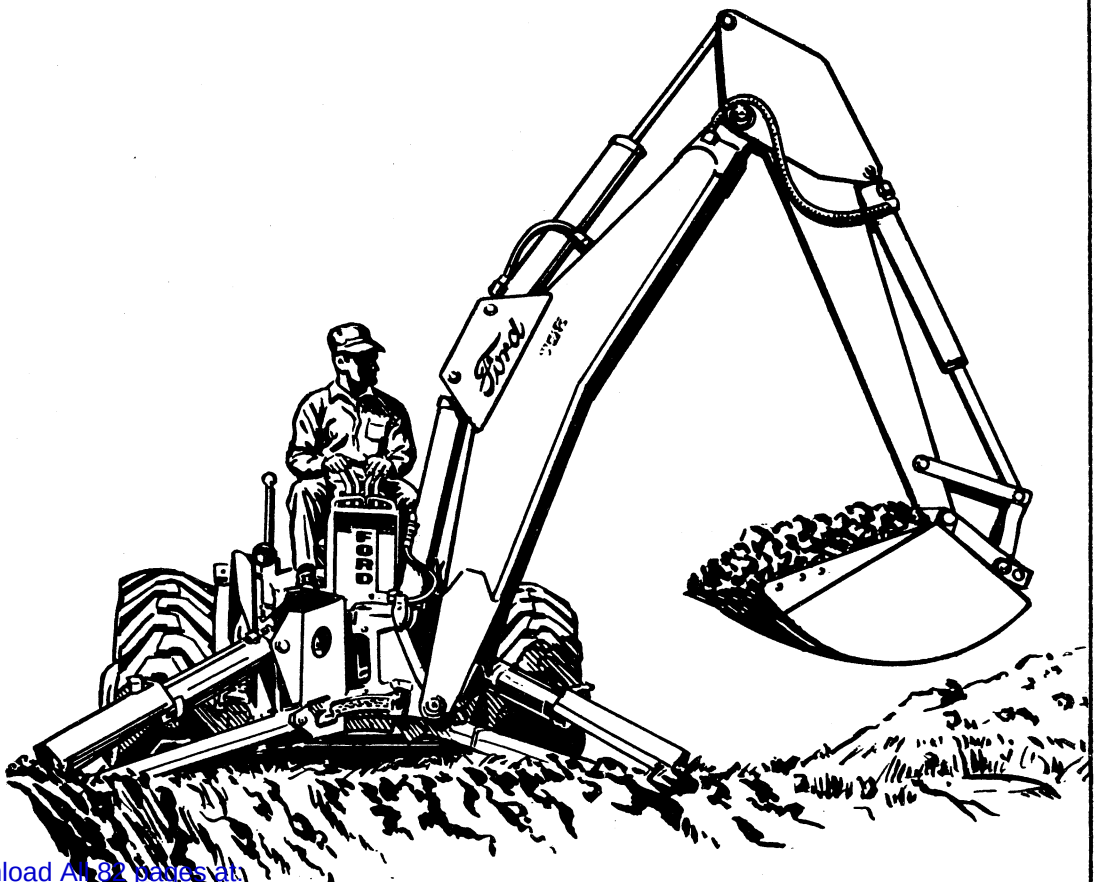
FORD

Service Manual

SERIES 750, 753, and 755

BACKHOE



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FOREWORD

THIS MANUAL CONTAINS SERVICE PROCEDURES FOR THE FORD INDUSTRIAL BACKHOES, SERIES 750 (10-FOOT), SERIES 753 (13-FOOT), AND SERIES 755 (15-FOOT). DETAILED INFORMATION IS GIVEN ON DESCRIPTION AND OPERATION, TROUBLE SHOOTING, TESTS AND ADJUSTMENTS, MAINTENANCE, LUBRICATION, AND SPECIFICATIONS. THE LISTS ON PAGES 66 AND 67 CONVERTS THE SPECIFICATIONS USED IN THE TEXT OF THIS MANUAL TO THE METRIC SYSTEM.

INSTALLATION OF THE BASIC BACKHOES, THE ATTACHING KITS, AND THE HYDRAULIC KITS IS NOT COVERED IN THIS PUBLICATION. REFER TO THE APPROPRIATE OPERATING AND ASSEMBLY MANUALS FOR INSTALLATION INFORMATION.

EACH BACKHOE IS SIMILAR IN CONSTRUCTION AND IDENTICAL IN OPERATION; THERE ARE, HOWEVER, VARIANCES IN DIMENSIONS AND SPECIFICATIONS. PARTICULAR ATTENTION SHOULD BE GIVEN TO THE CORRECT SERIES IDENTIFICATION WHEN ORDERING PARTS OR WHEN SERVICING THE UNIT.

THE SERVICE PROCEDURES IN THIS MANUAL ARE THE MOST APPARENT, PRACTICAL, AND EFFICIENT METHODS; HOWEVER, A PROCEDURE MAY NOT PROVE TO BE THE MOST DESIRABLE IN ALL SITUATIONS. ALTERNATE METHODS ARE SOMETIMES REQUIRED, DEPENDING UPON THE TOOLS AND EQUIPMENT AVAILABLE.

REFERENCE TO DIRECTION IN THE OPERATION AND SERVICING OF THE BACKHOE IS MADE AS VIEWED FROM THE BACKHOE SEAT. WHEN ORDERING PARTS, LEFT AND RIGHT ARE REVERSED AND REFERENCED AS FACING IN THE DIRECTION OF TRACTOR TRAVEL.

KEEP THIS MANUAL WITH YOUR OTHER SERVICE MATERIAL SO THAT IT WILL BE READILY AVAILABLE WHEN REQUIRED.

SERVICE DEPARTMENT
FORD TRACTOR OPERATIONS
FORD MOTOR COMPANY

FORD

Service Manual

FORD
NEW HOLLAND

Supplement for Automated Backhoe

FOREWORD

THIS MANUAL CONTAINS SERVICE PROCEDURES FOR THE FORD INDUSTRIAL AUTOMATED BACKHOE, SERIES 750, 753, AND 755. INFORMATION GIVEN IN THIS MANUAL COVERS ONLY THE PORTIONS OF THE AUTOMATED BACKHOE THAT ARE DIFFERENT FROM THE BASIC CENTER-PIVOT BACKHOE AND IS A SUPPLEMENT TO THE BACKHOE SERVICE MANUAL, SE 9358.

INSTALLATION OF THE BASIC BACKHOE, THE ATTACHING KIT, AND THE HYDRAULIC KIT IS NOT COVERED IN THIS PUBLICATION, REFER TO THE APPROPRIATE OPERATING AND ASSEMBLY MANUALS FOR INSTALLATION INFORMATION.

PARTICULAR ATTENTION SHOULD BE GIVEN TO THE CORRECT SERIES IDENTIFICATION WHEN ORDERING PARTS OR WHEN SERVICING THE UNIT.

THE SERVICE PROCEDURES IN THIS MANUAL CONSIDER THE MOST APPARENT, PRACTICAL, AND EFFICIENT METHODS; HOWEVER, A PROCEDURE MAY NOT PROVE TO BE THE MOST DESIRABLE IN ALL SITUATIONS. ALTERNATE METHODS ARE SOMETIMES REQUIRED, DEPENDING UPON THE TOOLS AND EQUIPMENT AVAILABLE.

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CONTENTS

GENERAL INFORMATION

The Ford Model 19-480, -481, and -482 backhoes are equipped with components that automate filling the bucket. These components in conjunction with the basic backhoe eliminate manual correction of the bucket dig angle throughout the bucket fill cycle.

Since many of the components are similar or identical to the center-pivot backhoes, this manual has been prepared to supplement the backhoe service manual, SE 9358. This manual is also used in conjunction with the loader service manual, SE 9356, which contains information on the hydraulic pump, reservoir, and related hydraulic system information. This service manual covers only the differences which relate to the automated backhoe.

DESCRIPTION AND OPERATION

In addition to the basic backhoe components, the Automated Backhoe consists of a sequencing valve, two control cylinders, a foot pedal and linkage, two adjusting screws and miscellaneous installation hardware. See Figure 1.

SEQUENCING VALVE

The sequencing valve assembly, Figure 2, consists of regulating valve, a shut-off valve, and two sequencing valves which are all contained in one housing that is connected by tubing to the backhoe main control valve.

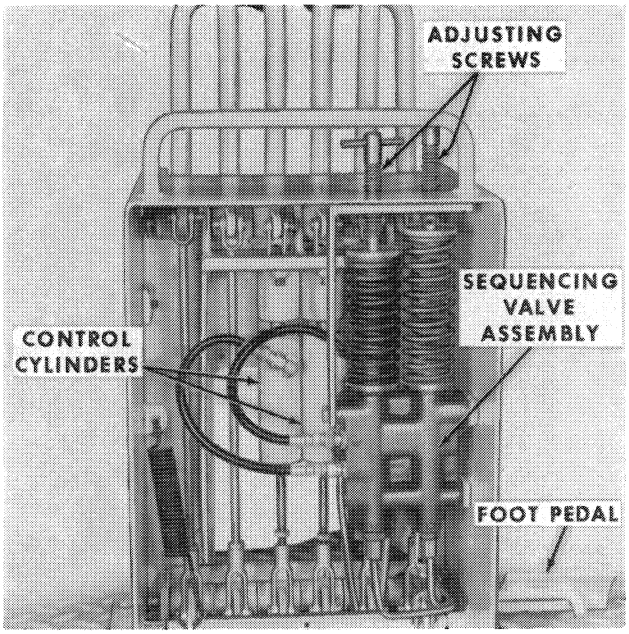

Figure 1
Automated Backhoe Components

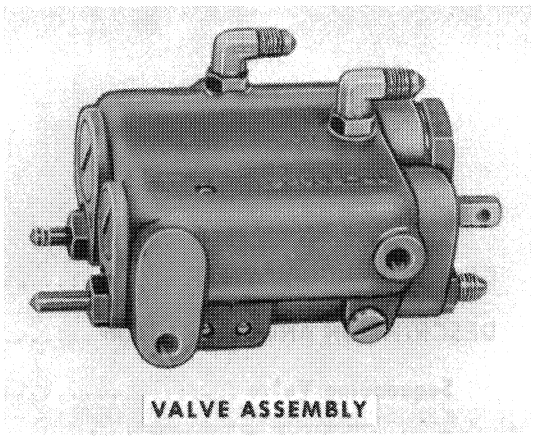

Figure 2
Sequencing Valve Assembly

The regulating valve, Figure 3, functions to reduce oil pressure entering the sequencing valve assembly from the backhoe main control valve. After the oil pressure has been reduced by the regulating valve to 350 ± 50 psi (24.5 ± 3.5 kg/cm^2), it flows to the shut-off valve.

The shut-off valve, Figure 4, is manually controlled by the foot pedal located on the side of the backhoe control tower. When the pedal is depressed (down) oil is permitted to flow to the bucket and lift sequencing valves.

Both the bucket and lift sequencing valves, Figure 5, are pressure sensitive valves which function to direct regulated oil to the control cylinders to actuate the bucket and lift linkage and in turn the spools in the main control valve. The two sequencing valves function in the following order: When pressure in the crowd circuit increases due to the bucket meeting resistance, the bucket sequencing valve spool is forced open by the pressure buildup, allowing oil flow to the bucket control cylinder for bucket correction (curling). If circuit pressure is not reduced by the bucket correction and continues to increase, pressure buildup will then force the lift sequencing valve open allowing oil flow to the lift cylinder for a lift correction. The amount of pressure in the bucket and lift circuits required to open the sequencing valves is determined by the position of the adjusting screws located on top of the backhoe control tower.

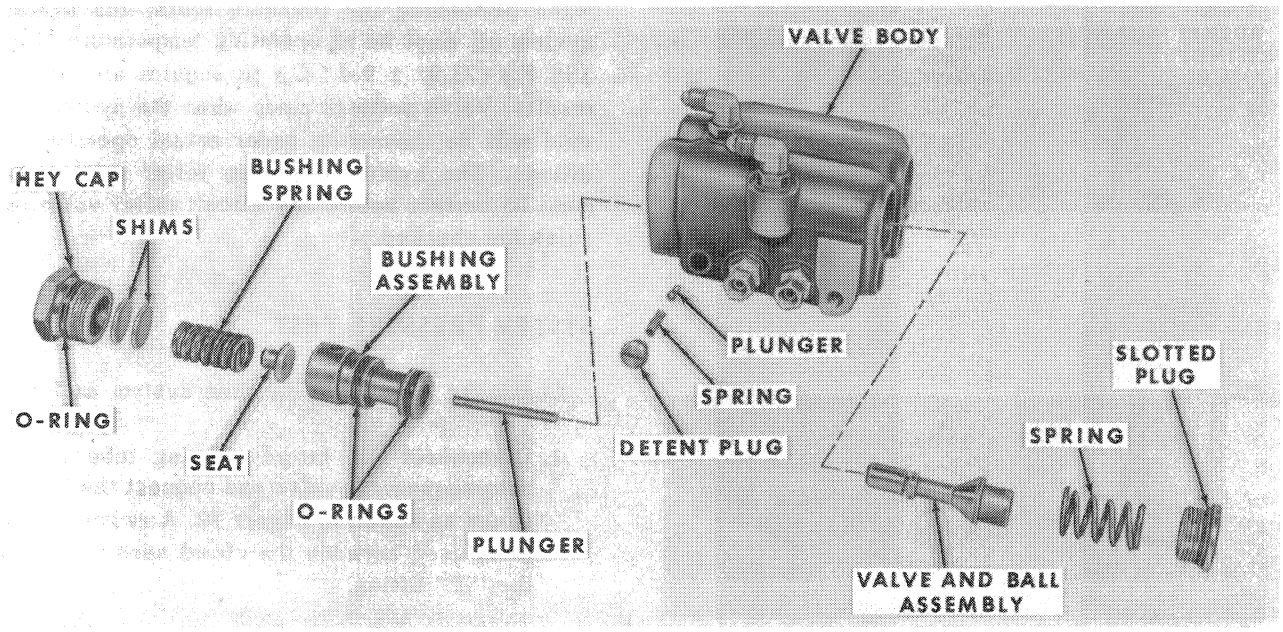

Figure 3
Oil Pressure Regulating Valve

BUCKET AND LIFT CONTROL CYLINDERS

The bucket and lift single-acting control cylinders, Figure 6, are attached through linkage to the bucket and lift spools in the backhoe main control valve. Regulated oil pressure from the sequencing valve forces the control cylinder piston downward which moves the spool in the main control valve and in so doing pressurizes the circuit.

