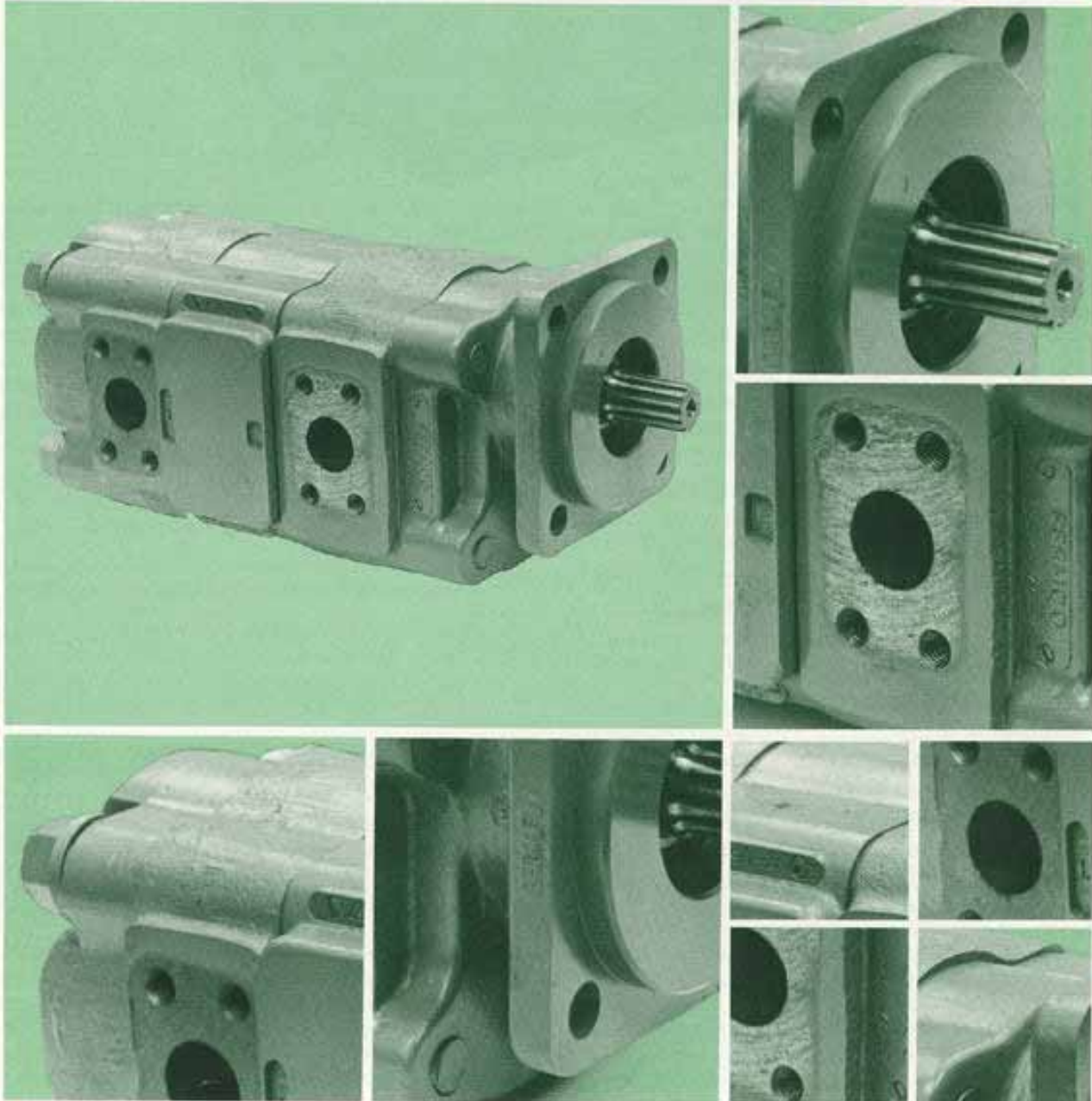


SERIES P3000, P5000, P7500 GEAR PUMPS

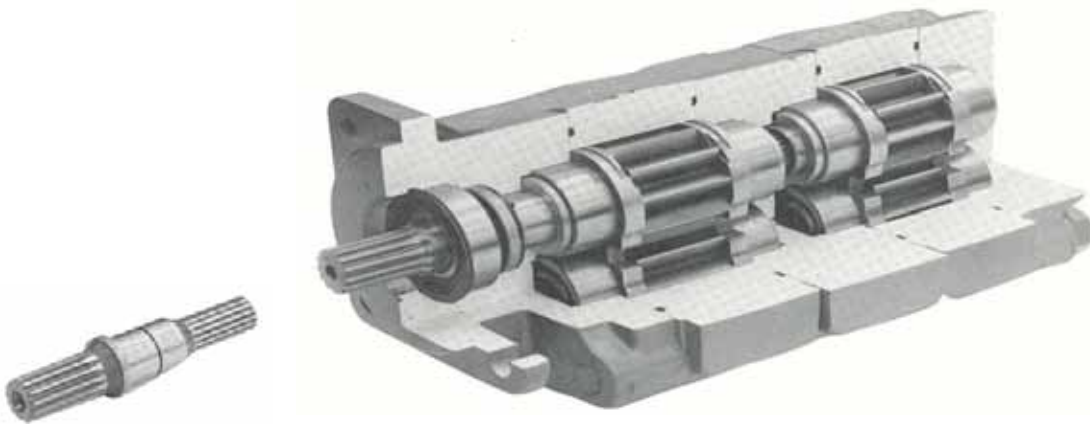
PERMCO SERVICE MANUAL



CONTENTS



Table of Content	Page
Wear, Checking parts for.....	3
Thrust Plates.....	3
Diverter Plates, Installing PERMCO.....	3
Bearings; Checking for wear.....	3
Gear Housing, checking for wear.....	3
Covers, Shaft-end and port-end: Checking for wear.....	3
Types of PERMCO Pumps: Type I, II.....	3
Exploded Views: PERMCO Pumps and parts.....	4-6
Parts numbers, PERMCO Pumps and Motors.....	7
Type I Pump: disassembly.....	8
reassembly.....	12
Type II Pump: disassembly.....	8
reassembly.....	12
Torques for reassembling, Table of.....	15
Trouble Shooting; List of symptoms and cures.....	17
Motors, PERMCO Pumps used as	18
Parts, How to order PERMCO replacement; information needed.....	19



If you intend to rebuild a pump that has thrust plates and you wish to replace the thrust plates with Permco diverter plates, inspect the original port end cover, shaft end cover, gear housing and bearing carriers very carefully. To obtain the maximum performance from diverter plates, all of the above components must be in good condition with minimal amount of wear. The following areas of wear are the most critical. . and often overlooked:

1. Shaft end covers, port end covers, and bearing carriers. . .Check bearing bores for out-of-roundness or elliptical shape. If more than 0.003" out-of-round, **do not use**.
2. Gear housings... If the wear pattern on the inlet side is in excess of 0.003" depth, **do not use**.
3. Gears... Inspect very carefully. If you have scored, scuffed or pitted journals, scratched or scuffed tooth faces, deep nicks on tooth edges, **do not use**; install new drive and driven gear.
4. Bearings... A loose fit between gear hub and bearing ID may not mean a bad bearing. The misalignment it can cause is detrimental to good pump performance. We recommend installing a **complete set** of new bearings at each rebuild.
5. Seals. . .It is recommended that **all seals** be replaced on any rebuild job.

Putting Permco diverter plates into a pump and reusing the old worn parts will not necessarily restore the pump to the high efficiency and performance of a new Permco pump. Merely installing new Permco diverter plates cannot restore the pump to its original performance. Permco's high efficiency, performance, and life expectancy are based on using all new **PERMCO** parts.

If you are rebuilding a Permco gear pump, you **must not** install thrust plates of another make. Tolerances and finishes on Permco parts are held closer than those of other manufacturers of pump parts. For warranty repairs under any circumstances, you **must not** substitute other makes of parts in a Permco pumps. **USE ONLY GENUINE PERMCO PARTS.**

You can successfully use Permco diverter plates to rebuild other makes of pumps to obtain increased operating pressures and pump life. However, read the above paragraphs carefully.

If you have any questions about rebuilding Permco pumps or about using Permco parts to upgrade other makes of pumps, call your local Permco pump and parts distributor.

