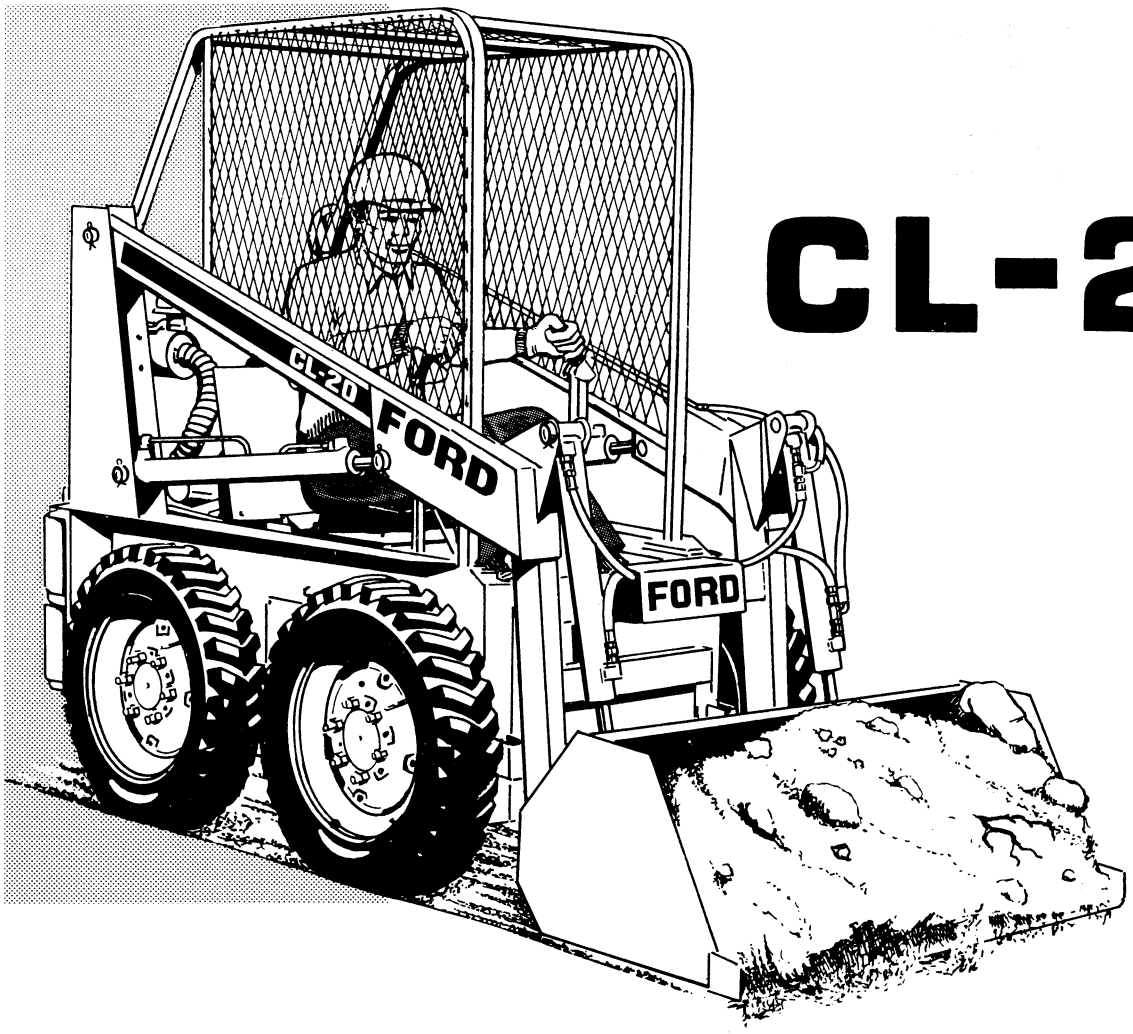
FORD

COMPACT LOADER



CL-20

REPAIR MANUAL

40002010

Reprinted

Foreword

This manual contains service information for the Ford Series CL 20 Compact Loader. Information is provided on description and operation, trouble shooting, tests and adjustments, component overhaul, lubrication and specifications.

Refer to the appropriate engine manual for information concerning the engine, its components, specifications and repair.

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

Service Department

Ford Tractor Operations
Ford Motor Company

Table of Contents

50 - HOUR INSPECTION
Check and Adjust as Required

INOPERATIVE SERVICE CHECKS

Engine

☐ 1. Check mounting bolts for tightness.

☐ 2. Drain and refill engine oil and replace engine oil filter. Inspect engine for leaks. Check engine oil level.

☐ 3. Blow off or wash off cylinder and cylinder head fins of dust and dirt. (Protect eyes from flying dust.)

☐ 4. Check governor for security.

Fuel System

☐ 1. Inspect fuel tank mounting.

☐ 2. Check all hoses and fittings for leaks.

☐ 3. Inspect fuel filter and clean if necessary.

Electrical

☐ 1. Inspect all wiring, harnesses, switches, buttons, and gauges for security.

☐ 2. Inspect battery terminals, cables, and mounting. Check battery fluid level.

Air Cleaner

☐ 1. Inspect element. Clean or replace as necessary.

☐ 2. Check air cleaner for dents, damage, and security.

☐ 3. Inspect air cleaner hose and hose clamps for tightness.

Hydraulic System

☐ 1. Check hydraulic oil reservoir level; check for leaks. Add oil if necessary. (Use only Ford Specification M2C48A oil. **Do not** use ordinary hydraulic fluid.) Inspect breather. Clean if necessary.

☐ 2. Check all hydraulic fittings for tightness and retighten all hose clamps on low pressure suction and return lines.

☐ 3. Check hydraulic pump and valve for secure mounting.

☐ 4. Replace hydraulic filter with new element. Check cover for security. Inspect filter gauge for security.

☐ 5. Inspect hydraulic oil cooler for security and leakage.

Drive System

REMOVE CHAIN HOUSING COVERS

☐ 1. Inspect axle chains and connecting link for wear. Adjust tension if necessary.

☐ 2. Check hydraulic motor mount bolts.

☐ 3. Check and tighten axle bearing mount bolts. [Tighten to 30 lbs. ft. (4.15 kgm).]

☐ 4. Check axle retaining nuts and cotter pins.

☐ 5. Check wheel lug nuts for tightness.

☐ 6. Check tire inflation.

Controls and Lift Arms

☐ 1. Check all clevis pins, cotter pins, and jam nuts on control linkage for free operation and security.

☐ 2. Check all levers for free operation and full valve spool travel. Adjust if necessary.

☐ 3. Check float position detent. Adjust if necessary.

☐ 4. Check all pivot pins, locking bolts, and locking tabs for security.

☐ 5. Inspect lift arms, parallel arm linkage, and tool bar for excessive wear, cracks, or deflection.

☐ 6. Lubricate all grease points. Refer to the Lubrication Chart, page 32.

OPERATIVE SERVICE CHECKS

Engine

- ☐ 1. Check operation of ignition switch and starter.
- ☐ 2. Operate choke and lubricate if necessary.
- ☐ 3. Set engine idle at 900 rpm and governor at 3600 rpm.

Hydraulic System

- ☐ 1. Check all hoses and fittings for leaks with system charged and unloaded. Check hydraulic pump, valve, filter and cooler for leaks.
- ☐ 2. Check hydraulic pressure in drive system at pump. [2000 psi (137.8 bar) at 3600 engine rpm].

Road Test

- ☐ 1. Road test machine. Check forward and reverse, turning both directions, and loader lift and bucket operation.

SAFETY PRECAUTIONS

A careful operator is the best operator. Most accidents can be avoided by observing certain precautions to prevent the possibility of injury or damage. The following precautions are suggested to help prevent accidents. Read them carefully before operating the new Ford CL 20 Compact Loader.

1. Read this manual carefully to acquaint yourself with the loader. Working with unfamiliar equipment can lead to accidents.
2. Do not allow anyone to ride on the loader with the operator.
3. Never run the loader engine in a closed building without adequate ventilation, as the exhaust fumes are very dangerous.
4. Always fasten the seat belt before starting the engine.
5. Never attempt to start the engine while standing beside the unit. Start the engine only while sitting in the operator's seat with the seat belt fastened. Always check to make certain that the seat support is secured to the frame.
6. Never enter or leave the loader while the engine is running. Always lower the lift arms down against the frame, drop the bucket down to contact the ground, and shut off the engine prior to leaving the loader.
7. Always be watchful of bystanders when operating the loader.
8. Always drive the loader at speeds compatible with safety, especially when operating over rough ground, crossing ditches, slopes, or when turning.
9. Avoid jerky turns, starts, stops or reverses.
10. Use care when operating on steep grades to maintain proper stability.
11. Always carry the bucket low for maximum stability and visability, whether the bucket is loaded or empty.
12. Never attempt to lift loads in excess of loader capacity.
13. Do not turn the unit while the lift arms are in the raised position.
14. Be careful when driving through door openings or under overhead objects. Always make sure there is sufficient clearance.
15. When traveling on public roads use accessory lights and devices for adequate warning to operators of other vehicles.
16. Exercise extreme caution when operating the loader with a raised, loaded bucket or fork.
17. Do not attempt to repair or tighten hydraulic hoses when the system is under pressure, when the engine is running, or when the lift arms are raised.
18. Do not get under the bucket or lift arms or reach through the lift arms when the loader is raised.
19. Never leave the loader when it is parked on an incline. Always park the loader on level ground where possible. If the loader is to be parked on an incline, always lower the bucket so that the cutting lip contacts the ground, and securely block the loader wheels.
20. Keep the operator's platform free of debris.
21. Never refuel the loader while smoking or with the engine hot or running.

