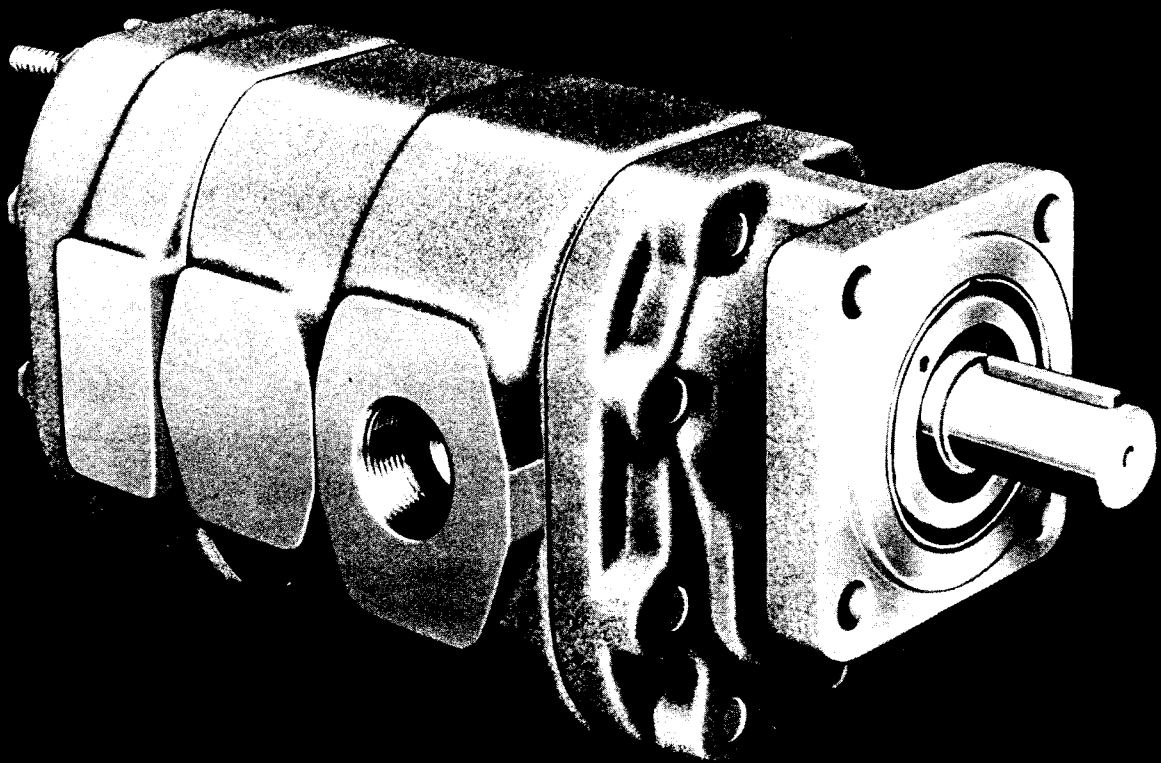


37X SERVICE MANUAL

SINGLE
AND TANDEM
OIL HYDRAULIC
PUMPS — MOTORS



foreword . . .

This descriptive guidebook will familiarize you with COMMERCIAL Model 37X single and tandem pumps and motors—their component parts—relative position of each part—proper methods for assembly or disassembly of units—care and use of these oil hydraulic units so that better performance and greater life expectancy will result for your benefit.

A photographic presentation with explanatory notes covers the steps that should be closely followed when

servicing the elements that comprise these units. Before any work is done in the repair of these units, it is suggested that all of the steps used in tearing down the assembled unit and all of the steps used in building up the unit be read. Such a digest will familiarize you with the general procedure of the work to be done and give you the feel of the specific operations involved.

general instructions . . .

Here you have a gear type fixed displacement oil hydraulic pump or motor which has been built to very high standards and a new design. The result is the Model 37X pump and motor having operating characteristics far superior to other pumps and motors of its type. Close fits and small running tolerances were originally built in to insure peak performance and highest operating efficiency.

Slippage is a factor which has considerable bearing on the performance. As the amount of slippage is reduced, the higher the operating efficiency. Best results develop when a close fit is made between the gears and all surfaces they come in contact with. Allowance of a minimum running clearance is, of course, necessary.

Inspection of all COMMERCIAL pumps and motors will disclose gears in matched pairs—all are original equipment, made by COMMERCIAL on specially built machines which produce surfaces within limits much closer than is standard practice.

Seldom should you find it necessary to service the Model 37X oil hydraulic pump or motor during its life expectancy, but should a noticeable drop in performance occur it is advisable to make an inspection and replace such parts or components which, due to some unusual condition, may have become worn. Should you find it advisable to replace the gears, insist they be in matched pairs and the product of the original manufacturer. Matched gears are the very vitals of the gear type pump or motor. Expendable parts such as “O” ring shaft seals, pocket seals, single and double-lip oil seals and back-up rings should never be re-used even though inspection may show these items as being serviceable for future use. Such parts for replacement are available at a cost which is insignificant in view of your investment and when you consider the vital function of these items is to prevent leakage. All replacement parts should be given your final inspection to insure that no damage has resulted after final factory inspection was made.

lubrication . . .

All parts of the units are lubricated by the hydraulic oil in the circuit. Particular attention must be paid to keep the oil in the circuit system clean. Whenever there is a pump or motor failure and there is reason to feel that metal particles may be in the system, the oil must be drained, the entire system flushed clean, and any filter screens thoroughly cleaned. New oil should be supplied for the entire system. Oil suitable and recommended for use in circuits involving Model 37X pumps and motors should meet the following specifications:

Hydraulic oils should have a viscosity index of 90 or higher and a viscosity SUS 150 to 200

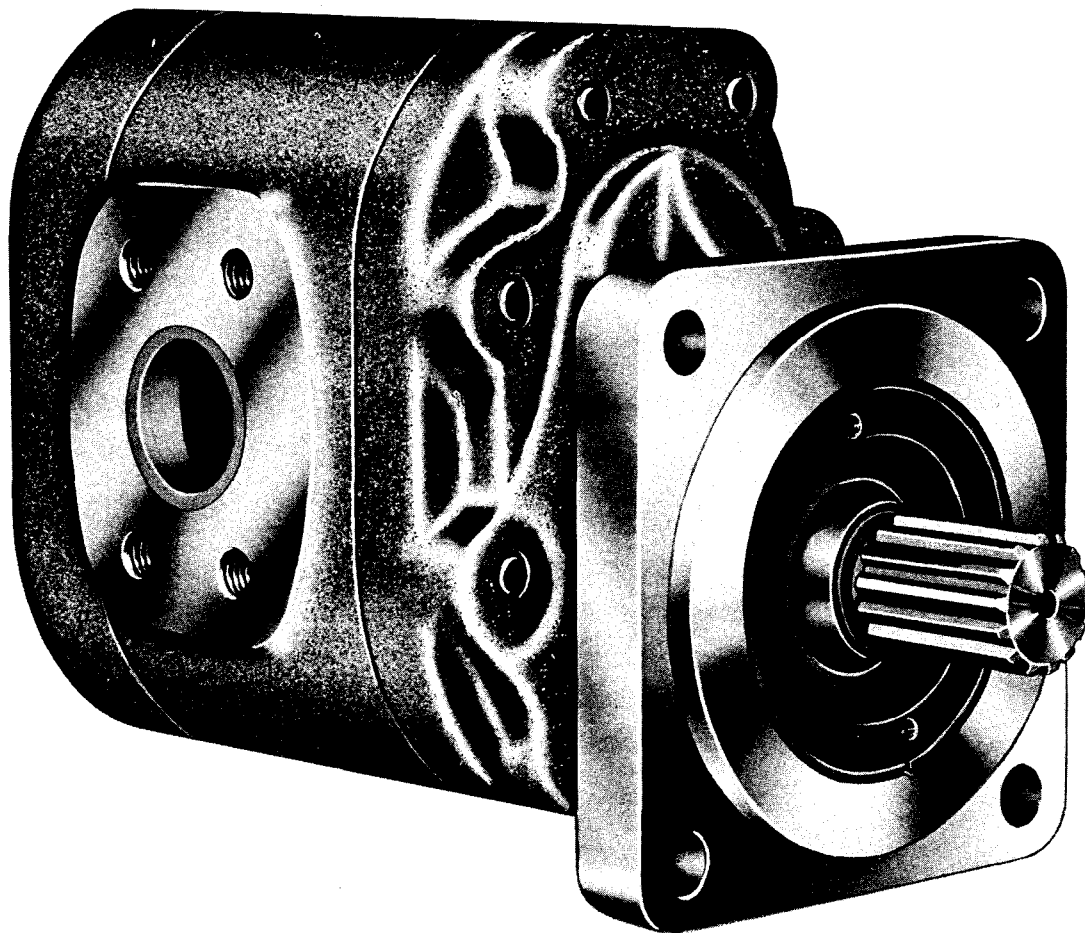
at 100°F. Aniline point should be 165 or higher.

Oil operating temperatures should not exceed 200°F.

Oil should have anti-foam and anti-oxidation additives.

Do not use low viscosity naphtha base oils, aircraft hydraulic fluid, or hydraulic brake fluid. Oil with a low pour point should be used when operation is to be in cold, low temperature climates.

