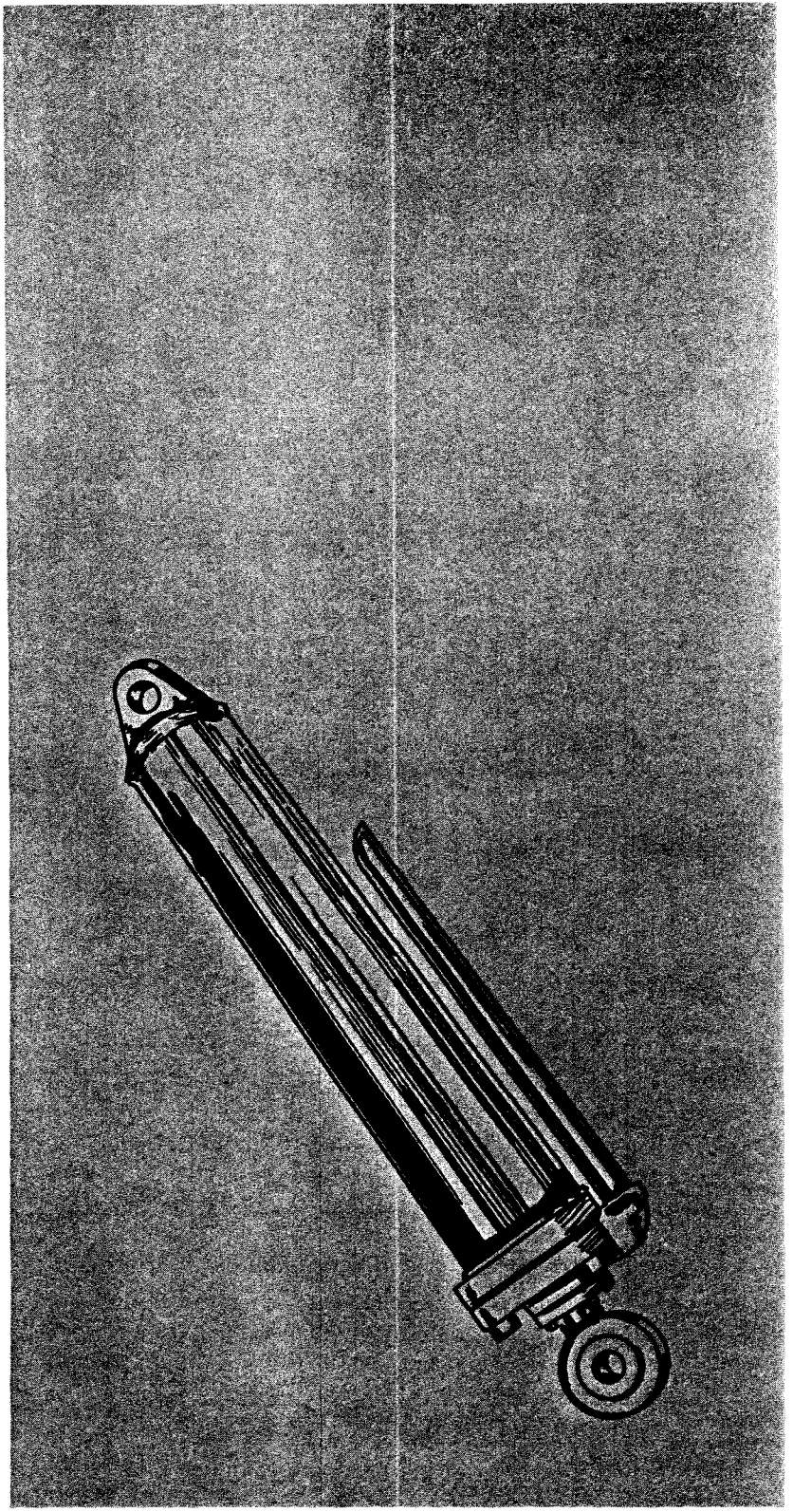


SERVICE MANUAL

950 LOADER HYDRAULIC SYSTEM

INTRODUCTION

This publication has instructions and procedures for the subject on the front cover. The information, specifications, and illustrations in this publication are on the basis of information that was current at the time this issue was written.

Correct operation, maintenance, test and repair procedures will give this product a long service life. Before starting a test, repair or rebuild job, the serviceman must read the respective sections of the Service Manual, and know all the components he will work on.

Your safety, and the safety of others, is at all times very important. When you see this symbol  in the manual, you must know that caution is needed for the procedure next to it. This symbol is a warning. To work safely, you must understand the job you do. Read all instructions to know what is safe and what is not safe.

It is very important to know the weight of parts. Do not lift heavy parts by hand. Use a hoist. Make sure heavy parts have a good stability on the ground. A sudden fall can cause an accident. When lifting part of a machine, make sure the machine has blocks at front and rear. Never let the machine hang on a hoist, put blocks or stands under the weight.

When using a hoist, follow the recommendation in the manual. Use correct lift tools as shown in illustrations to get the correct balance of the component you lift. This makes your work safe at all times.

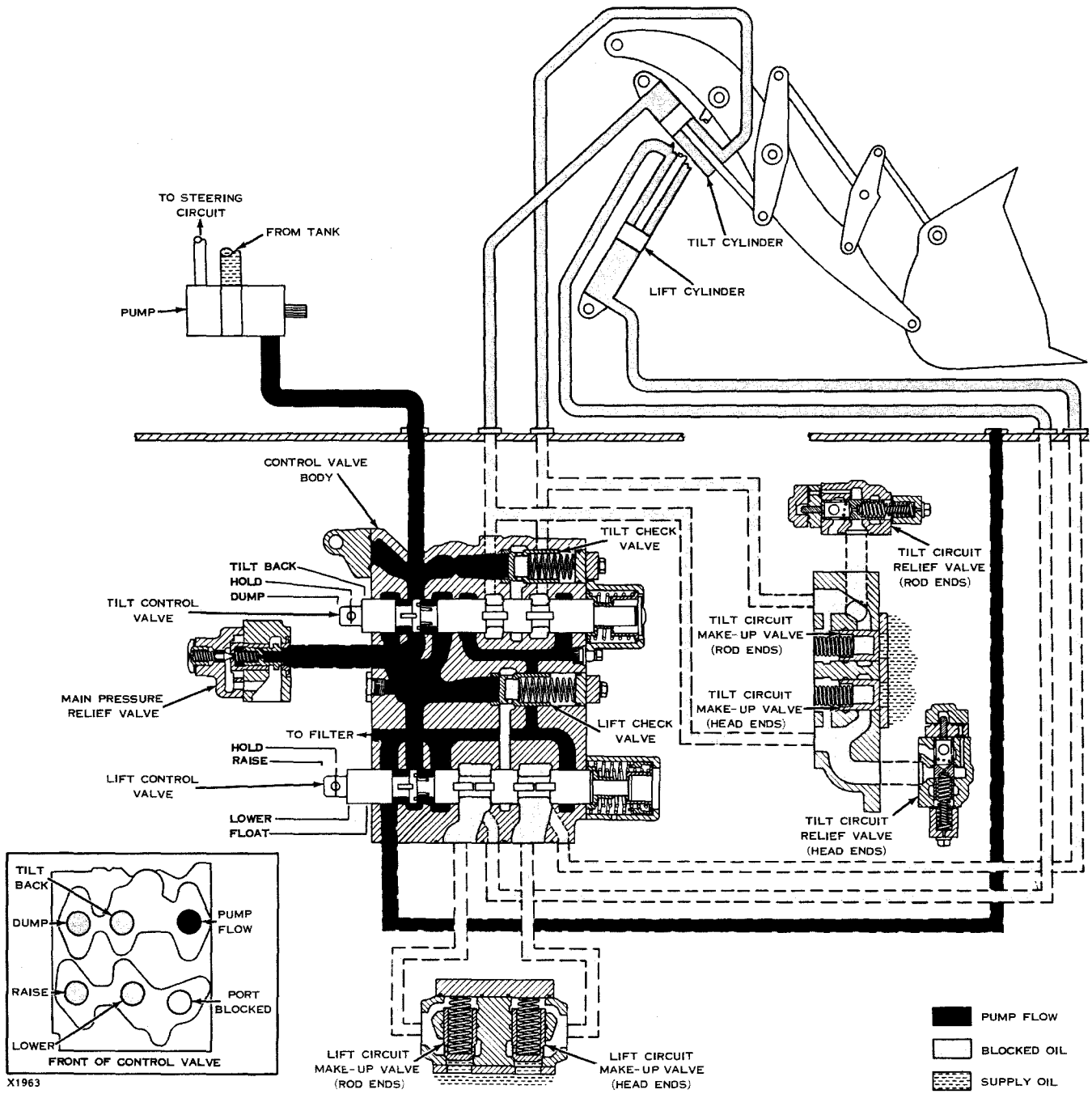
SYSTEMS OPERATION

TESTING AND ADJUSTING

SPECIFICATIONS

NOTE: For illustrated Specifications, make reference to LOADER HYDRAULIC SYSTEM SPECIFICATIONS FOR 950 WHEEL LOADER, Form No. REG01266. If the Specifications given in Form REG01266 are not the same as given in the Systems Operation and the Testing and Adjusting, look at the printing date on the back cover of each book. Use the Specifications given in the book with the latest date.

LOADER HYDRAULIC SYSTEM



SCHEMATIC OF HYDRAULIC SYSTEM IN HOLD POSITION

TILT AND LIFT CONTROL VALVE

The tilt and lift circuits are arranged in a modified series. Pressure oil is available to the lift circuit only when the tilt valve is in HOLD position.

The modified series arrangement allows the operator to control the raising and tilting of the bucket by placing the lift control lever in RAISE (locked) position and operating the tilt lever only.

Hold

With both control valves in HOLD position, all cylinder ports are blocked. Oil from the pump flows past the valves through the control valve body to the oil filter. Oil is filtered and returns to the tank. If the filter element becomes blocked or the oil is extremely viscous due to cold weather, a bypass valve in the filter allows the oil to bypass the element.

Tilt Back

When the tilt control lever is moved to TILT BACK position, the tilt valve moves into the valve body. Pump flow is directed to and opens the tilt check valve. The oil is directed to the head ends of the tilt cylinders, extending the rods and tilting the bucket. Oil in the rod ends of the tilt cylinders returns through the control valve and filter to the tank.

