Pump AME0413HD

Operation And Maintenance Manual

American Mfg Company
Quality Mud Pumps and Parts

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ISO 9001:2008 Registered

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American Mfg Company
Quality Mud Pumps and Parts

Operation And Maintenance Manual For AME0413HD Pump

Summary:

This is a manual for American Mfg Company AME0413HD vertical quadruplex piston pump with disc valves.

Alternate valve seat option:

The standard model AME0413HD comes with PPFMC 5260142 Valve seat, Raised face.
Optional valve seat version: PPFMC 1219615 Valve seat, Flat.

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AME0413HD Piston Pump Data

6.7 BHP Continuous Duty (8.5 BHP Intermittent Duty)

Specifications	
Pump Model	AME0413HD
Configuration	Vertical Quadruplex Piston
Number of Pistons	4
Stroke Length	1.0 Inches (25.4 mm)
Frame Load Rating	1240 lbs. (562.455 kg)
Pump Weight (Average)	80 lbs. (36.29 kg)
Direction of Rotation	Either
Internal Gear Rotation	1:1
Intermittent Duty Speed Rating	575 RPM
Continuous Duty Speed Rating	450 RPM
Minimum Speed	390 RPM
Mechanical Efficiency	85%
Lubrication System	Splash, Gravity Return
Lube Oil Capacity	1 Quart
Lube Oil Type	SAE 30
Maximum Fluid Temperature	140°F
Minimum Fluid Temperature	0°F
Standard Suction Size	1.25 Inch NPT
Standard Discharge Size	0.75 Inch NPT
Fluid End Material	Cast Iron
Valve Type	Disc Valve

Performance Rating

Pump Model	Diameter		Displacement/ REV		Maximum Pressure		Pump Capacity @ Input Speed (RPM)									
							390 RPM		400 RPM		425 RPM		450 RPM		575 RPM	
	Inch	mm	Gallon	Liter	PSI	kg/cm²	gpm	lpm	gpm	lpm	gpm	lpm	gpm	lpm	gpm	lpm
AME0413HD	1.625	41.27	0.036	0.12	550	38.6	14.01	53	14.36	54.35	15.26	57.77	16.16	61.17	20.65	78.17

Specifications subject to change without notice.

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

American Mfg Company
Quality Mud Pumps and Parts

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1.0 Important Safety Instructions

WARNING: Many accidents occur every year through careless use of mechanical equipment. You can avoid hazards associated with high pressure equipment by always following the safety precautions listed below.

- **SHUT DOWN OR DISENGAGE** the pump and all accessory equipment before attempting any type of service. Failure to do this could cause electrical shock or injury from moving pump parts or components under high pressure. Always adhere to "Lock Out" and "Tag Out" procedures. For mobile equipment, be sure engines and hydraulics cannot be accidentally started.

- **BLEED OFF ALL PRESSURE** to the pump and piping before performing any maintenance on the pump. Failure to do so may spray water or chemicals at high pressure or high temperature onto service personnel.

- **NEVER OPERATE THE PUMP WITHOUT A PRESSURE RELIEF VALVE**, rupture disc, or other type of properly sized over pressure safety device installed.

- **ALWAYS USE A PRESSURE GAUGE** when operating the pump. The pressure must never exceed the maximum pressure rating of the pump or damage may occur. This damage can cause leakage or structural damage resulting in injury to personnel.

- **ENSURE THAT NO VALVES ARE PLACED BETWEEN THE PUMP AND PRESSURE RELIEF VALVE.** If the pump is started with a closed or restricted valve in line before the pressure relief valve, the pump may exceed the rated or designed pressure limits and rupture causing injury to personnel.

- **USE SHIELDS OR COVERS AROUND PUMPS** when pumping hot water, chemicals, or other hazardous liquids. This precaution can prevent the exposure of service personnel to these fluids should leakage occur.

- **ALWAYS USE GUARDS** on all belt drives, couplings, and shafts. Guards can prevent personnel from becoming entangled and injured by rotating and reciprocating parts.

- **USE EXTREME CAUTION WITH SOLVENTS** used to clean or degrease equipment. Most solvents are highly flammable and toxic. Observe all safety instructions on packaging.

- **FOLLOW NORMAL ENVIRONMENTAL GUIDELINES WHEN** fluids, lubricants, or solvents are disposed of or spilled.

- **NEVER MODIFY THE PUMP** to perform beyond its rated specifications without proper authorization in writing from **AMERICAN MFG COMPANY**.

2.0 AME0413HD Pump Features

The AME0413HD drive shaft standard end comes with 1-1/8" diameter shaft and 1/4" square keyway.