FOOT PEDAL

The foot pedal, Figure 7, located on the left side of the backhoe control tower is attached to the shut-off valve spool in the sequencing valve assembly.

During operation of the automatic feature the foot pedal is depressed to allow oil to the sequencing valves for bucket correction. When the backhoe is operated as a conventional backhoe (manually) the foot pedal remains in the "up" position (not depressed).

ADJUSTING SCREWS

The two adjusting screws, Figure 8, located on top of the backhoe control tower are used to adapt the automated backhoe to various soil conditions. The "bucket" adjusting screw regulated bucket dig angle (curl). The "lift" adjusting screw regulates backhoe lift. Both adjusters, in conjunction with springs, Figure 9, regulate opening and closing of

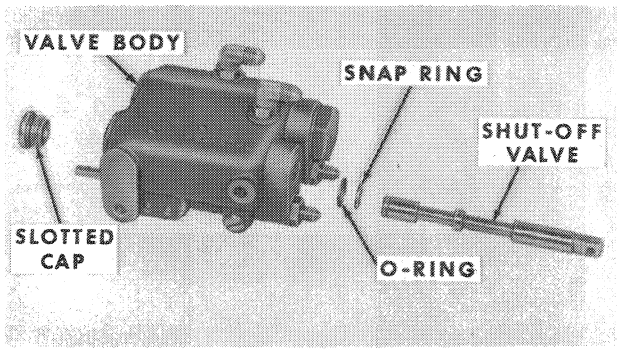

Figure 4
Shut-off Valve

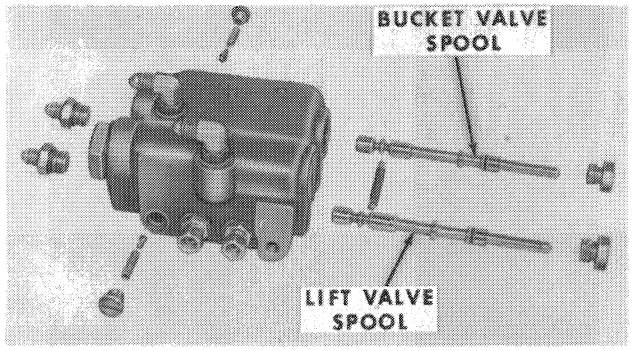

Figure 5
Bucket and Lift Sequencing Valve Spools

PRESSURE CHECKS

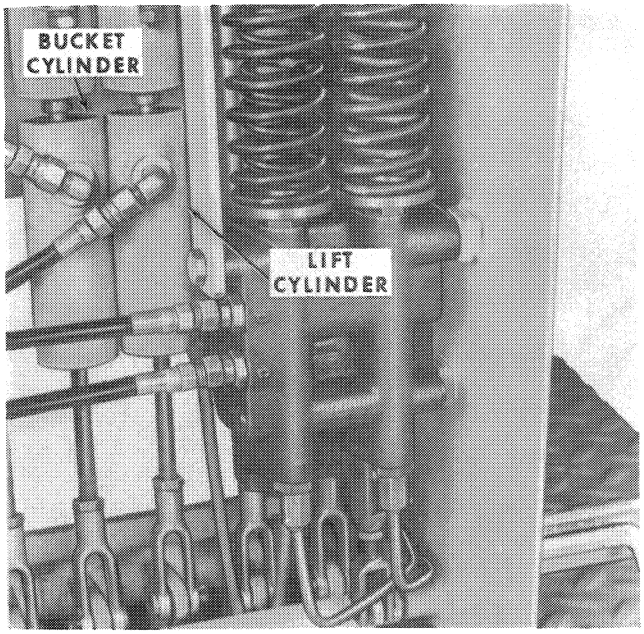

Figure 6
Bucket and Lift Control Cylinders

the bucket and lift sequencing valve spools. Turning the adjusting screws clockwise, increases spring pressure; whereby, a greater amount of oil pressure is required to move the spools to the open position. Subsequently, fewer corrections occur as spring tension is increased.

PRESSURE TESTS

Before performing the following pressure tests, check the hydraulic oil level. Add fluid if required.

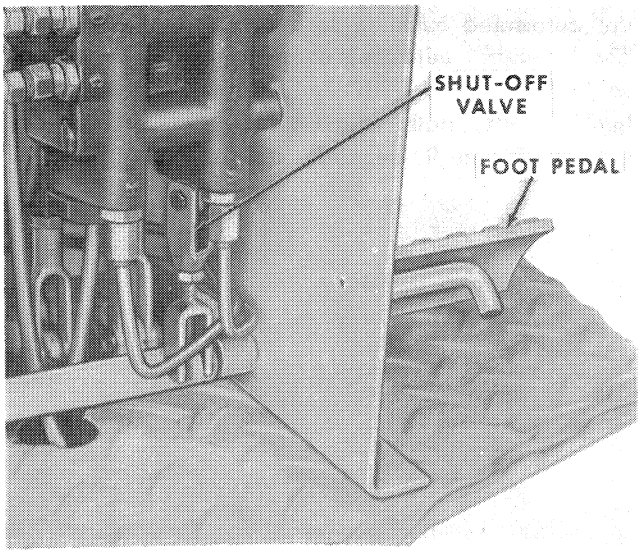

Figure 7
Foot Pedal Linkage

When performing the pressure tests, the hydraulic system oil must be at operating temperature (165° ± 15° F.) (73.9° ± 9.4° C.) to acquire accurate test results. Valve settings made when the system oil is cold will be inaccurate under actual operating conditions. The hydraulic system relief valve setting must be correct before any circuit relief valve pressures are checked.

SYSTEM PRESSURE TEST

Check the Automated Backhoe system as follows:

1. Disconnect the crowd sensing tube from the auto-sequencing valve and connect the N-1100-3 gauge as shown in Figure 10. A swivel connector is used between the crowd sensing tube and the "H" fitting.

2. Start the tractor engine and run at 1700 rpm as indicated on the Proof-Meter.

3. Actuate any one of the backhoe cylinder control levers (except the swing) and hold the cylinder in a retracted or extended position at intervals of 30 seconds so that the relief valve will function. This procedure also aids in quickly heating the oil.

4. Because the gauge is tapped into the crowd circuit, it will be necessary to activate the crowd circuit to check system pressure.

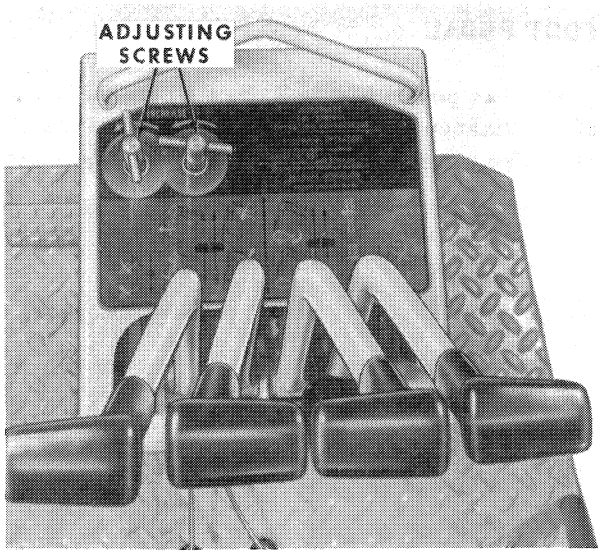

Figure 8
Valve Adjusting Screws

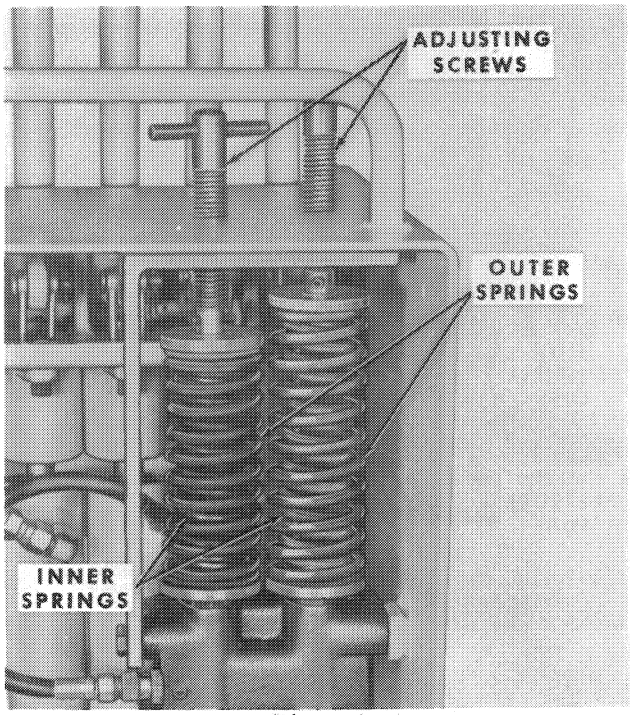

Figure 9
Adjusting Screws and Springs

5. With the engine speed at 1700 rpm, actuate and hold the crowd cylinder in the extended or retracted position, and observe the gauge. The gauge reading should be 2200 ± 50 psi (154 ± 3.5 kg/cm2) at 1700 engine rpm at 165 ± 15° F. (73.90 ± 9.4° C.)

6. The system pressure setting is the same for the automated backhoe as for the 750 Series Backhoes. 2200 ± 50 psi (154 ± 3.5 kg/cm2).

7. If the pressure is not to specification, remove the pressure relief valve acorn nut, and loosen the lock nut on the adjusting screw on the main control valve. See Insert, Figure 10.

8. With the relief valve operating, as outlined in Step 5, use a screwdriver to turn the screw in or out until 2200 ± 50 psi (154 ± 3.5 kg/cm2) is obtained on the gauge.

9. Lock the screw in position with the lock nut and install the acorn nut.

REGULATING VALVE PRESSURE TEST

The regulating valve pressure is 350 ± 50 psi (24.5 ± 3.5 kg/cm2). To check the pressure, disconnect the line from the bucket circuit control cylinder, Figure 11, and attach the gauge, as shown, using the N1100-3 gauge, the N1100-H swivel adapter and the hose connector. Start the tractor and run at 1700 rpm until the oil is up to operating temperature. With engine running at 1700 rpm, depress the foot pedal. Pull the crowd lever until the crowd cylinder reaches the end of its stroke.

Observe the pressure reading on the gauge. The gauge reading should be 350 ± 50 psi (24.5 ± 3.5 kg/cm2). The regulating valve can be adjusted by adding or removing shims, Figure 14, until the desired pressure reading is obtained. Low regulating valve pressure will result in the control cylinders failing to work. High regulating valve pressure will result in failure of the cylinder piston or gland packing and oil leakage.

AUTOMATED BACKHOE COMPONENT OVERHAUL

SEQUENCING VALVE OVERHAUL

CAUTION: *Do not attempt to start the tractor engine while any of the automated backhoe components are disconnected or removed.*

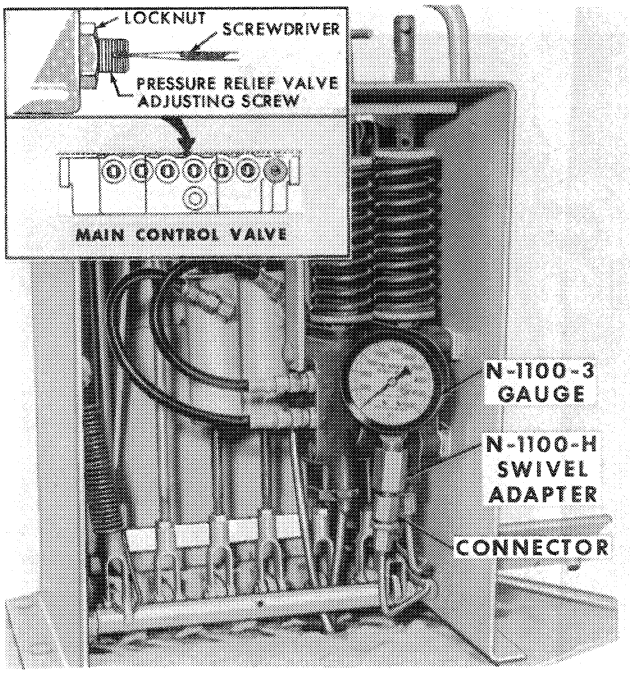

Figure 10
System Pressure Test

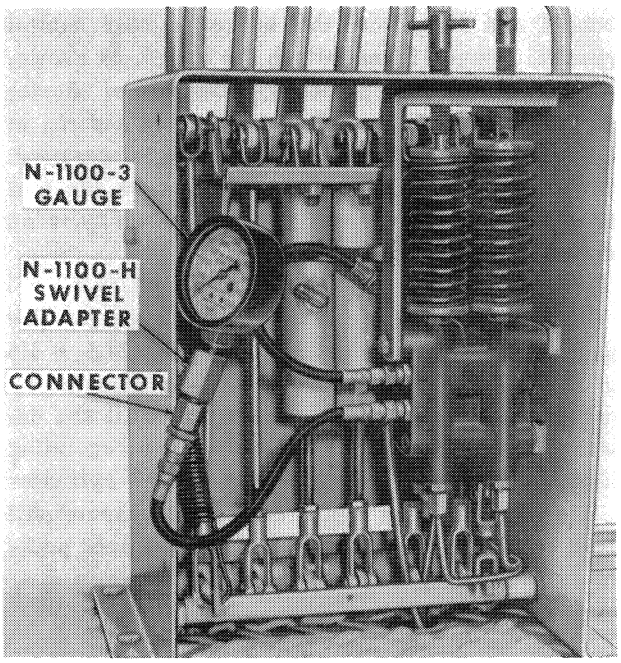

Figure 11
Regulating Valve Pressure Test

Removal

IMPORTANT: *Make certain that the backhoe elements (bucket and stabilizers) are resting firmly on the ground. Relieve the pressure in the system by actuating all control levers.*

