



Fluid Components  
Division of Snap-tite, Inc.

## OPERATION AND MAINTENANCE MANUAL

AIR DRIVEN/  
HAND OPERATED  
HIGH PRESSURE  
LIQUID PUMP

ACHL  
SERIES  
PUMP

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**ISO-9001 Certified**



Model # \_\_\_\_\_

Serial # \_\_\_\_\_

Date \_\_\_\_\_

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## SECTION 1.0 Introduction

Please read this manual in its entirety before attempting to operate an Autoclave Engineers high pressure liquid pump. The Autoclave Engineers pump discussed in this manual is operated using compressed air up to 150 psi (10 bar). Autoclave Engineers ACL Series pumps are used for pumping oil, water and oil/water mixtures. Special seals are also available for chemical service. Please contact Autoclave Engineers to discuss availability of special seals. The pump operates using a pressure ratio of the air piston surface area to the liquid plunger surface area.

(Output liquid pressure = actual pump pressure ratio x input air pressure). Refer to the product literature for each pump model's actual air pressure ratio.

## SECTION 2.0 Installation

For best performance and life, the pump should be installed in the vertical position. This will prevent side loading on the air piston seals. The pump will, however, function in any position.

Pump mounting requires (4) 5/16" bolts. There are 4 holes provided on each pump for mounting.

## SECTION 2.1 Compressed Air Supply

*Unless otherwise noted, all air line accessories for the pump air drive should have, at minimum, a 1/4" FNPT connection. The tubing/piping used to connect the components should have the maximum ID the pressure rating will allow. Reducing the size before the air inlet will reduce air pressure flow and reduce flow rate of the pump.*

The main air drive connection port on the pump is a female 1/4" FNPT and is located in the spool valve housing.

**The use of an air line lubricator is not required and is not recommended.** The pump is assembled at the factory using permanent synthetic grease in the air drive moving parts. The oil in the air lubricator will actually cause the factory installed grease to be purged from the pump. Once an air lubricator is used, the pump can never again be operated without an air lubricator.

An air line filter with a minimum 5 microns filtration rating must be used on the supply line. If the air supply is not dry, a mist separator must be used to remove moisture in the air line.

Autoclave Engineers can supply a complete air control package that includes a filter, air pressure regulator, air pressure gage and shutoff valve. Mist separators are also available. Contact the factory for more details on these options.

The pump is designed to function from 15 psi to 150 psi (1 to 10 bar) air input pressure.

## SECTION 2.2 Liquid Section

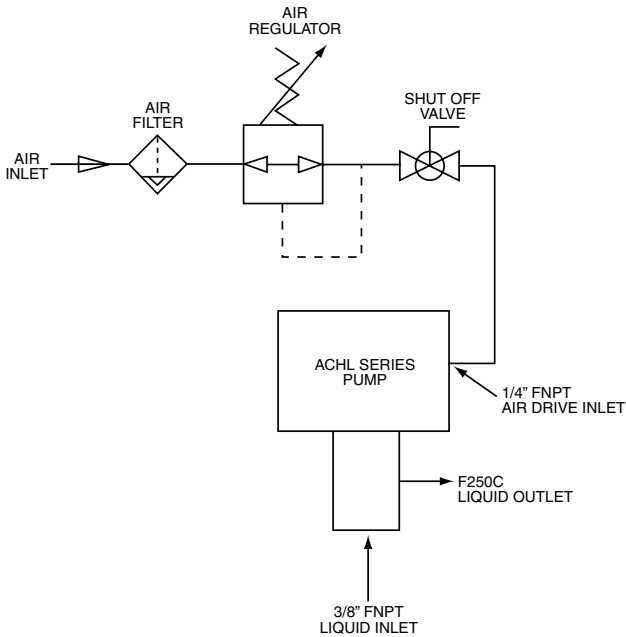
All ACHL series pumps have a high pressure liquid outlet port located on the side of the pump head. The suction inlet port on all ACHL series pumps is positioned either at the bottom or side of the head depending on the model purchased. See order code details in the product literature for catalog number suffix.