Whenever you see this symbol!  it means:
ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

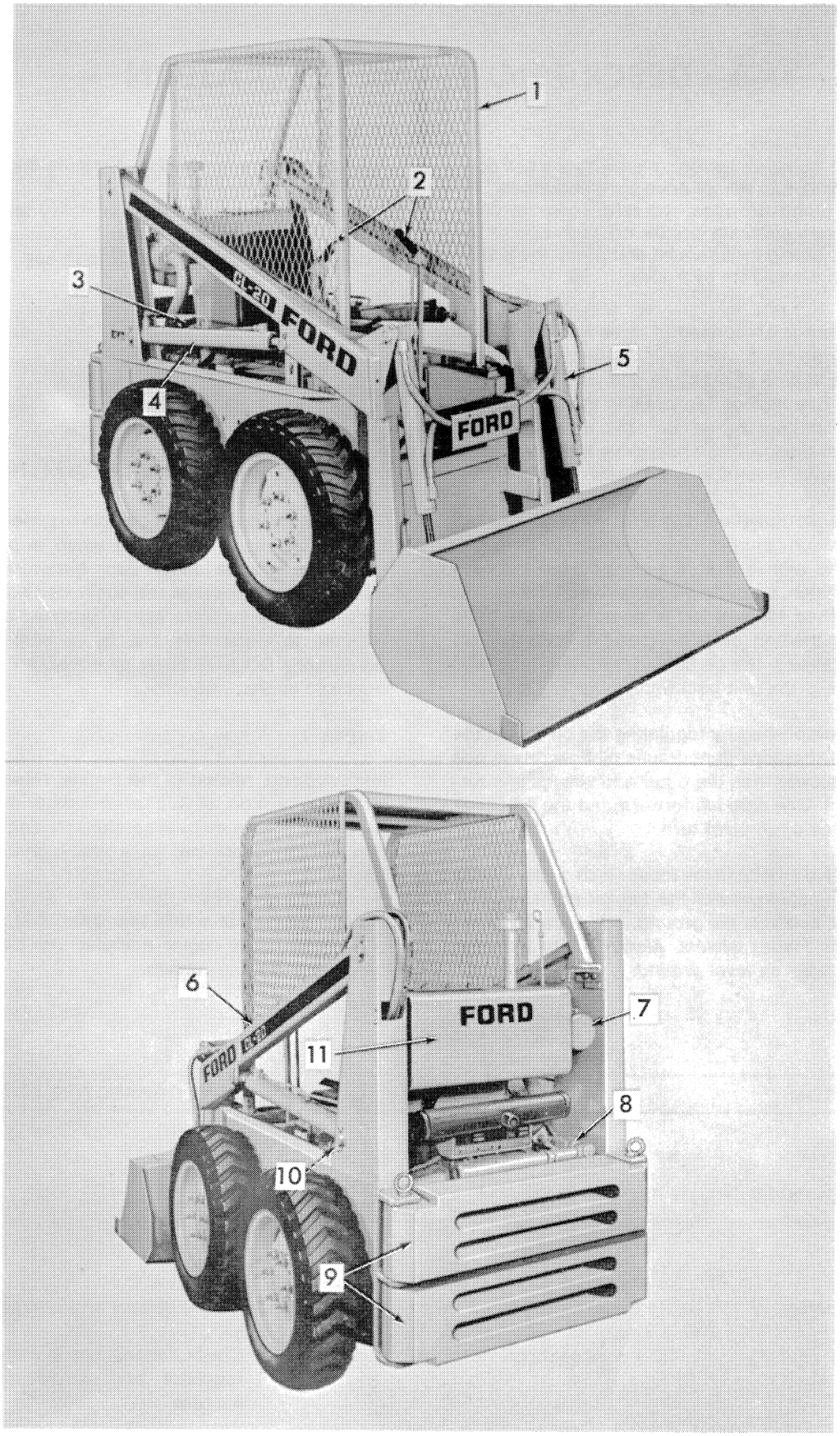


Figure 1
Ford CL-20 Compact Loader

1. Operator's Guard
2. Operating Control Levers
3. Engine
4. Lift Cylinder
5. Bucket Cylinder
6. Lift Arm
7. Air Cleaner
8. Hydraulic Oil Filter
9. Counterweights
10. Fuel Filler Cap
11. Hydraulic Oil Tank

DESCRIPTION AND OPERATION

The Ford CL20 Compact Loader, Figure 1, is a self contained, hydrostatic four-wheel drive front end loader. An engine driven pump provides hydraulic power to drive the loader through separate circuits on each side of the vehicle. Double acting cylinders lift and dump the loader bucket through a separate hydraulic circuit.

The drive system is comprised of three basic units; the pumps, the hydraulic motors and the chain drive. The pumps are the source of pressure and volume and they determine the direction of flow of oil in the drive circuit. The hydraulic motors power the unit utilizing a high torque, low rpm design. The chain drive transfers power from the hydraulic motors to the wheels.

Steering is accomplished by a lever and linkage arrangement which controls the hydraulic drive circuit on each side of the vehicle. With the drive control levers in the neutral position, no oil flow occurs. When the control levers are pushed forward, oil is pumped to the drive motors moving the unit forward. When the control levers are pulled backward, the oil flow to the drive motors is reversed, moving the unit backward.

Turning is accomplished by regulating the oil flow in the drive circuits. Difference in hydraulic oil flow drives one side faster or slower than the other and results in a turning movement. One side full forward and the other full reverse provides a full pivot turn.

CAUTION: *If the loader is to be parked on an incline, lower the bucket so the cutting lip contacts the ground, and securely block the loader wheels. Always try to park the loader on level ground.*

The engines are covered in separate engine manuals.

The frame assembly is built of heavy steel, electrically welded to form an integral unit. Additional reinforcing provides maximum resistance to stress.

TROUBLE SHOOTING

The following paragraphs contain trouble shooting information that may be helpful when a problem is encountered with the loader. Each symptom is followed by a list of possible causes and suggested corrective action. To isolate the possible cause, proceed in a systematic manner to determine the faulty component. These paragraphs DO NOT cover all possible malfunctions or deficiencies that may occur.

Engine

For problems related to the engine, refer to the trouble shooting portion of the appropriate engine manual. Study the engine manual carefully for complete information on the operation, care and maintenance of the engine.

NOTE: For units within Warranty, it is suggested the dealer review the engine manufacturer's warranty forms before performing repairs.

SYMPTOM	CAUSE	CORRECTIVE ACTION
ENGINE		
Refer to the appropriate engine manual.		
ELECTRICAL		
Improper Ammeter Indication	1. Battery discharged	1. Check battery and charge if necessary.
	2. Loose cable connections	2. Check connections at battery, ammeter, regulator and connections of wiring harness.
	3. Defective ammeter	3. Replace.
	4. Alternator not operating	4. Refer to engine manual.

TROUBLE SHOOTING

SYMPTOM	CAUSE	CORRECTIVE ACTION
DRIVE SYSTEM		
A. System Noisy	1. Air in system	1. Check reservoir oil level, replenish if required, and purge system of air.
	2. Loose suction line	2. Tighten connections.
	3. Clogged suction filter	3. Replace filter element.
	4. Oil too thick	4. Replace with correct grade of oil.
	5. Oil cold and stiff	5. Run system at low speed and no load until warm.
	6. Internal pump or motor damage	6. Disassemble, inspect and repair.
B. System Overheating	1. Internal leakage	1. Isolate and repair.
	2. Fluid level low	2. Replenish reservoir oil level.
	3. Oil cooler blocked	3. Clean oil cooler externally and flush internally.
C. System Not Developing Pressure	1. Relief valve damaged or malfunctioning	1. Install a new relief valve.
	2. Internal leakage in pump or motor	2. Isolate and repair.
	3. Pump drive failure	3. Locate and repair.
	4. Control linkage failure	4. Locate and repair.
	5. Charge pump defective or worn	5. Repair or replace charge pump components.
D. Loss of Fluid	1. Loose fittings	1. Check and tighten hose and tube connections.
	2. Ruptured hydraulic line	2. Locate and repair.
	3. Leaking gaskets or seals in pump or motor	3. Visually inspect mating sections of pump, shaft seal areas, etc., for signs of leakage. Repair as required.
E. Pump Vibration	1. Clogged pump	1. Clean.
	2. Loose pump mounts	2. Tighten.
	3. Defective bearings	3. Repair or replace.
F. Filter Gauge Indicates Red	1. Filter is clogged	1. Install new filter cartridge.

SYMPTOM	CAUSE	CORRECTIVE ACTION
LOADER SYSTEM		
A. Loss of Fluid	1. Loose fittings	1. Check and tighten all hose and tube connections.
	2. Ruptured hydraulic line	2. Locate and repair.
	3. Pump seal blown	3. Replace seal.
B. "Drift" of Lift or Bucket Cylinders	1. External cylinder leakage	1. Replace cylinder.
	2. Internal cylinder leakage	2. Replace packings and seals.
	3. Leakage at lines or fittings	3. Locate and repair.
	4. Internal valve leakage	4. Replace valve.

HYDRAULIC SYSTEM OPERATION

The hydraulic system of the Ford CL-20 Compact Loader operates both the loader and drive systems. The hydraulic system is powered by a 3-section tandem pump.

The front section (7), Figure 2, is a fixed displacement, gear-type pump which provides hydraulic power to the loader. The remaining two sections of the pump, each of which powers a drive motor to propel the wheels on one side of the loader. These are variable displacement piston type pumps.

Implement Pump and Cooling Circuit

The front pump section is supplied with oil directly from the reservoir (13) at the center port, Figure 2, and supplies oil to the loader control valve (5), where it is directed to the bucket cylinders (1) and (2), or to the lift cylinders (3) and (4).

From the loader control valve, the oil towards the cooler (12); then from the cooler through the filter (6). From the filter, the oil is directed through the outer case of the drive pumps (10) and (11) for cooling and lubrication, then return to the reservoir through the port at the right side.

Charge Pump Circuit

A gerotor type pump is used as a charging pump (15), Figure 3, for the two 18 gpm (68.2 lpm) (15 Imp. gpm) drive pumps (10) and (11). This is a 4 gpm (15.2 lpm) (3.3 Imp. gpm) pump that replenishes the oil lost from the drive circuits through normal internal leakage. The oil is supplied to the charge pump from the port on the left side of the reservoir. An additional line with a check valve (14) maintains a full supply of oil at the drive pumps and charge pump when the unit is shut down. The check valve prevents the charge pressure oil from returning to sump during pump operation. If this line is disassembled the check valve must be reinstalled to allow flow only from the tank. The pump is ported internally to supply make up oil for the left drive pump; the right drive pump oil is supplied by an external tube to the charging section.

HYDRAULIC PUMP REMOVAL

Drive Motor and Pump Circuit

The two 18 gpm (68.2 lpm) (15 Imp. gpm) drive pumps supply power to the drive motors. The rear pump (10), Figure 4, supplies the right drive motor (9). The center pump (11) supplies the left motor (8).

