges on the piping.
5. Adjust the stroke length (capacity) to maximum.
6. Remove the reservoir cover assembly.
7. Remove the coupling guard.
8. Rotate the motor coupling until the pump piston is withdrawn to full suction stroke (toward drive motor end).
9. Loosen the hydraulic bypass valve screw located on top of the hydraulic pumphead to be sure all hydraulic pressure has been relieved from behind the diaphragm.
10. Arrange to catch and properly dispose of oil and product leakage that will occur when disassembling head and valving.
11. Remove the inlet check valve to drain reagent head and cavity. Use extreme caution if product is hazardous and wear proper protective clothing.
12. Remove reagent head bolts and rinse the head in water or a compatible liquid.

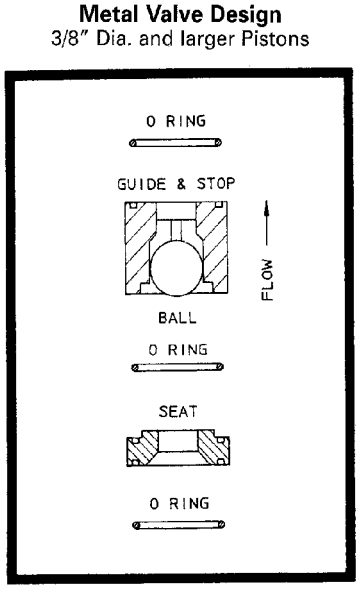



Figure 7.

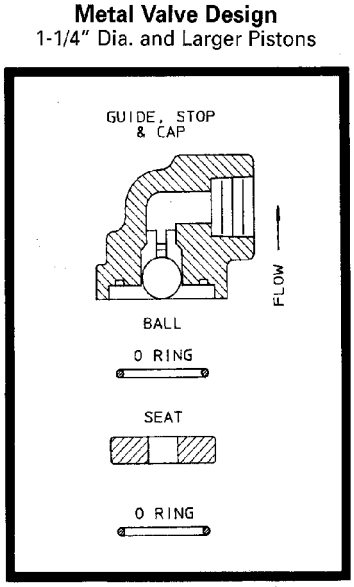



Figure 8.

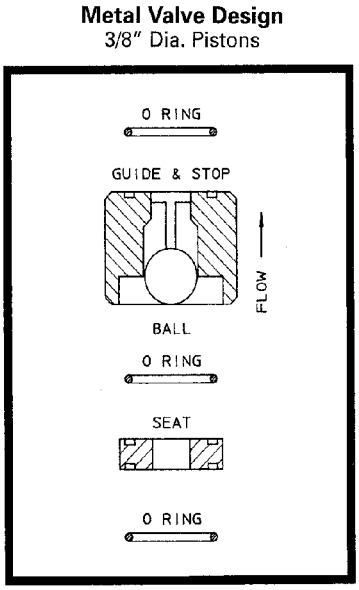



Figure 9.

13. Diaphragm can be removed from the reagent head by applying air pressure to one of the valve ports while blocking the other. Be sure diaphragm is directed away from personnel so that it does not strike the body when being expelled from the head.
14. 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.

**Repriming Hydraulic Systems on HYDRACONE Models**

1. Reassemble diaphragm and reagent head, tightening all bolts securely and evenly.
2. Reassemble valve housing, valves, seats and seat gaskets and take care in inserting gaskets that they are properly placed. Tighten securely.
3. Connect inlet piping.
4. With discharge line bypassed around process or to drain, start motor and prime reagent head.
5. Set stroke length adjustment to maximum stroke.
6. If not already lose, counting turns, loosen the hydraulic bypass valve located at the top of the hydraulic system to atmosphere and any air present will vent back into the gearbox oil reservoir as the automatic make-up valve fills the piston/diaphragm chamber. Air bubbles will be evident at the vent hole, top center of pump head in back of return spring.
7. When last traces of air have been expelled retighten the bypass valve the same number of turns or to a desired setting using a pressure gauge in the process line. Approximately a 1/2 turn more after process pressure setting has been reached will seat valve. The valve can be set higher if desired but do not exceed MAX. OPERATING PRESSURE indicated on the nameplate.

