



# SERVICE MANUAL

## Section 4 \_\_\_\_\_ PUMP DRIVE TRANSFER CASE TRANSMISSION

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## 4-1. GENERAL

This section contains the overhaul instructions for the pump drive, transmission and transfer case. Instructions also given in this section include removal, disassembly, inspection, cleaning, reassembly, installation, checks and adjustments and trouble analysis table.

Complete preventive maintenance procedures are provided in Section 2 of this manual. Whenever feasible, the component manufacturer's service instructions are also provided as a supplement to the EIMCO information.

## 4-2. SYSTEM DESIGN SPECIFICATIONS

ITEM	DESIGN DATA	ITEM	DESIGN DATA
<b>PUMP DRIVE</b>		<b>HYDROSTATIC TRANSMISSION</b>	
BEARINGS	Single row radial, open ball bearing.	GEAR CHANGING	No clutch required
GEAR TYPE	Spur	VARIABLE DIS- PLACEMENT PUMP	
WEIGHT	162 lbs (73.4 kg.)	Displacement, Maximum	3.15 Cu.In./Rev. (51.6 cm <sup>3</sup> /Rev.)
GEAR DATA		Torque at 1000 PSI (69 bars)	41.8 ft.-lbs. (6 kg-m)
Hydraulic Pump Drive Gear	1.5:1 Reduction	Speed, Maximum:	
Number of Teeth	54	High Idle	1412 RPM (Unloaded)
Material	4142H Annealed Alloy Steel	Rated Power	3100 RPM (Loaded)
Diameter	5.75 In. (146 mm)	Weight	118 lbs. (53.5 kg)
Total Backlash	0.007 - 0.015 In. (0.18 - 0.38 mm)	VARIABLE DIS- PLACEMENT MOTOR	
Main Drive Gear		Displacement, Maximum	5.43 Cu.In./Rev. (88.9 cm <sup>3</sup> /Rev.)
Number of Teeth	35	Torque at 1000 PSI (69 bars)	72 ft.-lbs. (10 kg-m)
Diameter	4.625 (117 mm)	Speed, Maximum:	
Total Backlash	0.007 - 0.015 In. (0.18 - 0.38 mm)	High Idle	819 RPM (Unloaded)l)
Transmission Pump Drive Gear	1.6:1 Reduction	Rated Power	2590 RPM (Loaded)
Number of Teeth	57	Weight	174 lbs. (79 kg)
Diameter	7.375 (187 mm)	<b>TRANSFER CASE</b>	
Total Backlash	0.007 - 0.015 In. (0.18 - 0.038 mm)	TYPE	Single reduction, spur gear
		REDUCED RATIO	2.77 to 1
		GEAR DATA	
		Pinion Gear	
		Number of Teeth	22
		Diameter	4.062 In. (103 mm)
		Total Backlash	0.010 - 0.020 In. (0.25 - 0.51 mm)
		Main Gear	
		Number of Teeth	61
		Diameter	10.50 In. (267 mm)
		Total Backlash	0.010 - 0.020 In. (0.25 - 0.51 mm)





## 4-3. TROUBLE ANALYSIS TABLES (Sheet 1 of 2)

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
PUMP DRIVE		
No response from pump drive engine running	Defective drive shaft assembly.	Replace the drive shaft.
	Defective spur gears.	Replace gears.
Pump drive running hot	Insufficient or incorrect lubricant.	Check level, fill with proper type and grade of lubricant.
	Bearing seizure.	Replace bearings.
Loss of lubricant	Overfilled with lubricant.	Drain and fill with correct amount of lubricant.
	Loose hold down cap screws.	Tighten cap screws.
	Obstructed vent.	Clean vent.
	Defective pinion bearing shim.	Replace Shim.
	Lubricant foams excessively.	Drain and fill with correct type and grade of lubricant.
Excessive Noise	Insufficient or incorrect lubricant.	Check level, fill with proper type and grade of lubricant.
	Chipped gear teeth.	Replace Gear.
	Scored roller bearings.	Replace Bearings.
TRANSMISSION		
Troubleshooting information can be found in the Sundstrand Hydrostatic Transmission Service Information, included in this Section.		
TRANSFER CASE		
Noise	Insufficient or incorrect lubricant.	Check level, fill with proper type and grade of lubricant.
	Chipped gear teeth.	Replace gear.
	Scored roller bearing.	Replace bearing.
Loss of Lubricant	Overfilled with lubricant.	Drain and fill with correct amount of lubricant.
	Loose hold down cap screws.	Tighten cap screws.
	Obstructed vent.	Clean vent plug.
	Defective pinion bearing shim.	Replace shim.
	Lubricant foams excessively.	Drain and fill with correct type and grade of lubricant.





## 4-4. CHECKS AND ADJUSTMENTS

### A. Hydrostatic Transmission

#### (1) Pressure Override Control

The pressure override control is used in conjunction with the Sundstrand heavy duty variable displacement pump equipped with a displacement control valve. The pressure override control will override the displacement control at a predetermined system pressure (3900 - 4000 PSI/269 - 276 bars), known as the override pressure.

#### (2) Override Pressure Adjustment (See Figure 4-1 and 4-2)

(a) With the machine off, remove the right-side cover of the engine compartment, exposing the transmission pump.

(b) Verify that the by-pass valve (towing valve) is fully closed.

(c) Remove the hex plug from the manifold block (opposite the by-pass valve). Connect a test pressure gauge at the plug port. Use a gauge that will register a minimum of 5000 PSI (350 bars).

(d) Apply the park brake and start the engine.

(e) Apply full forward control to build up sufficient pressure to register on the test gauge. The gauge should indicate 3900 - 4000 PSI (269 - 276 bars) pressure.

(f) If the gauge is not within the normal pressure range, adjust the pressure as required. Turn the adjusting screw on the override control valve clockwise to increase pressure or counterclockwise to decrease pressure.

(3) For additional transmission information, refer to the Sundstrand Hydrostatic Transmission Service Information.

### B. Transfer Case

Once the transfer case is properly installed, no checks or adjustments are required other than scheduled preventive maintenance.

## 4-5. GENERAL DESCRIPTION

### A. Pump Drive

The pump drive is engine mounted. It transmits power from the engine through a gear train to drive the hydraulic pump, and hydrostatic transmission pump.

### B. Hydrostatic Transmission

Refer to the Sundstrand Hydrostatic Transmission Service Information Bulletin for all transmission checks and adjustments. The Bulletin is included in this Section following the EIMCO information.

### C. Transfer Case

(1) The transfer case consists of an annealed cast steel housing, a gear train and other constituent parts.

(2) The primary function of the transfer case is to transmit the power generated by the hydrostatic transmission to the driveline and front differential. The transfer case also provides a support for the hydrostatic motor.

## 4-6. PUMP DRIVE

### A. Pump Drive Removal (See Figure 4-3 and 4-4.)

(1) Remove the engine. Refer to Subsection 3-7.

(2) Place the engine on a suitable engine stand.

(3) Remove the drain plug from the pump drive and drain the oil.

(4) Disconnect the hydraulic lines to the oil cooler and remove the cooler from the pump drive.

(5) Remove the hydraulic pump and the hydrostatic transmission pump. Refer to Subsection 6.

(6) Remove the engine starter from the engine.