REMOVAL OF ENGINE AND PUMP ASSEMBLY

This step by step procedure outlines the removal of the engine and pump assemblies.

Tools

a. 500 lbs. (226.8 kg) hoist.

b. 10 gallon (37.8 Liters) (8.3 Imp. gal.) drip pan.

c. Oil caddy.

d. Wrenches to 1-1/4 inch.

IMPORTANT: *Fabricate two safety angle iron supports 27 inches (68.6 cm) long, to tape to lift cylinder rods.*

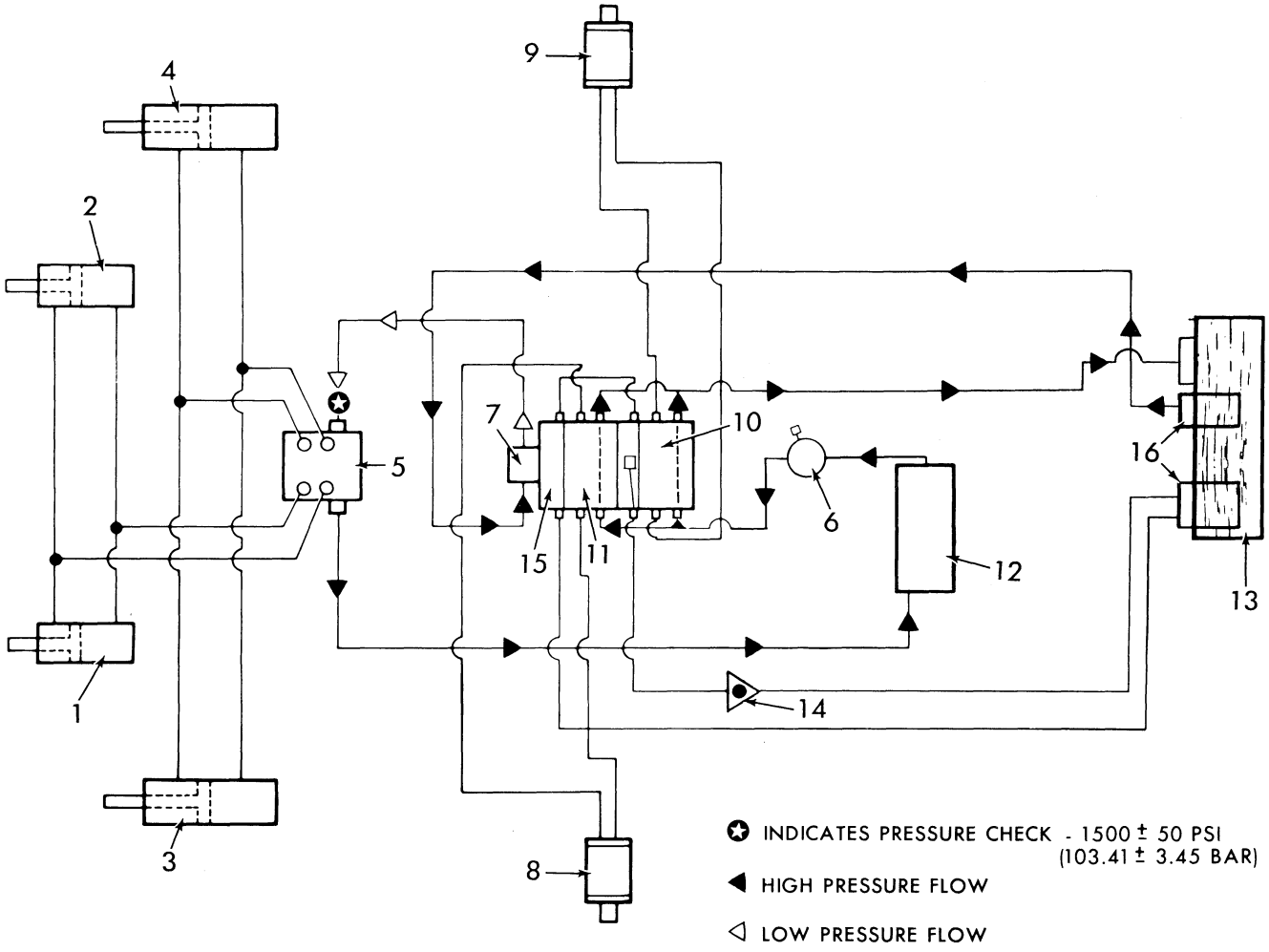


Figure 2
Implement Pump and Cooling Circuit

1. L. H. Bucket Cylinder
2. R. H. Bucket Cylinder
3. L. H. Lift Cylinder
4. R. H. Lift Cylinder
5. Loader Control Valve
6. Filter with Gauge
7. Loader Pump
8. L. H. Drive Motor
9. R. H. Drive Motor
10. R. H. Drive Pump
11. L. H. Drive Pump
12. Hydraulic Oil Cooler
13. Oil Reservoir
14. Check Valve
15. Charge Pump
16. Wire mesh Strainer

HYDRAULIC PUMP DISASSEMBLY

Disassembly

1. Open rear counterweight (9), Figure 1.
2. Remove ROPS if overhead hoist is to be used (1), Figure 1.
3. Place drip pan under machine.
4. Raise loader and tape safety angles in place on lift cylinders.
5. Remove seat platform and floor board (1 - 2), Figure 5.
6. Disconnect battery.
7. Drain and remove oil reservoir and cap all openings (11), Figure 1.
8. Remove and tag four wires from electrical junction strip on engine (2), Figure 7.
9. Remove air cleaner hose at engine (2), Figure 7.
10. Remove oil cooler. Disconnect lines at cooler base and at U tube on pump assemblies (1), Figure 6, and (3), Figure 7.
11. Remove two engine mount bolts.
12. Remove control lever linkage (4), Figure 7, and shock absorber at pump levers.

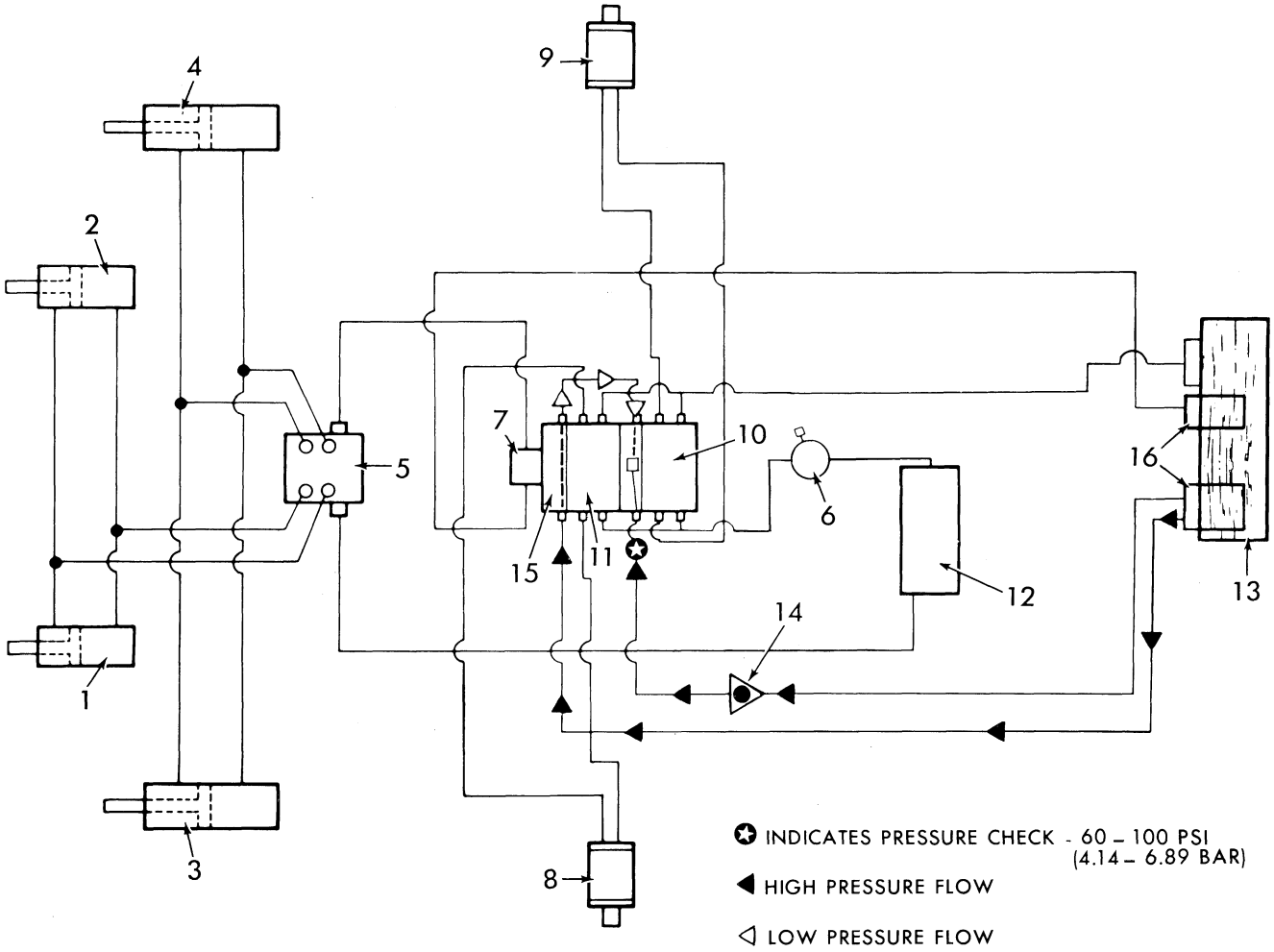


Figure 3
Charge Pump Circuit

1. L. H. Bucket Cylinder
2. R. H. Bucket Cylinder
3. L. H. Lift Cylinder
4. R. H. Lift Cylinder
5. Loader Control Valve
6. Filter with Gauge
7. Loader Pump
8. L. H. Drive Motor
9. R. H. Drive Motor
10. R. H. Drive Pump
11. L. H. Drive Pump
12. Hydraulic Oil Cooler
13. Oil Reservoir
14. Check Valve
15. Charge Pump
16. Wire mesh Strainer

13. Remove hose at implement pump to loader valve (5), Figure 7.
14. Disconnect and cap drive motor supply hoses at the pump (6), Figure 7.
15. Remove choke cable, accelerator cable, and clip for fuel line.
16. Disconnect fuel line at filter.
17. Remove ground wire on engine.
18. Sling chain between engine and pump assembly.
19. Remove front pump support from pump (7), Figure 7, and frame.
20. Lift engine about 10 inches (25.4 cm).
21. Remove electrical cable to starter.
22. Remove engine and pump assembly.
23. Remove bolts in fuel tank and remove tank.