**Slurry Valve Design**
1-1/4" Dia. and Larger Pistons

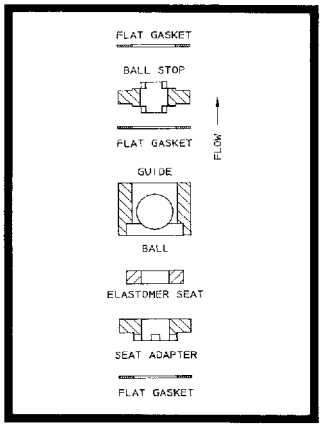



*FIGURE 10.*

8. Add PULSAlube oil to front and rear oil reservoirs to bring oil level up to top of partition.
9. After pump has run for several hours, again check for any last traces of air at the bypass valve.

**Check Valve**
*Figure 7, 8, 9 and 10*

Operating experience on thousands of installations has indicated that many 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.

When inspecting the valves, separate the assembly and examine the components for wear, damage or accumulation of solids. A ball valve seat should have a sharp 90° edge, free of any nicks or dents. Hold the ball firmly on the seat and examine against a light. If light is visible between the two then replace the seat and/or ball.

When reassembling after cleaning or replacement be sure to use new seals.

**Hydraulic Make-up Valves**
*Figure 12*

Hydraulic make-up valves are designed to maintain the correct volume of oil in the hydraulic system between the piston and the diaphragm. No adjustment or attention is required, provided the oil is clean and free of moisture and chemical contamination. 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.

**Hydraulic Bypass Valve**

The bypass valve is an adjustable spring loaded valve. It is designed to protect the pump against excessive hydraulic pressure. The valve is factory set to the setting specified on the specification data sheet or set to allow operation at the maximum pump pressure, indicated on the pump nameplate, without weeping.

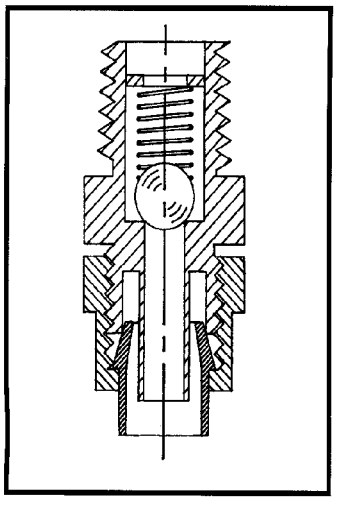


*FIGURE 11.*

To adjust the valve to a lower set pressure, turn counter-clockwise.

To check 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 bypass valve to reach its cracking pressure which will be observed on the gauge. When the bypass 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 dumping pressure can be considerably higher than cracking pressure on some large piston, fast stroke rate models, so the internal bypass valve should not be considered a safety valve for protection of the process piping and instrumentation. A separate process relief valve should be used for this purpose.

It is unusual for a hydraulic bypass valve to operate during normal pump operation. The following conditions will cause valve operation:

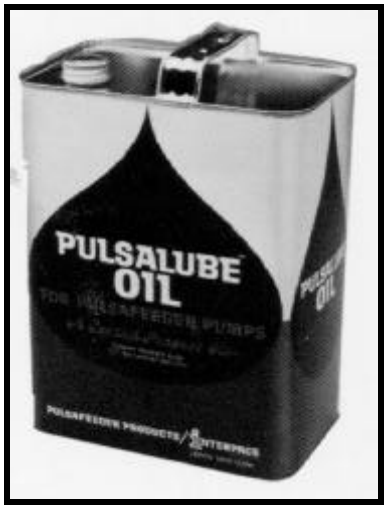
1. Excessive pressure buildup in the process which the pump is injecting into.
2. A plugged discharge line or someone shutting off a valve in the discharge line while the pump is operating.
3. Restricted flow to the pump causing the make-up valve to operate. If an inlet strainer is plugged, or someone closes an inlet valve thereby restricting flow of fluid to the pump, the diaphragm is then unable to follow movement of the plunger. The vacuums created between the diaphragm and the plunger upset the make-up valve allowing oil to replace the vacuum condition. This excess oil will be displaced through the hydraulic bypass valve on the discharge stroke of the plunger. Undersized (restrictive) piping must be avoided (see "Piping" page 5).

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 hydraulic bypass valve. Continuous oil recirculation against the bypass valve will eventually cavitate the hydraulic prime plus introduce unnecessary load conditions within the pump mechanism.