TWO TYPES OF PUMPS

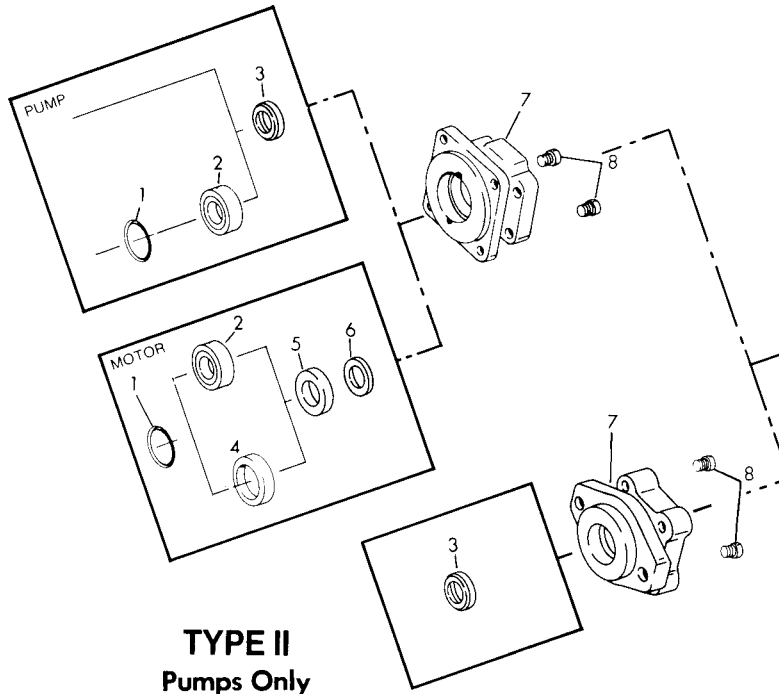
There are two types of Permco pumps as determined by the configuration of the shaft end covers... Type I & Type II. There are slight differences in disassembly and reassembly procedures, according to each shaft end cover. Also Type II is normally shorter from front to back than Type I. This is because no outboard bearing is used. Be sure you know which type you are working on.

CLEANLINESS IS HIGHLY IMPORTANT

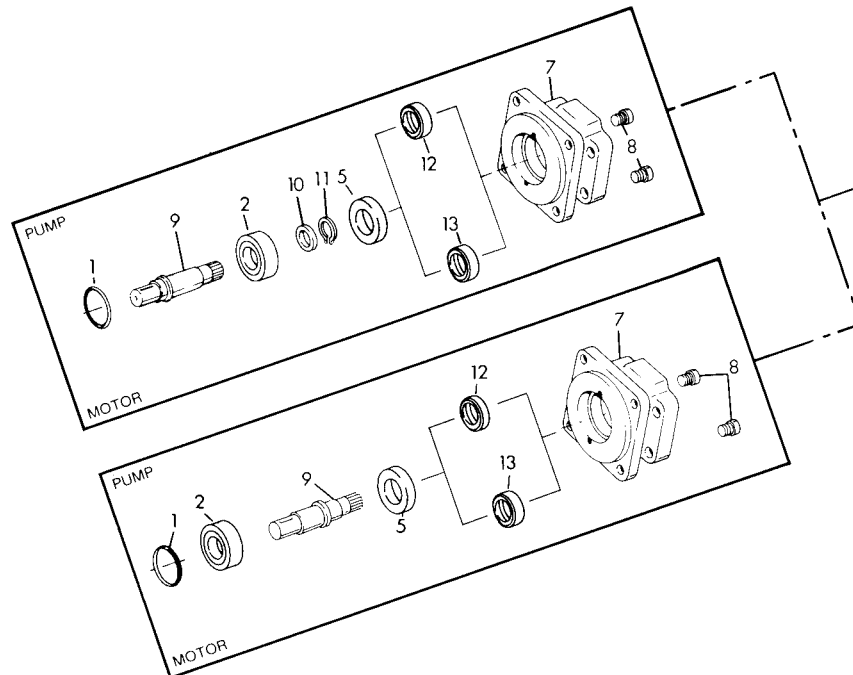
WARNING. Before you start disassembling the pump, clean up your work bench. This will avoid the headaches and danger of getting dirt, metal fragments, and foreign objects into the fine-finished cavities and threads of the pump and components, and eventually into the entire hydraulic system. In pump maintenance, extreme cleanliness is most important.

3000/5000 SERIES

TYPE I

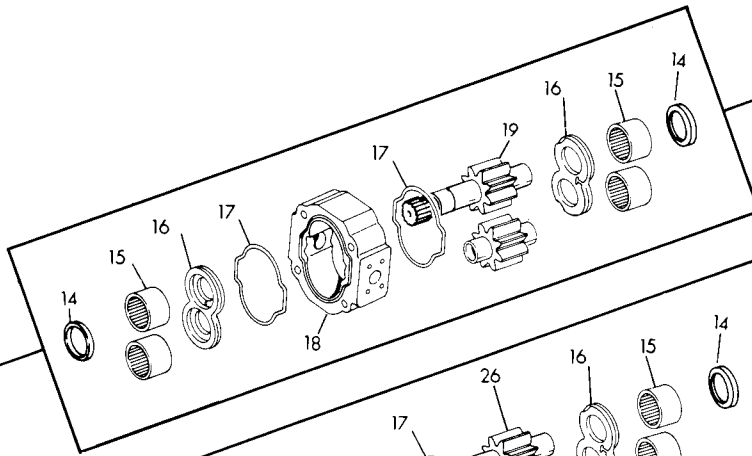


**TYPE I c
3000**

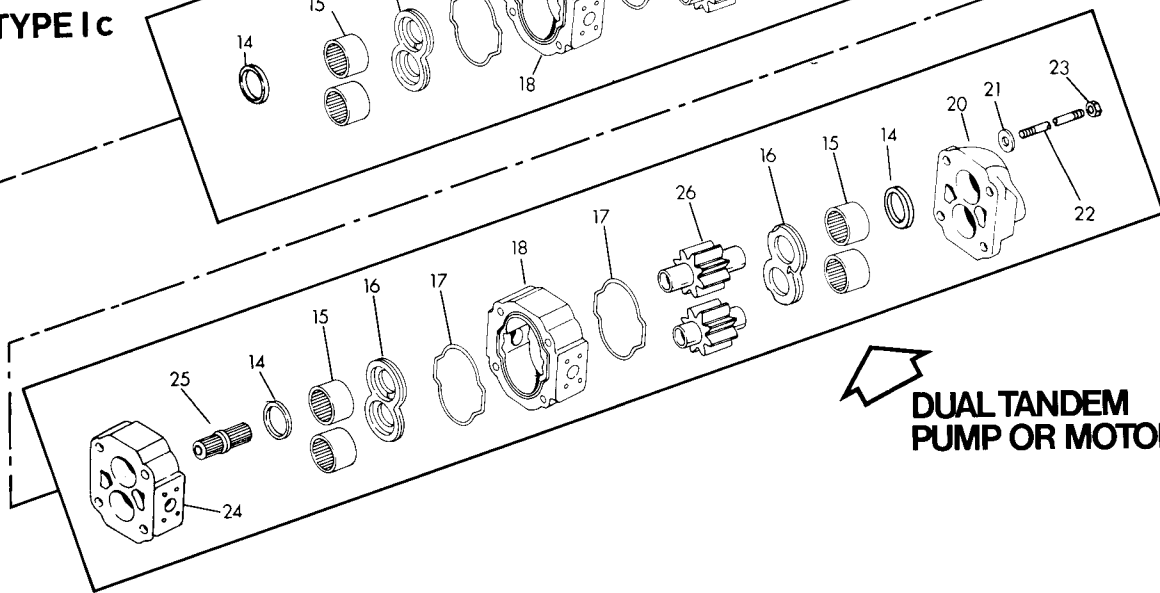
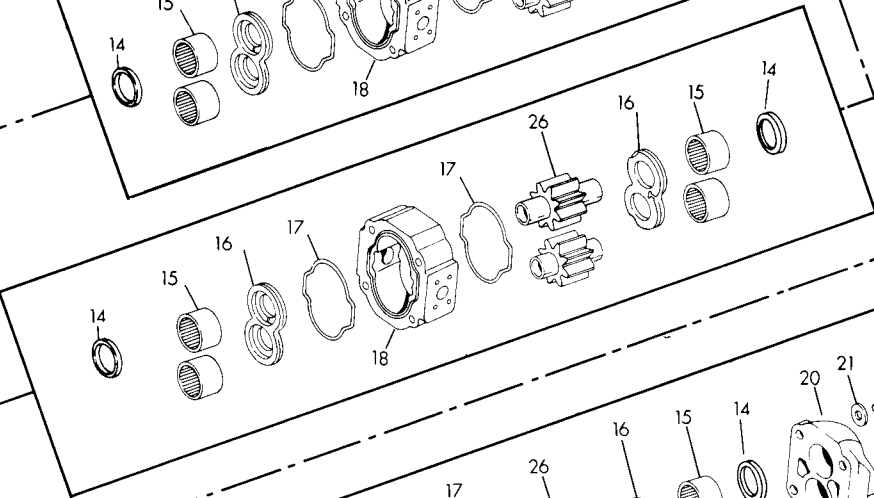