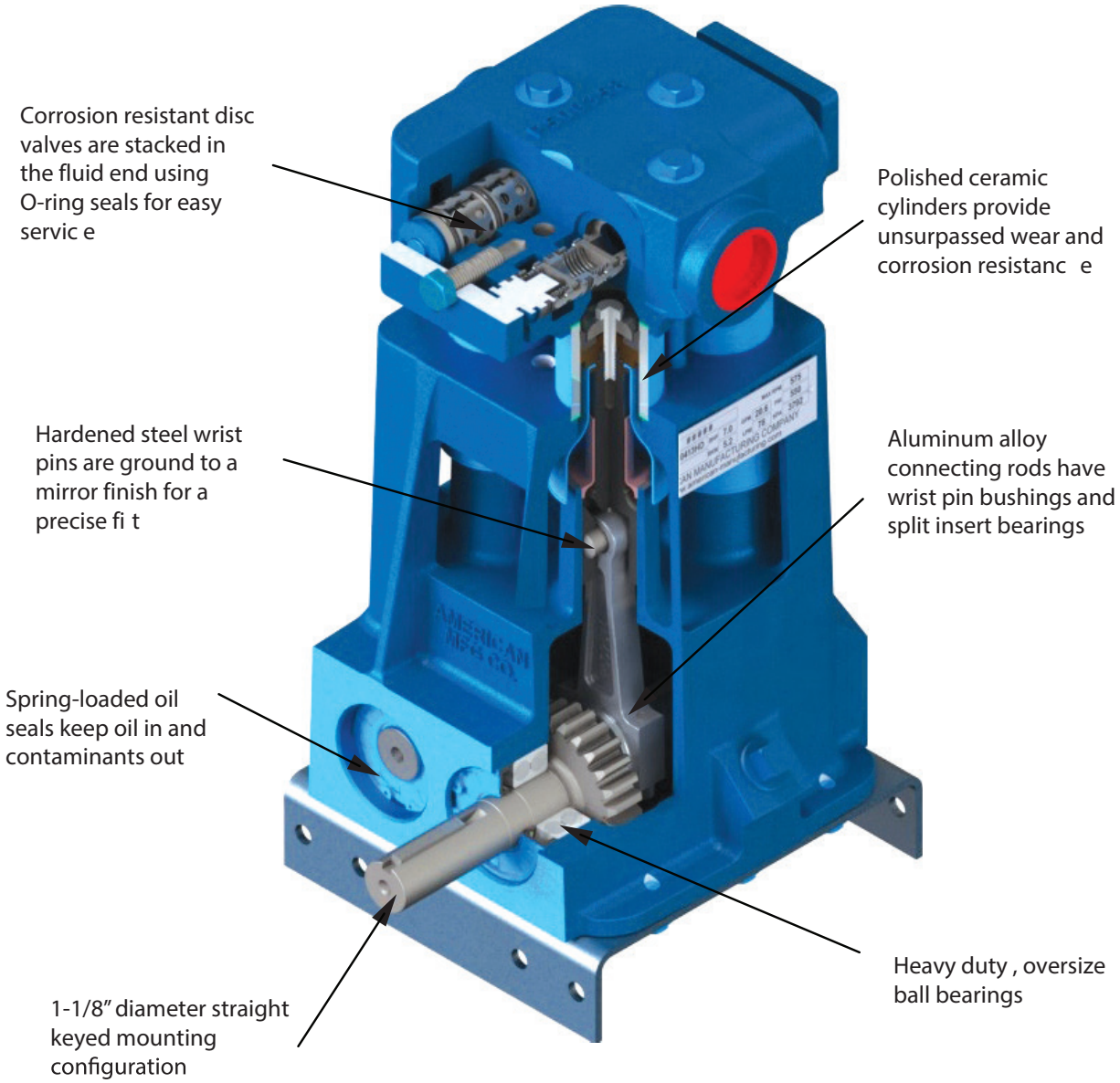


Figure 1: AME0413HD Pump Assembly

3.0 Storage Instructions

Proper storage of your American Mfg Company pump will ensure that it is ready for service 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 are prepared for storage periods of up to six (6) months in proper environmental conditions. Indoor storage in a dry, temperature-controlled location is always recommended. If pumps are to be stored short term (less than six (6) months) in a severe environment, they should be prepared using the procedures outlined in the "Short Term Storage for Severe Environments" section 3.2 below. Remember that any fluid that poses an environmental hazard or is toxic must be handled and disposed of properly.

3.1 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 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.

3.2 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 2 (see Recommended Lubricant Chart, Section 6.2), 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 ½ to 1 cup of internal rust inhibitor oil described in Table 2 into the oil fill hole and then install the filler cap. Coat all exposed, unpainted metal surfaces (for example, 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.

3.3 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). If the pump has a pinion bearing, remove the rear cover and apply recommended crankcase lubricant (Refer to Table 2 in Section 6.2) 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.

3.4 Precautions During Freezing Weather

Freezing weather can cause problems for equipment when pumping water-based fluids that expand in volume when changing from a liquid to a frozen solid state. When water is left in a pump fluid end and exposed to freezing temperatures, the expansion of the water as it freezes can rupture the fluid cylinder of the pump and cause equipment damage. Injury may result when starting equipment that has been damaged.

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

The best way to do this is to 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 as well as the suction and discharge manifolds. After the run, blow compressed air through the fluid end to remove all traces of fluid. Remove the bottom plugs and cylinder covers from the fluid cylinder. Drain the liquid from the discharge valves first and then the suction valves by lifting the valves. This ensures all fluid to be drained from the pumping chamber between the suction and discharge valves. As an alternative to the previous procedure, a compatible antifreeze solution can be circulated through the fluid end. RV antifreeze, propylene glycol, is recommended for this purpose. Remember that any fluid that poses an environmental hazard or is toxic must be handled and disposed of properly.

4.0 Installation Guidelines

A proper installation is essential to optimal performance, long service life, and reduced maintenance requirements. Take time to thoroughly plan all aspects of your installation.

4.1 General Location

It is important to position the pump on as flat and level a surface as possible to assist the splash oil lubrication system. Park mobile equipment, such as sewer cleaner trucks or drilling machines, 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.

4.2 Mounting Pump to Foundation and Power Source

The AME0413HD pump must be mounted in a vertical position only. Secure the pump to the mounting surface using the holes provided in the pump base. The design of the AME0413HD pump allows the drive shaft to be rotated in either direction. For units that are V-belt driven, check the alignment of the sheaves after the unit is installed on its permanent mounting. Tighten belts to the proper tension as recommended by the belt manufacturer. Verify that the sheaves are in line and parallel to each other with a straight edge.

CAUTION: Never operate the pump without the belt guard securely installed. For direct-coupled or spline-driven units, ensure that the shafts are centered and parallel when the driver is mounted to the pump. Follow the coupling maunufacturer instructions for installation procedures and tolerances.

CAUTION: Never operate the pump without a shaft guard securely installed.

4.3 Suction Piping Recommendations

Poor suction piping practices are a very common source of pump problems. To ensure proper operation it is very important to follow good design practice in the installation of the suction system before the pump is operated. A small amount of additional planning and investment in the piping system usually provides for better pump performance and longer periods between service requirements. 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 gauge always be installed in the suction line directly before it enters the pump.

The suction line from the fluid source to the pump should be as short and direct as possible. Use rigid piping, non-collapsible hose or a combination of both as circumstances require in your installation. The suction pipe size should be at least equal to or one size larger than the pump inlet. Long piping runs, low suction heads, or indirect

pipe routing may require even greater over sizing of the suction line for proper operation of the pump. A suction and discharge pulsation dampener is recommended to reduce the effects of acceleration head to 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 configured so there are no high spots in the line where air pockets can collect. These pockets may make the pump difficult to prime and cause rough, erratic operation. 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.

American Mfg Company recommends that all piping be supported independently of the pump. By supporting the piping this way, vibrations are reduced and stress on the pump is kept to a minimum. The use of elbows, nipples, unions, or other fittings should be minimized. Make sure that all joints and connections are airtight. Air leaks reduce the capacity of the pump and can result in cavitation, rough operation, and/or loss of prime. 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.

Always ensure that calculated system Net Positive Suction Head available, NPSHa, exceeds 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.

4.4 Discharge Piping Recommendations

1. Route the discharge piping in 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) it is suggested to use the next larger size pipe to minimize friction losses downstream of the pump.

CAUTION: 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 shown in Table 1.

Allowable Working Pressure For Steel Pipe (PSI @ 100F)				
Pipe Size (inches)	Pipe Schedule Number			
	40	80	160	XX
3/8	1,700	3,800	—	—
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

14.5PSI = 1 BAR

Table1: MAWP for steel pipe

2. **Always use 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 to conduct troubleshooting.

3. Ensure that all piping is supported independently of the pump to reduce vibrations and strain on the pump. Pulsation dampeners on the discharge are recommended to reduce pressure pulsation and resulting vibration. The use of elbows, nipples, unions, or other fittings should be kept to an absolute minimum. Avoid short radius 90° elbows; use two long radius 45° elbows instead. 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 or the use of pulsation dampeners.

4. A properly adjusted pressure relief valve or rupture disc must be installed directly downstream of the pump 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. Never install valves in the relief valve discharge line or between the pump and relief valve. American Mfg Company recommends that the discharge be returned to the tank or drain, not back into the pump suction line.

5. It is recommended that a start-up bypass line and valve be installed to allow flow to bypass the relief valve. This allows the pump to start in an unloaded condition (no discharge pressure).

