RH PUMP INSTRUCTIONS
Models RH, RHB, RHV

ISO 9001

SAFETY INSTRUCTIONS

Before using any Fluid Metering product, read the following safety instructions, as well as specific product specifications and operating instructions.

Warning! Fire, electrical shock or explosion may occur if used near combustibles explosive atmosphere, corrosive air, wet environment or submerged in fluid.

- Turn off the electrical power before checking pump for any problems.
- Connect motor, speed controllers, or any other electrical devices based on Fluid Metering specifications. Any unauthorized work performed on the product by the purchaser or by third parties can impair product functionality and thereby relieves Fluid Metering of all warranty claims or liability for any misuse that will cause damage to product and/or injury to the individual.
- Power cables and leads should not be bent, pulled or inserted by excessive force. Otherwise there is a threat of electrical shock or fire.
- Replace any inline fuses only with fuse rating as specified by Fluid Metering.
- When pump/drive is under operation, never point discharge tubing into face or touch any rotating components of pump.
- In a power down thermal overload cut-in condition, unplug or turn off power to pump. Always allow a cool down period before restarting: otherwise, injury or damage may occur.
- For 30 seconds after power is removed from pump/drive: do not touch any output terminals. Electrical shock may occur because of residual voltage.

Caution! Fire, electrical shock, injury and damage may occur if not used in accordance with Fluid Metering specifications and operation instructions.

- Do not put wet fingers into power outlet of unit.
- Do not operate with wet hands.
- Do not operate drive assemblies that require a hard mount (to be bolted down) unless they are mounted per Fluid Metering specifications, if not injury may occur and/or damage to unit.
- Do not touch any rotating pump or motor components: Injury may occur.
- Do not run pump dry, unless designed for that service. Running dry is harmful to the pump, and will cause excessive heating due to internal friction.
- Check pump rotation and inlet/outlet pump port orientation before connecting power to pump. If not, injury may occur.
- When pulling out cords from outlets - do not pull cord, grasp plug to prevent plug damage or electrical shock.
- Fluid Metering Drive Motors become HOT and can cause a burn. **DO NOT TOUCH!**

INSTALLATION & OPERATING TIPS

1. CLEAN FLUIDS. Abrasives in the pumped fluid may damage cylinder and piston surfaces and should therefore be avoided.

2. COMPATIBLE FLUIDS. Pump only fluids compatible with materials of construction of the pump head you have selected.

3. WET OPERATION. The pumped fluid provides surface cooling and lubrication to the piston and cylinder of your PUMP. Therefore, avoid dry operation (except pumps specifically designated “gas pump”).

4. PRESSURE. Do not operate pump against pressures in excess of design specification. Drive pin on piston may bend or break under overload and other irreparable damage may be suffered. Avoid dead heading. Check your fluid circuit before applying power to the pump!

5. CLEANING YOUR PUMP. Routine flushing with suitable solvent before shut-down will suffice for most applications. Set pump for maximum stroke and operate until solvent appears clear at discharge port.

CAUTION! Ceramic piston/cylinder sets are sensitive to neglect and may “freeze” if allowed to dry out without adequate cleansing. Fill a loop of flexible tubing with fluid that will thin or neutralize the last fluid pumped. Then connect one end of the tube to the pump suction port, the other to the discharge port. With this loop positioned above the pump head, the ceramic surfaces and seal areas stay moist and mobile for extended idle periods. If, however, a piston does freeze in the cylinder, DO NOT TRY TO FORCE IT FREE! Be gentle. Try to remove the pump head (refer to para. 15) from the base assembly so the whole pump head can be soaked in a suitable solvent. If the head is not conveniently removable, the tube loop discussed in the prior paragraph may permit solvent to dissolve the “frozen” residue in reasonable time.

