Testing And Adjusting

Introduction

Reference: This supplement contains the Specifications, Systems Operation, and Testing And Adjusting for the components and systems that are different than those of the D6H Steering Clutch and Brake Machines. For complete Specifications with illustrations, Systems Operation, and Testing and Adjusting Procedures for components and systems not shown in this supplement, make reference to D6H Service Manual, Form No. SENR3235.

Implement and Steering/Hydraulic System Testing and Adjusting

WARNING

Sudden movement of the machine or release of oil under pressure can cause injury to persons on or near the machine. To prevent possible injury, do the procedure that follows before testing and adjusting the implement and steering / hydraulic system.

1. Move the machine to a smooth horizontal location. Move away from working machines and personnel and lower implements to the ground.

2. Permit only one operator on the machine. Keep all other personnel either away from the machine or in view of the operator.

3. Engage the parking brake. With the parking brake engaged the steering tiller handle can not be moved. If the parking brake is OFF and the engine is running, the machine will turn when the steering tiller handle is moved. Engage the service brakes to prevent machine movement.

4. Stop the engine.

5. Move the implement control levers to all positions to release the pressure in the implement and steering / hydraulic system.

6. Carefully loosen the filler cap on the hydraulic tank to release the pressure in the tank.

7. Make sure all hydraulic pressure is released before any fitting, hose or component is loosened, tightened, removed or adjusted.

8. Tighten the filler cap on the hydraulic tank.

9. The pressure in the system has now been released and lines or components can be removed.

NOTE: During a diagnosis of the implement and steering / hydraulic system, remember that correct oil flow and pressure are necessary for correct operation. Oil pressure is caused by resistance to the flow of oil.

Procedure

When defining an implement and steering / hydraulic system problem, the following procedure should be followed. First, do Visual Checks. If when complete the problem has not been identified, do operation checks. If the problem is still not fully understood, do Instrument Tests. This procedure will help identify implement and steering / hydraulic system problems. As soon as the problem is defined, go to Troubleshooting. The Troubleshooting section will list the probable causes of a known problem. Since there may be more than one cause for a problem, the Troubleshooting section may suggest specific inspections or instrument tests be done. These inspections and tests will help identify which of the causes is most probable.

Use this as a reference for the location and correction of problems in the implement and steering / hydraulic system. When more checks are necessary, use the 8T5320 Hydraulic Test Group and the 4C4890 / 4C4892 Fitting Groups, a stop watch, a magnet, a thermometer and a mm (inch) ruler for basic tests to measure:

1. The opening pressure of the pressure limiter valves for the implement circuits and pump cut-off valve for the steering circuit. Pressure limiter valve and pump cut-off valve pressures that are too low will cause a decrease in the lift, dig, rip and steering characteristics of the machine. Opening pressures that are too high will cause a decrease in the life of hoses and components.
2. Drift rates in the implement circuits: Circuit drift is caused by leakage past cylinder pistons, control valve spools, load check valves or make-up valves. Excessive drift can be caused by problem with any one or combination of components.
3. Cycle times in the implement circuits: Cycle times that are longer than shown in the charts are the result of leakage, pump wear and/or pump speed (rpm). If the basic operation checks indicate excessive circuit leakage, then pressure tests are needed to determine which components have a problem.

NOTE: Locations of the pressure taps and procedures for testing and adjusting are given in the Implement and Steering / Hydraulic System, Testing and Adjusting.

Visual Checks

WARNING

Do not check for leaks with your hands. Pin hole (very small) leaks can result in a high velocity oil stream that will be invisible close to the hose. This oil can penetrate the skin and cause personal injury. Use cardboard or paper to locate pin hole leaks in pump or motor hoses during steer stall condition.

A visual inspection of the implement and steering / hydraulic system and its components is the first step when a diagnosis of a problem is made. Stop the engine, lower the blade and the ripper to the ground. To remove the tank filler cap, slowly turn the filler cap until it is loose. If oil comes out the bleed hole, let the tank pressure lower before the filler cap is removed. Make the following inspections:

1. Measure the oil level.

2. Look for air in the oil that is in the tank. Do this immediately after the machine is stopped. Use a clear bottle or container to get a sample of the oil. Look for air bubbles in the oil that is in the bottle.

3. Remove the filter elements and look for particles removed from the oil by the filter element. A magnet will separate ferrous particles from nonferrous particles (piston rings, O-ring seals, etc.).

4. Inspect all oil lines and connections for damage or leaks.

5. Inspect control linkage for bent, broken or damaged components.

Troubleshooting

Problem Checklist

Hydraulic System Problem List:

1. The temperature of the oil is too hot.
2. Pump makes unusual noise, the cylinder rods do not move smoothly and there are air bubbles in the oil.
3. There is a pause before pressure is reached in all circuits.
4. Hydraulic oil transfer into power train oil.
5. One or more of the implement control levers or the steering handle moves (when not in use) when another one of the control levers or steering handle is moved.

Steering Problem list:

1. Machine will not turn in either direction.
2. Machine will not turn in one direction.
3. Slow turning in either direction.
4. Machine turns when steering control handle is released.

Implement Problem list:

1. Implement cycle times are too slow (machine not being steered).
2. Too much implement drift.
3. Implement cycle times are too fast.
4. Excessive pause time at ground line when powering blade down.

Hydraulic System:

Problem 1: The temperature of the oil is too hot.

Probable Cause:

1. Oil cooler core plugged or no air flow over the core.
2. The crossover or main relief settings are too low or the pump cut-off pressure is set too high.
3. There is a restriction in an oil passage.
4. The cooler bypass valve is stuck open.
5. The oil level is too low.
6. Margin spool in compensator valve set too high.
7. Charging valve is stuck closed.
8. Control stem partially shifted.

Problem 2: Pump makes unusual noise, the cylinder rods do not move smoothly and there are air bubbles in the oil.

Probable Cause:

1. Oil aeration from a loose connection or restriction of the oil line on the inlet side of pump.
2. The oil level is too low.
3. The cylinders and lines are not properly purged of air.
4. Porous welds or broken baffles in hydraulic tank.

Problem 3: There is a pause before pressure is reached in all circuits.

Probable Cause:

1. Air in signal network.
2. Margin spool in compensator valve is set too low.
3. Orifice to flow control valve restricted.

Problem 4: Hydraulic oil transfer into power train oil.

Probable Cause:

1. Excessive pump seal leak into flywheel housing.
2. Excessive motor seal leak into bevel gear case.

Problem 5: One or more of the implement control levers or the steering handle moves (when not in use) when another one of the control levers or steering handle is moved.

Probable Cause:

1. Linkage interference.
2. Plug in the end of a control valve spool is missing.
3. End cover drain holes do not intersect.

Steering:

Problem 1: Machine will not turn in either direction.

Probable Cause:

1. Steering control linkage not adjusted correctly.
2. Pump will not develop steering pressure:

A. Signal line is damaged.
B. Shuttle valve will not move (stuck) or has failed seals.
C. Flow control sleeve behind flow control spring has failed seals.
D. Plug in end of steering valve spool is leaking.
E. Signal line orifice is plugged.
F. Main relief valve is stuck open, has failed seals or relief setting is too low.
G. Margin spool, pressure cutoff spool or piston in pressure cutoff spool is stuck.
H. Crossover relief valves set too low or have failed seals.
I. Pump has damage.

3. Steering motor has damage.
4. Mechanical damage in steering differential.

Problem 2: Machine will not turn in one direction.

Probable Cause:

1. Steering control linkage not adjusted correctly.
2. Crossover relief valves are damaged, sticking open, have failed seals or are set too low.
3. A steering control valve makeup valve is stuck open or has failed seals.
4. Counterbalance valve stem sticking.
5. Motor port plate broken or scored.
6. Mechanical damage in steering differential.

Problem 3: Slow turning in either direction.

Probable Cause:

1. Steering control linkage not adjusted correctly.
2. Margin spool in compensator valve is set too low or stuck.
3. Crossover relief valves are damaged, sticking open, have failed seals or are set too low.
4. Main relief valve is stuck open, has failed seals or relief setting is too low.
5. A steering control valve makeup valve is stuck open or has failed seals.
6. Signal line orifice to pump restricted.

7. Internal signal leak:

A. Shuttle valve will not move (stuck) or has failed seals.
B. Flow control sleeve behind flow control spring has failed seals.
C. Plug in end of steering valve spool is leaking.

8. Pressure cutoff spool in compensator valve is set too low.
9. Excessive internal leakage in pump and/or steering motor.

Problem 4: Machine turns when steering control handle is released.

Probable Cause:

1. Steering control linkage loose or not correctly adjusted.
2. Steering valve spool is sticky.

Implement:

Problem 1: Implement cycle times are too slow (machine not being steered).

Probable Cause:

1. Implement valve spool is not fully shifted.
2. Margin spool in compensator valve set too low.
3. Blockage or leakage in signal network:

A. Shuttle valve stuck open or has failed seals.
B. Flow control sleeve behind flow control spring has failed seals.
C. Plug in end of a control valve spool has a failed seal.
D. Pressure limiter poppet valve leaking or failed seals on valve body.

Problem 2: Too much implement drift.

Probable Cause:

(1). The valve spool in the control valve is not correctly centered. This problem can be caused by a broken spring or sticky valve spool or misadjusted linkage.
2. Leakage in and around the seals on the piston in the cylinder(s) affected.
3. Leakage past a makeup valve or failed makeup valve seals for the affected circuit (bulldozer lift and ripper lift control valves).
4. The quick-drop valve or end of stroke bypasses may be leaking.

Problem 3: Implement cycle times are too fast.

Probable Cause:

1. Margin spool in compensator valve set too high.
2. Flow control valve(s) failed.

Problem 4: Excessive pause time at ground line when powering blade down.

Probable Cause:

1. Quick-drop not operating correctly.
2. Charging valve stuck open.
3. Makeup valve stuck open.

Mechanic's Check And Data Sheet
For Use When Troubleshooting
Steering System Hydraulic Problems

Tractor Serial # _____
Date _____
Service Meter Hours _____

☐ Oil Levels

☐ Linkage Correctly Adjusted

☐ Steering Turn Diameter

	Steer Left	Steer Right
	_____ m/ft.	_____ m/ft.
(with blade lift)	_____ m/ft.	_____ m/ft.

☐ Low Pressure Standby

_____ kPa/psi

☐ Margin Pressure

_____ kPa/psi

☐ Engine No-Load Maximum RPM

_____ rpm

☐ Steer Stall Test

	Steer Left	Steer Right
Pump Discharge Pressure	= _____ kPa/psi	_____ kPa/psi
No-Load Engine RPM (maximum)	= _____ rpm	_____ rpm
Steer Stall Engine RPM	= _____ rpm	_____ rpm
Difference Between No-Load RPM and Steer Stall RPM	= _____ Δ rpm	_____ Δ rpm
Pump Differential Pressure (Δ P) At Steer Stall	= _____ Δ kPa/psi	_____ Δ kPa/psi

Implement Operation Checks

WARNING

Make reference to WARNING on the first page of the Implement and Steering/Hydraulic System Testing and Adjusting section.

The operation checks can be used to find leakage in the system. They can also be used to find a bad valve, pump or motor. The speed of rod movement when the cylinders move can be used to check the condition of the cylinders and the pump.

Raise and lower the blade and ripper several times. Operate the tilt control valve until the tilt cylinder is fully extended and retracted several times.

1. Watch the cylinders as they are extended and retracted. Movement must be smooth and regular.

2. Check for noise from the pump.

3. Check for the sound of the pressure limiter valves opening. The opening pressures of the pressure limiter valves are given in the subject, Pressure Tests of the Pressure Limiter Valves.

Cylinder Speed Tests

The oil in the system must be SAE 10 and at a temperature of 65 ± 3°C (150 ± 5°F) to get correct results. All speed tests are made with the engine at maximum rpm.

System speeds that are the same as those given in the chart is an indication that the circuit operation is normal. The pressure limiter valves must be tested to be sure that the opening pressure of each is correct. (See chart for settings).

If all the cylinder speeds are slow, check the steering circuit to see if the problem is in the pump or steering motor.

Bulldozer Blade	Bulldozer Tilt Cylinder Speed Test	Speed In Seconds
S & U	FULL TILT RIGHT to FULL TILT LEFT.	2.4 (Max.)
A		1.8 (Max.)

Bulldozer Blade	Bulldozer Lift Cylinder Speed Test	Speed In Seconds
S, U & A	FULL DOWN to FULL UP	4.3 (Max.)
	FULL UP to FULL DOWN (quick-drop)	5.6 (Max.)

Ripper Cylinders Speed Test	Speed In Seconds
FULL DOWN to FULL UP (w/o shank)	2.8 (Max.)

If the cylinder speeds are not correct:

1. If only one of the cylinder speeds is slow, check that circuit for cylinder drift.

2. If all the cylinder speeds are slow, check the steering circuit to see if the pump signal is plugged or if the pump has a problem.

Drift Tests for Bulldozer Lift Cylinders

Bulldozer Lift Cylinder Drift			
Oil Temperature	28° to 48°C (83° to 118°F)	49° to 68°C (120° to 155°F)	69° to 88°C (156° to 190°F)
Must not move more than 38.0 mm (1.5 in)	5 minutes	2.7 minutes	1.7 minutes

Test No. 1:

Raise the front of the machine off the ground by lowering a level blade. Put the control lever in HOLD position. Shut off the engine and watch the lift cylinder rods for movement.

Test No. 2:

Raise the front of the machine off the ground by lowering a level blade. Shut off the engine. Hold the lift control lever in LOWER position. Watch the lift cylinder rods for movement.

Test No. 3:

Raise the blade off the ground. Put the control lever in HOLD position. Shut off the engine and watch the lift cylinder rods for movement.

Test No. 4:

Raise the blade off the ground. Shut off the engine. Hold the lift control lever in RAISE position. Watch the lift cylinder rods for movement.

Test Results	Most Probable Causes
Drifting occurs in Tests No. 1 and No. 2	Lift circuit make-up valve (head ends) leaking.
Drifting occurs in Tests No. 1 and No. 3	Leakage between lift valve spool and body.
Drifting occurs in Tests No. 1, No. 2, No. 3 and No. 4	Leakage between pistons and cylinders. Bad piston valves in cylinders. Quick-drop valve leaks.
Drifting occurs in Tests No. 2 and No. 4	Lift circuit load check valve or flow control valve is leaking.

NOTE: Remember that an O-ring seal failure in the circuit will have the same effect as a major component failure.

Drift Tests for Bulldozer Tilt Cylinder

Bulldozer Lift Cylinder Drift			
Oil Temperature	28° to 48°C (83° to 118°F)	49° to 68°C (120° to 155°F)	69° to 88°C (156° to 190°F)
Must not move more than 11.0 mm (.43 in)	5.0 minutes	2.7 minutes	1.7 minutes

Test No. 1:

Put the blade flat on the ground. Raise the front of the machine off the ground by lowering the right side of the blade (tilt right). Put the tilt circuit in HOLD position. Shut off engine and watch the tilt cylinder rod for movement.

Test No. 2:

Put the blade flat on the ground. Raise the front of the machine off the ground by lowering the left side of the blade (tilt left). Put the tilt circuit in HOLD position. Shut off the engine and watch the tilt cylinder rod for movement.

Test Results	Most Probable Causes
Drifting occurs in Tests No. 1 and No. 2:	Leakage between piston and cylinder. Leakage between tilt circuit valve spool and body.

NOTE: Remember that an O-ring seal failure in the circuit will have the same effect as a major component failure.

Drift Tests for Ripper Lift Cylinder

Ripper Lift Cylinder Drift			
Oil Temperature	28° to 48°C (83° to 118°F)	49° to 68°C (120° to 155°F)	69° to 88°C (156° to 190°F)
Must not move more than 10.0 mm (.39 in)	5 minutes	2.7 minutes	1.7 minutes

Test No. 1:

Raise the rear of the machine off the ground by lowering the ripper. Put the ripper control lever in HOLD position. Shut off the engine and watch the ripper lift cylinder rod for movement.

Test No. 2:

Raise the ripper off the ground. Put the control lever in HOLD position. Shut off the engine and watch the ripper lift cylinder rod for movement.

Test Results	Most Probable Causes
Drifting occurs in Tests No. 1 and No. 2:	Leakage between piston and cylinder. Leakage between ripper lift circuit valve spool and body.
Drifting occurs in Test No. 1:	Lift circuit makeup valve (head end) leaking.

NOTE: Remember that an O-ring seal failure in the circuit will have the same effect as a major component failure.

Steering Operation Checks

WARNING

Make reference to WARNING on the first page of the Implement and Steering/Hydraulic System Testing and Adjusting section.

Steering operation checks are indications that the steering circuit operation is normal. The sprocket speed and steering turn checks are the checks that will give an indication of steering circuit problems.

Steering Turn Diameter Check

1. Move the machine to a flat and dry open area. Make sure the underfoot conditions are such that a limited amount of track slip will be present when turning the machine. Make sure the steering linkage is correctly adjusted.

2. Start and run the engine at maximum rpm. Raise all the implements to the FULL Raise position if so equipped.

3. Release the parking brake and put the transmission is first speed forward.

4. Move to steering control handle the FULL STEER LEFT position.

5. Make a full 360° turn.

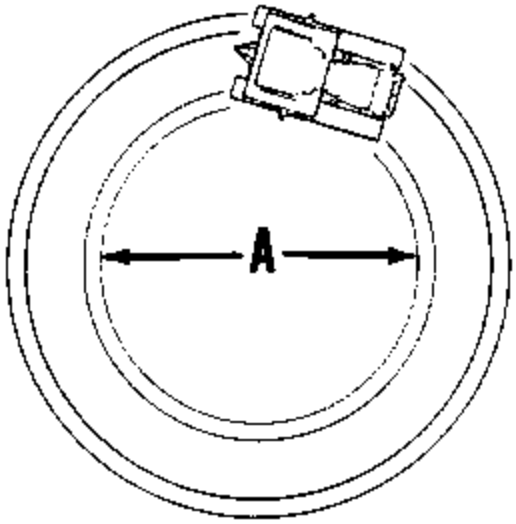
6. Stop the machine after the full turn, lower all implements to the ground (if equipped) and stop the engine.

7. Measure distance (A) as shown. Distance (A) should be 1.8 to 2.3 m (5.9 to 7.5 ft).

8. Do Steps 1 through 7 again with steering control handle at FULL STEER RIGHT position.

9. Do Steps 1 through 6 again with steering control handle at FULL STEER RIGHT and FULL STEER LEFT positions with the bulldozer control lever held in the FULL RAISE position.

10. Measure distance (A) as shown. Distance (A) should be 4.8 to 6.0 m (16 to 20 ft.).



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Full Turn Diameter
(A) Diameter of the turn.

11. If distance (A) is too wide after Steps 1 through 8, check steering linkage, pump, steering motor, control valve, and counterbalance valve for correct operation. If distance (A) is too wide after Step 9 and 10, check the priority flow control valve in the steering control valve.

12. If a problem has been indicated by this check, use the Diagnostic Instrument Test to get a more accurate indication to where the specific problem exists.

Sprocket Speed Checks

NOTE: This check should be used primarily in a shop area after a machine has been repaired or rebuilt.

1. Move the machine to a flat and open area. Lower the implements to the ground and stop engine.

2. Separate the tracks and remove from the final drive sprockets. See Power Train Disassembly and Assembly Form No. SENR4176.

3. Before checks are made, make sure the steering linkage is correctly adjusted. Also put a mark on both final drives, so the number of revolutions they make can be counted.

4. Start the engine and run at maximum rpm.

5. Release parking brake and move the steering control lever to the FULL STEER RIGHT position with transmission in Neutral.

6. With a stopwatch, count the number of revolutions the left and right side sprockets make in a minute. Subtract the right sprocket speed from the left sprocket speed. Forward rotation is positive and reverse rotation is negative. The speed difference between left sprocket and right sprocket should be 22.5 ± 1.1 rpm. This step checks the pumps flow through the system.

Example:

Left sprocket speed	=	+12.5 rpm
(Minus) Right sprocket speed	=	(−) − 10.5 rpm
Subtract right from left sprocket speed	=	+23.0 rpm

7. Now add the left sprocket speed and right sprocket speed. The sum should be ± 3.5 rpm. This step checks the mechanical drag balance between left and right sprockets.