Reassembly

1. Clean dirt from belly pan.
2. Install fuel tank in frame.
3. Lower engine and pump assembly to about 5 inches (12.7 cm) from engine mounts.

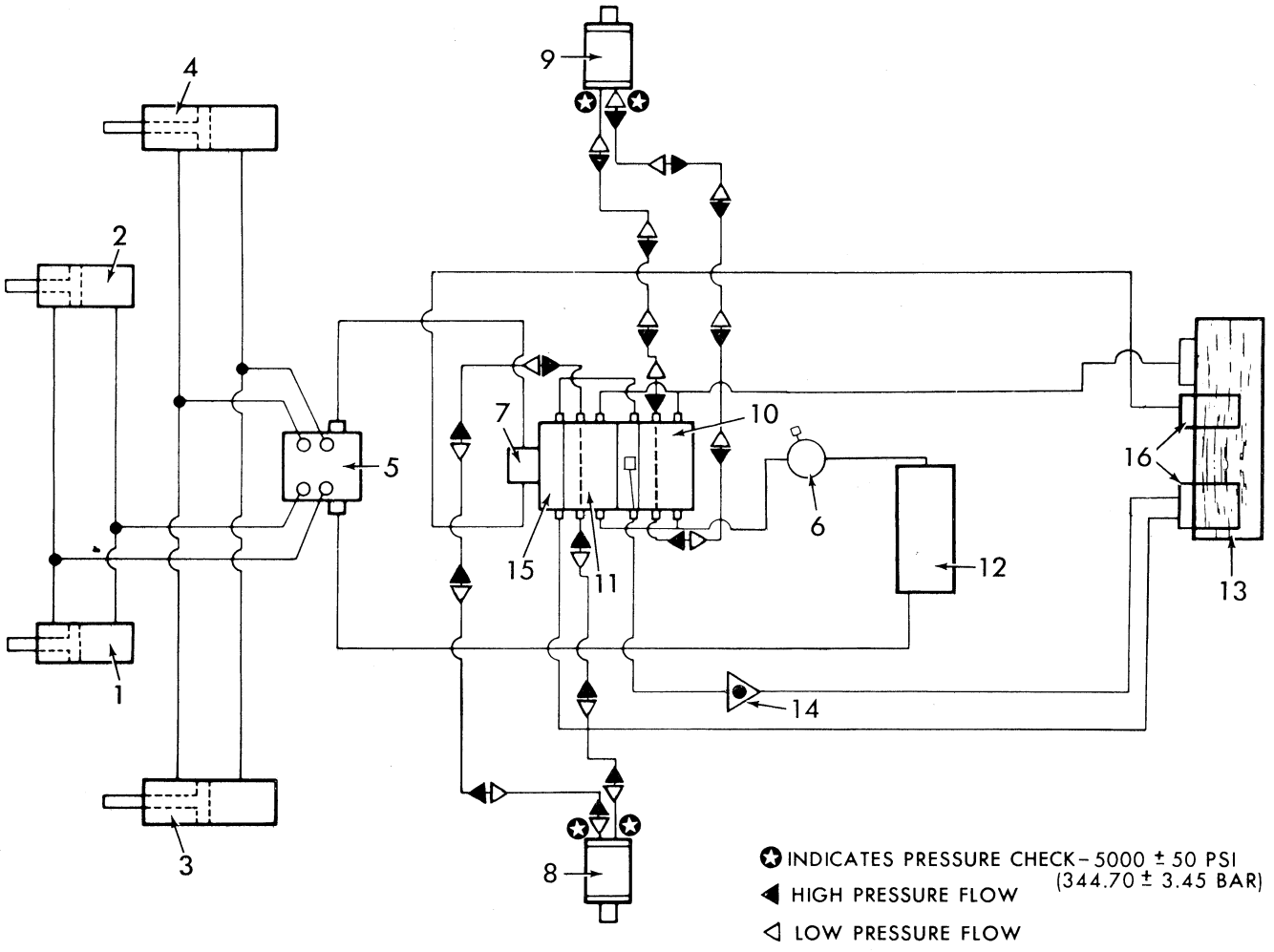


Figure 4
Drive Motor and Pump Circuit

1. L. H. Bucket Cylinder
2. R. H. Bucket Cylinder
3. L. H. Lift Cylinder
4. R. H. Lift Cylinder
5. Loader Control Valve
6. Filter with Gauge
7. Loader Pump
8. L. H. Drive Motor
9. R. H. Drive Motor
10. R. H. Drive Pump
11. L. H. Drive Pump
12. Hydraulic Oil Cooler
13. Oil Reservoir
14. Check Valve
15. Charge Pump
16. Wire mesh Strainer

4. Attach electrical wires to starter.
5. Lower engine, attach engine mounts, and attach air cleaner hose (1), Figure 7.
6. Install front pump support (7), Figure 7.
7. Attach drive motor hoses (6), Figure 7.
8. Attach hose between implement pump and valve (5), Figure 7.
9. Install oil cooler (1), Figure 6 and (3), Figure 7.
10. Attach hose from implement valve to bottom of oil cooler (1), Figure 6.
11. Attach hose from oil cooler to U tube on pump assembly (3), Figure 7.
12. Install two ground wires to engine.
13. Install tagged wiring harness to engine.
14. Install hydraulic tank.
15. Reinstall hoses to tank outlets.
16. Connect hose with check valve between tapped elbow on hydraulic tank and port on top of rear charge pump. Check valve must be placed to allow flow only out from tank (8), Figure 7.

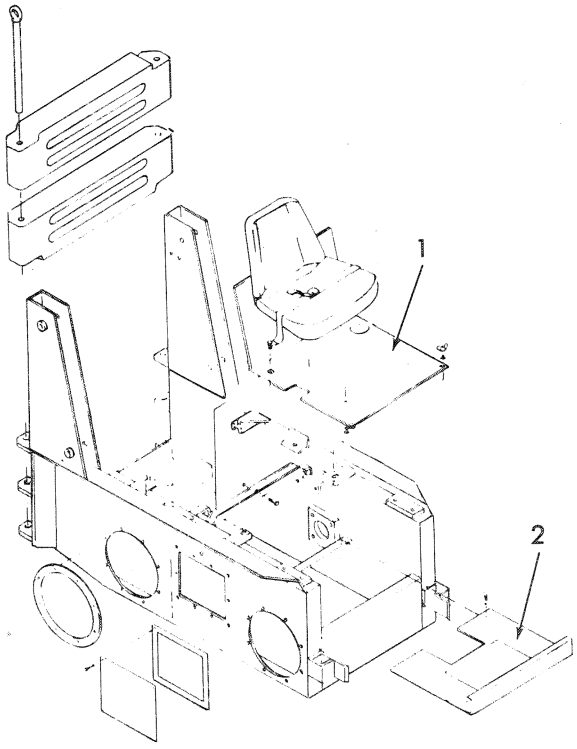


Figure 5
Frame Assembly
1. Seat Support Assembly
2. Floorboard

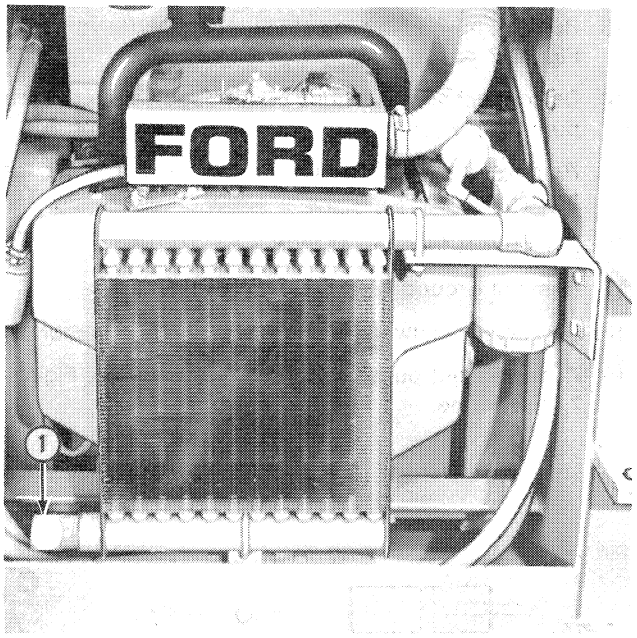


Figure 6
Cooler Hydraulic Line
1. Cooler Hydraulic Line

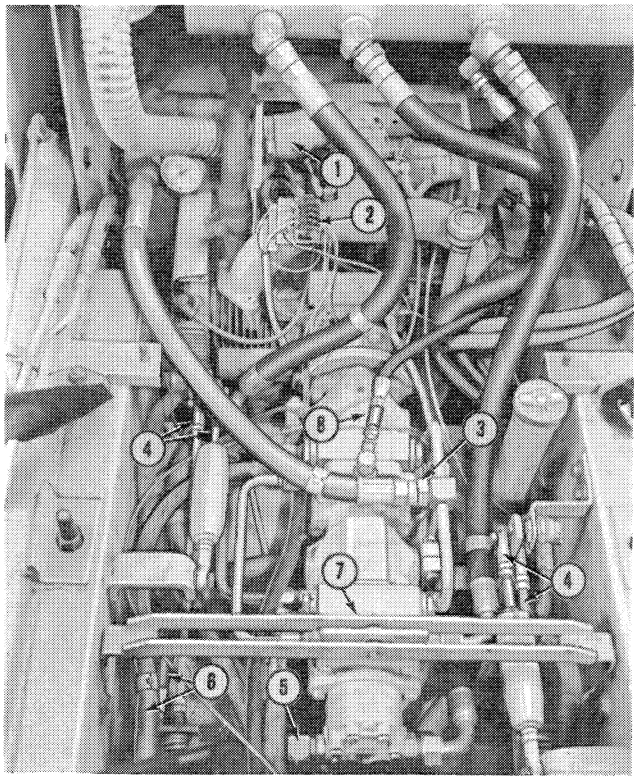


Figure 7
Engine Removal
1. Air Cleaner Hose
2. Electrical Junction
3. Cooler Line
4. Control Linkage
5. Pump to Loader Hose
6. Drive Motor Supply Hoses
7. Pump Support
8. Check Valve

17. Check that all hoses and connectors are tight.
18. Fill hydraulic tank.
19. Connect steering linkage and shock absorbers (4), Figure 7.
20. Install battery cables.
21. Install floor board (2), Figure 5.
22. Install operator's platform (1), Figure 5.
23. Close counterweights.
24. Remove safety supports.
25. Start engine and operate machine - 20 minutes.
26. Check hydraulic oil level.
27. Check drive control lever and safety start switch operation and readjust as necessary.