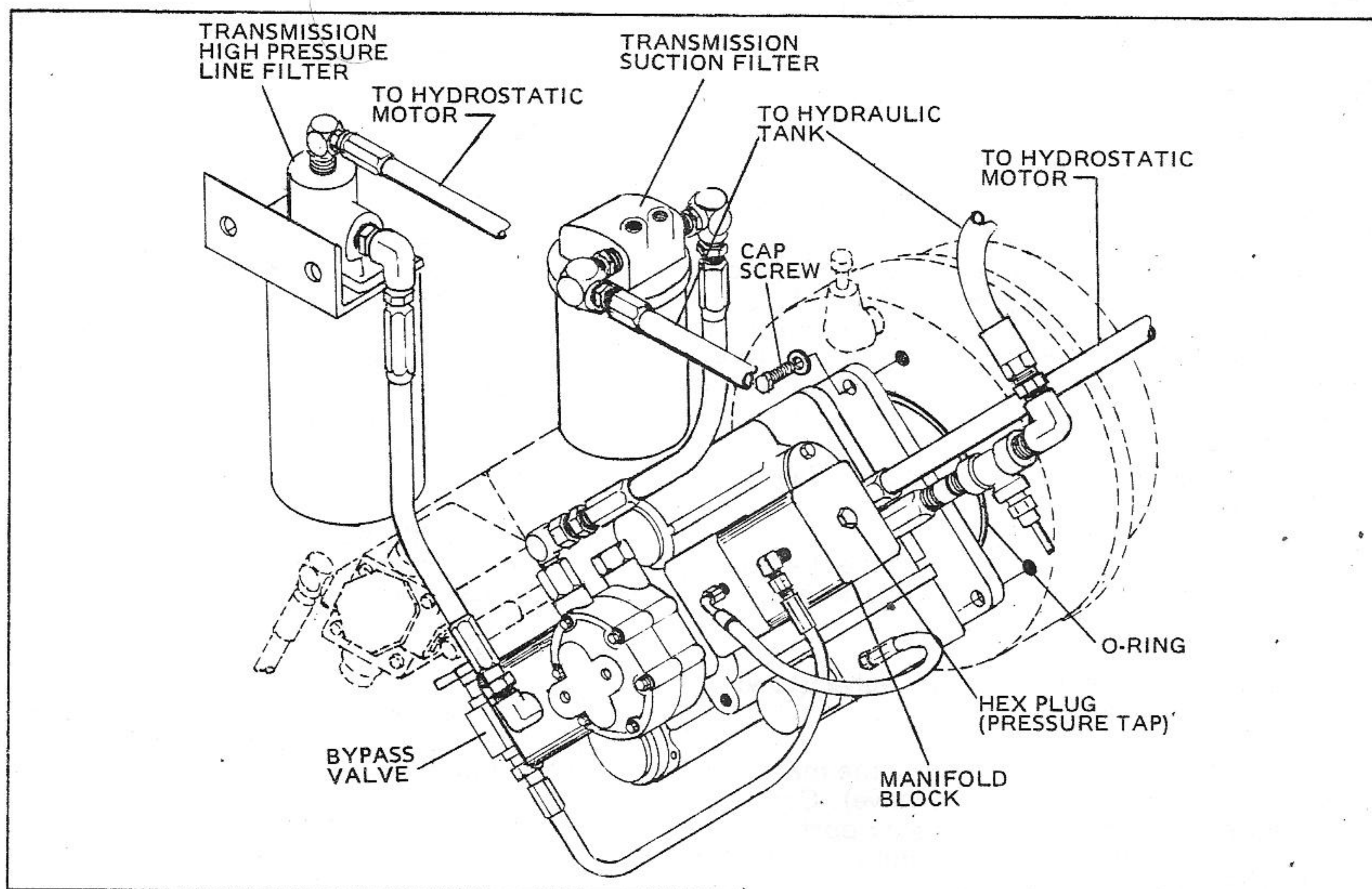


FIGURE 4 - 1. TRANSMISSION PUMP INSTALLATION