Dump

When the tilt control lever is moved to the DUMP position, the tilt valve moves outward, and pressure oil is directed to the rod ends of the tilt cylinders. Rods retract into the cylinders, and bucket dumps. Oil from the head ends of the tilt cylinders returns through the valve body, filter, and to the tank.

Raise

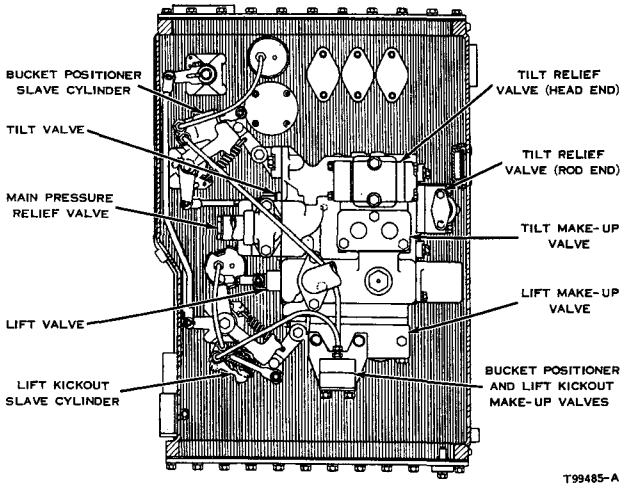
When the lift control lever is moved to RAISE position, lift valve is moved out of the valve body. Pressure oil is directed through the lift check valve to the head ends of the lift cylinders, raising the lift arm and bucket. Oil in the rod ends of the lift cylinders flows through the control valve and filter to the tank.

Lower

When the lift valve is moved to LOWER position, the oil flow is directed to the rod ends of the lift cylinders, retracting the rod. Oil from the head ends of the lift cylinders returns through the control valve and filter to the tank.

Float

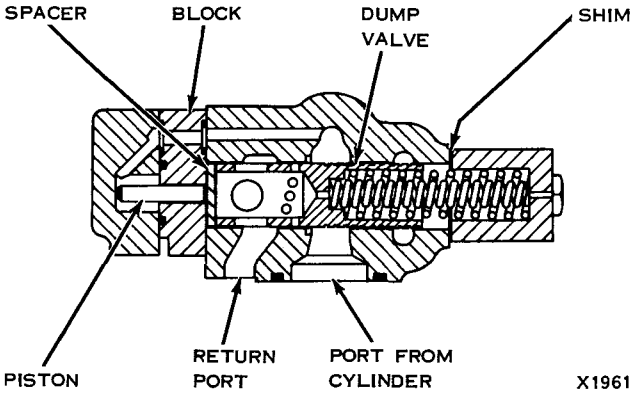
When the lift valve is in FLOAT position and the tilt valve is in HOLD position, oil from the pump flows past the tilt valve, but is restricted from flowing to the filter by the position of the lift valve. The rod and head ends of the lift cylinders are open to filter port and to each other; therefore, the pump flow can open the lift check valve and furnish oil to either rod or head end of the cylinders. This arrangement equalizes the pressure in both ends of the lift cylinders and allows the pistons to operate in either direction, depending upon the external forces on the bucket. As the pistons move, all excess oil flows to the filter and any make-up oil is supplied by the pump.



COMPONENT LOCATION

TILT CIRCUIT RELIEF VALVES

The two tilt circuit relief valves limit the external pressure imposed on either rod or head ends of the tilt cylinders when the tilt valve spool is in HOLD position. Both relief valves operate in the same manner. The rod end relief valve operation is explained.



TILT CIRCUIT RELIEF VALVE

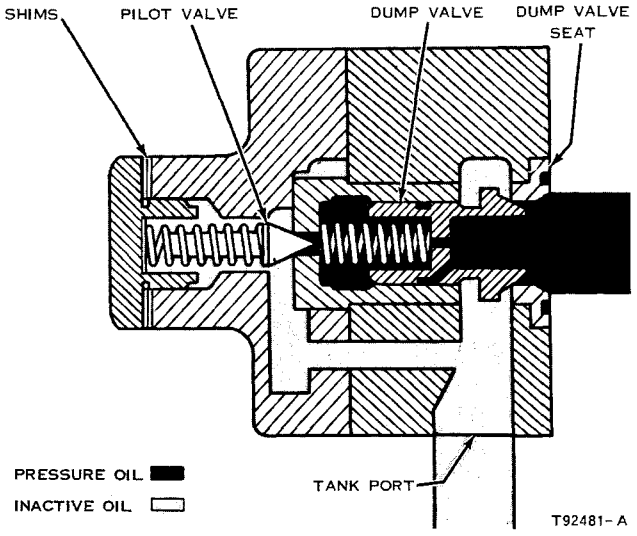
The dump valve and spacer are held against the block by springs. The pressure in the rod ends of the tilt cylinders is sensed in the piston chamber and on the piston. When the pressure of the oil in the piston chamber exceeds the tilt circuit relief valve setting, the piston and spacer are forced against the dump valve. The dump valve springs compress and the cylinder port is opened to the dump port. Oil from the rod ends of the tilt cylinders flows through the valve orifices and joins the supply oil in the tank. This allows the tilt cylinder pistons to be moved by external forces, preventing damage to the machine components. The orifices are patterned to allow a gradual pressure reduction.

Shims are provided to control the force of the springs on the dump valve. Adding or removing shims adjusts the tilt circuit relief valve setting.

MAIN PRESSURE RELIEF VALVE

The main pressure relief valve limits the pressure imposed on the hydraulic pump and the loader hydraulic circuit when a control valve is in an operating position.

The dump valve and the pilot valve are held seated by springs. Pump flow pressure is sensed in the dump valve chambers and at the pilot valve.



MAIN PRESSURE RELIEF VALVE

When the pump flow pressure exceeds the main pressure relief valve setting, the pressure unseats the pilot valve, and oil flows through the orifice and joins the supply oil in the tank. As the pressure behind the dump valve lowers, the pressure in front of the dump valve forces the dump valve to compress the dump valve spring, allowing full pump flow through the valve to the tank.

Shims are provided to control the force of the spring on the pilot valve. Adding or removing the shims adjusts the main pressure relief valve setting.

MAKE-UP VALVES

Make-up valves are held seated by springs and the pressure of the oil in their corresponding cylinder ends. If the pressure of the oil in any of the hydraulic circuits drops below tank oil pressure, the pressure of the oil in the tank opens the corresponding make-up valve allowing supply oil in the tank to enter the lines and cylinders. When the pressure in the line is approximately equal to the tank oil pressure, a spring reseats the make-up valve.

The make-up valves open to supplement pump flow in the event the cylinders are returning oil to the tank faster than the pump can supply oil to the cylinders. This prevents a void of oil and results in faster cylinder movement.

A tilt circuit make-up valve will open when either of the tilt relief valves are opened by excessive pressure and the tilt control valve is in HOLD position.

CHECK VALVES

The lift and tilt check valves prevent reverse oil flow and resulting cylinder drift. When a control valve is placed in an operating position, the check valve remains seated until the pressure of pump flow is sufficient to overcome the combined force of the check valve return spring and the pressure of the oil in the selected cylinder ends.

BUCKET POSITIONER HYDRAULIC CIRCUIT

The bucket positioner hydraulic circuit operates in conjunction with the tilt circuit. The bucket positioner circuit consists of a master cylinder (mounted on the tilt cylinder on the right side of the machine), and a slave cylinder (mounted inside the hydraulic tank). The bucket positioner automatically returns the tilt valve from TILT BACK (locked) position to HOLD position when the bucket reaches a preset digging angle.

When the tilt valve is in HOLD position and the master cylinder is in a non-actuated position, the oil pressure in all components of the bucket positioner circuit is approximately the same as tank pressure.

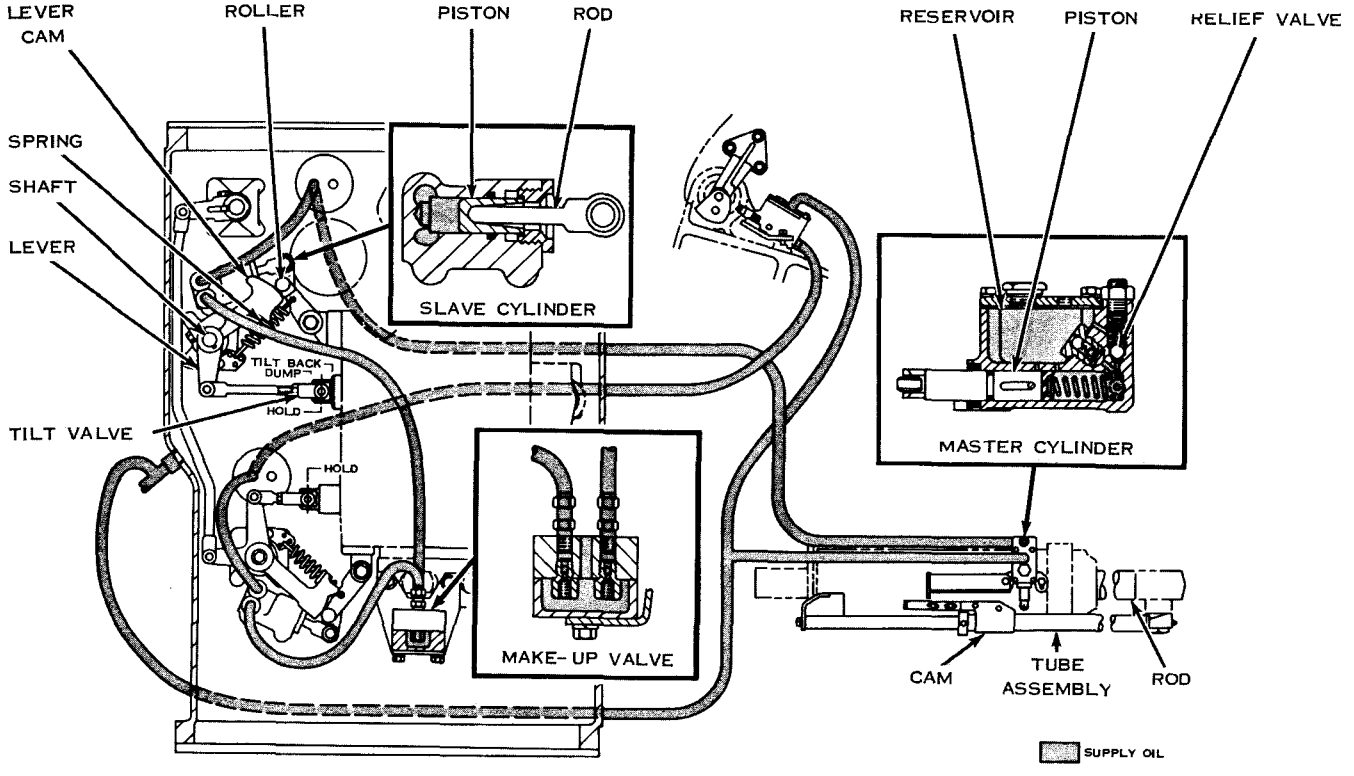
When the operator moves the tilt control lever to TILT BACK position, the tilt valve is moved into the control valve housing by the rotation of a shaft and lever. The rotation of the lever causes the lever cam surface to slide along a roller until a spring pulls the roller and lever downward, locking tilt valve and tilt control lever in TILT BACK position. [The tilt control lever can be returned from TILT BACK (locked) position by the operator.]

