SECTION V
GEARBOX

• Introduction

The gearbox is a housing for three gears that are attached to other units; therefore, there is no shop maintenance other than cleaning, inspection, and the replacement of one oil seal.

1. Removal

a. Disconnect the PTO shaft coupling and slide the PTO shaft back.
b. Disconnect both transmission control linkages.
c. Remove six transmission attaching bolts from each transmission and remove both transmissions.
d. Release setscrew and remove forward half of PTO shaft coupling from drive shaft.
e. Remove 5 gearbox attaching bolts and remove gearbox.

2. Inspection

Inspect the casting for cracks, evidence of warpage, and cuts or scratches on sealing surfaces. Inspect the shaft seal for excessive wear.

3. Repair

No repair of gearbox is recommended. Replace shaft seal.

4. Replacement

Use all new gaskets.

a. Set gearbox in place and install gearbox attaching bolts. Tighten to 22 to 32 ft. lb. (3.1 to 4.3 Kg m) torque.
b. Set each transmission in place and install six attaching bolts. Tighten evenly all around, then torque to 30 to 35 ft. lbs. (4.15 to 4.84 Kg m).
c. Connect transmission controls (See Section VI).
d. Install forward half of PTO shaft coupling.
e. Install PTO shaft.

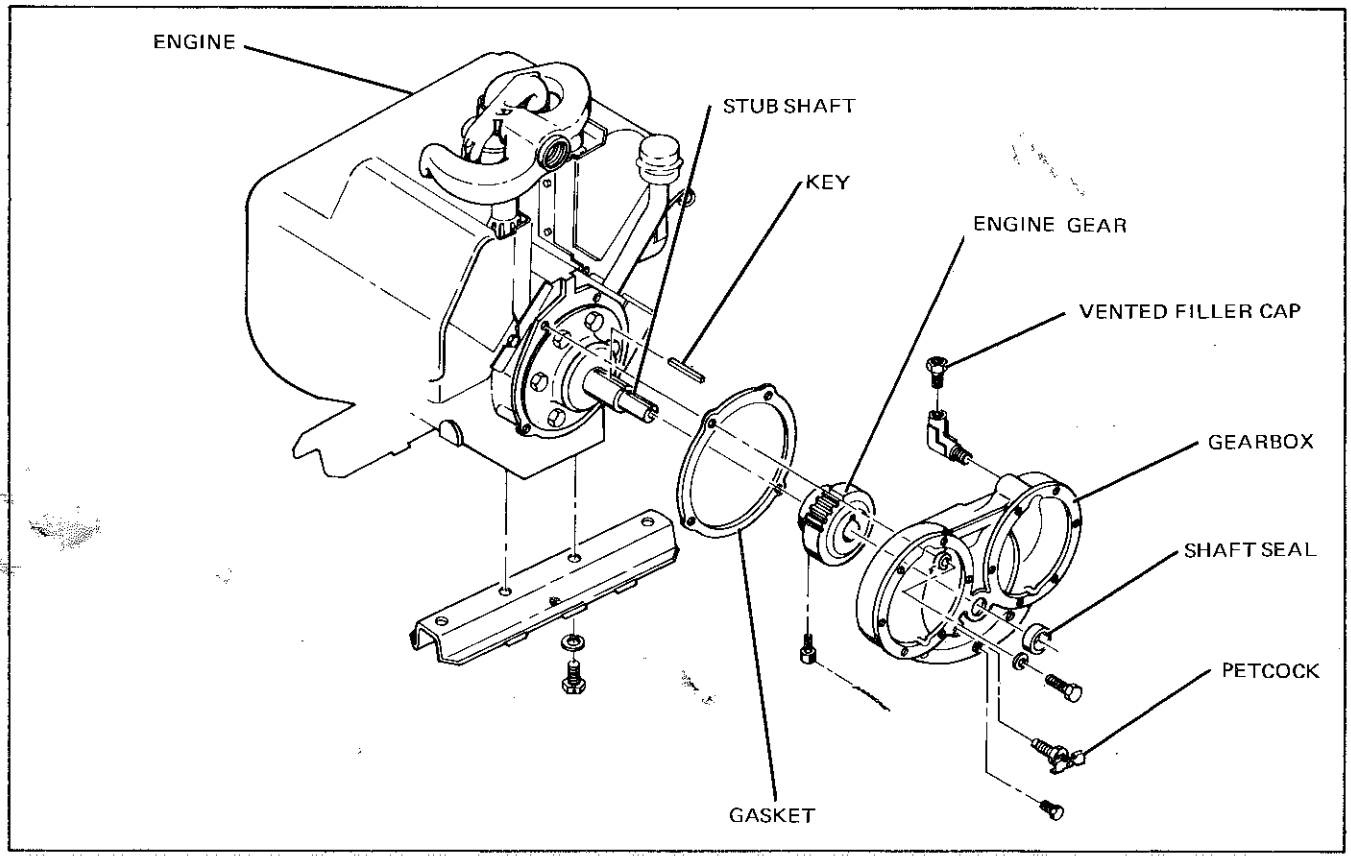


Figure V-1 Gearbox Installation

SECTION VI
TRANSMISSIONS AND HYDRAULICS

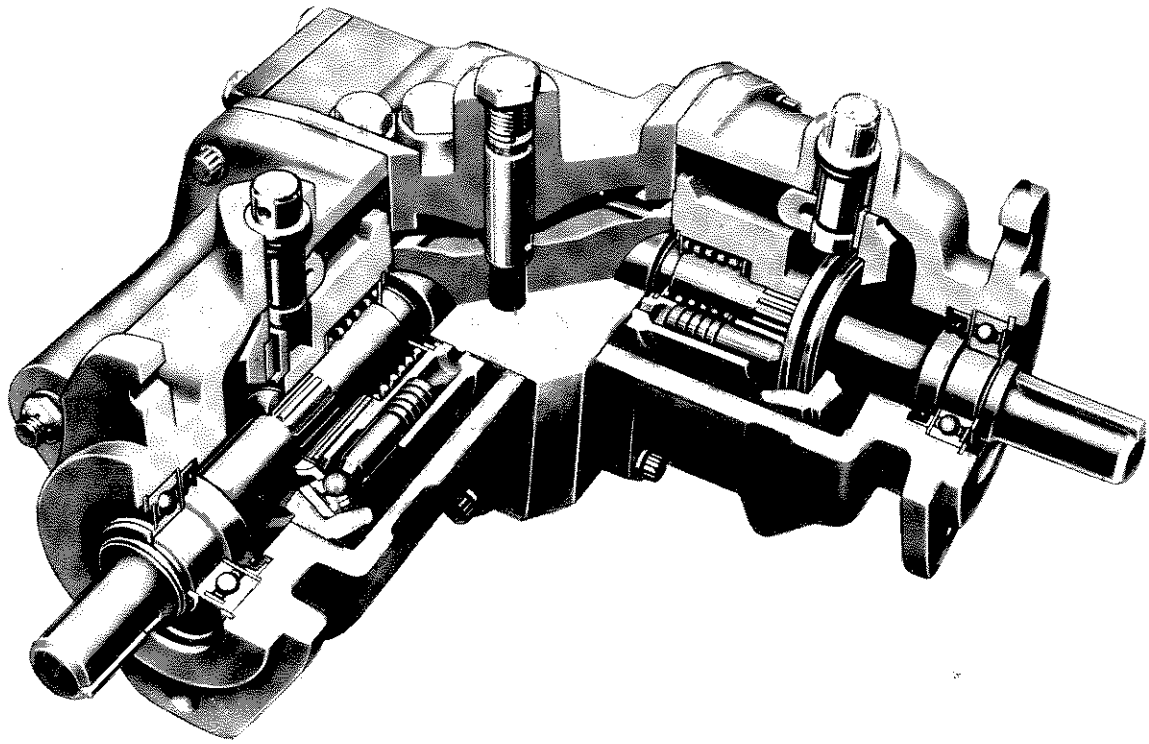


Figure VI-1 HYDROSTATIC TRANSMISSION

• Hydrostatic Transmissions

A. PURPOSE

This section describes basic operational characteristics of the Vickers Model T1515Y hydrostatic transmission unit and, in addition, provides service and latest design overhaul information.

B. GENERAL INFORMATION

The unit is designated as a right-angle, axial-piston transmission, and is made up of three smaller units: the hydrostatic pump, the hydrostatic motor, and the valve plate, which also contains the auxiliary or replenishing pump. The assembly of the hydrostatic transmission is shown in Figure VI-1. The major components of the units are the housing, drive shaft, rotating group, swash plate, valve plate, and a yoke which governs the angle of the swash plate and controls the stroke length of each piston. The pump and motor share a common valve plate which conducts the high pressure oil from pump to motor. This plate contains the auxiliary pump and all necessary closed-loop circuit valving, and rear bearings for shaft support. Before breaking a hydraulic circuit connection, ascertain that ignition is off and system pressure is released.

CAUTION: Block vehicle if it is on a slope. The transmission will not act as a parking brake.

Block any load that could cause pressure generation. Completely drain the fluid from the hydraulic system. Add new fluid to the system upon reassembly. Do not reuse the, Before disassembling the hydrostatic transmission, cap or plug all ports fluid removed from the system.

During overhaul, plug all system ports and cap all lines to prevent entry of dirt. During disassembly, pay particular attention to identification of parts, especially those of the rotating group.

C. DESCRIPTION

CAUTION: Cleanliness is of the utmost importance. Serious damage or poor operation can result if foreign matter enters the system.

Before disassembling the hydrostatic transmission, cap or plug all ports and thoroughly clean the outside of the unit. Cap or plug all disconnected hydraulic lines. Each of the transmission subassemblies should be disassembled individually. Do not disassemble the transmission unit any further than necessary to accomplish the repair. Special tools for the overhaul of the hydrostatic transmission are as follows (See Figure VI-2).

1. Bearing puller
2. Shaft seal drive
3. Bearing puller
4. Torque wrench (150 ft. lbs.)
5. Number 5 Truarc (90°) pliers
6. Number 21 Truarc (straight) pliers
7. Number 22 Truarc (90°) pliers
8. Number 23 Truarc (90°) pliers
9. Number 24 Truarc (90°) pliers

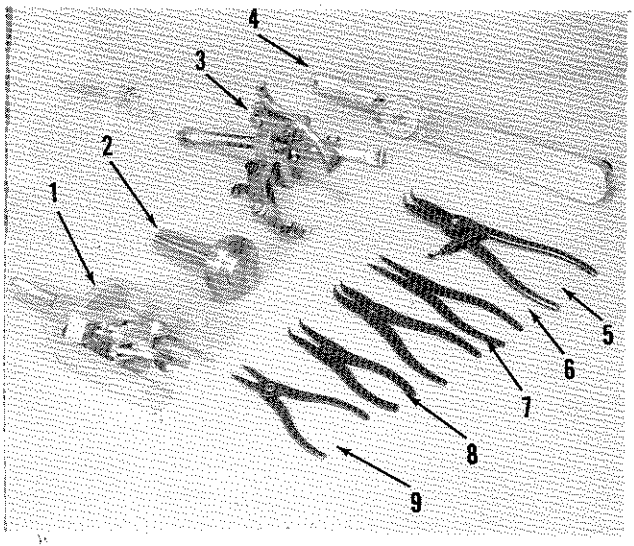


Figure VI-2. Transmission - Special Tools

Figure VI-3 illustrates the transmission with the motor in the forward position. Only the motor shaft bearing is covered with a grease shield. Due to the method of mounting the transmission to the gearbox, the pump bearing is lubricated by the gearbox fluid, but the motor bearing is not.

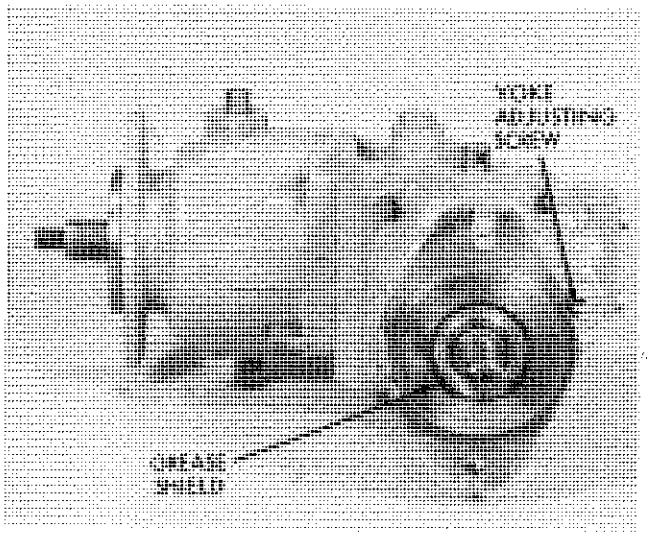


Figure VI-3. Transmission Assembly - Motor in Forward Position

Therefore, the motor bearing and grease shield must be packed with grease 1/2 to 1/3 full prior to assembly (Aeroshell #5 or equivalent). The external adjusting screw for the motor yoke minimum displacement setting is located at the right of the motor mounting flange.

NOTE: Field adjustment of the motor yoke minimum displacement stop is not recommended.

Figure VI-4 illustrates the valve plate in the forward position, the replenishing pump, and four port connections. The port located on the small cover is the replenishing pump outlet. The replenishing loop inlet is located above and to the left.

NOTE: The replenishing pump low pressure relief valve is in the replenishing loop inlet port.

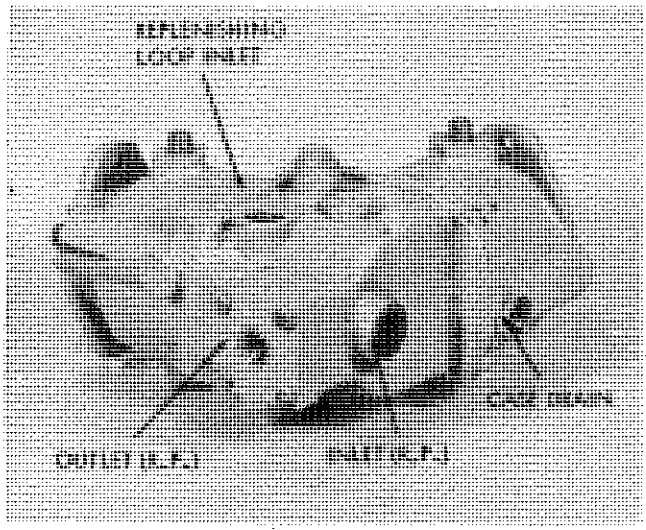


Figure VI-4. Transmission Assembly - Valve Plate in Forward Position

The replenishing pump inlet is located on the right hand side as indicated. The case drain port is located on the lower right of the pump housing.

