

# Pump AW11 Family

## Operation And Maintenance Manual

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*Quality Mud Pumps and Parts*

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This manual covers the American Mfg Company Model AW11 triplex piston pump family of pumps:

Valves	Model #	Pinion Shaft	Shaft End
Disc	AW1122D	Left-hand 1-1/2" diameter	3/8" square keyway shaft end
Disc	AW1122D-R	Right-hand 1-1/2" diameter	3/8" square keyway shaft end
Disc	AW1122D-SP	Left-hand 1-1/2" diameter	14-tooth splined shaft end*
Disc	AW1122D-R-SP	Right-hand 1-1/2" diameter	14-tooth splined shaft end*
Disc	AW1118D	Left-hand 1-1/2" diameter	3/8" square keyway shaft end
Disc	AW1118D-R	Right-hand 1-1/2" diameter	3/8" square keyway shaft end
Ball	AW1122BCD	Left-hand 1-1/2" diameter	3/8" square keyway shaft end
Ball	AW1122BCD-R	Right-hand 1-1/2" diameter	3/8" square keyway shaft end
Ball	AW1122BCD-SP	Left-hand 1-1/2" diameter	14-tooth splined shaft end*
Ball	AW1122BCD-R-SP	Right-hand 1-1/2" diameter	14-tooth splined shaft end*
Ball	AW1118B	Left-hand 1-1/2" diameter	3/8" square keyway shaft end
Ball	AW1118B-R	Right-hand 1-1/2" diameter	3/8" square keyway shaft end

\* 14-tooth 12/24 Diametral pitch female spline, per ANSI B92.1 specifications

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## Chapter 1—Safety

### Safety symbols

These symbols are printed beside all safety instructions contained in this manual, where potential danger to life and limb exist. All operators must be fully informed of the safety instructions.

**Table 1 Warning Code Symbols**

Symbol	Indication
	DANGER indicates an imminently hazardous situation which, if not avoided, <i>will</i> result in death or serious injury.
	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, may result in minor or moderate injury, or may result in damage to the machine.

## Safety When Using the Pump

**⚠ DANGER** **⚠ WARNING**

- Operate the pump only if this operating manual has been read completely and is well understood.
- Check the pump for any damage. Immediately inform the responsible superior about trouble or damage of the pump. Do not begin or continue production when problems are encountered.
- Ensure that no unauthorized persons are located near the moving parts of the pump.
- Wear the necessary ear protection and safety clothing.
- Check all safety and guard devices protecting the operating from the pump *and from other moving machinery*.
- Check any fluid-protection covers, shields or other protective devices around the pump, particularly when pumping hot or hazardous liquids.
- A properly sized and configured pressure safety device (pressure relief valve, rupture disc, etc.) **must** be installed before the pump is operated. Ensure that **no** valves are placed between the pump and pressure relief valve—these may defeat the safety purposes of the relief valve.

## Safety when Working on the Pump

**⚠ DANGER**

### Danger of Explosion!

Pneumatic, steam and hydraulic devices are under pressure. Serious accidents or explosions may result from the incorrect removal of these devices. *Before removing the devices, any pressure must be released.* Failure to do so may spray water or chemicals at high pressure or high temperature onto service personnel.

**⚠ DANGER**

Installation work in high positions may create a danger of falling. Use additional safety steps, scaffolding, etc. provided for this purpose. *Never use machine parts for climbing!*

**⚠ DANGER**

If necessary, **lockout** or **tagout** the pump and all accessory equipment and/or main electrical devices and main switch. Failure to do this could cause electrical shock or injury from moving pump parts or components under high pressure. Remove any keys. *Test the machine to make sure the machine is, in fact, de-energized.* The only person allowed to remove a Lockout or Tagout device is the person who put it there.

**Be absolutely sure that the engine or motor cannot be started!**

**⚠ CAUTION**

Use extreme caution when using solvents to clean or degrease equipment. Most solvents are highly flammable and toxic. *Observe all of the safety instructions on the solvent packaging.*

**⚠ WARNING**

Never attempt to modify the pump to perform beyond its rated specifications without proper written authorization from American Mfg Company.



## Personal Protective Equipment



**Personal Protective Equipment must be worn in accordance with Occupational Safety and Health Standards standard number 1910.132-138.**

Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

## Chapter 2—Product Description

The AW1122 pump includes the integral gear reduction pinion shaft. Standard features per model are specified in the table below.

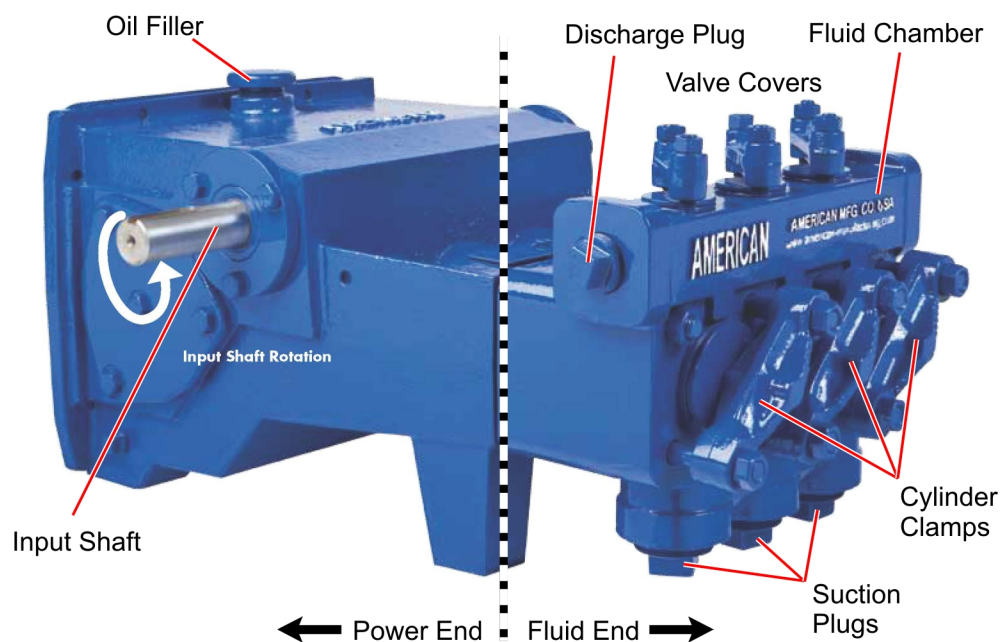
### Pump Models

This manual covers the American Mfg Company Model AW1122 triplex piston pump, and other pumps in the AW1122 family:

Valves	Model #	Pinion Shaft	Shaft End
Disc	AW1122D	Left-hand 1-1/2" diameter	3/8" square keyway shaft end
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Disc	AW1122D-R-SP	Right-hand 1-1/2" diameter	14-tooth splined shaft end*
Disc	AW1118D	Left-hand 1-1/2" diameter	3/8" square keyway shaft end
Disc	AW1118D-R	Right-hand 1-1/2" diameter	3/8" square keyway shaft end
Ball	AW1122BCD	Left-hand 1-1/2" diameter	3/8" square keyway shaft end
Ball	AW1122BCD-R	Right-hand 1-1/2" diameter	3/8" square keyway shaft end
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Ball	AW1122BCD-R-SP	Right-hand 1-1/2" diameter	14-tooth splined shaft end*
Ball	AW1118B	Left-hand 1-1/2" diameter	3/8" square keyway shaft end
Ball	AW1118B-R	Right-hand 1-1/2" diameter	3/8" square keyway shaft end

\* 14-tooth 12/24 Diametral pitch female spline, per ANSI B92.1 specifications

**Figure 1 AW1122 Pump Assembly with Pinion Shaft**



## AW11 Pump Specifications

## 30 BHP Continuous Duty (36 BHP Intermittent Duty)

<b>Pump Models:</b>	<b>AW1118, AW1122</b>
Configuration:	Horizontal Triplex Piston
Duty (Continuous):	30 BHP
Duty (Intermittent):	36 BHP
Number of Pistons:	3
Piston Diameter:	<b>AW1118:</b> 2.25" (57.2 mm) <b>AW1122:</b> 2.75" (69.9 mm)
Stroke Length:	2.75 Inches (69.9 mm)
Displacement:	<b>AW1118:</b> 0.0589 gal (0.223 Liter) <b>AW1122:</b> 0.0589 gal (0.223 Liter)
Frame Load Rating:	6000 lbs. (2,721 kg)
Pump Weight:	425 lbs. (197 kg)
Direction of Rotation:	Top of Shaft away from head
Internal Gear Rotation:	3.6:1
Intermittent Duty Speed Rating:	900 RPM (Jackshaft)
Continuous Duty Speed Rating:	750 RPM (Jackshaft)
Ball Valve Max Speed Rating:	635 RPM (Jackshaft)
Minimum Speed:	360 RPM
Mechanical Efficiency:	85%
Lubrication System:	Splash, Gravity Return
Lube Oil Capacity:	1 Gallon
Lube Oil Type:	SAE 30 (See Table 5 on page 27)
Maximum Fluid Temperature:	140°F (250° Capability)
Minimum Fluid Temperature:	0°F (-20° Capability)
Maximum Pressure:	1000 psi (70.3 kg/cm <sup>2</sup> )
Standard Suction Size:	2.00 Inch NPT (50.8 mm)
Standard Discharge Size:	1.25 Inch NPT (31.8 mm)
Fluid End Material:	Ductile Iron
Valve Type:	Disc Valves/Ball Valves
Hydraulic Motor Mount:	SAE C – 4 Bolt with 1.25"-14T

## Performance Rating

### Pump Capacity @ Input Speed

350 rpm (gals/min):	<b>AW1118:</b> 13.8 <b>AW1122:</b> 20.6
350 rpm (liters/min):	<b>AW1118:</b> 52.2 <b>AW1122:</b> 78
500 rpm (gals/min):	<b>AW1118:</b> 19.7 <b>AW1122:</b> 29.5
500 rpm (liters/min):	<b>AW1118:</b> 74.6 <b>AW1122:</b> 112
635 rpm (gals/min):	<b>AW1118:</b> 25 <b>AW1122:</b> 37.4
635 rpm (liters/min):	<b>AW1118:</b> 94.6 <b>AW1122:</b> 142
750 rpm (gals/min):	<b>AW1118:</b> 29.6 <b>AW1122:</b> 442
750 rpm (liters/min):	<b>AW1118:</b> 112 <b>AW1122:</b> 167
900 rpm (gals/min):	<b>AW1118:</b> 35.5 <b>AW1122:</b> 53
900 rpm (liters/min):	<b>AW1118:</b> 134.4 <b>AW1122:</b> 201

Horsepower is based on 85 or 90% efficiency. Actual application horsepower requirements can be calculated using this equation:  $BHP = (GPM \cdot PSI) / (1714 \cdot 0.85 \text{ or } 0.90)$  Pump capacities listed are based on 100% volumetric efficiency.

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Specifications are for both the AW1118 and AW1122 unless otherwise separately indicated. All specifications are subject to change without notice.

## Chapter 3—Installation and Storage

### Installation Guidelines

Proper installation of the pump is essential for best performance, a long service life, and reducing downtime and maintenance costs. Prepare your installation carefully, and observe the following guidelines.

#### *Location of the Pump*

Always position the pump on as flat, level a surface as much as possible—this is important for the pump’s splash oil lubrication system. For mobile equipment (sewer cleaning trucks, drilling, etc.) park the truck or trailer on as level a surface as possible.

Whenever possible the pump should be mounted in a clean, dry location with sufficient lighting and adequate space for easy inspection and maintenance. Locate the pump as close to the suction source as possible to allow for the shortest and most direct routing of the inlet piping.

#### *Mounting the Pump*

*The AW11 pump must be mounted in a horizontal position only.* Secure the pump to the foundation or other mounting surface using the four (4) holes provided in the pump base. Make sure to check the drive motor or engine direction of rotation to ensure that the top of the pump pinion shaft rotates away from the pump fluid end when in operation.

If you are driving the pump with a V-belt, make sure to double-check the alignment of the sheaves after the unit is installed on its permanent mounting. Tighten the belts to the proper tension as recommended by the belt manufacturer. Verify that the sheaves are in line with and parallel to each other, with a straight edge.

**⚠ DANGER**

**If you are driving the pump with a V-belt, never operate the pump without the belt guard securely installed!**

**⚠ DANGER**

**If your pump is direct-coupled or spline-driven, never operate the pump without a shaft guard securely installed!**

**Ensure that the shafts are centered and parallel when the driver is mounted to the pump. Follow the coupling manufacturer instructions for installation procedures and tolerances.**

## Suction Piping Recommendations

Poorly designed or implemented suction piping is the root of many pump problems. Here are some recommendations to follow in designing or construction the piping to the pump:

- The suction line from the fluid source to the pump as short and direct as possible.
- The pipe size should *at least* be equal to or one size larger than the pump inlet. Unavoidable long piping runs, low suction heads, or indirect pipe routing may require even greater oversizing of the suction line for proper operation of the pump. Avoid as best as practical the use of elbows, nipples, unions, or other fittings. *Make sure that all joints and connections are airtight.*
- All piping should be supported independently of the pump—do not make the pump inlet one of the supports! Properly supporting the piping this way reduces vibrations and stress on the pump. Use rigid piping, non-collapsible hose or a combination of both as circumstances require. To help isolate mechanical and hydraulic vibrations, American Mfg Company recommends the use of flexible pipe couplings or hose connections between the pump and any rigid piping.
- It is difficult to diagnose many pump problems without the aid of a suction pressure gauge. For this reason, American Mfg Company recommends that a suction pressure gauge always be installed in the suction line directly before it enters the pump.
- Use a suction and discharge pulsation dampener to reduce the effects of acceleration head—this will help when suction conditions are not optimal. In some cases it may be necessary to install a booster pump in the suction line of the pump to obtain sufficient pressure for the pump to operate successfully.
- The suction line must be designed so that there are no high spots in the line where air pockets can collect. Air pockets make the pump difficult to prime, and often cause rough and/or erratic operation.
- Air leaks reduce the capacity of the pump and can result in cavitation, rough operation, and/or loss of prime. A drain valve or plug should be installed at the low point of the suction line to allow for draining before freezing conditions or for maintenance.
- Always ensure that the calculated system Net Positive Suction Head available (NPSHa) exceeds the pump Net Positive Suction Head Required (NPSHr) by at least 5 feet (1.5 meters) of water for proper operation of the pump. NPSH requirements for each pump model are provided on the product data sheets available through American Mfg Company or your authorized American Mfg Company reseller. *American Mfg Company does not recommend using the pump in static lift conditions without prior factory approval.*

## Recommended Discharge Piping

Poorly designed or implemented discharge piping is also the root of many pump problems. Here are some recommendations to follow in designing or construction the piping *from* the pump:

- Design the discharge piping to have as short and direct a route as possible. Use the same pipe size as the outlet of the pump; in installations where the discharge piping is in excess of 50 feet (15 meters), use the next larger size pipe to minimize friction losses downstream of the pump.

