Service Manual

Domestic Series 7000 Compact Tractor

NOTE: These materials are prepared for use by trained technicians who are experienced in the service and repair of equipment of the kind described in this publication, and are not intended for use by untrained or inexperienced individuals. Such individuals should seek the assistance of an authorized service technician or dealer. Read, understand, and follow all directions when working on this equipment. This includes the contents of the Operators Manual, which came with your equipment. No liability can be accepted for any inaccuracies or omission in this publication, although every care has been take to make it as complete and accurate as possible. The right is reserved to make changes at any time to this document without prior notice and without incurring an obligation to make such changes to previously published documents. All information contained in this publication is based on product information available at the time of publication. Photographs and illustrations used in this publication are for reference use only and may not depict actual model and component parts.

MTD Products Inc. - Product Training and Education Department

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Domestic Series 7000 Hydraulics

1. STANDARD HYDRAULIC SYSTEMS ON THE DOMESTIC SERIES 7000: ORIENTATION

NOTE: Subsections 1 and 2 of the Domestic Series 7000 Hydraulics portion of this manual provide a basic orientation to the system. Subsection 3 and those that follow it contain specific test procedures.

NOTE: Hydraulic diagrams are contained in an apendix to this section.

1.1. The transmission housing acts as a reservoir for all of the hydraulic systems on the tractor: hydrostatic drive pump, hydrostatic steering system, lift cylinder, and accessories.

1.2. Fluid: the transmission and hydraulic system are filled with 6.5 gallons (24.6 L) of Cub Cadet Hydraulic Transmission Fluid (P/N: 737-3025 1Qt., 737-3062 1Gal., 737-3063 10 Qt., 737-3035 5 Gal.).

1.3. Filtration: The hydraulic system filter (P/N:723-0405) is located on a boss on the front surface of the transmission housing, adjacent to the mid-mount, 2000 R.P.M. P.T.O. shaft. The hydrostatic drive filter (P/N: 723-3014) is located on the front surface of the hydrostatic pump. See Figure 1.3.

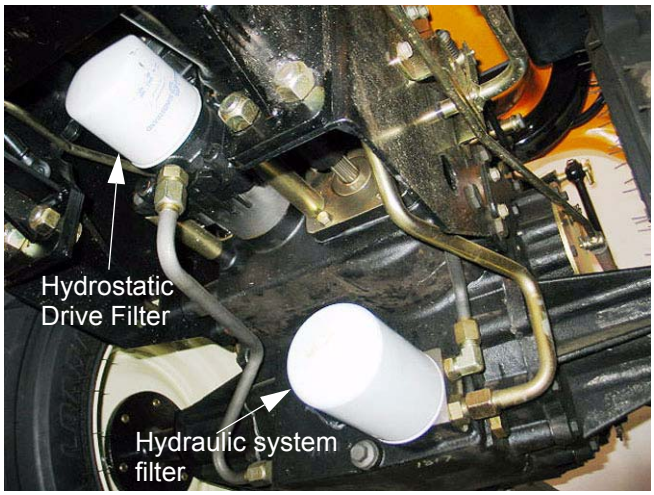

Figure 1.3

NOTE: Other than sharing a reservoir, the hydrostatic drive operates independently of the rest of the hydraulic system.

1.4. The hydrostatic drive is a Sauer model BDU15. It has an integrated gerotor charge pump that draws fluid up the suction pipe from the base of the transmission housing. See Figure 1.4.

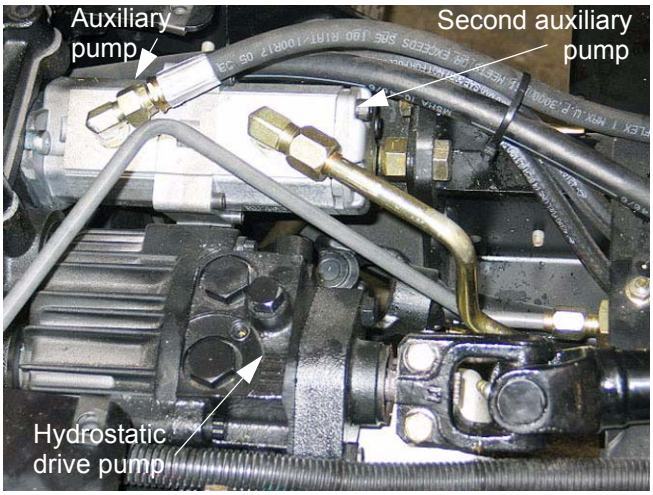

Figure 1.4

1.5. The steering and lift cylinder are powered by a Sauer-Danfoss SKP 1/4.3 S auxiliary pump.

1.6. If hydraulically powered accessories are installed, they are driven by a second auxiliary pump that mounts to and is driven by the standard auxiliary pump. The add-on auxiliary pump is a Sauer-Danfoss model SNP 1/7.8 S.

NOTE: Domestic Series 7000 tractors produced before 2004 included a single auxiliary pump as standard equipment. Later tractors include both auxiliary pumps and the valve used to operate a front-end loader.

Domestic Series 7000 Hydraulics

1.7. The steering pump, located in the dash pedestal contains it's own back-up gerotor charge pump that will enable steering control when the engine is not running. See Figure 1.7.

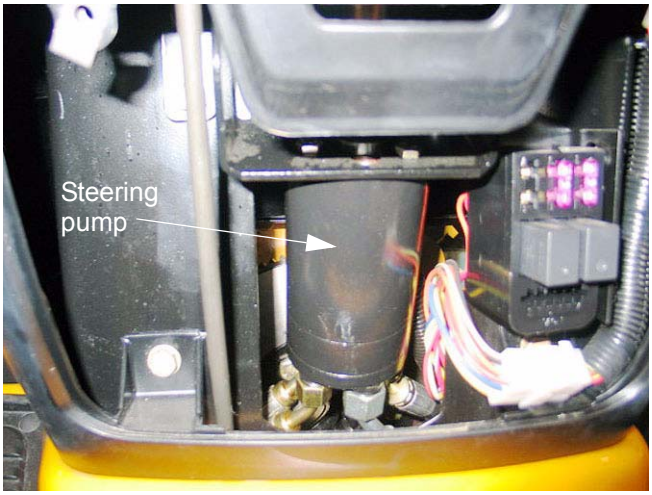

Figure 1.7

1.8. The steering pump directs fluid pressure to one end of the double-acting differential steering cylinder while allowing it to return from the other end of the cylinder in order to provide steering action.

1.9. The lift cylinder is operated by a control valve and feedback rod under the right rear fender. See Figure 1.9.

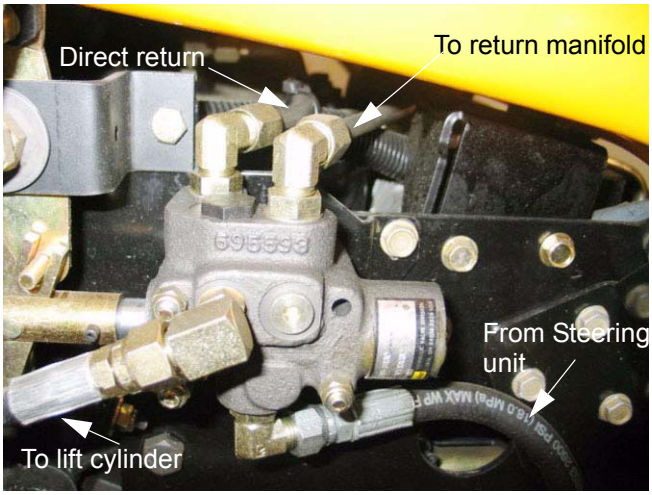

Figure 1.9

1.10. The control valve directs fluid pressure to a single-acting hydraulic cylinder that lifts the three-point lift arms.

1.11. The hydraulic fluid flow is as follows:

1.12. Through the pick-up tube from the transmission sump and filter, to the auxiliary pump. See Figure 1.12.

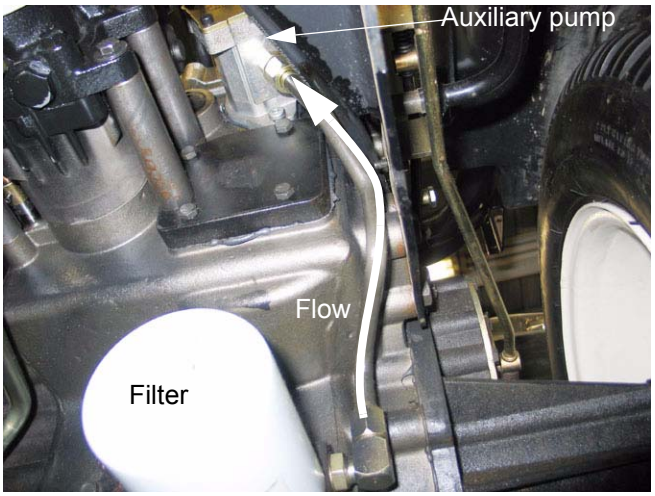

Figure 1.12

1.13. Under pressure from the auxiliary pump the fluid goes to the steering pump, connecting to the "P" port on Sauer steering pumps. On Ross steering pumps, it connects to the "IN" port.

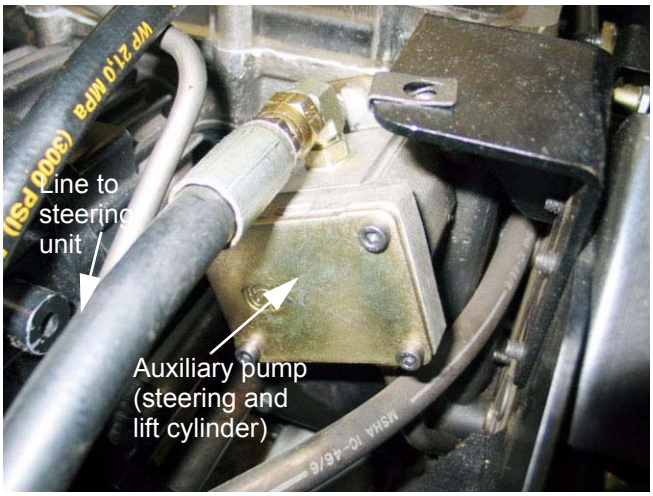

Figure 1.13

1.14. The steering unit distributes pressure to the steering cylinder according to the position of the steering wheel. On Sauer pumps this involves the ports labeled “L” and “R”. See Figure 1.12.

Figure 1.14

1.15. On Ross pumps, this involves the ports labeled “LT” and “RT”. See Figure 1.14.

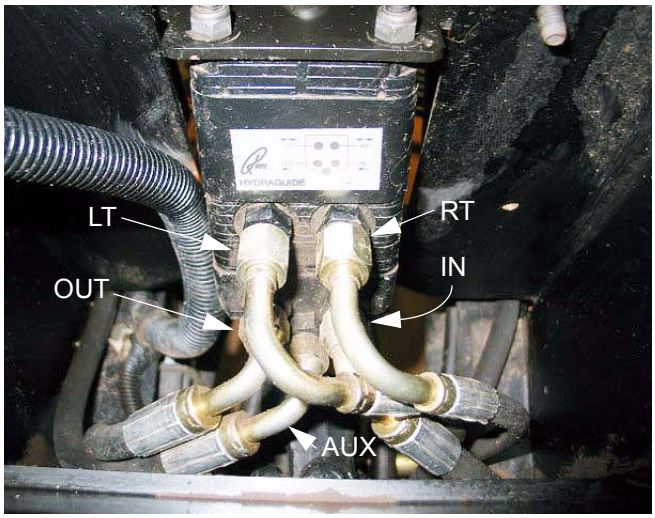

Figure 1.15

1.16. The power steering unit is first in line, and has priority over the rest of the system. From the steering unit, the fluid may follow one of two return paths:

1.17. The fluid may pass through the return manifold, through the oil cooler, then back to the transmission. See Figure 1.17.

