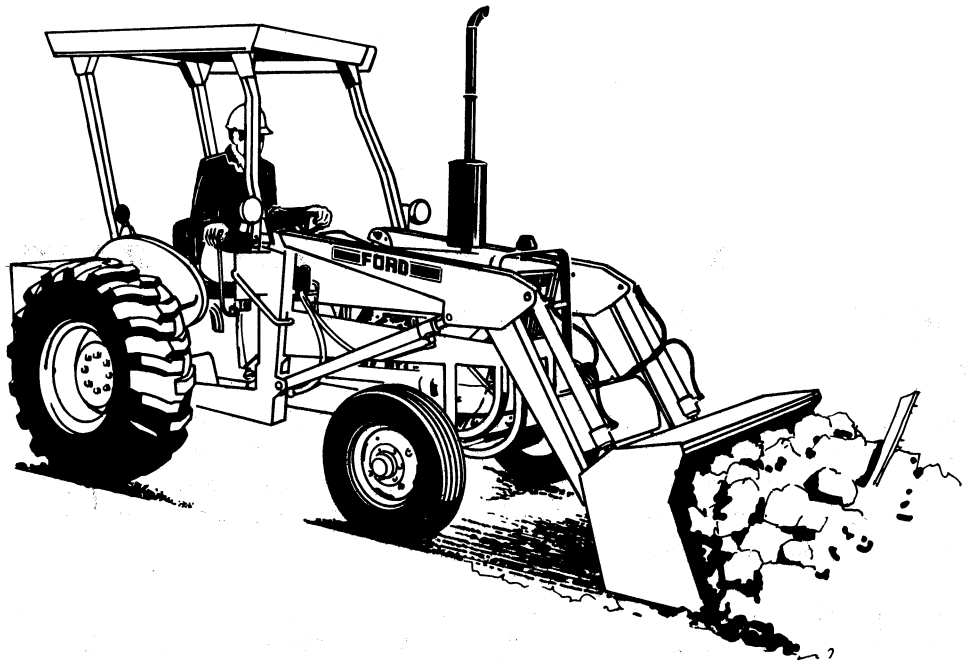
INDUSTRIAL EQUIPMENT

FORD

Series 745 Loader

19-863



REPAIR MANUAL

Reprinted

40074530

FOREWORD

This manual contains service information for the Ford Series 745 Loader, Model 19-863. Detailed information is provided on description and operation, trouble shooting, tests and adjustments, component overhaul, lubrication, and specifications.

Instructions for installing the loaders, loader components, or attaching kits are not covered in this manual. Refer to the appropriate operator's and assembly manuals for detailed information.

Keep this manual, along with your other service literature, available for ready reference.

SAFETY PRECAUTIONS

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all tractors and equipment as well as the personal safety of the individual doing the work. This Shop Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This Manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this Manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

Each loader package consists of a loader frame, lift arms, lift cylinders, bucket cylinders, float control valve, hydraulic pump and pump drive, hydraulic tubes and hoses, and attaching hardware: The Series 745 Loader Model 19-863 may be mounted on a Ford 340 or 540 Tractor. Figure 1 illustrates the loader major components.

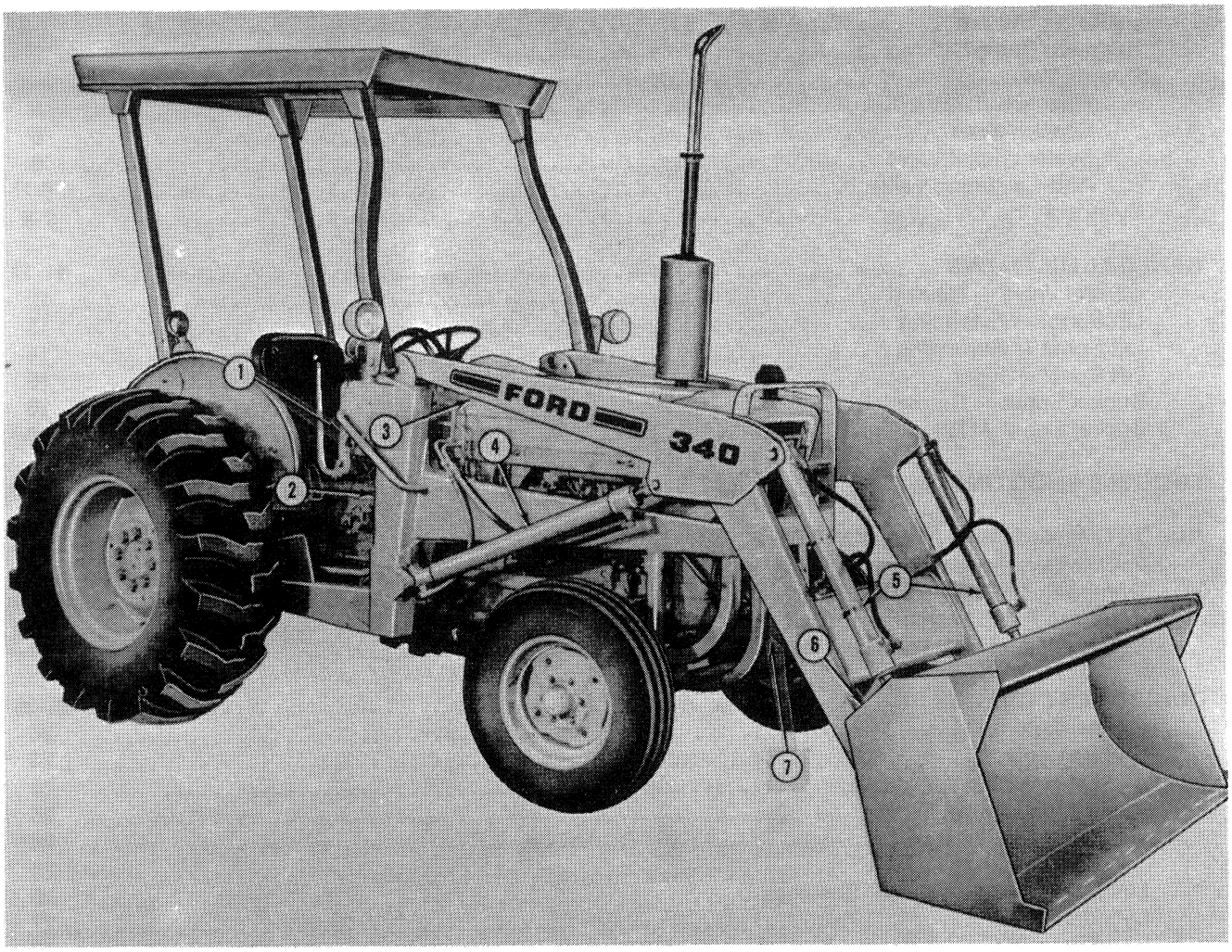


Figure 1
Loader Components

1. Control Valve
2. Loader Frame
3. Lift Arms
4. Lift Cylinders
5. Bucket Cylinders
6. Bucket
7. Hydraulic Pump Location

LOADER FRAME

The loader frame for the Series 745 Loader, Model 18-863, is welded box type construction. Serviceable bushings are used in the loader lift arms and cylinders. The loader frame also acts as the loader system hydraulic reservoir. A hydraulic oil filter which has a safety bypass is located in the bottom of the left hand loader frame post.

The loader frame is secured to the tractor at the rear axle housing and hydraulic pump mounting bracket.

HYDRAULIC SYSTEM

The loader hydraulic system consists of a hydraulic pump, pump drive, loader control valve with float, hydraulic fluid reservoir and double acting lift and bucket cylinders. The gear type hydraulic pump is mounted externally in front of the tractor front support casting. The pump is driven by the engine crankshaft through the use of a pump drive assembly.

DESCRIPTION AND OPERATION

The loader control valve incorporates double acting lift and bucket spools and a float mechanism. The valve is mounted to the right hand loader frame post and uses one control lever to actuate both the lift and bucket circuits. The return oil tube from the control valve is welded to the outside of the control valve mounting plate and at the loader frame side member. The loader frame acts as the hydraulic fluid reservoir. The hydraulic oil filter, oil breather and dipstick are located at the left hand loader frame post. Oil is delivered to its destination through the use of steel tubing and hydraulic hoses. The lift cylinders are mounted with the piston end at the bottom of the loader frame post and the rod end at the loader lift arms. Bucket cylinders are mounted with the piston end at the lift arm gusset and rod end attached to the loader bucket.

When the tractor engine is running, the hydraulic pump draws oil from the reservoir and delivers it via steel tubing to the loader control valve which delivers the oil to the cylinders as desired.

HYDRAULIC PUMP

The gear type hydraulic pump, Figure 2, for the Ford 340 and 540 Tractors is driven in a counter-clockwise direction and delivers oil taken from the hydraulic reservoir to the control valve. Oil enters the pump at the inlet port (1) and is transported via the two gears (5) to the pump outlet (3). Pumping action takes place as the drive gear rotates the driven gear. As the gears unmesh, oil fills the spaces between the gear teeth and is carried to the outlet side of the pump. As the gears begin to mesh, the oil is forced from between the gear teeth, thus building pressure and forcing oil through the outlet port.

A small amount of oil that is being transported by the gears during pump action is allowed to pass by the gears to lubricate the pump, gear shafts and bearings.