**Lubricating Instructions**

PULSAlube is a custom blend oil with additives for lubrication and hydraulic transfer service. (For emergency requirements, a list of acceptable commercial oils is available). The diaphragm on the cover of the gear box assembly generally protects the oil from contamination for extended periods of time. A periodic six month check should be made for oil level and possible contamination.

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 ports at the side of each chamber.




To establish a maintenance record and routine procedure, check lubricant and drive mechanism at three and six month intervals. At the first six month interval check the condition of the inlet and outlet check valves. These items along with oil seal inspection should be part of a routine service procedure.

**Oil Capacity**

The standard 680C metering pump requires approximately one quart of PULSAlube oil to fill both chambers and prime hydraulic pump head. PULSAlube oil is available in one gallon cans, cartons of six (6) one gallon cans, five gallon cans or 55 gallon drums.

**STORAGE INSTRUCTIONS**
**Short Term**

Storage of PULSA Series pump for up to 12 months after shipment is considered short term. Under this condition the recommended storage procedures are as follows:

1. The pump should be stored indoors at room temperature in a dry environment.
2. The pump gearbox and hydraulic reservoir is to be completely filled with PULSAlube oil within two months after date of shipment.
3. The gearbox and hydraulic reservoir should be inspected every 3-6 months. Maintain the oil level and assure that no water or condensation is present, follow Procedure II, Step A below.
4. It is recommended that the stroke length of the pump be adjusted to its midpoint and that the piston be manually cycled through 3-6 cycles every 6 months.
5. Prior to start-up, perform a complete inspection and then start up in accordance with instructions in this manual.

**Long Term**

For storage longer than 12 months in addition to the above, the following procedures should be followed.

1. Every 12 months PULSAlube oil should be drained from the gearbox and hydraulic reservoir. The gearbox and hydraulic reservoir should be flushed with kerosene or petroleum base solvent, thoroughly dried out with a rag, and then refilled with fresh PULSAlube oil.
2. Every 12 months the motor should be connected to a power source and the pump operated for a minimum of one hour. It is not necessary to have liquid in the reagent head during this operation but the suction and discharge ports must be open to atmosphere.

After 12 months storage Pulsafeeder's warranty cannot cover such items as oil seals, gaskets, piston cups and other items which are subject to deterioration with age. If the pump has been in storage for longer than 12 months it is recommended that these items be replaced prior to going into service. Material and labor to recondition or replace this class of item is the purchaser's responsibility. For a one year service warranty after extended storage the refurbishment and equipment inspection must be done by a Pulsafeeder serviceman.

**Maintenance Parts Stock**

Pulsafeeder offers a KOPkit which uses a group of recommended spares carried in stock for replacement due to normal wear. The Kit covers such items as diaphragm, diaphragm gaskets if used, inlet and discharge valve parts, a complete set of valve gaskets and hydraulic pump head gasket. The KOPkit part number for your pump is indicated on the nameplate. A sufficient quantity of PULSAlube oil should be on hand for periodic oil changes.

**Ordering Parts**

When ordering parts always specify:

1. Pump model and serial number (stamped on nameplate).
2. Part number (from parts list), or KOPkit number.
3. Material of reagent head construction (liquid end parts).

**Additional Pulsafeeder Services**

FIELD SERVICE - Including pump repair or conversion to different services is available at nominal cost.

FACTORY REPAIR - Complete pump reconditioning.

OPERATOR TRAINING SEMINARS - Conducted by experienced factory trained service personnel at the factory in Rochester, NY or in the field. Field trips are available at nominal cost.

**Trouble Shooting**

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 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 40 to 140 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 torquing all too often aggravate even the simplest application.

The third area is a 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 trouble shooting guide to help identify and cure any operating problems you might experience.