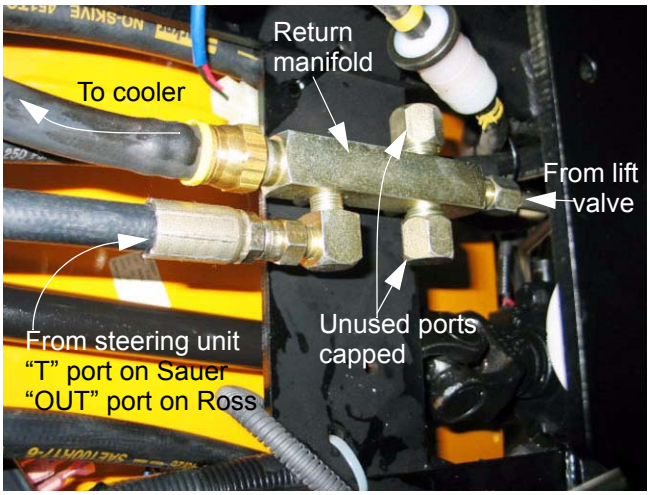

Figure 1.17

1.18. The oil cooler is located on the front of the radiator. See Figure 1.18.

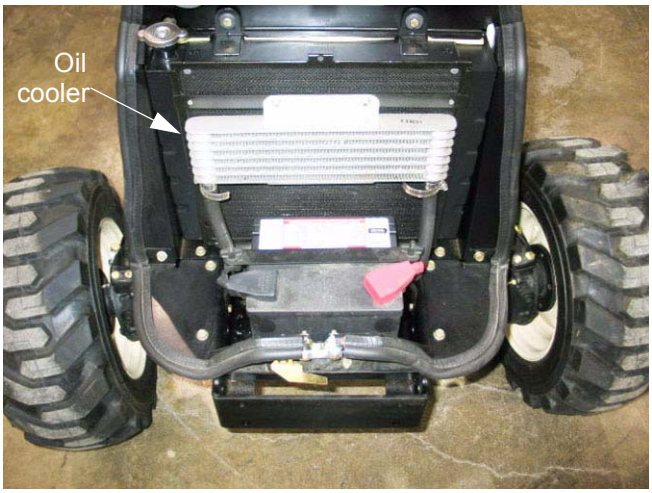

Figure 1.18

1.19. If the fluid is required by the lift cylinder, it will go to the bottom port of the lift valve instead of the return manifold.

1.20. The lift valve sends fluid to the single-acting lift cylinder when operator demand and the feed-back rod direct it to do so. See Figure 1.20.

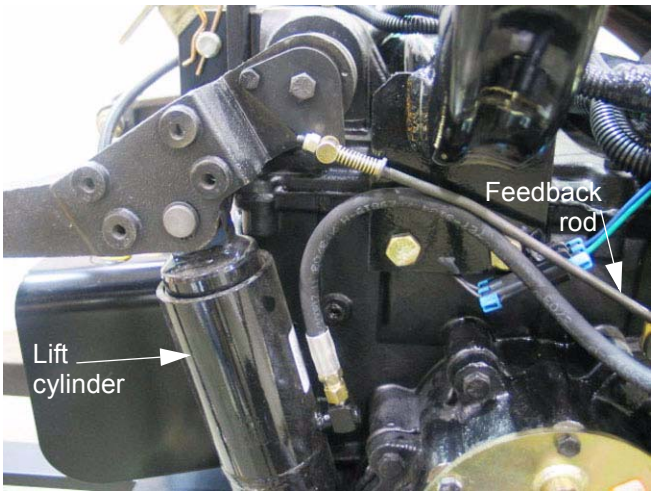

Figure 1.20

1.21. Fluid not required to lift the cylinder will be directed back to the transmission through the return manifold, via the cooler. See Figure 1.21.

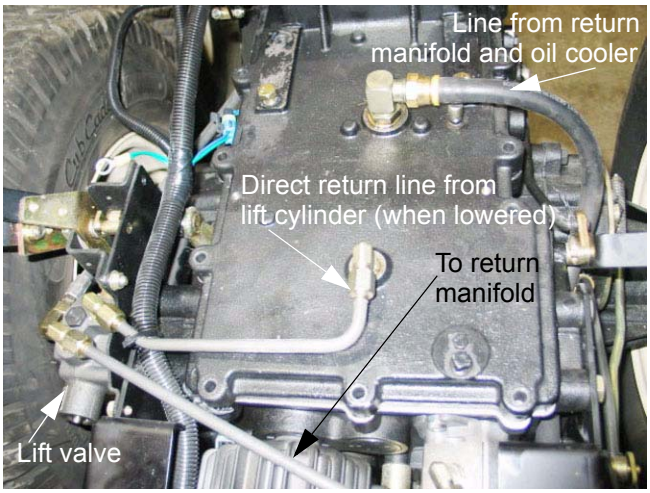

Figure 1.21

1.22. Excess fluid volume beyond normal return flow rate is generated when the lift arms are lowered. This flow is exhausted directly back into the transmission housing.

2. HYDROSTATIC DRIVE: BASIC OPERATION

2.1. The input shaft to the D15U turns a shaft that passes completely through the housing of the hydro., driving an engine speed input shaft in the transmission.

2.2. The input shaft drives the auxiliary hydraulic pump and the P.T.O. They are driven at relatively constant engine speed, rather than in relation to ground speed. See Figure 2.2.

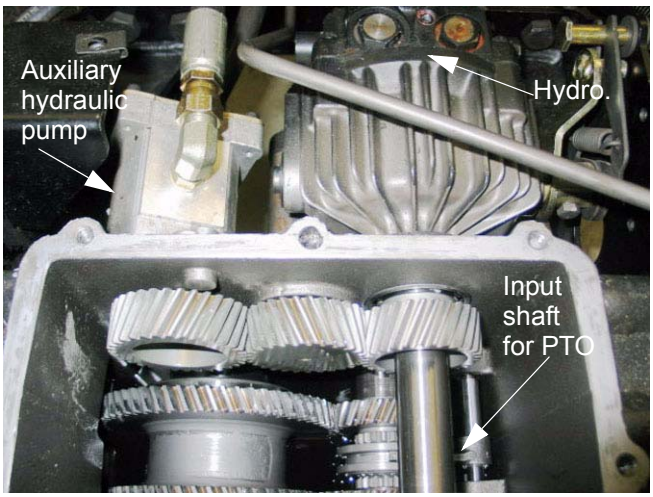

Figure 2.2

2.3. The input shaft also turns a gerotor style charge pump and an axial piston variable displacement hydraulic pump. See Figure 2.3.

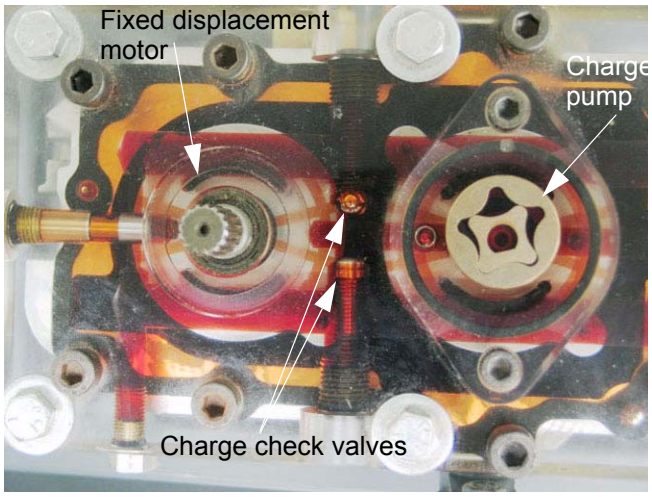

Figure 2.3

NOTE: Figure 2.3 is a similar model hydrostatic drive unit with some see-through components.

2.4. The lower part of the pump contains a fixed displacement axial piston hydraulic motor. The motor is driven by the output of the variable displacement pump.

2.5. The hydro. control arm (scissors bracket) moves a swash plate that controls the output of the pump: tilting the swash plate in one way causes the variable displacement pump to drive fluid through the fixed displacement pump in one direction. See Figure 2.5.

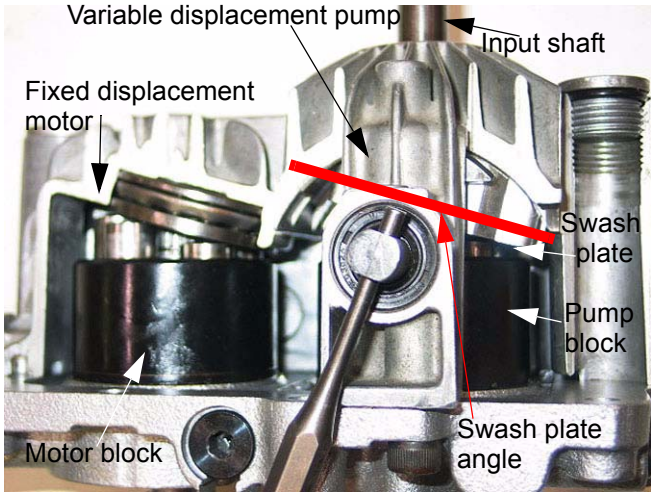

Figure 2.5

NOTE: In figure 2.5, the pistons in the variable displacement pump are alternately pressed into the bores, and then released from bores of the rotating pump block by the tilt of the swashplate.

- On the right side of the pump block in figure 2.5, the pistons are down.
- The pistons are extended on the left side of the pump block. They are forced up by springs contained in the pistons.
- This action causes the pistons to pump fluid in one direction.
- The further the swash plate is tilted, the greater the movement of the pistons as the pump block rotates.
- As the travel of the pistons is increased, the displacement of the pump is increased, and more fluid is pumped.
- The more fluid is pumped, the faster the fixed displacement motor is driven.

2.6. Tilting the swash plate the other way causes the variable displacement pump to drive fluid through the fixed displacement pump in the opposite direction. See Figure 2.6.

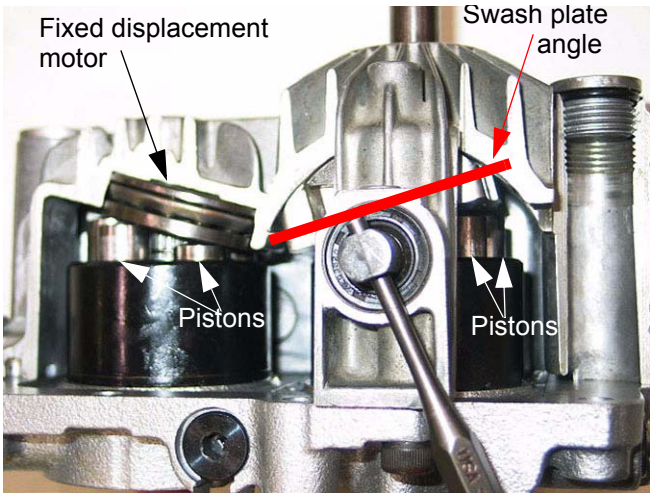

Figure 2.6

2.7. When the swash plate is flat, the pump pistons do not move up and down, no fluid is displaced and no power is transmitted to the fixed displacement pump.

2.8. The charge pump maintains a supply of pressurized fluid to the variable displacment pump to feed and lubricate the pump.

2.9. The charge check valves direct the flow of pressurized fluid to the ports that feed the pistons of the variable displacement pump.

- When driving forward, fluid flows into the varaible displacment pump thorugh one set of ports, and out through a second set.
- When driving backwards, the flow is reversed.
- One check valve opens and the other one closes, depending on the direction of fluid flow.
- If the hydro. is in “neutral”, lubrication is provided to ths spinning (but not pumping) pump and motor blocks through separate channels in the housing.

2.10. If the hydrostatic drive is not performing correctly, begin diagnosing with simple things that can bee seen with minimal disassembly.

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3. EXTERNAL CHECKS

NOTE: Linkage adjustment procedures are covered in the 2003 Cub Cadet Technical Handbook, pages 6-129 through 6-131.