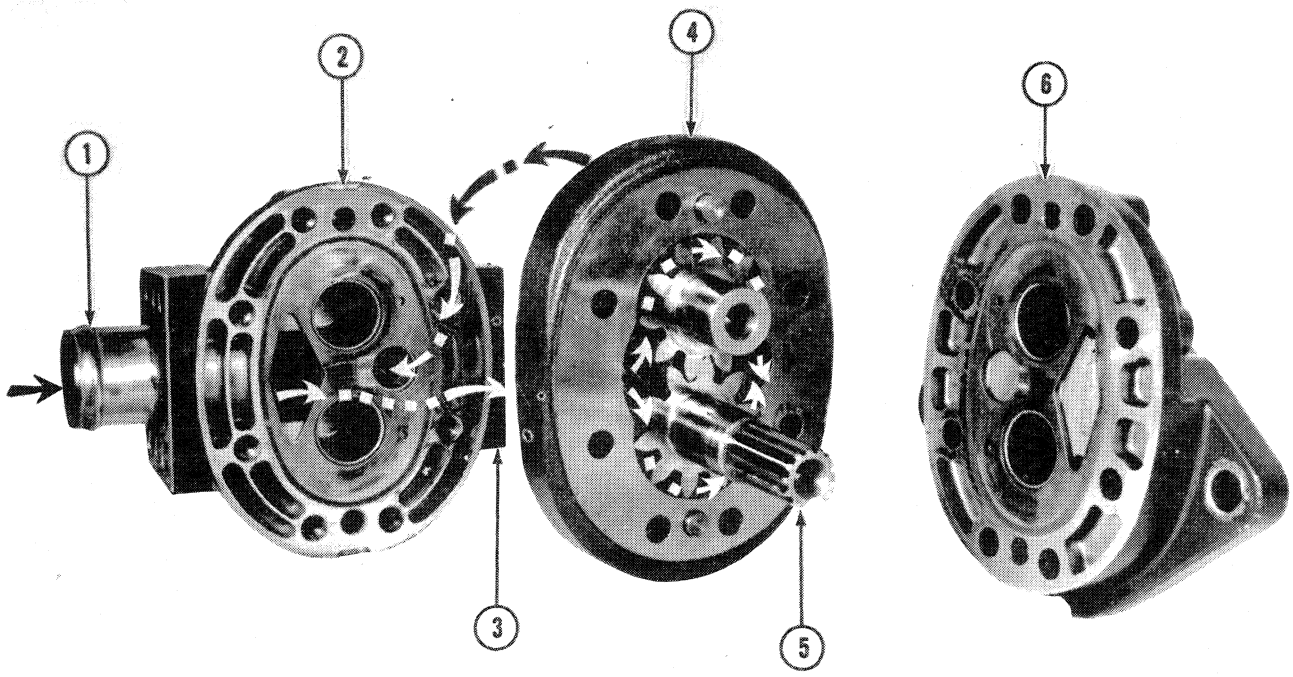


Figure 2
Hydraulic Pump Oil Flow

1. Pump Inlet
2. Back Plate Assembly
3. Pump Outlet
4. Pump Gear Body
5. Gear Set
6. Front Plate Assembly

CONTROL VALVE

Refer to the Control Valve Exploded View, Figure 3, and the Control Valve Assembly Cutaway, Figure 4.

The control valve used on Series 745 Loader Model 19-863 is a unit type valve with double acting lift and bucket spools. It also incorporates a "float" mechanism at the end of the lift spool. The double acting spools allow oil to travel to one end of a cylinder through one hose while oil being forced from the cylinder returns to the control valve through a separate hose. The position of the valve spool determines the direction of oil flow.

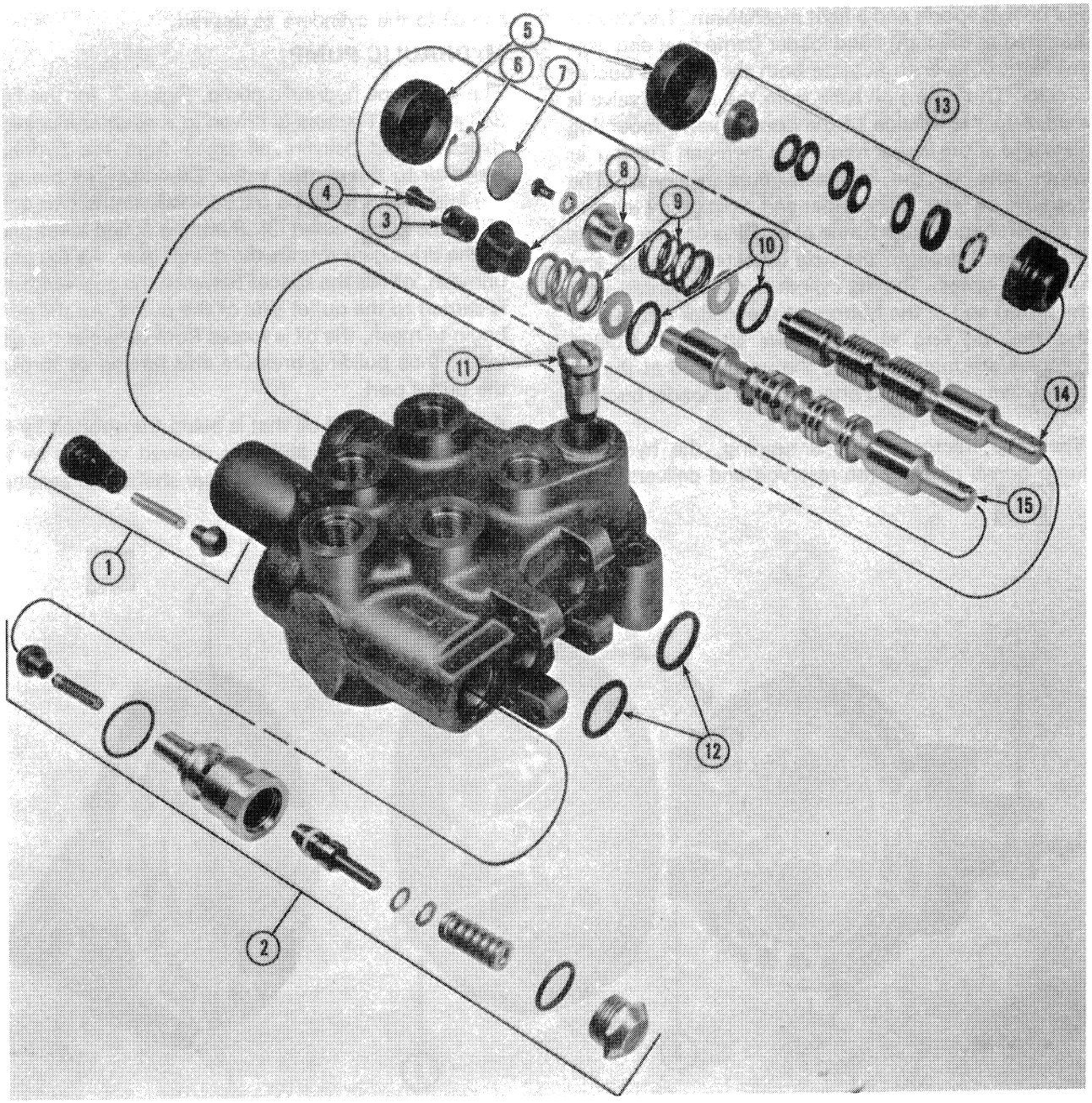


Figure 3
Control Valve — Exploded View

1. Check Valve Assembly
2. System Relief and Check Valve Assembly
3. Detent Sleeve
4. Spool Retaining Screw
5. Rubber Spool End Caps
6. Snap Ring
7. Spool End Cap
8. Spring Collars
9. Spool Centering Springs
10. Spring End Spool Seals
11. Anti-Cavitation Valve
12. Eyelet End Spool Seals
13. Float Detent Assembly
14. Bucket Spool
15. Lift Spool

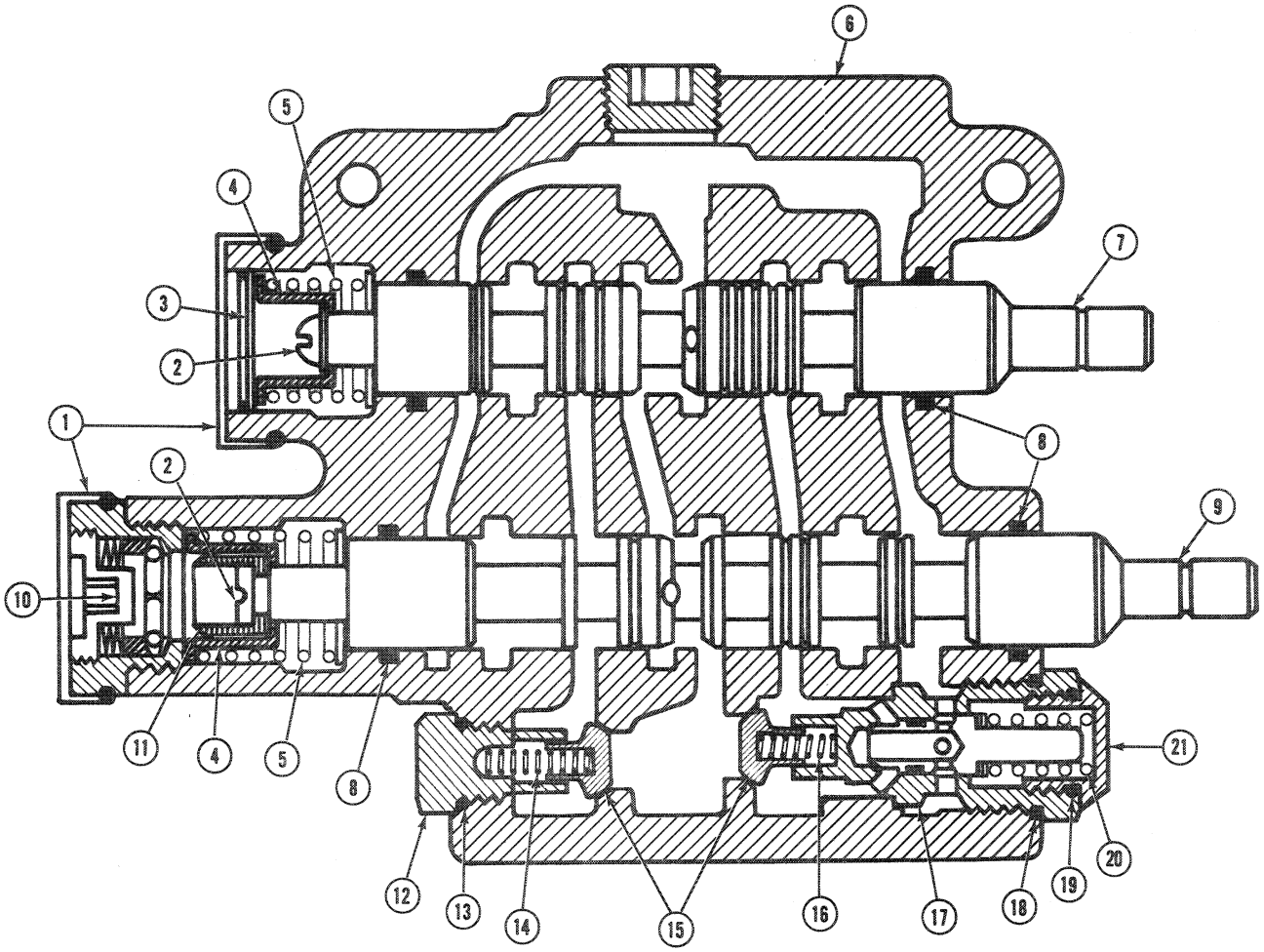


Figure 4
Control Valve Cutaway

1. Rubber Spool End Caps
2. Centering Spring Retaining Screws
3. Snap Ring and End Cap
4. Centering Spring Collars
5. Spool Centering Springs
6. Control Valve Body
7. Bucket Spool
8. Spool Seals
9. Lift Spool
10. Float Detent Assembly
11. Detent Sleeve
12. Check Valve Plug
13. O-Ring
14. Check Valve Spring
15. Check Valve Poppets
16. Check Valve Spring
17. System Relief Valve Body
18. O-Ring
19. O-Ring
20. Relief Valve Spring
21. Relief Valve Cap

