

SERVICE MANUAL
FOR
MODEL HD 11, HD 16 & HD 21
DOZER HYDRAULIC
SYSTEMS

(FRONT MOUNTED HYDRAULIC CONTROL UNIT TYPE)

JULY 1959

PROPERTY OF

Price \$2.50

FOREWORD

This manual is prepared to provide the customer and the maintenance personnel with information and instructions on the repairing and maintenance of the "Allis-Chalmers" Model HD 11, HD 16, and HD 21 Dozer Hydraulic Systems (Front Mounted Hydraulic Control Unit Type). Extreme care has been exercised in designing, selection of materials, and the building of the unit. By proper maintenance, the utmost satisfaction in performance and service will be obtained.

In order to become familiar with the various components of the unit, it is urged that the operator and the maintenance personnel study the instructions in this manual and use it as a reference when installing, operating, lubricating, and repairing the unit.

To assure the best results and to maintain the original quality built into the unit, it is important that Genuine "Allis-Chalmers" Parts be used when new parts are required.

Many owners of "Allis-Chalmers" equipment employ the Dealer's Service Department for all work other than routine care. This practice is encouraged as the dealers are kept well informed by the factory regarding advanced methods of servicing "Allis-Chalmers" products and are equipped to render satisfactory service.

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SECTION I — DESCRIPTION AND SPECIFICATIONS

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TOPIC 1 — GENERAL DESCRIPTION

On the Models HD 11, HD 16, and HD 21 Tractors, hydraulic power for control of the dozers is supplied by a gear-type hydraulic pump, mounted in the upper tank of the hydraulic control unit, and is driven by the front end of the engine crankshaft through a universal joint assembly. A hydraulic control valve, mounted on top of the hydraulic upper tank, directs the flow of oil in the hydraulic system for controlling the hydraulic cylinders and dozer moldboard. The hydraulic tank assembly is

designed in two parts; an upper tank and a lower tank. The upper tank contains the hydraulic pump, pump suction line, pressure line, and an oil return line. The lower tank serves as the oil reservoir for the hydraulic system. When the upper tank is installed on the lower tank as shown in Fig. 2, the pump suction line and the oil return line extend into the lower tank and are submerged in the oil of the lower tank. The hydraulic system described herein is not vented. It is a closed type design.

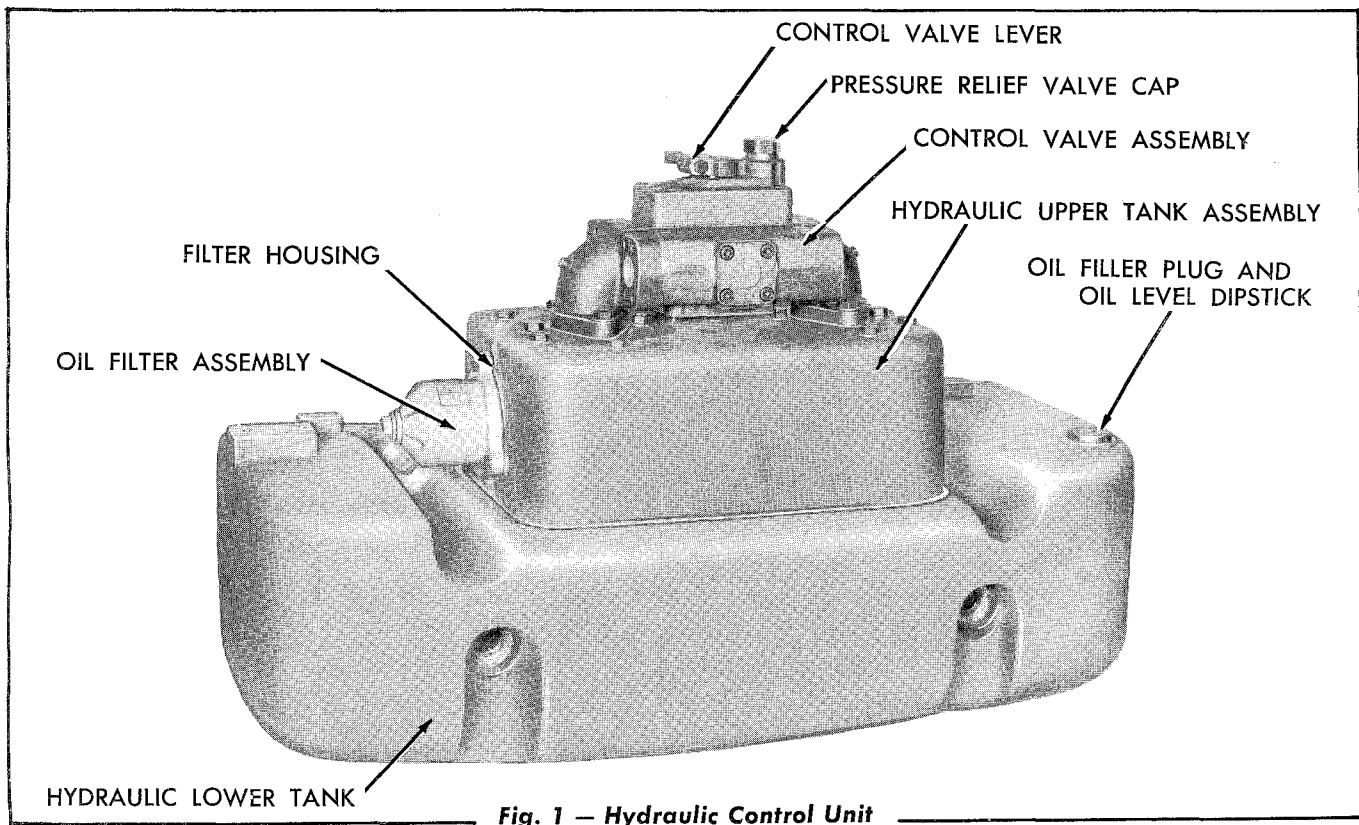
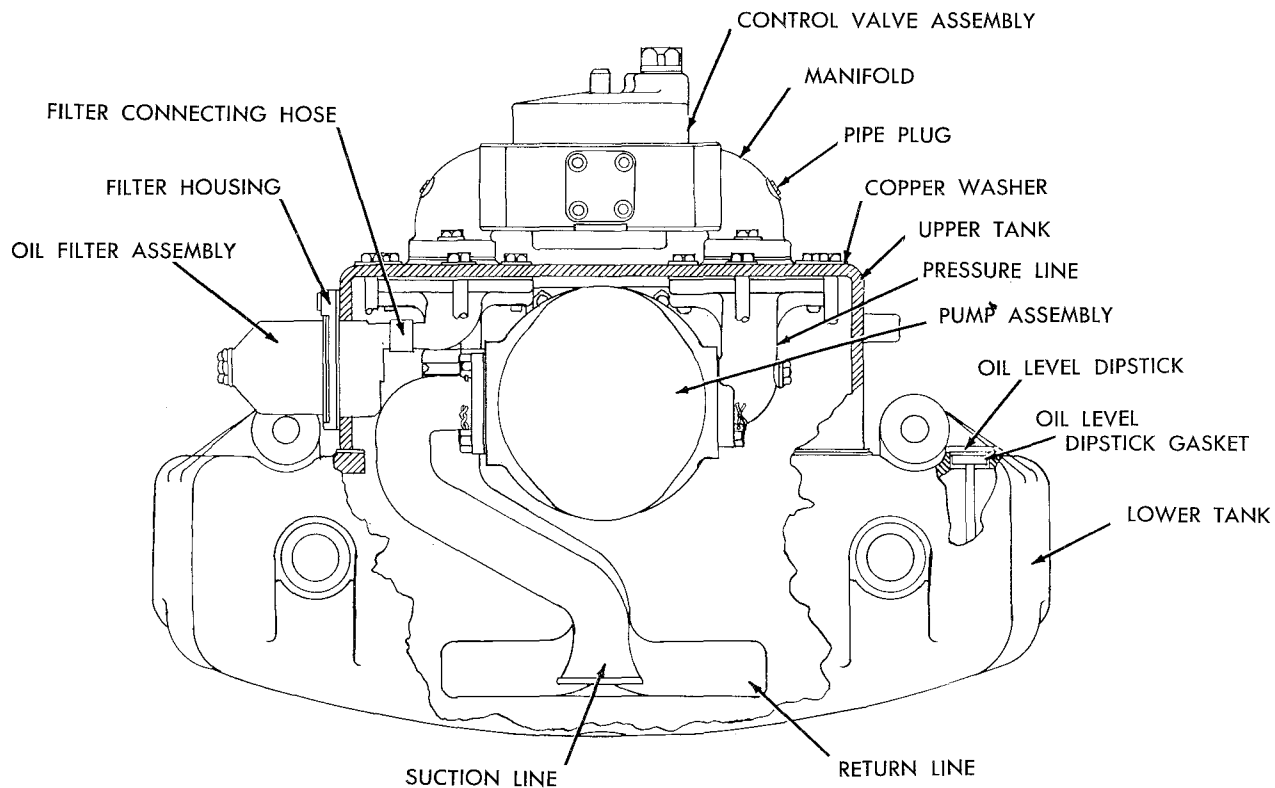
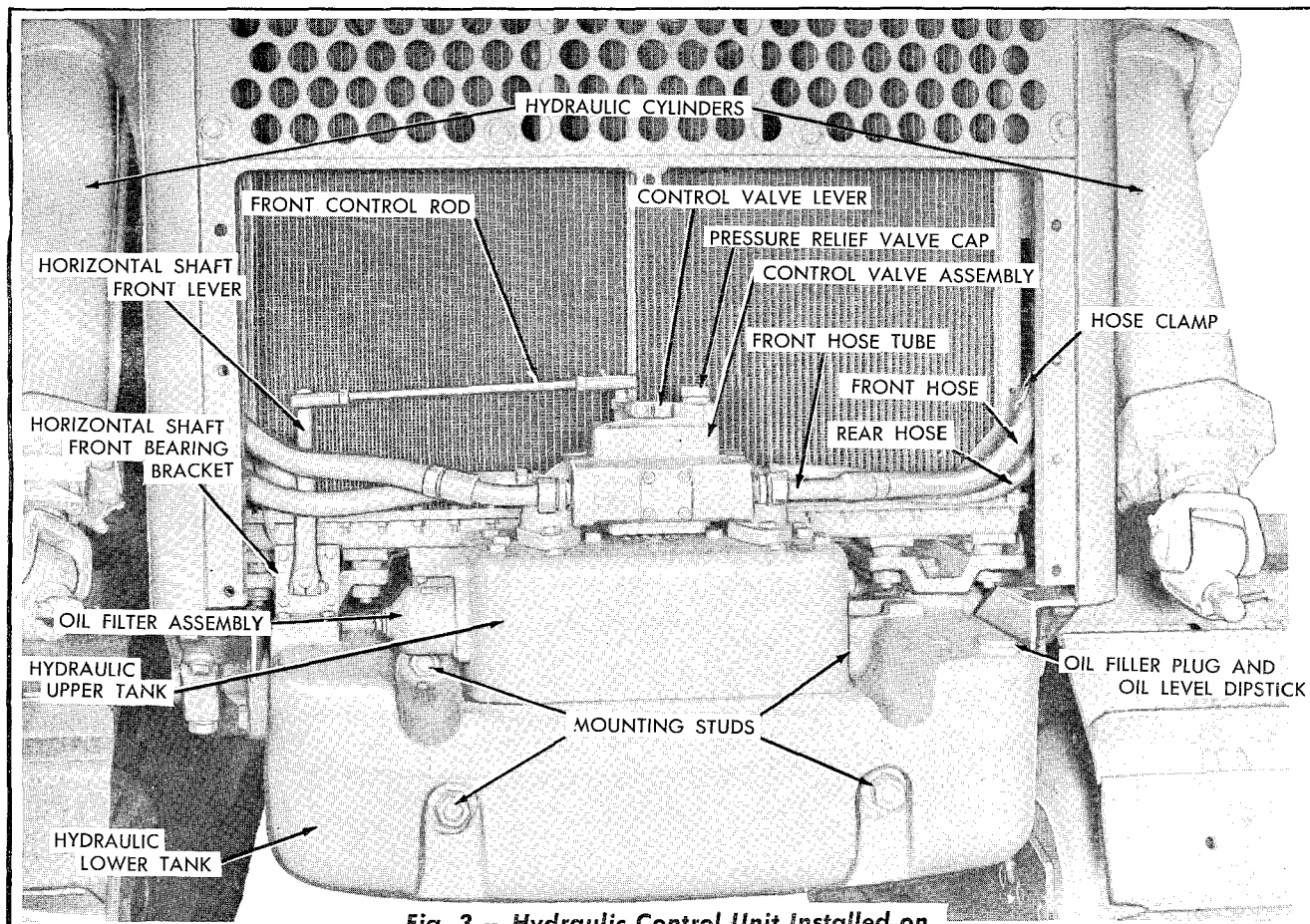


Fig. 1 — Hydraulic Control Unit



**Fig. 2 — Hydraulic Control Unit —
Sectional View**



**Fig. 3 — Hydraulic Control Unit Installed on
Model HD 21 Tractor**

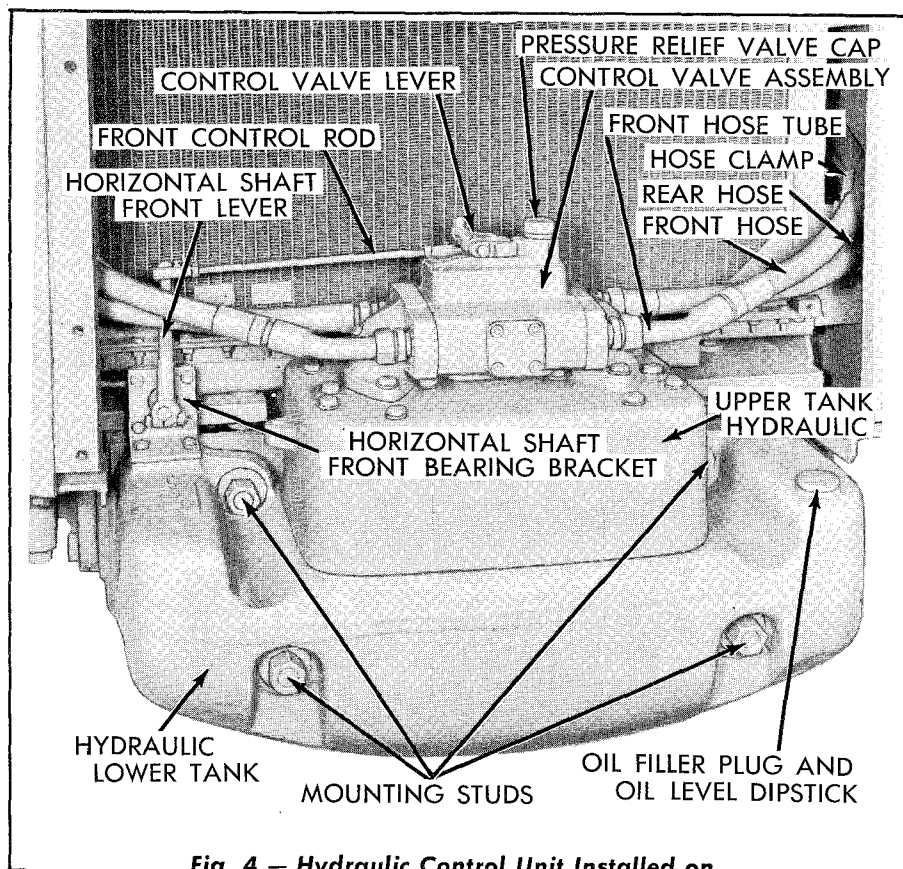


Fig. 4 — Hydraulic Control Unit Installed on Model HD 16 Tractor

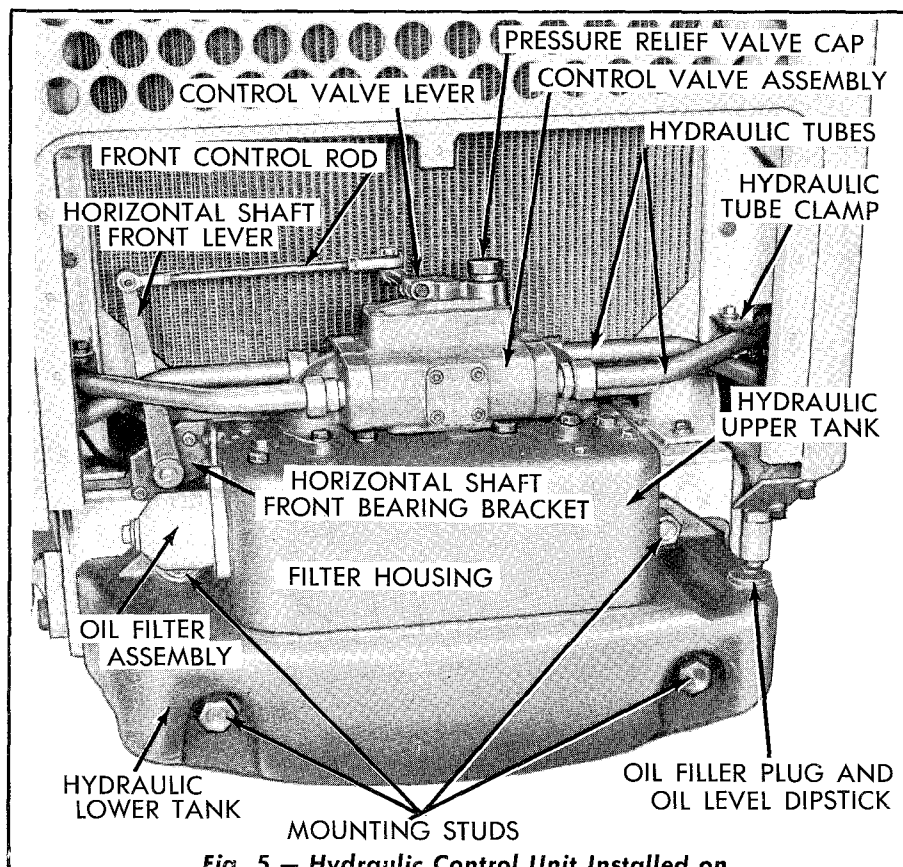


Fig. 5 — Hydraulic Control Unit Installed on Model HD 11 Tractor

TOPIC 2 — GENERAL SPECIFICATIONS

Type Hydraulic
Location Front Mounted

Hydraulic Pump

Manufacturer "Hydrecó"

Type Gear

HD 11 Tractor

Pump Model 3025-H11-B22

Pump Capacity at 1250 P.S.I. and at 1800 R.P.M. 72 G.P.M.

