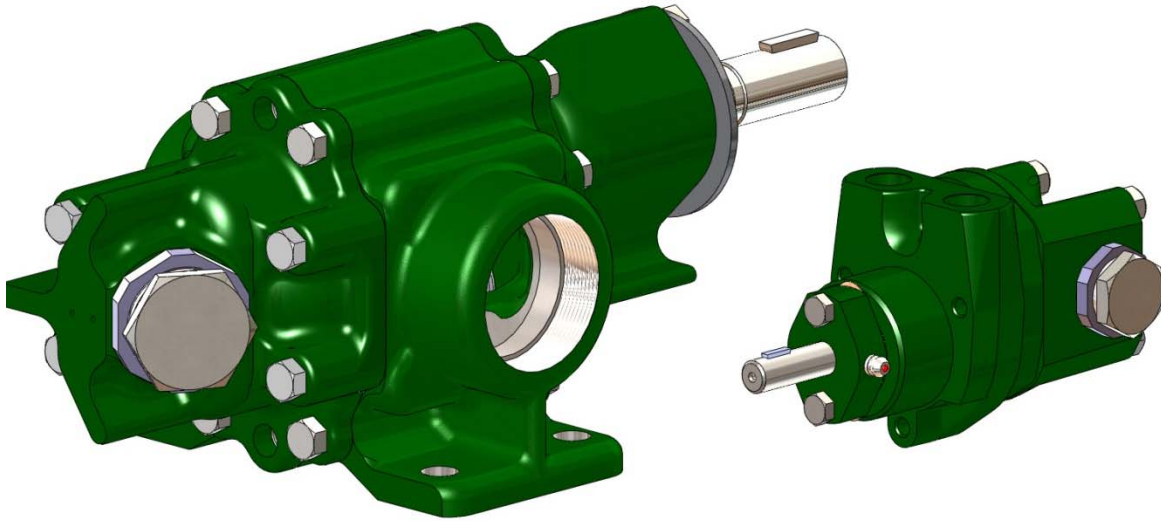




AM, AP, & AL SERIES OWNERS MANUAL

G12-207
09/01/2014



SAFETY INSTRUCTIONS

This is an industrial component. Only a qualified systems integrator should be allowed to design it into a system. The integrator must determine proper plumbing, mounting, driveline and guard components.

Improper installation or use could lead to a serious, even fatal, accident. The system integrator must communicate all safe operation procedures to the end user(s).

Before operation, fully understand and follow the instructions shown in this manual and any instructions communicated by the system integrator. No one should be allowed to operate or maintain this pump who has not been fully trained to work safely according to the configuration of the pump system and in accordance with all applicable government and industry regulations.

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Roper Pump Company
P.O. Box 269
Commerce, GA 30529 USA

Telephone: (706) 335-5551
TeleFAX: (706) 335-5490
Email: sales@roperpumps.com
www.roperpumps.com

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1. GENERAL GUIDELINES

Note: These are general guidelines and do not cover all possible situations. It is the responsibility of the system integrator to apply this product properly.

• Plumbing

1. The inlet pipe should be as short and straight as possible to minimize suction pressure losses. Excessive restrictions at the inlet can cause cavitation resulting in poor performance, noise, vibration, or pump damage.
2. Slope the inlet plumbing appropriately to avoid air pockets.
3. Plumbing weight, misalignment with the ports or thermal expansion can exert excessive force on the pump. Plumbing must be properly supported and aligned with expansion joints, if required, to minimize these forces.
4. To prevent over pressure situations, install a relief valve as close to the pump outlet as possible. Install the relief valve before any shut-off valves.

DO NOT use Thread Seal (Teflon®) tape on pump port threads.

• Pump and Drive Assemblies

1. Assure adequate guards have been installed to prevent personnel contacting moving components.
2. Follow all OSHA, Federal, state, and local codes.

• Check Alignment of Pump to Driveline

Excessive misalignment can overload the pump input shaft and cause premature failure. The figures below show parallel and angular misalignments.

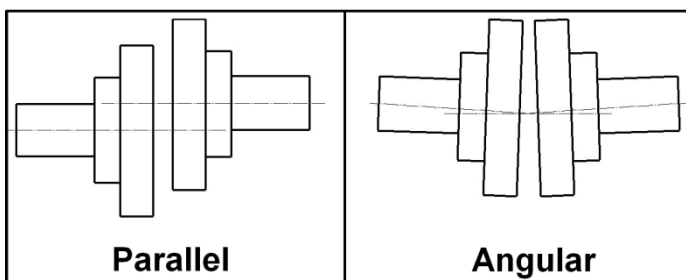
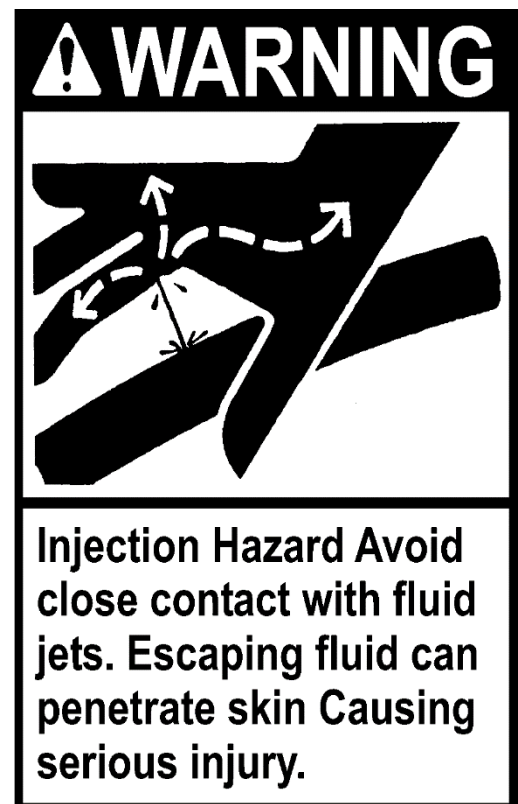
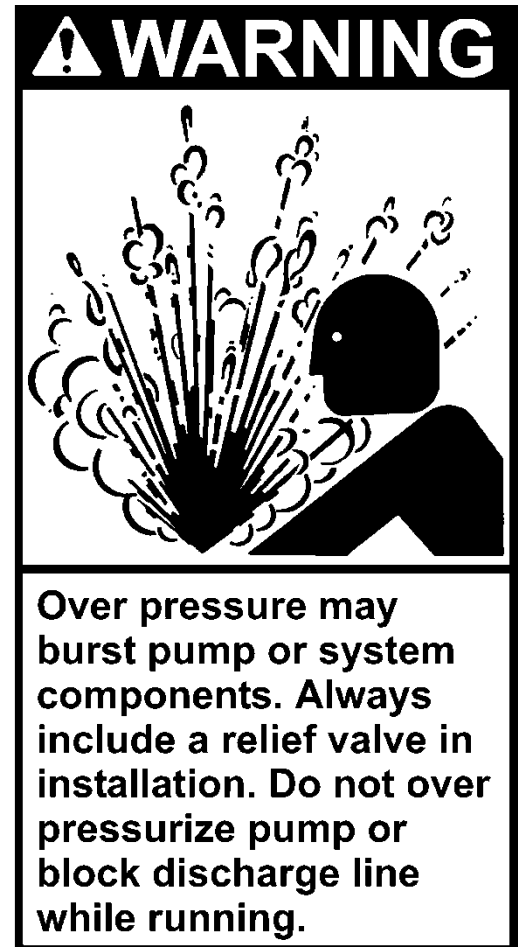


Figure 1-1: Coupling Alignment



- **Mounting Base**

1. Mount the unit on a rigid, heavy base to provide support and absorb shock. Bases should be designed for high rigidity; not just strength.
2. The pump feet were not designed for mounting to concrete and do not have enough contact area to prevent concrete from failing. When mounting to cement or concrete, use a steel baseplate to distribute the mounting stress over an area large enough to prevent the cement from failing. Grout it in place.

- **Roper Pumps' Close Coupled Drives**

The hydraulic or gearmotor units mount directly to the pump.

- Alignment between pump and driveline is maintained by the assembly.

Because the assembly absorbs reaction forces of the driveline, the mounting base does not need to be as robust. The level of rigidity and strength is determined by the piping stresses from the system.

- **Guarding PTO Drive Shafts**

PTO drive systems can be dangerous and when used, additional safety precautions, including guarding, may be required and must be provided by the drive system installer. Roper Pump Company has no responsibility for recommending or providing proper guarding or other safety measures in any particular application.

The installation of proper guards for the power take-off and its associated equipment is the responsibility of the drive system designer and the installer who know the particular product application and the user's exposure to danger. *The ultimate responsibility for the safe application and installation is the user's.*



2. NAMEPLATE DATA

Roper Pump Company identifies each pump manufactured by a metal nameplate attached to the pump. This nameplate describes the pump as built at the factory. Copy the nameplate data from your pump in the area provided below. Use this for ready reference when ordering repair parts or when consulting with a Roper distributor or Roper Pump Company about this pump.