The cast iron control valve body houses all of the valve components and acts as an attaching point for the hydraulic tubes. The valve is bolted to a mounting bracket which is welded to the right hand loader frame post. The valve spools (14 and 15), Figure 3, are constructed of high carbon, ground, polished and chrome plated steel. The centering springs (9) and spring collars (8) are secured by screws at the ends of the spools and function to return the spools to the neutral position.

Each valve spool is selectively fitted to its respective spool bore. Because of this selective fitting, the spools cannot be serviced separately. If the spools are damaged, the control valve must be replaced as an assembly.

Float Mechanism:

The control valve is equipped with a float mechanism at the spring end of the lift spool. Figure 5 shows an exploded and sectional view of the float assembly. In operation, the float detent is engaged by moving the control lever to the full forward position. During float, the loader bucket will rest on the ground and follow the contour of the working surface. Hydraulic oil flows freely in and out of the cylinders as conditions demand.

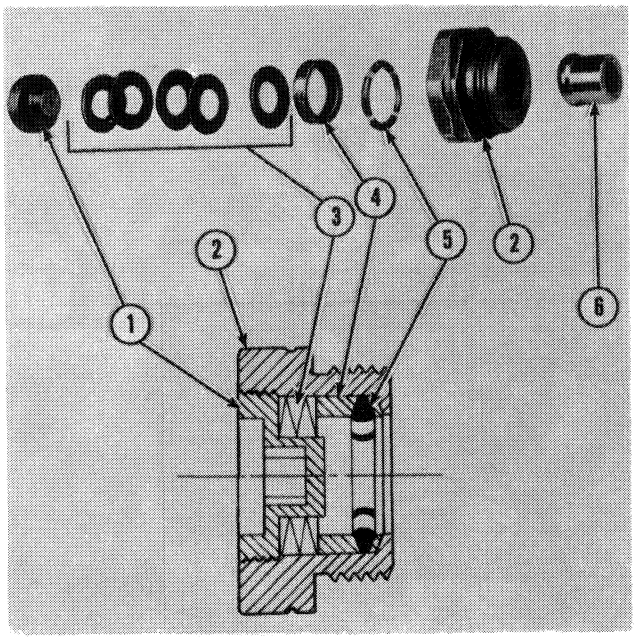


Figure 5
Float Detent Assembly

1. Adjustment Plug
2. Body Plug
3. Spring Washers
4. Spacer
5. Four Piece Lock Ring
6. Detent Sleeve (Attaches to Lift Spool)

When the lift spool is moved to the "float" position, the sleeve (6) at the end of the lift spool is pushed past the four piece lock ring (5) and compresses the spring washers (3). A shoulder on the sleeve catches against the ring and the spring washers keep tension on the spool so that it will stay in the detent position. To release the float detent, the lift spool must be manually moved back to the neutral position.

Check Valves:

Check valves are located in both high pressure passages of the control valve, Figure 4. When a hydraulic cylinder is under load and a valve spool is moved to actuate the cylinder, there would be a momentary tendency for oil to flow in the opposite direction. The check valves keep the circuits closed until there is sufficient flow and pressure to overcome the load in the cylinders. Figure 6 is an exploded view of the check valve components.

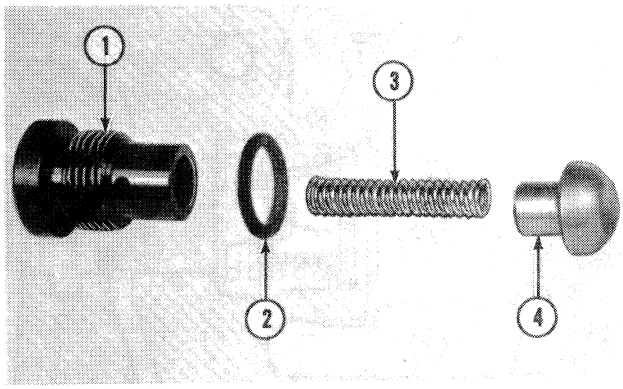


Figure 6
Spring End Check Valve Assembly

1. Plug
2. O-Ring
3. Spring
4. Poppet

System Relief Valve:

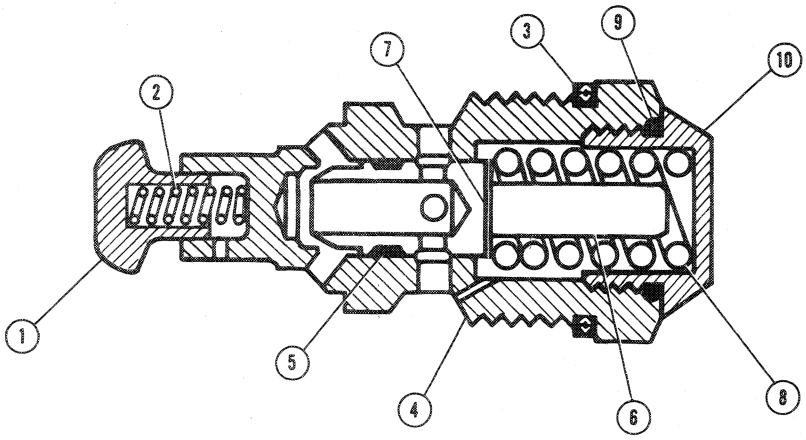
The system relief valve, Figure 7, is located between the high pressure passage and low pressure passage of the control valve.

When a spool is moved, oil is directed to one end of the cylinder. If the cylinder stalls, is restricted, or reaches the end of its stroke, oil pressure builds in the system. To protect against this pressure increase, the relief valve opens and allows high pressure oil to return to sump.

In operation, oil entering the inlet port of the control valve is normally maintained below the pressure required to unseat the relief valve poppet (7). When the system pressure exceeds the setting of the relief valve, the poppet unseats allowing oil to flow through the relief valve to sump as shown. As system pressure decreases, the spring (9) forces the poppet back onto its seat. The hydraulic oil then resumes its normal flow.

Anti-Cavitation Valve:

The anti-cavitation valve, Figure 8, is located between the bucket cylinder piston end port (4) and the return oil passage (5). During the dump cycle, oil can be forced out of the rod end of the cylinder faster than the pump can supply oil to the piston end of the cylinder. A void will be formed in the piston end of the cylinder if oil supply is not sufficient. To supplement pump oil, return oil is recycled to the cylinder piston end port.



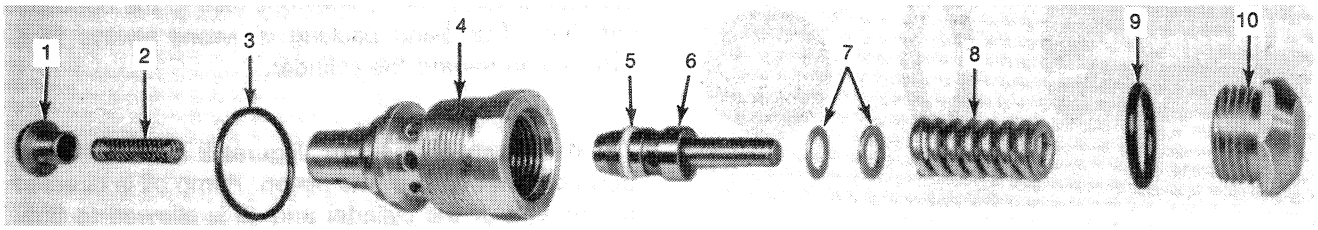


Figure 7
System Relief Valve Assembly

1. Check Valve Poppet
2. Check Valve Spring
3. O-Ring Seal
4. Relief Valve Body
5. Poppet Seal Ring
6. Poppet
7. Shim Pack
8. Adjusting Spring
9. O-Ring
10. Cap

In operation, the valve functions when oil leaving the cylinder rod ends exceeds the pumped oil supply. Because a void is being created in the piston end of the cylinder, the low pressure oil in the return passage (5) is sufficient to unseat the check ball (3) allowing oil to flow to the cylinder piston end port (4).

CYLINDERS

Double acting lift and bucket cylinders are used on all Ford Series 745 Loaders. Refer to Figures 9 and 10.

Cylinder tubes are fabricated from tubings with the bore honed to a fine finish to prolong packing life. The collar and closed ends are arc welded in place.

Cylinder rods are made of high-tensil, die-drawn steel, polished and chrome plated. The trunnion end of the rod is arc welded to the cylinder rod. The piston end is threaded and carries the piston packing.

