VICKERS

VARIABL
DISPLACEMEN
DOUBL
TRANSMISSIO
PUM

OVERHAUL MANUAL

TA1919V10* -20 DESIGN
TA1919V20* -20 DESIGN

SPERRY VICKERS
TROY, MI. 48084

sed 9-1-78

M-2835-S

TABLE OF CONTENTS

A. PURPOSE OF MANUAL

This manual describes the basic operational characteristics and provides service and overhaul information for the Sperry Vickers TA1919V10* and TA1919V20* transmission pump packages. 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:

Technical Publications
1401 Crooks Road
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 as stamped on the transmission mounting flange.

MODEL SERIES	PARTS DRAWING	INSTALLATION DRAWING
TA1919V10*	M-2834-S	MB-198
TA1919V20*	M-2837-S	

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 two piston pumps located back to back on a common valve block.

Four cross-line check valves and a supercharge relief valve are located in the common valve block.

Valving variations include four cross-line relief valves.

CAUTION

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

Connected to one end of the pump package is a supercharge vane pump which supplies circuit replenishing flow and auxiliary functions.

Four types of covers are available with the supercharge pump:

1. Standard - No special features.

2. F - Flow control cover - Maximum flow regulated to external circuit. Built in relief valve.

3. P - Priority valve cover - Primary circuit flow controlled, secondary circuit receives excess flow. Primary circuit relief, no secondary circuit relief.

4. D - Flow divider cover - Secondary outlet receives 60% and primary outlet 40% of total flow. (Available with V10 pumps only.)

NOTE

Special cover operating theory explained in section III.

B. APPLICATION.

Pump ratings 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.

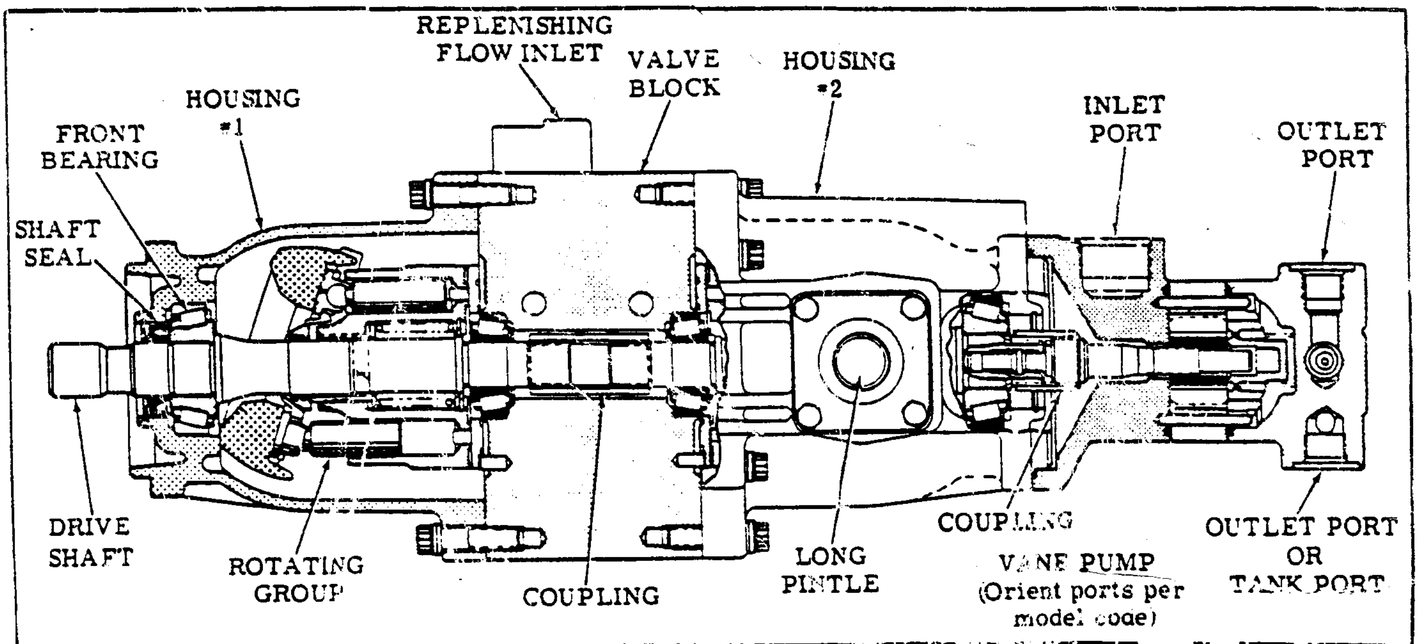

Figure 1. Sectional View of Typical Double Transmisson Pump Package.

MODEL CODE BREAKDOWN

TA1919 V10 F L - 1 A R - 07 A D 625 H - 20

TA1919 — DOUBLE TRANSMISSION PUMP EACH RATED AT 19 USGPM AT 1800 RPM

V10 — AUXILIARY VANE PUMP

F — VANE PUMP COVER OPTION (OMIT IF NOT REQUIRED)
- D - FLOW DIVIDER
- F - FLOW CONTROL
- P - PRIORITY FLOW

L — ROTATION VIEWED FROM SHAFT END
- R - RIGHT HAND (CLOCKWISE)
- L - LEFT HAND (C'CLOCKWISE)

1 — INPUT SHAFT
- 1 - SAE B-B STRAIGHT KEYED
- 2 - SAE B-B SPLINED

A — CONTROL PINTLE LOCATION VIEWED FROM SHAFT END WITH DRAIN PORT UP

CODE	PUMP #1	PUMP #2
A	Right Hand Side	Right Hand Side
B	Left Hand Side	Right Hand Side
C	Right Hand Side	Left Hand Side
D	Left Hand Side	Left Hand Side

R — MAIN RELIEF VALVE
- R - RELIEF VALVE
- O - NO RELIEF VALVE

07 — VANE PUMP RING CAPACITY USGPM AT 1200 RPM
- 04 - 4
- 05 - 5
- 06 - 6
- 07 - 7

A — VANE PUMP INLET POSITION VIEWED FROM COVER END
- A - IN LINE WITH CASE DRAIN
- C - 180° OPPOSITE CASE DRAIN

D — POSITION OF VANE PUMP OUTLET, OR PRIMARY OUTLET, VIEWED FROM COVER END.
- A - OPPOSITE INLET
- B - 90° C'CLOCKWISE FROM INLET
- C - IN LINE WITH INLET
- D - 90° CLOCKWISE FROM INLET

6 — PERCENT OF SECONDARY FLOW ("D" COVER)

2 — FLOW RATE THROUGH ORIFICE IN "P" COVER 1, 2, 3, 4 or 6 USGPM

5 — FLOW RATE THROUGH ORIFICE IN "F" COVER 2, 3, 4, 5, 6, 7 or 8 USGPM

H — VANE PUMP RELIEF VALVE SETTING, "F" & "P" COVER
- A - 250 PSI
- B - 500 PSI
- C - 750 PSI
- D - 1000 PSI
- E - 1250 PSI
- F - 1500 PSI
- G - 1750 PSI
- H - 2000 PSI
- J - 2250 PSI
- K - 2500 PSI
- O - No Relief Valve ("D" cover)

20 — DESIGN NUMBER

TABLE 1a.

MODEL CODE BREAKDOWN

TA1919V20FL-1AR-07AD6H-20

DOUBLE TRANSMISSION PUMP
EACH RATED AT 19 USGPM AT 1800 RPM

AUXILIARY VANE PUMP

VANE PUMP COVER OPTION
(OMIT IF NOT REQUIRED)
F - FLOW CONTROL
P - PRIORITY FLOW

ROTATION VIEWED FROM SHAFT END
R - RIGHT HAND (CLOCKWISE)
L - LEFT HAND (C'CLOCKWISE)

INPUT SHAFT
1 - SAE B-B STRAIGHT KEYED
2 - SAE B-B SPLINED

CONTROL PINTLE LOCATION VIEWED FROM SHAFT END WITH DRAIN PORT UP

CODE	PUMP #1	PUMP #2
A	RIGHT HAND SIDE	RIGHT HAND SIDE
B	LEFT HAND SIDE	RIGHT HAND SIDE
C	RIGHT HAND SIDE	LEFT HAND SIDE
D	LEFT HAND SIDE	LEFT HAND SIDE

MAIN RELIEF VALVE
R - RELIEF VALVE
O - NO RELIEF VALVE

DESIGN NUMBER

VANE PUMP RELIEF VALVE SETTING, "F" & "P" COVER
A - 250 PSI F - 1500 PSI
B - 500 PSI G - 1750 PSI
C - 750 PSI H - 2000 PSI
D - 1000 PSI J - 2250 PSI
E - 1250 PSI K - 2500 PSI

FLOW RATE THROUGH ORIFICE IN "F" COVER
2, 4, 6, 8 OR 10 USGPM

FLOW RATE THROUGH ORIFICE IN "P" COVER
2, 2.5, 3, 4, 6 OR 8 USGPM

POSITION OF VANE PUMP OUTLET, OR PRIMARY OUTLET, VIEWED FROM COVER END
A - OPPOSITE INLET
B - 90° C'CLOCKWISE FROM INLET
C - IN LINE WITH INLET
D - 90° CLOCKWISE FROM INLET

VANE PUMP INLET POSITION VIEWED FROM COVER END
A - IN LINE WITH CASE DRAIN
C - 180° OPPOSITE CASE DRAIN

VANE PUMP RING CAPACITY USGPM AT 1200 RPM
07 - 7 10 - 10 13 - 13
08 - 8 11 - 11
09 - 9 12 - 12

TABLE 15.

A. PISTON PUMP

Rotation of the pump drive shaft causes the cylinder block, shoe plate and pistons to move against the yoke face. 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.

B. VANE PUMP

Vane pump fluid flow is developed by the pumping cartridge. The action of the cartridge is illustrated in Figure 3. The rotor is driven within the cam ring by the drive shaft, which is coupled to a power source. As the rotor turns, centrifugal force causes the vanes to follow the elliptical inner surface of the cam ring.

Radial movement of the vanes and turning of the rotor cause the chamber volume between the vanes to increase as the vanes pass the inlet sections of the cam ring. This results in a low pressure condition which allows atmospheric pressure to force fluid into the chambers. (Fluid outside the inlet is at atmospheric pressure or higher.)

This fluid is trapped between the vanes and carried past the large diameter or dwell section of the cam ring. As the outlet section is approached, the cam ring diameter decreases and the fluid is forced out into the system. System pressure is fed under the vanes, assuring their sealing contact against the cam ring during normal operation.

C. HYDRAULIC BALANCE

The pump cam ring is shaped so that the two pumping chambers are formed diametrically opposed. Thus, hydraulic forces which would impose side loads on the shaft are cancelled.