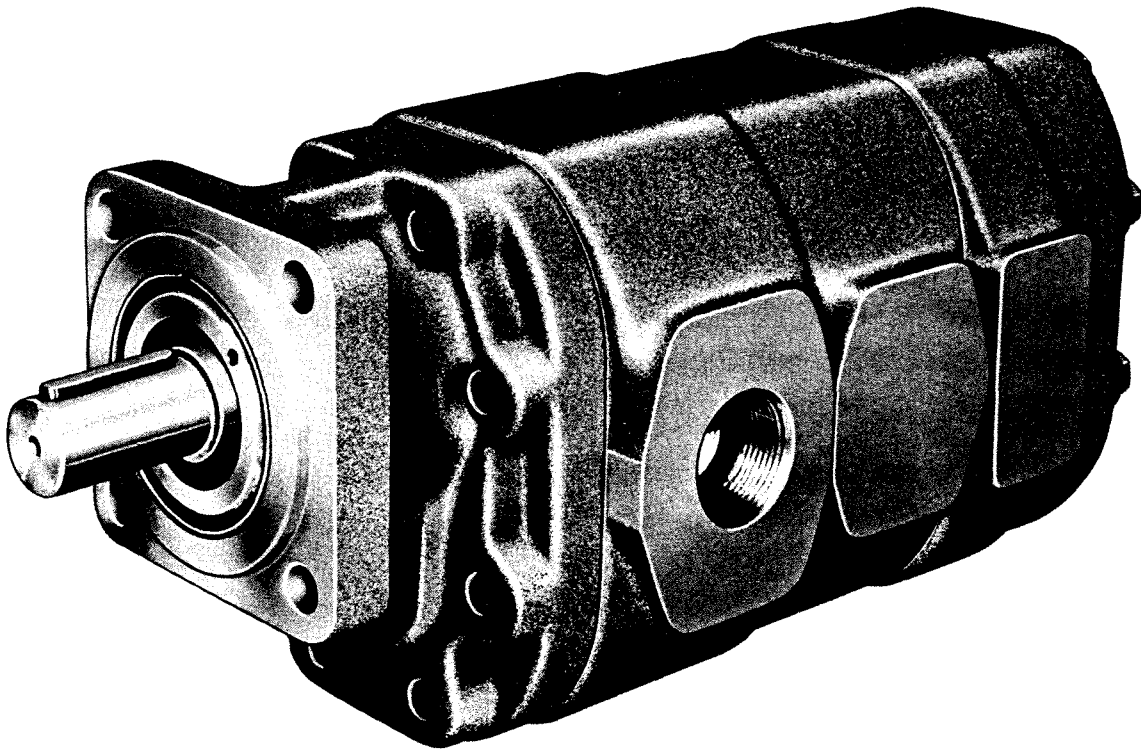
single COMMERCIAL Model 37X Oil Hydraulic Heavy Duty Pump — Motor



Exploded view, showing all parts and their nomenclature which are used in the Model 37X single pump or motor, is shown on page 6. Complete instructions are given on page 7 covering the disassembly by subassemblies of the single pump or motor.

Instructions to assemble all parts into subassemblies and to complete the assembly of the Model 37X single pump or motor, are outlined in detail on pages 8, 9, 10 and 11.

tandem COMMERCIAL Model 37X Oil Hydraulic Heavy Duty Pump — Motor



Exploded view, showing all parts and their nomenclature which are used in the model 37X tandem pump or motor, is shown on page 12. Complete instructions are given on page 13 and 14 covering the disassembly by subassemblies of the tandem pump or motor.

Instructions to assemble all parts into subassemblies and to complete the assembly of the Model 37X tandem pump or motor are outlined in detail on pages 14, 15, 16, 17, 18, and 19.

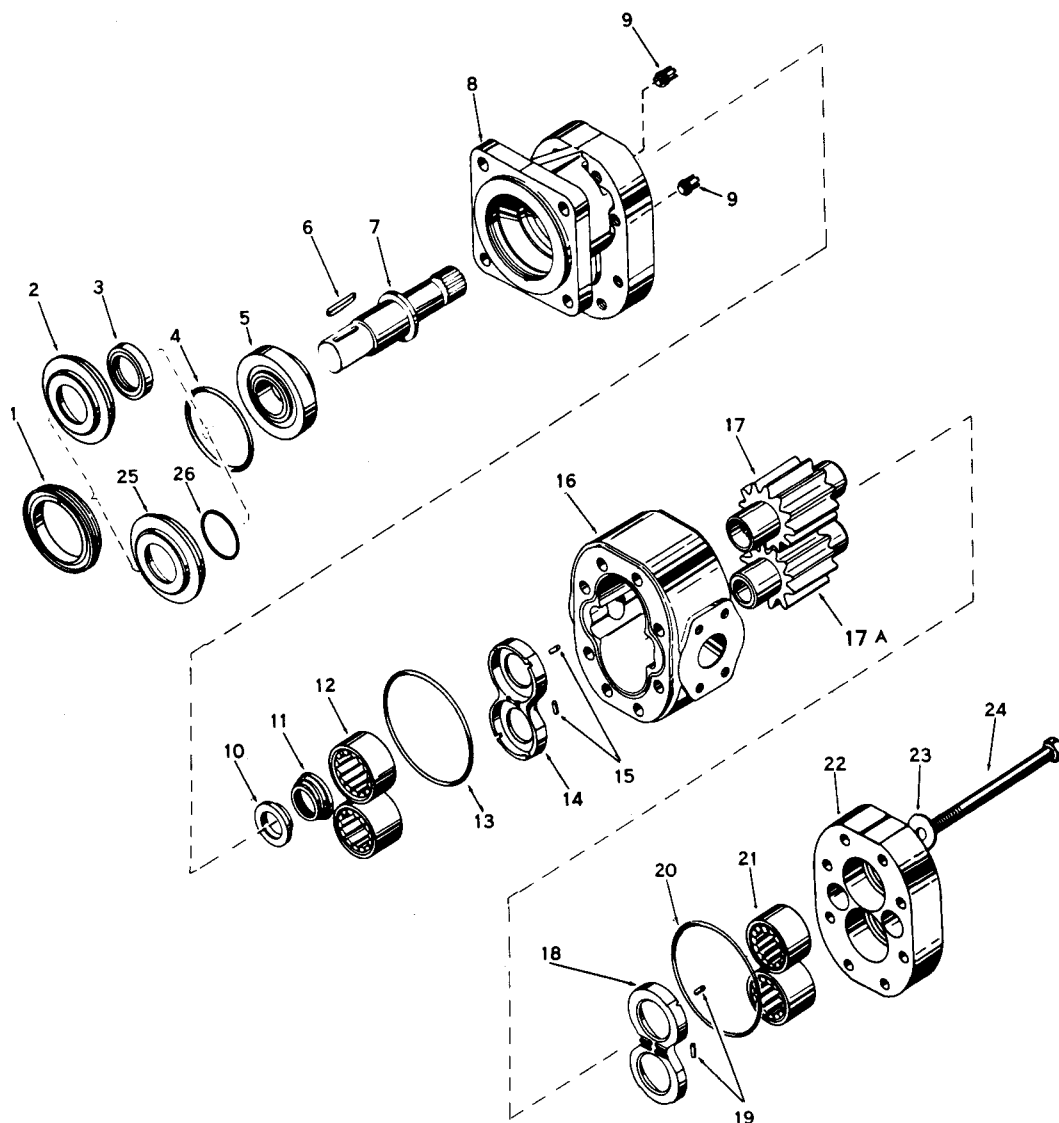


Fig. 1—Exploded View of Single Pump

No. Description

- 1 Retainer Ring _____
- 2 Seal Retainer _____
- 3 Double-Lip Seal (shaft seal-pump) _____
- 4 "O" Ring _____
- 5 Tapered Roller Bearing _____
- 6 Key _____
- 7 Drive Shaft _____
- 8 Shaft End Cover _____
- 9 Check Assembly or Set Screw _____
- 10 Shaft Bushing (Bronze) _____
- 11 Conical Spring _____
- 12 Bearings _____
- 13 Gasket Seal _____

No. Description

- 14 Thrust Plate _____
- 15 Pocket Seals _____
- 16 Gear Housing _____
- 17 Matched Gears _____
- 18 Thrust Plate _____
- 19 Pocket Seals _____
- 20 Gasket Seal _____
- 21 Bearings _____
- 22 Port End Cover _____
- 23 Washer _____
- 24 Hex Head Cap Screw _____
- 25 Seal Retainer _____
- 26 Hi Pressure Seal (shaft seal-motor) _____

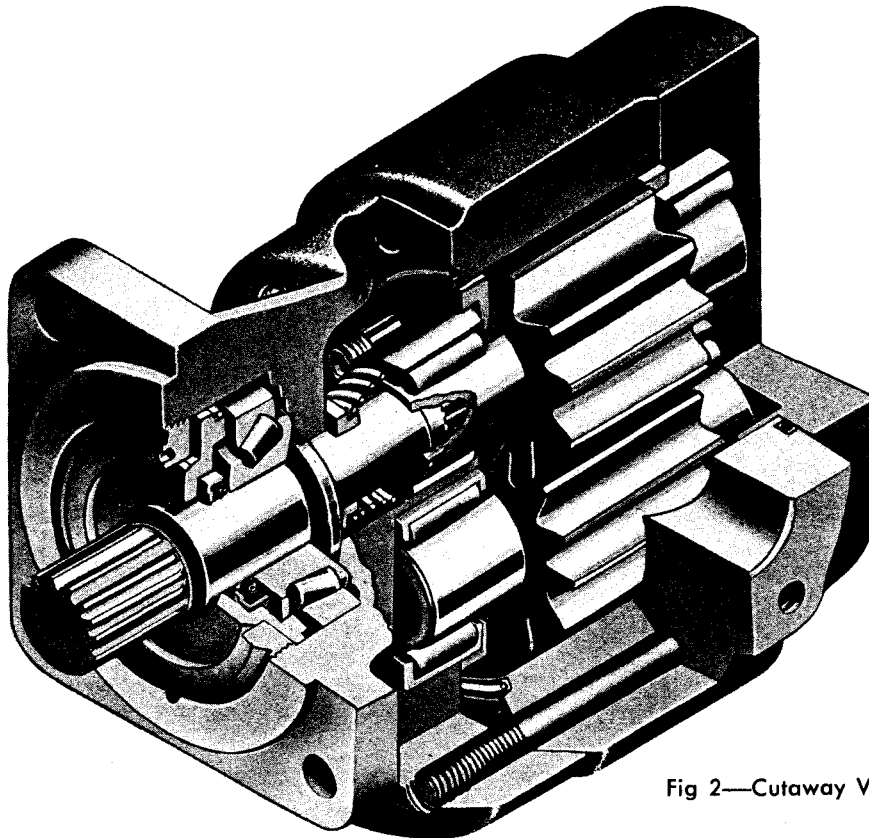


Fig 2—Cutaway View of Single Pump

single pump or motor disassembly

GENERAL NOTES

Remember dirt is the enemy of any hydraulic system. The best way to fight this enemy is to prevent its entry into the system. Make sure you disassemble and reassemble this pump in spotlessly clean surroundings. Apply a coating of grease (cup grease consistency) to surfaces of all "O" rings and oil seals to facilitate positive location as they are installed in a reassembly.