**⚠ DANGER**

**Always use pipe or hose that is designed for your particular pressure requirements. Inadequate pressure ratings can allow hose or pipe to fail, resulting in equipment damage and possibly personal injury.**

Normal hose pressure ratings are clearly marked on the outer surface of the hose.

Working pressure ratings for steel pipe can be obtained from the manufacturer or from the chart below:

**Table 2 Allowable Working Pressure For Steel Pipe**

PSI @ 100° F

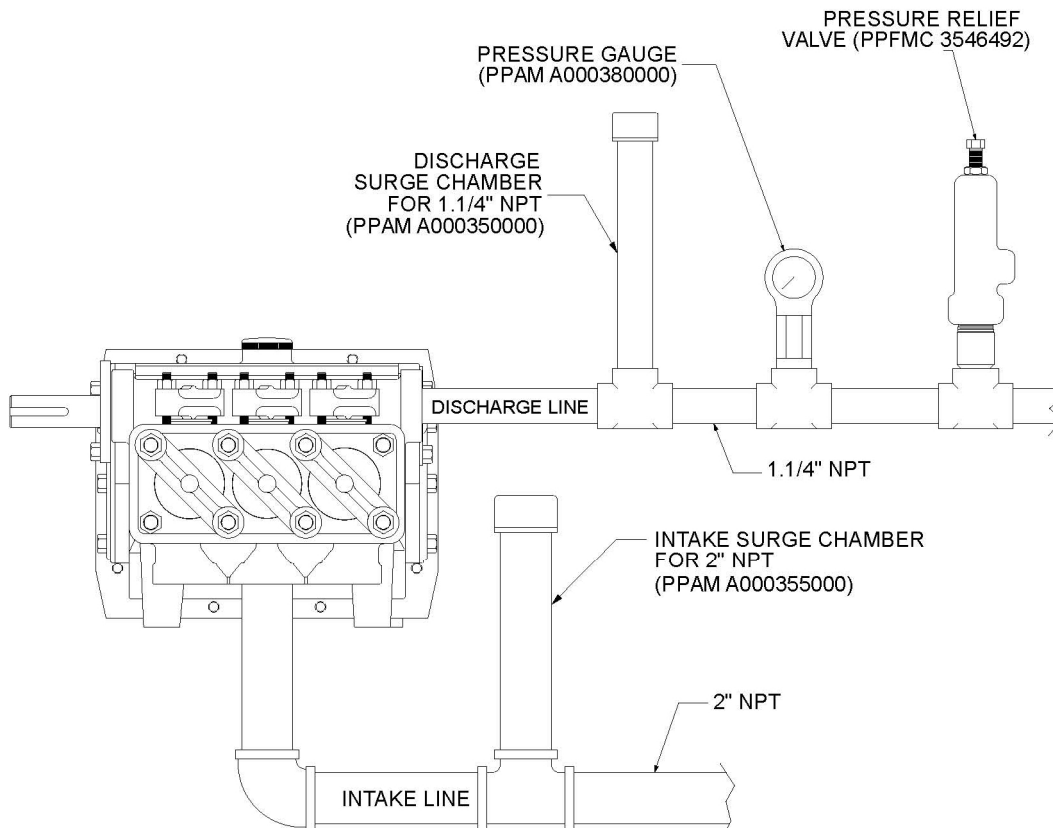
Note: 1 BAR = 14.5 p.s.i.

Pipe Size (inches)	— Pipe Schedule Number —				
	40	80	120	160	XX
1/2	2,300	4,100		7,300	12,300
3/4	2,000	3,500		8,500	10,000
1	2,100	3,500		5,700	9,500
1 1/4	1,800	3,000		4,400	7,900
1 1/2	1,700	2,800		4,500	7,200
2	1,500	2,500		4,600	6,300
2 1/2	1,900	2,800		4,200	6,900
3	1,600	2,600		4,100	6,100
4	1,400	2,300	3,350	4,000	5,300
5	1,300	2,090	2,950	3,850	4,780
6	1,210	2,070	2,850	3,760	4,660
8	1,100	1,870	2,840	3,700	3,560

- Always install a pressure gauge in the pump discharge line. A properly functioning gauge mounted at the pump (and before any valves) is required to accurately determine the operating pressure of a pump, and assists in troubleshooting.

- Ensure that all piping is supported independently of the pump to reduce vibrations and strain on the pump—do not make the pump outlet one of the supports! To help isolate mechanical and hydraulic vibrations, American Mfg Company recommends the use of flexible pipe couplings or hose connections between the pump and any rigid piping, and/or the use of pulsation dampeners.
- Pulsation dampeners on the discharge are recommended to reduce pressure pulsation and resulting vibration. Avoid as best as practical the use of elbows, nipples, unions, or other fittings. For example, instead of a short radius 90° elbows; use two long radius 45° elbows.
- Install and properly adjust a pressure relief valve or rupture disc directly downstream of the pump. This will help to prevent damage or injuries resulting from over pressure or deadhead conditions. The relief valve discharge line *must* be as large as the pipe outlet of the relief valve, and *never* install valves in the relief valve discharge line or between the pump and relief valve. American Mfg Company recommends that the discharge from the relief valve be returned to the tank or drain, not back into the pump suction line.
- For start-up purposes, install a start-up bypass line and valve to allow flow to bypass the relief valve. This allows the pump to start in an unloaded condition (no discharge pressure).

**Figure 2 Discharge Line Gauges and Valves**



## Storage Instructions

Proper storage of your American Mfg Company pump will ensure that it is ready for use when needed. Follow the guidelines below that fit the requirements of your application:

- American Mfg Company pumps come from the factory without crankcase oil and can be stored as-is for periods of up to six months in proper environmental conditions. Indoor storage in a dry, temperature controlled location is preferred.
- If pumps are to be stored short term (less than six months) in a severe environment, prepare them by following the procedure “Short Term Storage for Severe Environments” on page 16.
- If the pump is to be stored (or is inactive) for periods in excess of six months, prepare the pump as described in the procedure “Long Term Storage” (page 17).

### **⚠ CAUTION**

Remember that any fluid that poses an environmental hazard or is toxic must be handled and disposed of properly.

## *Short Term Storage*

If the pump is stored in an indoor, temperature-controlled environment for less than six (6) months, no special steps are required to prepare it for storage. As a general rule for pumps used in corrosive fluid applications, the fluid end should be drained, flushed with water or other non-corrosive cleanser, and compressed air used to blow dry whenever idle.

## *Short Term Storage for Severe Environments*

- If the pump has been in service, drain any fluid from pump fluid end, flush the fluid end with water to clean out any of the remaining pumpage, and blow dry with compressed air.
- Pour 1/4 to 1/2 cup of internal rust inhibitor oil described in Table 5 (Recommended Lubricants, page 27) into the suction and discharge ports of fluid end, and then install pipe plugs in openings.
- Drain the power end (crankcase) oil and remove the oil fill cap (or plug). Pour 1/2 to 1 cup of internal rust inhibitor oil into the oil fill hole, then install the filler cap.
- Coat all exposed, unpainted metal surfaces (for example, the driveshaft) with preservative oil.
- Replace the oil fill cap, and then cover the entire pump with a weather resistant covering such as a canvas or plastic tarp.



## **Long Term Storage**

Long-term storage is defined as any period when the pump is in storage or idle in excess of six months.

- If the pump has been in service, drain any fluid from pump fluid end, flush the fluid end with water to clean out any of the remaining pumpage, and blow dry with compressed air.
- Pour 1/4 to 1/2 cup of internal rust inhibitor oil described in Table 5 (Recommended Lubricants, page 27) into the suction and discharge ports of fluid end, and then install pipe plugs in openings.
- Remove the piston cup seals as described in “Servicing the Pistons” (page 32), seal them in a bag to protect against ozone, and store them in a separate location with a controlled environment where they are protected from UV exposure.
- Drain the oil from the pump power end. Remove the rear cover to expose the drive components. Spray all internal parts with a rust preservative that is soluble in lubricating oil while rotating the driveshaft several turns by hand to ensure complete coverage. Replace the rear cover and add 1/2 to 1 cup of internal rust inhibitor described in Table 5 (page 27). Spray a rust preventative onto all exterior machined surfaces paying attention to any unpainted areas like the crankshaft extension. Remove the oil fill cap and store with the piston cup seals. Cap the breather opening with a plug or other suitable means in order to keep the preservative atmosphere sealed inside the power end.
- Never store the pump on the floor or ground. Always place it on a shelf or pallet that is several inches above ground level. Cover the entire pump with a canvas or plastic tarp. Every two months inspect the unit. Rotate the crankshaft by hand at least 4 turns during each inspection. Drain and replace the rust inhibitor after every six months of storage.

## **Returning a Stored Pump to Operation**

Before operating a pump that has been prepared for storage, drain the preservative and lubricating oil mixture from the power end (crankcase). Remove the rear cover and apply recommended crankcase lubricant (see Table 5, Recommended Lubricants, page 27) to the pinion bearings. Reinstall the rear cover, drain plug, breather/filler cap, piston cup seals, and any other components that were removed for storage.

Once these steps have been completed, follow the normal pump start up procedures outlined in this manual.

**NOTE:** American Mfg Company can factory prepare units for long term storage for a nominal fee if specified at the time of order.

## Precautions during Freezing Weather

Freezing weather causes problems for equipment when pumping water-based fluids that expand in volume when frozen.

When water left in a pump fluid end is frozen, it can rupture the fluid cylinder of the pump and cause extensive equipment damage.

**⚠ WARNING** Injury may result when starting a pump that has been damaged!

Whenever the pump is stored, or is idle in conditions that are near or below freezing, ALL water based fluids should be removed from the pump:

1. Run the pump for a few seconds with the suction and discharge lines disconnected or open to atmosphere. This will clear the majority of the fluid from the pumping chamber, suction manifold and discharge manifold.
2. Blow compressed air through the fluid end to remove all traces of fluid.
3. Remove the cylinder head and lift up the discharge valves. Remove the plugs from the bottom of the fluid cylinder, and lift up the suction valve to ensure that all fluid is drained from the pumping chamber between the suction and discharge valves.
4. As an alternative to the previous three steps, a *compatible* antifreeze solution can be circulated through the fluid end. RV antifreeze, propylene glycol, is recommended for this purpose.

**⚠ CAUTION** Remember that any fluid that poses an environmental hazard or is toxic must be handled and disposed of properly.

## Chapter 4—Operation

**⚠ CAUTION**

Always take special precautions when starting a pump for the first time or after any extended shutdown. Never assume that someone else has properly prepared the pump and system for operation. Always check each component of the system prior to every start-up.

Operate the pump only if this operating manual has been read completely and is well understood.

Wear the necessary ear protection and safety clothing.

**⚠ WARNING**

Check the pump for any damage. Immediately inform the responsible superior about trouble or damage of the pump. Do not begin or continue production when problems are encountered.

Ensure that no unauthorized persons are located near the moving parts of the pump.

A properly sized and configured pressure safety device (pressure relief valve, rupture disc, etc.) must be installed before the pump is operated. Ensure that no valves are placed between the pump and pressure relief valve—these may defeat the safety purposes of the relief valve.

**⚠ DANGER**

Check all safety and guard devices protecting the operating from the pump and from other moving machinery.

Check any fluid-protection covers, shields or other protective devices around the pump, particularly when pumping hot or hazardous liquids.

## How to Start the Pump

The following checklist is a general guide for starting a pump in a typical installation—every installation is different, and each will have its own requirements to ensure safe and successful operation.

**It is the operator's responsibility to determine the correct start-up procedure for each installation.**

### ***Pump Starting Procedure***

1. Make sure that the drain plug(s) on the bottom of the pump crankcase have been installed and are tight!
2. If the pump is equipped with an oil level sight glass, make sure it has been properly installed. Check the oil level to ensure that the pump is properly filled with non-detergent motor oil, gear lube, or a synthetic oil as described in Table 5 (page 27) and that the oil has not been contaminated with any other fluid or particles.

**NOTE: American Mfg Company pumps are shipped with no oil in the power frame and must be filled to the proper level with the proper grade of oil prior to start-up.**

3. If they are accessible, check the piston rods to make sure that they are free from abrasive particles or debris.
4. Check to see that the pressure relief valve (and all related equipment) has been installed and properly adjusted. Verify that all joints are pressure tight.
5. Make sure that all guards are in place and secure. Verify that all personnel are in safe positions and that system conditions are acceptable for operation.
6. Check to ensure that power is locked out and tagged out.
7. Open the suction line valve to allow fluid to enter the pump. Prime the fluid cylinder if necessary on the initial start up, or after the system piping has been drained. (The valve covers may have to be cracked open to assist with priming.)
8. Apply 10 to 20 drops of glycerin, or mineral oil to the pistons, cylinders and piston rods to lubricate the packing and seals.
9. Turn the pump over by hand if possible to ensure free, unobstructed operation.
10. Remove the "tag out" and unlock the power.