5.0 How to Start a Pump

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. The checklist that follows is intended to be a general guide for starting a pump in a typical installation. Every installation is different, and each will have different requirements to ensure safe and successful operation. **It is the responsibility of the operator to determine the correct start-up procedure for each installation.**

1. Ensure that the drain plug(s) on the bottom of the pump crankcase have been installed and are tight. Ensure that the oil level sight glass, if equipped, has been properly installed.

2. 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 2 and that the oil has not been contaminated with water or other contaminants.

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 accessible, check the piston rods to ensure that they are free from abrasive particles or debris.

4. Ensure that the pressure relief valve and all accessory equipment have been installed and properly adjusted. Verify that all joints are pressure tight.

5. Open the suction line valve to allow fluid to enter 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.

6. Check to ensure that power is locked out and tagged out. Turn the pump over by hand if possible to ensure free, unobstructed operation.

7. 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.

8. The pump is now ready to start. **NOTICE:** 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. Shut down immediately if the flow becomes unsteady, pressure fluctuates, or if unusual sounds or vibrations are noted.

9. Take temperature readings of the power end and crosshead regions. Do not exceed 170°F (77°C) on power end and crosshead regions.

6.0 Lubrication of Power End

6.1 Recommended Lubricants

Few factors can influence the life of a pump more than the power end lubricant (oil). Careful selection of the right type of oil for each particular application will help ensure optimal performance from an American Mfg Company pump.

NOTE: 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 failure of power end components.

6.2 Oil Changes

Oil changes must be carried out after first 50 hours of operation, and subsequently after every 2,000 hours or at least every 3 months. These intervals may be modified depending on actual operating conditions. This model pump requires 1 quart (.95 liters) of oil.

- Oil should be changed when hot to prevent build up of sludge deposits.
- It is advisable to check 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.
- To avoid the risk of scalding or burns, pay attention to oil and power end temperature during an oil change.
- Follow environmental guidelines when changing and disposing of lubricants.

Recommended Lubricant Chart								
		Oil Lubricant				Synthetic Lubricant*		
Type of Service	Ambient Temperature	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 5W-40 NA	90.0@40 15.0@100 99.1@40 13.9@100	Shell® Rotella T Synthetic SAE 5W-40 Mobil® SCH 627
High Ambient Temperature Service	100 F to 130 F (38C 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 5W-40 NA	90.0@40 15.0@100 217@40 29.9@100	Shell® Rotella T Synthetic SAE 5W-40 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 5W-40 10W-30 NA	90.0@40 15.0@100 12.0@100 69.9@100 10.9@100	Shell® Rotella T Synthetic SAE 5W-40 BP® Vanellus E8 ULTRA 5W-30 Mobil® SCH 626
Frequent Start/Stop Operation		40	150	775	Texaco Meropa®150			
Specialty Items								
Internal Rust Inhibitor					Cortec® VCI 329			
External Rust Preventative					Texaco® Metal Protective Oil L			

Table 2: Lubricant Recommendations

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

7.0 Inspection and Preventative Maintenance Chart

Routine maintenance is an essential part of any successful pump installation. Properly maintained American Mfg Company pumps are designed to offer years of trouble-free service.

Regular maintenance and inspection will keep your pump operating at peak performance. 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 maintenance. The maintenance chart in Table 3 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.

Interval	Component	Service	Remarks
Break In Period	Crankcase Oil	Change	Drain and refill with new oil after first 50 hours of operation. Ensure that the magnetic drain plug is cleaned 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.
2,000 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 ensure they are within specification. This should be done in conjunction with oil change.

Table 3: Maintenance Chart

8.0 Component Parts List

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

AME0413HD Component Part List

Item #	Component Description	Part #	Qty
1	Power Frame	PPFMC 1273545	1
2	Crankshaft: Driven	PPFMC P509560	1
3	Crankshaft: Drive	PPFMC P510882	1
4	Connecting Rod Assembly	PPFMC P509546	4
5	Bearing Insert (Pair)	PPFMC P510834	4
6	Wrist Pin	PPFMC 1219650	4
7	Crosshead	PPFMC 1216823	4
8	Sleeve	PPFMC 1218743	4
9	Ball Bearing, Single	PPFMC 1104444	3
10	Retainer Ring	PPFMC 1118553	4
11	Seal, Oil	PPFMC 1101095	4
12	Ball Bearing, Double	PPFMC 1104508	1
13	Washer	PPFMC 1177455	12
14	Screw	PPFMC 1100068	12
15	Plug, 1/4" NPT	PPFMC 1101305	1
16	Mounting Base, Pump	PPFMC 1280633	1
17	Gasket, Pump Base	PPFMC 1273559	1
18	Key	PPFMC 1187577	1
19	Plug, 3/4" NPT	PPFMC 1105060	2
20	Screw, Drive	PPAM A100120000	4
21	Nameplate	PPAM A000522000	1
22	Fluid Cylinder	PPFMC P500358	1
23	Screw	PPFMC P522316	4
24	Valve Seat, Raised Face	PPFMC 5260142	8
25	Disc & Spring Assembly	PPFMC 5253499	8
26	Valve Cage	PPFMC 1219610	8
27	O-Ring	PPFMC 3264075	12
28	Valve Cover	PPFMC 1219614	4
29	Valve Cover Clamp	PPFMC 1255887	2
30	Screw	PPFMC 1100064	2
31	Plug, 1/4" NPT	PPFMC 1109987	1
32	Screw	PPFMC 1284516	4
33	Piston Retainer	PPFMC 5257986	4
34	Piston Cup	PPFMC 5257807	4
35	O-Ring	PPFMC 1101339	4
36	Piston Holder	PPFMC 1282557	4
37	Gasket	PPFMC A91684	8
38	Ceramic Liner	PPFMC 1241364	4
39	Umbrella (Plastic)	PPFMC 1279148	4
40	Washer, Umbrella	PPFMC 1269388	4
41	Cap Plug For 3/4" NPT	PPFMC 1177200	1
42	Cap Plug For 1-1/4" NPT	PPFMC 1177202	1

