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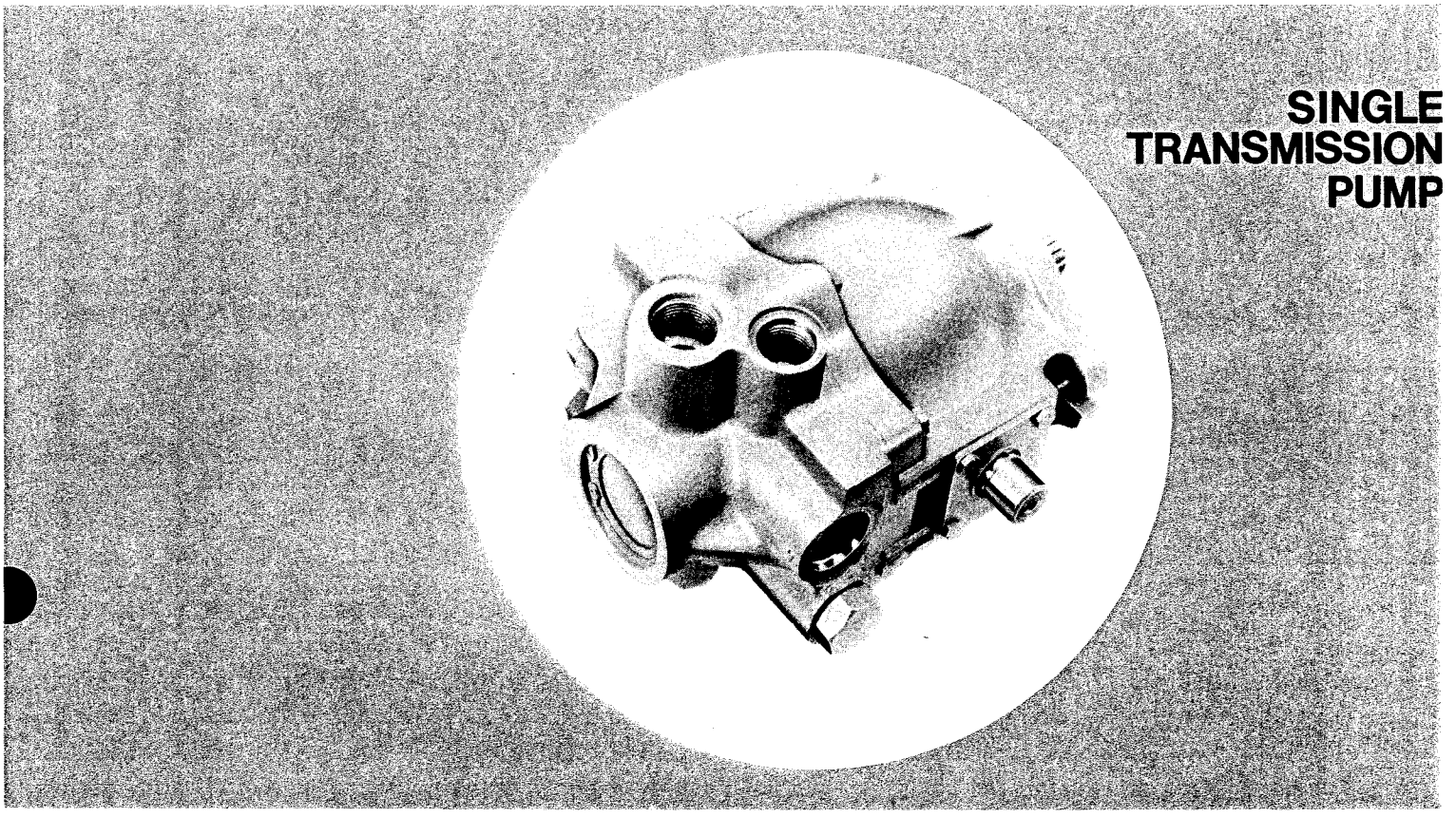


SINGLE TRANSMISSION PUMP

OVERHAUL MANUAL

TA19*-***-21

SPERRY VICKERS
TROY, MI. 48084

Released 6-1-78

M-2839-S

TABLE OF CONTENTS

MODEL CODE BREAKDOWN

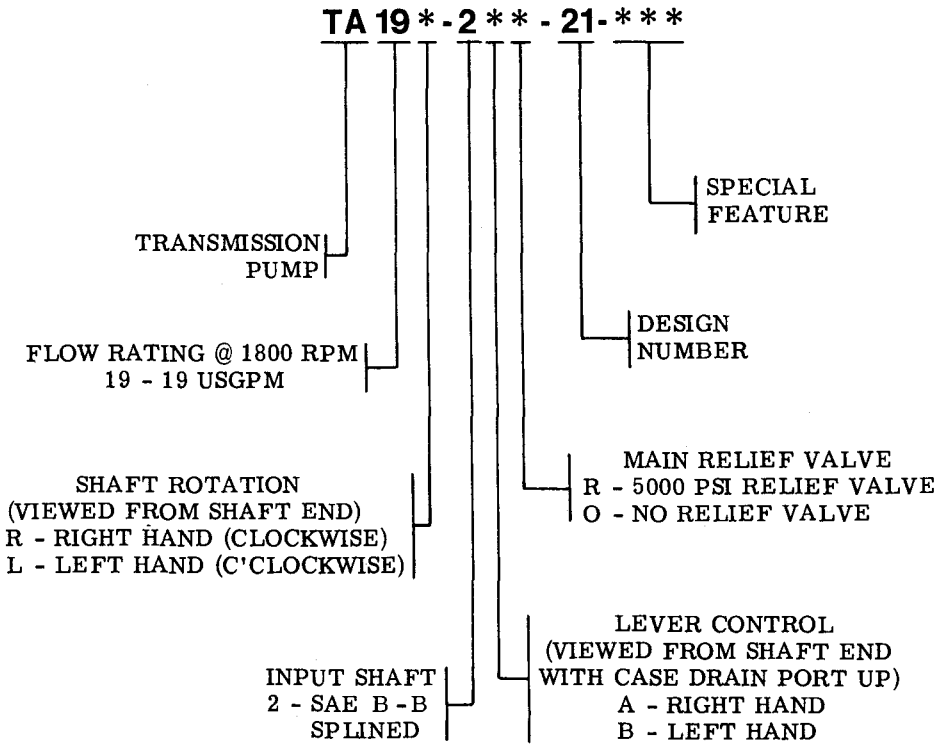


Table 1. Model Code Breakdown

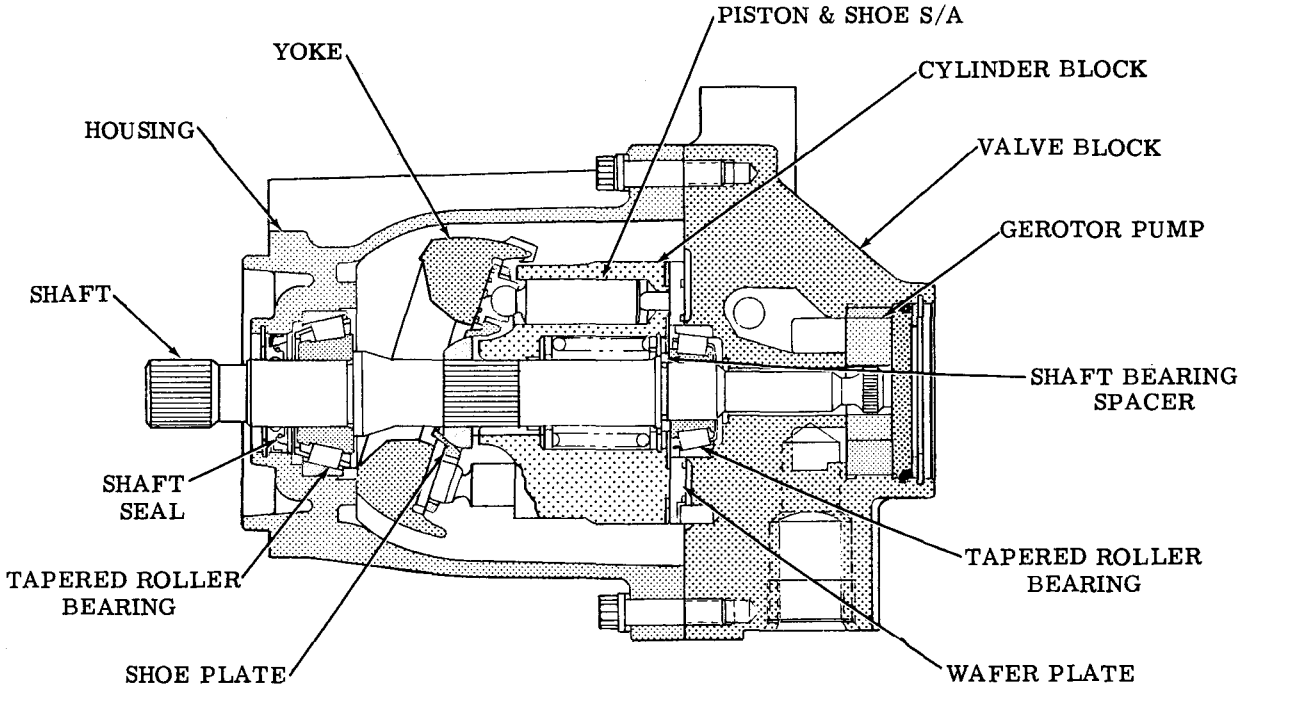


Figure 1. Sectional View of TA19*-***-21 Pump Package.

Section I - INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes basic operational characteristics and provides service and overhaul information for the Sperry Vickers TA19*-***-21 transmission pump package. The information contained herein pertains to the latest design series as listed in Table 1.