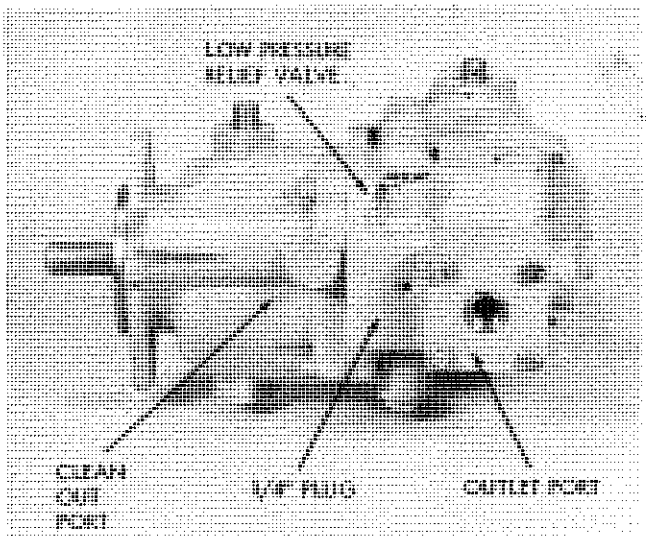


Figure VI-5. Transmission Assembly - Replenishing Pump in Forward Position

Figure VI-5 illustrates a side view of the motor and a front view of the replenishing pump. The outlet port on the replenishing pump is connected to the implement cylinder control valve. The large plug on top covers a clean-out port used in manufacturing the unit. A pressure gauge can be installed at this port to measure transmission working pressure. This is the only purpose of the port. A 1/4-inch plug is located at the left of the replenishing pump outlet. Replenishing pump pressure is measured at this port using a gauge to indicate the pressure in the transmission closed loop. This closed loop pressure should be 30 to 65 PSI (2.1 to 4.6 Kg/sq. cm) depending on the back pressure in the circuit between the transmission and the reservoir. The port shown open at the top contains a low pressure relief valve that is ported back to the reservoir from the outlet side.

Figure VI-6 illustrates an assembled hydrostatic transmission with a pump and a motor connected to a valve

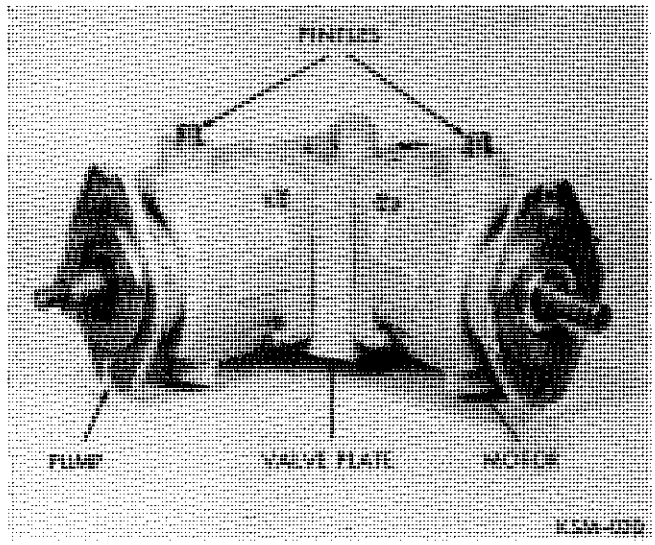


Figure VI-6. Transmission Assembly - Valve Plate Mounting

plate. The control pintles at the top of the pump and motor each control the movement of a yoke in the pump and in the motor. Lever control arms are connected to the control pintles. The KID transmission utilizes both pintles on each transmission for flexibility of mounting.

D. DISASSEMBLY

1. Removal of Hydrostatic Pump and Motor from Valve Plate (Figure VI-7).

a. Remove the four mounting bolts connecting the hydrostatic pump to the valve plate.

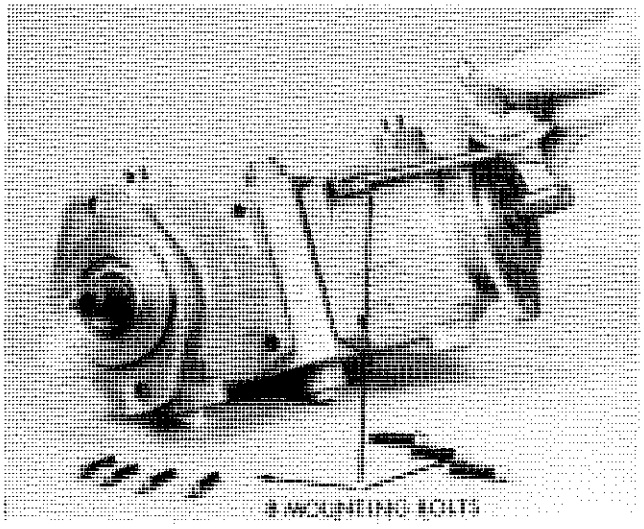


Figure VI-7. Removal of Hydrostatic Pump From Valve Plate

b. Remove the four mounting bolts connecting the hydrostatic motor to the valve plate.

NOTE: Except for the limit screw control of the motor yoke, disassembly of the motor and pump is the same. Both units are disassembled in the same sequence.

NOTE: Do not interchange pump parts and motor parts.

2. Removal of Transmission Gaskets

Figure VI-8 illustrates the three separate subassemblies. The piston pump is shown at the left. The valve plate, which includes the vane-type replenishing pump and the relief and replenishing valves, is shown in the center. The piston motor is shown at the right. All exposed machined surfaces

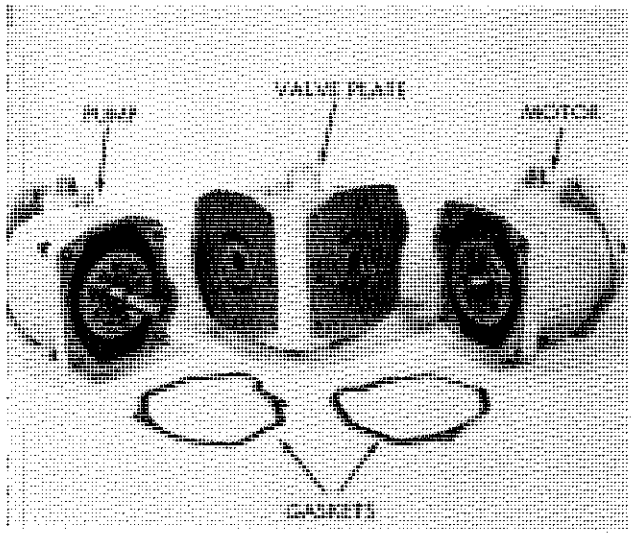


Figure VI-8. Transmission Units and Gaskets

should be protected from being scratched or nicked. New gaskets should be used between the valve plate and the pump and motor housings.

3. Removal of Low Pressure Relief Valve Assembly (Figure VI-9)

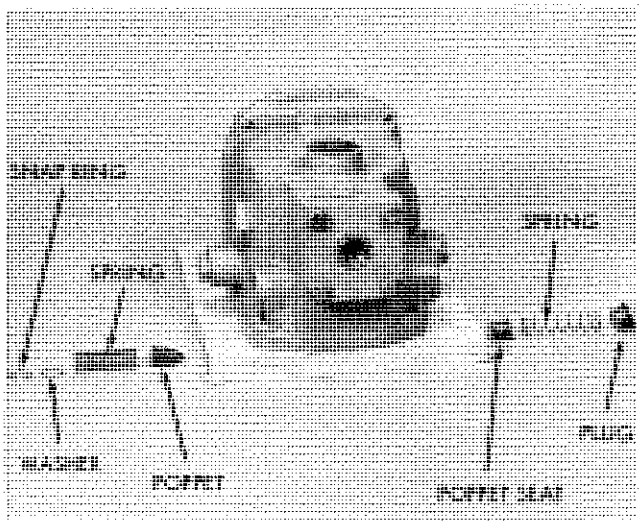


Figure VI-9. Removal of Low Pressure Relief Valve Assembly

a. Place the valve plate on a clean, unpainted wood surface with the replenishing pump facing you.
b. Remove the nearest plug on the right side, then the spring and poppet seat.
c. Remove the snap ring from the port opposite on the left side and slip out the washer, spring, and poppet.

4. Removal of Replenishing High Pressure Relief Valve (2) (Figure VI-10)

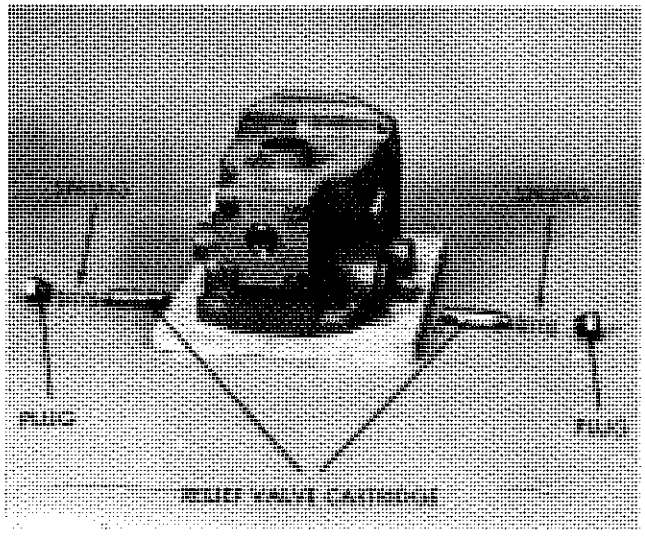


Figure VI-10. Removal of Replenishing High Pressure Relief Valves (2)

a. Remove plugs on the right and left side of the valve block.
b. Remove springs and cartridges.

CAUTION: The cartridges are factory assembled, and the maximum pressure setting is preset and not adjustable. They CANNOT be repaired in the field. A new cartridge must be used for repair.

5. Disassembly of Replenishing Pump (Figures VI-11 and VI-12)
a. Remove the four cover screws to release the cover and pressure plate spring.
b. Remove pressure plate, ring, rotor and vanes, wear plate, locating pins, drive shaft, and the two O'ring seals.

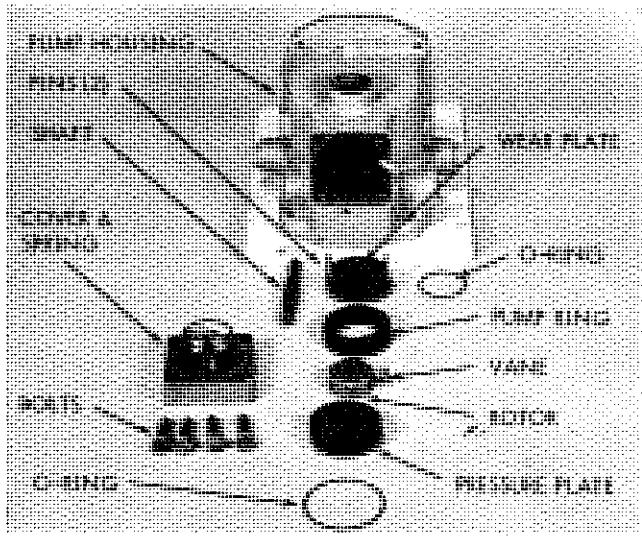


Figure VI-11. Disassembly of Replenishing Pump

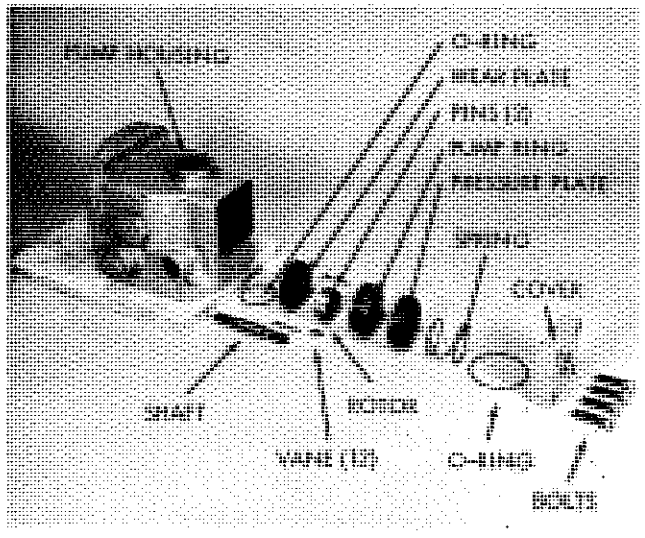


Figure VI-12. Disassembly of Replenishing Pump

NOTE: When repairing the vane-type replenishing pump, a complete cartridge should be used. The cartridge consists of the ring, rotor, vane kit (12 vanes) and O'ring seals.

Particular attention should be given to the direction of rotation of the pump. It should be noted that the arrow on the perimeter of the ring should point in the proper direction of rotation. (Rotation of pump is as viewed from the shaft end.) There is also an arrow on the replenishing pump cover indicating the direction of rotation. The arrow on the cover and ring should agree.

6. Removal of Coupling Sleeve
Remove coupling sleeve as shown in Figure VI-13.

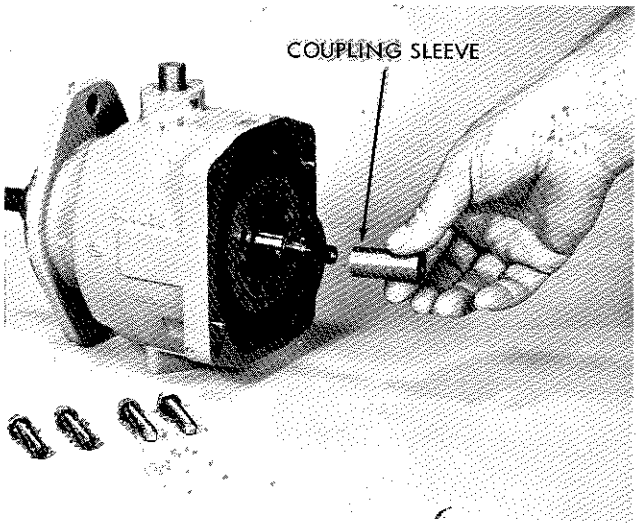


Figure VI-13. Removal of Coupling Sleeve

7. Removal of Snap Ring from Pump Shaft
Remove snap ring from pump shaft with Truarc snap ring pliers as shown in Figure VI-14.

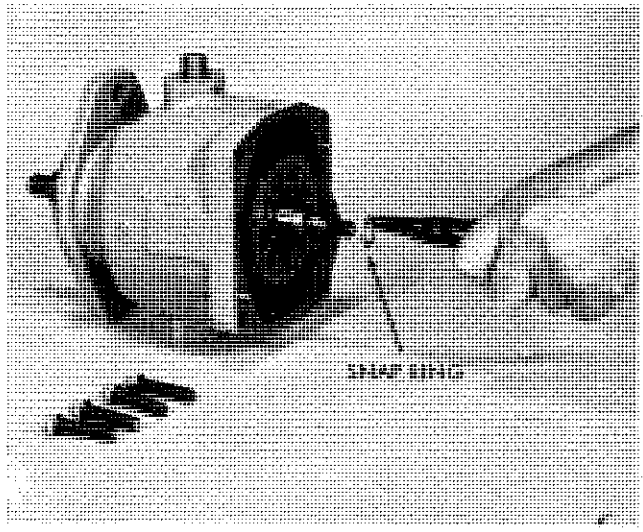


Figure VI-14. Removal of Snap Ring from Pump Shaft

8. Removal of Bearing Coupling Sleeve
Remove bearing coupling sleeve as shown in Figure VI-15.

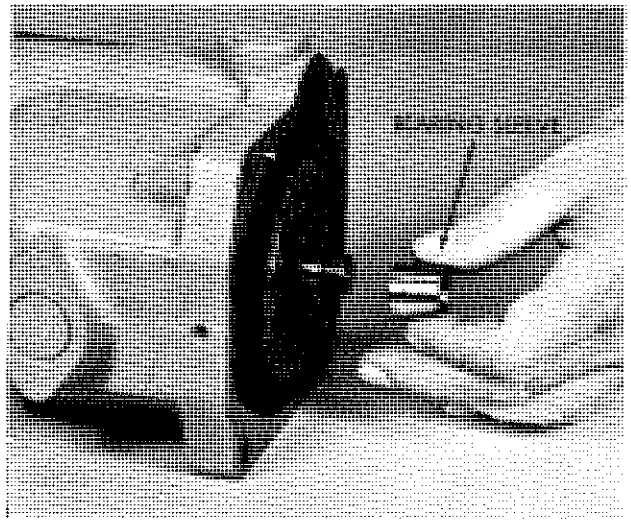


Figure VI-15. Removal of Coupling Sleeve

9. Removal of Rotating Group Assembly (Figure VI-16)

a. Carefully remove rotating group assembly, consisting of cylinder block and piston sub-assembly.

b. Hold the complete cylinder block-piston-shoe sub-assembly together to avoid separation while removing the pump.