Table 4: Component Part List

8.1 Power Frame Components

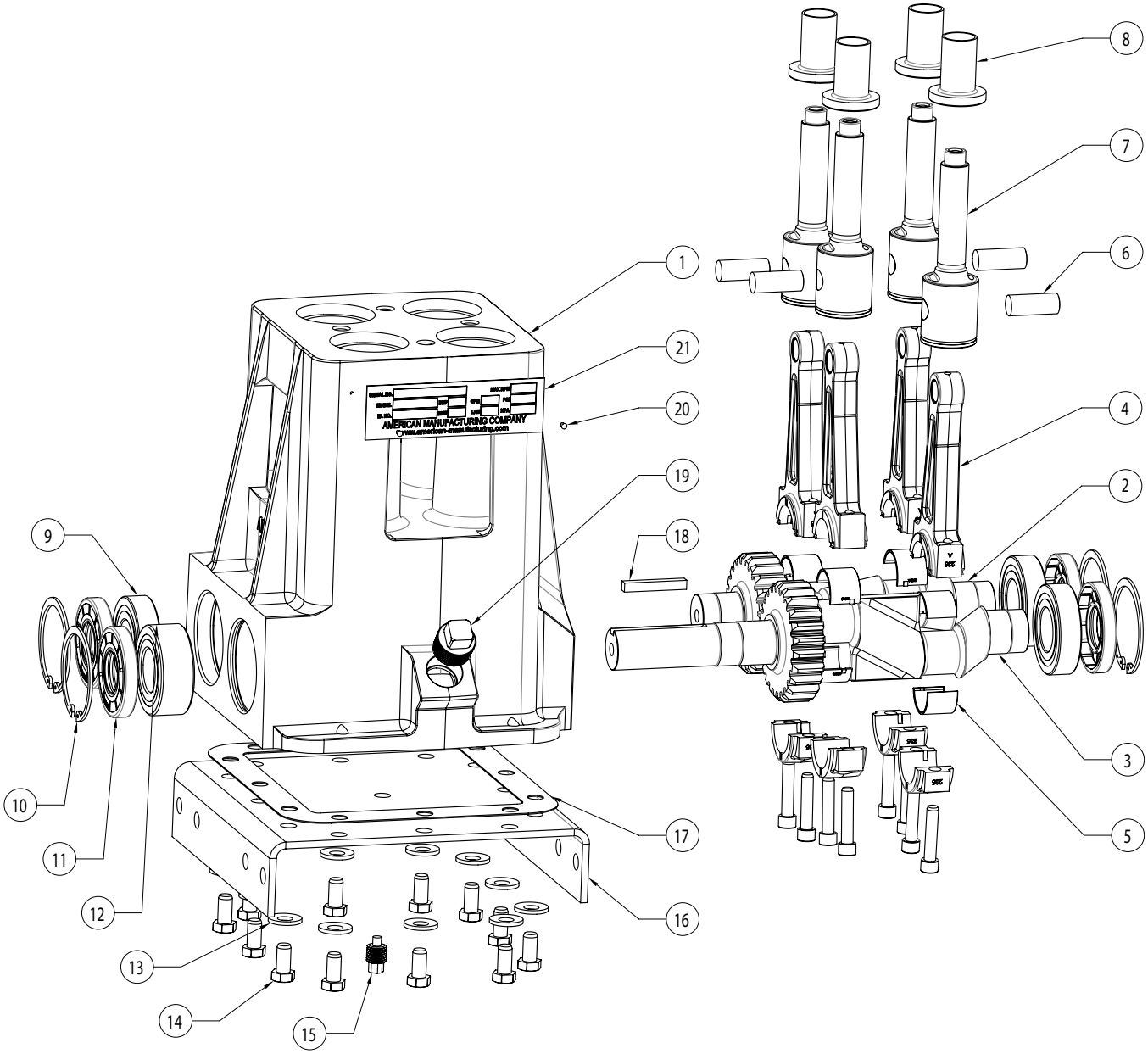


Figure 2: Power End Components

8.2 Fluid End Components

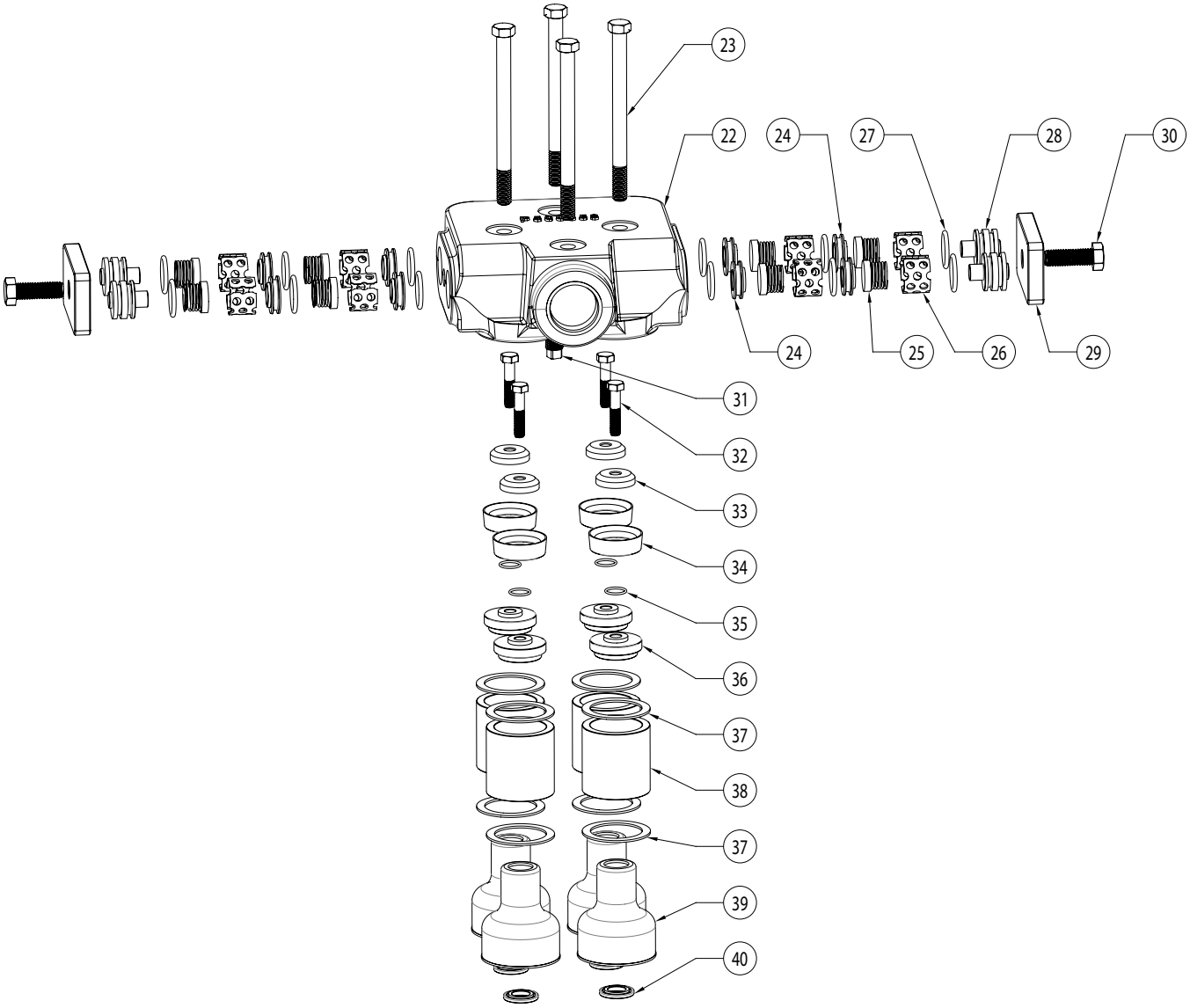


Figure 3: Fluid End Components

9.0 Service Procedures

American Mfg Company pumps are designed to simplify all required maintenance. The following sections illustrate step-by-step instructions for performing most common service procedures of a pump. Read each section before starting service work on the pump. Refer to figures 2 and 3 in section 8.0 for location of components.

CAUTION: Many accidents occur every year through careless use or service of mechanical equipment. You can avoid hazards associated with high-pressure equipment by always following the safety precautions listed in Section 1.0.

CAUTION: Ensure that all pressure inside the pump fluid cylinder has been bled off before starting any service work. Ensure that the power to the pump is off. If applicable, it should be locked and tagged out.

