

# AHL Series Pump

Air Driven, High Pressure Liquid Pump

Operation and Maintenance Manual

Manual: 02-9242ME | April 2022



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## Parker Instrumentation Products Divison (IPD)

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

Order # \_\_\_\_\_

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

Mfg. Date \_\_\_\_\_

Drawing # \_\_\_\_\_

Complete information above for future reference.



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

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog.

Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

ALL PARKER VALVES MUST PASS A RIGID OPERATIONAL AND LEAKAGE TEST BEFORE LEAVING THE FACTORY. IT IS RECOMMENDED AFTER ANY REASSEMBLY, THE VALVE SHOULD BE TESTED BY THE USER FOR OPERATION AND LEAKAGE. IF THESE INSTRUCTIONS ARE NOT FULLY COMPLIED WITH, THE REPAIRED PRODUCT MAY FAIL AND CAUSE DAMAGE TO PROPERTY OR INJURY TO PERSONS. PARKER HANNIFIN CANNOT ASSUME RESPONSIBILITY FOR PERFORMANCE OF A CUSTOMER SERVICED VALVE.



## Product Drawings

Typical Pump Cross Sectional View .....	4
AHL Pump Dimensional View .....	5

## Operation & Maintenance Information

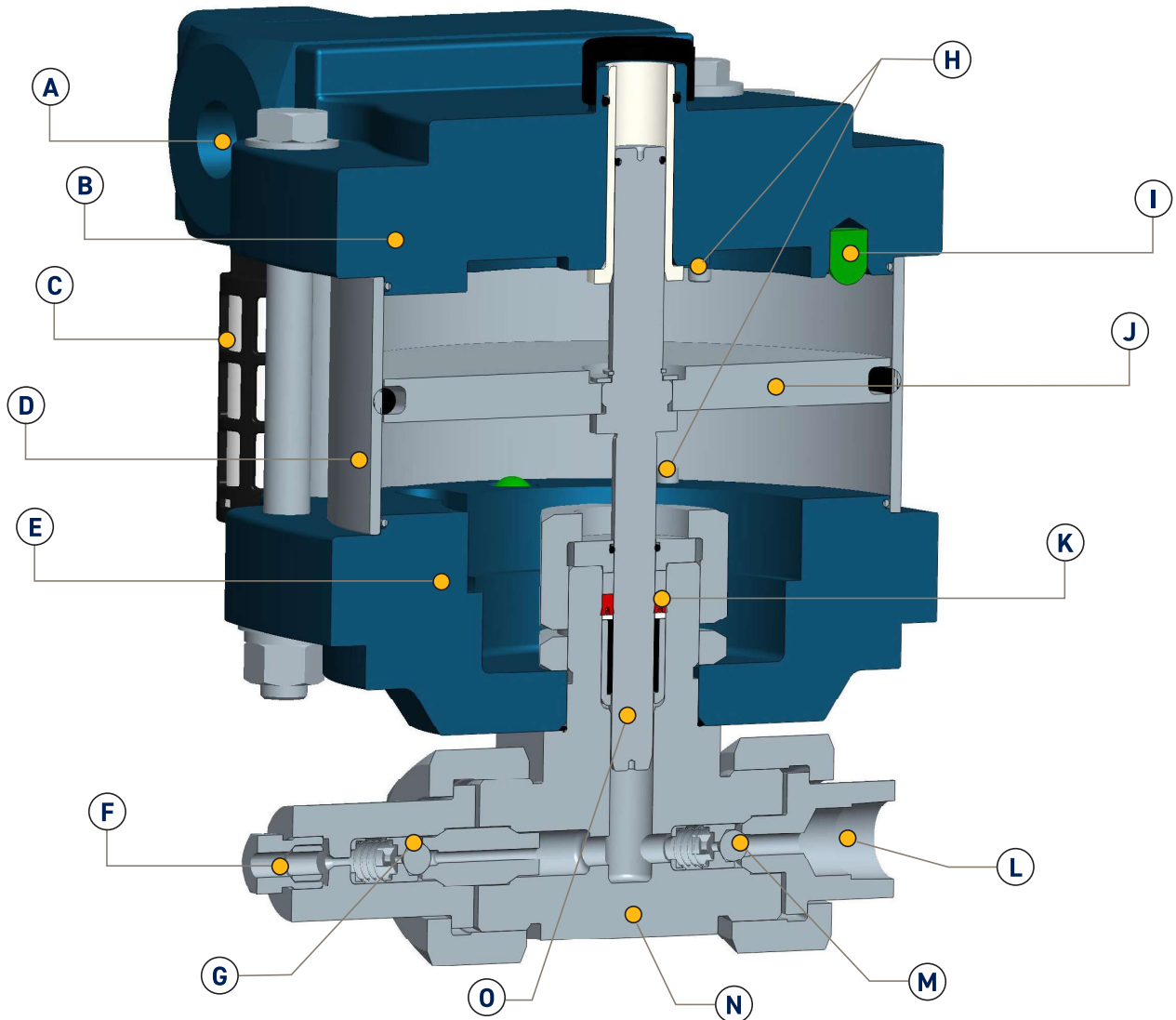
1.0 Introduction .....	6
2.0 Meaning of Safety Words.....	6
3.0 Product Specification.....	6
4.0 Unpacking .....	6
5.0 Tools .....	6
6.0 Installation .....	7
6.1 Compressed Air Supply .....	7
6.2 Liquid Section .....	8
7.0 Pump Start-Up .....	8
8.0 Process Media .....	9
9.0 Pump Functionality .....	10
10.0 Suggested Maintenance .....	10