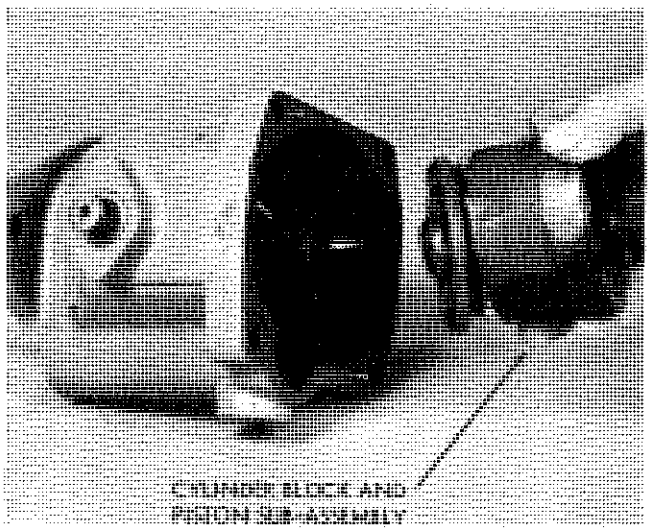


Figure VI-16. Disassembly of Rotating Group Assembly

10. Disassembly of Rotating Group Assembly (Figure VI-17)

a. Place rotating group on a clean surface, being careful

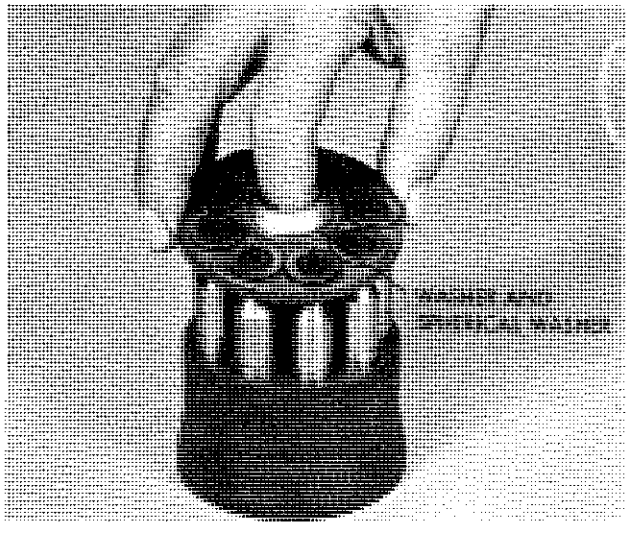


Figure VI-17. Disassembly of Rotating Group Assembly

not to drop or scratch the running surfaces of the assembly. Then with index finger (as shown in Figure VI-17), hold washer and spherical washer in place.

b. Remove piston sub-assembly from cylinder block by lifting straight up, still holding washers in place with index finger (Figure VI-18).

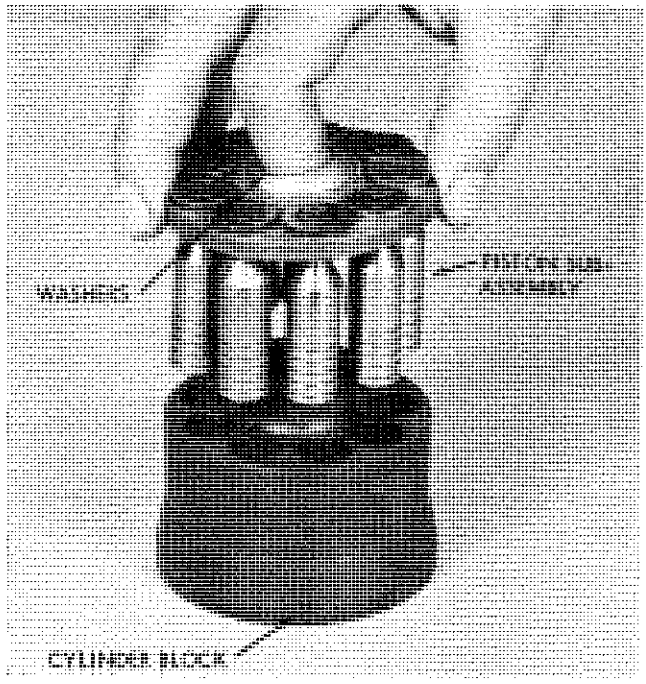
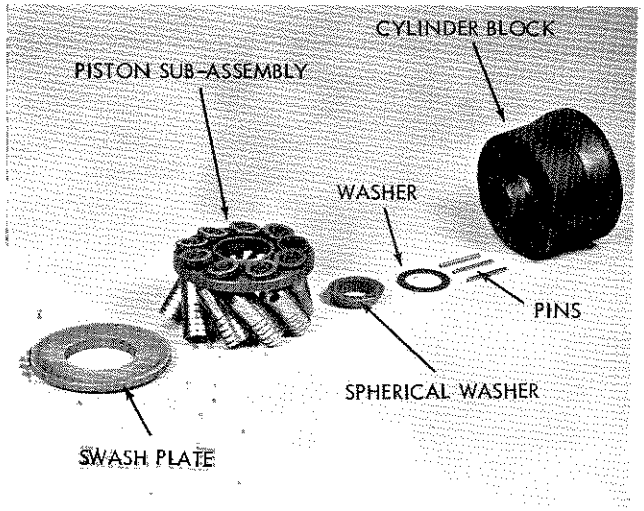


Figure VI-18. Disassembly of Rotating Group Assembly

c. Complete disassembly of rotating group assembly as shown in Figure VI-19.



KSM-033

Figure VI-19. Disassembly of Rotating Group Assembly

11. Disassembly of Cylinder Block Subassembly (Figure VI-20)

a. Disassemble the cylinder block subassembly, consisting of a snap ring, two washers, and a heavy spring.

WARNING: A bolt, nut, and two washers are used during disassembly of cylinder (Figure VI-21). Tension must be relieved prior to removal of spring from cylinder block to avoid possible injury to maintenance personnel.

b. Insert a 3/8-inch (9.53 mm) bolt, 3-1/2 inches (89 mm) long, through a 1 inch (25.4 mm) O. D. flat washer.

c. Thrust bolt through cylinder block and through second flat washer; thread nut on bolt.

d. Tighten nut until tension is removed from snap ring.

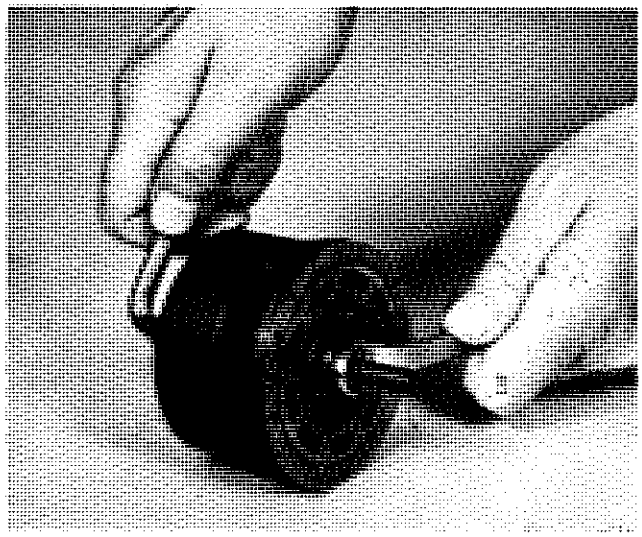


Figure VI-20. Disassembly of Cylinder Block Subassembly

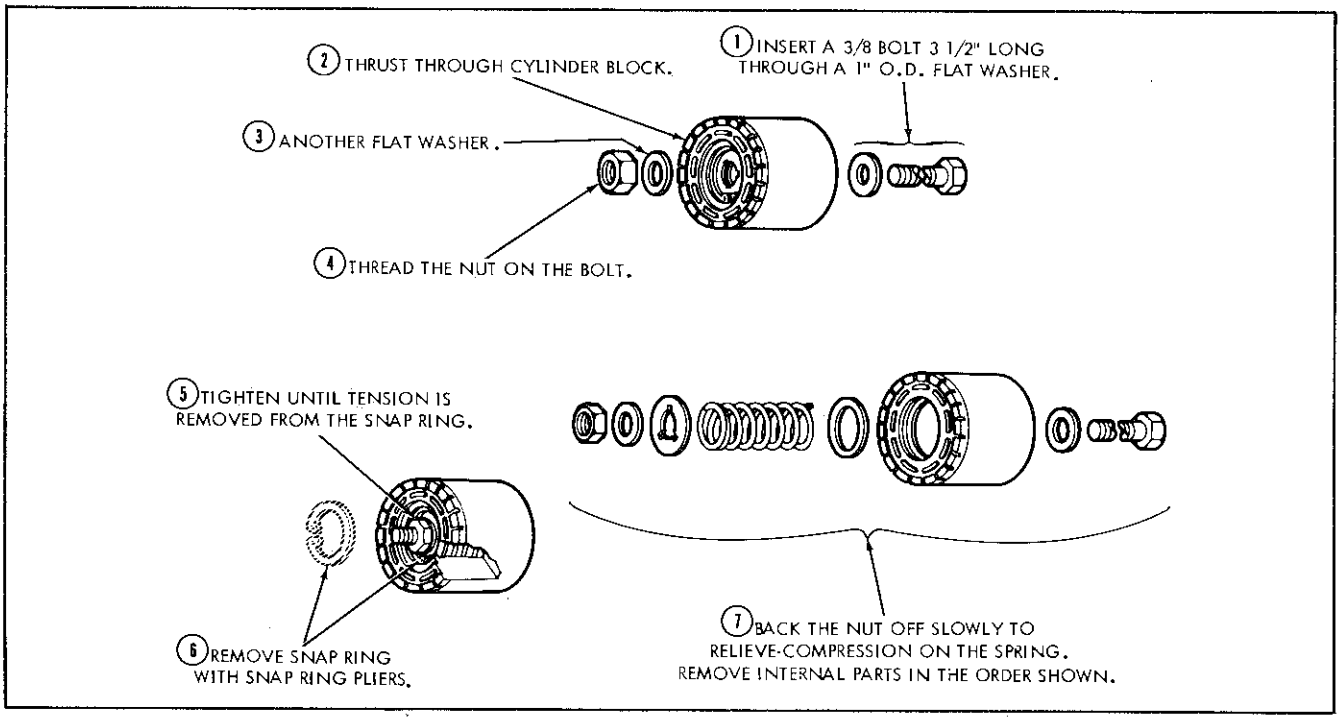


Figure VI-21. Special Tool Cylinder Block Spring Tension

12. Removal of Snap Ring

a. After compressing the spring (Figure VI-22), remove the snap ring from the cylinder block.

b. After removal of the snap ring, relieve the tension of the spring by gradually unscrewing the nut from special bolt, washers, and nut in the cylinder block.

13. Cylinder Block - Disassembled

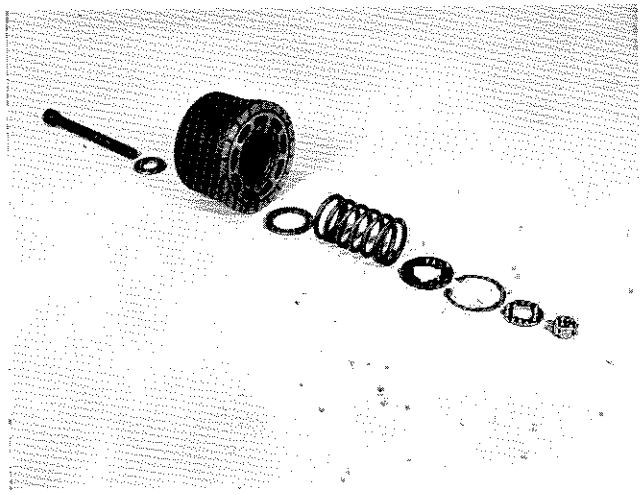


Figure VI-22. Removal of Snap Ring from Cylinder Block

NOTE: The cylinder block completely disassembled in sequence is shown in Figure VI-23. The bolts and washers at the extreme right and the nut and washer at the left is the disassembly "tool".

a. Remove special washer.

b. Remove spring and flat washer.

NOTE: The cylinder blocks and piston-shoe subassemblies of the motor and pump are side by side (Figure VI-24). There is a slight difference between pump and motor in the dimensions of the pressure land that contains the kidney-shaped ports in the cylinder block face. The pump lands are the wider. Also the holes through the center of the piston shoes on the pump pistons are a little larger than those of the motor. These dimensions affect the balance of the pump and motor, so it is important that they are not interchanged in the pump and motor.

Dimensions of hole in piston shoe:
Pump - 0.062" (1.5748 mm) diameter
Motor - 0.022" (.5588 mm) diameter

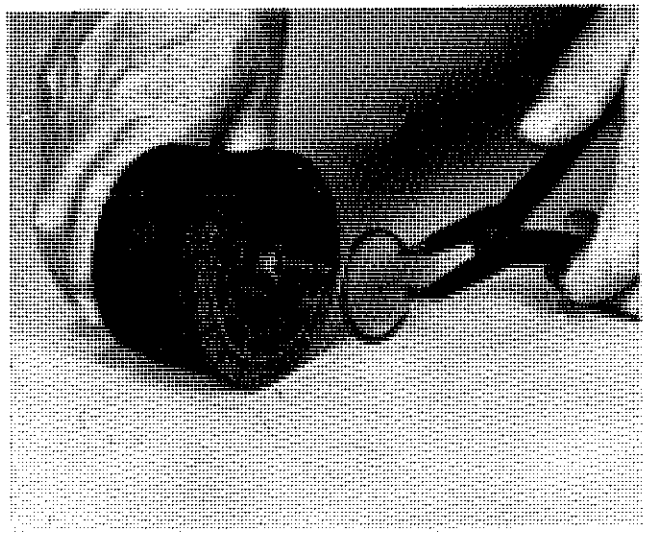


Figure VI-23. Cylinder Block Disassembled

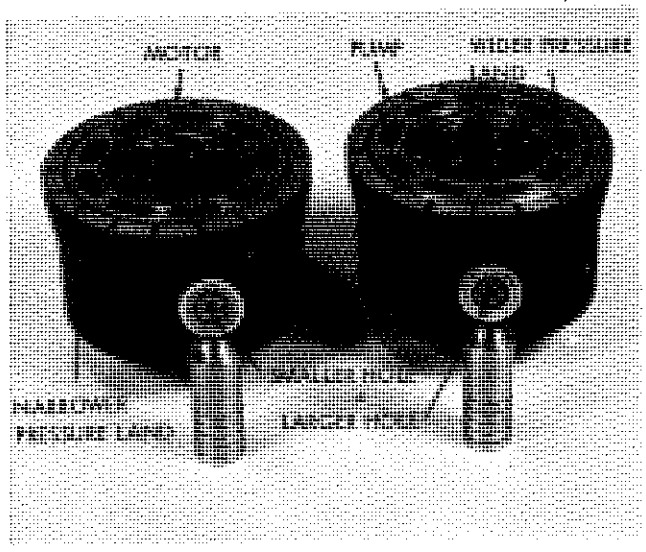


Figure VI-24. Cylinder Blocks and Pistons

14. Removal of Swash Plate (Figure VI-25)
In its assembled position, the swash plate rests in a recess of the yoke, and can be freely rotated with the finger tips. Removal may be difficult due to oil suction under the swash plate. Rotate the swash plate and pull out evenly from the yoke.