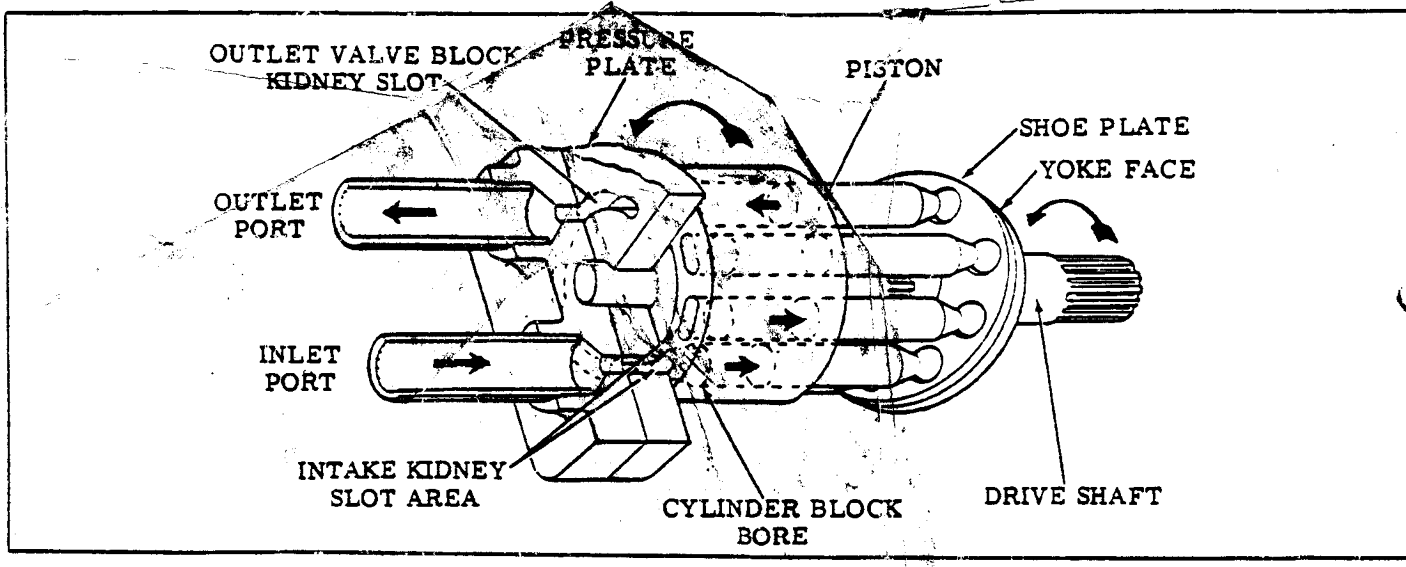

Figure 2.

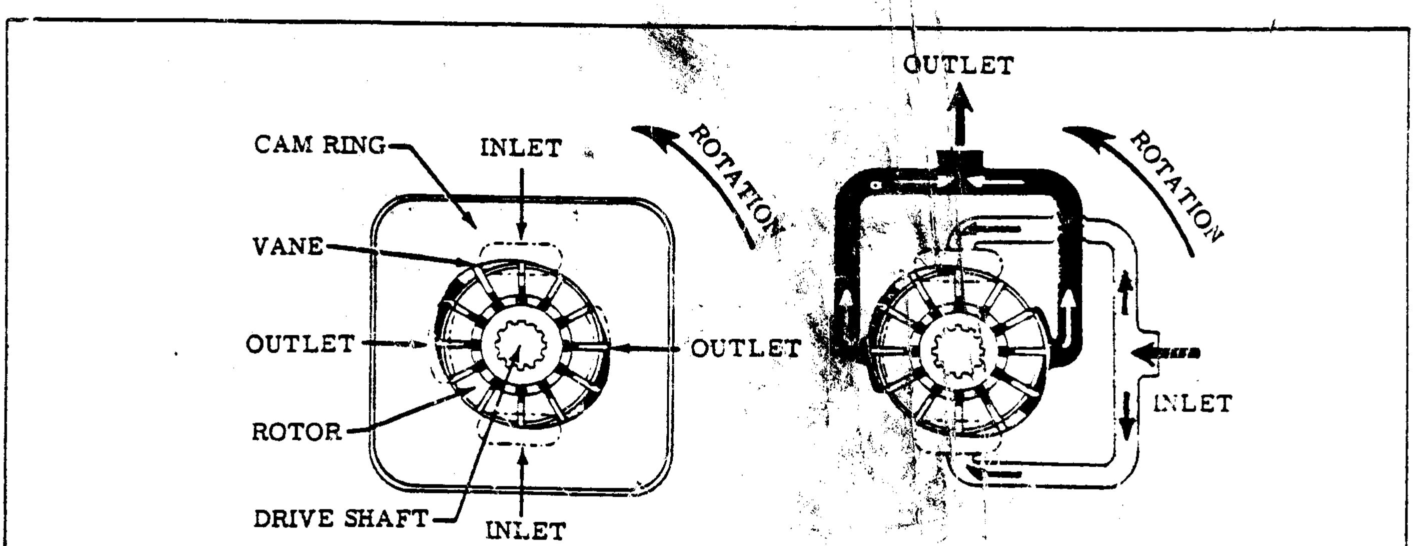

Figure 3.

MODEL CODE BREAKDOWN

TA1919 V20 FL - 1 A R - 07 A D 6 H - 20

DOUBLE TRANSMISSION PUMP
EACH RATED AT 19 USGPM AT 1800 RPM

AUXILIARY VANE PUMP

VANE PUMP COVER OPTION
(OMIT IF NOT REQUIRED)
F - FLOW CONTROL
P - PRIORITY FLOW

ROTATION VIEWED FROM SHAFT END
R - RIGHT HAND (CLOCKWISE)
L - LEFT HAND (C'CLOCKWISE)

INPUT SHAFT
1 - SAE B-B STRAIGHT KEYED
2 - SAE B-B SPLINED

CONTROL PINTLE LOCATION VIEWED FROM SHAFT END WITH DRAIN PORT UP

CODE	PUMP #1	PUMP #2
A	RIGHT HAND SIDE	RIGHT HAND SIDE
B	LEFT HAND SIDE	RIGHT HAND SIDE
C	RIGHT HAND SIDE	LEFT HAND SIDE
D	LEFT HAND SIDE	LEFT HAND SIDE

MAIN RELIEF VALVE
R - RELIEF VALVE
O - NO RELIEF VALVE

VANE PUMP RING CAPACITY
USGPM AT 1200 RPM
07 - 7 10 - 10 13 - 13
08 - 8 11 - 11
09 - 9 12 - 12

VANE PUMP INLET POSITION VIEWED FROM COVER END
A - IN LINE WITH CASE DRAIN
C - 180° OPPOSITE CASE DRAIN

POSITION OF VANE PUMP OUTLET, OR PRIMARY OUTLET, VIEWED FROM COVER END
A - OPPOSITE INLET
B - 90° C'CLOCKWISE FROM INLET
C - IN LINE WITH INLET
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FLOW RATE THROUGH ORIFICE IN "F" COVER
2, 4, 6, 8 OR 10 USGPM

FLOW RATE THROUGH ORIFICE IN "P" COVER
2, 2.5, 3, 4, 6 OR 8 USGPM

VANE PUMP RELIEF VALVE SETTING, "F" & "P" COVER
A - 250 PSI F - 1500 PSI
B - 500 PSI G - 1750 PSI
C - 750 PSI H - 2000 PSI
D - 1000 PSI J - 2250 PSI
E - 1250 PSI K - 2500 PSI

DESIGN NUMBER

TABLE 1b.

A. PISTON PUMP

Rotation of the pump drive shaft causes the cylinder block, shoe plate and pistons to move against the yoke face. 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.

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This fluid is trapped between the vanes and carried past the large diameter or dwell section of the cam ring. As the outlet section is approached, the cam ring diameter decreases and the fluid is forced out into the system. System pressure is fed under the vanes, assuring their sealing contact against the cam ring during normal operation.

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The pump cam ring is shaped so that the two pumping chambers are formed diametrically opposed. Thus, hydraulic forces which would impose side loads on the shaft are cancelled.

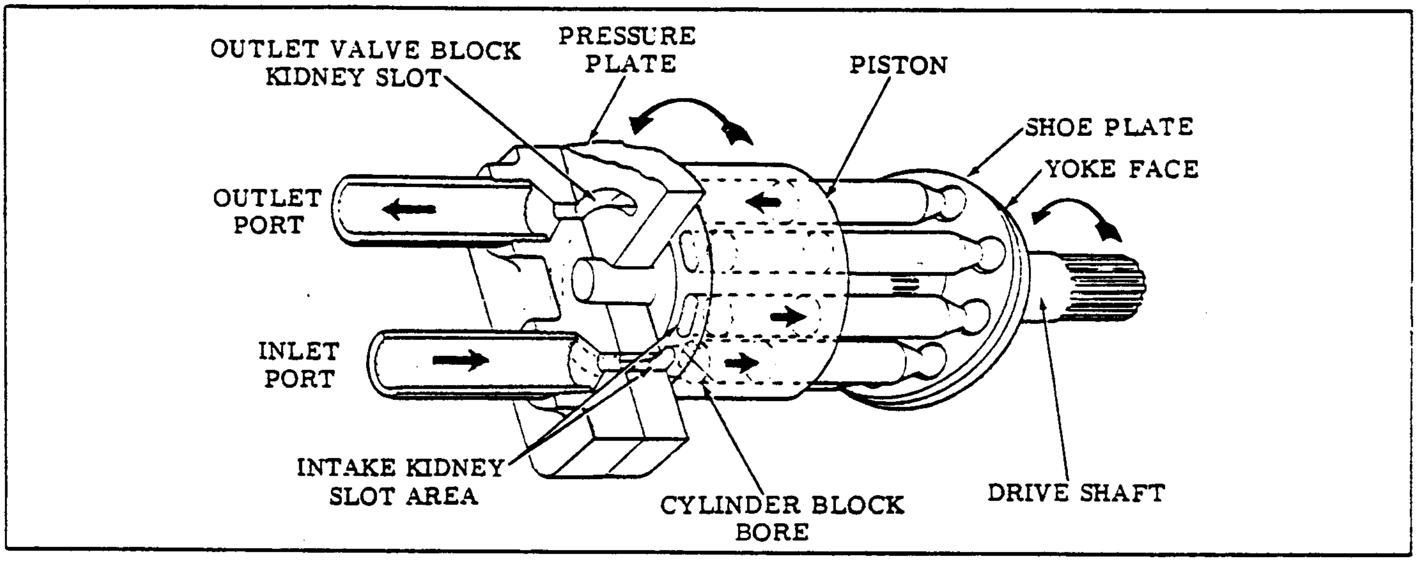


Figure 2.

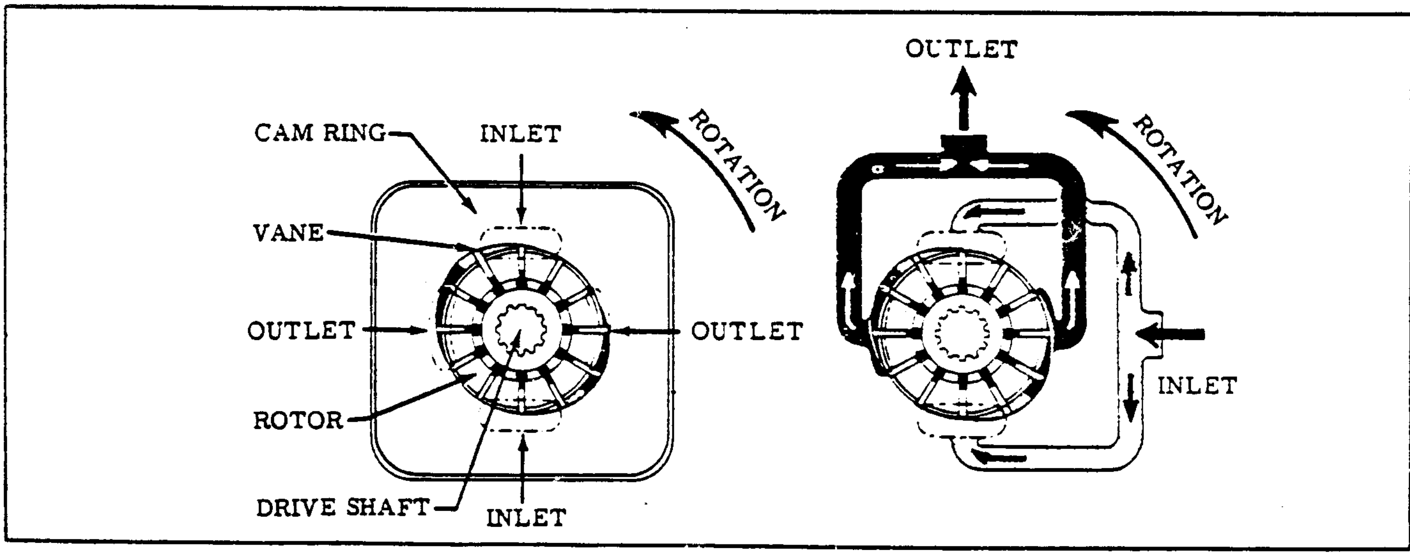


Figure 3.