11. The pump is now ready to start.

Whenever possible, use a bypass in the discharge line to allow the pump to start in the unloaded condition (no discharge and pressure). Slowly close the bypass line to bring the pump into full load conditions.

### ***During Operation***

**Shut down immediately** if the flow becomes unsteady, pressure fluctuates, or if unusual sounds or vibrations are noted.

Take periodic temperature readings of the power end. Do not exceed 170°F (77°C) on the power end.

## Chapter 5—Troubleshooting

**Table 3 Troubleshooting**

Problem / Symptom	Probable Cause	Action
No flow at all from pump	No flow to the pump.  Inlet strainer clogged.  Pump crankshaft is not being rotated.	Ensure lines are connected to the pump, the liquid supply is ready and the proper valves opened.  Clean or replace strainer.  Check pump drive mechanism and connections.
Low pressure from pump (flow OK)	Pump speed too low. The relief valve is out of adjustment, or worn. Worn nozzle / low system resistance. Problems with check valves. Leakage from pump seals.	Increase speed; check belts for slipping, power to drive motor.  Adjust or replace relief valve.  Service.  Repair or replace check valves.  Check for damaged parts, replace packing.
Low flow from pump (pressure OK)	Pump speed is too low. The relief valve is out of adjustment, or worn. Worn valves (pump). Work piston(s) or plunger(s). Valve seat bad or washed out.	Increase speed; check belts for slipping, power to drive motor.  Adjust or replace relief valve.  Service.  Service.  Service / repair or replace fluid cylinder.
Low pressure, low flow, rough operation	Not all cylinders are primed. Bypass or relief fluid is piped back to suction. Inlet line insufficient for desired flow. Insufficient NPSHA. Air leaks. Vortex near inlet pipe opening in tank affects flow to pump. Air in booster pump Pump valve is sticking, damaged or un-seated. Valve seat bad or washed out. Gas pockets forming due to high spots in action.	Prime all. Reroute bypass or relief fluid to tank. Increase pipe diameter and/or shorten run. Provide more Net Positive Suction Head. Service. Increase inlet depth, or use baffles to break up vortex. Service Service—clean / deburr / reseal or repair valve. Service / repair or replace fluid cylinder. Correct suction line installation.

Problem / Symptom	Probable Cause	Action
Rough operation, knocking, vibration.	Valve spring broken or weak, valve damaged. Loose plunger(s), piston(s), or rod(s). Low oil (power end). Too much connecting rod bearing clearance. Too much main bearing clearance. Worn wrist pin or bearings. Pump is running backwards. Loose sheaves/bushings in V-belt drive. Gear teeth cracked or missing. Insufficient NPSHA. Excessive acceleration head in suction line. Improper charge of pulsation dampener. Inlet line insufficient for desired flow. Worn piston seal; air enters pump. (More likely when booster not used.)	Service valves; replace springs as needed, repair or reseat valves. Service: Tighten all loose components. Fill to proper level. Check cap torque and/or replace bearings . Adjust end play. Service; replace worn components. Correct drive rotation. Inspect and tighten belt drive components. Service; replace gears. Provide more Net Positive Suction Head. Install a suction stabilizer. Set for proper pressure. Increase pipe diameter and/or shorten run. Service; Replace seal(s).
Piping vibration	Same as rough operation above. Excessive pressure variation in discharge. Piping support inadequate. Too many tight elbows or tees.	Same as rough operation above. Install discharge pulsation dampener. Install pipe supports at proper locations. Correct installation to minimize turns and short radius elbows or other fittings.
Rapid suction pressure fluctuation	Pump cavitation. Air is entering suction line.	Increase suction pipe diameter or NPSH. Service: Stop leaks.
Pump requires excessive power	Discharge pressure is too high. Speed too high. Misaligned coupling. Belts too tight. Power end bearings too tight. Low motor voltage.	Reduce system back-pressure or add/adjust relief valve. Reduce speed. Correct alignment. Reduce belt tension. Increase end-play. Supply correct voltage.
Power end overheats (>180° F) and/or shortened life for power component end	Discharge and/or suction pressure too high. Oil level too high or too low. Oil in the power end is contaminated. Incorrect oil viscosity or grade. Misaligned coupling. Drive belts too tight. Pump running backward. The pump is located too close to a heat source Worn or damaged power end bearings.	Reduce pressure. Adjust to correct oil level. Refill with clean oil & stop contamination. Drain and refill with correct oil. Correct alignment. Adjust belt tension. Correct rotation. Remove the heat source and/or insulate the power end. Service: Replace damaged bearings.

<b>Problem / Symptom</b>	<b>Probable Cause</b>	<b>Action</b>
Crankshaft jerks or starts and stops rotation	Drive belts loose/slipping (if so equipped). System relief valve pressure set too high. Discharge line blocked or partially blocked.	Adjust the belt tension (if applicable). Reduce the relief valve pressure setting. Clear obstructions.
Crankshaft jerks or starts and stops rotation	Worn Piston cup(s). The piston to rod O-ring is damaged. The fluid cylinder bolts are not properly tightened. Fluid cylinder O-rings (or gaskets) damaged.	Replace. Replace O-ring. Service: Properly tighten and torque the fluid cylinder bolts. Replace.
Short piston cup life	Abrasive particles in fluid. Piston cups run dry.  Incorrect cups for fluid type. Pump was run dry for extended time. Worn piston cup holder. Worn cylinder liner bore.	Install strainer or filter. Find reason and correct, then replace the cup. Change to correct cup. Correct problem and replace cups. Replace piston cup holder. Replace cylinder liner.
Short valve life	Abrasive particles in fluid. Damage from Cavitation.  Air leaking into suction line.  Suction inlet insufficiently submerged.  Relief valve or bypass piped to suction. Valve damaged by improper installation.	Install strainer or filter. Correct problem and replace damaged valves. Correct problem and replace damaged valves. Increase submergence or baffle to stop vortex. Pipe fluid back to reservoir (tank). Replace damaged components.
Cracked fluid cylinder or broken fluid end bolts	Discharge pressure too high.  Hydraulic shock (cavitation or trapped air). Discharge valve stuck closed. Fluid freezing in fluid cylinder. Material or manufacturing defect. Bolt or nut not properly torqued. Excessive piping loads on fluid end.	Reduce system back pressure or relief valve. Correct piping system problem. Replace. Change procedure to drain fluid when cold. Replace defective component. Replace fluid cylinder and properly torque. Add supports to piping.
Broken crankshaft or connecting rod	Discharge pressure too high.  Suction pressure too high.  Fluid freezing in fluid end. Hydraulic shock due to cavitation. Material or manufacturing defect.	Reduce system back pressure or relief valve. Reduce suction pressure or plunger diameter. Change procedure to drain fluid when cold. Correct piping system problems. Replace defective components.
Power end oil contaminated	Pump was operated with a failed piston cup.	Replace piston cup and improve monitoring



## Chapter 6—Maintenance

**⚠ WARNING**

Disconnect the pump from the driver system, and ensure that suction and discharge lines are disconnected or blocked, and that there is no pressure at the pump.

**⚠ DANGER**

If necessary, lockout or tagout the pump and all accessory equipment and/or main electrical devices and main switch. Failure to do this could cause electrical shock or injury from moving pump parts or components under high pressure. Remove any keys. Test the machine to make sure the machine is, in fact, de-energized. The only person allowed to remove a Lockout or Tagout device is the person who put it there.

**Be absolutely sure that engine or motor cannot be started!**



Review all of the safety warnings listed in under “Safety when Working on the Pump” on page 8.

## Inspection and Preventative Maintenance

Routine maintenance is an essential part of any successful pump installation.

Regular maintenance and inspection will keep your pump operating at peak performance for years of trouble-free service. American Mfg Company pumps have been carefully engineered to minimize maintenance requirements and simplify these tasks when they are required.

Regular inspections allow operators to become familiar with normal pump operation so they can recognize the signals of potential problems, and schedule the required maintenance. The Preventative Maintenance Chart in Table 4 shown below should be used as a guideline only—many applications will require adjustment of the intervals shown in this chart for severe or unusual operating conditions.

**Table 4 Preventative Maintenance Chart**

Interval	Component	Service	Remarks
Break In Period	Crankcase Oil	Change	Drain and refill with new oil after first 100 hours of operation. Clean the magnetic drain plugs to remove debris.
	Inlet Strainer	Inspect	Clean if required. The amount of material in the strainer will determine the interval of cleaning.
Daily	Complete Pump	Inspect	General inspection of pump and system to check for proper operation of equipment.
	Piston Cup Sets	Inspect	Check the cylinder liner area of the pump for signs of leakage. Replace piston cups if leakage becomes excessive.
	Pump System	Flush	Required for shutdown when pumping fluids that may harden or corrode the pump if left inside once stopped.
	Crankcase Oil	Inspect	Ensure that the oil is at proper level and has not been contaminated by pumpage or condensation.
12 Months / 4,000 Hours	Crankcase Oil	Change	Drain and refill with new oil. Clean magnetic drain plugs.
	Connecting Rod Bolts	Inspect	Check the connecting rod bolts with a torque wrench to insure they are within specification. This should be done in conjunction with the oil change.

## Lubrication

### Recommended Lubricants

Few factors can influence the life of a pump more than the power end lubricating oil. Careful selection of the right type of oil for each particular application will help ensure optimal performance and pump life.

**IMPORTANT:** Lubricant temperatures should not exceed 170° F (77° C) for continuous duty or 180° F (82° C) for intermittent duty applications. Crankcase temperatures that exceed these limits will cause the lubricant to prematurely break down. The result will be poor lubrication and the possible failure of power end components.

**Table 5 Recommended Lubricants**

Type of Service	Ambient Temperature	Oil Lubricant				Synthetic Lubricant *		
		SAE Grade	ISO Viscosity (cSt@40 C)	SSU Viscosity	Manufacturer Brand Name	SAE Grade	ISO Viscosity (cSt@40 C)	Manufacturer Brand Name
General Service	0 F to 100 F (-18 C to 38 C)	30	100	550	Texaco® Meropa 100 Shell® Omala 100 Shell® Rotella T SAE 30 Exxon® XD-3 30 wt Mobil® Trans HD-30	10W-30	90.0@40 15.0@100	Shell® Rotella T Synthetic SAE 5W-40
					5W-40	99.1@40 13.9@100	Mobil® SCH 627	
High Ambient Temperature Service	100 F to 130 F (38 C to 54 C)	50	220	1,165	Texaco® Meropa 68 Shell® Omala 220 Shell® Rotella T SAE 50 Exxon® HD-3 50 wt Mobil® Trans HD-50	5W-40	90.0@40 15.0@100	Shell® Rotella T Synthetic SAE 5W-40
					5W-40	217@40 29.9@100	Mobil® SCH 630	
Cold Ambient Temperature Service	0 F to -30 F (-18 C to -34 C)	20	68	350	Texaco® Meropa 68 Shell® Omala 68 Shell® Rotella T SAE 20 Exxon® HD-3 20 wt Mobil® Trans HD-20	5W-30	90.0@40 15.0@100	Shell® Rotella T Synthetic SAE 5W-40
					5W-40	12.0@100	BP® Vanellus E8 ULTRA 5W-30	
					10W-30	69.9@100 10.9@100	Mobil® SCH 626	
Frequent Start/Stop Operation		40	150	775	Texaco Meropa®150			

#### Miscellaneous Lubricants

Use	Manufacturer Brand Name
Internal Rust Inhibitor	Cortec® VCI 329
External Rust Preventative	Texaco® Metal Protective Oil L

\*Synthetic lubricants are suggested for high or low temperature service. Cortec® is a registered trademark of Cortec Corporation, St. Paul, MN.

## Oil Changes

The oil must be changed after the first 100 hours of operation, and thereafter every 4,000 hours of operation or every 6 months, whichever comes sooner. (These intervals may be modified depending on actual operating conditions.) The AW11 pumps require 4 quarts (3.8 liters) of oil.

The oil should be changed when hot to prevent the build up of sludge deposits.

**⚠ WARNING** Be aware of the oil and power end temperatures to avoid scalding or burns.

- Check the oil level daily. If more than 10% of the total capacity has to be added, check for oil leaks.
- Do not mix oils of different types, even if produced by the same manufacturer.
- Never mix mineral and synthetic oils.
- Follow environmental guidelines when changing and disposing of lubricants.

## Important Maintenance Information

Make sure you review the information in Critical Clearances (page 29) and Torque Requirements (page 30) as part of your servicing procedure.

If possible, always pump a sufficient quantity of clean water through the fluid end before starting any service procedures that involve fluid end components. This action will remove a significant portion of contaminants left in the fluid cylinder by the normal use, and improve the ability to work with parts or see potential problems.

### Critical Clearances

When any maintenance requiring disassembly of the power end is performed, check the following clearances to ensure that they are within factory specifications, or are within the maximum allowable component wear limits.

*A maximum of .002 additional clearance is allowed for component wear.* This additional clearance can be added to the clearance values in Table 6 below. (For radial clearance, use one-half of the total diametral values shown in the table.)

**Table 6 Critical Clearance Table**

Item	Clearance (inch)	Clearance (mm)
Crankshaft Throw Diameter (Stroke)	2.75	69.85
Crankshaft Pin or Journal (OD)	3.4990 / 3.4995	88.8746 / 88.8873
Connecting Rod / Crank Clearance (Max Total)	.003	0.0762
Crosshead Diameter (OD)	3.121 / 3.123	79.2734 / 79.3242
Crosshead Cylinder Bore (ID)	3.1245 / 3.1260	79.3623 / 79.4004
Crosshead to Bore Clearance (Max. Total)	.005	0.127
Wrist Pin Bushing Bore (ID)	1.2505 / 1.2515	31.7627 / 31.7881
Wrist Pin to Bore Clearance (Max. Total)	.002	0.0508

(Clearances shown are total diametral values.)

## Torque Requirements

Improperly tightened pump bolts or screws can cause pump leaks or failures. Use a calibrated torque wrench for the critical bolts and screws shown in Table 7.