3.1. Remove the fender cover using a phillips head screwdriver and a 1/2" wrench. See Figure 3.1.

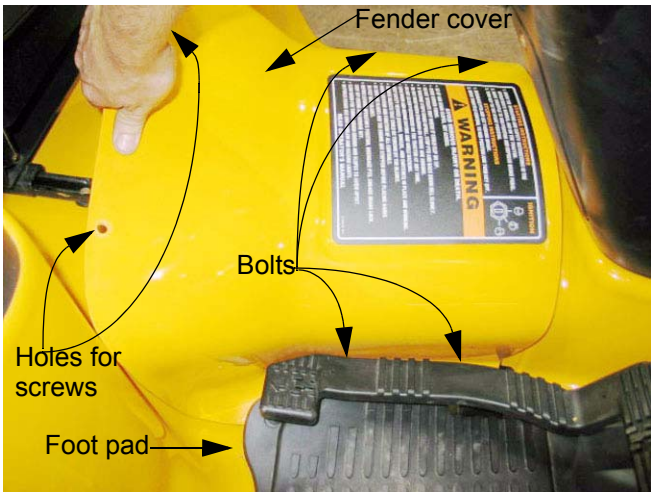

Figure 3.1

NOTE: It will be necessary to pry-up the inside edges of the black rubber floor pads to get the fender cover off.

3.2. If the transmission creeps, or the tractor fails to achieve normal ground speed, check the neutral control adjustment and control linkages to the hydro. See Figure 3.2.

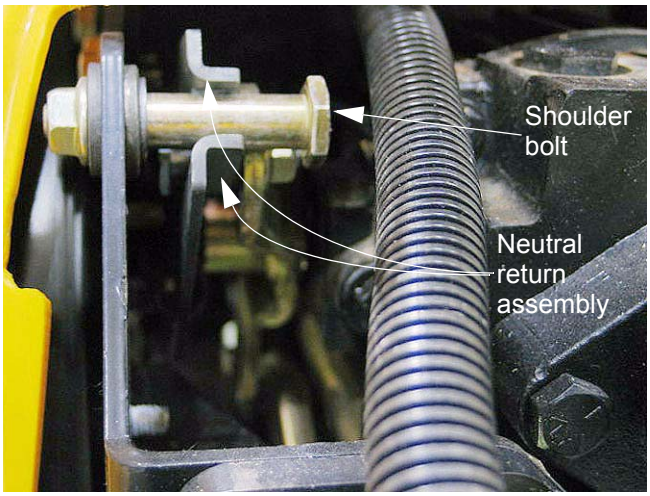

Figure 3.2

NOTE: Complete neutral control adjustment procedures can be found in the 2003 Cub Cadet Technical Handbook, page 6-129 through 6-131

3.3. If the brake and drive pedals "fight" with each other, the drive control linkage is out of adjustment. See Figure 3.3.

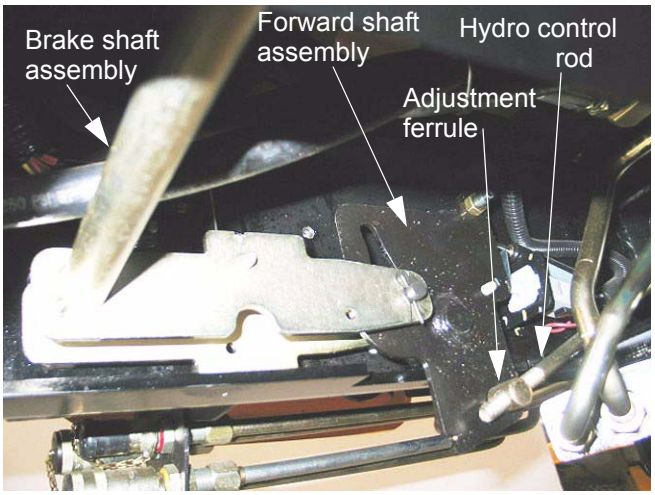

Figure 3.3

3.4. If the tractor fails to achieve normal ground speed, and the hydro pump emits an unusual amount of noise, check for brake drag:

- Confirm that the neutral return and hydro control linkages are correctly adjusted.
- With the tractor on a smooth, firm, level surface, place the gear selector in neutral, release the parking brake, and attempt to push the tractor.
- If the tractor does not roll with a reasonable amount of effort, check the brakes.
- The left and right brakes can be checked individually by jacking-up the rear of the tractor and attempting to rotate the rear wheels individually. Leave the transmission in neutral.
- If either or both brakes drag, confirm that the linkage moves firmly and is properly adjusted.
- If the linkages are properly adjusted, and brake drag is still present, remove the wheel and brake assembly on the side that drags. Inspect the brake assembly.

NOTE: Complete brake adjustment procedures can be found in the 2003 Cub Cadet Technical Handbook, page 6-131 through 6-133.

3.5. If there is no drive at all, confirm whether the problem lies in the hydro or elsewhere.

- With the engine running, confirm that the PTO operates when it is turned-on. This confims that the input shaft is turning.
- On smooth, firm, level ground, with the engine turned-off and the parking brake released:
- Place the gear selector in high range and attempt to push the tractor. It should not roll.
- Place the gear selector in low range and attempt to push the tractor. It should not roll.
- If the tractor rolls, the problem is gear-related.
- Place the gear selector in neutral and attempt to push the tractor. It should roll. If it does not, the problem may be gear or brake related.

3.6. Check the fluid by removing the plug / fluid level gauge on the back of the transmission. Check the level, and compare the fluid to a sample of Cub Cadet Hydraulic Transmission Fluid. Top-up or replace the fluid as necessary. See Figure 3.6.

Figure 3.6

3.7. Replace the hydrostatic filter if there is any question of it's condition.

3.8. Visually inspect the suction tube that feeds fluid to the hydrostatic drive from the sump of the transmission. If it is kinked or crushed, replace it. See Figure 3.8.

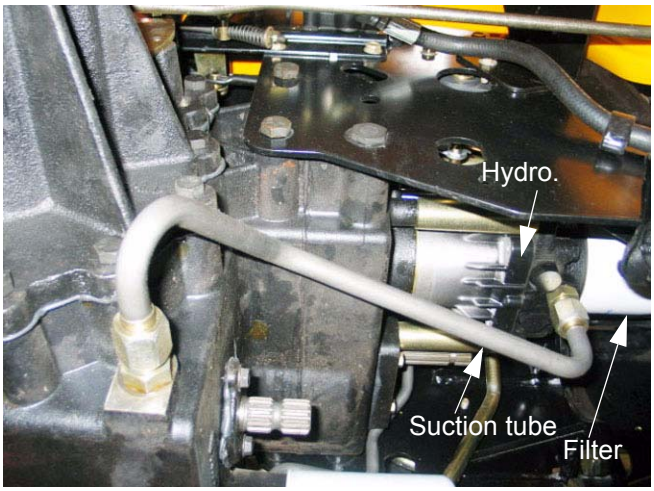

Figure 3.8

NOTE: Drain the transmission fluid before removing the suction tube.

3.9. Check that the set screw holding the control arm to the hydro control shall has not backed-out, worn, or sheared. See Figure 3.9.

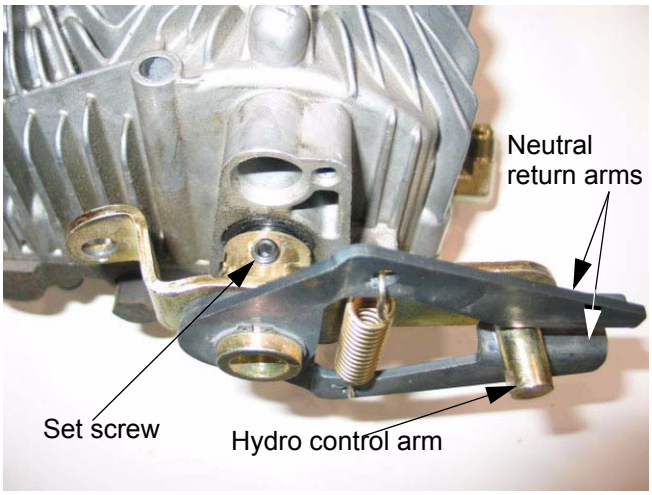

Figure 3.9

4. BEST PRACTICES: HYDRAULIC SYSTEMS

NOTE: TESTS All hydraulic tests should be done with the fluid at normal operating temperature, and the engine at normal operating speed. In practical terms, normal operating temperature means that the tractor should be operated (if not disabled) for about 5 minutes before testing in normal temperate climates. This should achieve a fluid temperature of 180 deg. f. (82 deg. c.) If the tractor has been sitting outside for a week during February in Green Bay, Wisconsin, it is advisable to store the tractor in a heated shop for 12 hours before testing. Normal operating speed is 3,000RPM.

NOTE: CLEANLINESS It is very important to keep dirt out of hydraulic systems.

- Cleaning the areas around any joint to be disconnected, or component to be removed is advisable.
- Contaminated fluid should be disposed of properly, not re-used.
- Tools and work benches used for work on hydraulic systems should also be kept clean.
- Catch pans beneath work will ease clean-up.

NOTE: CAUTION High pressure hydraulic leaks can be dangerous.

- Wear eye protection while performing tests.
- Do not operate any equipment with obvious damage to parts such as hoses.
- Do not disconnect any fittings that may be under pressure. Turn-off the engine and operate the circuit to relieve pressure.
- Remember that anything (front-end loaders, backhoe buckets, three-point hitches, etc....) that is supported by hydraulic pressure will be subject to gravitational force when that pressure is relieved.

NOTE: Sealants

- O-ring fittings require no sealant, though light lubrication with the fluid used in the system is sometimes helpful.
- Teflon tape is to be avoided. “Flash” from the tape can dislodge, blocking valves and damaging pumps.

5. FLOW AND PRESSURE TESTS: HYDROSTATIC DRIVE

5.1. If the problem is not revealed by any of the external checks, check the charge-pump pressure.

5.2. Clean the area surrounding the set screw in the top of the hydrostat. Remove the set screw using a 3/16” allen wrench. See Figure 5.2.

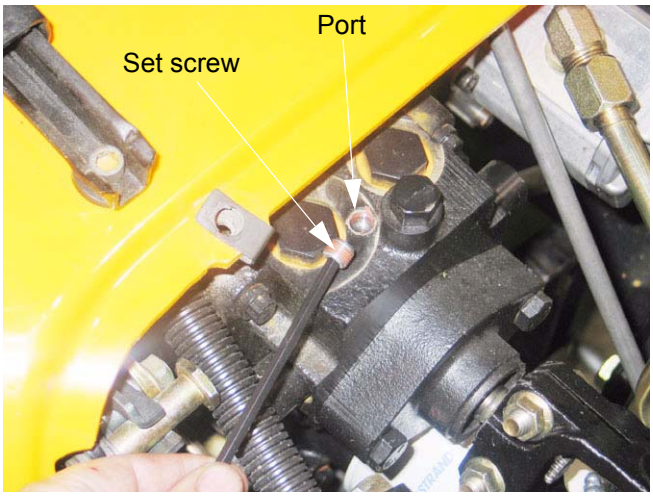

Figure 5.2

NOTE: The port accessed by removing the set screw will be pressurized by the charge pump when the engine is running.

5.3. Connect a gauge that is capable of reading 1,000 PSI (69 Bars) to the port that the set screw was removed from. The port is threaded to accept a 1/8” pipe thread.

NOTE: The gauge should be equipped with a hydraulic snubber or needle valve to damp the pressure pulses created by the pump.

CAUTION: Confirm that no unsafe conditions will be created by starting the engine or operating the drive system before perfoming the test. **Remember** that the front drive axle on four-wheel drive Domestic Series 7000 tractors will engage automatically.