D. PRESSURE PLATE

The pressure plate seals the pumping chamber as shown in Figure 4. A light spring holds the plate against the cartridge until pressure builds up in the system. System pressure is effective against the area at the back of the plate, which is larger than the area exposed to the pumping cartridge. Thus, an unbalanced force holds the plate against the cartridge, sealing the cartridge and providing the proper running clearance for the rotor and vanes.

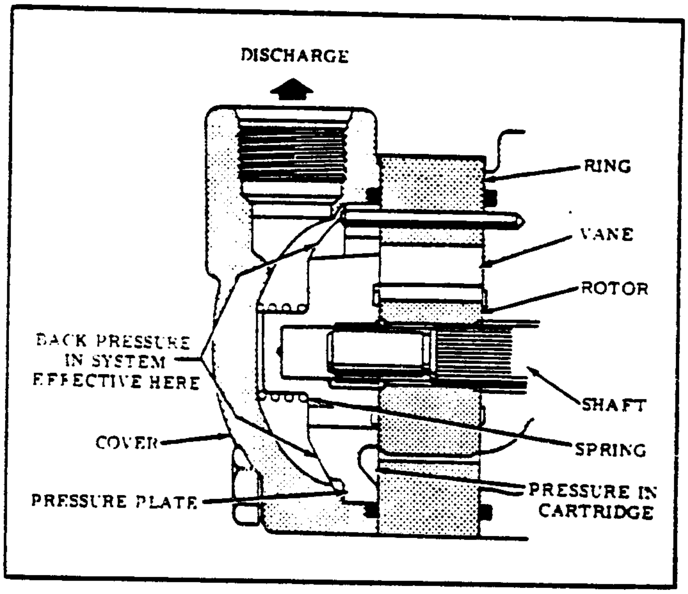


Figure 4

E. FLOW CONTROL AND RELIEF VALVE

1. Maximum flow to the operating circuit and maximum system pressure are determined by the integral flow control and relief valve in a special outlet cover used on some V10 and V20 pumps. This feature is illustrated pictorially in Figure 5. An orifice in the cover limits maximum flow. A pilot-operated type relief valve shifts to divert excess fluid delivery to tank, thus limiting the system pressure to a predetermined maximum.

2. Figure 5A shows the condition when the total pump delivery can be passed through the orifice.
This condition usually occurs only at low drive speeds. The large spring chamber is connected to the pressure port through an orifice. Pressure plus spring load in this chamber slightly exceeds pressure at the other end of the relief valve spool and the spool remains closed. Pump delivery is blocked from the tank port by the spool land.

3. When pump delivery is more than the flow rate determined by the orifice plug, pressure builds up across the orifice and forces the spool open against the light spring. Excess fluid is throttled past the spool to the tank port as shown in Figure 5B.

4. If pressure in the system builds up to the relief valve setting (Figure 5C), the pilot poppet is forced off its seat. Fluid in the light spring chamber flows through the spool and out to tank. This flow through the small sensing orifice, causes a pressure drop and prevents pressure in the light spring area from increasing beyond the relief valve setting. As pressure against the right end of the spool starts to exceed the relief valve setting, the pressure differential forces the spool to the left, against the light spring, porting the full pump flow to tank.

F. PRIORITY VALVE COVER

Refer to V10 and V20 priority valve cover schematic, Figure 6, pressure is sensed in cavities "A", "B" and "C". Primary flow into cavity "A" is restricted by the controlled flow orifice "O". Secondary flow will be zero until the pump flow rate through orifice "O" develops a pressure differential across the control spool.

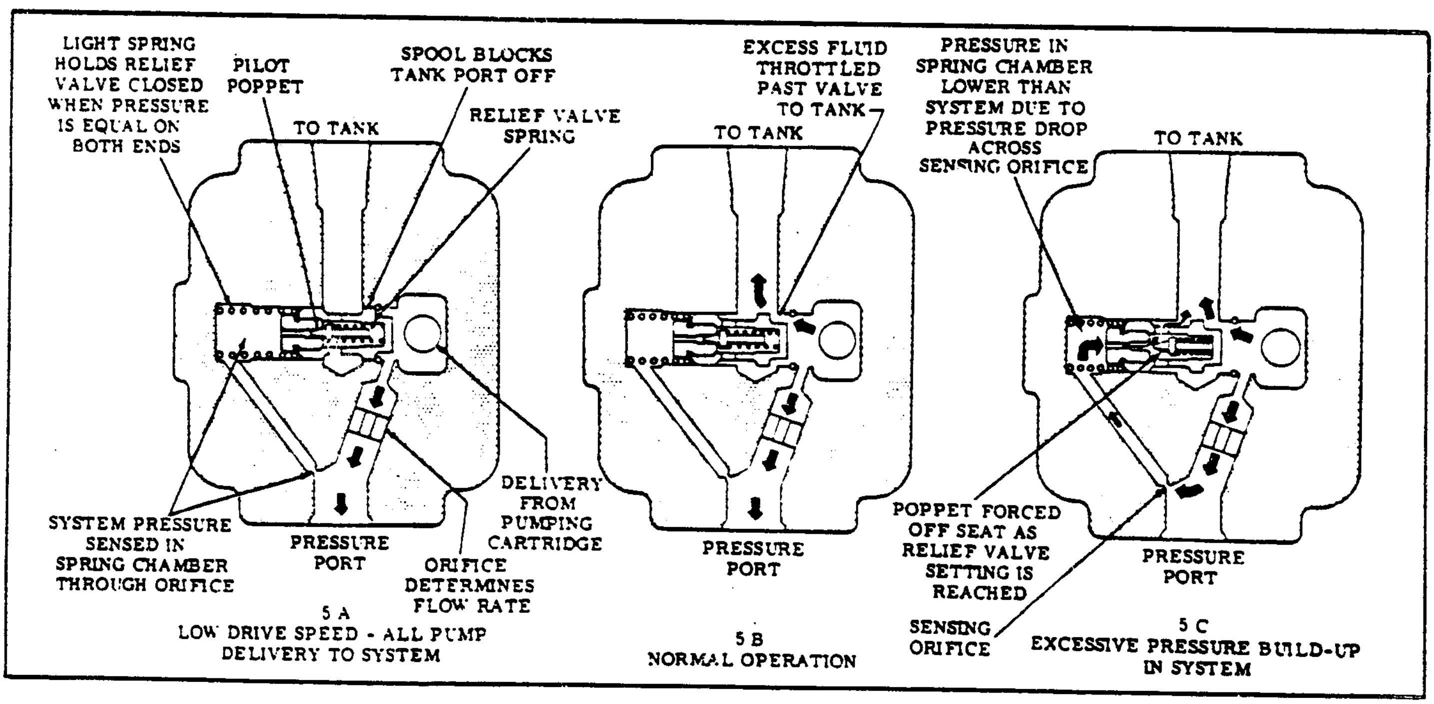


Figure 5

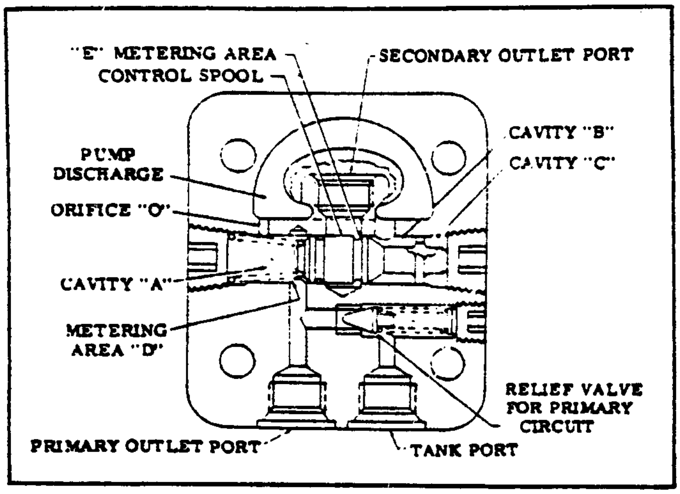


Figure 6. Priority Valve Cover

When pump delivery is increased, pressure builds up in cavities "B" and "C" because of the resistance to flow through orifice "O". This causes the spool to shift toward cavity "A" against the spring. The amount of spool shift is proportional to the pressure differential between cavities "A" and "C".

Flow from the primary port is held to an almost constant volume, as determined by orifice "O", and the metering action of the control spool at area "D". Flow to the secondary port varies with pump delivery. Metering area "E" diverts excess flow to the secondary port.

This single spool design cannot give precisely controlled flow to the primary circuit because of the effects of varying conditions of flows and pressures. For example: If the primary circuit is operating at 1000 PSI and the secondary at 100 PSI, the spool must be metering at "E". However, if primary pressure is 100 PSI and secondary is 1000 PSI, the spool must be metering at "D". As the two systems approach the same pressure, the probability of flow fluctuation increases because the spool may shift between these two metering points.

CAUTION

The pump has a built-in relief valve in the primary circuit. However, an external relief valve must be provided for the secondary circuit to protect the pump.

G. FLOW DIVIDER VALVE COVER.

V10 units are available with the flow divider valve cover. Refer to sectional view, Figure 7.

The vane pump cartridge develops flow which is forced through the large and small drilled orifices into the spool area.

Metering area "C" is open to the primary port. This prevents pressure from building up at the small orifice end of the spool.

Metering area "B" is closed preventing flow into the secondary port.

Pressure builds up in the large orifice area of the spool. This pressure slowly forces fluid across the dashpot spool land into area "A". As pressure builds up in area "A", the spool is forced to the left partially opening metering area "B" and partially closing metering area "A". Secondary flow begins from the pump cartridge passing through the large orifice, then crosses metering area "B" into the secondary port. The spool continues to move to the left until pressure in the small orifice area equals the pressure in the large orifice area. At this point, spool travel stops. A relationship of primary to secondary port flows will exist proportional to the drilled orifice areas.

The design of the flow divider valve cover is such that 60% flow will be available at the secondary port and 40% flow at the primary port.

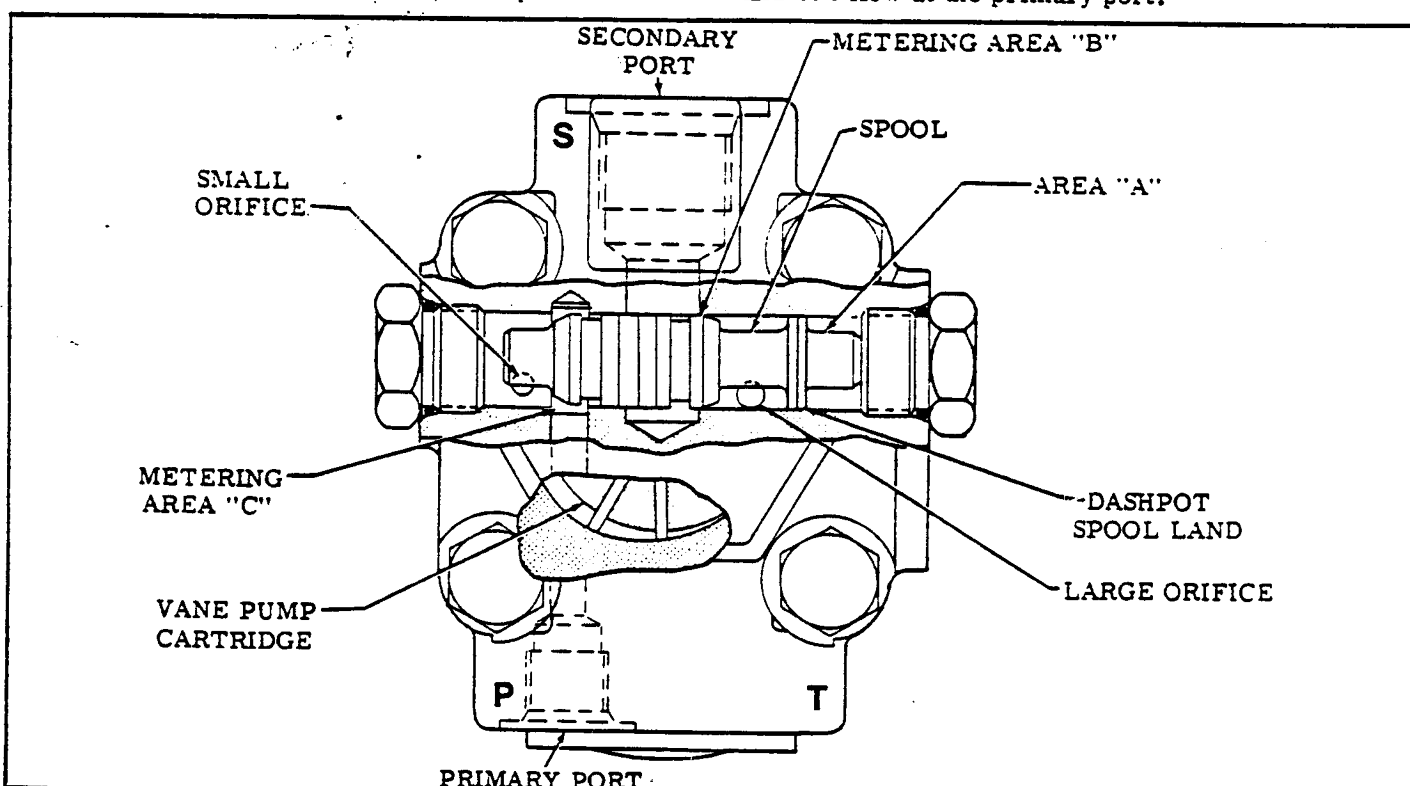


Figure 7. Flow Divider Valve Cover

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 8) 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 8. Transmission 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.