DISASSEMBLY BY SUBASSEMBLY

1. Back off the threaded seal retainer (1) at least three full turns to release the bearing preload. **WARNING:** This must be done before any servicing work is performed.
2. Index mark the port end cover (22), gear housing (16), and shaft end cover (8) to facilitate reassembly.
3. Remove the eight cap screws (24) and washers (23) from the port end cover (22).
4. Lift off port end cover (22). The thrust plate (18) with pocket seals (19) and roller bearings (21) will also be removed in this operation.
5. Remove the driven gear (17A), drive gear (17), and gear housing (16) from the shaft end cover (8). Be sure to keep gears together as they are a matched set.

SHAFT END COVER

1. Turn the shaft end cover (8) over so that the

drive end of the shaft is facing up. Remove key (6), if any, retainer ring (1), seal retainer (2), shaft seal (3), and "O" Ring (4).

2. Pull the drive shaft (7) out of the shaft end cover (8). The bearing outer race (5) and tapered bearing (5) will also be removed.
3. Turn the cover over so that the thrust plate is up. Pry off thrust plate (14) carefully with a knife blade or thin screwdriver. Remove and discard pocket seals (15).
4. Pull the bearings (12) with a bearing puller from the shaft end cover (8)—**ONLY**—if they are being replaced. To remove conical spring (11) and shaft bushing (10)—**ONLY THE SHAFT END DRIVE BEARING NEED BE PULLED.**
5. Remove and discard shaft seal (3) from seal retainer (2).
6. Press tapered bearing (5) from shaft (7).

HOUSING

1. Remove and discard "O" rings (13) and (20) from grooves in faces of housing.

PORT END COVER

1. Pry off the thrust plate (18) with a knife or thin screwdriver. Remove and discard pocket seals (19).
2. Pull the bearings (21) with a bearing puller from the port end cover (22)—**ONLY**—if they are being replaced.

single pump or motor assembly

SHAFT END COVER SUBASSEMBLY

1. Hold the shaft end cover (8) gear side up and install bronze shaft bushing (10) with flange side toward bottom of bore.
2. Install spring (11) with smaller end of spring over pilot shoulder of shaft bushing.

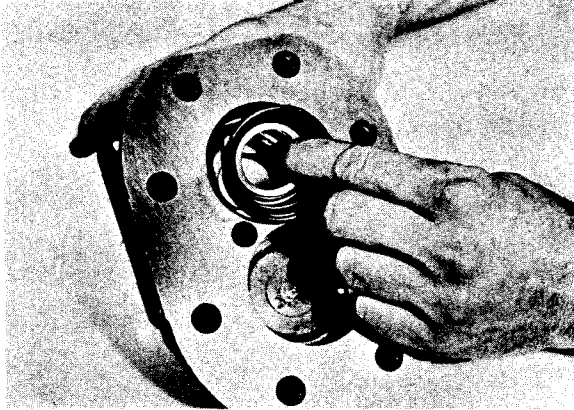


Fig. 3 Installing bronze bushing and spring

3. Install two roller bearings (12) in the bores of the cover—IF—they were removed.

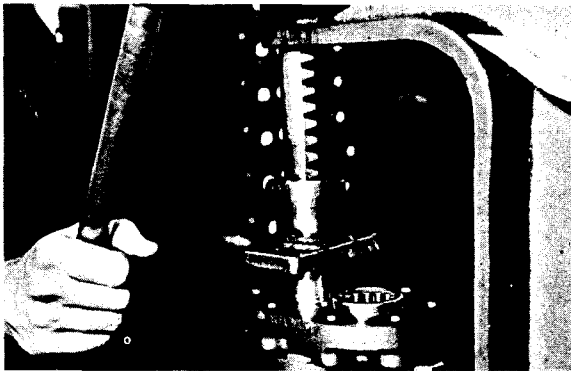
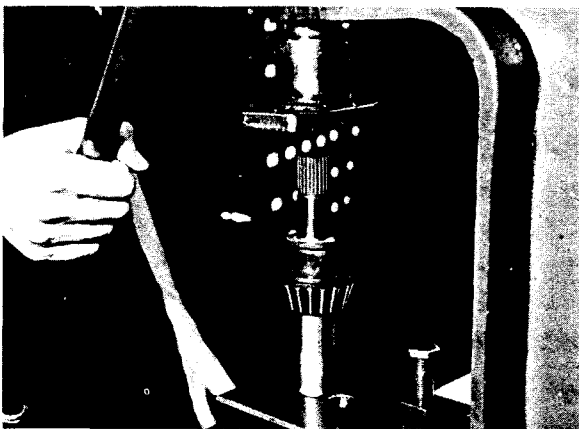


Fig. 4 Pressing bearings into cover

4. Place the shaft end cover (8) in vise with flange side up.
5. Repack the tapered roller bearing (5) with a high quality cup grease. Press bearing onto the drive shaft (7) being sure that the larger diameter of the bearing is seated against the shaft shoulder, then place the outer race or cup (5) over the

Fig. 5 Pressing bearing onto drive shaft



bearing. Insert the assembled shaft in the shaft end cover (8), making sure the shaft bushing (10) is centered in the bore. Tap or press cup (5) so that bearing seats solidly against bottom of bore.



Fig. 6 Installing drive shaft subassembly

6. Clean bore of the seal retainer for the pump (2) or motor (25) and the outside of the shaft seal (3 or 26) with naphtha. Dry and apply a thin coat of Permatix Aviation Type 3, Loctite 71-31 pipe sealant, or comparable anaerobic setting compound on both surfaces. Press seal into retainer. Make sure main lip of shaft seal is facing outward.



Fig. 7 Inserting "O" ring

7. Install greased "O" ring (4) in the groove on the seal retainer. In pumps "O" ring goes between outboard bearing (5) and retainer; it may be inserted on top of the outboard bearing.

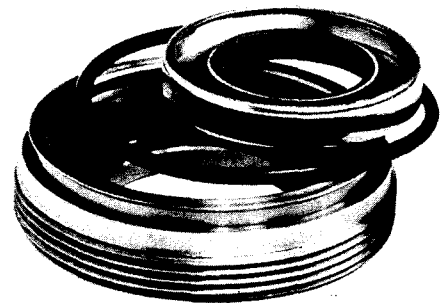


Fig. 8 Type I motor kit parts

NOTE: In double outboard bearing assemblies, there is a machined groove in the shaft end

cover (8) in which the greased "O" ring should be placed.

8. PUMPS: Install seal retainer sub-assembly onto the shaft (7) making sure it seats against the bearing cup (5). Thread retaining ring (1) loosely into the shaft end cover (8).

MOTORS: A fiber sleeve should be used when installing the seal retainer assembly over the drive shaft. Oil the seal and push the sleeve carefully

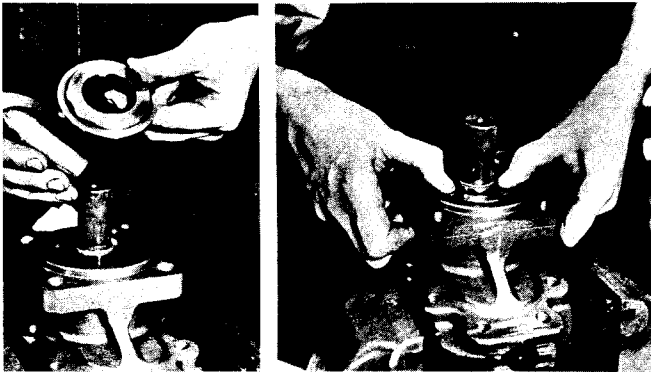


Fig. 9 Installing seal retainer subassembly

through it. Place the sleeve over the shaft. Hold it tightly against the shoulder and push the retainer from the sleeve onto the shaft with a turning motion. Hold the sleeve tightly against the shoulder until the retainer ring threads are started. If installing the seal retainer over a shaft without a sleeve, be careful not to cut the seal during installation.

9. Continue threading retaining ring into cover, but **DO NOT** tighten so as to preload the outboard bearing at this time.



Fig. 10 Installing retainer ring

10. Turn shaft end cover over in vise with gear side up. Using needle nose pliers or some other suitable tool, reassemble the two check valve assemblies (9)—IF—they were removed, by threading

Fig. 11 Installing check assembly



into respective threaded holes in the shaft end cover (8). Peen over the check valve retainer to prevent valves from backing out. (If original shaft end cover is re-used, it is not necessary to remove or replace check assemblies unless the checks are damaged.)

