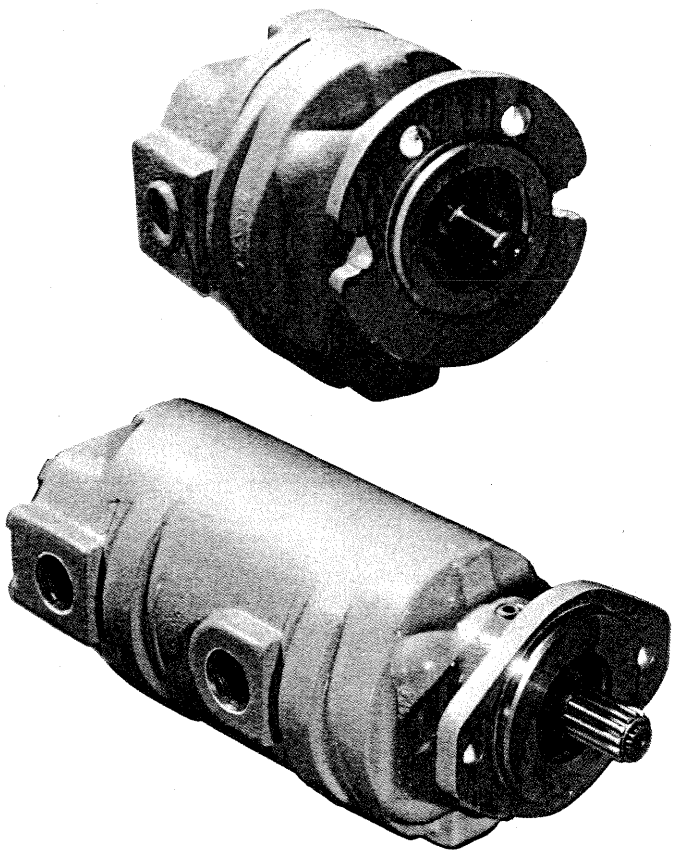
HYDRECO®

1500K series gear pumps service instructions



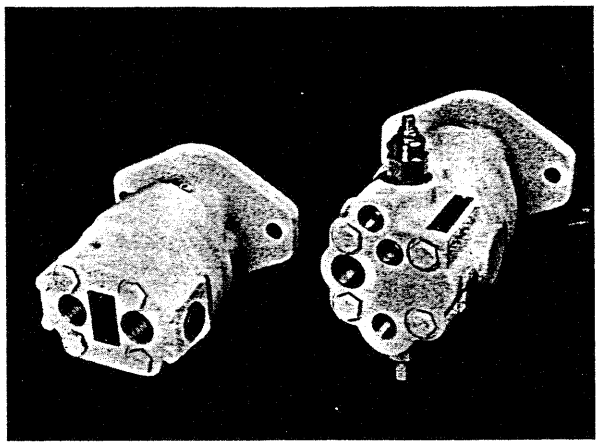
80-318 (8-87)

wagner

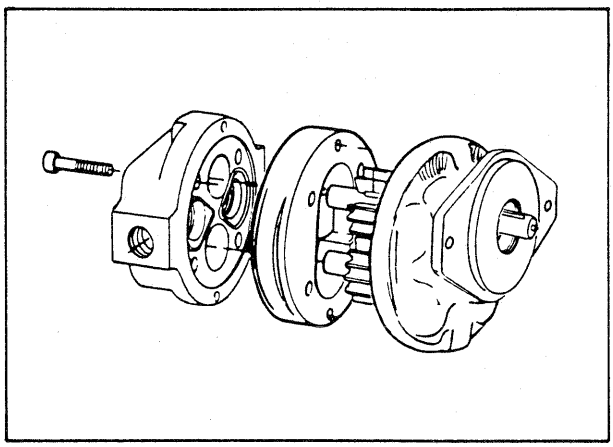
A Division of Allied Systems Company

1500K series
single gear pump introduction

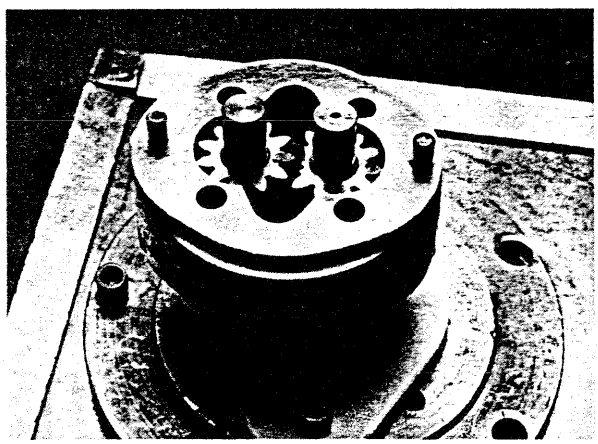
Hydreco gear pumps are precision mechanisms that convert mechanical power into hydraulic power. Pump operating efficiency depends upon close-tolerance running clearances; abnormal wear increases these clearances and results in internal "slippage". "Slippage" is the leakage within the pump from the discharge back to the suction sides and causes loss of power, reduced output and elevated oil temperatures.



Hydreco 1500K Series pumps consist of two gear assemblies and three cast sections: cover, center housing and adapter. For positive alignment, the three sections are piloted together with dowels. In operation, oil is confined between the gear teeth and the gear housing bores. When the gears are rotated, the oil is forced from the suction side of the pump to the discharge side.



In Hydreco gear pumps, slippage is minimized by controlled clearance between the gear teeth and gear housing bores and minimum running clearance between the face of the gears and the wear plates.



1500K series service instructions

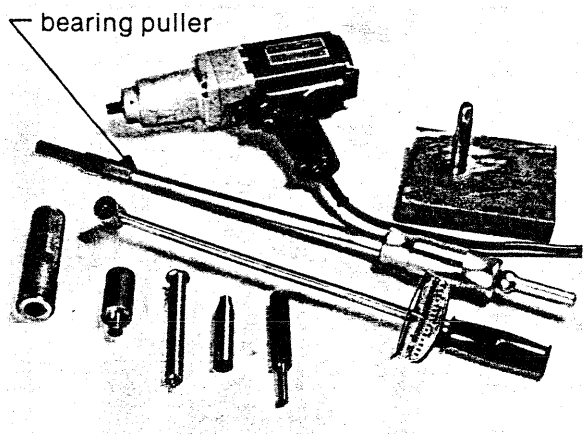
Index

I. Tools required

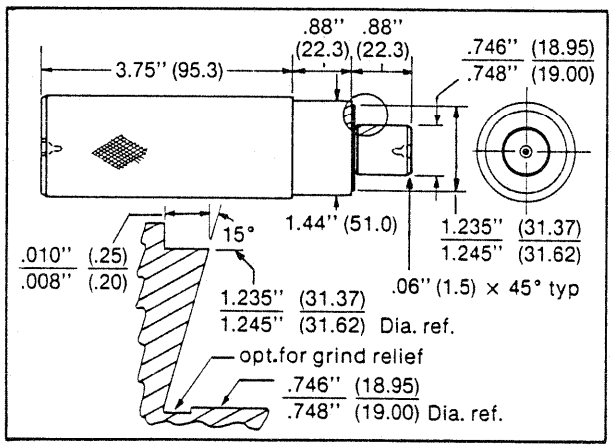
Several fixtures and tools are needed for efficient and proper disassembly and reassembly of Hydreco 1500K Series pumps.

Item 1 is available from the Owatonna Tool Company. The remainder can be fabricated using the dimensional drawings below.

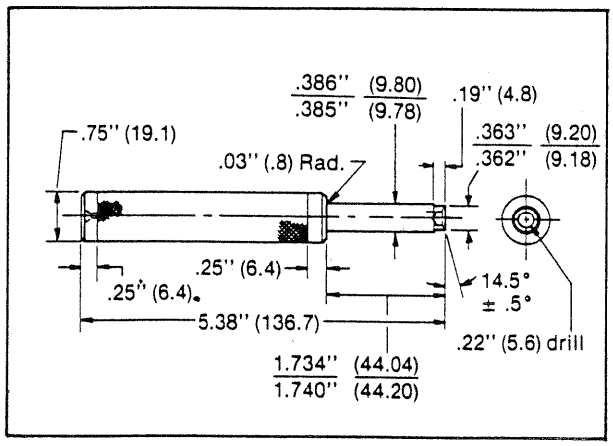
1. Owatonna Tool Company
   Standard slide bearing puller
   and slide puller adapter #OTC28253
   Expandable Jaw 3/4 Bearing puller #33861