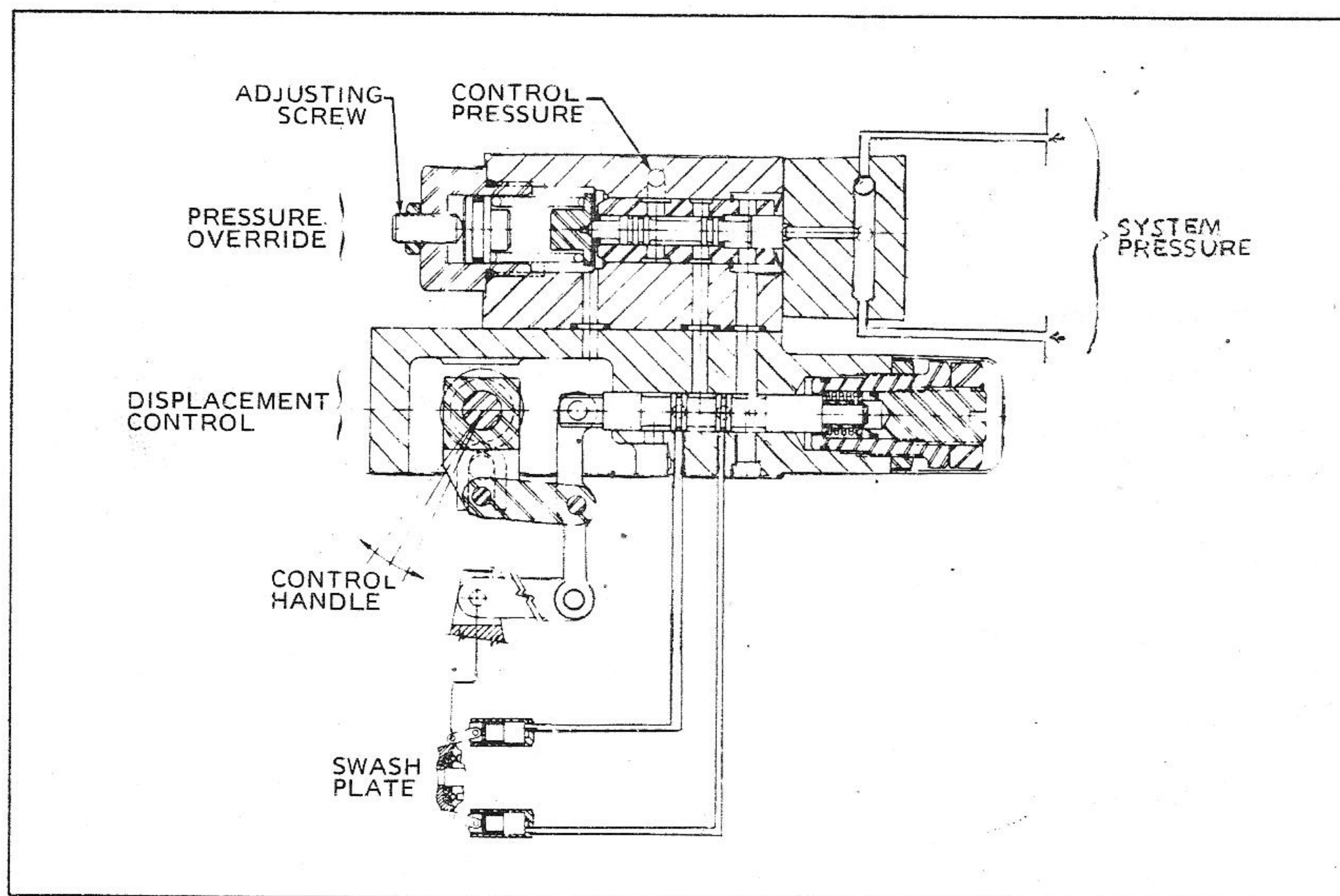
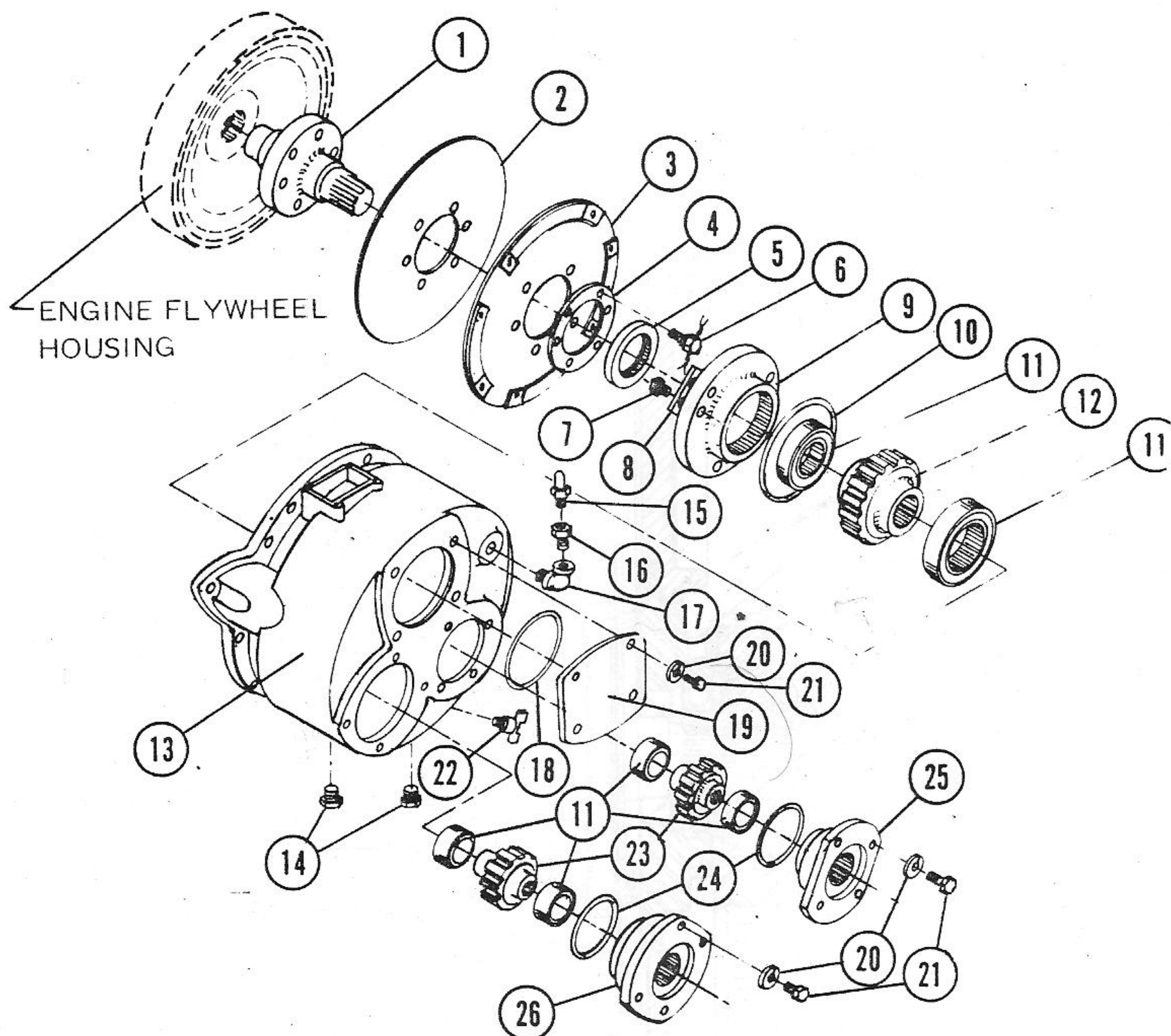