Example:

Left sprocket speed	=	+12.5 rpm
(Add) Right sprocket speed	=	(+) − 10.5 rpm
Add left and right sprocket speed	=	+ 2.0 rpm

8. Do Steps 5, 6 and 7 again but move the steering control lever to FULL STEER LEFT position. Sprocket speed difference for FULL STEER LEFT position should be -22.5 ± 1.1 rpm.

9. If sprocket speeds are not within the tolerances, check component operation; pump, steering motor, control valve, and counterbalance valve. If Step 6 is low, check the engine speed, leaks in signal system and priority flow control valve in steering control valve. If Step 6 is high, check the priority flow control valve and compensator valve adjustments. If Step 7 is out of tolerance, excessive mechanical drag may be present in differential steer unit and final drives.

10. If a problem has been indicated by this check, use Diagnostic Instruments Test to get a more accurate indication to where the specific problem exists.

11. When checks, tests and adjustments (if necessary) are complete, stop engine, remove all test equipment and connect the track.

Diagnostic Instrument Tests

WARNING

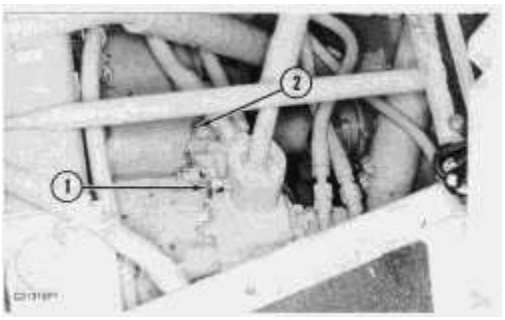
Make reference to WARNING on the first page of the Implement and Steering/Hydraulic System Testing and Adjusting section. Also, always replace floor plate when performing tests and whenever possible perform tests with oil temperature below 66°C (150°F) to prevent serious burns. Do not hold gauges in hand or lap when recording pressure readings.

This test is used mainly to determine where a problem may exist in the steering hydraulic circuit. It also gives some indication of a problem in an implement circuit.

1U5796 Pressure Differential (Delta P) Gauge Group.6V3121 Multitach Group.

1. Move the machine to a flat and open area. Lower all implements to the ground and stop engine.

2. Remove floor plate and install a 1U5755 Hose Assembly on pressure tap (1) and (2).



Hydraulic Pump
(1) Tap (pump discharge Pressure). (2) Tap (signal oil pressure).

3. Connect the other ends of the hoses to the 1U5793 Delta P (Delta P) Gauge. Connect the hose from pressure tap (1) to the tee side of the Delta P gauge. Connect the hose from pressure tap (2) to the elbow side of the Delta P gauge.

4. Install a 60 000 kPa (8700 psi) gauge on the tee side of the Delta P gauge.

5. Make sure the steering linkage is correctly adjusted. See Low Pressure Standby Test in this section.

6. Install the floor plate.

7. Install multitach on the engines tach drive.

8. Start and run the engine at maximum rpm. Record rpm, the reading should be 2075 ± 50 rpm. Check Vehicle Fuel Specifications (Zero T) for most current specification for engine.

9. With engine still at maximum rpm, move the bulldozer control lever to a position in between HOLD and FULL RAISE positions. Record the reading on Delta P gauge while the bulldozer blade is still moving up. The reading on the Delta P gauge is margin pressure or the difference between pump discharge pressure and the signal pressure from the control valve. The margin pressure should be 2100 ± 275 kPa (305 ± 40 psi). If the margin pressure is not correct, then see Compensator Valve Adjustments/Margin Pressure Adjustment for the correct procedure to make an adjustment. If the margin pressure is adjusted, the differential pressure setting should be held to 2100 ± 70 kPa (305 ± 10 psi).

10. Lower bulldozer blade to the ground and leave all implement control levers in the HOLD position.

11. Release the parking brake and fully activate the service brakes. Make sure the transmission is in neutral, both speed and direction.

NOTE: On later model machines the speed selector does not have a NEUTRAL position

12. With engine at maximum rpm move steering control handle to the MID STEER RIGHT position. This puts the hydraulic system in a steer stall condition.

NOTE: The machine must not move, if it does the brake system must be checked.

13. With the machine in a steer stall condition, record the following readings:

A. Pump discharge pressure (read gauge on tee side of Delta P gauge).
B. Engine rpm.
C. Pressure on Delta P gauge.

14. Readings from Step 13 should be as follows:

A. 38 000 ± 550 kPa (5510 ± 80 psi).
B. 50 rpm or less below the reading recorded in Step 8.
C. 50 psi maximum with a maximum oil temperature of 66°C (150°F).

If all readings are within specification, the steering hydraulic circuit should be alright but there still could be a problem in the individual implement circuits. If a steering problem still exists, it could be a mechanical problem in the steering differential unit or the final drives. A continued implement circuit problem could be a pressure limiter adjusted incorrectly or cylinder wear.

If reading (A) is too high or too low;

1. The pressure cut-off needs to be adjusted, see Compensator Valve Adjustments/Pressure Cut-Off Adjustment in this section.

NOTE: If the pressure cut-off can not be adjusted down, the pump or compensator valve has failed.

If reading (A) is correct or too low, reading (B) is correct and reading (C) is too high; this indicates a leak(s) in the signal network between the steering control valve and the compensator valve. The causes for the leak(s) could be the following.

1. Seals on shuttle valve in steering control valve.
2. Dirt or foreign material in shuttle valve in steering control valve.
3. Seal on plug at the end of the steering valve spool.
4. Seals on sleeve behind priority flow control valve spring in the steering control valve.
5. Dirt or foreign material in orifice in signal line between the inlet manifold and compensator valve.
6. Compensator valve. Do the Pump Load Test to make sure.
7. Steering valve spool or spool bore badly scratched.

If reading (B) is not correct and reading (A) is correct or too low; this indicates excessive power use by the pump in the Steer Stall Condition. The causes for this could be the following:

1. Setting of main relief valve is too low or valve is leaking. See Main Relief And Crossover Relief Valve Tests in this section.
2. Setting of crossover relief valve(s) in counterbalance valve is/are too low. See Main Relief And Crossover Relief Valve Tests in this section.
3. Makeup valves in steering control valve are leaking.
4. Pump is failed. Do a Pump Load Test to make sure.
5. Steering motor is failed.

15. Do Steps 10 through 13 again with the steering handle at the MID STEER LEFT position.

16. Remove test equipment after all tests, adjustments and needed repairs are completed.

Pump Discharge Pressure Tests

WARNING

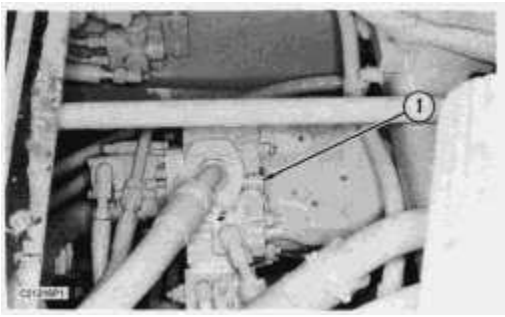
Make reference to WARNING on the first page of the Implement and Steering/Hydraulic System Testing and Adjusting section. Also, always replace floor plate when performing tests and whenever possible perform tests with oil temperature below 66°C (150°F) to prevent serious burns. Do not hold pressure gauges in hand or lap when checking pressure readings.

Pump discharge pressures are known values and can be tested. These tests are low pressure standby test, high pressure stall test, margin pressure test, and pump load test.

Low Pressure Standby Test

6V7830 Tetragauge Group

1. Remove the floor plate from the machine.



Hydraulic Pump
(1) Tap (pressure).

2. Install tetragauge on pressure tap (1) and install the floor plate.

3. Start the engine and run at maximum rpm. Make sure parking brake is in the ON position.

4. Leave all control levers in the HOLD position.

5. The pressure reading on the tetragauge should be approximately 3000 kPa (435 psi). This is the pumps pressure output in the low pressure standby condition. If the pressure reading is below 2100

kPa (305 psi) or above 3700 kPa (535 psi), check the margin pressure setting. See Margin Pressure Test in this section.

6. Move the steering control handle back and forth against the stop in the parking brake linkage. If the pressure reading on the tetragauge increases, the steering linkage should be adjusted.

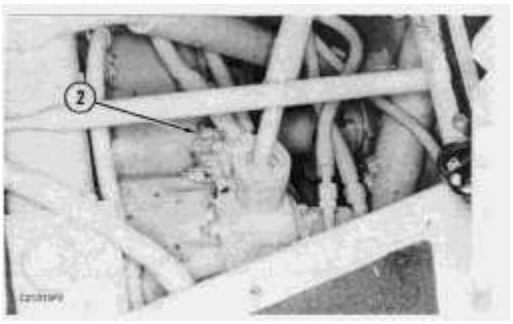
7. Adjustments to the pump output should not be made based on the results of this test. If the results are not correct, the Margin Pressure Test should be run.

High Pressure Stall Test

1U5796 Pressure Differential (Delta P) Gauge Group

1. Remove the floor plate from the machine.

2. Install a 1U5755 Hose Assembly on pressure tap (1) and pressure tap (2). Connect the other ends of the hoses to 1U5793 Delta P (Delta P) Gauge. Connect the hose from pressure tap (1) to the tee side of the Delta P gauge. Connect the hose from pressure tap (2) to the elbow side of the Delta P gauge.



Compensator Valve On Pump
(2) Tap (pressure).

3. Install the 8T0861 Gauge on the tee side of the Delta P gauge.

4. Install the floor plate.

5. Start the engine and run at maximum rpm. Release the parking brake and activate the service brakes.

6. Move the steering control handle to a position in between HOLD and the MID STEER LEFT position.

7. The pressure reading on the 8T0861 Gauge should be 38 500 ± 550 kPa (5575 ± 80 psi). This is the pumps pressure output in the high pressure stall condition. The pressure reading on the Delta P gauge should be less than 345 kPa (50 psi) at a maximum oil temperature of 66°C (150°F).

8. If the high pressure reading is not correct, then the pressure cut-off spool should be adjusted. See Compensator Valve Adjustments. If the pressure reading on the Delta P gauge is high and the high pressure reading is correct or too low, this indicates a leak(s) in the signal network. See Diagnostic Instrument Tests for more information.

Margin Pressure Test

1U5796 Pressure Differential (Delta P) Gauge Group

1. Remove the floor plate from the machine.

2. Install a 1U5755 Hose Assembly on pressure tap (1) and (2). Connect the other ends of hoses to the 1U5793 Delta P (Delta P) Gauge. Connect the hose from pressure tap (1) to the tee side of the Delta P gauge. Connect the hose from pressure tap (2) to the elbow side of the Delta P gauge.

3. Install the 8T0861 Gauge on the tee side of the Delta P gauge.

4. Install the floor plate.

5. Start and run the engine at maximum rpm. Make sure the parking brake is ON and the transmission in NEUTRAL.

6. Move the bulldozer control lever to a position in between HOLD and FULL RAISE positions. Read the pressure on the Delta P gauge. This is the margin pressure or the difference between pump discharge pressure and the signal pressure from the control valve. The margin pressure should be 2100 ± 275 kPa (305 ± 40 psi).

7. If the margin pressure is not correct, then see Compensator Valve Adjustments/Margin Pressure Adjustment for the correct procedure to make an adjustment. If the margin pressure is adjusted, the differential pressure setting should be held to 2100 ± 70 kPa (305 ± 10 psi).

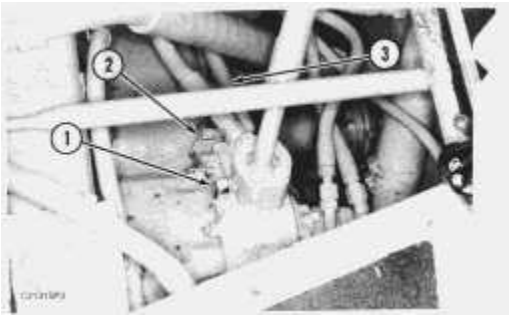
Pump Load Test

This test is a final test to determine if the pump or compensator valve is bad. This test should be done only after the compensator valve and main relief valve have been checked for correct operation.

1U5796 Pressure Differential (Delta P) Gauge Group, Test Tee (See Note)6V9829 Cap Assembly6V3965 Nipple Assembly.

NOTE: The Test Tee must be assembled from parts shown in illustration C21314P1. The 6V8636 Connector must be drilled and tapped before the 6T0421 Orifice Plug (1/16 in. - 27 NPT) can be installed. This orifice plug must be installed in the 9/16 in. THD end of the connector with a 4 mm (.16) hex wrench.

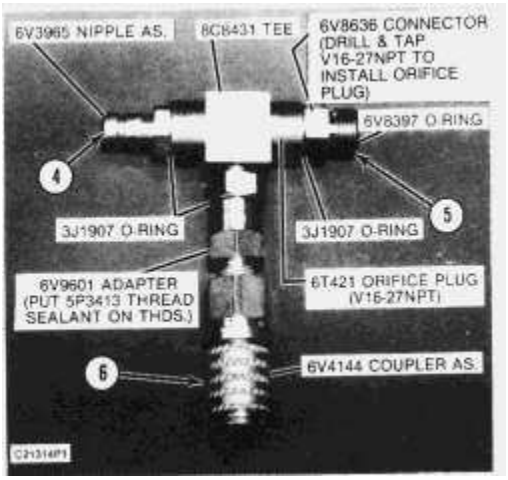
1. Remove the floor plate from the machine.



Hydraulic Pump
(1) Tap (pump discharge pressure). (2) Tap (signal oil Pressure). (3) Line (signal).

2. Connect one end of a 1U5755 Hose Assembly to pressure tap (5) on the Test Tee.

3. Connect coupler (6) on the Test Tee to pressure tap (1).



Test Tee
(4) Tap (Pressure). (5) Connector. (6) Coupler.

4. Disconnect signal line (3) from the elbow on the inlet manifold. Put the 6V9829 Cap Assembly on the elbow.

5. Connect signal line (3) to connector (4) on the Test Tee. This makes the pump outlet the load signal to the compensator valve.

6. Connect a 1U5755 Hose Assembly to pressure tap (2). Connect the nipple assembly to the other end of the hose assembly and put this end in a container to collect oil.

7. Make sure the transmission is in NEUTRAL and the parking brake is ON. Move the governor lever to the OFF position, so the engine will not start. With the bulldozer control lever held in the RAISE position, turn (crank) the engine over with the starter until a clear stream of oil comes out of the hose assembly. This will remove (purge) any air that is in the signal line.

NOTE: The bulldozer blade will raise when the engine is turned (cranked) over.

8. Stop turning (cranking) the engine and lower the bulldozer blade to the ground. Remove the nipple assembly from the hose assembly and connect the hose assembly to the elbow side of the 1U5793 Pressure Differential (Delta P) Gauge.

9. Connect the other end of 1U5755 Hose Assembly on pressure tap (5) to the tee side of the delta P (Delta P) gauge. Put a 0 to 60 000 kPa (0 to 8700 psi) pressure gauge on the other pressure tap on the tee side of the Delta P gauge.

10. Move the governor lever to the DECELERATE position. With the bulldozer control lever in the RAISE position, start the engine.

NOTE: The bulldozer blade will raise when the engine is started.

11. After the engine starts, move the bulldozer control lever to the HOLD position. This puts the pump in the high pressure stall condition. Record the pressure readings on both pressure gauges and stop the engine.

12. The pressure readings on the gauges should be as follows:

A. Pump discharge reading (gauge on the tee side of the Delta P gauge) should be 38 500 ± 550 kPa (5575 ± 80 psi).
B. Pressure differential reading (Delta P gauge) should be 550 kPa (80 psi) or less.

If the engine stalls (dies) when the bulldozer control lever is moved to the HOLD position, the pump is failed and should be replaced.

If reading (A) is low and reading (B) is correct, the compensator valve should be adjusted and Steps 10 and 11 should be done again. See Compensator Adjustments/Pressure Cutoff Spool Adjustment in this section. If the pump discharge pressure can not be increased through adjustments to the compensator valve, the pump is failed and should be replaced.

If reading (B) is high, the compensator valve should be replaced.

Compensator Valve Adjustments

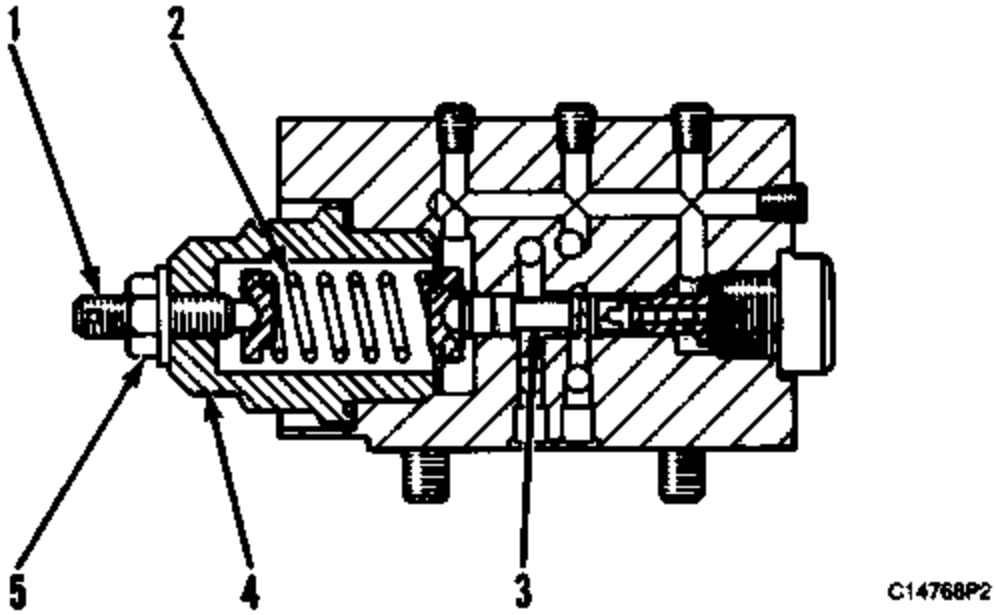
WARNING

Make reference to WARNING on the first page of the Implement and Steering/Hydraulic System Testing and Adjusting section. Do not make compensator valve adjustments with the engine running.

The compensator valve on the pump can be tested by running one of the pump discharge tests. The high pressure stall will tell if the pressure cut-off spool needs to be adjusted. The margin pressure test will tell if the margin spool needs to be adjusted.

Pressure Cut-Off Spool Adjustment

1U7564 Hex Wrench (5 mm)6V9097 Combination Wrench.



Cross Section of Pressure Cut-Off Spool in the Compensator Valve
(1) Stop. (2) Spring. (3) Spool (pressure cut-off). (4) Cap. (5) Nut.

If after a high pressure stall test an adjustment to the pressure cut-off spool needs to be done, do the following procedure:

1. Lower all implements to the ground.

2. Shut off the engine and move all the implement and steering control levers to release system pressure.

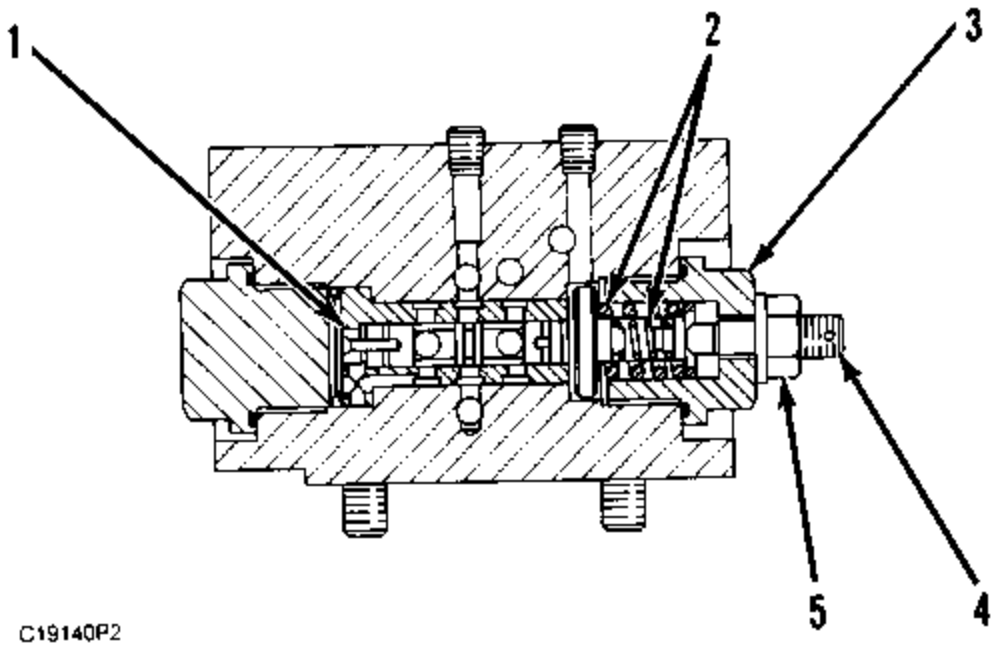
3. HOLD stop (1) with a 5 mm hex wrench and loosen nut (5) with a 17 mm combination wrench. Turn stop (1) counterclockwise to decrease pressure setting and clockwise to increase the setting. One revolution of stop (1) will change the pressure setting approximately 3500 kPa (510 psi).