## Troubleshooting Information

11.0 Repair Kit Options .....	11
12.0 AHL Series Drawings .....	12
13.0 Trouble Shooting-Pneumatic Section .....	15
14.0 Trouble Shooting-High Pressure, Liquid Section .....	16
15.0 Service .....	16



## Typical Pump: Cross Sectional View (ASL Pump Shown)



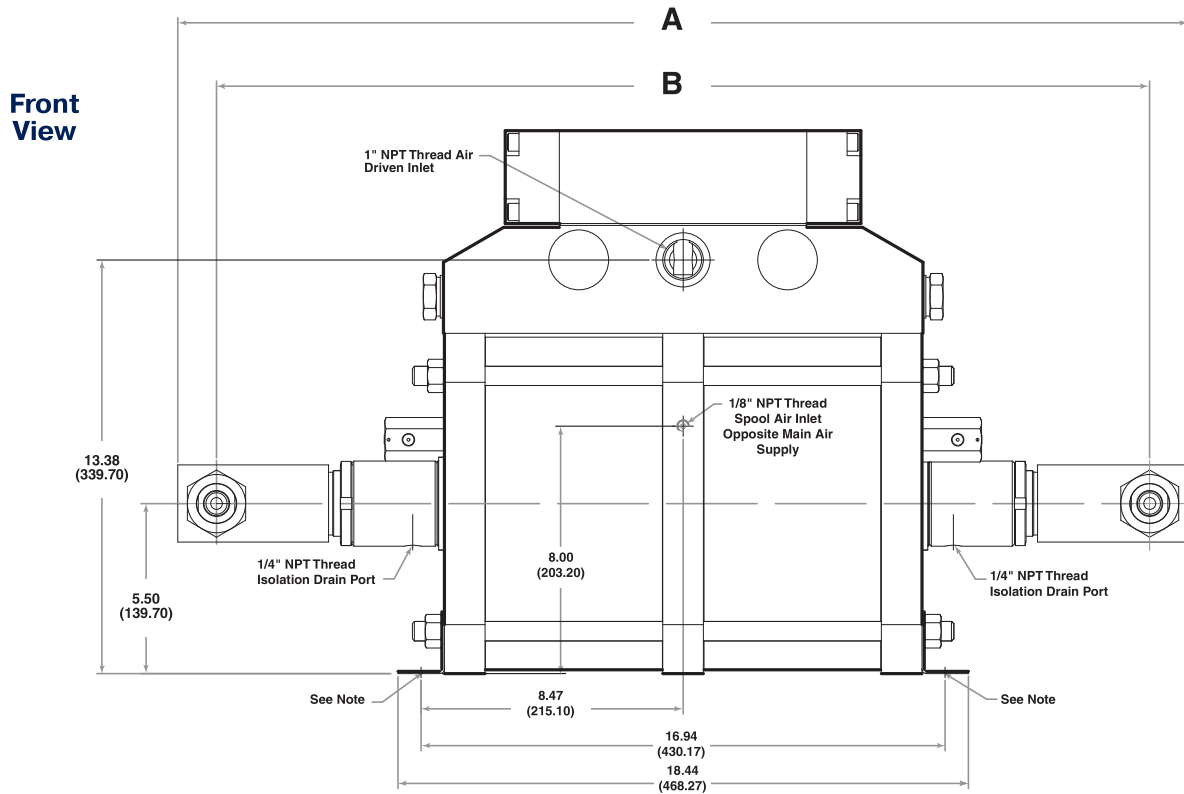
	Description
A	Air Inlet
B	Top End Cap
C	Air Muffler
D	Air Cylinder
E	Bottom End Cap
F	High Pressure Outlet Connection
G	Outlet Check Valve
H	Pilot Valve