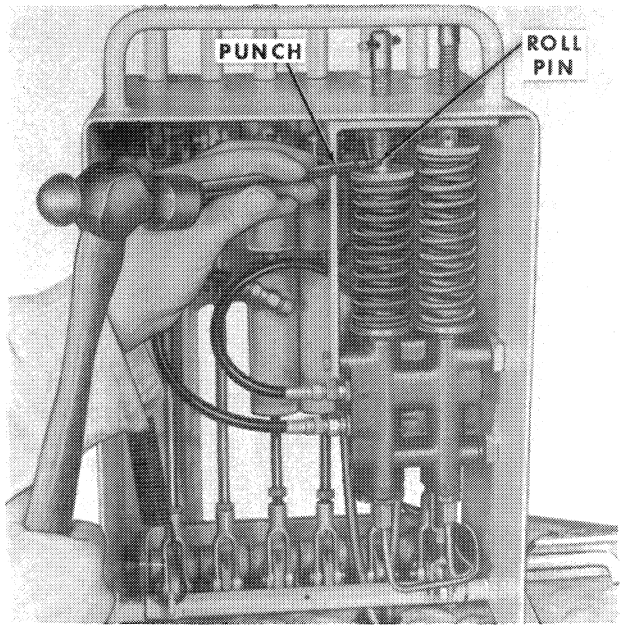

Figure 12
Adjusting Screw Retaining Pin Removal

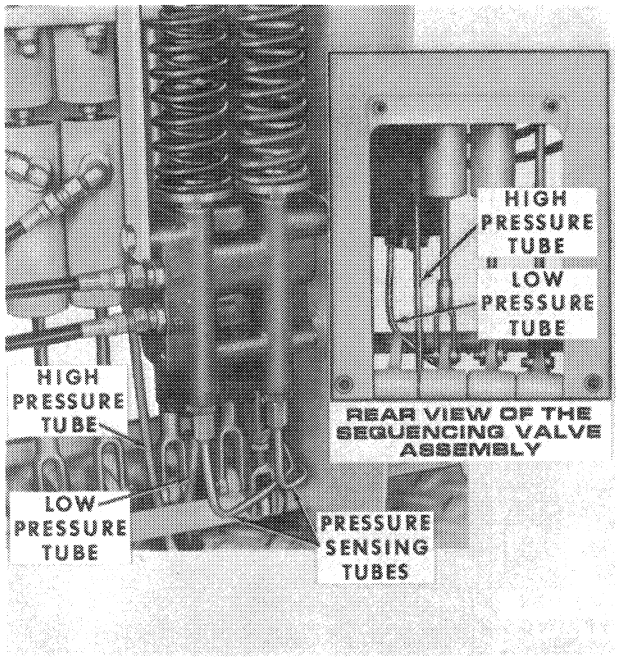

Figure 13
Pressure Sensing and High and Low Pressure Tubes

1. Remove the grille from the control tower by removing the four attaching screws.

2. Remove the retaining pin, Figure 12, from both adjusting screws with a punch and hammer. Then remove the adjusting screws by turning counterclockwise.

   CAUTION: *Care should be exercized when removing the spring assemblies.*

3. Remove the inner and outer springs and spring seats from sequencing valve spools by slightly compressing the springs and sliding the top end (screw end) from the control tower.

4. Disconnect the two hoses to the control cylinders at the sequencing valve assembly.

5. Disconnect the two pressure sensing tubes and the high and low pressure tubes, Figure 13, (rear of sequencing valve, see insert, Figure 13) at the sequencing valve assembly.

6. Disconnect the clevis attaching the shut-off valve spool to the foot pedal assembly by removing the cotter pin and clevis pin.

7. Remove the three attaching bolts securing the sequencing valve assembly to the backhoe control tower.

Disassembly

Refer to Figure 14 for parts identification.

1. Remove the shut-off valve spool from the sequencing valve body by removing the small slotted plug, Figure 14; then carefully slide the spool through the plug end of the valve body.

   NOTE: *Because of the spool stop, Figure 14, removal of the shut-off valve spool through the bottom of the valve body is not possible.*

2. Remove the internal 0-ring from the shut-off valve spool bore with a hooked wire.

3. Remove the regulating valve from the valve body by removing the large slotted plug; then remove the valve spring, valve and ball assembly and plunger.

4. Turn the valve body over and remove the large hex cap. Then remove the regulating valve bushing spring, the seat and the bushing assembly.

5. Remove the two detent plugs, the shims, the springs, and detent plungers from the bores.

6. Remove the valve spool guides from the sequencing valve spool bores.

   NOTE: *To prevent the loss of the inner detent plungers, the detent bores should be covered when removing either sequencing valve spool.*

7. Partially remove either the lift or bucket sequencing valve spool, Figure 14. This will permit the removal of the inner detent plungers and spring.

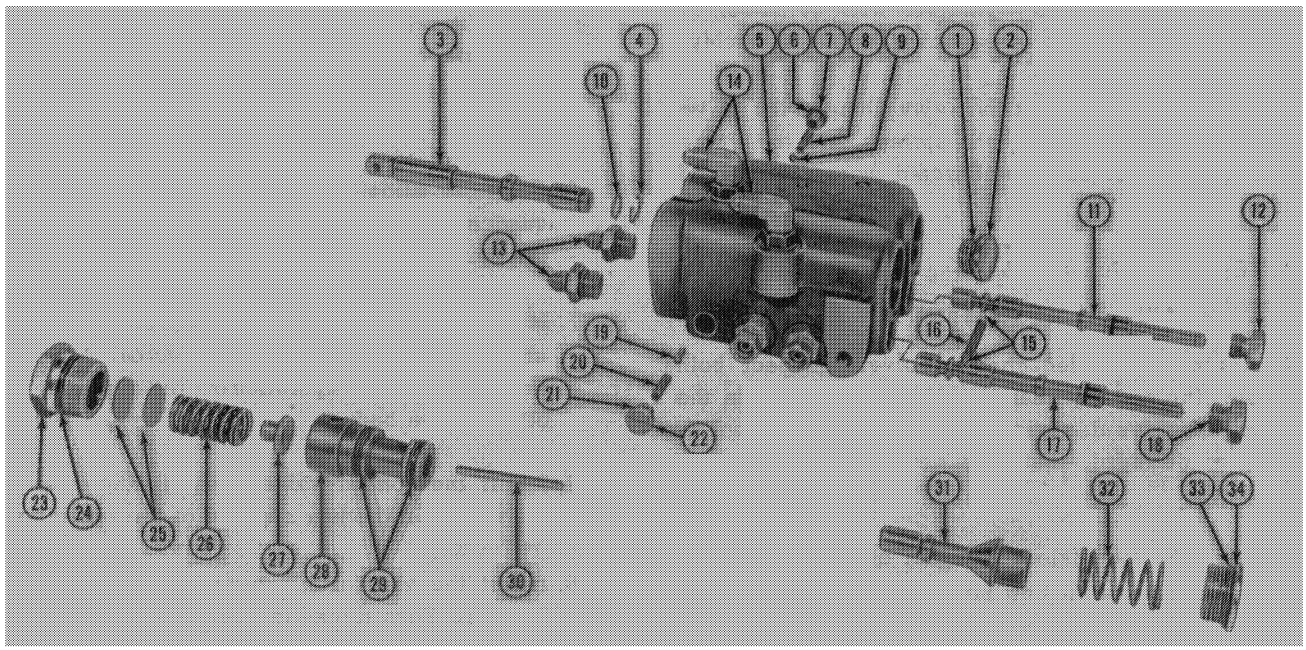

Figure 14
Sequencing Valve Assembly – Exploded View

KEY FOR FIGURE 14

1. Slotted Plug (small)
2. O-Ring Seal
3. Shut-off Valve Spool
4. Spool Stop
5. Valve Body
6. O-Ring Seal
7. Detent Plug
8. Detent Spring
9. Detent Plunger
10. O-Ring (internal)
11. Bucket Valve Spool
12. Spool Guide
13. Tube Connectors
14. Elbow 90°
15. Detent Plungers (inner)
16. Detent Spring (inner)
17. Lift Valve Spool
18. Spool Guide (bucket)
19. Detent Plunger
20. Detent Spring
21. Detent Plug
22. O-Ring Seal
23. Hex Cap
24. O-Ring Seal
25. Shims
26. Bushing Spring
27. Seat
28. Bushing Assembly
29. Quad Rings
30. Plunger
31. Valve and Ball Assembly
32. Valve Spring
33. O-Ring Seal
34. Slotted Plug (large)

8. Remove the sequencing valve spools from the valve body by grasping the protruding portion of the spool and pulling straight away from the bore.

9. If necessary, remove the two swivel connectors from the valve body. Then if equipped, remove the two orfice plates, located behind the swivel connectors by turning them counterclockwise with a screw driver.

10. If necessary, remove the 90° elbows and the sequencing valve pressure sensing tube connectors.

Inspection and Repair

IMPORTANT: *The shut-off and sequencing valve spools are matched to the bores in the valve body. If worn or damaged, install a complete assembly.*

Shut-off Valve; Inspect the spool and the spool bore for wear or damage. If either are worn or damaged, replace the complete sequencing valve assembly.

Regulating Valve: Check the valve plunger, the valve and bushing assembly, both springs and the valve seat for wear or damage. Discard worn or damaged parts.

NOTE: *The valve and bushing are serviced as an assembly. The ball is included as part of the valve.*

Bucket and Lift Sequencing Valves: Inspect both spools, the spool guides and the spool bores in the valve body for damage or wear. If either spool is worn or damaged, install a new sequencing valve assembly.

Check the four detent plungers and three springs. If necessary, install new parts as required.

Tubing and Hoses: Inspect the two hoses, the high and low pressure tubes and both pressure sensing tubes for wear or damage. If necessary, install new parts.

Assembly

Refer to Figure 14 for parts identification.

NOTE: *To prevent damage to the 0-rings and valve components, lightly coat each component with a film of petroleum jelly before assembling.*

1. If removed, install the 90° elbows and the pressure sensing tube connectors.

2. Insert the orfice plates in the valve body and tighten securely. Then install the two swivel connectors.

   IMPORTANT: *The sequencing valve spools are matched to their respective bores. Be sure they are correctly installed.*

3. Install the bucket sequencing valve spool (groove end) in the spool bore.

4. Partially install the lift sequencing valve spool so that it does not cover the inner detent plunger bore. Then insert in the inner detent plunger bore, in the following order; a detent plunger, a spring and another detent plunger. Compress the assembly with a suitable tool to allow positioning of the lift sequencing valve spool.

5. While the inner detent spring is compressed, move the lift sequencing valve spool inward until you feel it bottom on the pressure sensing tube connector.

6. Carefully slide the valve guides over the sequencing valve spools. Thread each guide into the valve body and tighten securely.

7. Install the outer detent plunger, the spring, the shim and secure it with the detent bore cap. Perform the same operation on the opposite side of the valve body.

8. Insert the control valve bushing, the seat and the spring in the hex cap end of the valve body.

9. Insert the shim(s) (if used) in the bore in the hex cap. Then thread the hex cap into the valve body and tighten securely.

10. Turn the valve body on end (opposite end indicated in Step 8) and install the regulator valve plunger, the valve assembly and the valve spring. Secure the assembly with the large slotted cap.

11. Position the shut-off valve spool in the valve body and secure it with the retaining ring. Then install the small slotted cap and tighten it securely.

Installation

1. Secure the sequencing valve assembly to the backhoe control tower with the three attaching bolts.
2. Connect the shut-off valve spool to the foot pedal assembly with the clevis and clevis pin. Secure the clevis pin with a cotter pin.
3. Attach the high and low pressure tubes, Figure 13, to the sequencing valve assembly. Tighten the fittings securely.
4. Connect the two hoses, Figure 15, to the control cylinder at the sequencing valve assembly.
5. Position the inner and outer spring and spring seats so that the lower spring seat is resting on the sequencing valve spool. Then, slightly compress the spring and position it to accept the adjusting screw.
6. Thread the adjusting screws through the top of the backhoe control tower and secure each with a roll pin.
7. Adjust the shut-off valve spool travel as outlined on page of this manual.
8. Install the grille and secure it to the backhoe control tower with the four attaching screws.

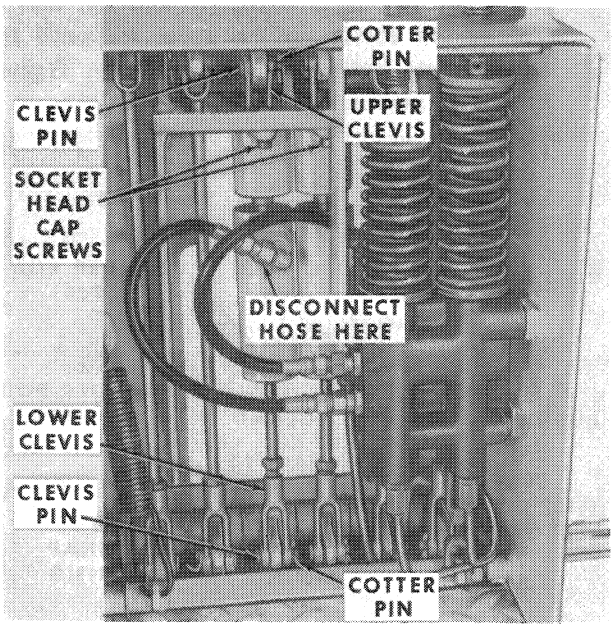

Figure 15
Control Cylinder Removal

CONTROL CYLINDER OVERHAUL

NOTE: *The bucket and lift control cylinders are similar; therefore, only the lift control cylinder will be discussed in those sections covering removal, disassembly, inspection, repair and assembly.*

Removal

1. Disconnect the hose from the control cylinder fitting.
2. Remove the cotter pin from the upper and lower clevis pins, Figure 15. Then remove the clevis pins.
3. Remove the two socket-head screws, lock washers and nuts, Figure 15, securing the control cylinder to the backhoe control tower.
4. The control cylinder is then removed from the backhoe control tower by moving the cylinder downward to allow the top clevis to clear the plate through which it is normally positioned.