PRESSURE TESTS AND ADJUSTMENTS

The hydraulic pump must deliver a specified amount of oil through the loader circuits within prescribed pressure limits. If the pump flow and/or system pressure falls below that specified, the efficiency of the hydraulic system will be impaired. If the system is not operating properly, the trouble usually can be traced to specific areas in the system. Because it is sometimes difficult to identify the particular malfunctioning component, hydraulic tests have been designed to assist the mechanic to diagnose trouble areas quickly.

Loader System Relief Pressure Test

The loader system relief pressure is checked with a pressure gauge installed at the inlet elbow of the loader control valve. See Figure 8.

1. Install a 0-5000 psi (0 - 344.7 bar) pressure gauge into the loader control valve pressure line as shown in Figure 8.
2. Operate the engine at maximum speed, then fully retract the bucket cylinders and observe the pressure gauge. The gauge should indicate 1550 ± 50 psi (106.7 ± 3.4 bar).
3. If the pressure reading is not within specifications, adjust the relief valve, Figure 9, by removing the cap nut, loosening the jam and tightening or loosening the adjusting screw as required.
4. When the specified pressure has been obtained, tighten the jam nut to lock the adjusting screw and reinstall the cap nut.
5. Recheck the relief pressure to verify the setting.

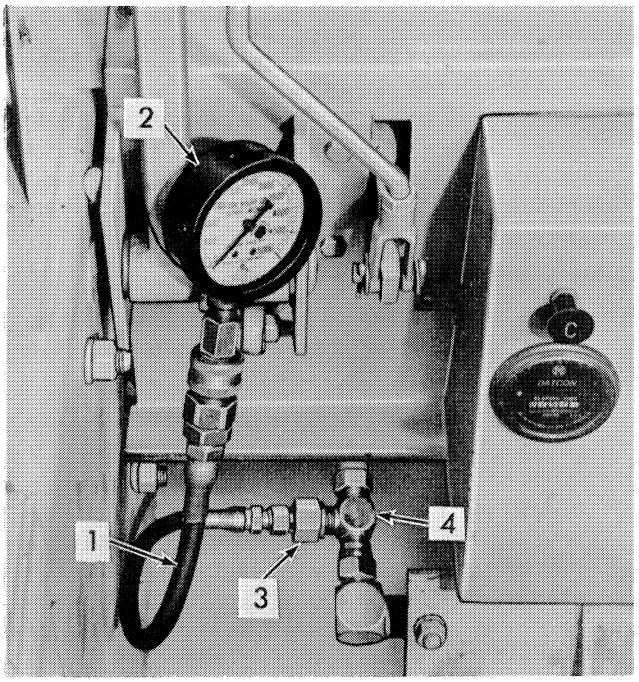


Figure 8
Loader System Relief Pressure Test

1. D-19 Hose
2. 0-5000 psi Gauge
3. D-17 Reducer
4. D-8.1 - Tee Fitting

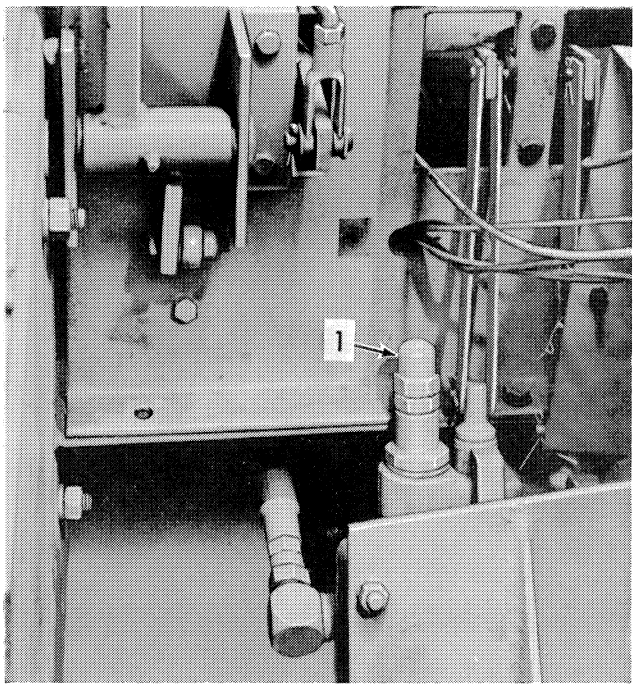


Figure 9
Lift/Tilt Valve

1. Relief Valve

Drive System Charge Pump Pressure Test

The charge pump pressure in the drive pump must be between 60 and 100 psi (4.13 - 6.89 bar) for proper drive operation. A pressure check should be made as shown in Figure 10. Use a D-19 hose, 0 - 500 psi (0 - 34.4 bar) gauge and reducer. Be sure the gauge is installed between the pump and the check valve for proper pressure reading.

Drive System Pressure Test

The drive system pressure is checked at the test port located in the outlet port fittings to which the motor hoses connect.

1. Remove both hoses from the motor to test the pump section. Cap both motor ports and plug both of the hoses.
2. Locate the hose at which the pressure is to be checked and install a 0-5000 psi (0 - 344.7 bar) pressure gauge as shown in Figure 11, the same as used on the CL-30 or CL-40; or install a 1/8 NPT fitting in 90° fitting provided that both hoses are plugged.
3. Start the engine and operate it at full governed rpm. Ease the appropriate control lever fully forward or rearward as required to obtain a pressure reading. The gauge should indicate a pressure of 2000 ± 50 psi (137.8 ± 3.4 bar).
4. If the pressure is not to specification, install a new relief valve assembly as the relief valve is not adjustable.

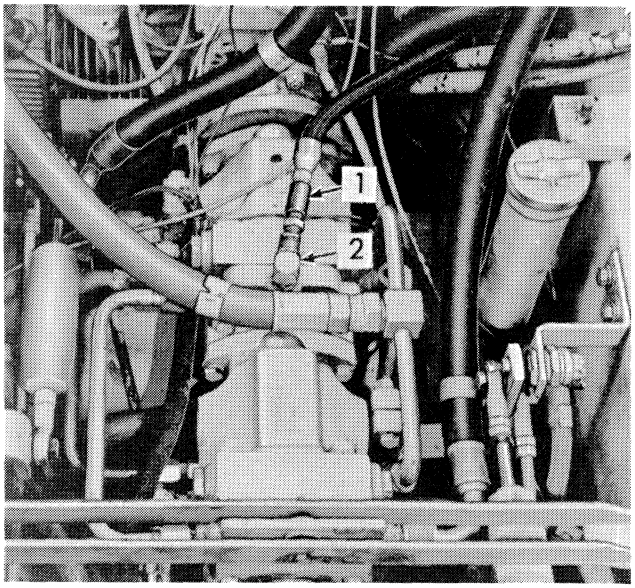


Figure 10
Charge Pump Pressure Check

1. Check Valve
2. Check Charge Pump Pressure Here

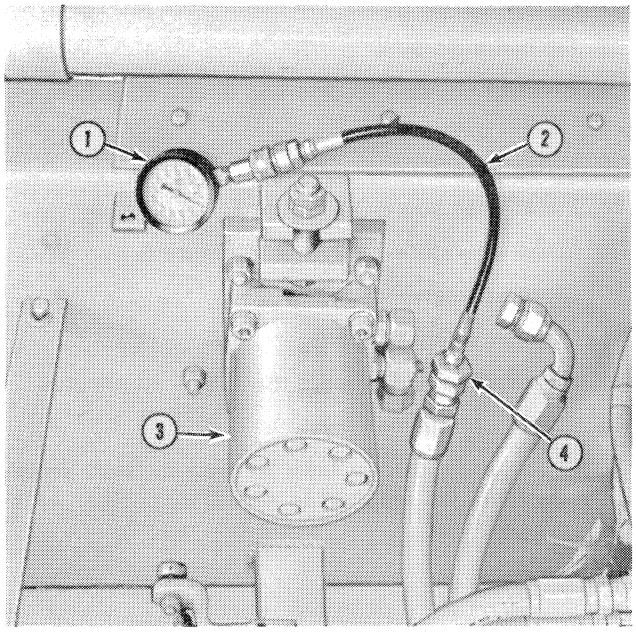


Figure 11
Drive System Pressure Test
(CL-30 and CL-40 Shown)

Cap lines in same manner for CL-20

1. 0-5000 psi Gauge
2. D-19 Hose
3. Drive Motor (R. H.)
4. D-30 Reducer

Hydraulic Pump Performance Test

The hydraulic pump performance test is performed with the loader pump isolated from the lift bucket circuits so the system leakage is not a factor in the test. With the hydraulic tester properly installed, all pumped oil is directed to the hydraulic test unit measured at the desired load and returned to the reservoir as illustrated in Figure 12.

Installing the Hydraulic Tester

1. Disconnect the loader pump high pressure hose from the control valve. Cap fitting in valve, as oil from reservoir will back flow.
2. Connect the hose to the inlet of the hydraulic tester.
3. Connect one end of the other tester hose to the outlet of the hydraulic tester and route the opposite end to the loader reservoir.

IMPORTANT: Do not under any circumstances exceed the system relief pressure of 1550 ± 50 psi (106.7 ± 3.4 bar). Excessive pressure will cause major pump damage.