B. GENERAL INFORMATION

1. Related Publications - Service parts information and installation dimensions are not contained in this manual. The parts and installation drawings listed in Table 2 are available from any Sperry Vickers application engineering office or from:

Sperry Vickers
Technical Publications
1401 Crooks Rd.
Troy, Michigan 48084

2. Model Codes - Variations within each basic model series are covered in the model code. Table 1 is a complete breakdown of the codes covering these units. Service inquiries should always include the complete unit model code number or the frame size and assembly number as stamped on the transmission pump mounting flange.

MODEL	PARTS DRAWING	INSTALLATION DRAWING
TA19*-***-21	M-2838-S	MB-198

Table 2.

Section II - DESCRIPTION

A. GENERAL

Assembly of a typical hydrostatic transmission pump package is shown in Figure 1. In general, the transmission consists of a piston pump and a gerotor pump connected to a common drive source. Crossline relief/check valves and a supercharge relief valve are located in the piston pump valve block.

CAUTION

Sperry Vickers engineering must review each new application to determine necessity of relief valves.

The gerotor pump is located within the valve block and supplies circuit replenishing flow.

B. APPLICATION

Pump rating in USGPM as shown in the model coding are at 1800 RPM. For ratings at other speeds, methods of installation and other application information, Sperry Vickers application engineering personnel should be consulted.

Section III- PRINCIPLES OF OPERATION

A. PISTON PUMP

The drive shaft causes the cylinder block, pistons and shoe plate to rotate within the pump. See Figure 2. The angle of the yoke face imparts a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted wafer plate. As the pistons move out of the cylinder block a vacuum is created and fluid is forced into the void by replenishing pressure. The fluid moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

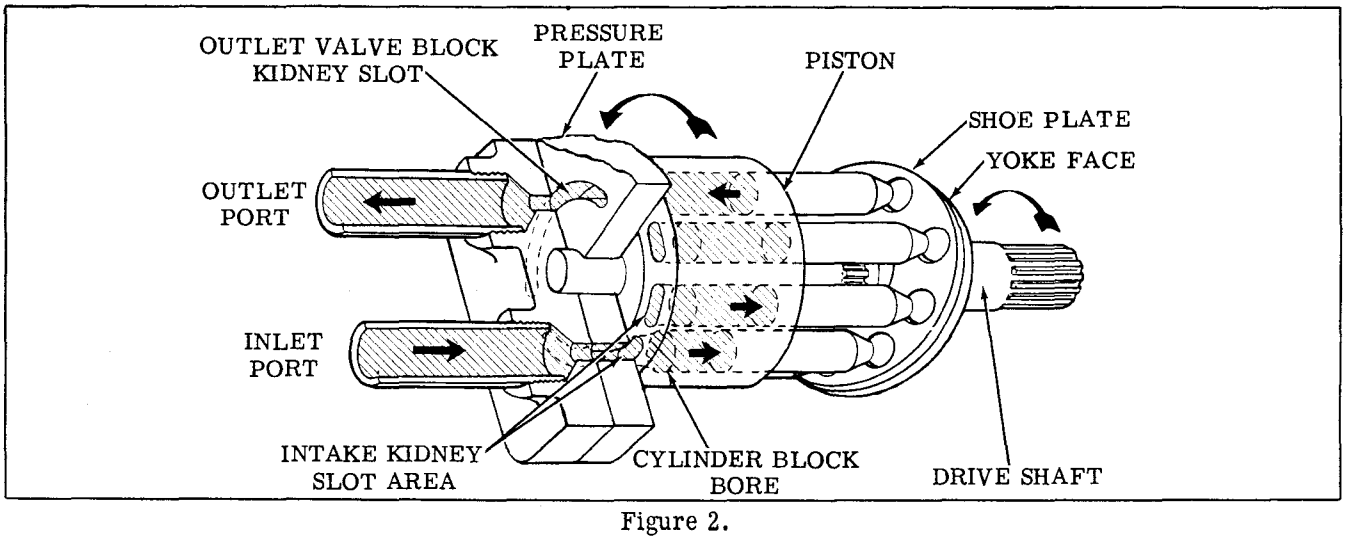


Figure 2.

B. GEROTOR PUMP

A gerotor pump is composed of three basic parts, an inner rotor and outer rotor and a housing. Refer to Figure 3. The inner and outer rotor are machined to very close tolerances to limit internal leakage.

The inner rotor is driven by the main pump shaft and carries the outer rotor around in mesh. As the rotors turn, the inner rotor lobe tips ride against the curvature of the outer rotor forming individual pumping chambers and sealing them from each other. The pumping chambers form at the top right of the centerlines shown in Figure 3. As each chambers volume increases, pressure within each chamber lowers causing a vacuum condition to exist. Atmospheric pressure pushes system fluid through the inlet into the chambers to equalize pressure. This action continues while the chambers move past the inlet kidney slot, (shown by dotted lines in Figure 3).

When the center of a chamber moves past the bottom centerline, shown in Figure 3, chamber volume starts to decrease and fluid is pushed into the outlet kidney slot.

The action of the inner and outer rotor is such that a given amount of fluid is moved from the inlet port to the outlet port each revolution. The output of the pump, except for leakage losses, is independent of outlet pressure.

Gerotor pumps are classified as constant displacement pumps making them well suited for use in supercharge and replenishing circuits.

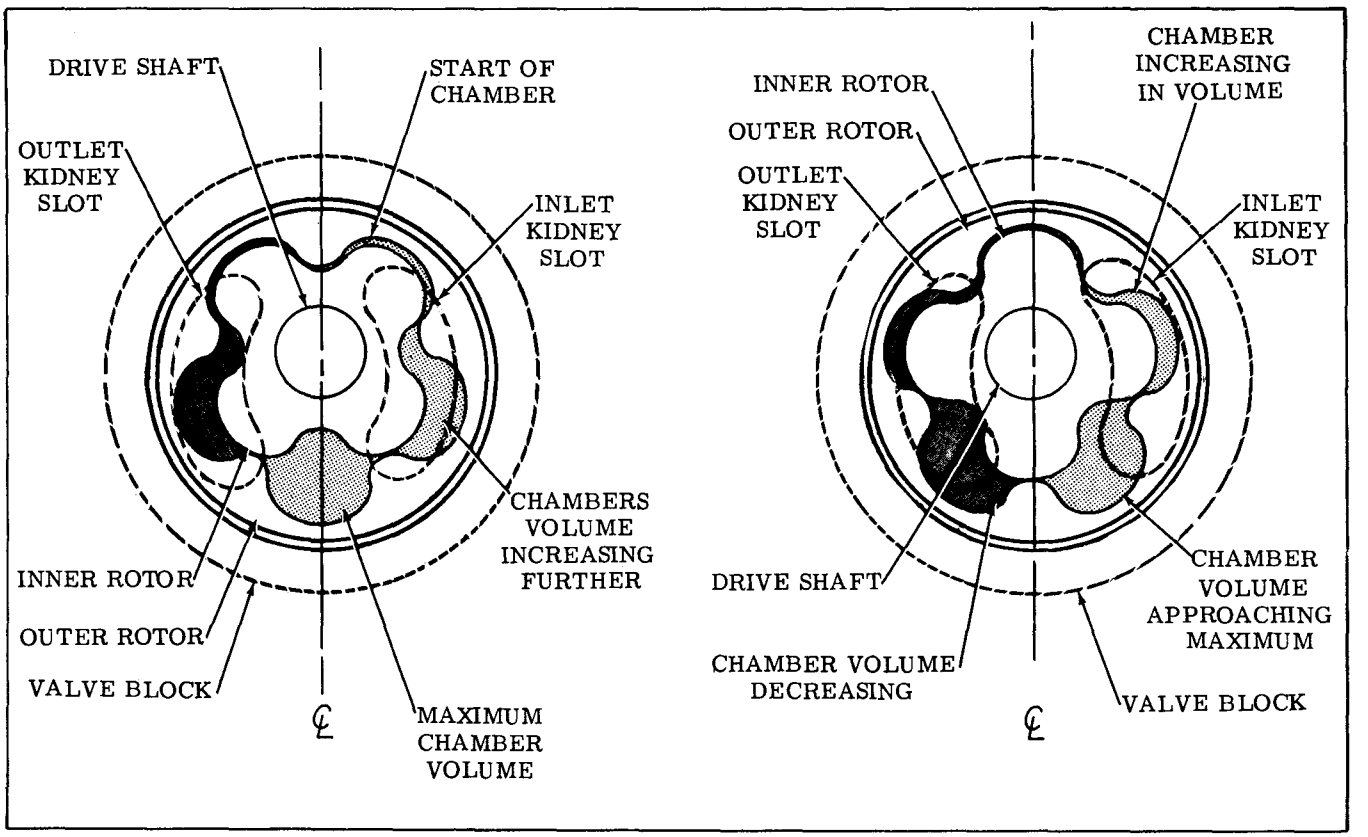


FIGURE 3. Gerotor Pump Operation.

Section IV - INSTALLATION AND OPERATING INSTRUCTIONS

A. INSTALLATION DRAWINGS

The installation drawing listed in Table 2 will show installation dimensions and port locations.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION

Pump shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings. Shaft tolerances are shown on the installation drawing. (See Table 2).