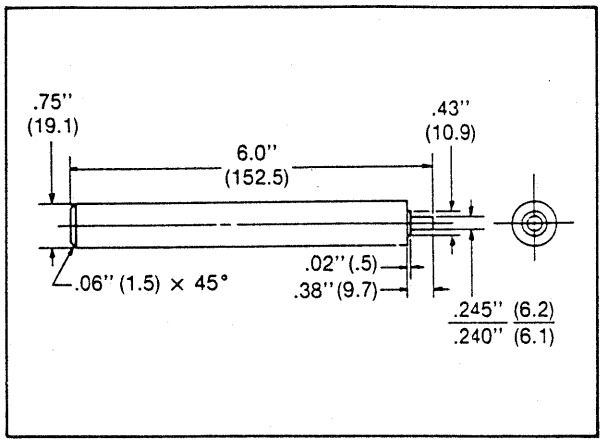
2. Bearing Driver #DPA-023-36



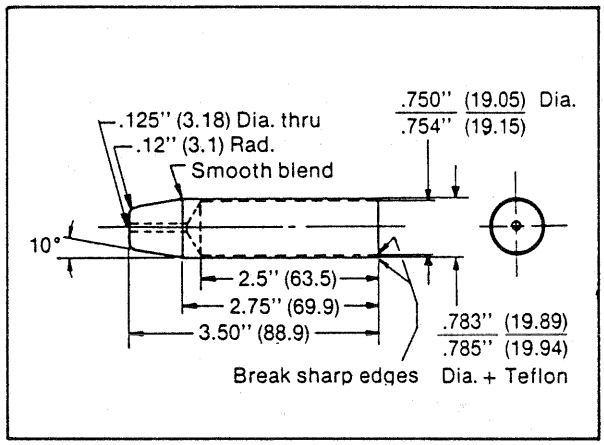
3. Ball Seat Tool #98402-5



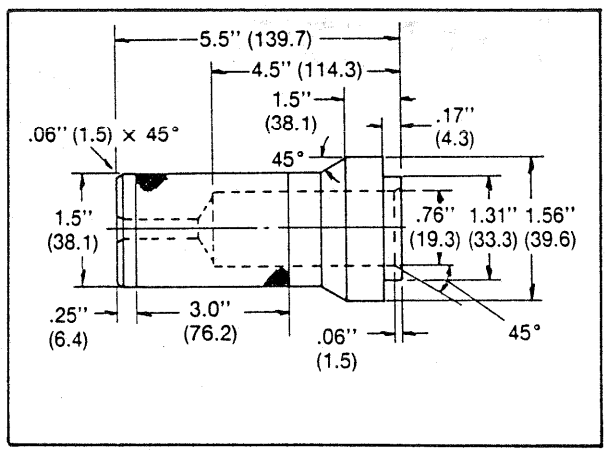
4. Ball Retainer Driver #DPA-38



5. Seal installation Thimble #TA004-9

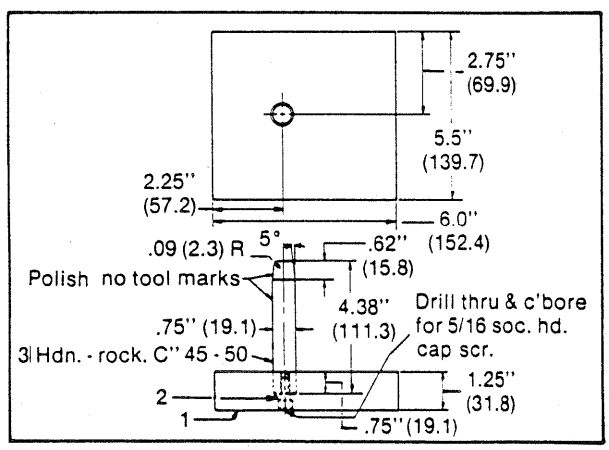


6. Seal Driver and Outboard Bearing Driver DPA 24-64



7. Seal installation fixture FPA-43
(used only for shafts 50, 51, 52, 53 and 54)

3	1	.750 Dia. x 4.50 Lg.	T.S.	1
2	1	5/16 - 18 x .75 Lg. Soc. Hd. Cap Scr.	STD.	1
1	1	1.25 x 6.00 x 5.62 Lg.	C.R.S.	1



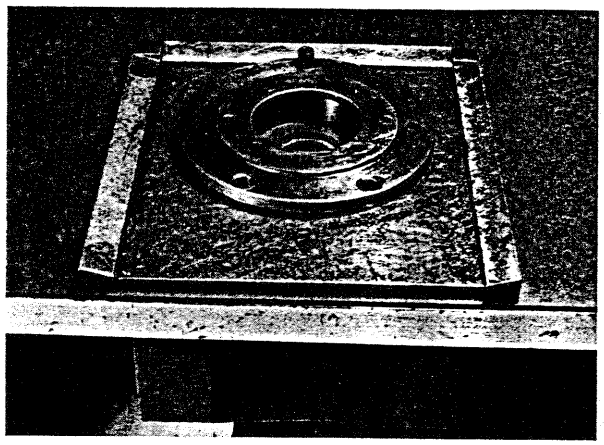
II. Preparation for disassembly

1. Be sure the work is done in a clean area.

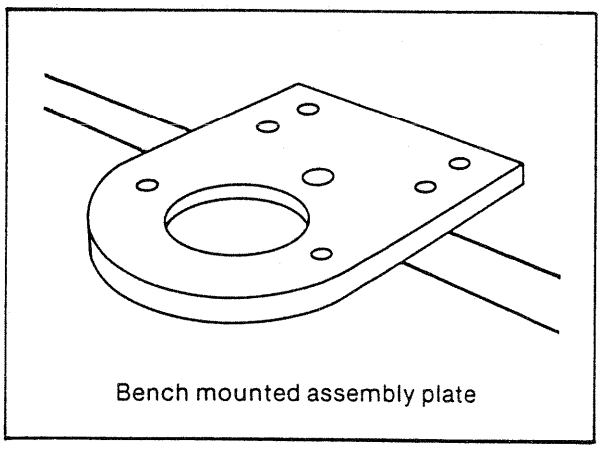
2. Clean the unit thoroughly with a solvent. Remove all sharp edges from splines, drill points, keyways and end of shaft. Mark the adapter and cover/ housing sections to ensure correct reassembly.

Bench mounted assembly plate

3. To aid in disassembly and reassembly, the pump should be retained in some manner. A secure holder is especially important in removal and torquing of capscrews.

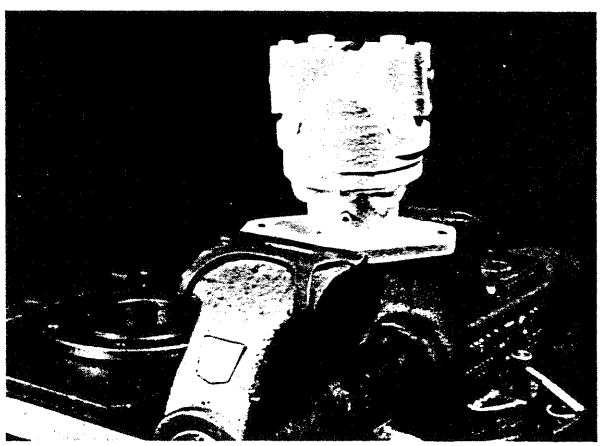


We recommend the use of a steel plate bolted to and extending over the edge of a work bench. The plate should have a hole large enough for the adapter flange pilot to drop through, and two holes matching the location of the mounting holes in the adapter flange. The pump can now be firmly fixed to the plate by bolts.

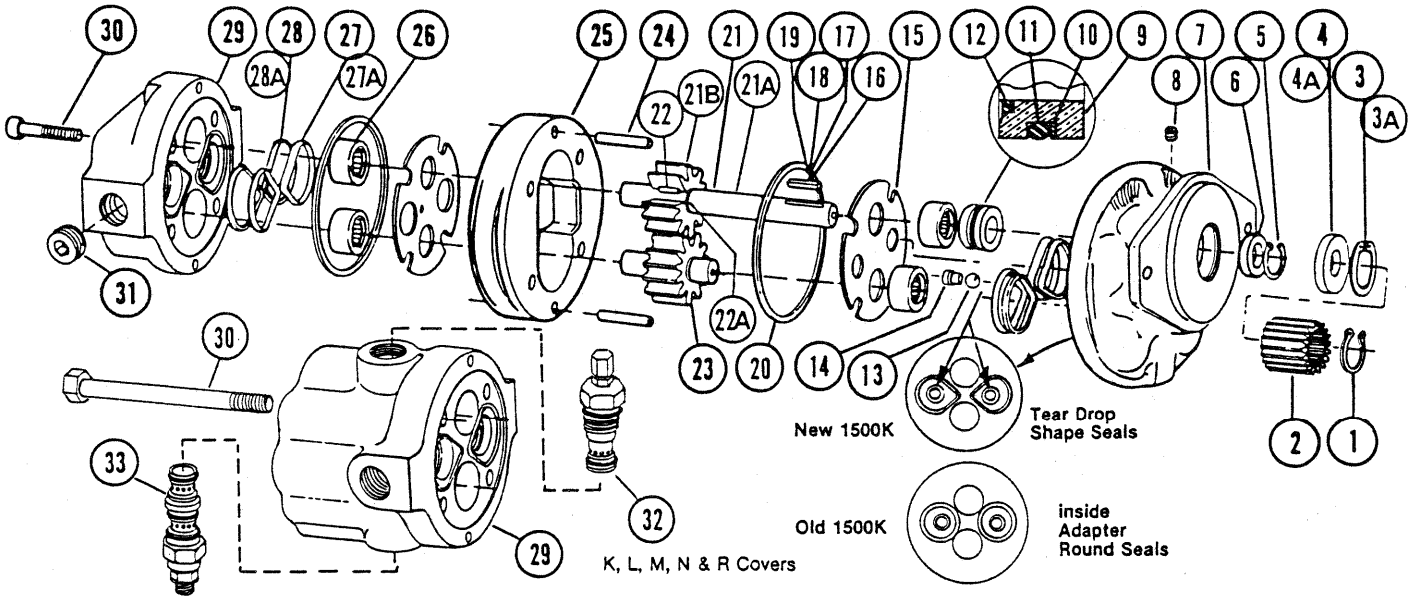


Bench mounted assembly plate

As an alternative, the adapter end of the pump can be clamped in a heavy-duty bench vise.



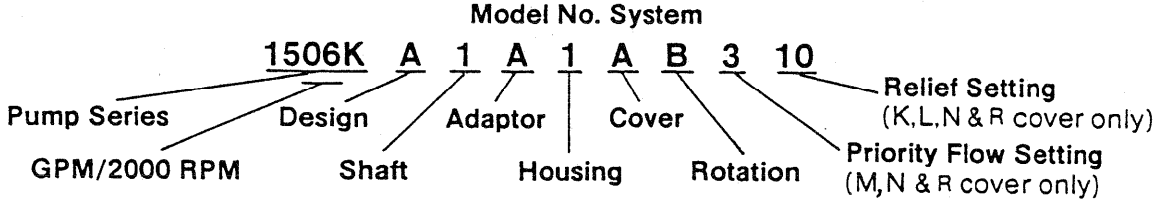
Typical single pump assembly



Parts List and Description

1. Snap ring for #7 shaft
2. Coupling for #7 shaft
3. Snap Ring
3A. Snap Ring
(Use with shafts 50, 51, 52, 53 & 54)
4. Outboard Bearing
4A. Outboard Bearing
(Use with shafts 50, 51, 52, 53 & 54)
5. Snap Ring
6. Seal
7. Adapter
8. Pipe plug
9. Seal (Bushing)
10. Back-up Ring
11. 'O' Ring
12. Seal ring
13. Ball Check (2 pcs. req.)
14. Ball Check Plug (2 pcs. req.)
15. Wear Plate (2 pcs. req.)
16. Key for #2 Shaft
17. Key for #3 Shaft
18. Woodruff Key for #4 Shaft
19. St. Key for #6 Shaft
20. 'O' Ring (2 req.)
21. Drive Shaft Ass'y (#49 & below)
21A. Drive Shafts #50, 51, 52, 53 & 54
21B. Drive Gear for Shafts #50, 51, 52, 53 & 54
22. Dowel for Drive Shafts #50, 51, 52, 53 & 54
22A. Snap Rings for Shafts #50, 51, 52, 53 & 54
23. Driven Shaft Ass'y
24. Dowels
25. Housing
26. Bearings (4 pcs. req.)
27. Back-up ring
28. Seal Rings
29. Cover
30. Cap Screw
31. Pipe Plugs (2 req.)
32. Relief Valve
33. Flow Control Valve