Disassembly

1. Remove the plunger cap, the spring seats, the spring, the bushing, and the two flat washers, Figure 16, by removing the upper clevis from the cylinder rod.
2. Using a manual or hydraulic press as shown in Figure 17, compress the internal cylinder spring slightly to relieve the pressure on the lower snap ring. Then, remove the snap ring with a suitable pair of pliers.
3. After removing the cylinder from the press, remove the lower rod and the cylinder spring.

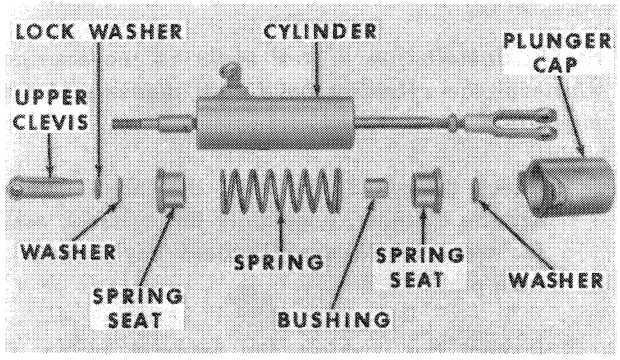

Figure 16
Control Cylinder Components

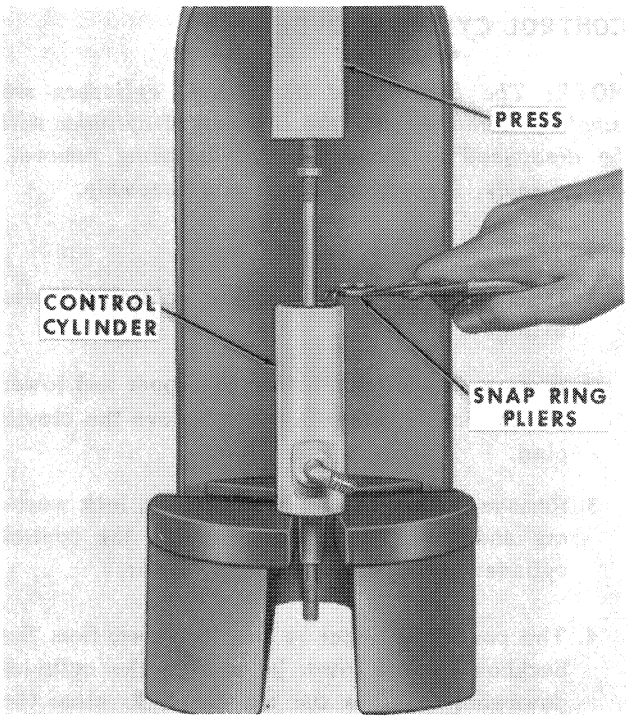

Figure 17
Control Cylinder Disassembly

4. Remove the bushing, Figure 18, from the cylinder rod (upper) by removing the roll pin with a suitable punch and hammer.

   IMPORTANT: *The spacer, Figure 18, located between the cylinder rod bushing and the cylinder is utilized only on the lift cylinder and is the only difference between the lift and bucket cylinders.*

5. The upper rod, the washer and the gland are removed from the cylinder by removing the upper snap-ring with a suitable pair of pliers.

Inspection and Repair

NOTE: *Installation of new seals is recommended whenever the cylinders have been disassembled for inspection.*

1. Check the gland, the rods, the internal spring and the cylinder, especially the cylinder walls, for wear or damage. Discard any damage or worn parts.

2. Inspect the bushing, the external spring, the spring seats, and the plunger cap for wear or damage. Install new parts as necessary.

Assembly

Refer to Figures 16 and 18 for parts identification.

NOTE: *A light film of petroleum jelly applied to the O-ring seals will prevent damage and ease assembly of the cylinder.*

1. Install a new O-ring seal on the upper cylinder rod and gland. Then insert the shaft through the bore in the gland.

2. Apply a small amount of petroleum jelly to the cup seal and position it in the gland.

3. Insert the upper rod and gland assembly into the cylinder.

4. Slide the large flat washer onto the cylinder rod (upper) and secure the components with a snap-ring.

5. Install the internal spring and the lower rod into the cylinder. Then, compress the spring, Figure 17, and secure the assembly with a snap-ring.

6. Install the spacer (lift cylinder only) and position the bushing on the upper rod. Secure the bushing with a roll pin.

7. Position the plunger cap on the upper rod. Then, in the following order, install a flat washer, a spring seat, a bushing, the spring, a spring seat, a flat washer, a lock washer and the clevis. Thread the clevis on the upper rod until the spring seats firmly in the plunger cap. Tighten the clevis securely.

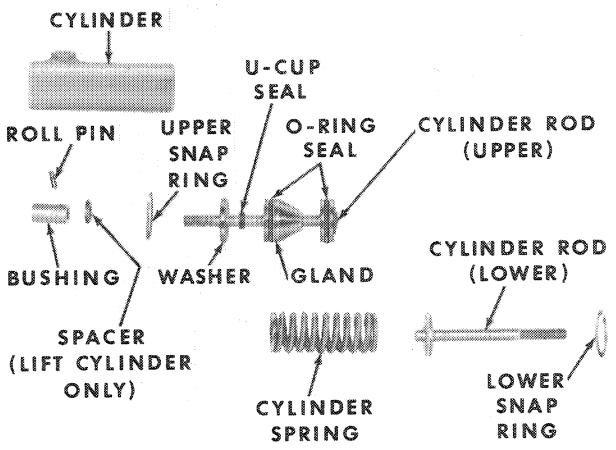

Figure 18
Control Cylinder – Exploded View

Installation

1. Position the control cylinder in the control tower, Figure 15, and secure the two socket head cap screws, washers and nuts.

2. Connect the upper clevis to the lever and the lower clevis to the bellcrank with clevis pins.

3. Adjust the upper clevis to position the control handles evenly. Then, secure the clevis pin with a cotter pin.

4. Adjust the lower clevis as outlined on page 00 of this manual.

ADJUSTMENTS

Shut-off Valve Spool Travel Adjustment: Adjust the clevis connecting the valve spool to the foot pedal rod to allow 7/16 ± 1/32 inch (11.01 ± 0.79 mm) spool travel when the foot pedal is depressed the full distance (against the platform). See Figure 19. The pedal must contact the platform prior to engagement of the internal stop within the valve.

Main Control Valve Spool Adjustment: The lift and bucket spools located in the backhoe main control valve are adjusted by turning the clevis on the lower rod of the control cylinder. After disconnecting the lower rod and clevis from the bellcrank, position the spool so that 9/16 inch (14.2 mm) protrudes beyond the rear of the main control valve body. Then, being careful not to reposition the spool, align the control cylinder lower rod clevis with the bellcrank assembly by turning the clevis clockwise or counterclockwise . To obtain a proper adjustment, the control lever must remain centered during this operation. *Do not* move the control lever to align the clevis with the bellcrank. Tighten the lock nut after completing the spool adjustment.

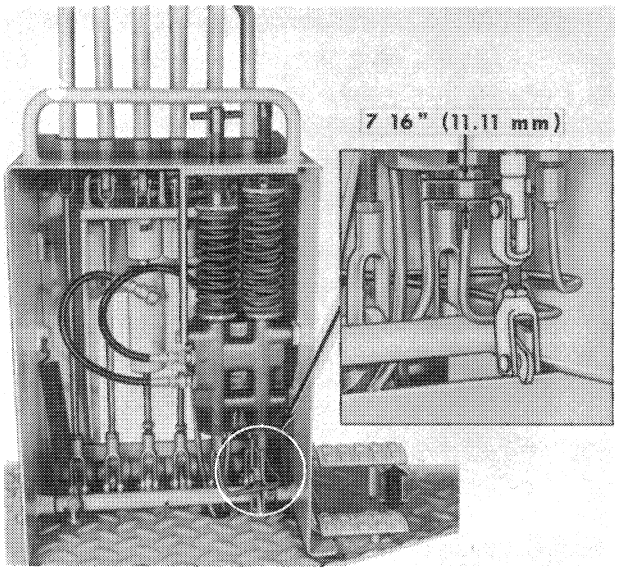

Figure 19
Shut-off Valve Travel

It is possible to make slight corrections to the bucket and lift spools without disconnecting the lower clevis from the bellcrank. This is accomplished by loosening the lock nut; then, grasp the lower rod with pliers and move it clockwise or counterclockwise. Tighten the lock nut after completing the adjustment.

FUNCTIONAL CHECK

- With the tractor engine running, and all boom elements extended, depress the foot pedal and pull the crowd lever. The following sequence of events should take place. When the crowd cylinder reaches the end of its stroke, the automatic function should cause the actuator cylinder to extend. When the actuator cylinder is fully extended, the boom should automatically lift.

- The actuator control handle should require equal displacement (within 1/8") to cause first noticeable movement (i.e. "cracking" of the main control valve) of the actuator cylinder in each direction. Adjust if necessary.

- The lift control handle should require equal displacement (within 1/8") to cause first noticeable boom raising and first discernable application of "down power" (i.e. "cracking" of main control valve cylinder ports). Adjust if necessary.

- With all elements about mid-position and with tractor at wide open throttle, retract one of the stabilizers until system is running at relief valve pressure. The elements should not creep under these conditions. Creeping elements indicate maladjustments in steps 2 and/or 3.

SPECIFICATIONS

Regulating Valve Setting	350 ± 50 psi (24.50 ± 3.50 kg/cm^2)
System Pressure	2200 ± 50 psi (154 ± 3.50 kg/cm^2)
Lift and Bucket Cylinder Link Travel	9/16" (14.28 mm)
Shut-Off Valve Travel	7/16" (11.11 mm)

SPECIAL TOOLS

N-1100-GA	Gauge Kit
N-1100-X	Fitting (male connection 7/16" – 20, 37° x 3/8" – 24, 37°)

CONTENTS

DESCRIPTION AND OPERATION

The backhoe consists of a mainframe, swing post, cylinders, boom, dipstick, hoses and tubing, valves, controls, bucket, and tractor attaching hardware. Refer to Figure 1 for location of the components. Power supply for the backhoe is provided by a hydraulic pump mounted on the tractor.

PUMP

The hydraulic pump is driven by the tractor engine crankshaft. Information covering pump flow and servicing is detailed in Loader Service Manual, SE 9356-A.

MAINFRAME

The mainframe is of welded construction. Internally, it houses the swing cylinders, the main control valve, and the combination flow and cushioning valve. Externally, it supports the control tower and the seat. The swing post and the stabilizers attach to the mainframe by means of pins.

STABILIZERS

Stabilizers are attached to the lower right and left side of the backhoe mainframe to level the unit and maintain rear stability when digging. Each stabilizer is controlled by a cylinder actuated by a control lever at the tower. Cylinder shields protect each cylinder rod and provide access steps to the controls and seat.

Pads, attached to the stabilizer ends, support the backhoe and tractor and provide stability during digging operations. A variety of pads are available for various ground requirements.

In transport, the boom is supported by chains attached to the end of each stabilizer to prevent the boom and stabilizers from lowering as a result of cylinder leakdown.

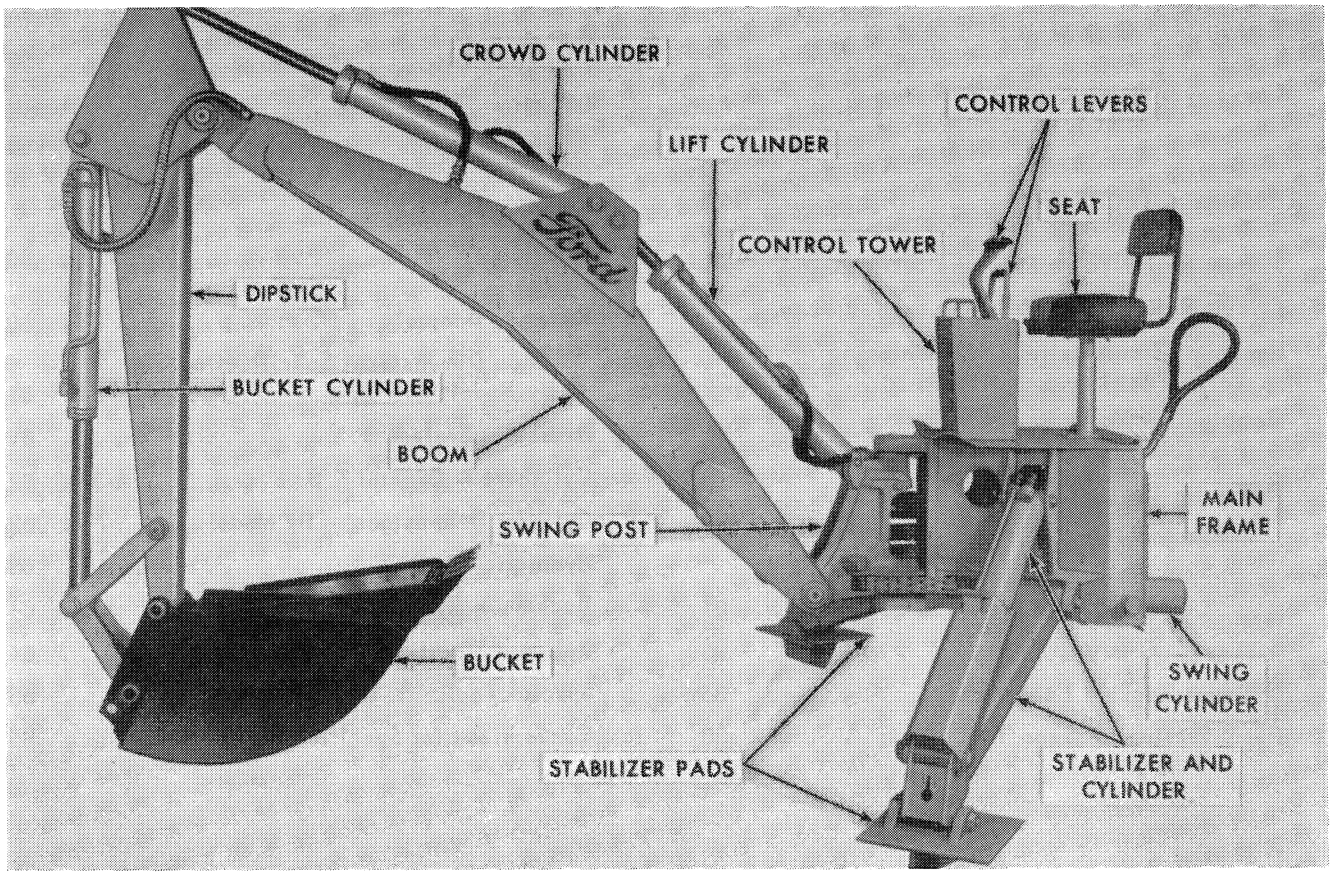

Figure 1
Backhoe Components

DESCRIPTION AND OPERATION

SWING POST, SWING CHAIN, AND LINKAGE

The swing post is a one-piece casting incorporating replaceable bushings at the boom and lift cylinder pivots. Replaceable bushings are also used in the mainframe attachment points of the swing post.