	Description
I	Air Piston Bumper
J	Air Piston
K	High Pressure Seal Assembly
L	Liquid Inlet Connection
M	Inlet Check Valve
N	Pump Head Body
O	Hydraulic Plunger

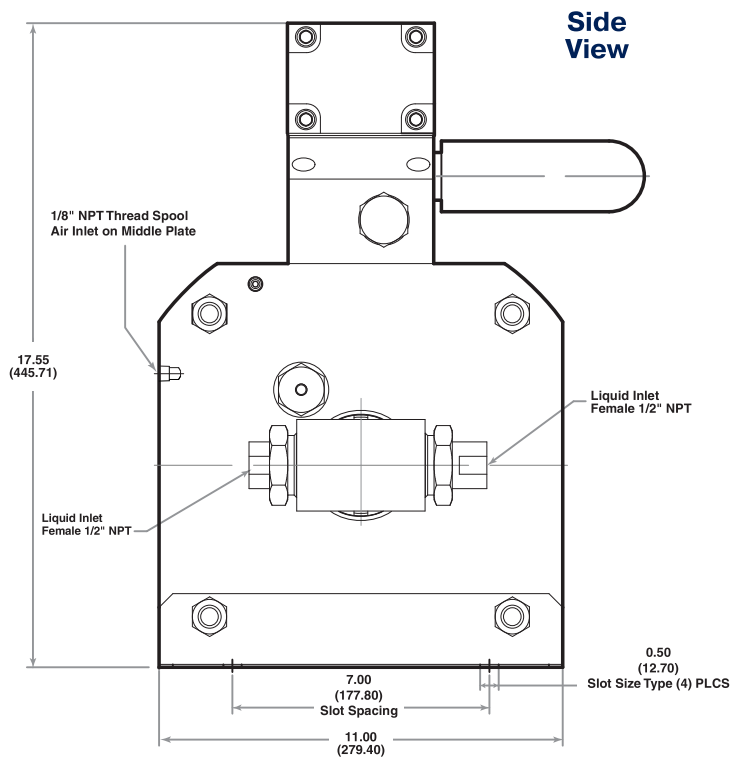




## AHL Pump Dimensional View



Model	A	B
AHL33	32.41 (823.21)	30.42 (772.41)
AHL66	32.66 (829.61)	30.16 (766.11)
AHL118	32.66 (829.61)	30.16 (766.11)



### Note:

- Each Mounting Bracket includes (2) 9/16" (14.29) holes for 1/2" Bolts.
- All dimensions are for reference only and are subject to change without notice.
- Primary Dimensions: Inches
- Secondary Dimensions: (Millimeters)



## Operation & Maintenance Information

### Section 1.0 Introduction

The Parker Autoclave Engineers pump discussed in this manual is operated using compressed air up to 110 psi (7.6 bar) max, however maximum inlet air pressure is limited by the maximum liquid output pressure. Autoclave Engineers AHL Series pumps are used for pumping oil, water, and oil/water mixtures.

Special seals are also available for chemical service. Please contact Parker 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 Meaning of Safety Words

A safety related message is identified by a safety alert symbol and a signal word to indicate the level of risk involved with a particular hazard. The definitions of the three signal words are as follows:

#### **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Special notes intended to bring attention to procedures that must be followed to ensure proper installation and performance will be placed in a box labeled **NOTICE**.