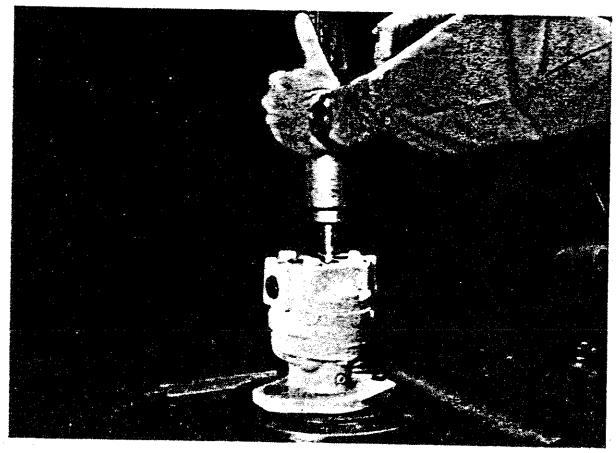
Model No. System



III. Disassembly

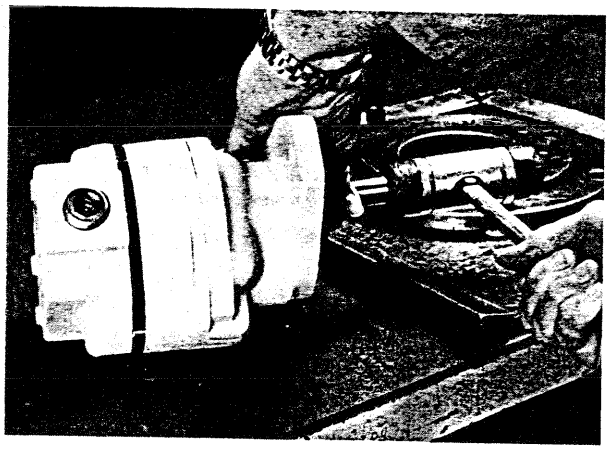
Before starting disassembly, identify the shaft number from the pump model number. (Example: for pump 1500KA4A1AB the "4" designates the shaft.) Shaft numbers 50, 51, 52, 53 and 54 require different disassembly and reassembly procedures than standard shafts that are numbered 49 and down. Where the instructions show alternative procedures, make sure you follow the steps that match the shaft number you are working with.

1. **Remove capscrews (30).**



For pumps with shaft numbers 49 and below

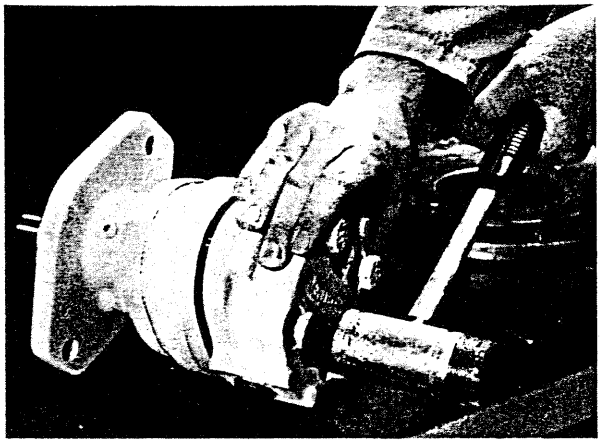
2. **Remove cover (29)** by tapping the drive shaft with a soft head hammer. The cover should separate from the center housing.



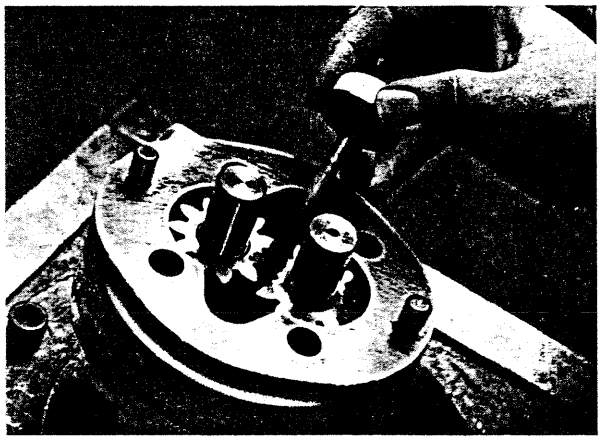
For pumps with shaft numbers 50 through 54

2. To get this pump apart, lay it down on its side and tap on the back of the flange ears with a soft head hammer while you hold the cover.

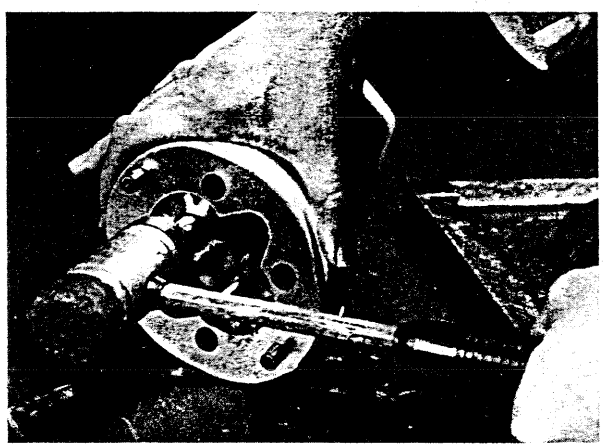
Another way to do this is to reinstall the bolts a couple of turns and then tap on the bolt heads with a soft head hammer.



IMPORTANT: Keep the gears meshed together until they have been marked to ensure replacement in the same position.



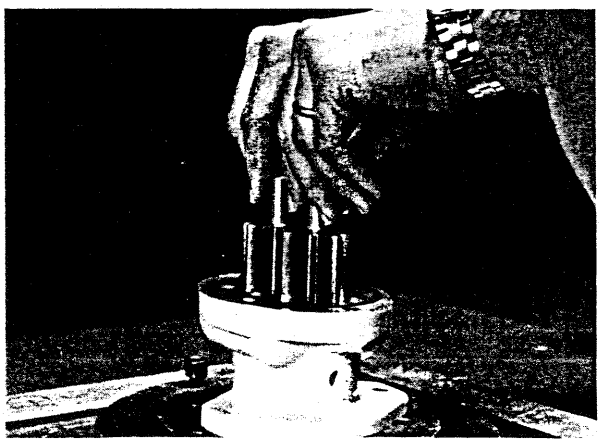
3. **Remove the center housing (25) from adapter (7).** Lay the pump on its side while holding onto the housing. Use a soft head hammer to tap on the ends of the drive and driven shafts (the ends that were in the cover). Do not use a screw driver or wedge to pry apart the separate sections. This will damage the machined sealing surfaces.



For pumps with shaft numbers 49 and below

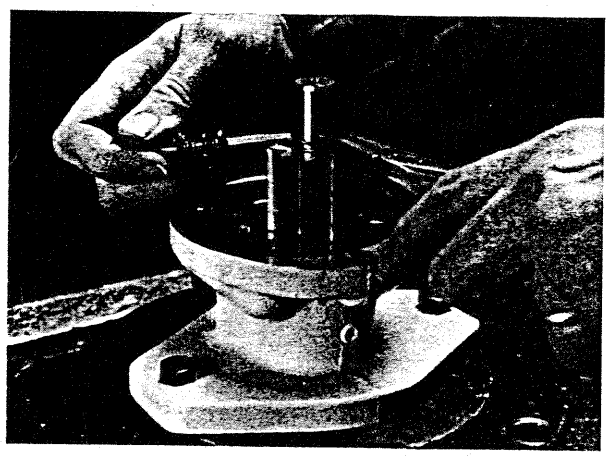
4. **Remove gear assemblies (21) and (23)** by first removing key (16, 17, 18 or 19) from drive shaft (21). The gears will pull straight up out of the adapter.

   On shaft number 7 only the snap ring (1) and coupling (2) must also be removed before the gears can be pulled out.

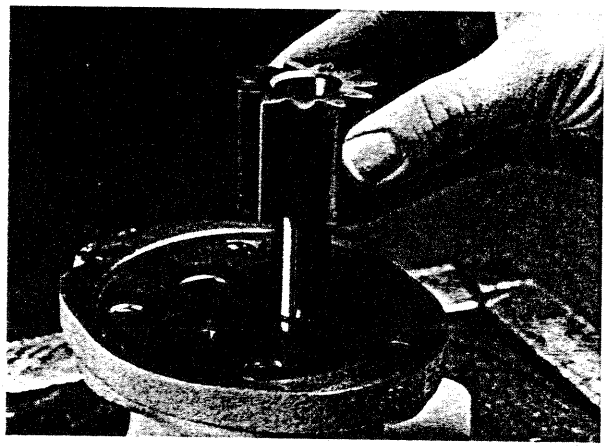


For pumps with shaft numbers 50 through 54

4. **Remove driven gear assembly (23).** Now remove the snap ring (22A) that is next to the gear on the drive shaft (21A). After the snap ring is removed the drive gear can be pulled off of the drive shaft.

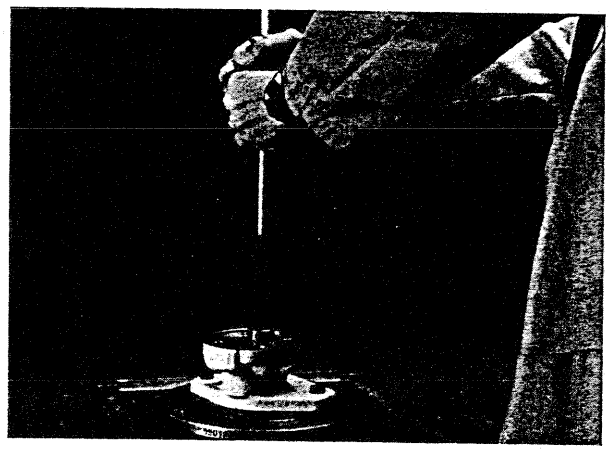


The drive gear (21B) is held in place by a friction dowel (22) and may require some force to pull it off. Next remove the snap ring (22A) that is **under** the gear. The drive shaft can now slide out from the adapter end.

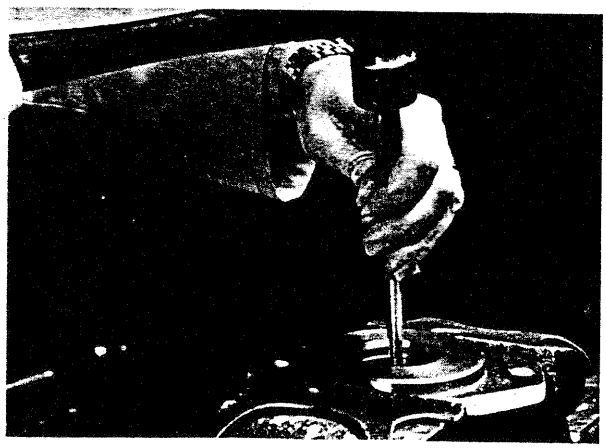


5. **Remove small parts:** wear plates (15), O Rings (20), back-up rings (27) or (27A), seal rings (28) or (28A), and dowels (24).