**TYPE I c
5000**

TYPE I II



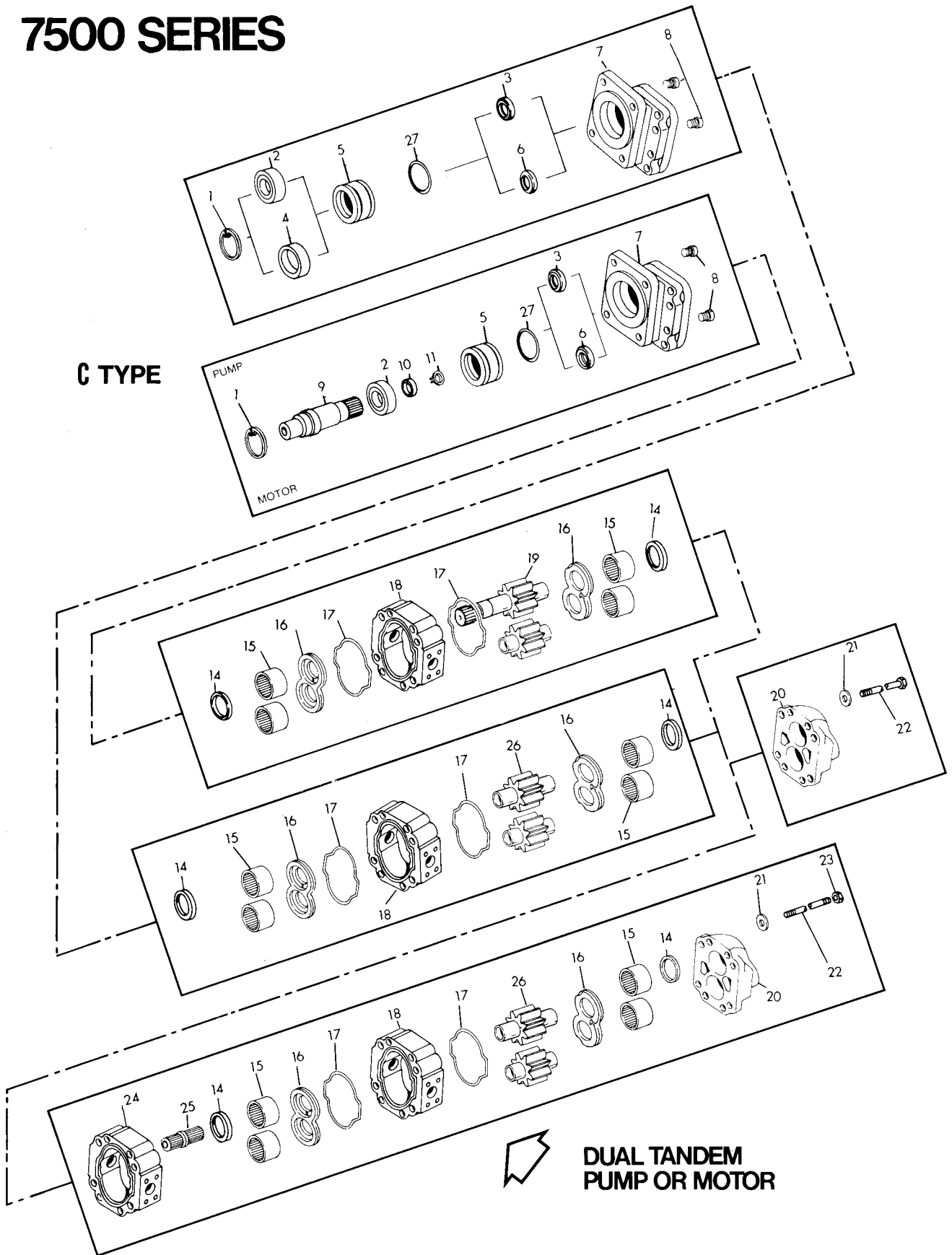
TYPE I c



**DUAL TANDEM
PUMP OR MOTOR**

7500 SERIES

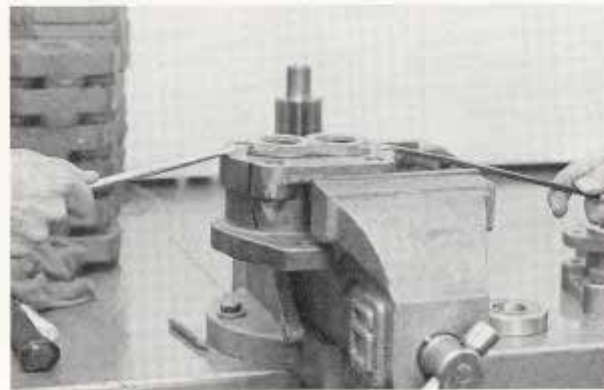
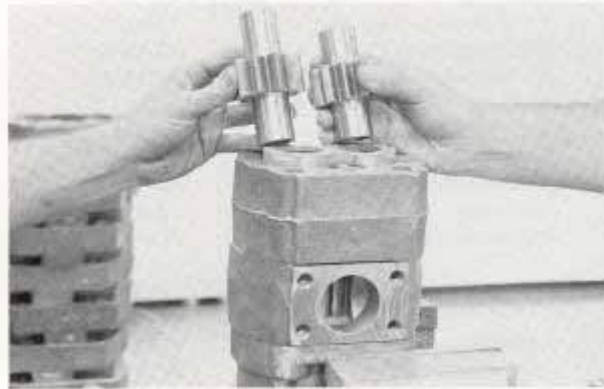
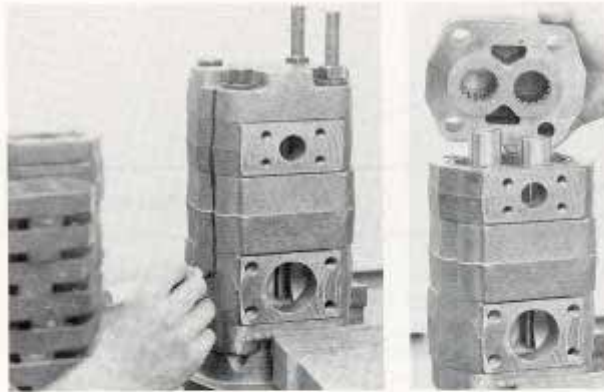
C TYPE



PARTS LIST

Item No. On Drawing	Description	Part Number	Item No. On Drawing	Description	Part Number
3000 SERIES PUMPS/MOTORS			16	Thrust Plate (TP)	X-0947
1	Snap Ring	W023-206		Teflon Coated Thrust Plate	X-0947-TC
2	Outboard Bearing	W58-39		Diverter Plate	X-0947-DS
3	Double Lip Seal	W62-26-16	17	Bi-Rotational Diverter Plate	X-0947-BRD
4	Bearing Carrier	UA-0558-2		Gasket Seal	TA-2995-244
5	Seal Retainer	ZD-0558	18	Housing	LZ-0577- ** - **
6	High Pressure Seal	W62-49-9	19	Drive Shaft & Gear Set	** -0024L- * - **
7	Shaft End Cover (SEC)	** - 0574- *	20	Port End Cover (PEC)	YZ-0592- *
8	Check Valve Assembly	L-0280-K	21	5/8" Grade 8 Washers	W033-2
9	Continental Shaft	** -0024	22	5/8-11 Grade 8 Threaded Rod	ZD-0391- ***
10	Spacer	SA-0558	23	5/8-11 Grade 8 Hex Nut	W3-65
11	Snap Ring	W86-100	24	Bearing Carrier	** -0576- ** - ***
12	Pump Shaft Seal	W62-26-18	25	Connecting Shaft	XZ-0022
13	Motor Shaft Seal	W62-49-11	26	Gear Set	LZ-0995L- **
14	Ring Seal	KA-0558-1XS	28	Grade 8 Hex Head Cap Screw	W1- **
15	Crowned Roller Bearing	X-0921	7500 SERIES PUMPS/MOTORS		
16	Thrust Plate (TP)	ZZ-0947	1	Snap Ring	W85-315
	Teflon Coated Thrust Plate	ZZ-0947-TC	2	Outboard Bearing	W58-48
	Diverter Plate	ZZ-0947-DS	3	Double Lip Seal	W62-26-10
17	Gasket Seal	TA-2995-242	4	Bearing Spacer	UA-0558
18	Housing	QZ-0577- ** - **	5	Seal Retainer	QZ-0961
19	Drive Shaft & Gear Set	** -0024L- * - **	6	High Pressure Seal	W62-49-1
20	Port End Cover	WZ-0592- *	7	Shaft End Cover (SEC)	** -0574- *
21	5/8" Grade 8 Washers	W033-2	8	Check Valve Assembly	L-0280-K
22	5/8-11 Grade 8 Threaded Rod	ZD-0391- ***	9	Continental Shaft	** -0024
23	5/8-11 Grade 8 Hex Nut	W3-65	10	Spacer	ZE-0558
24	Bearing Carrier	** -0576- ** - ***	11	Snap Ring	W86-137
25	Connecting Shaft	YZ-0022	14	Ring Seal	VA-0558-1XS
26	Gear Set	U-0996L- **	15	Crowned Roller Bearing	Q-0921
28	Grade 8 Hex Head Cap Screw	W1- **	16	Teflon Coated Thrust Plate	AZ-0947
5000 SERIES PUMPS/MOTORS				Diverter Plate	AZ-0947-DS
1	Snap Ring	W023-283		Bi-Rotational Diverter Plate	AZ-0947-BRD
2	Outboard Bearing	W58-47	17	Gasket Seal	TA-2995-252
3	Double Lip Shaft Seal	W62-26-17	18	Housing	RZ-0577- ** - **
4	Bearing Spacer	UA-0558-1	19	Drive Shaft & Gear Set	** -0024L- * - **
5	Seal Retainer	ZB-0558	20	Port End Cover (PEC)	XZ-0592- *
6	High Pressure Seal	W62-49-8	21	5/8" Grade 8 Washers	W033-2
7	Shaft End Cover (SEC)	** -0574- *	22	5/8-11 Grade 8 Threaded Rod	ZD-0391- ***
8	Check Valve Assembly	L-0280-K	23	5/8-11 Grade 8 Hex Nut	W3-65
9	Continental Shaft	** -0024	24	Bearing Carrier	** -0576- ** - ***
12	Pump Shaft Seal	W62-26-17	25	Connecting Shaft	ZA-0022
13	Motor Shaft Seal	W62-49-8	26	Gear Set	OZ-0995L- **
14	Ring Seal	MA-0558-1XS	27	O-Ring	K-2995-164
15	Crowned Roller Bearing	R-0921	28	Grade 8 Hex Head Cap Screw	W1- **