6. ADAPTING RH PUMP HEADS TO STANDARD Q PUMP DRIVE MODULES. (refer to Fig. 1) The RH/Q Kit adapts the RH pump heads to standard Q Pump Drive Modules. Assemble as follows:

a) Assemble Kit parts to RH pump head as shown (Fig. 1) with “shoe” of the MOUNTING BRACKET down. Slip the COUPLING fully onto the pump shaft, with its slot away from the pump head and the SET SCREW contacting the flat on the pump shaft.

b) Insert the DRIVE PIN of Kit into the SPHERICAL BEARING as shown.

c) Orientate coupling slot to accept the DRIVE PIN. On Q drives the shoe is slipped between the BASE and RETAINER ASSEMBLY.

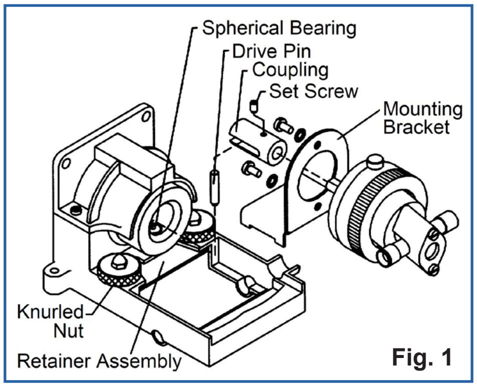


Fig. 1

d) Tighten thumb NUTS and operate motor. If noisy, alter position of BRACKET under RETAINER PLATE slightly while operating until minimal noise position is found. Retighten thumb NUTS.

7. MOUNTING RH PUMP. For maximum pump performance, mount RH pump with motor at 12 o’clock and pump head at 6 o’clock position. This orientation will allow air bubbles that enter the pumping chamber to directly exit through buoyant assist. Discharge lines should be inclined upward from pump head.

7.1. PANEL MOUNTING OF RH PUMP HEADS. Two threaded holes (#8-32) are provided on the back side of each RH pump head for panel mounting purposes. A bear

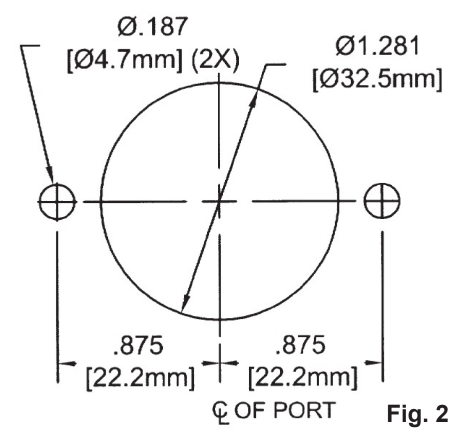


Fig. 2

ing adjustment access hole is also required. Each panel mount layout should, therefore, provide the three holes as shown in Fig. 2. It will be noted that the center line of the pump ports is displaced 90° from the center line of the pump mounting holes. Thus, a vertical hole pattern in the mounting panel will result in horizontal port alignment of the pump; a horizontal hole pattern will give vertical port alignment.

RH PUMP HEAD CALIBRATION

8. HOOK-UP. The pump ports of the RH Pump Head are designed to accept 1/4" outside diameter (O.D.) tubing and/or tubing adapters. The lower port is normally for suction, the upper port for discharge. Suction tubing should be soft and flexible with largest possible inside diameter, shortest practical length. Discharge tube may have smaller inside diameter than suction tube and may incorporate dispense tip or other partial flow restrictors.

9. BUBBLE-CLEARING: After tubing has been securely installed in each of the pump head fittings and the suction line is in the supply fluid, plug electric cord into outlet and operate pump in forward mode until apparent bubbles are cleared from fluid lines. Then, while pump is still operating, pinch-close the suction line for 10 to 15 seconds to cavitate residual bubbles from pump head. Continue to operate until all bubbles are cleared from discharge tube.