4. When the pressure setting is adjusted, hold stop (1) with hex wrench and tighten nut (5) to a torque of 25 ± 5 N·m (18 ± 4 lb ft).

5. Do the High Pressure Stall Test again to make sure the pressure setting is 38 500 ± 550 kPa (5575 ± 80 psi).

Margin Spool Adjustment

1U7564 Hex Wrench (5 mm)6V9097 Combination Wrench.



Cross Section of Margin Spool in the Compensator Valve
(1) Spool (margin). (2) Springs. (3) Plug. (4) Stop. (5) Nut.

If after a margin pressure test an adjustment to the margin spool needs to be done, do the following procedure:

1. Lower all implements to the ground.

2. Shut off the engine and move all the implement and steering control levers to release system pressure.

3. Hold stop (1) with a 5 mm hex wrench and loosen nut (5) with a 17 mm combination wrench. Turn stop (1) counterclockwise to decrease pressure setting and clockwise to increase the setting. One revolution of stop (1) will change the pressure setting approximately 3500 kPa (510 psi).

4. When the pressure setting is adjusted, hold stop (1) with hex wrench and tighten nut (5) to a torque of 25 ± 5 N·m (18 ± 4 lb ft).

5. Do the Margin Pressure Test again to make sure the differential pressure setting is 2100 ± 70 kPa (305 ± 10 psi).

Pressure Tests of Pressure Limiter Valves

WARNING

Make reference to WARNING on the first page of the Implement and Steering/Hydraulic System Testing and Adjusting section.

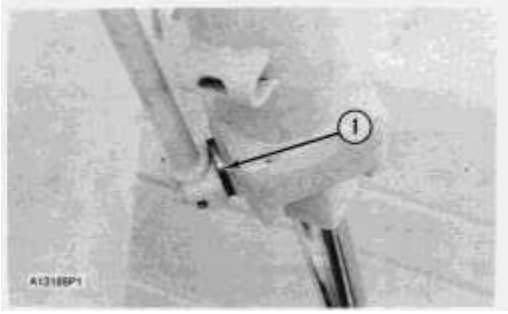
Pressure limiter valves are installed on each of the implement control valves. They control the maximum pressure in each implement circuit.

Pressure Limiter Valve Settings			
	Bulldozer Lift Circuit	Bulldozer Tilt Circuit	Ripper Lift Circuit
kPa	19 800 ± 600	19 800 ± 600	19 800 ± 600
(psi)	(2875 ± 88)	(2875 ± 88)	(2875 ± 88)

Bulldozer Lift Circuit

4C4890 Pressure Gauge Kit

1. Disconnect the rod end hydraulic line from each lift cylinder and install a blocking plate assembly (1) in each line.



Blocking Plate Installation (Typical Example)
(1) Plate (blocking assembly).

2. Put a 0 to 50 000 kPa (0 to 7500 psi) pressure gauge on the 6V3081 Hose.

3. Remove the floor plate from the machine.

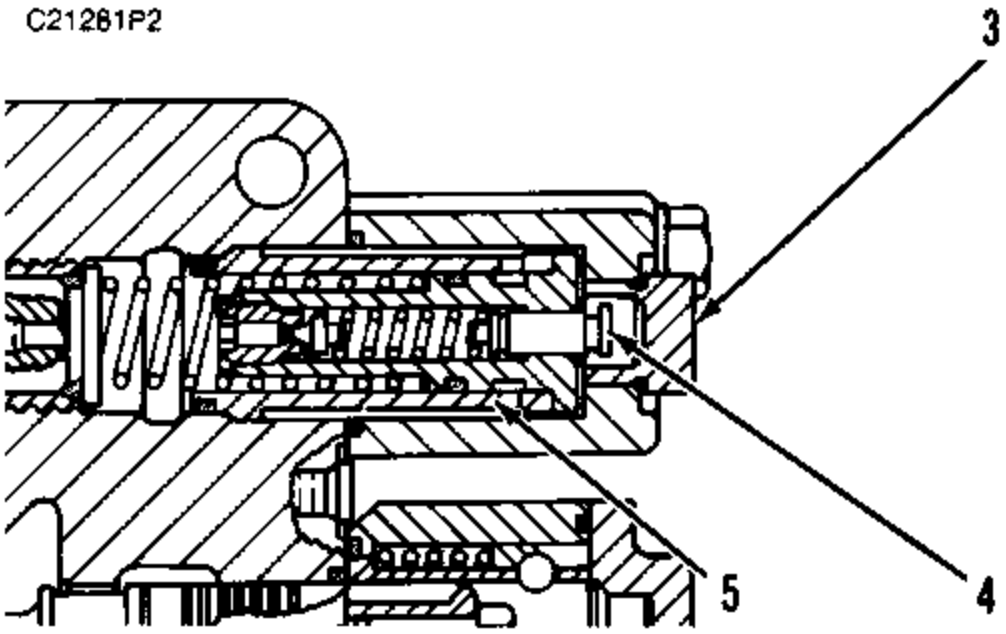
Compensator Valve on Pump
(2) Tap (pressure).

4. Install hose and pressure gauge on pressure tap (2).

5. Install floor plate.

6. Start and run the engine at maximum rpm. Look at the test gauge and slowly move the bulldozer control lever to the RAISE position. The high reading on the pressure gauge is the pressure setting of the pressure limiter valve. The pressure setting of the pressure limiter valve for the bulldozer lift circuit is 19 800 ± 600 kPa (2875 ± 88 psi).

7. If it is necessary to change the pressure setting of the pressure limiter valve, stop the engine.



Bulldozer Lift Control Valve
(3) Plug. (4) Plunger (adjusting). (5) Valve (pressure limiter).

8. Remove plug (3) from the bulldozer lift control valve.

9. Turn adjusting plunger (4) clockwise to increase the pressure setting or counterclockwise to decrease the setting. One revolution will change pressure setting about 5520 kPa (800 psi). Do Step 6 again.

10. When the pressure setting is correct, install plug (3) and tighten it to a torque of 60 ± 5 N·m (44 ± 4 lb ft).

11. Remove floor plate and test equipment. Install floor plate.

Bulldozer Tilt Circuit

4C4890 Pressure Gauge Kit

1. Put a 0 to 28 000 kPa (0 to 4000 psi) pressure gauge on the 6V3081 Hose.

2. Remove the floor from the machine.

Compensator Valve on Pump
(2) Tap (pressure).

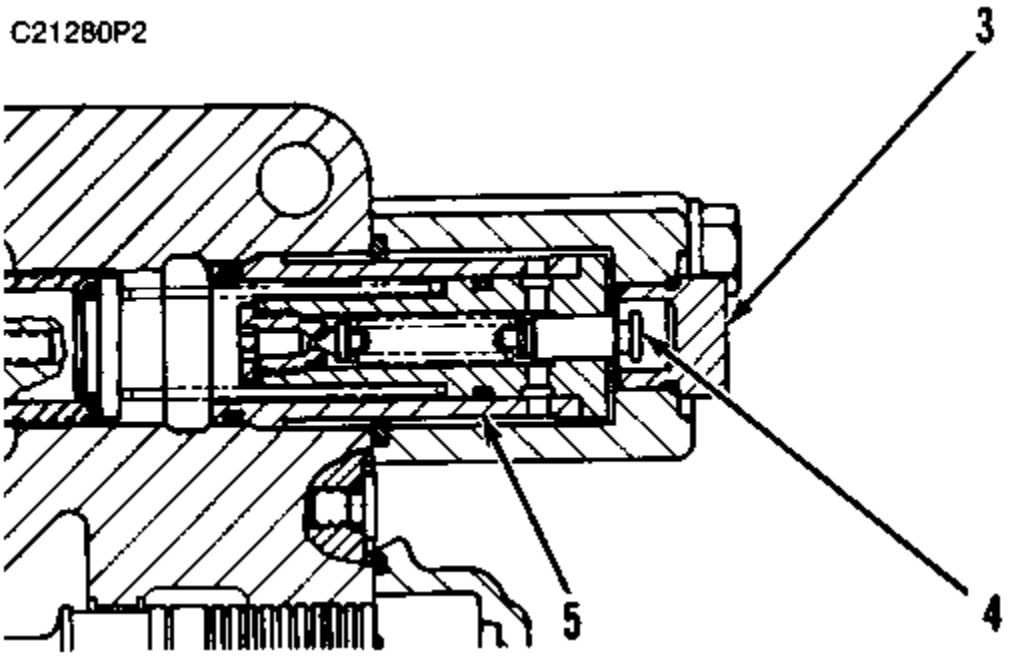
3. Install hose and pressure gauge on pressure tap (2).

4. Install floor plate.

5. Start and run engine. Lift the bulldozer blade approximately 300 mm (12 in) off the ground. Tilt the blade to the right as far as it can tilt.

6. Run the engine at maximum rpm. Look at the test gauge and slowly move the bulldozer control lever to the TILT RIGHT position. The high reading on the pressure gauge is the pressure setting of the pressure limiter valve. The pressure setting of the pressure limiter valve for the bulldozer tilt circuit is 19 800 ± 600 kPa (2875 ± 88 psi).

7. If it is necessary to change the pressure setting of the pressure limiter valve, stop the engine.



Bulldozer Tilt Control Valve
(3) Plug. (4) Plunger (adjusting). (5) Valve (pressure limiter).

8. Remove plug (3) from the bulldozer tilt control valve.

9. Turn adjusting plunger (4) clockwise to increase the pressure setting or counterclockwise to decrease the setting. One revolution will change the pressure setting about 5520 kPa (800 psi). Do Step 6 again.

10. When the pressure setting is correct, install plug (3) and tighten it to a torque of 60 ± 5 N·m (44 ± 4 lb ft).

11. Remove floor plate and test equipment. Install floor plate.

Ripper Lift Circuit

4C4890 Pressure Gauge Kit

1. Put a 0 to 50 000 kPa (0 to 7500 psi) pressure gauge on the 6V3081 Hose.

2. Remove the floor plate from the machine.

Compensator Valve on Pump
(2) Tap (pressure).

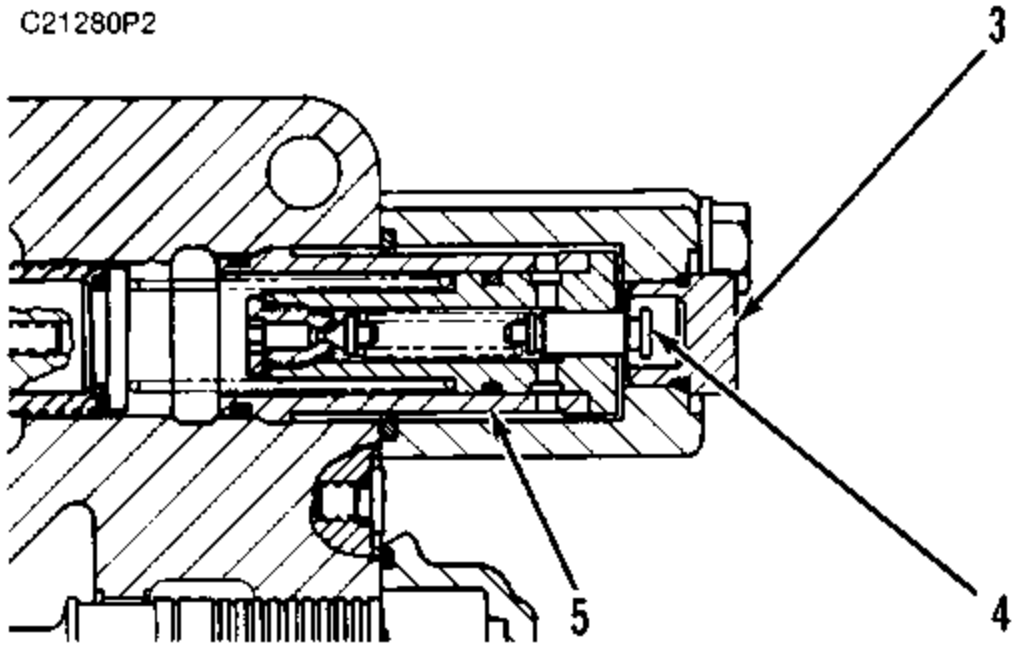
3. Install hose and pressure gauge on pressure tap (2).

4. Install floor plate.

5. Start and run the engine. Lift the ripper as high as it can lift.

6. Run the engine at maximum rpm. Look at the test gauge and slowly move the ripper control lever to the RAISE position. The high reading on the pressure gauge is the pressure of the pressure limiter valve. The pressure setting of the pressure limiter valve for the ripper lift circuit is 19 800 ± 600 kPa (2875 ± 88 psi).

7. If it is necessary to change the pressure setting of the pressure limiter valve, stop the engine.



Ripper Lift Control Valve
(3) Plug. (4) Plunger (adjusting). (5) Valve (pressure limiter).

8. Remove plug (3) from the ripper lift control valve.

9. Turn adjusting plunger (4) clockwise to increase the pressure setting or counterclockwise to decrease the setting. One revolution will change the pressure setting about 5520 kPa (800 psi). Do Step 6 again.

10. When the pressure setting is correct, install plug (3) and tighten it to a torque of 60 ± 5 N·m (44 ± 4 lb ft).

11. Remove floor plate and test equipment. Install floor plate.

Main Relief and Crossover Relief Valves Test

The pressure settings for the main relief and crossover relief valves (located on the counterbalance valve) are higher than the pumps cut-off pressure setting. Therefore normal system pressures will not open these relief valves. A test to check for low pressure settings can be done by checking engine rpm during given conditions.

WARNING

Make reference to WARNING on the first page of the Implement and Steering/Hydraulic System Testing and Adjusting section. Also do not attempt to adjust the main relief or crossover relief valves on the machine with the engine running.

6V3121 Multitach Group

1. Move the machine to an open area, lower all implements to the ground, engage parking brake and stop engine.

2. Install 6V3121 Multitach on the tach drive.

3. Start and run engine at maximum rpm.

4. Record the maximum rpm reading on the tach.

5. Release parking brake and engage service brakes. Move the steering control handle to mid steer left position and then to mid steer right position.

6. Record the rpm reading on the tach at each control handle position.

If the difference in the rpm readings from maximum rpm is more than 50 rpm at both control handle positions, then the main relief or both crossover relief valves may have low pressure setting.

If the rpm reading one control handle position is less than 50 rpm and over 50 rpm at the other position, then one of the crossover relief valves has a low pressure setting or a makeup valve may be leaking in the steering control valve.

7. To determine if the main relief or both crossover relief valves have low pressure settings, the main relief valve should be turned in exactly 1/8 revolution (maximum). Then do Steps 5 and 6 again.

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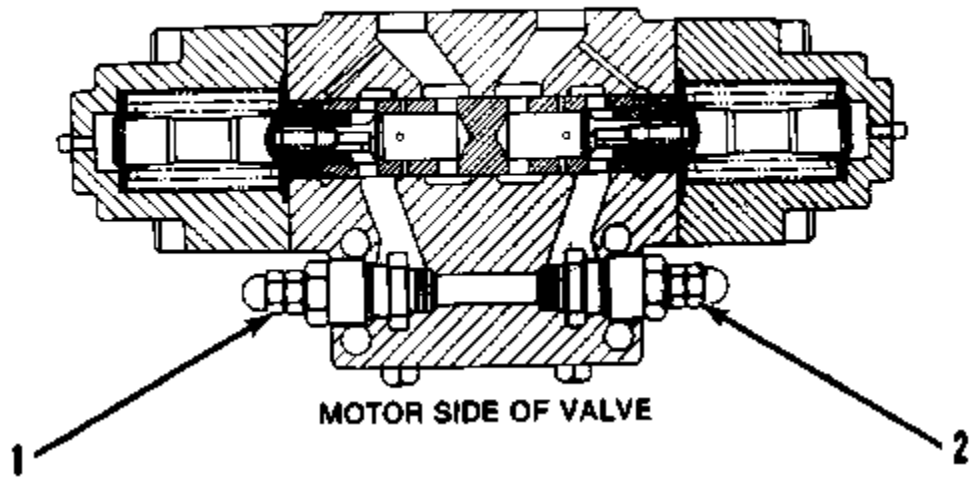


Counterbalance Valve (Earlier Model Shown)
(1) Valve (crossover relief for right turn). (2) Valve (crossover relief for left turn).

8. If both rpm readings are less than 50 rpm from maximum rpm, then the main relief valve has to be replaced or adjusted on a test bench.

If both rpm readings are over 50 rpm from maximum rpm, then replace or inspect the main relief valve and do Steps 5 and 6 again.

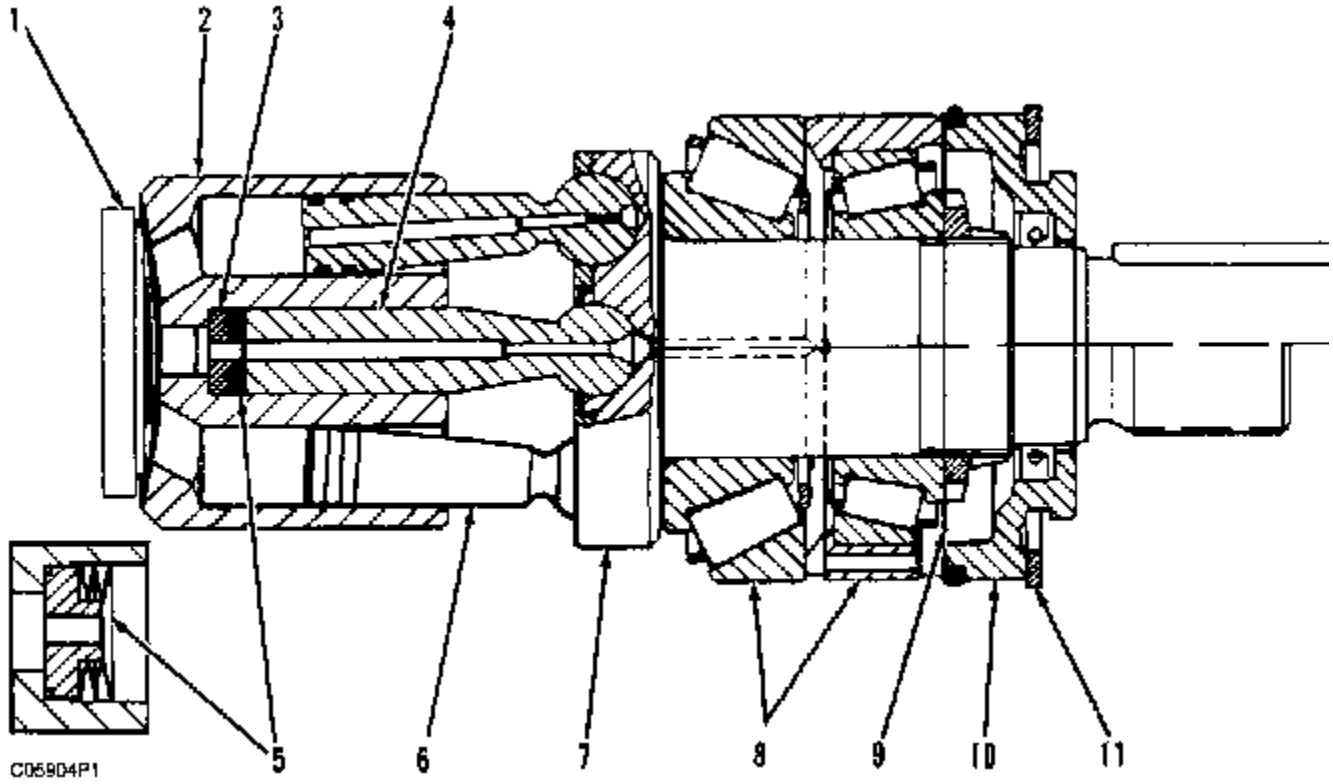
If both readings remain over 50 rpm from maximum rpm, then replace or inspect both crossover relief valves.