DISASSEMBLY



All Series:

1. With a sharp metal scribing tool, grease pencil, Magic Marker, or paint, make an indexing mark that runs straight across a surface of the port end cover (20), gear housing (18), and shaft end cover (7). This will enable you to reassemble these parts into the same position when you put the unit back together.
2. Clamp the unit in a vise, shaft end down.
3. Remove the cap screws or threaded rod (22) and washers (21) at the rear of the unit that hold the port end cover (20) and the gear housing (18) together. Remove the port end cover (20) and diverter plate (16) **or** thrust plate (16).

The roller bearings (15) will remain with the port end cover (20). On those units with thrust plates, the pocket seals will come out easily. (Permco pumps having diverter plates do not require pocket seals.)

4. Remove the pump drive gear, the driven gear, and the gear housing (18) from the shaft end cover (7). **BE CAREFUL** to keep the drive gear and the driven gear together; you must reassemble them as the original pair, since they have been worked-in together.

3000/5000 Series Pumps, Types I and II.

Disassembly of Shaft End Cover

1. If unit is equipped with a shaft bearing (2) or spacer (4), set the partially disassembled unit (shaft end cover (7)) from which the gear housing was separated in a vise with the pilot end up.

If unit is a Type II, it cannot be fitted with a shaft bearing (2) or spacer (4). Skip Step 2 below, and proceed to Step 3.

2. Remove the snap ring (1) from the shaft end cover (7). If a bearing is present, pull it out with a bearing puller; (this is not a press fit.) In units used as motors, a bearing (2) or bearing spacer (4) should be removed. Then remove the seal retainer (5).
3. Turn the shaft end cover into pilot-down position to make diverter plate (16) accessible.
4. Using a knife blade or thin-blade screwdriver pry the diverter plate (16) **very gently** off the bearings of the shaft end cover (7). Bearings should remain in cover. If they don't, or can be removed by hand, discard cover. If working on another make of pump to be refitted with **PERMCO** diverter plates, remove the pocket seals and throw away; on **PERMCO** Pumps, no pocket seals are required.

- If you plan to replace the bearings, use a bearing puller to pull the roller bearings (15) out of the shaft end cover.
If you do pull the bearings, check the bores for out-of round and elliptical shape. If out-of-round is over 0.003", **DO NOT RE-USE**
- Examine ring seal (14); if worn, replace. Do this by pulling the drive gear bearing.
- Remove lip seal (3, if pump; 6, if motor) by inserting a curved tool between the seal and shaft end cover (7). Tap out seal and discard.

Disassembly of Type 1"C" (Continental) Shaft End Cover

The Type 1"C" unit has a separate shaft and gear set.

Disassembly will follow the same steps as described above. Tap the drive shaft assembly out of the shaft end cover. The shaft (9) must then be pressed out with the bearing (2).

Bearing (2) will be removed from shaft (9) as follows:

For 3000 Series, all "C" shafts

- Remove snap ring (11) and spacer (10) from gear end of shaft (9).
- Press the bearing (2) off the **GEAR** end of the shaft (9).

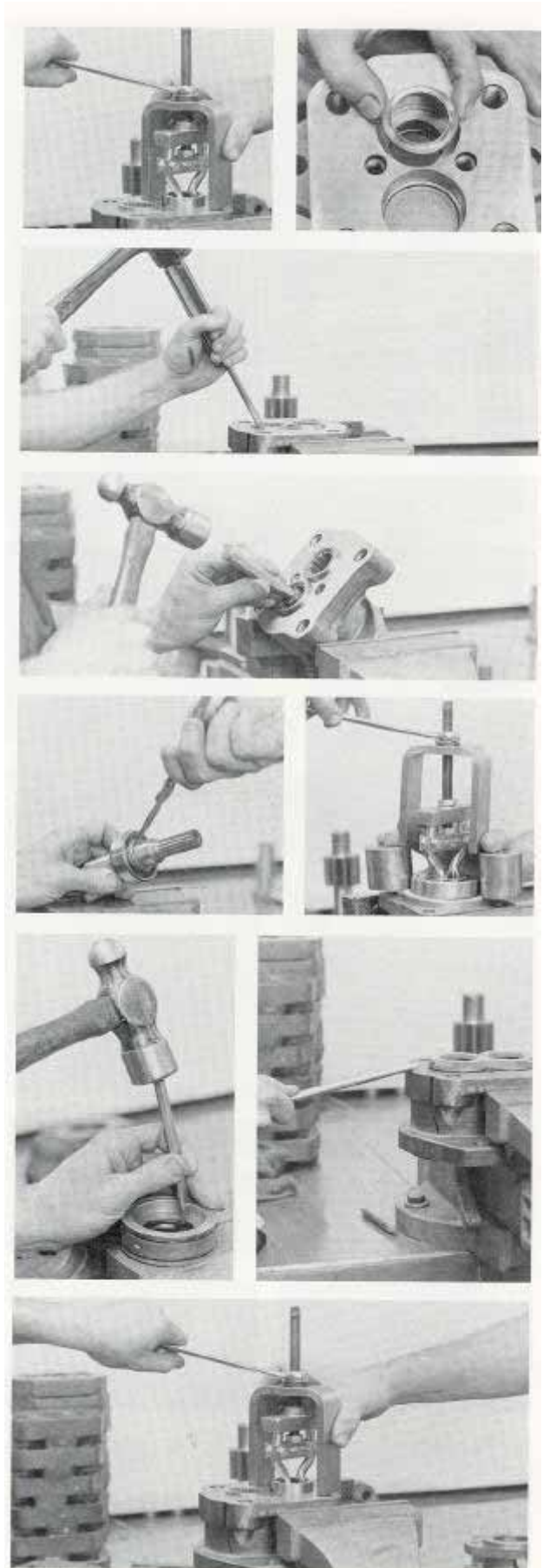
For 5000 Series

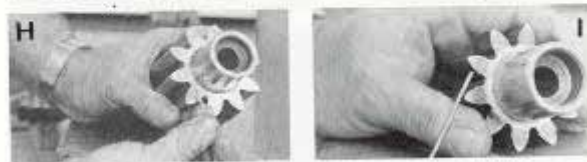
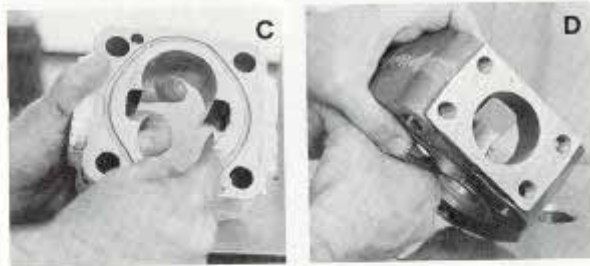
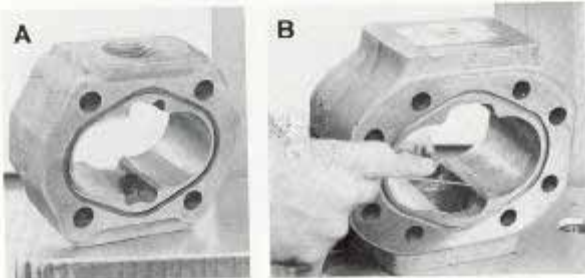
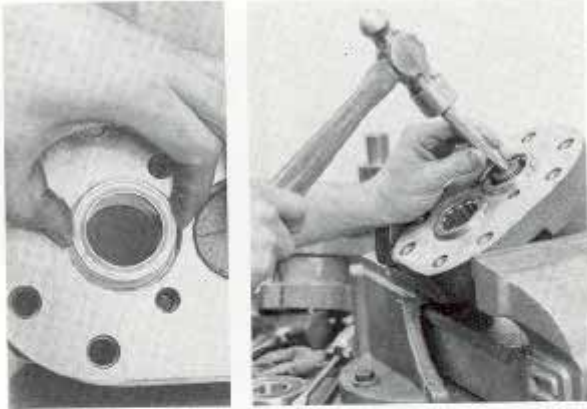
Press the bearing (2) off the **DRIVE** end of the shaft (9).