6. **Remove bearings (26), if necessary,** using Bearing Removal Tool.
NOTE: Even with the use of the Bearing Removal Tool, bearings will likely be damaged upon removal and will require replacement. For minor service such as outboard seal (6) replacement, bearings may not need to be removed. See **SERVICE INSPECTION** for suggestions on inspecting bearings without removing them.

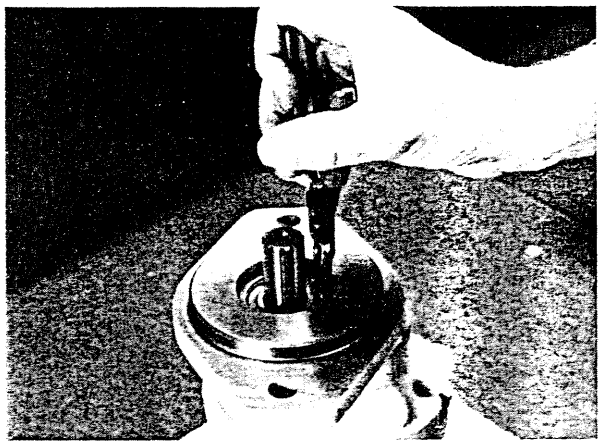


7. **Remove bushing (9)** from adapter (7). (This step presumes that bearings have been removed.)

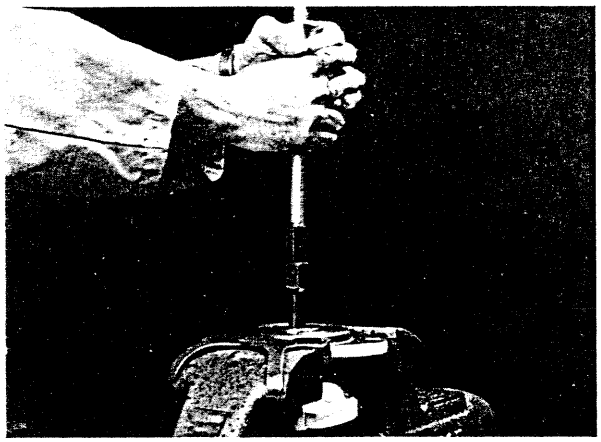


8. **For C-design pump only** (see Model Number legend on page 5)

remove snap ring (3, 3A)

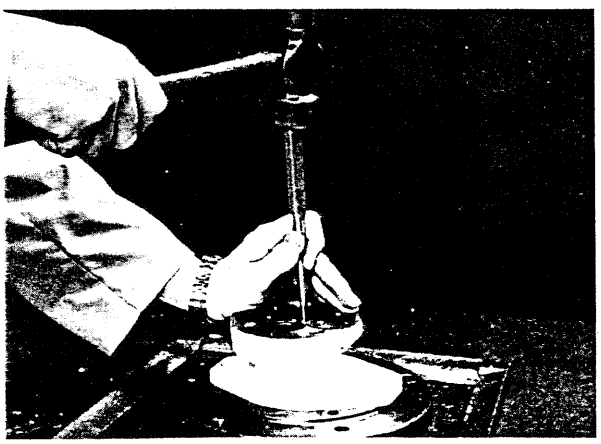


and outboard bearing (4, 4A).



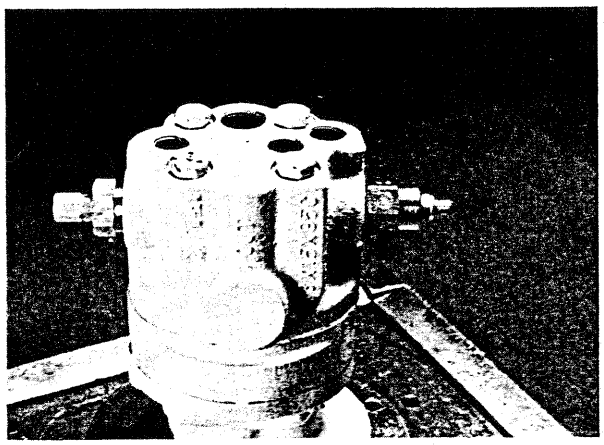
9. **Remove snap ring (5)**

and seal (6).



10. **For pumps with K, L, M, N and R covers (29)** remove relief valve (32) and/or flow control valve (33). If your cover has one or both of these parts, clean these valves as they are. Do not disassemble them.

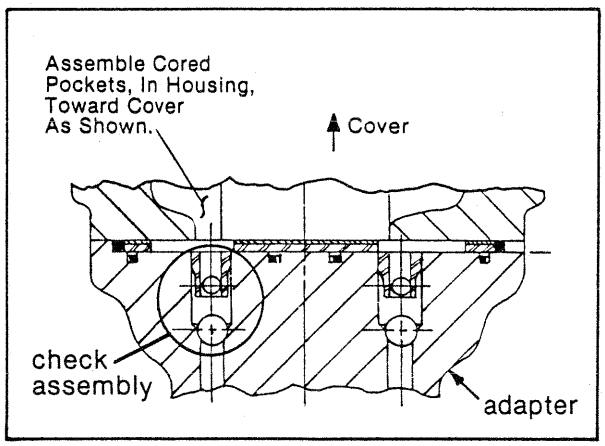
This completes disassembly.



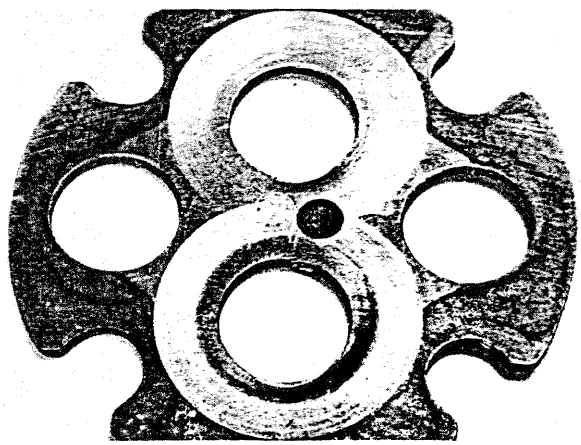
IV. Service inspection

This is decision making time to determine what parts are reusable. In all cases, O-rings and seal components should be replaced. The following factors should be considered in determining the re-usability of a component: (For individual parts see page 5)

1. The adapter (7) and cover (29) are normally reusable. The check assemblies (13) and (14) in the adapter normally do not need to be replaced.

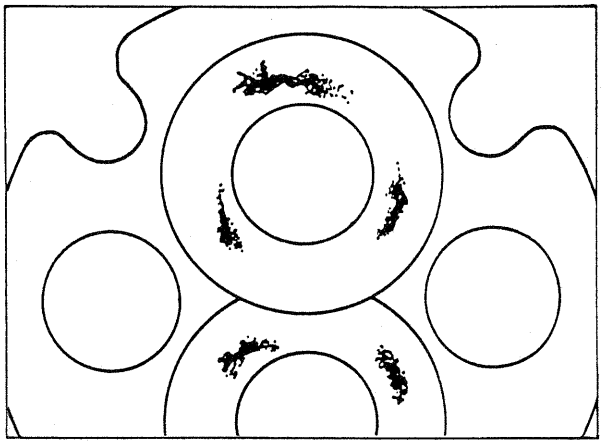


2. Discard wear plates (15) that have score marks or show a heavy wear pattern.



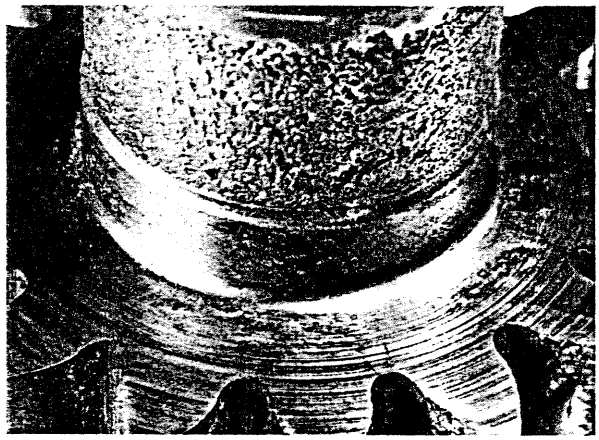
Also discard plates that show pitting or erosion marks that indicate cavitation or aerated oil condition.

It is not necessary to replace wear plates in pairs; a single plate can be replaced if wear is unequal.

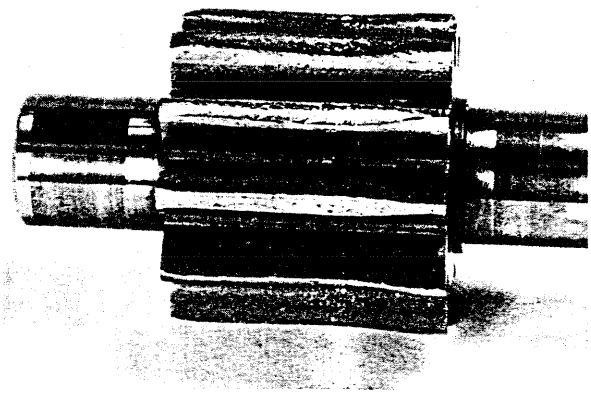


3. Gear assemblies (21) and (23) should be discarded if:

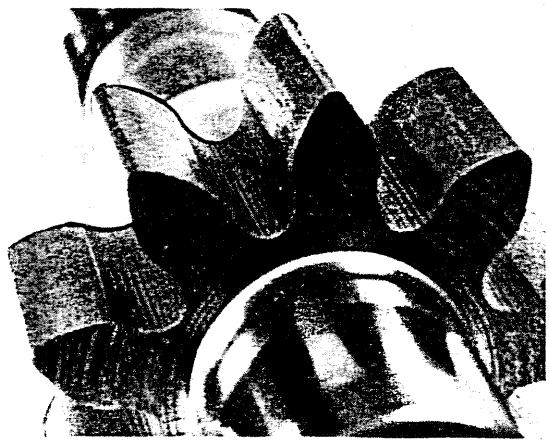
   a. Shaft journals show excessive wear or pitting.