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 is based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicated 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.

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 filters, 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 the relief valve depends on the work requirements of the system components.

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

G. VANE PUMP PORT POSITIONS

The pump cover can be assembled in four positi with respect to the body. A letter in the model c (Table 1) identifies the cover position as shown in Fi ure 9.

Disassembly and assembly procedures are in se tion VI-B through O.

H. START-UP

With a minimum drive speed of 800 RPM, a pu should prime almost immediately, if provision is ma to initially purge the air from the system.

Failure to prime within a reasonable length of ti may result in damage due to lack of lubrication. In lines must be tight and free from air leaks. Howeve it may be necessary to crack a fitting on the outlet s of the pump to purge entrapped air

Section V - SERVICE AND MAINTENANCE

A. SERVICE TOOLS

The following standard tools for overhauling the transmission unit are shown in Figure 10.

1. Torque wrench with short extension and sockets.
2. 1" micrometer
3. 1" depth micrometer
4. Internal Truarc pliers (2300)
5. External Truarc pliers (0200)

In addition to the above 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 11, 12, 13 and 14.

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.

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

3. Filter elements also should be checked and r placed periodically. A clogged filter element resul in a higher pressure drop. This can force partic through the filter which would ordinarily be trapp or can cause the by-pass to open, resulting in a p tial or complete loss of filtration.

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

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

C. ADDING FLUID TO THE SYSTEM

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

It is important that the fluid be clean and free any substance which could cause improper operatic or wear of the pump or other hydraulic units. Ther fore, the use of cloth to strain the fluid should be avoid ed to prevent lint getting into the system.

D. ADJUSTMENTS

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

E. LUBRICATION

Internal lubrication is provided by the fluid in th

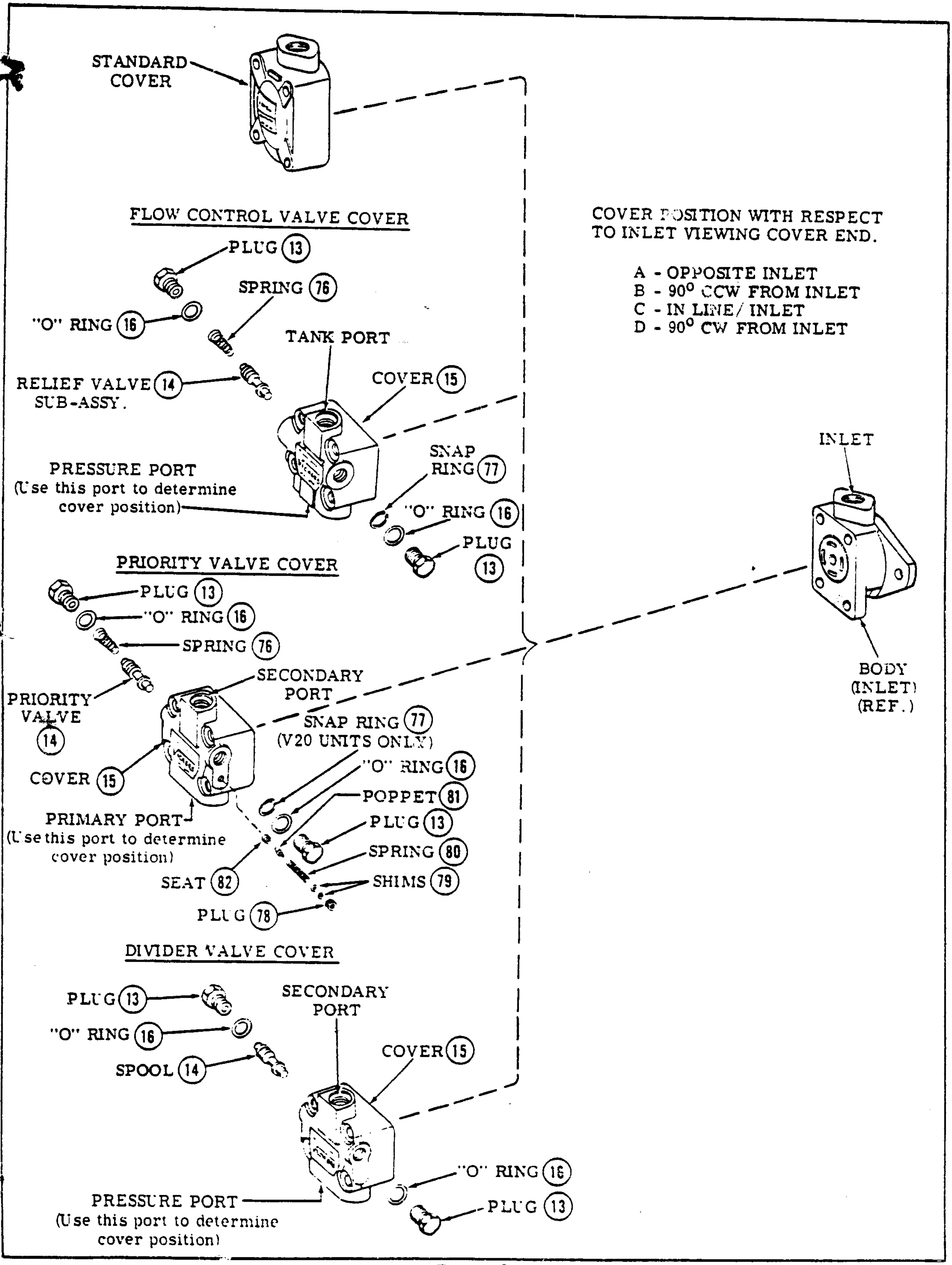

STANDARD COVER
FLOW CONTROL VALVE COVER
PLUG (13)
SPRING (76)
"O" RING (16)
TANK PORT
RELIEF VALVE (14) SUB-ASSY.
COVER (15)
PRESSURE PORT (Use this port to determine cover position)
SNAP RING (77)
"O" RING (16)
PLUG (13)
COVER POSITION WITH RESPECT TO INLET VIEWING COVER END.
A - OPPOSITE INLET
B - 90° CCW FROM INLET
C - IN LINE/ INLET
D - 90° CW FROM INLET
INLET
BODY (INLET) (REF.)
PRIORITY VALVE COVER
PLUG (13)
"O" RING (16)
SPRING (76)
PRIORITY VALVE (14)
SECONDARY PORT
SNAP RING (77) (V20 UNITS ONLY)
"O" RING (16)
POPPET (81)
PLUG (13)
SPRING (80)
SHIMS (79)
COVER (15)
PRIMARY PORT (Use this port to determine cover position)
SEAT (82)
PLUG (78)
DIVIDER VALVE COVER
PLUG (13)
"O" RING (16)
SPOOL (14)
SECONDARY PORT
COVER (15)
"O" RING (16)
PLUG (13)
PRESSURE PORT (Use this port to determine cover position)

Figure 9.

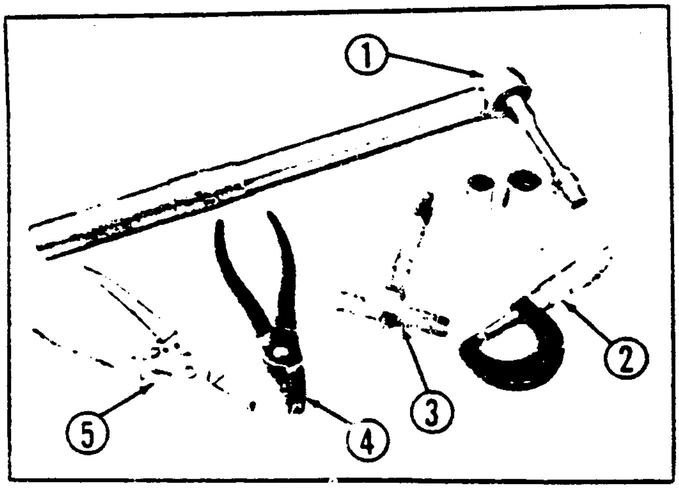
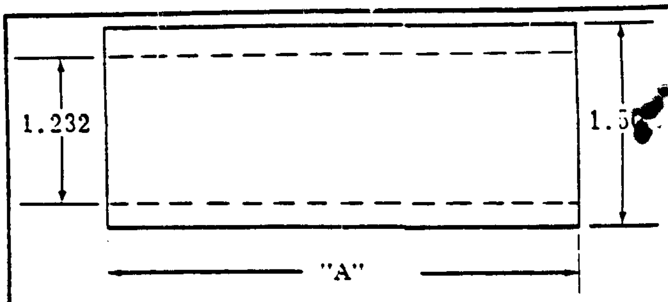
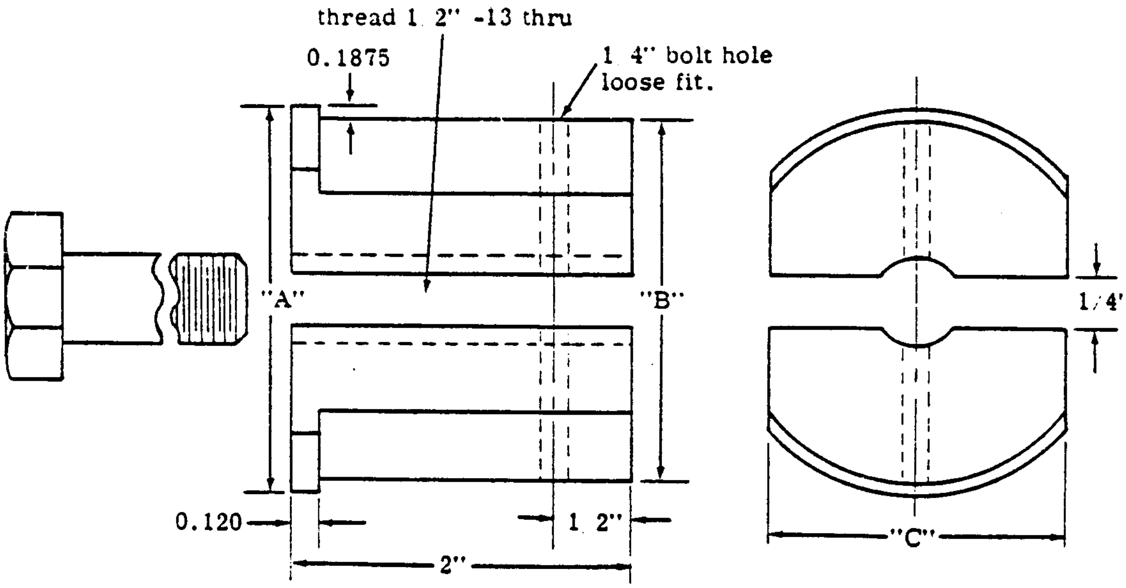


Figure 10. Standard Tools



USE FOR	"A"
Intermediate shaft bearing installation	4"
Drive shaft bearing installation	6"
Drive shaft bearing removal	9"
1 1/2" heavy wall tubing	

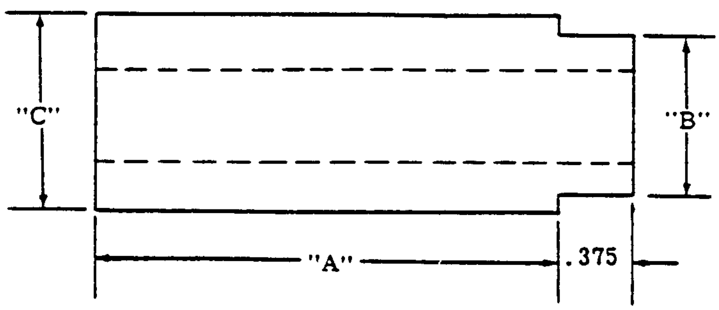
Figure 11. Special Shaft Bearing Removal and Installation Tools.