5.4. The charge pump should generate between 70 and 150 PSI (4.8 to 10.3 Bars) @ 1,200 RPM. See Figure 5.4.

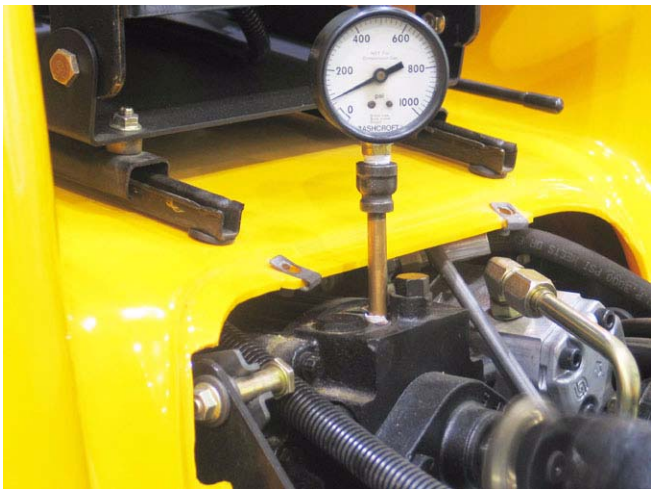

Figure 5.4

5.5. As the RPM is increased to the governed top no-load sped, the pressure may increase somehwat. If pressure goes down as engine speed increases, turn-off the engine and determine the cause. See Figure 5.5.

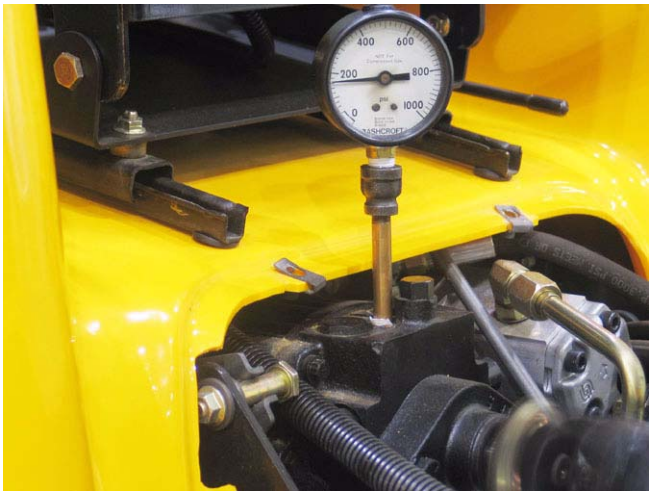

Figure 5.5

5.6. Operate the system at full input and output speeds in both directions,and confirm that charge pressure is maintained.

5.7. Assuming the supply to the pump is good, low pressure or a complete lack of pressure at this port indicates a charge pump that is not working.

5.8. The charge pump could be disabled by a sticking charge pump relief valve. See Figure 5.8.

Figure 5.8

- This valve is located under the hexagonal cap next to the pressure test port for the charge pump.
- The valve consists of a light compression spring and a ball that seats in a bore.
- The cap can be easily removed to inspect the valve using a 5/8” wrench. Failure of this valve would be unusual, but if the ball fails to seat, charge pump pressure will leak off.

NOTE: The charge pump is not available separately through Cub Cadet.

NOTE: The reason for testing the charge pump is to help distinguish between a problem within the hydrostatic drive and a problem that lies elsewhere in the drive system.

5.9. If the charge pump is working, but drive has been lost in one direction only, one of the charge check valves may not be working. See Figure 5.9.

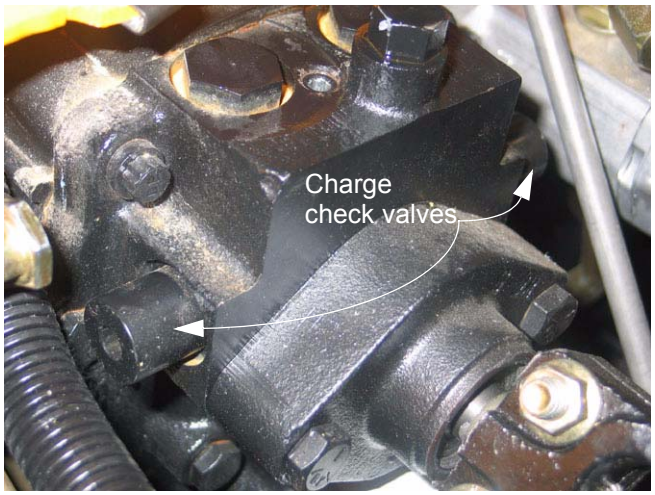

Figure 5.9

- There is a charge relief valve located in each circuit: one for forward, one for reverse.
- These check valves enable the charge pump to provide charge oil to the side of the circuit that has the lowest pressure, while sealing-off the side that has higher pressure.
- The charge check valves are located on either side of the hydrostatic drive.
- The one on the left side maintains pressure in the forward circuit, the one on the right side maintains pressure in the reverse circuit.

5.10. The charge check valves can be removed using a 5/16” allen wrench.

NOTE: The one on the right side is easy to reach. The one on the left side will be obscured by the auxiliary pump and a steel hydraulic line if the tractor is equipped with a second auxiliary pump to operate a loader or backhoe.

5.11. When removed, each charge relief valve comes out as a cartridge. See Figure 5.11.

Figure 5.11

5.12. The output of the variable displacement pump is dependent upon the performance of the check valves

5.13. If the hydrostatic drive must be replaced, it can be removed from the tractor without removing the fenders.

6. AUXILIARY PUMPS

6.1. The standard auxiliary pump provides pressure for the hydrostatic power steering unit and the lift cylinder attached to the three-point hitch.

6.2. Domestic Series 7000 tractors produced before the 2004 season came with a single auxiliary pump. See Figure 6.2.

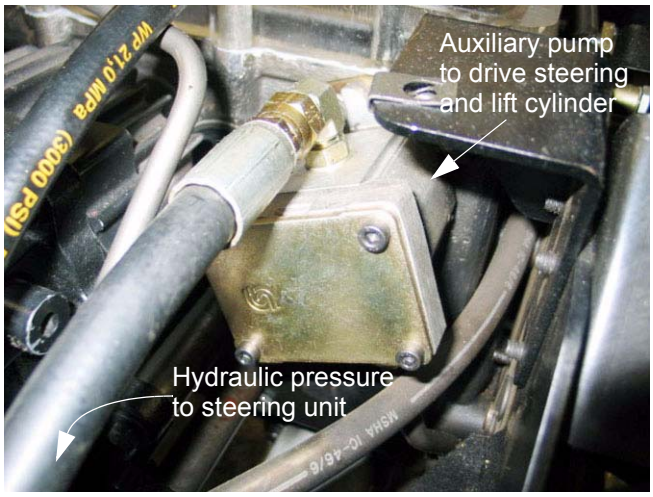

Figure 6.2

6.3. Current production Domestic Series 7000 tractors are fitted with a tandem auxiliary pump to power attachments such as a back-hoe or front-end loader. See Figure 6.3.

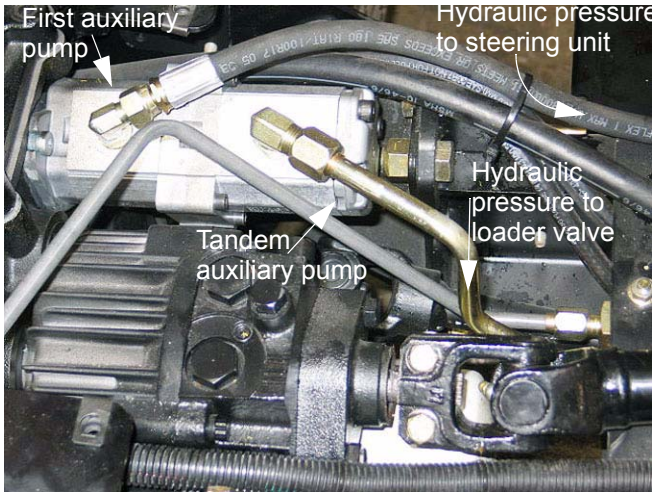

Figure 6.3

6.4. If performance of hydraulic features (steering or lift cylinder) or attachments (front-end loader or back-hoe) is poor, it is necessary to confirm that sufficient hydraulic power is being supplied by the pump that drives it.

6.5. As with the hydrostatic drive, confirm that the pump drive and supply are intact before drawing conclusions about the pump itself by making these preliminary checks:

- Check the fluid. If the fluid level is low, or the fluid is not the correct type, both the hydrostat and the auxiliary pump will perform poorly.
- Replace the hydraulic filter if there is any question of its condition.
- Confirm that the suction tube that provides fluid to the auxiliary pump from the sump of the transmission is not crushed or kinked, and that the connections are free of leaks.
- If there is no hydraulic pressure, confirm that the pump drive is intact. The auxiliary pump is driven by a series of gears at the front of the transmission.

6.6. The filter and suction tubes are easily reached for inspection with little or no disassembly. See Figure 6.6.

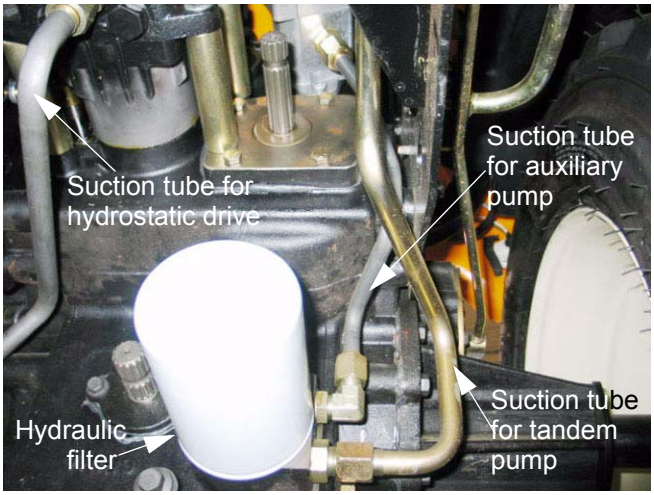

Figure 6.6

Domestic Series 7000 Hydraulics

6.7. If the tractor has a speed sensor mounted in the transmission cover, it is a hall effect device that employs the auxiliary pump drive gear as a tone-ring to generate a tachometer signal. This was done on early (2003 production) tractors. See Figure 6.7.

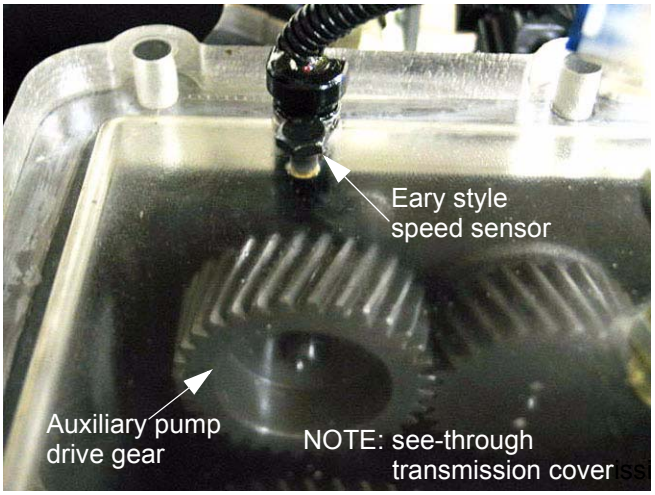

Figure 6.7

6.8. On tractors with the transmission mounted speed sensor, if the tachometer works, the pump drive is confirmed to be working as well.

6.9. The speed sensor is visible without removing the fenders. It is located on the transmission cover, directly above the auxiliary pump.

6.10. Current production uses an engine-mounted speed sensor, or an ignition generated tachometer signal on gasoline engines. See Figure 6.10.

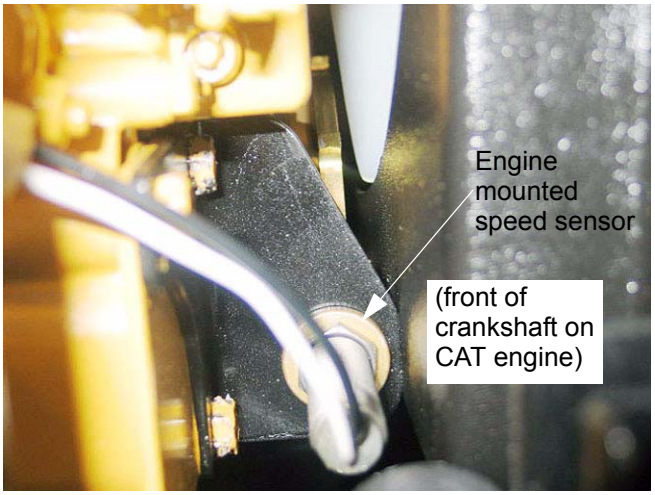

Figure 6.10

6.11. The rear fenders must be removed to access the auxiliary pump itself. Fender removal is detailed in the 2003 Cub Cadet Technical Handbook on pages 6-21 through 6-27.