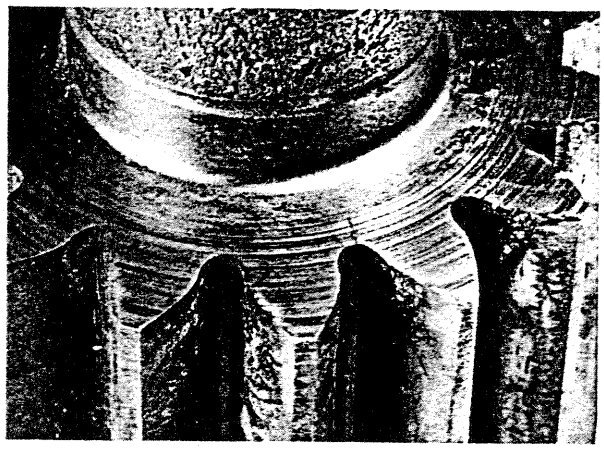
   b. Gear teeth show excessive wear.



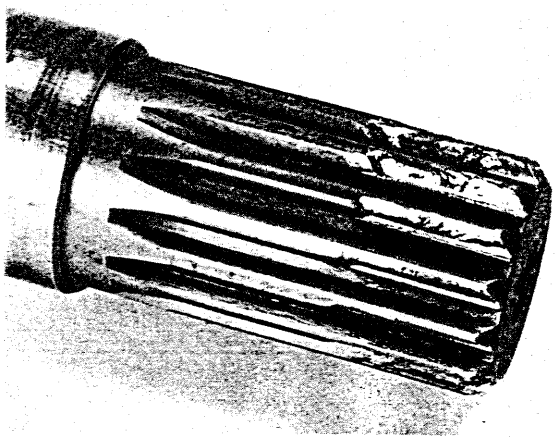
   c. Edges of gear teeth have developed ridges.



d. Gear face is scored or cracked.

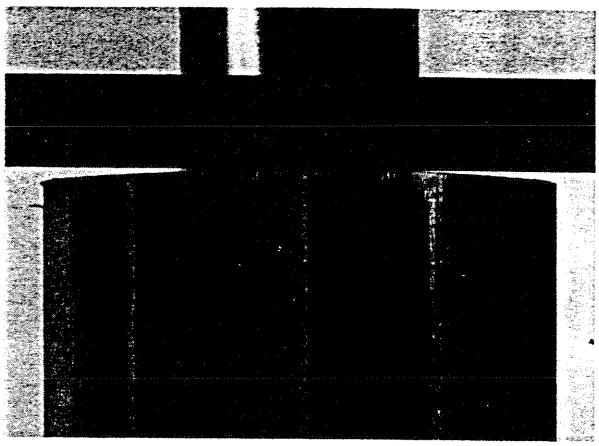


e. Drive shaft splines or keyways are distorted or badly worn.

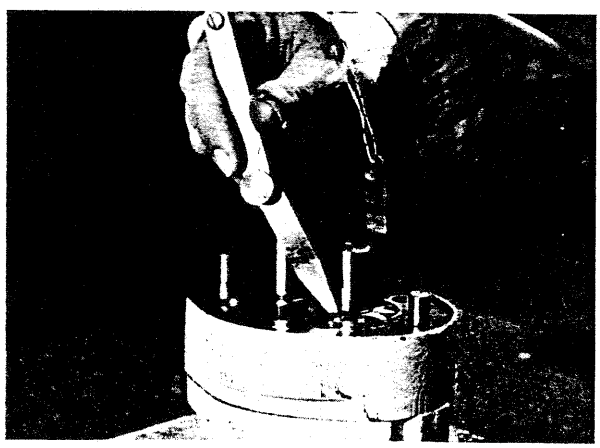


f. Gear faces not parallel.

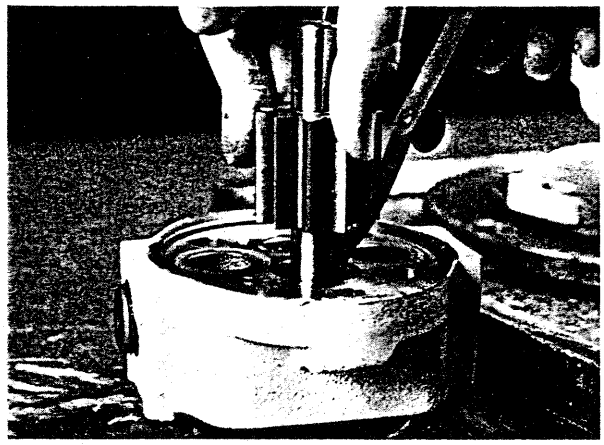
IMPORTANT: Gear assemblies must be replaced in pairs, along with all four bearings.



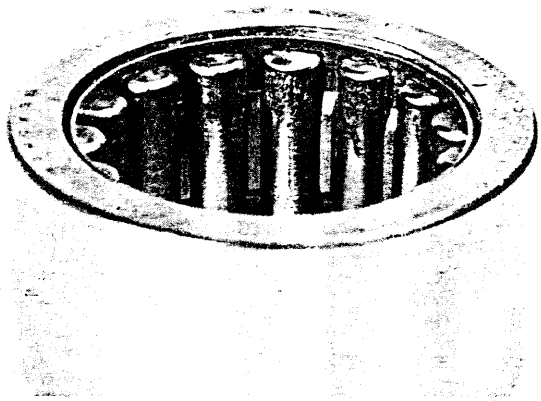
4. Check clearance between the gear housing and gear teeth. To measure this clearance, place a .005 inch thick shim at point 'A'. Measure clearance at point 'B' while holding the gear against the shim at point 'A'. The housing and/or gears should be replaced if the clearance exceeds .010 inch at point 'B'.



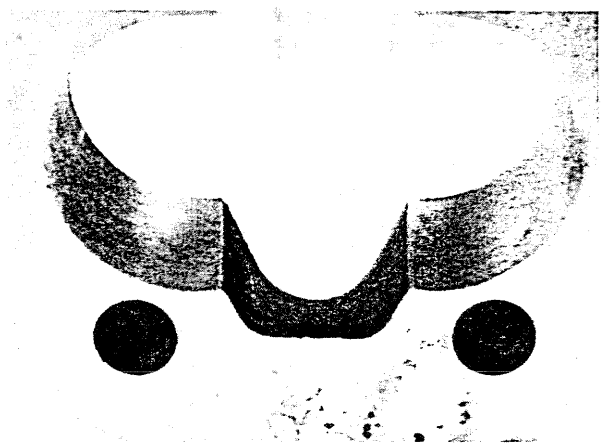
5. Check roller bearings for internal clearance by use of a feeler gauge. Bearings and gear assemblies should be replaced if clearance exceeds .003 inch.



6. Bearings should be examined for evidence of spalling of rollers and fracture of stamped cages. Check roughness of outer race by sliding rollers around periphery of cage. If bearings were not removed, bearing condition can be checked by seeing if rollers move smoothly and easily with finger pressure. Any bearing showing excessive wear or other damage will need to be replaced.



7. Check inside of housing (25) for visible signs of wear. Typically, housing wear will match gear teeth wear, and if gear assemblies require replacement, so will the housing.

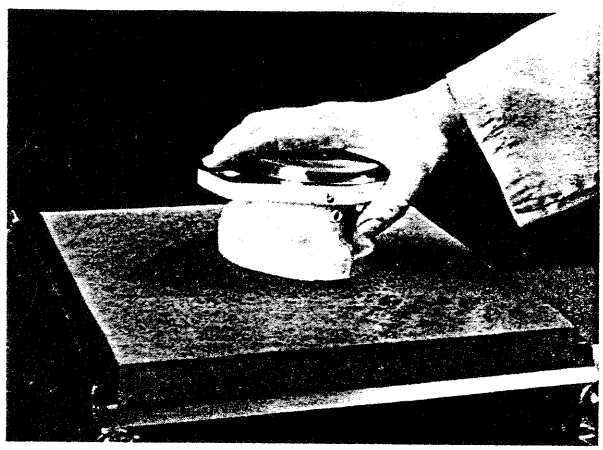


In addition to these specific areas of inspection, common sense and knowledge of the product are also important. A pump having many hours of operation under ideal conditions would not necessarily reveal extreme wear signs. But shafts and bearings can and do fail as a result of fatigue. Therefore, consideration must be given to length of time in service as well as the application of the pump.

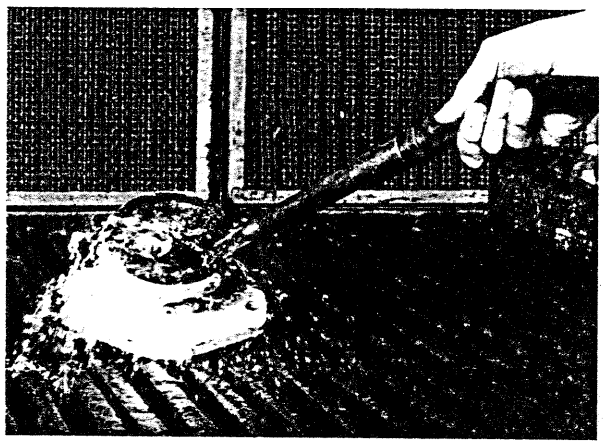
V. Reassembly

Keep It Clean!

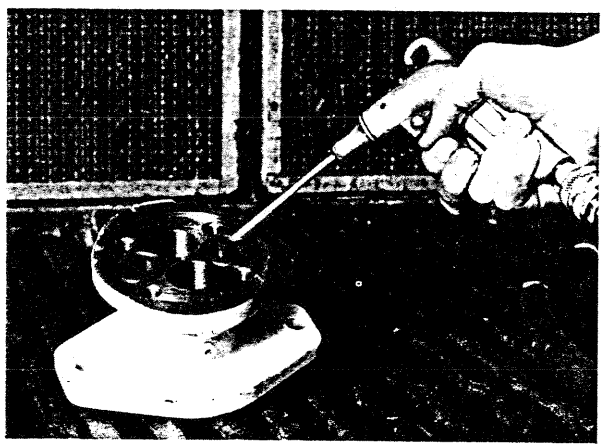
Prior to reassembly all parts should be deburred by sanding or stoning,



washed in a solvent, wiped with a clean lint free cloth and air dried.



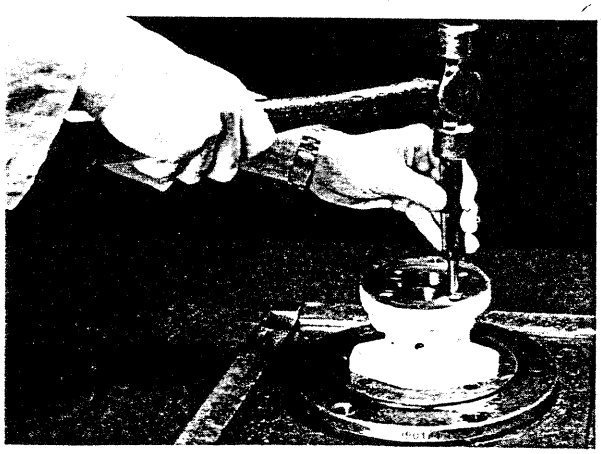
Use of compressed air will both speed drying and ensure removal of small abrasive and metal particles.