PUMP NOMENCLATURE EXAMPLE:

FIGURE 17AM08LW

SPEC 00000 TYPE 1

SERIAL NO. 000000

PUMP NOMENCLATURE (from your nameplate):

FIGURE: _____

SPEC: _____ TYPE: _____

SERIAL NO. _____

A. Figure (Model Number)

The figure number consists of a five, six, or seven digit number.

- The first and, in some instances, the second digits indicates the mounting arrangement and relief valve (RV).

1 = Foot mounted, No RV
 2 = Foot mounted with RV
 17 = Flange mounted, No RV
 18 = Flange mounted with RV

25 = Baseplate mounted, No RV
 26 = Baseplate mounted with RV
 33 = Close Coupled, No RV
 34 = Close Coupled with RV

- The next two digits indicate shaft sealing.

AL = Lip Seal
 AM = Mechanical Seal
 AP = Packing

- The next two or three digits indicate the approximate theoretical displacement in US gallons per 100 revolutions [Liters/100 rev].

005 = .005 [.019]
 01 = .01 [.038]
 02 = .02 [.076]
 03 = .03 [.114]

06 = .06 [.227]
 08 = .08 [.303]
 12 = .12 [.454]
 16 = .16 [.606]

21 = .21 [.795]
 27 = .27 [1.022]
 32 = .32 [1.211]
 40 = .40 [1.514]

- The next one or two letters indicate the direction of rotation and shaft position. The letter "L" indicates low drive. If the letter "L" is not used, the shaft position is high drive. Not all rotations are available for all sizes. Refer to **Section 6. DIRECTION OF ROTATION** for illustrations and further explanation of directions of rotations. CW = clockwise rotation; CCW = counterclockwise rotation.

High Drive:
 No letter or W = CW (standard rotation for most sizes)
 X = CCW
 Y = CW
 Z = CCW

Low Drive:
 LW = CW
 LX = CCW
 LY = CW
 LZ = CCW

B. Spec

Occasionally, special pumps or configurations are required which are unique for a particular application. These modifications are clarified by a **SPEC**ification number. Identification of any items different than a standard pump can be made by consulting Roper Pump Company or an authorized distributor.

C. Type

The TYPE number is a number used by Roper Pump Company for in-house identification of construction and hydraulics. Always include the type number in any references to the pump.

D. Serial Number

The SERIAL number is a unique number assigned to each pump built by Roper Pump Company.

In any communication concerning this pump, always be sure to include the Model, Spec, Type, and Serial number so proper identification of the pump can be assured.

As stated in the explanation of the pump nomenclature, all characters may not appear on every pump nameplate. The preceding description of the figure number is to assist in identifying your Roper A Series pump only. **DO NOT** attempt to derive any ratings or performance from the figure number. **DO NOT** use the explanation of the figure number to construct your own pump. Not all combinations are possible. For assistance in pump selection, it is recommended that you consult Roper Pump Company or an authorized distributor.

3. MAXIMUM PUMP RATINGS

Maximum Ratings				
Pump Size	Flow Rate GPM	Pressure PSI	*Temperature °F	Input Speed RPM
005	1.8	300	212	3600
01	3.6	300	212	3600
02	7.6	300	212	3600
03	11.6	300	212	3600
06	11.2	150	212	1800
08	16.3	150	212	1800
12	23.5	150	212	1800
16	30.8	150	212	1800
21	40.2	150	212	1800
27	49.8	150	212	1800
32	59.1	150	212	1800
40	75.6	150	212	1800

Note: Optional outboard ball bearing is recommended on A 06 – A 40 sizes for applications that have over 25 PSI inlet pressure or the viscosity of the liquid pumped is 40 SSU or below.

***Temperatures up to 450°F may be achieved using material options available. Consult factory for details.**

4. PREOPERATIONS CHECK

Read and understand the instructions and recommendations contained in this manual.

Disconnect the coupling between the driver and pump.

Test the rotation of the driver to make sure it will operate the pump in the desired direction of rotation. When an integral relief valve is used, make sure it is positioned and adjusted as discussed in **Section 6. DIRECTION OF ROTATION**. After the unit is mounted and the piping is connected, the pump should be checked to be sure it operates freely without binding. After operation is proved satisfactory, both pump and driver should be tightly secured and the alignment rechecked before operation.

Before starting, make sure all guards are in place and the inlet and discharge valves are opened.

After starting the unit, check to see that the pump is delivering liquid. If not, stop the driver immediately and correct the problem. After the pump is delivering liquid, check the unit for: excessive vibration, localized heating, or excessive shaft seal leakage. Check the pressure or vacuum by installing gauges at both the inlet and discharge sides of the pump to make sure the pressure or vacuum conforms to specifications.

5. RECOMMENDED TOOL LIST

NOTE: Tools are not furnished with the pump.

- **Tools for all Pumps:**

- (1) Safety Glasses
- (1) 7/16" Combination Wrench
- (1) 1/2" Combination Wrench
- (1) 9/16" Combination Wrench
- (1) CG-40C Snap-On®¹ Tool Bearing Puller
- (1) 8oz. Ball-Peen Hammer

- **Additional Tools for Pumps with an RV Type Relief Valve:**

- (1) 18" Pipe Wrench

- **Additional Tools for Pumps with Shaft Packing:**

- Packing Hook for .25" or .38" square packing rings

- **Additional Tools for Pumps with Mechanical Seals:**

- (1) 0200 External Retaining Ring Pliers

¹ Snap-On® is a registered trademark of Snap-On Tool Corporation

6. DIRECTION OF ROTATION



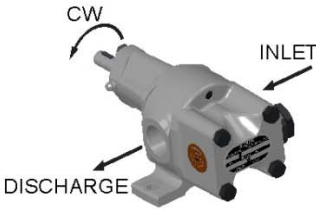
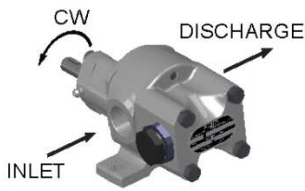
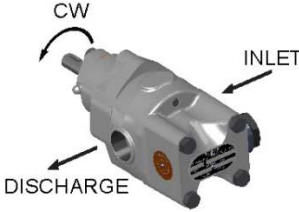
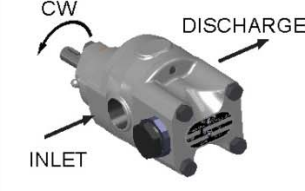
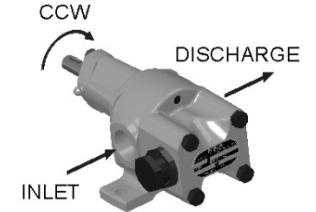
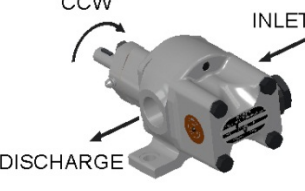
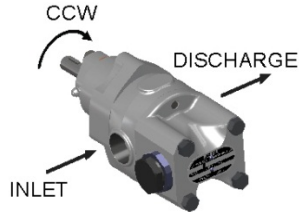
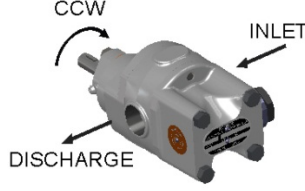
17 & 18 A005-02 ROTATION			
LW		LZ	
			
1 & 2 A03 ROTATION		17 & 18 A03 ROTATION	
W	LW	W	LW
			
Z	LZ	Z	LZ
			

Figure 6-1: Direction of Rotation for A005-A03

Note: The relief valve must be positioned as shown for the valve to be operable.

1 & 2 A06-16 ROTATION		17 & 18 A06-16 ROTATION	
W	LW	W	LW
	N/A		
Z	LZ	Z	LZ
	N/A		
1 & 2 A21-40 ROTATION		17 & 18 A21-40 ROTATION	
W	LW	W	LW
Z	LZ	Z	LZ

Figure 6-2: Direction of Rotation for A06-A40

Note: The relief valve must be positioned as shown for the valve to be operable.

Note: The plain (non-relief valve) faceplate must be positioned correctly (see **Figure 7-3**) with the cast “INLET” to the inlet side of the pump.