### Section 3.0 Product Specifications

See assembly drawing for product specifications:

- Pump Geometry
- Pump Materials of Construction
- Maximum Allowable Working Pressure
- Maximum Working Temperature
- Pressure Ratio
- Displacement
- Repair Kit Part Numbers
- Torque Information
- Weights

### Section 4.0 Unpacking

The pump has been assembled and pressure tested at Parker Autoclave Engineers and is ready to be put into service. The shipping carton should be opened and the contents carefully examined upon receipt from the carrier. Make sure there is no obvious damage to the contents. **DO NOT** use the equipment if any damage is evident. If damage has occurred, file a claim with the shipper before contacting Parker Autoclave Engineers Service Department.

Examine all material within the container and check against the packing list to be sure all items are accounted for and are not damaged. Verify that the equipment model number supplied agrees with what was ordered.

### Section 5.0 Tools

At minimum, the tools required for installation of the pump include a torque wrench, an open end wrench adapter (crows foot adapter) and an open end adjustable wrench.

Refer to the Tools, Maintenance and Installation Manual provided with the Data Book for information on torque wrenches and torque values for Parker Autoclave Engineers tubing and fittings.

## Section 6.0 Installation

### **WARNING**

Please read this manual in its entirety before attempting to operate an Parker Autoclave Engineers high pressure liquid pump

### **WARNING**

Installation to be performed only by properly trained individuals.

### **WARNING**

Proper protective safety gear must be worn while installing and operating the pump.

### **WARNING**

Always bolt the pump to a substantially solid surface using the slotted holes provided.

### **CAUTION**

AHL Pumps have a maximum sound level of 90 dBA. Wear hearing protection while working with or near the pump.

## Section 6.1 Compressed Air Supply

### **NOTICE**

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" FNPT and is located in the spool base housing. An additional female 1/8" FNPT air pilot valve connection port is located in the middle plate at the opposite side of the 1" NPT air inlet.

This pilot connection must be plumbed to an unregulated and 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 supply port.

### **NOTICE**

**The use of an air line lubricator is not required and is not recommended.** The oil in the air lubricator will 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.

The pump is designed to function from 20 psi to 110 psi (1.4 to 7.6 bar) air input pressure, however maximum inlet air pressure is limited by the maximum liquid output pressure.



## Section 6.2 Liquid Section

All AHL series pumps have high pressure liquid outlet ports located on the side of the pump head's. The suction inlet ports on all AHL series pumps are positioned opposite of the inlet checks.

**Inlet:** A liquid filter with at least a 100 mesh size must be installed before the suction port inlet to prevent damage to the check valves and high pressure seals due to debris.

### NOTICE

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 FNPT connection size.

Refer to product literature for inlet connection details for each pump. The tubing or piping should be made from a corrosion resistant material and sized with a maximum ID to fit the inlet pipe connections.

### NOTICE

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.

### NOTICE

In order for the pump to flow properly, both outlets must be plumbed together into a tee to one single outlet.

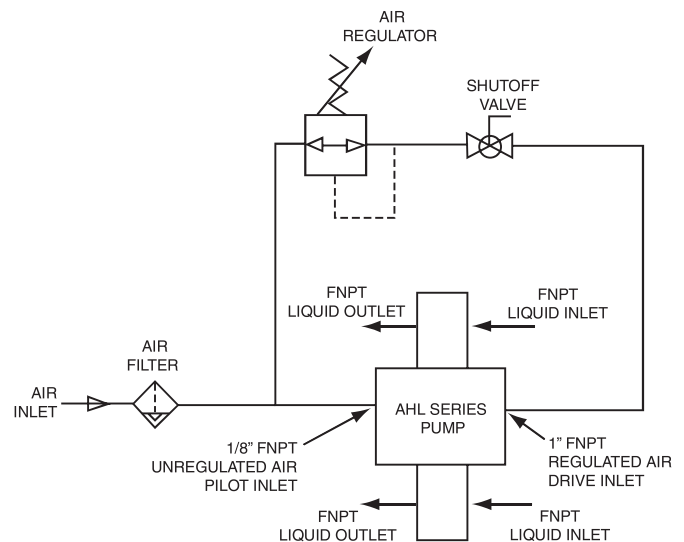
### ! WARNING

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

### ! WARNING

Verify liquid pressure system is protected with an over pressure relief device.