Width of Gears 2½"

HD 16 Tractor

Pump Model 3030-H11-B22

Pump Capacity at 1250 P.S.I. and at 1800 R.P.M. 85 G.P.M.

Width of Gears 3"

HD 21 Tractor

Pump Model 3035-H11-B22

Pump Capacity at 1250 P.S.I. and at 1800 R.P.M. 97.8 G.P.M.

Width of Gears 3½"

Oil Capacity — Hydraulic System — (Approximate)

HD 11 13.5 gal.

HD 16 18.5 gal.

HD 21 26 gal.

Oil Reservoir Front Mounted

Type of Filter By-Pass Type

Control Valve Rotor Type, Four Positions — Raise, Hold, Lower, and Float

Cylinders

Type Double Acting

Diameter and Stroke

HD 11 Tractor 5" x 34"

HD 16 Tractor 5½" x 38"

HD 21 Tractor 6" x 40"

The Allis-Chalmers Manufacturing Company reserves the right to make changes in the above specifications or to add improvements at any time without notice or obligation.

TOPIC 3 — SPECIFICATIONS OF LUBRICANTS

A. Hydraulic System

A good quality of rust inhibiting hydraulic oil or automotive crankcase oil having a viscosity of 210-225 S.U.S. at 100° F. (SAE 10W) and a viscosity index of 90 minimum is recommended for use in the hydraulic system. NOTE: *Do not use an oil that foams.*

No specific brand of oil is recommended. Use only products qualified under the above viscosity specification and recommended by reputable oil companies.

B. Pressure Gun Lubricant

Use a ball and roller bearing lubricant with a

minimum melting point of 300° F. at all points where pressure-type lubricating fittings are provided. This lubricant should have a viscosity range so as to assure easy handling in the pressure gun at the prevailing atmospheric temperature and MUST be waterproof.

C. Hydraulic Pump Universal Joint Lubricant

Lubricate with regular "Universal Joint Grease." Industries general specifications for universal joint grease according to the National Lubrication and Grease Institute is listed as follows: N.L.G.I. No. 2 Soda Soap, Fiber base grease.

TOPIC 4 — ROUTINE SERVICE

A. Service

The oil in the hydraulic system should be checked after each 10 hours of operation and the oil in the hydraulic system must be changed after each 1000 hours of operation. On hydraulic control units having an oil filter, the filter element MUST be replaced after the first 50 hours and every 200 hours thereafter. NOTE: *The oil should be at normal operating temperature when draining.*

1. Draining of Hydraulic System

- a. Remove the radiator guard lower front plate. Place wood blocks, approximately 12 inches thick, in front of each track and drive the tractor forward until the front of the tractor is raised off the ground, or the tractor may be driven up to the edge of a ditch. Move the dozer operating control lever to the "RAISE" position and raise the moldboard until the dozer hydraulic cylinder piston rods are fully retracted. Stop the engine. As a safety precaution, place suitable blocking under the moldboard push beams or under the "C" frame.
- b. Remove the oil drain plug from the bottom of the hydraulic lever tank and allow the

oil to drain. Remove the blocking from under the moldboard push beams or "C" frame. With the engine stopped, move the control lever to the "LOWER" position. This will allow the moldboard to lower, forcing the oil from the hydraulic cylinders into the hydraulic tank and out through the oil drain hole. When the system has thoroughly drained, clean the oil drain plug, then install and tighten securely.

- c. On hydraulic control units with an oil filter, loosen the oil filter centerbolt and remove the oil filter shell, filter element, and shell gasket. Thoroughly clean the inside of the filter shell and insert a new filter element. Install the filter in position on the upper tank, using a new shell gasket.

2. Filling of Hydraulic System

- a. Thoroughly clean the oil filler plug and oil level dipstick (Fig. 6) and the surrounding area. Remove the oil filler plug and oil level dipstick from the hydraulic tank. Fill the hydraulic tank with the specified oil to the oil level mark on the dipstick. Turn the oil filler plug and dipstick about $\frac{3}{4}$ turn into the upper tank; do not tighten.

- b. Start the engine and operate it at approximately $\frac{1}{2}$ throttle for a few minutes, with the dozer operating control lever in the float position, and allow the oil to circulate.
- c. With the engine running at $\frac{1}{2}$ throttle, move the dozer operating control lever to the "RAISE" position then to the "LOWER" position. Repeat this operation several times until the hydraulic cylinders operate properly.
- d. With the moldboard in the "RAISED" position, drive the tractor off the blocks. Lower the moldboard to the ground and stop the engine. Inspect the oil filter, hydraulic lines and connections for leaks and make any corrections necessary.
- e. Allow a few minutes for the oil to settle before checking the oil level. Remove the oil filler plug and dipstick and dry the dipstick with a clean cloth. Insert the dipstick back into the tank and tighten the oil filler plug. Loosen and withdraw the dipstick and note the oil level; the level should be even with the oil level mark on the dipstick. Add oil to the hydraulic tank as necessary to raise the level even with the oil level mark on the dipstick. Install the oil filler plug and dipstick; tighten securely.

3. Lubrication of Hydraulic Pump Universal Joint Assembly

Two lube fittings are provided on the hydraulic pump universal joint assembly and the assembly should be lubricated after every 500 hours of operation. To gain access to the universal joint assembly, remove the radiator guard lower front plate. Using a flexible extension on a hand operated type grease gun, lubricate the assembly with Universal Joint Grease (refer to "SPECIFICATIONS OF LUBRICANTS"). **CAUTION:** *To prevent rupture of the grease seals, do not use high pressure lubricating equipment when lubricating the Universal Joint Assembly.*

B. General Care of Hydraulic System

1. Check the oil level after every 10 hours of

operation and add oil if necessary. Use only **CLEAN** oil in the system; dirty oil causes rapid wear on the hydraulic pump, control valve, and other components.

2. Change oil after every 1000 hours of operation (refer to "SPECIFICATIONS OF LUBRICANTS"). The filter element must be replaced after the first 50 hours and every 200 hours thereafter.
3. Keep all fittings and hose connections tight to prevent oil leaks. Do not overtighten or use sealing compound.
4. Use such compounds as "PERMATEX" No. 2 on pipe threads when replacing fittings. Make certain that all parts are thoroughly cleaned before installation.
5. When installing a hose assembly be sure that it is not twisted as the connections are tightened.
6. Keep all hose clamps tightened to avoid hose chafing.
7. Keep the packing gland retainer of each hydraulic cylinder properly adjusted to avoid oil leakage. Each packing gland retainer should be adjusted so that there is a light film of oil on the cylinder piston rod when the unit is in operation. The packing gland retainer of each cylinder is adjusted by removing the locking wire from the retainer capscrews and tightening the two retainer capscrews evenly. Secure the capscrews with locking wire.

CAUTION: *Do not overtighten a packing gland retainer; tighten only enough to stop oil leakage. Excessive tightening of a packing gland retainer results in rapid wear on the packing rings and severe wiping of the cylinder piston rod. If the packing rings leak oil after being adjusted properly, it is an indication that the packing rings are worn and should be replaced.*

TOPIC 5 — SERIAL NUMBER LOCATION

On all parts orders and in all correspondence relative to the hydraulic control units it is necessary that the control unit and the tractor serial numbers be given. This will properly identify the particular unit and will assure obtaining the correct replacement parts for it.

The hydraulic control unit serial number is stamped on the top of the hydraulic lower tank, to the rear of the oil filler plug and oil level dipstick opening, as shown in Fig. 6.

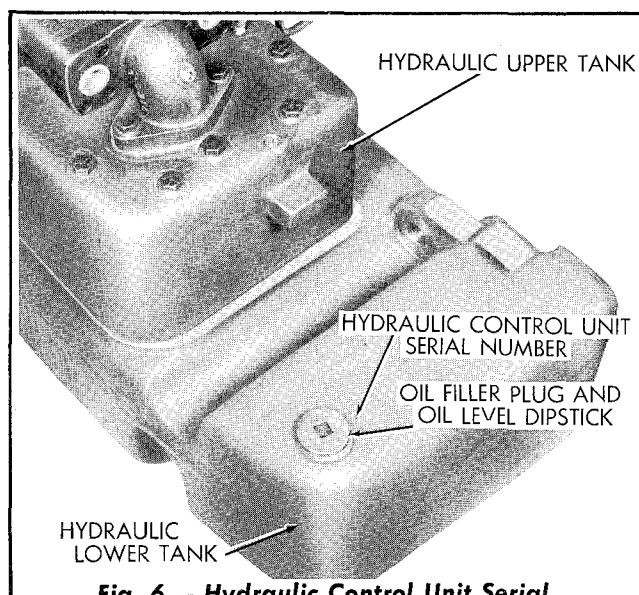


Fig. 6 — Hydraulic Control Unit Serial Number Location

SECTION II — HYDRAULIC PUMP

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TOPIC 1 — DESCRIPTION

There are numerous types of hydraulic pumps which may be used to supply oil under pressure, the most common of which is the gear type pump. From a standpoint of simplicity, economy, and durability, gear type pumps have proven superior to other types under the most severe operating conditions.

A simple gear type pump is one having two gears (usually spur), mounted on shafts in bearings, within a housing having end covers. One end of the shaft, suitably sealed, extends through one cover for connection to the power source. The pump gears are rotated by power applied to the

extended gear shaft, which in turn drives the second gear. Oil drawn by the pump from the oil reservoir is circulated within the pump housing by the cavities between the gear teeth. As the gears mesh, the oil is forced from these cavities, causing a displacement which produces pressure. Contact of the teeth of the two gears at the center line forms a seal, preventing the oil from passing back to the low pressure side. Controlled clearance between the outside diameter of the gears and the housing, and between the face of the gears and end covers, prevents the oil under high pressure from returning to the low pressure side. Pressure is produced only when the flow from the discharge

side is resisted, such as by hydraulic cylinders doing work. When the discharge system is open

(controls in neutral), the pump acts merely as two gears running in oil.

TOPIC 2 — REMOVAL OF HYDRAULIC PUMP AND LINES FROM UPPER TANK

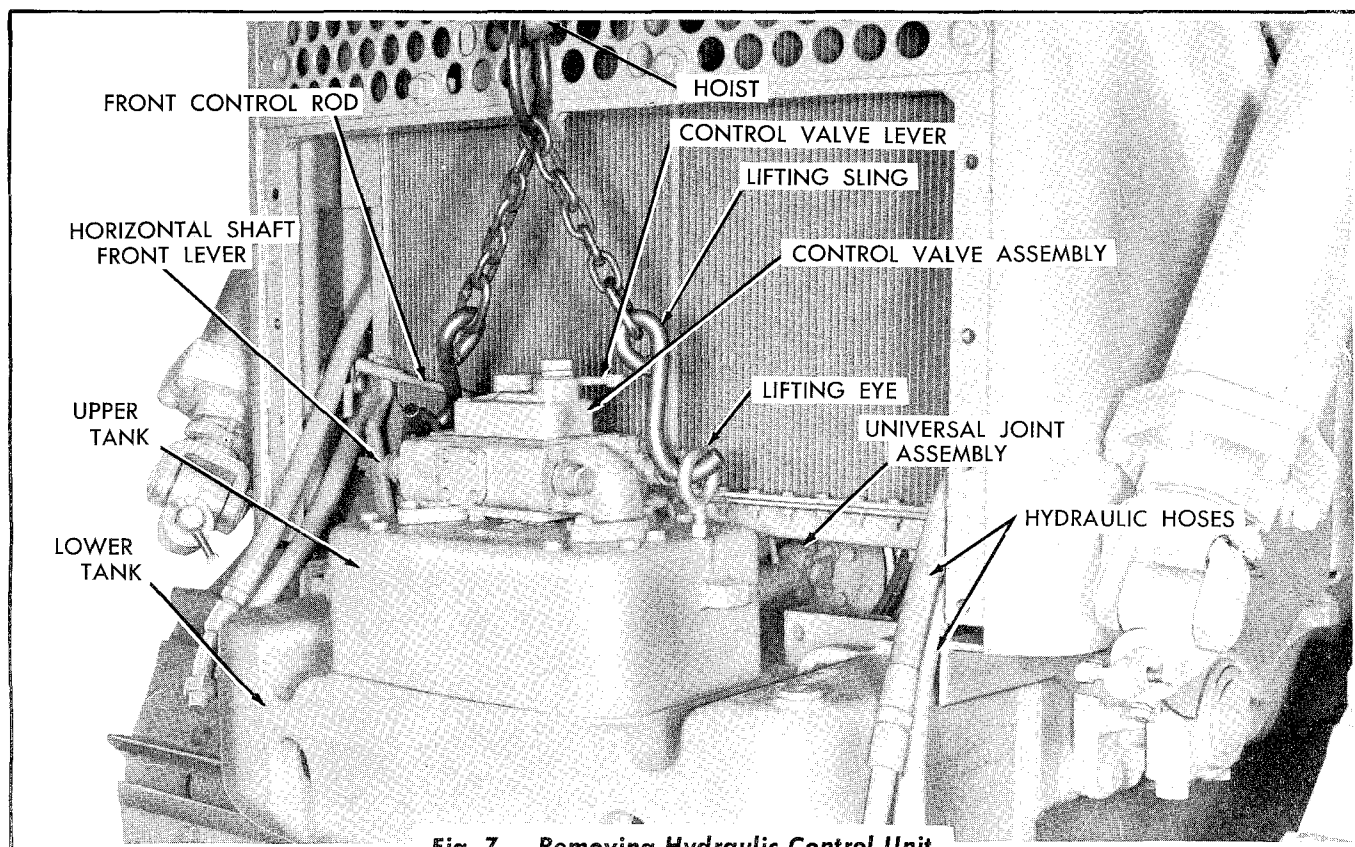


Fig. 7 — Removing Hydraulic Control Unit
(HD 21 Shown — HD 16 Similar)

1. Thoroughly clean the hydraulic tank assembly, control valve, and surrounding area.
2. Remove the oil drain plug (Fig. 9) from the bottom of the hydraulic lower tank and allow the oil to drain.
3. Disconnect the hydraulic hoses or tubes from the control valve. Disconnect the front control rod from the control valve lever. Remove the two capscrews attaching the horizontal shaft front bearing bracket (Figs. 3, 4, or 5) to the hydraulic tank.
4. Remove the four nuts securing the hydraulic tank assembly on the mounting studs. Using a suitable hoist, sling, and eye bolts, move the control unit forward until it is free of the mounting studs and remove the control unit from the tractor as shown in Figs. 7 or 8.