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 12. 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 13. Special Bearing Race Installation Tools.

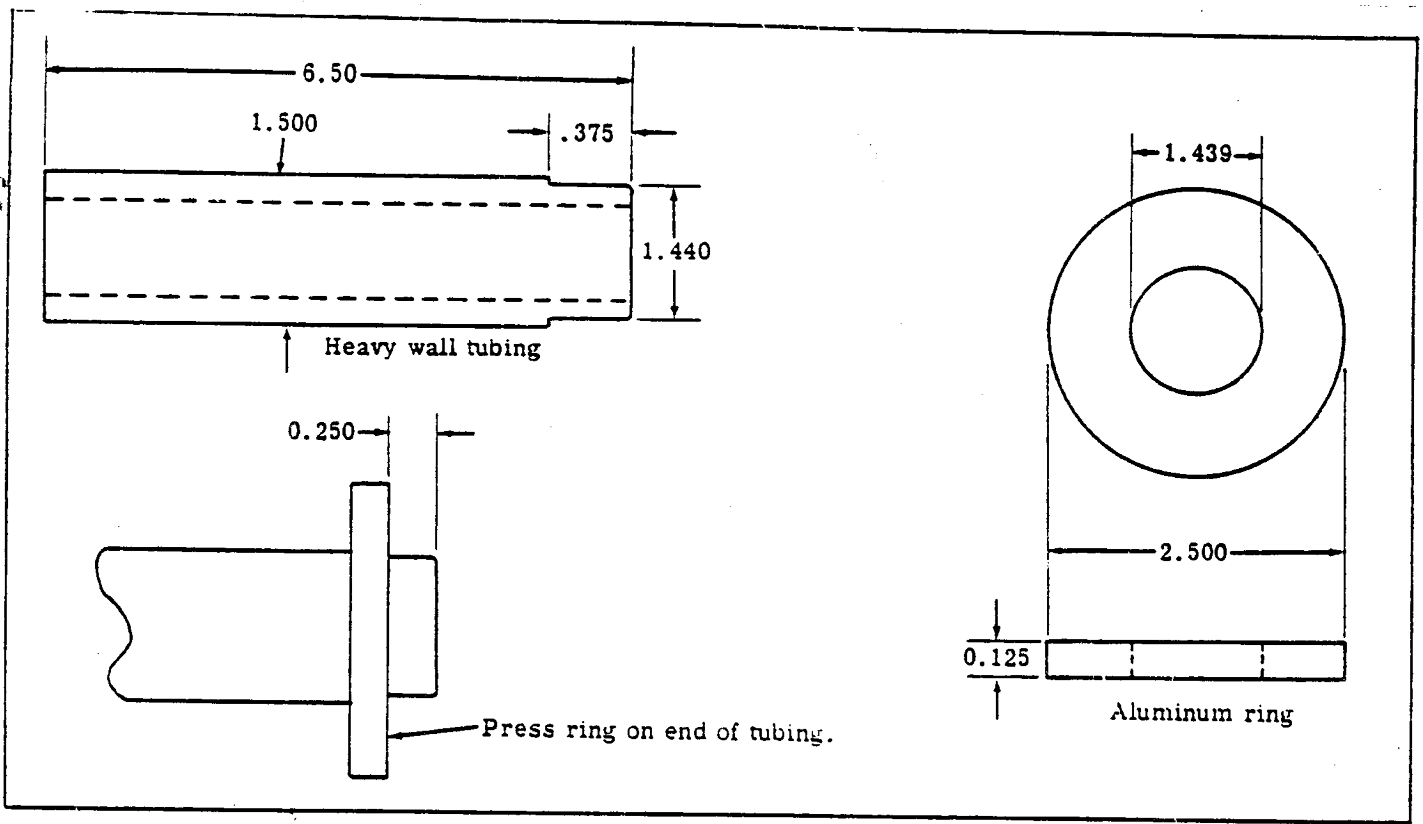


Figure 14. Shaft Seal Driver

system. Lubrication of the shaft couplings should be as 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. Substitutions may result in early failure. Part numbers are shown in the parts drawings listed in Table 2.

G. TROUBLE-SHOOTING

Table 3., lists the common difficulties experienced with transmission pumps and hydraulic systems. It also indicates probable causes and remedies for each of the troubles listed

Section VI - OVERHAUL

GENERAL

CAUTION

Block vehicle if it is on a slope. The transmission 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 transmission 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 transmission will generally not require disassembly to the extent described here. However, the sequence can also be used as a guide for partial disassembly. In general, disassembly is accomplished in the item number sequence shown in Figure 15. Special procedures are included in the following steps:

NOTE

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

A. REMOVAL AND DISASSEMBLY OF THE V10 VANE PUMP.

INDEX NO.	QTY.	NOMENCLATURE
1	2	SCREW
2	1	"O" RING
3	4	SCREW
4	1	SPRING
5	1	"O" RING
6	1	PRESSURE PLATE
7	2	ALIGNMENT PINS
8	1	RING
9	1	ROTOR
10	12	VANES
11	1	INLET BODY
12	1	"O" RING
13	2	PLUG
14	1	DIVIDER VALVE SPOOL
15	1	COVER
16	2	"O" RING
17	1	RETAINING RING
18	1	COUPLING
19	1	SHAFT
20	6	SCREW
21	1	HOUSING #2
22	1	L.H. WAFER PLATE (FOR R.H. UNITS) R.H. WAFER PLATE (FOR L.H. UNIT-SEE FIG. 25)
23	1	LOCATING PIN
24	1	GASKET
25	1	TAPERED ROLLER BEARING
26	1	BEARING SPACER
27	1	CYLINDER BLOCK S/A
28	9	PISTON & SHOE S/A
29	1	SHOE PLATE
30	1	SPHERICAL WASHER
31	3	PINS
32	1	PIN RETAINER
33	1	YOKE
34	8	SCREW
35	2	PINTLE COVER
36	–	
37	A/R	PINTLE SHIMS
38	2	"O" RING
39	2	BEARING SPACER
40	2	BEARING RACE
41	2	TAPERED ROLLER BEARING
42	1	INTERMEDIATE SHAFT
43	1	TAPERED ROLLER BEARING
44	1	BEARING RACE
45	1	VALVE BLOCK
46	1	COUPLING
47	4	ALIGNMENT PINS
48	6	SCREWS
49	1	HOUSING #1
50	1	GASKET
51	1	R.H. WAFER PLATE (FOR R.H. UNIT) L.H. WAFER PLATE (FOR L.H. UNIT-SEE FIG 25)

INDEX NO.	QTY.	NOMENCLATURE
52	1	LOCATING PIN
53	1	TAPERED ROLLER BEARING
54	1	BEARING SPACER
55	1	DRIVE SHAFT
56	1	TAPERED ROLLER BEARING
57	1	YOKE
58	1	RETAINING RING
59	1	SHAFT SEAL
60	1	RACE
61	1	CYLINDER BLOCK S/A
62	1	PIN RETAINER
63	3	PINS
64	1	SPHERICAL WASHER
65	1	SHOE PLATE
66	9	PISTON & SHOE S/A
67	1	PLUG & "O" RING
68	1	SPRING (REPLENISHING)
69	1	REPLENISHING RELIEF VALVE
70	4	PLUG & "O" RING
71	4	CHECK VALVE
72	4	SPRING
73	4	RELIEF VALVE & CHECK S/A
74	2	PLUG
75	1	PLUG

FIG. 9 INDEX NO.	QTY.	NOMENCLATURE
76	1	SPRING
77	1	SNAP RING
78	1	PLUG
79	A/R	SHIMS
80	1	SPRING
81	1	POPPET
82	1	SEAT

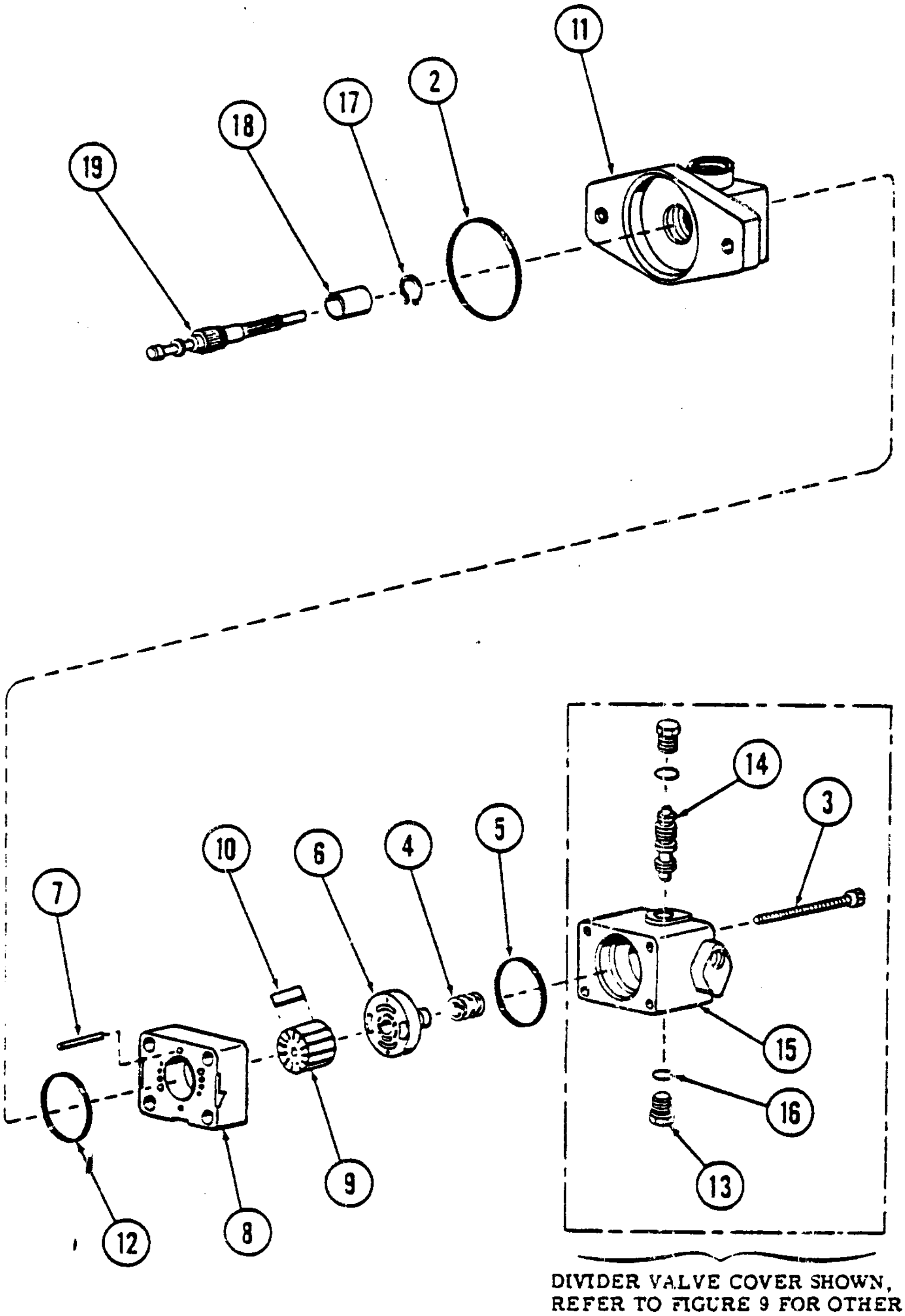


Figure 15A. Exploded View

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 transmis[illegible] 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 auxiliary pump and while system is under pressure.
	Vacuum condition.	1. Check inlet (suction) lines and fittings for air leaks. 2. Check auxiliary 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 is evident, 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 no[illegible] tempt to repair cartridges, [illegible] are factory assembled and preset.
	Loss of fluid internally (slippage).	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. Sheared shaft key. 2. Misadjusted or broken control linkage. 3. Disconnected or broken drive mechanisms.	Locate and repair.