The roller action also moves the slave cylinder rod and piston into the slave cylinder housing. The piston displaces the oil in the slave cylinder chamber. This displaced oil flows through lines into the master cylinder chamber, through orifices, and into master cylinder reservoir.

When the tilt valve is in TILT BACK position, oil is directed to the head ends of the tilt cylinders, and the tilt cylinder rods are extended. As the right rod extends, a tube assembly and cam move forward. This cam contacts a roller on the master cylinder piston, forcing the piston into the master cylinder, blocking the orifices. As the piston moves further into the housing, oil pressure in master cylinder chamber and in slave cylinder housing increases. Increased pressure in slave cylinder chamber forces slave cylinder piston and rod outward, moving the lever and roller up, unlocking the tilt control lever. A centering spring returns the tilt control valve and lever to HOLD POSITION, positioning the digging angle of the bucket. The tube assembly cam can be adjusted to increase or decrease the bucket digging angle.

When the operator moves the tilt control lever to DUMP position, the shaft and lever move the tilt valve outward. (The tilt control lever is held in DUMP position by the operator, but will return to HOLD position when released.) Pressure oil is directed to the rod ends of the tilt cylinders, retracting the cylinder rods and moving the tube assembly and cam back. As the cam moves back, the master cylinder piston is moved outward by its spring.

If the oil pressure in either slave or master cylinder chambers drops below tank oil pressure, make-up valves (mounted to the lift circuit make-up valves) open to equalize pressures.



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SCHEMATIC OF BUCKET POSITIONER CIRCUIT

LIFT KICKOUT HYDRAULIC CIRCUIT

The lift kickout circuit consists of the master cylinder (mounted on the top of the loader frame) and slave cylinder (mounted inside the hydraulic tank). The lift kickout circuit automatically returns the lift valve from RAISE position to HOLD position just before the lift cylinders reach their maximum strokes.

When the lift valve is in HOLD position and the master cylinder is in a non-actuated position, the oil in all components of the lift kickout circuit is approximately the same pressure as the supply oil in the hydraulic oil supply tank.

When the operator moves the lift control lever to RAISE position, the lift valve is moved outward. At the same time, the lever cam surface slides along roller until a spring pulls lever and roller up. This locks lift valve and lift control lever in RAISE position. [The lift control lever can be returned from RAISE (locked) position to HOLD position by the operator.]

The roller action moves the slave cylinder rod and piston into the slave cylinder. The piston displaces the oil in the slave cylinder chamber, causing oil to flow to master cylinder chamber, through orifices and into master cylinder reservoir.

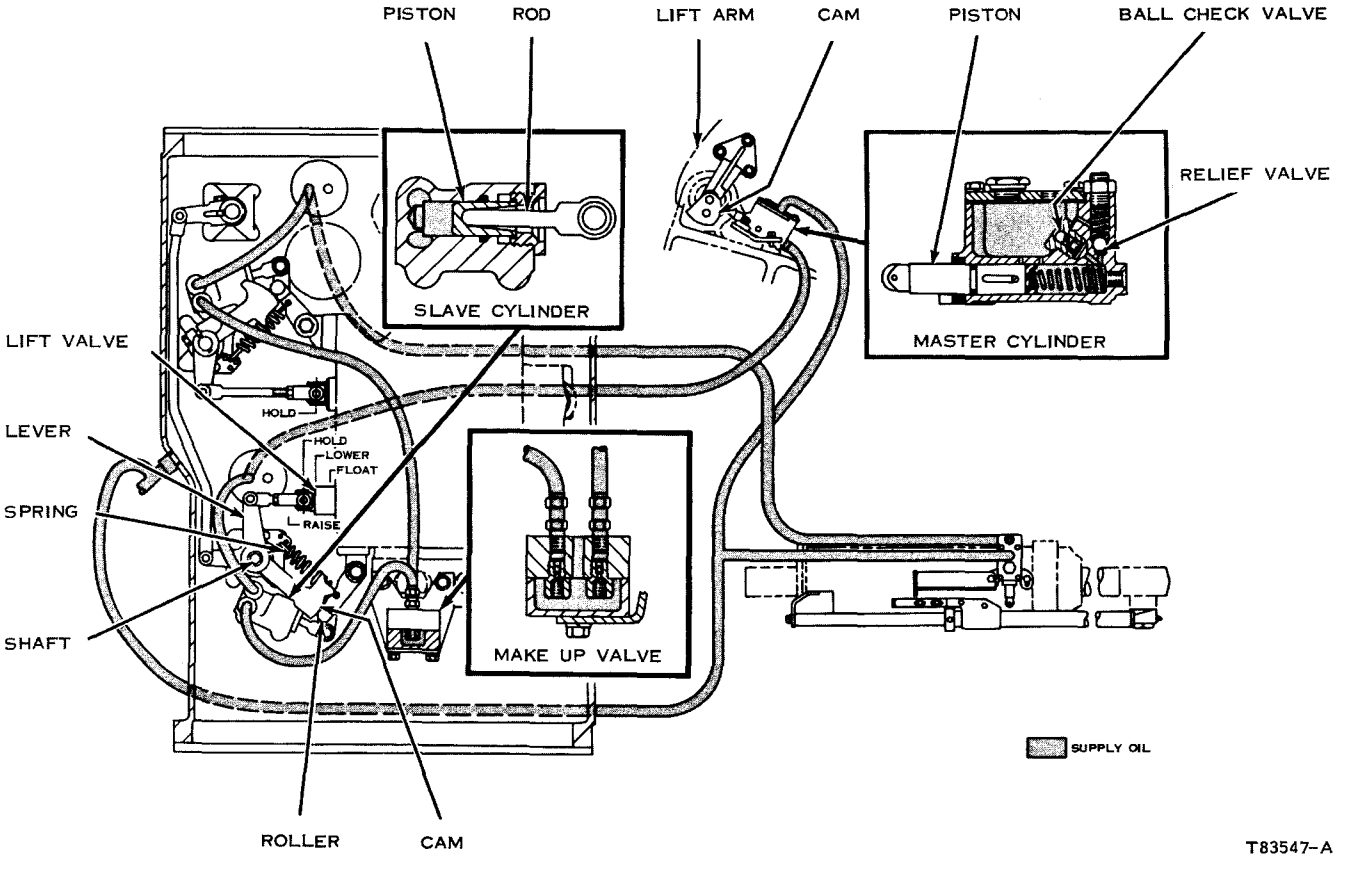
When lift valve is in RAISE position, oil is directed to the head ends of the lift cylinders and raises the lift arm. As the lift arm moves, a cam contacts the roller on master cylinder piston, forcing piston into housing. This moves a cup, blocking orifices. As the piston moves further into the housing, oil pressure in master cylinder and slave cylinder chambers increases, forcing the slave cylinder piston and rod outward. The rod moves roller and lever down, unlocking the lift valve and the lift control lever. The centering springs return the lift valve and the lift control lever to HOLD position, thereby preventing the lift cylinder pistons from bottoming in the cylinders.

A lift kickout relief valve in the master cylinder protects the lift kickout circuit components.

When the operator moves the lift control lever to LOWER position, the lift valve moves into the housing. (The lift control lever has to be held in LOWER position by the operator, but will return to HOLD position when released.) Pressure oil is directed to the rod ends of the lift cylinders, lowering the lift arm and moving the cam away from the roller on the master cylinder piston. As the cam moves away from the roller, piston is forced outward by its spring.

If the pressure of the oil in the master and slave cylinder chambers drops lower than tank oil pressure, the tank pressure unseats the lift kickout make-up valve and ball check valve in the master cylinder. Supply oil flows from tank to master cylinder reservoir, through passage into the master cylinder and slave cylinder chambers and equalizes oil pressures in the lift kickout circuit and the tank.

NOTE: A detent in the slave cylinder roller cam will lock the lift valve in FLOAT position. The operator returns the valve to HOLD position.



SCHEMATIC OF LIFT KICKOUT CIRCUIT

LOADER HYDRAULIC SYSTEM

When analyzing the hydraulic system, remember that proper oil flow and correct oil pressure are necessary for proper operation. Oil flow is dependent on the pump output which is a function of engine speed. Oil pressure is a result of restriction to the oil flow.

In all instances, visual checks and measurements should be made first. Then proceed to operational checks and finally to instrumentation checks.

Use the 5S5123 Hydraulic Testing Group, a stop watch, a magnet and an inch (mm) scale for basic test to measure:

1. Opening pressure of the main pressure relief valve and the tilt circuit relief valves. Low relief valve pressure reduces the lifting and digging capabilities of the machine. Too high opening pressures can reduce hose and component life.

2. Lift and tilt circuit drift rates. Circuit drift results from leakage past cylinder piston seals, control valve O-ring seals, poorly seated check or make-up valves and/or excessive spool to valve bore clearances.

3. Lift and tilt circuit cycle times. Excessive circuit cycle times results from leakage, pump wear and/or pump speed.

If basic testing reveals internal circuit leakage, install a 9S2000 Flow Meter and follow the FLOW METER TEE TEST PROCEDURE—II to isolate the probable leakage source.