7. RELIEF VALVES

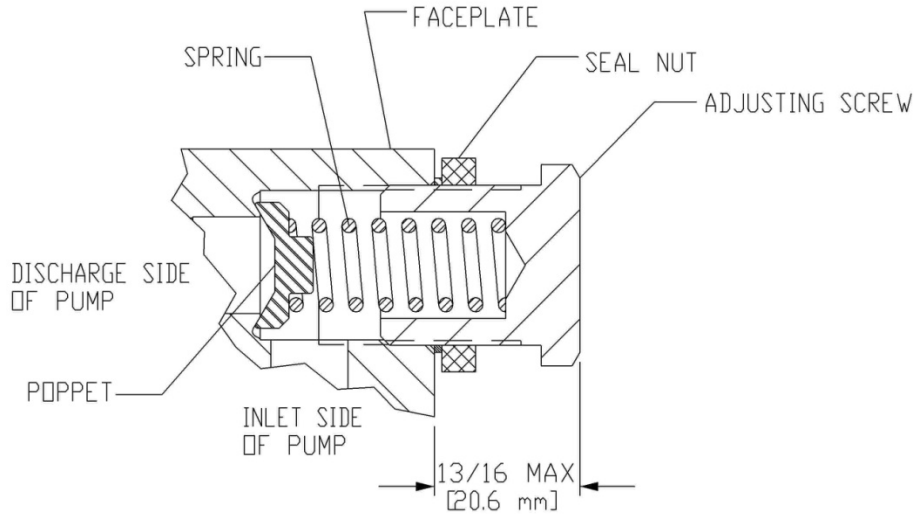


Figure 7-1: Relief Valve for A05-A03

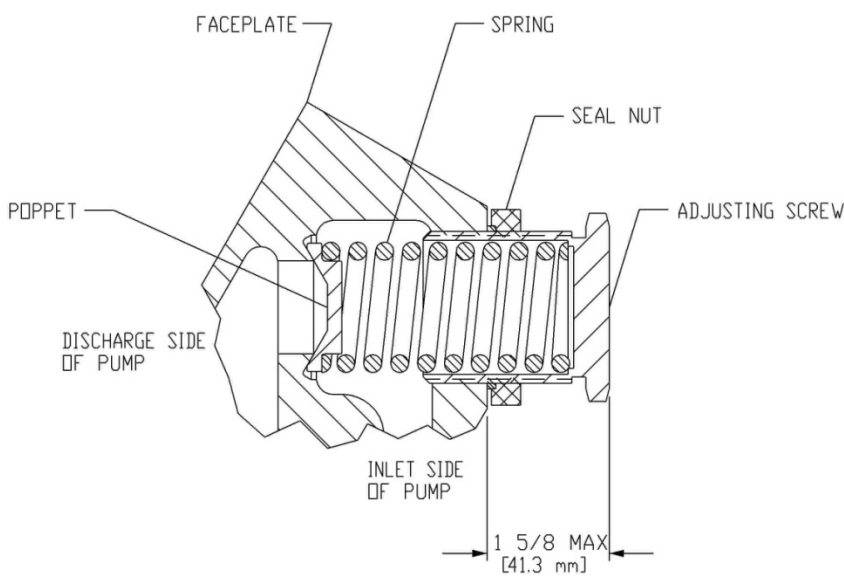
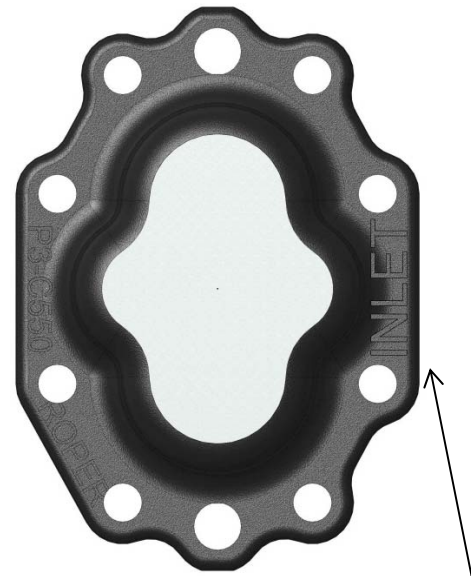


Figure 7-2: Relief Valve for A06-A40



"INLET" MUST BE ON INLET SIDE OF PUMP

Figure 7-3: Plain Faceplate for A06-A40

The integral (built-in) relief valve must be positioned as shown in **Figure 6-1: Direction of Rotation for A05-A03** or **Figure 6-2: Direction of Rotation for A06-A40** – otherwise the relief valve will not work.

If the integral (built-in) relief valve is used, it is mandatory that the relief valve be set **BY THE USER**, since maximum relief valve pressure depends upon the viscosity and specific gravity of the liquid, the flow rate (pump RPM), and also the initial relief valve setting.

NOTE: the fact that the pump has the correct rotation and discharges liquid thru the desired port does **NOT** insure that the relief valve is installed in the correct position, or that it has the correct setting for the application.

A. Adjusting Relief Valve

- **WARNING!** Take necessary precautions to prevent personal injury or physical damage that could be caused by loss of the product being pumped. **DO NOT** adjust relief valve without coupling guards in place.

Relief valve must be adjusted under conditions identical to the operating conditions (viscosity, RPM, etc.).

1. Connect a pressure gauge near pump in discharge line (between pump and where discharge line will be closed).
2. Loosen seal nut on adjusting screw.
3. Loosen adjusting screw to max dimension shown in **Figure 7-1: Relief Valve for A005-A03** or **Figure 7-2: Relief Valve for A06-A40**.
4. Start pump and close discharge line slowly. **DO NOT** exceed pressure rating of pump or other equipment between pump and discharge line valve. If this pressure is reached while closing the discharge valve, do not close any further (may occur with very high viscosity liquids). It would then be necessary to install a separate relief valve in the system for protection. **DO NOT** run pump with closed discharge line for more than two minutes at a time.
5. With discharge line closed, turn adjusting screw clockwise in ½ turn increments until the pressure gauge shows the desired pressure setting.
6. Tighten seal nut.
7. Open discharge line and turn pump off.

B. Disassembly of Relief Valve

- **WARNING!** Take necessary precautions to prevent personal injury or physical damage that could be caused by loss of the product being pumped.

Refer to drawings shown in **Figure 7-1: Relief Valve for A005-A03** or **Figure 7-2: Relief Valve for A06-A40**.

1. Turn off pump and lock out energy source to driver.
2. Close inlet & discharge valves.
3. Decrease pressure on spring by loosening seal nut and unscrewing adjusting screw until it turns freely.
4. Remove adjusting screw, spring, and poppet.
5. Inspect all parts and replace worn or damaged parts as required.

C. Assembly of Relief Valve

Refer to drawings shown in **Figure 7-1: Relief Valve for A005-A03** or **Figure 7-2: Relief Valve for A06-A40**.

1. Install poppet and spring, with spring centered on poppet, into faceplate.
2. Screw adjusting screw with seal nut into faceplate.
3. Adjust relief valve by following steps shown above in **Section 7.A. Adjusting Relief Valve**.

8. HIGH DRIVE TO LOW DRIVE

Prior to operating pump, make sure that the shaft rotation, pipe connections, and the relief valve position are in accordance with the appropriate illustrations shown in **Figure 6-1: Direction of Rotation for A005-A03** or **Figure 6-2: Direction of Rotation for A06-A40**. In order to change the rotation and/or piping orientation, it may be necessary to remove the piping from the pump or the pump from the mounting. Refer to **Figure 13-1: 17 or 18 AL, AM, AP 005 – 03**, **Figure 13-2: 1 or 2 AL, AM, AP 03**, or **Figure 13-3: AM, AP 06 – 40**.

Whenever changing rotation, inspect all parts before reassembly. Replace all worn parts and install new gaskets or O-rings in appropriate numbers as removed.

1. Remove coupling and drive key from drive shaft. Remove all burrs and sharp edges from drive shaft and keyway.
2. A.) To reverse pump rotation and keep piping arrangement the same, drive shaft position must be changed. Follow steps 3 – 9.
B.) To reverse pump rotation and leave drive shaft and case in same position; liquid flow through pump will be reversed. Follow steps 10 – 11.

• **Reverse Rotation, Same Piping Arrangement**

3. To reverse pump rotation and keep piping arrangement the same, it is necessary to change from high drive to low drive or low drive to high drive (low drive is not applicable on the A005-02 size or 1 & 2 A06-16 size pumps).
4. A.) On A03 size pumps, remove four hex head cap screws securing faceplate to case and backplate. Separate backplate assembly from case. The drive gear/shaft is a one-piece design and will pull out with the backplate assembly.
B.) On A06-16 size pumps, remove eight hex head cap screws securing faceplate to case and backplate. Separate backplate assembly from case. The drive shaft and drive gear will pull out with the backplate assembly.
C.) On A21-40 size pumps, remove eight hex head cap screws securing backplate to case. Separate backplate assembly from case. The drive shaft and the drive gear will pull out with backplate assembly.
5. Switch the idler gear/shaft position in case to the bore that was previously used by the drive.
6. Position appropriate number of case gaskets or O-rings on case (oil or grease may be used to hold gaskets in place).
7. Rotate backplate assembly 180°.
8. Slide drive gear/shaft or drive shaft with drive gear into case bore.
9. Position backplate assembly and secure.

• **Reverse Rotation, Reverse Piping, Same Shaft & Case Arrangement**

10. To reverse flow of liquid through pump ports, reverse rotation of drive shaft, maintain the original positions of the drive shaft and case.
11. A.) On all A series pumps with integral (built-in) relief valves, the faceplate must be removed, rotated 180°, and remounted.
B.) On all A06-40 pumps without relief valves, the faceplate must be removed, rotated 180°, and remounted.
C.) On A005-A03 pumps without integral (built-in) relief valves, the faceplate does not need to be rotated.

9. INSTRUCTIONS FOR PUMP DISASSEMBLY

- **All pumps**

Refer to **Section 13. EXPLODED VIEWS**.