Pump Performance Test Procedure

NOTE: This test is not recommended for variable displacement drive pumps because the inadvertent reversing of the oil flow may damage the test unit. Further, precise test results are difficult due to variations in engine speeds and swash plate angles, both of which affect pump volume.

1. Set the tester load valve to no load (fully open) and the flow meter at 75 gpm (62.5 Imp. gpm) (283.9 liters per minute).
2. Start the loader engine and adjust the throttle to 2000 rpm.
3. Heat the oil in the system by closing the load valve to 1000 psi (68.9 bar). Reduce the load valve setting to 0 psi when the oil temperature reaches 180° F ± 15° F (82.2 ± 9.4° C).
4. Record the flow meter gpm reading at 2000 engine rpm, 0 psi (0 kg/cm²), and 180° F ± 15° F (82.2 ± 9.4° C).
5. Gradually increase the pressure to 1550 ± 50 psi (106.7 ± 3.4 bar). Correct the reduced engine speed to 2000 rpm by increasing the throttle setting.

   Record the gpm reading on the flow meter at 2000 engine rpm, 1550 ± 50 psi (106.7 ± 3.4 bar) system pressure and 180° F ± 15° F (82.2 ± 9.4° C).

   NOTE: The readings taken at no load psi and 1550 ± 50 psi (106.7 ± 3.4 bar) system pressure must be taken at a constant 2000 engine rpm. If the engine rpm is not constant, the volume readings will not give the desired results when determining pump efficiency.

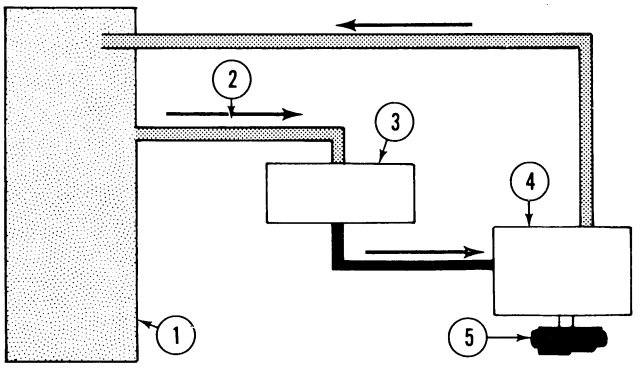


Figure 12
Pump Performance Test

1. Hydraulic Oil Reservoir
2. Oil Flow
3. Pump
4. Hydraulic Tester
5. Loading Valve

6. Determine pump efficiency by dividing the no load psi volume into the volume under 1550 psi (106.7 + 3.4 bar) system pressure. The efficiency must be approximately 65% or more. A pump that is less than 65% efficient will generate sufficient heat to be detrimental to the system and should be replaced.
7. To determine if the loader pump is cavitating (not receiving sufficient oil to charge the pump at all speeds), set the load valve at no load psi and the throttle at 1000 rpm, then record the flow. Increase the speed to 2000 rpm and record the flow. The pump is a positive displacement pump and when it is capable of producing system pressure, the no load volume at 2000 rpm should be twice the no load volume at 1000 rpm. If the volume is not doubled, a restriction in the suction line or filter is evident because sufficient oil is not entering the pump.

Cylinder Packing Leakage Test

If cylinder leakage at the packing is suspected, a simple test can be performed to determine if oil is leaking to the low pressure side of the cylinder.

1. Start the loader and extend or retract the cylinder to its full length.
2. Remove the hose from the low pressure side of the cylinder.
3. Actuate the control lever and hold. This will exert system pressure on the packings.
4. Note the quantity of oil leaking from the hose port of the cylinder.

CAUTION: *Do not get under the bucket or reach through the lift arms when the loader is raised.*

Various factors contribute to the volume of packing leakage. Each of these factors should be considered prior to installation of new packings.

- Leakage increase proportionally with an increase in temperature and pressure.
- Cylinders containing single piston packings will leak more in one direction, depending on the direction of the V-facing of the packing.
- All cylinder packings leak in small quantities for packing-to-cylinder barrel lubricating purposes.
- Cylinder dimensions must be considered because an increase in the surface provides additional area for leakage.

CONTROL VALVES

Valve Removal

The control valve is secured to its mounting plate with mounting bolts. Depending upon the service required, it may not be necessary to remove the complete valve body. The relief valve in the lift bucket control valve, for example, may be serviced with the valve body in place.

1. Relieve hydraulic pressure by actuating the control levers.
2. Disconnect the pump pressure hose at the valve coupling.
3. Tag and disconnect the cylinder-to-valve hoses at the control valve.
4. Disconnect the oil return hose at the valve coupling.

   NOTE: Cap all valve hose openings with suitable plugs or caps to prevent the entry of dirt.

5. Remove the valve mounting bolts and the valve.

Disassembly

The lift bucket control valve and auxiliary control valve are disassembled in a similar manner. Refer to Figure 13.

1. Plug the control valve inlet and outlet ports. Clean the body in a suitable solvent and dry with compressed air.
2. Remove the bonnet, snap ring, and stop disc from the valve body. Remove the parts connected to the spool.
3. Remove all parts connected to the front of the spool.
4. Push the spool into the housing from the front of the valve until the front seal is exposed. Remove the front seal. Pull the spool out of the housing from the front end.

   NOTE: Be careful not to scratch or damage the spool or bore when removing the spool.

5. Remove the back seal.

Inspection

The majority of valve failures occur because of dirt and other foreign matter entering the valve, causing marring and erosion. Inspect the valve body and poppet seats for evidence of scoring and distortion. Minor imperfections can be corrected using crocus cloth, emery cloth, or fine lapping compound. Use extreme care when using burnishing materials to assure that all particles are removed from the valve body.

1. Inspect the spools for scratches, wear, and other damage. Where evidence of distortion, cracks, or damage is evident, install a new control valve assembly. Small scratches may be removed with emery or crocus cloth.
2. Inspect the check valve seals for evidence of damage or wear. Minor imperfections may be removed using a fine lapping compound.
3. Inspect the circuit check valve poppets for distortion or pits; install new poppets if defective.
4. Inspect the relief valve components for breaks, burrs, or distortion that could contribute to malfunctioning. Inspect the relief valve poppet seat for cracks, pits, or other damage. Install new parts as required.
5. Inspect springs for evidence of set, cracks, or other damage, Discard damaged springs.

   NOTE: In attempting to determine the "set" of springs, compare the springs with new springs from parts stock. Compare the height of the new spring to the height of the old spring.

Assembly and Seal Replacement

Coat all parts with clean hydraulic oil to facilitate reassembly and to provide initial lubrication. Use small amounts of petroleum jelly to hold the O-Rings in place during assembly. Always install new O-Rings and spool seals.

1. Thoroughly clean both seal grooves.
2. Replace the spool through the front of the housing, being certain that the end having the bolt hole enters first. Push the spool into the valve until the spool end touches the back seal groove.
3. Insert a new seal in the back groove, being careful that the U-cup of the seal is placed toward the valve body. It is helpful to pinch one side of the seal, causing the seal to bend into a shape slightly smaller than the seal groove in the valve. When the seal has been properly placed in the seal groove, straighten the seal by running a smooth rod around the exposed surface of the seal until there is a perfect fit. To check this, run a finger around the exposed edge of the seal. There should be a smooth, perfect ridge with no kinks.
4. Insert the special tool provided in the seal kit into the valve body from the back, and through the seal until the shoulder of the tool touches the valve housing.
5. Push the spool into the housing from the front, keeping a firm grip on the special tool until the shoulder of the tool touches the valve housing. In pushing the spool through the housing, a slight