7500 Series Pumps

Disassembly of Shaft End Cover

- Set the partially-disassembled unit (shaft end cover 7) from which the gear housing has been separated in the vise, pilot-end up.
- Remove the snap ring (1) from the shaft end cover (7). The bearing (2) or bearing spacer (4) can now be removed. It is a slip fit. A bearing puller can be used, if necessary.
- Remove the seal retainer (5). Discard the O-ring (27).
- Remove the seal by inserting a curved tool between seal and seal retainer (5), tapping it out, and discarding.
- Turn shaft end cover (7) pilot-end down in vise. Diverter plate will now be accessible.
- With a knife blade or thin-blade screwdriver, Very Gently pry diverter plate (16) off the bearings of the shaft end cover (7). If working on another make of pump to be refitted with **PERMCO** diverter plates, remove the pocket seals and throw away. **PERMCO** pumps and diverter plates require no pocket seals.
- Use a bearing puller to pull the roller bearings





of the shaft end cover (7), if you plan to replace bearings. If you pull the bearings, check bores for out-of-round condition and elliptical shape. If more than 0.003" out-of-round, **do not** use again.

8. Examine the ring seal (14). Replace if worn by pulling the drive gear bearing.

Type "C" pump has a separate shaft-and-gear set.

Disassembly of Type "C" (Continental)

Shaft End Cover

Follow the steps described above for the standard shaft end cover. However, on the Type "C" unit, the shaft (9) will be pressed out of the cover (7) along with the bearing (2).

Separate the shaft (9) from the bearing (2) as follows:

1. Remove snap ring (11) and spacer (10) from **gear** end of shaft (9).
2. Press bearing (2) off **gear** end of shaft (9).

Disassembly of All Series Gear Housing; Single Units and Multiple Units

1. Remove square gasket seals (17) from gear housing (18), and discard. Have identical replacements at hand for reassembly. **DO NOT USE "O" RINGS**. Check for depth of wear in gear housing at this time; use a telescoping gage and a micrometer. If wear pattern on gear housing exceeds 0.003", discard housing and replace with a new one.

Figure A shows a satisfactory housing with little wear. Figure B shows a housing with excessive wear; notice large cavities that indicate cavitation was present.

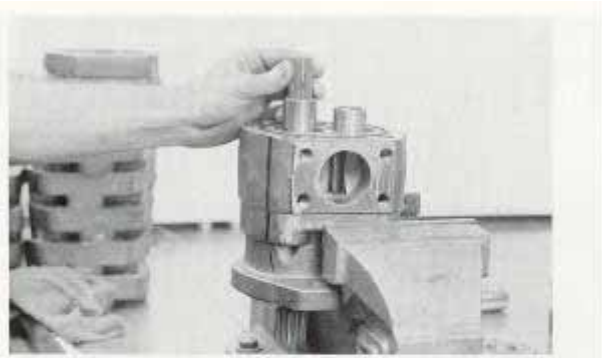
Examine the housing for cracks (Figure C). This is caused by overpressure or by possible over tightening of an **NPT** thread.

If a new gear housing is required and a large port is present, step-drill the housing (Figure D) if **PERMCO** diverter plates are to be installed.

2. Examine gears for wear, scuffed or pitted journals, scratched or scuffed tooth faces, or deep nick on tooth edges. If any of these defects are present, install new drive and driven gears. Figure E shows a satisfactory gear hub, with no nicks. Figures F and G show gear hubs that are breaking down from contamination, over-pressurization, pressure shock, or bearing failure. On examination of gear faces, some scratches may be found; if they can be removed by stoning, the set can be reused (see Figures H and I).

Also examine the ring seal surface (Figure J) for wear.

Figure K shows a rotating group that ran without oil.



For Multiple units:

3. Remove the connecting shaft (25).
4. Remove the bearing carrier (24), diverter plate (16) or thrust plate, bearings (15), and ring seals (14), using procedure described previously for disassembly.

Port End Cover

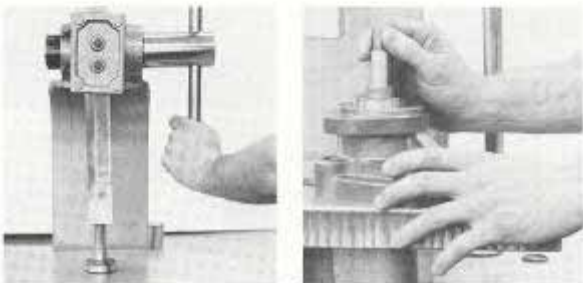
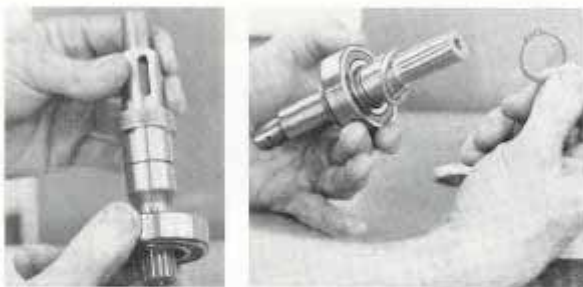
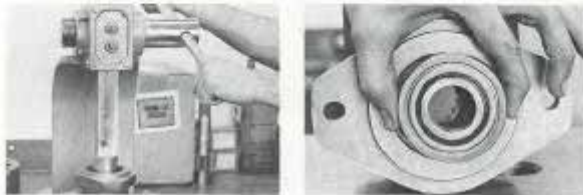
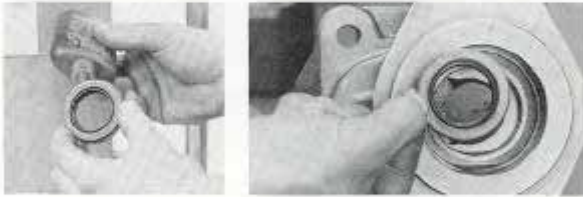
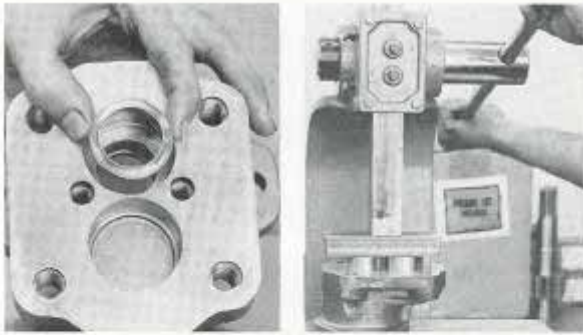
1. Use a knife blade or thin-blade screwdriver to gently pry the diverter plate (16) or the thrust plate off the bearings (15) of the port end cover (20).
2. When working on pumps other than **PERMCO** Pumps, remove and discard the pocket seals. When installing **PERMCO** diverter plates, you do not install replacement pocket seals; **PERMCO** Diverter Plates do not require pocket seals.
3. If you plan to replace the two shaft roller bearings (15) with new ones, pull the bearings (15) out of the port end cover (20) with a bearing puller.
4. Examine the ring seal (14). If worn, replace by pulling the drive gear bearing (15) out, leaving the driven gear bearing (15) in place.

Examine all diverter or thrust plates. Some wear will always appear, because of gear flexing. Figure L indicates very slight wear, with some scratches because of contamination. Figure M shows wear in the trapping area caused by contamination.

In bi-rotational units where there are two trapping grooves, a diagonal groove may develop connecting the two slots. This is caused by contamination.