The swing post is actuated by the swing cylinders through chain linkage. The chain is attached to the ends of the swing cylinder rods and is pinned to the swing post.

BOOM AND DIPSTICK

Both the boom and dipstick frames are of reinforced welded tapered box construction. The boom houses tubing for the crowd and bucket cylinders and supports the lift and crowd cylinders. The dipstick supports the rod end of the crowd cylinder and the bucket cylinder. Both the boom and dipstick utilize replaceable bushings at the pivot pin locations. The lift and crowd boom pivots do not have bushings.

BUCKETS

Buckets are of welded construction with replaceable bushings in the pivot pin locations. Repositioning the bucket linkage permits straight wall digging, additional bucket curl or power as desired. Bucket teeth and cutting edges are replaceable.

HOSES AND TUBING

Hose and tube routing for each backhoe is similar. Tubes contained in the boom supply oil to the crowd and bucket cylinders.

CYLINDERS

All cylinders are double acting with the exception of the swing cylinders and are honed for concentricity and finish. The piston rods are high-tensile, die-drawn steel, turned, ground, polished and chrome-plated.

Cylinder piston packing and rod packings are the chevron-type supported by phenolic or glass-filled nylon top and bottom bearing rings. The packing gland, which supports and retains the rod packing, also incorporates a rod wiper and packing nut.

Bushings and lube fittings are located at the trunnion or rod end of the cylinder and at the pivot or anchor end.

Swing cylinders are single acting and contain the same components as described for the double-acting cylinder. The swing cylinders are mounted in, and attached to, the mainframe.

Figure 2 illustrates a cross section view of the cylinder types. The swing cylinders employ a connecting hose at the piston end of the barrel. This permits air to flow from one cylinder to the other during operation, thus avoiding the possibility of a partial vacuum occuring at the piston end of the extending cylinder. It also prevents the entry of dirt and moisture which could cause damage to the internal surfaces of the cylinders.

The chevron packing incorporated in the glands for the swing, crowd, lift, and bucket cylinders contain a low pressure seal, Figure 2. This low pressure seal functions to seal the piston rod under low pressure conditions, as when the cylinder is standing idle.

The piston and gland packings are positioned so the lips of the chevrons face toward the pressured oil under cylinder power loading conditions. As the cylinder pressure increases, the lips of the chevrons are forced outward to the inner wall of the cylinder barrel and toward the rod surface. This action provides for a more positive seal against oil transferring from the high pressure side to the low pressure side of the packing. The double-acting packings on the piston of the lift, crowd, and bucket cylinders face in opposite directions so as to face high pressure in either direction of piston travel. This is essential as these cylinders exert force in both directions of travel.

MAIN CONTROL VALVE

The main control valve is a monoblock type assembly containing six spring-centered, manually-operated control plungers (spools) which direct pump oil to the individual cylinder circuits. Each circuit contains a spring-loaded check valve to check the flow from both ends of the plunger. An adjustable 2200 psi system relief valve is incorporated to relieve excessive system pressure. Adjustable circuit relief valves, in the lift, crowd and bucket cylinder circuits, function to protect the cylinders against pressure overloading during acutal digging operations. The valve body has twelve cylinder ports, a power-beyond port for loader operation, and an inlet and outlet port. Fixed orifice, flow restrictor valves are used at the lift cylinder and crowd cylinder to prevent cylinder cavitation (or voiding) during the cylinder power stroke.

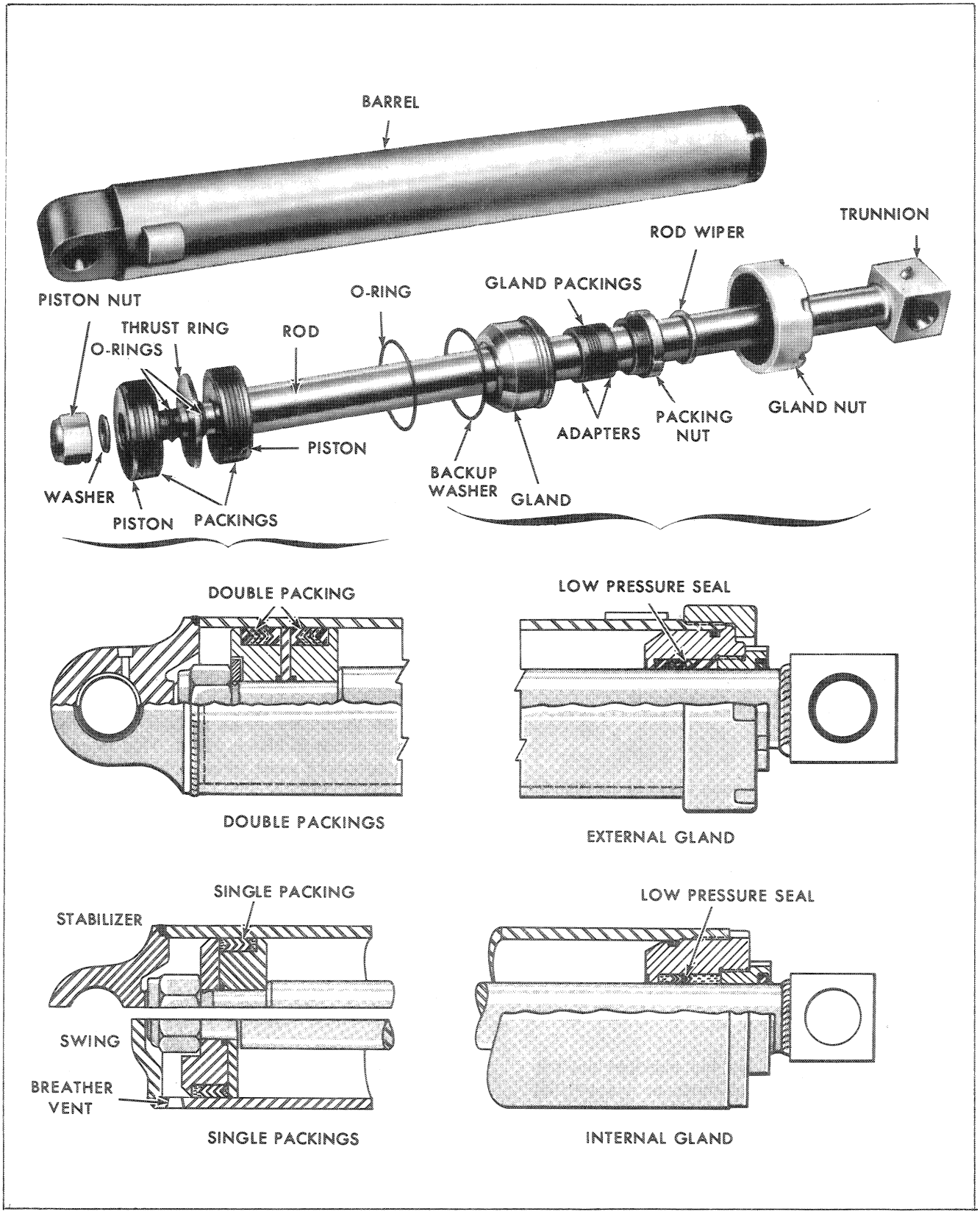

Figure 2
Cylinder Types

The power-beyond port supplies oil to the loader valve, when a loader is installed on the tractor. All pumped oil is supplied to the backhoe main control valve before it reaches the loader. This eliminates the necessity of using a selector valve.

If a loader circuit is not in the system, the power-beyond feature must be removed. This will require removal of the power-beyond plug, Figure 3, to permit free flow of the oil to sump. This plug is threaded internally and directs oil to the power-beyond port under pressure instead of permitting oil to go directly to sump. Access for removal of this plug is through the outlet port.

Neutral Flow: Figure 4 represents a cutaway view of the main control valve illustrating:

- Plunger arrangement
- System relief valve
- Internal circuit relief valves
- Oil pressure passage
- Return passage

Pumped oil enters the valve at the inlet pressure port and is directed through the center passages (A and B) passing by each spool in a zigzag course and flows to sump. If a power-beyond plug is installed, the oil is diverted to provide high pressure oil for the loader. As pressure in the center passages (A and B) exceeds 2200 psi, the system relief valve functions to direct oil through the low pressure passage (I) where it flows to the reservoir. Any oil that is in the cylinders is trapped due to the neutral position of the control valve spool; therefore, there is no cylinder movement.

Spool Operation: If a control valve spool is moved from its neutral position, pump oil is blocked from following the zigzag course through the main control valve to the valve outlet. Figure 5 shows a control valve spool moved from neutral to block oil and direct it to a cylinder. With the spool moved, the oil is directed to the high pressure passage (C), unseating the check valve. The oil then flows through passage (E), by the spool, to hose port (G) and out to the cylinder. Because the cylinder piston offers resistance to oil flow, the oil pressure increases until a force sufficient to move the piston is developed by the pressure buildup. As the piston moves in the cylinder, displaced oil (in the case of double-acting cylinders) is forced from the opposite end of the cylinder. This oil enters the main control valve at hose port (F) and flows into the return passage (H) to the valve outlet and on to sump. If the control valve spool is moved to the opposite position, a reversal of the oil flow takes place. The check valve closes as soon as oil flow stops.

Cylinder Circuit Check Valve (Poppet): The spring-loaded check valve located in each circuit, Figure 5, prevents the cylinders from dropping under load. The check valve functions when the spool is initially shifted from its neutral position and before the pump has time to build sufficient pressure to overcome the external load.

Controlled Feathering Action: The spool of the main control valve is designed to provide controlled oil flow to the cylinders. Each land edge has four small notches, Figure 6. As the spool is moved, the notches meter a small amount of oil, slowly pressurizing the system before the main land opens and allows full flow. Easing the spool through its first stage of movement provides the pinpoint movement needed for accurate control.

System Relief Valves: The system relief valves, Figure 7, in the main control valve serve to protect the backhoe hydraulic components from damage by preventing excessive internal pressures in the system when the valve spools are activated. When a spool is actuated and the cylinder reaches the end of its stroke, or is physically prevented from moving, the system relief valve opens and directs pump oil to the low pressure return passage of the control valve. The system relief valve is located between the high pressure inlet port and the low pressure return passage of the control valve. See Figure 4.

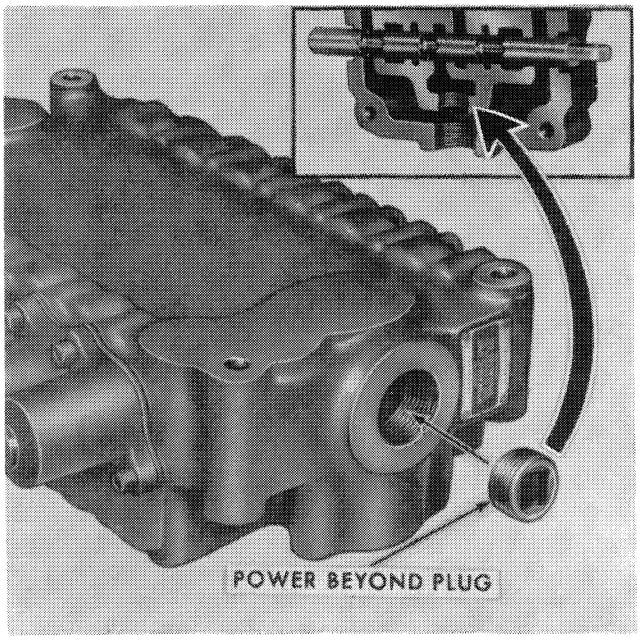

Figure 3
Power Beyond Plug

As the pressure in the inlet port begins to equal the system pressure the oil pressure begins to overcome the force of the light-rate spring on the poppet seat causing the seat to move toward the poppet. As the seat moves toward the poppet, the guide moves also so that when the seat makes contact with the poppet, the guide is barely covering the relief port. A slight increase in system pressure at this point, will begin to overcome the force of the heavy rate spring on the poppet and begin to move the poppet, seat, and guide, thus slightly opening the relief port and permitting high pressure oil to begin passing to the low pressure return passage. Any further increase in pressure will cause the poppet, seat, and guide to move further, thus increasing the size of the relief port and allowing a greater quantity of high pressure oil to pass over to the low pressure return passage of the valve.

Oil continues to pass through the system relief valve until the obstruction is overcome or the control handle is returned to neutral.