1. Direct Mounting - A pilot on the transmission pump mounting flange (Figure 4) assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

2. Indirect drive is not recommended for these pumps without Sperry Vickers Engineering approval.

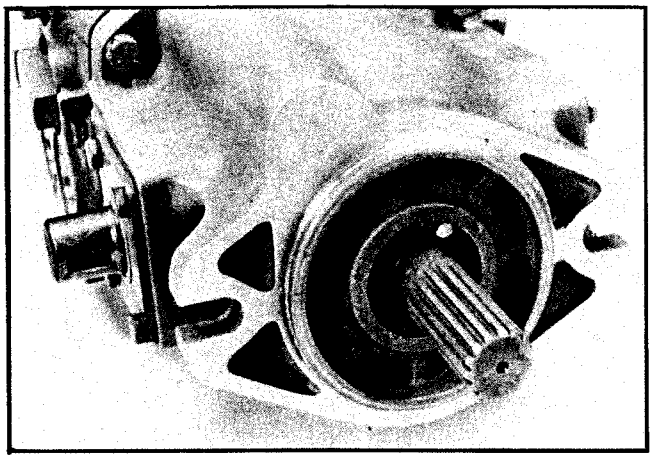


Figure 4. Transmission Pump Pilot Flange.

C. SHAFT ROTATION

Pumps are normally assembled for right-hand (clockwise) rotation as viewed from the shaft end. A pump made for left-hand rotation is identified by an "L" in the model code (See Table 1).

CAUTION

Never drive a pump in the wrong direction of rotation. Seizure may result necessitating expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sand blasting, wire brushing and pickling.

NOTE

For instructions on pickling, refer to instruction sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage, only as many fittings and connections as are necessary for proper installation should be used. The minimum hose or tubing diameter should not be less than the connecting SAE opening of the transmission.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended radius for bends is three times the inside diameter of the tube.

E. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Data sheet M-2950-S for oil selection is available from Sperry Vickers Technical Publications Troy, Mi.

Oil recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your Sperry Vickers representative.

CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean:

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system. The maximum contamination level should be less than three (3) milligrams/100 milliliters.

4. Provide continuous protection of system from entry of airborne contamination by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of filter, breathers, reservoirs, etc., cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

1. Very high viscosities at start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

F. OVERLOAD PROTECTION

Relief valves limit pressure in the system to a prescribed maximum and protect components from excessive pressure. The setting of a relief valve depends on the work requirements of the system components and are for intermittent use only.

Relief valves are not required for all applications. In applications designed without relief valves, pressure relief is obtained by spinning the wheels.

A. SERVICE TOOLS

The following standard tools for overhauling the transmission pump are shown in Figure 5.

1. Torque wrench with short extension and sockets.
2. (0-1 inch) micrometer.
3. (0-1 inch) depth micrometer.
4. Internal Truarc pliers.
5. External Truarc pliers.

In addition to the service tools, an arbor press is required to service bearings, etc. Maintenance of this unit is intricate and should not be attempted without the proper tools.

SPECIAL TOOLS

Special tools are shown in Figures 6, 7, 8, and 9.

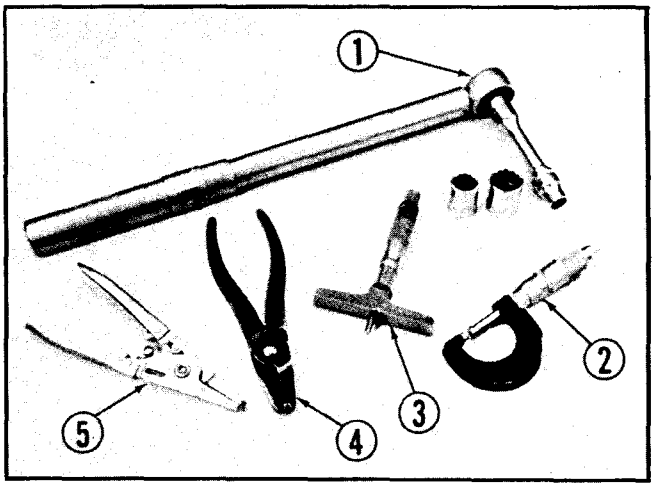
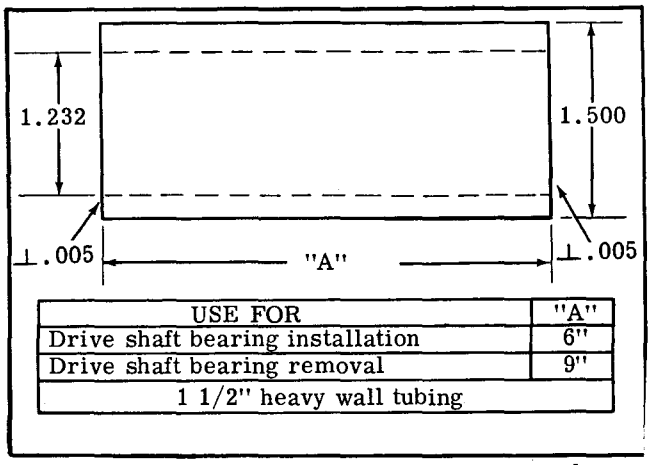
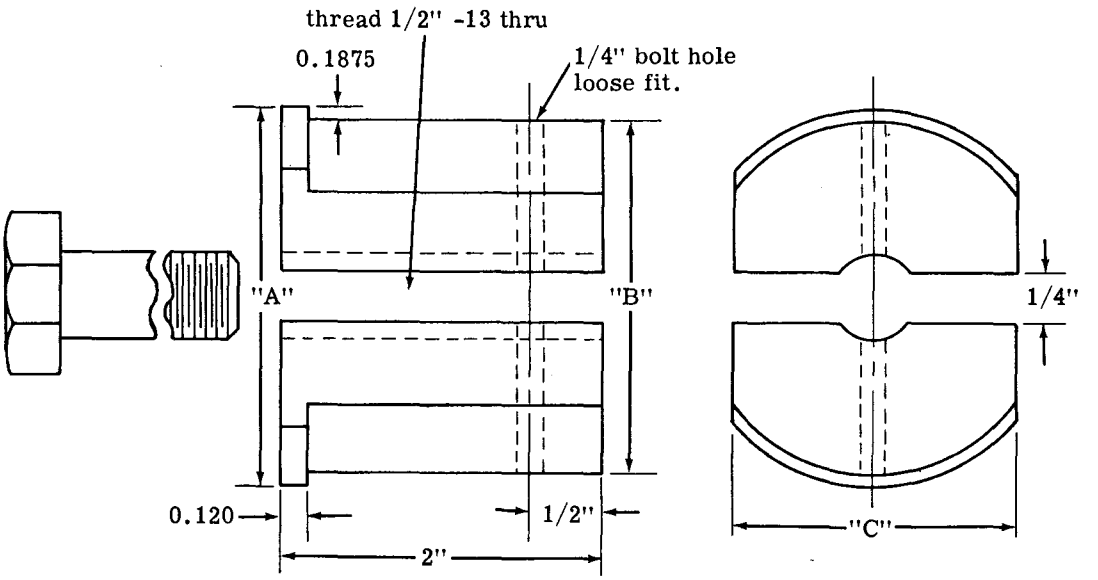


Figure 5. Standard Tools



USE FOR	"A"
Drive shaft bearing installation	6"
Drive shaft bearing removal	9"
1 1/2" heavy wall tubing	

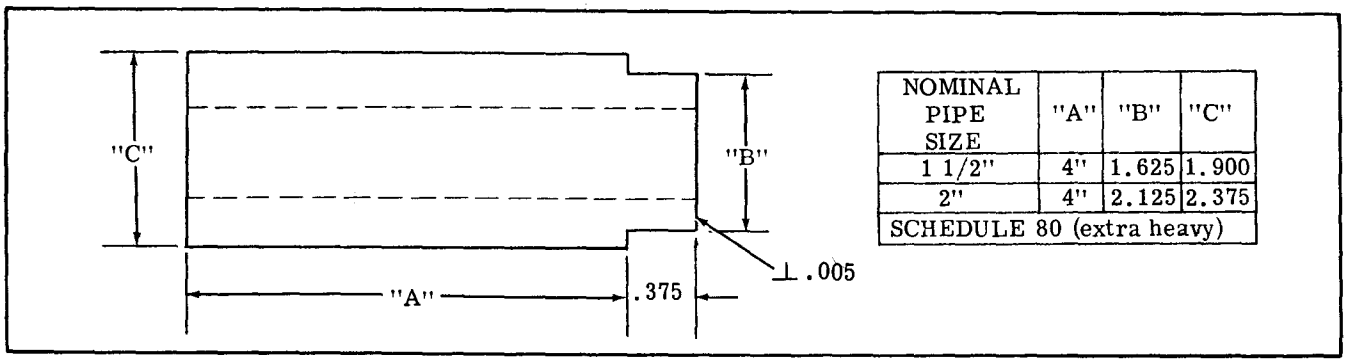
Figure 6. Special Shaft Bearing Removal and Installation Tools.



Bearing Race Puller			
Description	A	B	C
Valve Block	1.675	1.300	1.250
Housing	2.125	1.625	1.500

Use a 5" long 1/2" -13 hex head screw with this tool.

Figure 7. Bearing Race Removal Tools



NOMINAL PIPE SIZE	"A"	"B"	"C"
1 1/2"	4"	1.625	1.900
2"	4"	2.125	2.375
SCHEDULE 80 (extra heavy)			

Figure 8. Special Bearing Race Installation Tools.