### refers to the item numbers in the drawings in the AW1122 Component Parts List (see page 49) and Table 9 AW11 Component Item and Part Numbers (page 53).

**Table 7 Critical Pump Fastener Torque Values**

###	Item	Bolt or Screw Size	Torque Ft-lb	Torque (N-m)
4	Connecting Rod Bolts	.5	65	88
43	Piston Assembly Nut	.75	35	47
42	Piston Rod Hex Nut	.5	35	47
27	Bearing Housing Screws	.5	55	75
27	Pinion Housing Screws	.5	55	75
34	Back Cover Bolts	.5	30	41
21	Crosshead Set Screw	.313	10	14
48	Cylinder Attach/Clamp Nut	.625	120	163
53	Valve Cover Nut	.500	60	81

## Specialized Service Tools

The following tools are available and may be purchased at American Mfg Company's world-wide network of distributors.

**Table 8 American Mfg Company Service Tool Part Numbers**

<b>Tool Description</b>	<b>Part #</b>
Tool, To Press Seals On Seal Holder	PPAM A000384000
Tool, To Tighten Packing Nut	PPAM A000385000
Tool, To Press In Seal On Pinion Caps	PPAM A000386000
Tool, Bearing Press For Pinion	PPAM A000387000
Tool, For Housing Cup Press	PPAM A000388000
Tool, Hand Crank Pinion	PPAM A000392000
Tool, Stud Nut	PPAM A000393000
Tool, Disc Valve Seat Driver	PPAM A000399000
Tool, Ball Seat Driver	PPAM A000233000
Tool, Piston Nut Remover	PPFMC A5049
Tool, Ball Magnet	PPAM A000239000

## Servicing the Pistons

**⚠ WARNING**

Disconnect the pump from the driver system, and ensure that suction and discharge lines are disconnected or blocked, and that there is no pressure at the pump.

**⚠ DANGER**

If necessary, lockout or tagout the pump and all accessory equipment and/or main electrical devices and main switch. Failure to do this could cause electrical shock or injury from moving pump parts or components under high pressure. Remove any keys. Test the machine to make sure the machine is, in fact, de-energized. The only person allowed to remove a Lockout or Tagout device is the person who put it there.

**Be absolutely sure that engine or motor cannot be started!**



Review all of the safety warnings listed in under “Safety when Working on the Pump” on page 8.

If possible, always pump a sufficient quantity of clean water through the fluid end before starting any service procedures that involve fluid end components. This action will remove a significant portion of contaminants left in the fluid cylinder by the normal use, and improve the ability to work with parts or see potential problems.

For item numbers, see:

**AW1122:** Drawings starting on page 49  
Table 9 AW11 Component Item and Part Numbers (page 53)

**AW1118:** Drawings starting on page 54  
Table 10 AW1118D Component Item and Part Numbers (page 58) or  
Table 11 AW1118B Component Item and Part Numbers (page 59)

To service the pistons, a minimum of two feet of clearance is required between the front of the pump cylinder cover (Item #54) and any obstructions. If there is insufficient clearance, the pump must be removed and relocated to an area where adequate clearance exists.





The following procedure is written under the assumption that sufficient clearances exist.

1. To access the piston cup seals (Item #40), the cylinder cover clamps (Item #57) must be removed. Remove six of the nuts (Item #48) holding the cylinder cover clamps in place, and then remove the cylinder covers (Item #54). **Do not** remove the two nuts (Item #48) on the opposite corners of the fluid cylinder, as those two nuts keep the cylinders (Item #39) and fluid cylinder mounted on the pump during this procedure.
2. Using a socket wrench with a long extension, remove the hex piston nut (Item #42) from the piston/crosshead rod (Item #7). This nut secures the piston assembly to the piston/crosshead rod.
3. Next, use the American Mfg Company piston tool (PPFMC A5049) to pull the piston assembly from the cylinder (Item #39). Insert the American Mfg Company piston tool inside the cylinder until flush with the face of the slotted piston retainer nut (Item #43). Twist the tool to engage and lock the tabs of the tool inside the mating slots in the retainer nut.
4. Using a combination pulling and twisting motion, pull the piston assembly free of the pump.



5. Place the flats on the bottom of the piston holder (Item #41) in a vice and clamp them securely. Using the American Mfg Company piston tool (PPFMC A5049), unscrew and remove the piston retainer nut (Item #43). The piston cup (Item #40) and piston retainer (Item #44) may now be removed.



6. Inspect all parts for damage or unusual wear. Ensure that the interior surface of the cylinder (Item #39) is smooth and free of cracks or grooves. *New piston cups will fail prematurely if installed in liners with damaged bores.* American Mfg Company strongly recommends that all three piston cups be replaced, not just those that show signs of leakage, whenever this type of service is performed. This will maximize operational time between service intervals.



7. Reverse steps 1 through 6 to rebuild the pump after worn or damaged components have been replaced. American Mfg Company recommends replacing all seals and gaskets that are disturbed during the service procedures. This includes the rod seal O-ring (Item #45) that is located on the piston/crosshead rod (shown) directly behind the piston assembly. (AW11 pump models have the O-ring in a groove in the piston holder instead of a separate seal holder.)



O-Ring

**Tip:** When reassembling, press the piston assembly into the liner until the sealing lip has *just* entered the front of the liner. Use a small amount of glycerin on the ID of the liner to help lubricate the piston during installation.

After the liner has been installed in the pump power frame, drive the piston assembly fully to its stop using the American Mfg Company piston tool (PPFMC A5049) and a rubber mallet.

**Lubricate the piston cups and piston rods during assembly.**

8. Torque all fasteners as listed on page 28.

## Removing the Fluid Cylinder

**⚠ WARNING**

Disconnect the pump from the driver system, and ensure that suction and discharge lines are disconnected or blocked, and that there is no pressure at the pump.

**⚠ DANGER**

If necessary, lockout or tagout the pump and all accessory equipment and/or main electrical devices and main switch. Failure to do this could cause electrical shock or injury from moving pump parts or components under high pressure. Remove any keys. Test the machine to make sure the machine is, in fact, de-energized. The only person allowed to remove a Lockout or Tagout device is the person who put it there.

**Be absolutely sure that engine or motor cannot be started!**



Review all of the safety warnings listed in under “Safety when Working on the Pump” on page 8.

The fluid chamber (Item #37) may be removed to inspect for internal damage, to be repaired, to replace the fluid cylinder, to replace damaged cylinders, cylinder O-rings, or to service piston rod seals.

If possible, always pump a sufficient quantity of clean water through the fluid end before starting any service procedures that involve fluid end components. This action will remove a significant portion of contaminants left in the fluid cylinder by the normal use, and improve the ability to work with parts or see potential problems.

For item numbers, see:

<b>AW1122:</b>	Figure 6:	AW1122D Fluid End Components	(page 51)
	Figure 7:	AW1122BCD Fluid End Components	(page 52)
	Table 9:	AW11 Component Item and Part Numbers	(page 53)
<b>AW1118:</b>	Figure 10:	AW1118D Fluid End Components	(page 56)
	Figure 11:	AW1118B Fluid End Components	(page 57)
	Table 10:	AW1118D Component Item and Part Numbers	(page 58)
	or Table 11:	AW1118B Component Item and Part Numbers	(page 59)

1. Remove the cylinder cover clamps Item # (57) and cylinder covers (Item #54) as described in the Servicing the Pistons section (page 32). Remove the outside corner fluid cylinder nuts (Item #48) if they are still in place.



2. Rock the fluid cylinder (fluid chamber) to loosen from the cylinders (liner—Item #39), and then pull free of the fluid end studs. If the pistons have already been removed, take care to ensure that the cylinders (liners) do not fall off of the front of the power end and become damaged.



3. To remove the piston assemblies, see the Servicing the Pistons section (page 32).
4. Inspect all parts for signs of wear or damage. Replace parts if required.
5. Always replace the cylinder gaskets (Item #46) when the cylinders have been moved or replaced.
6. To re-install, reverse the preceding steps.



Torque all fasteners as listed on page 30. **It is important to note that if the nuts (Item #48) on the fluid cylinder studs (Item #47) are not properly torqued, a failure is likely.**

## Replacing Valves

**⚠ WARNING**

Disconnect the pump from the driver system, and ensure that suction and discharge lines are disconnected or blocked, and that there is no pressure at the pump.

**⚠ DANGER**

If necessary, lockout or tagout the pump and all accessory equipment and/or main electrical devices and main switch. Failure to do this could cause electrical shock or injury from moving pump parts or components under high pressure. Remove any keys. Test the machine to make sure the machine is, in fact, de-energized. The only person allowed to remove a Lockout or Tagout device is the person who put it there.

**Be absolutely sure that engine or motor cannot be started!**



Review all of the safety warnings listed in under “Safety when Working on the Pump” on page 8.

For item numbers, see:

**AW1122:** Drawings starting on page 49  
Table 9 AW11 Component Item and Part Numbers (page 53)

**AW1118:** Drawings starting on page 54  
Table 10 AW1118D Component Item and Part Numbers (page 58) or  
Table 11 AW1118B Component Item and Part Numbers (page 59)

Disc or Ball type valves are used depending upon the pump model purchased.

**Note:** A minimum of two feet of clearance is required above, below, and in front of the pump fluid cylinder in order to perform valve service without removing the fluid end of the pump. If sufficient clearance is not available, the fluid end must be removed (see “Removing the Fluid Cylinder” on page 35) and taken to a work shop for valve service.

***The following procedure assumes that sufficient clearances exist.***

7. Remove the three suction plugs (Item #56) from the bottom of the fluid chamber (Item #37).



8. Remove the six valve cover nuts (Item #53) holding the valve cover clamps Item # (51), then remove the three valve covers (Item #49) from the fluid cylinder.



9. Removing the cylinder covers (Item #54) allows access for inlet valve removal. Remove the cylinder covers as described in the previous procedure "Removing the Fluid Cylinder" (page 35).



10. Removing valves:

- For disc valves, use knock out tool PPAM A000399000.
- For ball valve seats, use knockout tool PPAM A000233000.

Insert the tool from the bottom of the fluid cylinder, and push up until it is stopped by the bottom of the valve seat. Strike the tool sharply with a hammer to loosen the valve seat. First remove the suction valve seat through the cylinder cover, then the discharge valve seat through the valve cover.

**Figure 3** Using the Knock Out Tool



Strike on this end with a hammer to remove the valve

*Installation of valves.*

11. The suction valves must be installed before the discharge valves can be installed. The same reassembly procedure is applicable for both:
  - 5A. Select a valve and check to ensure the taper on the seat is clean.
  - 5B. Clean the taper in the fluid cylinder and on the seat with a cleaning solution and a clean cloth. Small scratches can be removed with steel wool or 100 grit emery paper. Remove all dirt, grease, oil, water, or any other contaminants from the surfaces. *Do not oil the seats or the seating surfaces in the fluid cylinder. Make sure that they are dry before installation.*
  - 5C. Position the valves seat directly over the mating taper in the fluid cylinder.
  - 5D. Let the valves seat drop into the taper. Make sure that the seat is sitting in the taper properly and not cocked to one side. If the seat drops straight, it will seize on the taper. When correctly seated, it cannot be pulled up by hand.
  - 5E. Place the valves seat installation tool (PPAM A000399000 or PPAM A000233000) on the top surface of the valves. Strike with a hammer three times to set the seat.
  - 5F. Repeat steps A through E for the discharge valves.
  - 5G. Drop balls into seats (if applicable).
12. After the disc valves or balls and seats have been replaced, the valve cover should be reinstalled. Place the valve cover (Item #49) with the new gasket (Item #50) in position, then install the valve cover clamps (Item #51) over the valve cover studs (Item #52). Replace the valve cover washers (if installed) and the valve cover hex nuts (Item #53).
13. Torque the valve cover hex nuts to the recommend values listed on page 30.

## Servicing the Power End

### Replacing Piston Rod Oil Seals

**WARNING**

Disconnect the pump from the driver system, and ensure that suction and discharge lines are disconnected or blocked, and that there is no pressure at the pump.

**DANGER**

If necessary, lockout or tagout the pump and all accessory equipment and/or main electrical devices and main switch. Failure to do this could cause electrical shock or injury from moving pump parts or components under high pressure. Remove any keys. Test the machine to make sure the machine is, in fact, de-energized. The only person allowed to remove a Lockout or Tagout device is the person who put it there.

**Be absolutely sure that engine or motor cannot be started!**



Review all of the safety warnings listed in under “Safety when Working on the Pump” on page 8.

For item numbers, see:

**AW1122:** Drawings starting on page 49  
Table 9 AW11 Component Item and Part Numbers (page 53)

**AW1118:** Drawings starting on page 54  
Table 10 AW1118D Component Item and Part Numbers (page 58) or  
Table 11 AW1118B Component Item and Part Numbers (page 59)

14. The piston rod oil seals (Item #9) retain oil in the power end, and prevent contamination from entering the power end by way of the piston rods. The fluid end and cylinders must be removed (as outlined in the previous sections) to provide access to these seals.
15. Rotate the seal retainer (Item #10) counter clockwise until it is unscrewed from the frame, then slide it off the rod. Use a larger flat head screw driver as shown.

A tool (PPAM A000385000) is also available.





16. Pull the seal holder (Item #8) out of the pump frame, and slide it off of the rod.
17. Remove the seal retainer gasket (Item #11) from the power frame. Inspect the seals (Item #9) and note the orientation of the seals prior to removal. The old seals may now be removed from the seal holder and discarded.
18. To rebuild, insert new seals (Item #9) in the seal holder (Item #8), taking care to ensure they are oriented in the same direction as the ones that were removed. *Never re-use seals that have been removed from the pump.* Replace the seal retainer gasket (Item #11) if it shows signs of wear, deformation or damage.
19. Wrap tape or other material over the exposed piston rod threads to protect the new seal lips from damage. Install the seal retainer gasket, then slide the seal holder over the (protected) threads and into the pump frame. *Take care that the seal lips are not folded or cut when passing over the ends of the rod.*
20. With the gasket (Item #11) and seal holder (Item #8) in place, install the seal retainer (Item #10) and tighten until it bottoms out. Do not over-tighten as it can damage the seal retainer gasket.
21. Remove the protective material that is covering the rod threads. Rebuild the remainder of the pump as outlined in previous sections. Torque all fasteners to the torque specifications listed on page 30.