If the rpm reading for the MID STEER LEFT position is over 50 rpm from maximum, then crossover relief valve (2) or the one toward the left side of the machine, should be replaced or adjusted on a test bench.

If the rpm reading for the MID STEER RIGHT position is over 50 rpm from maximum rpm, then crossover relief valve (1) or toward the right side of the machine, should be replaced or adjusted on a test bench.

9. Turn the main relief back out 1/8 revolution, if it was not replaced in Step 8.

Adjustment of Steering Motor Rotary Group



Motor Rotary Group
(1) Plate (port). (2) Barrel (cylinder). (3) Spacer. (4) Pin (center). (5) Springs [compression (four)]. (6) Piston (seven). (7) Shaft. (8) Bearings. (9) Shims. (10) Cover assembly. (11) Ring.

The steering motor rotary group is divided into a mechanical drive group [shaft (7), bearings (8) and cover (10)] and a hydraulic group [barrel (2), port plate (1), spacer (3), compression springs (5), pistons (6) and center pin (4)].

If parts of the motor are serviced, there are two critical dimensions which should be checked in assembling the motor rotary group. Shims (9) on the mechanical drive group and one of four spacers (3) on the hydraulic group are used to get these respective dimensions.

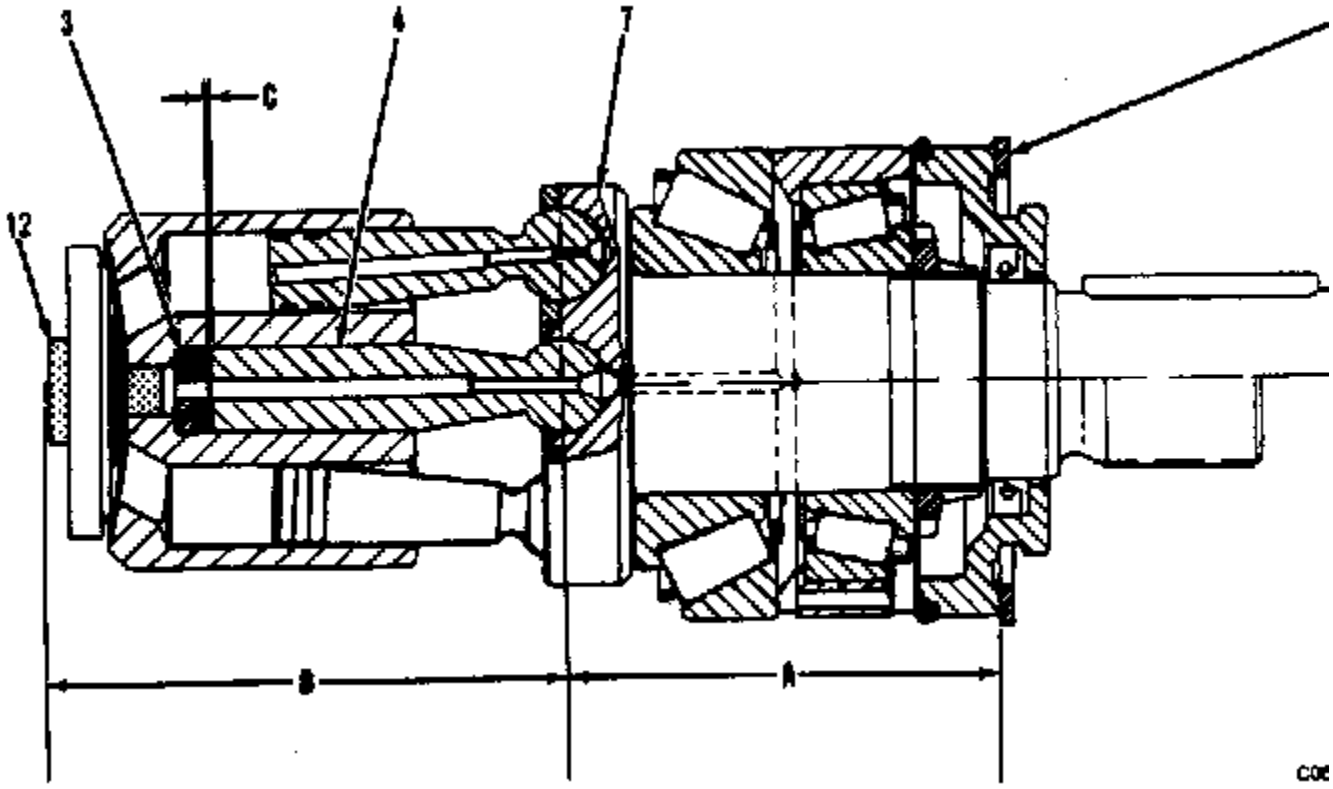
At this point in time, the mechanical drive group is a non-serviceable group except for the cover assembly (10).

NOTICE

To prevent damage to the motor, it is very important that the cases are filled with hydraulic oil at least to the fill port before operation.

Use the following chart for adjustment dimensions in servicing the rotary group.

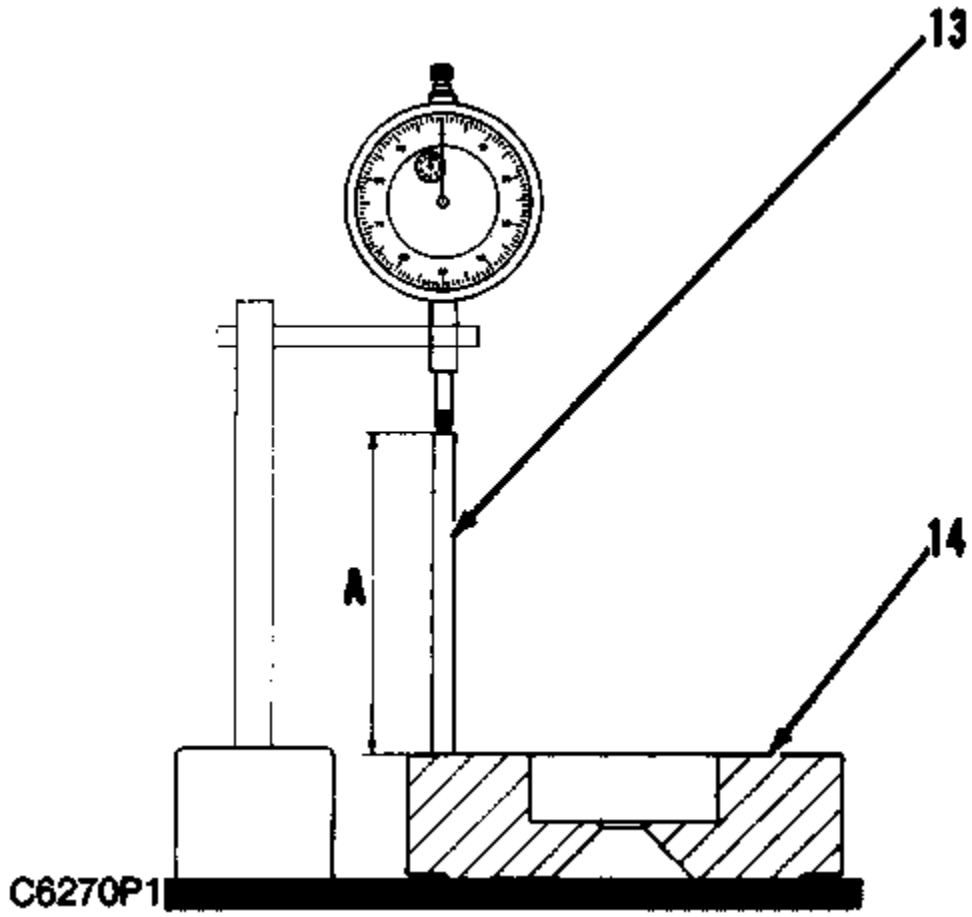
Type Of Motor	Part No.	Gauge Block Dimension A	Dial Indicator Reading	Gauge Block Dimension B	Dial Indicator Reading
Steering	9T3749	107.3 mm (4.224 in)	−0.1 mm (−.004 in)	136.5 mm (5.374 in)	−0.1 to −0.2 mm (−.004 to −.008



Adjusting Dimensions
(12) Pin [centering (tooling)]. (A) Distance from ring (11) to shaft (7). (B) Distance from shaft (7) to centering pin (12). (C) Play [spacer (3) to center pin (4)].

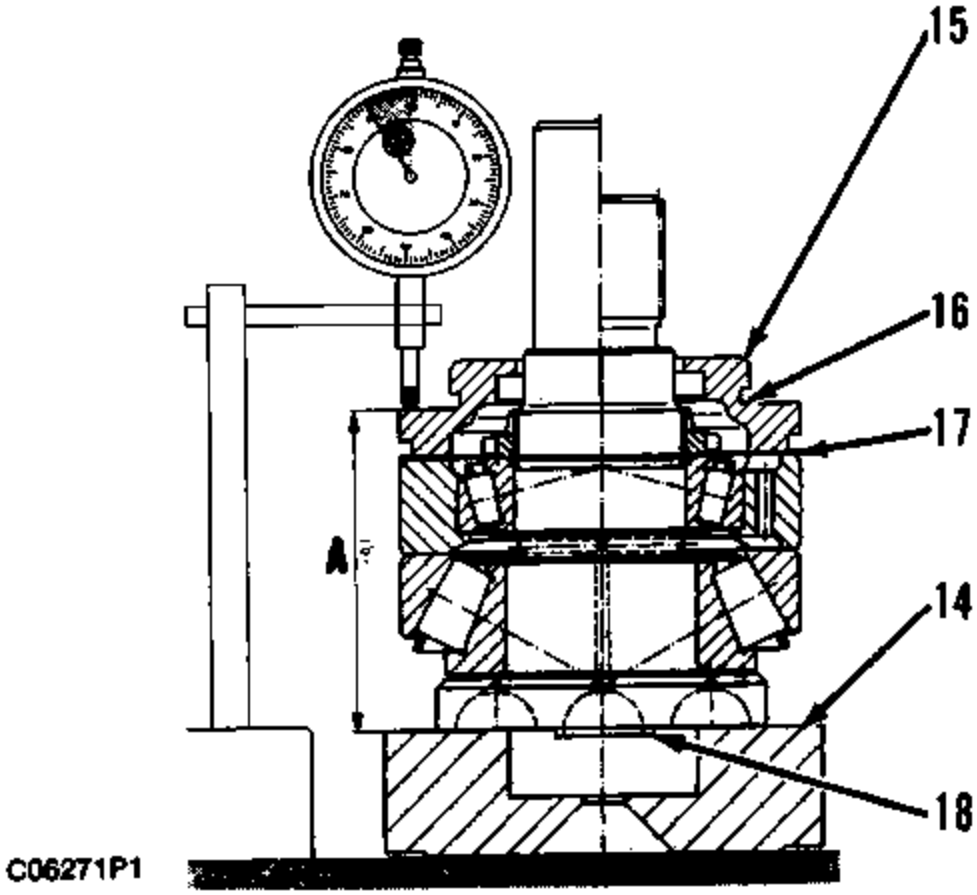
Adjustment for 40° Displacement Angle

Gauge Blocks (Use standard gauge set)8T5096 Dial Indicator8T7760 Measuring Kit8T7756 Support



Setup for Dial Indicator
(13) Blocks (gauge). (14) Support.

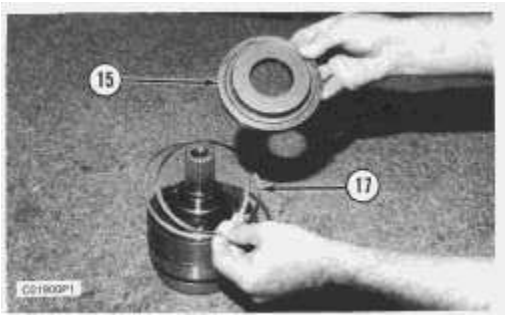
This shim adjustment is necessary to maintain an exact angle between the center lines of drive shaft (7) and center pin (4). In turn, this maintains the proper alignment between the barrel (2) and its pistons (6).



Measurement for Shim Thickness
(14) Support. (15) Cover. (16) Ring location. (17) Shims. (18) Boss.

Place support (14) on a surface plate. Position the gauge blocks (13) on the support to get dimension (A). Set the indicator in position over the gauge blocks and zero the dial.

Position the mechanical drive group on support (14) so that boss (18) is located over the hole in the support. Place cover (15) (without the seal and O-ring) on the drive group. Do not install the ring at location (16). Slide drive group and support under the dial indicator. Add shims (17) to get a reading on the indicator between 0 and -0.10 mm (-.004 in).



Mechanical Drive Group
(15) Cover. (17) Shims.

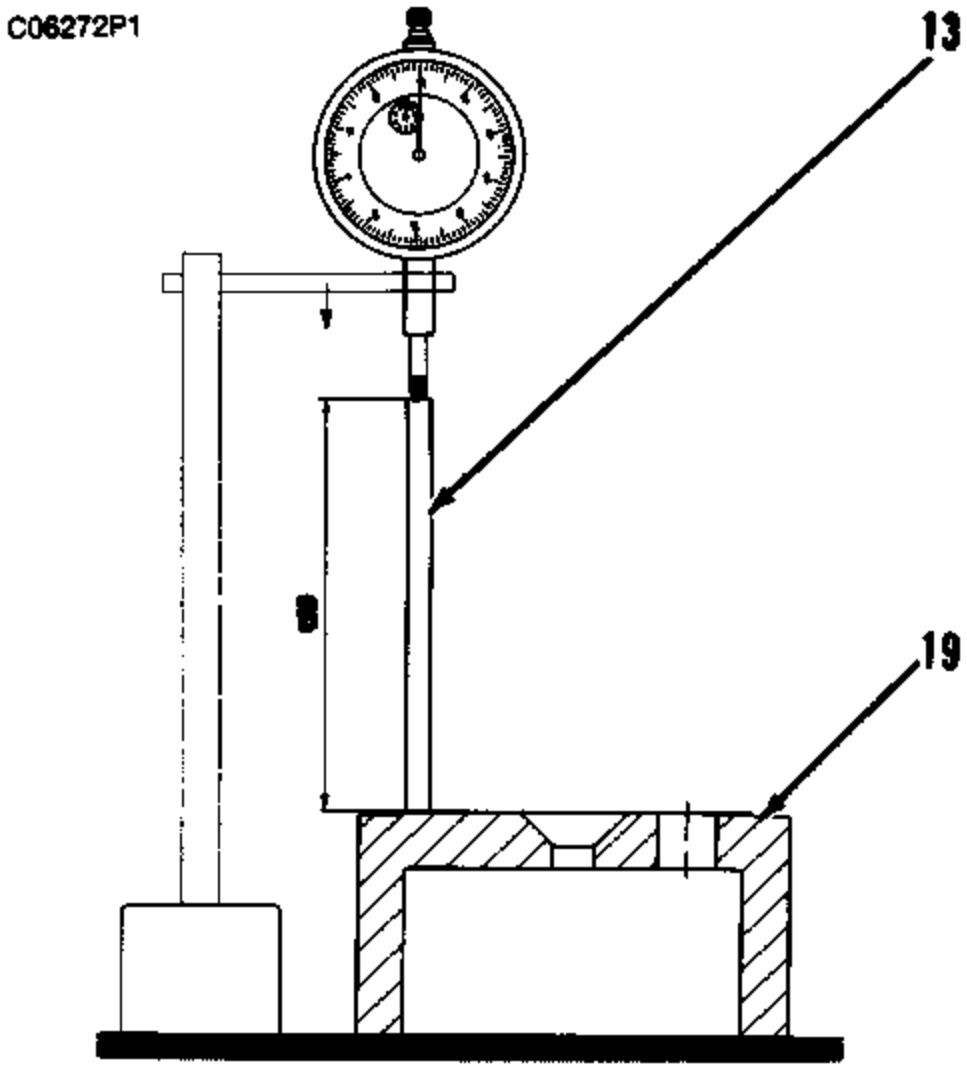
Adjustment of Lift-Off Limitation (Cylinder Barrel to Port Plate Maximum Separation)

Tools Needed:

Motor		9T3749
Gauge Blocks		–
Dial Indicator Group		8T5096
Measuring Kit (8T7760)	Support	8T7756
	Cylinder	8T7764
	Centering Pin	8T7763
	Centering Disc (with two screws)	8T7759

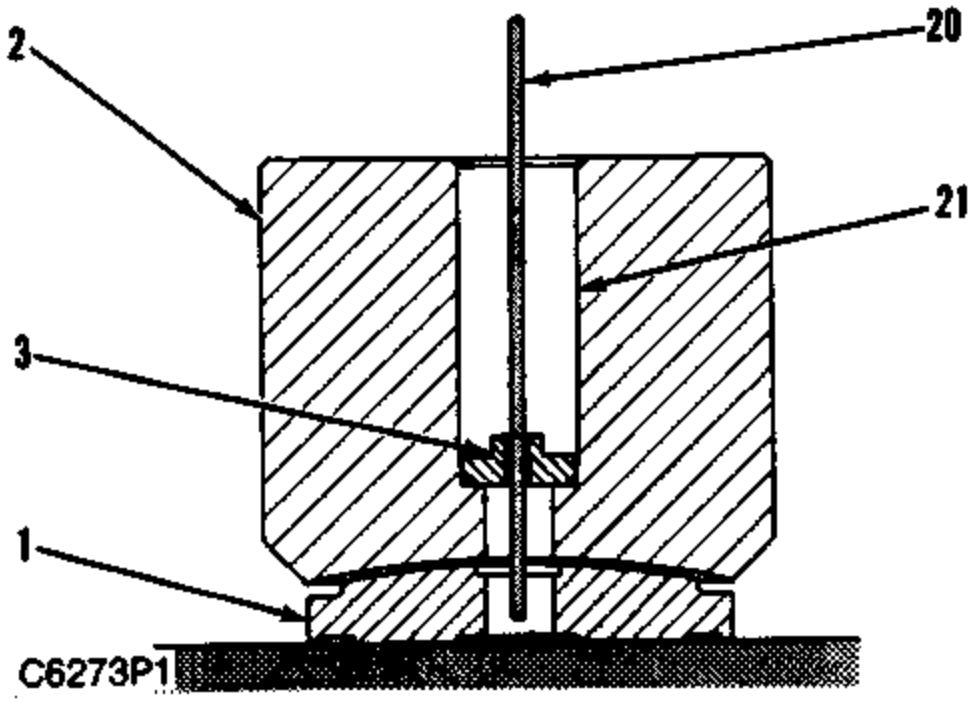
Spacer (3) to pin (4) clearance in combination with the compression springs (5) maintain the correct barrel (2) to port plate (1) maximum separation. This maximum separation limits leakage during start up and downhill operation.

This adjustment procedure determines the correct size of spacer to get the distance (B) between the center pin (center of pivot head) and the centering pin (12). With the correct distance (B), clearance (C) between spacer (3) and center pin (4) will be 0.10 to 0.25 mm(.004 to .010 in)



Setup Of Dial Indicator
(13) Blocks (gauge). (19) Support.

Place support (19) on a surface plate. Using gauge blocks (13), build up the dimension (B) as listed in the above chart. Set up the dial indicator and zero.