**Inlet:** A liquid filter with at least a 100 micron rating must be installed before the suction port inlet to prevent damage to the check valves and high pressure seals due to debris. For best performance, a liquid supply reservoir should be located higher than the inlet gland on the pump to create a small pressure head. Be sure to make an air tight seal between the reservoir and the pump inlet connection. The connections between the reservoir and pump inlet should not be reduced from the 3/8" FNPT connection size. The tubing or piping should be made from a corrosion resistant material and sized with a maximum ID to fit the 3/8" pipe connections. Restricting flow at the liquid inlet will cause problems with check valve performance and reduce output flow.

**Outlet:** The outlet tubing ID must, at minimum, match the same size of the pump check valve gland port. Refer to product literature for outlet connections details for each pump. Reducing outlet tubing or connection will reduce output liquid flow capacity.

The high pressure tubing must be rated to at least the maximum pump output pressure.

### SECTION 3.0 Pump Start-Up



**Air Line Schematic**

As shown above, a filtered main air supply line is required. The filtered air supply will go to a pressure regulator which can be set to achieve the desired output liquid pressure according to the pressure ratio of the pump.

The pump and high pressure liquid system must be vented prior to installation and start-up.

The pumps unique design allows for self priming. To prime, regulate the air pressure to between 5-15 psi or use an air flow regulator to reduce to a slow stroke frequency. With the high pressure side connected to a vented system, allow the pump to cycle till a consistent flow of liquid is achieved. Let the pump flow freely to purge any air in the liquid system. Loosening the outlet gland or pipe can also assist in priming the pump. Be sure to securely tighten the high pressure tube or gland with the appropriate torque after the priming has been achieved. Increase the air pressure using the air pressure regulator until you achieve your desired output liquid pressure. At this point the pump will stall. You can calculate the output pressure by multiplying the input air supply by the pressure ratio of the pump. The pump will automatically restart if there is a drop in downstream high pressure.

### SECTION 4.0 Process Media

Autoclave Engineers pumps discussed in this manual are used for pumping oil, water and oil/water mixtures. Special seals are also available for chemical service. Please contact Autoclave Engineers to discuss availability of special seals.

Pumps are not designed to run for long periods of time without liquid process media. Short, dry pumping cycles should not be a cause for concern. However, pumps are built using lubricant in the seal areas and pumping without fluid will wear away lubricant and compromise the seal.

The operating temperatures of the pump are between 0°F to 150°F.

### SECTION 5.0 Pump Functionality

When the pump is installed, regulated air is connected to the spool housing at the 1/4" FNPT pump inlet. The explanation below assumes pump is already primed with liquid.

1. The pump is supplied with the piston in the upward position, which keeps the pilot valve in the open position.
2. When regulated air is supplied to the pump, it enters the spool housing and energizes the large end of the spool, which shifts the spool to the left.
3. The shifting of the spool causes regulated air to pass through the spool valve and pushes the air piston and head plunger downward toward the pump head.
4. The liquid plunger moving toward the head compresses fluid and forcing the inlet check valve to close and the outlet check valve to open.
5. The plunger continues in the downward motion until it reaches the full stroke length.
6. At the end of the stroke, air pressure is released from the large side of the spool, which causes the spool to shift and exhaust the air from the top of the piston through the muffler.
7. The spring underneath the piston then returns the piston to the starting position.
8. During the return, the pump performs a suction stroke. During a suction stroke, the plunger is moving away from the head causing the inlet check valve to open, which allows liquid to be drawn into the head while the outlet check valve is forced closed.

9. Once the pump returns to the original starting position, the pilot valve opens and the entire process will continue to repeat until the pump reaches its stall pressure.



Note: The ACHL series pump can be operated using a manual hand lever. It is recommended that the air pressure be turned off to the pump when you use the manual hand lever.

Push the hand lever down to manually compress fluid and build liquid pressure. You can either stop when you reach your desired pressure, or when the pump reaches the end of its stroke. At the end of the stroke, keep your hand on the hand lever and slowly allow the springs to return the pump hand lever to its original position and perform a suction stroke. Do not let go of handle until the springs have returned the hand lever to its original position. Repeat this action until desired output pressure is reached. **Do not exceed Maximum Operating Pressure of the pump.**

## SECTION 6.0 Suggested Maintenance

The maintenance schedule of the pump depends on the frequency of use, cleanliness of media, type of media, cycle rates, output pressures, cleanliness of air or any other conditions that may be damaging to seal integrity. Once a clear pattern develops of how long a pump is in service before pump performance declines, it is recommended to perform maintenance in advance of this time frame.