NOTE: Double rotation units require two check assemblies as shown by item (9). Single rotation pumps do not require check assemblies. Instead a plug is installed on the high-pressure side with the low-pressure side left open.

11. Place small amount of heavy grease into the two center slots in the open face of the thrust plate (14) and insert pocket seals (15).

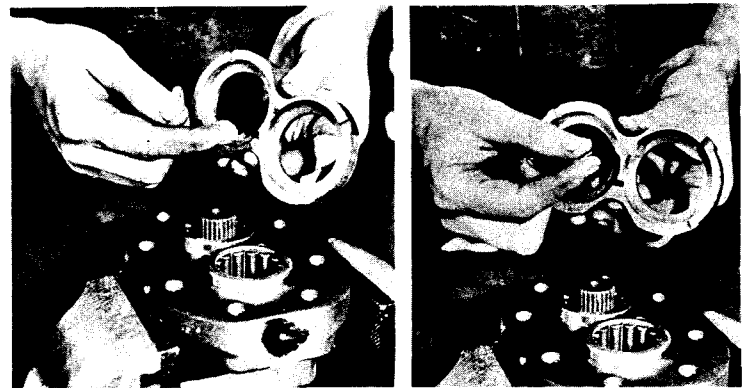


Fig. 12 Inserting center pocket seals

12. Place the thrust plate (14) with pocket seal slots toward the face of the shaft end cover (8) over the bearings (12). Check to see that the pocket seals (15) in the center slots are still in place before tapping the thrust plate into position. Leave a clearance of approximately $\frac{1}{32}$ " between the thrust plate (14) and the shaft end cover (8).

13. Into each of the four open slots in the thrust plate (14) insert a pocket seal (15). Push each seal all the way into the slot so that the hidden



Fig. 13 Inserting outer pocket seals

end is always in contact with the roller bearing race. Tap the assembled thrust plate into position against the face of the shaft end cover. Using a razor blade or sharp knife, trim away in excess from the exposed ends of the pocket seals (15) square and flush with sides of the thrust plate.

single pump or motor assembly (continued)

PORT END COVER SUBASSEMBLY

1. Install the two roller bearings (21) into their respective bores in the port end cover (22)—IF—they were removed.

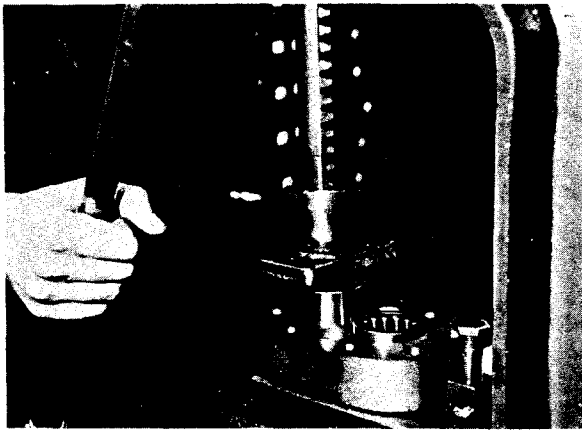


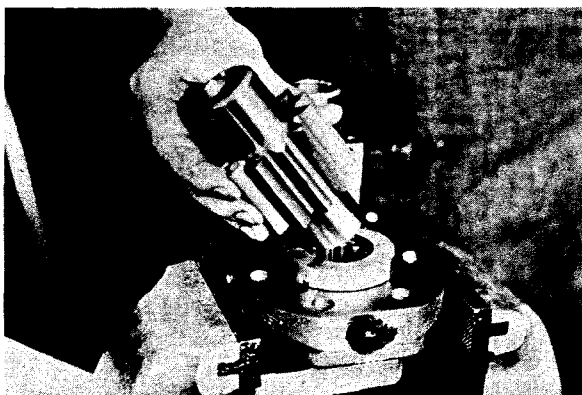
Fig. 14 Pressing bearings into port end cover

2. Place small amount of heavy grease into the two middle slots in the open face of the thrust plate (18) and insert pocket seals (19).
3. Place the thrust plate (18) with pocket seal slots toward the face of the port end cover (22) over the bearings (21). Check to see that the pocket seals in the center slots are still in place before tapping the thrust plate into position. Leave a clearance of approximately $\frac{1}{32}$ " between the thrust plate (18) and the port end cover (22).
4. Into each of the four open slots in the thrust plate (18) insert a pocket seal (19). Push each seal all the way into the slot so that the hidden end is always in contact with the roller bearing race. Tap the assembled thrust plate into position against the face of the port end cover. Using a razor blade or sharp knife, trim away the excess from the exposed ends of the pocket seals (19) square and flush with sides of the thrust plate.

FINAL ASSEMBLY

1. Place the assembled shaft end cover in a vise, gear side up.
2. Pour a small amount of oil on face of thrust plate to provide lubrication of gears. Install the drive gear (17) on the shaft (7) and the driven gear (17A) in its respective bore. Stone the gear ends before installation to remove any minute burrs.

Fig. 15 Installing driven gear



3. Stone the faces of the gear housing (16) to remove any burrs that might have occurred in handling. Blow or carefully wipe clean before installing pregreased "O" rings (13) and (20) in the grooves in the faces of the housing (16).
4. Place the gear housing (16) over the gears (17), (17A) and tap into position with a soft hammer (plastic or leatherhead). Be careful not to pinch the "O" ring (13) when positioning the housing.



Fig. 16 Installing gear housing

Pour a small amount of oil over the gears to provide initial lubrication when putting the assembled unit back into service.

5. Install the port end cover subassembly on the gear housing (16). Hubs of gears fit into the

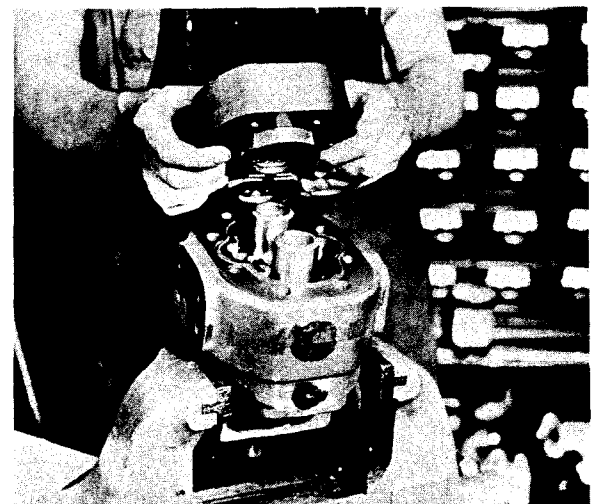


Fig. 17 Installing port end cover subassembly

I. D. of the roller bearings (21) and thrust plate (18) fits into the gear housing. Use a soft hammer to seat or position the port end cover assembly against the housing, making sure the "O" ring (20) on the face of the housing is not pinched.

6. Thread the eight cap screws (24) with washers (23) under the heads of the cap screws, into the shaft end cover. Tighten the four cap screws along the side edge of the port end cover alternately or cross corner to 117 ft. lbs. of torque. Rotate the shaft by hand or with a six inch wrench. Protect the shaft splines when using a wrench. If the shaft is easily rotated, tighten the other four cap screws cross corner to 117 ft. lbs. of torque.

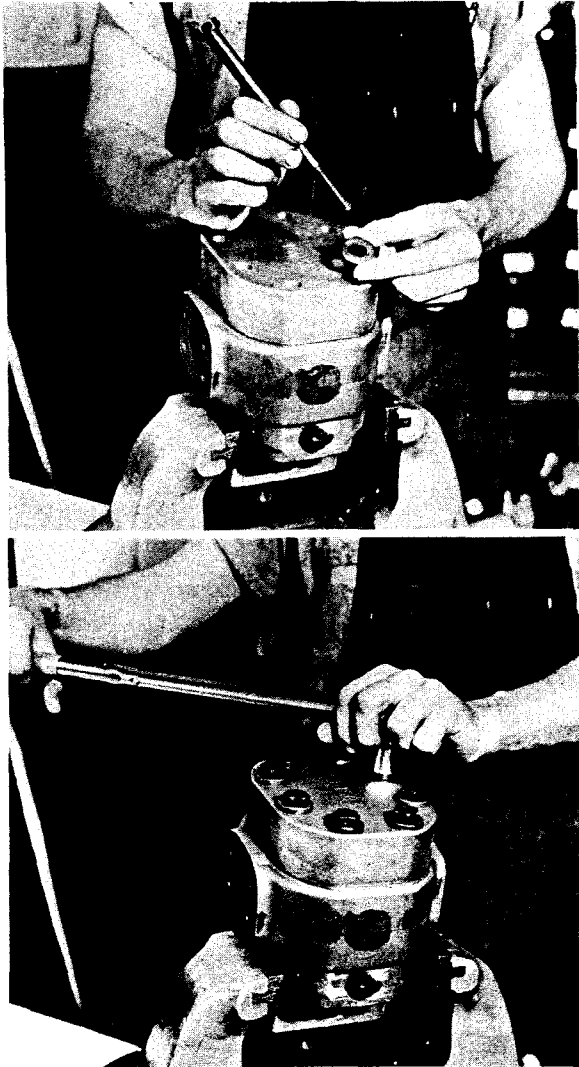


Fig. 18 Inserting and tightening cap screws

7. Remove the assembled unit from the vise and turn it over so that end of the shaft is up. Tighten the retainer ring (1) with a pin type wrench until it is tight. Proper bearing preload and running clearance is obtained by backing off the threaded retainer ring.
8. Final adjustment of running clearance is obtained in the following manner:
With the threaded retainer ring tightened until it stops or is snug, scribe a line, so that it is visible, across the face of the retainer ring and

over onto the face of the flange or pilot of shaft end cover. Now back the retainer ring off $\frac{1}{2}$ ", measuring from the scribed line at the outside diameter or edge of the retainer ring.