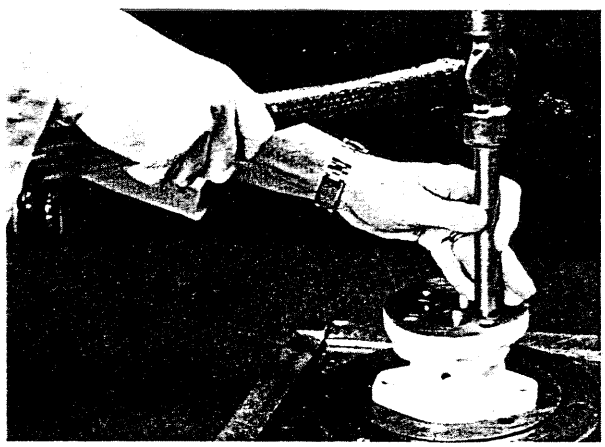
As with disassembly instructions, check the shaft number of the pump you are working on. Alternate procedures are listed for pumps with shaft numbers 50, 51, 52, 53 and 54.

NOTE: Steps 1 and 2 are applicable only when assembling a new adapter.

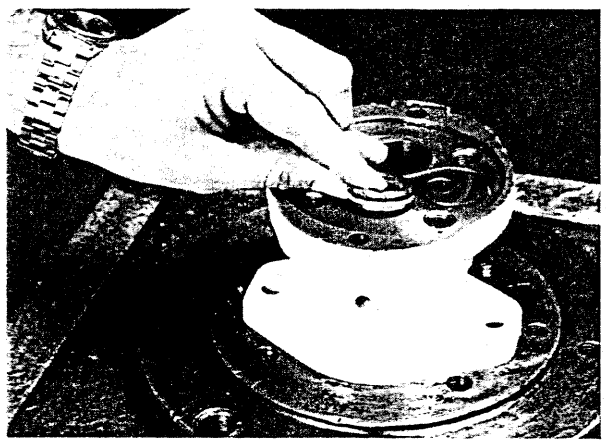
1. **Install new steel balls (13)** in adapter and seal them by tapping with hammer. See ball seat tool #98402-5.



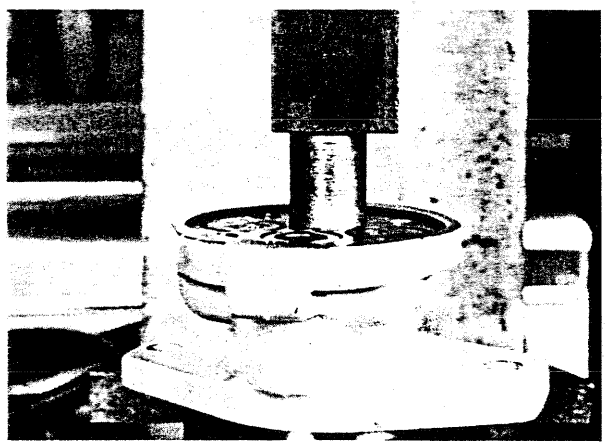
2. **Install new ball retainers (14)** in adapter. Press flush to .030 below machined surface. See ball retainer driver #DPA-38.



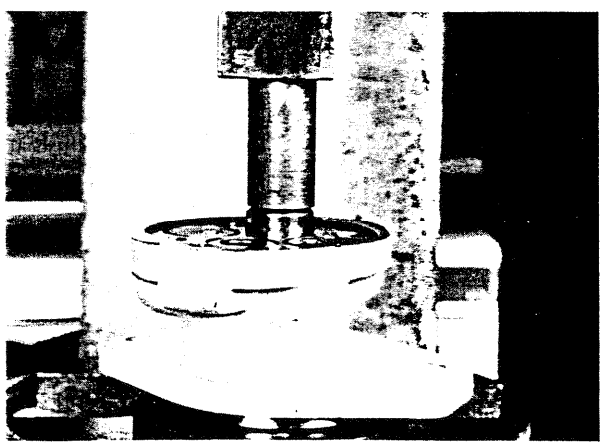
3. **Sub assemble bushing (9)** by installing O-ring (11) towards counterbore and inserting back-up ring (10) next to the O-ring (away from the counter bore). Lubricate exposed O-ring and back-up ring to prevent cutting them on installation.



4. **Install bushing assembly in adapter.** Insert it "counter bore up" in the bore that holds the drive shaft. Press firmly in place until seated. Install seal ring (12) in the bushing counter bore. Make sure bushing is firmly seated at bottom of shaft bore.

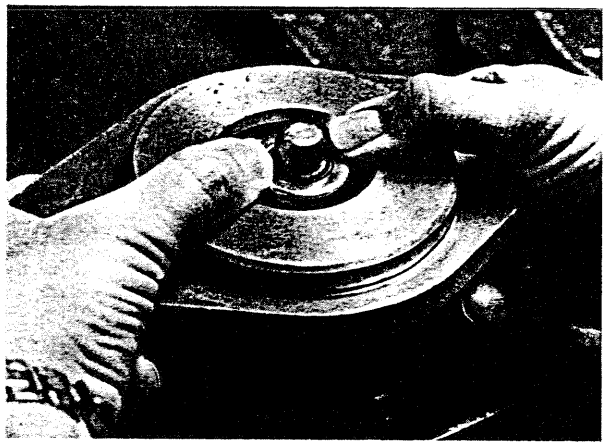


5. **Install bearings (26)** in the adapter (7) and cover (29). Make sure part numbers on the bearings are facing up. Press flush to .005 below machined surface. See bearing driver tool #DPA-023-36.

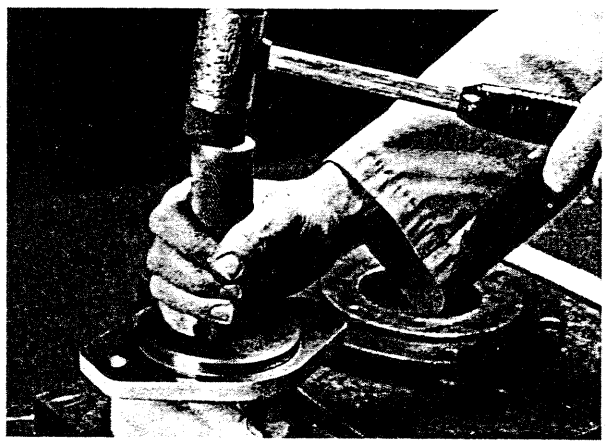


For pumps with shaft numbers 50 through 54

6. Put the adapter (7) on fixture FPA 43. Lubricate seal (6) and place it on fixture flat edge up (counter bore down). Slide the seal (6) down the fixture until it stops on the adapter.

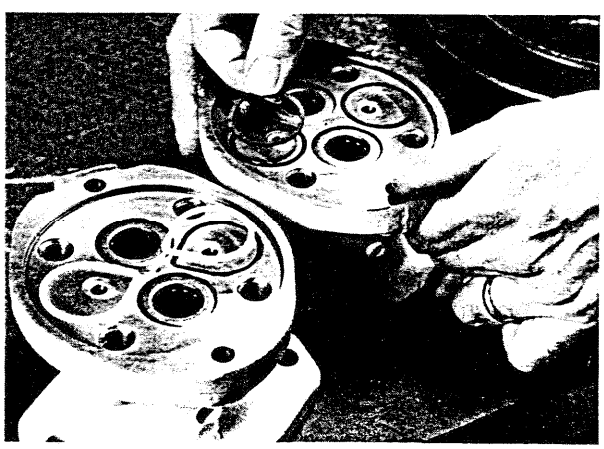


Using Seal Driver DAP24-64 drive the seal into the adapter.



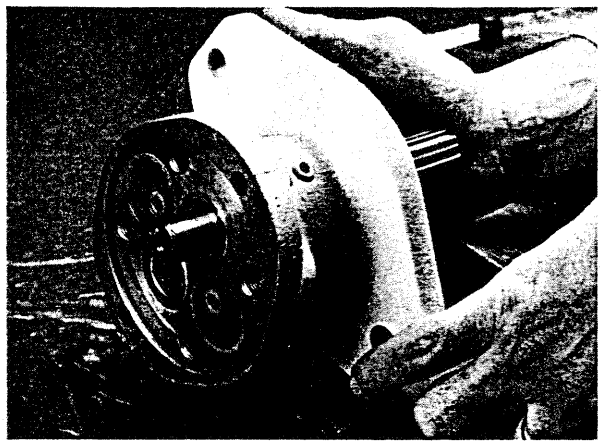
Remove adapter from the fixture and install snap ring (5).

7. **Install O-rings (27) (27A)** and back-up rings (28) (28A) in the adapter and cover. Rubber O-rings are inserted first; back-up rings go on top of the O-rings.

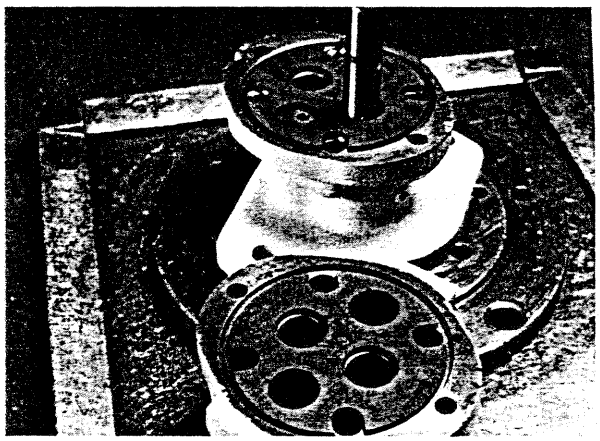


For pumps with shaft numbers 50 through 54

8. Slide the drive shaft (21A) through the adapter (7) from the pilot side. Be careful not to damage the seal. After the shaft is fully engaged in the adapter, place the adapter up so that the shaft will stay engaged while you put one snap ring (22A) on the shaft closest to the adapter.