Figure N shows the effect of cavitation... the rapid formation and collapse of vapor cavities within a fluid. This effect is caused by high-vacuum inlet conditions or by air entering the pump inlet.

REASSEMBLY



3000/5000 Series Pumps:

Reassembly of Shaft End Cover:

1. Grip shaft end cover (7) gear end up. Place ring seal (14) in bearing bore of shaft end cover (7) with the flat side down.
2. Replace the two roller bearings (15) in the bores of the shaft end cover (7). Take care that the bearings do not cock or wedge between ring seal (14) and bottom of bearing counter-bore.
3. Place shaft end cover (7) in a soft-jaw vise. Turn cover (7) end-for-end, and clamp with flange end up.
4. Apply Loctite Adhesive Sealant No. 271 to outside of seal (3, 6, 12, or 13). Press seal into shaft end cover (7) until seal is flush with counter-bore. If working on a Type I pump, which has no outboard bearing, or a Type II pump, assembly of shaft end cover is now complete.

If working on Type I unit having bearing or bearing spacer and integral gear shaft continue as follows:

5. In motors only, insert the seal retainer (5) into the shaft end cover (7).
6. Guide the bearing (2) or bearing spacer (4) into the shaft end cover (7). This is NOT a press fit.
7. Install snap ring (1) into the groove. Reassembly of shaft end cover (7) is now complete.

3000/5000 Continental Shafts

For Type I pumps with "C"-type shafts, follow the above Steps 1 through 5. Then proceed as follows:

For 3000 Series: All "C" Shafts

6. Press the outboard bearing (2) on the drive shaft (9), from the gear end.
7. Push the spacer (10) over the end of the shaft (9). Install the snap ring (11) in the groove on the shaft (9).
8. Press the bearing (2) and spacer (10) tightly against the snap ring (11).
9. Lubricate the drive shaft (9), and put this assembly into the shaft end cover (7). Be careful not to damage seal (12 or 13).
10. Install the snap ring (1) into the groove of shaft end cover. Assembly of shaft end cover is now completed.

For 5000 Series: "C" shafts

Follow Steps 1 through 5 from previous page then proceed as follows:

6. Press the outboard bearing (2) onto the drive shaft (9) from the drive shaft end.
7. Lubricate the drive shaft (9), and put this assembly into the shaft end cover (7). Be careful not to damage seal (12 or 13).
8. Install snap ring (1) into the shaft end cover groove. Assembly of shaft end cover is now completed.

7500 Series

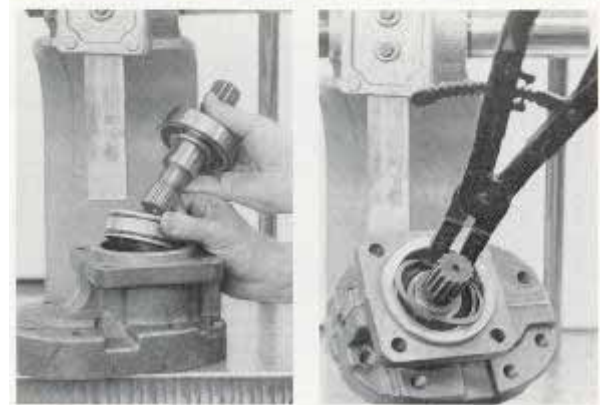
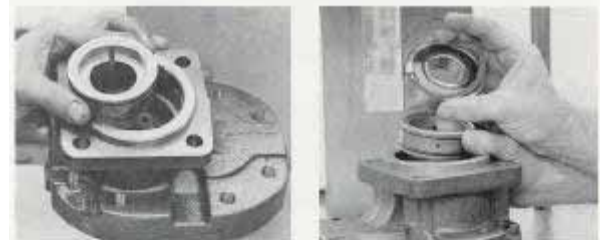
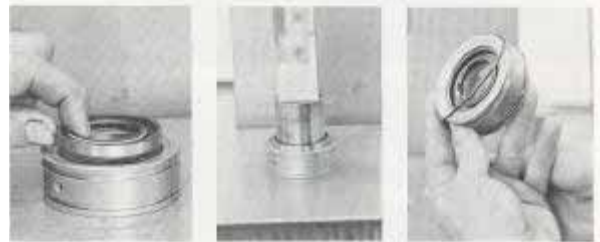
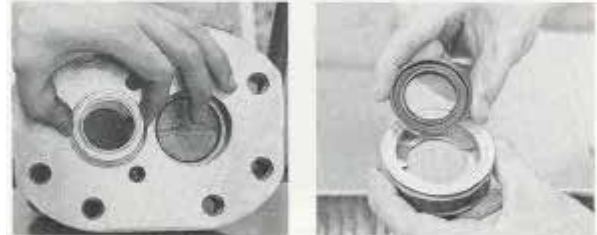
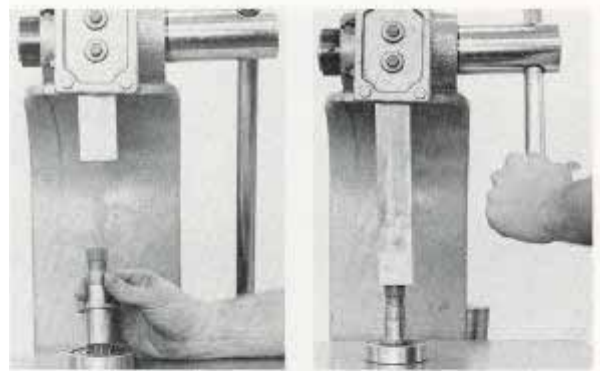
Reassembly of Shaft End Cover:

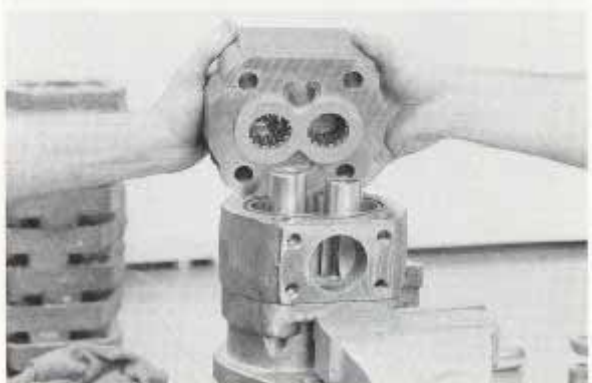
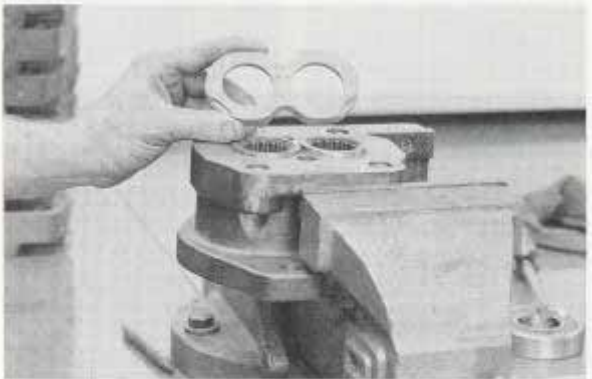
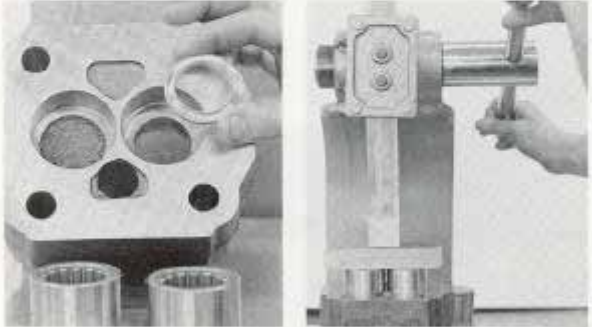
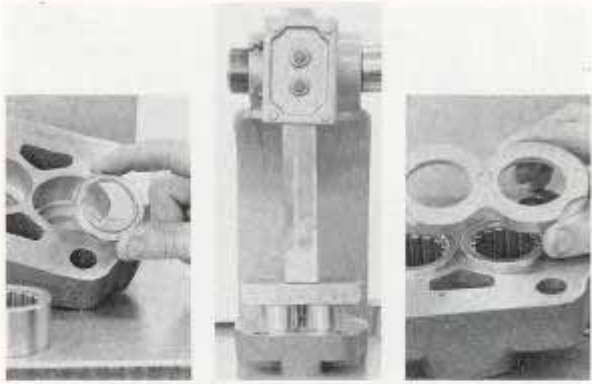
1. Grip shaft end cover (7), gear end up. Place ring seal (14) in the bearing bore of the shaft end cover (7) with flat side down.
2. Replace the two roller bearings (15) in the bores of the shaft end cover (7). Take care that the drive bearing (15) does not cock or wedge between the ring seal and bottom of bearing counter-bore.
3. Place shaft end cover (7) in a soft jaw vise. Turn cover end-for-end, and clamp with flange end up.
4. Apply Loctite Adhesive Sealant No. 271 to outside of seal (3 or 6). Press seal into seal retainer (5) metal side down. Be careful not to damage seal. Install O-ring (27) on outside of seal retainer (5).
5. Push this assembly into shaft end cover (7), with seal on inboard side. You can install bearing or bearing spacer and snap ring now, or at the end of assembly.