This amount of movement or back off will provide approximately .005" clearance, which has been carefully calculated as the prescribed bearing adjustment.

With the retainer ring backed off to the proper setting, upset or stake the outer edge of the retainer ring



Fig. 19 Staking outer edge of retainer ring

into the groove or slot provided at the inside diameter of the pilot of the shaft end cover. Use a blunt tool to force the metal from the outer edge of the retainer ring into the groove or slot. Make sure the retainer ring is securely locked in this manner. Replace key (6) if any.

NOTE: THE RETAINER RING MUST NOT BE BACKED OFF IN DOUBLE OUTBOARD BEARING ASSEMBLIES. TIGHTEN UNTIL SNUG AND STAKE TO PREVENT LOOSENING.

IMPORTANT PRECAUTION TO OBSERVE BEFORE OPERATING NEW OR REBUILT HYDRAULIC PUMP

To avoid possible damage to a new or rebuilt hydraulic pump, back off the main relief valve adjusting screw (or remove adjusting shims or spacers), before operating pump. Then, **AFTER PUMP HAS RUN-IN FOR ABOUT 5 MINUTES AT ZERO PRESSURE** (with all control levers in neutral position) adjust relief valve pressure to proper and prescribed setting. Failure to observe this precaution can result in almost immediate failure of the hydraulic pump—if the relief valve pressure setting should be excessive. Motors should be run-in as pumps on a test stand, but in both directions of rotation.

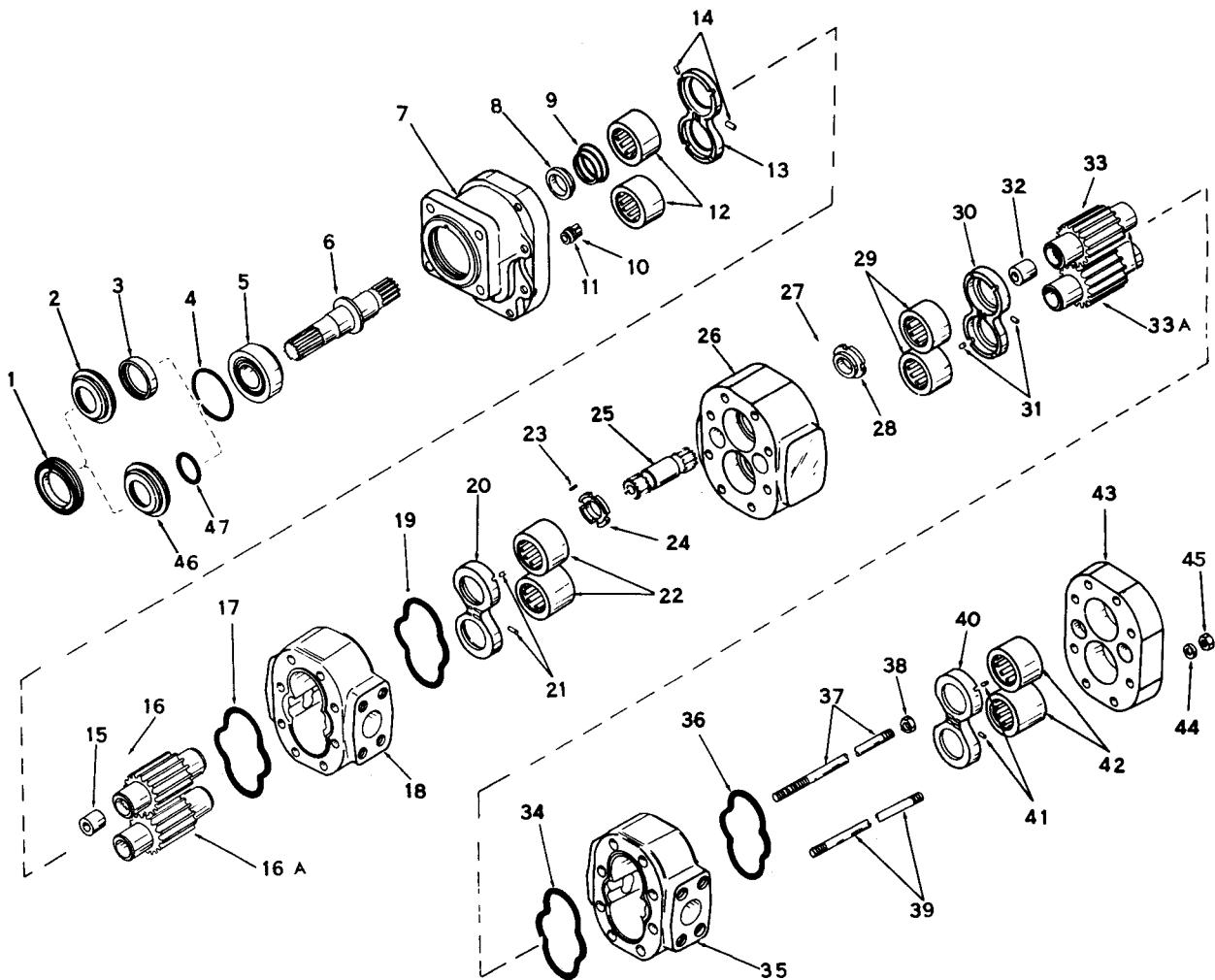


Fig. 20—Exploded View of Dual Tandem Pump or Motor

No. Description

1	Retainer Ring
2	Seal Retainer
3	Double-lip Seal (shaft seal-pumps)
4	"O" Ring
5	Tapered Roller Bearing
6	Drive Shaft
7	Shaft End Cover
8	Shaft Bushing (Bronze)
9	Conical Spring
10	Set Screw
11	Check Assembly
12	Bearings
13	Thrust Plate
14	Pocket Seals
15	Spacer
16	Matched Gears
17	Gasket Seal
18	Gear Housing
19	Gasket Seal
20	Thrust Plate
21	Pocket Seals
22	Bearings
23	Roll Pin
24	Shaft Bushing

No. Description

25	Connector Shaft
26	Bearing Carrier
27	Roll Pin
28	Shaft Bushing
29	Bearings
30	Thrust Plate
31	Pocket Seals
32	Spacer
33	Matched Gears
34	Gasket Seal
35	Gear Housing
36	Gasket Seal
37	Connector Stud
38	Hex Head Nut
39	Studs
40	Thrust Plate
41	Pocket Seals
42	Bearings
43	Port End Cover
44	Washer
45	Hex Head Nut
46	Seal Retainer
47	Hi Pressure Seal (shaft seal-motors)

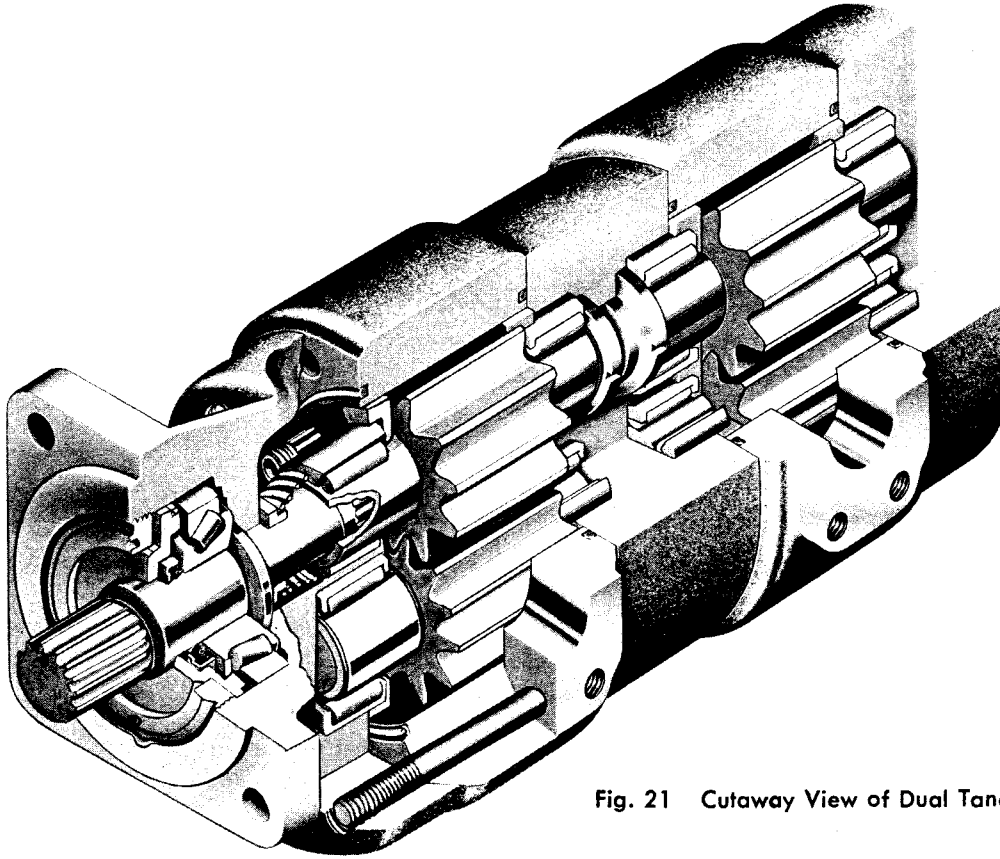


Fig. 21 Cutaway View of Dual Tandem Pump

tandem pump or motor disassembly

GENERAL NOTES

Remember dirt is the enemy of any hydraulic system. The best way to fight this enemy is to prevent its entry into the system. Make sure you disassemble and reassemble this pump in spotlessly clean surroundings. During reassembly lubricate all "O" rings and oil seals with a sticky grease before installation.