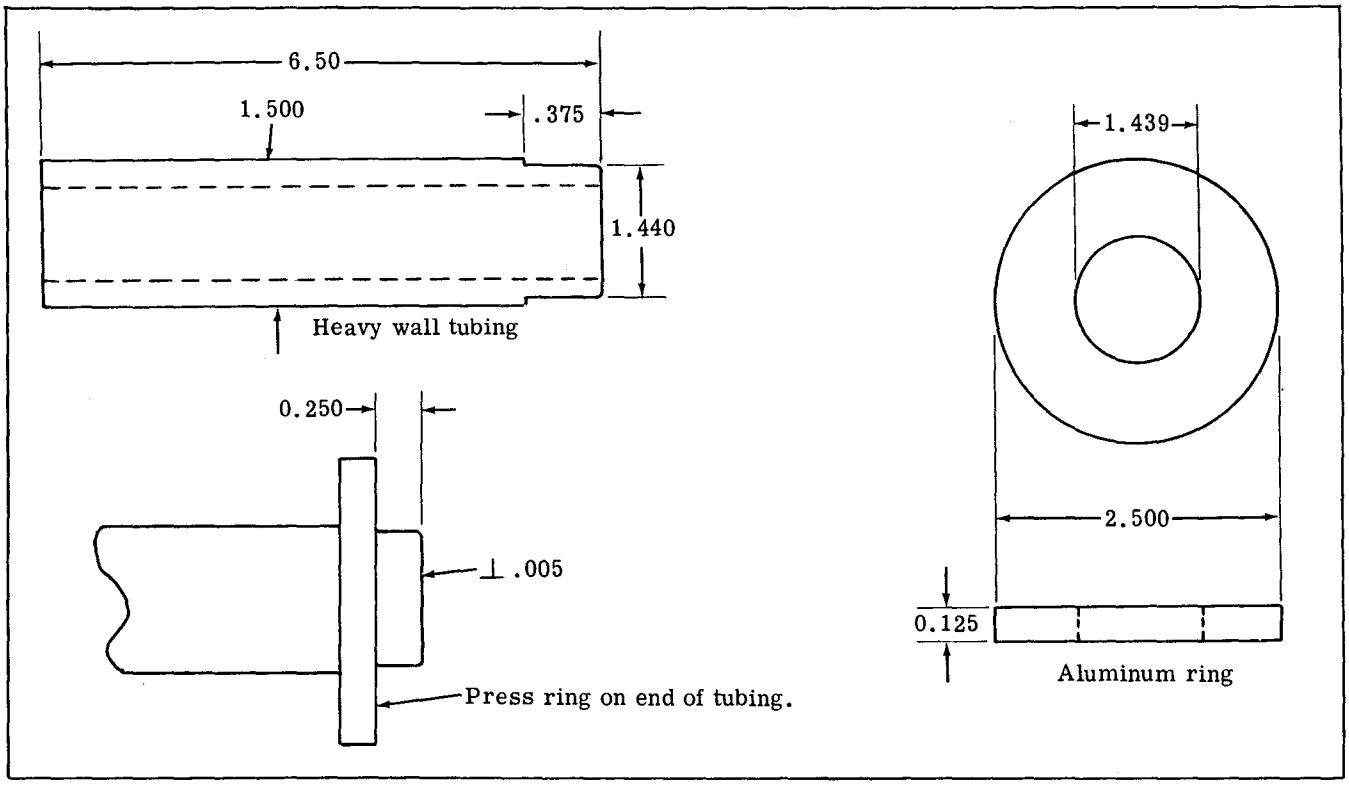


Figure 9. Shaft Seal Driver

B. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. Contamination level should not exceed three (3) milligrams/ 100 milliliters.

If the fluid becomes contaminated the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. (See Table 3).

5. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

C. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be poured through a fine wire screen (200 mesh or finer) or preferably pumped through a 10 micron (absolute filter).

It is important that the fluid be clean and free of any substance which could cause improper operation or wear of the pump or other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint from getting into the system.

D. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

E. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be specified by their manufacturers. Coat shaft splines with a dry lubricant, (Molycoat or equivalent) to prevent wear.

F. REPLACEMENT PARTS

Reliable operation throughout the specified operating range is assured only if genuine Sperry Vickers parts are used. Sophisticated design processes and material are used in the manufacture of our parts. Substitutes may result in early failure. Parts numbers are shown in the parts drawings listed in Table 2.

G. TROUBLE SHOOTING

1. Refer to Table 3 for trouble shooting data.

Section VI - OVERHAUL

A. GENERAL

CAUTION

Block vehicle if it is on a slope. The transmission pump cannot act as a parking brake.

CAUTION

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators and block any load whose movement could generate pressure.

Drain the oil from the vehicle hydraulic system. Use new clean oil when restoring the unit to service.

After removing the pump from the vehicle and before disassembly, cap or plug all ports and disconnected hydraulic lines. Clean the outside of the unit thoroughly to prevent entry of dirt into the system.

CAUTION

Absolute cleanliness is essential when working on a hydraulic system. Always work in a clean area. The presence of dirt and foreign materials in the system can result in serious damage or inadequate operation.

Periodic maintenance of the pump will generally not require disassembly to the extent described here. In general, disassembly is accomplished in the item number sequence shown in Figure 10. Special procedures are included in the following steps:

NOTE

Discard and replace all "O rings", gaskets and shaft seals removed during disassembly.

B. REMOVAL AND DISASSEMBLY OF THE GEROTOR PUMP

1. Remove retaining ring (1) from valve block (51). See Figure 10.

NOTE

Two methods may be used to remove the cover from the valve block. The easiest method is to apply a source of shop air to the inlet. The air will build up pressure behind the cover and lift it out of valve block. The second method requires removal of the valve block from the housing. A brass rod can then be used through the shaft opening to remove the cover.

2. Remove spacer (2), "O" ring (3), and cover (4) from valve block (51). Refer to Figure 10 for part location.

3. Remove the inner and outer rotors (6) and (5), and place on clean Kraft paper.

C. INSPECTION REPAIR AND REPLACEMENT

NOTE

Replace all parts that do not meet the following specifications.

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. The close tolerance of the parts makes this requirement very important. Clean all removed parts using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning the relief valve spool and valve block passages.

1. Check all components for excessive wear and erosion.

2. Check each lobe of the inner and outer rotors for evidence of seizure.

3. Inspect the sides and outer edge of the rotors for evidence of pickup or wear. Install the outer rotor into the valve block and check for bind and/or excessive wear.

TABLE 3. TROUBLE SHOOTING CHART

Trouble	Cause	Remedy
I. Excessive noise in hydrostatic transmission.	Low oil level in the reservoir.	Fill reservoir to proper level with the recommended transmission fluid. DO NOT over fill transmission or damage may result.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged.
		2. "Bleed" hydraulic lines at highest point downstream of supercharge pump and while system is under pressure.
	Vacuum condition.	1. Check inlet (suction) lines and fittings for air leaks. 2. Check supercharge pump function.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Hydraulic transmission overheating.	Internal leakage.	If established that excessive internal leakage exists, return vehicle to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to operating level.
III. System not developing pressure.	Relief replenishing valve open.	Replace one or both. Do not attempt to repair cartridges, they are factory assembled and preset.
	Loss of fluid internally. slippage or cylinder block lift caused by excessive motor speed.	Return vehicle to maintenance shop for repair of hydraulic system.
IV. Loss of fluid.	1. Ruptured hydraulic lines. 2. Loose fittings. 3. Leaking gaskets or seals in hydrostatic transmission.	1. Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose. 2. Observe mating sections of hydrostatic transmission for leaks. Replace seals or gaskets if possible.
V. Miscellaneous.	1. Misadjusted or broken control linkage. 2. Disconnected or broken drive mechanisms.	Locate and repair.