# Trouble Shooting Chart

| Difficulty | Probable Cause | Remedy |
|---|---|---|
| Pump Does Not Start | 1. Coupling disconnected | Connect and align |
| | 2. Faulty power source | Check power source |
| | 3. Blown fuse, circuit breaker | Replace -- Locate overload |
| | 4. Broken wire | Locate and repair |
| | 5. Wired improperly | Check diagram |
| No Delivery | 1. Motor not running | Check power source. Check wiring diagram |
| | 2. Supply tank empty | Fill with liquid |
| | 3. Lines clogged | Clean and flush |
| | 4. Closed line valves | Open pipeline valves |
| | 5. Ball check valves held open with solids | Clean -- inspect |
| | 6. Vapor lock, cavitation | Increase suction pressure |
| | 7. Prime lost | Reprime, check for leak |
| | 8. Strainer clogged | Remove and clean. Replace screen if necessary |
| | 9. Hydraulic system under-primed | Refer to "Repriming Hydraulic System" |
| | 10. Check valves installed upside down | See check valve illustrations |
| Low Delivery | 1. Motor speed too low | Check voltages, hertz, wiring, and terminal connections. Check nameplate vs. specifications |
| | 2. Check valves worn or dirty | Clean, replace if damaged |
| | 3. Bypass valve opening each stroke | Refer to "Hydraulic Bypass Valve" |
| | 4. Calibration system error | Evaluate and correct |
| | 5. Product viscosity too high | Lower viscosity by increasing product temperature.<br>Increase pump size. |
| | 6. Product cavitating | Increase suction pressure. Cool product as necessary |
| Delivery Gradually Drops | 1. Stroke adjustment creeping | Consult factory. Replace worn parts. |
| | 2. Check valve leakage | Clean, replace if damaged |
| | 3. Leak in suction line | Locate and correct |
| | 4. Fouled bypass or make-up valve | Refer to "Operation and Maintenance" |
| | 5. Strainer fouled | Clean or replace screen |
| | 6. Product change | Check viscosity |
| | 7. Bypass leakage | Correct for bypass valve leakage |
| Delivery Erratic | 1. Leak in suction line | Locate and correct |
| | 2. Product cavitating | Increase suction pressure |
| | 3. Entrained air or gas in product | Consult factory for suggested venting |
| | 4. Motor speed erratic | Check voltage, hertz |
| | 5. Fouled check valves | Clean, replace if necessary |

| Difficulty | Probable Cause | Remedy |
|---|---|---|
| Delivery Higher Than Rated | 1. Suction pressure higher than discharge pressure | Install back pressure valve or consult factory for piping recommendations |
| | 2. Suction piping too small | Increase pipe size -- Install PULSAtrol pulsation dampener at pump in suction line |
| | 3. Back pressure valvae set too low | Increase setting |
| | 4. Back pressure valve leaks | Repair, clean, or replace |
| Pump Loses Oil | 1. Diaphragm ruptured | Replace |
| | 2. Leaky oil seal | Replace |
| | 3. Cover gasket leaks | Replace or tighten |
| | 4. Pump head gasket leaks | Replace -- tighten pump head bolts. Seal with permatex. |
| | 5. Gear box overfilled | Remove excess oil |
| Air Continuously Bleeds From Automated Air Bleed Valve | 1. Oil in reservoir low | Refill to correct level |
| | 2. Hydraulic Bypass valve opening continuously | Refer to "Hydraulic Bypass Valve" |
| | 3. Suction pressure too low | Increase pressure |
| | 4. Breakdown of oil, temperature high | Change oil type, consult factory |
| Noisy Gearing, Knocking | 1. Discharge pressure too high | Reduce pressure or discharge pipe size |
| | 2. Water hammer | Install PULSAtrol |
| | 3. Worn bearings | Replace |
| | 4. Worn gears | Replace gears & check for improper hydraulic bypass valve setting |
| | 5. End play in worm shaft | Consult factory |
| | 6. Eccentric or worm gear | Tighten or replace assembly |
| | 7. Bypass valve set too high | Readjust (see "Hydraulic Bypass Valve") |
| Piping Noisy | 1. Pipe size too small | Increase size of piping, install PULSAtrol |
| | 2. Pipe runs too long | Install PULSAtrol in line |
| | 3. Surge chambers full of liquid | Recharge with air or inert gas, replace diaphragm and recharge |
| | 4. No surge chambers used | Install PULSAtrols -- pulsation dampeners |
| Motor Overheats | 1. Pump overloaded | Check operating conditions against pump design |
| | 2. Oil too viscous | Consult factory |
| | 3. Low voltage | Check power supply |
| | 4. Loose wire | Trace and correct. Check no load amps |