## Section 7.0 Pump Start-Up



### Air Line Schematic

As shown above, a filtered main air supply line is required. The air line then must be split through a tee. One line will attach to the 1/8" FNPT pilot valve connection in the middle plate of the pump.

The air pressure on this connection must be 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.



### **WARNING**

Use an air pressure regulator to assure maximum air drive pressure listed on the pump label is not exceeded. An air pressure regulator must also be used to assure the pump will not exceed maximum liquid output pressure listed on the pump label.

### **WARNING**

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.

### **WARNING**

Be sure to securely tighten high pressure tube, pipe or gland with the appropriate torque after the priming has been achieved.  
Reference Tools, Installation, Operation and Maintenance Manual for tube gland torque value.

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 actual pressure ratio of the pump. The pump will automatically restart if there is a drop in downstream high pressure.

### **WARNING**

**DO NOT** exceed the maximum liquid pressure and temperature rating specified on the assembly drawing and label for your pump.

It is recommended to use a liquid relief valve or rupture disk to prevent over pressurization of your high pressure system.

**DO NOT** exceed the maximum air drive pressure listed on your pump label.

## Section 8.0 Process Media

Parker 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 Parker Autoclave Engineers to discuss availability of special seals.

### **WARNING**

While testing has shown o-rings to provide satisfactory service life, actual life will vary widely with differing service conditions, properties of reactants, pressure and temperature cycling and age of the o-ring.

**FREQUENT INSPECTIONS SHOULD BE MADE** to detect any deterioration and o-rings replaced as required.

### **WARNING**

The user is required to verify material compatibility with fluid based on corrosion resistance. A material list is provided on the assembly drawing to aid you in the evaluation.

**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 140°F (18°F to 60°F).



## Section 9.0 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" FNPT pump inlet.

1. Regulated inlet air pressure enters the spool housing and is diverted to the air cylinders and their pistons, which causes one plunger to build pressure in one of the hydraulic pump heads while the second plunger performs a suction stroke that will pull liquid into the second hydraulic pump head.
2. When a hydraulic pump head is in the 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.
3. When the hydraulic pump head is building pressure, the plunger is moving toward the head compressing the fluid and forcing the inlet check valve to close and the outlet check valve to open.
4. The air pistons continue to move until a piston hits the pilot valve assembly in the end cap.
5. The pilot control valve shifts allowing max system air pressure to shift the spool valve so that it now directs air drive pressure through to the opposite side of the pistons in the air cylinders and pushes the air piston and liquid plunger in the opposite direction.
6. While the air drive pressure is acting on the pressure side of the piston, the opposing area of the piston's are vented through the exhaust mufflers.
7. This action causes the reverse action of step #1 (the suction head will change to a compression stroke, while the pressurize head will change to a suction stroke).
8. The air pistons continue to move until a piston hits the pilot valve assembly in the second end cap which will again cause the spool to shift and divert air to move the pump in the opposite direction.

9. This alternating action of steps #1 to step #8 continues until the maximum outlet hydraulic pressure is reached based on the pressure ratio of the pump.

## Section 10.0 Suggested Maintenance

### **WARNING**

All pumps must be inspected periodically in order to assure proper and safe operating condition. Failure to inspect pump can result in serious and catastrophic harm to personnel and the surrounding facility.

- A. Before each pump use, a quick inspection should be performed to insure there are no loose bolts, nuts, set screws or check valve glands. Tighten any loose bolts and fittings according to the torque values listed on the pump assembly drawing. A visual inspection should also be made before each use and at startup to make sure there is no evidence of fluid leaks from isolation chamber drain ports, check valves connections and muffler. If liquid mists out of the muffler for more than 5 strokes, it is time to replace your hydraulic high pressure seals. Refer to the troubleshooting guide for solutions to these fluid leaks.
- B. 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. At minimum, perform maintenance on the pump once a year as described below.



**Maintenance would include:**

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

- C. Maintenance instructions are supplied with appropriate rebuild kits. Kit part numbers are listed on the assembly drawing.

**WARNING**

Before attempting to disassemble the pump or loosen fittings in a pressure system, be sure that liquid pressure has been totally vented.