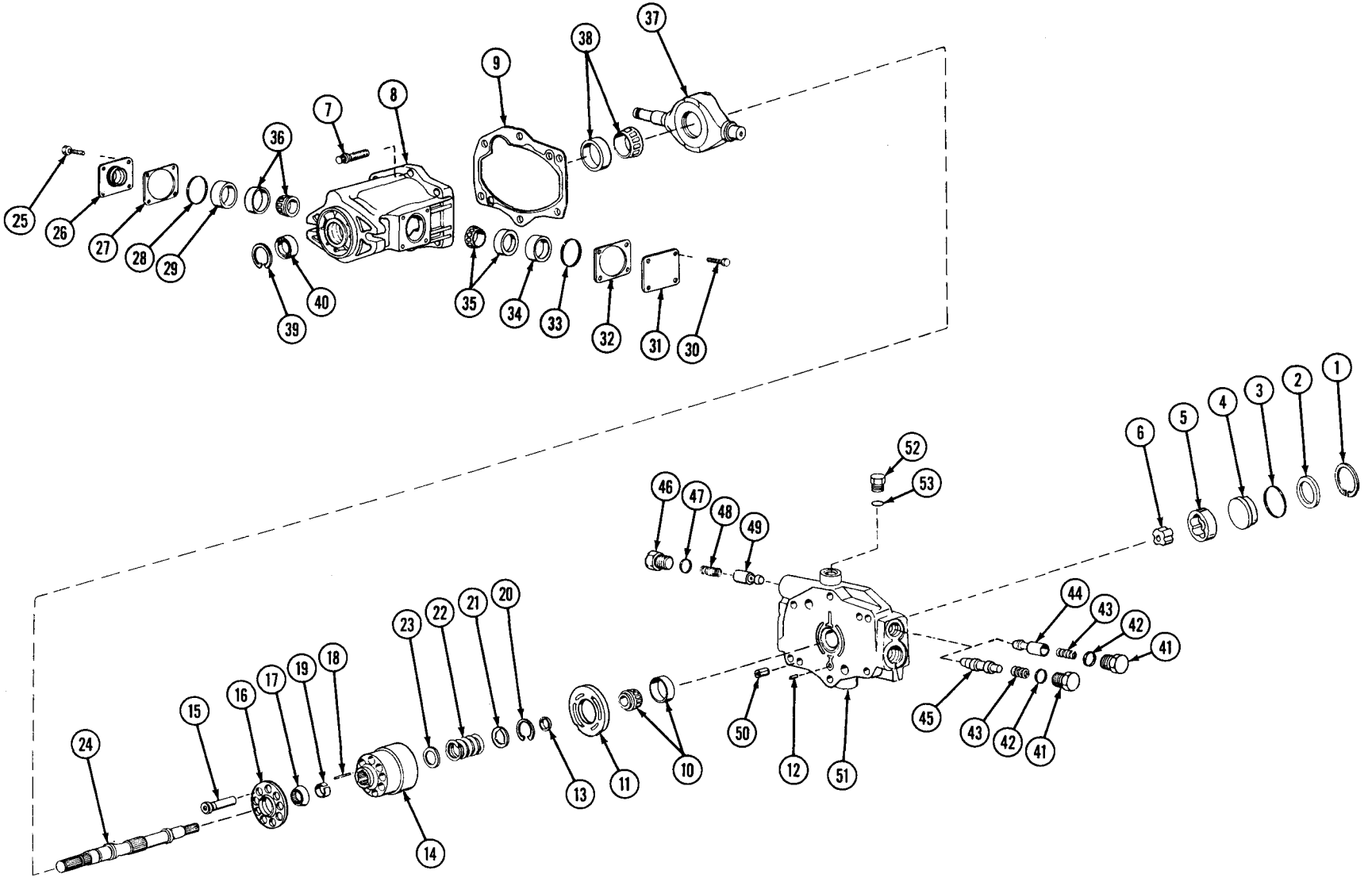


Figure 10. Exploded View of Transmission Pump.

ITEM NUMBER		DESCRIPTION	QUANTITY PER UNIT
1		RETAINING RING	1
2		SPACER KIT	1
3	▲	"O" RING	1
4		END PLATE	1
5		OUTER ROTOR (GEROTOR)	1
6		INNER ROTOR (GEROTOR)	1
7		SCREW	6
8		HOUSING	1
9	▲	GASKET	1
10		BEARING AND RACE	1
11		WAFER PLATE	1
12		PIN	1
13		BEARING SPACER KIT	1
14		CYLINDER BLOCK	1
15		PISTON & SHOE SUBASSEMBLY	9
16		SHOE PLATE	1
17		SPHERICAL WASHER	1
18		PIN	3
19		PIN RETAINER	1
20		RETAINING RING	1
21		WASHER	1
22		SPRING	1
23		WASHER	1
24		SHAFT	1
25		SCREW	4
26		PINTLE COVER	1
27		SHIM KIT	1
28	▲	"O" RING	1
29		PINTLE BEARING SPACER	1
30		SCREW	4
31		COVER	1
32		SHIM KIT	1
33	▲	"O" RING	1
34		PINTLE BEARING SPACER	1
35		BEARING AND RACE	1
36		BEARING AND RACE	1
37		YOKE	1
38		BEARING & RACE	1
39		RETAINING RING	1
40	▲	SHAFT SEAL	1
41		PLUG	1
42		"O" RING	1
43		SPRING	2
44		REPLENISHING CHECK	2
45		REPLENISHING CHECK & RELIEF	2
46		PLUG	3
47		"O" RING	3
48		SPRING	1
49		POPPET	1
50		ROLL PIN	2
51		VALVE BLOCK	1
52		PLUG	1
53	▲	"O" RING	1

ALL PARTS PREFIXED WITH AN ▲ MAY BE OBTAINED IN THE SEAL KIT. REFER TO PARTS DRAWING SHOWN IN TABLE 2.

NOTE

If failure of the Gerotor gear set has occured, check the valve block and the cover for defects. Replace all parts that show deep cuts or scratches.

4. Place cleaned parts on a piece of Kraft paper and cover them to prevent dirt contamination. These parts will be used during final assembly of the pump.

D. DISASSEMBLY OF PISTON PUMP ROTATING GROUP AND VALVE BLOCK

1. Remove six screws (7) from housing (8). Separate housing (8) and valve block (51).

2. Remove gasket (9) then slide tapered roller bearing (10) from the end of shaft (24).

3. Remove wafer plate (11) from valve block (51) then remove pin (12) from valve block.

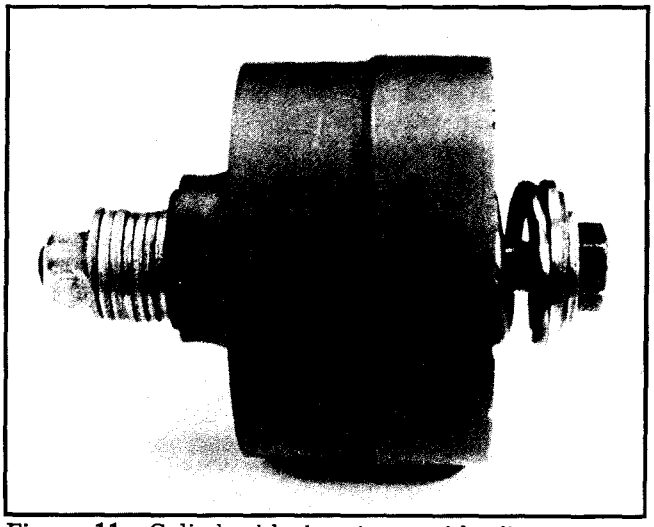


Figure 11. Cylinder block subassembly disassembly tool. (Tighten nut, remove snap ring, loosen nut to relieve spring tension).

4. Slide bearing spacer (13) off shaft (24).

5. Remove rotating group parts (14 through 23) as a unit. Hold the shoe plate (16), piston and shoe subassemblies (15), and cylinder block (14) to prevent separation of the rotating group during removal.

NOTE

The rotating group consists of a cylinder block (14), nine piston and shoe subassemblies (15), a shoe plate (16), a spherical washer (17), three pins (18), a pin retainer (19), retaining ring (20), washer (21) spring (22) and flat washer (23).

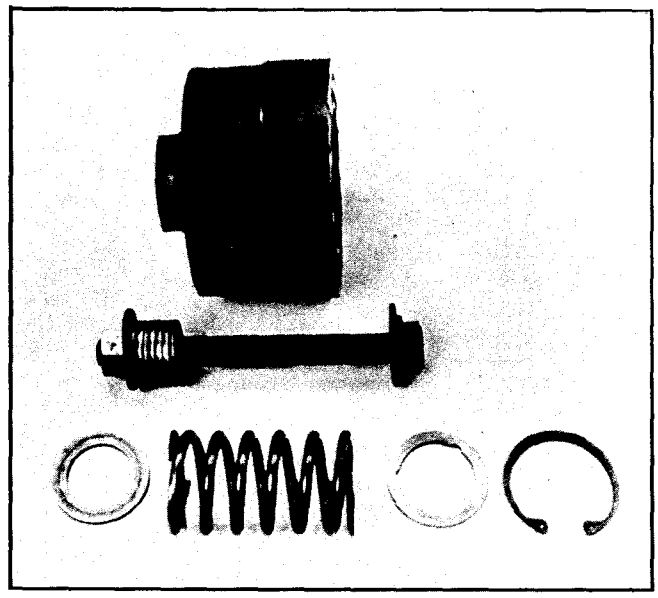


Figure 11a. Cylinder block subassembly parts.

CAUTION

In the following step, the spring located within the cylinder block is under a high tension and can cause bodily harm if the retaining ring (20) is removed with out adequate caution.

6. Remove parts (20 through 23) from cylinder block (14). See Figure 11 for disassembly instructions.

7. Disassemble valve block (51) as follows:

NOTE

Mark each valve to permit reassembly into the same bore opening. The check valves develop a wear pattern within the valve block and may leak if the valves are interchanged.

a. Remove the two plugs (41), "O" rings (42), springs (43) and cross line replenishing check valves (44) or (45) from valve block (51). A pencil type magnet is useful in this operation.

NOTE

The combination relief and check valves are not repairable, replace the complete assembly if found defective. Refer to trouble shooting section V-G.

b. Remove plug (46), "O" ring (47), spring (48) and replenishing relief valve (49) from valve block (51).

c. Remove two locating pins (50) if damaged, be careful not to scratch the face of valve block or housing during removal.

d. Check bearing (10) for score marks, scuffing, peeling or spalling of the rollers and races. If the shaft bearing (10) is defective, remove the bearing race from the valve block. Use tool shown in Figure 7 and refer to Figure 12 for removal information.

e. Remove plug (52) and "O" Ring (53).

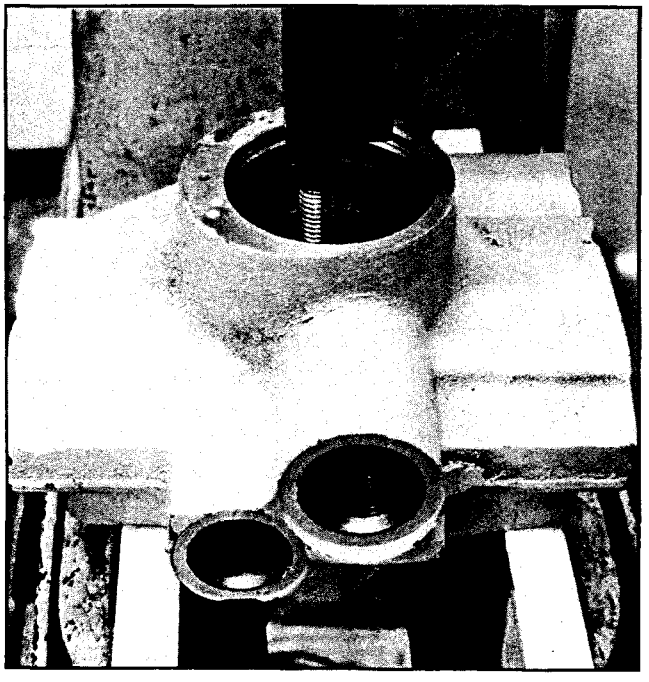


Figure 12. Bearing race removal from the valve block.