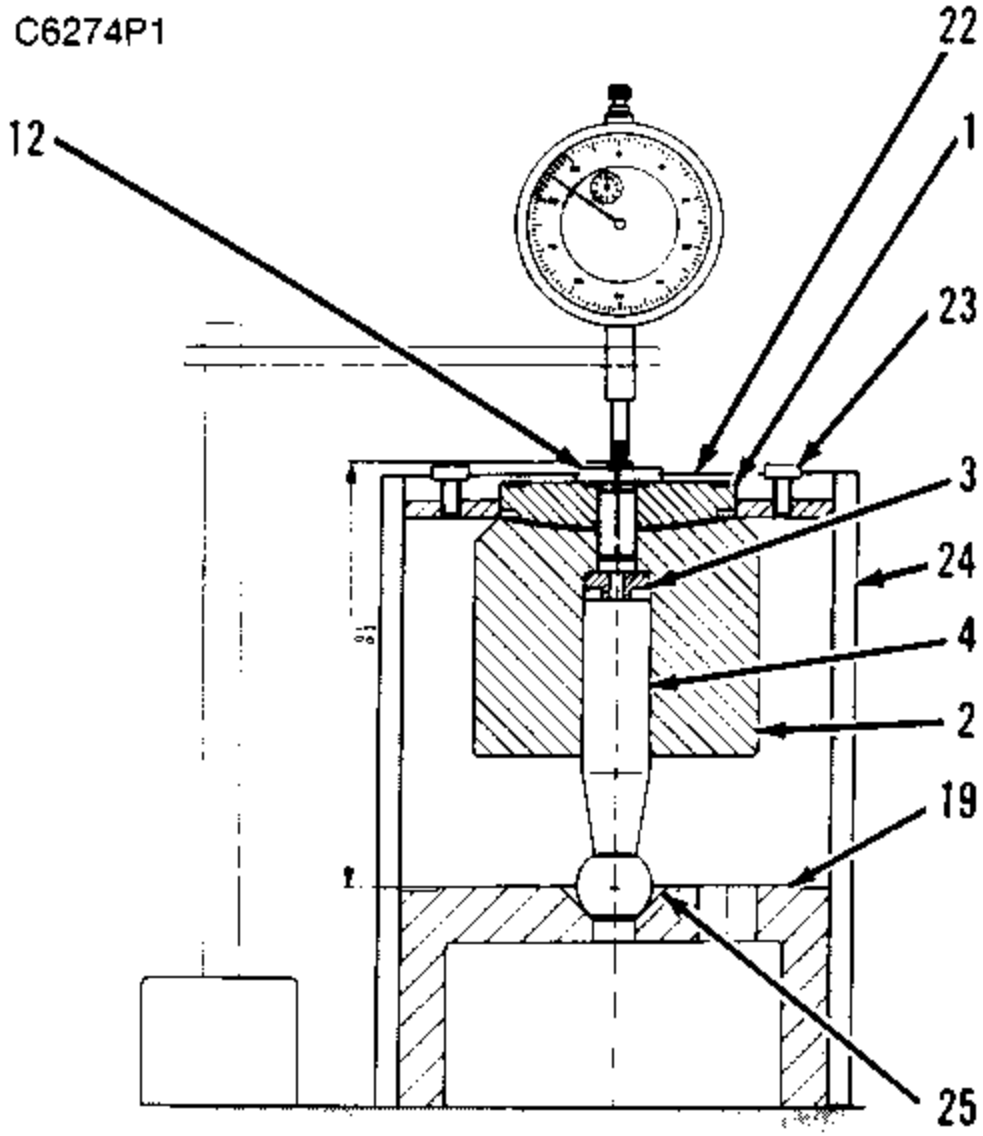


Installation Of Spacer
(1) Plate (port). (2) Barrel (cylinder). (3) Spacer. (20) Wire (21) Cylinder.

Using a piece of wire (20), guide the spacer (3) (minimum thickness) into center pin cylinder (21) of barrel (2). Place center pin in cylinder (21) without compression springs (5).

NOTICE

To avoid damage to center pin (4) and support (19) in the next step, place measuring kit cylinder (24) over support and lay cylinder on its side (horizontal).



Measurement For Spacer Thickness
(1) Plate (port). (2) Barrel (cylinder). (3) Spacer. (4) Pin (center). (12) Pin (centering). (19) Support. (22) Disc (centering). (23) Screws (lifting). (24) Cylinder (measuring kit). (25) Hole (centering).

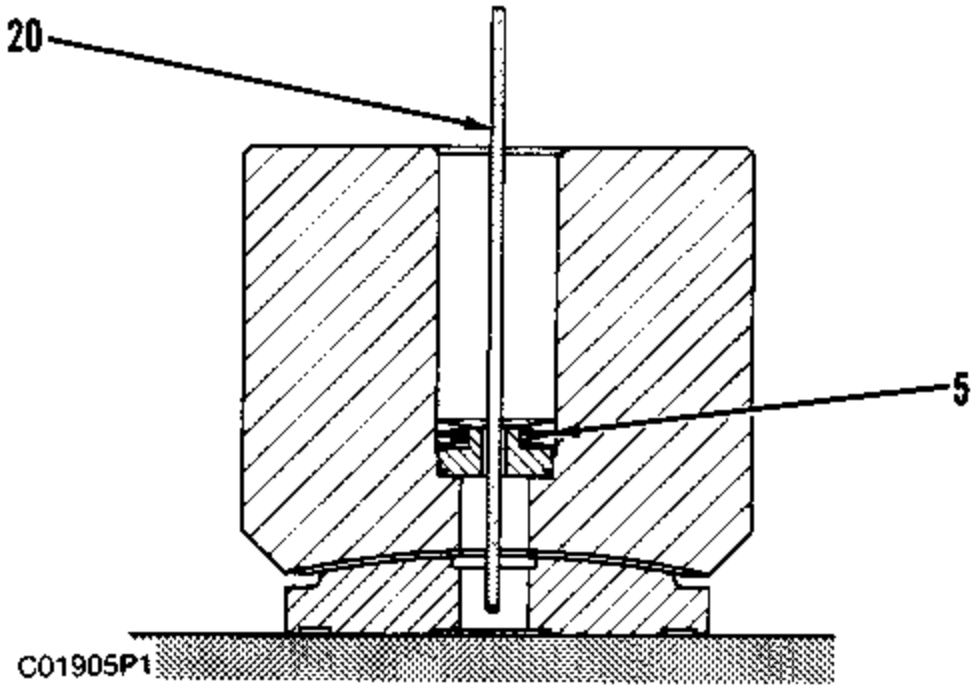
Insert barrel (2), spacer (3) and center pin (4) into the centering hole (25) in support (19). Stand cylinder in a vertical position. Insert centering pin (12) in port plate (1) and barrel (2). Position centering disc (22) [with two lifting screws (23)] over the port plate. Slide this assembly under the dial indicator.

The dial indicator must read between -0.10 mm (-.004 in) and -0.20 mm (-.008 in). The motor has four different sizes of spacers to get the correct center pin to port plate distance. There is a minimum spacer size. Each succeeding size of spacer is 0.10 mm (.004 in) thicker. Depending on the dial indicator reading, the correct spacer is selected.

Motor	Spacer	Thickness (MM)	Difference From Minimum Spacer (MM)
9T3749	9T1650	9.6	0 (min. spacer)
	9T1651	9.7	.1
	9T1646	9.8	.2
	9T1648	9.9	.3

For example, tolerance for dimension (B) is -0.40 mm (-.016 in) on the dial indicator. In this case, remove the spacer with the minimum thickness and replace with a spacer that increases the indicator reading by 0.20 mm (.008 in) to give a B dimension of 136.3 mm (5.366 in).

Once the correct spacer has been selected, the center pin (4) can be removed. The four compression springs (5) can then be inserted using a piece of wire (20) as a guide.



Installation Of Compression Springs
(5) Springs (compression). (20) Wire.

Power Shift Transmission Testing And Adjusting

WARNING

When some tests and adjustments are made to the transmission, the parking brake must be OFF. To prevent movement of the machine and personal injury, do the procedure that follows:

1. Lower the bulldozer and ripper to the ground.

2. Put blocks in front of and behind the tracks.

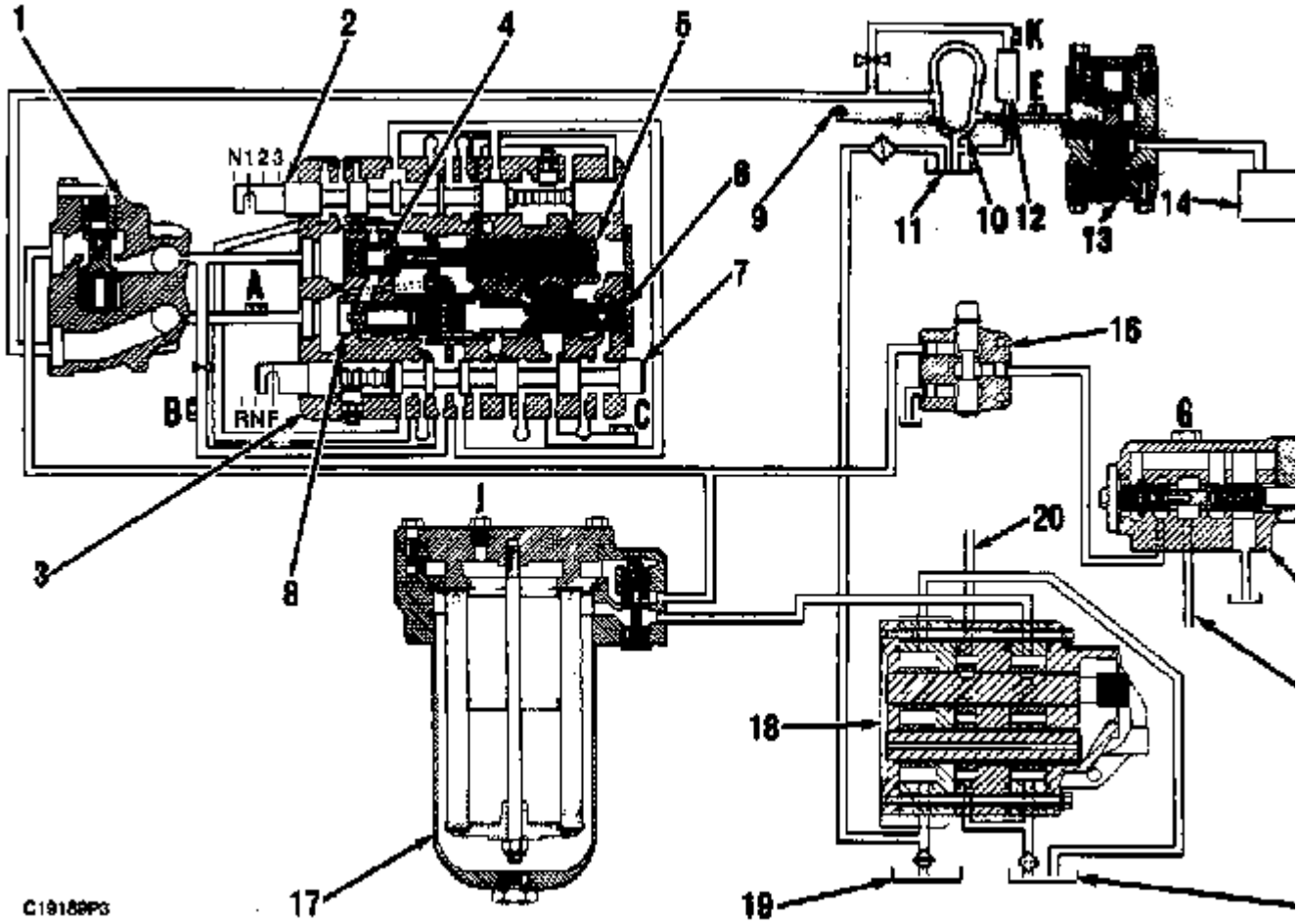
3. Let only approved personnel on the machine and keep other personnel off the machine and in clear view of the operator.

4. When testing must be done in a closed area and whenever possible, engage the service brakes if the parking brake can not be used.

NOTE: All tests and adjustments must be made with the oil in the power train hydraulic system at normal temperature for operation. Make sure that the linkage adjustments are correct before any tests are made.

Many of the pressure taps for testing the power train hydraulic system have quick disconnect couplings already installed.

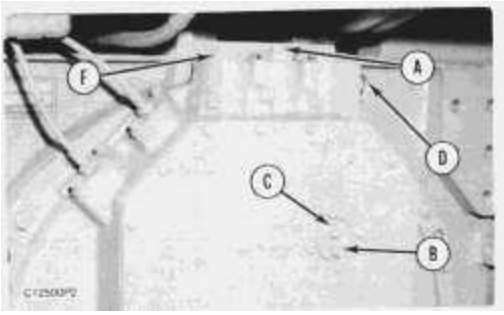
Do not connect or disconnect the couplings when there is pressure in the system. This will prevent damage to the seal that is in the coupling.



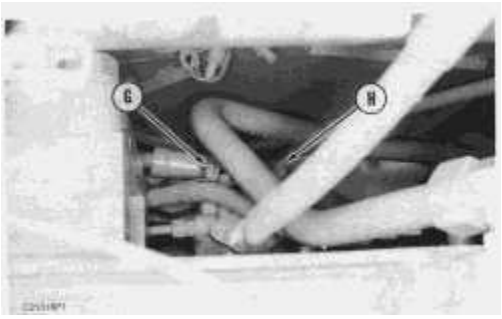
Power Train Hydraulic System Schematic
(1) Valve (priority). (2) Spool (speed selector). (3) Valve (selector and pressure control). (4) Valve (modulation relief). (5) Piston (load). (6) Valve (pressure differential). (7) Spool (direction selector). (8) Valve (ratio). (9) Breather. (10) Converter (torque). (11) Sump (torque converter). (12) Drive (pump). (13) Valve (torque converter outlet relief). (14) Cooler (oil). (15) Line (transmission lubrication). (16) Valve (parking brake). (17) Filter (transmission oil). (18) Pump (oil). (19) Sump (transmission). (20) Passage (brake lubrication). (21) Passage (brakes). (22) Valve (service brake control). (23) Sump (case). (A) Tap (torque converter inlet pressure). (B) Tap (P1 pressure). (C) Tap (P2 pressure). (E) Tap (torque converter outlet pressure). (G) Tap (brake pressure). (J) Tap (pump pressure). (K) Tap (pump drive lube pressure).

NOTE: Speed selector spool (6) has a NEUTRAL detent position. This is for earlier models only, later models do not have a NEUTRAL detent position.

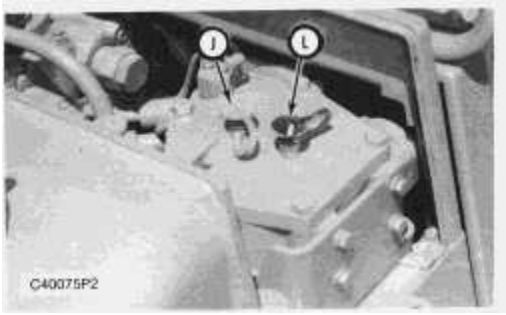
Location Of The Pressure Taps



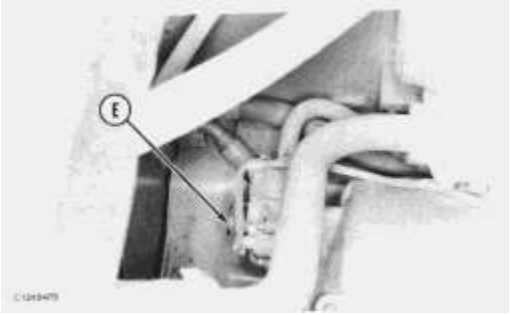
(A) Inlet (torque converter). (B) Clutch [speed (P1)]. (C) Clutch [direction (P2)]. (D) Lubrication (transmission). (F) Valve (priority).



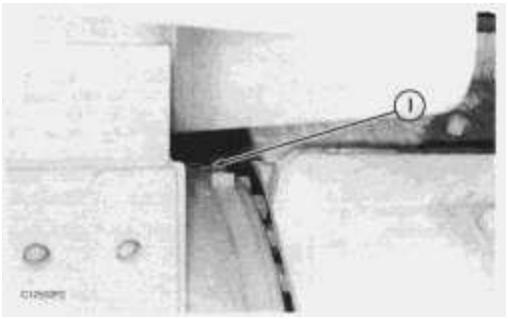
(G) and (H) Brake pressure.



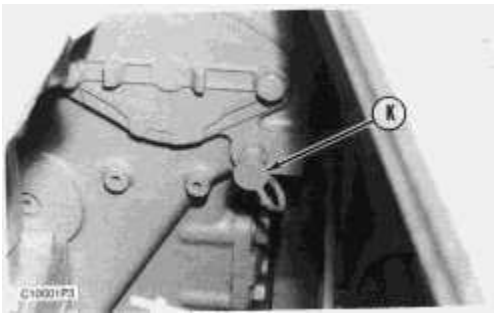
(J) Pump pressure. (L) Oil sampling.



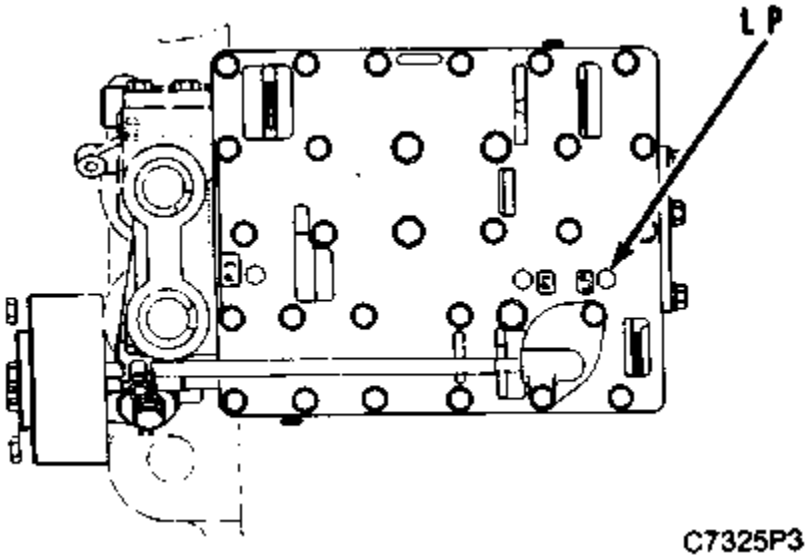
(E) Outlet (torque converter).



(I) Lubrication [Brake (Left And Right Side Of Machine)].



(K) Lubrication (Pump Drive).



(LP) Plug (Load piston).

Transmission Pressure Chart				
Pressure	Pressure Tap	Low Idle	High Idle	Adjustment
Converter Inlet Pressure (P3)	(A)		785 kPa (115 psi)	None
Speed Clutch (P1) (Initial Pressure)	(B)	580 ± 20 kPa (77 ± 3 psi) minimum with transmission selection lever in NEUTRAL. Load piston plug (LP) removed.		Add or remove spacers (25) for load piston (5) in selector and pressure control valve. See space chart.
Speed Clutch (P1)	B	Maximum of 345 kPa (50 psi) less than the pressure at MAXIMUM RPM. Selector lever in any FORWARD or REVERSE speed. Load piston plug (LP) installed.	2550 ± 105 kPa (370 ± 15 psi) with selector lever in any FORWARD or REVERSE speed. Load piston plug (LP) installed.	None. (Final pressure is controlled by the Initial Pressure Setting.)
Direction Clutch (P2)	(C)	380 ± 55 kPa (55 ± 8 psi) less than the speed clutch pressure at tap (B). Selector lever in any FORWARD or REVERSE speed. Load piston plug (LP) installed.	380 ± 55 kPa (55 ± 8 psi) less than the speed clutch pressure at tap (B). Selector lever in any FORWARD or REVERSE speed. Load piston plug (LP) installed.	NONE. (Direction clutch pressure is controlled by the spring rate for th pressure differential valve spring.)
Transmission Lubrication Oil	(D)	3.5 kPa (.5 psi) Minimum.	260 ± 50 kPa (37.5 ± 7.5 psi)	NONE.
Converter Outlet Pressure	(E)		410 ± 70 kPa (60 ± 10 psi) with brakes engaged, selector lever in THIRD SPEED FORWARD, and converter in a stall condition.	Add or remova spacers (26) in converter outlet relief valve (13). See Spacer Char
Priority Valve	(F)	2900 ± 140 kPa (420 ± 20 psi).		Add or remove to spacers (24) in priority valve (1). See Spacer Char
Brake (right or left)	(G) (H)		2825 ± 140 kPa (410 ± 20 psi) with foot brake off. Less than 7 kPa (1 psi) with foot brake ON.	NONE.
Brake Lubrication	(I)		80 ± 20 kPa (12 ± 3 psi).	NONE.
Pump Pressure	(J)		3375 ± 175 kPa (495 ± 25 psi).	NONE.
Pump Drive Lubrication	(K)		550 kPa (80 psi).	NONE.