1. Read and understand all safety instructions and warnings before starting to disassemble pump. Replace worn or damaged parts as required.
2. Collect nameplate info and refer to **Section 2. NAMEPLATE DATA**, to determine your pump arrangement. Consult a Roper distributor or Roper Pump Company, if you have questions.
3. Use only cleaning solutions and lubricants that are compatible with product being pumped and with sealing elastomers. **DO NOT** use petroleum based products with seals using EPR elastomers.
4. Turn off pump and lock out energy source to driver. **DO NOT** proceed further with disassembly of pump if there is the slightest possibility that the driver may be started.
5. If used, turn off and disconnect flush from mechanical seal.
6. Close inlet and discharge valves.
7. Remove guard and disconnect coupling between driver and pump.
8. Drain inlet and discharge lines. Disconnect lines from pump inlet and discharge.

- **A 005 – A 03 pumps**

Refer to **Figure 13-1: 17 or 18 AL, AM, AP 005 – 03** or **Figure 13-2: 1 or 2 AL, AM, AP 03**.

1. Remove key from drive end of drive shaft.
2. A. On mechanical seal pumps, remove two hex head cap screws, bearing cage assembly, and bearing cage gasket. Clean and lubricate drive shaft prior to removing mechanical seal, making sure drive shaft is smooth and free from all burrs. Remove mechanical seal and retaining ring from backplate. Inspect sealing surfaces and replace seal if required. See **Section 14.A. Mechanical Seal (AM) Pumps** for more information.

B. On packed box pumps, remove two hex head cap screws, retainer plate, packing gland, and packing rings from backplate. Packing hooks are commercially available to assist in packing removal. See **Section 14.C. Packed Box (AP) Pumps** for more information.

C. On lip seal pumps, remove lip seal from backplate. See **Section 14.B. Lip Seal (AL) Pumps** for more information.
3. Remove two hex nuts and two hex head cap screws (A 005 – A 02 size) or four hex head cap screws (A 03 size) securing faceplate to case and into backplate. Remove faceplate.
4. Remove O-ring from groove on faceplate.
5. If pump has relief valve, refer to **Section 7.B. Disassembly of Relief Valve** for instructions.
6. Remove two dowel pins between faceplate and case.
7. Remove idler gear & shaft from case.

8. Remove drive gear & shaft from case.
9. Separate case from backplate.
10. Remove O-ring from groove on backplate.
11. Remove two dowel pins between backplate and case.
12. Remove two studs from backplate (A 005 – A 02 size only).
13. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new O-rings, gaskets, and seals be installed each time pump is disassembled and reassembled.

- **A 06 – A 40 pumps**

Refer to **Figure 13-3: AM, AP 06 – 40**.

1. Remove key from drive end of drive shaft.
2.
 - A. On mechanical seal pumps, remove two hex head cap screws, and retainer plate. Clean and lubricate drive shaft, making sure it is smooth and free from all burrs. Remove mechanical seal, locator ring, and retaining ring from backplate. Inspect sealing surfaces and replace seal if required. See **Section 14.A. Mechanical Seal (AM) Pumps** for more information.
 - B. On mechanical seal pumps that also have an optional outboard ball bearing, loosen set screws on ball bearing and remove from drive shaft. Remove two hex head cap screws and two lockwashers. Remove bearing cage and gasket. Clean and lubricate drive shaft, making sure it is smooth and free from all burrs. Remove mechanical seal, locator ring, and retaining ring from backplate. Inspect sealing surfaces and replace seal if required. See **Section 14.A. Mechanical Seal (AM) Pumps** for more information.
 - C. On packed box pumps, remove two hex nuts, two studs, retainer plate, packing bushing, packing rings, and packing washer from backplate. Packing hooks are commercially available to assist in packing removal. See **Section 14.C. Packed Box (AP) Pumps** for more information.
3. Remove eight hex head cap screws securing faceplate to case. Remove faceplate.
4. Remove case gasket between case and faceplate.
5. If pump has relief valve, refer to **Section 7.B. Disassembly of Relief Valve** for disassembling relief valve.
6. Remove two dowel pins between faceplate and case.
7. Remove idler gear & shaft from case.
8. Remove drive gear and drive shaft from case.
9. Remove case from backplate.
10. Remove case gasket between backplate and case.
11. Remove two dowel pins between backplate and case.
14. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new case gaskets be installed each time pump is disassembled and reassembled.

10. BEARINGS (BUSHINGS)

• **Bearing Removal**

Pump bearings are available in bronze, iron, and carbon. Any of these bearings may be removed using a Snap-On® tool puller, part number CG-40C. This tool may be purchased through your local tool dealer or through Roper Pump Company. If you do not have this bearing puller, any of the bearings may be removed by using a hacksaw blade to cut through the bearing in two places 180° apart. This procedure will usually loosen the bearing enough to be pulled out. If this procedure is used, take care to prevent damage to the bore into which the bearing is pressed.

Carbon bearings may also be removed by carefully chipping the bearing out with a chisel. Take care not to scar the endplate bores during the bearing removal process.

After removing the bearings, always check the endplate bores for nicks and burrs caused by the removal process. The bores must be clean, smooth, and free of burrs before attempting to install new bearings.

• **Bearing Installation**

1. Remove all burrs and raised edges from bores for bearings.
2. Place faceplate or backplate on a press base with milled face upward. Support endplate so that milled face is perpendicular (square) with press ram.
3. Position endplate so that one bearing bore is located directly under press ram.
4. A. If iron or bronze bearings are to be installed, lubricate endplate bores with a light oil that is compatible with product to be pumped.
B. If carbon bearings are to be installed, lubricate bearings by submerging them in cold water prior to installation.
5. Place end of new bearing at entrance of bore in endplate.
6. Press bearing into endplate bore. *When carbon bearings are being installed, it is important to press them in with one slow uninterrupted stroke to prevent cracking.* It is best to use a stepped arbor with a few thousandths of an inch clearance between arbor and bore of bearing. Be sure to press bearings in until they are .002 to .007 of an inch [.051mm to .178 mm] below milled face of endplate.
7. Repeat procedure for second bearing.

11. DIMENSIONAL DATA FOR INTERNAL PARTS

Nominal dimensions are given below. With the exception of gasket thickness and lateral clearance, your actual measurements should vary from these numbers by no more than .002". Use properly calibrated measuring equipment to measure parts.

		PUMP SIZE			
ITEM		A005	A01	A02	A03
Bearing Bore		.6253	.6253	.6253	.6253
Shaft OD		.4997	.4997	.4997	.4997
Case Bores		1.1325	1.1325	1.1325	1.1325
Gear OD		1.1288	1.1288	1.1288	1.1288
Gear to Case Diametral Clearance		.0038	.0038	.0038	.0038
BRONZE	Bearing OD	.6273	.6273	.6273	.6273
	Bearing Press Fit	.0015 min	.0015 min	.0015 min	.0015 min
	Bearing ID (Free)	.5043	.5043	.5043	.5043
	Bearing ID (Installed)	.5025	.5025	.5025	.5025
	Shaft to Bearing Diametral Clearance	.0035	.0035	.0035	.0035
IRON	Bearing OD	.6270	.6270	.6270	.6270
	Bearing Press Fit	.001 min	.001 min	.001 min	.001 min
	Bearing ID (Free)	.5040	.5040	.5040	.5040
	Bearing ID (Installed)	.5025	.5025	.5025	.5025
	Shaft to Bearing Diametral Clearance	.0035	.0035	.0035	.0035
CARBON	Bearing OD	.6273	.6273	.6273	.6273
	Bearing Press Fit	.0015 min	.0015 min	.0015 min	.0015 min
	Bearing ID (Free)	.5040	.5040	.5040	.5040
	Bearing ID (Installed)	.5025	.5025	.5025	.5025
	Shaft to Bearing Diametral Clearance	.0035	.0035	.0035	.0035
Case Width		.2158	.4373	.8748	1.3758
Gear Face Width		.2148	.4363	.8738	1.3738
Lateral Clearance		.0010	.0010	.0010	.0015

Figure 11-1: Internal Dimensional Data A005-A03

		PUMP SIZE			
ITEM		A06	A08	A12	A16
Bearing Bore		1.2505	1.2505	1.2505	1.2505
Shaft OD		.9990	.9990	.9990	.9990
Case Bores		2.1060	2.1060	2.1060	2.1060
Gear OD		2.0990	2.0990	2.0990	2.0990
Gear to Case Diametral Clearance		.0075	.0075	.0075	.0075
BRONZE	Bearing OD	1.2515	1.2515	1.2515	1.2515
	Bearing Press Fit	.001 min	.001 min	.001 min	.001 min
	Bearing ID (Free)	1.0035	1.0035	1.0035	1.0035
	Bearing ID (Installed)	1.0025	1.0025	1.0025	1.0025
	Shaft to Bearing Diametral Clearance	.0035	.0035	.0035	.0035
IRON	Bearing OD	1.2515	1.2515	1.2515	1.2515
	Bearing Press Fit	.001 min	.001 min	.001 min	.001 min
	Bearing ID (Free)	1.0050	1.0050	1.0050	1.0050
	Bearing ID (Installed)	1.0040	1.0040	1.0040	1.0040
	Shaft to Bearing Diametral Clearance	.0050	.0050	.0050	.0050
CARBON	Bearing OD	1.2535	1.2535	1.2535	1.2535
	Bearing Press Fit	.003 min	.003 min	.003 min	.003 min
	Bearing ID (Free)	1.0065	1.0065	1.0065	1.0065
	Bearing ID (Installed)	1.0038	1.0038	1.0038	1.0038
	Shaft to Bearing Diametral Clearance	.0048	.0048	.0048	.0048
Case Width		.8360	1.1249	1.6870	2.2485
One Gasket Thickness (Uncompressed)		.0070	.0070	.0070	.0070
Two Gasket Thickness (Compressed)		.0092	.0092	.0092	.0092
Gear Face Width		.8385	1.1270	1.6875	2.2510
Lateral Clearance (Two Comp Gaskets)		.0067	.0067	.0067	.0067