9.1 Replacing Cup Pistons

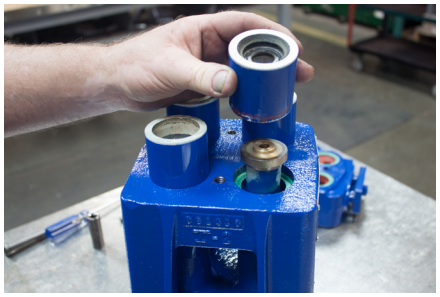
1. Remove the fluid cylinder (22) to provide access the piston cups (34). To remove the fluid cylinder, first remove the four hex bolts (23) holding the fluid cylinder to the power frame (1), then lift it off exposing the ceramic cylinders (38).

2. Remove the gaskets (37) from the top of the cylinders or from the counter bores of the fluid cylinder.

3. Each piston cup (34) is held in place with a cap screw (32) and piston retainer (33). Remove the cap screw and piston retainer from each of the four cylinders.

4. Lift each ceramic cylinder (38) off from the top of the power frame. Friction will usually keep the piston cup inside the cylinder as it is removed. Once the cylinder and pistons are removed, take them to a bench and push the piston cup out of the cylinder.

5. Remove the piston holder (36) and o-ring (35) from the crosshead shaft (7).



6. Inspect all o-rings, gaskets, seals, and other components for signs of damage or wear. Any damaged components should be replaced at this time. Inspect the ceramic cylinders for cracks or grooves by visual inspection and running thumbnail around the bore of the cylinder. Replace if grooves, wear or cracks are detected. New piston cups will wear quickly if operated in cylinders with rough or grooved bores.

Note: To provide maximum operational time between service, American Mfg Company recommends that all four piston cups, not just the one that shows signs of leakage, be replaced whenever piston service is required. Also, it is recommended that all gaskets and/or o-rings be replaced at each piston cup service interval.

7. The plastic umbrella shields (39) keep any fluid that leaks past the piston cups (34) from entering the power frame and contaminating the oil reservoir. Ensure that the umbrella fluid shield is not damaged. If the umbrella requires replacement, the best way to remove it from the pump is to cut it free with a sharp knife.

8. To install new umbrella shields, fold the plastic as shown and insert through the opening of the crosshead bore of the power frame, and over the ends of the crosshead shaft. For easier installation of the umbrella, immerse in boiling water for 2-3 minutes to soften. Use caution to avoid burns or scalds when working with hot water.

9. Once the umbrellas are installed over the crosshead shaft, lift them up slightly and insert the umbrella washer (40) through the upper opening of the umbrella. Ensure the groove of the washer is facing up. Press the top of the umbrella down to seat over the umbrella washer and crosshead shaft.

10. To rebuild, first place piston o-rings (35) and piston holders (36) in position on ends of crosshead shaft (7).

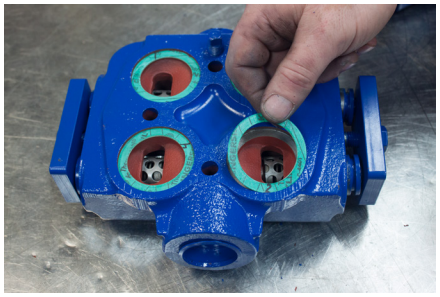
11. Place gaskets (37) and ceramic cylinder in counterbore of power frame.

12. Apply light oil or glycerin around the OD of the piston cups, then place them in the open (top) end of the cylinders. Use thumb to press the cups down firmly into the holder of each cylinder.

13. Insert the piston retainer (33) into the cylinders with the ribbed side facing the piston cup.

14. Secure piston assembly using cap screws (32). Torque to specification per the Fastener Torque table in section 10.0 (See Table 5).

15. Insert gasket (37) in fluid cylinder counterbore using heavy oil or grease to hold in place.

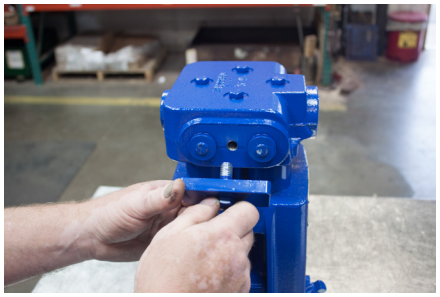


16. Return fluid cylinder to position over cylinders and ensure that all seals are in place. Use a slight twisting motion on the fluid end to ensure all cylinders are fully seated in fluid end counterbores.

17. Replace fluid end cap screws (23). Torque cap screws in 3 stages to specification per the Fastener Torque table in section 10.0 (See Table 5).

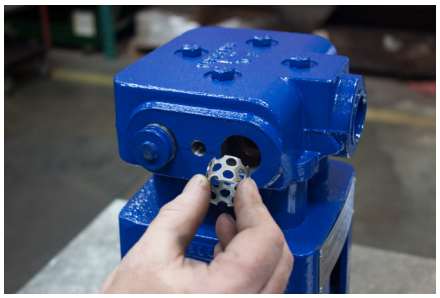
9.2 Replacing Suction and Discharge Valves

1. To access the suction and discharge valves, the valve cover clamps (29) must be removed from each side of the fluid cylinder. Remove the cap screws (30) and valve cover clamp from the each side of the fluid cylinder.

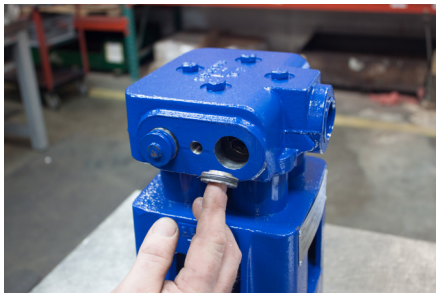


2. Insert the end of a standard screwdriver into the valve cover groove and pry each of the four the valve covers (28) away from the fluid cylinder.

3. Remove the valve cage (26) and disc-spring assembly (25) from all 4 cylinder bores of the fluid cylinder.



4. Use a finger to reach through the opening at the center of the seat (24) and work the valve seat loose from the fluid cylinder bore. Note, the optional valve seat removal tool (PPFMC 1250638, Figure 4) may be used to simplify this procedure.



5. Use the same procedure to remove the suction valve cage, valve disc-spring and valve seat, which are located directly under the discharge valve seat. Turning the valve seat on edge will help it go through the discharge valve seating area easier. Repeat for the remaining three (3) pump cylinders.

6. Inspect all valve components and replace as necessary.

NOTE: Even small damage or erosion to the sealing area of the valve or the o-ring can adversely affect the performance of the pump.

7. With the new o-ring (27) in place on each valve seat, place a few drops of light oil around the o-ring to aid in installation. Place each valve seat SQUARELY in the counterbore in the bottom of the fluid cylinder.

8. Place the valve cage (26) on the valve seat (24) and insert the disc and spring assembly (25) inside of the cage on the valve seat.

9. Repeat the previous two steps to install the discharge valve seat and the discharge valve cage.

10. Place the valve covers (28), with o-rings (27) on BOTTOM groove, in place over the valve assembly.

11. Replace valve cover clamp and cap screw and torque to specification per the Fastener Torque table in section 10.0 (See Table 5). Note: Over-tightening the cap screw can damage the valve components.