To adjust components located in the tank, it is necessary to drain the tank and remove the tank side cover.

The analysis of a malfunction will be easier and the conclusion more certain if the following loader hydraulic system fundamentals are remembered.

The tilt circuit and lift circuit are arranged in a series circuit. (In bucket dump, pressure oil is not available to the lift circuit.) The hydraulic pump and main pressure relief valve are common to both the lift and tilt circuits. Each circuit has a check valve to prevent cylinder drift during valve spool movement. Each circuit also has make-up valves to supplement pump flow.

Relief valves in the tilt circuit, limit the external pressure imposed on the circuit when the tilt control valve is in the HOLD position.

WARNING: When testing and adjusting the hydraulic system, move the machine to a suitable location in dirt, not rock or concrete. Move away from job traffic pattern and away from personnel. Allow only one man on the machine. Keep all other personnel off to one side and within view of the operator.

VISUAL CHECKS

A visual inspection of the system with the engine stopped should be the first step when troubleshooting a problem. With the bucket lowered to the ground and the oil reasonably cool, perform the following inspections:

1. Check the oil level. Slowly loosen the tank filler cap. If oil comes out the bleed hole when the filler cap is loosened, allow tank pressure to bleed off before removing the filler cap.

2. Remove the filter elements and check for presence of foreign material. A magnet will separate ferrous metal material from non-ferrous metal and non-metallic sealing material (piston rings, O-ring seals, etc.).

3. Inspect all lines and connections for damage or leaks.

OPERATIONAL CHECKS

The operational check of the system is useful in detecting possible internal leakage, faulty valves or a faulty pump. The speed of cylinder operation can be used as a check of the pump and cylinders.

Raise, lower, tilt and tiltback the bucket several times.

1. Observe cylinder extension and retraction for erratic movement.

2. Listen for pump noise.

3. Listen for relief valve action. Relief valves should not open except at full cylinder extension or retraction when bucket is empty.

4. Observe bucket positioner and lift kickout action.

Lift control lever should lock in RAISE.

Tilt control lever should lock in TILT BACK.

Bucket positioner mechanism should return the tilt control lever from TILT BACK to HOLD at the pre-set position.

Lift kickout should return lift control lever from RAISE to HOLD at pre-set height.

Test and check adjustment of any area where incorrect operation is evident or suspected. (See appropriate section of LOADER SYSTEM TEST PROCEDURES.)

When or if hydraulic circuit internal leakage is determined or suspected, perform pressure checks first. If operation is still slow or sluggish install a 9S2000 Flow Meter to isolate the suspected leakage source (See FLOW METER TEE TEST PROCEDURE—II.)

LOADER SYSTEM TEST PROCEDURES

Checking Pump Efficiency

For any pump test, the pump flow, measured in gpm (lit/min) at 100 psi (7.0 kg/cm^2) will be larger than the pump flow at 1000 psi (70.3 kg/cm^2) at the same rpm.

The difference between the pump flow of two operating pressures is the flow loss.

Method of finding flow loss . . .

Pump flow at 100 psi ..... 57.5 gpm (lit/min)*
Pump flow at 1000 psi .... —52.0 gpm (lit/min)*
Flow loss ..... 5.5 gpm (lit/min)*

Flow loss when expressed as a percent of pump flow is used as a measure of pump performance.

Example of finding percent of flow loss . . .

$$\left(\frac{\text{gpm flow loss}}{\text{Pump flow @ 100 psi}}\right) \times 100 = \text{Percent of flow loss}$$

or $\left(\frac{*\ 5.5}{*57.5}\right) \times 100 = 9.5\%$

If the percent of flow loss is more than 10%, pump performance is not good enough.

*Numbers in examples are for illustration and are not values for any specific pump or pump condition. See SPECIFICATIONS for pump flow of a new pump at 100 psi and 1000 psi.

Test On The Machine

Install a 9S2000 Flow Meter. [See subject, PUMP TESTS (CHART B) in FLOW METER TEE TEST PROCEDURE II, FORM NO. REG00880]. Measure pump flow at 100 psi (7.0 kg/cm^2) and at 1000 psi (70.3 kg/cm^2) with engine at 2000 rpm.

Formula I:

$$\left(\frac{\text{gpm @ 100 psi} - \text{gpm @ 1000 psi}}{\text{gpm @ 100 psi}}\right) \times 100 = \text{Percent of flow loss}$$

Test On The Bench

If the test bench can not be run at 1000 psi at a high rpm, do the first part of the test with the pump shaft rotation at half speed of the pump. See SPECIFICATIONS for HALF SPEED data for pump being tested. Measure pump flow at 100 psi (7.0 kg/cm^2) and at 1000 psi (70.3 kg/cm^2). Then in order to measure the pump flow for the last part of the test, see SPECIFICATIONS for: Pump rpm at 100 psi with the engine at 2000 rpm.

Formula II:

$$\left(\frac{\text{gpm @ 100 psi} - \text{gpm @ 1000 psi}}{\text{gpm @ 100 psi @ pump rpm}}\right) \times 100 = \text{Percent of flow loss}$$

Lift and Tilt Circuit Speeds

The loader filter elements should be changed, if dirty, before performing the following speed tests. The oil must be of recommended viscosity and at normal operating temperature to obtain accurate test results. The speed tests are made with the engine at high idle.

The speeds in the charts are those of a machine equipped with a general purpose bucket.

System speeds similar to the speeds given, indicate that the circuits are operating normally. However, the relief valves should be tested to be certain they are set at the proper ratings.

If only the lift circuit or only the tilt circuit has slow speeds, check the slow circuit for excessive drifting.

TILT CIRCUIT SPEED TEST	SPEED IN SECONDS
With lift arms at maximum height: *Move empty bucket from full tilt back to full dump.	1.8
*Move loaded bucket from full tilt back to full dump.	1.27
Move level bucket to full tilt back. (Bucket on ground.)	.60
*If the tilt circuit has extremely slow speed, check for pump malfunctioning. Also check the main pressure relief valve for leakage or low pressure setting.	

CAUTION: Set the lift kickout so the lift cylinder piston rods stop .12 in. (3.05 mm) from end of their strokes.

LIFT CIRCUIT SPEED TEST	SPEED IN SECONDS
*Raise empty bucket from ground level to kickout height.	6.1
*Raise loaded bucket from ground level to kickout height.	7.0
Lower empty bucket from kickout height to ground level with control lever in FLOAT position.	3.0
Lower empty bucket from kickout height to ground level with control lever in LOWER position.	3.2
*If the lift circuit has extremely slow speed, check for pump malfunctioning. Also check the main pressure relief valve for leakage or low pressure setting.	

Lift Circuit Drift

TEST NO. 1: Raise the front of the machine off the ground by lowering the bucket. Place the lift control lever in HOLD position. Shut off the engine and observe if lift cylinder rods extend.

TEST NO. 2: Raise the front of the machine off the ground by lowering the bucket. Shut off the engine and place the lift control lever in LOWER position. Observe if the lift cylinder rods extend.

TEST NO. 3: Raise the bucket (loaded with dirt) off the ground. Place the lift control lever in HOLD position. Shut off the engine and observe if the lift cylinder rods retract.

TEST NO. 4: Raise the bucket (loaded with dirt) off the ground. Shut off the engine and place the lift control lever in Raise position. Observe if the lift cylinder rods retract.

TEST RESULTS	PROBABLE CAUSE
Drifting occurs only in Test No. 1.	1. Lift circuit make-up valve (rod ends) leaking.
Drifting occurs only in Test No. 3.	1. Lift circuit make-up valve (head ends) leaking.
Drifting occurs only in Tests No. 1 and No. 3.	1. Leakage between pistons and cylinders, and/or leakage between lift circuit control valve spool and body.
Drifting occurs only in Tests No. 2 and No. 4.	1. Lift circuit check valve leaking (leakage between valve and seat and/or seat and body).
NOTE: Remember that an O-ring seal failure in the circuit can have the same effect as a main component failure.	

Tilt Circuit Drift

TEST NO. 1: Raise the front of the machine off the ground by partially dumping the bucket. Place the tilt control lever in HOLD position. Shut off the engine and observe if the tilt cylinder rods extend.

TEST NO. 2: Raise the front of the machine off the ground by partially dumping the bucket. Shut off the engine and place the tilt control lever in DUMP position. Observe if the tilt cylinder rods extend.

TEST NO. 3: Start the engine, raise a level bucket (loaded with dirt) off the ground. Place the tilt control lever in HOLD position. Shut off the engine and observe if tilt cylinder rods retract.

TEST NO. 4: Start the engine, raise a level bucket (loaded with dirt) off the ground. Shut off the engine and place the tilt control lever in TILT BACK position. Observe if tilt cylinder rods retract.

TEST RESULTS	PROBABLE CAUSE
Drifting occurs only in Test No. 1.	1. Tilt circuit relief valve (rod ends) damaged or leaking. 2. Tilt circuit make-up valve (rod ends) leaking.
Drifting occurs only in Test No. 3.	1. Tilt circuit relief valve (head ends) damaged or leaking. 2. Tilt circuit make-up valve (head ends) leaking.
Drifting occurs only in Tests No. 1 and No. 3.	1. Leakage between pistons and cylinders. 2. Leakage between tilt circuit valve spool and body.
Drifting occurs only in Tests No. 2 and No. 4.	1. Tilt circuit check valve leaking (leakage between valve and seat and/or seat and body).
NOTE: Remember that an O-ring seal failure in the circuit can have the same effect as a major component failure.	

MAIN PRESSURE RELIEF VALVE AND TILT CIRCUIT RELIEF VALVES

Tools Needed to test relief valves: 5S5123 Hydraulic Testing Group, FT584 Lift Arm Supports (two) (Fabricated Tool).