Figure 11-2: Internal Dimensional Data A06-A16

		PUMP SIZE			
ITEM		A21	A27	A32	A40
Bearing Bore		1.2505	1.2505	1.2505	1.2505
Shaft OD		.9990	.9990	.9990	.9990
Case Bores		2.1060	2.1060	2.1060	2.1745
Gear OD		2.0990	2.0990	2.0990	2.1675
Gear to Case Diametral Clearance		.0075	.0075	.0075	.0075
BRONZE	Bearing OD	1.2515	1.2515	1.2515	1.2515
	Bearing Press Fit	.001 min	.001 min	.001 min	.001 min
	Bearing ID (Free)	1.0035	1.0035	1.0035	1.0035
	Bearing ID (Installed)	1.0025	1.0025	1.0025	1.0025
	Shaft to Bearing Diametral Clearance	.0035	.0035	.0035	.0035
IRON	Bearing OD	1.2515	1.2515	1.2515	1.2515
	Bearing Press Fit	.001 min	.001 min	.001 min	.001 min
	Bearing ID (Free)	1.0050	1.0050	1.0050	1.0050
	Bearing ID (Installed)	1.0040	1.0040	1.0040	1.0040
	Shaft to Bearing Diametral Clearance	.0050	.0050	.0050	.0050
CARBON	Bearing OD	1.2535	1.2535	1.2535	1.2535
	Bearing Press Fit	.003 min	.003 min	.003 min	.003 min
	Bearing ID (Free)	1.0065	1.0065	1.0065	1.0065
	Bearing ID (Installed)	1.0038	1.0038	1.0038	1.0038
	Shaft to Bearing Diametral Clearance	.0048	.0048	.0048	.0048
Case Width		2.9995	3.7495	4.4995	4.4995
One Gasket Thickness (Uncompressed)		.0070	.0070	.0070	.0070
Two Gasket Thickness (Compressed)		.0092	.0092	.0092	.0092
Gear Face Width		3.0020	3.7520	4.5020	4.5020
Lateral Clearance (Two Comp Gaskets)		.0067	.0067	.0067	.0067

Figure 11-3: Internal Dimensional Data A21-A40

12. INSTRUCTIONS FOR PUMP ASSEMBLY

- **All pumps**

Refer to **Section 13. EXPLODED VIEWS**.

Refer to **Section 6. DIRECTION OF ROTATION** to assure proper configuration for pump rotation, port location, and relief valve position prior to assembling pump.

1. Read and understand all safety instructions and warnings before starting to assemble pump. Visually inspect all parts during assembly. Replace worn or damaged parts as required. Although they may appear reusable, it is recommended that new O-rings or case gaskets and lip seal (if used) be installed when pump is being reassembled.
- **WARNING!** Only use genuine Roper gaskets. Gasket thickness determines proper clearances. Always check quantities of gaskets removed and replace with exact quantity. Proper material must be used based on application.
2. When cleaning or lubricating, only use products that are compatible with product being pumped and with sealing elastomers. **DO NOT** use petroleum based products with seals using EPR elastomers.

- **A 005 – A 03 pumps**

Refer to **Figure 13-1: 17 or 18 AL, AM, AP 005 – 03** or **Figure 13-2: 1 or 2 AL, AM, AP 03**.

1. Install two dowel pins on each side of case.
2. Install O-ring in groove on backplate.
3. On 17 or 18 A 005 – 02 pumps only, install two studs in screw holes near ports on backplate.
4. Install case onto backplate by aligning dowel pins to holes.
5. Install drive gear and shaft into case.
6. Install idler gear and shaft into case.
7. Install O-ring in groove on faceplate.
8. Install faceplate onto case and backplate using two hex nuts and two hex head cap screws (A 005 – A 02) or four hex head cap screws (A 03).
9. If pump has a relief valve, refer to **Section 7.C. Assembly of Relief Valve** for instructions.
10. A. On mechanical seal pumps, carefully remove all burrs and sharp edges from seal area of drive shaft. Install retaining ring onto drive shaft. Apply a compatible lubricant to drive shaft and inside diameter (shaft bore) on seal. Slide seal onto drive shaft against retaining ring. Use extreme care not to damage seal faces or elastomers during assembly. Install bearing cage gasket and bearing cage assembly using two hex head cap screws. See **Section 14.A. Mechanical Seal (AM) Pumps** for more information.

B. On packed box pumps, install packing rings in backplate bore. Stagger joints on each packing ring 180 degrees apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly. Check drive shaft for free movement after each ring is installed. Install packing gland and retainer plate using two hex head cap screws. See **Section 14.C. Packed Box (AP) Pumps** for more information.

C. On lip seal pumps, lubricate drive end of drive shaft and lip seal with light oil compatible with fluid pumped. Gently push lip seal, with lip facing inward, to front of backplate bore. See **Section 14.B. Lip Seal (AL) Pumps** for more information.

11. Install key on end of drive shaft.
12. Read and understand all safety instructions and warnings before installing and operating pump.

- **A 06 – A 40 pumps**

Refer to **Figure 13-3: AM, AP 06 – 40.**

1. Install two dowel pins on each side of case.
2. Place gasket on backplate side of case and install backplate on case.
3. Install idler gear and shaft into case.
4. Place drive gear on drive shaft and secure with one retaining ring on each side.
5. Install drive shaft with drive gear attached into case.
6. Place gasket on faceplate side of case and install faceplate and backplate to case by using eight hex head cap screws.
7. If pump has a relief valve, refer to **Section 7.C. Assembly of Relief Valve** for instructions.
8.
 - A. On mechanical seal pumps, carefully remove all burrs and sharp edges from seal area of drive shaft. Install retaining ring onto drive shaft. Slide locator ring to against retaining ring. Apply a compatible lubricant to drive shaft, stationary seat O-ring, and inside diameter (shaft bore) on seal. Make sure lapped face of stationary seat is toward rotating member of seal. Install mechanical seal onto drive shaft, down backplate bore, to against locator ring. Use extreme care not to damage seal faces or elastomers during assembly. Install retainer plate using two hex head cap screws. See **Section 14.A. Mechanical Seal (AM) Pumps** for more information.
 - B. On mechanical seal pumps with outboard ball bearing, carefully remove all burrs and sharp edges from seal area of drive shaft. Install retaining ring onto drive shaft. Slide locator ring to against retaining ring. Apply a compatible lubricant to drive shaft, stationary seat O-ring, and inside diameter (shaft bore) on seal. Make sure lapped face of stationary seat is toward rotating member of seal. Install mechanical seal onto drive shaft, down backplate bore, to against locator ring. Use extreme care not to damage seal faces or elastomers during assembly. See **Section 14.A. Mechanical Seal (AM) Pumps** for more information. Install bearing cage gasket and bearing cage using two lockwashers and two hex head cap screws. Install ball bearing onto drive shaft and tighten set screws. **Note:** Optional outboard ball bearing is recommended on A 06 – A 40 sizes for applications that have over 25 PSI inlet pressure or the viscosity of the liquid being pumped is under 40 SSU.
 - C. On packed box pumps, install packing washer and packing rings in backplate bore. Stagger joints on each packing ring 180 degrees apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly. Check drive shaft for free movement after each ring is installed. Install packing bushing and retainer plate using two studs and two hex nuts. See **Section 14.C. Packed Box (AP) Pumps** for more information.
9. Install key on end of drive shaft.
10. Read and understand all safety instructions and warnings before installing and operating pump.