6.12. If the tractor has an engine mounted speed sensor, the pump drive can be inspected with a flashlight and probe.

6.13. Remove the pipe plug that fills the hole previously used for the speed sensor.

6.14. The auxiliary pump drive gear should be visible through the hole. See Figure 6.14.

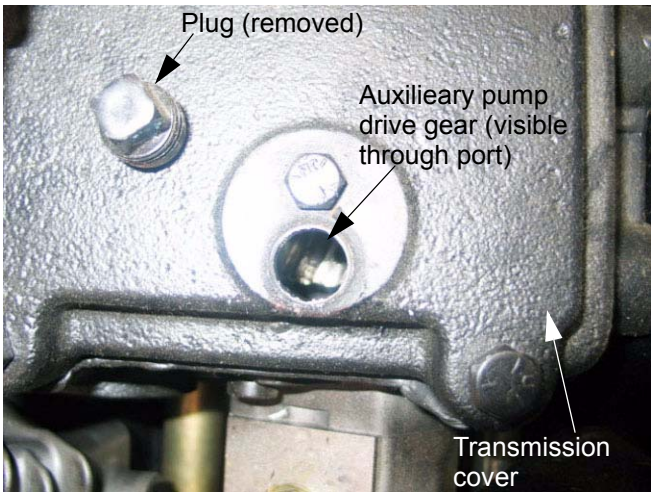

Figure 6.14

6.15. To test the auxiliary pump that powers the steering and lift cylinder, use a flow and pressure gauge set. See Figure 6.15.

Figure 6.15

NOTE: Equipment will vary from shop to shop, but operating principles are similar.

6.16. Disconnect the output line from the top of the pump using a 3/4” wrench and a 9/16” wrench.

6.17. Install the gauge set in-line between the auxiliary pump and the steering pump. The pressure gauge should be near the auxiliary pump, and the flow meter should be near the steering unit.

6.18. Set the parking brake, place the gear selector in neutral, open the flow valve on the gauge set all the way, and confirm that no unsafe conditions will be created by starting the tractor engine. See Figure 6.18.

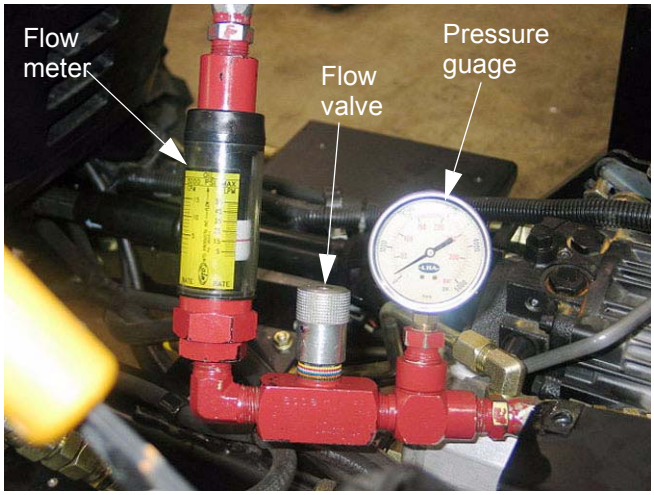

Figure 6.18

6.19. Start the engine, allow the engine and hydraulics to warm-up.

6.20. **Performance:**

- The SKP1/4.3 S auxiliary pump does not contain a relief valve. It is capable of producing roughly 3600 PSI (250 bars) at engine speeds beyond 1,200 RPM.
- This is far in excess of the needs of the rest of the system, which is designed to operate at 1,500 PSI (103 Bars).
- **For our purposes**, it is not necessary to test the pump to its full capacity, only to establish that it produces enough flow and pressure to operate the hydrostatic steering and hydraulic lift cylinder.
- The auxiliary pump was observed to move about 4.6 Gal./min. (15 L/min.) at an engine speed of 3,000 RPM, with no load applied.
- Flow will vary with engine speed, but pressure tests can be done at lower engine speeds: 1,200-1,500 RPM.
- Set the throttle to maintain an engine speed in this range, and note the reading on the flow meter.

6.21. Close the flow valve until the pressure gauge reads 1,500 PSI (103 Bar). Note the flow reading. See Figure 6.21.

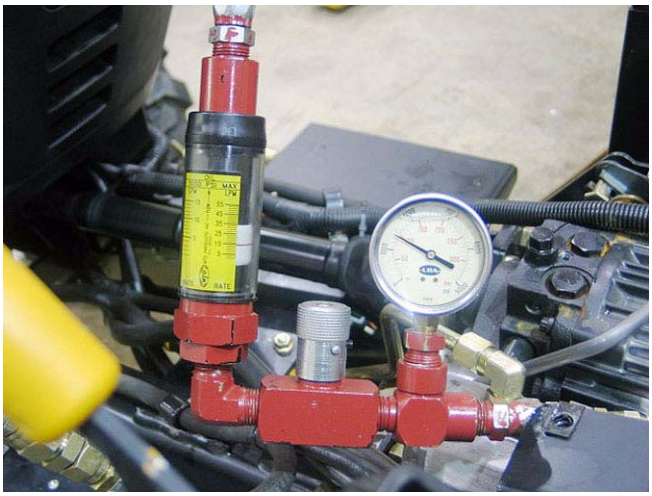

Figure 6.21

6.22. As soon as the flow reading is noted, open the the flow valve completely, relieving pressure from the system. Turn -off the engine.

6.23. The flow readings noted at zero pressure and 1,500 PSI (103 Bars) should not vary significantly. Flow is more related to engine RPM than to pressure.

7. STEERING PUMP AND CYLINDER

7.1. Two steering units have been used in domestic Series 7000 production: one produced by Sauer/ Danfoss, and one produced by Ross (Parker-Hannifin).

NOTE: It is normal for the spokes of the steering wheel on an open-center hydrostatic power steering system to change orientation with use. There is no mechanical connection between the steering wheel and the front wheels.

7.2. **Identification:** The Sauer OSPM 63 PB unit has a round body. The Ross steering unit has a square body. See Figure 7.2.

Sauer Steering Unit

Ross Steering Unit

Figure 7.2

7.3. R&R: instructions for removal and replacement of the steering units can be found in the DASH PANEL AND STEERING PUMP section of this manual.

7.4. If there is a warrantable problem with the power steering unit, it is to be replaced as a complete unit. Cub Cadet does not stock any internal components for the steering units.

7.5. The following set of symptoms, causes, and solutions has been adapted from a list compiled by Sauer-Danfoss to aid in the diagnosis of hydrostatic steering issues. Internal steering unit problems are described to aid technicians in distinguishing internal steering unit problems from problems that lie elswhere in the system. Internal problems dictate replacement of the steering unit.

- **High Effort Required to Turn Steering Wheel:**

Cause 1: The auxiliary pump is not supplying sufficient fluid to the steering unit. Confirm by testing auxiliary pump out-put.

Solution 1: Correct the problem with the auxiliary pump.

Cause 2: The priority spool within the steering unit is not moving, causing fluid to be directed to other parts of the system when the steering system needs it.

Solution 2: Internal problem; priority spool.

Cause 3: The relief valve in the steering unit is stuck open.

Solution 3: Internal problem; relief valve.

- **"Motoring" Steering Wheel: rotates on its own:**

Cause 1: Bad leaf spring in steering unit.

Solution 1: Internal problem; leaf spring.

Cause 2: The relief valve is stuck open.

Solution 2: Internal problem: relief valve.

- **Poor Straight Line Steering Charactersistics:**

Cause 1: There is a bind in the steering column.

Solution 1: Binds may be created by angular or radial misalignment between the steering column and the steering unit. Binds may also be created by a lack of axial clearance between the steering column and the steering unit. Correct any situation that may create friction or binding in the steering column.

Cause 2: Bad leaf spring in steering unit.

Solution 2: Internal problem; leaf spring.

- **Backlash**

Cause 1: Wear or play between the steering column and the cardan shaft.

Solution 1: If the wear is in the steering column, replace the steering column (steering shaft per Cub Cadet IPL). If the wear is in the cardan shaft, this is an internal problem.

Cause 2: Bad leaf spring in steering unit.

Solution 2: Internal problem; leaf spring.

- **Shimmy:**

Cause 1: Air in steering system.

Solution 1: Repair any leaks in the hydraulic system. Be aware that a leak on the suction side of the auxiliary pump would entrain air into the hydraulic fluid, but may not display significant fluid loss.

Cause 2: Worn mechanical connections.

Solution 2: Inspect the MFD and steering linkage for sources of excessive play: worn wheel bearings, worn tie rod ends, worn king pins, worn steering cylinder mounting points, etc... Replace the worn components.

- **Steering Wheel Input Does Not Cause Steering cylinder to Move:**

Cause 1: No fluid in the system.

Solution 1: Fill the system.

Cause 2: Worn steering cylinder / blow-by. Confirm with flow test in line to cylinder.

Solution 2: Replace the steering cylinder.

- **Heavy Impacts to Steering Wheel in Both Directions:**

Cause 1: The hydraulic hoses are incorrectly connected; the hose that should connect to the “P” port is connected to the “ L” port or the “R” port.

Solution 1: Correct the hydraulic connections.

Cause 2: Incorrect setting of the cardan shaft to the gear wheel (timing).

Solution 2: Internal problem; cardan shaft / gear wheel timing.

- **Slow Steering:**

Cause 1: Insufficient fluid flow to the steering unit. Confirm by testing the out-put of the auxiliary pump.

Solution 1: Repair of replace the auxiliary pump or delivery line from the pump to the “P” port on the steering unit.

Cause 2: The priority valve in the steering unit is not working properly. This valve normally maintains precidence of the steering system over all subsidiary systems (lift cylinder).

Solution 2: Internal problem; priority valve.

- **The Steering Wheel Does Not Return to Center:**

Cause 1: There is a mechanical bind in the steering column.

Solution 1: Repair or adjust the steering column (steering shaft) to eliminate the bind.

Cause 2: Bad leaf springs.

Solution 2: Internal problem; leaf springs.

Cause 3: The spool is pressing against the sleeve in the steering unit.

Solution 3: Internal problem; relief valve causing too much pressure to build, displacing the spool.

Cause 4: Binding between spool and sleeve caused by fluid contamination.

Solution 4: Internal problem; **contamination.** If this is a possibility, cleaning, fluid replacement, and filter replacement will help prevent a repeat failure.

- **Steering Action is Opposite of Input:**

Cause 1: The “L” and “R” hoses are reversed at their conections to tht steering cylinder or steering unit.

Solution 1: Correct the connections of the hydraulic lines from the steering unit to the steering cylinder.

Cause 2: Incorrect setting of cardan shaft to gear wheel.

Solution 2: Internal problem; cardan shaft / gear wheel timing.

- **Steering Power Too Low:**

Cause 1: The relief valve is set too low or malfunctioning.

Solution 1: Internal problem; relief valve.

- **Fluid Leakage:**

Cause 1: The seal around the cardan shaft is leaking.

Solution 1: Internal problem; cardan shaft seal.

Cause 2: The port fittings are leaking.

Soluton 2: Replace port adaptors or O-rings. Tighten the fittings to a maximum torque of 221 in-lbs. (25 NM) on the “T”, “R”, and “L” ports. Tighten the fittings to a maximum of 239 in-lbs. (27 Nm) on the “P”, and “E” ports.

7.6. Engine-off test: With the engine turned-off so that no pressure is supplied by the auxiliary pump, the pump within the steering unit should work well enough in manual mode to turn the front wheels from one steering stop to the other (full travel) with roughly 2.75 turns of the steering wheel.

NOTE: The tractor was engineered to comply with German TUV directive #38stVZo. It will provide steering action without pressure from the auxiliary pump, maintaining steering wheel force within a specified limit.