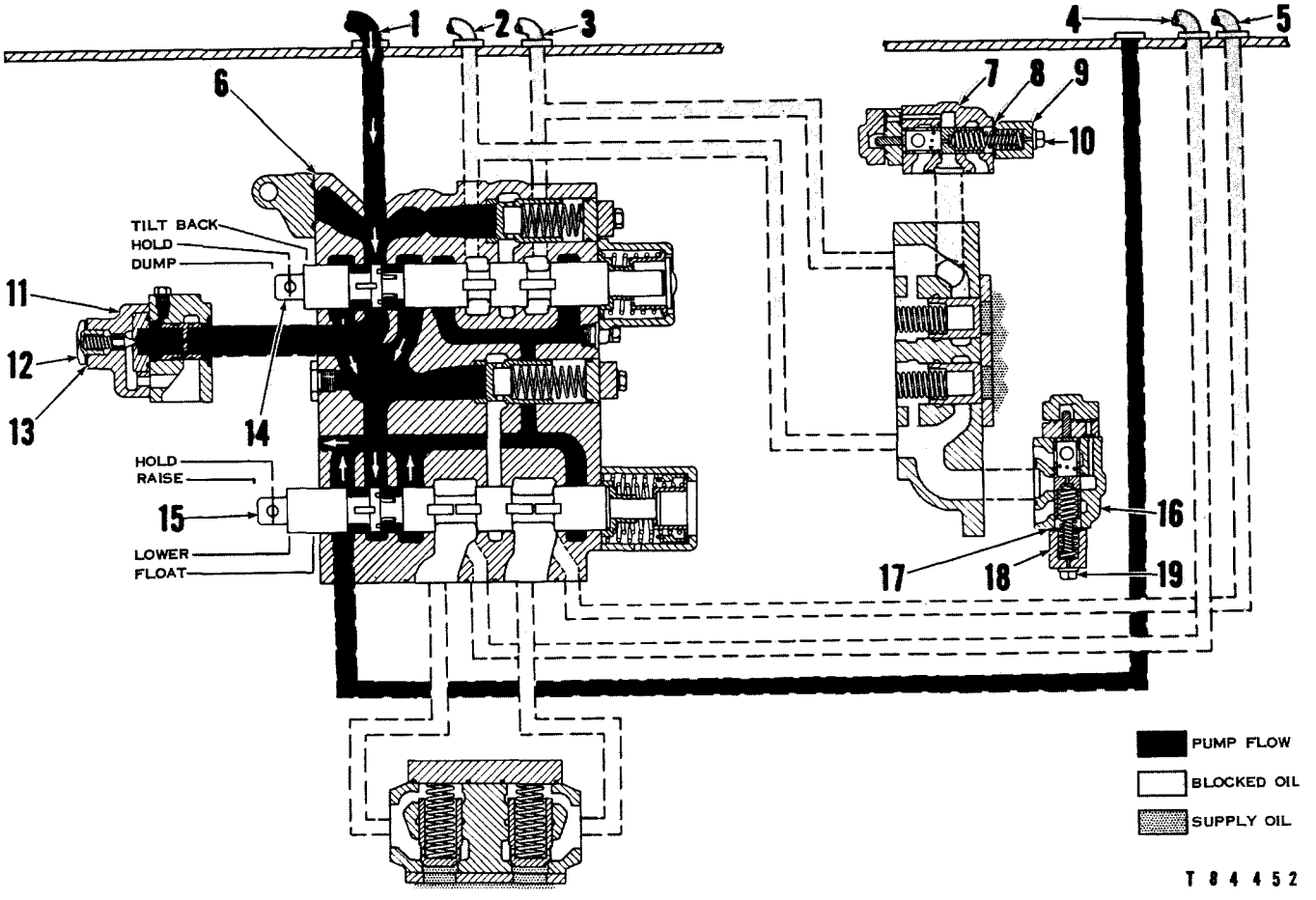
WARNING: Use only high pressure testing equipment; pressure can exceed 2600 psi (182.8 kg/cm^2).

The oil must be at normal operating temperature during testing.

The tilt circuit relief valves and the main pressure relief valve can be tested while installed on the machine or they can be removed and tested on a hydraulic test bench. The test procedures are illustrated on the machine using the 5S5123 Hydraulic Testing Group.

The pressure at which the relief valves open should be tested occasionally and reset, if necessary, to ensure correct operating pressure. The hydraulic tank or control valve need not be disturbed to check the pressure settings.

NOTE: The main pressure relief valve opens at a lower pressure than the tilt circuit relief valves. Since the tilt circuit relief valves sense the same pressure as the main pressure relief valve when the tilt control valve spool is in an operating position, it is necessary to have the tilt circuit relief valve (rod ends) at the correct pressure setting before attempting to test the main pressure relief valve in the testing sequence that follows.



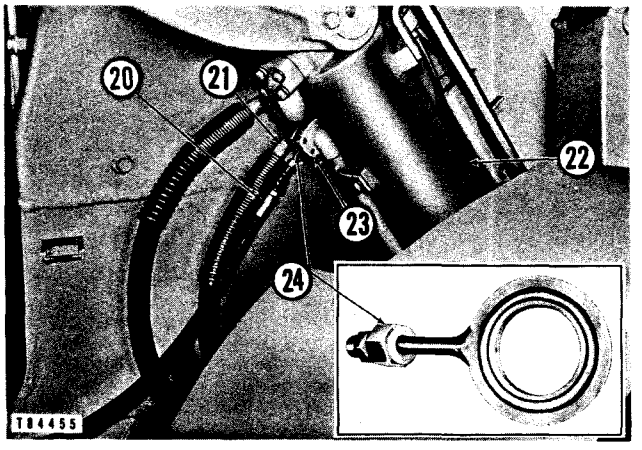
SCHEMATIC OF LOADER CONTROL VALVE IN HOLD POSITION
(Typical Example)

1. Pressure line (large section of pump to control valve). 2. Line (control valve to head ends of tilt cylinders). 3. Line (control valve to rod ends of tilt cylinders). 4. Line (control valve to rod ends of lift cylinders). 5. Line (control valve to head ends of lift cylinders). 6. Lift and tilt control valve. 7. Tilt circuit relief valve (rod ends of cylinders). 8. Shims. 9. Retainer. 10. Bolts (two). 11. Main pressure relief valve. 12. Plug. 13. Shims. 14. Tilt valve spool. 15. Lift valve spool. 16. Tilt circuit relief valve (head ends of cylinders). 17. Shims. 18. Retainer. 19. Bolts (two).

Testing the Tilt Circuit Relief Valve (Rod Ends):

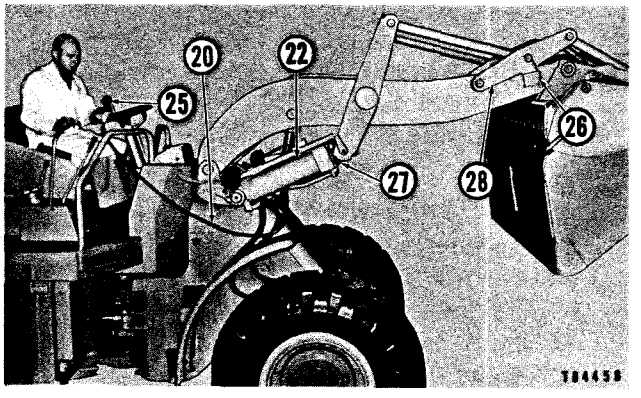
1. Place the bucket flat on the ground. Then, with the engine shut off, move the tilt control lever to all positions to ensure there is no pressure in the hydraulic lines. Return the control lever to HOLD position.
2. Attach pressure gauge (25) and pressure plate assembly (24) to hose (20). Install the pressure plate between hose assembly (21) and tube assembly (23). Or, remove the tank guard and tap into the line, using the plug on the tilt rod end line.
3. Start the engine, and raise the lift arm until it

is parallel to the ground. Place the bucket in a full dumped position. Then, with the lift control lever in RAISE position observe the pressure reading on the gauge as rod (27) is pulled out of cylinder (22). The tilt control lever must be in HOLD position during this test.



PRESSURE PLATE ASSEMBLY INSTALLED

20. Hose. 21. Hose assembly (rod end). 22. Tilt cylinder. 23. Tube assembly (rod end). 24. Pressure plate assembly.



TESTING TILT CIRCUIT ROD END RELIEF VALVE

20. Hose. 22. Tilt Cylinder. 25. Pressure gauge (0 to 4000 psi). 26. Stop. 27. Piston rod. 28. Arm.

4. If the pressure reading is not within the range of 2500 ± 25 psi (175.8 ± 1.8 kg/cm^2), record the pressure reading and repeat Step 1. Then remove the top cover from the oil supply tank. Carefully remove bolts (10) and retainer (9).

CAUTION: Retainer (9) is spring loaded.

NOTE: On early machines with a 4J8675 relief valve the relief setting is 2200 ± 25 psi (154.7 ± 1.8 kg/cm^2).

5. Add or remove shims (8) to obtain the correct pressure setting. Removal of shims increases the pressure setting.

PRESSURE CHANGE BY REMOVAL OR ADDITION OF ONE SHIM (8) (7J3972 Valve)		
SHIM PART NO.	SHIM THICKNESS	CHANGE IN psi (kg/cm^2)
2J8200	.010 in. (0.25 mm)	42 psi (2.9 kg/cm^2)

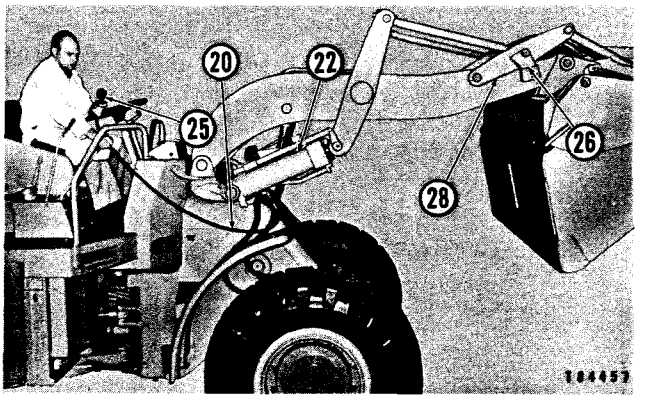
PRESSURE CHANGE BY REMOVAL OR ADDITION OF ONE SHIM (8) (4J8675 Valve)		
SHIM PART NO.	SHIM THICKNESS	CHANGE IN psi (kg/cm^2)
2J8200	.010 in. (0.25 mm)	35 psi (2.5 kg/cm^2)

6. Install retainer (9) and tighten bolts (10) to 27 ± 2 lb. ft. (3.7 ± 0.3 mkg).

7. Temporarily install the tank top cover and check the pressure again. Repeat the procedure if necessary.

Testing the Main Pressure Relief Valve:

8. Raise the lift arm parallel to the ground. Dump the bucket until arm (28) contacts stop (26). With the governor pedal completely depressed, hold the lever in the DUMP position and observe the reading on gauge (25).