Figure 4: Valve Seat Removal Tool (PPFMC 1250638)

9.3 Servicing the Power End

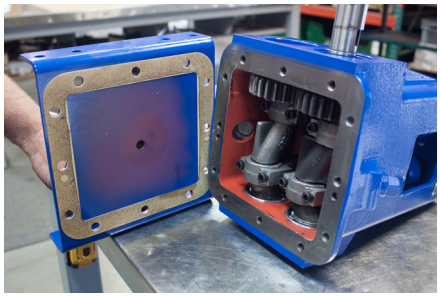
CAUTION: Ensure that all pressure inside the pump fluid cylinder has been bled off before starting any service work. Ensure that the power to the pump is off. If applicable, it should be locked and tagged out.

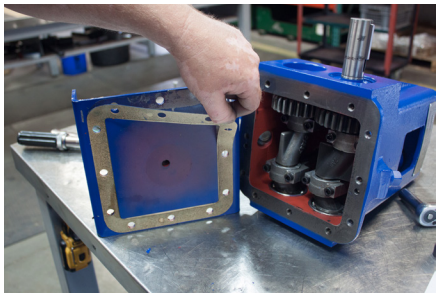
1. Remove bottom drain pipe plug (15) and drain all oil from the power frame.

2. Disconnect suction and discharge piping, power source, and remove pump from mounting base.

3. Although it is not required, it is easier to remove the crankshafts (2,3) if the fluid end and pistons have been removed first. To remove the fluid end, refer to Section 9.1.

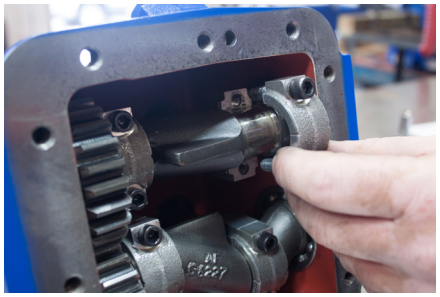
4. Remove the 12 hex head cap screws (14), washers (13), and base (16) from bottom of pump. After the base is removed, the pump base gasket (17) can be removed. Take care not to damage the pump base gasket.





5. Remove cap screws (4) from the connecting rod assemblies (4) and take out the back half of connecting rod shell bearings (5). Note the orientation of the machine markings on the connecting rod and cap.

NOTE: Connecting rod halves are not interchangeable and must be reassembled in their original orientation and in the same cylinder.



6. Push the connecting rods and crosshead assemblies as far forward into the power frame as possible to provide clearance for the crankshafts.

7. Use snap ring pliers to remove the four crankshaft retainer snap rings (10) from each side of the pump.

8. Using a hammer and wood block (or rubber mallet) drive each crankshaft until one bearing (9, 12) on each shaft clears the power frame. Drive from the gear side of the shafts.

9. If bearing replacement is required, remove bearings from the crankshaft using a press. Be sure to provide suitable support for the backside of the bearings during this step.

NOTE: Never pound directly on the bearings or they may be damaged.

10. The wrist pin (6) is a slip fit through the connecting rod and crosshead. Check for signs of wear on the pin and connecting rod bushing. For critical clearance dimensions see section 11.0. (Reference Table 6).

11. Replace the pin if noticeable wear is found. The complete connecting rod assembly must be replaced if the bushing is worn, as the wrist pin bushing is not field replaceable.

12. When reassembling the connecting rod and cap, ensure that these parts are reassembled in their exact former orientation and position.

13. Carefully clean and inspect all parts. Replace worn or damaged components as necessary.

14. Ensure that timing marks on gears are aligned as shown for proper piston motion. Arrow (or dot) on one gear must be centered between two arrows (or dots) on other gear.

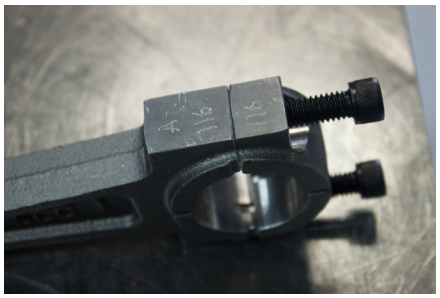
15. Install the crosshead and connecting rod assemblies to their original position in the power frame.

16. Install the crankshafts with bearings in the power frame.

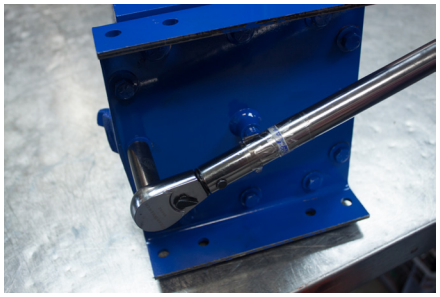
17. Place the oil seals (11) over the ends of the crankshaft with the lip of the seals facing the inside of the power frame.

18. Seat the snap rings in the grooves in the bearing housing against the oil seals and tap the crankshaft to allow a SLIGHT endplay in the crankshaft.

19. Reassemble the connecting rods and shell bearings around the crankshaft. The connecting rod and cap are a matched set. Be sure to properly match the connecting rods and caps back into their original position, orientation, and cylinder. Torque connecting rod bolts to specification per the Fastener Torque table in section 10.0 (See Table 5).



20. Complete the reassembly by reversing steps 1-4. Torque the back cover cap screws (14) and washers (13) to specification per the Fastener Torque table in section 10.0 (See Table 5).



21. Reinstall the drain pipe plug in the mounting base.

22. Refill the power frame with oil and turn the shaft over several revolutions by hand. When piston cups are not installed the pump shaft should rotate freely. See Table 2 in section 6.2 for oil type and filling instructions.

NOTE: The AME0413HD pump models require 1 quart (0.95 liters) of oil.

10.0 Fastener Torque Requirements

NOTICE: No pump service procedure is complete without applying the proper fastener torque. Failure to properly tighten the pump bolts could cause the pump to leak or possibly allow the pump to fail. Always use a calibrated torque wrench during the installation of all critical fasteners listed in Table 5 below. Values are in foot- pounds (Ft-lb) and Newton meters (N-m). Typical sizes are shown in Table 5 below.

Torque Requirements

Item #	Component Description	Bolt Size	Ft-lb	(N-m)
	Power End			
4	Connecting Rod Bolts	.313 (5/16)	15	20
32	Piston Assembly Bolts	.313 (5/16)	15	20
14	Pump Base Bolts	.375 (3/8)	15	20
	Fluid End			
23	Fluid End Attaching Bolts	.4375 (7/16)	60	81
30	Valve Cover Clamp Bolts	.500 (1/2)	60	81

Table 5: Torque Values for Critical Pump Fasteners

11.0 Critical Clearances

When maintenance requiring disassembly of the power end is performed, the following clearances should be checked to see if they are within factory specification or within maximum allowable limits. Additional clearance is allowed for component wear. This additional clearance is a maximum of .002 inches of total diametral wear that can be added to the clearance values in Table 6. For radial clearance, use ½ of the total diametral value. All dimensions are shown in inches.