E. DISASSEMBLY OF YOKE PARTS AND REMOVAL OF THE FRONT SHAFT BEARING AND SHAFT

NOTE

The following steps concerning removal of the yoke and front shaft bearing may not be required. Inspect the yoke for excessive wear, scratches and pickup. If the yoke is not defective, check the front bearing for scuffing, peeling or spalling of the rollers and/or roughness when turned in the race. DO NOT disassemble the yoke pintle bearing if the yoke and shaft bearing are functional. If either the yoke or the front shaft bearing were defective, perform the following steps in the order indicated. See Figure 6 for special removal tool dimensions and refer to Figure 13 during shaft removal. To replace only the shaft seal, perform steps E. 1. and E. 4.

1. Remove drive shaft (24) as follows:

a. Install a nine inch piece of 1-1/2" heavy wall tubing over drive shaft (24) within the housing. The end of the tubing will rest against the inner race of tapered roller bearing (38) and extend out beyond the end of the pump housing.

b. Place the complete unit with tubing into an arbor press with drive spline up. See Figure 13.

c. Press the drive shaft through the bearing and out of the unit.

A 0.001 inch press exists between the shaft and bearing so considerable force is required to remove the bearing from the shaft.

2. Remove yoke as follows:

NOTE

In the following step, keep the parts removed from each pintle separate. The parts should be installed into the same relative position at assembly. This will match the bearing/race wear patterns and if the original shims are used again will provide the same preload.

a. Remove yoke bearing parts (25 through 36). Be careful not to damage the seal on the long pintle during removal.

b. Retain shims (27) and (32) if possible and use a micrometer to measure the total shim thickness. If the pintle bearings are not defective, the same shims or new shims of the same thickness will be needed to preload the bearings at installation.

NOTE

If shims (27) or (32) were destroyed during disassembly, a yoke bearing preload adjustment will be required at assembly.

c. Slide yoke (37) from side to side to loosen yoke bearing races (35) and (36) within the housing. The races are a normal slip fit but may be tight. Use an open end wrench between the yoke and the pintle bearing to help slide out the races. Apply pressure to bearing (35) or (36) at the approximate center and allow the bearing rollers to gently press the race out of the housing.

d. Remove yoke (37) from housing (8).

3. Lift front shaft bearing (38) from the housing. DO NOT remove the bearing race unless bearing was found defective. Refer to Figure (14) for bearing race removal instructions. Use special tool shown in Figure 7.

4. Remove retaining ring (39) and press shaft seal (40) out of the housing. Use a short piece of 1-1/2 inch heavy wall tubing as a tool or if the yoke was not removed, use a brass rod and work from the inside of the housing to remove seal (40).

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. Clean all removed parts, using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning valve block passages.

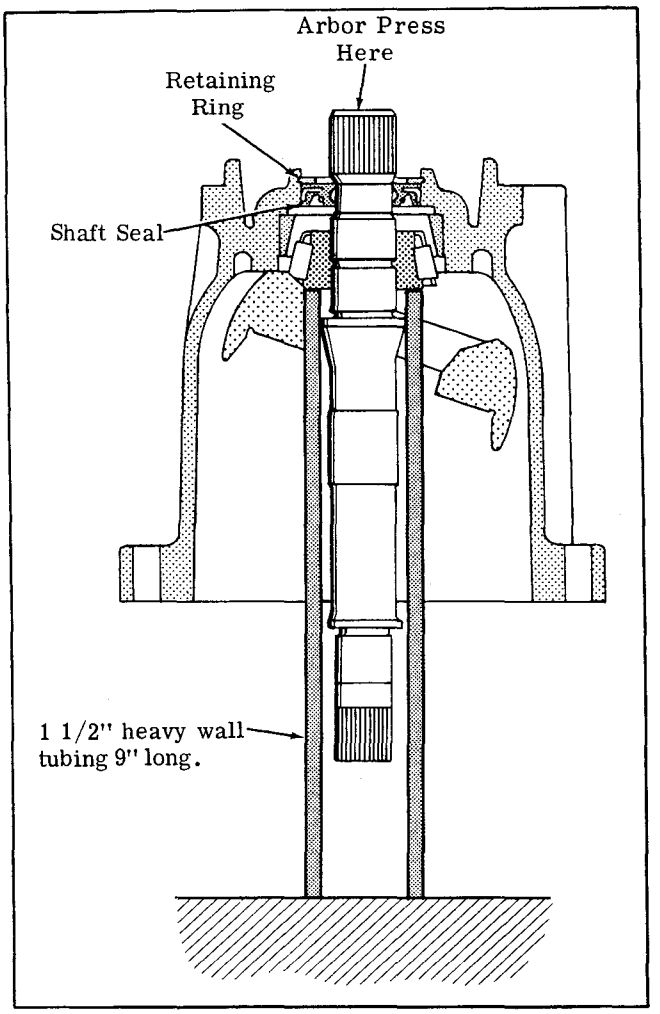


Figure 13. Front Bearing Removal

F. INSPECTION REPAIR AND REPLACEMENT

NOTE

Replace all parts that do not meet the following specifications.

1. Check bearing spacer (13) for burrs. Remove small burrs with an India stone.

2. Inspect cylinder block face (14) for wear, scratches and/or erosion between cylinders. Check the spring, washers and retaining ring located within the cylinder block.

3. Check each cylinder block bore for excessive wear. Use the piston and shoe subassemblies (15) for this purpose. The piston should be a very close fit and slide easily in and out of the bore. No bind can be tolerated. If binding is evident, clean the cylinder block and piston, lubricate with clean hydraulic fluid and try again. Even minor contamination of the fluid could cause the piston to freeze up in the cylinder bore.

4. Inspect each piston and shoe subassembly (15) for a maximum end play of 0.005 inch between the piston and shoe.

5. The face thickness dimension of each shoe must be within 0.001 inch of each other.

6. Inspect shoe plate (16) for excessive wear and cracking in the area of spherical washer (17). If heavy wear or cracks are found, replace the shoe plate and spherical washer at the same time.

7. Check spherical washer (17) for burrs, wear and possible scratches due to pin (18) breakage. Replace if wear is excessive.

8. Inspect pins (18) for equal length, excessive wear and possible bending. Replace all pins simultaneously if one is defective.

9. The pin retainer (19) may develop burrs. Remove all burrs with an India stone.

10. Inspect the bronze face of wafer plate (11) for excessive wear, scratches, and possible fracture. If the wafer plate is fractured, make sure the new plate rests flat against the valve block at assembly and that wafer plate pin (12) does not extend too far and hold the wafer plate away from the valve block.

11. Inspect shaft (24) for broken splines, burrs, and wear in the area of shaft seal (40). Remove burrs with an India stone. Wear in excess of 0.005 T.I.R. requires shaft replacement to prevent leakage.

12. Inspect shaft bearing (38) for brinelling, pitting of the rollers and roughness when turned in race located in the housing. If the bearing is defective, both the bearing and the race must be replaced. If the bearing race requires removal, perform the following step.

13. Remove bearing race (38) from housing (8) shown in Figure (14). Use special tool shown in Figure 7.

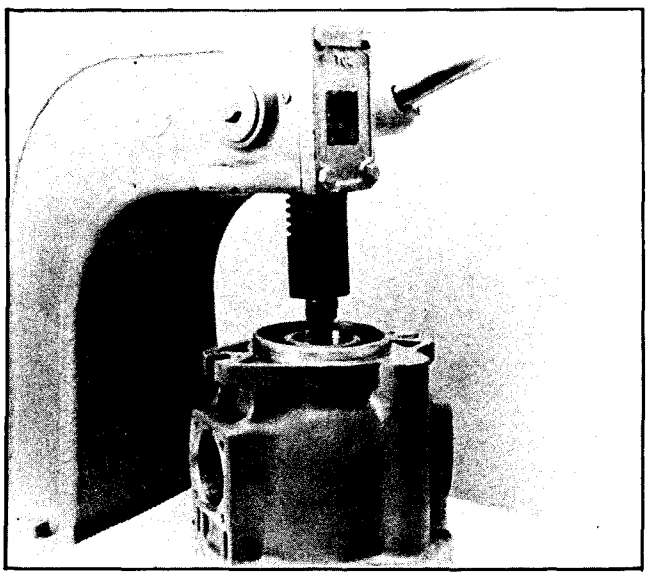


Figure 14. Removal of bearing race located within the housing.

14. Inspect housing (8) for cracks, cross threads and wear in the areas of pintle bearing races. Check each pintle face for flatness and burrs. Check snap ring groove for wear and the proper depth. Check mounting face for deep scratches that could cause leakage past the gasket. Clean up burrs and small scratches with an India stone.

15. Inspect pintle covers for flatness and burrs. Check the pintle seal for wear. Replace cover (26) if pintle seal is defective.

16. Check yoke bearings and bearing races for evidence of bearing seizure, brinelling, pitting of the rollers and roughness when turned in the race. If a bearing is replaced, a yoke preload adjustment must be performed at assembly.