DISASSEMBLY BY SUBASSEMBLY

1. Back off the threaded retainer ring (1) at least three full turns to release the bearing preload. A little extra effort may have to be applied in order to loosen the ring since it was originally staked to create the necessary lock of ring to cover. **WARNING:** Before any servicing work is performed, the bearing preload **MUST** be released.
2. Index mark the port end cover (43), gear housings (18) and (35), bearing carrier (26), and shaft end cover (7) to facilitate reassembly.
3. Remove the eight hex nuts (45) and washers (44) from the studs (39).
4. Lift off port end cover (43). The thrust plate (40) with pocket seals (41) and roller bearings (42) will also be removed in this operation.
5. Remove the driven gear (33A), drive gear (33), and gear housing (35) from the bearing carrier (26). Keep the gears together as they are a matched set.
6. Remove eight studs (39).
7. Using a wrench to hold the drive end of the shaft (6), remove lock nut (38) from shaft connector bolt (37). Protect splines or threads, if any, on end of shaft when using a wrench.
8. Remove spacer (32) from end of connector shaft (25).
9. Remove connector shaft (25) from I. D. of drive gear hub.
10. Remove the bearing carrier (26) from the gear housing (18). The thrust plates (20), and (30) with pocket seals (21) and (31), roller bearings (22) and (29), shaft bushings (24) and (28) will also be removed.
11. Remove driven gear (16A), drive gear (16), and gear housing (8) from the shaft end cover (7). Be sure to keep gears together as they are a matched set.
12. Remove shaft spacer (15) and shaft connector bolt (37) from gear end of drive shaft.

The above explanation covers a two section tandem pump. The same routine is followed when working on three or four section pumps.

tandem pump or motor disassembly (continued)

SHAFT END COVER

1. Turn the shaft end cover (7) over so that the drive end of the shaft is facing up. Remove retainer ring (1), and seal retainer (2) with shaft seal (3), and 'O' ring (4).
2. Pull the drive shaft (6) out of the shaft end cover (7). The bearing outer race (5) and tapered bearing (5) will also be removed.
3. Turn the cover over so that the thrust plate (13) is up. Pry off thrust plate (13) carefully with a knife blade or thin screw driver. Remove and discard the pocket seals (14).
4. Pull the bearings (12) with a bearing puller from the shaft end cover (7)—ONLY—if they are being replaced. Remove conical spring (9) and shaft bushing (8).
5. If only the shaft bushing (8) is to be replaced, only the bearing (12) from the drive side need be removed.
6. Remove and discard shaft seal (3) from the seal retainer (2).
7. Press tapered bearing (5) from shaft (6).

BEARING CARRIER

1. Pry off the thrust plates (20) and (30) with a knife blade or thin screw driver. Remove and discard all the pocket seals (21) and (31).
2. Pull the four bearings (22) and (29) with a bearing puller from the bearing carrier (26)—ONLY—if they are being replaced.
3. Remove the two shaft bushings (24) and (28).
4. Remove the two roll pins (23), (27) if desired.

PORT END COVER

1. Pry off the thrust plate (40) with a knife blade or thin screw driver. Remove and discard the pocket seals (41).
2. Pull the two bearings (42) with a bearing puller from the port end cover (43)—ONLY—if they are being replaced.

HOUSING

1. Remove and discard "O" rings (17) (19) (34) and (36) from grooves in housing (18) and (35) faces.

tandem pump or motor assembly

SHAFT END COVER SUBASSEMBLIES

1. Hold the shaft end cover (7), gear side up, and install bronze shaft bushing (8) with flange side toward bottom of bore.
2. Install conical spring (9) with smaller end of spring over pilot shoulder of shaft bushing.

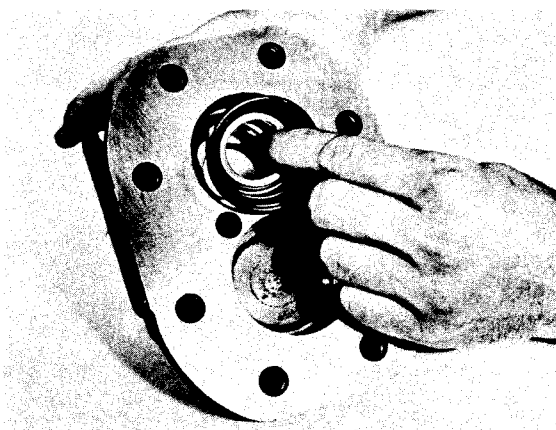


Fig. 22 Installing bronze bushing and spring

3. Install two roller bearings (12) in the bores of the cover—IF—they were removed. Be sure top of spring (9) does not become wedged between bearing and bottom of bearing counterbore.
4. Place the shaft end cover (7) in vise with flange side up.
5. Repack the tapered roller bearing (5) with a high quality cup grease. Press bearing onto the drive

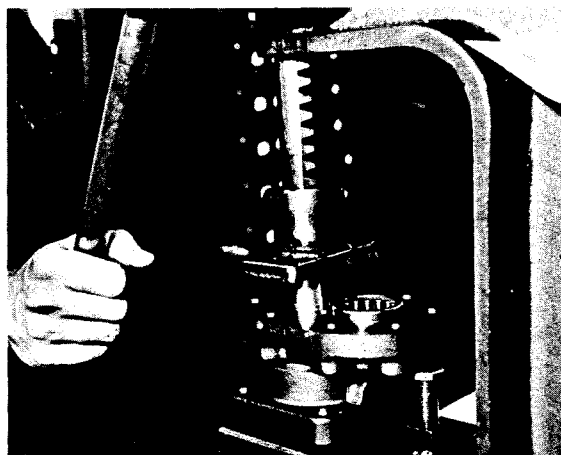
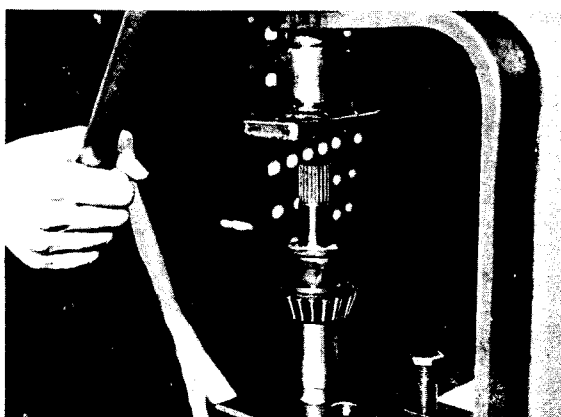


Fig. 23 Pressing bearings into shaft cover

shaft (7) being sure that the larger diameter of the bearing is seated against the shaft shoulder, then place the outer race or cup (5) over the

Fig. 24 Pressing bearing onto drive shaft



tandem pump or motor assembly (continued)

bearing. Insert the assembled shaft in the shaft end cover (8), making sure the shaft bushing (10) is centered in the bore. Tap or press cup (5) so that bearing seats solidly against bottom of bore.



Fig. 25 Installing drive shaft subassembly

6. Clean bore of the seal retainer for the pump (2) or motor (25) and the outside of the shaft seal (3 or 26) with naphtha. Dry and apply a thin coat of Permatix Aviation Type 3, Loctite 71-31 pipe sealant, or comparable anaerobic setting compound on both surfaces. Press seal into retainer. Make sure main lip of shaft seal is facing outward.



Fig. 26 Inserting "O" ring

7. Install greased "O" ring (4) in the groove on the seal retainer. In pumps "O" ring goes between outboard bearing (5) and retainer; it may be inserted on top of the outboard bearing.



Fig. 27 Type I motor kit parts

■ 37X pump and motor service manual

NOTE: In double outboard bearing assemblies, there is a machined groove in the shaft end cover (8) in which the greased "O" ring should be placed.

8. PUMPS: Install seal retainer sub-assembly onto the shaft (7) making sure it seats against the bearing cup (5). Thread retaining ring (1) loosely into the shaft end cover (8).

MOTORS: A fiber sleeve should be used when installing the seal retainer assembly over the drive shaft. Oil the seal and push the sleeve carefully



Fig. 28 Installing seal retainer subassembly

through it. Place the sleeve over the shaft. Hold it tightly against the shoulder and push the retainer from the sleeve onto the shaft with a turning motion. Hold the sleeve tightly against the shoulder until the retainer ring threads are started. If installing the seal retainer over a shaft without a sleeve, be careful not to cut the seal during installation.

9. Continue threading retaining ring into cover, but DO NOT tighten so as to preload the outboard bearing at this time.



Fig. 29 Installing retainer ring

10. Turn shaft end cover over in vise with gear side up. Insert the two check valve assemblies consisting of items (10) and (11)—IF—they were removed, by threading into their respective holes in the shaft end cover (7). Peen over the check

tandem pump or motor assembly (continued)

valve retainer to prevent valves from backing out.



Fig. 30 Installing check assembly

(If original shaft end cover is re-used, it is not necessary to remove or replace check assemblies unless the checks are damaged.)

NOTE: Double rotation units require two check assemblies as shown by items (10) and (11). Single rotation pumps do not require check assemblies. Instead, a plug is installed on the high pressure side with the low-pressure side left open.

11. Place small amount of heavy grease into the two middle slots in the open face of the thrust plate (13) and insert pocket seals (14).