Description	Clearance
Crankshaft Throw Diameter (Stroke)	1.00
Crankshaft Pin or Journal (OD)	1.1733/1.1743
Connecting Rod / Crank Clearance (Max. Total)	.007
Crosshead Diameter (OD)	1.498/1.500
Crosshead Cylinder Bore (ID)	1.501/1.504
Crosshead to Bore Clearance (Max. Total)	.006
Wrist Pin Bushing Bore (ID)	.560/.562
Wrist Pin to Bore Clearance (Max. Total)	.0035

Table 6: Clearance Chart

Metric Conversion: 1 inch = 25.4 mm
1 mm = 0.03937 inches

NOTE: Clearances shown are total diametral values: For radial clearance use ½ the value shown.

12.0 Trouble-Shooting Pumps

This chart is designed to aid in the solution of pump and pump system problems. Once the problem has been identified, work through the possible causes and solutions until the problem has been corrected.

Symptom	Possible Cause	Possible Solution
No flow from pump	• No liquid in reservoir (tank) • Inlet line valve closed • Inlet strainer is totally clogged with debris • Crankshaft is not turning	• Ensure lines are connected and fill tank • Ensure lines are connected and open valve • Clean or replace strainer • Check for power to drive and drive connections
Insufficient pressure from pump (ONLY)	• Pump speed is too low • Relief valve improperly adjusted or worn • Insufficient system resistance (worn nozzle) • Worn check valves • Excessive leakage from pump seals	• Check belt tightness or power to motor • Check relief valve and adjust setting • Properly service system • Inspect check valves and repair or replace • Adjust or replace piston cup or damaged parts
Insufficient flow from pump (ONLY)	• Pump speed is too low • Relief valve improperly adjusted or worn • Worn pump valves • Excessive leakage from pump seals • Plunger or piston worn • Valve seat washed out in fluid cylinder	• Check belt tightness or power to motor • Check relief valve and adjust setting • Inspect pump valves and repair or replace • Adjust or replace packing or damaged parts • Replace plunger or piston • Repair or replace fluid cylinder
Insufficient flow or pressure AND rough operation (pump pounds or vibrates)	• All pump cylinders not primed • By-pass or relief is piped back to suction • Inlet line too long or too small in diameter • Insufficient NPSHA • Air leaks in suction line or fittings • Vortex in tank near inlet pipe opening • Pump valve stuck open or closed • Valve assembly damaged or unseated • Valve seat washed out in fluid cylinder • Gas pocket formation from high spots in suction	• Prime all chambers • Pipe back to reservoir (tank) • Increase suction pipe size • Provide more NPSH • Correct installation to stop leaks • Increase submergence or baffle to stop vortex • Clean and deburr valve • Properly seat or repair valve • Repair or replace valve seats • Correct suction line installation

Symptom	Possible Cause	Possible Solution
Pump runs rough, knocks, or vibrates (ONLY)	• Broken or weak valve spring • Valve damaged or unseated • Loose plunger, piston, or rod • Low oil level in power end • Excessive connecting rod brg clearance • Excessive main bearing clearance • Worn wrist pin or bearing • Insufficient NPSHA • Excessive acceleration head in suction line • Pulsation dampener improperly charged • Inlet line too long or too small in diameter • Worn piston seal allows air ingress (usually observed when booster not used)	• Replace disc and spring assembly • Repair/replace valve or re-seat • Tighten loose components • Fill to proper level • Check cap torque or replace bearings • Adjust end-play • Replace worn components • Provide more NPSH • Install suction stabilizer • Charge to proper pressure • Increase suction pipe size • Replace piston seal
Rapid suction pressure fluctuation	• Pump cavitation • Air is entering suction line	• Increase suction size or NPSH • Correct installation to stop leaks
Piping vibration	• Same as Pump runs rough above • Excessive pressure variation in discharge • Piping inadequately supported • Excessive short-radius elbows or tees	• See above • Install discharge pulsation dampener • Install supports at proper locations • Correct installation to minimize turns and short-radius fittings
Pump requires excessive power	• Discharge pressure too high • Speed too high • Misaligned coupling • Belts too tight • Low motor voltage	• Reduce system back-pressure or adjust relief valve • Reduce speed • Correct alignment • Correctly adjust belt tension • Supply correct voltage
Power end overheats (over 180° F) and/ or reduced power component end life	• Discharge and/or suction pressure too high • Oil level too high or too low • Contaminated power end oil • Incorrect oil viscosity or grade • Misaligned coupling • Belts too tight • Pump located too close to heat source • Worn or damaged power end bearings	• Reduce pressure or reduce plunger size • Adjust to correct oil level • Refill with clean oil & eliminate contamination • Fill with correct oil • Correct alignment • Correctly adjust belt tension • Remove heat source or insulate power end • Replace damaged bearings

Symptom	Possible Cause	Possible Solution
Crankshaft jerks or starts and stops rotation	• Drive belts loose and slipping (if equipped) • System relief valve pressure set too high • Discharge line blocked or partially blocked	• Correctly adjust belt tension • Reduce relief valve pressure setting • Clear obstructions from piping system
Fluid leaking from pump	• Piston cups are worn • Piston to rod o-ring damaged • Fluid cylinder bolts not properly tightened • Fluid cylinder o-rings (or gaskets) damaged	• Replace piston cup • Replace o-ring • Properly tighten and torque bolts • Replace damaged o-rings or gaskets
Reduced piston cup life	• Highly abrasive particles in fluid • Packing or piston cups run dry • Incorrect cups for fluid type • Pump was run dry for extended time • Worn plunger or cup holder • Worn cylinder liner bore	• Install strainer or filter • Correct problem & replace packing or cup • Change to correct cup • Correct problem and replace cups • Replace plunger or cup holder • Replace cylinder liner
Reduced valve life	• Highly abrasive particles in fluid • Cavitation damage • 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 • Increase submergence or baffle to stop vortex • Pipe back to reservoir (tank) • Replace damaged components
Cracked fluid cylinder or broken fluid end bolts	• Discharge pressure too high • Hydraulic shock (cavitation or entrained 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 damaged components • 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 is contaminated	• Extended operation with failed piston cup • Hi-pressure sprayer nozzle near breather or seals • Pony rod seals or umbrella damaged	• Replace piston cup and improve monitoring • Provide shields to protect breather and seals • Replace oil seals or umbrellas

13.0 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 drawing and bill of material included on pages 17, 18, and 19 with this manual to determine the components and corresponding part numbers required to service the pump. Make sure that the model number on the drawing or bill of material matches the model number of the pump requiring parts.

When ordering parts, always reference the model 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.