Circuit Relief Valves: Circuit relief valves, view "C", Figure 7, are used in the lift, crowd, and bracket circuits. These circuits are subjected to externally-caused high pressures during normal backhoe operation. Relief valves are used at both ends of the lift circuit, the piston end of the crowd circuit, and the rod end of the bucket circuit. The circuit relief valves limit the pressure which is allowed to build in these circuits during backhoe operation. The valves are positioned between the cylinder port and the return passage in the control valve. High pressure cylinder oil enters the relief valve through the end of the hollow piston. This oil acts against the pilot valve and the inner side of the poppet. When

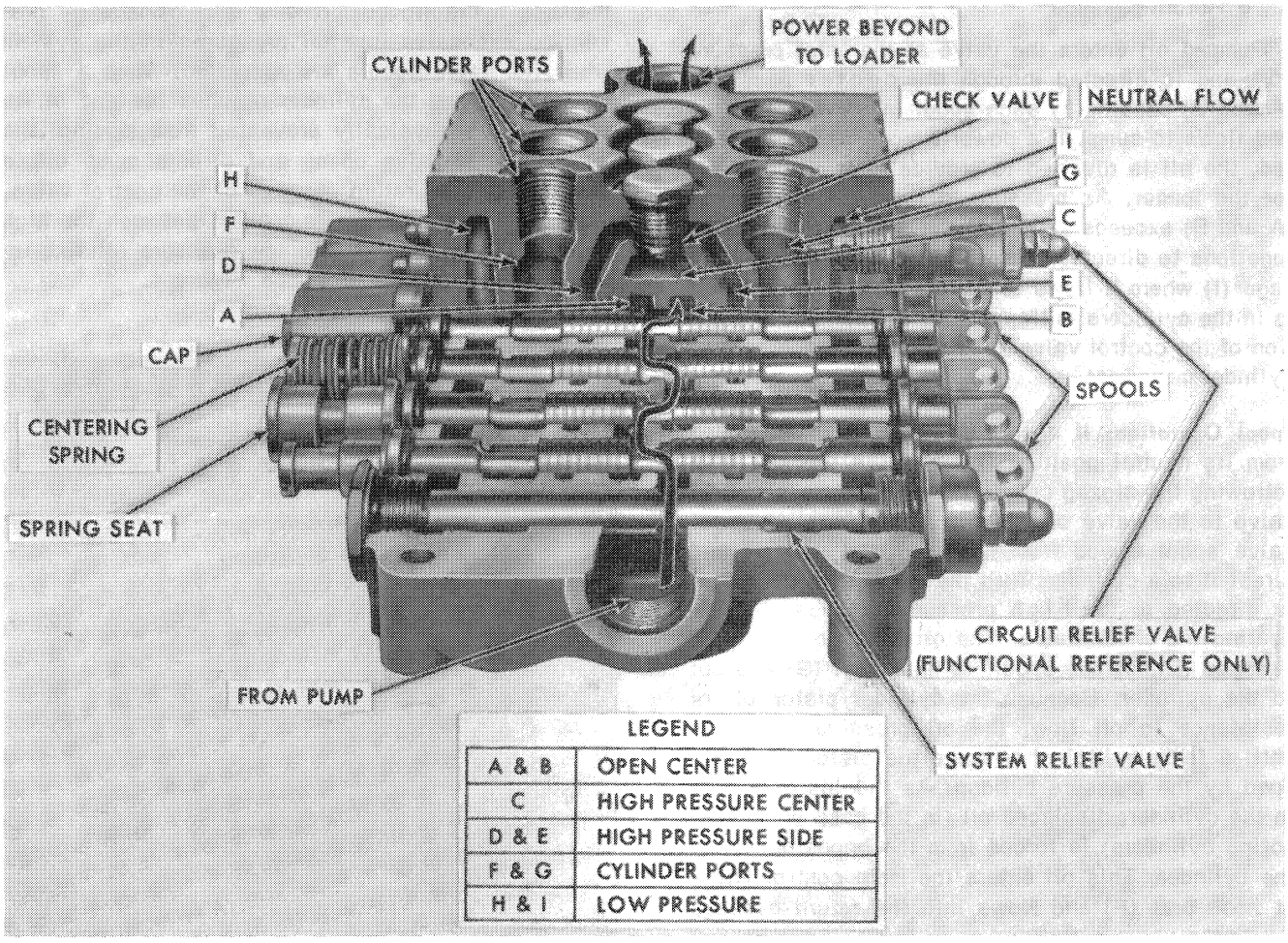

Figure 4
Main Control Valve Oil Flow

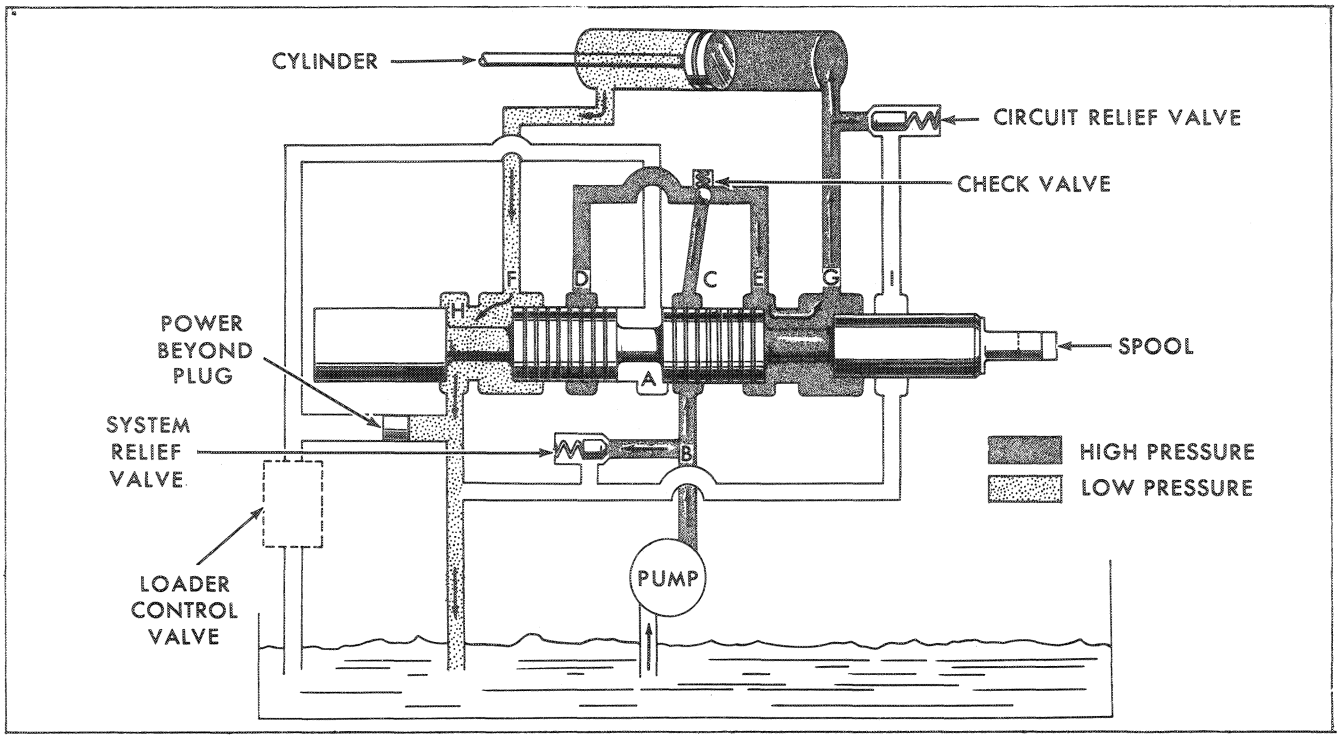

Figure 5
Oil Flow to a Cylinder

the pressure at the cylinder port exceeds the force exerted by the pilot poppet spring, the pilot poppet is unseated, view "C", and oil flows around the outside of the sleeve and to the low pressure return passage (sump).

Oil flowing from behind the poppet, due to the opening of the pilot valve, lowers the pressure in that area, and allows the piston to move back and seat against the pilot valve. This shuts off the oil flow to the area behind the poppet so that the pressure in that area remains low. The higher cylinder port pressure forces the circuit relief valve poppet off its seat, relieving the high pressure oil directly to sump.

The circuit relief valve assemblies are adjusted at the factory to the following pressures which are stamped on the metal band around the circuit relief valve body:

- Bucket
  Rod End (Dump) . . . . . 2350 ± 100 psi (165 ± 7 kg/cm)

- Lift
  Rod End (Raise) . . . . . 3500 ± 100 psi (245 ± 7 kg/cm)
  Piston End (Lower) . . . . . 3500 ± 100 psi (245 ± 7 kg/cm)

- Crowd
  Piston End (Crowd In) . . . . . 4000 ± 100 psi (280 ± 7 kg/cm)

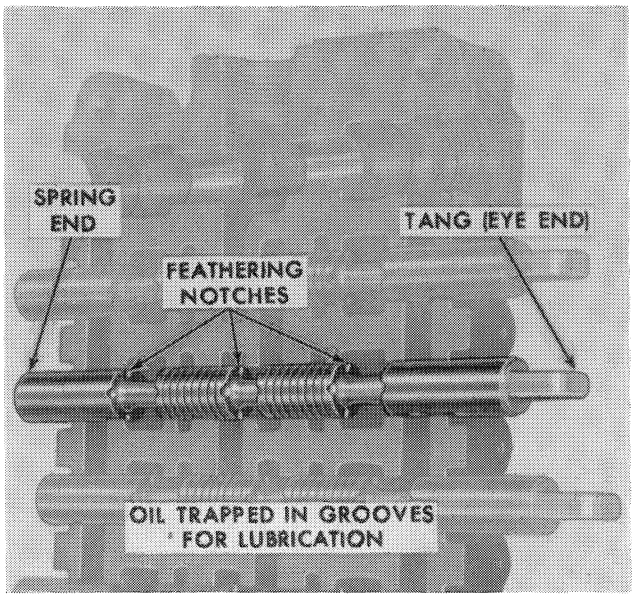

Figure 6
Controlled Feathering

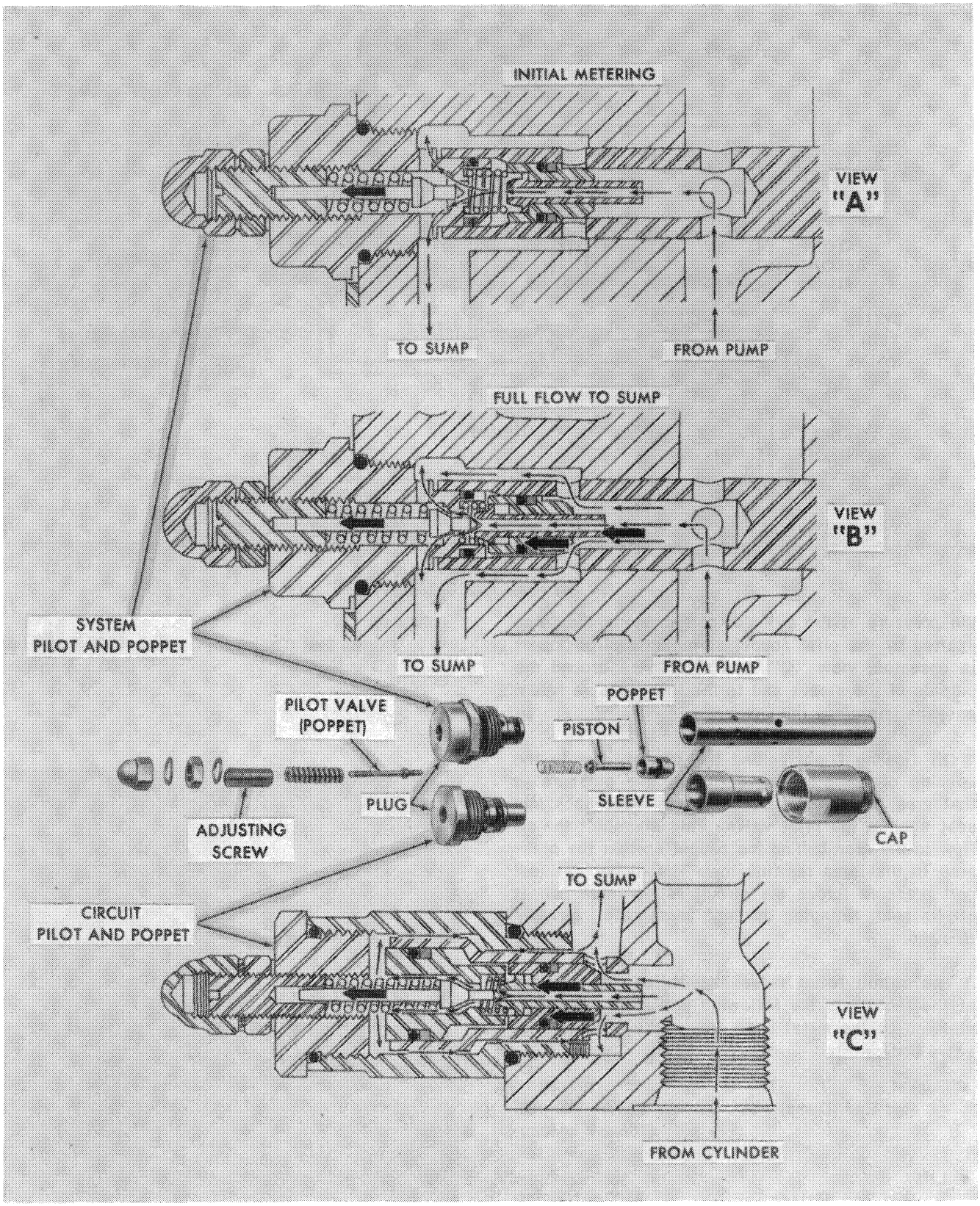

Figure 7
System and Circuit Relief Valves

Crowd and Lift Circuit Flow Restrictor Valves: The flow restrictor valve, Figure 8, contains a loose-fitting sleeve which is free to move axially in the valve bore. The sleeve either blocks off or uncovers five holes drilled radially at the closed end of the valve. Sleeve movement is dependent on the direction of oil flow through the valve and provides either a restricted or free flow condition during cylinder activation. Figure 8 illustrates a general schematic of oil flow during cylinder activation.

