

**Autoclave
Engineers** 

Fluid Components
Division of Snap-tite, Inc.

OPERATION AND MAINTENANCE MANUAL

AIR DRIVEN
HIGH PRESSURE
LIQUID PUMP

ASL
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 ASL 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 diameter to the liquid plunger diameter. Pumps are available in pressure ranges up to 60,000 psi (4137 bar).

The pump model number coincides with the approximate nominal ratio of the pump; ex. ASL400-01 is a 400:1 ratio, with an input air of 100 psi the output pressure would amount to 40,000 psi (2758 bar). (Output pressure = actual ratio x input air pressure). Refer to the product literature for the 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) 3/8" bolts. There are 4 slotted 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 1/2" 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 1/2" FNPT and is located in the spool valve housing. An additional female 1/8" FNPT air pilot valve connection port is located in the top end cap at the opposite side of the 1/2" NPT air inlet. This pilot connection must be plumbed to an unregulated filtered air source. The purpose of this connection is to aid in low pressure differential start-up and restart of the pump while providing a more accurate pressure control. The pump will not function if this unregulated air supply is not connected to the pilot valve port.

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

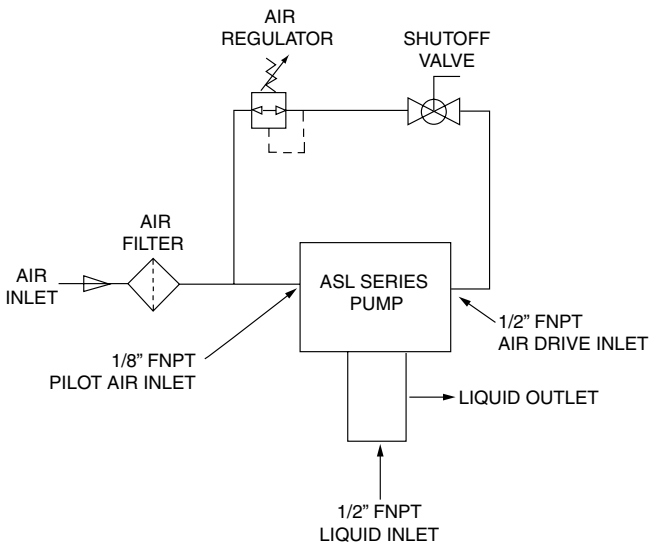
All ASL series pumps have a high pressure liquid outlet port located on the side of the pump head. The suction inlet port on all ASL series pumps is positioned either at the bottom or side of the head depending on the model purchased. See order code details in the product literature for catalog number 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 1/2" FNPT connection size. The tubing or piping should be made from a corrosion resistant material and sized with a maximum ID to fit the 1/2" 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 air line must then be split through a tee. One line will attach to the 1/8" FNPT pilot valve connection on the top of the pump. The air pressure in this line should be unregulated and higher than the regulated main air supply on the air drive section. The second line out of the tee 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, maximum system air is connected to 1/8" FNPT pilot air inlet and is sealed off by pilot valve assembly in the top end cap and does not enter the spool housing.

Regulated air is connected to the spool housing at the 1/2" FNPT pump inlet.

- 1) Regulated inlet air pressure enters spool housing and moves spool to the left directing air into large pressure tube to the bottom end cap pushing the air piston and liquid plunger upward.
- 2) The upward movement causes a suction of liquid into the high pressure pump head while inlet check valve is open and outlet check valve is closed.
- 3) The air piston continues to move up until it hits the pilot valve assembly in the top end cap.
- 4) The top pilot valve opens allowing max system air pressure to shift the spool valve so that it now directs air drive pressure through the top end cap and pushes the air piston and liquid plunger downward.
- 5) The plunger action moving down compresses the fluid on the high pressure pump head while the inlet check valve is closed and outlet check valve is open.
- 6) While the air drive pressure is acting on top of the piston, the bottom area of the piston is vented through the exhaust muffler.
- 7) Piston continues to move down until it hits the pilot valve assembly in the bottom end cap.
- 8) The bottom pilot opens which vents max system air pressure from the large diameter side of the spool.

- 9) This causes spool to move to the left, while air is vented from the top end of the air cylinder through the exhaust muffler.
- 10) The entire process starts again at step one until the maximum outlet hydraulic pressure is reached based on the pressure ratio 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
- Replace check valve components
- Replace high pressure seals

Before each pump use, a quick inspection should be performed to insure 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.

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

- Cause:*
- a) Air is leaking through the piston guide bushing in the top end cap.
 - b) Air is leaking through the o-rings between the top end cap and air cylinder.

- Solution:*
- a) Replace and lubricate o-rings on upper plunger and between bushing and top cap.
 - b) Replace and lubricate o-ring on lip of top end cap.

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.
 - c) Outside o-ring(s) on air piston(s) is leaking.
 - d) Seal between air piston and liquid plunger is leaking.

- Solution:*
- a) Replace and lubricate spool valve o-rings.
 - b) Replace and lubricate sleeve o-rings.
 - c) Replace and lubricate air piston o-ring(s).
 - d) Replace o-ring on bottom plunger (two piece plunger designs), or add Loctite 2760 thread locker with sealant on plunger threads (one piece plunger designs).
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Problem: Pump will not run and air escapes through the small hole in the spool valve housing.

Cause: Spool valve sleeve o-rings are leaking.

Solution: Replace and lubricate spool valve o-rings.

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

Cause: Pilot valve tappet is not sealing in the bottom cap.

Solution: Replace and lubricate tappet gasket and o-ring. If necessary, also replace the tappet rod.

Problem: Pump operates at a high frequency and short strokes.

Cause: The top or bottom pilot valves are defective.

Solution: Replace and lubricate both tappet gaskets and o-rings. If necessary also replace the tappet rods.

Problem: Pump will not run and air flows out of the separation plate vent (double stage pump only).

Cause: The rod seal in the separation plate is leaking.

Solution: Replace and lubricate rod seal assembly.

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.
 - c) Clean or replace air muffler.

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.

- 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 seal assembly.
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Problem: Fluid escapes through the air exhaust (non-isolation chamber version only).

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 seal.

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

! WARNING !

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