10. PUMP STROKE ADJUSTMENT. The knurled ADJUSTMENT NUT on the pump head controls stroke to stroke piston displacement. Turning it clockwise to zero stops displacement. Turning the ADJUSTMENT NUT counterclockwise four and one half turns from zero (450 on scale) (Figs. 3,4) causes maximum pump reciprocation, i.e., 50 µl per stroke for the H-0 or 100 µl for the H-1 unit. Thus each 1-1/8 turn (112.5 on scale) of the ADJUSTMENT NUT represents 25% of maximum (12.5 µl for H-0 and 25 µl for H-1) and each graduation on the ring represents an adjustment of 1/450th of maximum (0.111 µl for H-0, 0.222 µl for H-1).

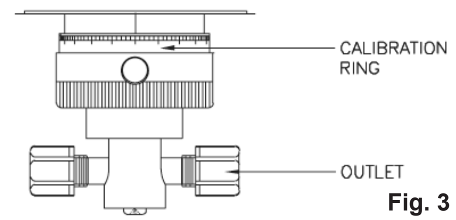


Fig. 3

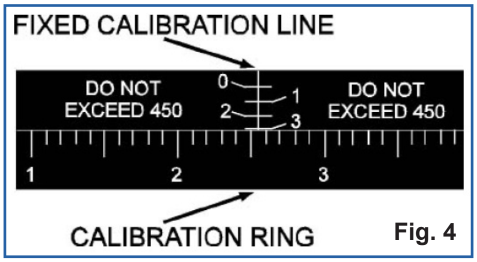


Fig. 4

11. NOISE AT HIGH PUMP RATES. SA metallic hammering noise during operation of your pump (particularly high speed units such as RHB and RHV) when pumping liquids indicates presence of gas bubbles in the pumping chamber which are reducing pumping capacity and may be damaging cylinder walls. Such bubbles may be traced to 1) a poor seal at the suction fitting, 2) fluid vaporization (cavitation), or 3) degassing of the fluid.

a) To eliminate vaporization and degassing noise, reduce suction load. This may be accomplished by: 1) Increase in suction line inside diameter; 2) reduction of suction supply height; 3) pressurization of suction supply container; 4) locating pump below supply source to permit gravity flow aid; 5) reduce viscosity of fluid by heating or thinning; 6) reduce flow rate by adjusting pump to lower setting on flow scale; 7) install PD-HF PULSE SUPPRESSORS in suction and discharge lines. We hear of good results in noise abatement and pump life extension from folks who put pulse suppression hardware in their plumbing circuits adjacent to the pump suction and discharge ports - particularly with high speed pumps, RHB and RHV, that are plumbed with rigid tubing. Theory holds that if part of a generated pulse is resiliently stored, the part not stored is smaller and thus easier to get in motion; the stored part of the pulse dissipating behind the part that is in motion sustains motion, causing an undulating flow to betransmitted rather than a series of pulses. Results: less noise, less energy used, and less agitation of the pumped fluid. For pulse noise and vibration problems, put a little resilience in your circuit. There are a number of easy ways to do it.

b) The simplest method is to use resilient tubing between the pump and the fluid circuit. Experiment a bit with standard elastomers - viton, hypalon, gum rubber, soft vinyl or other. Use only unreinforced tubing (reinforcement takes away the resilience). Always shield this type of arrangement so that a possible tube rupture will not endanger people or equipment.

d) Since each fluid and circuit exhibits a differing characteristic, a bit of experimentation may be necessary. The results are usually worth the effort.

12. FOR BEST LOW FLOW PUMPING RESULTS. Use a pump having maximum flow rating as near to the desired flow rate as possible and keep suction and discharge pressures essentially constant (see para. 14). You may obtain fine results with the RH-LF Pump Head fitted with the Small Bore Tubing Kit. And, to assure continuous good results, beware of bubbles! (See para. 13.)