17. Inspect the valve block parts as follows:

a. Inspect the threaded plugs for worn corners on the hex head, stripped threads and burrs in the "O" ring groove. Use an India stone to remove burrs, if threads are defective replace plug.

b. Inspect springs (43) and (48) for damaged coils. Replace springs if coils are damaged. Inspect springs for distortion. The ends of the springs must be parallel to each other. Replace springs if distorted.

c. Inspect the supercharge relief valve (49) for excessive wear, galling, erosion and burrs. The seat contact area of the relief valve will have a bright circular contact area. Leakage paths across the relief valve will show up as a break in the bright circular area. Erosion in the seat area may also cause a leakage path to develop. Replace the valve if defective.

d. Inspect the two combination relief and check valves (45), or replenishing checks (44) if used. Refer to the procedure developed in the previous step. If the valves are defective replace them with new assemblies.

e. Inspect valve block (51) for burrs, nicks, plugged body passages, flatness of the pump wafer plate area and porosity. If a relief valve or a check valve is replaced, thoroughly inspect the valve block bore from which the defective valve was removed. The valve seat may have eroded to a depth that a new valve cannot correct cross check leakage. Repair or replace the valve block if defective.

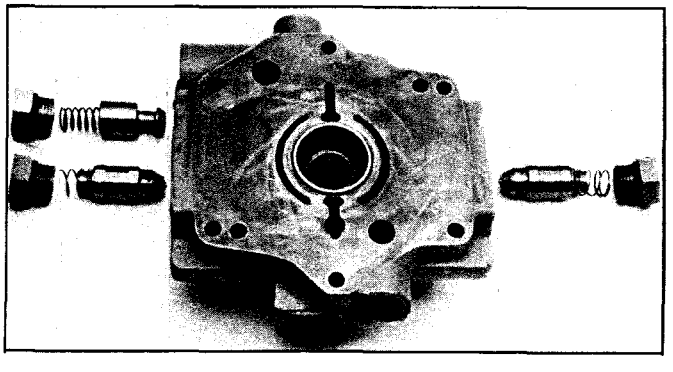


Figure 15. Exploded view of the valve block parts.

G. ASSEMBLY OF VALVE BLOCK PARTS.

NOTE

Refer to Figures 10 and 15 during the following assembly procedure.

NOTE

Check the flatness of the valve block face in the areas around locating pins (50) and bolt openings. Use an India stone to remove burrs or raised metal in these areas.

1. Install supercharge relief valve (49) into valve block (51). The valve must slide free within the bore and show no evidence of bind when rotated through 360°.

NOTE

New valves must be seated within the valve block to prevent leakage. To seat a valve, first install valve into the valve block, then insert a brass rod (smaller than the spring) behind the valve. Give rod end a sharp tap with a small hammer. This will seat the new valve within the valve block. Remove the brass rod and valve. You will notice a circular pattern at the seat contact area of the valve. This pattern must not be broken or the valve will leak when put into service. Repeat the seating operation if required.

2. Install supercharge relief spring (48) behind the valve.

3. Assemble a new "O" ring (47) on plug (46), thread plug (46) into valve block (51) and torque to 128-148 lbf. ft., (174-201 N. m).

4. Assemble each cross line check valve into its appropriate valve block bore. Test cross line check valves (44) or (45) for bind as noted in step G. 1.

5. Assemble two cross line check valve springs (43) into valve block (51), (color coded green). See Figure 15.

6. Assemble a new "O" ring (42) on each of the two hex plugs (41) then thread the plugs into valve block (51). Torque plugs to 128-148 lbf. ft., (174-201 N. m).

NOTE

If the bearing race was removed from valve block (51), install a new bearing race as shown in Figure 16. Use tool shown in Figure 8. This completes the assembly of the relief and check valves into the valve block. The Gerotor parts will be assembled into the valve block during final assembly section VI. Paragraph I.

H. ASSEMBLY OF PISTON PUMP HOUSING PARTS

NOTE

If new shaft bearings (19 or 38), shaft (24), valve block (51) or housing (8) are being replaced, a complete shaft bearing preload adjustment must be performed. If the same parts are returned to service, the preload adjustment can be omitted. The same procedure applies to yoke (37) and its associated bearings.

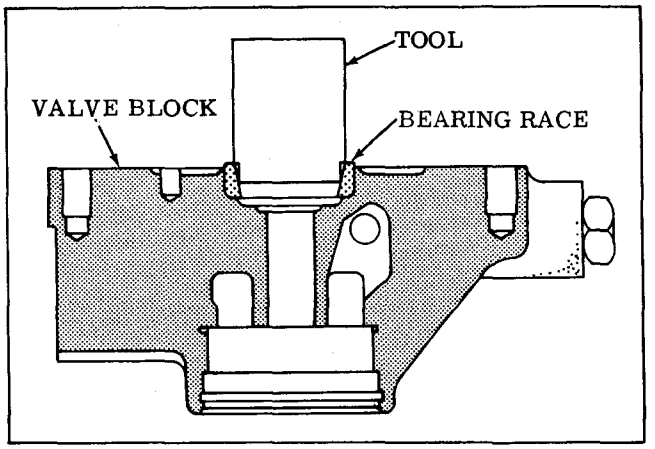


Figure 16. Valve Block Race Installation Procedure.

1. If the shaft bearing (38) requires replacement, install a new bearing race into housing (8). Use tool shown in Figure 8 to press bearing race in place. Make sure the bearing race is oriented properly to accept the roller bearing before pressing into the housing. The race must be bottomed against the shoulder of the housing at completion of press.

2. Place housing (8) on a flat surface with the shaft seal end down. Lay the front shaft bearing (38) into the race.

3. Orient the yoke pintle properly and install yoke (37) into housing (8). Assemble the yoke bearings, races and spacers as follows:

a. Assemble pintle bearings (35) and (36) on each end of the yoke and insert bearing races (35) and (36). See Figure 10.

b. Install bearing spacer (34) at the short pintle end.

c. Install "O" ring (33) against spacer (34) into the groove, then install a 0.010 inch shim (32) under pintle cover screws (30) and torque to 175-185 lbf. ft. (237-251 N. m). Early designs used a screw and washer arrangement. These should be torqued to 115-125 lbf. ft. (156-169 N. m).

d. Set housing (8) on its side so the long pintle is up. Install bearing spacer (29) fully in against the bearing race. Install the pintle cover (26), (without shims and "O" ring), then thread four pintle screws (25) through the cover into the housing. Cross torque the screws to 2 lbf. inches while moving the yoke back and forth to align the bearings and races, (keep cover as square to pintle boss as possible.) Continue to cross torque the cover screws until the yoke has a constant drag and the attaching screws are set to 2 lbf. in. torque. Remove the cover being careful not to disturb the yoke bearings and spacer. Measure the height of the spacer with respect to the housing pintle face in two places (180^{o} apart). Use a depth micrometer to perform this measurement. See Figure 17. Average the readings to obtain a nominal value. A 0.007-0.009 inch preload is required on the pintle bearings.

Calculate the necessary shims to provide this preload as follows: Assume the depth readings were 0.029 and 0.027 inch. Add the two figures together and divide by two (2) to obtain the average. In this case the calculated average is 0.028 inch. Subtract the nominal preload of 0.008 inch from the calculated average to obtain the required shim thickness.

NOTE

If the calculated shim thickness is greater than 0.020, another shim must be added to the opposite side of the yoke to reduce the total shim thickness to less than 0.020 inch. Shim thickness at either pintle must not exceed 0.020 inch. This is necessary to provide proper "O" ring compression and prevent pintle seal leakage.

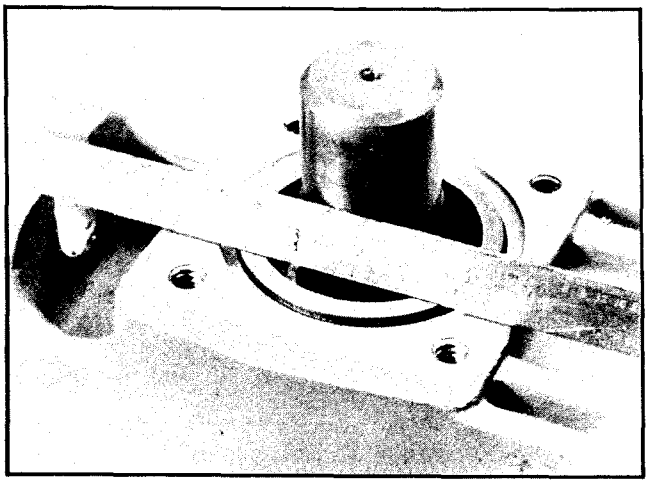


Figure 17. Pintle bearing spacer height with respect to pintle face.

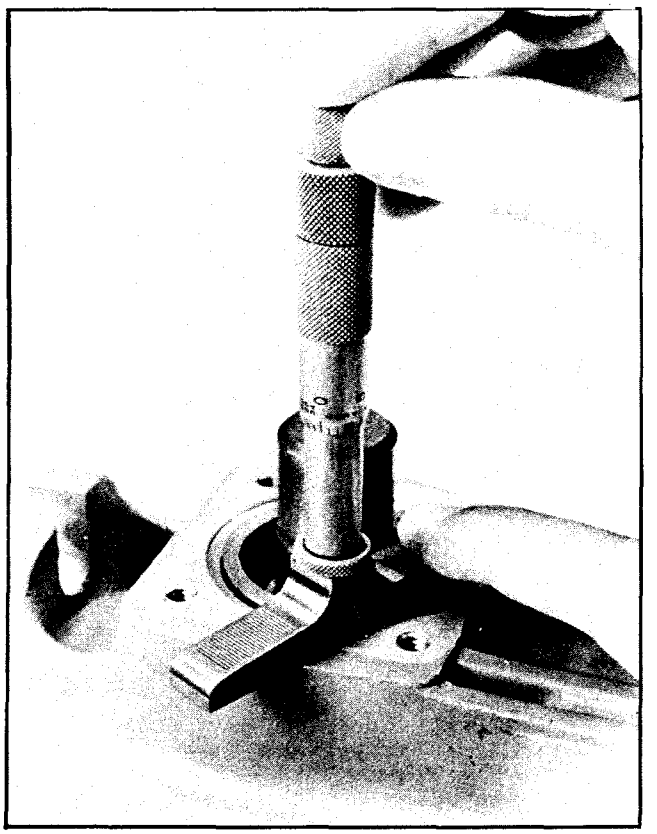


Figure 17a. Measuring height of pintle bearing spacer with respect to the pintle face.

e. Install "O" ring (28) and correct shims (27). Slide cover (26) over yoke pintle and flush against the shims. Insert screws (25) through pintle cover (26) and thread into pintle face. Cross torque screws to 175-185 lbf. ft., (237-251 N. m). Early designs used a screw and washer arrangement. These should be torqued to 115-125 lbf. ft., (156-169 N. m).