The packing assembly is composed of chevrons and phenolic bearing rings. The chevrons are "V" shaped, rubber-impregnated, fiber rings. The "V" feature of the rings allows for a secure seal against the cylinder bore. The phenolic bearing rings support the chevrons and act as bearings for the pistons to prevent cocking of the rod. The piston packings are carried by a spacer which is machined to close tolerances to provide packing compression (stack height). Piston packings are retained on the rod by a piston nut. The gland packing

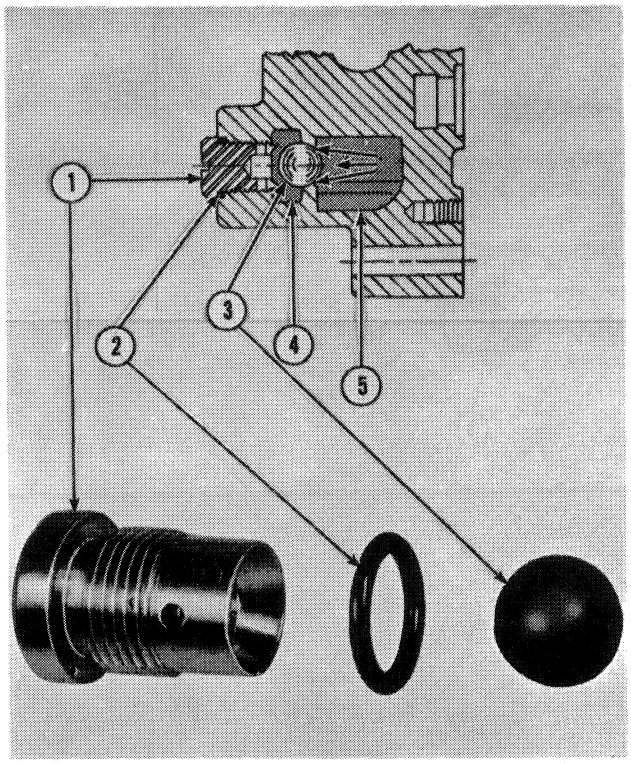


Figure 8
Anti-Cavitation Check Valve

1. Plug
2. O-Ring
3. Check Ball
4. Bucket Spool Piston End Port
5. Return Oil Passage

nut secures the gland packing in the gland and houses a rod wiper to clean foreign material from the rod as it retracts. A U-cup seal in the gland packing is used to achieve more efficient sealing at the gland.

The piston packings are installed so that the lips of the chevrons face toward the pressured oil when the greater force is applied. As the cylinder pressure increases, the lips of the chevrons are forced to the inner face of the cylinder barrel. This action provides for a more positive seal against oil transferring to the low-pressure side of the packing. The packings for the piston can face in opposite directions, depending on the application, so as to face high pressure in either direction of travel. In general, the lift cylinder piston packing chevrons face in one direction, and the bucket cylinder piston packing chevrons face in the opposite direction. The gland packing chevrons always face with the lip toward the cylinder.

The double-acting cylinder, Figures 9 and 10, has oil ports on both ends of the piston. Pump oil is directed to one end of the cylinder and oil is allowed to flow from the other end and to the reservoir. During the time the control valve spool is in the neutral position the oil is trapped in both ends of the cylinder.

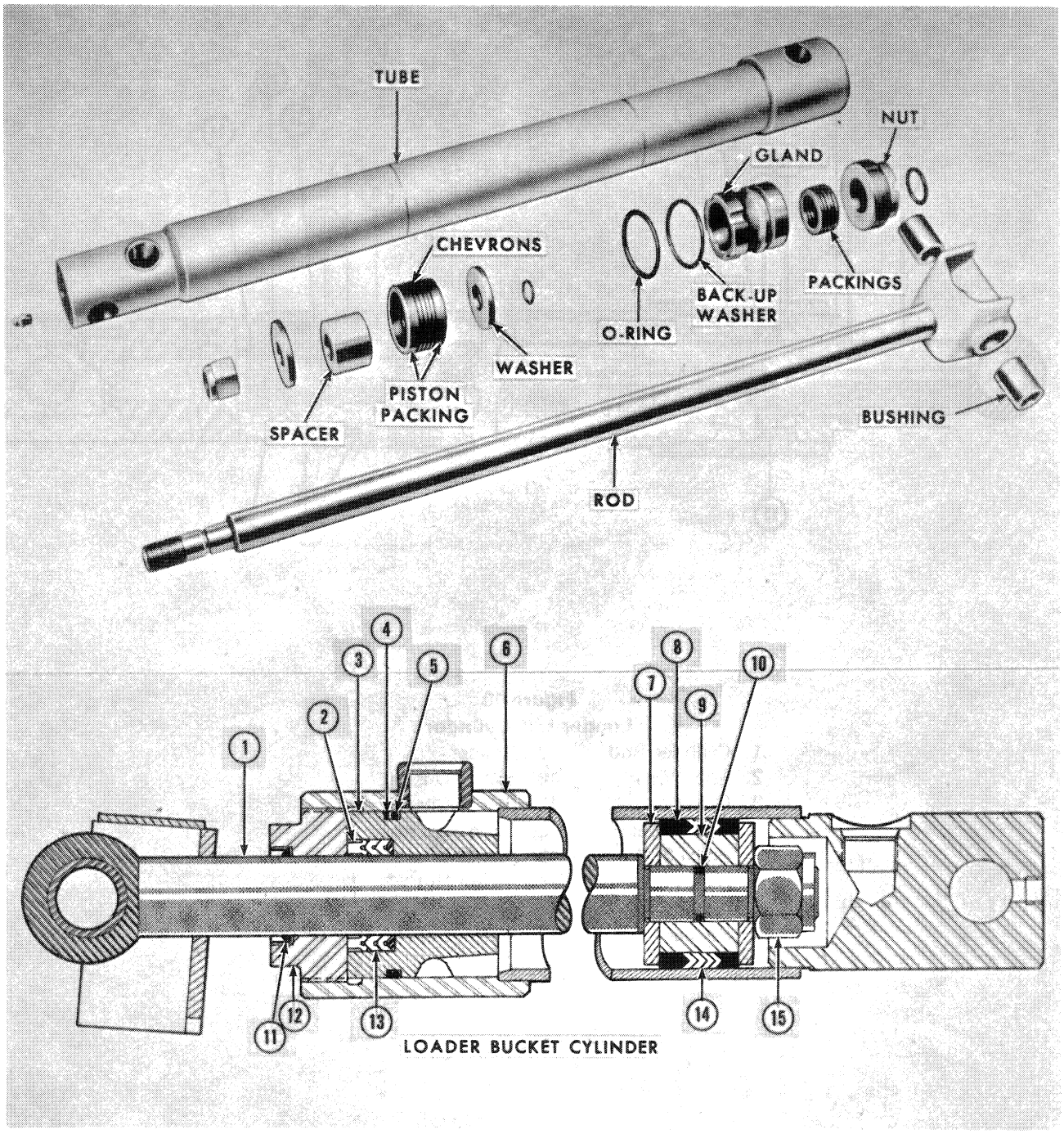


Figure 9
Loader Bucket Cylinder

1. Cylinder Rod
2. U-Cup Seal
3. Gland
4. Back-Up Ring
5. Gland O-Ring
6. Tube Assembly
7. Washer
8. Piston Bearing Ring
9. Spacer
10. Piston O-Ring
11. Rod Wiper
12. Gland Nut
13. Gland Packings
14. Piston Chevrons
15. Piston Nut

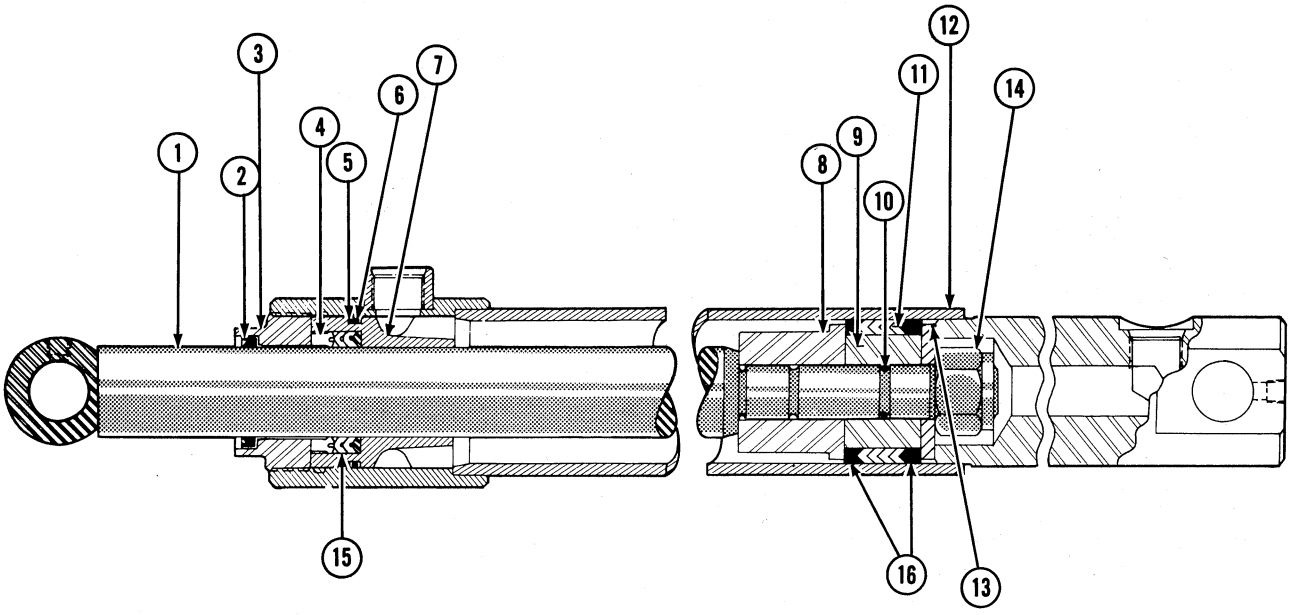


Figure 10
Loader Lift Cylinder

1. Cylinder Rod
2. Rod Wiper
3. Gland Nut
4. U-Cup Seal
5. Back-Up Ring
6. Gland O-Ring
7. Gland
8. Spacer
9. Spacer
10. Piston O-Ring
11. Piston Chevrons
12. Tube Assembly
13. Washer
14. Piston Nut
15. Gland Packings
16. Piston Bearing Rings