NOTE

Mark all body sections with a prick punch to provide correct reassembly.

1. Remove the two bolts (1) which hold the vane pump to the transmission.

2. Slide vane pump off the shaft and remove the large "O" ring (2).

3. Remove the four bolts (3) which hold the vane pump cover and remove the cover.

4. Remove spring (4), "O" ring (5), pressure plate (6) and locating pins (7) from the vane pump.

5. Slide the ring (8), rotor (9) and vanes (10) as an assembly off the inlet body. Hold the rotor and vanes to prevent them from dropping.

6. Remove "O" ring (12) from inlet body (11).

7. Vane pump cover disassembly procedures: Refer to Figure 9.

a. DIVIDER VALVE COVER - Remove hex plugs (13) and "O" rings (16) from the divider valve bore, then slide the divider valve spool (14) from the cover.

b. PRIORITY VALVE COVER - Remove hex plugs (13) and "O" rings (16) from each end of the priority valve bore. Remove spring (76) and priority valve spool (14). Remove the small pipe plug (78), shims (79), spring (80) and poppet (81) from the primary port relief valve. Do not remove seat (82) unless poppet condition indicates seat to be defective.

c. FLOW CONTROL COVER - Remove hex plugs (13) and "O" rings (16) from each end of the flow control spool bore. Remove spring (76) and relief valve S/A spool (14). Remove snap ring (77) from the bore.

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 spool, cover and valve block passages.

B. INSPECTION REPAIR AND REPLACEMENT

NOTE

Replace all parts that do not meet the following specifications.

1. Inspect all components for excessive wear, erosion and/or seizure.

2. Check ring (8) for chatter marks, cracks and excessive wear. Minor surface marks may be lapped to remove imperfections.

3. Inspect cover bore for burrs and possible seizure marks due to dirt contamination. Check spool for burrs and chips and evidence of wear.

4. Check vanes (10) and rotor (9) clearance. Vanes must slide easily in and out of the rotor and fit without being loose.

C. REASSEMBLY

1. Place inlet body (11) face down on a clean surface covered with kraft paper.

NOTE

During assembly of the transmission package, do not use grease to hold the seals in place. Use a viscosity improver (STP or equivalent). Flood all parts with system fluid to provide initial lubrication and prevent seizure.

2. Install body "O" ring (12).

3. Install locating pins (7) into inlet body (11).

4. Install ring (8) with arrow pointing in the direction of rotation.

5. Install vanes (10) into rotor (9) with the radius edge of the vane toward the ring.

6. Hold the rotor and vanes together and install into the ring.

7. Install pressure plate (6) over the locating pins and rotor. The pressure plate is symetrical and can be assembled on the pins in either direction.

8. Install "O" ring (5) over pressure plate and place spring (4) on the boss of the pressure plate.

9. Install cover (15); observe markings to position pressure port in the correct direction. Thread four bolts (3) into cover and torque to 35-45 lb. ft.

10. Assembly of vane pump covers.

a. DIVIDER VALVE COVER-Refer to Figures 7 and 9 during this procedure.

1. Install divider valve spool (14) then thread both hex plugs (13) with new "O" rings (16) into each end of the divider valve bore. Torque to 70-80 lb. ft.

b. PRIORITY VALVE COVER-Refer to Figures 6 and 9 during this procedure.

1. Install the relief valve poppet (81) and spring (80) together. If a new seat (82) was installed, the poppet must be seated before assembly of poppet and spring.

NOTE

Shims (79) are used to set relief valve

cracking pressure. The addition of shims increases pressure. Set relief valve cracking pressure during test after pump is assembled.

2. Install relief valve plug (78) without shims (79). This will set relief valve at minimum pressure.

3. Install snap ring (77) in priority valve spool bore (V20 units only).

4. Install priority valve spool (14) and spring (76) then install the two pipe plugs (13) at each end of the bore. Reference Figure 6 and 9. Make sure spool does not bind within the bore.

c. FLOW CONTROL COVER-Refer to Figures 5 and 9 during this procedure.

1. Install snap ring (77) into flow control valve spool bore. Make sure the snap ring is located securely within its groove.

2. Install the flow control relief valve spool (14) into the bore. Make sure the spool moves free and does not bind within the bore. Refer to the Figures for spool orientation.

3. Install spring (76) into flow control bore over the relief valve spool.

4. Install plugs (and "O" rings if required) at each end of the relief valve spool bore and secure.

NOTE

This completes the assembly of the vane pump. Cover the pump with kraft paper and set aside until the final assembly of the complete unit is accomplished.

D. REMOVAL AND DISASSEMBLY OF PISTON PUMP NUMBER 2.

1. Remove retaining ring (17) located on the vane pump shaft next to coupling (18) which is visible at the back of the transmission. Use external Truarc pliers model #0200.

2. Slide coupling (18) off the shaft.

3. Unscrew vane pump shaft (19) from the intermediate shaft and remove.

4. Remove six bolts (20) that hold the piston pump housing to the valve block and remove housing (21) by sliding the intermediate shaft from coupling (46) located within the valve block.

5. Remove wafer plate (22) and pin (23), set aside for inspection.

6. Remove the housing gasket (24) and alignment pins (47), discard housing gasket.

7. Remove tapered roller bearing (25) and bearing spacer (26).

8. Slide rotating group from the housing. Hold the shoe plate with both hands during the removal to prevent the group from separating.

NOTE

The rotating group consists of a cylinder block S/A (27), nine piston and shoe sub-assemblies (28), the shoe plate (29), a spherical washer (30), three pins (31) and a pin retainer (32).

E. INSPECTION REPAIR AND REPLACEMENT

1. Inspect vane pump shaft (19) for wear and chipped splines.

2. Check bearings (25) for score marks or brinelling of the rollers.

3. Check bearing spacer (26) for burrs.

CAUTION

The spring located within the cylinder block S/A is under a high tension and can cause bodily harm if the retaining ring is removed. See Figure 16 for disassembly instructions.

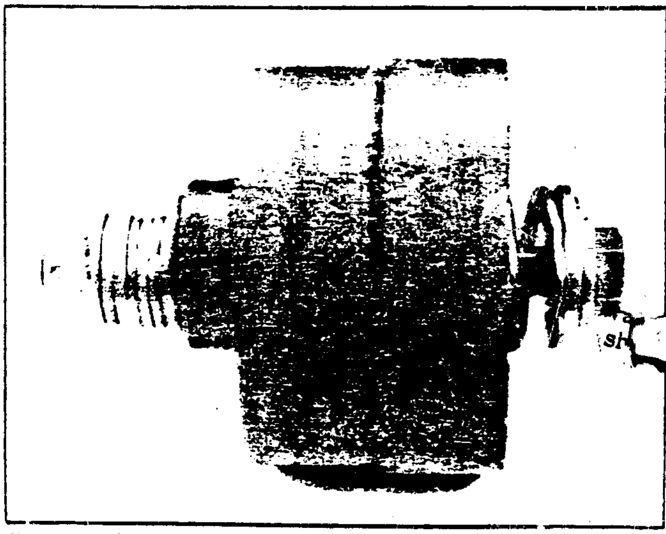


Figure 16. Cylinder block subassembly disassembly tool. (Tighten nut, remove snap ring, loosen nut to relieve spring tension).

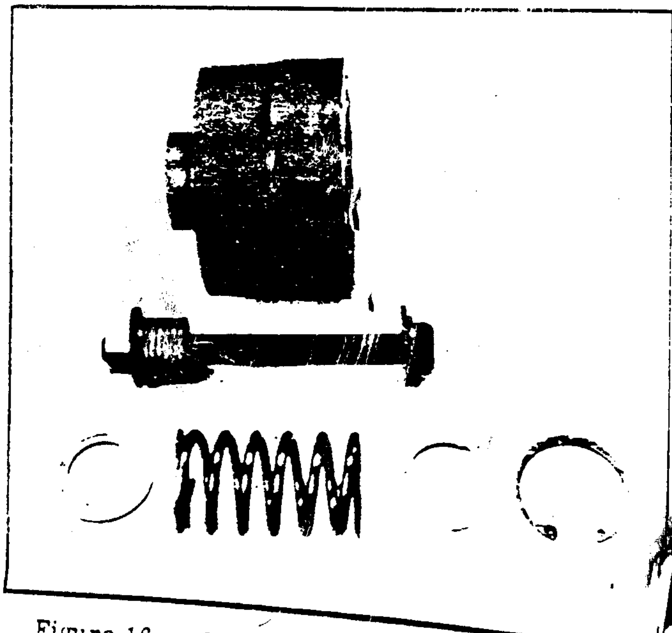


Figure 16a. Cylinder block subassembly parts.

4. Inspect cylinder block S/A face (27) for wear, scratches and/or erosion between cylinders. Check the spring, washers and retaining ring located within the cylinder block S/A.

5. Check each cylinder block bore for excessive wear. Use the piston and shoe subassemblies (28) 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.

6. Inspect each piston and shoe subassembly (28) for a maximum end play of 0.005 inch between the piston and shoe.

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

8. Inspect shoe plate (29) for excessive wear and cracking in the area of spherical washer (30). If heavy wear or cracks are found, replace the shoe plate and spherical washer at the same time.

9. Check spherical washer (30) for burrs, wear and possible scratches due to pin (31) breakage. Replace if wear is excessive.

10. Inspect pins (31) for equal length, excessive wear and possible bending. Replace all pins simultaneously if one is defective.

11. The pin retainer (32) may develop burrs. Remove all burrs with an India stone.

12. Inspect the bronze face of wafer plate (22) 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 (23) does not extend too far and hold the wafer plate away from the valve block.

13. Inspect face of yoke (33) for wear, roughness, or scoring. If the yoke is serviceable, inspect shaft bearing (43) as noted in step D.16. If both the yoke and shaft bearing can be re-used, DO NOT remove the yoke from the housing. If either the yoke or the bearing was defective, remove the yoke as follows:

a. Remove the four screws (34) that hold pintle covers (35) on each side of the housing. Remove the pintle covers. Be careful not to damage the seal on the long pintle.

b. Remove shims (37). Retain shims if the yoke was serviceable. Remove and discard "o"rings (38). Remove bearing spacers (39) from each pintle.

c. Slide yoke from side to side to loosen the yoke bearing races (40) within the housing. The races are 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 (41) at the approximate center and allow the bearing rollers to gently press the race out of the housing.

d. Inspect yoke races (40) and bearings for brinelling, pitting, and roughness when turned in the race. If defective, replace with new bearings, discard old shims (retained in step D.13.b.), and perform a yoke bearing preload adjustment at assembly. If the yoke and bearings are to be re-used, the preload adjustment can be omitted. The same shims, or a new shim of the same thickness, will be required to preload the yoke bearings at assembly.