Maintenance would include:

- Re-lubrication or replacement of spool valve o-ring
- Re-lubrication or replacement of tappet o-rings and gaskets
- Re-lubrication or replacement of air drive o-rings
- Replace check valve components
- Replace high pressure seals

Before each pump use, a quick inspection should be performed to ensure there are no loose bolts, nuts, set screws or check valve glands. A visual inspection should also be made to make sure there is no evidence of fluid leaks from drain ports or check valves.

## SECTION 7.0 Trouble Shooting - Pneumatic Section

*Problem:* Pump will not operate with low air pressure.

*Cause:* Excessive friction of o-rings on the spool valve has increased the pressure required to move spool.

*Solution:* Replace and lubricate the o-rings on spool.

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*Problem:* Pump can only be actuated at high air pressure.

- Cause:*
- a) Air is leaking through the plunger bore in the top end cap.
  - b) Air is leaking through the o-rings between the top end cap and air cylinder.
  - c) Bottom cap breather vent clogged.

- Solution:*
- a) Replace and lubricate o-rings on upper plunger and in the bore located in the top cap.
  - b) Replace and lubricate o-ring on lip of top end cap.
  - c) Clean or replace breather vent.
- 

*Problem:* Pump will not run and air escaped through the exhaust muffler.

- Cause:*
- a) Spool valve o-rings are leaking.
  - b) Spool sleeve o-rings are leaking.

- Solution:*
- a) Replace and lubricate spool valve o-rings.
  - b) Replace and lubricate sleeve o-rings.
- 

*Problem:* Pump will not run and air escapes through the breather vent in the bottom end cap.

- Cause:*
- a) Outside o-ring on air piston is leaking.
  - b) Seal between air piston and liquid plunger is leaking.

- Solution:*
- a) Replace and lubricate air piston o-ring.
  - b) Add Loctite 2760 thread locker with sealant on the plunger threads (one piece plunger designs).
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*Problem:* Pump operates at a high frequency and short strokes.

- Cause:*
- a) The top pilot valve is defective.
  - b) Air is leaking through the piston bore in the top end cap.

- Solution:*
- a) Replace and lubricate both tappet gaskets and o-ring. If necessary, also replace the tappet rod.
  - b) Replace and lubricate o-ring on upper plunger and in the bore located in the top cap.

- Problem:* Pump functions slowly or doesn't operate at all.
- Cause:*
- a) Condensation from air supply is freezing the spool valve.
  - b) Air muffler is clogged.
- Solution:*
- a) Stop pump for a short period and replace or add a mist separator in the air line.
  - b) Clean or replace air muffler.

## **SECTION 9.0**

### **Service**

Contact Autoclave Engineers for service. Pumps can be sent directly to Autoclave Engineers for service. Pumps returned for service should be accompanied with the model number, serial number, manufacture date and problems you are experiencing.

For service information: 814-860-5729

## **SECTION 8.0**

### **Trouble Shooting - High Pressure Liquid Section**

- Problem:* Pump does not produce liquid flow, operates irregularly or does not maintain pressure.
- Cause:*
- a) Air in the hydraulic system.
  - b) Suction line excessively long.
  - c) Suction tubing sized too small.
  - d) Failure of one of the check valves.
  - e) Liquid inlet filter is blocked.
  - f) High pressure seal excessively worn.
  - g) Supply liquid pressure head too low.
- Solution:*
- a) Check inlet suction line and connections for leaks and allow pump to flow freely downstream so as to remove any air.
  - b) Shorten liquid supply line.
  - c) Increase tubing ID size between reservoir and pump inlet.
  - d) Clean or replace both inlet and outlet check valve assemblies.
  - e) Clean or replace liquid inlet filter.
  - f) Replace high pressure liquid seal assembly and the air rod seal assembly.
  - g) Raise liquid reservoir to higher location until pump is fully primed.

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- Problem:* Fluid escapes through the breather vent.
- Cause:* High pressure seal is leaking.
- Solution:*
- a) Clean fluid from air section.
  - b) Replace and lubricate o-rings as necessary in the air section.
  - c) Replace high pressure liquid seal assembly.

**! WARNING !**

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS  
DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND/OR PROPERTY DAMAGE.

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