PRESSURE DIFFERENTIAL VALVE TEST	
Pressure Differential Valve (B)	With the engine not running, move the direction selection lever to any position except NEUTRAL. Start the engine and run at HIGH IDLE. The direction clutch pressure (P2) must be 0 kPa (0 psi), the speed clutch pressure (P1) must be 2550 ± 105 kPa (370 ± 15 psi). Move the direction selection lever to NEUTRAL and then to THIRD SPEED FORWARD or REVERSE. The direction clutch pressure (P2) must be 380 ± 55 kPa (55 ± 8 psi) less than the speed clutch pressure.

NOTE: If the vehicle is equipped with a neutral start switch, the transmission control lever must be in NEUTRAL before the starter ca engaged to start the engine.

Transmission Oil Pump Bench Test Specifications

Type ... Gear

Number of sections ... Three

Rotation (seen from drive end) ... Counterclockwise

Output of transmission charging section:

[use SAE 10W oil at 49°C (120°F)] (minimum) ... 106 liter/min (28 U.S. gpm)

At a pump speed of ... 1800 rpm

At a pressure of ... 3100 kPa (450 psi)

Output of brake lubrication section:

[use SAE 10W oil at 49°C (120°F)] (minimum) ... 53 liter/min (14 U.S. gpm)

At a pump speed of ... 1800 rpm

At a pressure of ... 140 kPa (20 psi)

Output of transmission and torque converter scavenge section:

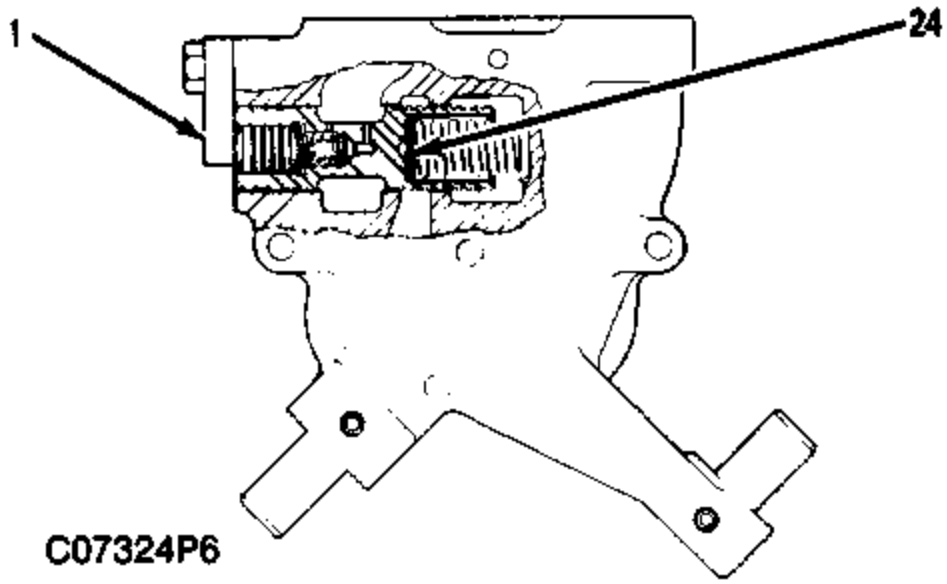
[use SAE 10W oil at 49°C (120°F)] (minimum) ... 98 liter/min (26 U.S. gpm)

At a pump speed of ... 900 rpm

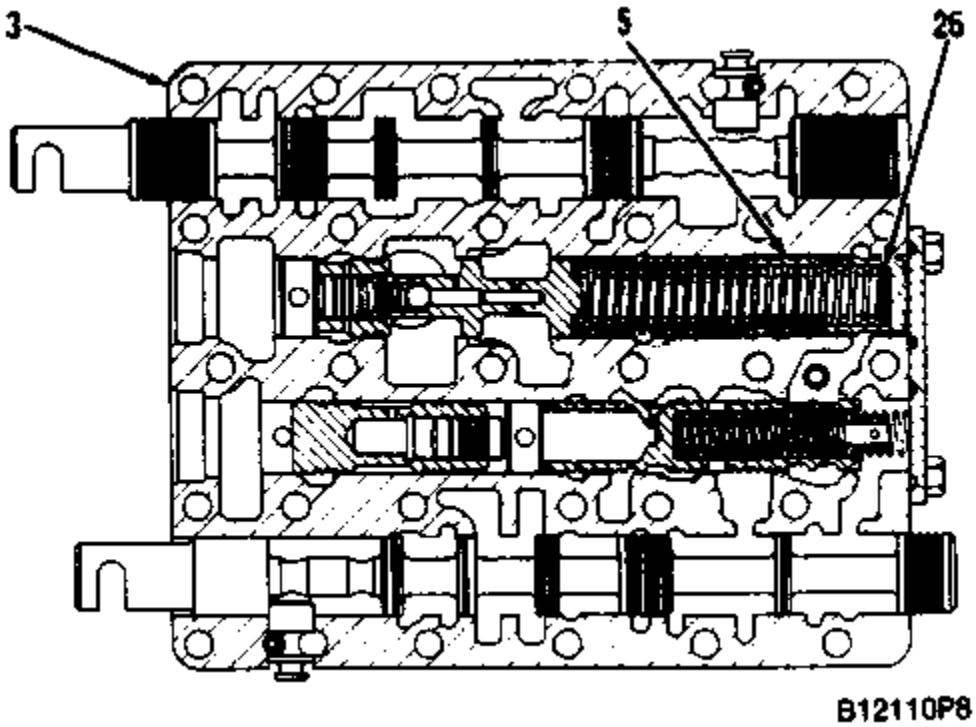
At a pressure of ... 140 kPa (20 psi)

SPACER CHART PRESSURE CHANGE TO THE VALVES BY REMOVAL OR ADDITION OF ONE SPACER			
Part No. For Spacer	**Thickness**	**Change In Pressure**	**Where Used**
(24) 5M9622 5M9623 5M9624	1.60 mm (.063 in) 0.90 mm (.035 in) 0.25 mm (.010 in)	505 kPa (73.0 psi) 293 kPa (42.7 psi) 81 kPa (12.0 psi)	Priority Valve (1)
(25) 5M9622 5M9623 5M9624	1.60 mm (.063 in) 0.90 mm (.035 in) 0.25 mm (.010 in)	98 kPa (14.2 psi) 57 kPa (8.3 psi) 16 kPa (2.3 psi)	Load Piston (5)
(26) 5M9623	0.90 mm (.035 in)	16.5 kPa (2.40 psi)	Converter Outlet Relief Valve (13)

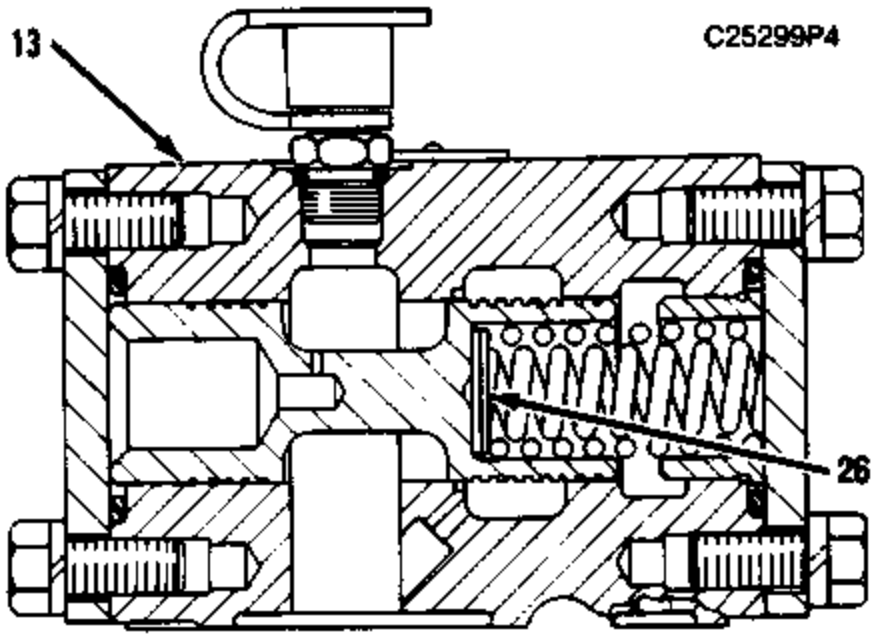
Transmission Selection	Clutches Engaged In Transmission
Neutral	3
First Speed Forward	2 and 5
Second Speed Forward	2 and 4
Third Speed Forward	2 and 3
First Speed Reverse	1 and 5
Second Speed Reverse	1 and 4
Third Speed Reverse	1 and 3



Priority Valve
(1) Valve (priority). (24) Spacers.



Transmission Hydraulic Control Valve
(5) Piston (load). (3) Valve (selector and pressure control). (25) Spacers.



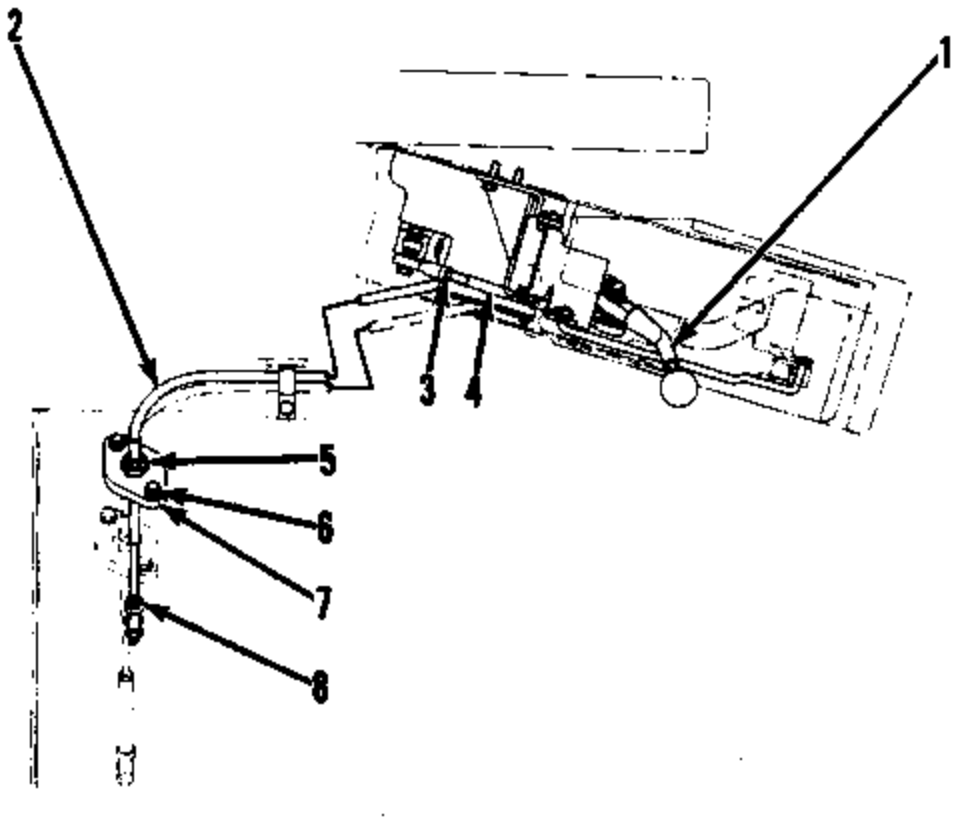
Converter Outlet Relief Valve
(13) Valve (converter outlet relief). (26) Spacers.

Linkage Adjustments

Transmission Speed Control (Earlier Models)

WARNING

Transmission control linkage adjustment should be made only with engine OFF. Accidental transmission engagement and sudden machine movement could cause personal injury.



C10000P1

Transmission Control Linkage
(1) Lever (control). (2) Cable assembly. (3) Locknut. (4) Rod assembly. (5) Locknut. (6) Bolt. (7) Cover. (8) Locknut.

Torque for 1/4 in. locknuts (8) on cable assembly (2) that hold the rod ends in place ... 8 ± 3 N·m (6 ± 2 lb ft)

Torque for 3/8 in. locknuts (3) on rod assembly (4) ... 12 ± 4 N·m (9 ± 3 lb ft)

Torque for all 5/8 in. jam nuts ... 38 ± 7 N·m (28 ± 5 lb ft)

Assembled length of rod assembly (4) ... 202.0 ± 1.5 mm (7.95 ± .06 in)

Procedure For Adjustment

1. Remove bolts (6) that hold cover (7) to the housing.

2. Loosen locknut (5) for cable (2). Turn cover (7) to move cable (2) that adjusts control lever (1).

3. Adjust control lever (1) so that it does not make contact with the guide in any speed or in neutral.

Steering And Transmission Directional Control (Earlier Models)

WARNING

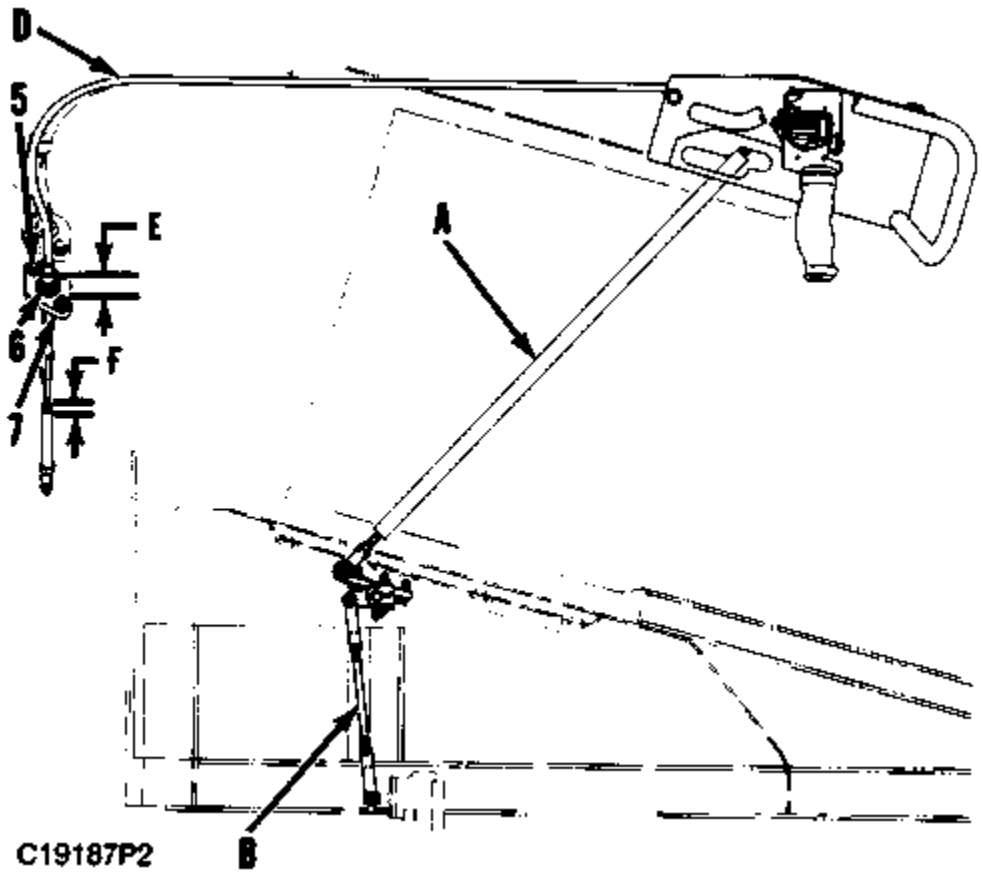
Do not make any adjustments to the control linkage with the engine running. Accidental disengagement of the parking brake while the engine is running could cause sudden machine movement and personal injury.

Torque for 1/4 in. locknuts on cable assembly that hold the rod ends in place ... 8 ± 3 N·m (6 ± 2 lb ft)

Torque for all 3/8 in. locknuts (jam nuts) that hold the rod ends in place on the rod ... 12 ± 4 N·m (9 ± 3 lb ft)

Torque for all 5/8 in. locknuts (jam nuts) on cable assembly ... 38 ± 7 N·m (28 ± 5 lb ft)

NOTE: All rod assembly measurements must be made in a straight line between the centerlines of the rod end mounting holes.



Transmission And Steering Control Linkage
(5) Bolt. (6) Locknut. (7) Cover. (A) Rod assembly. (B) Rod assembly. (D). Cable assembly. (E) Dimension. (F) Dimension.

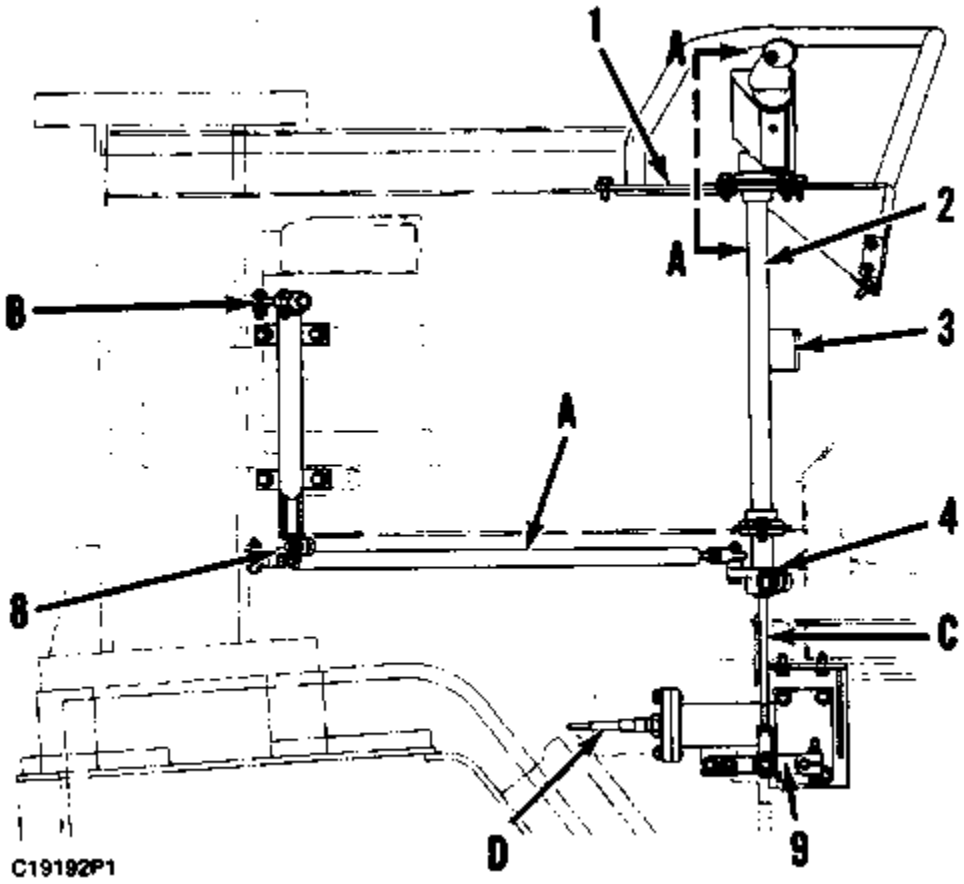
(A) Assembled length of rod assembly ... 876 mm (34.5 in)

(B) Assembled length of rod assembly ... 280 ± 1.5 mm (11.02 ± .06 in)

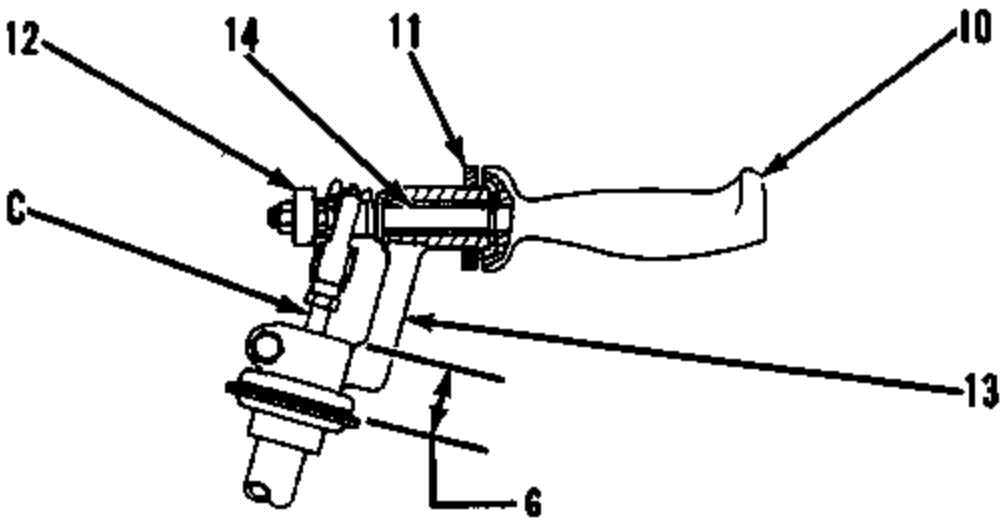
(C) Assembled length of rod assembly ... 823 mm (32.4 in)

(E) Dimension ... 16 ± 2 mm (.63 ± .08 in)

(F) Dimension ... 12 ± 2 mm (.47 ± .08 in)



Transmission And Steering Control Linkage
(1) Plate. (2) Shaft assembly. (3) Plate. (4) Lever. (8) Lever. (9) Lever. (A) Rod assembly. (B) Rod assembly. (C) Rod assembly. (D) Cable assembly.