When oil from port (A) of the main control valve moves the cylinder in the direction shown, oil that is displaced from the cylinder by way of line (C) enters the flow restrictor valve and moves the sleeve to close off the five radially-drilled holes in the valve. Oil being exhausted through line (C) can flow only through the sleeve and the small adjoining orifice at the valve end, discharged oil from the cylinder rod end is restricted in its flow. The restricted flow retards the action of the rod and piston when the cylinder is externally loaded. This prevents a possible void in the cylinder, and provides for smooth operation, by allowing the pump to fill the piston end as rapidly as oil is being exhausted from the rod end.

When pumped oil is directed to the rod end of the crowd cylinder through port (B) of the main control valve, the pumped oil forces the sleeve in the flow restrictor valve to move so that the five radially-drilled holes are uncovered. This action provides for a full pump flow volume through the flow restrictor valve which is directed to the rod end of the cylinder through line (C). In this case, there is no restriction of oil flow.

The lift circuit flow restrictor is located at port (D). The oil flows in the same manner described above for the crowd circuit.

The body of the restrictor is coded with the size of the orifice in sixty-fourths of an inch. The size of the orifice in the restrictor for each backhoe is as follows:

	Code	*Size*
750 Lift	3	3/64
750 Crowd	9	9/64
753 Lift	9	9/64
753 Crowd	11	11/64
755 Lift	10	10/64
755 Crowd	11	11/64

COMBINATION VALVE

The combination valve, Figure 9, is positioned between the main control valve and the swing cylinders. The valve functions as a flow control, a cushioning, and a pressure relief valve.

- The flow control valve operates to maintain pressure at the swing cylinders to prevent cylinder voiding which would result in swing chain slack.
- The cushioning valves operate to eliminate sudden and violent stops during boom movement.

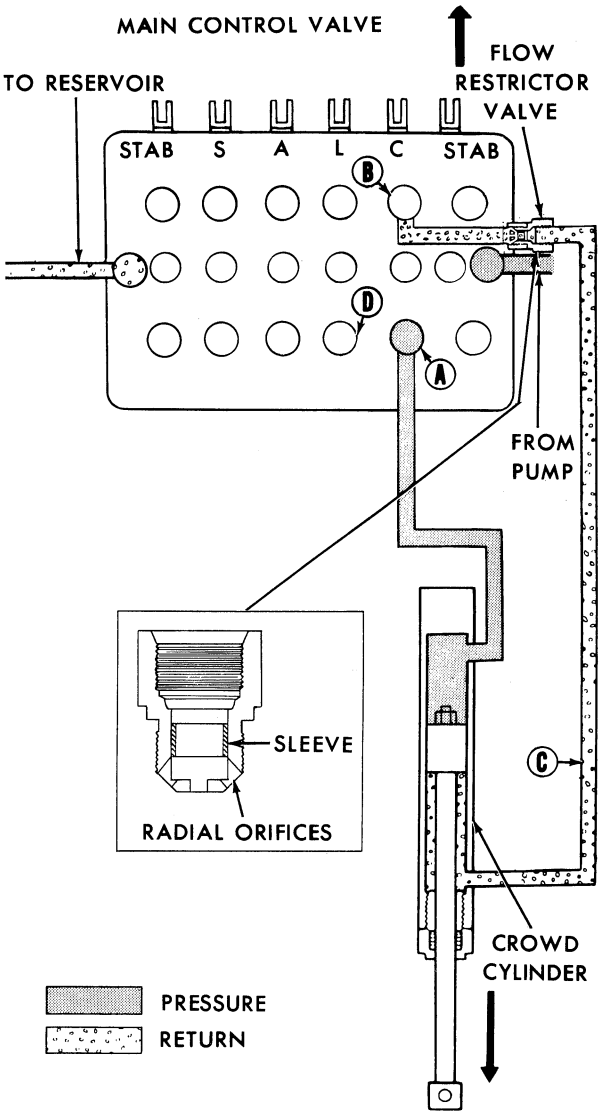

Figure 8
Flow Restrictor Valve

- The cushioning valve also acts as a relief valve to prevent excessive pressure buildup in the swing circuit.

The combination valve is joined to the main control valve by hoses at ports (A) and (F). Oil to or from the swing cylinders enters or leaves the valve through hoses at ports (C) and (D).

The combination valve is divided into two segments:

- The flow control spool assembly consists of two check valves (poppets) and two plunger centering compression springs.

- The cushioning and relief valve consists of two direct operating relief valves bearing against a common sliding seat.

Flow Control Action: Pumped oil from the main control valve is directed to port (A), Figure 10, when the control handle is actuated. Oil flows through the spool at (B) and unseats the poppet (H) and allows oil to flow through to an internal valve cavity; hence, to port (C), and to the right swing cylinder. Because of the mechanical linkage of the cylinders, oil in the opposing cylinder is forced out of the cylinder and to port (D) through the valve to the spool.

The position of the spool at initial cylinder loading is such that oil cannot return through the spool to port (F), Figure 11. The oil at (E), being unable to return to sump builds pressure back to port (A). As pressure builds to approximately 75 psi, oil at (G), Figure 10, forces the spool to slide down the bore and open port (E), as shown, allowing oil to return to port (F) and to the control valve.

The flow control spool prevents oil flow from returning to sump when the pressure is less than 75 psi. This oil being pumped to the opposite swing cylinder is thus of sufficient volume to keep up with the exhausted oil flow from the other swing cylinder. Exhausted oil cannot flow until sufficient oil and pressure is available to equal the rate of flow of exhausted oil. This pressure maintains chain tension and positive swing action.

Cushioning Valve Action: The cushioning valve, Figure 11, operates independently of the flow control valve, previously discussed, and functions when the oil flow to or from the swing cylinders has been cut off at the main control valve. Figure 11 represents a continuation of the right swing cylinder flow pattern shown in Figure 10 and is described as follows:

When the main control valve swing lever is returned to neutral, pressure in passage (A), Figure 11, of the flow control valve drops, and the spool at (B) returns

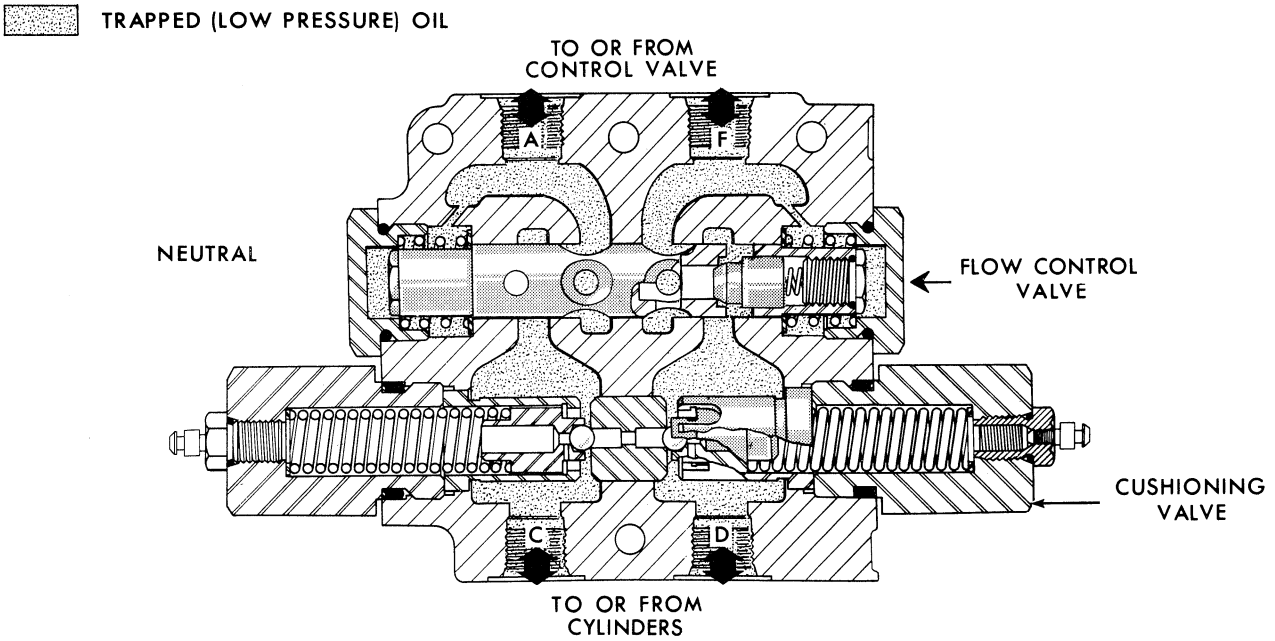

Figure 9
Combination Valve – Neutral

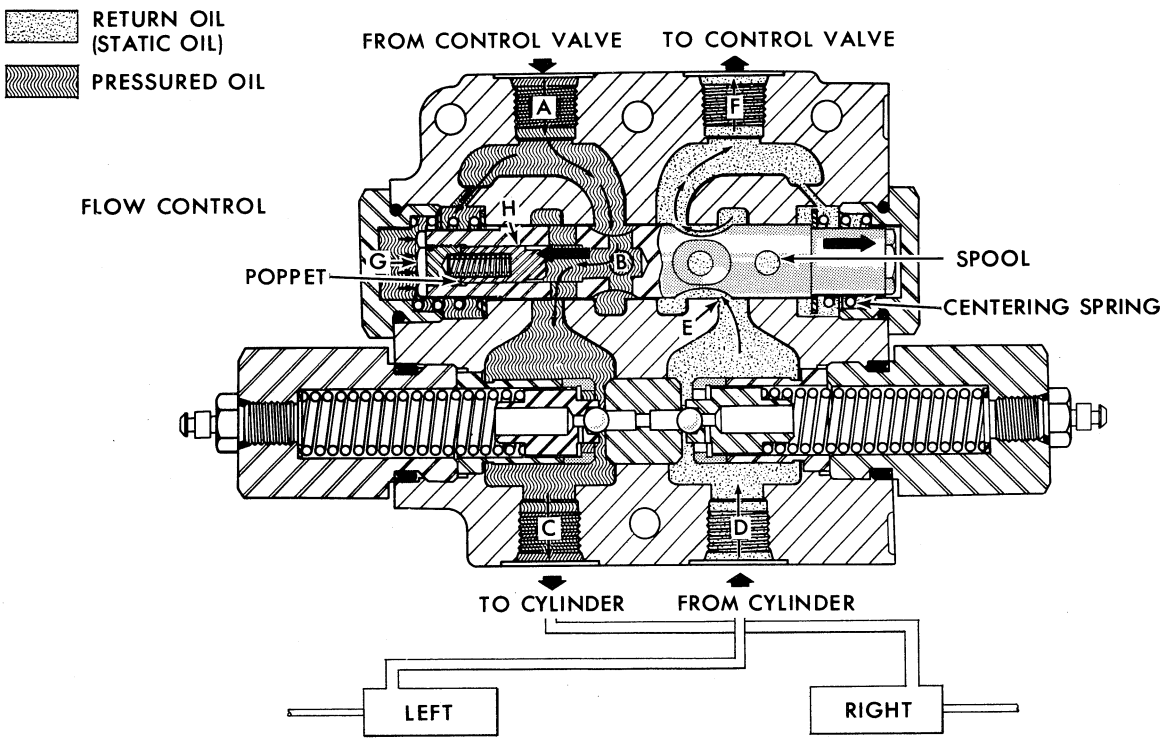

Figure 10
Combination Valve – Flow Control

to neutral as shown, due to spring loading. In this situation, oil cannot flow past the spool, as the spool blocks passages (J) and (E) at the flow control valve. Due to inertia, the left swing cylinder rod continues to extend, causing displaced oil to flow into the return passage (D) of the cushioning valve. The oil flow is stopped by the spool, resulting in a pressure buildup condition occuring in passage (E), and in the left swing cylinder. In effect, the oil displaced from the left swing cylinder is now static oil under pressure, reacting against the face of the sliding seat (I). When the pressure increases, the sliding seat is moved approximately 1/8-inch toward the low pressure side until it contacts the valve sleeve in the low pressure passage (J). This separates the sleeve from the valve at the seat on the high pressure side, as the check valve (poppet) will only move 1/16-inch. High pressure oil is thus forced to flow through the centrally-drilled passage (K) in the sliding seat, moving the opposite check valve (poppet), that is acting as a relief valve, off its seat and allowing high pressure oil to flow to the right swing cylinder. This transfer of oil from the left swing cylinder to the right swing cylinder subsides when the momentum of the left swing cylinder has been cushioned to a gradual stop by the relief valve action in the cushioning valve. At this moment, the spring-loaded check valve (poppet) reseats, as pressure in passages (C) and (D) equalize.

The same action, just described for the cushioning of the right swing action, occurs for cushioning during left swing action. In this case, oil being-discharged from the right swing cylinder becomes pressurized and ultimately flows into the left swing cylinder.

Pressure Relief Action: If the pump flow being directed to the right swing cylinder, as shown in Figure 12, becomes excessive due to cylinder overloading, this pressure reacts against the sliding seat in the same manner as detailed under "Cushioning Action". It should be noted that in this situation the oil does not flow to the opposite cylinder, but returns to sump through the control valve.

OIL FLOW

The two schematics, Figures 13 and 14, are shown as viewed from the backhoe operator's seat. This reference is maintained for servicing and operating the backhoe.

Figure 13 represents the circuit as oil is drawn from the loader frame for those units not having a

common reservoir with the tractor (Series 730 and Series 735 Loaders). Oil is drawn from the loader frame sump through the loader filter by the hydraulic pump and directed to the backhoe control valve. As long as the backhoe control plungers are in neutral the oil circulates freely through the power-beyond port to the loader control valve. If the loader control valve plungers are in neutral, the oil circulates freely through the loader valve to sump.

In this situation, there is continuous flow of oil with little or no pressure buildup. This oil does not reach the backhoe cylinders because the cylinder circuit passages in the backhoe main control valve are blocked by the neutral positions of the six control plungers. Oil that is in the cylinders is trapped because all cylinder lines leading to or from the main control valve are blocked by the neutral plunger positioning.