**WARNING**

Before attempting to perform maintenance on the pump, assure that air supply pressure is shut off and vented from the pump.

## Section 11.0

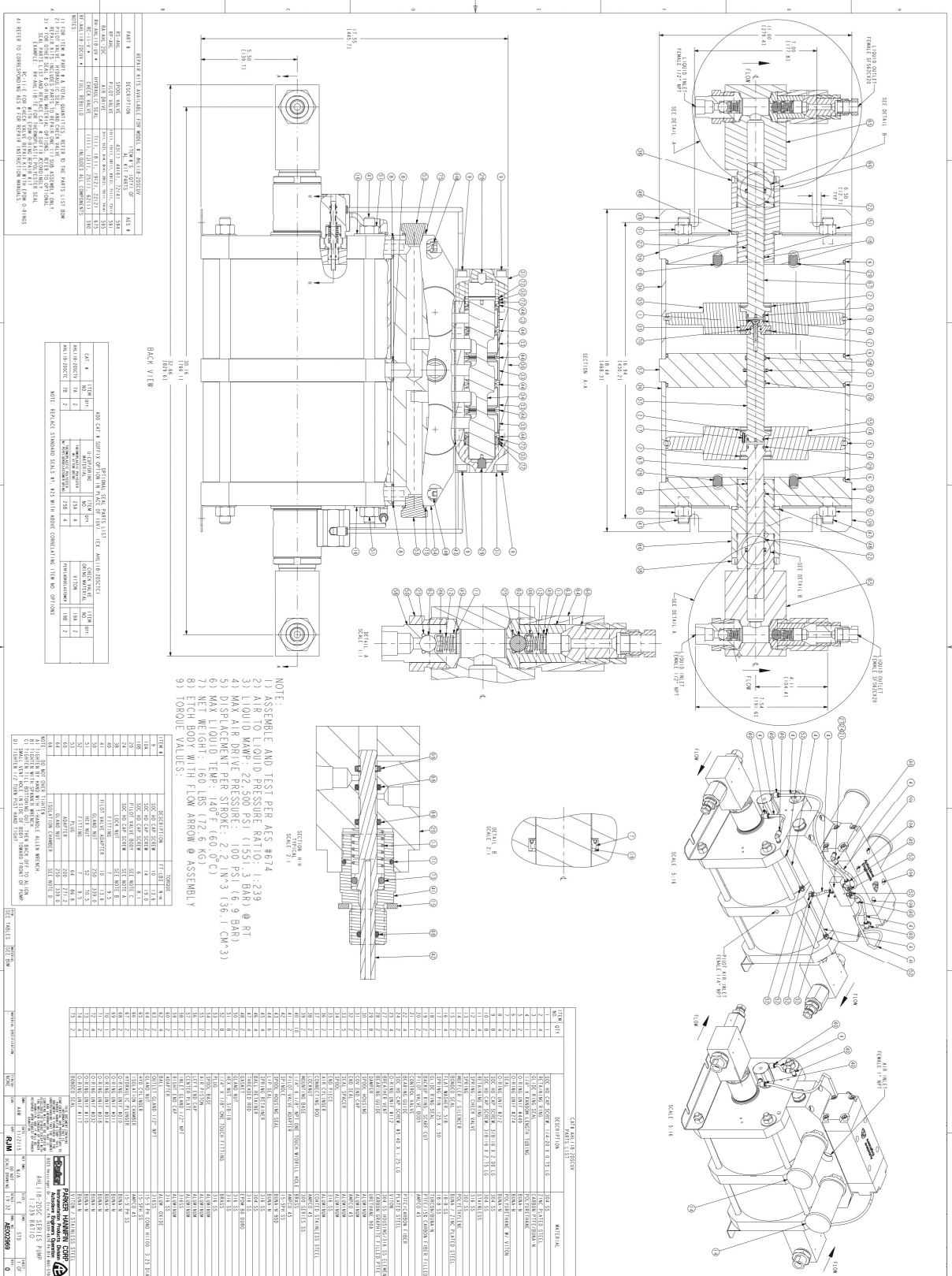
### AHL Series Repair Kit Options

Pump Model Number	O-Ring Material	Spool Valve Kit	Pilot Valve Kit	Air Drive Kit	Hydraulic Seal Upper	Inlet Check Valve Kit	Outlet Check Valve w/ Seal	Full Rebuild Kit
AHL33-2DSCTB	Buna-N	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL33-TB	RC-11-B	RC-11-B	RF-AHL33-2DCTB
AHL33-2DSCTC	FFKM	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL33-TC	RC-11-C	RC-11-C	RF-AHL33-2DCTC
AHL33-2DSCTV	FKM	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL33-TV	RC-11-V	RC-11-V	RF-AHL33-2DCTV
AHL66-2DSCTB	Buna-N	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL66-TB	RC-11-B	RC-11-B	RF-AHL66-2DCTB
AHL66-2DSCTC	FFKM	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL66-TC	RC-11-C	RC-11-C	RF-AHL66-2DCTC
AHL66-2DSCTV	FKM	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL66-TV	RC-11-V	RC-11-V	RF-AHL66-2DCTV
AHL118-2DSCTB	Buna-N	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL118-TB	RC-11-B	RC-11-B	RF-AHL118-2DCTB
AHL118-2DSCTC	FFKM	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL118-TC	RC-11-C	RC-11-C	RF-AHL118-2DCTC
AHL118-2DSCTV	FKM	RS-AHL	RP-AHL	RA-AHL-2DC	RH-AHL118-TV	RC-11-V	RC-11-V	RF-AHL118-2DCTV





Section 12.0  
AHL118-20SC Series Pump Drawing





## Troubleshooting

### Section 13.0

#### Troubleshooting - 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).

**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 gasket or o-ring is not sealing in the bottom cap.

**Solution:** Replace and lubricate pilot valve 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 pilot valve 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.

- b) Clean or replace air muffler.