7.7. If there is air in the system, it will not perform to design intent:

- If there are any leaks in the steering hydraulics, air will be drawn into the system, degrading preformance.
- If the system has been disassembled for any reason, the engine must be started to provide pressure from the auxiliary pump. With auxiliary pump pressure to assist, turn the steering wheel lock-to-lock three times, to purge air from the steering system.
- After the air is purged, the engine-off test can be performed with validity.

7.8. If the hydraulic steering lacks speed, test the auxiliary pump as described in the previous section of this manual.

7.9. Once it has been established that the auxiliary pump is developing enough flow and pressure, then test the steering unit.

7.10. Install the hydraulic test kit in either one of the two hydraulic lines leading from the steering pump to the steering cylinder.

7.11. Disconnect the hydraulic line between the steering unit and the steering cylinder using a 5/8" wrench and a 3/4" wrench. See Figure 7.11.

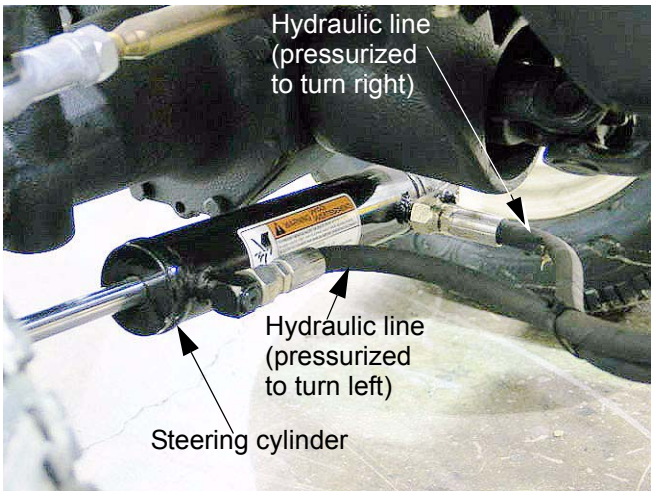

Figure 7.11

7.12. Connect the test kit so that the pressure gauge side (as opposed to the flow meter side) is near the source (steering unit). See Figure 7.12.

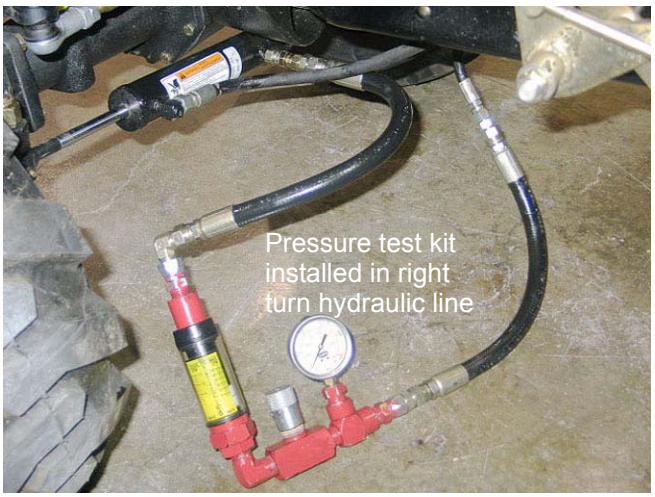

Figure 7.12

7.13. Confirm that the test kit valve is all the way open, and that no unsafe conditions will arise from starting the tractor engine.

7.14. Start the engine, warm-up the engine and hydraulic system, then position the throttle to 1,200-1,500 RPM.

7.15. Have an assistant slowly turn the steering wheel until the steering linkage hits the end of its travel. Applying pressure to the steering wheel while the linkage is at full lock will build pressure in the system.

7.16. Observe the pressure reading on the test kit, at full-lock. The pressure should be in the range of 1,087 to 1,160 PSI (75 to 80 Bars) for the Sauer unit, and 1,450 PSI (100 Bars) for the Ross unit. See Figure 7.16.

Figure 7.16

NOTE: The wheel can be turned in either direction to get a pressure reading.

NOTE: The Sauer steering pump is equipped with a relief valve that will not permit the pressure to rise above 1,087 to 1,160 PSI (75 to 80 Bars). The Ross steering pump is equipped with a relief valve that will not permit the pressure to rise above 1,450 PSI (100 Bars).

7.17. If steering pressure is low, and the auxiliary pump has been confirmed to be functioning properly, then the steering unit is the problem.

NOTE: Steering unit failure is a rare occurrence.

7.18. If the pressure is good between the steering unit and the steering cylinder, but the steering system lacks power, then the steering cylinder is the most likely hydraulic problem.

7.19. It is possible for the piston seals in the steering cylinder to experience “blow-by” without creating an externally visible leak.

7.20. To check for blow-by, turn the steering wheel in whichever direction causes the flow meter on the test kit to rise:

- If the test kit is attached (as illustrated in figure 7.11) to the fitting at the base end of the cylinder, turn the steering wheel to the right.
- If the flow meter is attached to the fitting at the rod end of the steering cylinder, turn the wheel to the left.

7.21. If the steering hits the end of its travel, builds terminal pressure, and the flow meter continues to have a reading above zero, then fluid is blowing-by the seals on the piston.

7.22. If the flow meter falls to zero and remains there as pressure builds, then fluid is not blowing-by the seals on the steering cylinder piston.

7.23. If blow-by exists, the steering cylinder is bad.

NOTE: A steering cylinder can get “blown-out” by a steering pump with a relief valve that fails to keep the pressure below 1,500 PSI (103 bars). If this is the case, replacing the cylinder without replacing the pump will result in rapid failure of the replacement cylinder.

7.24. If the hydraulic system (Auxiliary pump, steering unit, cylinder, lines) is all good, then the problem may be a mechanical bind in the steering linkage.

8. HYDRAULIC LIFT CYLINDER AND CONTROL VALVE

8.1. If the hydraulic lift cylinder does not work or is low on power, begin by making a visual inspection of the cylinder, linkage, and feedback rod. See Figure 8.1.

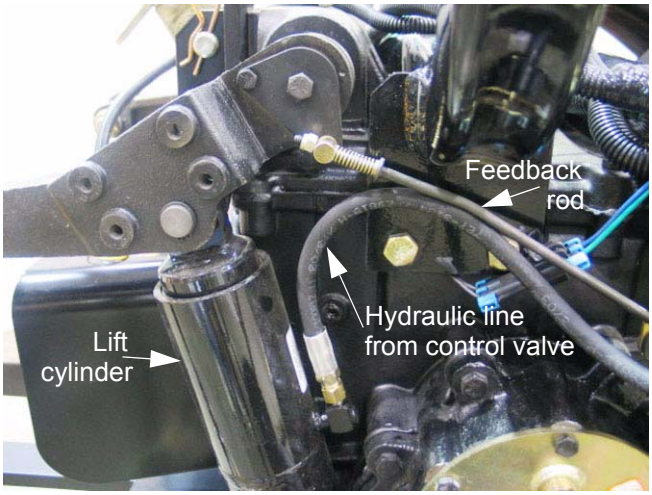

Figure 8.1

8.2. If the lift cylinder is operable, run it through the full range of travel to confirm that the feedback rod is working correctly. Normal operating characteristics include:

- The travel of the lift arms should be directly related to the height of the lift arms.
- In all positions, the lift cylinder will apply only upward force to the lift arms. It is a single-acting cylinder.
- Downward travel is not under hydraulic force, and is only caused by the weight of the lift arms and any accessories mounted to them.
- At any point in their travel, the lift arms may be manually lifted beyond the point that the hydraulic system is holding them at. They will always “float”.
- Because the steering system has priority over the lift cylinder, it is normal for the lift cylinder to have less power when the steering system is in motion.

8.3. Orientation of the valve: See Figure 8.3.

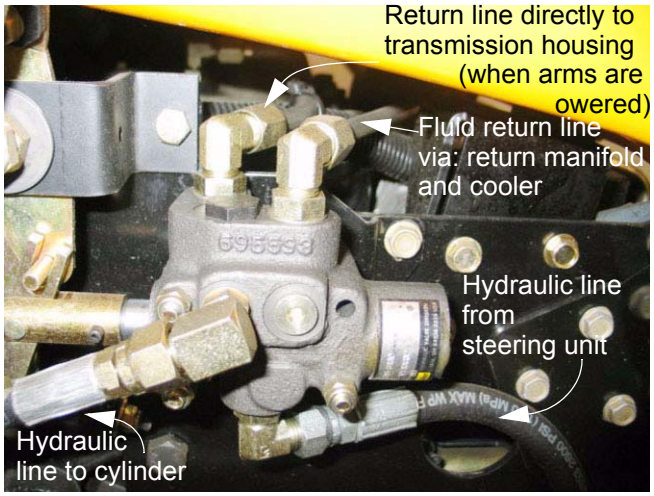

Figure 8.3

8.4. Hydraulic Connections:

- The flexible line to the bottom of the valve provides pressure from the steering pump.
- A second flexible line leads back to the lift cylinder.
- The steel line leading from the top of the valve forward directs fluid through the oil cooler, via the return manifold, and back to the transmission housing.
- Fluid is constantly circulating through this path, from the steering pump, through the valve, then to the return manifold.
- When the valve is actuated to raise the lift arms, it redirects fluid from this path to the lift cylinder.
- When the valve is actuated to lower the lift arms, fluid is allowed to empty from the lift cylinder through the steel line leading from the top of the valve to the transmission cover.

8.5. Control Linkage Description:

- The feedback rod and link assembly governs the motion of the lift arms. It transmits motion from the lift arms back to the pin that provides the fulcrum point that the bottom end of the feedback link pivots on.
- A pin on the operator controlled linkage engages the top end of the feedback link.
- The valve link is connected to the center point of the feedback link.
- The control input to the valve is determined by the balance between the two ends of the feedback link.
- As the arms aproach the position set by the operator controlled lever, the feedback rod moves the feedback link back to a position that returns the control valve to neutral.

8.6. If a high pitched squeal emanates from the control valve after repositioning the lift arms, the feedback rod is not working properly.

8.7. Inspect the feedback rod and link. If there is any sign of damage (bent rod, worn ferrule, stripped threads, etc....) or corrosion, repair the linkage. See Figure 8.7.

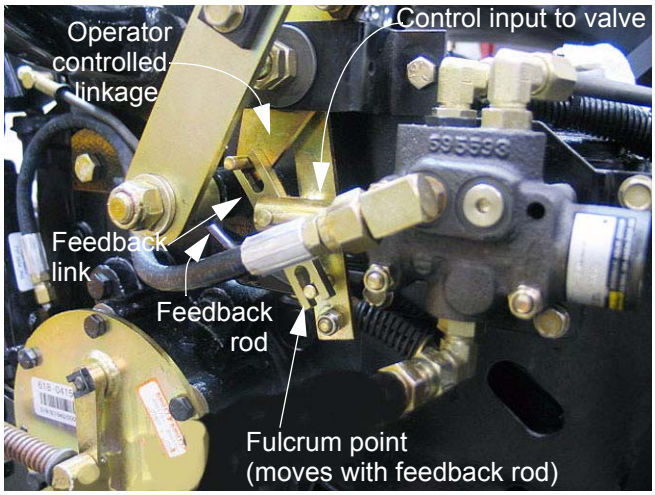

Figure 8.7

8.8. The length of the feedback rod is not adjustable. Only the load on the compression springs at each end is adjustable. The locking nuts should each be.25 inch (.65 cm.) from the end of the rod.

8.9. The category 1 three point hitch system on the domestic Series 7000 tractor should be capable of lifting 950 lbs. (430 Kg.), 24 in. (61 cm.) behind the hitch. If it does not perform as designed, use the following procedure to diagnose it.

8.10. Confirm that the lift cylinder control valve is getting pressure from the steering pump:

8.11. Remove any rear mounted attachments that are supported by the lift arms or will interfere with access to the lift cylinder and control valve.

8.12. Lift and safely support the rear of the tractor.

8.13. Remove the right rear wheel using a 21mm wrench.

8.14. Lower the lift arms to the bottom of their travel, and confirm that the lift cylinder is fully retracted. See Figure 8.14.