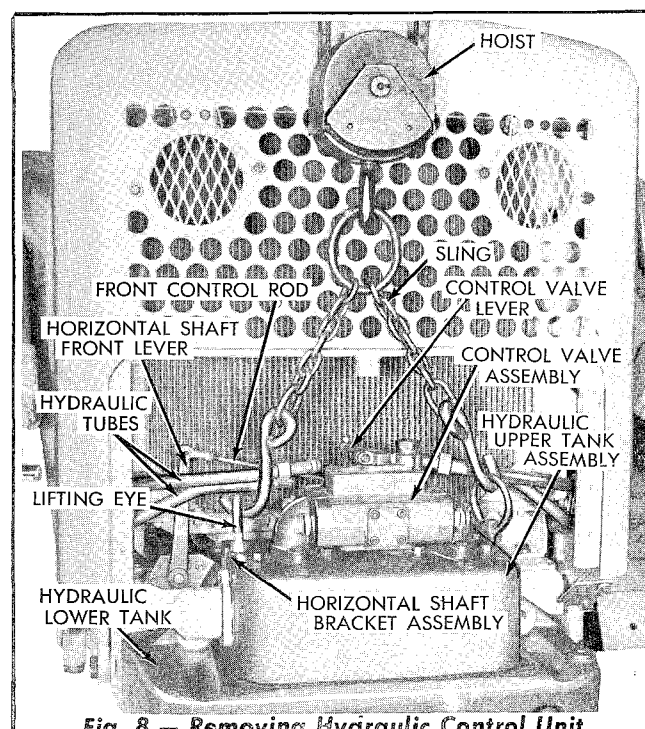


Fig. 8 — Removing Hydraulic Control Unit
(HD 11 Shown)

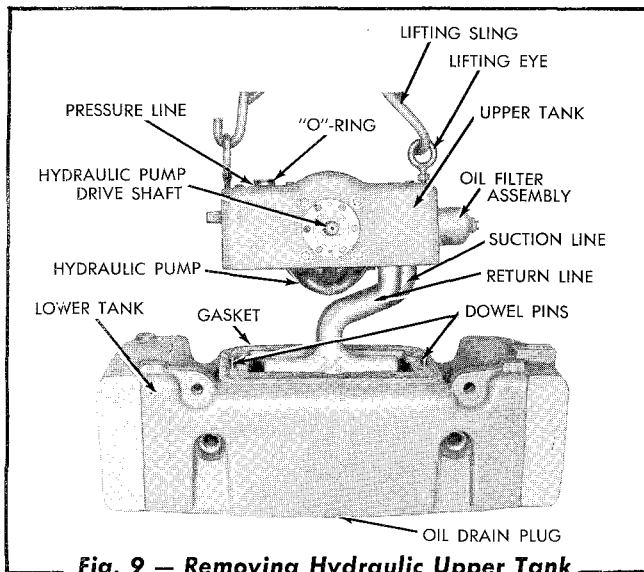


Fig. 9 — Removing Hydraulic Upper Tank Assembly from Lower Tank (HD 21 Shown — HD 16 and HD 11 Similar)

5. Remove the four capscrews securing the control valve assembly to the upper tank and remove the control valve assembly. Remove the eight capscrews securing the upper tank assembly to the lower tank and remove the upper tank from the lower tank as shown in Fig. 8.
6. Remove the three capscrews securing the oil filter housing (Fig. 10) to the upper tank and remove the filter assembly. Remove the filter connecting hose.

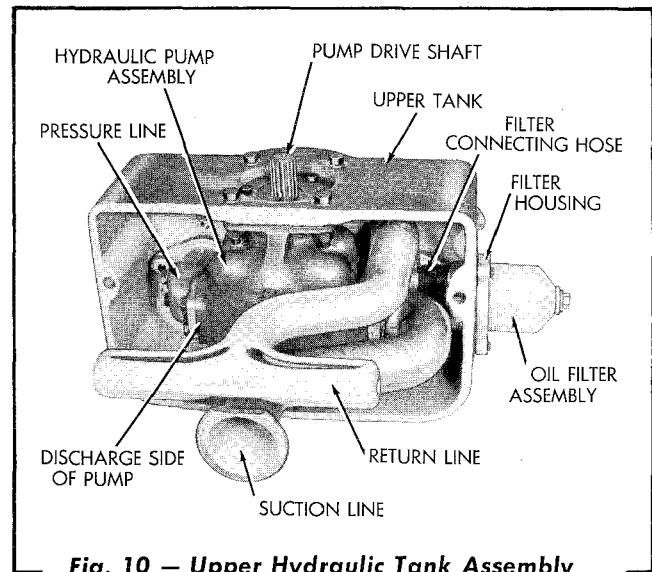


Fig. 10 — Upper Hydraulic Tank Assembly Bottom View

7. Remove the two capscrews attaching the oil return line (Fig. 10) to the upper tank and remove the return line. Remove the two capscrews securing the oil pressure line (Fig. 10) to the upper tank.
8. Remove the four bolts attaching the pump to the upper tank and remove the pump, pressure line, and suction line as an assembly from the upper tank. Remove the pressure line and suction line from the pump.

TOPIC 3 — DISASSEMBLY OF HYDRAULIC PUMP

1. Thoroughly clean the exterior of the pump. Using a file or oil stone, remove any sharp edges or burrs from the drive shaft splines, or shaft end, before disassembling the pump. Punch mark the seal retainer, pump adapter, housing, and cover so that they may be reassembled in their original positions. Remove the six seal retainer capscrews. Place the pump assembly in a vise.
2. Using a pry or heel bar in the two slots provided in the seal retainer, pry out and remove the seal retainer and seal assembly as a unit.
3. Remove the pump cover capscrews and remove the cover and bearings as an assembly.
4. Remove the capscrews attaching the adapter to the pump housing. Separate the adapter and the pump housing by tapping with a soft hammer. **CAUTION:** Avoid scoring the flat machined surfaces (mating surfaces) of the pump sections.
5. Remove the cover end wear plate (note the position of the oil relief pocket in the wear plate), "O"-ring seal, and the wear plate shims.
6. Index the drive and driven gears with chalk as shown in Fig. 12. Remove the drive and driven gear shaft assemblies.

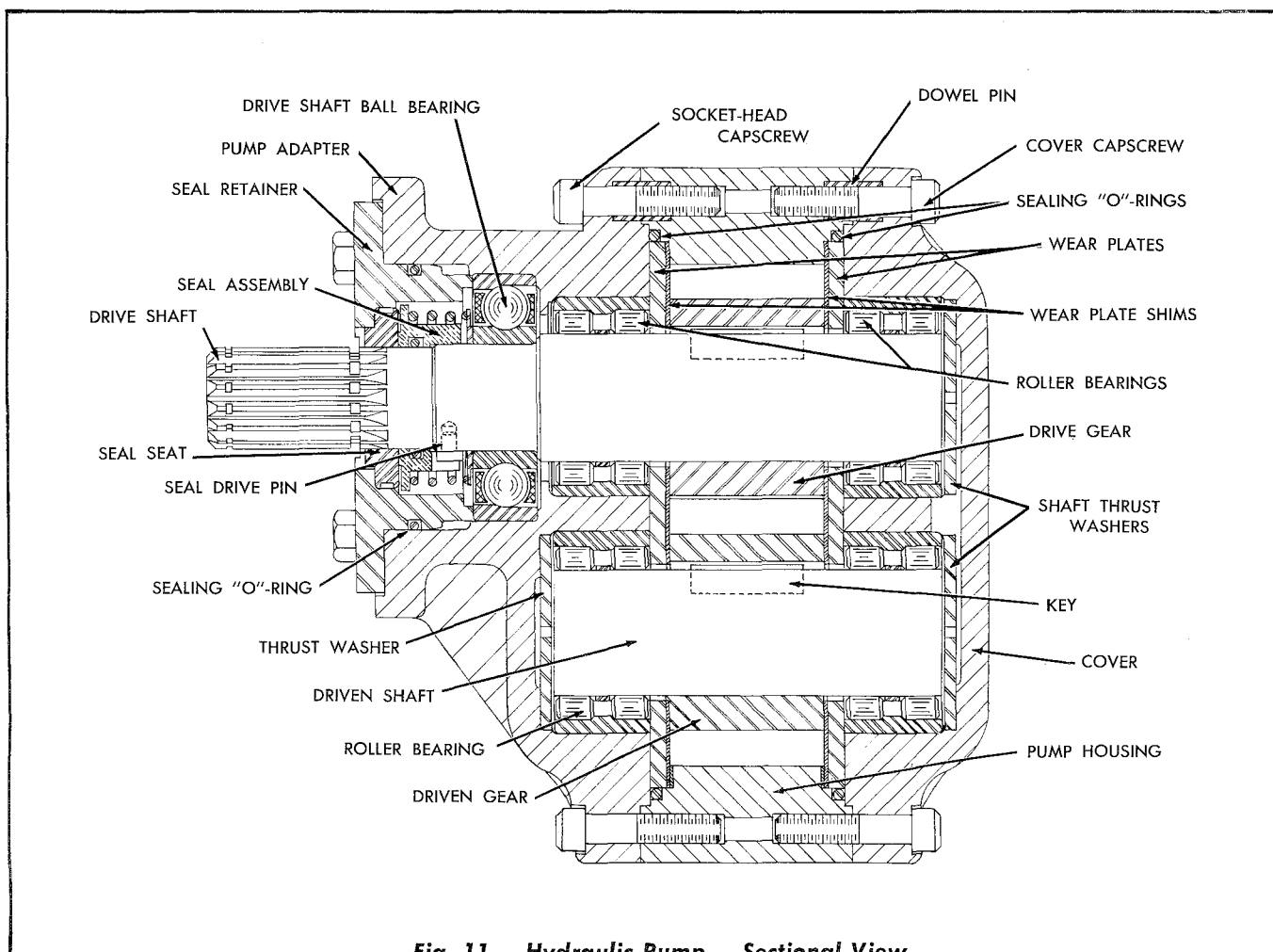


Fig. 11 — Hydraulic Pump — Sectional View

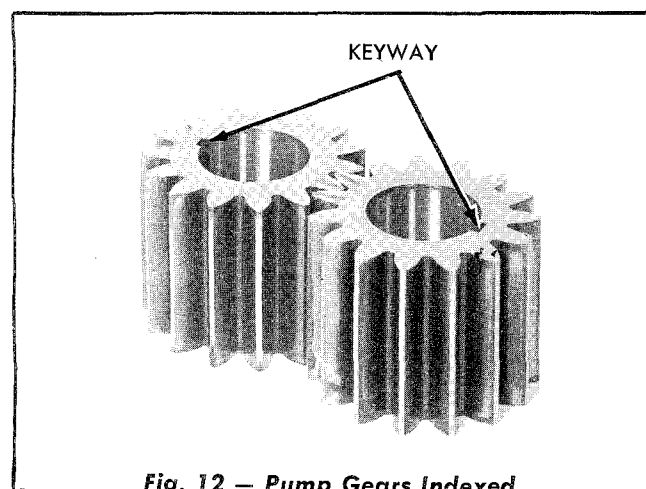


Fig. 12 — Pump Gears Indexed

7. Remove the adapter end wear plate (note the position of the oil relief pocket in the wear plate), "O"-ring seal, and the wear plate shims.

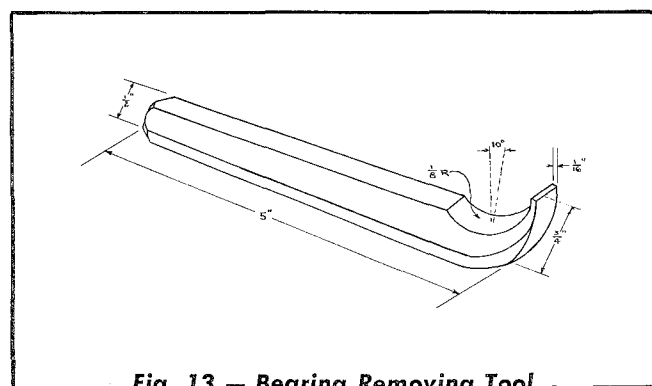


Fig. 13 — Bearing Removing Tool

8. Check the condition of the roller bearings and replace if necessary. Using a tool similar to the one shown in Fig. 13, insert the end of the tool under the bearing(s) and tap the tool with a hammer until the bearing(s) is raised sufficiently so that a suitable bearing puller tool may be used to remove the bearing(s).

TOPIC 4 — INSPECTION AND REPLACEMENT OF PUMP PARTS

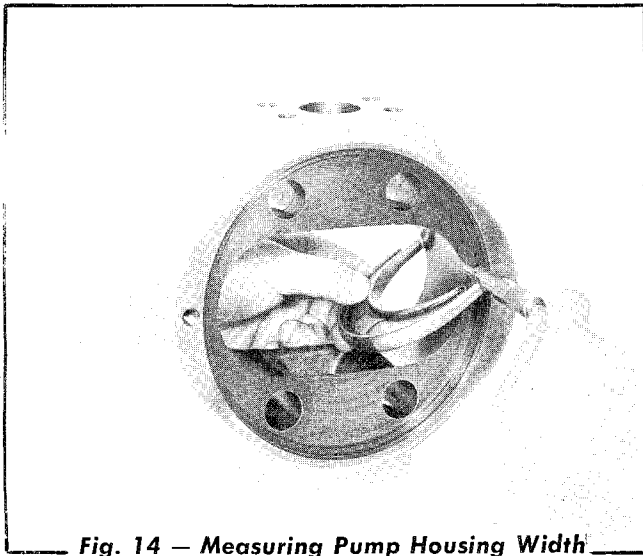


Fig. 14 — Measuring Pump Housing Width

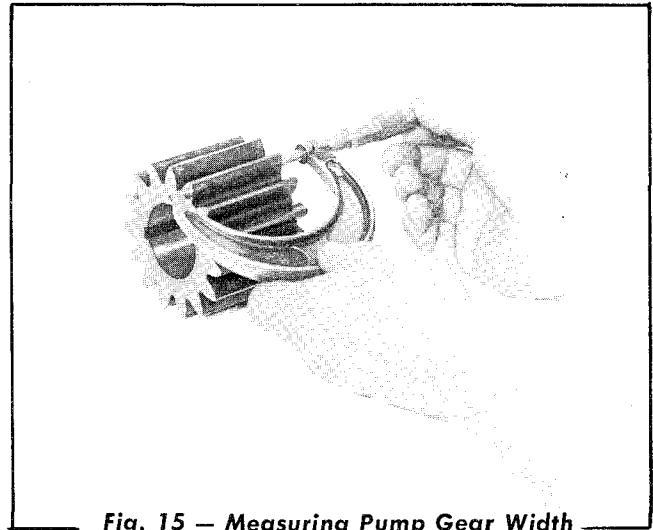


Fig. 15 — Measuring Pump Gear Width

A. Ball Bearings

Replace the ball bearing, if there is lack of free movement, cracks, pitted surfaces, worn balls, worn races, or the presence of excessive end play between the outer and inner races. To check for excessive end play between the outer and inner races, hold one race steady, while the other is moved end wise, and compare this movement with that of a new bearing. Replace creeping bearings; such bearings can be detected by marks on the bearing races or on the bearing area of the bore or shaft where the bearing is used.

B. Roller Bearings

Check roller bearings for free movement, cracks, pitted surfaces, or worn rollers. Always install new bearings when a new drive or driven gear and shaft assembly is installed.

C. Seals and Gaskets

Replace any damaged, shrunken, or hardened gaskets, and sealing "O"-rings. Replace the driven gear shaft seal assembly. Replace all copper sealing washers.

D. Gears

1. Thoroughly clean and inspect the gears for worn, pitted, or cracked teeth. Inspect tooth edges and gear faces for scoring. Stone the gear faces and tooth edges if slight scoring or burrs is observed.

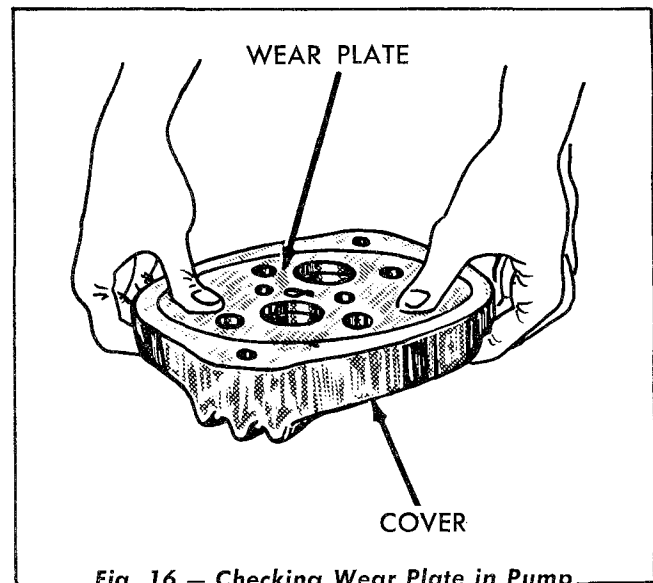


Fig. 16 — Checking Wear Plate in Pump Cover for Proper Seating

2. Measure the width of the gears and housing as shown in Figs. 14 and 15. Replace both gear and shaft assemblies if the difference between the housing width and the gear widths exceed .005".

E. Shafts

Inspect the shafts at the bearing and seal location for rough surfaces and excessive wear. Determine the major diameter by measuring the shaft at a point not subject to wear. Replace shafts having a roller bearing wear pattern that is .001" under the major diameter. Install new bearings with a new shaft.

F. Adapter, Housing, and Cover

1. Remove nicks and burrs from around the bearing bores, drilled holes, and mating surfaces of the three pump sections; use a short fine mill file and India stone. Wash the surfaces to remove filings.
2. Check the seating of the wear plates for proper fit in the adapter cover and end cover. A rocking motion of the wear plates indicates a burr on the machined surface of the adapter or cover and/or a bent wear plate (refer to Fig. 16).
3. Discard any housing in which the gear bores measure more than 6.412" through the dowel pin hole center line. Replace housings that show severe score marks beyond the gear bore center line. This does not include smooth wear.