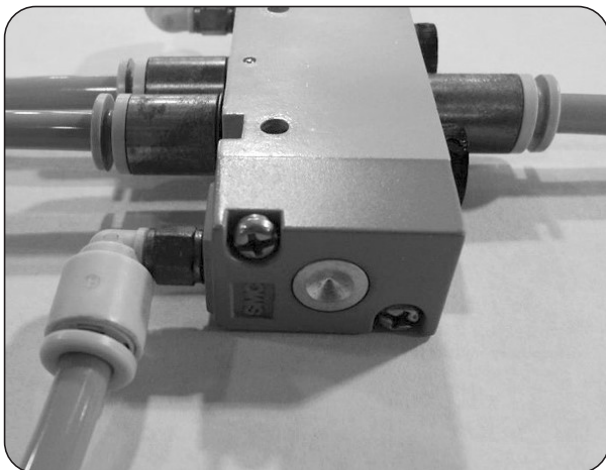
**Problem:** When air is applied to pump the spool will not actuate.

**Cause:** Unregulated air pilot feed line pressure was shut off at the same time as regulated main air drive pressure. This caused the Pilot Control Valve to stop in an incorrect position at shutdown.

**Solution:** Assure unregulated pilot air, regulated air drive and shutoff valve are arranged as shown in the "Air Line Schematic" in Section 7.0.

Turn off regulated air drive pressure. Pressure should now only be supplied to the unregulated pilot connection.

Press the manual push button switch on either end of Pilot Control Valve (see image below). This will shift the Pilot Control Valve and then the spool to the position required for restart. Now supply pump with main regulated air pressure.



**Pilot Control Valve**

## Section 14.0

### Troubleshooting - 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.

## Section 15.0

### Service

Parker Autoclave Engineers now require all pump repair be sent to an authorized repair facility. Contact Parker Autoclave Engineers for recommendations. Pumps returned for service should be accompanied with the model number, serial number, manufacture date and problems you are experiencing.

### **WARNING**

Use only originally specified parts when installing or maintaining high-pressure equipment and follow all Parker Autoclave Engineers maintenance and assembly procedures. Do not use any parts from other equipment to make repairs or modifications. Contact Parker Autoclave Engineers with any questions or if sufficient information to complete the installation, maintenance and operation of the equipment has not been included.



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At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further information call 1-800-C-Parker.