C12549P4 VIEW A–A

Steering Control Lever
(10) Handle. (11) Collar. (12) Plate (shaft assembly). (13) Lever. (14) Shaft assembly. (C) Rod assembly. (G) Dimension.

(G) Dimension ... 40.0 ± 2.0 mm (1.57 ± .08 in)

Procedure For Adjustment Of Steering Control Linkage

1. Install assembled and adjusted rod assemblies (A) and (B).

2. Install lever (13) on shaft assembly (2) so that lever (13) forms a 75° ± 4° angle with plate (3) on shaft assembly (2).

3. Install shaft assembly (2) on the machine and make sure the top of shaft assembly (2) and lever (13) are above plate (1) the dimension shown in view A-A.

4. Install lever (4) on shaft assembly (2) so that lever (4) forms a 193° ± 4° angle with plate (3).

5. Move parking brake lever to the ON position and then adjust rod assembly (A) so there is a free fit between lever (8) and the bolt to hold rod assembly (A) to lever (8).

6. Move parking brake lever to the OFF position. Move steering control handle to the FULL RIGHT TURN position and FULL LEFT TURN position. Make sure the steering control valve lever moves its full travel at both turn positions before the steering linkage stops (bottoms out).

Procedure For Adjustment Of Transmission Directional Control Linkage

1. Install assembled and adjusted rod assembly (C) through shaft assembly (2). Install shaft assembly (14) and lever (9). Make sure lever (9) and shaft assembly plate (12) part of shaft assembly (14) are parallel.

2. Install cable assembly (D) and adjust to dimensions (E) and (F). Dimension (E) 16 ± 2 mm (.63 ± .08 in) is the distance from the top of cover (7) to the end of threads on cable. Dimension (F) 12 ± 2 mm (.47 ± .08 in) is the distance from the end of rod end to the end of threads on cable.

3. Install collar (11) and handle (10) on shaft assembly (14) so timing mark on handle is perpendicular within ± 5° to shaft assembly plate (12).

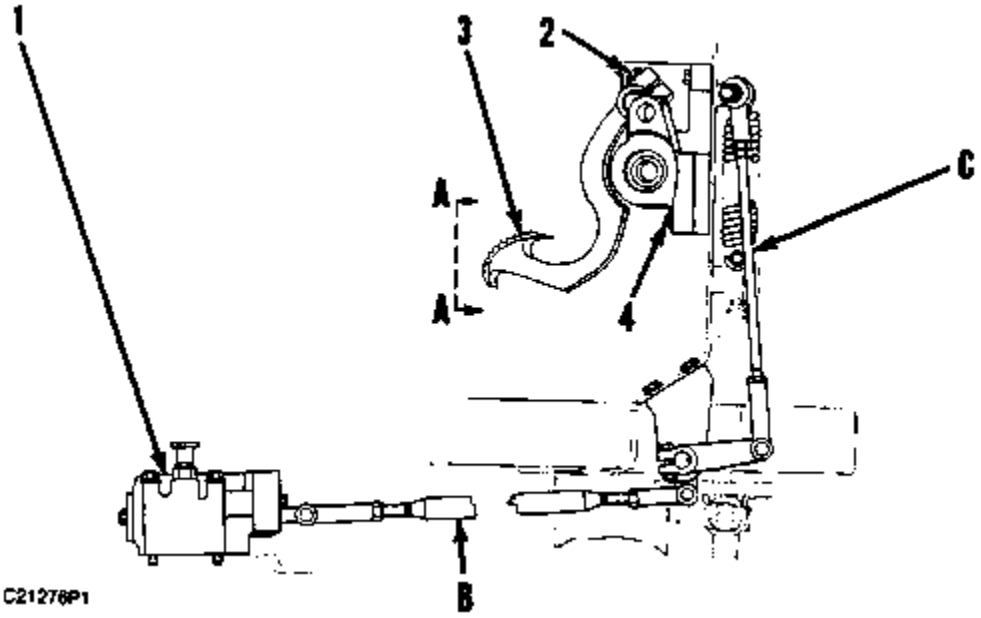
4. Put handle (10) in NEUTRAL position. If timing mark on handle is not vertical within ± 2°, then adjust cable assembly (D). To adjust cable assembly, remove bolts (5) and loosen locknut (6). Turn cover (7) to move timing mark to vertical position.

5. With handle (10) in NEUTRAL position, adjust collar (11) to line up NEUTRAL symbol on collar with timing mark on handle.

Service Brake Pedal (Earlier Models)

WARNING

Do not make any adjustments to the control linkage with the engine running. Accidental disengagement of the parking brake while the engine is running could cause sudden machine movement and personal injury.



Brake Pedal Linkage
(1) Valve (service brake control). (2) Bolt. (3) Pedal (brake). (4) Bolt (adjusting). (B) Rod assembly. (C) Rod assembly.

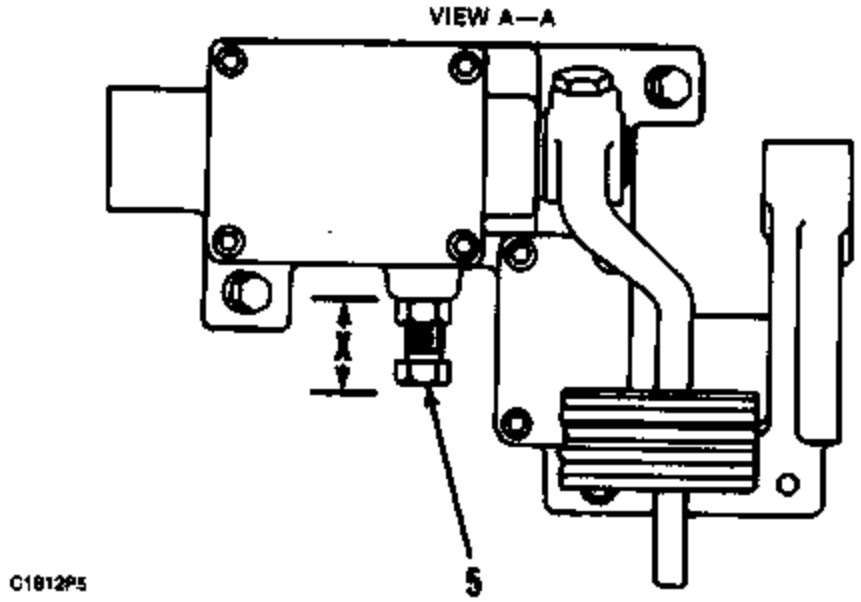
Torque for all 1/2 in. locknuts (jam nuts) that hold the rod ends in place on the rod ... 45 ± 7 N ± m (33 ± 5 lb ft)

NOTE: All rod assembly measurements must be made in a straight line between the centerlines of the rod end mounting holes.

(B) Assembled length of rod assembly ... 975.0 ± 1.5 mm (38.38 ± .06 in)

(C) Assembled length of rod assembly ... 386.0 ± 2.0 mm (15.20 ± .08 in)

(2) Torque for bolt ... 135 ± 15 N·m (100 ± 11 lb ft)



Brake Pedal Linkage
(5) Bolt [adjusting (upper stop)]. (X) Distance.

Procedure To Adjust Service Brake Pedal Linkage

1. Install adjusted rod assemblies (B) and (C).

2. Install pedal (3) so that the slot of the pedal is one spline tooth down (counterclockwise) from the timing mark on the shaft.

NOTE: To bring the pedal closer to the operator, the centerline of the slot of pedal (3) must be in alignment with the timing mark on the shaft.

3. Adjust the head of bolt (5) to dimension (X) 45 mm (1.8 in) from the support. Bolt (5) is the upper stop for the brake pedal.

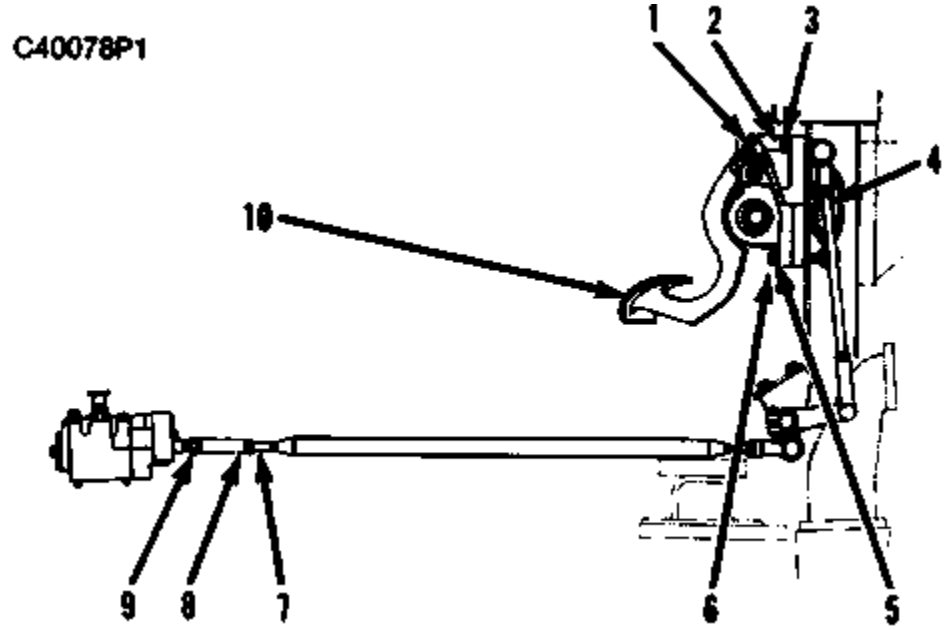
4. Hold brake pedal against upper stop and push valve plunger all the way into valve (1). Then adjust rod end on rod assembly (C) so that the pin that connects rod end to valve plunger has a free fit.

5. Push brake pedal down until valve plunger stops.

6. Adjust bolt (4) until head contacts brake pedal.

7. Release brake pedal and turn bolt (4) an additional 1/2 turn out. Tighten locknut.

(Later Models)



(1) Bolt. (2) Adjustment Bolt. (3) Locknut. (4) Spring. (5) Adjustment Bolt. (6) Locknut. (7) Locknut. (8) Rod end. (9) Pin. (10) Service brake pedal.

(1) Torque for bolt ... 120 ± 20 N·m (90 ± 15 lb ft)

(7) Torque for locknut ... 45 ± 7 N·m (33 ± 5 lb ft)

Procedure To Adjust Service Brake Pedal Linkage

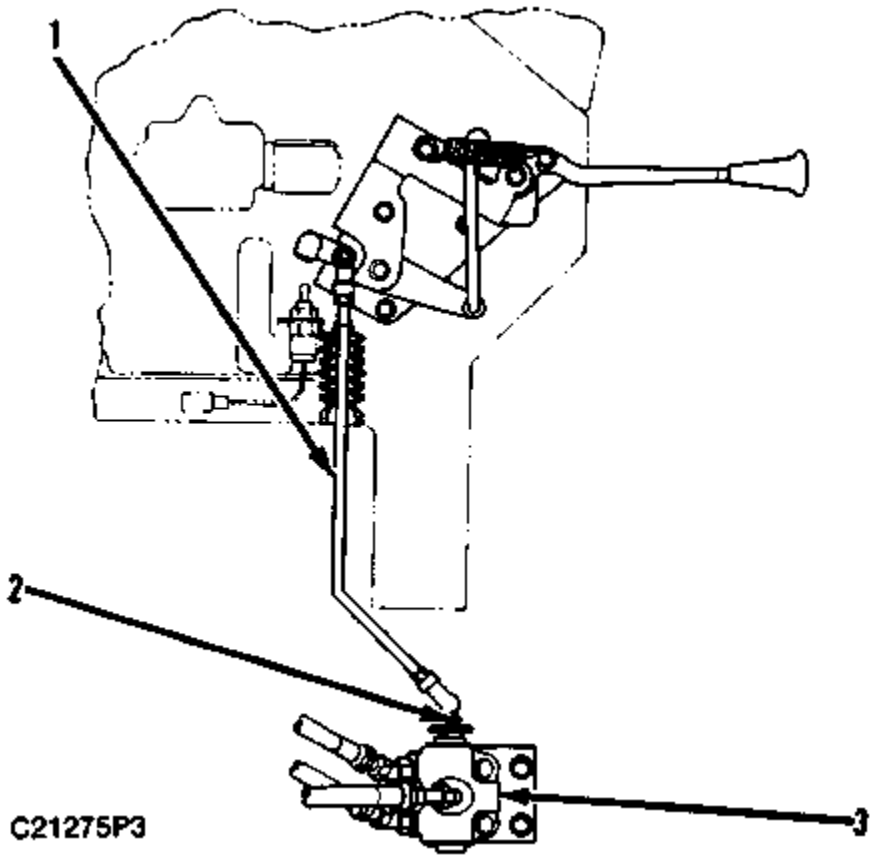
1. Adjust spring (4) stretch to 3 ± 1 mm (.11 ± .04 in) with adjustment bolt (2) and secure in place with locknut (3).

2. With service brake pedal (10) against the upper stop and valve stem depressed, adjust rod end (8) to allow free fit of pin (9) in rod end and valve stem.

3. With service brake pedal (10) depressed and valve stem extended, adjust bolt (5) until it is in contact with service brake pedal.

4. Release service brake pedal and adjust bolt (5) out 1/2 turn and secure in place with locknut (6).

Parking Brake (Earlier Models)



Parking Brake Linkage
(1) Rod assembly. (2) Locknuts. (3) Valve (parking brake control).

(2) Torque for locknut ... 14 ± 4 N·m (10 ± 3 lb ft)

Procedure to Adjust Parking Brake

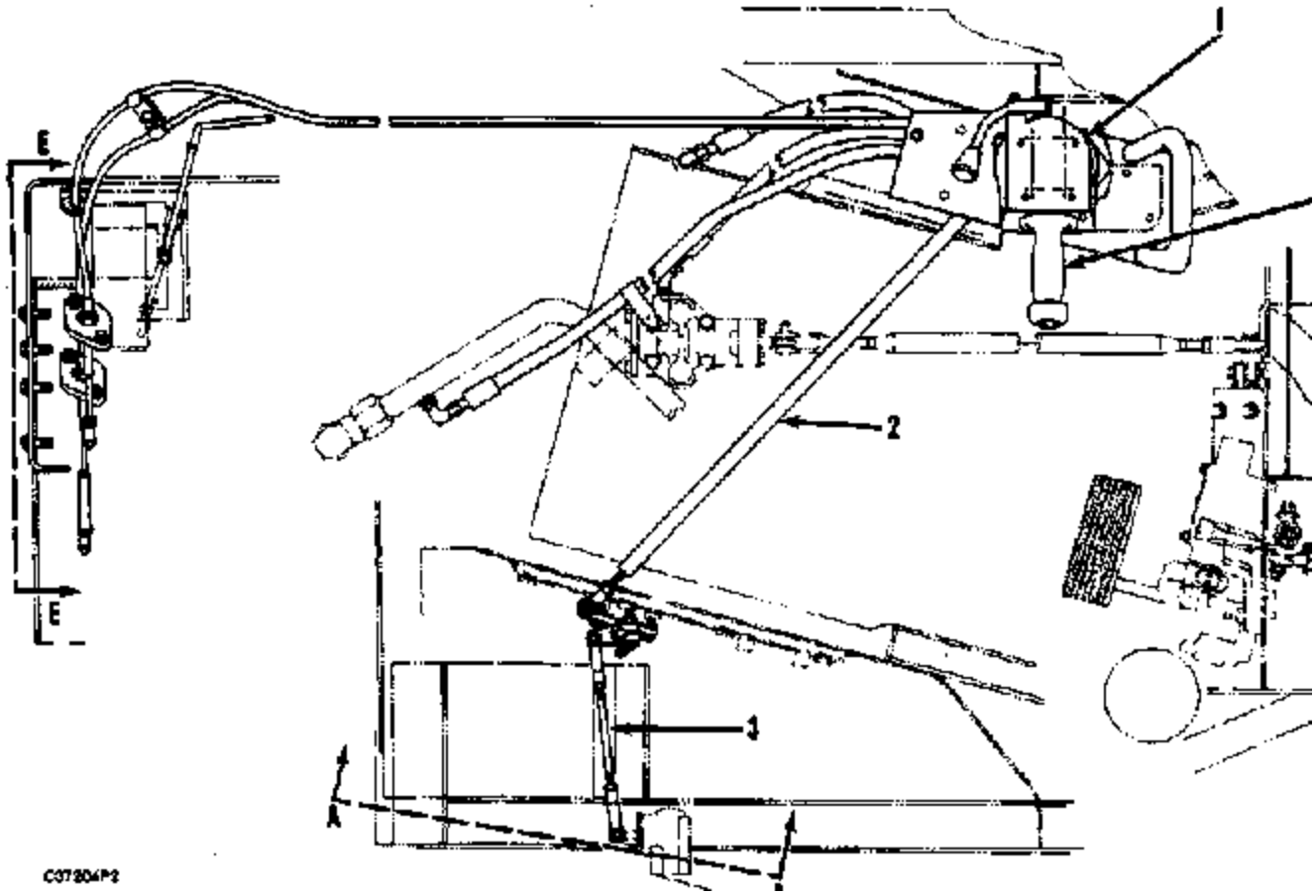
1. Check brake pressure at pressure tap (G) (see transmission pressure chart) with the parking brake lever in the ON and OFF positions.

2. The brake pressure with the parking brake lever in the ON position should be 0 kPa (0 psi). If not, make rod assembly (1) longer.

3. The brake pressure with the parking brake lever in the OFF position should be 2825 ± 140 (410 ± 20 psi). If not, make rod assembly (1) shorter.

4. Do Step 1 again, if rod assembly adjustments were needed.

Steering And Transmission Directional Control (Series II)



WARNING

Do not make any adjustment to the control linkage with the engine running. Accidental disengagement of the parking brake while the engine is running could cause sudden machine movement and personal injury.

Torque for all 1/4 in. locknuts on cable assembly that hold the rod ends in place ... 8 ± 2 N·m (6 ± 1.5 lb ft)

(1) See Steering And Transmission Hand Control Group for adjustment procedures.