## Replacing the Power End Bearings and Crankshaft

**⚠ WARNING**

Disconnect the pump from the driver system, and ensure that suction and discharge lines are disconnected or blocked, and that there is no pressure at the pump.

**⚠ DANGER**

If necessary, lockout or tagout the pump and all accessory equipment and/or main electrical devices and main switch. Failure to do this could cause electrical shock or injury from moving pump parts or components under high pressure. Remove any keys. Test the machine to make sure the machine is, in fact, de-energized. The only person allowed to remove a Lockout or Tagout device is the person who put it there.

**Be absolutely sure that engine or motor cannot be started!**



Review all of the safety warnings listed in under “Safety when Working on the Pump” on page 8.

For item numbers, see:

**AW1122:** Drawings starting on page 49  
Table 9 AW11 Component Item and Part Numbers (page 53)

**AW1118:** Drawings starting on page 54  
Table 10 AW1118D Component Item and Part Numbers (page 58) or  
Table 11 AW1118B Component Item and Part Numbers (page 59)

22. Remove the fluid cylinder—this simplifies crankshaft removal on AW1122 model pumps.
23. Remove the magnetic pipe plug (Item #32) to allow all of the oil to drain from the power frame (Item #1).
24. Remove all of the rear cover cap screws (Items #34).
25. Remove the back cover (Item #15) and the back cover gasket (Item #16) from the power frame.



26. Remove the end cap of each connecting rod (Item #4) by unscrewing the two hex nuts that hold each cap to the connecting rod body. The cap can then be removed from the body by tapping on the cap screws with a rubber mallet to remove them, then tapping on the end cap with the rubber mallet to loosen the cap.

**⚠ CAUTION**

*Be careful not to damage the threads on the cap screws.*



27. Slide the two rod bearing halves (Item #5) from each connecting rod. (These parts can sometimes stick to the pins/journals on the crankshaft (Item #2); take care in the force used to separate them.)



The connecting rods and caps are carefully matched sets, and must always be reassembled in the same orientation with their original mate.

There are numbered codes stamped on each half of the connecting rod assemblies to help in keeping the matched sets together. Don't forget to make certain they are installed in the same orientation when re-assembling the pump.

**TIP:** You may wish to make your own orientation marks on the connecting rod assemblies when disassembling the pump.



28. AW1122 pumps use pinion shafts for internal gear reduction. If the pinion shaft must be removed, start by removing the hex head cap screws (Item #27), and the left and right pinion housings (Item #17 and Item #18). The gaskets (Item #20) may adhere to the power frame surface—they can safely be left in place if undamaged.
29. Remove the pinion shaft (Item #3) with its bearings by driving the shaft out with a mallet and brass rod (or other soft material).



30. Remove the hex head cap screws (Item #27), bearing housings (Item #12), O-ring (Item #29) and shims Item # (13) from both sides of the pump. Count and write down the number of shims on each side to facilitate assembly. Again, the gaskets (Item #20) may adhere to the power frame surface—they can safely be left in place if undamaged. *The O-rings should always be replaced.* The bearing cones (Item #23) will remain in the bearing housing.



31. To remove the crankshaft, line up the bearing cones with the cutouts in the power frame, and pull out of the back. Handle the crankshaft very carefully to prevent critical bearing surfaces from being scratched or damaged.



32. The bearing cups (Item #24) may be removed from the crankshaft. The bearing cones (Item #23) can be removed from the bearing housing by using a puller (if a sufficient lip is available for the puller arms to grab). Alternately, a weld bead can be run around the inside surface of the cup—when cool, this will reduce the interference between the cup and bearing housing enough to free the cup.

*If either the cup or cone is replaced, the corresponding cup or cone should be replaced as they are a matched set.*

33. Pull the connecting rod/crosshead assemblies (Item #7) from the power frame. Mark each connecting rod and crosshead assembly to make sure you can reassemble them into the same bore from which they were removed.



34. If either the crosshead or the connecting rod requires service, remove the set screw (Item #21) and slide the wrist pin (Item #6) out of the crosshead (Item #7). Again, keep the components matched together.
35. Inspect all components and replace any worn or damaged components, remembering to replace matched components in pairs. Carefully check the crankshaft bearing surfaces for pits, scratches, or other signs of wear. The connecting rod bearings should be inspected for deep scratches or for the top metal surface being worn away.

36. If it is damaged, remove the crankshaft oil seal (Item #19) using a screwdriver or similar object and discard the old seal.
37. Thoroughly clean all parts with solvent and apply a thin coat of oil before reassembly.
38. The tapered roller bearing cups (Item #24) may be heated to aid in assembly onto the shaft. Always take proper safety precautions, use heat resistant tools, and wear gloves when handling hot parts.

There are a number of recommended methods for heating bearings. Electric ovens or electrically heated oil baths may be used, but not without proper thermostatic control.
39. To replace the tapered roller bearings on the crankshaft, heat the cones to a maximum of 300° F (149° C). Slide them down the shaft until they are fully seated against the shoulder. The hot cup may pull away from the shoulder—hold it in position until it cools (and shrinks) enough to grab the shaft. Use a .001" thick feeler gauge to ensure that the cone is fully seated against the shoulder after the parts have cooled.
40. Use a press to seat the new cones (Item #23) into the bearing housings. *Never use new bearing cups with old bearing cones.* Always use matched bearing/cone sets from one manufacturer.
41. Reassemble the crosshead assemblies and connecting rods. Ensure that the set screws (Item #21) that retain the wrist pin (Item #6) are in place. (They may have been removed for repair or inspection of the wrist pin bushing). The set screw must engage the cut-out on the wrist pin. See page 30 for torque specifications.
42. Push the crosshead/connecting rod assemblies fully forward in the power frame to provide maximum clearance for the crankshaft. Ensure that the crosshead assemblies are replaced in the same orientation and in the same cylinder bore that they were originally from.

The oil cup pocket feeds lubricant to the wrist pin bushing. Located on the top of the connecting rod, this should be in the "up" position.
43. Install the crankshaft in the power frame. *Take care not to scratch the bearing surfaces of the crankshaft.*
44. Inspect the gasket (Item #14) that seals the bearing housing, and replace it if it is damaged. Reinstall the shims (Item #13) and bearing housings. As a starting point, install the same number of shims that the pump originally had prior to service work (this number should have been written down during disassembly). When tightening the fasteners retaining the bearing cover, use a criss-cross pattern when using a torque wrench to tighten them down.

45. Replace the rod bearings (Item #5) in the connecting rod and connecting rod caps. Make sure that rod caps are properly assembled with their mating connecting rod. Torque the fasteners holding the end caps to the mating rod—see page 30 for the torque specifications. Use a back-and-forth pattern when tightening with a torque wrench.

After the cap screws are torqued, a light strike to the cap with a rubber hammer will help properly seat the rod bearings.

46. Use a dial indicator to adjust the endplay of the crankshaft. Improper adjustment may result in excessive temperature, noise, and/or reduced bearing life. American Mfg Company recommends between .002" (tight) to .003" (loose) of internal axial clearance ("end play") when properly assembled.

The final adjustment must be verified using a dial indicator. This is described in later in this procedure, under the heading "Checking Crankshaft End-Play with a Dial Indicator" on page 47.

47. Turn the crankshaft three revolutions or more to ensure that the connecting rods are loose and that there is no binding in the rod bearings, that the wrist pin joints are free, and that the crossheads move freely in the power frame.
48. Using a light tap from a rubber mallet or a pry bar, move the crankshaft to one side of the power frame. Rotate the crankshaft several turns, and repeat the light taps from a rubber mallet (or use of a pry bar) to ensure the crankshaft is fully to one side.



### Checking Crankshaft End-Play with a Dial Indicator

49. Mount the indicator base on the power frame with the indicator tip on a machined shoulder surface of the crankshaft--do not measure from a cast surface. Align the axis of the indicator parallel to the crankshaft.
50. Set the dial indicator to zero.
51. Move the crankshaft back over to the opposite side, and read the bearing end play as total indicator movement. Rotate the crankshaft several turns, then repeat moving the crankshaft in the direction described in this step. Repeat the dial indicator measurement.

Remove or add shims as necessary to achieve proper endplay (.002" tight to .003" loose). Distribute the shims equally on both bearing housings. Verify the endplay with the dial indicator before final assembly.



### Reassembly continued...

52. Install the oil seal (Item #19) into the bearing housing (Item #12). The oil seal can be installed with light hammer blows. When properly seated, it will be flush with the face of the bearing housing.
53. Install the piston rod seal holder (Item #9) and the seal retainer (Item #8) in the power frame per the instructions in "Replacing Piston Rod Oil Seals" on page 40. The crankshaft (Item #2) should turn freely.
54. Complete the reassembly of the pump. A tool (PPAM A000387000) can be purchased to aid in the assembly of the pinion bearing if needed.
55. Torque all fasteners to the torque specifications listed on page 30.

## Chapter 7—Spare Parts / Additional Products

### Ordering Parts

Service parts are available through American Mfg Company 's worldwide network of distributors or from the original supplier. If unsure where to purchase parts, contact American Mfg Company customer service for the location of an authorized parts retailer in your area.

Always insist on genuine American Mfg Company replacement parts.

Use the assembly drawings included with this manual to determine the components and corresponding part numbers required to service the pump. Make sure that the part number on the drawing matches the part number of the pump requiring parts.

When ordering parts, always reference the part number of the pump with the order. These numbers can be found stamped on the metal name tag affixed to the power end of every pump. By referencing these numbers you can ensure that the components you receive work as intended with your pump. Be sure to inquire about any special service tools or complete maintenance kits.

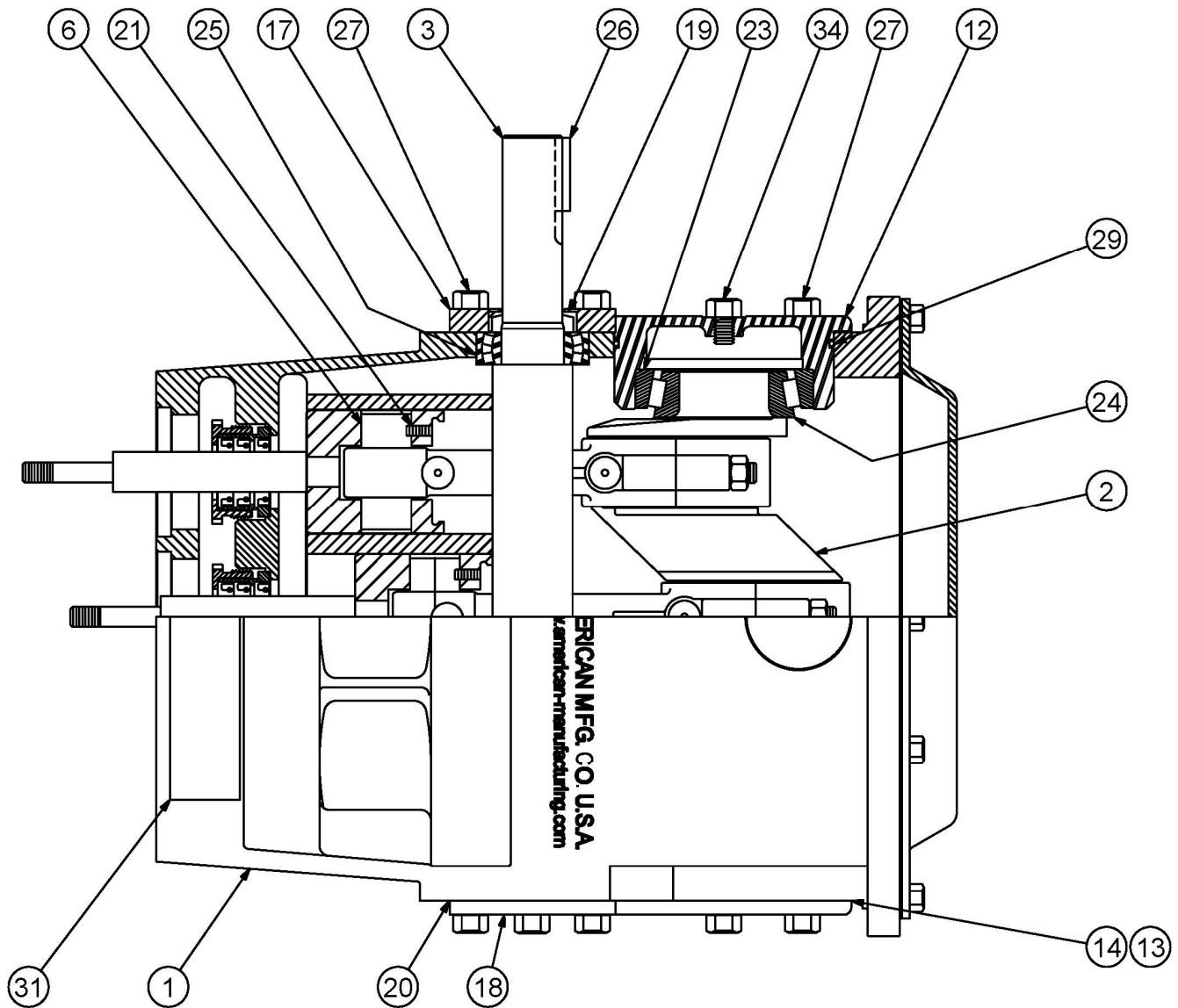
Also see the Component Parts diagrams on the following pages.