Continental Shafts

For Type I pumps with "C" Type shafts, follow the above steps 1 through 4; then proceed as follows:

5. Push seal assembly into shaft end cover (7) with seal on inboard side.
6. Press the outboard bearing (2) on the drive shaft (9) from the gear end.
7. Push spacer (10) over the end of the shaft (9). Install snap ring (11) in the groove on shaft (9).
8. Press the bearing (2) and spacer (10) tightly against the snap ring (11).
9. Lubricate the drive shaft (9), and put this assembly into the shaft end cover (7). Be careful not to damage the seal.
10. Install the snap ring (1) in the groove. The shaft end cover reassembly is now complete.





All Series Reassembly of Port End Covers:

1. If you removed the two roller bearings (15) or the ring seal (14) during disassembly, install new bearings (15) and ring seal (14) in the port end cover (20). Place the ring flat side down in the drive gear bearing bore, and make a medium press fit.
2. Place the diverter plate (16) over the two roller bearings (15). The counter-bored side of the diverter plate (16) should be placed over the bearings (15) with the high-pressure crescent recesses toward the pump inlet side. Double-check the placement of the diverter plate (16) for correct positioning.

Reassembly of Bearing Carrier:

1. If you removed the four roller bearings (15) or ring seals (14) during disassembly, install new bearings (15) and ring seals (14) in the bearing carrier (24). Place the ring seals (14) flat side down in the drive gear bearing bore and press bearing with a medium press fit.
2. Place the diverter plate (16) over the two roller bearings (15). The counter-bored side of the diverter plate (16) should be placed over the bearings (15) with the high-pressure crescent recesses on the pump inlet side. Double-check the placement of the diverter plate (16) for correct positioning.

Final Reassembly:

1. Clamp the shaft end cover (7) assembly in a soft jaw vise, gear end up.
2. Place the diverter plate (16) over the two roller bearings (15). The counter-bored side of the diverter plate (16) should be placed over the bearings (15) with the high-pressure crescent recesses on the pump inlet side. Double-check the placement of the diverter plate (16) for correct positioning.
3. Pour a little hydraulic, "STP" or a compatible fluid over face of diverter plate (16) to lubricate gears immediately on start-up. Gently stone the sides of each gear (119 and 26) to remove any burrs. Dip entire gear into cleaning solvent to remove all dirt and metal dust. Install drive gear first, then the driven gear. Be sure both gears are firmly in contact with diverter plate.
4. Lightly grease square gasket seals (17) and carefully install them in the grooves in the two faces of the gear housing (18). Be sure they are fully seated.
5. Carefully place the gear housing subassembly over the gears, on top of the shaft end cover (7). Make sure the square gasket (17) is not pinched or cocked, then tap the gear housing (18) down on the shaft end cover (7) with a

soft mallet. Pour a little fluid over the gears while rotating the drive shaft. This will provide immediate lubrication when starting up pump.

(If the unit is a **single** one, skip Step 6 and go to Step 7.)

6. Position the assembled bearing carrier over the gear journals and gently tap it into place. Be sure the high-pressure crescents of the diverter plate (16) are positioned towards the pump low-pressure side. Install the connecting shaft. (25) Repeat Steps 3 through 7, above, until you attach the final gear housing (18). Then pick up at Step 7, below.
7. Place the port end cover (20) over the gear hubs (19) and place in gear housing (18), face down. The drive gear has longer bearing hubs to engage the ring seal. Tap the port end cover (20) assembly gently down on the housing (18) with a soft mallet. Be sure the square gasket (17) is not pinched or cocked.
8. Put flat washers (21) over cap screws (22), or use Grade 8 threaded rod. Place screws or threaded rod in holes in port end cover (20). Tighten evenly and alternately with a torque wrench to recommended torque shown in table.

Recommended torque for pumps and motors

Series	Size	No. Req.	Torque Lb.ft.
3000/5000	5/8-11 UNC-2A Thread	4	200
7500	5/8-11 UNC-2A Thread	8	200

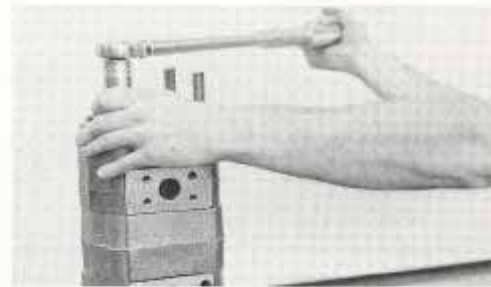
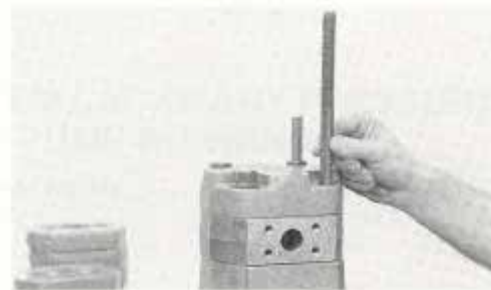
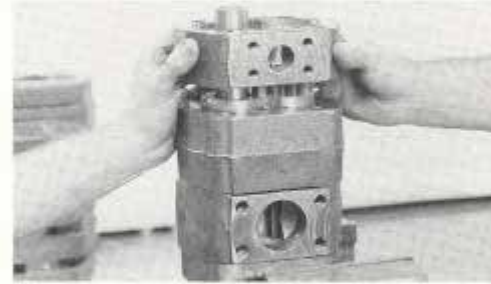
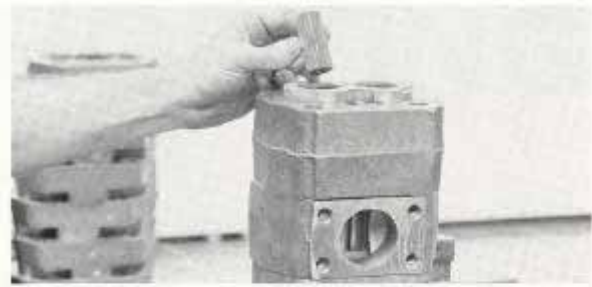
Note: All bolts or tie rods must be SAE Class 8, with 150,000 PSI minimum tensile strength.

9. Test the assembled pump for free rotation by turning drive shaft by hand, using a wrench for leverage. **Caution:** Wrap several layers of cloth around shaft ends before applying wrench. The shaft should turn with slight effort, NO hard spots and NO rubbing noises.

If your pump or motor is a 3000/5000 or 7500-”C” series, it is ready to put back in service.

But if it is a **standard** 7500 series unit, and you did not install the bearing and snap ring earlier, proceed to the following steps before putting it in service:

10. Release the unit from the vise and turn end-for-end so that the shaft end is facing up. Re-clamp unit in vise.
11. Install bearing (2) or bearing spacer (4). This is a slip fit over the shaft (9) and into shaft end cover (7).
12. Install the snap ring (11) into groove. Your **standard** 7500 series unit is now ready to put back in service.



START-UP INSTRUCTIONS FOR PERMCO PUMPS

FOLLOW THESE INSTRUCTIONS CAREFULLY.
If you don't, you can instantly ruin your pump
if the relief pressure setting is too high.

1. Before you operate the pump, unscrew the main relief valve adjusting screw on the main hydraulic system. **OR** remove adjusting shims or spacers.
2. Run the pump about five minutes under **ZERO PRESSURE**, with all control valves in neutral position. If the test system has a throttling valve, set it at 100 psi. above user's expected operating pressure.
3. If everything seems to function properly and no unusual noises are heard, back-off the throttling valve to zero. Shut down the system.
4. Adjust the relief valve pressure to the setting your hydraulic system requires.

LUBRICATION OF PERMCO PUMPS

1. The hydraulic oil used in the entire circuit provides the lubrication for all parts of the pump. **KEEP THIS OIL CLEAN AND FREE OF DIRT.** PERMCO recommends a 25-micron return filter and a 149-micron (100-mesh screen) suction filter to fully protect the pump and system from excessive wear and damage from dirt.
2. If the pump fails and you think metal particles have gotten in the circuit:
 - a. Drain **ALL** oil from the whole system,
 - b. Flush the system with kerosene,
 - c. Refill the system with fresh oil of correct grade,
(These are correct oils:
Viscosity index at 100°F (37°C): 90 or higher;
Viscosity SUS at 100° F (37° C): 150 to 300
(32-65 CST);
Aniline point: 165 or higher;
Anti-foam and anti-oxidant additives.)
3. Temperature of oil should never exceed 185°F (85°C.)
4. **NEVER** use low-viscosity naphtha-base oils, aircraft hydraulic fluids, or automotive brake fluids without consulting **PERMCO, INC.** or a Permco distributor.
5. For extended operation at temperatures below 20° F (-7° C) always use a low-pour-point oil of top quality.