G. Wear Plates

Replace scored wear plates or those showing ero-

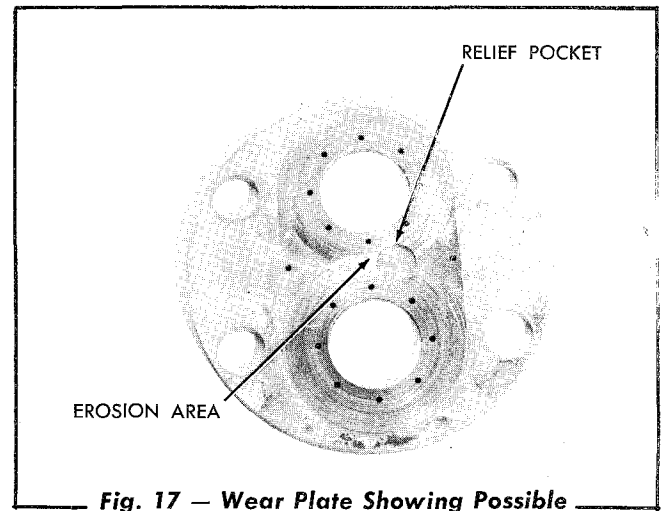


Fig. 17 — Wear Plate Showing Possible Erosion Area

sion marks in the vicinity of the counter-bored relief pocket as shown in Fig. 17.

NOTE: Do not reverse the wear plates as the relief pocket is located on the gear side (bronze side) only.

TOPIC 5 — ASSEMBLY OF HYDRAULIC PUMP

A. Roller Bearing Installation

Lubricate the bearings with a light grease. Coat the I.D. of the bearing bores in the adapter and cover with white lead. Install the three shaft thrust washers in their respective bores, with the bronze side of each washer toward the shaft end. Drive or press the bearings into their respective bores with a tool similar to the one shown in Fig. 18.

B. Adapter, Housing, and Cover Sections

1. Install the hollow type dowel pins in the adapter and cover, if the pins were removed.
2. Install a sealing "O"-ring in each of the two grooves in the inner face of the adapter.
3. Install the wear plate in position in the pump adapter. IMPORTANT: When installing the wear plate, make certain that the counterbored relief pocket in the wear

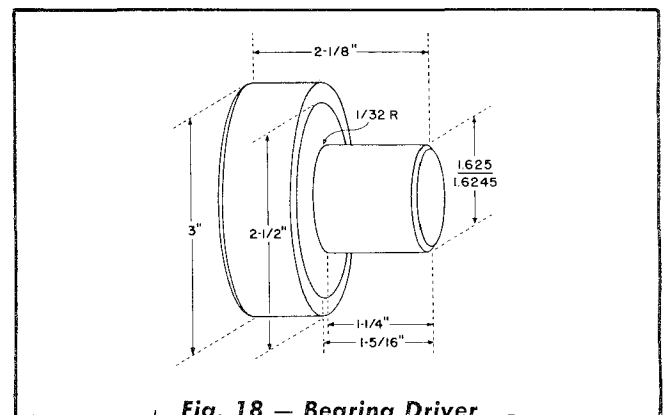


Fig. 18 — Bearing Driver

plate is next to the gears and the relief pocket is on the side toward the pump housing discharge port. The discharge port in the pump housing is smaller in diameter than the inlet port in the housing. Lubricate the gear contact surface of the wear plate with clean oil.

4. Install the sealing "O"-ring in position around the O.D. of the wear plate of the pump adapter.

5. Measure the gear and pump housing widths (refer to Topic 4, Par. D.). Proper clearance between the gear faces and the wear plates is obtained by the use of wear plate shims installed between the pump adapter and the pump housing and between the pump cover and the pump housing. The following chart indicates the location and number of shims required to provide the proper wear plate to gear face clearance:

Pump Gear Width Variation from Housing Width	Shim Thickness Required for Adapter End	Shim Thickness Required for Cover End
+ .002"	.003"	.003"
+ .001"	.003"	.003"
.000"	.003"	.002"
— .001"	.002"	.001"
— .002"	.002"	.001"

6. Install the drive and driven gear shaft assemblies. If the old parts are used, align the marked teeth Fig. 12. If new gear and shaft assemblies are used, keep the keyways 180 degrees apart as shown in Fig. 12. Lubricate the gear faces with clean oil.
7. Refer to the above chart and install the adapter end wear plate shims of the specified thickness. *NOTE: The shims are available in two thicknesses: .001" and .002".*
8. Align the punch marks and install the pump housing in position on the pump adapter; tap the housing down evenly with a soft hammer. If a new pump housing is used, make certain that the pump housing is installed in the pump adapter with the discharge side of the pump housing positioned as shown in Fig. 10. Install the two $\frac{3}{8}$ " NF x $1\frac{3}{4}$ " hex-socket-head capscrews to secure the housing to the adapter and tighten the capscrews to a torque of 50 lbs. ft.
9. Refer to the above chart and install the cover end wear plate shims of the specified thickness in position on the pump housing. *NOTE: The shims are available in two thicknesses: .001" and .002".*

10. Install the cover end wear plate in position on the pump shafts and gears. **IMPORTANT:** *When installing the wear plate, make certain that the counterbored relief pocket in the wear plate is next to the gears and the relief pocket is on the side toward the pump housing discharge port.* The discharge port in the pump housing is smaller in diameter than the inlet port in the housing. Lubricate the gear contact surface of the wear plate with clean oil.

11. Install the sealing "O"-ring in position around the O.D. of the cover wear plate. Install a sealing "O"-ring in each of the two grooves in the face of the cover.
12. Align the housing and cover punch marks and start the cover into place. Tap the cover down evenly on the dowel pin until it bottoms on the housing, using care to prevent damage to the sealing "O"-rings. Secure the pump cover to the pump housing with four $\frac{7}{8}$ " NF x $5\frac{1}{2}$ " and two $\frac{3}{8}$ " NF x $1\frac{3}{4}$ " hex-socket-head capscrews; tighten the four $\frac{7}{8}$ " capscrews evenly to a torque of 110 lbs. ft. Tighten the two $\frac{3}{8}$ " capscrews to a torque of 50 lbs. ft.
13. Install the drive shaft ball bearing on the shaft, making certain that the side of the bearing marked thrust side and having the bearing manufacturer's identification is toward the splined end of the shaft.

C. Installation of Seal Assembly and Seal Seat

1. Install the steel washer of the seal assembly in position on the shaft, with the flat even surface of the washer toward the splined end of the shaft. Install the seal drive pin in the hole in the shaft and turn the pin so that the head of the pin is straight with the splines of the shaft. Place the coil spring in position on the shaft.
2. Using light grease, lubricate the seal ring and the back-up ring in the seal assembly.

- Install the seal assembly over the drive shaft, with the lapped surface toward the splined end of the shaft. *NOTE: Make certain that the slot in the seal assembly is aligned with the head of the seal drive pin.*
3. Using light grease, lubricate the "O"-ring on the seal seat. Press the seal seat (with outer seal ring) into position in the seal retainer. Install the sealing "O"-ring in position in the groove in the seal retainer and lubricate with light grease. Wipe off any foreign matter from the seal seat and the seal assembly and lubricate the sealing surfaces (lapped surfaces) with clean oil.
 4. Start the seal retainer in position on the shaft, press down on the assembly, and start the capscrews. *CAUTION: When compressing the seal assembly, make certain the seal drive pin engages in the slot in the seal assembly.* Tighten the seal retainer capscrews evenly to a torque of 50 lbs. ft.

TOPIC 6 — INSTALLATION OF HYDRAULIC PUMP AND LINES IN UPPER TANK

1. Thoroughly clean the interior of the upper tank. *CAUTION: Some of the component parts are cast aluminum, therefore, care should be taken during assembly to properly align all mating parts before the attaching capscrews are tightened.* When installing the pump and lines, refer to Figs. 9 and 10.
2. Place the suction line in position on the hydraulic pump, using a new gasket between the suction line and pump. Secure the oil suction line to the pump with four $\frac{1}{2}$ " NF x $1\frac{1}{4}$ " drilled-head capscrews. Tighten the capscrews to a torque of 50-60 lbs. ft. and secure with lockwire.
3. Install an "O"-ring in the recess of the flanged end of the oil pressure line and place the pressure line in position on the pump. Install two $\frac{1}{2}$ " NF x 3" capscrews with copper washers and two $\frac{1}{2}$ " NF x $1\frac{1}{4}$ " drilled-head capscrews to attach the pressure line to the pump, but do not tighten the capscrews at this time.
4. Place the upper tank on a clean work bench with the front side of the tank downward. Coat the pump mounting flange lightly with grease and install a new gasket on the pump mounting flange. *NOTE: The grease will hold the gasket in place while the pump is being installed.*
5. Place the pump assembly in position in the upper tank, inserting the upper end of the pressure line through the hole provided in the top of the tank. Attach the pump to the upper tank with four $\frac{1}{2}$ " NF x $2\frac{1}{2}$ " capscrews, copper washers, and elastic stop nuts, but do not tighten at this time.
6. Install two $\frac{1}{2}$ " NF x $1\frac{3}{4}$ " capscrews and copper washers to attach the top of the pressure line to the upper tank but do not tighten at this time.
7. Move the pump and lines as necessary to eliminate any binding and snug all of the attaching capscrews and nuts evenly. Tighten the capscrews, which were installed previously, in the following sequence:
 - a. Tighten the two capscrews attaching the pressure line to the top of the tank to a torque of 35 to 40 lbs. ft.
 - b. Tighten the four capscrews attaching the pressure line to the pump to a torque of 50-60 lbs. ft. Secure the drilled-head capscrews with lockwire.
 - c. Tighten the four bolts attaching the pump to the upper tank to a torque of 50-60 lbs. ft.

the oil filter connecting hose on the oil inlet end of the filter housing and install the filter housing in its proper position in the upper tank. *NOTE: Make certain the filter connecting hose is properly positioned on the filter housing and on the return line of the upper tank.*

Secure the filter housing to the upper tank with three socket-head capscrews. Install a new filter element in the shell. Place a new gasket in position in the filter housing and secure the filter shell to the housing with the shell centerbolt.

9. Thoroughly clean the interior of the lower tank.

10. Install a new gasket on the mounting surface of the lower tank and over the dowel pins.
11. Lower the upper tank assembly onto the lower tank as shown in Fig. 9, inserting the suction line and oil return line into the lower tank. Position the upper tank on the dowel pins of the lower tank and install eight $\frac{1}{2}$ " NF x $8\frac{1}{8}$ " capscrews and copper washers. Tighten the capscrews evenly to a torque of 50-60 lbs. ft. Install the control valve assembly (refer to Section III, Topic 3).

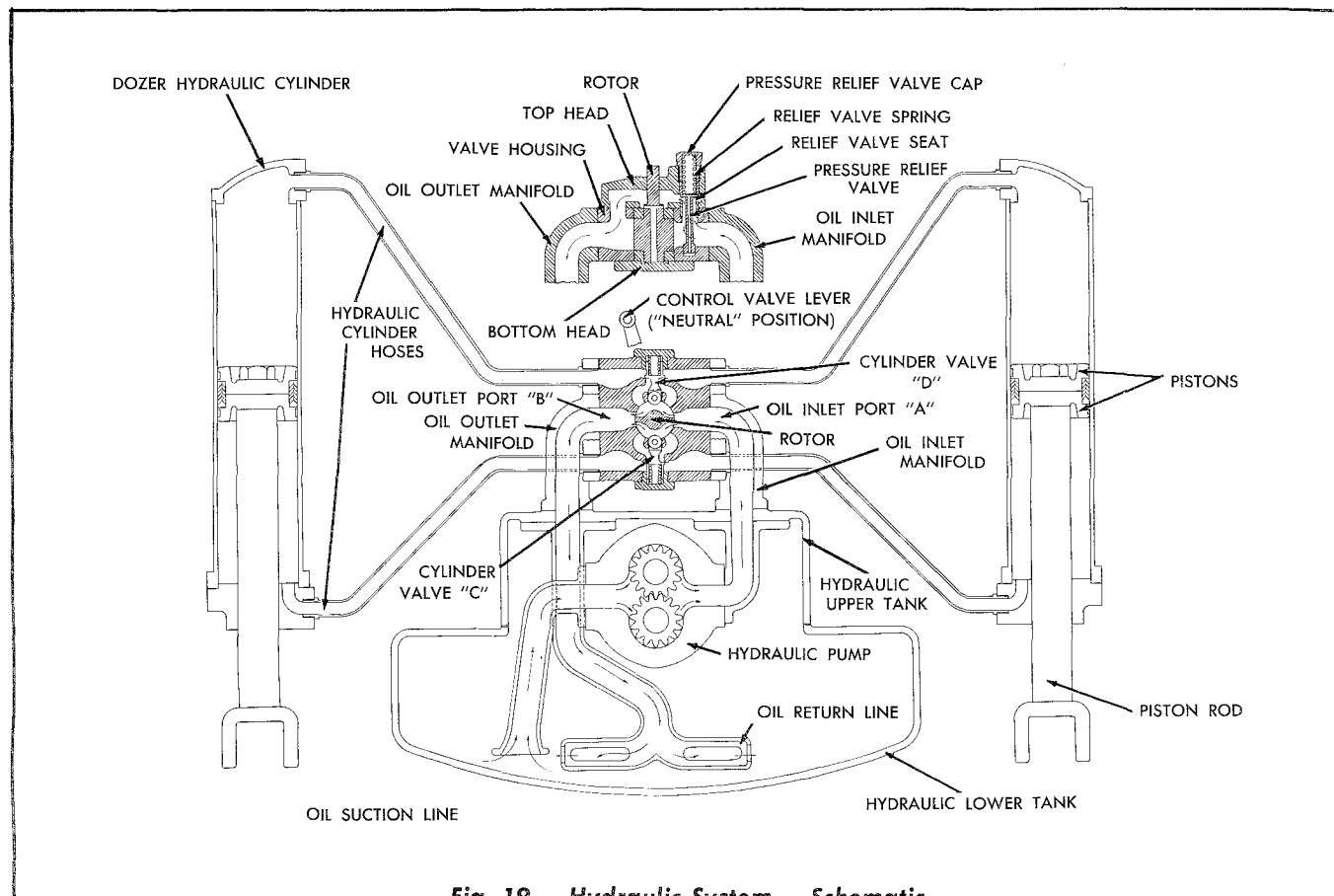
TOPIC 7 — INSTALLATION OF HYDRAULIC UNIT ON TRACTOR

1. Using a suitable hoist, sling, and eye bolts as shown in Fig. 7 or 8, raise the hydraulic unit and start the unit in position on the mounting studs. Hold the front end of the universal joint assembly in alignment with the hydraulic pump drive shaft and move the hydraulic unit back in position against the tractor main frame. Place the washers in position on the lower two mounting studs, install the nuts on the studs, and tighten the nuts securely.
2. Refer to Figs. 3, 4, or 5 and install the capscrews and lockwashers to secure the horizontal shaft front bearing bracket to the upper tank. Connect the front control rod to the control valve lever.
3. Connect the hydraulic hoses or tubes to the control valve as shown in Figs. 3, 4, or 5. Install and tighten the oil drain plug.
4. Fill the hydraulic system with the specified lubricant (refer to Section I, Topic 4).