13. LOW FLOW BUBBLE PROBLEMS. A common cause of trouble in metering pump applications requiring low flow rates - a few milliliters per minute or less - is the seemingly inevitable gas bubble trapped in the pumping head of the metering pump. It expands on the suction stroke and contracts on the discharge stroke, allowing little, if any, liquid to pass through the pump. Such bubbles, though often attributed to leaks in pump seals, can usually be traced to gases released by the pumped fluid in response to pumping agitation or pressure/temperature changes. When so identified, this potential source of metering pump error can be effectively controlled in most fluid circuits. The familiar bubbles that form on the inside walls of a tumbler of tap water after it stands for a period of time at room temperature demonstrate the typical liquid degassing that results from pressure reduction (water line pressure to atmospheric) and/or temperature elevation (from ground ambient to air ambient). In this case, the bubbles contain air, hydrogen, carbon dioxide, or other gaseous materials carried in the water, only small quantities of vaporized water are present. Some liquids respond to agitation and/or pressure/temperature changes by chemically separating into liquid and gas fractions; others simply vaporize, physically changing from liquid to gaseous form. Examples of liquids releasing gas or changing from liquid to gaseous form in response to agitation and temperature/pressure changes are numerous in the modern technical environment and many techniques have been devised to compensate for or correct their presence. The most common practices for bubble control employ:

a) pressure on the suction side of the pump circuit to encourage gas retention in the liquid or

b) employ natural buoyancy of the bubbles to carry them away from or through the pump head. To apply pressure on the suction side of the pump, locate the pump physically below the supply vessel. Each two feet of elevation difference represents pressure of approximately one pound per square inch (psi). Bubbles that do occur will return to the supply vessel by buoyant lift. This is called a positive suction or flooded suction arrangement.

If it is necessary to draw liquid up from the supply vessel to the pump head, negative suction pressure must be contemplated - again, approximately 1 psi per two feet of lift. Most liquids will release some gas when held at negative pressure and since the volume of gas released is generally proportionate to the volume of liquid subjected to the negative pressure, suction line diameter should be kept small for small flows (except heavy, viscous or tacky liquids which require large flow area for mobility). A vertical deadend extension of the suction line can be provided above the pump suction port to trap line-generated bubbles before they enter the pump. This extension should be liquid filled at the start of a pumping period. Hanging the pump vertically with motor at 12 noon and pump head at 6 pm will allow bubbles that enter the pump head to pass directly through with buoyant assist. Discharge lines should be inclined upward from pump head and bubble traps should be purged as often as necessary to assure liquid flow continuity.

14. SYSTEM PRECISION FACTORS Several interrelated factors are involved in the exceptional operating precision possible in systems using our LAB PUMPS. Of primary concern are the following:

a) LAB PUMP DISPLACEMENT precision is based on a simplified positive stroke mechanism which has no secondary linkages to produce stroke to stroke mechanical errors and has no gravity actuated or spring loaded valves to introduce random valve seating errors. The single mechanical linkage components between the LAB PUMP piston and its drive elements is a precision spherical bearing which transforms circular drive motion into elliptical thrust motion (reciprocation). The total mechanical clearance of this linkage is less than 0.1% of the maximum pump stroke length or approximately 0.0003”. Thus it may be said that **displacement precision** (stroke to stroke) is in the order of the mechanical linkage clearance; that is to say, stroke to stroke displacement is reproducible to less than 0.5% within the rated capacity of a given pump model.

b) LAB PUMP VALVING is performed by a slot in the piston which is mechanically aligned with one cylinder port during the suction portion of each stroke and with the other cylinder port during the discharge portion of each stroke. The slot alignment is controlled by the single drive bearing discussed in the preceding sentences. The valve action is therefore mechanically precise, and free of random closure variations.

c) FLUID SLIP, a term commonly used to describe the migration of fluid around the internal moving parts of gear, lobe, and vane pumps, is the volumetric difference between physical component displacement and fluid through-put of a pump system. In the LAB PUMP, slip loss refers to the fluid which passes through the clearance space (approx. 0.0002”) between the piston and the cylinder wall. Since this clearance represents a restrictive passage of essentially constant dimension, it will be readily seen that the slip rate is determined by viscosity, pressure, and time: i.e., assuming constant fluid viscosity and pressure, slip will be a smaller factor in a high repetition rate pump (short time per stroke) than in a low repetition rate pump. As viscosity increases and pressure decreases, time (or repetition rate) becomes less a significant contributor to slip loss.