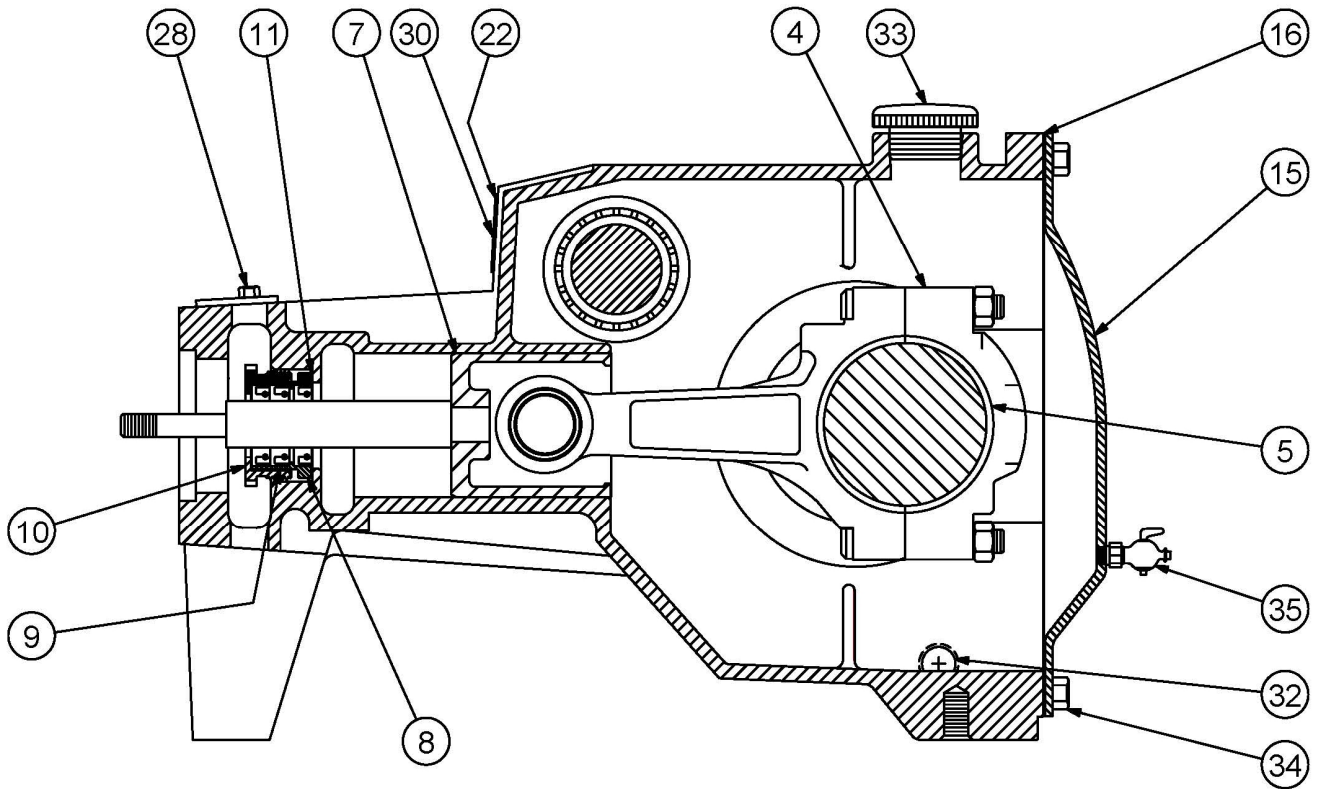
## AW1122 Component Parts List

To order service parts or see exact component configurations for your particular pump, refer to the cross-section parts drawing in the literature kit supplied with the pump. Contact your local American Mfg Company pump distributor or American Mfg Company if you do not have this information.

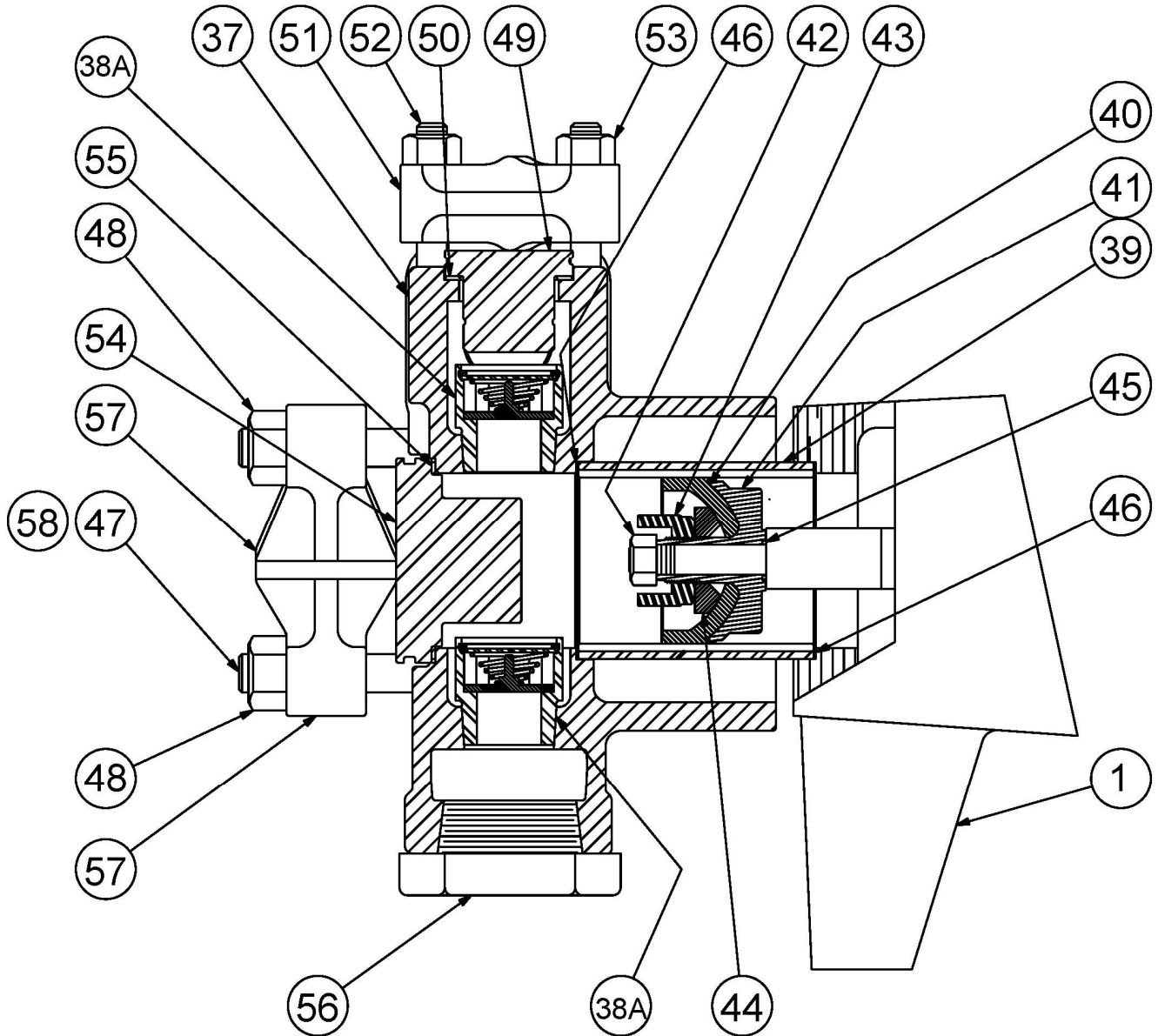
**Figure 4 AW1122 Power End Components**



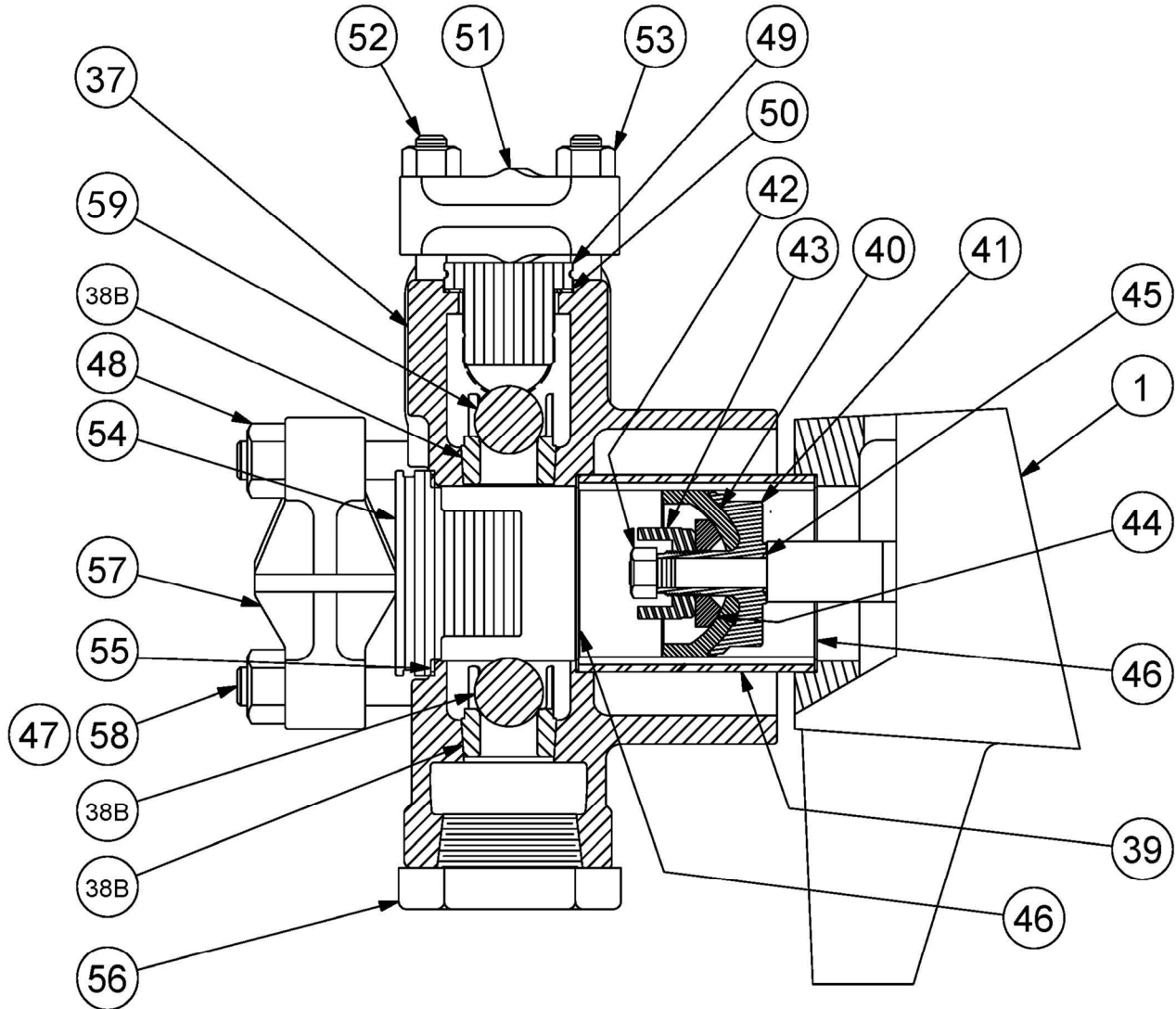
**Figure 5** AW1122 Power End Components



**Figure 6** AW1122D Fluid End Components



**Figure 7 AW1122BCD Fluid End Components**



**Table 9 AW1122 Component Item and Part Numbers**

Item #	Component	Part #	Qty		Item #	Component	Part #	Qty
1	Power Frame	PPFMC 5257698	1		30	Screw, Self Tapping	PPFMC 1187413	2
2	Crankshaft	PPFMC 1285094	1		31	Plate, Inspection	PPFMC 5260567	1
3	Pinion Shaft	PPFMC P511596	1		32	Pipe Plug, Power End	PPFMC 1187048	2
4	Connecting Rod Assembly	PPFMC 5266814	3		33	Filler Cap or Vent	PPFMC A5054	1
5	Rod Bearing	PPFMC P514965	3		34	Screw	PPFMC 1106980	20
6	Wrist Pin	PPFMC A91014	3		35	Petcock	PPFMC 1187039	1
7	Crosshead Assembly	PPFMC 1252939	3		37	Fluid Chamber	PPFMC 1284777	1
8	Seal Holder	PPFMC 3268369	3		38A	Disc Valve Assembly*	PPFMC 1278104	6
9	Oil Seal, Piston Rod	PPFMC 1177489	9		38B	Valve seat**	PPFMC 1284740	6
10	Seal Retainer Nut	PPFMC 1266323	3		39	Cylinder	PPFMC 1267586	3
11	Gasket, Seal Retainer	PPFMC 3268418	3		40	Piston Cup	PPFMC A268N	3
12	Bearing Housing, Blind	PPFMC 1248369	2		41	Piston Holder	PPFMC A91663	3
13	Shim, Bearing Housing	PPFMC 1252595	6		42	Hex Nut	PPFMC 8309	3
14	Gasket, Bearing Housing	PPFMC A91675	2		43	Plunger Nut	PPFMC A5016	3
15	Back Cover	PPFMC P508969	1		44	Piston Retainer	PPFMC 1216753	3
16	Gasket, Back Cover	PPFMC P508966	1		45	O-Ring, Rod Seal	PPFMC 1101176	3
17	Pinion Housing, Drive	PPFMC 5257338	1		46	Gasket, Fluid Cylinder	PPFMC 1279676	6
18	Pinion Housing, Blind	PPFMC P508916	1		47	Stud, Fluid Cylinder	PPFMC A91672	2
19	Oil Seal, Rotating	PPFMC 5257339	1		48	Hex Nut	PPFMC 1121513	8
20	Gasket, Pinion	PPFMC A91674	2		49	Valve Cover	PPFMC 1285113	3
21	Screw Set	PPFMC 1182004	3		50	Gasket, Valve Cover	PPFMC 1279675	3
22	Name Plate*	PPAM A000441000	1		51	Clamp, Valve Cover	PPFMC A80391	3
22	Name Plate**	PPFMC 5277981	1		52	Stud, Valve Cover	PPFMC A5076	6
23	Bearing Cone, Crank	PPFMC 1177473	2		53	Hex Nut, Valve Cover	PPFMC 1121511	6
24	Bearing Cup, Crank	PPFMC 1177474	2		54	Cylinder Cover	PPFMC 1285112	3
25	Bearing, Pinion	PPFMC P511746	2		55	Gasket, Cylinder Cover	PPFMC 1279674	3
26	Key	PPFMC 1104349	1		56	Suction Plug	PPFMC 1105121	3
27	Cap screw, Pinion Bearing	PPFMC 1100054	12		57	Clamp, Cylinder	PPFMC A80392	3
28	Cap Screw, Inspection Plate	PPFMC 1100804	2		58	Stud, Cylinder Cover	PPFMC 1279602	6
29	O-Ring, Bearing	PPFMC 3226710	2		59	Valve Ball**	PPFMC 1101419	6