15. Removal of Shaft

a. Remove snap ring retainer using Truarc pliers (Figure VI-26).

b. After removal of the snap ring retainer, tap the shaft on the small end with a plastic tip hammer for proper removal. Remove spacer that fits between the bearing shaft seal (Figure VI-27).

c. Remove the bearing from the shaft, first removing the snap ring as shown in Figure VI-28.

d. Remove bearing with a bearing puller (or arbor press, if available). Any other method of bearing removal may damage the bearing (Figure VI-29).

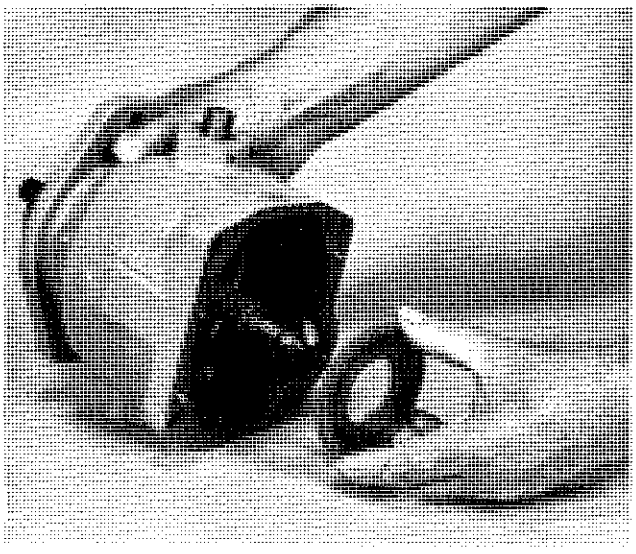


Figure VI-25. Removal of Swash Plate

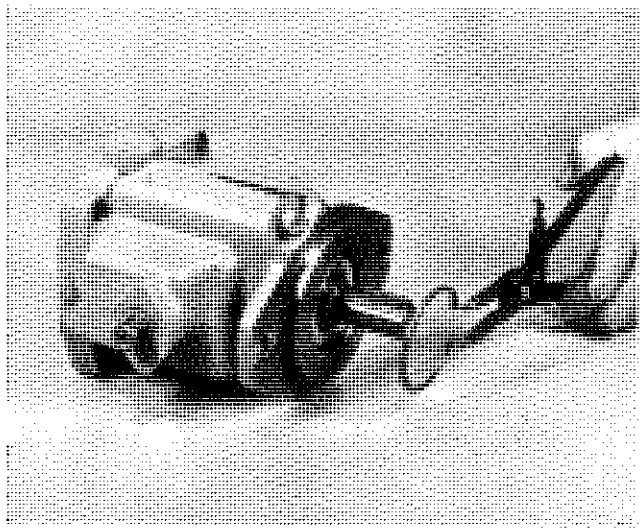


Figure VI-26. Removal of Shaft

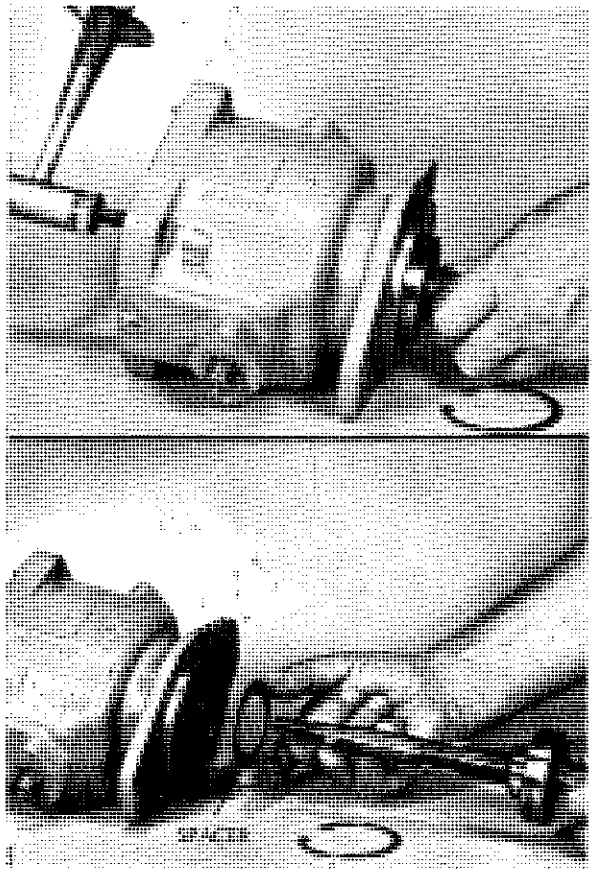


Figure VI-27. Removal of Shaft

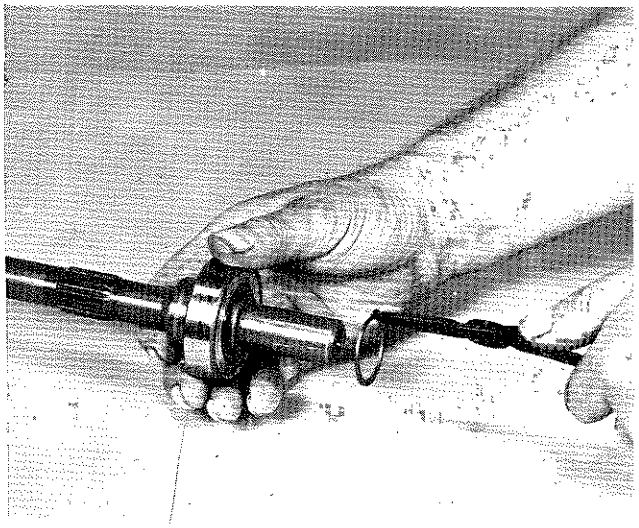


Figure VI-28. Removal of Shaft

16. Removal of Pintles and Yoke

a. Remove retaining screws from the yoke (Figure VI-30).

NOTE: The housing containing the yoke should be held firmly in a vise when removing the yoke screws because of torque necessary.

b. After removal of the yoke screws, it is possible to remove the pintles. The tools needed for this operation are a hammer and a 3/8 inch (9.53 mm) brass rod approximately 10 inches (254 mm) long. Remove pintle number 1 (Figure VI-31).

c. Remove pintle number 2 by inserting the brass rod through the hole vacated by pintle number 1 and tap it out (Figure VI-32).

d. Remove the yoke and pintles (with keys) in sequence shown in Figure VI-33.

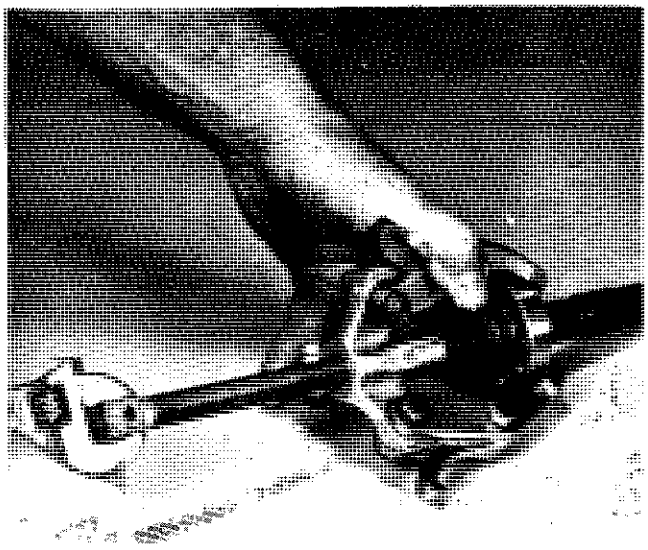


Figure VI-29. Removal of Shaft

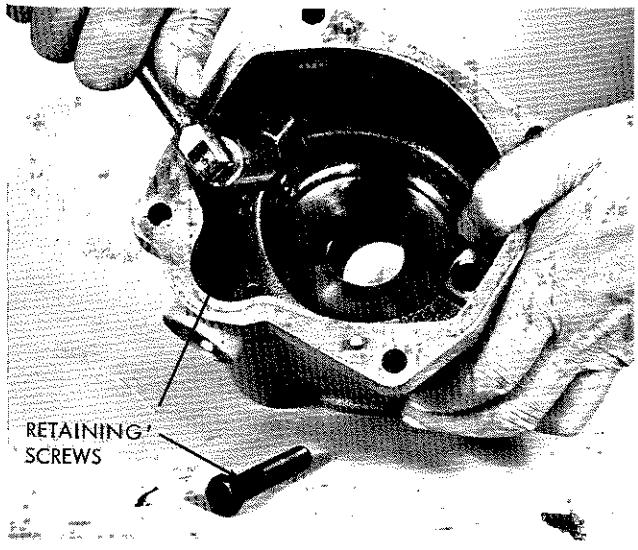


Figure VI-30. Removal of Pintles and Yoke

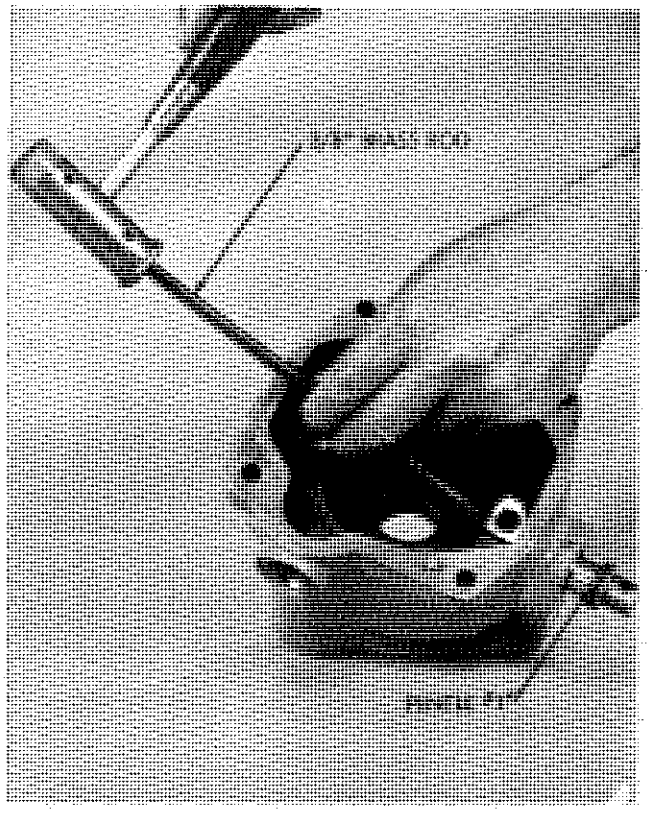


Figure VI-31. Removal of Pintles and Yoke

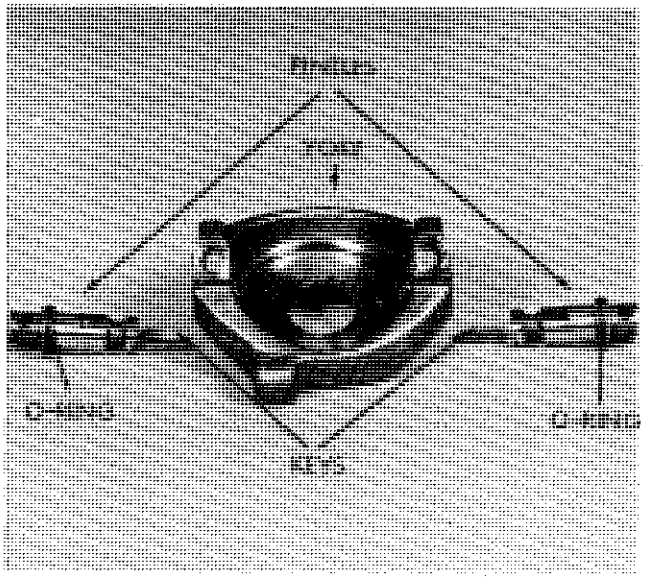


Figure VI-33. Removal of Pintles and Yoke

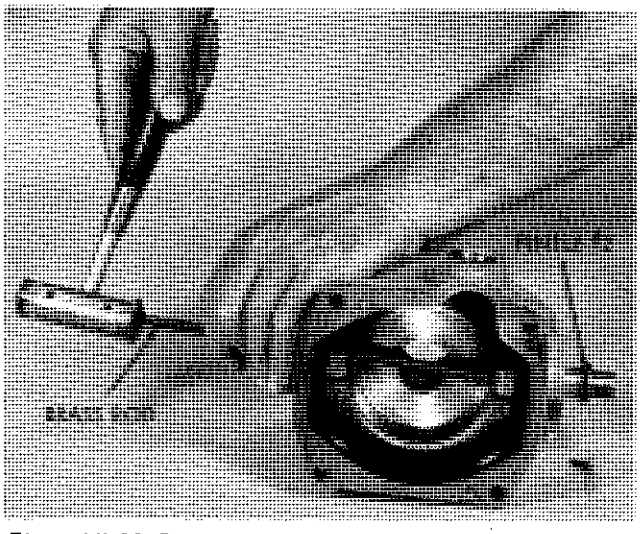


Figure VI-32. Removal of Pintles and Yoke

NOTE: Figure VI-34 shows one side of the yoke, emphasizing the keyway, key and pintle, which must be assembled with the key to lock the pintle to the yoke, so that the yoke can be positioned from outside the transmission.

e. Once the yoke and pintles are removed, it is possible to pull the pintle bearings, as required, after pintles and yoke are removed as shown in Figure VI-35.

NOTE: Figure VI-36, shows pintle bearing after removal.

17. Removal of Bearings from Valve Plates (Figure VI-37)

a. Position valve plate on piece of unpainted, smooth wood.

b. Use bearing puller to pull bearings in the valve plates. Protect against scratches or nicks during the operation.

NOTE: Use two pieces of copper or brass shim stock to protect valve plate surface from contact with bearing puller.