FIGURE 4 - 2. DISPLACEMENT CONTROL AND PRESSURE OVERRIDE VALVES





- |                             |                      |
|-----------------------------|----------------------|
| 1. SHAFT & SLEEVE ASSEMBLY  | 16. BUSHING, REDUCER |
| 2. DISC, FLEXIBLE           | 17. ELBOW, 90°       |
| 3. DISC & WASHER ASSEMBLY   | 18. O-RING           |
| 4. PLATE                    | 19. COVER            |
| 5. SEAL                     | 20. LOCK WASHER      |
| 6. CAP SCREW WITH LOCK WIRE | 21. CAP SCREW        |
| 7. CAP SCREW                | 22. PETCOCK          |
| 8. LOCKPLATE                | 23. GEAR             |
| 9. CARTRIDGE                | 24. O-RING           |
| 10. O-RING                  | 25. CARTIRDGE        |
| 11. BEARING                 | 26. CARTIRDGE        |
| 12. GEAR                    |                      |
| 13. BOX, PUMP DRIVE GEAR    |                      |
| 14. PLUG                    |                      |
| 15. VENT PLUG               |                      |

FIGURE 4 - 3. PUMP DRIVE, EXPLODED VIEW



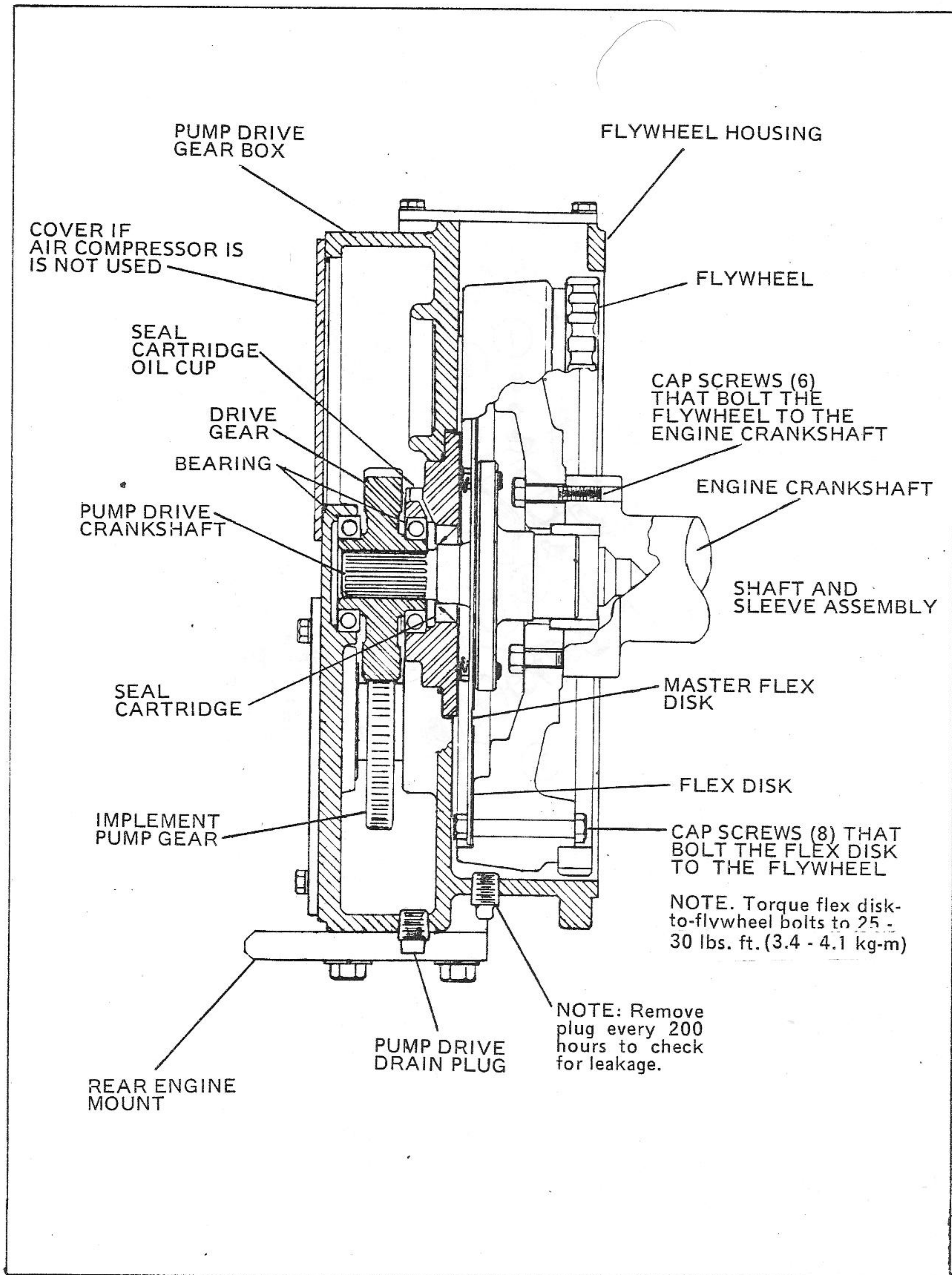


FIGURE 4 - 4. PUMP DRIVE INSTALLATION





(7) Partially support the pump drive with an overhead hoist or jack stand.

(8) Remove the eight cap screws that secure the flex disc to the flywheel housing.

(9) Separate the pump drive gear box from the engine.

#### **B. Inspection**

(1) Wash all bearings thoroughly in dry-cleaning solvent or volatile mineral spirits. Place bearings on a clean surface and let dry. Never dry bearings with compressed air or spin bearings when they are not lubricated.

(2) Inspect bearings for wear by spinning them with one hand, after they have been cleaned and lubricated. If the bearings are rough or noisy, they should be replaced.

(3) Inspect and replace all spur gears and drive shaft for chipped teeth, radial cracks or other signs of wear.

(4) Inspect all components of the pump drive for burnt spots or warping.

(5) Replace all seals and O-rings.

#### **CAUTION**

**WHEN REINSTALLING THE CENTER CARTRIDGE OF THE PUMP DRIVE, INSTALL THE CARTRIDGE WITH THE OIL POCKET UP. THE OIL SEAL IN THE CARTRIDGE MUST BE INSTALLED WITH THE LIP POINTED TOWARD THE PUMP DRIVE.**

#### **C. Pump Drive Installation**

(1) Assemble the flex discs to the drive shaft.

### **4-7. TRANSMISSION**

#### **A. Transmission Motor Removal**

(1) Gain access to the transmission motor from the pivot area. Park the machine with the bucket end turned to a full right or left turn.

(2) Remove the driveline. Refer to Section 5.

(3) Disconnect the control linkage at the motor shifter.

(4) Disconnect the case drain line, control pressure line, two pilot lines and two high pressure drive lines from the transmission motor.

#### **CAUTION**

**TAG AND CAP ALL DISCONNECTED HY-**

Make sure that the outer bolt holes in the discs line up perfectly with each other before tightening the six cap screws. The cap screws must be lock wired.

(2) Slip the shaft and sleeve assembly into the pilot bore in the end of the engine crankshaft.

(3) Bolt the flex discs to the flywheel with the cap screws inserted through the starter opening.

(4) Rotate the engine flywheel with a bar inserted through the holes in the outer perimeter of the flywheel.

(5) Do not tighten these eight cap screws at this time. Wait until the pump drive housing is bolted to the engine.

(6) With all components of the pump drive assembled in the pump drive gear box, fit the gear box to the flywheel housing.

(7) Bolt the pump drive housing to the flywheel housing.

(8) Rotate the pump drive gear two complete revolutions before torquing the flywheel to flex disc cap screws through the starter opening. Torque the cap screws 25 - 30 ft.lbs. (3.4 - 4.1 kg-m).

#### **CAUTION**

**EXCESS TIGHTENING OF THE FLEX DISC TO FLYWHEEL CAP SCREWS WILL DISTRESS THE MATING NUTS.**

(9) Fill the pump drive with oil through the filler elbow until it emerges from the oil level plug opening.

#### **HYDRAULIC LINES FOR PROPER INSTALLATION.**

(5) Partially support the motor and remove the four cap screws that attach the motor to the transfer case.

#### **WARNING**

**THE TRANSMISSION MOTOR WEIGHS APPROXIMATELY 174 LBS. (79 KG). USE CAUTION WHEN REMOVING THE MOTOR FROM THE MACHINE.**

(6) Remove the motor from the machine.





## B. Transmission Motor Inspection

Visually check the motor for any leakage at all flanges. Tighten, repair or replace as required. Should it become necessary to perform repairs to the transmission motor, refer to the Sundstrand Hydrostatic Transmission Service Information included in this section for detailed information.

### NOTE

CLEANLINESS IS MOST IMPORTANT. ANY ITEM RELATED TO THE TRANSMISSION MUST BE CLEAN. ALL TOOLS, HOSES, CONTAINERS, ETC. MUST BE PROTECTED FROM CONTAMINENTS.

## C. Transmission Motor Installation (See Figure 4-5)

- (1) Install the O-ring in the groove on the transmission motor drive shaft end.

### NOTE

THE SPLINES ON THE MOTOR DRIVE SHAFT MUST ALIGN WITH THE SPLINE GROOVES ON THE TRANSFER CASE PINION.