SECTION III — HYDRAULIC CONTROL VALVE

Topic Title	Topic No.	Page No.
Description	1	19
Removal, Disassembly, Inspection, and Assembly	2	22
Installation	3	23

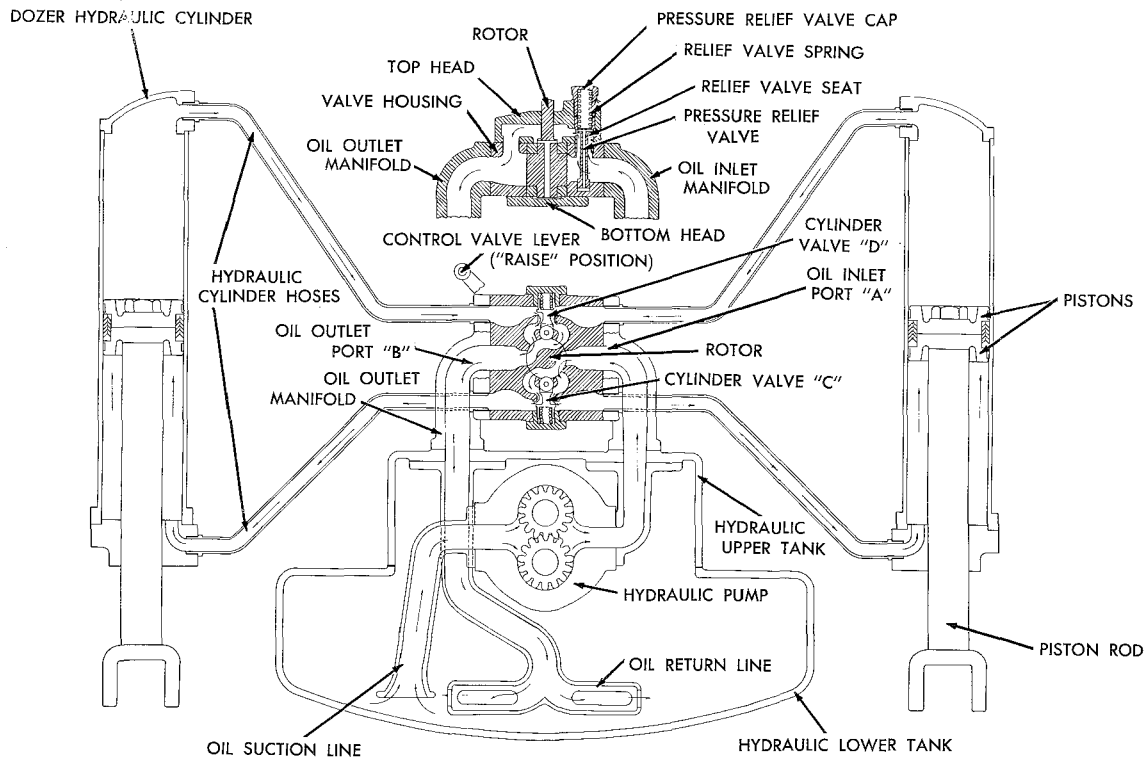
TOPIC 1 — DESCRIPTION



**Fig. 19 — Hydraulic System — Schematic
(Control Valve Lever in
"Neutral" Position)**

The hydraulic pump supplies oil under pressure to the oil inlet port "A" (Fig. 19). When the control valve lever is in the "Neutral" position (Fig. 19), oil passes through port "A," around the rotor of the control valve and returns to the reservoir through the outlet port "B"; at this time the two cylinder valve assemblies are seated in the valve housing and hold the pistons and piston rods of the dozer hydraulic cylinders stationary.

When the control valve lever is moved to the "Raise" position (Fig. 20), the rotor of the control valve moves the cylinder valve "D" from its seat and allows oil to return from the upper side of the dozer hydraulic cylinders to the reservoir. Also at this time, the rotor diverts oil under pressure from the hydraulic pump through the cylinder valve "C" and to the lower ends of the dozer cylinders, raising the pistons and piston rods of the dozer hydraulic cylinders.



**Fig. 20 — Hydraulic System — Schematic
Control Valve Lever in
"Raise" Position**

When the control valve lever is moved to the "Lower" position (Fig. 21), the rotor of the control valve moves the cylinder valves "C" and "D" from their seats; oil under pressure is then diverted through the cylinder valve "D" and to the upper side of the dozer hydraulic cylinders. The oil from the lower side of the dozer hydraulic cylinders returns to the oil reservoir through the cylinder valve "C."

When the control valve lever is moved to the "Float" position (Fig. 22), the rotor of the control valve is moved to the detent position in the control valve, and holds the cylinder valves "C" and "D" open. With the rotor of the control valve in this

position, the oil can flow freely from one end of the dozer hydraulic cylinders to the opposite end; thus allowing the pistons and piston rods of the dozer hydraulic cylinders to float freely.

A spring loaded pressure relief valve (Fig. 25), located in the hydraulic control valve housing, regulates the pressure within the hydraulic system. The pressure relief valve is of the pre-set type and is not adjustable; the specified opening pressure for the relief valve is 1200 to 1300 P.S.I. When the relief valve opens, the oil is by-passed through an opening in the control valve assembly and returns to the hydraulic reservoir.

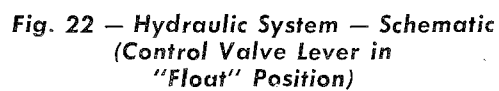
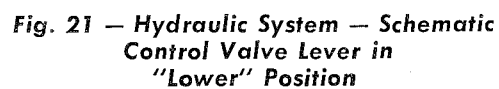


FIG 2 — REMOVAL, DISASSEMBLY, INSPECTION, AND ASSEMBLY

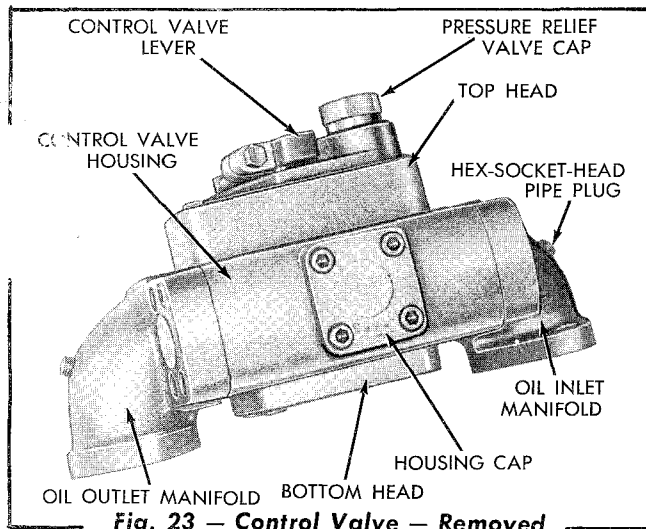


Fig. 23 — Control Valve — Removed

A. Removal (Figs. 3, 4, or 5)

1. Lower the dozer moldboard to the ground. Remove the radiator guard lower front plate. Thoroughly clean the control valve and surrounding area.
2. Disconnect the front control rod from the control valve lever. Disconnect the hydraulic hoses or tubes from the control valve.
3. Remove the two capscrews and copper washers attaching the oil inlet and oil outlet manifolds to the upper tank.
4. Raise the control valve assembly and remove from the upper tank.

B. Disassembly (Figs. 23 and 24)

1. Remove the eight hex-socket-head capscrews from each of the control valve manifolds and remove the manifolds from the control valve housing assembly.
2. Remove the four hex-socket-head capscrews from the two housing caps and remove the housing caps from the control valve housing. Remove the cylinder raise and cylinder lowering valve assemblies from the control valve housing.
3. Remove the pressure relief valve cap, pressure relief valve spring, and the pressure relief valve from the control valve housing.

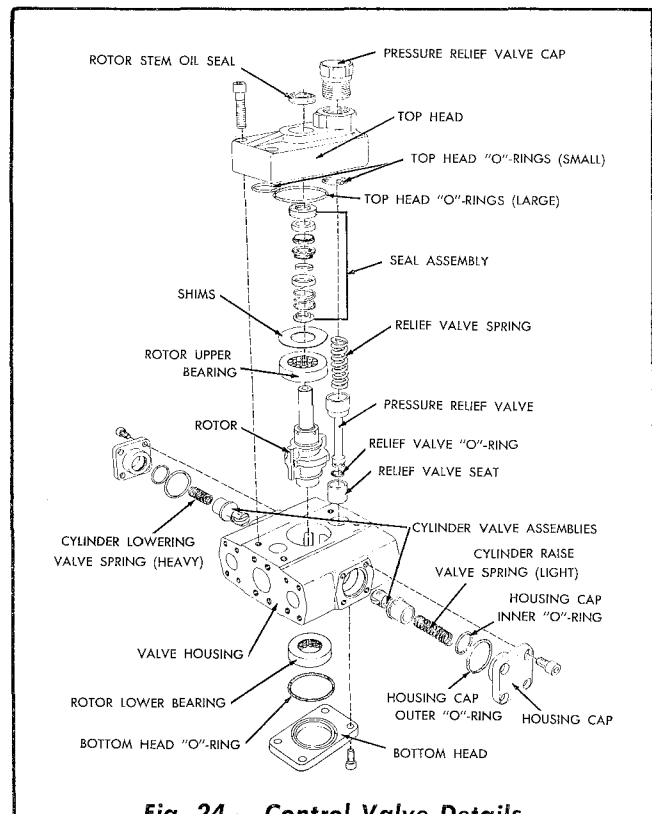


Fig. 24 — Control Valve Details

4. Loosen and remove the control valve lever from the rotor. Remove the "Woodruff" key from the upper end of the rotor. Remove the four hex-socket-head capscrews from the top head and remove the top head from the control valve housing.
5. Remove the four hex-socket-head capscrews attaching the bottom head to the valve housing and remove the bottom head. Remove the rotor, oil seal assembly, and rotor upper bearing from the control valve housing, taking care to prevent damage to any of the components. Remove the rotor lower bearing from the valve housing.
6. Remove the oil seal assembly, shim(s), and the rotor upper bearing from the rotor.

C. Inspection

Thoroughly clean all the components in clean solvent. Inspect the rotor, two rotor bearings, valve springs, pressure relief valve, rotor stem oil seal assembly, and all the valve seats in the control valve housing for wear or damage and replace

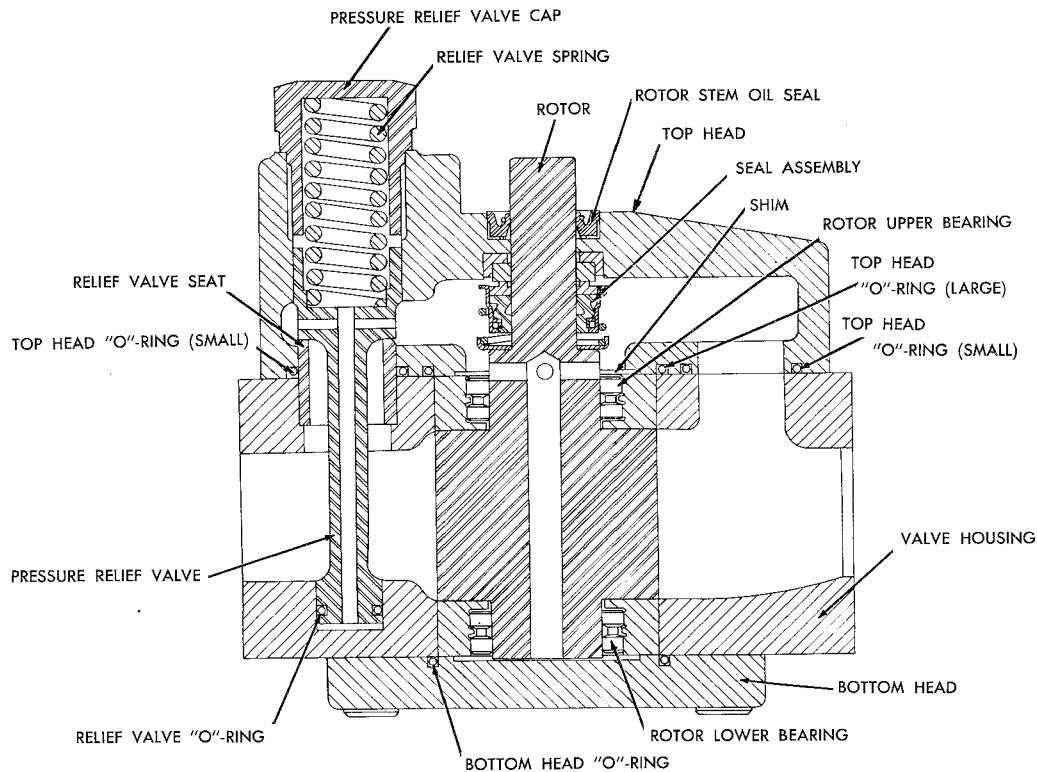


Fig. 25 — Control Valve — Sectional View

the necessary components. All the seal rings ("O"-rings) must be replaced when assembling the control valve. All machined surfaces must be free of burrs or nicks.

D. Assembly (Figs. 23 and 24)

Make certain all the components are clean and assemble the control valve as follows:

1. Install the ceramic sealing ring in position in the "Neoprene" type sealing ring cup, with the flat side of the sealing ring outward. With the thumbs, press the sealing ring cup and ceramic sealing ring in position in the rotor shaft bore of the top head, with the sealing ring cup side toward the top of the top head.
2. Install the rotor stem oil seal in position in the top head, with the lip of the oil seal directed upward. Lubricate the sealing lip with clean oil.
3. Lubricate the rotor lower bearing with clean oil. Install the lower bearing in position in the valve housing, with the shield
- side of the bearing toward the top of the housing.
4. Install a new bottom head "O"-ring gasket in position in groove in the bottom head and place the bottom head in position on the valve housing. Secure the bottom head to the housing with four $\frac{7}{16}$ " NC x $1\frac{3}{4}$ " hex-socket-head capscrews.
5. Carefully insert the rotor into position in the control valve. Lubricate the rotor upper bearing with clean oil. Install the rotor upper bearing in position on the rotor and in the valve housing, with the shielded side of the bearing downward toward the rotor.
6. Shims are provided between the rotor upper bearing and the top head to control the end play of the rotor. Use shims as necessary to obtain approximately .001" clearance between the top of the shim pack and the bottom surface of the top head; the shims are available in .001", .002", and .003" thicknesses.

7. Refer to Fig. 24 and install the seal assembly components in position on the rotor stem.

8. Install the top head "O"-ring (small) in position around the upper end of the pressure relief valve seat. Install the top head "O"-ring (large) and the other top head "O"-ring (small) in position in the grooves in the bottom of the top head.

9. Lubricate the sealing faces of the seal and the shaft of the rotor with clean light oil. Install the top head in position on the valve housing, using care to prevent damage to the seals. Secure the top head to the valve housing with four $\frac{7}{16}$ " NC x $1\frac{3}{4}$ " hex-socket-head capscrews; tighten the capscrews evenly.

10. Install the relief valve "O"-ring in position in the groove at the lower end of the pressure relief valve. Lubricate the pressure relief valve and the valve seat with clean light oil and insert the relief valve into position in the control valve housing. Place the relief valve spring in position on the top of the relief valve and install and tighten the pressure relief valve cap.

11. Turn the rotor so that the keyway in the shaft of the rotor is toward the pressure relief valve cap.

12. Lubricate the cylinder valve assemblies with clean light oil. Install the cylinder valve assemblies in position in the control valve housing, making certain the rollers of the valve assemblies are properly engaged in the machined slots in the valve housing.

Insert the cylinder raise valve spring (light) and the cylinder lowering valve spring (heavy) in position in their respective valves. *NOTE: The cylinder raise valve is the valve located in the side of the control valve housing on which has the serial number stamping.*

Install the housing cap inner and outer "O"-rings and install the housing caps; secure each cap to the valve housing with

four $\frac{3}{8}$ " NC x $\frac{3}{4}$ " hex-socket-head capscrews.

13. Install three new "O"-rings in position in the counterbores of the oil inlet and the oil outlet manifolds. Place the manifolds in position on the valve housing and start the $\frac{3}{8}$ " NC x $1\frac{1}{4}$ " hex-socket-head capscrews; do not tighten the capscrews at this time.

14. Install the "Woodruff" key in position in the rotor shaft and install the control valve lever.

E. Installation (Figs. 3, 4, or 5)

1. Place a new oil manifold gasket in position on each manifold mounting surface of the hydraulic upper tank.

2. Install a new "O"-ring in position in the upper end of the oil pressure line of the hydraulic pump. Lubricate the "O"-ring and the inside of the oil inlet manifold with grease to prevent damage to the "O"-ring when installing the control valve assembly.

3. Place the control valve assembly in position on the upper tank, lowering the oil inlet manifold into position on the upper end of the oil pressure line of the hydraulic pump.

4. Start two $\frac{1}{2}$ " NF x $1\frac{3}{8}$ " capscrews with copper washers to attach each manifold to the upper tank; do not tighten the capscrews at this time. Move the control valve and manifolds as necessary to eliminate any binding and tighten the capscrews attaching the manifolds to the upper tank evenly to a torque of 50 to 60 lbs. ft.

5. Tighten the hex-socket-head capscrews securing the manifolds to the valve housing evenly to a torque of 30 to 35 lbs. ft.

6. Connect the hydraulic hoses or tubes to the control valve. Connect the front control rod to the control valve lever.

7. Fill the hydraulic system to the proper level with the specified lubricant (refer to Section I, Topic 4).

SECTION IV — DOZER HYDRAULIC CYLINDERS

Topic Title	Topic No.	Page No.
Description	1	25
Disassembly and Inspection	2	25
Assembly	3	26

TOPIC 1 — DESCRIPTION

The two dozer hydraulic cylinders (Fig. 26) are of the double acting type and are provided for raising and lowering the moldboard. When the dozer operating control lever is moved to the "Lower" position, oil under pressure from the hydraulic pump passes through the dozer control valve, enters the top of the hydraulic cylinders, and forces the cylinder pistons and piston rods downward; oil in the cylinders below the pistons is returned to the oil reservoir. When the dozer operating control lever is moved to the "Raise" position, oil under pressure from the hydraulic pump passes through the dozer control valve, enters the bottom of the hydraulic cylinders, and forces the cylinder pistons and piston rods upward; oil in the cylinders above the pistons is returned to the oil reservoir.

The piston in each hydraulic cylinder is of the two piece type and is retained on the upper end of the piston rod by a castellated nut and cotter pin. A chevron type piston packing set and two one piece type piston rings are installed on the pistons as shown in Fig. 27. A chevron type packing gland set, a gland packing seating ring, and a piston rod wiping seal is installed in the piston rod packing gland retainer located at the lower end of each cylinder as shown in Fig. 28. A universal assembly is used to connect the lower end of each hydraulic cylinder piston rod to the dozer moldboard or the C-frame.