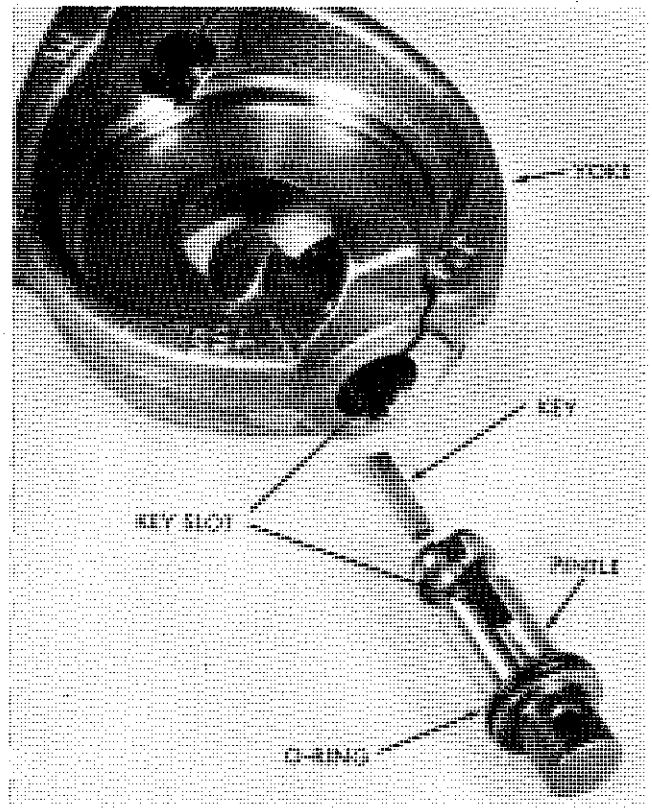


Figure VI-34. Removal of Pintles and Yoke

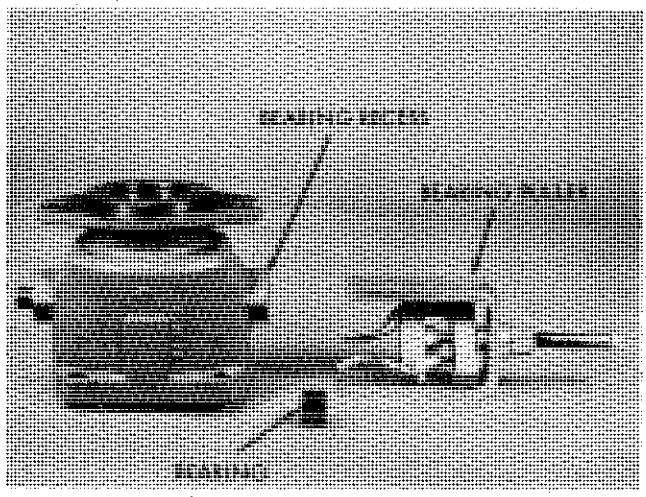


Figure VI-36. Removal of Pintles and Yoke

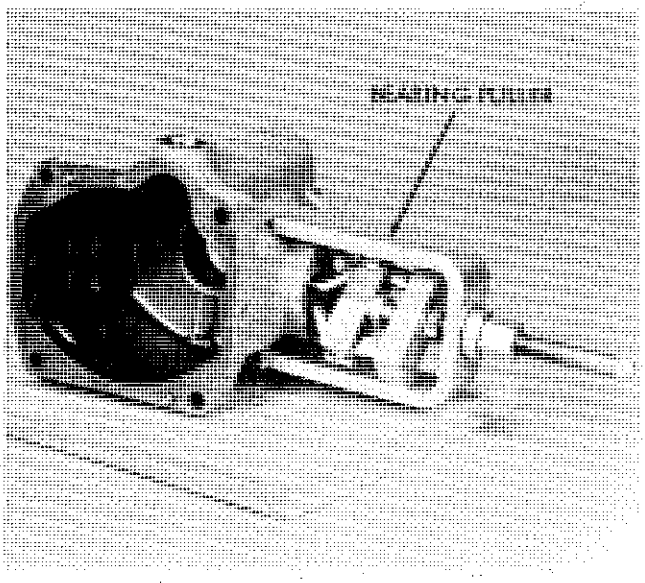


Figure VI-35. Removal of Pintles and Yoke

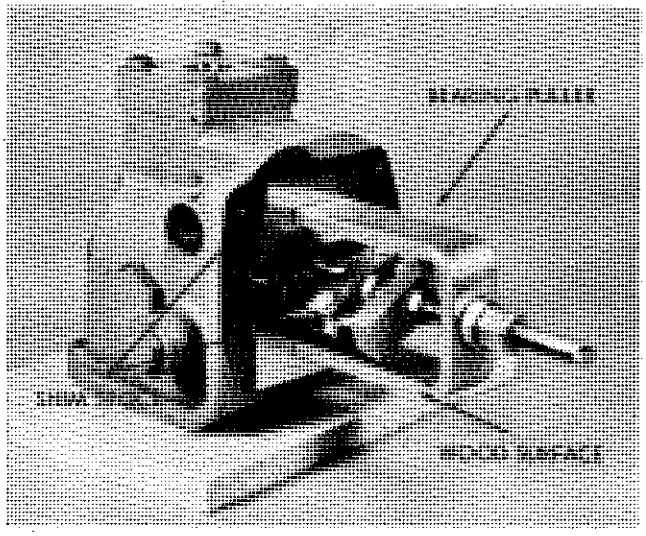


Figure VI-37. Removal of Bearings from Valve Plates

18. Removal and Replacement of Pump or Motor Shaft Seal

NOTE: If the shaft seal is to be replaced, a shaft seal driver of the proper dimension should be used. An arbor press can be used if available.

a. Position shaft seal on the driver (Figure VI-38).
b. Place the seal in position and drive it into the pump or motor housing. See Figure VI-39 for shaft seal driver dimensions.
c. After seal is in place, remove driver (Figure VI-40).
d. Shaft seal should be properly seated and bottomed out against the shoulder of the recess as shown in Figure VI-41.

The next sequence emphasizes the importance of properly torquing the screws in reassembly.

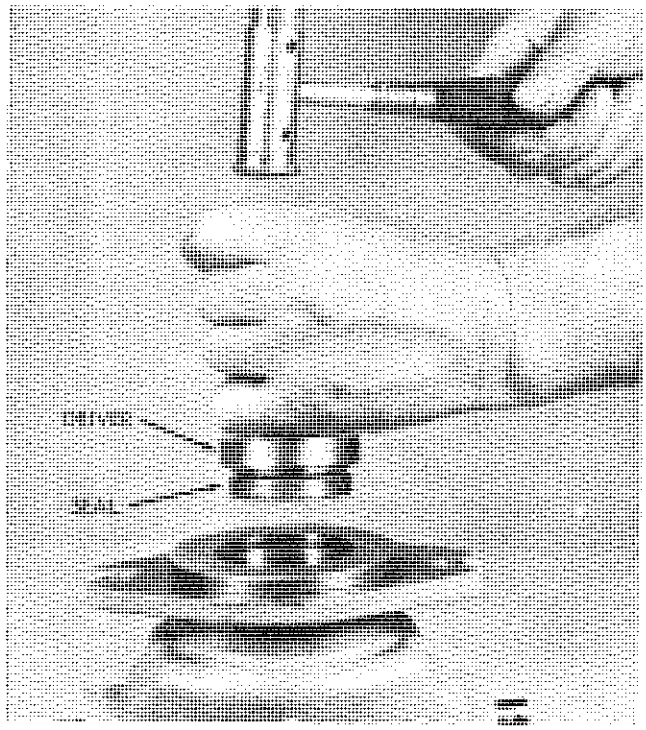


Figure VI-38. Removal or Replacement of Pump or Motor Shaft Seal

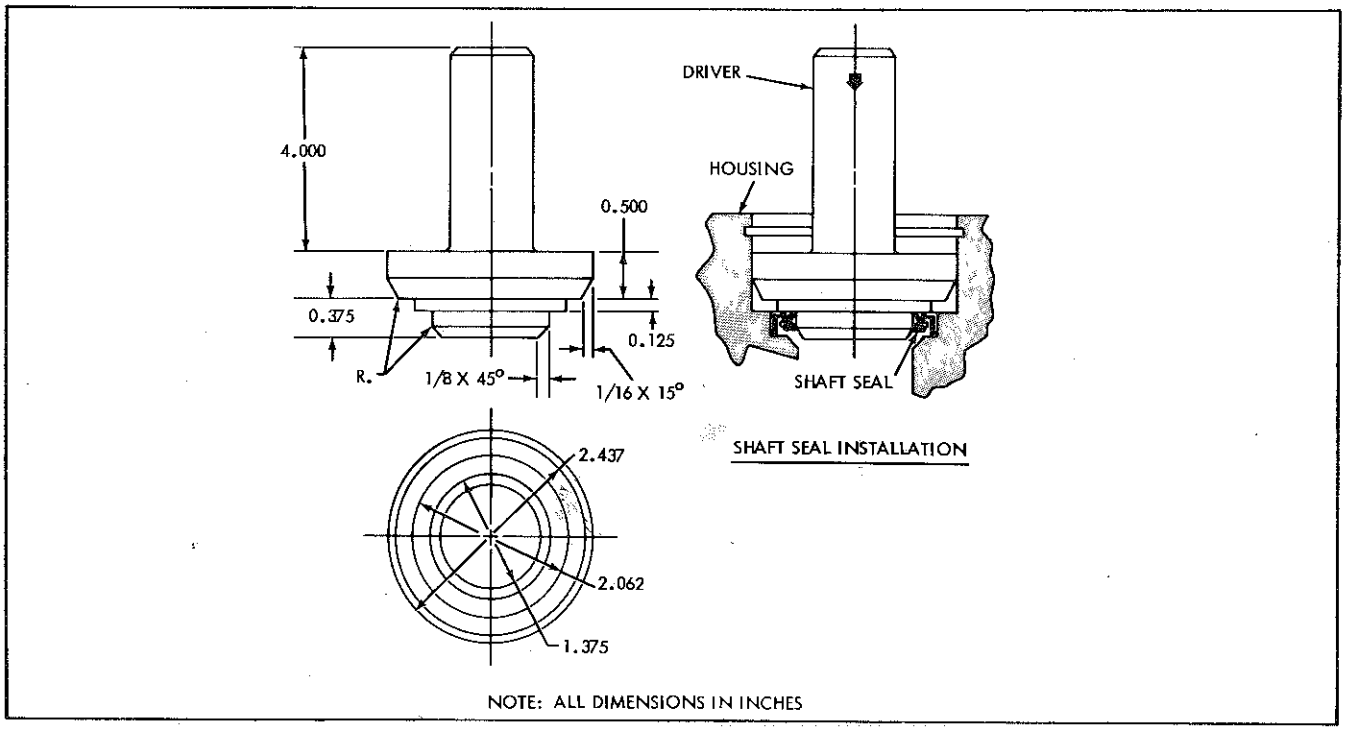


Figure VI-39. Shaft Seal Driver

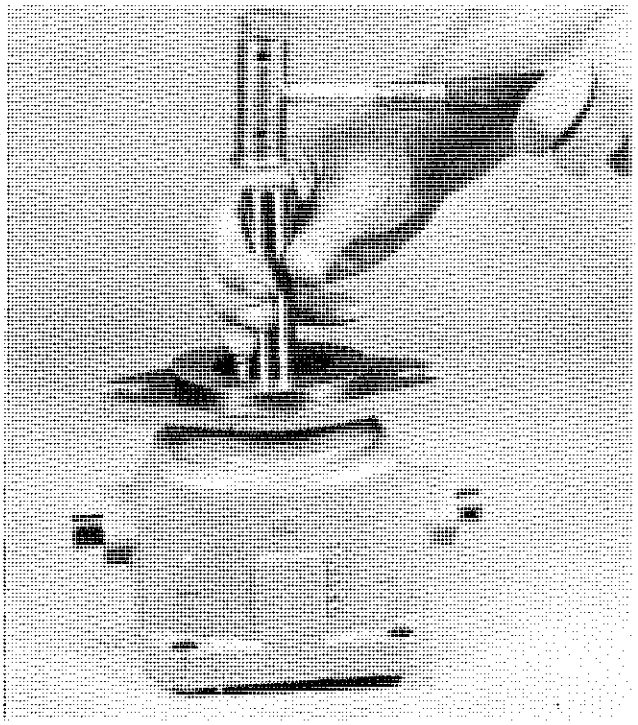


Figure VI-40. Removal and Replacement of Motor or Pump Shaft Seal

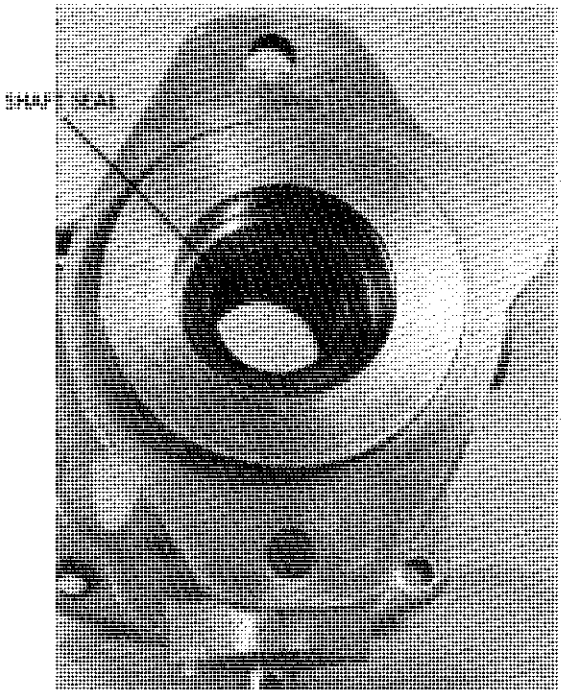


Figure VI-41. Removal and Replacement of Motor or Pump Shaft Seal

19. Torquing Procedures

a. Torque yoke screws to 55-60 ft. lbs. (7.6 to 8.3 Kg m) (Figure VI-42).

b. Torque four screws on the replenishing pump to 25-30 ft. lbs. (3.4 to 4.1 Kg m) (Figure VI-43).

c. Torque eight housing screws at final assembly of pump, motor and valve plate to 42-45 ft. lbs. (5.8 to 6.2 Kg m) (Figure VI-44).