d) STROKE REPETITION RATE is directly related to drive motor speed which in turn is influenced by work load and electrical supply voltage, i.e., motor speed decreases when work load increases and when electrical supply voltage (115 Volts AC) decreases. This motor speed variation may amount to as much as 15% for work load variations between zero discharge pressure and maximum rated discharge pressure. A 10% voltage drop may result in as much as 20% motor speed reduction when the pump is operating against a significant head pressure.

e) THE FLOW STABILITY (precision) of a LAB PUMP is therefore principally related to consistency in fluid slip rate and stroke repetition rate and these functions in turn are related to external system load factors such as viscosity, differential pressure, and electric line voltage; i.e., when load factors remain essentially constant, slip rate and repetition rate remain essentially constant; when viscosity increases, fluid slip rate and stroke repetition rate both decrease; when differential pressure increases fluid slip rate increases and stroke repetition rate decreases.

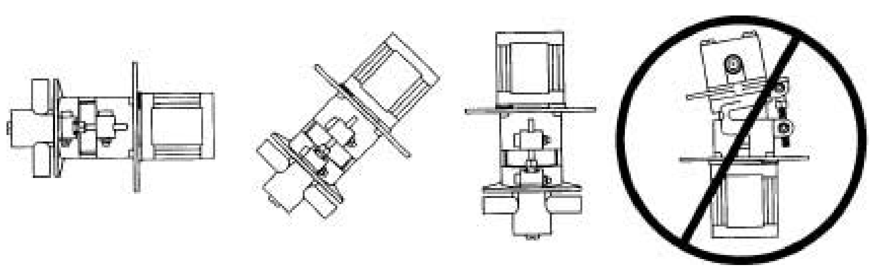
In short, LAB PUMP PRECISION is influenced by fluctuations of fluid differential pressures, fluid viscosity, and electric line voltage. When these factors are controlled predictably reproducible pumping precision better than 0.5% may be expected.

MAINTENANCE & REPAIR
INSTRUCTIONS

15. REMOVING PISTON/CYLINDER GROUP ASSEMBLY. (Refer to Fig. 7.) Remove two screws and while holding cylinder ports in place, slip the CYLLINDER CAP off of the CYLINDER ASSEMBLY. Tilt the assembly as shown in Fig 7. 7. This will permit removal of the PISTON DRIVE PIN from the SPHERICAL BEARING without fully withdrawing piston from liner.

16. PISTON/CYLINDER GROUP ASSEMBLY REPLACEMENT. (Refer to Figs. 7,8) Install the “O” RING over the GLAND NUT. Note in Fig. 7 that the PISTON DRIVE PIN must be guided into the SPHERICAL BEARING while the piston and cylinder remain assembled. This for the purpose of avoiding assembly damage to the seals. When PIN is in bearing, seat GLAND NUT with “O” RING in SUPPORT as shown in Fig. 8.

IMPORTANT
RECOMMENDED PUMP MOUNTING FOR MAXIMUM PERFORMANCE



GOOD **BETTER** **BEST** **NOT RECOMMENDED**

For maximum pump performance, mount the pump with motor at 12 o’clock and pump head at 6 o’clock position. This orientation will allow air bubbles that enter the pumping chamber to directly exit thru buoyant assist. Discharge lines should be inclined upward from pump head.

Fig. 5

OPERATE PUMP MANUALLY FOR SEVERAL STROKES BEFORE APPLYING POWER.

NOTE THAT PISTON IS VISIBLE IMMEDIATELY BEHIND “LOGO” DURING AT LEAST PART OF EACH REVOLUTION OF PUMP SHAFT - WITHOUT ACTUALLY CONTACTING BACK OF “LOGO”.