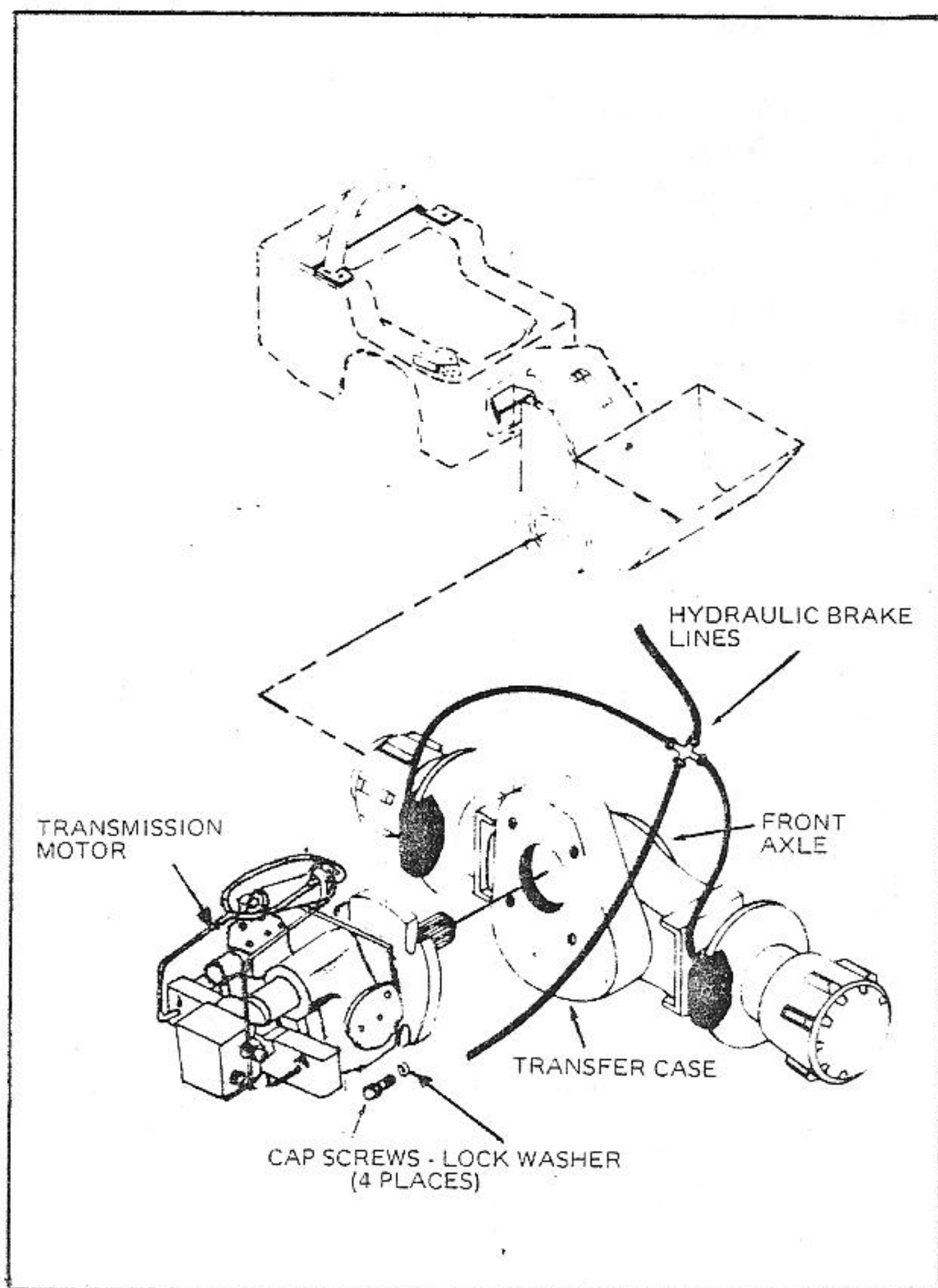


FIGURE 4 - 5. TRANSMISSION MOTOR INSTALLATION

- (2) Position the transmission motor for installation and install it to the transfer case with four cap screws. Torque the cap screws to 75 ft.-lbs. (10 kg-m).

- (3) Connect the case drain line, control pressure line, two pilot lines and two high pressure drive lines to the transmission motor.

- (4) Connect the control linkage to the motor shifter cylinder. The transmission motor lever should have an adjustment travel of 9/16 inch (14 mm) for maximum and minimum displacement. (See Figure 4-6.)

### CAUTION

FILL MOTOR WITH OIL BEFORE STARTING.

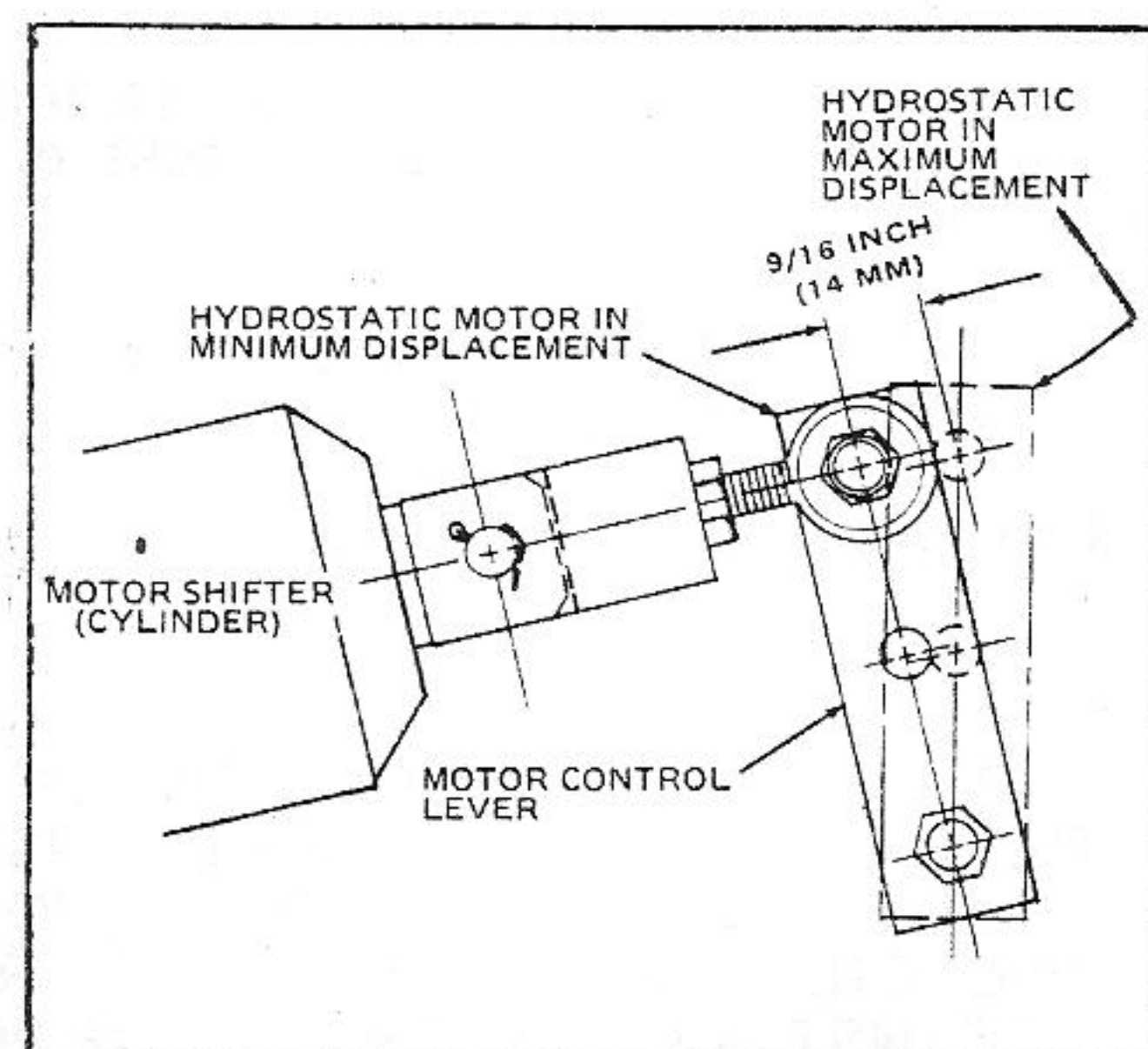


FIGURE 4 - 6. MOTOR SHIFTER ADJUSTMENT

## D. Transmission Pump Removal (See Figure 4-7)

- (1) Park the machine with the motor end and bucket end in line.
- (2) Open the engine hood and access door.
- (3) Remove the cap screws that attach the right-side cover to the engine compartment and remove the cover.
- (4) Verify that the hydraulic system pressure is depleted by operating the hydraulic controls and observing the gauge.
- (5) Work through the access door opening and right-hand cover opening to disconnect the transmission pump.
- (6) Disconnect the case drain line, control pressure line, two high pressure drive lines, tank supply line, return line and the transmission temperature gauge lead from the transmission.