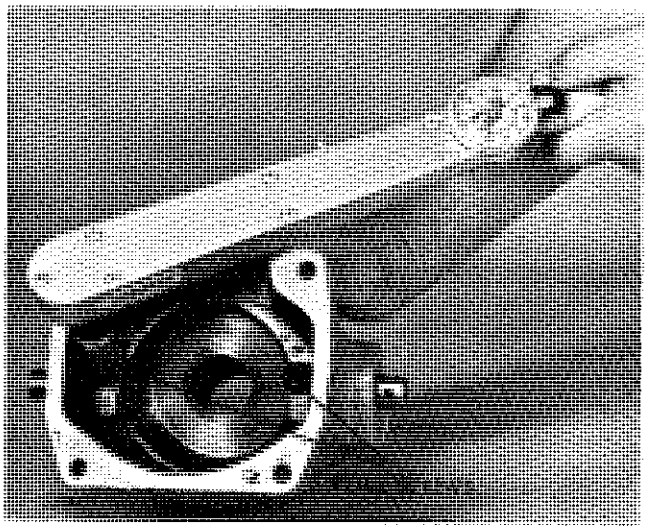


Figure VI-42. Torquing Yoke Screws

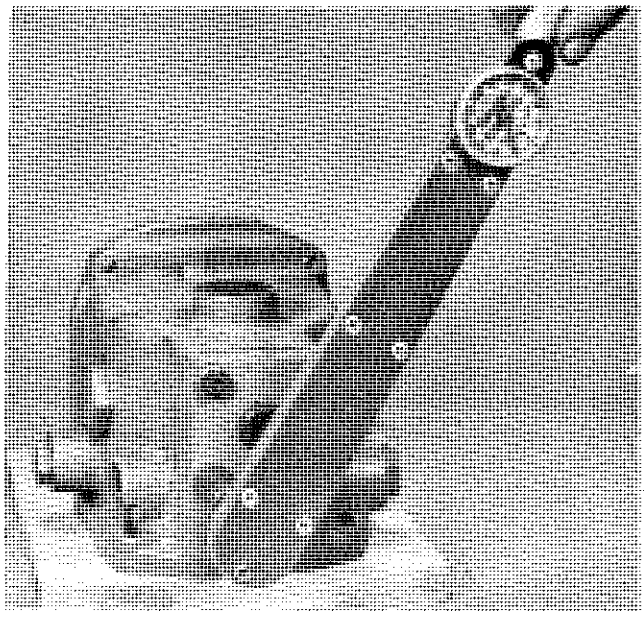


Figure VI-43. Torquing Replenishing Pump Cover Screws

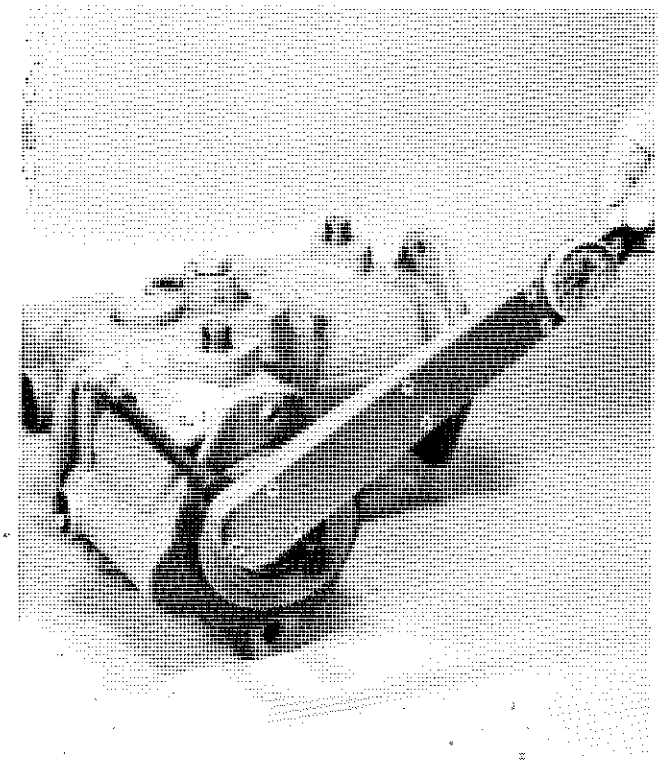


Figure VI-44. Torquing Transmission Housing Screws

E. INSPECTION AND REPAIR

NOTE: Clean all parts thoroughly with mineral spirits prior to inspection and after any stoning or machining operation.

1. Valve Plate

Inspect the flat surface which mates with the cylinder block for wear or scoring. Minor defects can be removed by lightly stoning the surface with a hard Arkansas stone.

NOTE: The surface is hardened, and excessive stoning will remove this hardened surface. If the wear or damage is extensive, replace the valve plate.

2. Rotating Group

Inspect the bores and valve plate mating surface of the cylinder block for wearing and scoring. Minor defects on the running face can be removed by lightly stoning the surface or by lapping. If the defects cannot be removed by this method, the cylinder block should be replaced.

When conditions indicate that one or more piston-and-shoe sub-assemblies should be replaced, all piston-and-shoe sub-assemblies in the unit should be checked to insure that all piston shoes ride properly on the swash plate. Variations in thickness greater than 0.001 inch (.0254 mm) from one shoe to another in 9 pistons will result in excessive internal leakage and shoe wear (Figure VI-45). At overhaul, the replacement of all nine piston-and-shoe sub-assemblies in the pump and motor, as well as the cylinder block, is recommended for maximum overhaul life.

If necessary, hand lap the shoes using 500 A emery paper (Tuff-Bak Durite Silicon Carbide) backed up by a lapping plate. Good results may be obtained if the paper is dipped in kerosene and kept wet during polishing.

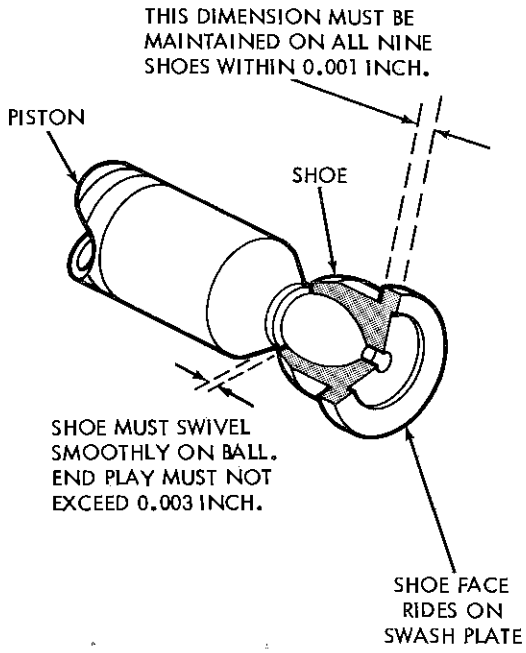


Figure VI-45. Piston and Shoe Subassembly Tolerances

3. Swash Plate

Inspect the swash plate for wear and scoring. If the defects are minor, lightly stone the swash plate. If wear or damage is extensive, replace the swash plate.

4. Bearings and Drive Shaft

Inspect all bearings for roughness or excessive play and replace if necessary. Inspect the seal area of the shaft for

scoring or wear. Replace the drive shaft if bent or excessively worn.

5. Vanes, Rotor and Ring

Inspect the surfaces of all parts that are subject to wear. Light scoring may be removed from the faces of the end plate with crocus cloth on a flat surface, medium India stone, or by lapping.

F. ASSEMBLY

NOTE: Assembly is basically the reverse of disassembly. Install new gaskets, seals, and "O" rings when assembling the unit. A light film of clean hydraulic fluid will ease assembly. Squirt oil on the cartridge for initial lubrication. Use Vaseline on the "O" rings when installing.

1. Piston Pump

a. Yoke. Install the yoke in the housing as illustrated in Figures VI-30 through VI-36. Insert the pintles with "O" rings and keys in place, through the housing, into the yoke. Align the holes and install the screws.

b. Drive Shaft and Bearing. Install a new shaft seal in the housing. Place the flat washer over the shaft seal. Pack the bearing and the grease shield of the motor shaft 1/3 to 1/2 full with a good grade of high temperature ball bearing grease, then install the drive shaft in the housing. Secure the drive shaft bearing with the retaining snap ring, making certain that the sharp edge on the snap ring faces out.

c. Swash Plate. Install the swash plate with chamfered edge toward shaft seal. It is important that the swash plate be properly seated in the yoke, and can be freely rotated with the fingers.

d. Rotating Group Assembly. If the spring and washers were removed from the cylinder block, assemble them as shown. If properly assembled, the spring can be compressed about 1/8 inch (3.2 mm) with the three pins in place. Install the pump and motor assemblies on the valve plate. Be sure to install the coupling sleeve and gaskets before installing the four retaining screws. Torque screws to 42-45 ft. lbs. (5.8 to 6.2 Kg m).

2. Replenishing Pump and Valving

a. Carefully install the pump shaft. To prevent damage to the housing bushing, position the shaft in the mating splines of the coupling shaft. After the shaft is

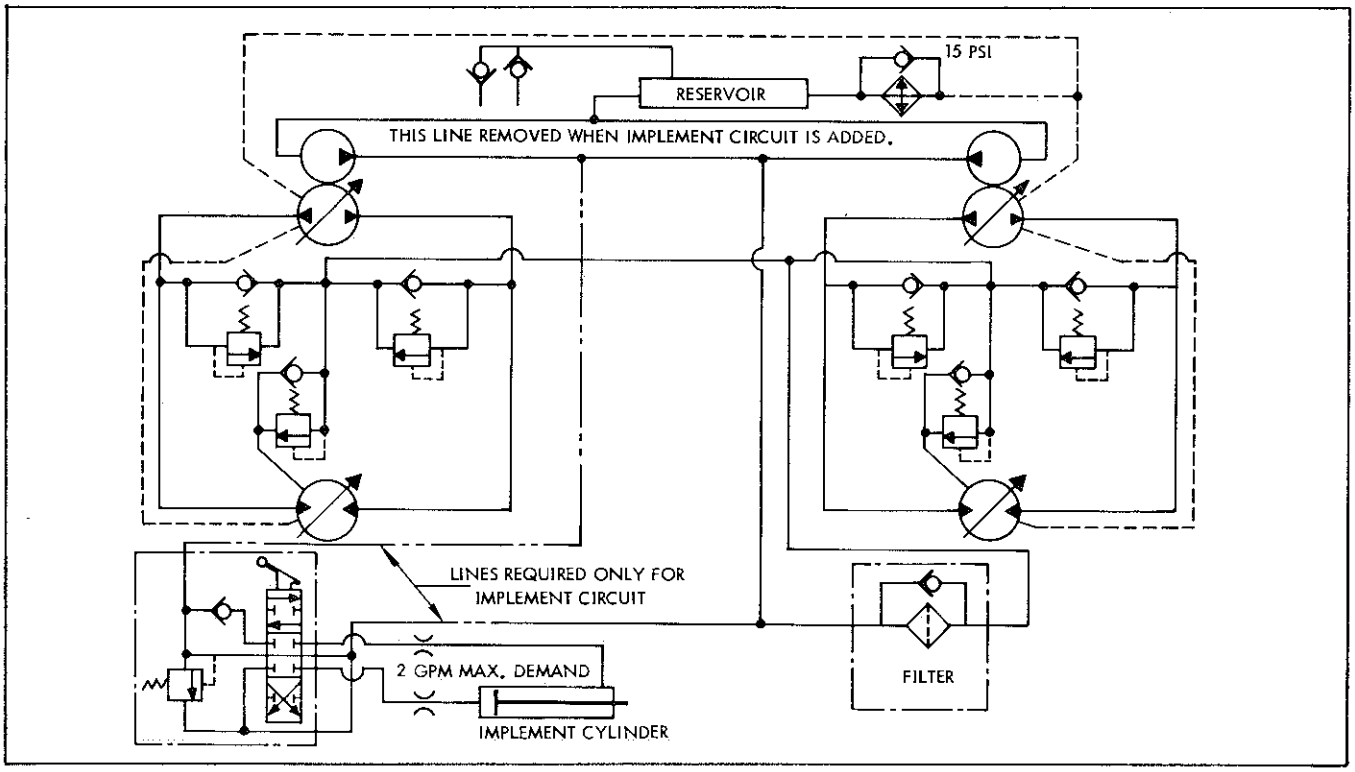


Figure VI-46. Transmission Hydraulic Schematic

in, turn the shaft coupling by hand. The shaft must turn freely.

b. Install locating pins in valve plate. Install wear plate, "O" rings, and pumping ring over pins. Be certain the arrow on the ring points to the correct direction of rotation.

NOTE: Install with chamfered edge of splined hole "in" or toward the wear plate. The chamfer facilitates assembly.

c. Install vanes with their radius edge toward the inner ring contour.

d. Oil the cartridge with clean hydraulic oil and install pressure plate.

e. Install cover "O" ring. Install pressure plate, spring, and cover. Tighten cover screws to 25-30 ft. lbs. (3.4 to 4.1 Kg m).

f Carefully install the remaining housing parts, relief valve, cartridges, springs, "O" rings, and plugs.

G. TESTING

1. Precautions in Starting Vehicle After Repairing Hydraulic Unit

a. Fill transmission case with oil through case drain openings before connecting drain lines and before installing transmission in vehicle.

b. Connect all hydraulic lines to the proper transmission port lines and set hydraulic controls in neutral position.

c. Loosen or remove reservoir cap, add oil to reservoir to proper operating level. This will dispel air from system after the unit is started.

d. Jog the starter several times with engine coil wire disconnected. Recheck reservoir oil level and add oil if necessary to maintain operating oil level.

e. Replace engine coil wire - start the engine and run it to a speed of about 800 rpm. (Avoid high speed start-up). Recheck reservoir oil level again.

f. Move the steering lever control to forward position and run vehicle slowly on level ground for a few yards. (A short interval should be allowed before placing control lever in reverse).

g. Move vehicle slowly backwards an equal span.

h. After several short trips back and forth, the air should be dispelled from the hydraulic system.

i. Check oil level in reservoir, add oil if necessary. Tighten reservoir cap, check system for leaks.

NOTE: After all the above steps are complete, the KID vehicle can be operated at regular speeds and loads. In cold weather, the hydraulic components should be warm to the touch before operating under load.

2. Adding Fluid to the System

When hydraulic fluid is added to replenish the system, it should always be added through a 10 micron filter. If such a filter is not available, a funnel with a fine wire screen (200 mesh or better) can be used. It is important that the oil is clean and free of any substance that will cause improper operation and excessive wear of any unit in the system.

3. Lubrication

Internal lubrication is provided by system oil flow, except main motor bearing which must be packed 1/3 to 1/2 full of high temperature grease when unit is rebuilt.

4. Replacement Parts

Only genuine parts manufactured or sold by an authorized KID distributor should be used as replacement parts for these pumps.

5. Adjustments

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

H. TRANSMISSION CONTROLS

The transmission controls (see figure VI-47) consist of a control lever in the driver's compartment; two sets of push-pull type control linkages; and control arms on each transmission in fixed relationship.

1. Control Arms

There is no adjustment of the transmission control arms required during the operational life of the transmissions. The control arms are installed on the transmissions with roll pins and pivot bolts in a fixed relationship and cannot be changed.

a. Transmission Neutral

When the roll pin through the transmission pump control shaft is aligned fore-and-aft with the vehicle (parallel to the PTO shaft) the transmission is in the neutral condition. If the transmission is not in neutral when the control shaft is in this position, the trouble is internal and the transmission should be replaced.

b. Maintenance

The transmission control arms should be checked periodically for excessive wear at friction points. Check security of all nuts, bolts, and roll pins, and replace when worn. Lubricate all friction points with 10W-30 oil.

2. Control Linkage

a. Removal

(1) Turn ignition switch OFF.

(2) Push operator's control lever full forward and release the forward end of control linkage (8) by turning self-aligning ball nut counterclockwise until free of control lever.

(3) Loosen large locknuts (7) holding control linkage to control pedestal.

(4) Loosen large locknuts (6) holding control linkage to bracket.

(5) Remove clevis bolt and release the aft end of control linkage (5) from the transmission control arm.

(6) Pull the control linkage out of the control pedestal

(7) Pull the control linkage out of the bracket and remove from vehicle.

WARNING: Do not start engine with control linkage off. Serious injury may result.

b. Inspection and Repair

(1) Inspect the linkage for sharp bends, worn or binding ball joint end fittings, excessive binding.

c. Installation

(1) Slide the forward end of control linkage (8) through locknuts (7).

(2) Hold the control lever in neutral (straight up and down with handle parallel to axles), and screw the rod and bolt (8) in finger tight.