Figure 14 represents the oil flow of the Series 740 Loader with the backhoe. This flow differs from the previous one in that:

- The hydraulic reservoir is included as a part of the tractor hydraulic power package.
- A screen filter located at the intake line protects the pump from foreign objects.
- The micronic filter is located on the return side of the loader control valve and the oil is filtered prior to its entering the tractor reservoir.

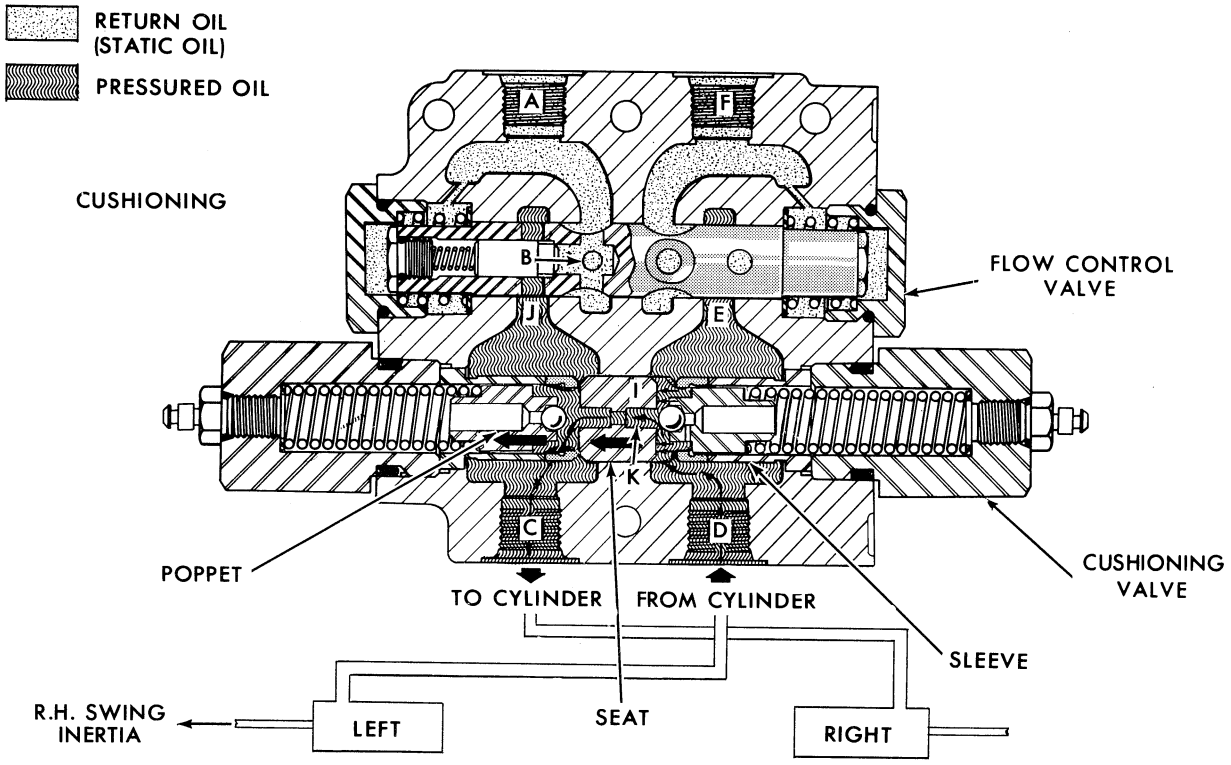

Figure 11
Combination Valve – Cushioning

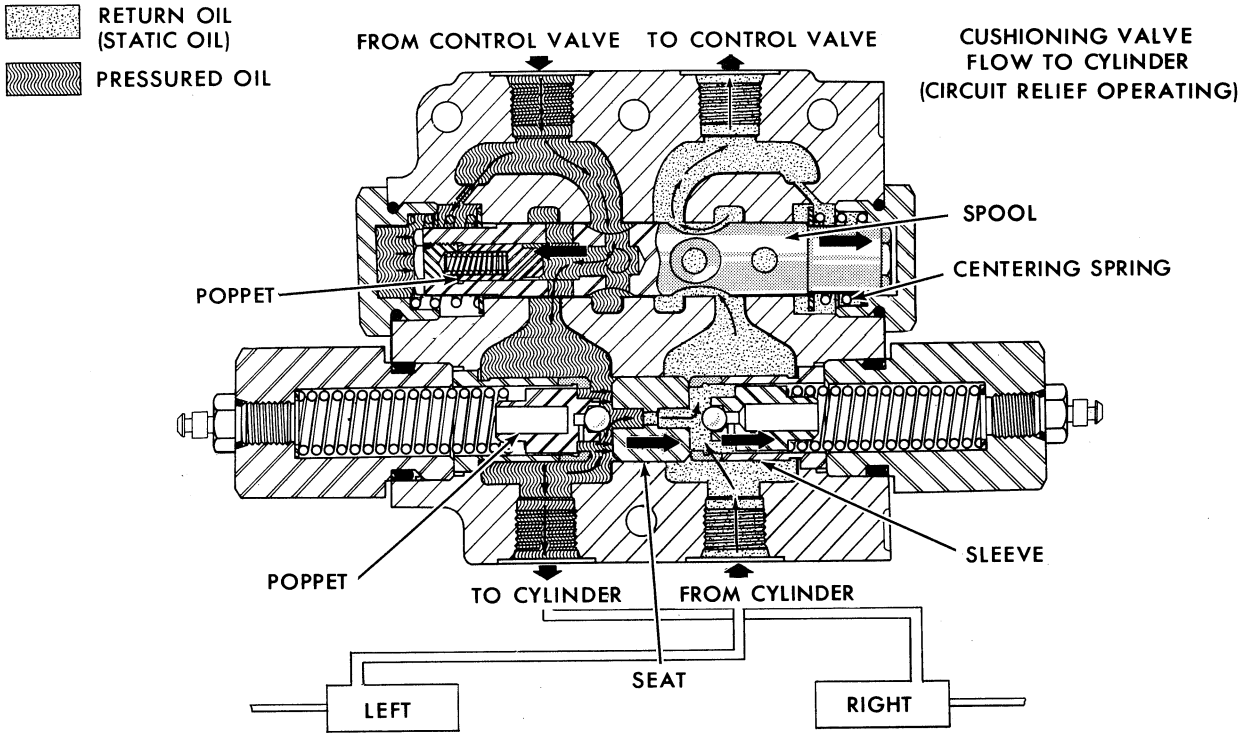

Figure 12
Combination Valve – Pressure Relief

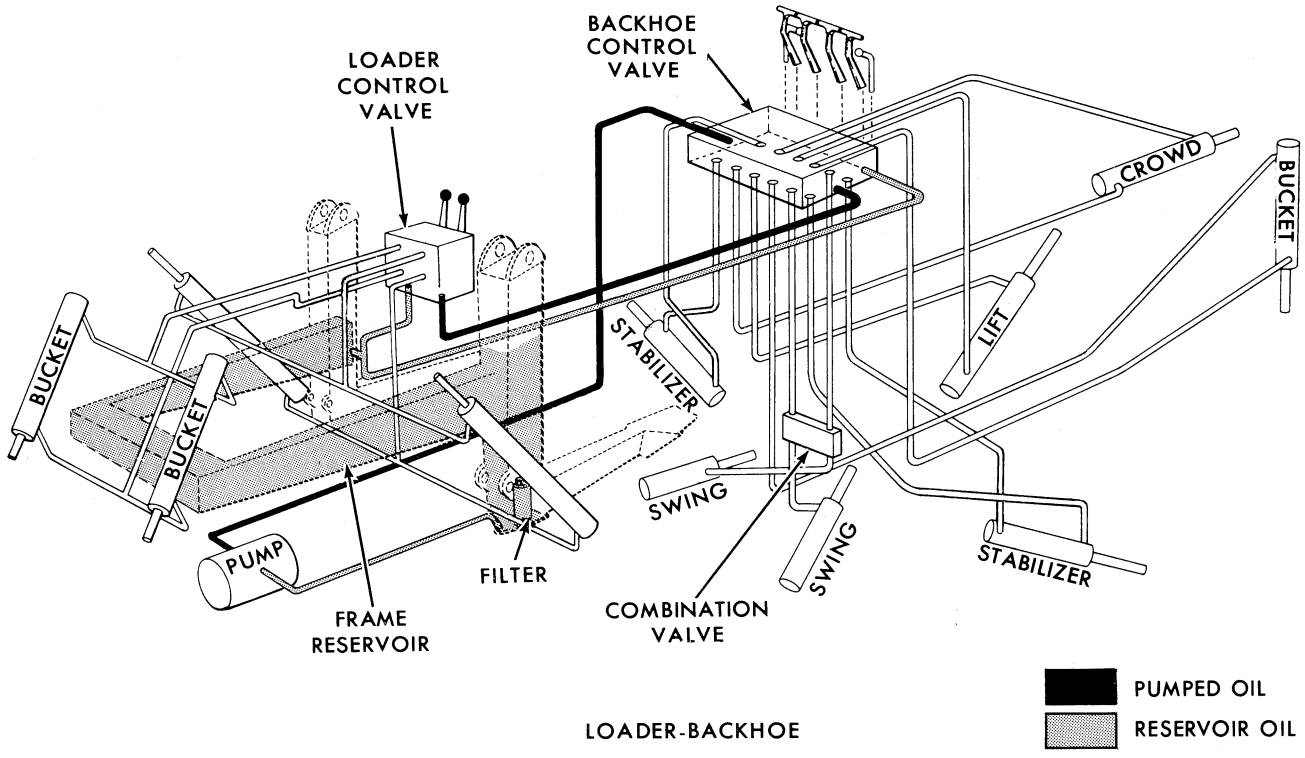

Figure 13
730 and 735 Oil Flow – Neutral

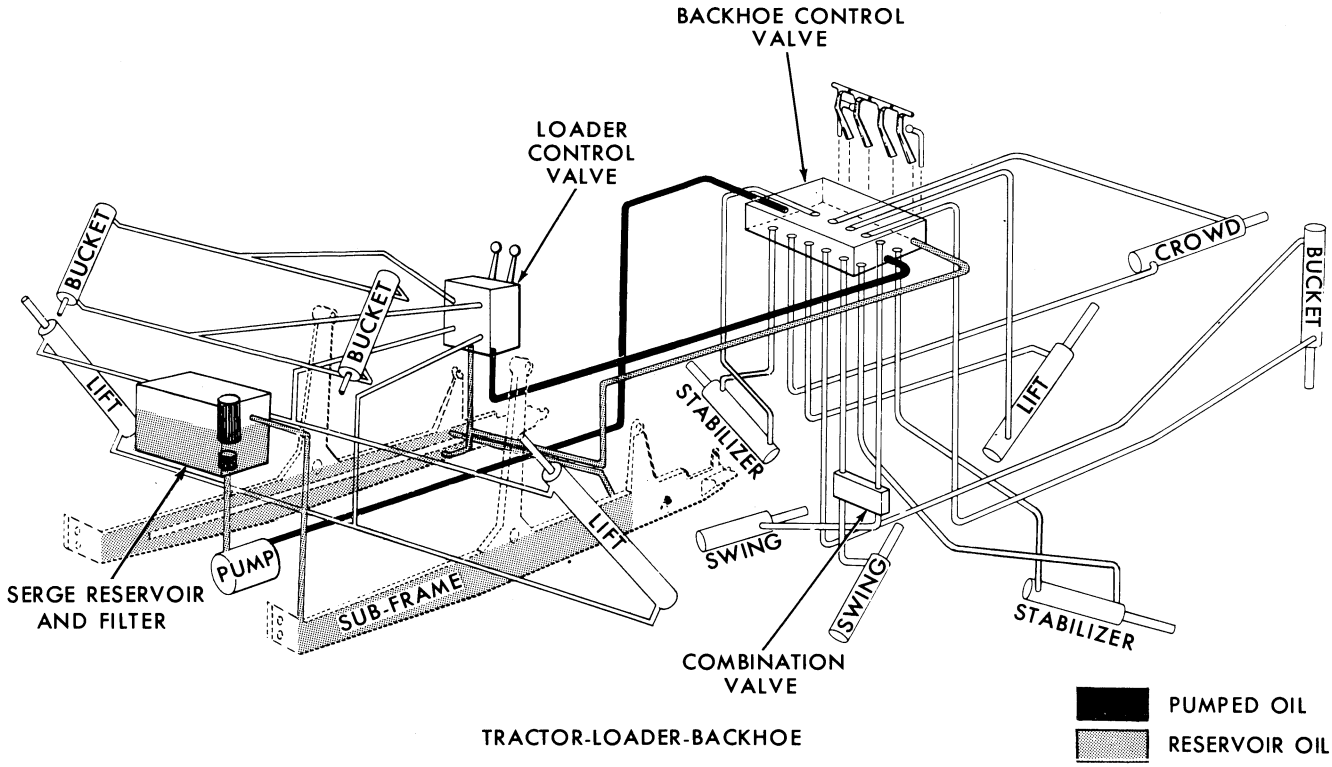

Figure 14
740 Oil Flow – Neutral

TROUBLE SHOOTING

Essentially, trouble shooting involves locating a failure point. This failure can be mechanical or hydraulic, and many factors can contribute to the cause of the failure. Isolation of the particular cause or causes involves a systematic approach, to determine which components are functioning properly.

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 backhoe installation.
- Check oil level.
- Check for external oil leaks.
- Check for external mechanical damage such as burst or kinked hoses, tubes, damaged cylinders, bent or binding structural members.
- Perform the system relief valve pressure check and adjust, if necessary, as covered on page 21. If pressures cannot be adjusted to specification, refer to Step 1 below.

Having performed the preliminary checks and failing to locate the cause of malfunctioning, the following procedures should be used.

1. If possible, operate the backhoe. Make note of the operating characteristics and failure. Cycle each control lever to operate each of the cylinders in both the extended and retracted position.

2. Compare the operating characteristics observed in Step 1 with the problems covered in Table I to determine areas of failure.

For example, operating the backhoe indicates that "the lift cylinder fails to operate". In Problem III, "Lift or Crowd Fails to Operate" is selected as corresponding to the observed problem.