TESTING THE MAIN PRESSURE RELIEF VALVE

20. Hose. 22. Tilt cylinder. 25. Pressure gauge (0 to 4000 psi). 26. Stop. 28. Arm.

9. If the pressure reading is not within the range of 2200 ± 25 psi (154.7 ± 1.8 kg/cm^2), record the reading and repeat Step 1. Then remove the top cover from the oil supply tank. Carefully remove plug (12) from valve (11).

CAUTION: Plug (12) is spring loaded.

NOTE: On early machines with a 4J8131 relief valve the relief setting is 2000 ± 25 psi (140.6 ± 1.8 kg/cm^2).

10. Add or remove shims (13) to obtain the correct pressure setting. Removal of shims increases the pressure setting.

PRESSURE CHANGE BY REMOVAL OR ADDITION OF ONE SHIM (13) (7J3975 Valve)		
SHIM PART NO.	SHIM THICKNESS	CHANGE IN psi (kg/cm²)
2J2866	.005 in. (0.13 mm)	35 psi (2.5 kg/cm²)

PRESSURE CHANGE BY REMOVAL OR ADDITION OF ONE SHIM (13) (4J8131 Valve)		
SHIM PART NO.	SHIM THICKNESS	CHANGE IN psi (kg/cm²)
2J2866	.005 in. (0.13 mm)	40 psi (2.8 kg/cm²)

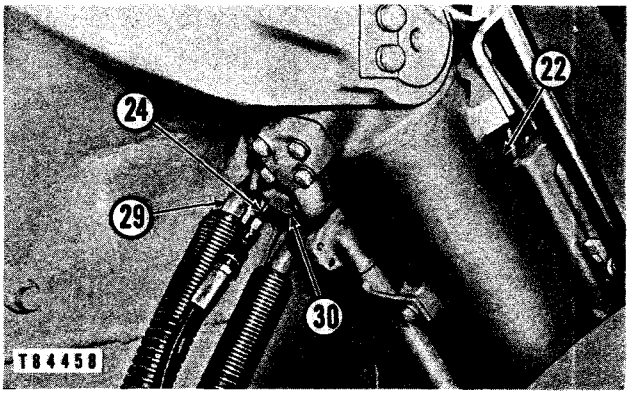
11. Tighten plug (12) to 80 ± 5 lb. ft. (11.1 ± 0.7 mkg).

12. Temporarily install the tank top cover and check the pressure again. If necessary, repeat this procedure until the correct pressure setting is obtained.

Testing the Tilt Circuit Relief Valve (Head Ends):

13. Repeat Step 1.

14. Use the same hose (20), gauge (25), and pressure plate assembly (24) used in the previous tests. Install pressure plate (24) between hose assembly (29) and elbow (30).

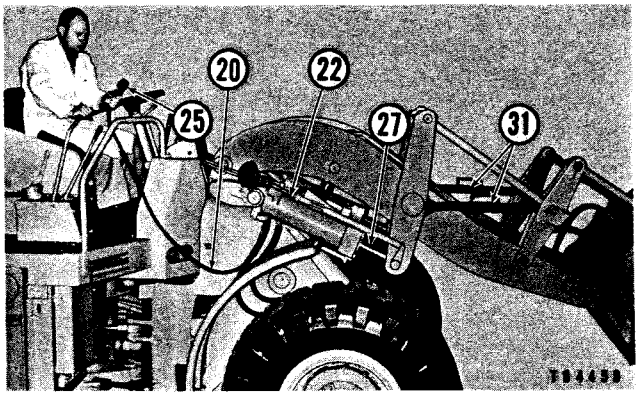


PRESSURE PLATE ASSEMBLY INSTALLED

22. Tilt cylinder. 24. Pressure plate assembly. 29. Hose assembly (head end). 30. Elbow (head end of cylinder).

15. Start the engine. Raise the lift arms and install the supports (31) as illustrated.

16. Move the lever for the lift control valve to the LOWER position; observe the pressure reading on gauge (25) as rod (27) is forced into cylinder (22). The tilt control lever must be in HOLD position during this test.



TESTING TILT CIRCUIT HEAD END RELIEF VALVE

20. Hose. 22. Tilt cylinder. 25. Pressure gauge (0 to 4000 psi). 27. Piston rod. 31. FT584 Lift Arm Supports (Fabricated Tool).

17. If the pressure reading is not within the range of 2500 ± 25 psi (175.8 ± 1.8 kg/cm²), then record the reading and repeat Step 1. Then remove the top cover from tank. Carefully remove bolts (19) and retainer (18).

CAUTION: Retainer (18) is spring loaded.

NOTE: On early machines with a 4J8675 relief valve the relief setting is 2200 ± 25 psi (154.7 ± 1.8 kg/cm²).

18. Add or remove shims (17) to obtain the correct pressure setting. Removal of shims increases the pressure setting.

PRESSURE CHANGE BY REMOVAL OR ADDITION OF ONE SHIM (17) (7J3972)		
SHIM PART NO.	SHIM THICKNESS	CHANGE IN psi (kg/cm²)
2J8200	.010 in. (0.25 mm)	42 psi (2.9 kg/cm²)

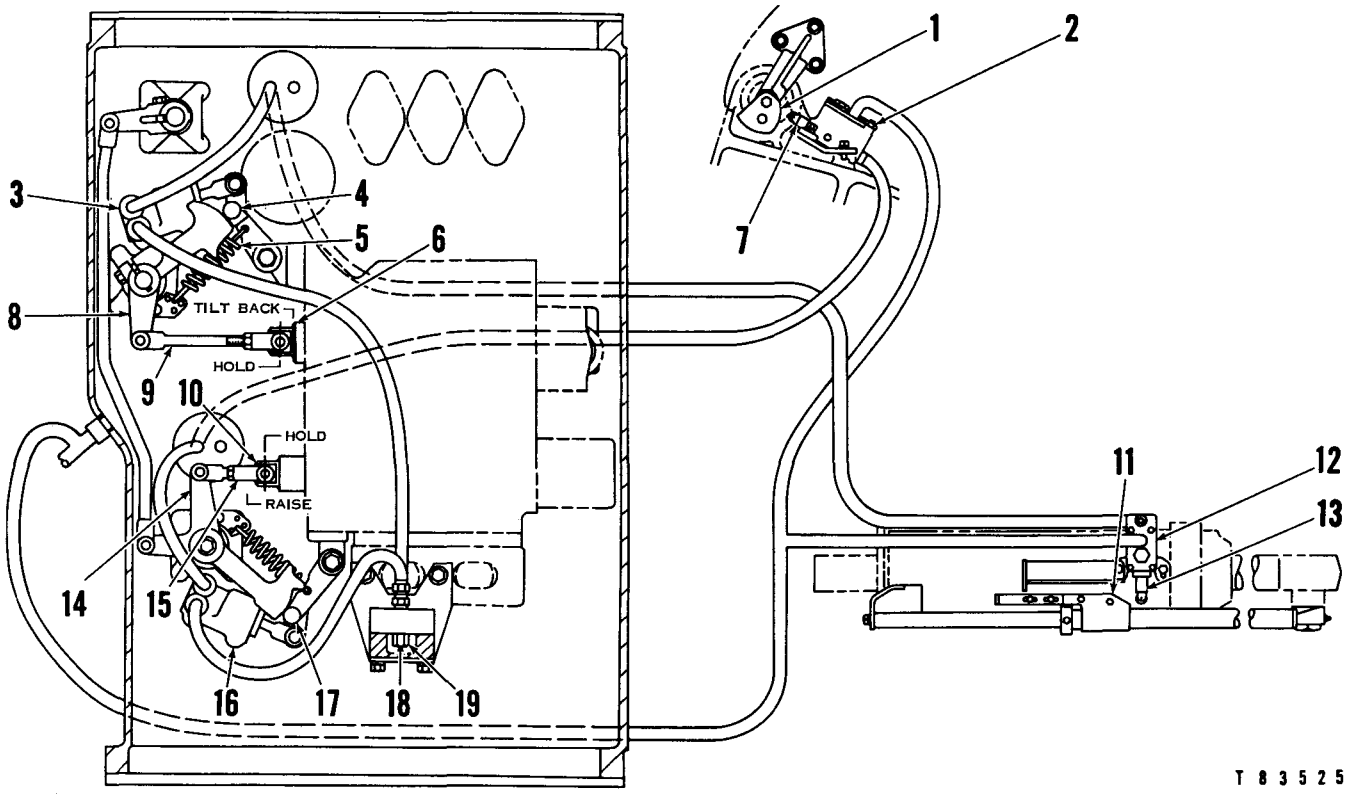
PRESSURE CHANGE BY REMOVAL OR ADDITION OF ONE SHIM (17) (4J8675 Valve)		
SHIM PART NO.	SHIM THICKNESS	CHANGE IN psi (kg/cm²)
2J8200	.010 in. (0.25 mm)	35 psi (2.5 kg/cm²)

19. Install retainer (18) and tighten bolts (19) to 27 ± 2 lb. ft. (3.7 ± 0.3 mkg).

20. Temporarily install the tank top cover and check relief valve pressure setting.

21. If necessary, repeat procedure until the correct pressure setting is obtained.

BUCKET POSITIONER AND LIFT KICKOUT CIRCUITS



SCHEMATIC OF THE BUCKET POSITIONER AND LIFT KICKOUT

1. Cam. 2. Lift kickout master cylinder. 3. Bucket positioner slave cylinder. 4. Roller. 5. Roller spring. 6. Tilt valve spool. 7. Piston. 8. Cam lever. 9. Rod assembly. 10. Lift valve spool. 11. Cam. 12. Bucket positioner master cylinder. 13. Piston. 14. Cam lever. 15. Rod assembly. 16. Lift kickout slave cylinder. 17. Roller. 18. Bucket positioner circuit make-up valve. 19. Lift kickout circuit make-up valve.

Bucket Positioner Circuit

The length of rod assembly (9) controls the relationship between cam lever (8) and roller (4). The tilt valve spool (6) will not lock in the TILT BACK position if rod assembly (9) is set too long. If the rod assembly is set too short, the valve spool will not return automatically from the TILT BACK (locked) position to the HOLD position.