(2) Assembled length of rod assembly ... 880 mm (34.6 in)

(3) Assembled length of rod assembly ... 280.0 ± 1.5 mm (11.02 ± .06 in)

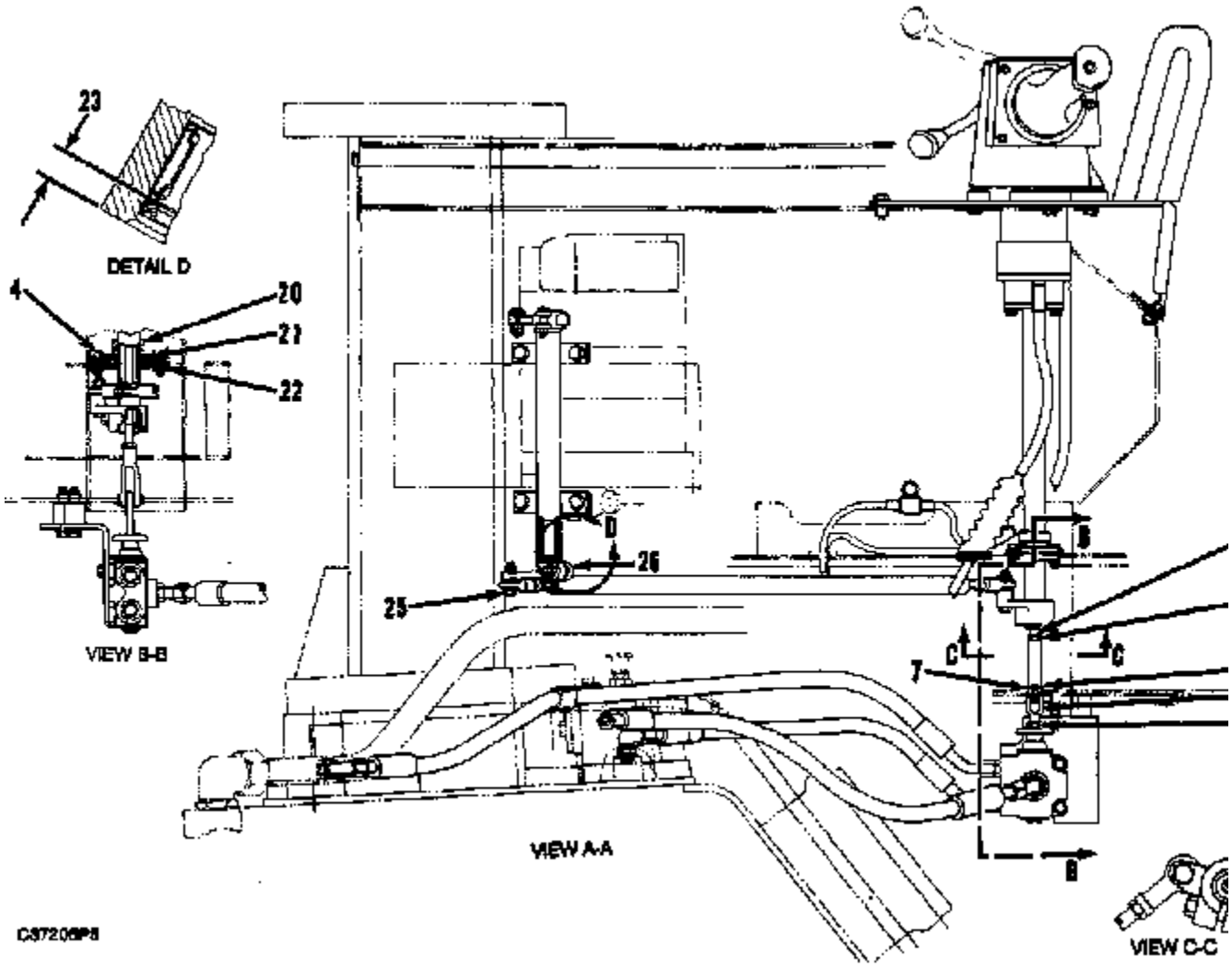
(4) Torque for bolts ... 30 ± 7 N·m (22 ± 5 lb ft)

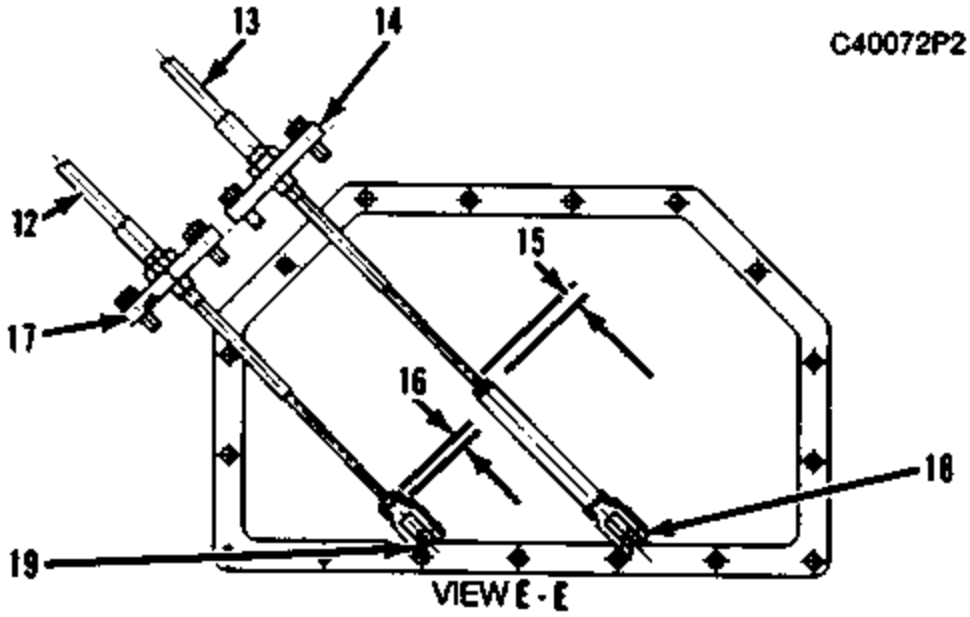
(6) Torque for nut ... 30 ± 7 N·m (22 ± 5 lb ft)

(11) Torque for nut ... 30 ± 7 N·m (22 ± 5 lb ft)

(15)(16) Dimension ... 12 ± 2 mm (.47 ± .08 in)

(23) Depth to install bearing ... 4.5 ± 1.5 mm (.18 ± .06 in)





Steering And Transmission Hand Control Installation Procedure

1. Make any necessary adjustments to the Steering And Transmission Hand Control Group.

2. Install control group (1) into the vehicle along with collar (20), bearing (21), and two flanges (22).

3. With bearing (21) between two flanges (22), install bolts (4) to flanges (22) shown in View B-B. Tighten bolts (4) to 30 ± 7 N·m (22 ± 5 lb ft).

4. Turn collar (20) quickly clockwise (as viewed from the top) until the eccentric groove in collar (20) engages the eccentric on bearing (21) and the two parts are locked together.

5. Place a punch or drift in the blind hole in collar (20) and strike it sharply with a hammer in the clockwise direction.

6. Tighten the setscrew in collar (20).

Forward-Reverse Assembly Procedure

1. Engage the parking brake.

2. Move the transmission direction selector spool to the NEUTRAL position (middle detent).

3. Assemble cable (13) to cover (14) and rod end. Adjust cable (13) to dimension (15) shown in View E-E.

4. Adjust cable (13) to allow free fit of pin assembly (18) into the transmission bellcrank. To adjust the cable, remove bolts that hold cover (14) to the housing. Loosen the locknut on cable (13) and turn cover (14) as necessary.

Speed Control Assembly Procedure

1. Assemble cable (12) to cover (17) and rod end. Adjust cable (12) to dimension (16) shown in View E-E.

2. Move the transmission speed selector spool to the SECOND gear position (middle detent).

3. Turn handle (5) to the SECOND gear position (white mark on handle aligned with the number 2 on speed collar).

4. Adjust cable (12) to allow free fit of pin assembly (19) into the transmission bellcrank. To adjust the cable, remove bolts that hold cover (17) to the housing. Loosen the locknut on cable (12) and turn cover (17) as necessary.

Steering Control Assembly Procedure

1. Install rod assemblies (2) and (3) after they have been adjusted to the correct dimensions.

2. Assemble lever (24) to the shaft assembly. Align the timing mark on the tube assembly with the lever arm and bolt head side of the lever saw cut. If unable to align the timing mark with the bolt head side of the lever saw cut, rotate the lever counterclockwise (as viewed from the bottom) one spline and install lever. Lever should be installed 5 ± 1 mm (.20 ± .04 in) above the bottom of the splined tube assembly. Tighten the lever clamping bolt.

3. Engage the parking brake.

4. Adjust the length of rod (2) to allow free fit of bolt (25) into bellcrank (26).

Parking Brake Adjustment Procedure

1. Engage the parking brake.

2. Assemble rod end (9) and nut (6) to threaded rod (8). Do not tighten nut (6).

3. Assemble rod eye (10) into the parking brake valve spool until bottomed. Tighten nut (11) against the washer and the valve spool to a torque of 30 ± 7 N·m (22 ± 5 lb ft).

4. Push the parking brake valve spool to the down position.

5. Hold rod end (9) and turn rod (8) until pin (7) will assemble through rod end (9) and rod eye (10).

6. Adjust the parking brake valve bracket to center rod (8) in the tube.

7. Hold rod end (9) and turn rod (8) until pin (7) is firmly bottomed (resistance is felt) in the slot in rod eye (10). Then turn rod (8) 1/4 turn in the opposite direction. Tighten nut (6) to a torque of 30 ± 7 N·m (22 ± 5 lb ft).

To Check Parking Brake Adjustment

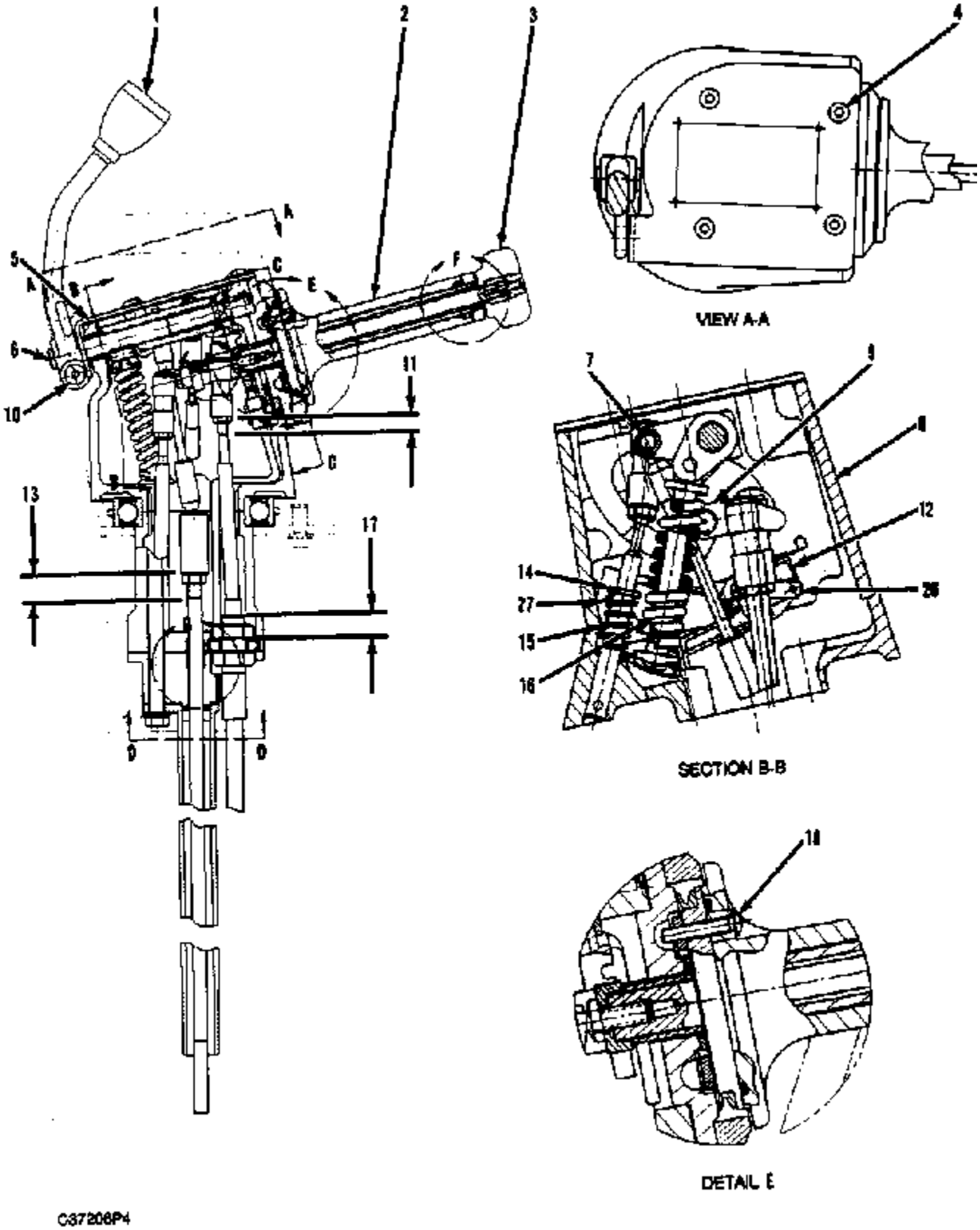
1. Check brake pressure with the parking brake lever in the ON and OFF position: See Power Shift Transmission Testing And Adjusting in this module for location of pressure tap.

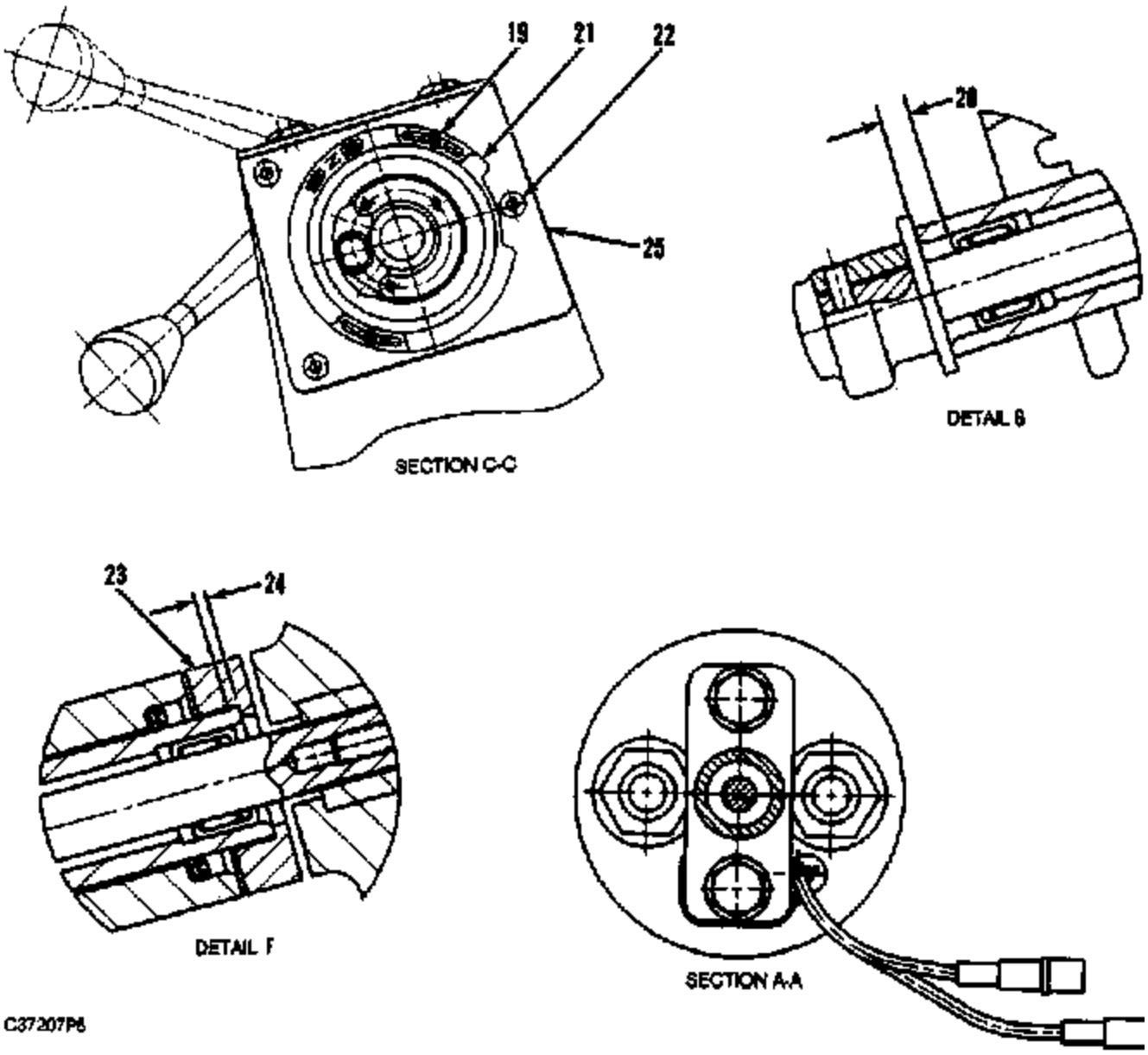
2. The brake pressure with the parking brake lever in the ON position should be 0 kPa (0 psi). If not, make rod assembly (8) longer.

3. The brake pressure with the parking brake lever in the OFF position should be 2825 ± 140 kPa (410 ± 20 psi). If not, make rod assembly (8) shorter.

4. Do Step 1 again if rod assembly adjustments were needed.

Steering And Transmission Hand Control





WARNING

Do not make any adjustment to the control linkage with the engine running. Accidental disengagement of the parking brake while the engine is running could cause sudden machine movement and personal injury.

Torque for all 1/4 in. locknuts on cable assembly that hold the rod ends in place ... 8 ± 2 N·m (6 ± 1.5 lb ft)

Torque for the 3/8 in. locknut (jam nut) that holds the swivel rod end on the center rod ... 30 ± 7 N·m (22 ± 5 lb ft)

Torque for all 5/8 in. locknuts (jam nuts) on cable assembly ... 38 ± 7 N·m (28 ± 5 lb ft)

(4) Torque for four screws ... 8 ± 2 N·m (6 ± 1.5 lb ft)

(7) Torque for nut ... 8 ± 2 N·m (6 ± 1.5 lb ft)

(10) Torque for screw ... 17 ± 4 N·m (13 ± 3 lb ft)

(11) Dimension (two places) ... 15 ± 2 mm (.59 ± .08 in)

(13) Dimension ... 16 ± 2 mm (.63 ± .08 in)

(15) 5N6096 Spring:

Length under test force ... 25.50 mm (1.004 in)

Test force ... 19.57 N (4.40 lb)

Free length after test ... 48.77 mm (1.920 in)

Outside diameter ... 13.82 mm (.544 in)

(16) 6Y2846 Spring:

Length under test force ... 74.64 mm (2.939 in)

Test force ... 626 N (140.8 lb)

Free length after test ... 79.92 mm (3.146 in)

Outside diameter ... 20 mm (.79 in)

(17) Dimension (two places) ... 16 ± 2 mm (.63 ± .08 in)

(18) Torque for three screws ... 1.7 ± 0.25 N·m (15 ± 2.2 lb in)

(19) Torque for two bolts that hold collar ... 0.8 ± 0.1 N·m (7 ± 1 lb in)

(20) Depth to install bearing ... 4.5 ± 1.0 mm (.18 ± .04 in)

(22) Torque for three screws ... 8 ± 2 N·m (6 ± 1.5 lb ft)

(24) Depth to install bearing ... 1.5 ± 1.0 mm (.06 ± .04 in)

(26)(27) Torque for four bolts that tighten switch ... 0.5 ± 0.05 N·m (4.4 ± .5 lb in)

Speed Control Adjustment Procedure

1. Rotate collar (23) until the number "2" is 30° ± 1° counterclockwise from vertical as viewed from the end of handle (2). Tighten the bolt that holds collar (23) to a torque of 1.7 ± 0.20 N·m (15 ± 1.8 lb in).

2. With plate (5) removed, rotate lever (9) until it is parallel with the top of housing (8). Install handle assembly (3) with the white mark in line with the number "2" on collar (23).

Forward-Reverse Adjustment Procedure

1. Rotate ring (21) so screw (22) is in the center of the slot. Tighten two screws (19) to a torque of 0.8 ± 0.1 N·m (7 ± 1 lb in).

2. With parking brake lever (1) in the engaged position, rotate handle (2) until the white mark on the handle lines up with "N" (NEUTRAL) on ring (21). Tighten three screws (18) to a torque of 1.7 ± 0.25 N·m (15 ± 2.2 lb in).

Neutral Start Switch Adjustment Procedure

1. With parking brake lever (1) in the engaged position, loosen screw (10) and remove parking brake lever (1).

2. Install parking brake lever (1) on splined shaft (6) so that the hole in lever (1) is in line with the hole in plate (5).

3. Check continuity through switch (12). If there is no continuity, adjust the position of switch (12) with the following steps.

4. To adjust the position of switch (12); remove three screws (22) and cover assembly (25).

5. Loosen switch screws (26) and reposition switch (12). Recheck continuity as in Step 3 and reposition switch if necessary.

Backup Alarm Adjustment Procedure

1. Engage the parking brake. Release the brake and rotate handle (2) 15° toward Reverse (counterclockwise). Check continuity through switch (14). If there is no continuity within 1° of the 15° angle, adjust the position of switch (14).

2. To adjust the position of switch (14), remove three screws (22) and remove cover assembly (25).

3. Loosen switch screws (27) and reposition switch (14). Recheck continuity as in Step 1 and readjust switch if necessary.