APPENDIX PULSAFEEDER ACCESSORIES

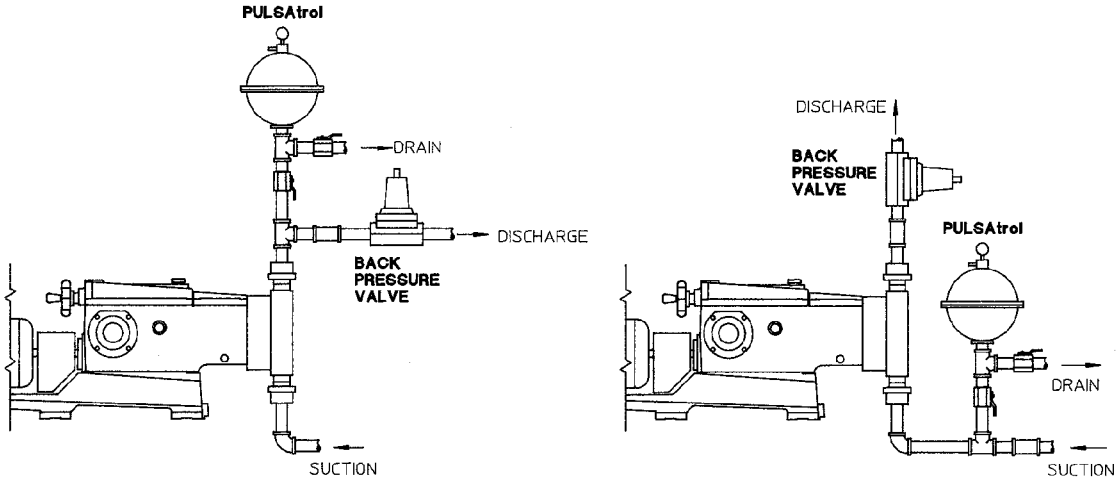
## I. PULSATROL INSTALLATION, OPERATION AND REMOVAL INSTRUCTIONS

The PULSAtrol is a pneumatically charged diaphragm type chamber that continuously stores energy. Used on the inlet it will improve $NPSH_a$ (Net Positive Suction Head available) characteristics of the suction piping system. On the discharge line it will reduce dangerous peak pressures, eliminate shock waves and if of sufficient volume will reduce pulsating flow to almost linear.

INSTALLATION

Figures 13 a and b

On both discharge and suction lines it is desirable to mount the PULSAtrol as close to the pump connection as possible. It can be mounted in any position, but vertical is preferred for ease of charging, draining and servicing. The air chamber is sealed and will not require replenishing regardless of position. A shut off valve should always be used between the piping system and PULSAtrol, also a drain valve should always be installed directly below the PULSAtrol. If the discharge line is open to atmospheric pressure then a back pressure valve should also be incorporated in the system near the PULSAtrol to assure proper operation.



OPERATION (Charging the PULSAtrol)

A. Discharge Installation

The air side of the PULSAtrol must be precharged to approximately 50 percent of anticipated mean line pressure before placing on stream. This will permit the diaphragm to move to a neutral position between the chambers when operating.

PROCEDURE

Pre Charge Procedure for Discharge Installation

1. Calculate the precharge pressure

Mean Line Pressure (PSIG)
+ Atmospheric Pressure
Absolute Pressure (PSIA)
x Precharge Percentage (80% Max.)
Pressure Absolute
- Atmospheric Pressure
Precharge Pressure (PSIG)

**= Precharge Pressure**

2. Isolate PULSAtrol from line.

3. Carefully drain off process fluid by opening a drain valve (see recommend piping arrangement).

4. Apply precharge pressure (additional liquid may drain as diaphragm moves).

5. Close drain valve.

6. Place PULSAtrol in stream.

B. Suction Installation (Flooded Suction)

Charge the PULSAtrol with adequate pressure to overcome the static suction head. Start up the pump. Depress the stem on the charge valve, but only during discharge strokes of the pump, until the gauge indicates pressure pulses. The diaphragm has not centered allowing the PULSAtrol to accumulate liquid while the pump is discharging. If too much air becomes released and the gauge will not indicate pressure pulses then recharge the PULSAtrol and repeat the procedure.