14.0 Pump Mounting Dimensions

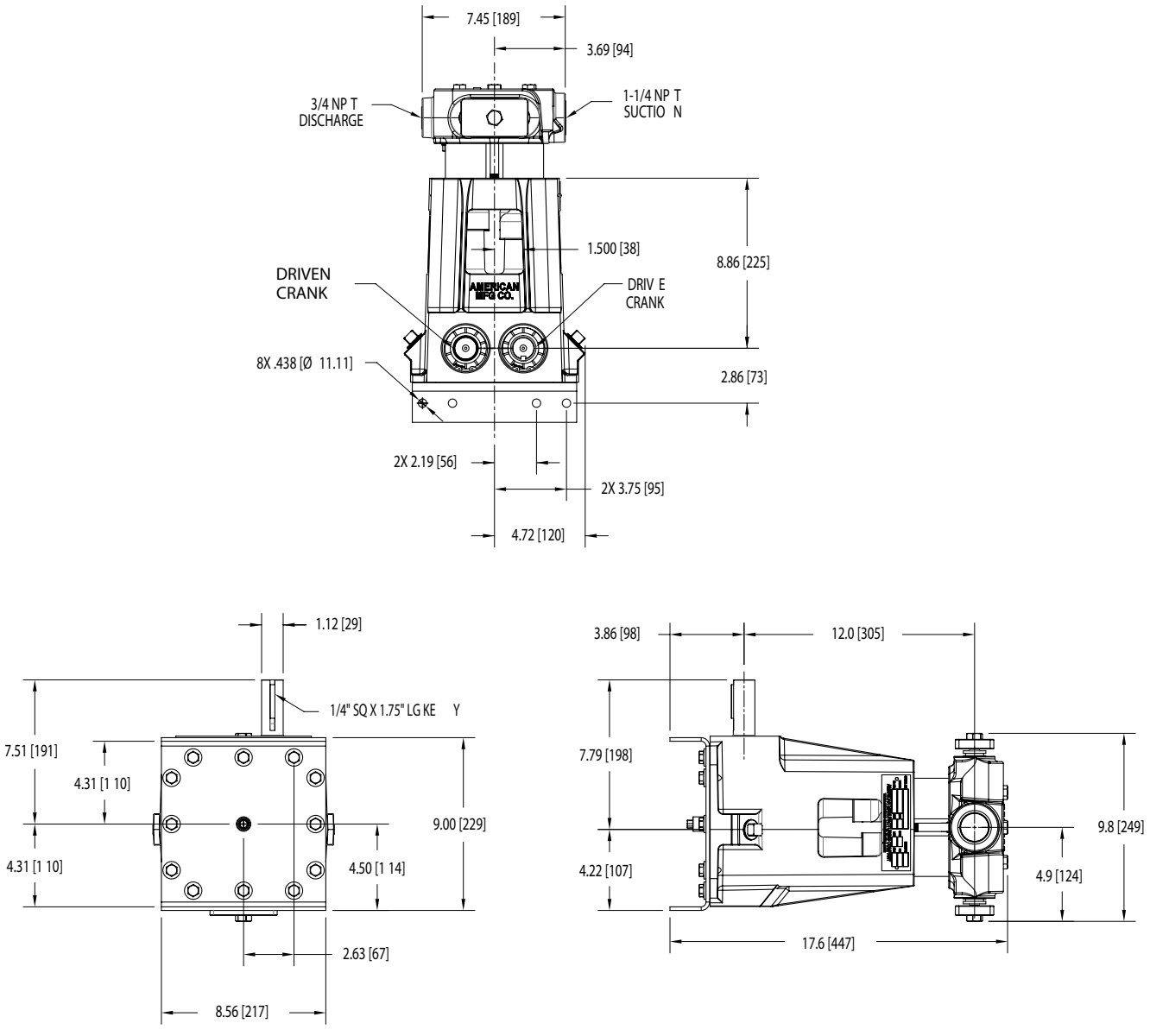


Figure 5: Pump Mounting Dimensions

15.0 Glossary of Commonly Used Terms

CAPACITY – The total volume throughput per unit of time at suction conditions. It includes both liquid and any dissolved or entrained gases. For all practical purposes this can be considered the volume flow rate in the suction pipe. The standard unit of pump capacity is U.S. gallons per minute (GPM) and metric cubic meters per hour (m3/hr).

CAVITATION – The state where fluid pressure drops below vapor pressure, causing the liquid to begin to change from a liquid to a gas and boil. Usually occurs in the chamber between the suction and discharge valves during the suction stroke, and often sounds like a mechanical knock. Cavitation results in the formation of gas bubbles, or cavities, in the fluid that cause vibration and damage to components when they collapse.

DAMPENER – A device that reduces pressure pulsations in the suction or discharge piping. This may be referred to as a suction stabilizer, accumulator, or surge suppressor.

DISPLACEMENT – The volume swept by all pistons or plungers per unit time. This term is typically expressed as gallons per revolution.

FLOODED SUCTION – Implies that the level of liquid in the suction vessel is above the centerline of the suction port of the pump.

FLUID END – The portion of the pump that converts the linear motion supplied by the power end into fluid flow at pressure. This may also be called the Liquid End. It is called a valve chamber in old literature.

MECHANICAL EFFICIENCY – Mechanical efficiency (ME) is the ratio, expressed as a percentage, of pump power output to the pump power input. The mechanical efficiency of reciprocating pumps is very high, typically 85% to 90%.

NPSHa – An abbreviation that stands for Net Positive Suction Head Available. NPSHA is the total suction pressure, including allowance for acceleration head, available from the system at the pump suction connection, minus the vapor pressure of the liquid at actual pumping temperature. NPSHA for a reciprocating pump is normally expressed in units of feet of water.

NPSHr – An abbreviation that stands for "Net Positive Suction Head Required". This is the minimum total inlet pressure required by the pump for proper operation. This value is a function of pump design and speed and is determined by the pump manufacturer through a specific NPSH test. NPSHA should exceed NPSHR by at least 5 feet.

PISTON PUMP – A type of power pump that uses a cylindrical seal (piston) mounted on a holder to drive fluid through the valves. The piston seal reciprocates within a stationary cylinder.

PLUNGER PUMP – A type of power pump that uses a cylindrical plunger to drive fluid through the valves. The plunger reciprocates through a stationary set of seals known as packing.

POWER END – The portion of the pump that converts supplied rotary motion into linear motion used by the Fluid End to move the pumpage.

POWER FRAME – The major portion of a power pump that encloses and supports all other components of the power (or drive) end. It is called a pump case in old literature.

POWER PUMP – A reciprocating pump that drives the pumping element(s) using a slider crank mechanism. Power pumps are piston, plunger, or diaphragm type. All require a driver with a rotating shaft, such as a motor or engine, as a power source.

PUMP VALVE – A check valve that allows flow of liquid in one direction. American Mfg Company pumps have a series of two valves, one suction (inlet) and one discharge, per pumping cylinder.

STROKE LENGTH – The length of one complete, unidirectional motion of the piston or plunger. Stroke length is usually expressed in inches.

VOLUMETRIC EFFICIENCY – Volumetric efficiency (VE) is the ratio of actual pump capacity output to theoretical displacement. The volumetric efficiency is affected by the fluid being pumped and the discharge pressure.

16.0 Reference Information

Use the following section to record key information about your specific pump model. Information such as part and serial numbers will be needed when ordering service parts. This data may be found stamped on the metal nameplate located on the pump power frame. This area may also be used to make notations about special parts, procedures, phone numbers, or other important information related to your pump.

Pump Model _____

Serial Number _____

Rated Pressure _____

Rated Capacity _____

Rated Speed _____

Notes:

17.0 Maintenance Log

Date	Service By	Service Performed	Remarks