13. EXPLODED VIEWS

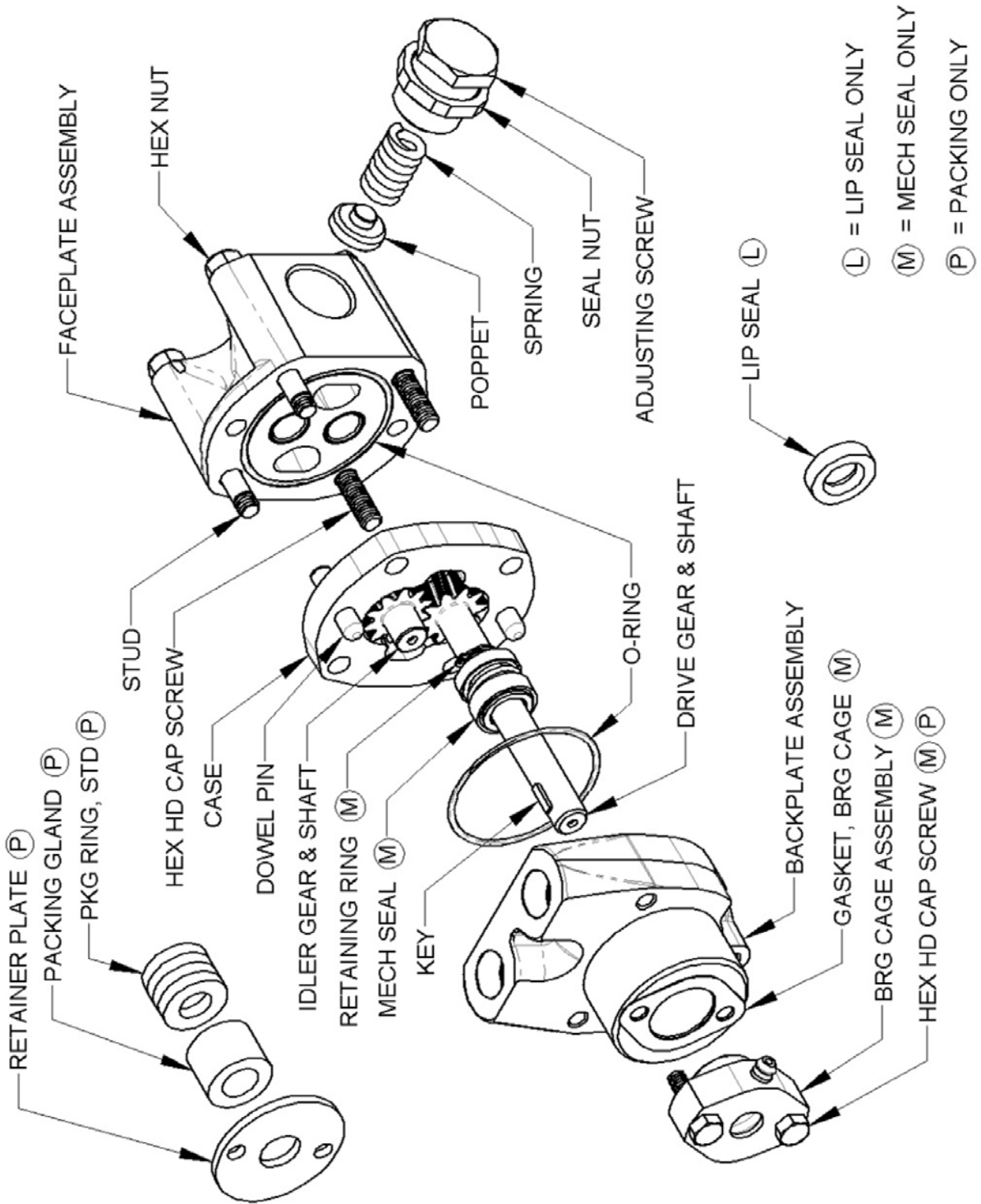


Figure 13-1: 17 or 18 AL, AM, AP 005 – 03

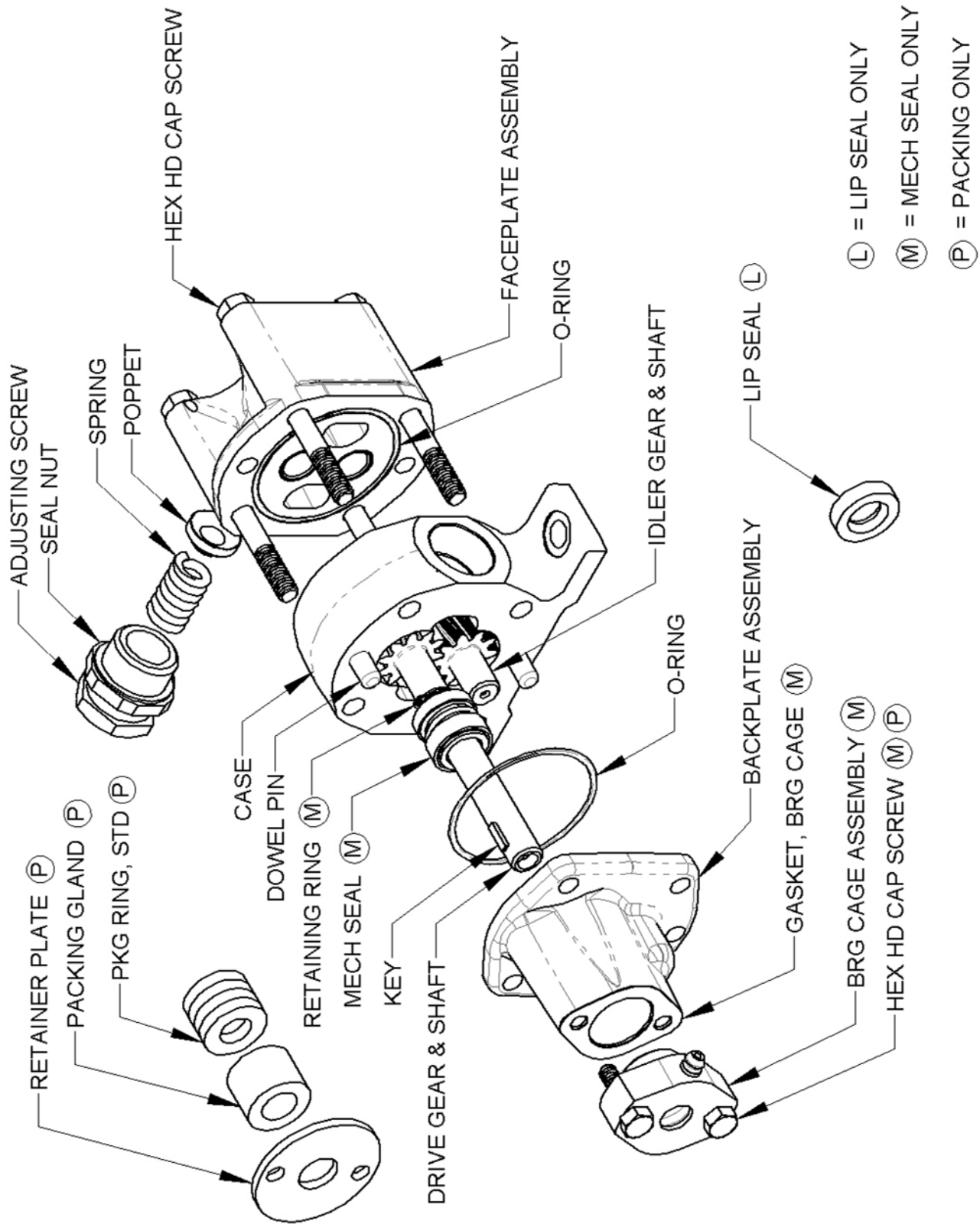


Figure 13-2: 1 or 2 AL, AM, AP 03

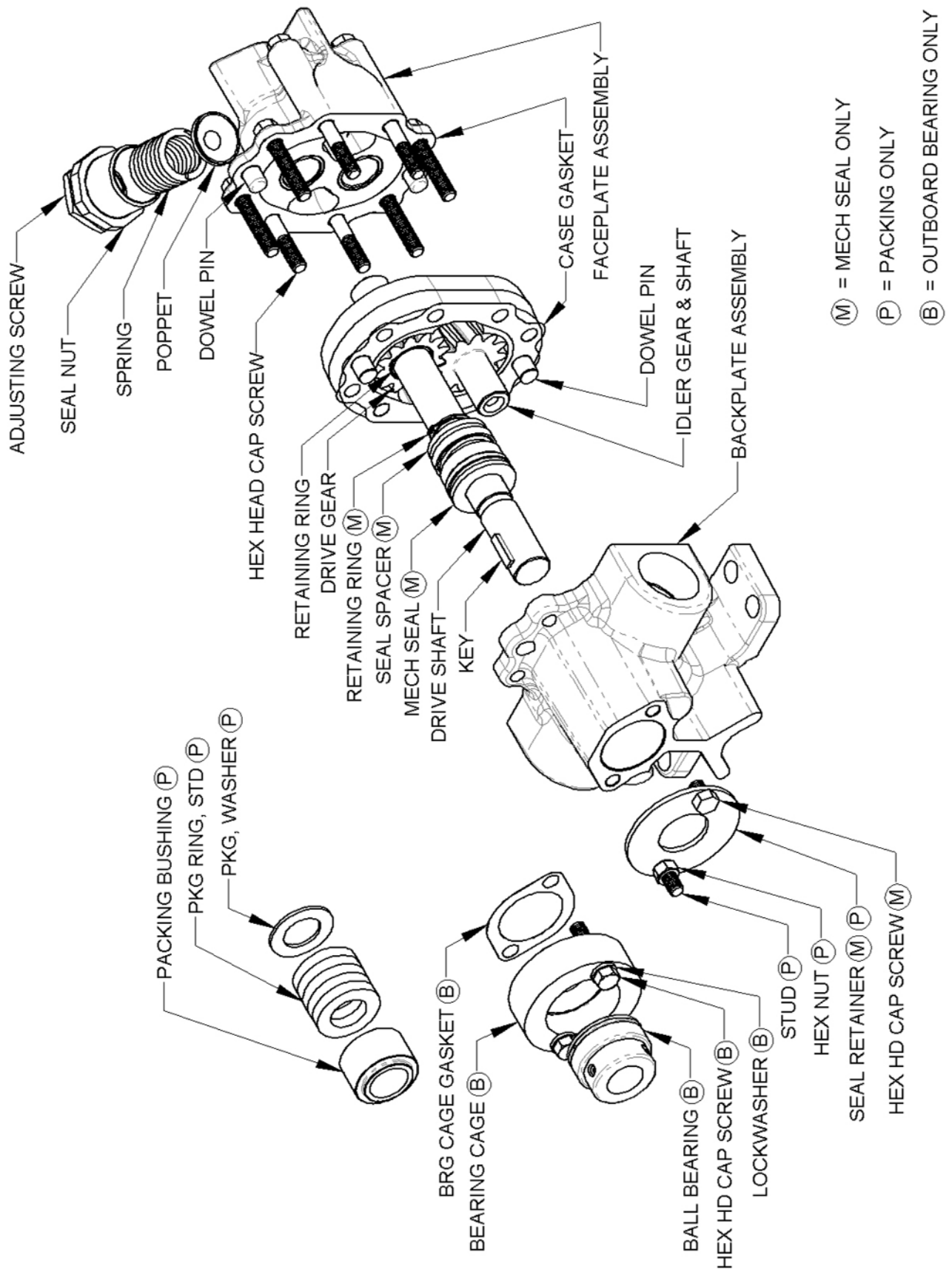


Figure 13-3: AM, AP 06 – 40

14. SHAFT SEALING

A. Mechanical Seal (AM) Pumps

Mechanical Seals do not require adjustment. Leakage developed at the seal may be due to one of the following conditions: worn, marred, or cracked rotating or stationary seal face, or bellows that have become hard, soft, cracked, expanded, or extruded.

When replacing or servicing a mechanical seal, take particular care not to mar or scratch the sealing surfaces or injure the bellows. If the seal has been used, do not put it back into service unless both sealing surfaces are perfectly flat and smooth or else replaced.

To replace the mechanical seal, see disassembly instructions in **Section 9. INSTRUCTIONS FOR PUMP DISASSEMBLY** and assembly instructions in **Section 12. INSTRUCTIONS FOR PUMP ASSEMBLY**.

Figure 14-1: AM005-AM03

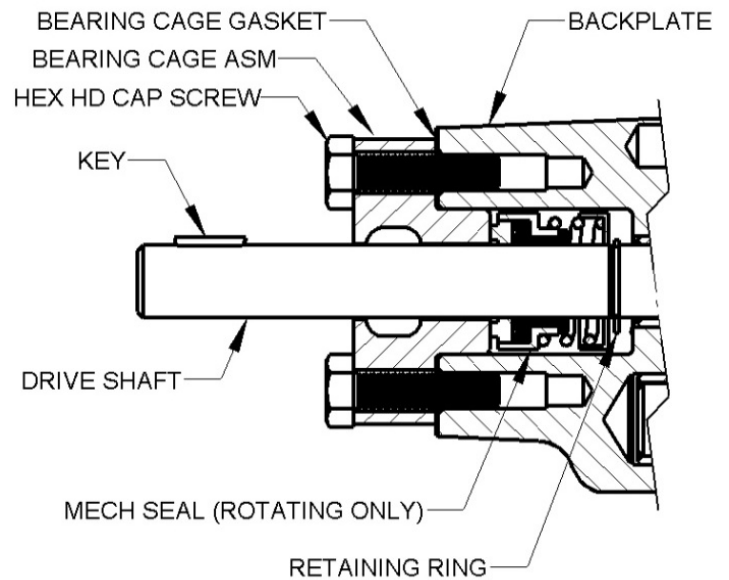
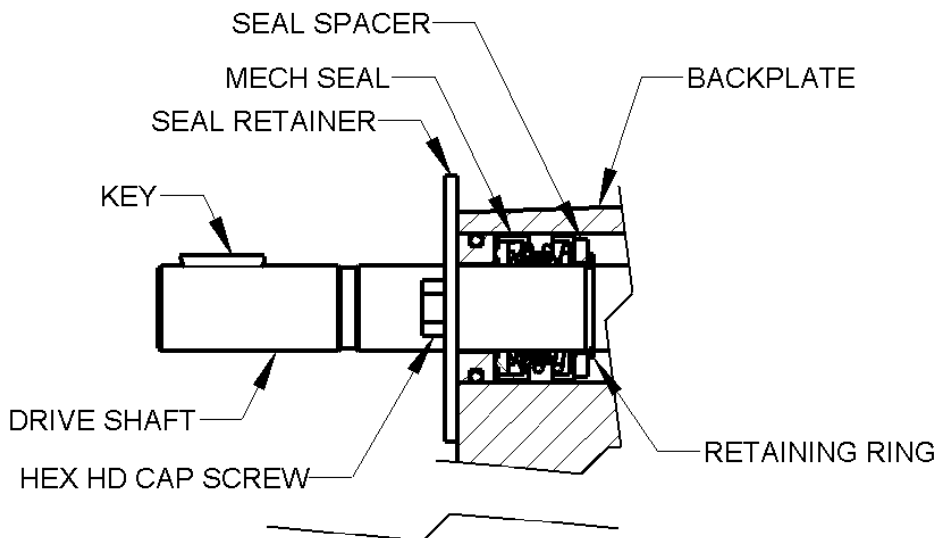


Figure 14-2: AM06-AM40



- **Change from Packing (AP) to Mechanical Seal (AM)**

When it is desirable to change from packed box to mechanical seal, remove the key, cap screws, packing plate, packing gland, packing rings and washer (AM06-AM40 only). The exposed surface of the shaft should be free from burrs and sharp edges. Clean the shaft and apply a film of light machine oil. Install the retaining ring. Refer above to **A.**

Mechanical Seal (AM) Pumps to install the seal.

- **Change from Mechanical Seal (AM) to Packing (AP)**

When it is desirable to change from mechanical seal to packed box, remove the key, cap screws, retainer plate (AM06-AM40 only) or bearing cage assembly with gasket (AM005-AM03 only), mechanical seal, seal spacer (AM06-AM40 only), and retaining ring.

Use formed packing rings when installing packing. **DO NOT** use a one-piece spiral wrap of packing. Before installing packing, carefully clean the stuffing box and shaft. The exposed surface of the shaft should be free from burrs and sharp edges.

Packing rings should be installed one ring at a time, with the joints of adjacent rings staggered approximately 180°. Each ring should be seated firmly before the next ring is installed.

Refer below to **C. Packed Box (AP) Pumps** to install the packing.

B. Lip Seal (AL) Pumps