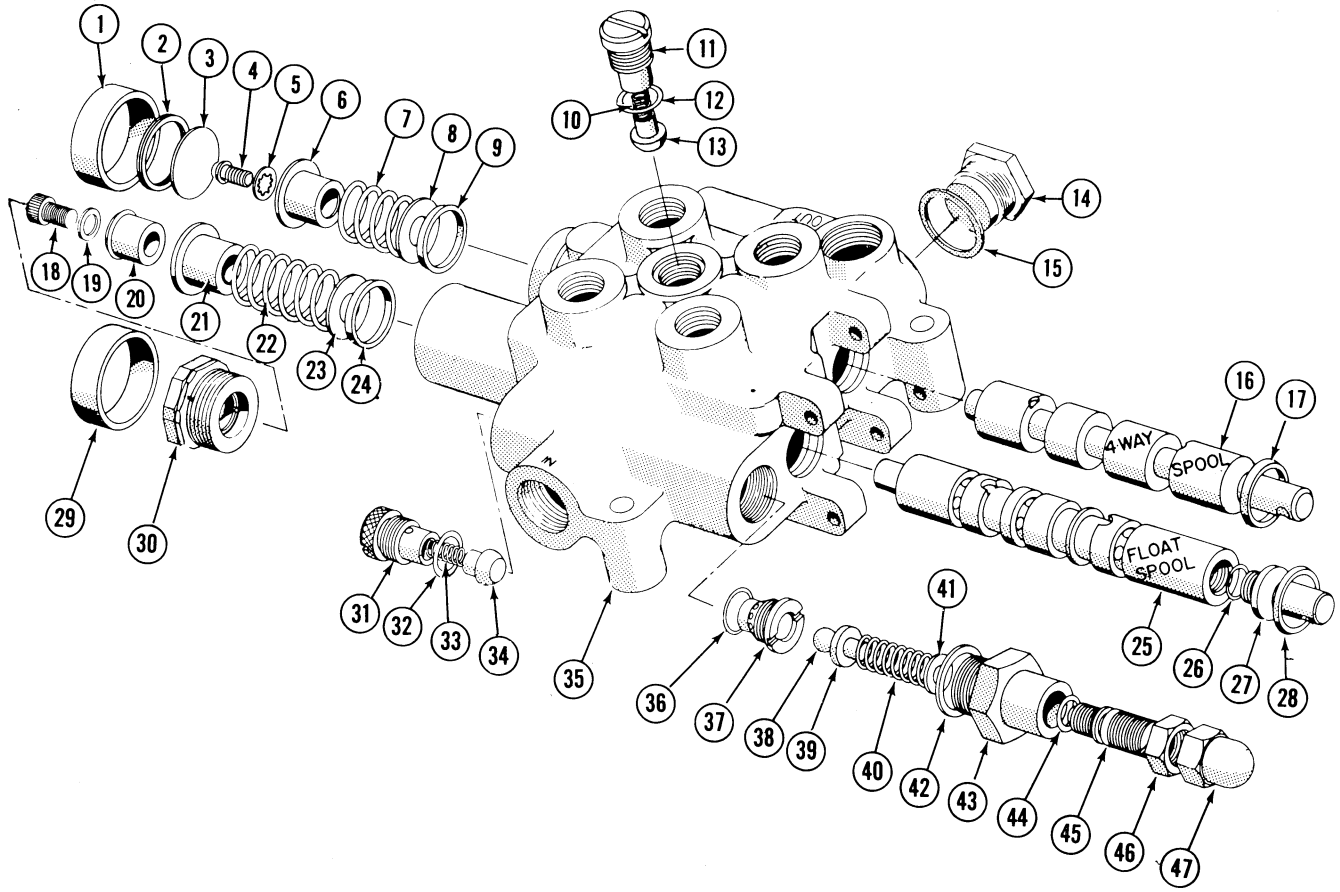


Figure 13
Lift and Tilt Valve Assembly

1. Rubber Bonnet
2. Snap Ring
3. Stop Disc
4. 1/4 in. Bolt
5. Lock Washer
6. Stop Collar
7. Centering Spring
8. Stop Washer
9. Seal
10. Check Poppet Spring
11. Check Ball Plug
12. O-Ring
13. Check Poppet
14. Plug
15. Gasket
16. 4-Way Spool
17. Seal
18. Float Detent Adapter
19. 1/4 in. Lock Washer
20. Float Detent Plunger
21. Float Spring Collar
22. Float Centering Spring
23. Stop Washer
24. Seal
25. Float Spool
26. Float Spool Adapter Spool
27. Float Spool Adapter
28. Seal
29. Rubber Bonnet
30. Float Detent
31. Check Ball Plug
32. O-Ring Plug
33. Check Poppet Spring
34. Check Poppet
35. Housing
36. O-Ring
37. Relief Valve Seat
38. Relief Valve Ball
39. Spacer
40. Relief Spring
41. Washer
42. Gasket
43. Relief Valve Body
44. O-Ring Screw
45. Adjusting Screw
46. Jam Nut
47. Acorn Cap

twisting of the spool and special tool will assist in the movement.

NOTE: Do not push the spool too far, as this may allow the rear seal to enter the grooves of the spool and cut the new seal.

6. Install the front seal in the same manner as described for the rear seal. Be certain the U-cup side of the seal is toward the valve housing.
7. Insert the special tool into the front of the spool bore and with a twisting motion, carefully push the tool through the new seal until the spool shoulder is met. With a twisting motion, push the spool back against the special tool until 1/4 in. of the polished surface of the spool remains exposed at the front of the valve. Remove the special tool from the front of the valve.
8. Reassemble all parts removed from the front of the spool.
9. Reassemble parts bolted to the spool. Tighten the bolt to 10 lbs. ft. (1.38 kgm) of torque. Reinstall the stop disc, snap ring, and bonnet.

Installation

1. Secure the control valve to the frame using the mounting bolts previously removed. Tighten the mounting bolts securely.

   NOTE: Be careful not to overtighten the mounting bolts. Severe stress on the valve body may cause distortion in the internal passages of the body and contribute to an early failure.

2. Connect the high pressure hoses securely to their respective ports. Connect the return hose to the outlet port.
3. Start the loader engine and actuate the control levers to purge the system of air.

   IMPORTANT: Check all hydraulic connections for leakage. If leakage is observed, shut off the loader engine, relieve all hydraulic pressure, and tighten the connections. Do not tighten any hydraulic connections while the system is under pressure.

4. Perform the system relief valve pressure check when the lift bucket valve has been overhauled.

CYLINDERS

The lift and bucket cylinders are 2-1/2 in. (6.35 cm) double-acting. The lift and bucket cylinders are identical in construction and vary only in length. The cylinders may be repacked without completely removing the cylinder from the machine.

Removal

All loader cylinders are easily removed from the loader frame. Basic procedures to be followed in the removal of lift and bucket cylinders are as follows:

1. Make sure the loader bucket and lift arms are properly supported and in a stable position to prevent movement when the cylinders are removed.
2. With the loader engine shut off, actuate the control levers to eliminate pressure in the system.

   NOTE: For the purpose of cleanliness, the cylinders should be removed from the loader for servicing. However, the collar nut may be loosened prior to removing the cylinder from its anchor position. Because of the high torques required to secure the collar nut, considerable force is required to loosen it. The cylinder anchor points and pins installed provide a good anchor position while exerting force.

3. Disconnect the hoses at the cylinder. Cap or plug the cylinder ports and hose ends to prevent the entry of dirt or foreign matter.
4. Remove the hex bolts and pins anchoring the rod and base end of the cylinder to the loader.

   IMPORTANT: Use care in handling of the cylinders. Dropping and mishandling can cause severe damage to the cylinder barrel and subsequently affect cylinder operation.

5. Clean the external surface of the cylinder of dirt, grease, and other material. Use a suitable cleaning solvent and dry the cylinder with compressed air.

Disassembly

Lift and bucket cylinders are identical in construction, and disassembly of the cylinders is the same. Refer to the exploded view, Figure 14.

1. If not previously loosened, secure the cylinder in a vise and loosen the collar nut, using a spanner or chain wrench.

   NOTE: To prevent cylinder wall distortion, the cylinder must be secured in a vise as near as possible to the closed end.

2. Remove the piston rod assembly from the cylinder barrel. Be careful not to damage the chrome finish of the piston rod.

   NOTE: Removal is normally accomplished by inserting a bar through the rod end and with a twisting motion, pull the rod out of the barrel. It may become necessary to use a jack or mechanical force to remove the rod and packing.

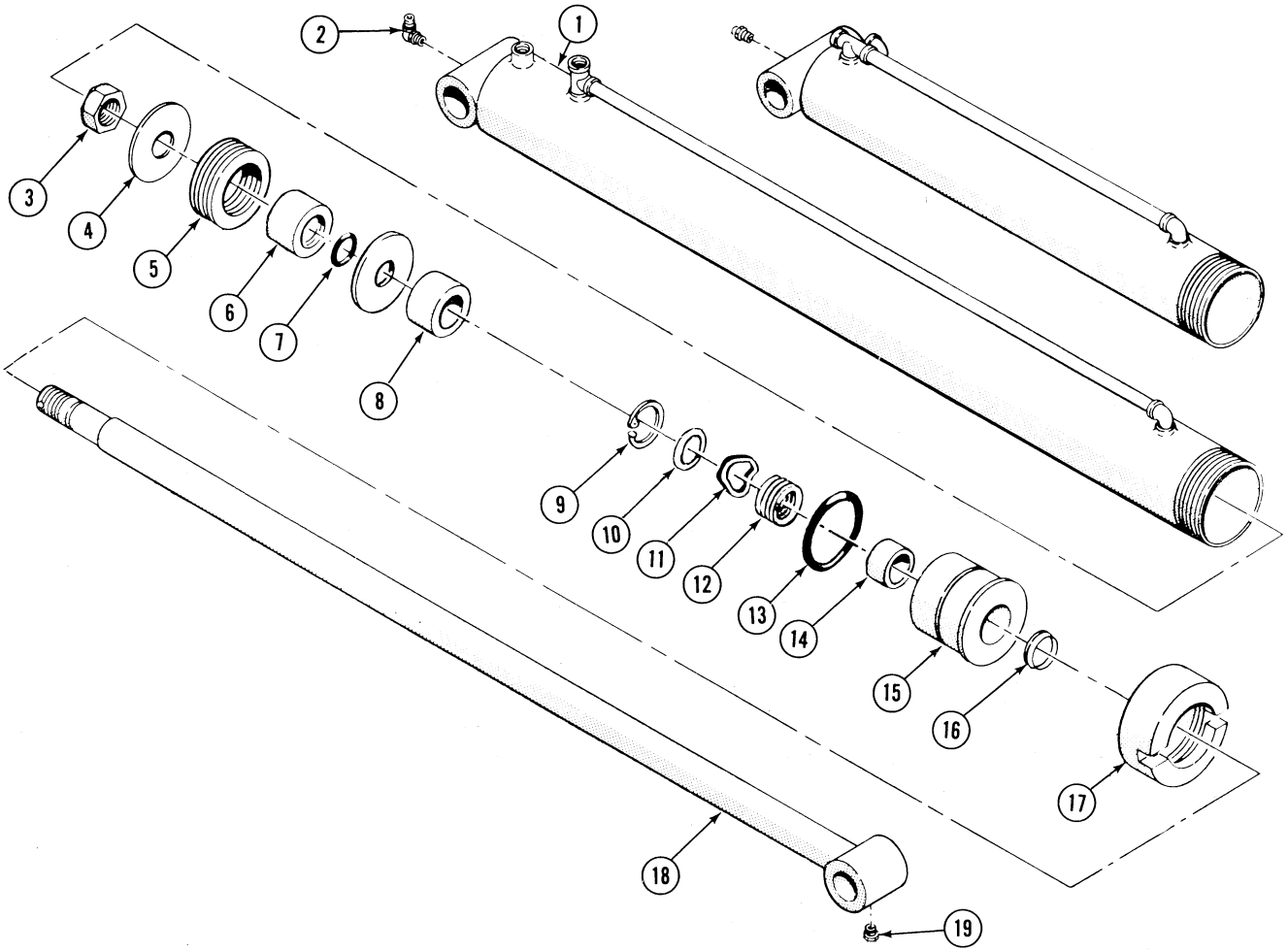


Figure 14
Lift and Tilt Cylinders

1. Cylinder Tube
2. Lube Fitting
3. Bushing
4. Retainer
5. Piston Packing
6. Piston
7. Piston O-Ring
8. Spacer
9. Lock Ring
10. Washer
11. Washer
12. Gland Packing
13. Gland O-Ring
14. Bushing
15. Gland
16. Wiper Ring
17. Collar
18. Shaft
19. Lube Fitting

3. Remove the piston nut by securing the rod trunnion in a vise, support the piston, then remove the nut.
4. Remove the retainer, piston packing, piston O-Ring and retainer from the cylinder rod.
5. Slide the spacer and gland off the cylinder rod.
6. Remove the lock ring, washers and gland packing from the gland.
7. Remove the cylinder rod wiper ring from the gland.
8. Slide the collar nut off the cylinder rod.