Piston (13) must have a stroke of .72 in. (18.3 mm). A longer stroke can result in damage to master cylinder (12); a shorter stroke can result in failure of the circuit to return valve spool (6) from the TILT BACK (locked) position to the HOLD position.

Cam (11) can be moved to adjust the bucket digging angle.

Lift Kickout Circuit

The length of rod assembly (15) controls the relationship between cam lever (14) and roller (17). The lift valve spool (10) will not lock in RAISE position if rod assembly (15) is set too short. If rod assembly (15) is set too long, valve spool (10) will not return automatically from RAISE (locked) position to HOLD position.

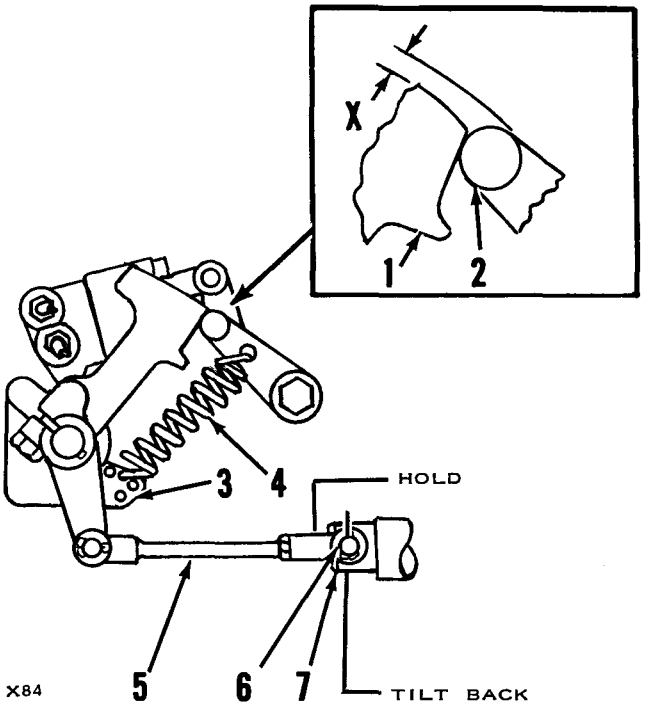
Piston (7) must have a stroke of .72 in. (18.3 mm). A longer stroke can result in damage to master cylinder (2); a shorter stroke can result in failure of the circuit to return the valve spool (10) from the RAISE (locked) position to the HOLD position.

Cam (1) should be adjusted so the lift valve spool (10) is returned to HOLD position when the lift cylinder piston rods are .12 in. (3.0 mm) from the ends of their strokes.

Bucket Positioner Cam Lever and Cam Spring Adjustments

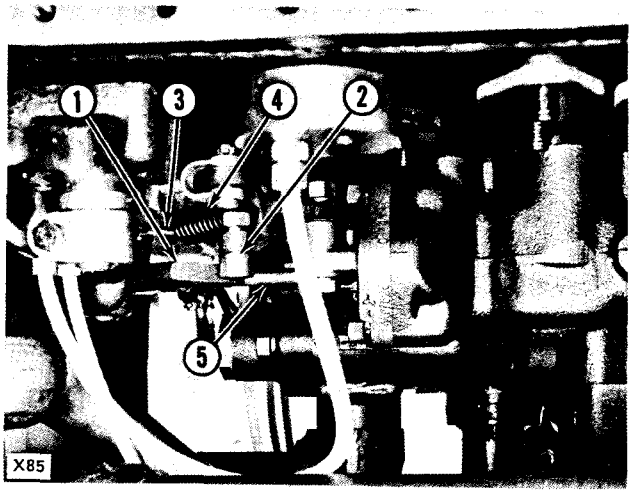
1. Drain the hydraulic oil supply tank.
2. Remove the top cover from the tank.
3. Place the tilt control lever in TILT BACK (locked) position.

4. Adjust the length of rod assembly (5) to obtain dimension (X). **DO NOT** exceed this dimension.



LINKAGE FOR TILT CONTROL VALVE SPOOL IN TILT BACK POSITION

1. Cam. 2. Roller. 3. Plate. 4. Roller spring. 5. Rod assembly. 6. Pin. 7. Tilt control valve spool. X. .24 in. (6.1 mm) dimension (distance from cam surface to top of roller).



TILT CONTROL LINKAGE IN HOLD POSITION

1. Cam. 2. Roller. 3. Plate. 4. Roller spring. 5. Rod assembly.

NOTE: Pin (6) must be perpendicular to the front of the tank after the final adjustment is made.

5. Install the roller spring (4) in the adjustment hole in plate (3) that requires a force of approximately 20 lbs. (9.1 kg) to pull the tilt control lever from TILT BACK (locked) position to HOLD position. Measure this force with a spring scale at the base of the tilt control lever handle.

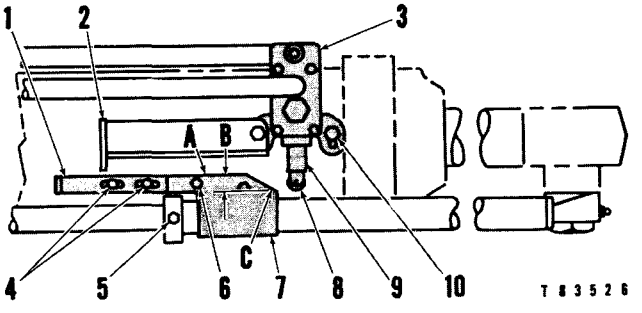
6. Fill the tank and bleed the bucket positioner and lift kickout hydraulic circuits.

Bucket Positioner Master Cylinder Piston Stroke Adjustment and Bucket Digging Angle Adjustment

The distance piston (9) travels into the master cylinder housing from a fully extended position must be equal to dimension (B). The full stroke is obtained when roller (8) is on the flat portion (A) of cam (7).

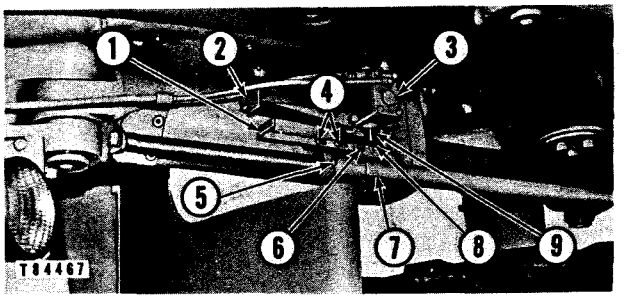
1. Bleed the bucket positioner and lift kickout hydraulic circuits if any line in the circuits has been disconnected or the tank has been drained. See the covering topic.

2. If master cylinder (3) has not been removed, check the piston stroke by measuring the linear distance roller (8) travels from a fully extended position to when it is on the flat portion (A) of cam (7). This distance should be .72 in. (18.3 mm).



EXTERNAL COMPONENTS OF BUCKET POSITIONER CIRCUIT

1. Adjustable strip. 2. Stationary strip. 3. Bucket positioner master cylinder. 4. Bolts. 5. Oil cup. 6. Bolts (two). 7. Cam. 8. Piston roller. 9. Piston. 10. Bolts (two). A. Flat portion of cam. B. .72 in. (18.3 mm) dimension [the distance from point (C) to flat portion (A) of cam (7)]. C. Scribed point on cam.



MASTER CYLINDER IN ACTUATED POSITION

1. Adjustable strip. 2. Stationary strip. 3. Bucket positioner master cylinder. 4. Bolts. 5. Oil cup. 6. Bolts (two). 7. Cam. 8. Roller. 9. Piston.

3. If the master cylinder has been removed, measure the distance (B), on cam (7) to determine point (C). Mark point (C) on cam (7).

4. Loosen bolts (6) and (10). Move cam (7) and master cylinder (3) as necessary, until the end of the roller is aligned with point (C). While the roller and cam are in this position, tighten bolts (6) and (10).

5. Adjust cam (7) to obtain the desired digging angle. Moving the cam toward oil cup (5) will increase the digging angle; moving it away from the cup will decrease the digging angle.

6. With the bucket at the desired digging angle, loosen bolts (4) and move strip (1) so the back sides of strips (1) and (2) are aligned. Tighten bolts (4). Leave .12 in. (3.0 mm) between the ends of the strips.

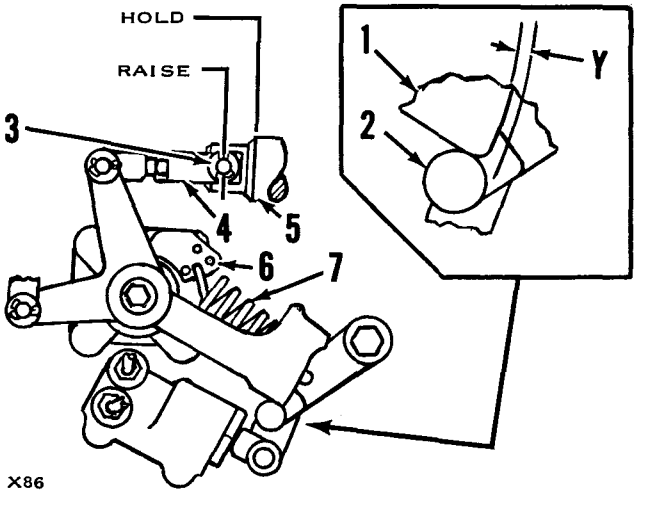
Lift Kickout Cam Lever and Cam Spring Adjustments

1. Drain the hydraulic oil supply tank.

2. Remove the bottom cover from the tank.

3. Place the lift control lever in RAISE (locked) position.

4. Adjust the length of rod assembly (4) to obtain dimension (Y). **DO NOT** exceed this dimension.

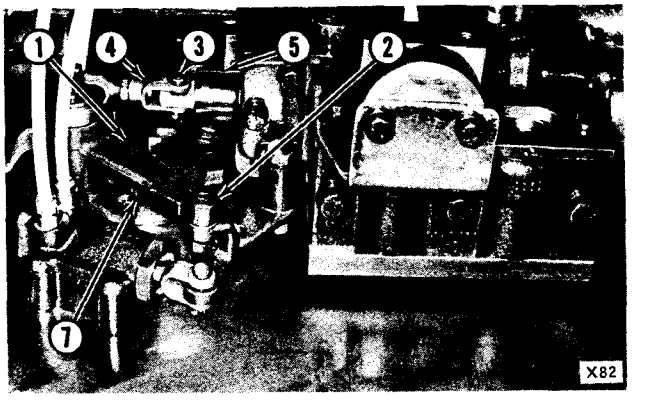


LINKAGE FOR LIFT CONTROL VALVE SPOOL IN RAISE POSITION

1. Cam. 2. Roller. 3. Pin. 4. Rod assembly. 5. Lift valve spool. 6. Plate. 7. Roller spring. Y. .29 in. (7.3 mm) dimension (distance from cam surface to top of roller).