GENERAL OIL FLOWS

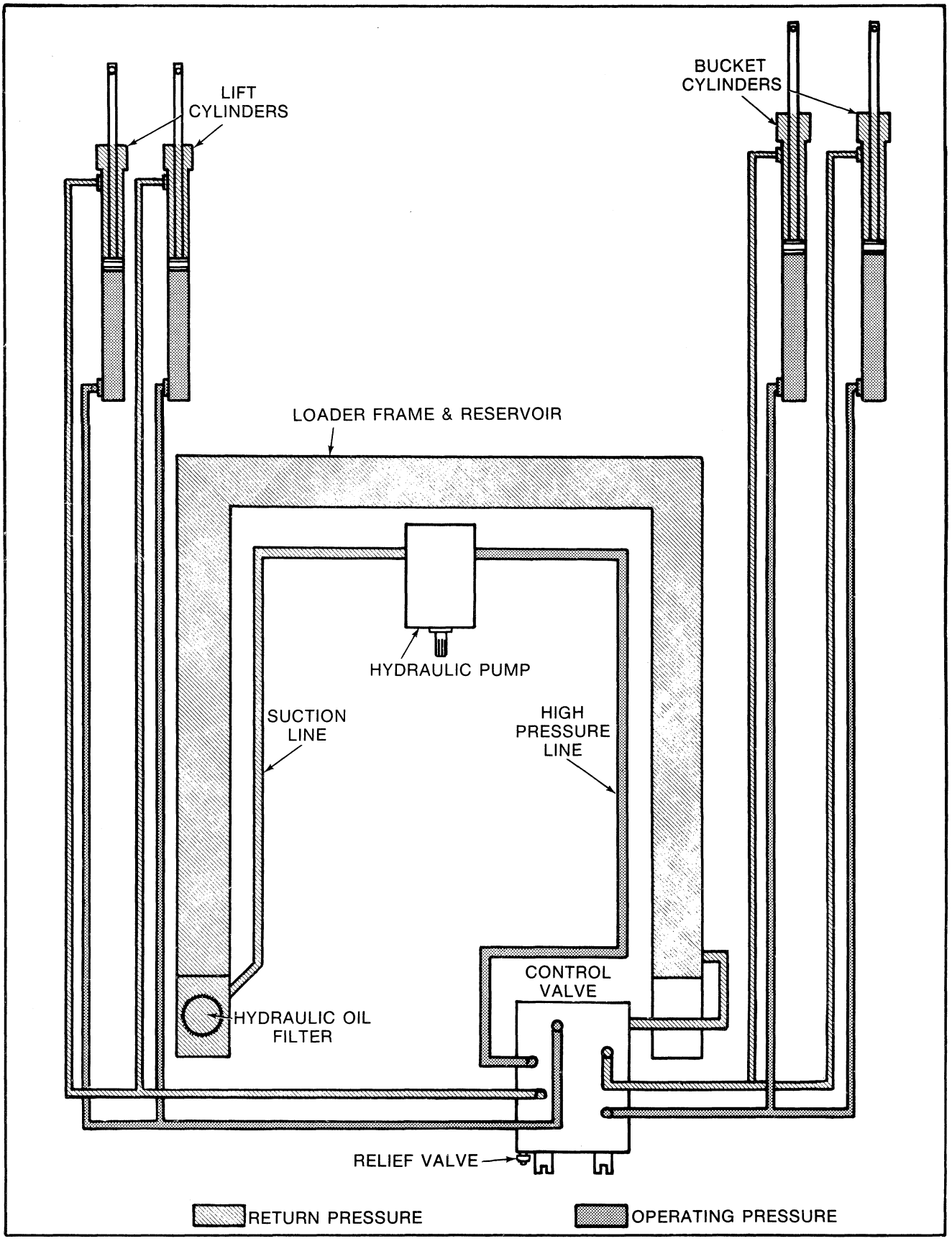


Figure 11
Oil Flow Schematic

GENERAL OIL FLOWS

GENERAL OIL FLOW

Figure 11 illustrates the flow of hydraulic oil through the loader hydraulic system.

The oil for the loader system is stored in the hydraulic reservoir. Oil flows to the externally mounted hydraulic pump from the reservoir. Oil is then pumped to the loader control valve where the direction of flow is determined by the position of the valve spools. With the spools in the neutral position, the oil flows through the control valve and directly back to the reservoir. As the control lever is activated, the valve spools function to direct oil to and away from the cylinders. All oil returning from a cylinder flows through the control valve and back to the hydraulic reservoir. All oil flows through the hydraulic oil filter before being delivered to the pump.

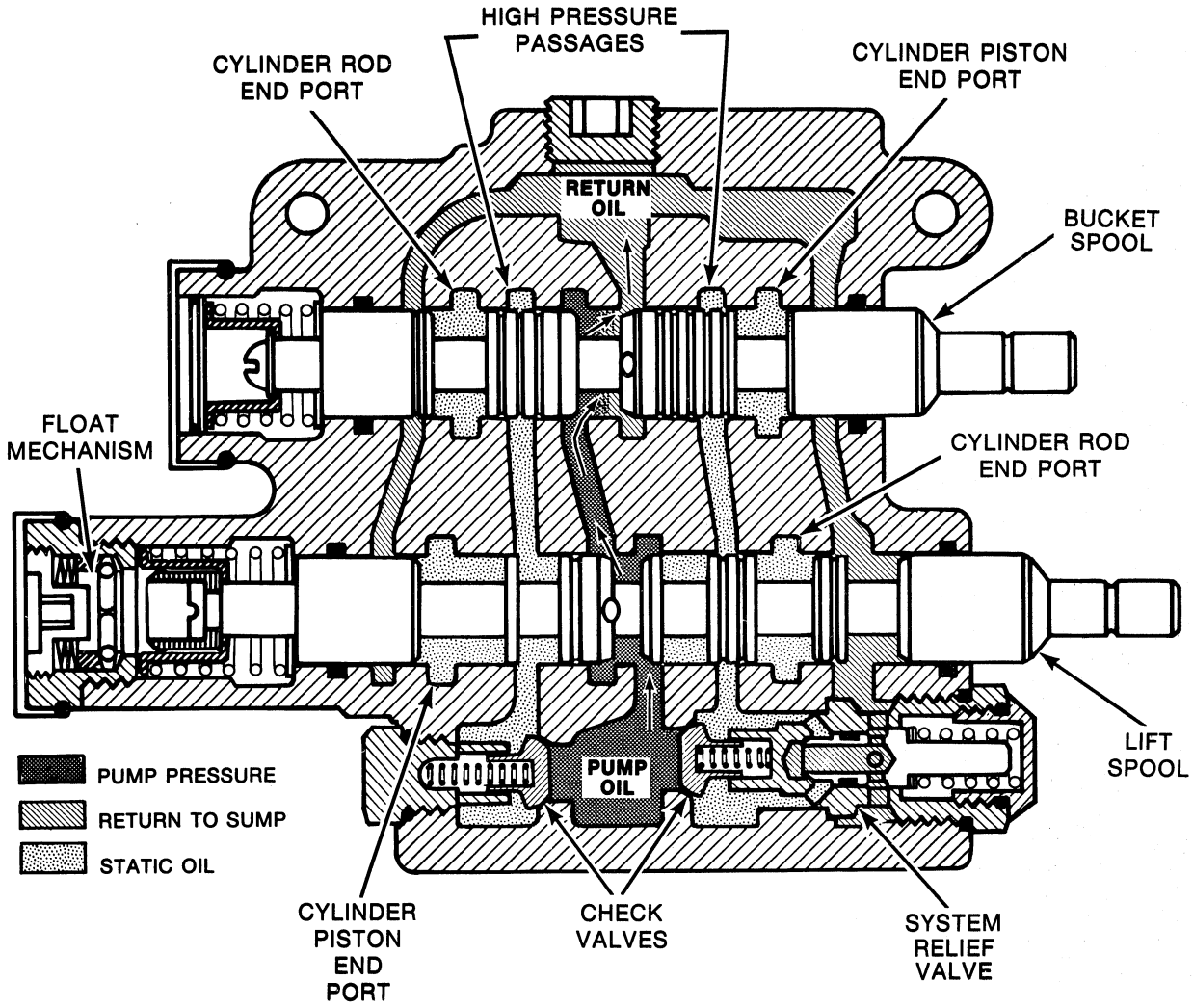


Figure 12
Control Valve — Neutral

CONTROL VALVE — NEUTRAL

Figure 12 illustrates a sectional view of the control valve with the valve spools in the neutral position. Pumped oil enters the valve at the inlet and flows through the open center, past the spools to the outlet as shown. Oil in the cylinders is trapped because of the closing of the passages by the control valve spools.