Inspection and Repair

A careful inspection of all cylinder components is essential for a satisfactory repair. Small nicks, burrs, scratches, and other damage can be hidden by oil film.

1. Clean all of the cylinder components in a suitable solvent and dry with compressed air.
2. Inspect the cylinder rod for straightness, scoring, thread condition, burrs, or excessive wear. Minor damage can be corrected. Using crocus cloth or emery cloth, or a fine file.
3. Examine the packing glands for cracks, scores, burrs, and other damage. Install a new packing gland if there is evidence of non-repairable damage.
4. Examine gland packings for distortion, frayed edges, or excessive wear. Discard packings that show evidence of leaking and/or other damage.
5. Inspect the spacers and washers for cracks, scores,burrs, flatness, and other damage. Install new parts where required.
6. Examine the piston packing assembly for damage. Packing assemblies showing signs of damage such as frayed edges, distortion, crimping, or excessive wear should be discarded and new assemblies installed.
7. Inspect the cylinder barrel for scoring, thread condition, dents, or other damage. Replace damaged cylinder barrels.
8. Carefully check O-Ring grooves for burrs and inspect the wiper seal in the packing nut. If wear or damage is indicated, install a new wiper.

Assembly

Reassembly procedures are most important in obtaining effective repair. Use care in the assembly of the cylinder and components. Complete packing sets should be installed when cylinders are reassembled, unless the existing packings have had little or no use.

NOTE: The piston packings and gland packings with required O-Rings are serviced as a repair kit.

1. Lubricate the piston rod with hydraulic oil to aid in easier installation of the packing nut, wiper, gland, and gland packing.
2. Slide the collar, threads toward piston end, on the piston rod.
3. Slide the gland, wiper, bushing and packing installed, on the rod. Make sure the packing is properly positioned.
4. Install the gland washers and lock ring.
5. Slide the spacer and retainer onto the cylinder rod. Install the piston, piston packing and piston O-Ring as an assembly on the cylinder rod.
6. Install the retainer and secure the components with the piston packing lock nut. Torque the assembly to 150 - 175 lbs. ft. (20.74 - 24.20 kgm).
7. Lubricate the piston end of the rod assembly and the cylinder tube with hydraulic oil. Position the piston in the cylinder tube and carefully start the lips of the packing into the tube. Slowly force the piston into the cylinder tube using a rotating or wobbling motion. With the cylinder held vertically, push the piston and rod into the cylinder.
8. Push the gland into the cylinder so that the O-Ring is not damaged.
9. Thread the collar nut on the cylinder and tighten to a torque of 125 - 150 lbs. ft. (17.29 - 20.74 kgm).

Installation

1. Position both the bucket and lift cylinders with the cylinder rod end toward the front of the loader. Secure the cylinders in their respective locations with the retaining bolts previously removed.

   IMPORTANT: Before securing the cylinders to their anchoring positions, be sure the hose ports on lift cylinders are facing up and hose ports on bucket cylinders are facing down.

2. Connect the cylinder hoses to the cylinders.
3. Start the loader and operate the engine and loader at 1200 to 1500 rpm to purge the system of air.
4. Check all hydraulic connections for leakage. If leakage is observed, shut off the engine, release all hydraulic pressure and tighten the connection.

CL-20 POWER TRAIN

The components of the CL-20 power train are identified in Figure 15.

TROUBLESHOOTING

Possible Pump Trouble	Causes	Remedies
1. Noisy pump caused by cavitation.	a. Oil supply low. b. Oil too heavy. c. Oil filter plugged. d. Suction line plugged or too small.	a. Fill reservoir. b. Change to proper viscosity. c. Clean filters. d. Clean line and check for size.
2. Oil heating.	a. Oil supply low. b. Contaminated oil. c. Setting of relief valve too high or too low. d. Oil in system too light.	a. Fill reservoir. b. Drain reservoir and refill with clean oil. c. Set to correct pressure. d. Drain reservoir and refill with proper viscosity oil.
3. Shaft seal leakage.	a. Worn shaft seal. b. Broken diaphragm seal or back-up gasket c. Bearings out of position. d. Excessive internal wear.	a. Replace shaft seal. b., c., d. If replacing the shaft seal does not stop leakage the pump should be disassembled and checked for items b., c. and d.
4. Foaming oil.	a. Low oil level. b. Air leaking into suction line. C. Wrong kind of oil.	a. Fill reservoir. b. Tighten fittings. c. Drain and fill reservoir with non-foaming oil.

SERVICE INSTRUCTIONS FOR GEAR PUMP ASSEMBLY

Disassembly

1. Clean outside of pump thoroughly.
2. Clamp pump in vise, shaft down.
3. Remove tie bolts (#2) 4 each, Figure 16.
4. Remove tie bolts (#1 and #3) 2 each.
5. Use sharp tool to mark across front plate, body and back plate. This will assure proper reassembly.
6. Remove pump from vise — Hold pump in hands and bump shaft against wooden block to separate front plate (#15) from back plate (#4). Body (#6) will remain with either front plate or back plate.
7. To separate body from section it remains with, place drive gear (#8) in bearing and tap protruding end with plastic hammer.
8. Remove O-Ring (#5) from back plate assembly.
9. Remove diaphragm (#9) from front plate by prying with sharp tool.
10. Remove spring (#13) and steel ball (#14) from front plate.
11. Lift back-up gasket (#10) and protector gasket (#11) from front plate.
12. Lift diaphragm seal (#12) from front plate.
13. Remove shaft seal (#16) from front plate.

INSPECT PARTS FOR WEAR

General

1. Clean and dry all parts.
2. Remove nicks and burrs from all parts with emery cloth.

Gear Assembly

1. Inspect drive gear shaft (#8) for broken splines.
2. Inspect both the drive gear and idler gear shafts at bearing points and seal areas for rough surfaces and excessive wear.
3. If shafts measure less than .685 in. (17.39 mm) in bearing area the gear assembly should be replaced. (One gear assembly may be replaced separately; shafts and gears are available as assemblies only.)
4. Inspect gear face for scoring and excessive wear.
5. If gear width is below the following figures — gear assembly should be replaced.

	Inch	mm
Pump Disp.	.602	15.29
Gear Width	.441	10.99

6. Assure that snap rings are in grooves on either side of drive and idler gears.
7. If edge of gear teeth are sharp — break edge with emery cloth.

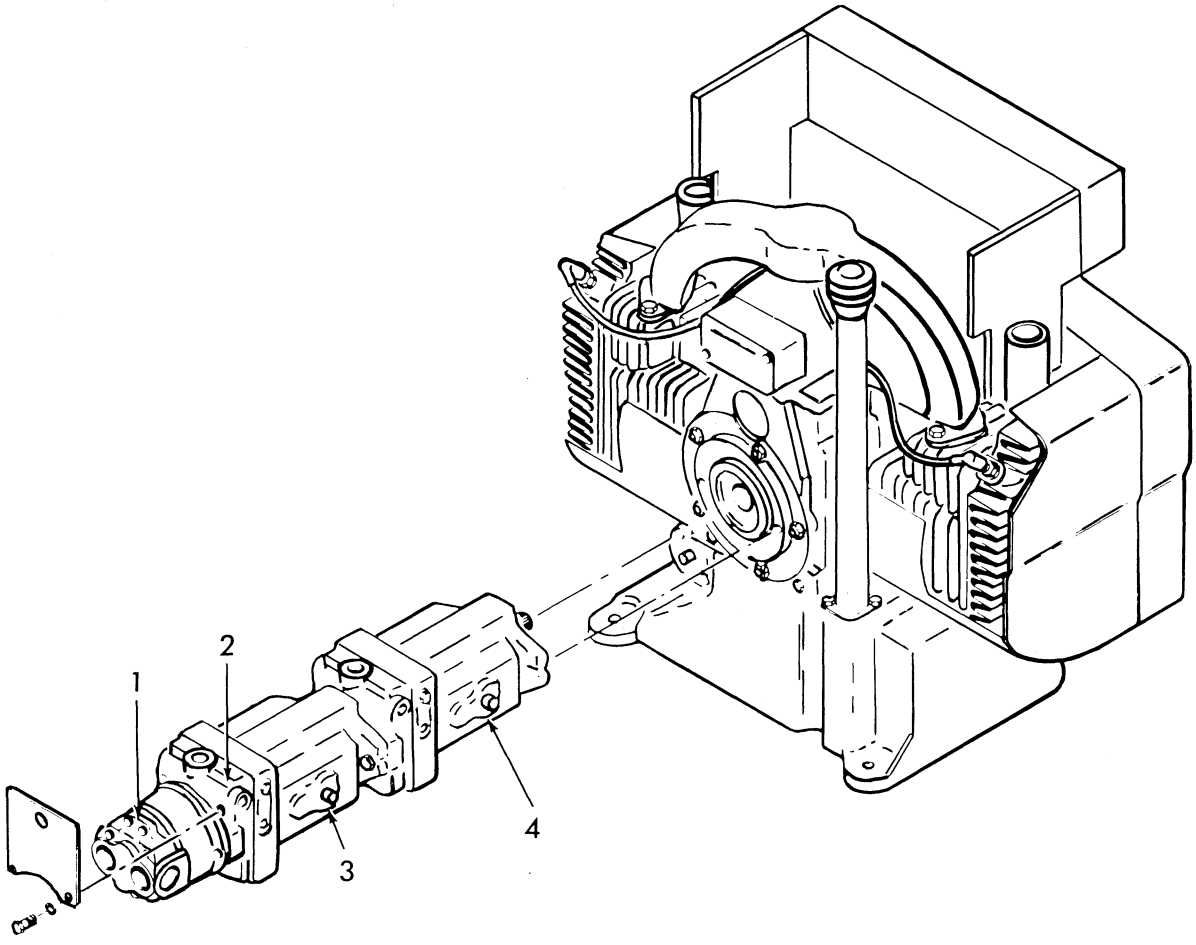


Figure 15
CL-20 Power Train

1. Loader Pump
2. Charge Pump
3. Drive Pump - Center
4. Drive Pump - Engine End