TROUBLE SHOOTING

PROBLEM	REMEDY	PROBLEM	REMEDY
---------	--------	---------	--------

EXCESSIVE NOISE IN PUMP:

Insufficient Fluid	Replenish fluid to proper level, with proper grade
Fluid is too heavy	Drain system and refill with specified grade of fluid
Oil filter is dirty	Clean or replace filter element
Suction line too small	Install larger suction line
Clogged suction line	Clean line thoroughly
Pump over-speeding	Check pump maximum speed; Slow down pump driver; Or install larger pump
Air vent on fluid reservoir clogged	Clean or replace breather on reservoir
Air bubbles in fluid	Drain system and refill with non-foaming hydraulic fluid
Filter too small	Replace with larger filter
Coupling misalignment	Realign flexible coupling between pump and driver
Air leaks at pump intake on pump shaft packing or inlet pipe	Drip oil over suspected joint; listen for change in sound of pump; tighten joints
Worn or broken pump parts	Replace parts as necessary

FOAMING FLUID:

Improper fluid	Drain system and refill to correct level with proper grade of anti-foaming fluid
Low fluid level	Top off with proper grade of anti-foaming fluid
Inadequate baffling in tank	Install correct baffling
Air leaking into suction line between reservoir and pump	Tighten all connections

OIL LEVEL IN TANK CONTINUES TO DROP

Oil level in tank continues to drop	Indicates a broken pipe line or a pipe left out between a bulkhead coupling and the bottom of the tank after cleaning tank. Replace pipe.
-------------------------------------	---

Pump rotating in wrong direction	IMMEDIATELY STOP PUMP DRIVER to prevent damaging pump. Then reverse direction of pump rotation
Pump fails to prime itself a. Air leak into suction line b. Oil is too heavy	Tighten up joints. Drain system and replace fluid with proper grade of anti-foaming fluid
c. System not in Neutral	Open valve on pressure side of pump, or install air bleed valve

SYSTEM LACKS ANY PRESSURE WITH PUMP RUNNING:

Relief valve not set correctly	Use pressure gauge and reset valve to specified pressure
Relief valve leaking	Check relief valve seat for score marks. Reseat by grinding. Or replace.
Broken relief valve spring	Replace spring; reset relief valve
Flow of fluid to tank is unrestricted	Check for control valve in "Neutral" or for open return line
Internal leakage in control valve or power cylinder	Repair or replace leaking valve or cylinder

EXCESSIVE WEAR IN PUMP:

Abrasive contaminants in fluid	Drain and flush entire system. Install new filter. Fill system with fresh oil of proper grade or filter contaminated oil through a 10-micron filter before refilling. Operate pump an hour. Drain system again. Install new filter element and fluid.
Fluid too light for pump service	Drain and replace with anti-foaming fluid of proper grade.
Sustained pressure above pump maximum rating	Check and reset relief valve pressure, using pressure gauge.



PROBLEM	REMEDY	PROBLEM	REMEDY
Sustained excessive speed at pressure above pump maximum rating	Recheck pump rated speed. Slow down driver to produce this speed.	Internal leak in control valve or cylinder.	Repair or replace control valve. Replace cylinder packing. Check cylinder walls for scoring and replace if necessary.
Drive misalignment; Tight belt; weight of pump supported by its drive shaft	Check pump/driver coupling or belt alignment. Install adequate support for pump.	Erratic pump performance:	a. Drain system and refill with lighter grade anti-foaming fluid.
Entrapped air in hydraulic system	Bleed air from hydraulic system	a. If pump runs slow on startup, and speeds up after fluid is warm, fluid grade is too heavy.	b. Drain system and refill with heavier grade anti-foaming fluid.
		b. If pump slows down after fluid has heated up, fluid is too light	

OVERHEATED FLUID:

Fluid too heavy	Drain system and refill with lighter grade of anti-foaming fluid.
Fluid too light for high temperature pump location	Drain system and refill with heavier weight anti-foaming fluid.
Dirty fluid	Drain and flush system; refill with proper grade of anti-foaming fluid; replace filter element.
Dirt or chip caught between plunger and seat of relief valve	Disassemble relief valve and remove contaminant. Check condition of filter to prevent recurrence.
Incorrect setting on relief valve	Use gauge and adjust relief valve setting to correct pressure
Worn pump permits oil to bypass internally	Repair worn pump parts or replace pump.
Relief valve leaks or not operating	Repair or replace relief valve
Excessive friction caused by pump components over-torqued	Disassemble pump and back off over-torqued component to tightness specified in this maintenance manual
Undersize hoses and valves in system	Replace with proper size hose and valves
Restrictions and excessive bends in lines	Re-plumb system to eliminate restrictions
Inadequate reservoir prevents adequate cooling of fluid	Install larger reservoir or add fluid radiator
Internal leaks not in pump	Locate and repair leaks

PUMP NOT EFFICIENT:

Worn pump parts reduce pump efficiency	Repair or replace pump
Air in system	Bleed air from system; check line connections for air leaks

MOTOR DOESN'T DEVELOP PROPER TORQUE OR SPEED (when pump is used as a motor)

Relief valve incorrectly adjusted	Use a pressure gauge and increase relief valve pressure setting to proper level
Relief valve sticking open	Disassemble relief valve and remove dirt from under ball or piston. Check condition of filter to prevent recurrence.
Flow of fluid to tank is unrestricted	Check for control valve in "Neutral" or for open return line.
Insufficient pump pressure or volume	Use pressure and flow gauges to check pump out-put and pressure.
Misalignment of pump/driver	Realign belt drive or coupling, recheck torque requirements of pump for maximum input.

MOTOR SUBJECTED TO OVERPRESSURE. (when pump is used as hydraulic motor)

If you have used a standard control valve to control a hydraulic motor, serious and catastrophic harm can result. When the standard control valve is returned to "Neutral", to start or stop the motor sudden excessive pressure develops. This pressure can burst seals, fracture drive shafts, burst housings, and rupture hoses.

HOW TO ORDER PARTS

ALWAYS GIVE US THE SERIES NUMBER, please. It instantly tells us what PERMCO Pump or Motor you want parts for. You will find this Series Number on the nameplate.

IF YOU CANNOT SUPPLY THE SERIES NUMBER, Please answer these questions:

1. Is the unit a pump or a hydraulic motor?
2. If a pump, which way does it rotate when you look at it from the shaft end? Clockwise? Or Counter-Clockwise?
3. How many gear housing sections does the unit have?
4. Check "Series Identification Table" below to determine series.

STEPS IN IDENTIFICATION:

1. Shaft end cover:
Mounting flange: Is it pad mounting or foot mounting? How many bolts, 2, 4, 6, 8? If round flange, measure pilot diameter, center diameter, and bolt-hole diameters.

2. Bearing arrangement:
With or without outboard bearings? Double outboard bearings? Bearing measurements? Any drains or grease fittings?
3. Drive shaft:
Diameter of shaft end? Keyed or not? Length of spline? Number of spline teeth O.D.? Total length of shaft?
4. Housing:
Width of housing? Inside diameter of ports?
5. Port end cover:
Inside diameter of ports?
6. Bearing carrier:
Inside diameter of ports? Direction of flow thru internal passage or coring?
7. Gears:
Gear tooth width? Gear O.D. measured over teeth? If gears are integral, describe drive end of drive gear, as in Paragraph 3 above.

SERIES IDENTIFICATION

SERIES	STUD HOLES No. and Dia.	STUD DIA.	CONTINENTAL (Two-Piece Drive Shaft & Gear Set)	INTEGRAL (One-Piece Drive Shaft & Gear Set)	HOUSING Height	HOUSING WIDTH= GEAR WIDTH, +
1200	10-9/16"	1/2"	X		7"	1/2"
1500	4-9/16"	1/2"	X		5-1/4"	3/4"
2500	4-11/16"	5/8"	X		6"	3/4"
3700	8-9/16"	1/2"	X		7-5/16"	1"
3000 3100 (Doweled)	4-11/16"	5/8"	*	X	5-3/8"	3/4"
5000 5100 (Doweled)	4-11/16"	5/8"	*	X	6"	3/4"
7500 7600 (Doweled)	8-11/16"	5/8"	*	X	7-7/8"	1"

* Continental (Two-Piece Drive Shaft & Gear Set) available on Series 3000, 5000 and 7500 as specials; consult factory.