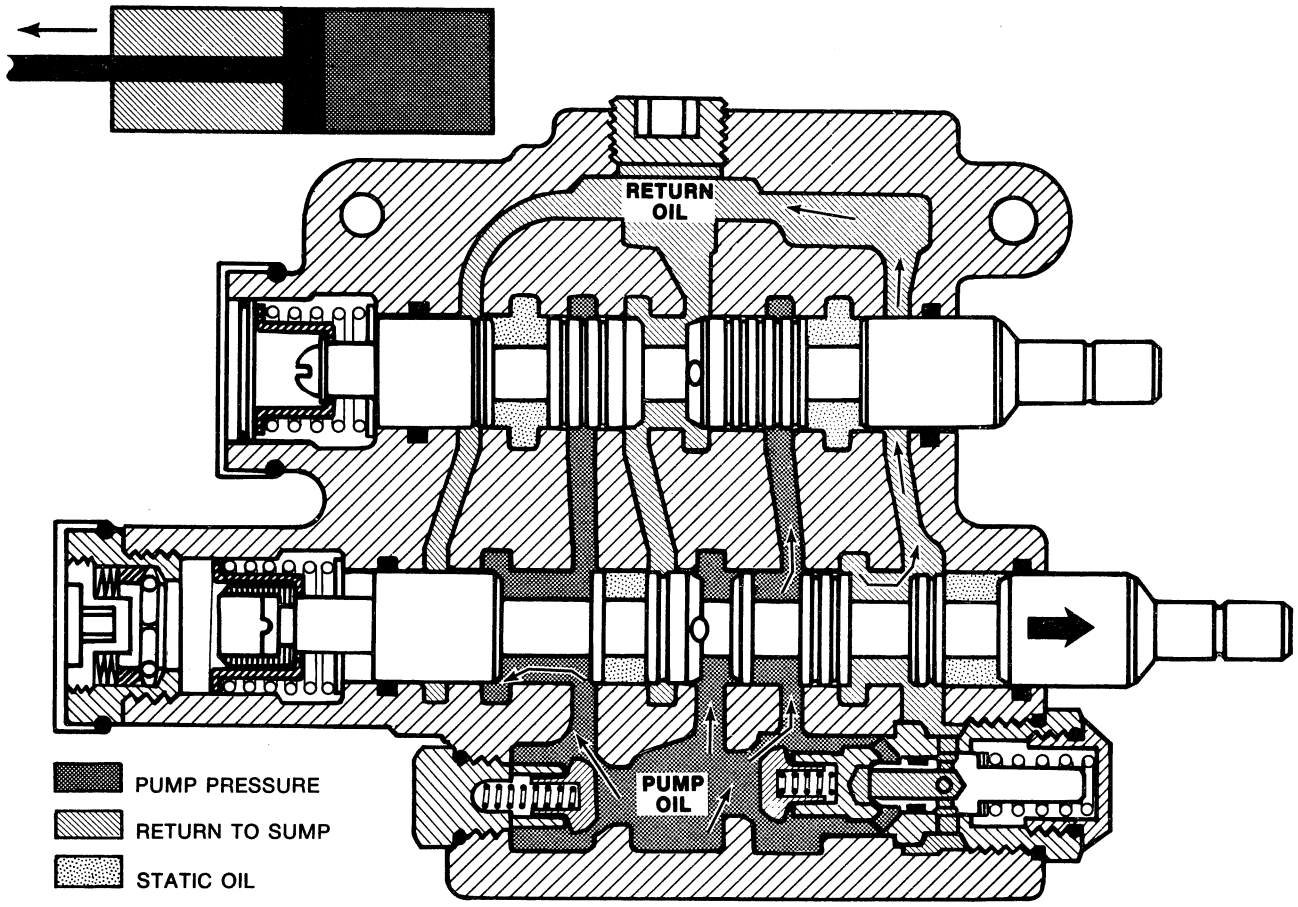


Figure 13
Lift Spool — Extending

LIFT SPOOL — EXTENDING

Figure 13 illustrates oil flow through the control valve with the lift spool moved to direct oil to the piston end of the lift cylinders. Oil entering the valve at the inlet port is blocked by the positioning of the spool land, causing a pressure increase. As pressure builds, the check valves are unseated allowing oil to flow through the high pressure passages to the cylinder piston end port. Return oil from the cylinder rod end port enters the valve and flows to sump as shown.

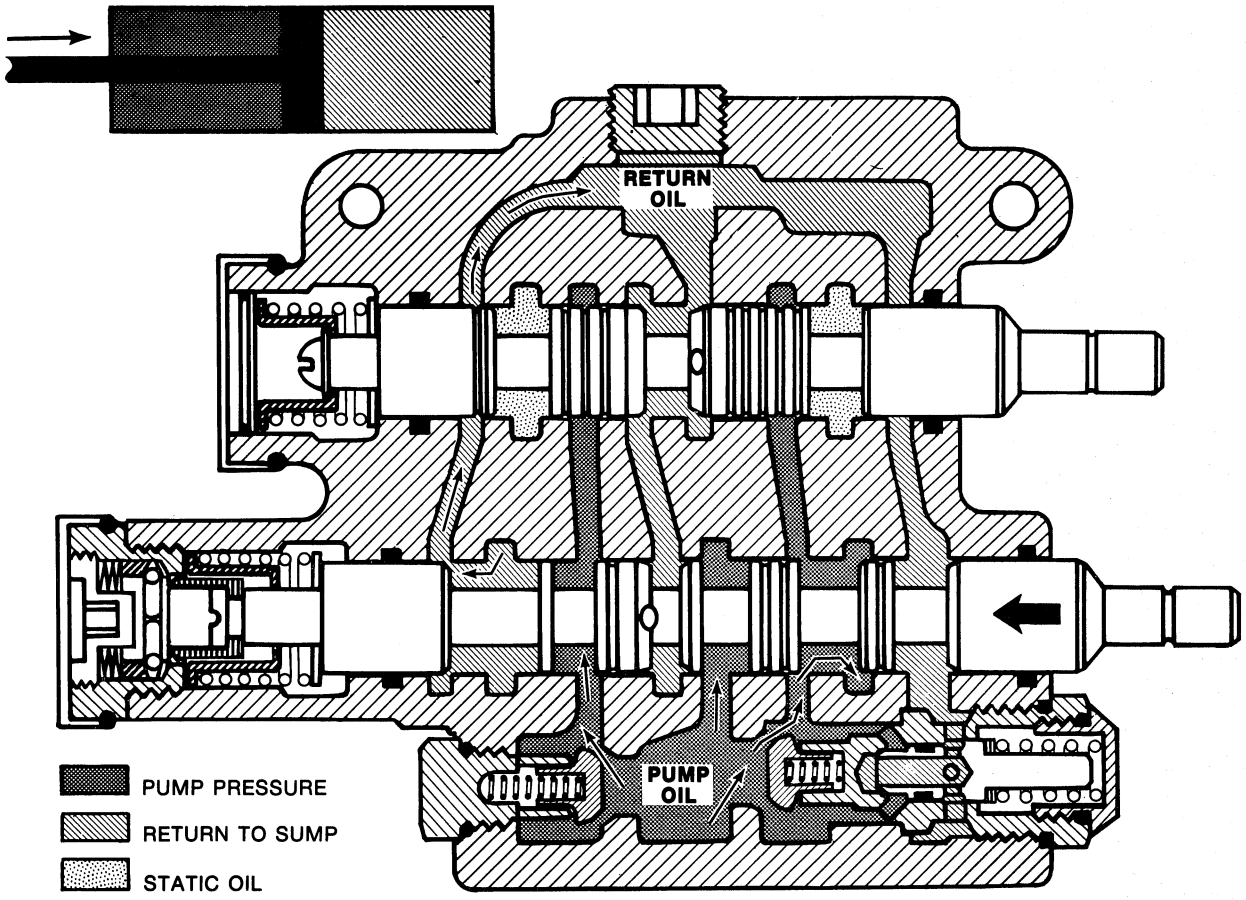


Figure 14
Lift Spool — Retracting

LIFT SPOOL — RETRACTING

Figure 14 illustrates oil flow through the control valve with the lift spool moved to direct oil to the rod end of the lift cylinder. Oil entering the valve at the inlet port is blocked by the positioning of the spool land causing a pressure increase. As pressure builds, the check valves are unseated allowing oil to flow to the high pressure passages to the cylinder rod end port. Return oil from the cylinder piston end port enters the valve and flows to sump as shown.

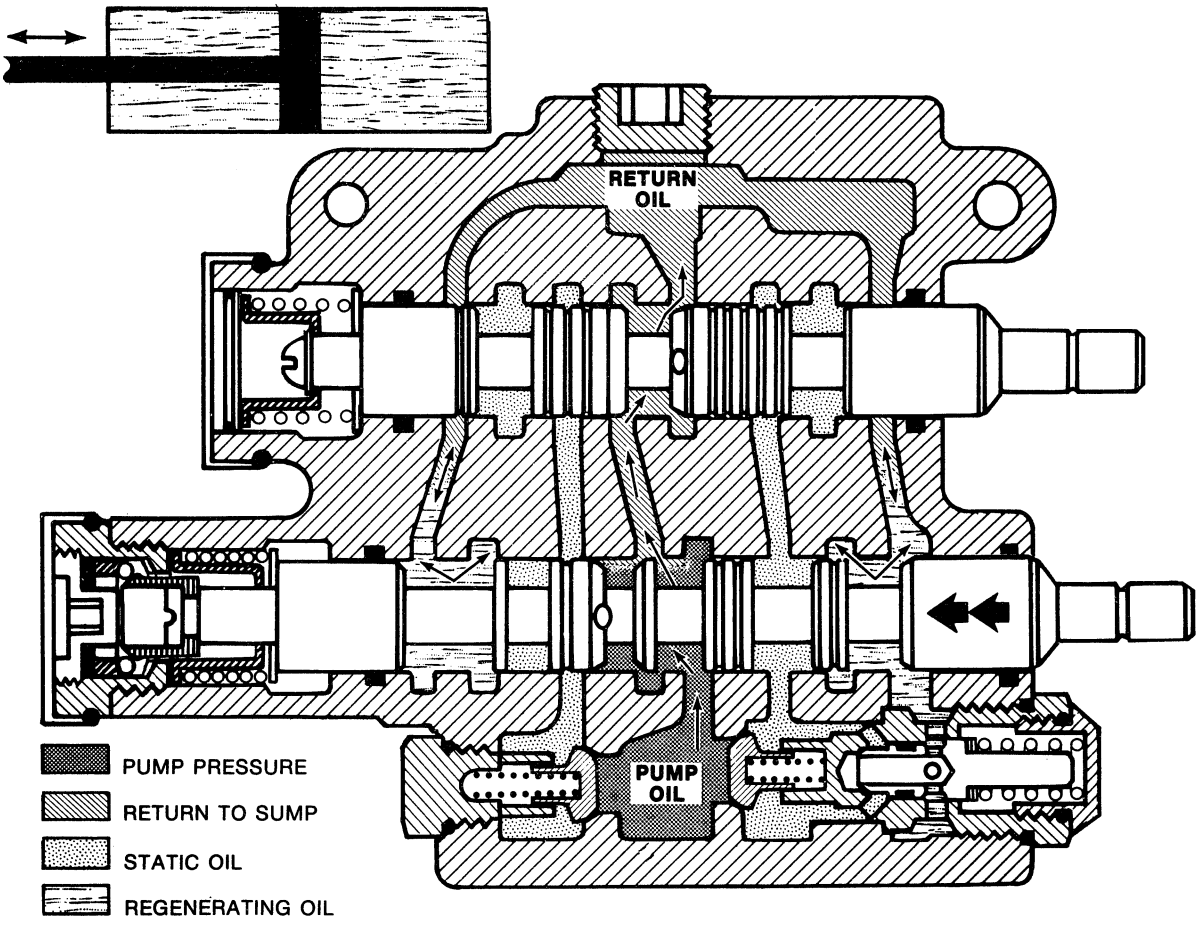


Figure 15
Lift Spool — Float

LIFT SPOOL — FLOAT POSITION

When the lift spool, Figure 15, is moved completely left, the detent mechanism engages to hold the spool in this position. The positioning of the spool allows pumped oil to pass through the open center of the control valve. During operation, the loader bucket will follow the ground contour or "float". Oil will flow in and out of the lift cylinder ports as conditions demand.