14. Remove yoke (33) and intermediate shaft (42) from the housing together. Turn the yoke at an angle and slide the two parts out of the housing. See Figure 17.

15. Inspect shaft (42) for broken splines and burrs; remove burrs with an India stone.

16. Inspect shaft bearing (43) for brinelling, pitting of the rollers and roughness when turned in race (44) located in the housing. If the bearing is defective, both the bearing and the race must be replaced. If the bearing shows no evidence of wear, do not remove the bearing race from the housing or the bearing from the shaft. If the bearing requires removal, perform the following two steps 17 and 18.

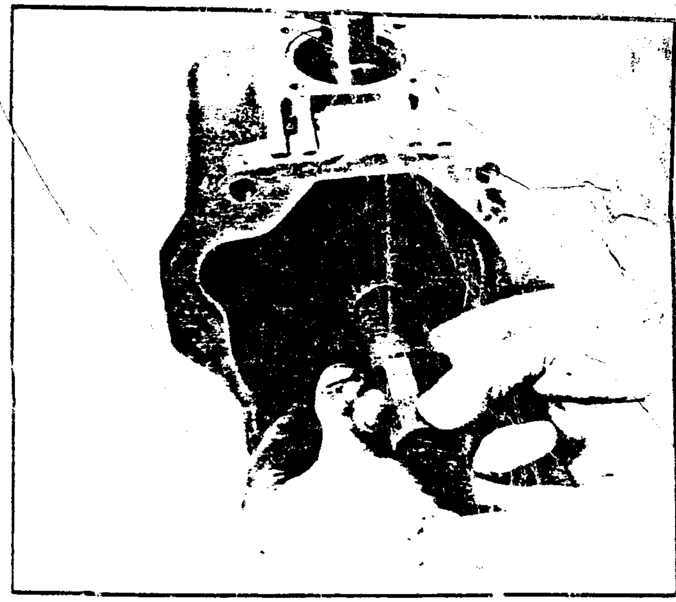


Figure 17. Removal of shaft and yoke from the housing.

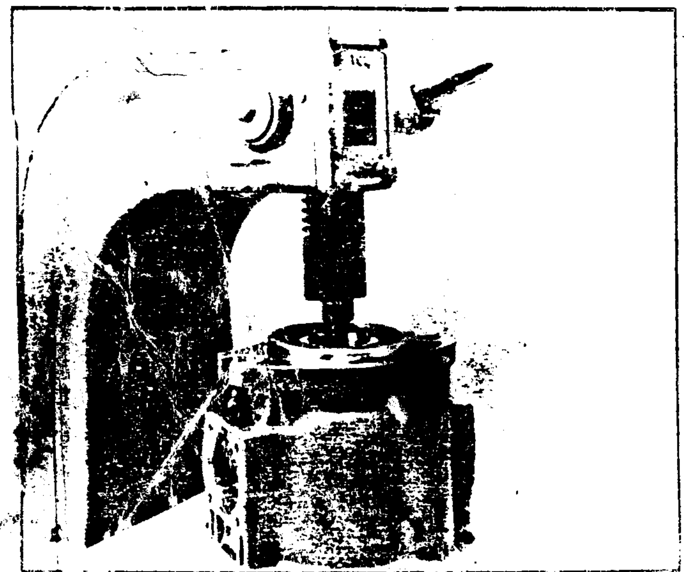


Figure 18. Removal of the bearing race located within the housing.

17. Remove bearing (43) from shaft (42) with the nine inch piece of 1 1/2" heavy wall tubing shown in Figure 11. Press off with an arbor press.

18. Remove bearing race (44) from housing (21) as shown in Figure 18. Use special tool shown in Figure 12.

NOTE

If tapered roller bearing (27) is replaced, the race located in the valve block must be replaced. See paragraph "L" for bearing race removal and paragraph "N" for race installation.

F. REASSEMBLY (Housing #2)

1. If bearing (43) was removed, press a new race (44) into the housing until it bottoms against the shoulder. Use tool shown in Figure 13. Fit tool into race as shown in Figure 24.

2. Use a four inch piece of heavy wall 1 1/2" tubing to press the roller bearing on the intermediate shaft. Make sure the bearing is oriented properly and bottoms against the shoulder. See Figure 11 for special tool data.

3. Install shaft (42) and bearing (43) with yoke (33) into housing (21). Be sure the long pintle of the yoke is oriented properly within the housing.

4. Assemble pintle bearings (41) on each end of the yoke and insert bearing races (40).

5. Install bearing spacer (39) at the short pintle end.

6. Install "O" ring (38) against spacer (39) into the groove, then install a 0.010 inch shim (37) under pintle cover (35B). Install four pintle cover screws (34) and torque to 170-190 lb. in. (NOTE: Early designs used a screw and washer arrangement. Torque the screw and washer to 115-125 lb. in.)

7. Set housing #2 on its side so the long pintle is up. Install bearing spacer (39) and rotate the yoke back and forth to seat bearings (41) within the bearing races. With spacer (39) fully in against the bearing race, measure the height of the spacer with respect to the housing pintle face in two places (180° apart). Use a depth micrometer to perform this measurement. See Figure 19. 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 average calculated 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. Shim thickness at either pintle must not exceed 0.020. This is necessary to provide proper "O" ring compression and prevent pintle seal leakage.

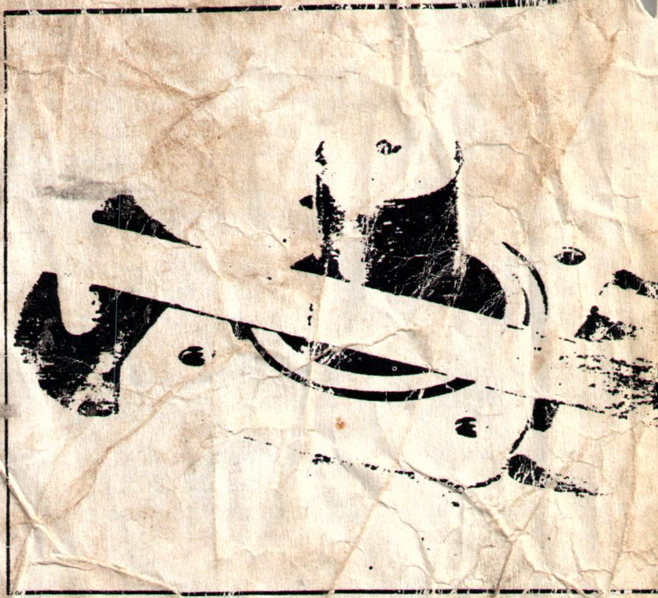


Figure 19. Pintle bearing spacer height with respect to pintle face.

Figure 19a. Measuring height of pintle bearing spacer with respect to the pintle face.

8. Install the correct shims (37) and cross torque long pintle cover (34) screws to 170-190 lb. in. (NOTE: Early designs used a screw and washer arrangement. Torque the screw and washer to 115-125 lb. in.

NOTE

The yoke (33) will be stiff but should be loose enough to be moved by hand, (Approximately 20 lb. 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.

G. SHAFT BEARING PRELOAD ADJUSTMENT (Housing number 2)

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 and perform steps G.3 and G.8. If preload adjustment is necessary, perform steps G.1. through G.8.

1. Install the thickest bearing spacer (26) over shaft (42) with the chamfer facing into the housing (toward the shoulder on the shaft).

2. Slide new bearing (25) on the shaft and up against spacer (26). The small diameter of the tapered roller bearing must face out of the housing.

3. Temporarily thread vane pump shaft (19) into intermediate shaft (42).

4. Install housing #2 (21) to valve block (45) without gasket (24) and rotating group. Turn shaft (19) to seat the bearings, then torque the six housing attaching screws (20) to two (5) lb. in. Continue to turn the shaft while adjusting the torque until no change of torque is obtained. Check the opening between the valve block and housing to be as even as possible after tightening.

5. Use a feeler gage to measure the opening between valve block (45) and housing (21). Four measurements should be obtained equidistant around the unit. A tapered feeler gage is especially useful for this purpose. Average the four readings 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 thickness to provide a 0.001 to 0.003 bearing preload.

6. Remove six mounting screws (20) and remove housing #2 from the valve block.

7. Remove bearing (25) and bearing spacer (26).

8. 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.

9. Assemble the spring, two washers and retaining ring into the cylinder block. See Figure 16 for instructions. Set the cylinder block S/A (27) face on a flat clean surface. Use kraft paper between the block and surface to prevent scratching the cylinder block face.

10. Install pin retainer (32) into cylinder block. Position the pin retainer approximately 1/4" below the surface, and orient the open end of the pin retainer to be away from the large spline openings.

11. Slide the three pins (31) into cylinder block S/A (27) until they bottom against the spring washer within the block.

12. Place spherical washer (30) on top of the three pins; then install shoe plate (29) with nine piston and shoe subassemblies (28) over spherical washer (30) and into the cylinder block. Wobble shoe plate (29) to make sure that each piston is free within its bore in the cylinder block.

13. Set housing #2 (21) on its side and hold vane pump shaft (19) so intermediate shaft (42) is horizontal. Slide rotating group into the housing. Rotate the shaft to match the shaft splines to the cylinder block and spherical washer.

14. Remove vane pump shaft (19) and set housing #2 on a flat surface with vane pump end pointing down.

15. Install bearing spacer (26) with chamfer toward the shoulder of shaft.

16. Install tapered roller bearing (25) over the shaft and against the spacer. The small diameter of the roller bearing must face up, (toward the valve block end).

17. Install two (2) housing alignment pins and place a new gasket (24) over them. Cover the unit and set aside for final assembly.

H. REMOVAL AND DISASSEMBLY OF PISTON PUMP NUMBER 1.

1. Remove the six (6) screws (48) which hold #1 piston pump housing (49) to valve block (45).

2. Pull housing (49) away from valve block (45) then discard gasket (50).

3. Remove wafer plate (51) and pin (52) from the valve block and set aside for inspection.

4. Remove bearing (53) and bearing spacer (54) from the end of drive shaft (55).

5. Slide the rotating group from the pump housing. (Use two hands for this operation).

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 brinelling of the rollers and/or roughness when turned in the race. Do not disassemble further if the yoke and bearing are functional.

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

1. Install a nine inch piece of 1 1/2" heavy wall tubing over drive shaft (55) within the housing. The end of the tubing will rest against the inner race of tapered roller bearing (56) and extend out beyond the end of the pump housing. Place the complete unit with tubing into an arbor press with drive spline up. Press the drive shaft through the bearing and out of the unit. A 0.001 press exists between the shaft and bearing so considerable force is required to remove the bearing. See Figure 20.