TOPIC 2 — DISASSEMBLY AND INSPECTION

A. Disassembly (Fig. 26)

1. Remove the six capscrews attaching the end cover to the hydraulic cylinder. Slide the end cover out on the piston rod, away from the hydraulic cylinder. Pull the piston rod from the hydraulic cylinder.
2. Place the piston rod assembly horizontally in a vise; use suitable blocking under the rod for support. Install the piston rod pin in the yoke end of the piston rod and clamp the yoke securely by tightening the vise. Remove the cotter pin, castellated nut, and remove the piston assembly, and cyl-

inder end cover assembly from the piston rod. *NOTE: Use care to prevent damage to the components.* Remove the piston rings from the pistons.

3. Cut the locking wire from the two capscrews securing the packing gland retainer to the end cover and remove the capscrews, packing gland retainer, packing gland set, and the gland seating ring. *NOTE: Use care to prevent damage to the components.*
4. Remove the piston rod wiping seal and the packing gland set from packing gland retainer.

Thoroughly clean all components and carefully inspect as follows: The piston rod wiper seal, pistons, piston rings, piston packing set, and the piston rod gland packing set for excessive wear or damage. Check the interior of the hydraulic cylinder, bore of the end cover, bore of the packing gland retainer, and the surface of the piston rod for nicks, scratches, and scoring. Polish out all rough spots, using a dry medium abrasive cloth. Replace any worn or damaged parts.

C. Assembly (Figs. 26, 27, and 28)

Clean and lubricate all components with clean oil and install as follows:

1. Install a new piston rod wiping seal in the counterbore of the packing gland retainer, with the lip of the seal directed outward; the wiping seal serves to wipe the dirt from the piston rod surface. Lubricate the wiping seal and install the packing gland retainer on the piston rod using care to prevent damage to the lip of the seal.
2. Install a new packing gland seating ring in position in the end cover, making certain that the chamfered end of the ring is toward the outside. Install a new packing gland set into the end cover as shown in Fig. 28. NOTE: Make certain that the split ends of the packing glands are staggered when installed in the end cover. Lubricate the packing glands and start the end cover onto the piston rod, using care to prevent damage to the packing glands.
3. Slide the packing gland retainer into position in the end cover and secure the retainer to the cover with the two packing gland retainer capscrews; do not tighten the capscrews at this time.
4. Install the lower half of the piston on the piston rod, making certain that the counterbore in the piston is facing the yoke end of the piston rod. Place a new piston packing ring set onto the small diameter of the piston as shown in Fig. 27, then install the upper half of the piston onto the piston

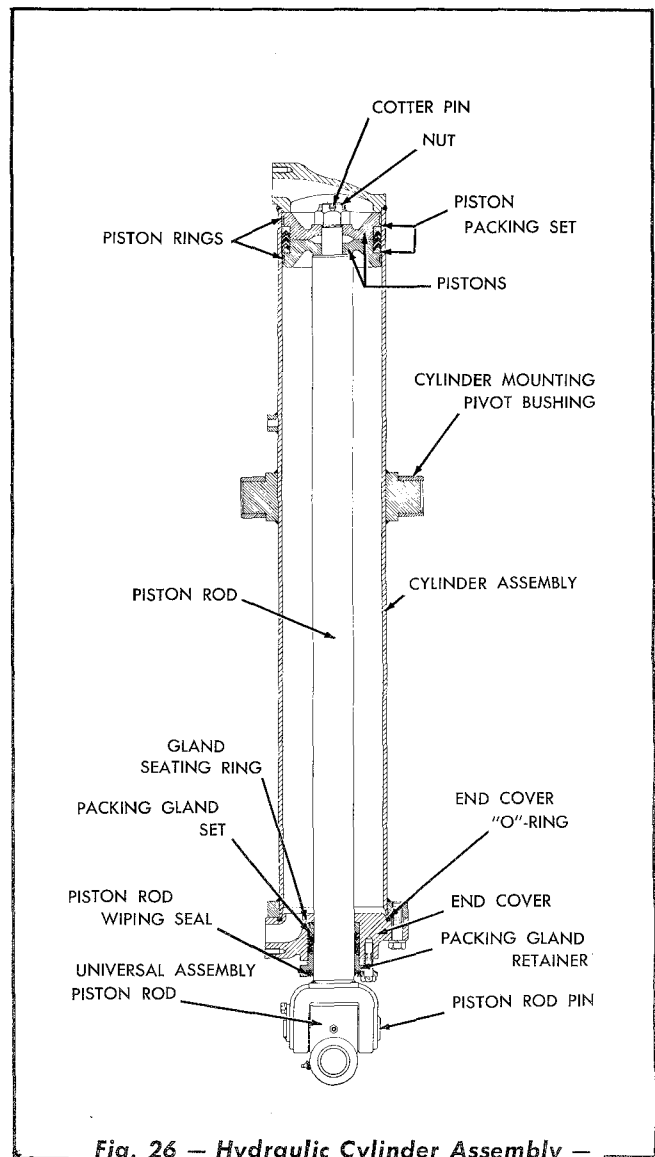


Fig. 26 - Hydraulic Cylinder Assembly - Sectional View

rod and insert the small outer diameter of the piston into the packing ring set. Place a new piston ring in the groove of each piston. NOTE: Make certain that the piston ring packing set is installed on the pistons in the sequence shown in Fig. 27. Care should be taken so that each ring is properly seated and the edges are not doubled back or the ends lapped. Install nut on the piston, tighten the nut securely, and install the cotter pin.

5. Coat the end cover with heavy grease and install the "O"-ring in position in the groove of the end cover. Lubricate the pistons, piston rings, and packing, the piston rod assembly, and the inside of the cylinder with clean oil. Using care to prevent

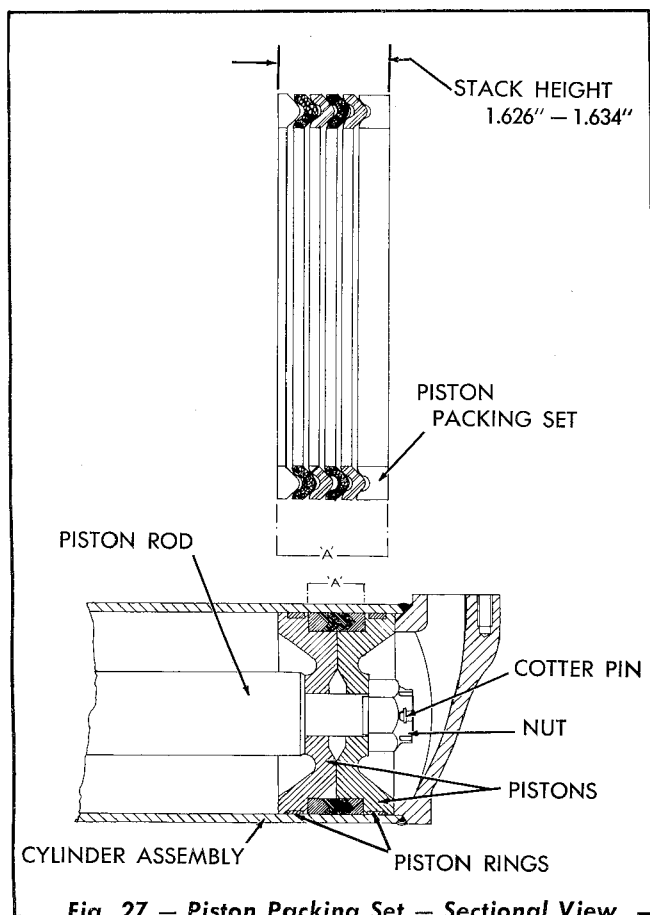


Fig. 27 — Piston Packing Set — Sectional View

damage to the piston rings and packing, install the piston rod assembly in the cylinder. Secure the end cover to the cylinder (making certain the end cover "O"-ring is in the correct position) with six $\frac{5}{8}$ " NF x $2\frac{1}{2}$ " capscrews and lockwashers; tighten the capscrews evenly and securely.

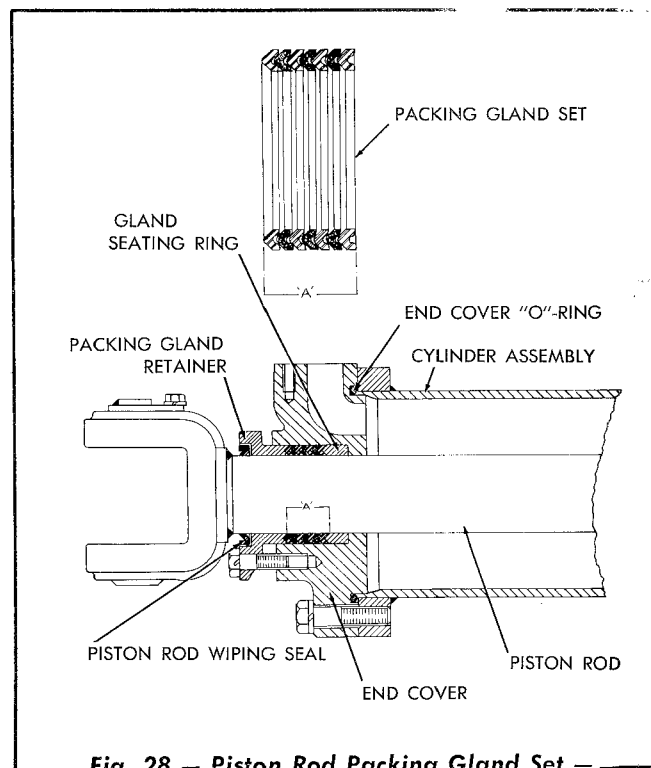


Fig. 28 — Piston Rod Packing Gland Set — Sectional View

6. Tighten the packing gland retainer capscrews evenly using slight pressure on a short wrench. Lock the capscrews with locking wire. NOTE: Excessive tightening of the packing gland retainer results in rapid wear on the packing glands and severe wiping of the piston rod. After the cylinder is placed in operation, observe the piston rod; a light film of oil should be present on the rod.

SECTION V — DIVERTER VALVE GROUP — SPECIAL EQUIPMENT

Topic Title	Topic No.	Page No.
Description	1	28
Diverter Valve	2	30
Rear Control Valve	3	30

TOPIC 1 — DESCRIPTION

The diverter valve group is available as special equipment for tractors equipped with a dozer hydraulic control unit. This group provides a rear hydraulic outlet for single valve hydraulically controlled auxiliary equipment, such as a rear mounted ripper, and eliminates the need for two separate hydraulic systems.

The diverter valve group consists basically of the following: Diverter valve assembly, diverter valve control cable, hydraulic rear control valve assembly and control lever and linkage, and the necessary hydraulic lines. The function of the diverter valve is to direct oil under pressure to the hydraulic rear control valve assembly. The diverter valve is installed on the pressure side (inlet side) of the dozer control valve assembly and is manually operated by a push-pull control cable, located on the left side of the cowl. When the push-pull control cable is pushed IN, the oil under pressure from the hydraulic pump is directed to the dozer control valve for operation of the dozer and the flow of oil to the rear control valve is shut off. When the push-pull control cable is pulled OUT, the oil under pressure from the hydraulic pump is directed to the rear control valve for operation of the auxiliary equipment and the flow of oil to the dozer is shut off.

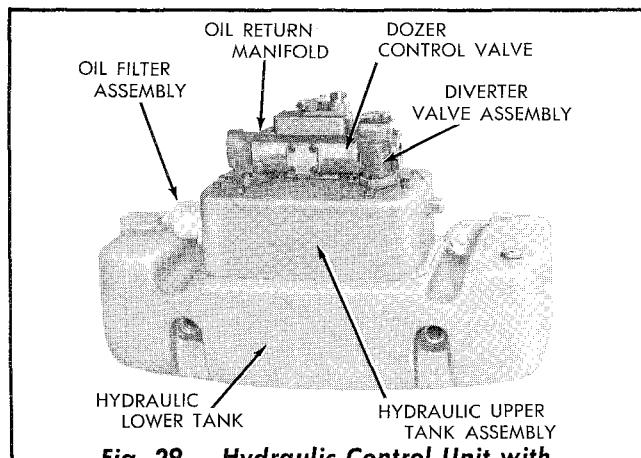


Fig. 29 — Hydraulic Control Unit with Diverter Valve Installed

The rear control valve is mounted on a special mounting bracket attached to the rear face of the steering clutch and final drive housing. The valve is manually operated by a control valve operating lever located to the right of the operator. The rear control valve has three operating positions: RAISE, NEUTRAL (HOLD), AND LOWER. When the rear control valve is in either of the three positions, the flow of oil is similar to that described for the dozer control valve in Section III, Topic 1 (refer to Figs. 19, 20, and 21).

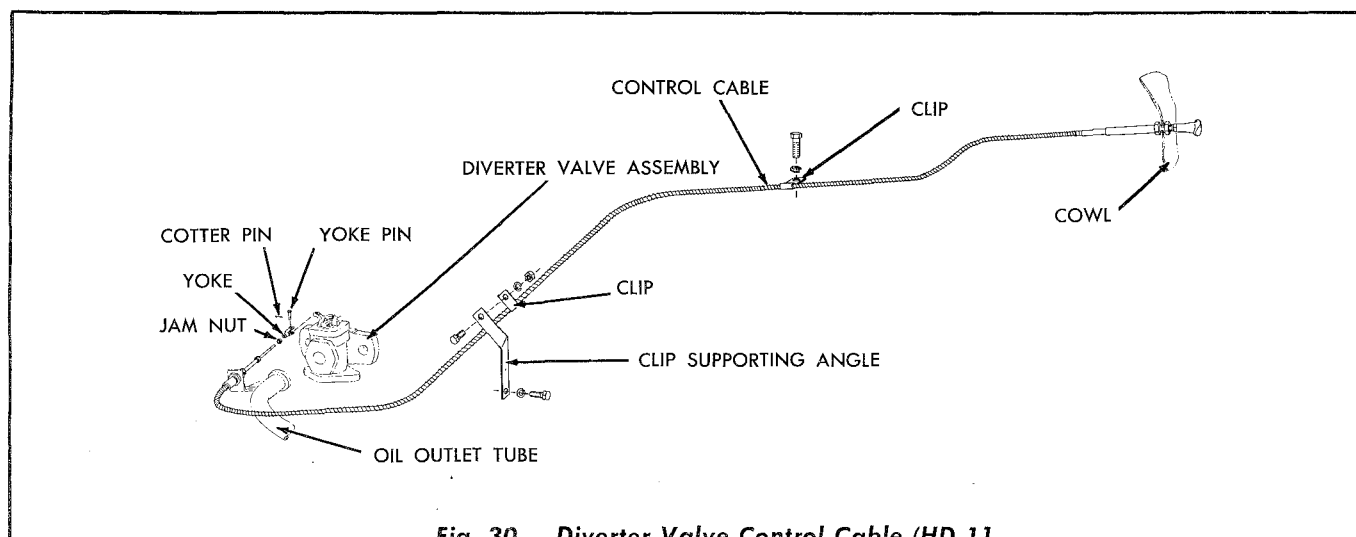


Fig. 30 — Diverter Valve Control Cable (HD 11 Shown — HD 16 and HD 21 Similar)

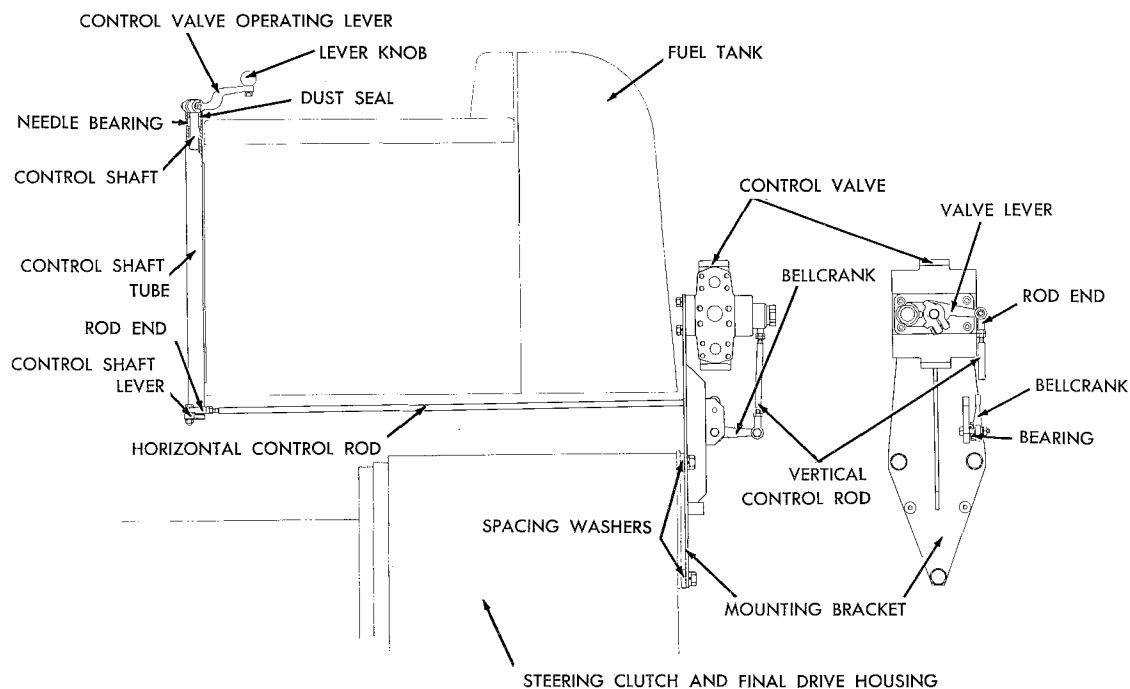


Fig. 31 — Rear Control Valve, Lever, and Control Linkage (HD 11 Shown)