PROCEDURE

**Pre Charge Procedure for Suction Installation**

1. Isolate accumulator from line.
2. Carefully drain off process fluid by opening a drain valve (see recommended piping arrangement, attached).
3. Apply 5-10 psi precharge pressure (additional liquid may drain as diaphragm moves).
4. Close drain valve.
5. Bleed off all pressure on the PULSAtrol.
6. Open the valve to put PULSAtrol in stream.
7. Push in on the stem of the charging valve during the discharge stroke of the pump and release during the suction stroke.
8. Continue this for about 10 times and observe the compound gauge. As accumulator functions, the needle will go from pressure to vacuum.

C. Suction Installation (Suction Lift)
Consult your PULSA Series representative or the factory for details.

## II. DIAPHRAGM BACK PRESSURE VALVES

Figure 14

Pulsafeeder diaphragm back pressure valves create a constant back pressure without chatter or cycling. A TFE diaphragm, offering maximum chemical protection and service life, seals spring and bonnet from product. This diaphragm seals directly on a replaceable seat.

Be sure to install with fluid flow in direction of arrow on valve body. If arrow is missing from plastic valve body, install with flow exiting out center hole of valve body.

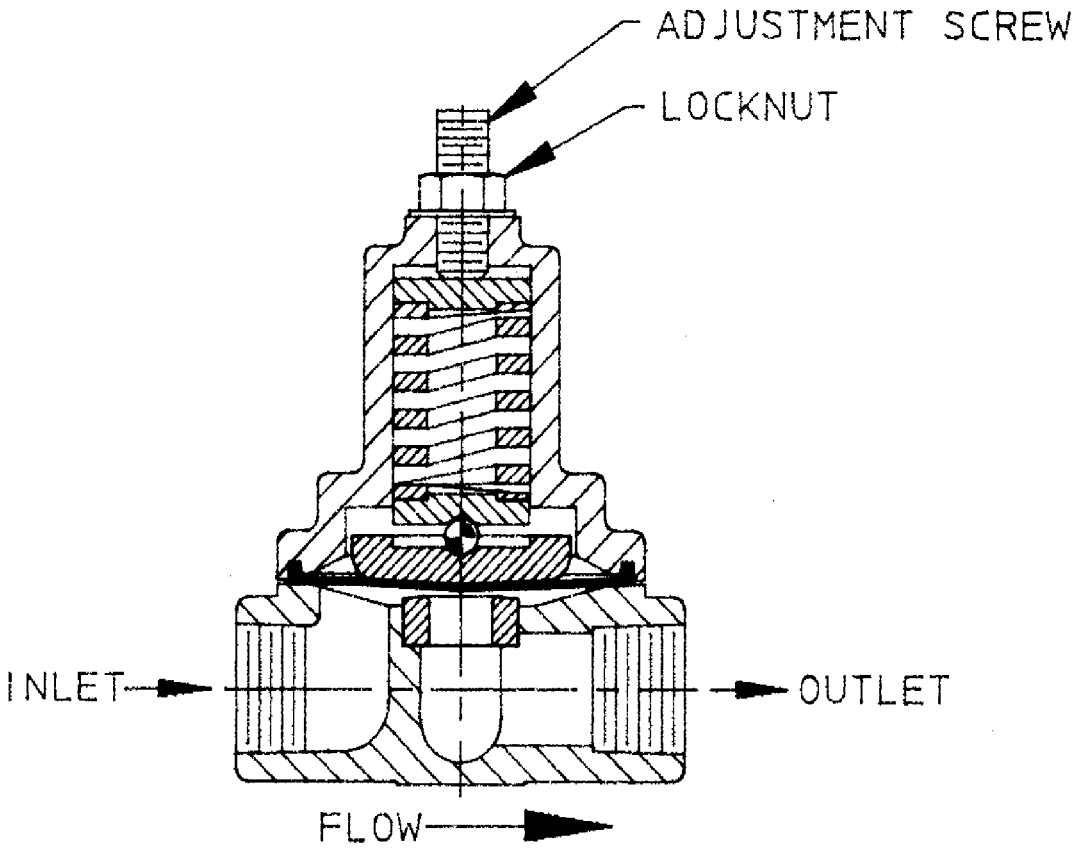



Figure 14

## MAINTENANCE LOG

Pump Model_____ Serial #_____

Gear Ratio_____ Maximum Flow_____

Piston Diameter_____ Maximum Pressure_____

KOPKit_____

All the above information can be obtained from the pump nameplate. Refer to the Pump Specification Data Sheet for additional information.

| Date | Serviced By | Maintenance Performed |
|---|---|---|
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