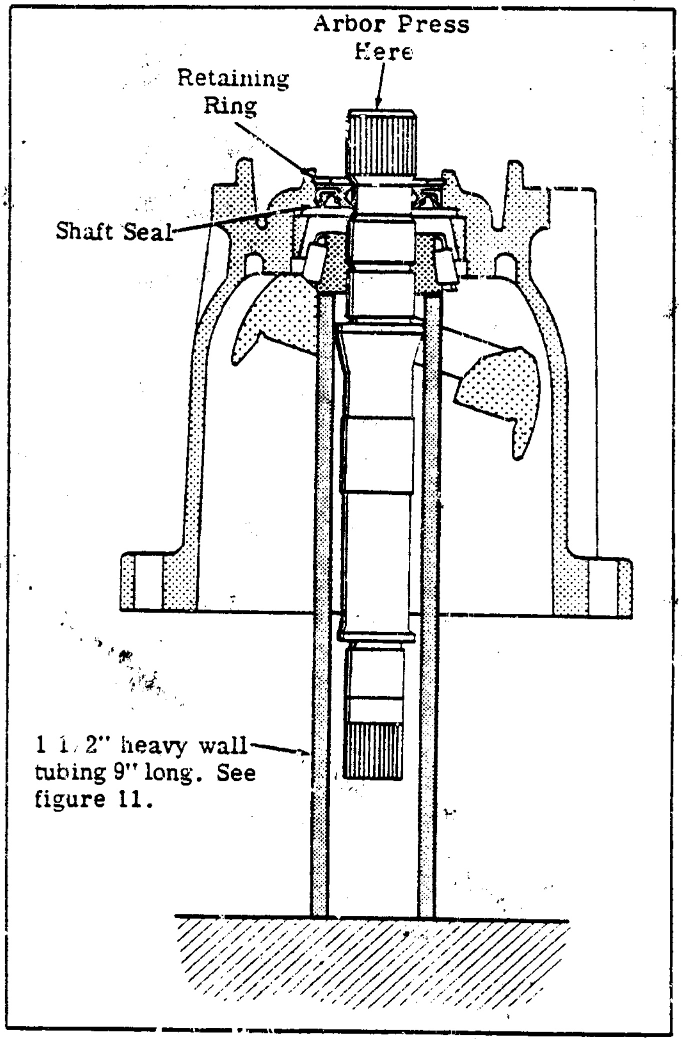


Figure 20. Front Bearing Removal

2. Remove yoke (57) bearings as noted in housing #2 procedure. See step E.13.

3. Remove yoke (57) from housing #1. Note position of long pintle.

4. Remove the loose shaft bearing (56) from housing (49).

5. Remove retaining ring (58) from the front of shaft seal (59). Use internal Truarc pliers (2300) to remove retaining ring.

6. Press shaft seal (59) from housing (49). Use short piece of the 1 1/2" heavy wall tubing. See Figure 11 for tool.

J. INSPECTION REPAIR AND REPLACEMENT

1. Inspect the rotating group, yoke and bearings as noted in housing #2. See steps VI. E. 4. through VI. E. 12. Special procedures for housing #1 follow:

2. Inspect drive shaft (55) for wear in the area of shaft seal (59). Clean up any sharp burrs with 500 grit paper or crocus cloth. If the shaft diameter is worn in the area of the shaft seal more than 0.005, replace the shaft.

3. Inspect the shaft splines for chips and wear. Check the bearing area of the shaft for evidence of twisting within the bearing. If the shaft shows galling in the bearing area replace large shaft bearing (56) and race. Replace the shaft if galling is extensive.

CAUTION

Do not replace a roller bearing (56) without replacing the bearing race (60). The bearings and races are sold only as a subassembly.

4. Inspect the housing shaft seal retaining ring groove for burrs and the proper depth.

K. REASSEMBLY OF HOUSING #1.

NOTE

If a new shaft bearing (56), shaft (55), valve block (45) or housing (49) is required, a complete 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 (57) and its associated bearings.

1. If the shaft bearing (56) requires replacement, install a new bearing race into housing #1. Use tool shown in Figure 13 to press bearing race in place. Make sure bearing race (60) 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 (49) on a flat surface with the shaft seal end down. Lay the front shaft bearing (56) into the race.

3. Orient the yoke pintle properly and install into the housing. Assemble the yoke bearings, races and spacers as noted in housing #2. See steps VI. F.4. through [illegible] F.8.

4. Press drive shaft (58) into shaft bearing (56) as follows: Use a short piece of 1 1/2" inch heavy wall

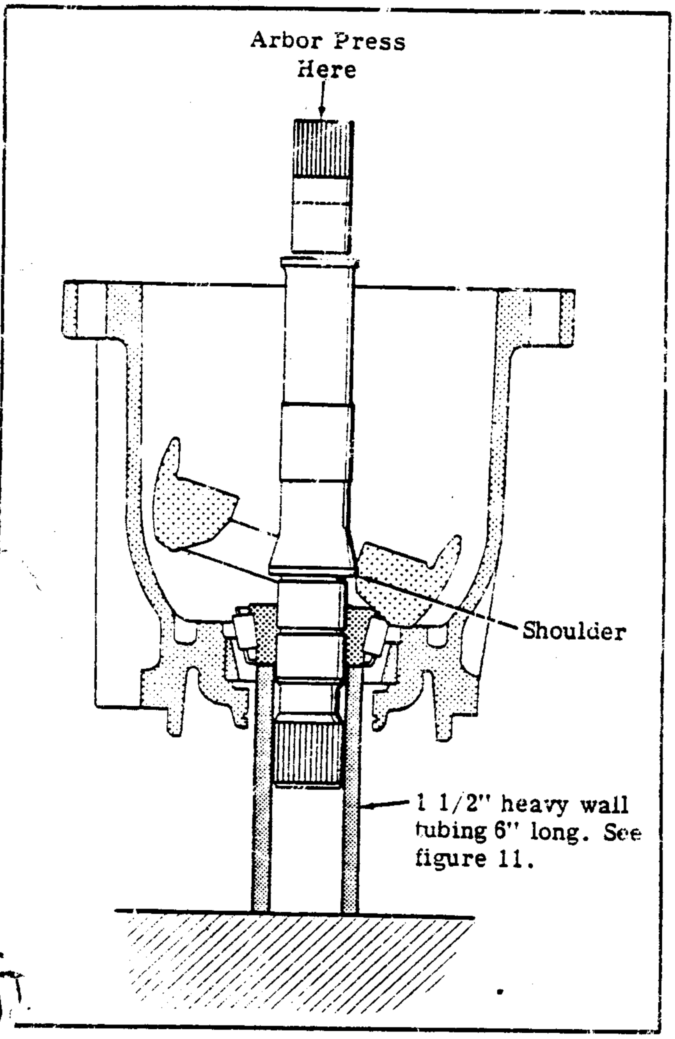


Figure 21. Front Bearing Installation.

tubing (approximately 6" 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 21.

5. Remove the short piece of tubing and turn shaft bearing (56) 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 (55) with plastic tape to prevent cutting new shaft seal (59). Start taping the shaft close to the housing and work toward the end of the shaft. Install a new shaft seal in position over the shaft and press evenly into the housing. Use shaft seal driver shown in Figure 14. The seal must be positioned just below the retaining ring groove. Install retaining ring (58) into the housing. Use internal Truarc pliers (2300) to install retaining ring.

NOTE

If the bearings, shaft, valve block and housing are being returned to service, the preload adjustment step F.7 can be omitted. The same bearing spacer will be used to preload the bearings. If any of the above parts were replaced, a complete shaft preload adjustment must be performed.

7. Refer to housing #2 Shaft Bearing Preload Adjustment Procedure steps G.1, G.2, and G.4 through G.8.

8. Assemble the spring, two washers and retaining ring into the cylinder block. See Figure 16 for instructions. Set the cylinder block S/A (61) on a flat surface. Use kraft paper between the block and surface to prevent scratching the cylinder block.

9. Install pin retainer (62) into the cylinder block. Position the pin retainer approximately 1/4" below the surface, and orient the open end of the pin retainer to be away from the large spline openings.

10. Slide three pins (63) into cylinder block S/A (61) until they bottom against the spring washer.

11. Place spherical washer (64) on top of the three pins; then install the shoe plate (65) with nine piston and shoe subassemblies (66) 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.

12. Set housing #1 on its side and hold the shaft end so drive shaft (55) is horizontal. Slide the rotating group into the housing. Rotate drive shaft (55) if necessary to match the shaft splines to the cylinder block and spherical washer.

13. Install bearing spacer (54) with chamfer toward the shoulder of drive shaft (55).

14. Install tapered roller bearing (53) over the shaft and against the spacer. The small diameter of the tapered roller bearing must face toward valve block (45).

15. Install two (2) housing alignment pins (47) and place a new gasket (50) over them. Cover the unit and set aside for final assembly.

L. DISASSEMBLY OF THE VALVE BLOCK

1. Remove plug and "O" ring (67) from valve block (45).

2. Remove spring (68) and replenishing relief valve (69) from the valve block. A pencil type magnet is useful in this operation.

NOTE

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

3. Remove the four plugs and "O" rings (70), cross line replenishing check valves (71), and springs (72) from valve block (45).

NOTE

Some models utilize four combination cross line relief and check valve assemblies (73) in place of replenishing checks (71). The combination relief and check valves are not repairable, replace the complete assembly if found defective. Refer to the trouble shooting section V-G.

4. Remove pipe plugs (74) from each side of valve block (45).

5. Remove gage pipe plug (75) from the valve block. This completes disassembly of the valve block.

NOTE

If the bearing race located in valve block requires replacement, use tool shown in Figure 12. Refer to Figure 22 for removal information.

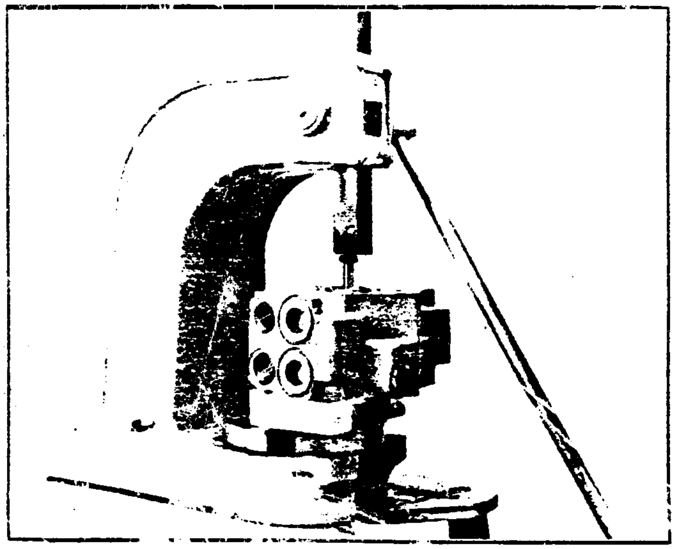


Figure 22. Bearing race removal from the valve block.

M. INSPECTION REPAIR AND REPLACEMENT

1. Clean all parts and place them on a clean sheet of kraft paper for inspection. Follow general procedure noted in paragraph VI. A.

2. 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 the plug.

3. Inspect springs (68) and (72) 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.

4. Inspect the replenishing relief valve (69) 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.

5. Inspect the four replenishing check valves (71), or combination relief and check valves (73), if used. Refer to the procedure developed for the replenishing relief valve (69) in the previous step. If the valves are defective replace them with new assemblies.

6. Inspect valve block (45) 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.

N. ASSEMBLY OF VALVE BLOCK.

NOTE

Refer to Figures 15 and 23 during the following assembly procedure.

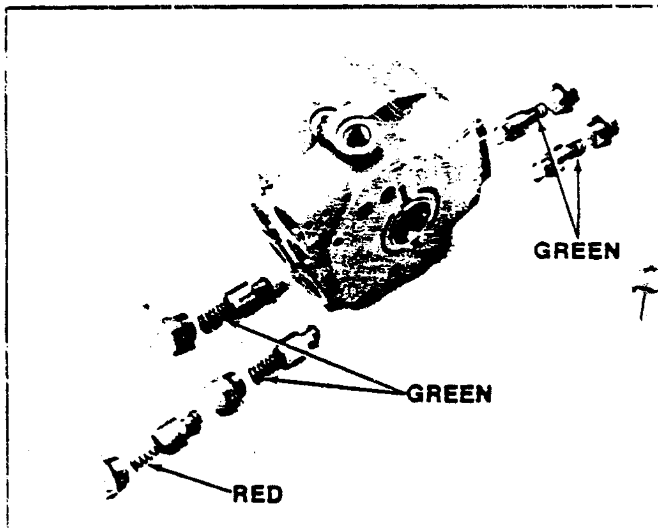


Figure 23. Exploded view of the valve block parts.

1. Install pipe plugs (74) into each side of the valve block. The plugs must be below the machined surface after assembly.

NOTE

Check the flatness of each valve block face in the areas around locating pins (47) and (67), pipe plugs (74) and bolt openings. Use an India stone to remove burrs or raised metal in these areas.

2. Install pipe plug (75) into valve block and secure.

3. Install replenishing relief valve (69) into valve block (45). The valve must slide free within the bore and show no evidence of bind when rotated through 360°.

NOTE

New valves will require a seating operation be performed within the valve block