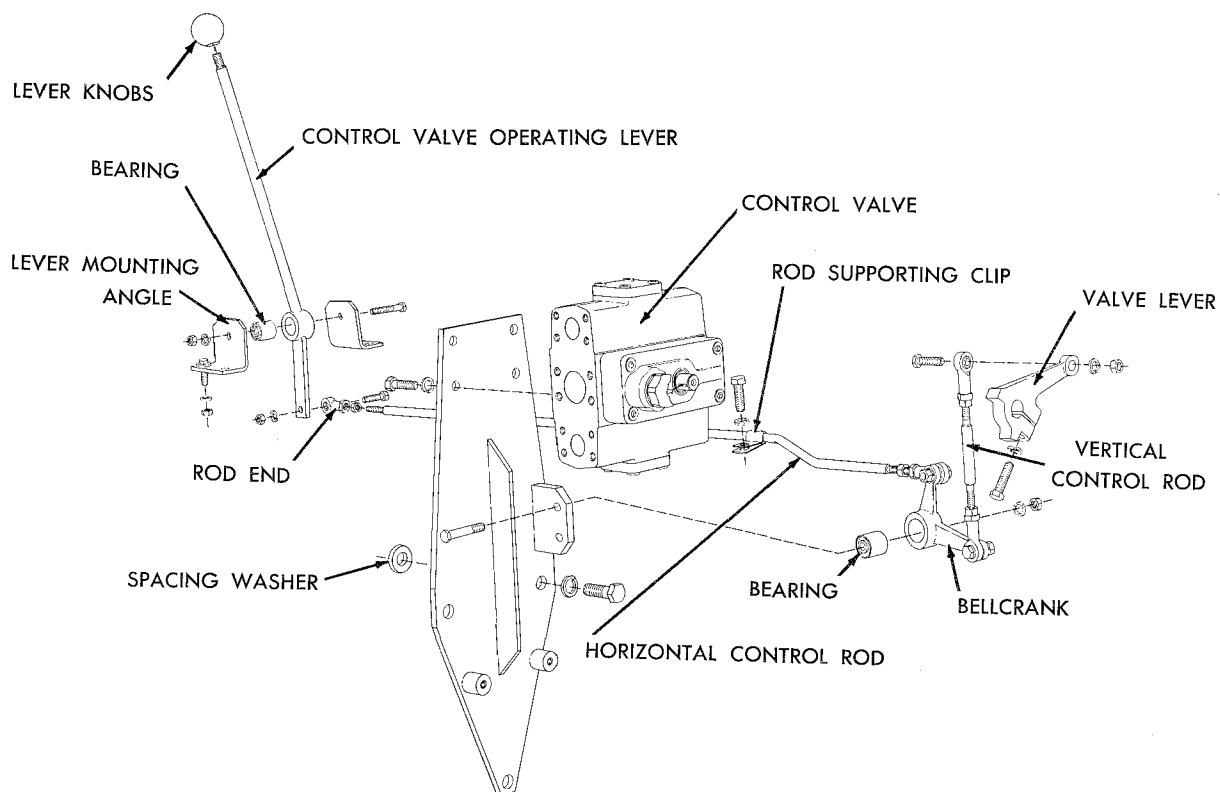


Fig. 32 — Rear Control Valve, Lever, and Control Linkage — HD 21 Shown — HD 16 Similar)

TOPIC 2 — DIVERTER VALVE

A. Disassembly

Loosen the diverter valve lever clamping capscrew and remove the valve lever from the diverter valve.

2. Remove the "Woodruff" key from the rotor shaft. Remove the four hex-socket-head capscrews from the rotor cap.
3. Withdraw the rotor assembly from the diverter valve manifold. Remove the valve cap assembly, bearing washer, and thrust bearing from the rotor. Remove the lip type dirt seal from the valve cap.

B. Inspection

Thoroughly clean all the components in clean solvent or fuel. Inspect the rotor and manifold for roughness or score marks. Install new seal rings ("O"-rings) and a new dirt seal when assembling the diverter valve. Inspect the thrust bearing and bearing washer for roughness, wear, or damage and replace if necessary.

C. Assembly

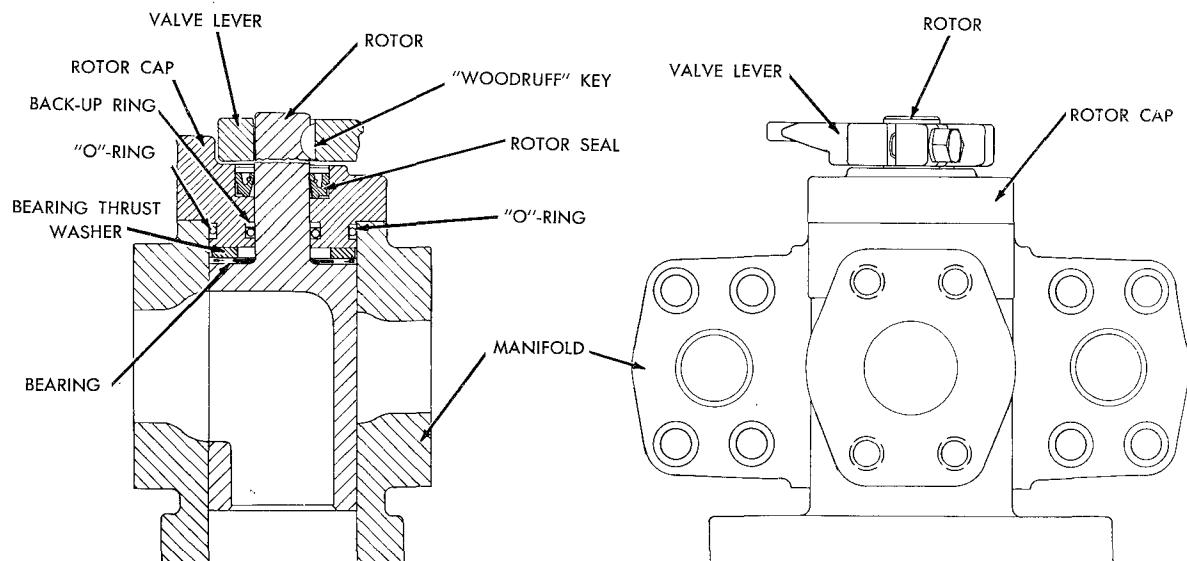
Lubricate all parts with clean oil when assembling the diverter valve.

1. Install a new rotor seal in position in the rotor cap, with the sealing lip of the seal directed outward. Install the back-up ring and the two "O"-rings in their proper positions in the rotor cap as shown in Fig. 33.
2. NOTE: Make certain that there are no rough edges or burrs on the keyway slot in the rotor shaft that may damage the seal when installing the rotor cap assembly on the rotor shaft. Place the thrust bearing and the bearing washer on the rotor shaft and install the rotor cap assembly on the rotor shaft.
3. Install the "Woodruff" key in the slot in the rotor shaft. Install the diverter valve lever on the rotor shaft and secure the lever to the shaft with the $\frac{5}{16}$ " NF x $1\frac{1}{4}$ " capscrew and lockwasher.
4. Install the rotor and rotor cap assembly into the diverter valve manifold. NOTE: Care should be taken when installing the rotor and rotor cap assembly into the diverter valve manifold to prevent damage to the "O"-ring and make certain that the components are in their proper place as shown in Fig. 33. Secure the rotor cap to the manifold with four $\frac{7}{16}$ " NC x $\frac{3}{4}$ " hex-socket-head capscrews.

TOPIC 3 — REAR CONTROL VALVE

The rear control valve is identical to the dozer control valve, therefore, if disassembly or repairs

become necessary, refer to the instructions in Section III, Topic 2.



**Fig. 33 — Diverter Valve Assembly —
Sectional View**

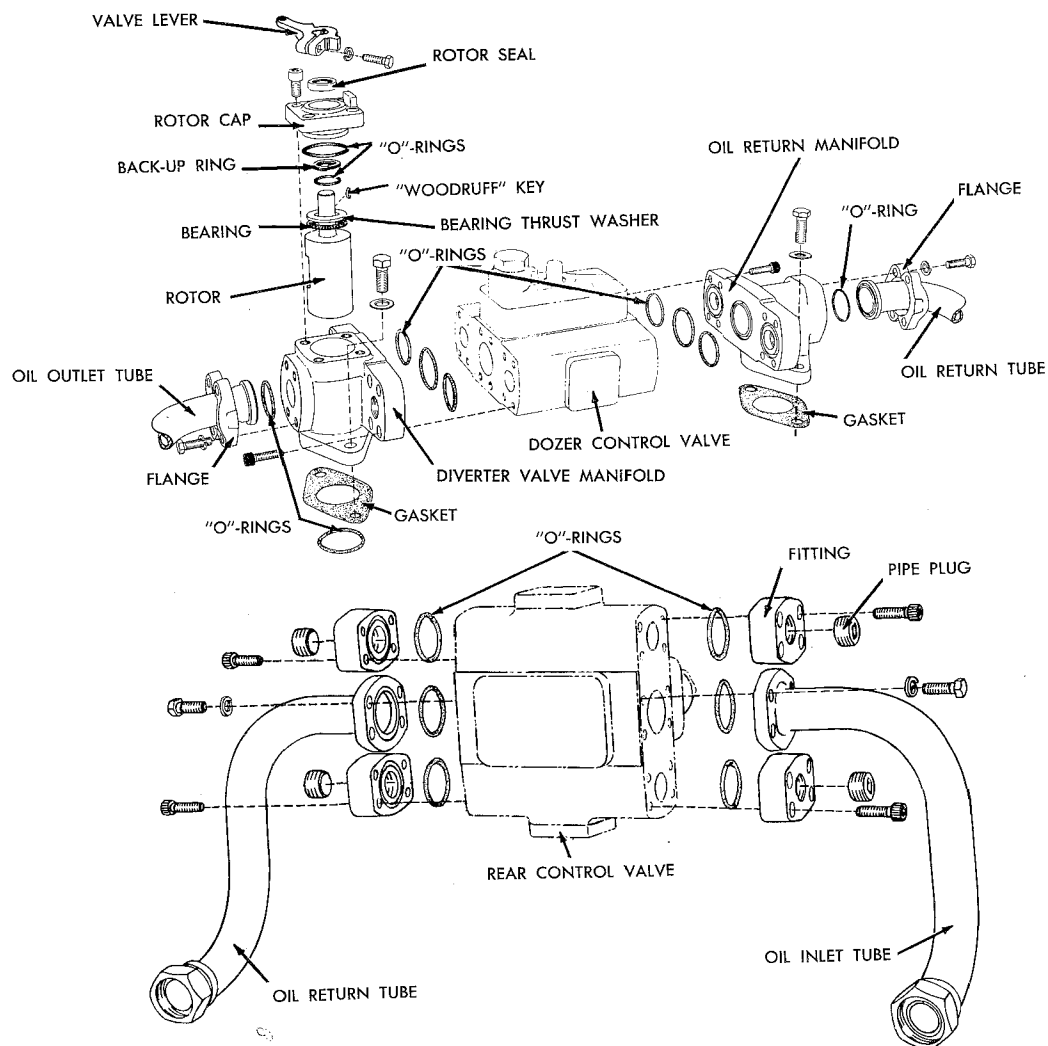


Fig. 34 — Diverter Valve Details

SECTION VI — PRESSURE TESTING AND TROUBLE SHOOTING OF DOZER HYDRAULIC SYSTEM

Topic Title	Topic No.	Page No.
Pressure Testing	1	32
Trouble Shooting	2	33

TOPIC 1 — PRESSURE TESTING

A. General

The spring loaded pressure relief valve (Fig. 25), located in the control valve housing, regulates the pressure within the hydraulic system. The pressure relief valve is of the pre-set type and is not adjustable; the specified opening pressure for the relief valve is 1200 to 1300 P.S.I. When the pressure relief valve opens, oil is by-passed through an opening in the control valve assembly and returns to the hydraulic reservoir.

The hydraulic system must be pressure tested after making any repairs to the dozer control valve assembly, after the replacement of the dozer control valve, and after the installation of a new or rebuilt hydraulic pump to make certain that the pressure relief valve of the dozer control valve assembly is functioning properly (refer to Paragraph C. below).

B. Testing of Hydraulic System for Proper Operation

The following test can be made to determine if the hydraulic system is functioning properly: The time required to raise the dozer moldboard from ground level to the fully raised position, with the engine running at full throttle, should not exceed approximately 4.3 seconds for the HD 11, 4.5 seconds for the HD 16, and 5.1 seconds for the HD 21 Tractors. *NOTE: The oil in the hydraulic system should be at normal operating temperature when making this test.*

If it is found that the moldboard raises slowly when testing as above, check the following:

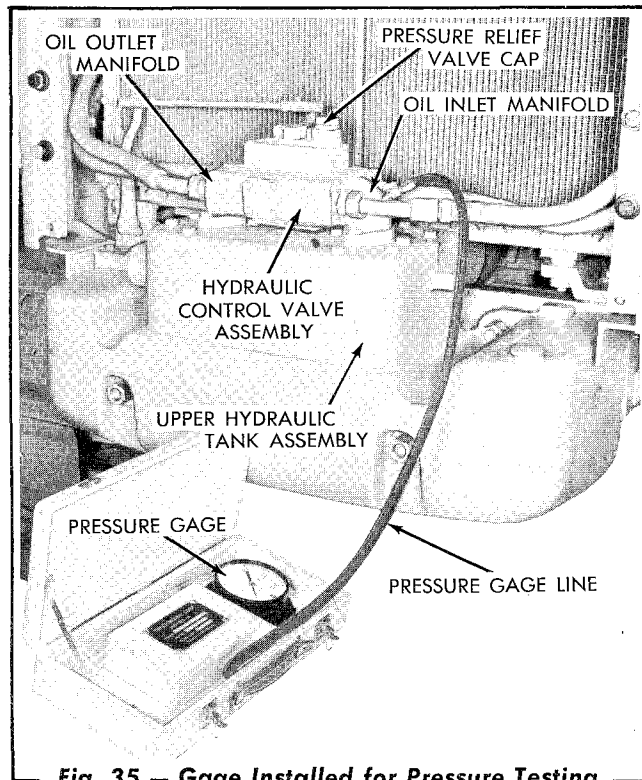


Fig. 35 — Gage Installed for Pressure Testing the Hydraulic System

1. Make certain that the oil in the hydraulic reservoir is at the proper level.
2. Pressure test the hydraulic system to make certain that the pressure relief valve in the dozer control valve assembly is functioning properly (refer to Paragraph C. below).
3. The hydraulic pump should be removed, disassembled, and inspected after one year (or season) of operation even though no noticeable decrease in operating efficiency has become apparent. Without actually inspecting the internal parts of the pump,

it is difficult to determine from the operating test exactly when an overhaul should be made to the gear type pump. A gear type pump may maintain its maximum operating efficiency to a point where the bearings start to fail (refer to Section II).

C. Pressure Testing of Hydraulic System

To pressure test the hydraulic system proceed as follows:

1. Remove the radiator guard lower front plate. Thoroughly clean the hydraulic tank assembly, control valve, and the surrounding area.
2. **IMPORTANT:** *The oil in the hydraulic system should be at normal operating temperature when pressure testing.* Move the dozer operating control lever to the "Float" POSITION. Remove the hex-socket-head pipe plug (Fig. 23) from the oil inlet manifold and install a pressure gage (gage having a minimum capacity of 2000 P.S.I.) as shown in Fig. 35. **NOTE:** *The Master Gage Kit shown in Fig. 35 is available; contact your "Allis-Chalmers" Construction Machinery Dealer.*
3. Start the engine and operate at full throttle. Lower the moldboard to its maximum lowered position and observe the pressure indicated by the gage; the pressure should be between 1200 and 1300 P.S.I. Return the dozer operating control lever to the "Float" position.

CAUTION: *When performing this test, do not hold the operating control lever in the "Lower" position for long periods of time; just long enough to obtain an accurate gage reading.*

4. If the pressure indicated by the gage is above the recommended pressure setting (1200 to 1300 P.S.I.), replacement of the pressure relief valve spring is necessary.