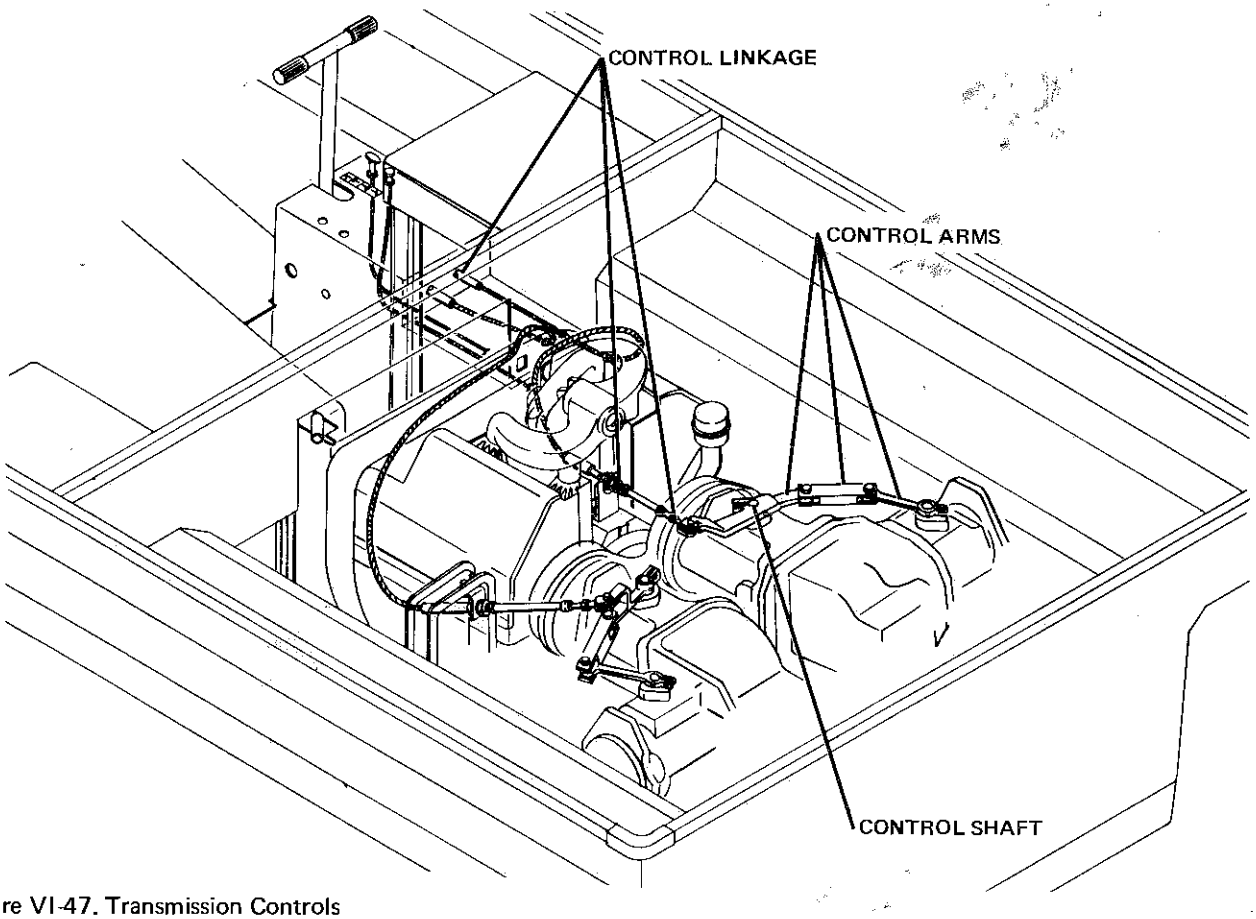


Figure VI-47. Transmission Controls

(3) With the control lever still in neutral, tighten locknuts (7).

(4) Hold the transmission in neutral (See 4a(1)) and connect the aft end of control linkage (5) with nut finger tight.

(5) With transmission still in neutral, tighten locknuts (6).

(6) Using rod end adjustments (8 and 5), adjust for neutral at transmission and control lever (See 4b(4)).

(7) Tighten forward rod end bolt to control lever, and tighten aft rod end connecting bolt and adjustment jam nut.

d. Neutral Adjustment

When the control lever is straight up and down with the handle paralled to the axles, the transmissions should be in neutral (See 4a(1)).

Adjust as follows:

(1) Disconnect the aft end of the control linkage (5) by removing clevis bolt.

(2) Set the control lever and transmission both in neutral and HOLD in that position.

(3) Loosen jam nut at (5) and turn the clevis on or off the rod as necessary to allow the clevis bolt to slide in place with ease.

NOTE: Leave at least 4 threads engaged at all times in linkage adjustment.

(4) If all the allowable adjustment at (5) is not enough, connect (5) and adjust at (8).

(5) To adjust at (8), push control lever forward, remove bolt from lever, loosen jam nut, and turn ball joint end on or off the rod as necessary.

(6) If the combined adjustments of (5) and (8) are not enough, a coarse adjustment may be obtained by loosening either locknuts (6) or (7), feeding through more linkage, and repeating steps (a) through (d).

(7) Tighten all jam ,nuts, locknuts and connecting bolts

TROUBLESHOOTING TRANSMISSIONS

1. General

The cause of improper functioning in a hydraulic system is best diagnosed with adequate testing equipment and a thorough understanding of the complete hydraulic system.

A hydraulic transmission unit exhibiting an excessive increase in heat or noise is a potential failure. When either of these conditions are noticed, immediately shut down the KID vehicle engine, locate the trouble, and take corrective action. Use the hydraulic flow diagram for reference when troubleshooting the transmission.

Major reasons for hydraulic system failure are heat, dirt, air and cavitation. The information below is a guide for recognizing and correcting some of these failures and preventing breakdowns.

2. Transmission Creating Excessive Noise

a. Air in the System.

Air in the system sometimes presents a "milky" appearance in the reservoir oil. A leak at the intake (suction) side of the pump will cause aeration in the fluid. When this condition exists, there is a mixture of air with the oil. Since air is compressible, it is pressurized and released within the high pressure pump and an explosion of the tiny air bubbles occurs. This phenomena can be translated into an audible sound above the normal hydraulic system sound level. Air in the fluid system presents a rattling sound within the pump, resulting in reduced lubrication and an erratic action in the hydraulic system. In the event of aeration in the transmission, check the operation of the auxiliary pump.

b. Cavitation.

Cavitation is caused by a low pressure condition at the inlet port of the pump. Vapor pockets are formed which separate the oil molecules, resulting in noisy and erratic operation of the hydraulic transmission. Serious erosion of the pumping unit parts will occur in a short operational period.

A worn or failed replenishing pump is the primary cause of cavitation in a closed-loop hydrostatic transmission circuit.

Cavitation can also be caused by using too heavy an oil in the hydraulic system. After overhaul or when refilling, use the oil specified. During cold weather the oil will thicken while standing overnight or for any considerable length of time. Cavitation may be experienced at initial start. This condition will disappear as the oil begins to warm and thin out.

3. Hydraulic Transmission Overheating

Overheating of the hydraulic system can cause system failure. When hydraulic oil becomes excessively hot, it will oxidize. When oxidation occurs, the oil will have less lubricity and the transmission will wear out faster. As an example, the rate of oxidation will double for every 10 degrees of temperature rise over 160° F. At high temperatures, O'rings, seals, and gaskets will deteriorate. One of the reasons for excessive heat is internal leakage. If the pumping unit becomes worn, slippage occurs, causing rapid heat build-up. This condition can be recognized by a slowing down of the vehicle or loss of power.

check temperature

Another reason for excessive heat may be a plugged or failed oil cooler. This can be readily determined and remedied.

In summary, if the vehicle loses speed, specifically after it has been operating for a while, check the hydraulic fluid temperature. This can be done with a thermometer submersed in the reservoir. Compare the resultant temperature reading with maximum operating temperature recommendations.

4. System Not Developing Pressure

The reasons for loss of pressure in the transmission hydraulic system are:

a. One of the two replenishing relief valves has failed to open.
b. Internal leakage (slippage).
c. External loss.

If the replenishing relief valve fails, normally there will be movement of the vehicle in one direction but not in the other. It is not likely that both replenishing relief valves will fail simultaneously; therefore, the failed valve can be located by exchanging valves from one side to the other.

If the vehicle slows down or stops in both directions, the fluid supply is passing directly back to the reservoir through internal slippage, or there is external loss of fluid.

5. External Leakage

Ruptured lines, loose connections or worn gaskets and seals can cause leakage. Line or connection leakage is usually easy to correct; however, seal or gasket leakage requires disassembly of a part or all of the transmission. If an O-ring within the unit is cut, worn, or hardened, internal leakage will be evident by slowing down of the vehicle when it is in motion.

6. Miscellaneous

When troubleshooting the hydraulic system do not overlook the possibility of mechanical failure of parts related to the hydrostatic transmission. Look for the following indications:

a. Sheared shaft keys.
b. Disconnected or improperly adjusted control linkage.
c. Disconnected or broken drive mechanisms.

7. Trouble, Cause and Remedy

The following table lists the most prevalent trouble and causes for transmission malfunction. Use this table as a guide if trouble with the transmission is indicated.

TRANSMISSION	
CAUSE	**REMEDY**
Transmission Pump Not Delivering Fluid to Motor End	
Reservoir fluid level low.	Add fluid to reservoir.
Inlet strainer plugged.	Clean strainer after new fluid is added.
Air leak in inlet line prevents priming and causes irregular control circuit action.	Pour fluid on intake joints while listening for change in sound of operation. Tighten as required.
Coupling or shaft sheared or disengaged.	Disassemble unit and check shaft and rotating group for damage. Replace necessary parts.
Speed Fluctuations with Constant Input Flow	
Irregular wear between housing and cylinder block	Lap housing and cylinder block. Minor defects can be removed by lightly stoning the surface. Lapping should not exceed 0.002 inches. The surface is hardened and excessive lapping will remove this hardened surface. If the wear or damage is extensive, replace the housing.
Excessive Noise in Transmission	
Air in the system.	Correct cause of air leak.
	Open reservoir cap and operate hydraulic system until purged.
	Bleed hydraulic lines at highest point downstream of auxiliary pump while system is under pressure.
Vacuum Condition.	Check inlet (suction) lines and fittings for air leaks or obstruction.
	Check auxiliary pump function.
Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.

TRANSMISSION	
CAUSE	**REMEDY**
Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
Coupling Misalignment.	Check for damaged shaft bearing or other parts. If necessary, replace and realign the coupled shaft.
Partly clogged inlet line, inlet strainer or restricted inlet pipe.	Service the inlet strainers. Check the fluid condition and, if necessary, drain and flush the system. Refill with clean fluid.
Air bubbled in fluid.	Check to be certain return lines are below fluid level and well separated from intake line.
Reservoir ari vent plugged.	Must be open through breather opening or air filter.
Unit running too fast.	Conform with recommended maximum speeds.
System Not Developing Pressure or Slow Operation	
Replenishing relief valve stuck open.	Replace one or both. Do not attempt to repair Cartridges. They are factory assembled and preset.
Unit not delivering fluid.	Check circulation by watching fluid in reservoir.
Relief valve setting not high enough.	Test with pressure gauge.
Relief valve sticking open.	Remove contamination in relief valve.
Leak in hydraulic control system (cylinders or valves).	Test independently by progressively blocking off the circuit.
Charge pump ring in backwards.	Remove charge pump cover and check for proper rotation. Reverse pump ring if improperly installed.
Worn pump.	Repair or replace pump.
Hydraulic Transmission Overheating	
Internal leakage.	If established that excessive internal leakage is evident, return vehicle to shop for repair.

TRANSMISSION	
CAUSE	**REMEDY**
Oil cooler not functioning.	Locate trouble and repair and replace.
Fluid level low.	Add oil to operating level.
Loss of Fluid	
Ruptured hydraulic lines or loose fittings.	Check all external connections, tubing, and hoses. Tighten connections, replace ruptured tube or hose.
Leaking gaskets or seals in hydrostatic transmission.	Observe mating sections of hydrostatic transmission for leaks. Replace seals or gaskets if possible.
Miscellaneous	
Sheared shaft.	Replace.
Misadjusted or broken control linkage.	Locate and repair.
Disconnected or broken drive mechanism.	Repair.

• Hydraulic System (figure VI-48)

A. DESCRIPTION

The Hydraulic system consists of a reservoir, an oil cooler, a filter, and the necessary plumbing to supply clean, temperature-controlled oil to the transmissions and the implement actuators (See simplified flow diagram). The hydraulic pumps are an integral part of the transmissions. Oil flows out of the reservoir to replenishing pumps in the transmissions, filling the main pumps and motors. The oil then flows out of the replenishing pumps through the filter and into the main pumps. From the main pumps the oil flows through the cooler and back into the reservoir.

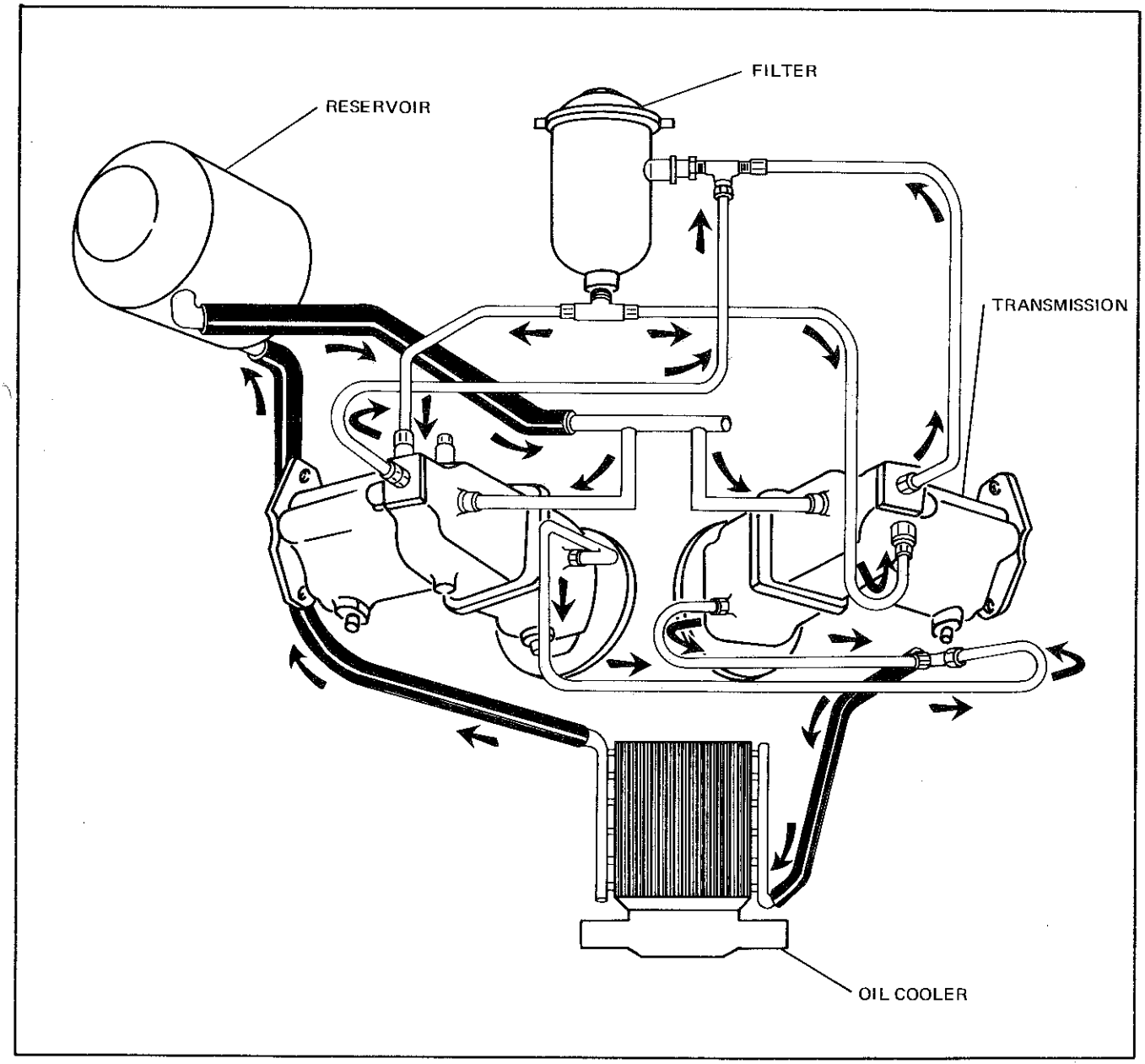


Figure VI-48. Simplified Flow Diagram KID Hydraulic System

1. Hydraulic System Oil Level

Remove the hydraulic system oil reservoir cap and check that the oil level is up to the bottom of the filler neck screen. If necessary, fill to the correct level with 10W-30 oil. DO NOT overfill. If the screen is dirty, remove and wash in kerosene. Dry thoroughly and replace. Replace the cap.