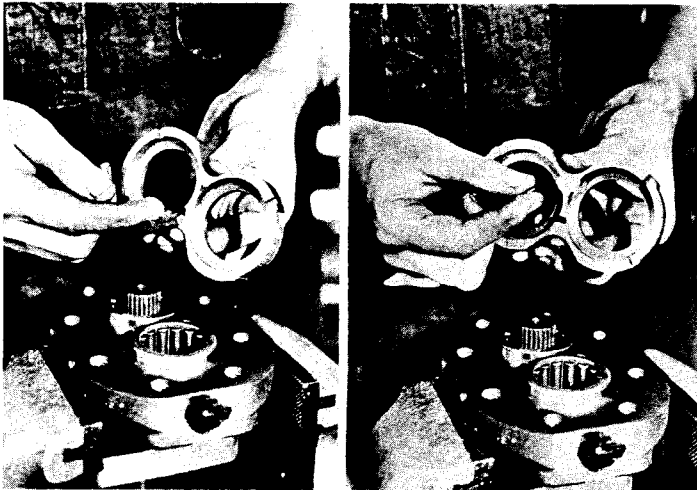


Fig. 31 Inserting center pocket seals

12. Place the thrust plate (13) with pocket seal slots toward the face of the shaft end cover (7) over the bearings (12). Check to see that the pocket seals (14) in the center slots are still in place.

Now tap the thrust plate into position until a clearance of approximately $\frac{1}{32}$ " is left between the thrust plate (13) and the shaft end cover (7).

13. Into each of the four open slots in the thrust plate (13) insert a pocket seal (14). Be sure to

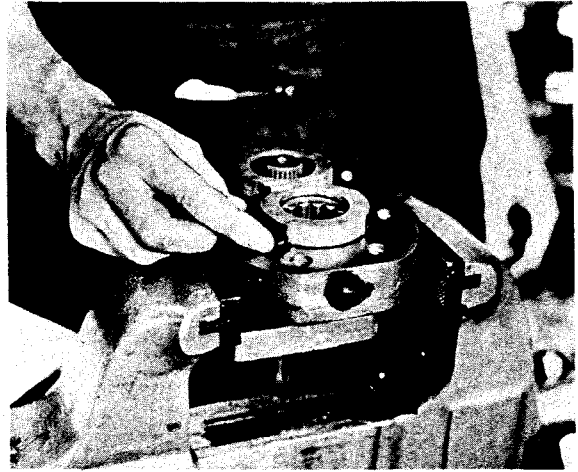


Fig. 32 Inserting outer pocket seals

push each seal all the way into the slot so that the hidden end is always in contact with the roller bearing race. Then tap the assembled thrust plate into position against the face of the shaft end cover. Trim away the excess from the exposed ends of the pocket seals (14) with a razor blade or sharp knife. Be sure to trim the exposed ends of the pocket seals square and flush with sides of the thrust plate.

PORT END COVER ASSEMBLY

1. Install the two roller bearings (42) into their respective bores in the port end cover (43)—IF— they were removed.

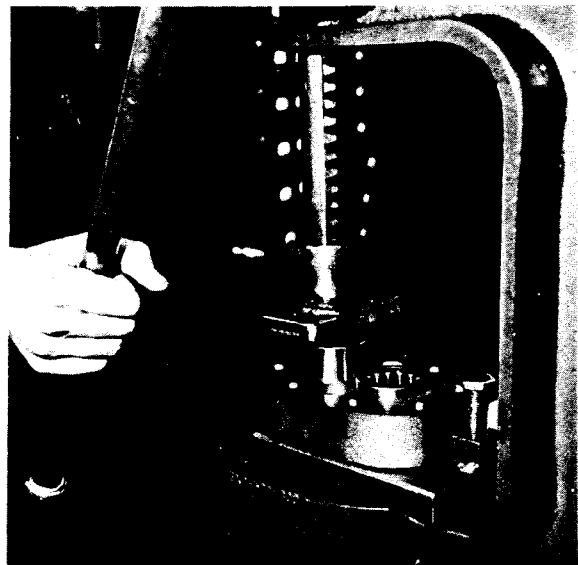


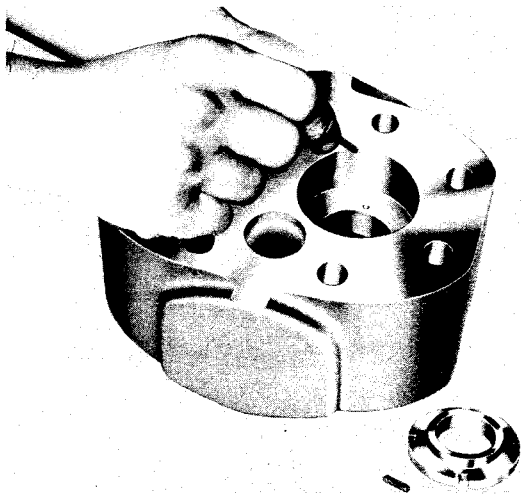
Fig. 33 Pressing bearings into port end cover

2. Place small amount of heavy grease into the two middle slots in the open face of the thrust plate (40) and insert pocket seals (41).
3. Place the thrust plate (40) with pocket seal slots toward the face of the port end cover (43) over the bearings (42). Check to see that the pocket seals (41) in the center slots are still in place. Now tap the thrust plate into position until a clearance of approximately $\frac{1}{32}$ " is left between the thrust plate (40) and the port end cover (43).
4. Into each of the four open slots in the thrust plate (40) insert a pocket seal (41). Be sure to push each seal all the way into the slot so that the hidden end is always in contact with the roller bearing race. Then tap the assembled thrust plate into position against the face of the port end cover. Trim away the excess from the exposed ends of the pocket seals (41) with a razor blade or sharp knife. Be sure to trim the exposed ends of the pocket seals square and flush with sides of the thrust plate.

BEARING CARRIER SUBASSEMBLY

1. Install the two roll pins (23) and (27) in the holes provided for them in the drive shaft bores.
2. Install two shaft bushings (24), (28) in the shaft holes so that flange side of each bushing will be against bottom of bearing bore. Fit one slot of bushing over roll pin. This prevents bushing from turning on shaft. Do one side at a time.
3. Install four roller bearings (22, 29)—IF—they were removed.
4. Place small amount of heavy grease into the two middle slots in the open face of the thrust plate (30) and insert pocket seals (31).
5. Place the thrust plate (30) with pocket seal slots toward the face of the bearing carrier (26) over the bearings (29). Check to see that the pocket seals in the center slots are still in place before tapping the thrust plate into position. Leave a clearance of approximately $\frac{1}{32}$ " between the thrust plate (30) and the bearing carrier (26).
6. Into each of the four open slots in the thrust plate (30) insert a pocket seal (31). Push each seal all the way into the slot so that the hidden end is always in contact with the roller bearing

Fig. 34 Inserting roll pin



race. Tap the assembled thrust plate into position against the face of the bearing carrier. Using a razor blade or sharp knife, trim away the excess from the exposed ends of the pocket seals square and flush with sides of the thrust plate.

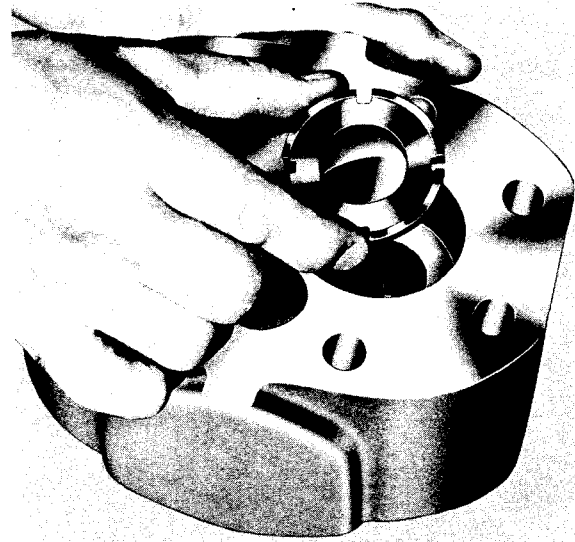


Fig. 35 Inserting shaft bushings

FINAL ASSEMBLY

1. Place the assembled shaft end cover in a vise, gear side up.
2. Pour a small amount of oil on face of thrust plate to provide lubrication of gears. Install the drive gear (16) on the shaft (6) and the driven gear (16A) in its respective bore. Stone the

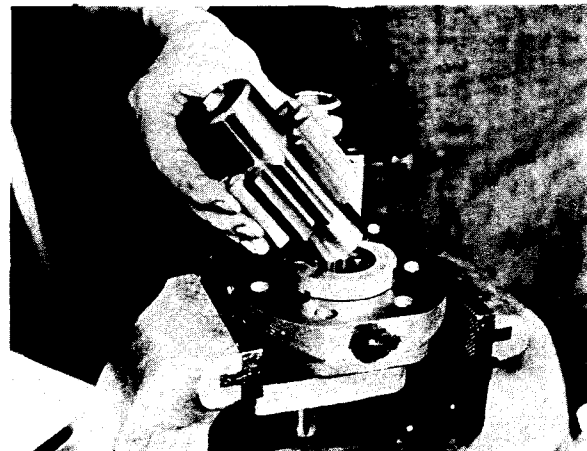


Fig. 36 Installing driven gear

gear ends before installation to remove any minute burrs.

3. Stone the faces of the gear housing (18) to remove any burrs that might have occurred in handling. Blow or carefully wipe clean. Install pre-greased "O" rings (17) and (19) in the grooves in the faces of the housing (18).

tandem pump or motor assembly (continued)

4. Place the gear housing (18) over the gears (16), (16A) and tap into position with a soft hammer.



Fig. 37 Installing gear housing

5. Insert shaft connecting bolt (37) into the bore of the drive gear (16) and thread into tapped hole in the end of drive shaft (6). Use LOCKTITE SEALANT on end of bolt before threading.
6. Over the connecting bolt (37) install spacer (15). Be sure correct length of spacer is used. Use spacer $\frac{1}{2}$ " shorter than gear length.