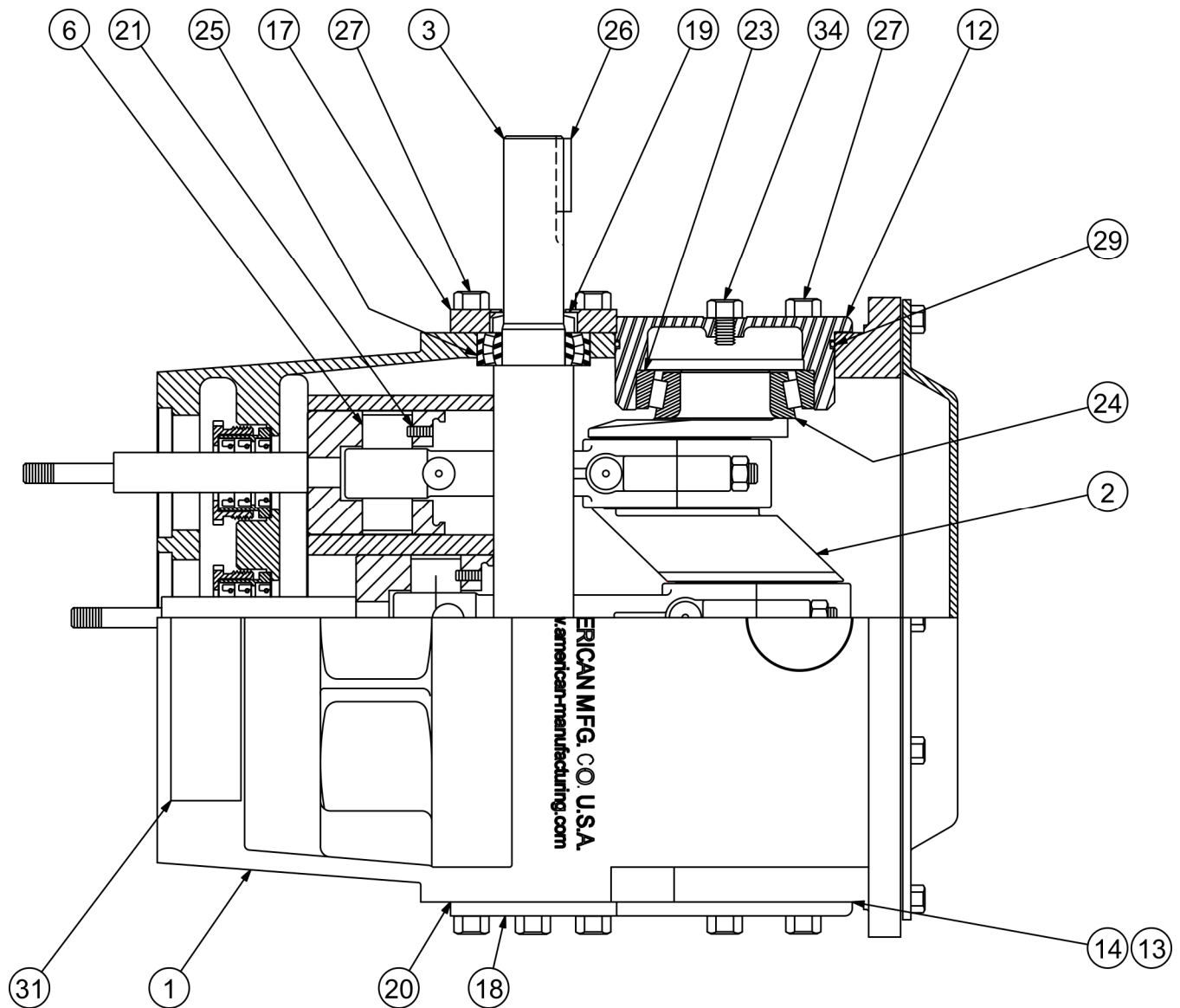
\* AW1122D

\*\* AW1122BCD

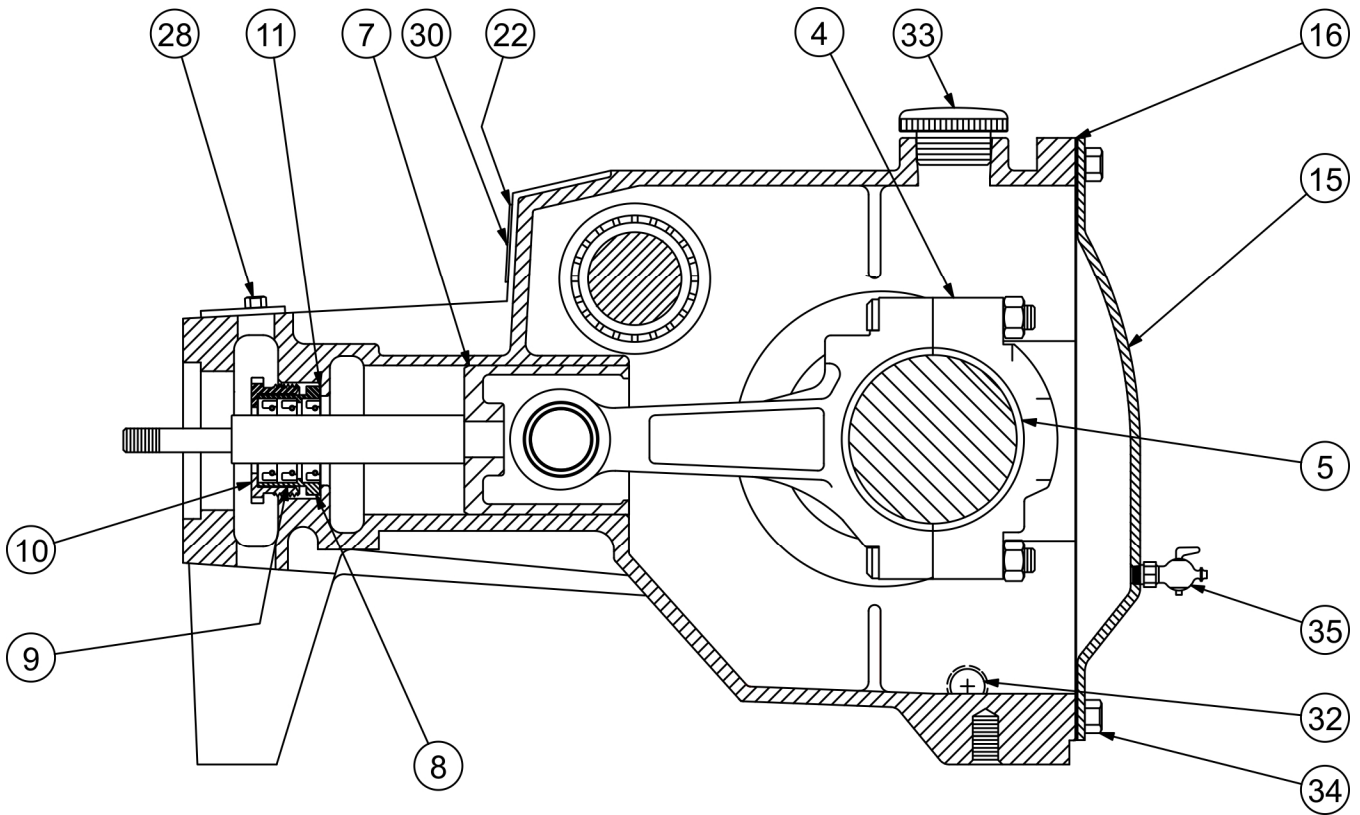
## AW1118 Component Parts List

To order service parts or see exact component configurations for your particular pump, refer to the cross-section parts drawing in the literature kit supplied with the pump. Contact your local American Mfg Company pump distributor or American Mfg Company if you do not have this information.

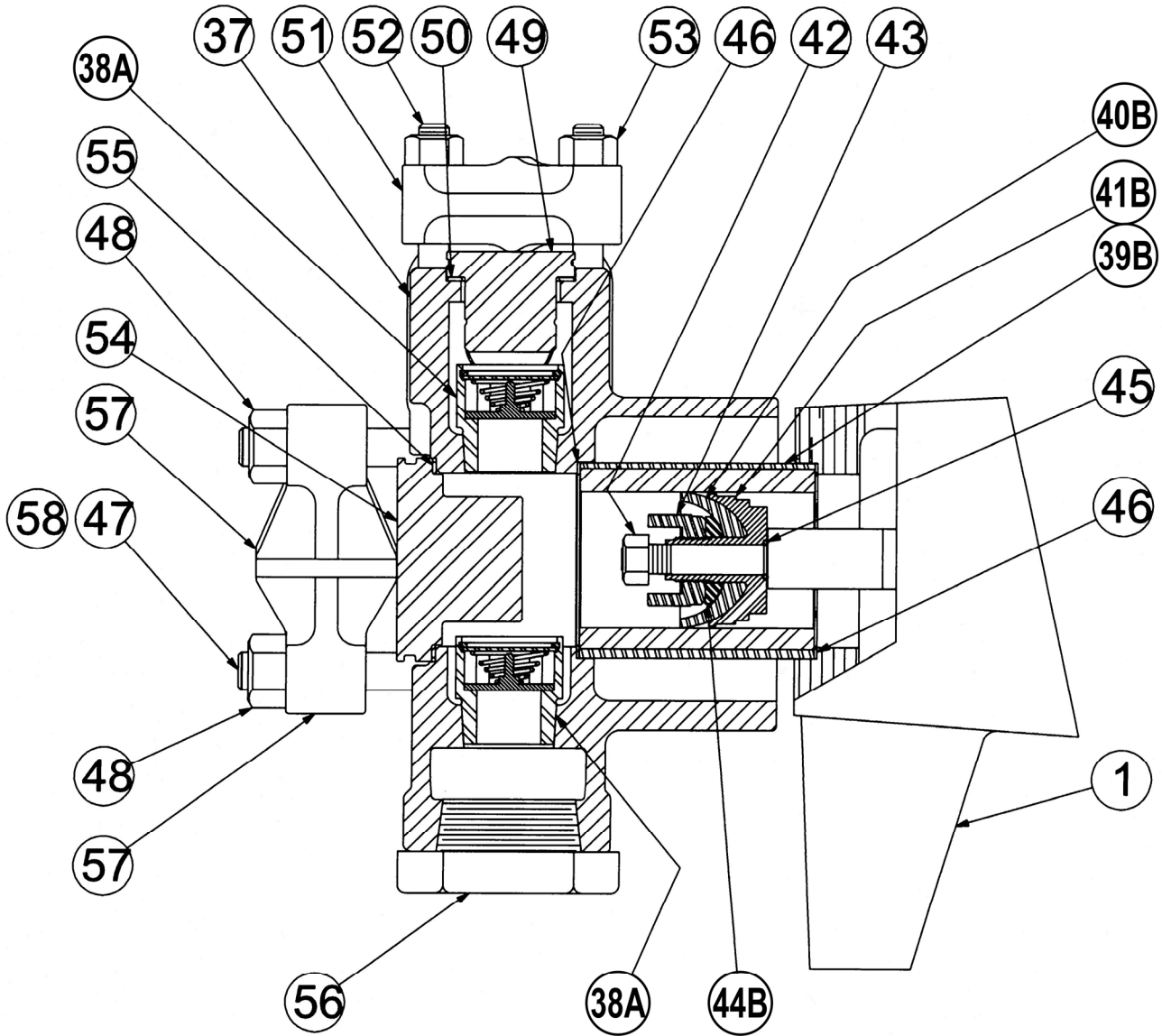
**Figure 8 AW1118 Power End Components**