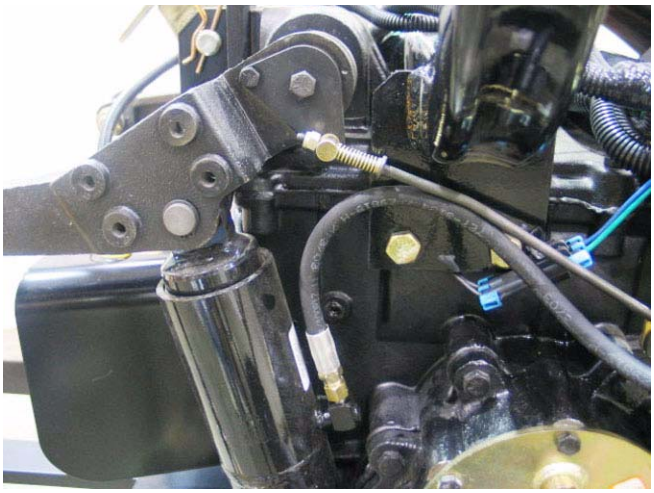

Figure 8.14

8.15. Disconnect the flexible hydraulic line from the bottom of the control valve using a 3/4” wrench and a 5/8” wrench.

Domestic Series 7000 Hydraulics

8.16. Install the test kit with the flexible line connected to the pressure gauge end of the kit, and the control valve connected to the flow meter end of the kit. See Figure 8.16.

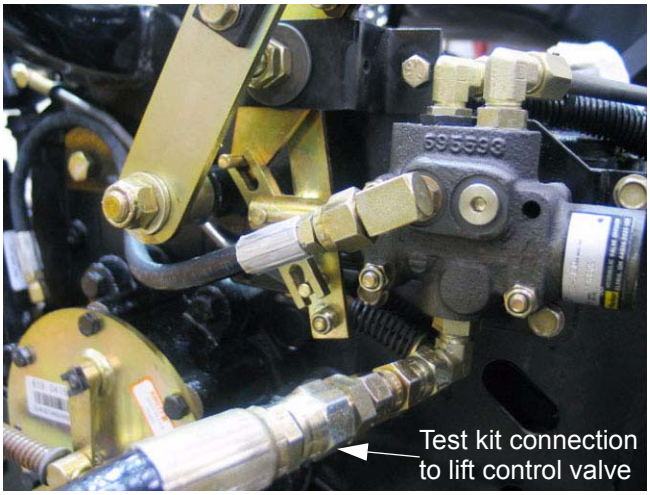

Figure 8.16

8.17. Confirm that the test kit valve is all the way open, and that no unsafe conditions will arise from starting the tractor engine.

8.18. Start the engine, warm-up the engine and hydraulic system, then position the throttle to 3,000 RPM.

8.19. The flow meter should rise to 4 GPM (15 L/m) and hold steady at that level. See Figure 8.19.

Figure 8.19

8.20. After the flow rate is established, lower the throttle setting to 1,200-1,500 RPM

8.21. Carefully close the valve on the test kit. Do not close the valve all the way. It is not necessary to move the lift cylinder to generate pressure. See Figure 8.21.

Figure 8.21

8.22. The flow should remain constant, while the pressure climbs to 1,500 PSI (103 Bars). Open the valve a soon as the readings are confirmed.

NOTE: Remember, the flow varies with engine RPM, but does not vary with pressure generated unless the auxiliary pump is failing.

8.23. Turn off the engine.

8.24. Remove the test kit from the line between the steering unit and the lift control valve, and connect the hydraulic line to the control valve.

8.25. Install the test kit between the control valve and the lift cylinder. See Figure 8.25.

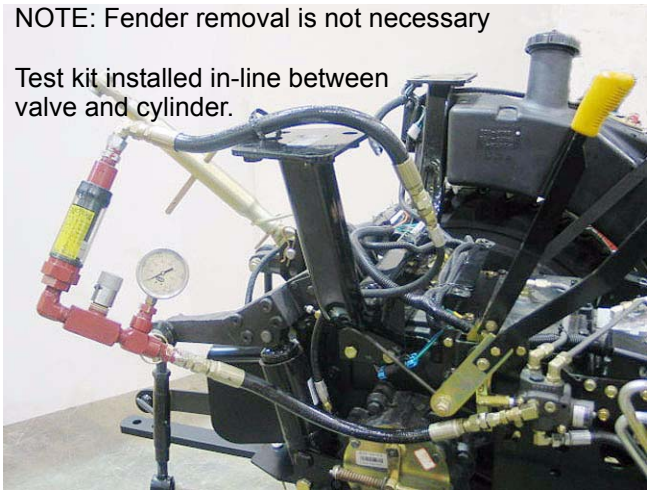

Figure 8.25

8.26. Set the parking brake, place the gear selector in neutral, open the flow valve on the gauge set all the way, and confirm that no unsafe conditions will be created by starting the tractor engine.

8.27. Start the engine, allow it to warm-up. Set the throttle to maintain 1,200-1,500 RPM.

8.28. Have an assistant move the hydraulic lift lever rearward to raise the lift arms.

8.29. As the lift arms travel upward, close the valve on the test kit. Note the pressure. See Figure 8.29.

Figure 8.29

NOTE: It will take several successive steps to close the valve far enough to reach maximum pressure:

- Close the valve partially while the cylinder is extending.
- Note the pressure reading and the color of the highest exposed colored band on the valve.
- Open the valve completely.
- Lower the lift arms completely.
- Close the valve to the point that was reached on the previous lift, as indicated by the exposed colored bands.
- Extend the cylinder, and close the valve further to build more pressure: repeat the process until maximum pressure is achieved.
- Open the valve on the test kit immediately after the pressure reading is noted.

8.30. The pressure should approach but not exceed 1,500 PSI (103 Bars).

8.31. If the pressure delivered to the control valve is low, the auxiliary pump has tested good, and the hydraulic lines show no signs of physical damage or leakage, then the problem lies in the steering unit.

8.32. If the pressure delivered to the control valve is sufficient, but the pressure delivered to the cylinder is low, then the problem is likely to be in the control valve.

8.33. If the pressure delivered to the cylinder is sufficient, yet the cylinder does not perform adequately, look for leakage from the cylinder.

8.34. If all pressures are O.K., no leakage exists, yet the cylinder does not perform adequately, there may be a mechanical bind, or the operator may be overloading the equipment.

9. TANDEM PUMP

9.1. Attachments are covered in a separate section. This section covers the portions of the hydraulic system that remain permanently attached to the tractor.

NOTE: Unless stated otherwise, it is not necessary to remove the fenders to perform the tests described in this section. Some of the figures in this section show the fenders removed. This was done for photographic purposes, not for mechanical purposes.

9.2. If there is a performance problem with an attachment controlled by the loader valve, confirm that adequate flow and pressure are being delivered to the loader control valve by the tandem pump.

9.3. The output of the tandem pump may be checked at the line to the loader valve, or at the line from the loader valve to the return manifold. See Figure 9.3.

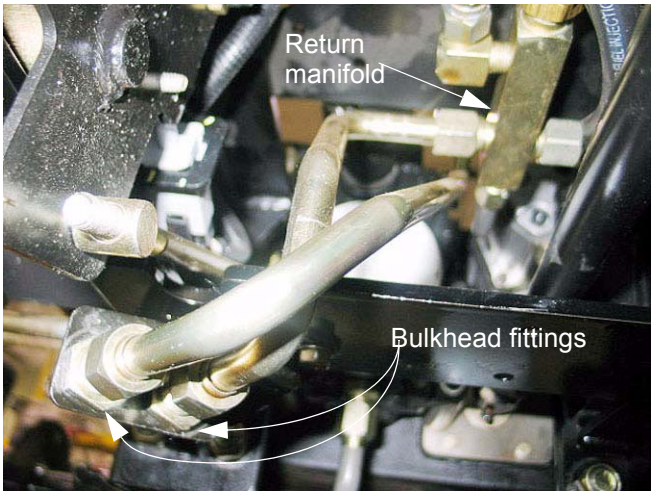

Figure 9.3

NOTE: Because there is no power beyond from the loader control valve, there is only one return path for the hydraulic fluid.

NOTE: A pressure and flow test performed in either line will yield valid results.

9.4. To gain easy access to the loader valve:

- Lift, and safely suppport the right rear of the tractor.
- Remove the right rear tire using a 21mm wrench.

9.5. Disconnect either hydraulic tube between the bracket / bulkhead fitting on the frame, and the loader valve. Use a 7/8” wrench and a 1” wrench to disconnect the tube. See Figure 9.5.

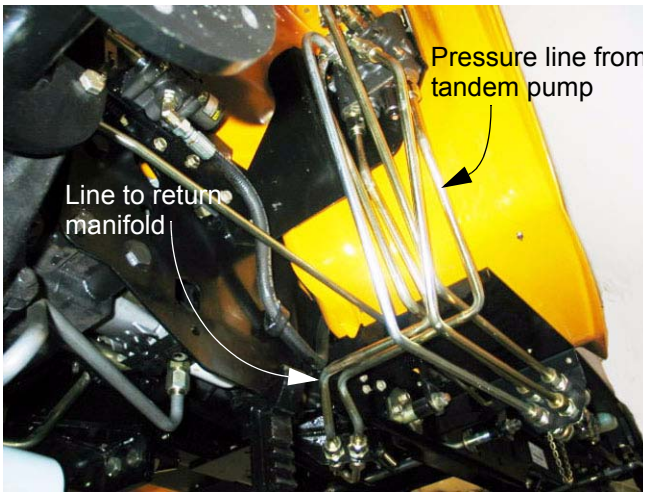

Figure 9.5

9.6. Install the test kit with the pressure gauge nearest the source of pressure.

- If testing on the line from the pump to the valve, the pressure gauge should be near the pump.
- If testing on the line from the valve to the return manifold, the pressure gauge should be near teh valve.

9.7. Confirm that no unsafe conditions will result from starting the tractor and operating the hydraulic system. Confirm that the valve on the test kit is fully open.

9.8. Start the engine, and allow the hydraulic fluid to warm-up if necessary.

9.9. Set the throttle to maintain 3,000 RPM.

9.10. Observe the flow rate. It should be in the 6.5 GPM (25 L/m) range. See Figure 9.10.

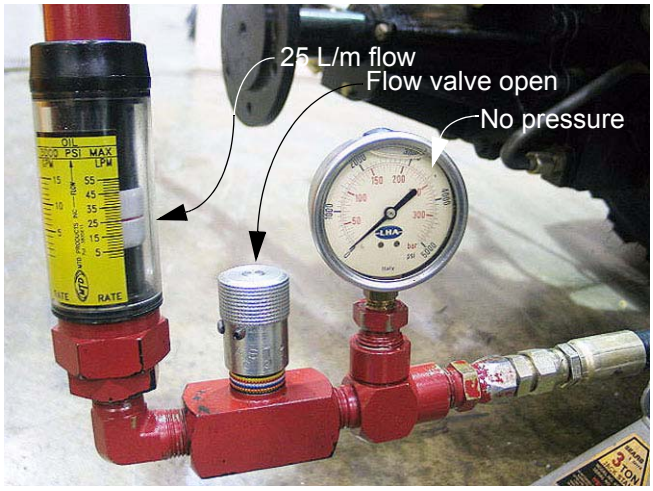

Figure 9.10

9.11. Set the throttle to maintain 1,200-1,500 RPM, and observe the flow rate.

9.12. Close the valve on the test kit until it is confirmed that the pump will generate at least 1,500 PSI (103 Bars). Observe the flow rate. See Figure 9.12.