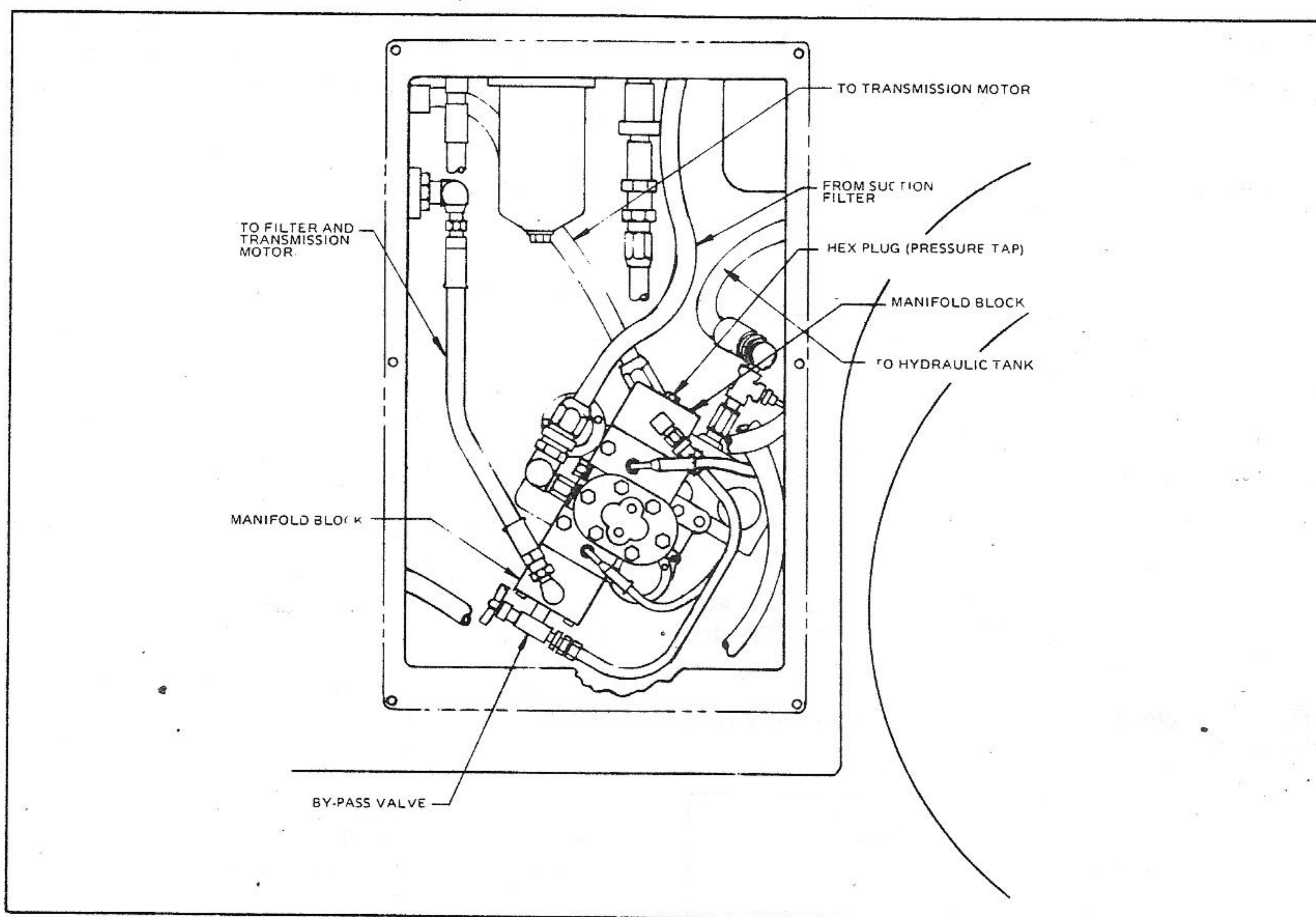


FIGURE 4 - 7. TRANSMISSION PUMP INSTALLATION

#### CAUTION

TAG AND CAP ALL DISCONNECTED HYDRAULIC LINES FOR PROPER REASSEMBLY.

(7) Place a wooden plank under the transmission pump. Pry up on the plank to partially support the pump.

(8) Remove the four cap screws that anchor the pump drive housing.

(9) Separate the pump from the pump drive housing and slide the pump on the wooden plank out the right-side cover opening.

#### E. Transmission Pump Inspection

Visually check for any fluid leakage. Tighten, repair or replace as required. Should it become necessary to perform repairs to the transmission pump, refer to the Sundstrand Hydrostatic Transmission Information included in this section.

#### NOTE

CLEANLINESS IS MOST IMPORTANT. ANY ITEM RELATED TO THE TRANSMISSION

MUST BE CLEAN. ALL TOOLS, HOSES, CONTAINERS ETC. MUST BE PROTECTED FROM CONTAMINENTS.

#### F. Transmission Pump Installation

#### WARNING

BEFORE REINSTALLING THE TRANSMISSION PUMP, VERIFY THAT THE O-RING ON THE DRIVE SHAFT END IS INSTALLED.

(1) Pass the transmission pump through the right-side cover opening to reinstall.

(2) Align the shaft of the transmission pump with the pump drive gear and mate the transmission pump to the pump drive housing.

(3) Secure the transmission pump to the pump drive housing with four cap screws. Torque the cap screws to 80 to 85 ft. lbs. (11 to 12 kg-m).

(4) Connect the case drain line, control pressure line, two high pressure drive lines, tank supply line, oil return line and the transmission temperature gauge lead to the transmission pump.

#### CAUTION

FILL THE PUMP WITH OIL BEFORE STARTING;





(5) Start up the machine to build up hydraulic system pressure. Check all connections to the transmission pump for signs of leakage.

#### 4-8. TRANSFER CASE

##### A. Removal (See Figure 4-8 and 4-9)

- (1) Remove the front axle. Refer to Section 5.
- (2) Remove the transmission motor from the transfer case. Refer to Subsection 4-6.
- (3) Confirm that the transfer case oil is drained. Remove the cap screws that attach the case to the cover.
- (4) Separate the case from the cover.
- (5) Remove the lock wire and six cap screws that secure the transfer case cover to the differential housing.
- (6) Remove the cover from the differential housing.