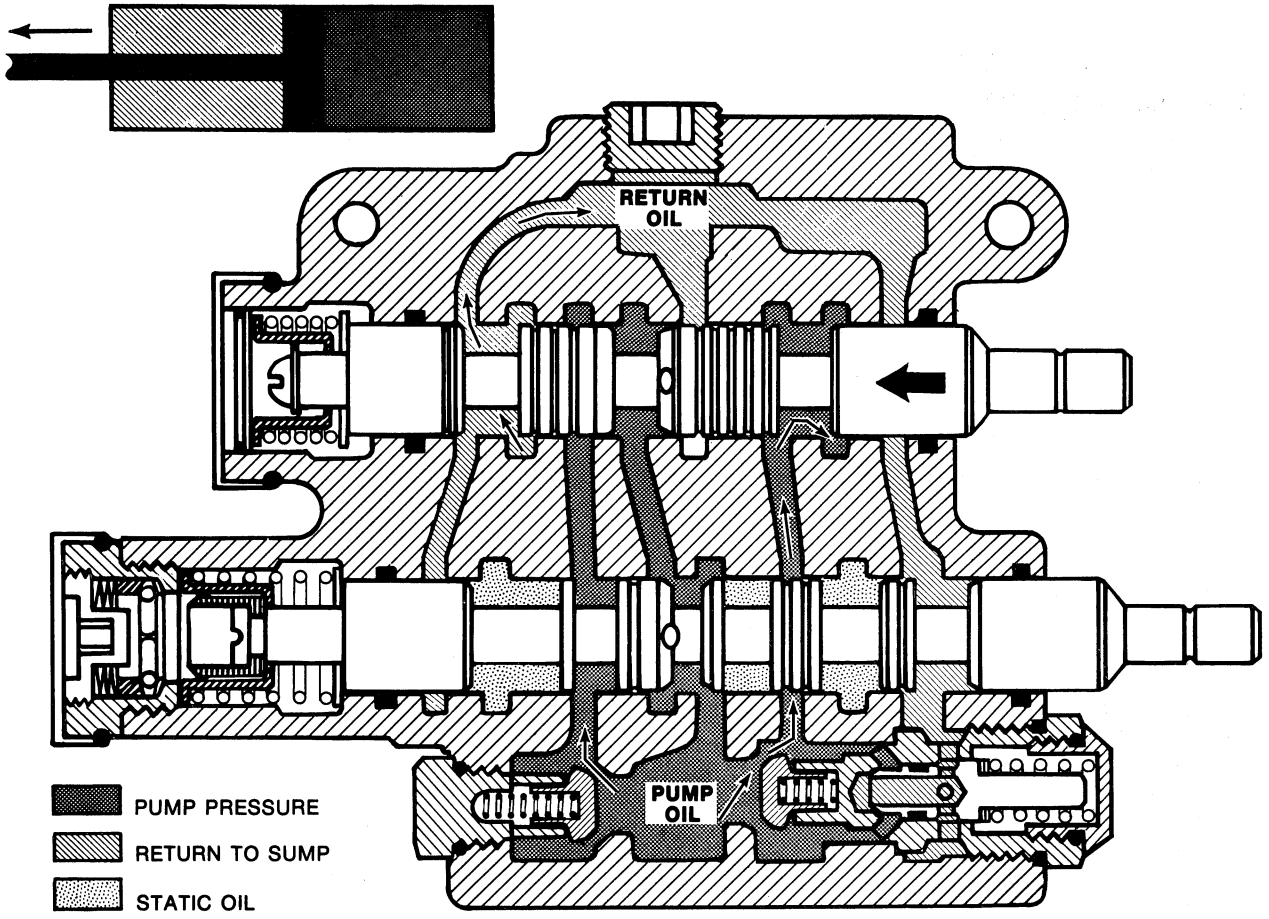


Figure 16
Bucket Spool — Extending

BUCKET SPOOL — EXTENDING

Figure 16 illustrates oil flow through the control valve with the bucket spool positioned to direct oil to the piston end of the bucket cylinders. Oil entering the valve at the inlet port passes through the open center of the lift spool, but is blocked off by the positioning of the bucket spool lands. As pressure builds, the check valves are unseated allowing oil to flow into the high pressure passages to the cylinder piston end port. Return oil from the cylinder rod end port enters the valve and flows to sump as shown.

BUCKET SPOOL — RETRACTING

Figure 17 illustrates oil flow through the control valve with the bucket spool positioned to direct oil to the rod end of the bucket cylinders. Oil entering the valve at the inlet port passes through the open center of the lift spool, but is blocked off by the positioning of the bucket spool lands. As pressure builds, the check valves are unseated allowing oil to flow into the high pressure passages to the cylinder rod end port. Return oil from the cylinder piston end port enters the valve and flows to sump as shown.

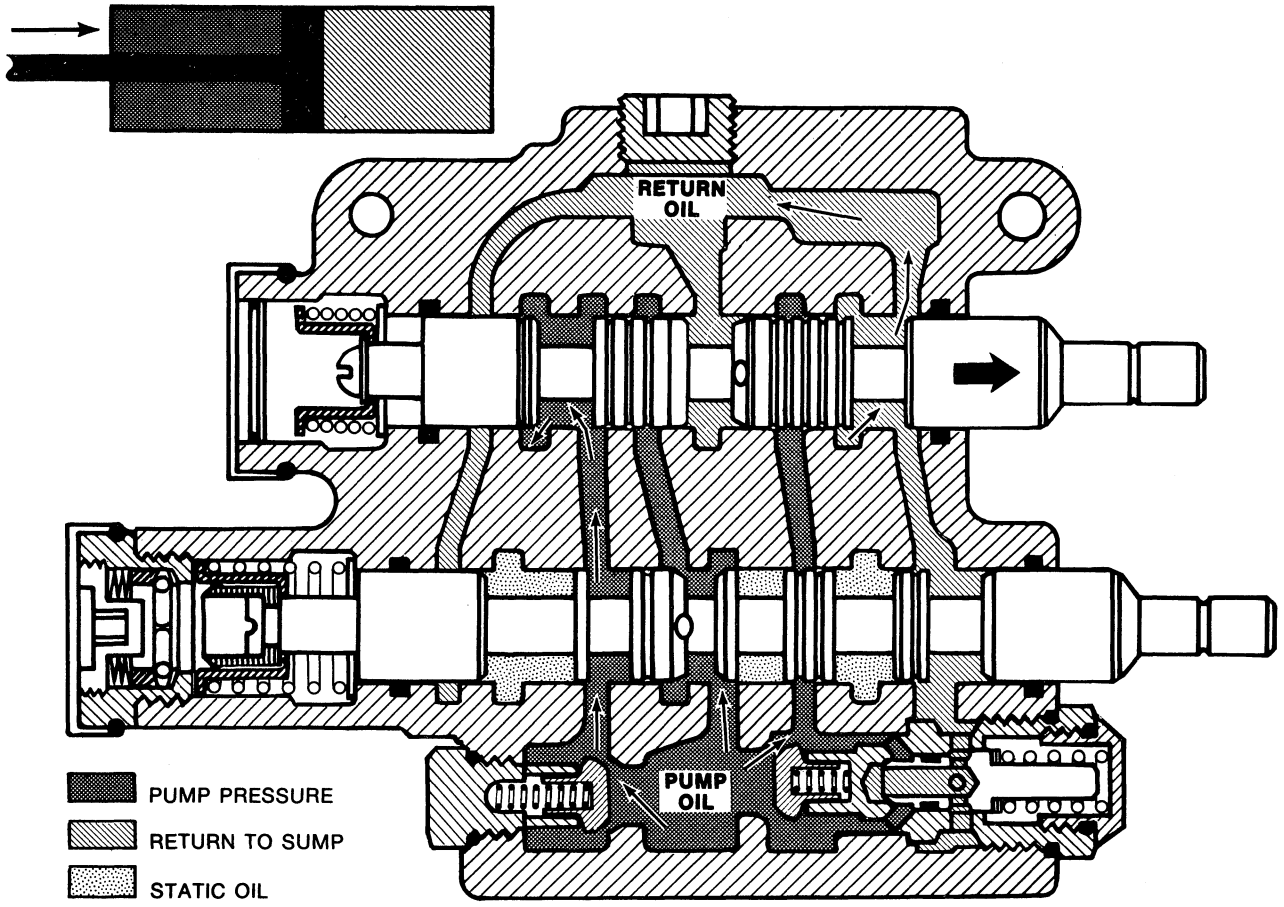


Figure 17
Bucket Spool — Retracting

TROUBLE SHOOTING

This portion of the manual is devoted to trouble shooting loader malfunctions. If trouble shooting is approached in a systematic manner, the malfunction can be diagnosed quickly and accurately. Follow the step-by-step procedures outlined below.

1. As a first step in the trouble shooting procedure, several preliminary checks should be made. These checks are essential in that once performed they need no longer be considered as a possible cause of the immediate malfunction.

   - Check for proper loader installation.
   - Check oil level.
   - Check for external oil leaks.
   - Check for external mechanical damage such as kinked hoses or tubes, damaged cylinders, bent or binding structural members.
   - Perform the system relief valve pressure check and adjust if necessary, as covered on page 22. If the pressures cannot be adjusted to specifications, refer to Step 2, below. Having performed the preliminary checks and failing to locate the cause of malfunctioning, the following procedures should be used.

2. If possible, operate the loader and make note of the operating characteristics. Cycle each control lever to operate each of the cylinders to both the extended and retracted positions.

TROUBLE SHOOTING

Compare the operating characteristics observed in Step 2, above, with the problems listed in the Trouble Shooting Table.