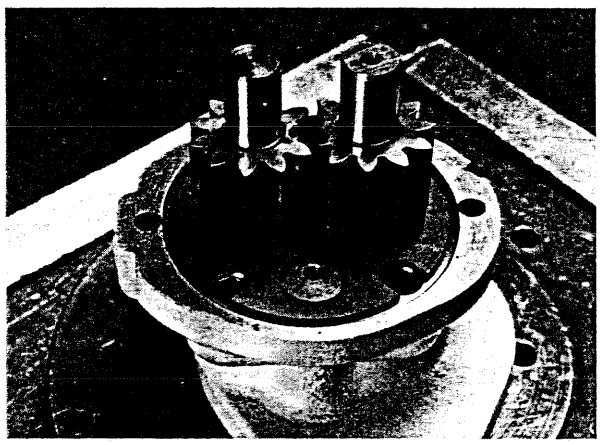


9. **Put wear plates (15)** in the adapter (7) and cover (29). High pressure pockets on wear plates must face gears. **IMPORTANT: The high pressure pocket in the cover will have to be 180° opposite the high pressure pocket in the adapter when the pump is finally assembled.**



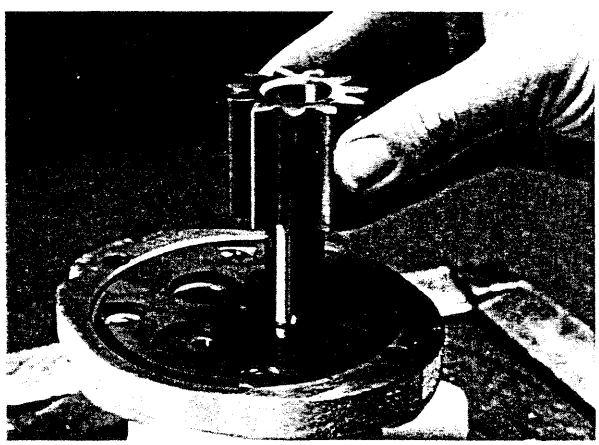
For pumps with shaft numbers 49 and below

10. Install drive gear assembly (21) and the driven gear assembly (23) in the adapter (7). If using original gears, make sure to align marks made during disassembly.

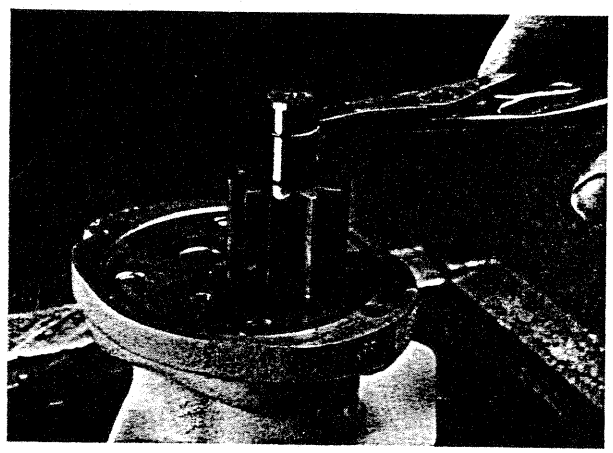


For pumps with shaft numbers 50 through 54

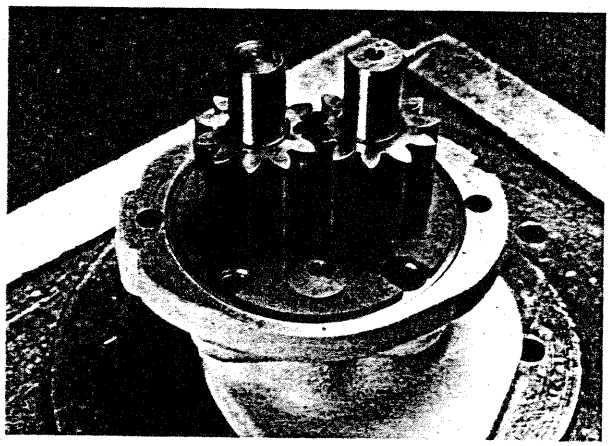
10. **Insert the dowel pin (22)** in the groove on drive shaft. Place drive gear (21B) on shaft flat side down (side with champfer towards rear of pump). Slide the gear (21B) down the shaft until it clears the second snap ring groove.



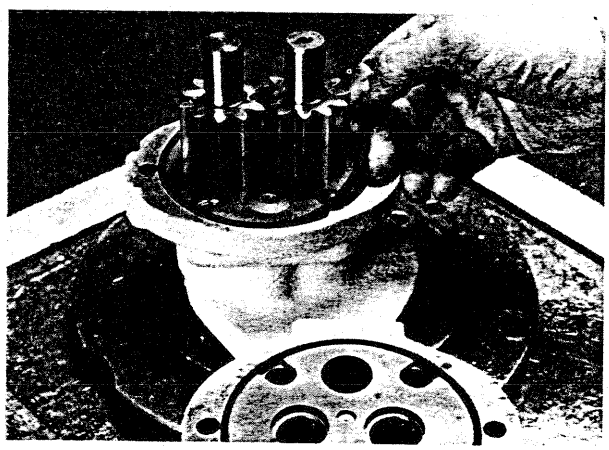
Install the second snap ring (22A). Install driven gear (23) in the adapter.



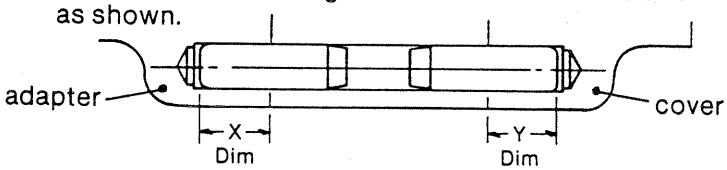
If using original gears, make sure to align marks made during disassembly.



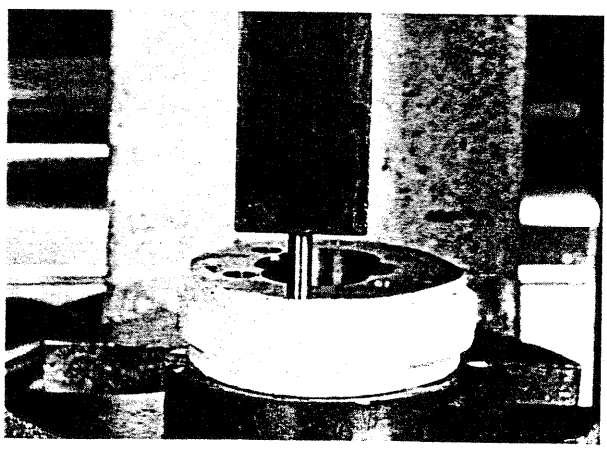
11. **Install O-rings (20)** around the wear plates (15) in the adapter and cover.



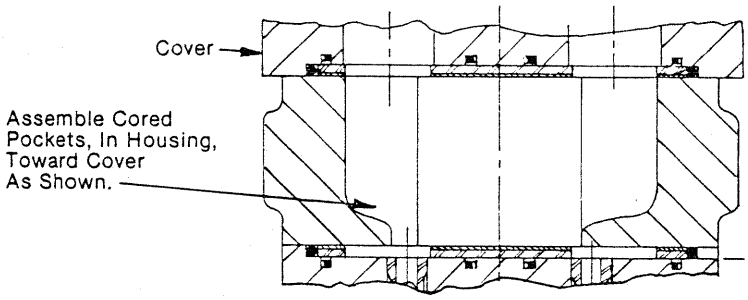
12. **Install both dowels (24)** in the housing (25). Press dowels in the housing to the X and Y dimensions as shown.

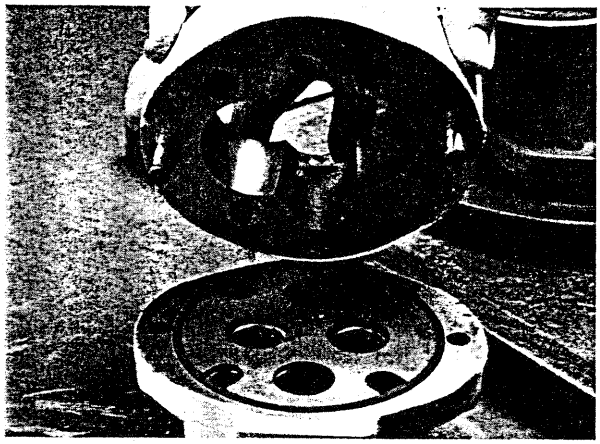


Pump Size	Dowel	Qty. Req'd.	"X" Dim.	"Y" Dim.
1506	A552 x 8	2	.562	—
1510	A552 x 9	2	.500	—
1512	A552 x 5	4	.500	.500
1515	A552 x 6	4	.594	.594
1518	A552 x 6	4	.594	.594

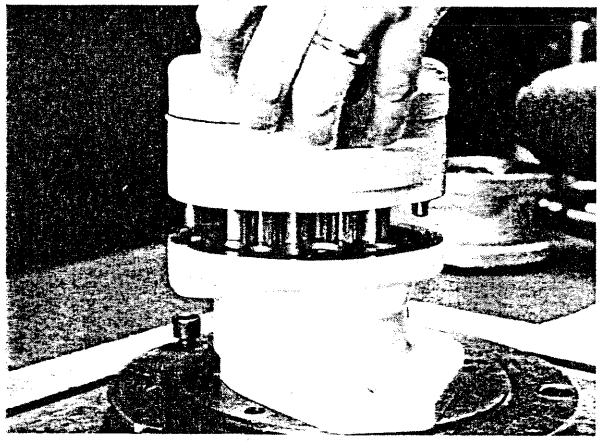


13. **Join the housing (25)** to the cover (29) with the cored pockets of the housing toward the cover.

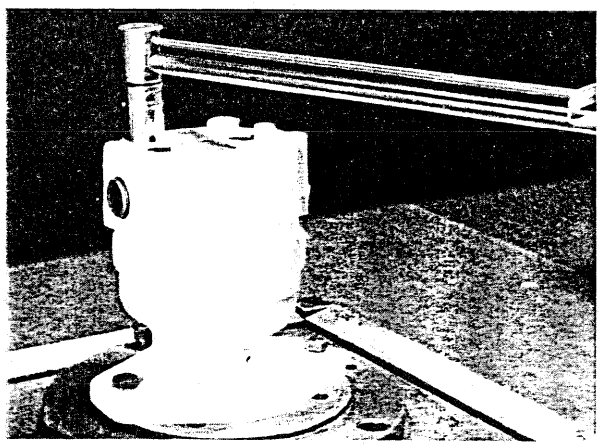




14. **Install the cover and housing assembly** onto the adapter (7). Don't forget to have the high pressure pockets of the wear plates positioned 180° opposite of each other. Note that the wear plate in the cover (29) can still be rotated even with the housing attached.