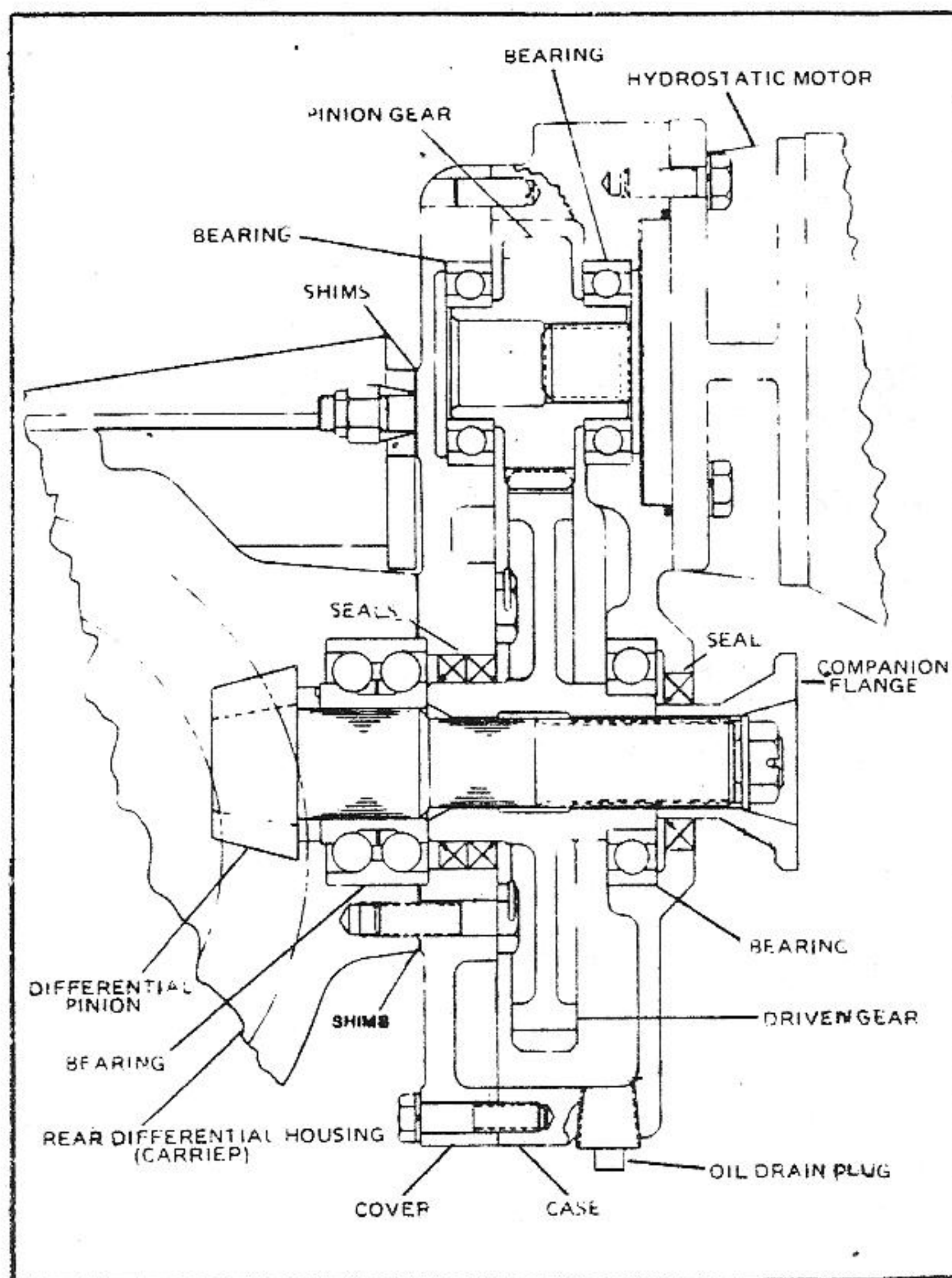


FIGURE 4 - 8. TRANSFER CASE, CROSS-SECTIONAL VIEW

##### B. Transfer Case Inspection

- (1) Clean all parts in a suitable solvent and wipe dry. Place the transfer case bearings in a wire basket (or equivalent) and suspend the basket

in a suitable container with clean petroleum solvent or kerosene and allow the bearings to soak, preferably overnight.

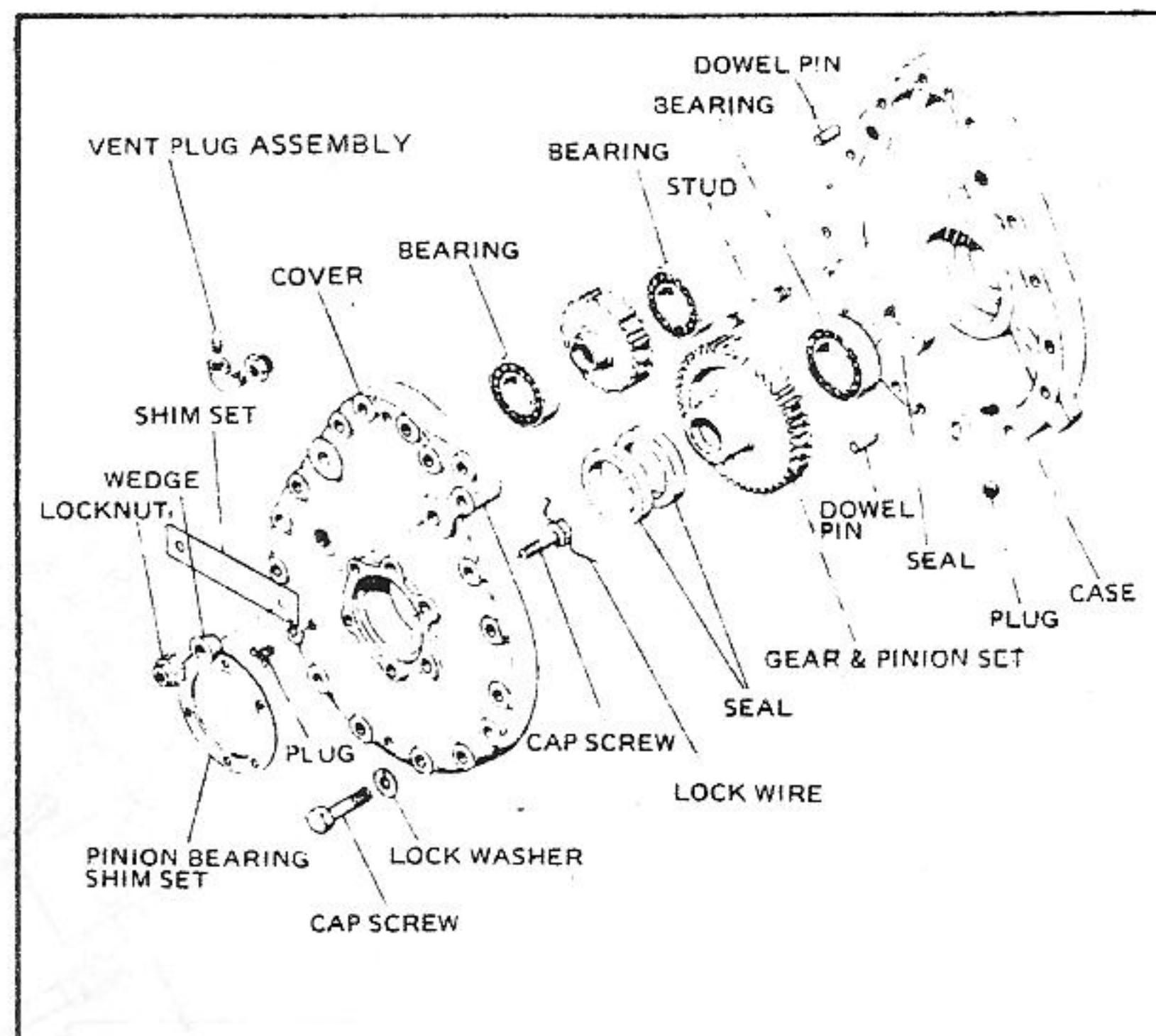


FIGURE 4 - 9. TRANSFER CASE, EXPLODED VIEW

- (2) Turn the bearings slowly and work with a brush to dislodge chips or solid particles before finally spinning the bearings partially submerged in solvent.
- (3) After the bearings have been cleaned, they should be spun in light oil in order to remove the solvent completely. If compressed air is used to dry bearings, they must not be allowed to spin during the blowing.
- (4) Inspect the cover and case for nicks, burrs and cracks. If cracks are present, replace the part. Burrs may be removed with a fine or medium stone.
- (5) Inspect the pinion and drive gear. Gears which are worn, ridged, pitted or scored, should be replaced.
- (6) Check the bearings for pitting, rust, scorches and freedom of movement. Replace defective bearings.
- (7) Discard seals and replace with new ones.

##### C. Transfer Case Installation (See Figures 4-8 & 4-9)

##### CAUTION

SHIMS BETWEEN THE COVER AND CARRIER ASSEMBLY PROVIDE 0.003 TO 0.005 INCH (0.0762 TO 0.127 MM) END PLAY FOR THE DIFFERENTIAL PINION BEARING. THIS ADJUSTMENT MUST BE MADE WHENEVER THE TRANSFER CASE, DIFFERENTIAL PINION GEAR OR BEARINGS ARE REPLACED.