AL pumps with lip seals must be run in the clockwise direction of rotation only. Maximum discharge pressure is 100 PSIG (6.9 BAR) and maximum inlet pressure is 5 PSIG (.3 BAR). For a pump equipped with a lip seal, follow these instructions. Leaking lip seals should be replaced. Note the direction of the lip on the old seal. Carefully pry the defective seal from the bore, making certain that the bore is not scored or damaged. Clean the shaft and bore. Inspect the shaft for wear. If worn or scored, replace. The exposed surface of the shaft should be free from burrs and sharp edges. Lightly oil shaft and bore into which the lip seal is to be fitted. Be careful not to damage the sealing lip and be certain that the lip on the new seal is turned the same direction as the old seal. Slide the seal onto the shaft and press into the bore.

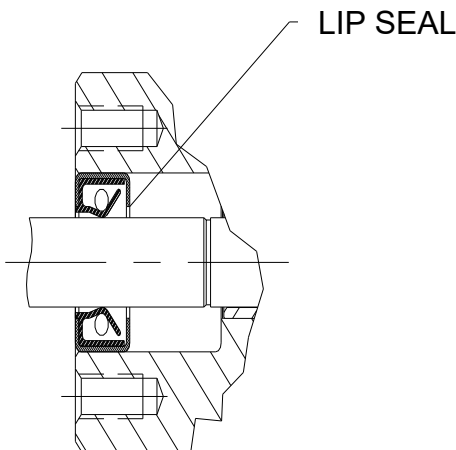


Figure 14-3: AL005-AL03

C. Packed Box (AP) Pumps

Operate the pump under normal conditions and, after a short run-in period, examine the packing for leakage. If leakage is excessive, stop the pump and follow the procedure described below. A slight leakage is a necessary and normal condition for packing and allows for expansion and proper seating.

To replace packing, remove the key, cap screws or nuts, packing plate, packing gland, and packing rings. (Packing hooks are commercially available to assist in removing the packing rings.)

Clean the shaft and adjacent parts. Examine the shaft. If it is excessively worn or scored, replace shaft and gear assembly. It is generally not recommended to reuse old packing rings. Use formed packing rings when installing packing. **DO NOT** use a one-piece spiral wrap of packing. Before installing packing, carefully clean the stuffing box and shaft.

Packing rings should be installed one ring at a time, with the joints of adjacent rings staggered approximately 180°. Each ring should be seated firmly before the next ring is installed.

The packing gland cap screws or nuts should first be evenly tightened with a wrench to seat the packing firmly in the stuffing box and against the shaft. **DO NOT** over-tighten the packing. The gland cap screws or nuts should then be backed off until finger-tight. After the pump is started, visually examine the stuffing box for excessive leakage. If the packing leakage exceeds ten drops per minute, stop the pump and adjust the gland nuts. The gland cap screws or nuts should be adjusted evenly in 1/6 to 1/3 turn (1 to 2 flats on the nut) increments. Start the pump and allow it to operate for several minutes. Again, visually examine the stuffing box for excessive leakage. Repeat the above procedure until the stuffing box leakage is between five to ten drops per minute.