2. Seals

Check around all hydraulic system seals for evidence of leaks. If leaking excessively, replace the seals.

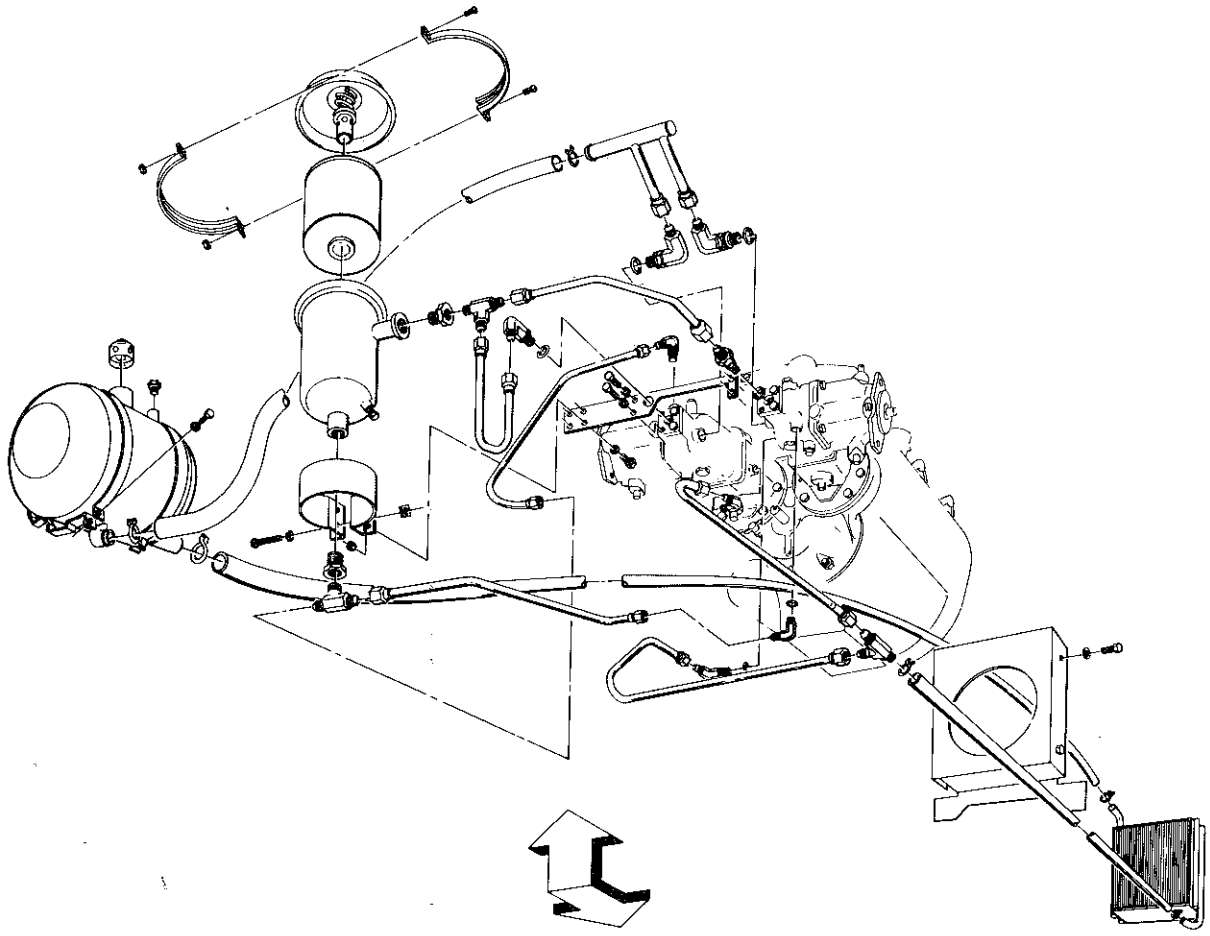


Figure VI-49 Piping - KID Hydraulic System

3. Transmission Oil Cooler

WARNING: It is extremely important that the transmission oil cooler have maximum cooling air flow at all times. DO NOT BLOCK THE INTAKE (FRONT) OF COOLER. Clean out all dirt and debris accumulated on fins at least once daily.

When cleaning dirt and debris from the transmission oil cooler, use only a medium-stiff bristle brush or whisk broom to clean between the fins. Do not clean with wire brush or metal probes. Care must be exercised to avoid bending or otherwise damaging the cooling fins. If vacuum is available, vacuum on the front will aid in cleaning.

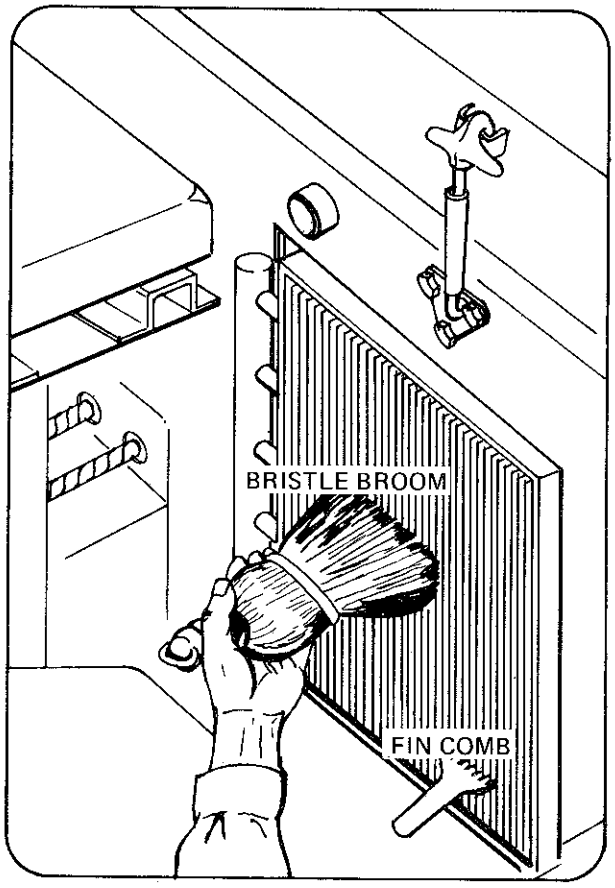


Figure VI-50. Hydraulic Oil Cooler Cleaning

4. Transmission Oil Filter

The transmission oil filter is a replaceable cartridge type, capable of 25 micron filtration.

Replace Transmission Oil Filter as follows:

a. Release 2 filter cover clamp screws.
b. Remove filter cover.
c. Remove filter element and replace with new element.
d. Check cover gasket for breaks, cracks or creases, and replace if necessary.
e. Replace cover and tighten clamp screws.

• Implement Hydraulic Circuit (Optional)

1. INSTALLATION

Install the hydraulic implement circuit as follows (See Figure IV-51.)

CAUTION: When installing this system, cleanliness is extremely important. Dirt entering this system can also damage the transmissions. Do not remove protective caps until just prior to installing. Blow through lines and valves with clean, dry air, and wipe each port and fitting with a dry, lint-free cloth.

a. Locate the control valve on the bulkhead with the handle on top as illustrated.
b. Set the control valve in place, install four mounting bolts, and tighten.
c. Remove the hydraulic line that is installed between the left-hand transmission auxiliary pump plate and the "tee" in the filter inlet line (rear of transmission and top of filter).

CAUTION: Do not start engine with hydraulic lines disconnected.

d. Connect a 1/2" ID line to the open port on the rear of the left-hand transmission. Connect the other end to the "inlet" port of the control valve (right-hand side of valve). Tighten the fittings.
e. Connect a 3/8" ID line to the open port of the "tee" in the filter inlet line. Connect the other end to the "return" port of the control valve (left-hand side of valve). Tighten the fittings.

NOTE: Make sure lines between transmissions and control valve are connected as outlined. If connected improperly, serious damage to transmissions can result.

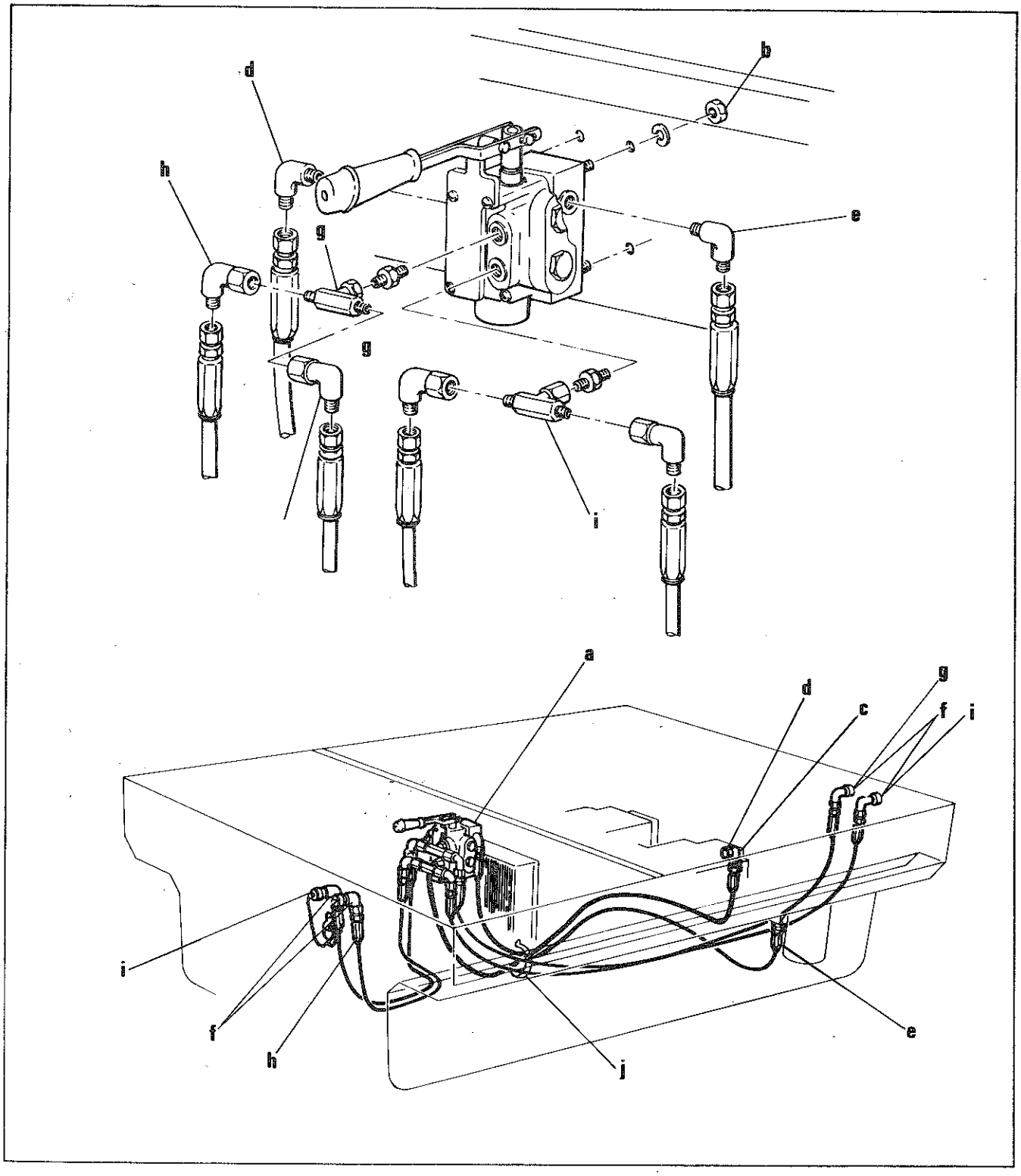


Figure VI-51. Implement Hydraulic Circuit (Optional Accessory)

f. Drill two 7/8" holes at least 4" between centers, in the rear bulkhead and two in the front bulkhead, as illustrated. Install quick-disconnect bulkhead fittings, using two snap rings on each fitting. (One on each side of panel)

g. Install a "tee" fitting in port "A" of the control valve (top port, nearest handle). Connect a 3/16" ID line to the left-hand port of the "tee". Connect the other end to the right-hand fitting on the rear bulkhead. Tighten the fittings.

h. Connect a 3/16" ID line to the right-hand port of the "tee" fitting. Connect the other end to the right-hand fitting on the front bulkhead. Tighten the fittings.

NOTE: Pressure from control valve port "A", through the lines presently installed, is for EXTENDING the hydraulic actuator and RAISING the implement. When connecting an implement, these lines should be connected to the port at the base of the actuator cylinder.

i. Install a connector fitting in port "B" of the control valve (bottom port). Install a swivel tee on connector fitting. Connect a 3/16" ID line to the left-hand port of the "tee". Connect the other end to the left-hand fitting on the rear bulkhead. Tighten the fittings. Connect a 3/16" ID line to the right-hand port of the "tee", connect the other end to the left-hand fitting on the front bulkhead. Tighten the fittings.

NOTE: Pressure from control valve port "B" through these lines is for RETRACTING the hydraulic actuator and LOWERING the implement. When connecting an implement, these lines should be connected to the port at the rod end of the actuator cylinder.

j. Arrange the four lines leading aft so they are not chafing on moving parts and clip as shown in the illustration picture. Arrange the two lines leading forward so they will not be damaged and clip as necessary.

2. BLEEDING SYSTEM

Bleed air from the system as follows:

a. Make sure the hydraulic fluid tank is full, and start the engine.

b. Hold the control valve lever in the UP position. Using a soft metal rod (brass or aluminum) push in the ball-checks in the quick-disconnects on the two right-hand bulkhead fittings, front and rear. Hold in until all air is dispelled and clear hydraulic fluid is running out. Release the ball-check and install the dust plug. Release the control lever.

c. Hold the control valve lever in the DOWN position. Push in the ball-checks in the quick-disconnects on the two left-hand bulkhead fittings, front and then the rear. Hold in until all air is dispelled and clear hydraulic fluid is running out. Release the ball-check and install the dust plug. Release the control lever.

d. Stop the engine and refill the hydraulic fluid tank. The hydraulic implement circuit is ready to use.

NOTE: The hydraulic implement circuit control valve does not select front or rear, but applies "up" or "down" pressure to both front and rear simultaneously. It is therefore important to make sure that the lines not in use have their quick-disconnect check valve seated and the dust plug in place.