MARKET	KEY MARKETS		KEY PRODUCTS	
 <b>AEROSPACE</b>	Aircraft Engines Commercial Commercial Transports Military Aircraft Regional Transports	Business and General Aviation Land-Based Weapons Systems Missiles and Launch Vehicles Unmanned Aerial Vehicles	Flight Control Systems & Components Fluid Conveyance Systems Fluid Metering Delivery & Atomization Devices Fuel Systems & Components	Hydraulic Systems & Components Inert Nitrogen Generating Systems Pneumatic Systems & Components Wheels & Brakes
 <b>CLIMATE CONTROL</b>	Agriculture Food, Beverage and Dairy Precision Cooling Transportation	Air Conditioning Life Sciences & Medical Processing	Co2 Controls Electronic Controllers Filter Driers Hand Shut-Off Valves Hose & Fittings	Pressure Regulating Valves Refrigerant Distributors Safety Relief Valves Solenoid Valves Thermostatic Expansion Valves
 <b>ELECTRO-MECHANICAL</b>	Aerospace Life Science & Medical Packaging Machinery Plastics Machinery & Converting Semiconductor & Electronics Factory Automation	Machine Tools Paper Machinery Primary Metals Textile Wire & Cable	AC/DC Drives & Systems Electric Actuators, Gantry Robots & Slides Electrohydrostatic Actuation Systems Electromechanical Actuation Systems Human Machine Interface	Linear Motors Stepper Motors, Servo Motors Drives & Controls Structural Extrusions
 <b>FILTRATION</b>	Food & Beverage Life Sciences Mobile Equipment Power Generation Transportation	Industrial Machinery Marine Oil & Gas Process	Analytical Gas Generators Compressed Air & Gas Filters Condition Monitoring Engine Air, Fuel & Oil Filtration & Systems	Hydraulic, Lubrication & Coolant Filters Process, Chemical, Water Microfiltration Filters Nitrogen, Hydrogen & Zero Air Generators
 <b>FLUID and GAS HANDLING</b>	Aerospace Agriculture Bulk Chemical Handling Construction Machinery Food & Beverage Fuel & Gas Delivery	Industrial Machinery Mobile Oil & Gas Transportation Welding	Brass Fittings & Valves Diagnostic Equipment Fluid Conveyance Systems Industrial Hose	PTFE & PFA Hose, Tubing & Plastic Fittings Rubber & Thermoplastic Hose & Couplings Tube Fittings & Adapters Quick Disconnects
 <b>HYDRAULICS</b>	Aerospace Aerial lift Agriculture Construction Machinery Forestry	Industrial Machinery Mining Oil & Gas Power Generation & Energy Truck Hydraulics	Diagnostic Equipment Hydraulic Cylinders & Accumulators Hydraulic Motors & Pumps Hydraulic Systems Hydraulic Valves & Controls	Power Take-Offs Rubber & Thermoplastic Hose & Couplings Tube Fittings & Adapters Quick Disconnects
 <b>PNEUMATICS</b>	Aerospace Conveyor & Material Handling Factory Automation Life Science & Medical	Machine Tools Packaging Machinery Transportation & Automotive	Air Preparation Brass Fittings & Valves Manifolds Pneumatic Accessories Pneumatic Actuators & Grippers Pneumatic Valves & Controls	Quick Disconnects Rotary Actuators Rubber & Thermoplastic Hose & Couplings Structural Extrusions Thermoplastic Tubing & Fittings Vacuum Generators, Cups & Sensors
 <b>PROCESS CONTROL</b>	Chemical & Refining Food, Beverage & Dairy Medical & Dental	Microelectronics Oil & Gas Power Generation	Analytical Sample Conditioning Products & Systems Fluoropolymer Chemical Delivery Fittings, Valves & Pumps High Purity Gas Delivery Fittings, & Valves & Regulators	Instrumentation Fittings, Valves Regulators Medium Pressure Fittings & Valves Process Control Manifolds
 <b>SEALING and SHIELDING</b>	Aerospace Chemical Processing Consumer Energy, Oil & Gas Fluid Power General Industrial	Information Technology Life Sciences Military Semiconductor Transportation	Dynamic Seals Elastomeric O-Rings EMI Shielding Extruded & Precision-Cut, Fabricated Elastomeric Seals	Homogeneous & Inserted Elastomeric Shapes High Temperature Metal Seals Metal & Plastic Retained Composite Seals Thermal Management

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