DO NOT over-tighten the packing. Slight leakage is a necessary requirement for proper packing operation. Leakage of five to ten drops per minute when the pump is operating is desirable, as it will preserve the packing and avoid scoring of the shaft. Over-tight packing may score shafts, increase torque requirements of the pump, damage couplings and drives, and generate excessive heat.

The packing gland should be adjusted whenever leakage exceeds ten drops per minute. The condition of the packing should be checked at regular intervals, the frequency depending on the type of service. Experience will dictate how frequently the inspections should be made.

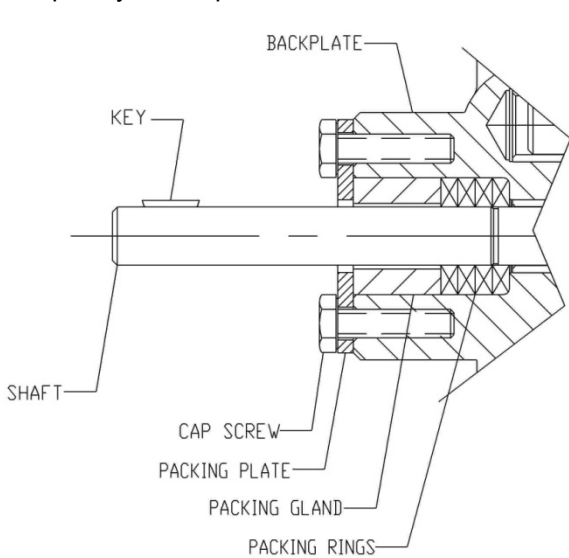


Figure 14-4: AP005-AP03

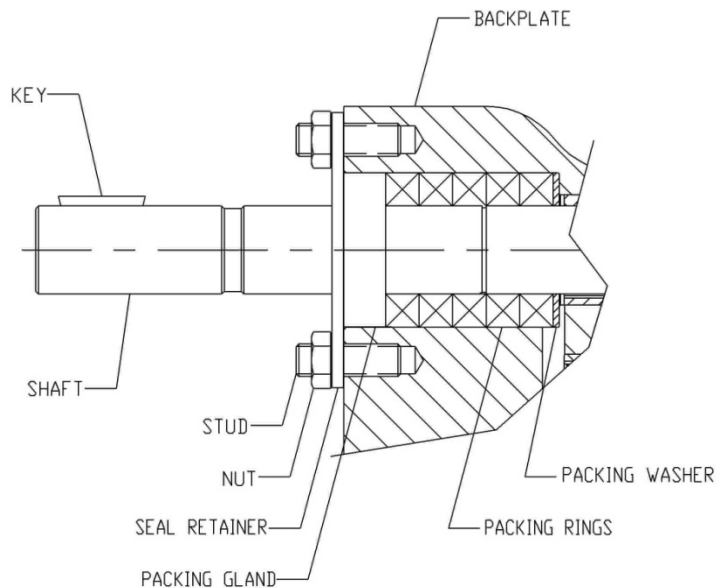


Figure 14-5: AP06-AP40

D. Seal Chamber Dimensions

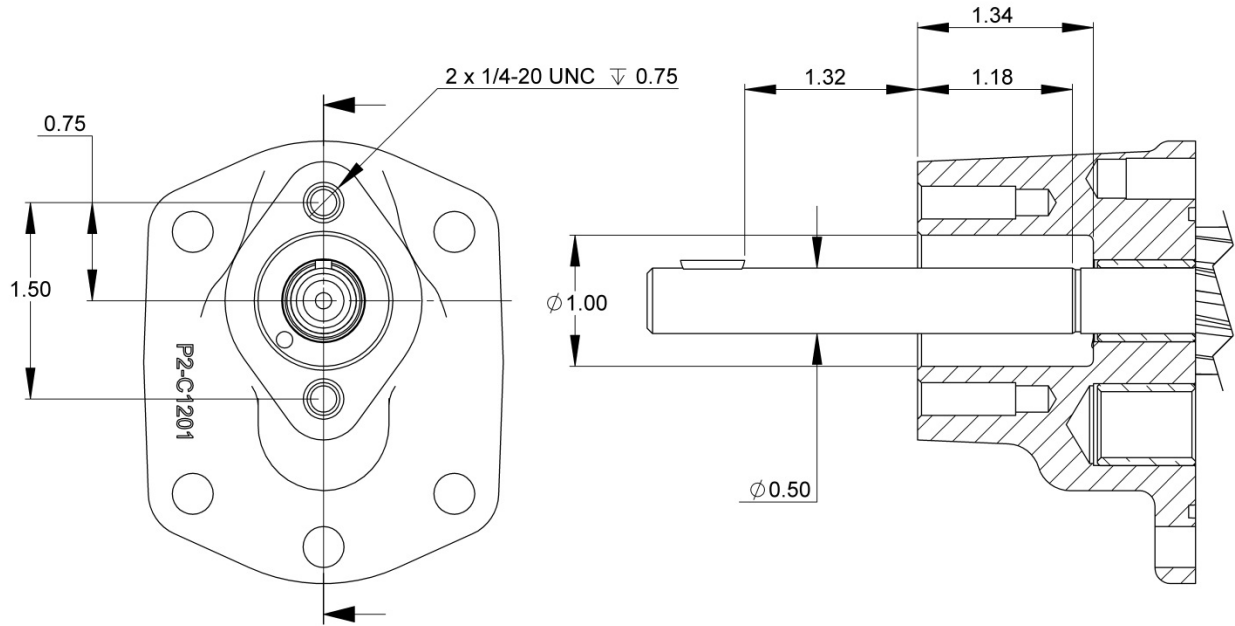


Figure 14-6: A005-A03

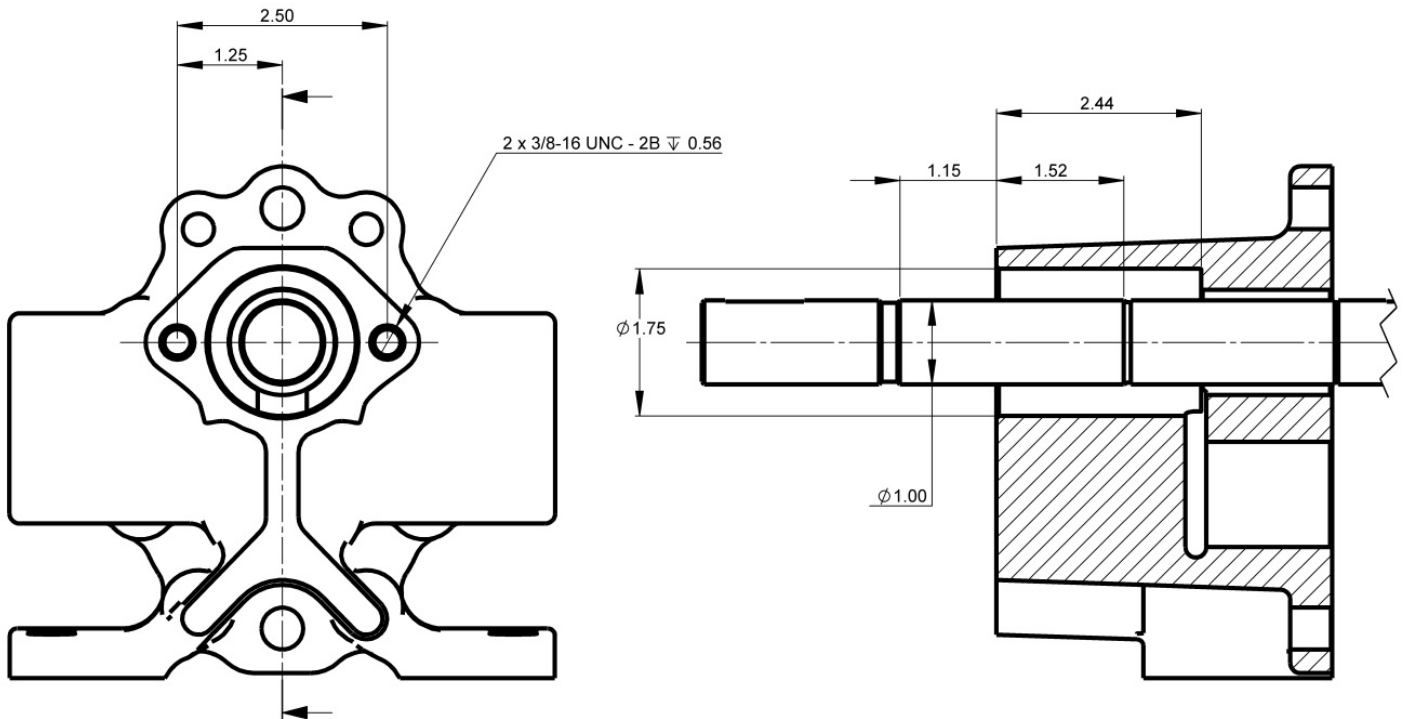


Figure 14-7: A06-A40

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