NOTE: Pin (3) must be perpendicular to the front of the tank after final adjustment is made.

5. Install the roller spring (7) in the adjustment hole in plate (6) that requires a force of approximately 20 lbs. (9.1 kg) to pull the lift control lever from RAISE (locked) position to HOLD position. Measure this force with a spring scale at the base of the lift control lever handle.



LIFT CONTROL LINKAGE IN HOLD POSITION

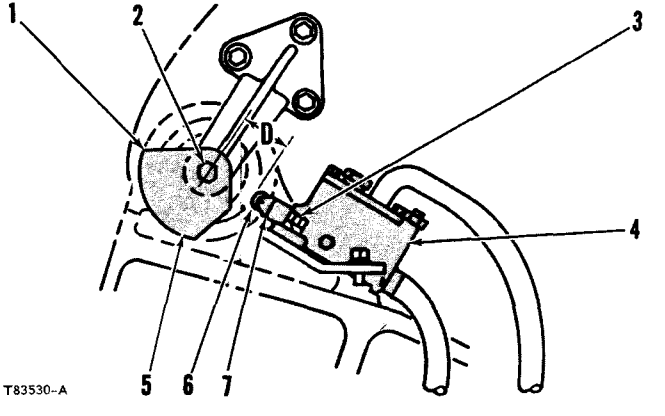
1. Cam. 2. Roller. 3. Pin. 4. Rod assembly. 5. Lift control valve spool. 7. Roller spring.

6. Fill the tank and bleed the kickout and positioner circuits.

Lift Kickout Master Cylinder Piston Stroke Adjustment and Kickout Height Adjustment

The distance piston (7) travels into the master cylinder housing from a fully extended position must be equal to .72 in. (18.3 mm). The full stroke is obtained when roller (6) is on surface (5) of cam (1).

1. Bleed the bucket positioner and lift kickout hydraulic circuits if any line in the circuits has been disconnected. See the covering topic.

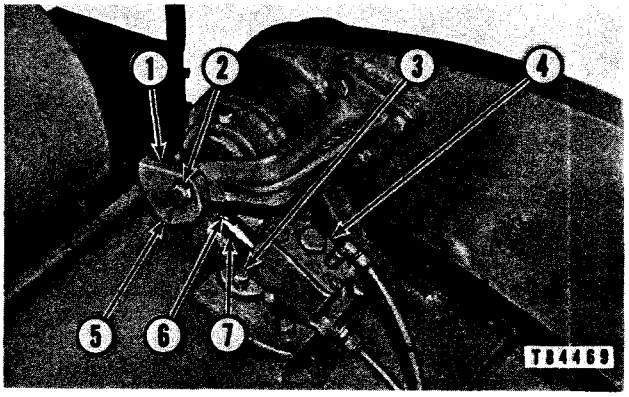


EXTERNAL COMPONENTS OF LIFT KICKOUT CIRCUIT

1. Cam. 2. Bolt. 3. Bolts (two). 4. Lift kickout master cylinder. 5. Surface of cam. 6. Roller. 7. Piston. D. 1.5 in. (38.1 mm) reference dimension.

2. If the master cylinder has not been removed, check the piston stroke by measuring the distance roller (6) travels when it initially contacts cam (1) to when it is on surface (5) of cam (1).

3. If the master cylinder has been removed, position the master cylinder (4) so the distance from roller (6) to the centerline of bolt (2) is 1.50 in. (38.1 mm), dimension (D). Tighten bolts (3). Then check to ensure the piston stroke is .72 in. (18.3 mm). Adjust, if necessary, by loosening bolts (3) and moving master cylinder (4).



MASTER CYLINDER AND CAM

1. Cam. 2. Bolt. 3. Bolts (two). 4. Lift kickout master cylinder. 5. Surface of cam. 6. Roller. 7. Piston.

4. Adjust cam (1) so the lift control lever returns from RAISE (locked) position to HOLD position when the lift cylinder piston rods are .12 in. (3.0 mm) from the ends of their strokes. Move the cam toward roller (6) to make kickout occur earlier and away from the roller to make kickout occur later.

Bleeding The Bucket Positioner and Lift Kickout Circuits

Tools Needed: 5K3921 Air Relief Valve.

CAUTION: The bucket positioner and lift kickout hydraulic circuits must be bled if any line in the circuits has been disconnected or the hydraulic oil supply tank has been drained.

1. Be certain the machine is level.

2. Raise the bucket until the tilt cylinders are horizontal with the ground to place master cylinder (4) in a level position. Place the bucket in a full dumped position.

NOTE: The bucket positioner and lift kickout master cylinder pistons must be fully extended throughout this procedure.

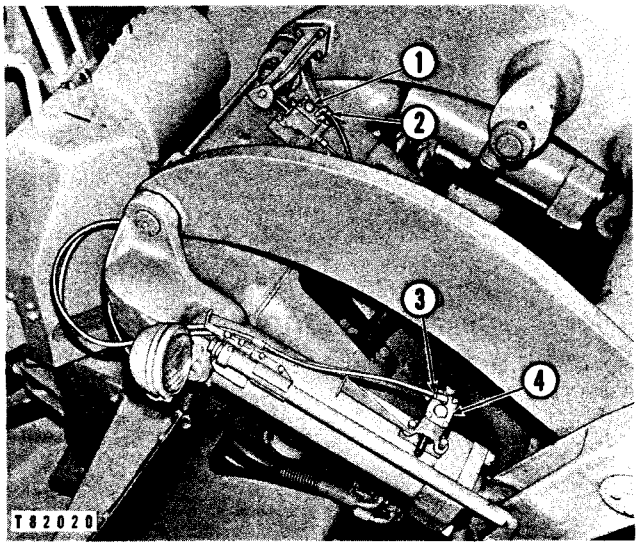
3. Put FT584 supports under the lift arm to prevent the bucket from falling. Shut off the engine.

4. Loosen filler cap (5), and bleed air from tank.

5. Place the tilt control lever in TILT BACK (locked) position. (The tilt lever must remain in this position throughout the bleeding procedure).

6. Remove the guard from the front of the oil supply tank.

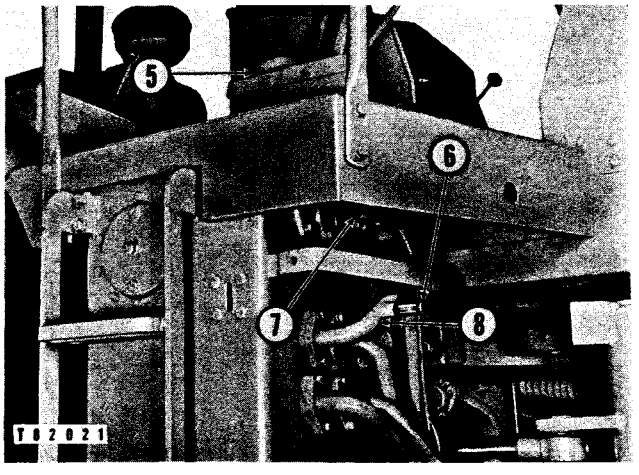
7. Remove plug from line (8). Install valve (6).



LIFT KICKOUT AND BUCKET POSITIONER MASTER CYLINDERS

1. Lift kickout master cylinder. 2. Line. 3. Line. 4. Bucket positioner master cylinder.

8. Tighten filler cap (5).



INSTALLATION OF AIR RELIEF VALVE

5. Hydraulic oil supply tank filler cap. 6. 5K3921 Air Relief valve. 7. Bleed plug. 8. Tilt circuit hydraulic line (rod ends).

9. Pressurize the hydraulic oil supply tank by applying air pressure through the stem of valve (6). Valve (6) will allow the tank to be pressurized to a maximum of 25 psi (1.8 kg/cm^2). For prolonged bleeding, repressurize as required.

10. Remove the bolts securing master cylinder (1) to the frame and position the master cylinder so it is level.

11. Loosen lines (2) and (3) and allow the oil to run simultaneously from the lines and the fitting bodies in the master cylinder covers. When the flow of oil is continuous and contains no air bubbles, allow the oil to flow for approximately 30 seconds longer to ensure the circuits are bled completely. Tighten lines (2) and (3).

NOTE: Both master cylinders must be level.

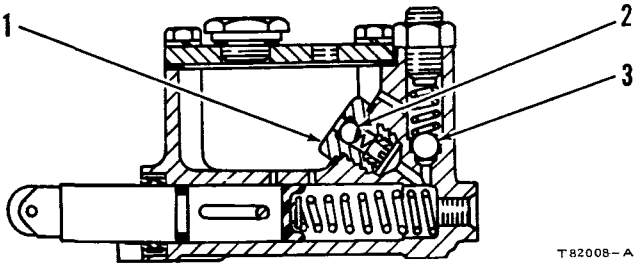
12. Open bleed plug (7) and exhaust the air pressure within the tank. Tighten bleed plug when the air is exhausted.

13. Remove valve (6) and install the plug.

14. Return tilt lever to HOLD position.

15. Install the bolts securing master cylinder (2) to the frame and adjust the master cylinder piston stroke. See the covering topic.

Bucket Positioner and Lift Kickout Master Cylinder Relief Valve Settings



LIFT KICKOUT MASTER CYLINDER.

1. Check valve. 2. Ball. 3. Relief valve.

Both the bucket positioner and lift kickout master valve relief valve settings and check valve settings are the same. The pressure settings can be checked; however, if the settings are not within tolerances, DO NOT attempt to adjust the valves. If the check valve (1) is not within tolerances, install a new valve. If the relief valve (3) does not open within the tolerances given, the body assembly must be replaced. The relief valve setting is 225 ± 25 psi (15.8 ± 1.8 kg/cm^2). Ball (2) must unseat at .6 ± .5 psi (0.04 ± 0.03 kg/cm^2).

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