NOTE: *The pressure relief valve, when compressed to a length of 1/2" should impose a load of 251 or 15 lbs.). If the pressure is over the recommended pressure setting of 1300 P.S.I., this may be due to dirt on the pressure relief valve seat and the pressure relief valve should be flushed.*

5. To flush the pressure relief valve, stop the engine and loosen the pressure relief valve cap (Fig. 35) approximately three turns. Loosening the pressure relief valve cap will allow the pressure relief valve to open at a lower pressure and allow the oil to flush away any dirt from the valve seat. Start the engine and operate it at about 1/2 throttle. Move the operating control lever to the "Raise" and "Lower" positions several times to obtain the flushing action necessary to remove any dirt from the valve seat.
6. Stop the engine and tighten the pressure relief valve cap. Repeat step 4 above. If the pressure relief valve still fails to operate properly, remove the relief valve cap and inspect for a broken or weak relief valve spring or a worn or damaged relief valve seat and replace the necessary parts.

NOTE: *Pressure in excess of 1300 P.S.I. has no effect on speed or efficiency of operation but definitely causes unnecessary wear on component parts — particularly the hydraulic pump assembly.*

7. Slow the engine to idling speed and lower the dozer moldboard to the ground. Move the dozer operating control lever to the "Float" position and stop the engine.
8. Remove the pressure gage and install the hex-socket-head pipe plug. Install the radiator guard lower front plate.

TOPIC 2 — TROUBLE SHOOTING

Following information should be used as a guide for locating and correction of any function that may develop.

TROUBLE	POSSIBLE CAUSE	REMEDY
Moldboard will not respond to operating controls.	Insufficient oil in hydraulic tank.	Fill to proper level.
	Obstruction in lines, control valve, or hydraulic cylinder connections.	Check flow of oil from hydraulic tank through system and remove obstructions. Change oil and replace oil filter element.
	Pressure relief valve not seating properly, or relief valve spring weak or broken.	Clean the relief valve and seat and flush system. Replace pressure relief valve spring and recheck hydraulic pressure. Pressure should be 1200 to 1300 P.S.I.
	Hydraulic pump worn or damaged.	Inspect and repair or replace.
	Foreign particles lodged in control valve.	Inspect control valve and remove foreign particles. Change oil and replace oil filter element.
Moldboard responds slowly to operating controls.	Excessively worn piston packings and rings or broken piston in hydraulic cylinder.	Install new packings and rings or replace piston. Inspect the hydraulic cylinder and replace if scored.
	Broken hydraulic line.	Repair or replace.
	Worn hydraulic pump.	Repair or replace.
	Oil foaming.	Refer to Page 35
	Insufficient engine speed.	Speed up engine.
Failure of moldboard to remain in "Neutral" (Hold) position.	Worn hydraulic cylinder piston, rings and packings.	Replace.
	Worn control valve rotor or control valve body.	Inspect the control valve rotor and control valve body for scoring and replace necessary parts.
Failure of moldboard to remain in "Neutral" (Hold) position.	Dirt on control valve seat, damaged control valve seat, or broken control valve spring.	Remove foreign particles and replace damaged or broken parts. Change oil and replace oil filter element.
Moldboard raises or lowers when control lever is in "Neutral" (Hold) position.	Control linkage improperly adjusted.	Adjust control linkage for proper operation.

Oil heating.	Use of improper oil.	Use specified oil (refer to "SPECIFICATIONS OF LUBRICANTS").
	Dirty oil.	Flush and refill with new oil and change oil filter element.
	Insufficient oil in hydraulic tank.	Fill to proper level.
	Hydraulic pressure too high.	Replace pressure relief valve spring and check hydraulic pressure. Pressure should be 1200 to 1300 P.S.I.
Oil foaming.	Air leaks into suction line between hydraulic tank and pump.	Tighten capscrews and check "O"-ring seals.
	Use of improper oil.	Use specified oil (refer to "SPECIFICATIONS OF LUBRICANTS").

SECTION VII — FITS AND TOLERANCES

Topic Title	Topic No.	Page No.
Hydraulic Pump	1	35
Control Valve	2	37
Hydraulic Cylinders	3	38
Diverter Valve	4	38

This section has been prepared to provide those responsible for the maintenance of the front mounted hydraulic control unit with the proper fits and tolerance information for the various assemblies.

The information herein deals with the fits and tolerance of parts when they are new and the amount of wear permissible before parts must be replaced.

When making repairs, refer to this section for the proper fits and tolerance information.

NOTE: The dimensions which follow apply to all front mounted hydraulic control units unless otherwise stated.

TOPIC 1 — HYDRAULIC PUMP

Description	Size of New Parts
A. Adapter	
1. Bore diameter in adapter for roller bearings	2 $\frac{9}{16}$ "
2. Bore diameter in adapter for drive shaft ball bearing	3 $\frac{5}{32}$ "
3. Width of adapter pilot boss	$\frac{9}{64}$ "
4. Thread size of holes drilled in adapter for mounting capscrews	$\frac{7}{8}$ " — 14 NF 2B thread

to

A. Housing

1. Width of housing at gear location 3.501" — 3.503"
2. Counterbore depth in housing for wear plate247" — .249"

C. Cover

1. Bore diameter for roller bearings $2\frac{9}{16}"$
2. Width of cover pilot boss $\frac{1}{8}"$

D. Shafts

1. Diameter of drive shaft at seal seat location 1.249" — 1.250"
2. Diameter of drive shaft at ball bearing location 1.3771" — 1.3776"
3. Diameter of drive and driven shafts at gear and roller bearing locations 1.6240" — 1.6245"

E. Gears (Drive and Driven)

1. Width
 - a. HD 11 2.500" — 2.5005"
 - b. HD 16 3.000" — 3.0005"
 - c. HD 21 3.500" — 3.5005"
2. Pitch diameter (all models) 3"
3. Backlash with mating gear (all models)012" — .016"
4. Inside diameter (all models) 1.6250" — 1.6255"

F. Bearings

1. Roller
 - a. Outside diameter $2\frac{9}{16}"$
 - b. Width $1\frac{1}{4}"$
 - c. Number of rollers 14
2. Ball
 - a. Outside diameter $3\frac{5}{32}"$
 - b. Inside diameter $1\frac{3}{8}"$
 - c. Width $\frac{53}{64}"$
 - d. Number of balls 11

G. Plates

1. Outside diameter of wear plates $6\frac{31}{32}"$
2. Thickness of wear plate $\frac{1}{4}"$

H. Washers

1. Outside diameter of thrust washer $2\frac{7}{16}"$
2. Thickness of thrust washers126" — .128"

TOPIC 2 — CONTROL VALVE

NOTE: The rear control valve of the diverter valve group (Special Equipment) is identical to control valve.

Description	Size of New Parts
A. Top Head	
1. Bore diameter for pressure relief valve	1.252" — 1.254"
2. Bore diameter for pressure relief valve seat	1.126" — 1.128"
3. Bore diameter for rotor stem oil seal	1.254" — 1.258"
4. Bore diameter for rotor seal assembly	1.373" — 1.375"
B. Housing	
1. Bore diameter for rotor bearings and rotor	2.500" — 2.501"
2. Bore diameter for pressure relief valve seat	1.122" — 1.123"
3. Bore diameter for pressure relief valve750" — .752"
4. Bore diameter for cylinder valve assemblies812" — .814"
5. Bore diameter for housing caps	1.625" — 1.627"
C. Rotor	
1. Diameter of rotor shaft at seal locations749" — .750"
2. Diameter of rotor shaft at bearing locations	1.2673" — 1.2683"
3. Outside diameter of the rotor	2.496" — 2.497"
4. Outside diameter of rotor bearings	2.4995" — 2.5000"
5. Rotor-to-top head running clearance (controlled by shims)001"
D. Relief Valve	
1. Outside diameter at upper end	1.244" — 1.246"
2. Outside diameter at lower end747" — .749"
3. Pressure relief valve spring	
a. Free length (approximate)	2.875"
b. Load at 2 $\frac{13}{32}$ " assembled height	291 lbs. (+ or — 15 lbs.)
E. Cylinder Valve Springs	
1. Cylinder lowering valve spring	
a. Free length	1 $\frac{5}{8}$ "
b. Number of coils	8
2. Cylinder raise valve spring	
a. Free length	2 $\frac{1}{4}$ "
b. Number of coils	12
F. Housing Caps	
1. Outside diameter at housing location	1.621" — 1.623"
2. Bore for cylinder valve	1.064" — 1.066"

TOPIC 3 — HYDRAULIC CYLINDERS

Size of
New Parts

Cylinder

1. Inside diameter of cylinder tube	6.000" — 6.010"
2. End cover bore for piston rod	2 $\frac{9}{16}$ "
3. Bore diameter for packing gland retainer	3.125" — 3.128"
4. Outside diameter of end cover pilot boss	6.224" — 6.226"
5. Diameter of packing gland seating ring	
Outside	3.120" — 3.122"
Inside	2.506" — 2.508"
6. Bore diameter in packing gland retainer for piston rod	2.506" — 2.508"
7. Outside diameter of packing gland retainer at end cover location ..	3.120" — 3.122"

B. Piston Rod

1. Outside diameter of piston rod	2.499" — 2.500"
2. Diameter of piston rod at piston location	1.249" — 1.252"
3. Diameter of bores in piston rod yoke	1.504" — 1.506"
4. Diameter of piston rod pin	1.493" — 1.495"

C. Piston

1. Bore diameter in piston for piston rod	1.254" — 1.256"
2. Width of groove in piston for piston rings503" — .508"
3. Diameter of piston at piston packing location	4.988" — 4.992"
4. Outside diameter of piston	5.940" — 5.945"

TOPIC 4 — DIVERTER VALVE

Description

Size of
New Parts

A. Cap

1. Outside diameter of rotor cap at manifold housing location	1.998" — 2.000"
2. Bore diameter in rotor cap for rotor shaft757" — .760"

B. Rotor and Manifold

1. Bore diameter in manifold for rotor	2.002" — 2.004"
2. Rotor diameter	1.999" — 2.000"
3. Diameter of rotor shaft at bearing location749" — .750"
4. Width of bearing thrust washer123" — .126"

Make the following changes on pages indicated:

Page 31 - Step 7. Clearance Chart

Change: HD11G .0035" - .005"

to read: HD11G .004" - .006"

Change: HD16G, HD21G .0035" - .0055"

to read: HD16G, HD21G .003" - .006"

Page 31 - Step 8.

Change: Step 8. to read as follows:

8. Inspect main housing for wear. Fig. 34, if wear pattern extends no closer to 12:00 than the 45° line, housing may be re-used. If however, wear pattern extends to the 1:00 area, housing must be considered worn out. If housing is to be re-used, turning the housing over to put the wear on the pressure side will help, but only for a very short while. When housing is worn on one side the pressure supporting-----

Page 31 - Fig. 34 - Typical Main Housing Wear Pattern

Change: Mark illustration void; use illustration included in this supplement.

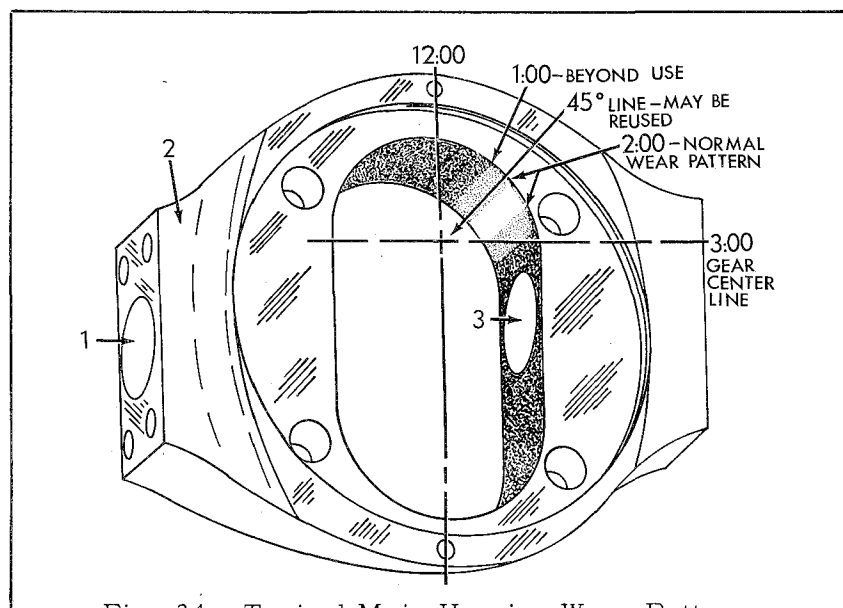


Fig. 34 - Typical Main Housing Wear Pattern

1. Pressure Port
2. Main Housing
3. Suction Port

Page 33 - Step 7.

Change: .0035" - .005" to read: .004" - .006"

Page 34 - Step 17.

Change: 110 lbs. ft. to read: 190 lbs. ft.

Page 34 - Step 19.

Change: 50 lbs. ft. to read: 65 lbs. ft.

Page 35 - Step 20.i.

Change: 50 lbs. ft. to read: 30 lbs. ft.

Page 35 - Step 1.g.

Change: .0035" - .0055" to read: .004" - .006"

Change: exceeds .0055" to read: exceeds .007"

36 - Step 1.m.
Change: 55-60 lbs. ft. to read: 70 lbs. ft.

Page 38 - Step 2.n.
Change: 50 lbs. ft. to read: 40 lbs. ft.

Page 38 - Paragraph J. Hydraulic Pump Installation

Change: Paragraph J. to read as follows:

1. Make certain the capscrews securing drive coupling, or universal joint, to crankshaft are tight and coupling gear (if used) is in position.

2. Align pump drive shaft splines with coupling gear, or universal joint splines and push pump into position on bracket.

3. Install pump-to-bracket capscrews, lockwashers and nuts, and tighten securely.

NOTE: Make sure there is clearance between pump drive shaft and coupling.

4. Make certain hydraulic system has been thoroughly drained and is clean.

5. Replace filter elements.

6. Check suction hose for obstructions, such as a rubber flap, collapsing or hardness.

7. Position a new gasket and attach suction line to pump with capscrews and lockwashers; tighten capscrews securely.

8. Position O-ring in end fitting of pressure hose and attach pressure hose to pump using the two split flange halves, capscrews, and lockwashers. Tighten capscrews securely.

9. Fill the hydraulic tank (refer to "Hydraulic Oils").

10. Back off the main relief valve adjustment at the control valve.

11. Start engine and allow it to run for approximately 3 minutes at low idle speed.

12. Cycle system every 3 minutes for 10 minutes.

13. Set main relief valve to 1000 psi and cycle system as above.

14. Readjust main relief valve to specifications.

Page 63 - Paragraph A.1.

<u>Change:</u> HD11G	-----	.003" - .005"	.005"
to read: HD11G	-----	.004" - .006"	.007"
<u>Change:</u> HD16G, HD21G	-----	.0035" - .0055"	.0055"
to read: HD16G, HD21G	-----	.003" - .006"	.006"

Page 63 - Paragraph A.7.

Change: HD11G
110 lbs. ft. to read: 190 lbs. ft.
50 lbs. ft. to read: 65 lbs. ft.

Change: HD16G, HD21G
55-60 lbs. ft. to read: 70 lbs. ft.
50 lbs. ft. to read: 40 lbs. ft.

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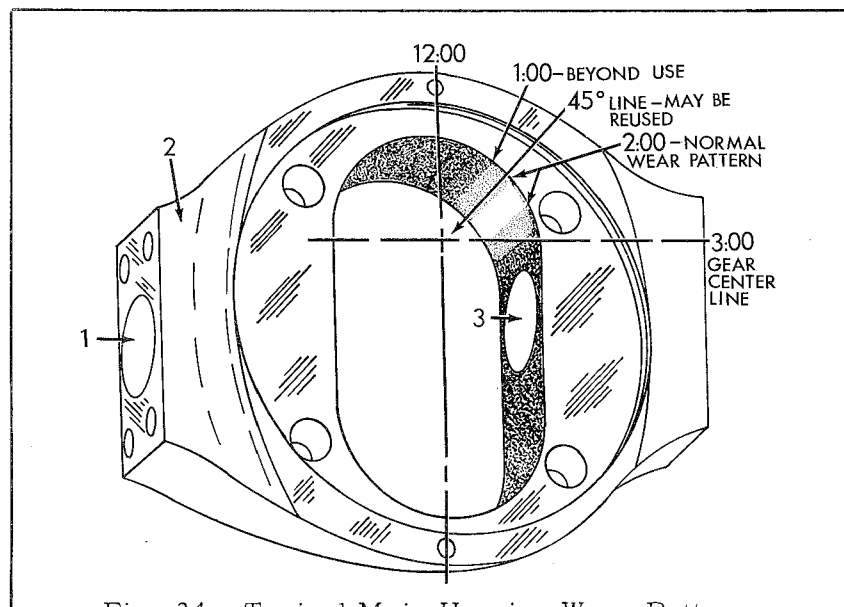


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7. Position a new gasket and attach suction line to pump with capscrews and lockwashers; tighten capscrews securely.
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11. Start engine and allow it to run for approximately 3 minutes at low idle speed.
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Page 63 - Paragraph A.1.

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