- The column labeled "PROBLEM" lists the observed malfunctions when the loader is operated.
- The column labeled "POSSIBLE CAUSES" lists all the items in the circuit which could cause the observed malfunction.

Refer to the "ADJUSTMENTS AND PRESSURE CHECKS" section of this manual for adjustment, pressure checks and hydraulic test procedures.

PROBLEM	POSSIBLE CAUSES
Lift or bucket fails to operate, is slow, or has loss of power in one or more circuits.	Cylinder piston seal ring leakage. Valve spool leakage. Hydraulic pump drive defective. Hydraulic pump assembled incorrectly. Hydraulic pump worn. **Aeration:** Air entering the system between the reservoir and pump high pressure port. **Cavitation:** Restriction between the reservoir and high pressure port. System relief valve failure. System relief pressure set too low. System relief valve stuck open. Defective relief valve seals.
Cylinders leak down with control valve in neutral position.	Cylinder piston seal ring leakage. Control valve spool leakage.
Hesitation in lift or bucket when control valve is initially moved.	Cylinder cavitation. System relief valve stuck open. Check valve damaged or stuck open.

TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSES
System noisy.	Aeration. Cavitation. Water in system. System relief valve chatter. Tubing vibration. Cold hydraulic oil (below 30° F. (-1° C.)).
Oil exhausts from breather cap.	Aeration. Cavitation. System oil overfull.
Float mechanism fails to operate or slips out of detent.	Excessive wear or broken detent components. Foreign material in detent mechanism.
Valve spools return to neutral slowly.	Spring retaining screw, detent plunger or positioner stud (return-to-dig) loose. Weak or broken spool centering springs.

ADJUSTMENTS AND PRESSURE CHECKS

BUCKET LEVEL INDICATOR

The bucket level indicator (1), Figure 18, is attached to the right side bucket cylinder with clamps as shown.

1. To check for proper adjustment, position the bucket so the bottom is resting flat on a smooth level surface. The pointer (2) should be in the center of the reflective tape (3) when the indicator rod (4) is resting on the cylinder rod trunnion end.
2. If adjustment is necessary, loosen the two clamps and relocate the assembly so the proper adjustment is obtained.

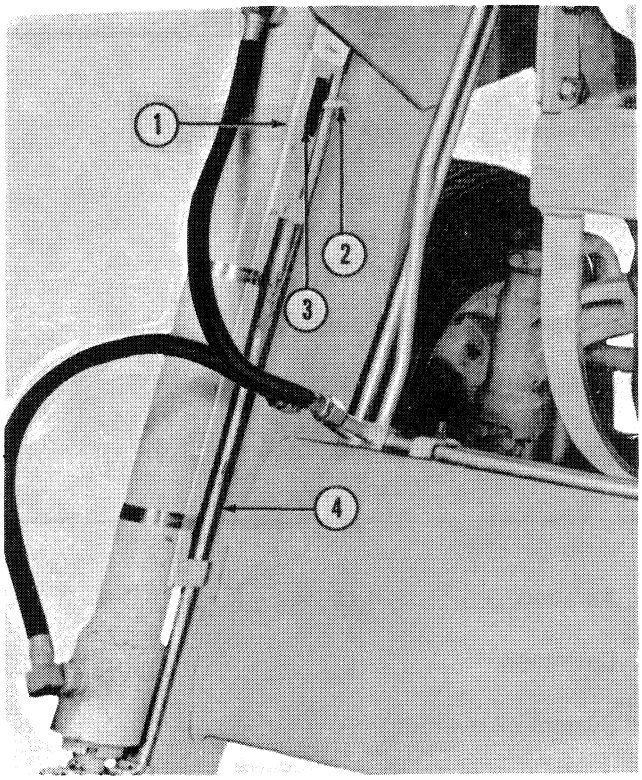


Figure 18
Bucket Level Indicator

1. Indicator Assembly
2. Pointer
3. Reflector Tape
4. Indicator Rod

SYSTEM RELIEF VALVE PRESSURE TEST AND ADJUSTMENT

The System Relief Pressure Test will indicate a possible cause of loader malfunction due to incorrect system pressure.

The following test equipment is needed for performing the test. The following hardware is included in the Universal Pressure Test Kit #2203:

Tool No.	Description
D-19-HP	3000 psi hose 3/16" I.D.; 7/16"-20F swivel nut, one end; 1/4"F high pressure quick disconnect other end.
D-22	0-5000 psi gauge with 1/4"M quick disconnect plug.
ND-135-10.1*	7/8"-14M, 37° x 7/8"-14F, 37° Swivel x 7/8"-14M, 37°
Used with	
D-32	7/8"-14F, 37° x 7/16"-20M, 37°

*The #1401 tee fitting may be used in place of the ND -135-10.1 and D-32 fittings.

IMPORTANT: *When checks are made for relief valve presure settings, the hydraulic system oil must be at 165 ± 15° F. (66-82° C.) Valve settings made when the system oil is cold will be inaccurate under actual operating conditions. The system relief valve (5), Figure 19, is located in the bottom front portion of the loader control valve (6).*

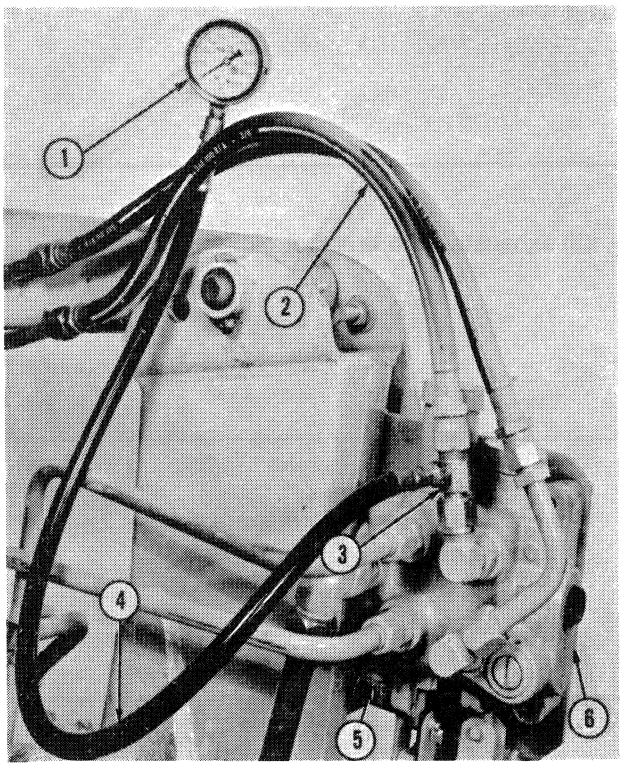


Figure 19
Checking System Relief Pressure

1. 0-5000 psi Gauge (D-22)
2. Bucket Hose
3. Flare Tee (1401)
4. Hydraulic Hose (D-19-HP)
5. Relief Valve Cap
6. Control Valve

CAUTION: *Hydraulic oil escaping under pressure may be nearly invisible and have enough pressure to penetrate the skin. Always relieve the hydraulic system pressure by actuating the control lever with the tractor engine stopped before loosening any hydraulic fittings.*

1. Disconnect the bucket cylinder rod end hose (2), Figure 19, from the control valve.

2. Install the ND-135-10.1 and D-32 or 1401 fitting (3), D-19-HP hose (4) and D-22 pressure gauge (1).

3. Start the tractor and curl the bucket fully toward the tractor. Repeat the cycling of the bucket or loader until the hydraulic system oil is 165 ± 15° F. (66-82° C.).

4. When the oil is at normal operating temperature, set the engine speed to rated rpm. Actuate the control lever for full bucket curl and hold it. Adjust the throttle setting to maintain rated rpm.

5. Observe the pressure gauge. It should read 2000 $\pm \frac{50}{100}$ psi.

6. If the pressure observed is not within specifications, stop the tractor engine, relieve hydraulic presssure and slowly and carefully remove the relief valve cap (5).

7. Remove the poppet assembly and add or remove shims to change the relief pressure. Adding shims will increase the pressure at which the relief valve poppet unseats.

8. Recheck the relief pressure and reset if necessary.

HYDRAULIC TESTS

The hydraulic pump must deliver a specified amount of oil through the loader circuit within specified pressure limits as governed by the system relief valve. If the pump flow and/or system pressure falls below that specified, the efficiency of the hydraulic pump will be impaired. If the system is not operating properly, trouble can usually be traced to a specific area of the system. The pump may be worn, the system pressure may be low due to a low setting or leakage or oil may be leaking around the valve spools, cylinder piston or valve seats.

The hydraulic tester may be used as an effective tool in determining hydraulic pump efficiency. The tester unit will:

- Measure the volume and temperature of oil passing through the tester.
- Provide a manually variable means of restricting oil flow through the tester and measure the resultant pressure.

HYDRAULIC PUMP PERFORMANCE TEST

The pump performance test determines pump efficiency and indicates pump starvation. The test is performed with the pump isolated from the loader circuit so that system leakage is not a factor. With the tester installed, all pumped oil is directed to the tester unit, measured at the desired load and returned through the tester outlet to the reservoir.

Installation of the Hydra Analyzer Tester (Model 2450 or 2015):

The following fittings and hoses are necessary for installing the tester:

PUMP HIGH PRESSURE TUBE TO HYDRAULIC TESTER

Tool No.		Description
2210	Reducer	1-3/16"-12,, 37° x 1-1/16"-12F, 37°
1-N105	Reducer	1-1/16"-12M, 37° x 1/2"-14F, NPT
1340 or 1391	Hose	118" long x 3/8"I.D. 1/2" NPT Male Ends
1-N105	Reducer	1-1/16"-12M, 37° x 1/2"-14F, NPT
2-N109	Double Female	1-1/16"-12F, 37° x 1-1/16"-12F, 37°
	Union Adapter	Swivel Nut

HYDRAULIC TESTER TO HYDRAULIC RESERVOIR

Tool No.		Description
2-N109	Double Female	1-1/16"-12F, 37° x 1-1/16"-12F, 37°
	Union Adapter	Swivel Nut
1-N105	Reducer	1-1/16"-12M, 37° x 1/2"-14F, NPT