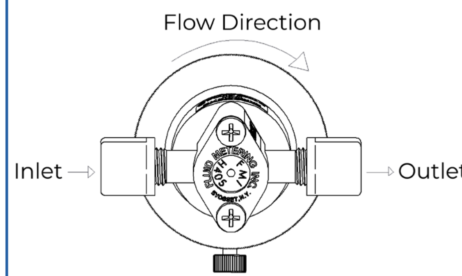


Fig. 6

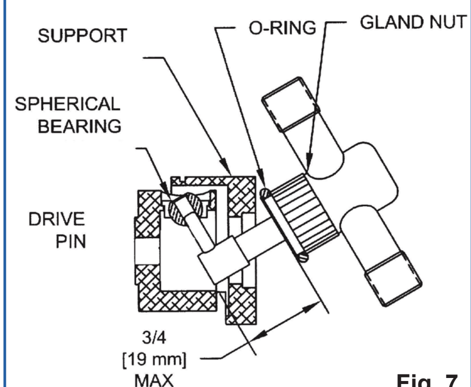


Fig. 7

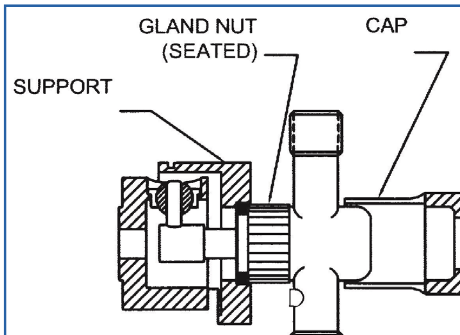


Fig. 8

17. ADJUSTING PISTON/CYLINDER RELATIONSHIP. If the piston is not visible behind “LOGO” or if it contacts “LOGO” during operation, the BEARING ASSEMBLY should be adjusted. This situation may occur when the PISTON ASSEMBLY has been replaced. To make this correction:
a) Loosen the THUMB SCREW and remove the CALIBRATION RING, then loosen the SET SCREW in the BASE ASSEMBLY.

b) Turn the BEARING ASSEMBLY with supplied spanner wrench counterclockwise 1 full turn.

c) Turn the ADJUSTMENT NUT clockwise until its threads are completely seated on the BASE.

d) Rotate the BEARING ASSEMBLY clockwise until the PISTON ASSEMBLY just touches back of logo (as described above) when rotated 360°.

e) Once properly adjusted, rotate the BEARING ASSEMBLY counterclockwise 1/4 turn and tighten the SET SCREW. Replace the CALIBRATION RING.

f) Turn ADJUSTMENT NUT back to its normal operating range and run pump.

17.1 RHB & RHV PISTON/CYLINDER RELATIONSHIP. To correct piston position on RHB and RHV pumps:

a) Loosen the THUMB SCREW on the CALIBRATION RING, rotate until 1/4" hole lines up with piston adjustment hole on the BASE.

b) Looking into piston adjustment hole, rotate motor shaft until the SET SCREW is visible, loosen set screw.

c) Turn the ADJUSTMENT NUT clockwise until threads are completely seated on the BASE.

d) Position the SPINDLE forward until the PISTON ASSEMBLY is visible at back of logo as described above. Tighten set screw.

e) Check for smooth shaft rotation by turning motor shaft by hand. Repeat step (d) if required. To recalibrate see para. 10.

PARTS ORDERS

MINIMUM ORDER APPLIES FOR DOMESTIC or FOREIGN (Invoice price exclusive of shipping)

SHIPPING

Parts orders will be shipped via United Parcel Service or U.S. Postal Service unless other means are specified.

ALL PRICES ARE QUOTED IN U.S. DOLLARS, FOB SYOSSET, NY - Subject to change without notice.

For Additional Information Call - Toll Free 800-223-3388 or email us at: pumps@fluidmetering.com

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