EXAMPLE: If tandem pump is made up of 2" pump and $1\frac{1}{4}$ " pump—use $1\frac{1}{2}$ " spacer between drive shaft and connecting shaft, and $\frac{3}{4}$ " spacer under lock nut. A $\frac{1}{2}$ " pump does not require a spacer.

7. Install the bearing carrier (26) subassembly on the gear housing (18). Care must be taken so as not to score the shaft bushing in the shaft bore.
8. Tap bearing carrier (26) in place with a soft hammer, being careful not to pinch "O" ring (19) in the face of the housing (18).
9. Install connector shaft (27) over bolt (37). Install spacer (32) over bolt and on top of connector shaft. Install drive gear (33) over the connecting shaft (27) and spacer (32). Install lock nut (38) and tighten to 19 ft. lbs. Hold the drive end of shaft (6) with a wrench while tightening the nut.
10. Install the driven gear (33A) into its respective bore.

Fig. 38 Installing spacer and tightening lock nut

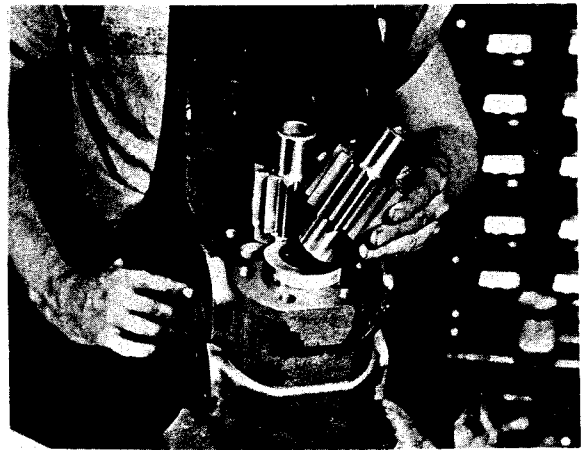
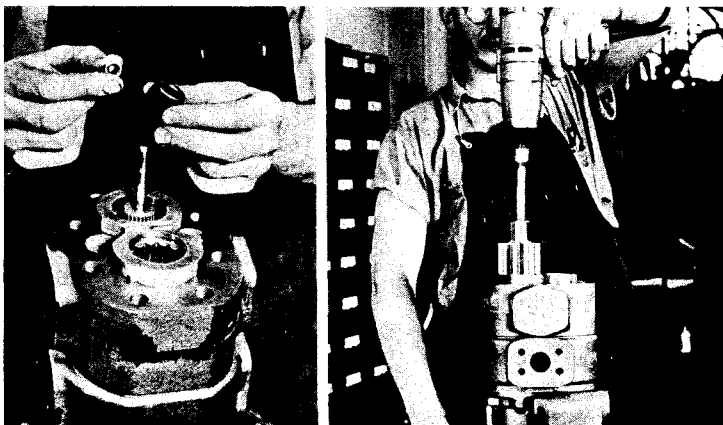


Fig. 39 Installing driven gear

11. Place gear housing (35) over gears and tap into place against bearing carrier. Pour a small amount of oil over the gears to provide initial lubrication when putting unit back into service.

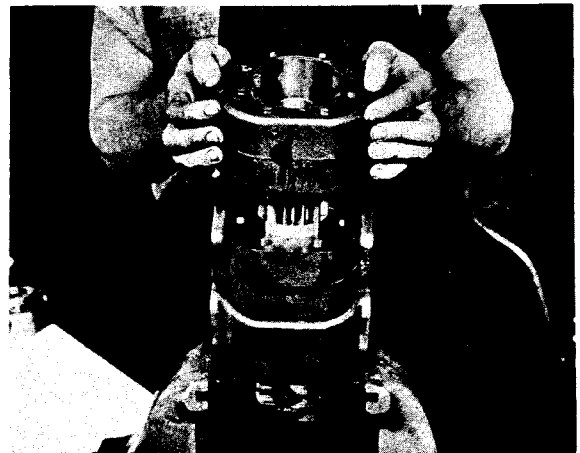
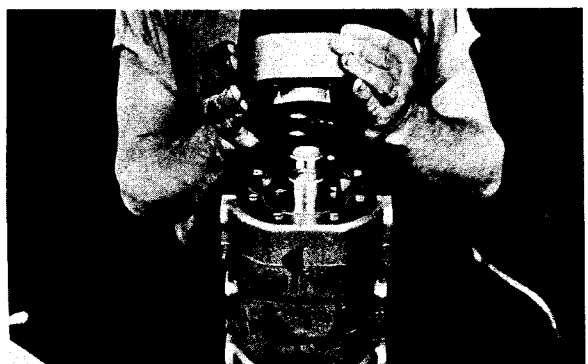


Fig. 40 Installing gear housing

12. Install the port end cover subassembly on the gear housing (35). Hubs of gears fit into the I. D. of the roller bearings (42), and thrust plate (40) fits into the gear housing. Use a soft hammer to seat or position the port end cover assembly against the housing, making sure the "O" ring (36) on the face of the housing is not pinched.

Fig. 41 Installing port end cover subassembly



13. Thread the eight studs (39) into the shaft end cover leaving enough thread protruding above the port end cover to accommodate the washers (44) and nuts (45). Tighten the four studs along the side edge of the port end cover alternately or cross corner to 100 ft. lbs. of torque. Rotate the shaft by hand or with a six inch wrench. Protect

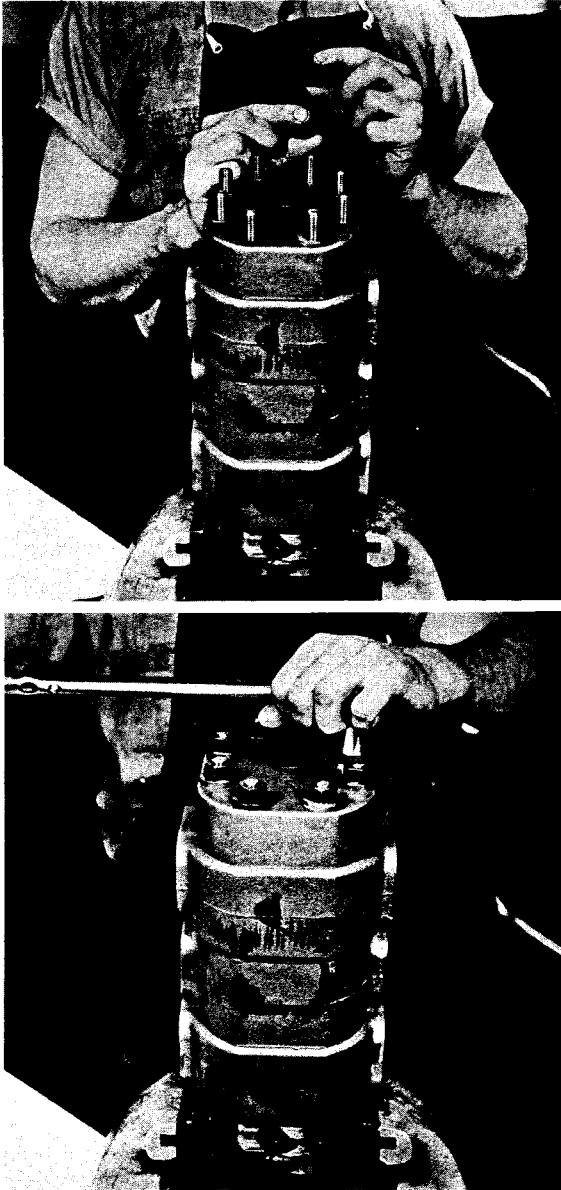


Fig. 42 Inserting and tightening nuts

- the shaft splines when using a wrench. If the shaft is easily rotated, tighten the other four studs cross corner to 100 ft. lbs. of torque.
14. Remove the assembled pump from the vise and turn it over so the end of the shaft is up. Tighten the retainer ring (1) with a pin type wrench until it is tight. Proper bearing preload and running clearance is obtained by backing off the threaded retainer ring.
15. Final adjustment of running clearance is obtained in the following manner: With the threaded ring tightened until it stops or is snug, scribe or mark a line so that it is clearly visible, using a straight edge or scale, across the face of the retainer ring and over onto the face of the flange or pilot of shaft end cover. Now, back the retainer ring off $\frac{1}{2}$ ", measuring from the scribed line at the outside diameter or edge of the retainer ring. This amount of movement, or back off, will provide approximately .005" clearance, which has been carefully calculated as the prescribed bearing adjustment. With retainer ring backed off to the proper setting, upset or stake the outer edge of the retainer ring into the groove or slot provided at the inside diameter of the pilot of the shaft end cover. Use a blunt tool to force the metal from the outer edge of the retainer ring into the groove or slot. Make sure the retainer ring is securely locked in this manner.

NOTE: THE RETAINER RING MUST NOT BE BACKED OFF IN DOUBLE OUTBOARD BEARING ASSEMBLIES. TIGHTEN UNTIL SNUG AND STAKE TO PREVENT LOOSENING.

IMPORTANT PRECAUTION TO OBSERVE BEFORE OPERATING NEW OR REBUILT HYDRAULIC PUMP

To avoid possible pump damage to a new or rebuilt hydraulic pump, back off the main relief valve adjusting screw (or remove adjusting shims or spacers) before operating pump, then, **AFTER PUMP HAS RUN-IN FOR ABOUT 5 MINUTES AT ZERO PRESSURE** (with all control levers in neutral position) adjust relief valve pressure to proper and prescribed setting. Failure to observe this precaution can result in almost immediate failure of the hydraulic pump—if the relief valve pressure setting should be excessive.

Motors should be run-in as pumps on a test stand, but in both directions of rotation.



THIRD CLASS MAIL

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