NOTE

The yoke (37) will be stiff but should be loose enough to be moved by hand, approximately 20 lbf. in. torque. The tightness/drag indicates the bearings are preloaded. If the yoke cannot be moved by hand, the preload is too great. Repeat the preload adjustment until correct.

4. Install shaft (24) into front shaft bearing (38) as follows:

Use a short piece of 1-1/2 inch heavy wall tubing (approximately 6 inches long) over the drive spline of the shaft. The tubing must be long enough to go through the shaft seal end of the pump and make contact with the inner race of the front bearing. Press the shaft through the bearing with an arbor press until the bearing bottoms against the shoulder of the shaft. See Figure 18.

5. Remove the short piece of tubing and turn shaft bearing (38) in its race with the end of the shaft. The bearing rollers must turn free and smooth.

6. Tape the spline end of drive shaft (24) with plastic tape to prevent cutting new shaft seal (40). Start taping the shaft close to the housing and work toward the end of the shaft. Install a new shaft seal (40) (garter spring inward) in position over the shaft and press evenly into the housing. Use shaft seal driver shown in Figure 9. The seal must be positioned just below the retaining ring groove. If the seal is pressed to deep into the housing bore, contact with the tapered roller bearing can damage the seal. DO NOT press the seal more than 0.020 inch past the retaining ring groove. Install retaining ring (39) into the housing. Use internal Truarc pliers to install retaining ring.

NOTE

If the shaft bearings, shaft, valve block or housing were not replaced, use the bearing spacer removed during the disassembly procedure to preload the shaft bearings and perform step H. 13. If preload adjustment is necessary, perform steps H.7. through H.13.

7. Obtain a shaft bearing spacer kit and install the thickest bearing spacer (13) over shaft (24) with the chamfer facing into the housing (toward the shoulder on the shaft).

8. Slide new bearing (10) on the shaft and up against spacer (13). The small diameter of the tapered roller bearing must face out of the housing.

9. Install housing (8) to valve block (51) without gasket (9) and rotating group. Turn shaft (24) to seat the bearings then torque the six housing attaching screws (7) to five (5) lbf. in. Check the opening between the valve block and housing to be as even as possible after tightening.

10. Use a feeler gage to measure the opening between valve block (51) and housing (8). Four measurements should be obtained equidistant around the unit. A tapered feeler gage is especially useful for this purpose. Average the four reading by adding them together and dividing by four (4). Calculate thickness of the shaft bearing spacer as follows:

+0.150		Measured thickness of bearing spacer
-0.027		Average gap
+0.003	±0.001	Preload setting
+0.020		Compressed thickness of gasket
0.146	±0.001	Required bearing spacer to thickness provide a 0.003 ±0.001 inch preload.

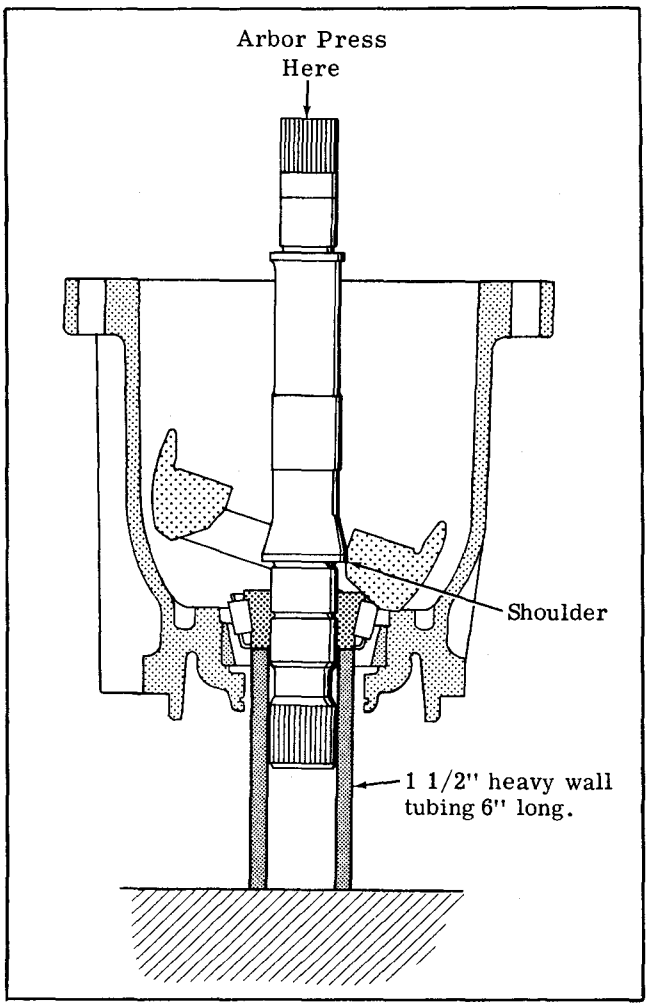


Figure 18. Front Bearing Installation.

11. Remove six mounting screws (7) and remove housing from the valve block.

12. Remove bearing (10) and bearing spacer (13).

13. Locate a bearing spacer with calculated dimensions and place next to the new bearing. Chamfer must face shoulder on shaft. Use the original spacer if preload is not performed.

14. Assemble spring (22), two washers (21) and (23) and retaining ring (20) into cylinder block (14). See Figure 11 for instructions. Set the cylinder block S/A on a flat surface. Use Kraft paper between the block and surface to prevent scratching the cylinder block.

15. Install pin retainer (19) into the cylinder block (14). Position the pin retainer approximately 1/4 inch below the surface, and orient the open end of the pin retainer to be away from the large spline openings.

16. Slide three pins (18) into cylinder block S/A until they bottom against the pin washer (23).

17. Place spherical washer (17) on top of the three pins; then install the shoe plate (16) with nine piston and shoe subassemblies (15) over the spherical washer and into the cylinder block S/A. Wobble the shoe plate to make sure that each piston is free within its bore in the cylinder block.

18. Set housing (8) on its side and hold the shaft end so drive shaft (24) is horizontal. Slide the rotating group into the housing. Rotate drive shaft (24) if necessary, to match the shaft splines to cylinder block (14) and spherical washer (17).

19. Install bearing spacer (13) with chamfer toward the shoulder of drive shaft (24).

20. Install tapered roller bearing (10) over the shaft and against the spacer. The small diameter of the tapered roller bearing must face toward valve block (51).

21. Install two (2) housing alignment pins (50) and place a new gasket (9) over them. Cover the unit and set aside for final assembly.

I. FINAL ASSEMBLY OF PISTON PUMP, VALVE BLOCK AND GEROTOR PUMP

1. Assemble wafer plate locating pin (12) into valve block (51). Refer to Figure (10).

2. Assemble wafer plate (11) over the bearing race and locating pin (12) with bronze surface away from valve block (51). See Figure 19. Make sure wafer plate is flat against valve block (51).

3. Place valve block (51) on its side. See Figure 10 for position required.

4. Assemble housing (8) against valve block (51) with six screws (7), cross torque the screws to 23-26 lbf. ft., (31-35 N. m).

5. Assemble the Gerotor pump as follows:

a. Turn the piston pump to gain access to the valve block opening (shaft end downward).

b. Lubricate the inner and outer rotors with system fluid, then install inner rotor (6) over the shaft spline. Install outer rotor (5) in mesh with the inner rotor within the valve block cavity.

c. Install cover (4) into valve block (51) with "O" ring groove toward the outside of the unit.

d. Install the "O" ring (3) into place.

e. Install spacer (2) and retaining ring (1). Make sure the rolled edges of retaining ring (1) face inward, (sharp edges out).

6. Assemble a new "O"Ring (53) over plug (52) and thread in place. Torque to 90 - 100 lbf. ft. (122 - 135 N.m).

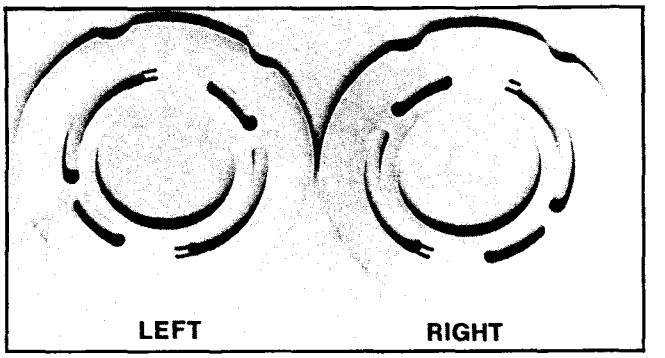


Figure 19. Wafer plates showing right and left hand configurations.

Section VII - TEST PROCEDURE

If test equipment is available, the pump should be tested at the recommended speeds and pressures shown on the installation drawings. (See Table 2.)

NOTE

Refer to general procedures concerning oil recommendations, filling of the pump housings, etc., before placing the transmission pump into service.