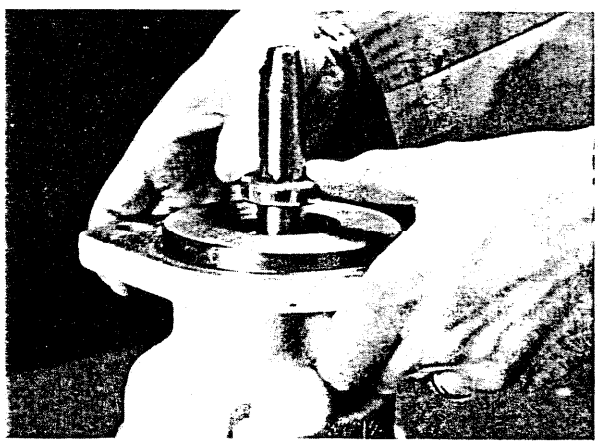
15. **Install capscrews (30)** and torque evenly to 70 foot pounds.



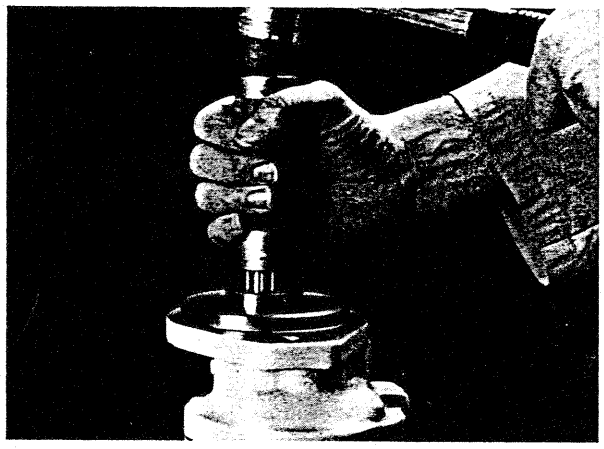
For pumps with shaft numbers 49 and below

16. **Install seal (6)** by first lubricating seal lips and using thimble #TA004-9 to prevent damaging seal on installation. Install seal with flat side up (counter bore towards pump).

    Install snap ring (5).

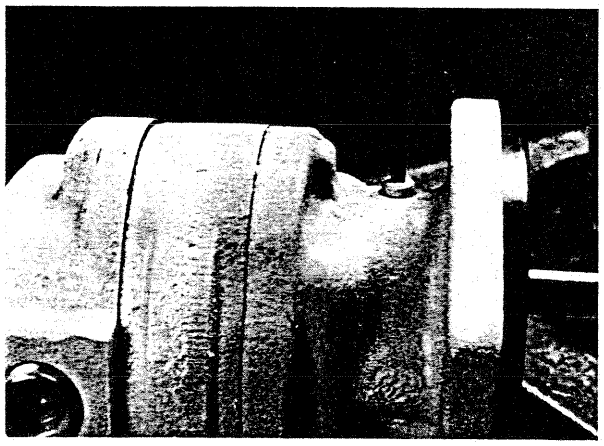


17. **For C-design pump** install outboard bearing (4, 4A) using the outboard bearing driver DPA 24-64.

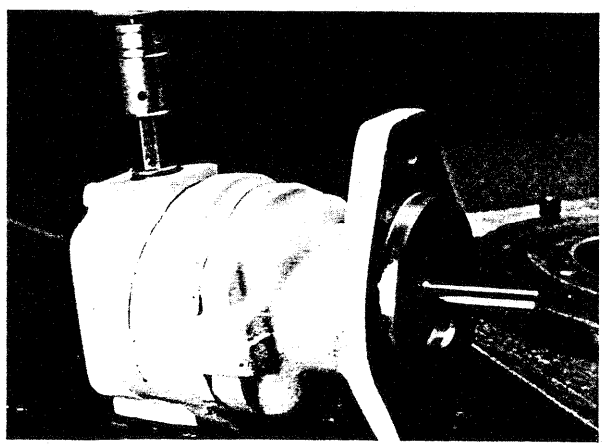


Install the snap ring (3, 3A).

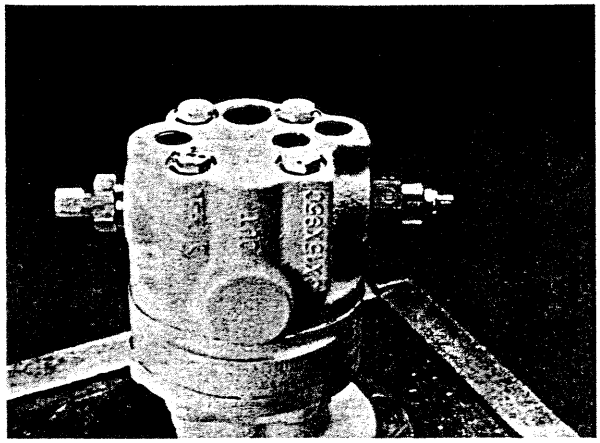
18. **Install the pipe plug (8)** in the adapter (7). Note: When pump is used as a motor in series, remove pipe plug and install a small external drain line.



19. **Install the pipe plugs (31)** on two inactive ports.



20. **For cover styles K, L, M, N and R** install relief valve (32) and/or flow control valve (33) in cover (29) if your cover has one or both of these parts.



This completes assembly. The pump should be checked for tightness by hand or crescent wrench. If the shaft is too tight and cannot be turned, disassemble and inspect for burrs, pinched O-rings, or other obstructions.

VI. Break-in of repaired pumps

NOTE: Bi-rotational and uni-direction pumps have different test procedures as noted.

If shop test stand is available on which pump can be mounted and operated against full pressure and at maximum speed, the following procedure is recommended for break-in and testing:

1. **FLUID CONDITIONS:**
   1.1 fluid per Hydreco Oil specifications
   1.2 temperature 110°F +/– 10°F
   1.3 filtration 10 micron nominal

NOTE: Make sure you have a bi-rotational pump. If you have a uni-direction pump (covers K, L, M, N or R) you must use procedures 4 and 5.

2. **BREAK-IN CYCLE:** (both directions of rotation)
   2.1 speed – 1800 + 50 rpm
   – 100 rpm
   2.2 pressure time cycle
   500 psi: 1 second on load/2 seconds off load — 3 cycles
   1000 psi: 1 second on load/2 seconds off load — 3 cycles
   1500 psi: 1 second on load/2 seconds off load — 3 cycles
   2000 psi: 1 second on load/2 seconds off load — 3 cycles
   *2250 psi: 1 second on load/2 seconds off load — 4 cycles
   *2500 psi: 1 second on load/2 seconds off load — 4 cycles
   *omit these two steps for model 1518K

3. **PERFORMANCE CHECK:**
   (both directions of rotation)
   3.1 speed: 1800 +/– 10 rpm
   3.2 pressure: 2000 psi
   3.3 minimum allowable flow:
   Model 1506K - 4.6 gpm
   Model 1510K - 8.1 gpm
   Model 1512K - 10.4 gpm
   Model 1515K - 12.7 gpm
   Model 1518K - 14.9 gpm

NOTE: This procedure is for uni-directional pumps only (covers K, L, M, N or R). (ONE ROTATION ONLY)

4. **BREAK-IN CIRCUIT**
   4.1 Internal relief blocked.
   4.2 External relief on priority and secondary circuits.
   4.3 Connect relief bypass to tank.

5. **BREAK-IN**
   5.1 Follow break-in per 1500K General Specification steps 2 and 3 (except one rotation only). Maintain priority circuit at min. pressure and pressurize secondary circuit.
   5.2 Minimum flow (combination of primary and secondary) to conform to 1500K General Specification (step 3.3).
   5.3 Check priority flow by loading both priority and secondary to 1000 PSI. Read priority flow at 1200 RPM.

   Minimum allowable flow:
   422X117-3 – 3 ± .3 GPM
   422X117-6 – 6 ± .6 GPM
   422X117-9 – 9 ± .9 GPM

   5.4 Check priority flow by loading priority to 1000 PSI and secondary to 100 PSI. Read priority flow at 1200 RPM.
   5.5 Check priority flow by loading priority to 100 PSI and secondary to 1000 PSI. Read priority at 1200 RPM.
   5.6 Priority flow checks in 5.4 and 5.5 to be within ± .2 GPM of that read in 5.3.

6. **RELIEF SETTING**
   6.1 Adjust 422X100 relief valve adjustment screw to give specified setting ± 50 PSI at full relief flow (0 priority flow).

VII. Hydraulic system maintenance

Hydraulic mechanisms are precision units, and their continued smooth operation is dependent on proper care. Foreign matter can cause considerable trouble and every precaution should be taken to keep the system clean. Change the oil and filter at regular intervals.

Best results are obtained by using a good grade of hydraulic oil having a viscosity index of not less than 173 to 185 SUS at 100°F. Operating oil temperature should not exceed 200°F as the viscosity and lubricating qualities are reduced at a higher temperature.

Always use a good grade of oil that has satisfactory characteristics for the elimination of **FOAMING, OXIDATION** and the **PREVENTION of corrosion.**

DO NOT use the following fluids in the hydraulic systems:
a. Hydraulic brake fluid
b. Low viscosity naptha base engine oils

Consult our engineering department when considering the use of the following fluids:
a. Aircraft hydraulic fluids
b. Non-flammable hydraulic fluids

Always drain dirty oil, remove and replace filters, flush and refill the system with clean oil.

Check the oil level frequently and add oil if necessary. Add only clean oil to the system.

TROUBLESHOOTING

Possible pump troubles	Causes	Remedies
Pump unusually noisy.	Low supply of oil.	Fill to proper level.
	Heavy oil.	Change to proper oil.
	Dirty oil filter.	Clean and replace filter.
	Suction line too small.	Increase size of suction line.
	Restriction in suction line.	Remove.
	Air leak in suction line.	Check for loose connection.
	Oil temperature extremely high causing vapor to form in the oil.	Check entire circuit.
	Pump sucking air through the shaft oil seal when pump is idling.	Check by squirting oil around the seal. —Replace if faulty.
Pump takes too long to respond or fails to respond.	Low oil supply.	Fill to proper level.
	Insufficient relief valve pressure.	Reset to correct pressure setting using gauge.
	Pump worn or damaged.	Inspect, repair or replace.
Oil heating up.	Foreign matter lodged between the relief valve plunger and relief valve seat.	Inspect and remove foreign matter.
	Using very light oil in hot climate.	Drain and refill with proper oil.
	Dirty oil.	Drain, flush and refill with clean oil.
	Oil level too low.	Fill to proper level.
	Insufficient relief valve pressure.	Set to correct pressure.
	Relief valve pressure too high.	Same as above.
	Pump worn (slippage)	Replace or repair.
Oil foaming.	Air leaking into suction line from tank to pump.	Tighten all connections.
	Wrong kind of oil.	Drain and refill with non-foaming type of hydraulic oil.
	Oil level too low.	Fill to proper level.
	Improper tank or reservoir baffling.	Baffle correctly.
	Discharge lines not below oil level.	Extend lines below oil level.