**Figure 9 AW1118 Power End Components**

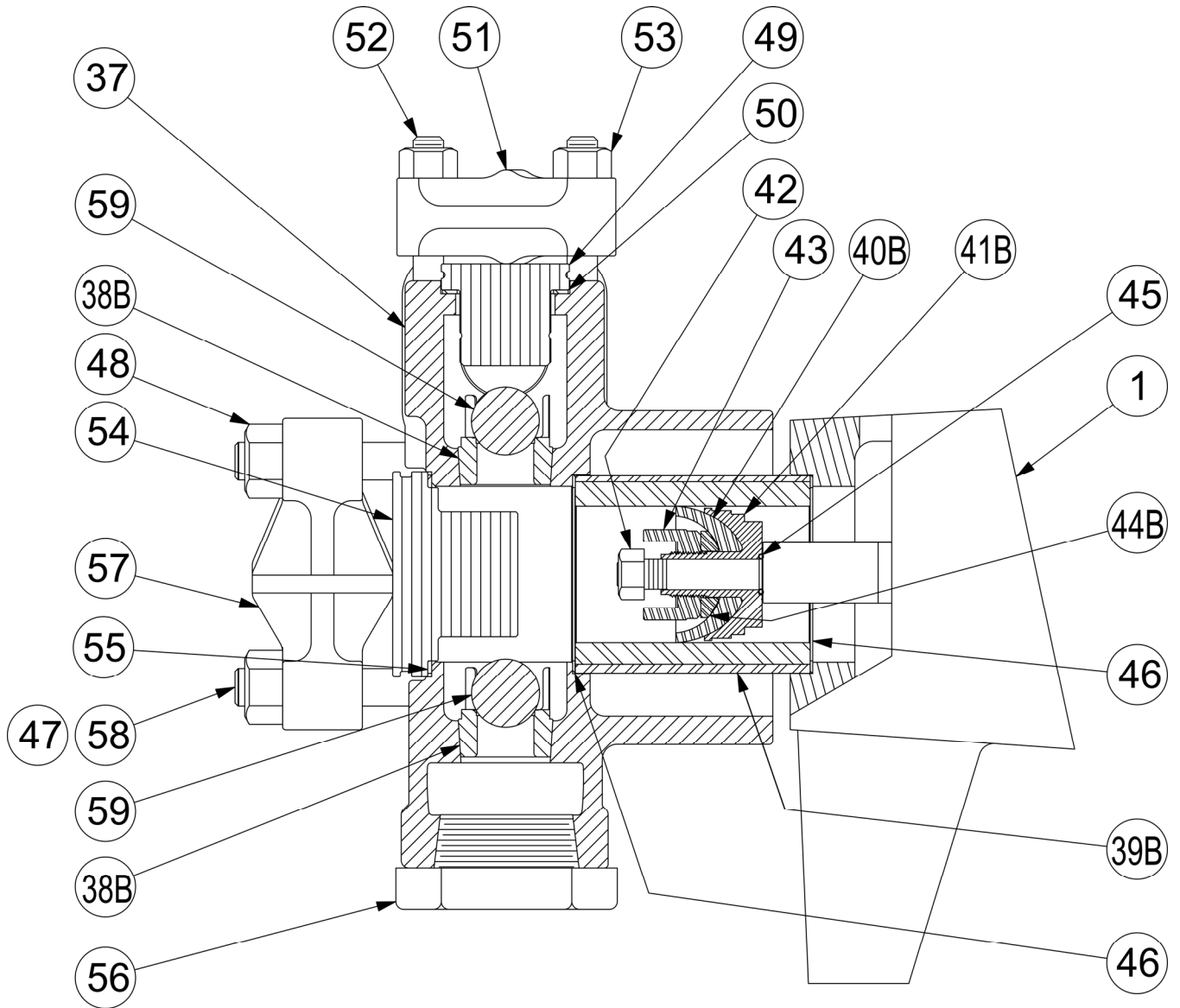


**Figure 10 AW1118D Fluid End Components**





**Figure 11 AW1118B Fluid End Components**



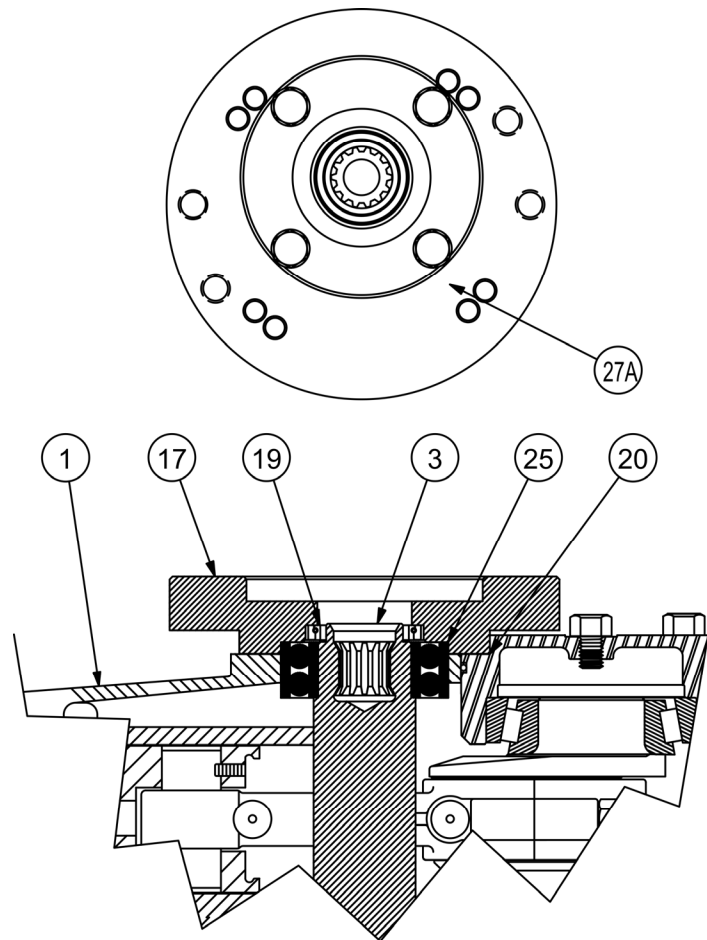
**Table 10 AW118D Component Item and Part Numbers**

Item #	Component	Part #	Qty		Item #	Component	Part #	Qty
1	Power Frame	PPFMC 5257698	1		30	Screw, Self Tapping	PPFMC 1187413	2
2	Crankshaft	PPFMC 1285094	1		31	Plate, Inspection	PPFMC 5260567	1
3	Pinion Shaft	PPFMC P511596	1		32	Pipe Plug, Power End	PPFMC 1187048	2
4	Connecting Rod Assembly	PPFMC 5266814	3		33	Filler Cap or Vent	PPFMC A5054	1
5	Rod Bearing	PPFMC P514965	3		34	Screw	PPFMC 1106980	20
6	Wrist Pin	PPFMC A91014	3		35	Petcock	PPFMC 1187039	1
7	Crosshead Assembly	PPFMC 1252939	3		37	Fluid Chamber	PPFMC 1284777	1
8	Seal Holder	PPFMC 3268369	3		38A	Valve Assembly	PPFMC 1278104	6
9	Oil Seal, Piston Rod	PPFMC 1177489	9		39B	Cylinder	PPFMC 1267452	3
10	Seal Retainer Nut	PPFMC 1266323	3		40B	Piston Cup	PPFMC A3434N	3
11	Gasket, Seal Retainer	PPFMC 3268418	3		41B	Piston Holder	PPFMC 1278125	3
12	Bearing Housing, Blind	PPFMC 1248369	2		42	Hex Nut	PPFMC 8309	3
13	Shim, Bearing Housing	PPFMC 1252595	6		43	Plunger Nut	PPFMC A5016	3
14	Gasket, Bearing Housing	PPFMC A91675	2		44B	Piston Retainer	PPFMC 1207289	3
15	Back Cover	PPFMC P508969	1		45	O-Ring, Rod Seal	PPFMC 1101176	3
16	Gasket, Back Cover	PPFMC P508966	1		46	Gasket, Fluid Cylinder	PPFMC 1279676	6
17	Pinion Housing, Drive	PPFMC 5257338	1		47	Stud, Fluid Cylinder	PPFMC A91672	2
18	Pinion Housing, Blind	PPFMC P508916	1		48	Hex Nut	PPFMC 1121513	8
19	Oil Seal, Rotating	PPFMC 5257339	1		49	Valve Cover	PPFMC 1285113	3
20	Gasket, Pinion	PPFMC A91674	2		50	Gasket, Valve Cover	PPFMC 1279675	3
21	Screw Set	PPFMC 1182554	3		51	Clamp, Valve Cover	PPFMC A80391	3
22	Name Plate*	PPAM A000467000	1		52	Stud, Valve Cover	PPFMC A5076	6
22	Name Plate**	PPFMC 5277981	1		53	Hex Nut, Valve Cover	PPFMC 1121511	6
23	Bearing Cone, Crank	PPFMC 1177473	2		54	Cylinder Cover	PPFMC 1285112	3
24	Bearing Cup, Crank	PPFMC 1177474	2		55	Gasket, Cylinder Cover	PPFMC 1279674	3
25	Bearing, Pinion	PPFMC P511746	2		56	Suction Plug	PPFMC 1105121	3
26	Key	PPFMC 1104349	1		57	Clamp, Cylinder	PPFMC A80392	3
27	Cap screw, Pinion Bearing	PPFMC 1100054	12		58	Stud, Cylinder Cover	PPFMC 1279602	6
28	Cap Screw, Inspection Plate	PPFMC 1100804	2					
29	O-Ring, Bearing	PPFMC 3226710	2					

**Table 11 AW118B Component Item and Part Numbers**

Item #	Component	Part #	Qty		Item #	Component	Part #	Qty
1	Power Frame	PPFMC 5257698	1		30	Screw, Self Tapping	PPFMC 1187413	2
2	Crankshaft	PPFMC 1285094	1		31	Plate, Inspection	PPFMC 5260567	1
3	Pinion Shaft	PPFMC P511596	1		32	Pipe Plug, Power End	PPFMC 1187048	2
4	Connecting Rod Assembly	PPFMC 5266814	3		33	Filler Cap or Vent	PPFMC A5054	1
5	Rod Bearing	PPFMC P514965	3		34	Screw	PPFMC 1106980	20
6	Wrist Pin	PPFMC A91014	3		35	Petcock	PPFMC 1187039	1
7	Crosshead Assembly	PPFMC 1252939	3		37	Fluid Chamber	PPFMC 1284777	1
8	Seal Holder	PPFMC 3268369	3		38B	Valve Seat	PPFMC 1284740	6
9	Oil Seal, Piston Rod	PPFMC 1177489	9		39B	Cylinder	PPFMC 1257452	3
10	Seal Retainer Nut	PPFMC 1266323	3		40B	Piston Cup	PPFMC A3434N	3
11	Gasket, Seal Retainer	PPFMC 3268418	3		41B	Piston Holder	PPFMC 1278125	3
12	Bearing Housing, Blind	PPFMC 1248369	2		42	Hex Nut	PPFMC 8309	3
13	Shim, Bearing Housing	PPFMC 1252595	6		43	Plunger Nut	PPFMC A5016	3
14	Gasket, Bearing Housing	PPFMC A91675	2		44B	Piston Retainer	PPFMC 1207289	3
15	Back Cover	PPFMC P508969	1		45	O-Ring, Rod Seal	PPFMC 1101176	3
16	Gasket, Back Cover	PPFMC P508966	1		46	Gasket, Fluid Cylinder	PPFMC 1279676	6
17	Pinion Housing, Drive	PPFMC 5257338	1		47	Stud, Fluid Cylinder	PPFMC A91672	2
18	Pinion Housing, Blind	PPFMC P508916	1		48	Hex Nut	PPFMC 1121513	8
19	Oil Seal, Rotating	PPFMC 5257339	1		49	Valve Cover	PPFMC 1285113	3
20	Gasket, Pinion	PPFMC A91674	2		50	Gasket, Valve Cover	PPFMC 1279675	3
21	Screw Set	PPFMC 1182554	3		51	Clamp, Valve Cover	PPFMC A80391	3
22	Name Plate	PPAM A000468000	1		52	Stud, Valve Cover	PPFMC A5076	6
23	Bearing Cone, Crank	PPFMC 1177473	2		53	Hex Nut, Valve Cover	PPFMC 1121511	6
24	Bearing Cup, Crank	PPFMC 1177474	2		54	Cylinder Cover	PPFMC 1285112	3
25	Bearing, Pinion	PPFMC P511746	2		55	Gasket, Cylinder Cover	PPFMC 1279674	3
26	Key	PPFMC 1104349	1		56	Suction Plug	PPFMC 1105121	3
27	Cap screw, Pinion Bearing	PPFMC 1100054	12		57	Clamp, Cylinder	PPFMC A80392	3
28	Cap Screw, Bearing	PPFMC 1100804	2		58	Stud, Cylinder Cover	PPFMC 1279602	6
29	O-Ring, Bearing	PPFMC 3226710	2		59	Ball, Valve	PPFMC 1101419	6

**Figure 12 AW11 Spline Shaft Components**



**Table 12 AW11 Spline Shaft Component Item Numbers**

Item #	Component	Part #	Qty
1	Power Frame	PPFMC 3269402	1
3	Pinion Shaft Splined	PPFMC 3269385	1
17	Motor Mounting Plate	PPFMC 3269351	1
19	Oil Seal	PPFMC 3269370	1
20	Gasket	PPFMC 3269398	2
25	Bearing	PPFMC 3269369	2
27A	Screw	PPFMC 3268086	4
27	Screw	PPFMC 1100054	8
18B	Pinion Cover	PPFMC 3269396	1
59	HHCS Bolt	PPFMC P501682	1
60	Flat Washer	PPFMC 1107386	1

Items in blue are located on the opposite end of the pinion shaft, and are not shown in the drawing above.

**Table 13 Replacement Rubber Item Numbers**

Replacement Rubbers - Component Description	Part #
<b>2 3/4 Rubbers (AW1122 Pumps)</b>	
Standard Rubbers:	
Piston Rubber 2-3/4 (Neoprene) standard production part	PPFMC A268N
Alternate rubbers:	
Piston Rubber 2-3/4 (HSN)	PPFMC 3266810
Piston Rubber 2-3/4 (Carbox Nitrile XNBR)	PPFMC 5260221
<b>2 1/4 Rubbers (AW1118 Pumps)</b>	
Standard Rubbers:	
Piston Rubber 2-1/4 (Neoprene) standard production part	PPFMC A3434N
Alternate rubbers:	
Piston Rubber 2-1/4 (HSN)	PPFMC P513766
Piston Rubber 2-1/4 (Carbox Nitrile XNBR)	PPFMC 5260052

## Chapter 8—Reference

### Information about Your Pump

Fill in the blanks below with the key information about your specific pump model; this information will make it easier to order parts. The information is stamped on the metal nameplate on the pump power frame.

Pump Model: \_\_\_\_\_

Part Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Rated Pressure: \_\_\_\_\_

Rated Capacity: \_\_\_\_\_

Rated Speed: \_\_\_\_\_

Other notes:

## Maintenance Log

Date Performed	Serviced By	Service	Comments

**Figure 13 Pump Mount Bolt Pattern**