(1) Bolt the transfer case cover to the differential housing without shims installed and the mating surfaces between the cover and carrier clean and dry.

(2) Measure the gap between the cover and carrier with a feeler gauge at both sides of the housing. This measurement plus 0.003 inch (0.0762 mm) is the thickness of the shims that should be used between the transfer case cover and carrier.

(3) Unbolt the cover from the differential housing and install the two seals into the cover. Install one seal to prevent oil in the differential from going into the transfer case and the other seal to prevent oil in the transfer case from going into the differential.

(4) Use Permatex No. 3 (or an equivalent non-hardening gasket cement) on the mating surfaces of the differential housing and cover (both sides of shims).

(5) Before installing the cover with the correct thickness of shims, one of the bottom cap screws that bolt the cover to the transfer case housing must be installed. This cap screw cannot be installed after the cover is bolted in place because of interference by a differential housing rib.

(6) Bolt the cover to the differential housing and torque the six bolts to 150 ft.-lbs. (20.8 kg-m). Lock wire the cap screws.

(7) Shims are also required between the cover and the mounting bracket which is welded to the axle. Determine the shim thickness required after the transfer case cover is installed.

(8) The ball bearings are pressed onto both ends of the pinion gear and onto the outer end of the driven gear. Install the pinion gear so that the shaft serrations are on the hydrostatic motor side and the smooth shaft side is toward the differential.

(9) Use Permatex No. 1 (or an equivalent hardening gasket cement) between the cover and case (no gasket). Install the cap screws that secure the cover to the case. Torque the 1/2 inch UNC cap screws to 60 ft.-lbs. (8.3 kg-m).

(10) The companion flange has internal splines and it slips over the differential pinion splines. The seal in the case seals around the companion flange. Be certain that the sealing lip points inward to keep the oil in.

(11) Torque the companion flange nut to 130 - 170 ft.-lbs (18 - 24 kg-m) then back off the nut to the nearest notch where a cotter pin can be installed.

## **4-9 MOTOR SHIFTER ADJUSTMENT**

### **A. Procedure**

Adjust the linkage between the motor shifter and the hydrostatic motor control lever as follows:

(1) Disconnect the linkage from the end of the motor shifter rod. When disconnected, the motor control lever should swing towards the valve end of the hydrostatic motor after engine is started. This places the hydrostatic motor in the low range position.

(2) With the machine positioned against a bank or a rib and the park brake applied, have a helper start the engine and operate it at one-half speed. Observe the motor shifter rod while the helper operates the direction control pedal. The rod should extend when the control is pushed in the forward and reverse positions and retract completely when the pedal is released.

(3) With the motor shifter rod retracted completely and the motor control lever in the low range position, measure the distance from the center of the motor shifter rod hole to the center of the clevis or linkage hole. To obtain maximum tractive effort in low range and maximum high speed range this dimension should be 9/16 inch.

**NOTE: THE MOTOR CONTROL LEVER WILL MOVE FURTHER THAN THE 9/16 INCH REQUIRED, BUT THIS WILL ONLY UNWIND THE CONTROL LEVER SPRING. SUCH AN ADJUSTMENT WOULD PREVENT THE TRANSMISSION FROM BEING SHIFTED COMPLETELY INTO LOW RANGE.**

(4) Tighten clevis lock nuts.

(5) Pull the motor control lever towards the motor shifter and connect the linkage to the cylinder rod with pin and cotter pin.

## **4-10 ATTACHMENTS**

### **A. SUNDSTRAND HYDROSTATIC TRANSMISSION SERVICE INFORMATION**



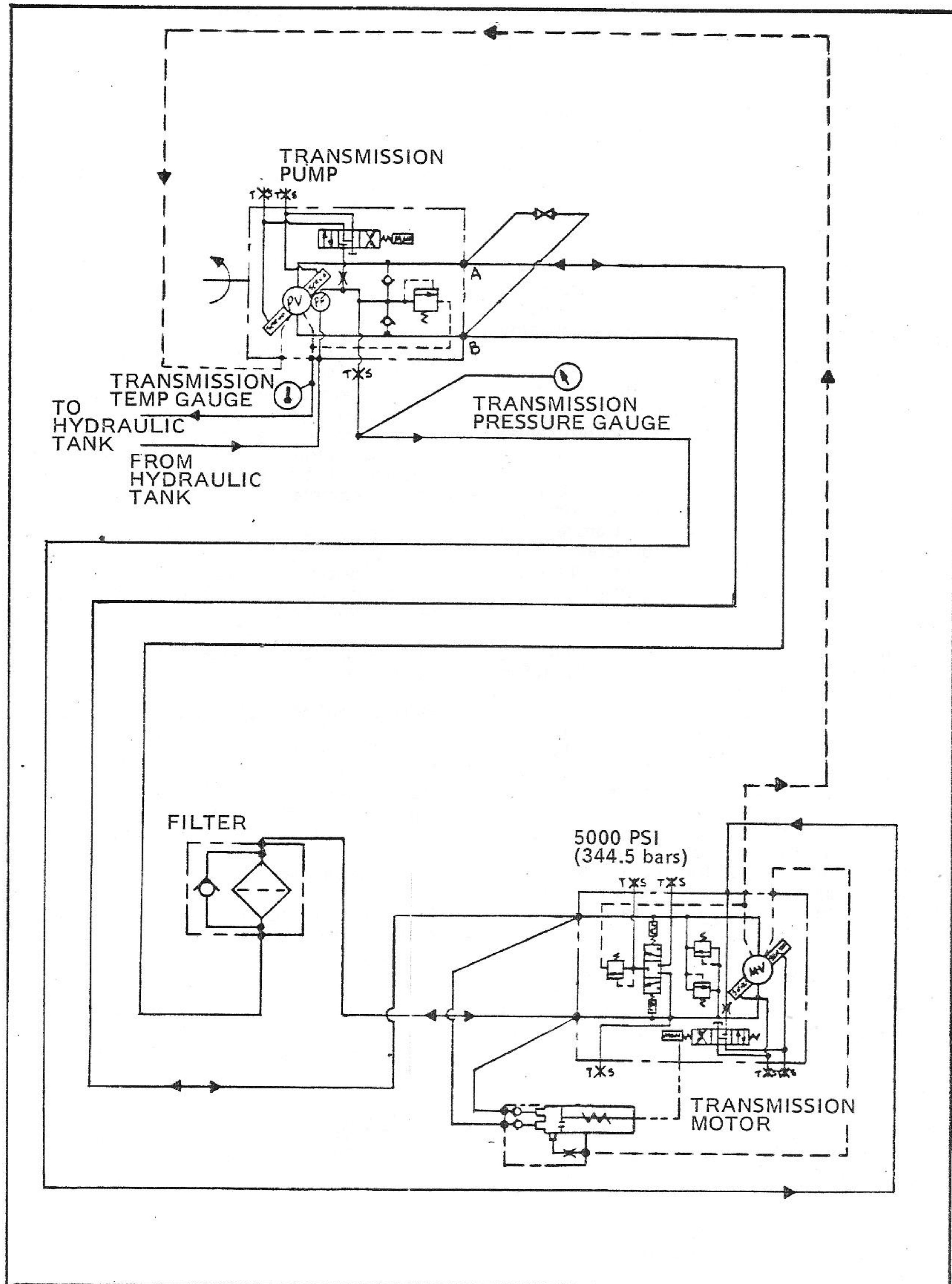


FIGURE 4 - 10. HYDROSTATIC TRANSMISSION