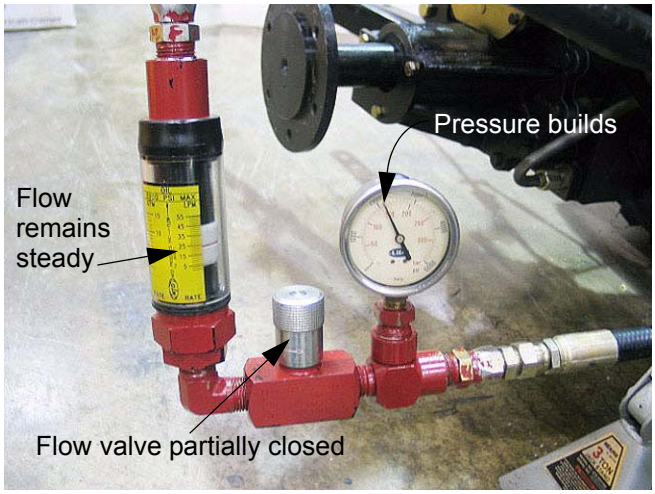

Figure 9.12

- The flow rate should not be significantly reduced from the initial 1,200-1,500 RPM observation by the increase in pressure.
- Like the auxiliary pump, the tandem pump is capable of generating pressure well in excess of the intended operating pressure of the rest of the system.
- System pressure is regulated by a relief valve in the loader valve.
- In this test, we have effectively disabled that relief valve. Use **caution** not to overload the system by closing the valve farther or longer than necessary to test pump performance.

9.13. If the tandem pump fails to perform as specified, confirm that the problem is not due to external factors such as:

- Insufficient or incorrect working fluid.
- Blocked filter.
- Pump drive failure.
- Crushed, kinked, or blocked suction tube.
- Crushed, kinked or blocked return path.

9.14. If external factors do not account for the lack of performance, replace the tandem pump.

10. LOADER VALVE

10.1. the simplest way to check pressure to the attachment is by connecting the test kit to the Quick Disconnect ports. See Figure 10.1.

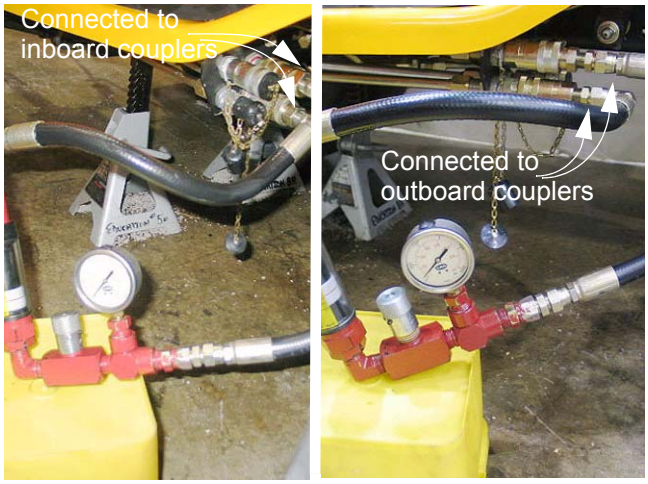

Figure 10.1

- Connecting to the outboard pair of hydraulic tubes will give a reading when the loader valve lever is moved forward or back.
- Connecting to the inboard pair of hydraulic tubes will give a reading when the loader valve lever is moved from side to side.
- Connect to the inboard set of tubes, or the outboard set of tubes. Do not connect to the top set or the bottom set.
- One female quick disconnect and one male quick disconnect will be required on the test kit.

10.2. If the performance problem is isolated to one dimension of movement, connect first to the set of tubes that is associtated with that dimension.

10.3. After the test kit is connected, confirm that no unsafe conditions will result from starting the engine or operating the hydraulic system.

10.4. Open the flow valve on the test kit completely, then start the engine, and set the throttle to maintain 3,000 RPM.

10.5. With the test kit installed as shown, pushing the loader valve forward to the detent will generate a reading on the flow meter of about 6.6 GPM (25 L/m) when the test kit flow valve is open. Pressure will be zero. See Figure 10.5.

Figure 10.5

NOTE: Pushing the loader valve lever all the way forward, past the detent, will put the valve into “float” mode. This is reflected by a flow meter reading that falls to zero, and a pressure gauge reading falls to zero.

NOTE: Pushing the loader valve lever forward, but not all the way to the detent will produce readings with less flow, but increased pressure.

10.6. Reducing throttle to the 1,200-1,500 RPM range, observe the flow while pushing the loader valve lever forward to the detent. The flow should be around 4 GPM (15 L/m).

10.7. While holding the loader valve lever forward, close the flow valve on the test kit. Because there is a pressure relief feature in the loader valve, the pressure should rise to 1,500 PSI (103 Bars) and hold steady. See Figure 10.7.

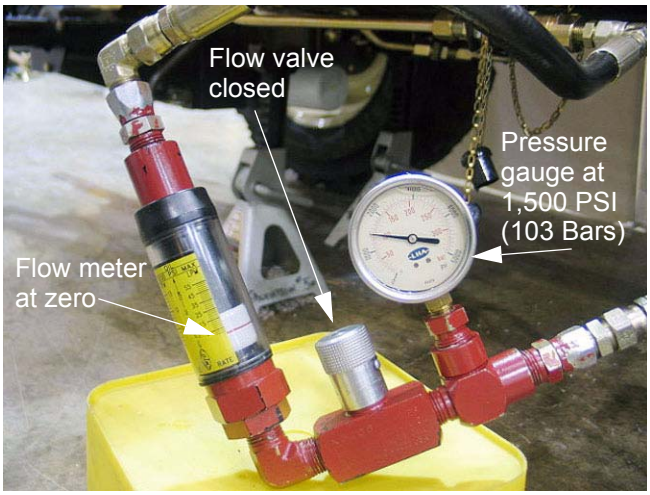

Figure 10.7

NOTE: Because of the relief feature built into the loader valve, as pressure aproaches the relief point of 1,500 PSI (103 Bars) more fluid will be diverted to the return manifold. As more fluid is diverted, the flow meter will show progressively lesser readings. If the flow valve on the test kit is closed completely, flow will stop completely.

CAUTION: If pressure rises substantially above 1,500 PSI (103 Bars) discontinue the test immediately. Correct the pressure relief issue before continuing.

10.8. If the pressure varies slightly in either direction, the relief valve can be adjusted. It is located on the top, outboard corner of the loader valve.

10.9. In order to adjust the relief valve, it is necessary to remove the fenders. The fender removal process is described in detail in the 2003 Cub Cadet Technical Handbook, page 6-21 through page 6-26.

10.10. It is necessary to unbolt the pivot bracket assembly from the loader valve in order to get a wrench on the relief valve adjustment screw. The pivot bracket can be unbolted using a 3/8" wrench. See Figure 10.10.

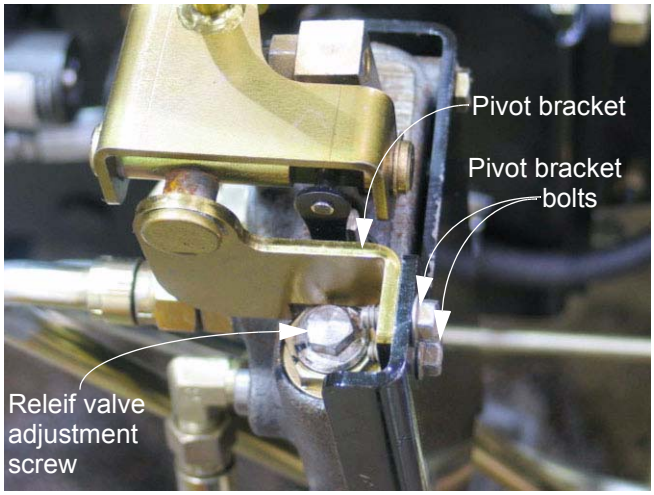

Figure 10.10

10.11. The pivot bracket bolts are inaccessible without removing the fender. See Figure 10.11.

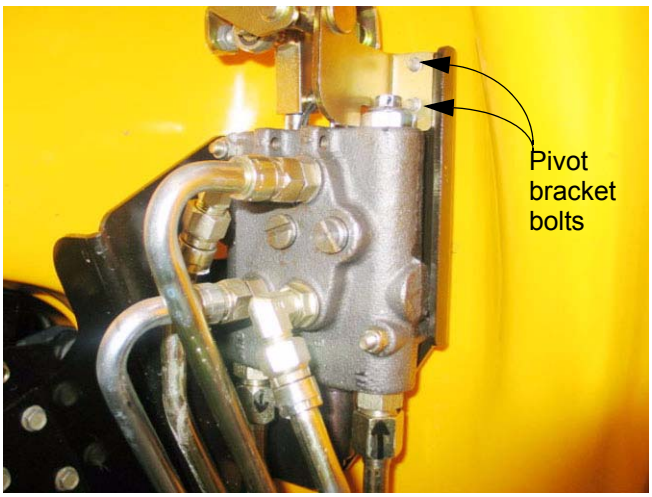

Figure 10.11

10.12. Once access is gained to the adjustment screw, index the screw, jam nut, and housing using a marker.

10.13. Loosen the jam nut using a 7/8” wrench and turn the adjuster screw using a 7/16” wrench. See Figure 10.13.

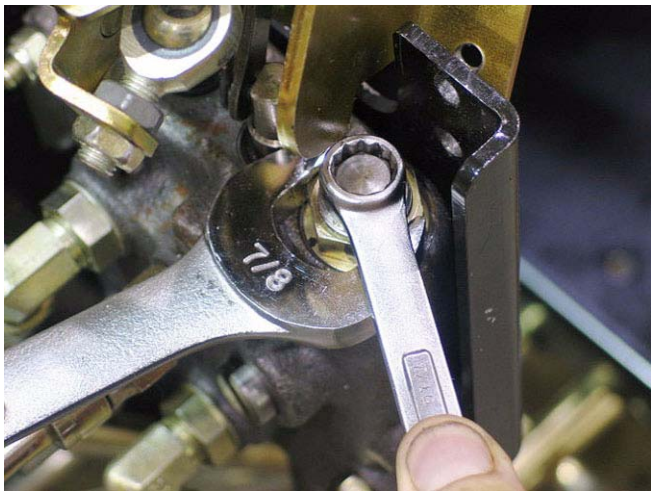

Figure 10.13

10.14. Make adjustments to the relief valve in single-facet increments:

- Loosen the jam nut.
- Make adjustment: 1/6th turn or less.
- Tighten jam nut.
- Install pivot bracket.
- Test relief valve pressure.
- Repeat as necessary.
- **DO NOT** “crank-up” the pressure beyond 1,500 PSI (103 Bars).
- Install the fenders when adjustment is completed.

10.15. The pressure readings at both sets of ports should respond equally to adjustments made to the relief valve. If there is substantial difference between the pressures found at the two sets of ports, there is an internal problem with the loader valve.

10.16. If the loader valve does not respond to adjustment, or does not perform as described in this section, replace the valve.

11. COMPONENT BREAKDOWN: AUXILIARY PUMP (TANDEM PUMP SIMILAR)

NOTE: The auxiliary pump is to be replaced as a unit if it fails. Dissassembling it will **VOID the warrantee.** The pump has been disassembled here to illustrate how it works.

NOTE: Individual pump components will not be available through Cub Cadet.

11.1. The gear must be removed from the pump in order to remove the pump from the transmission. See Figure 11.1.

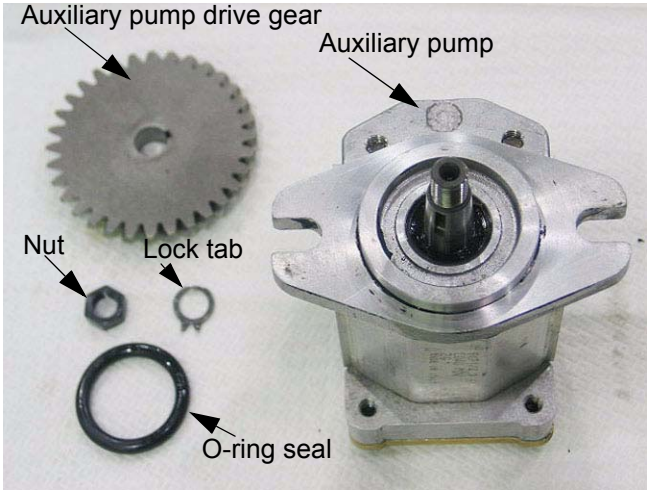

Figure 11.1

- The gear is a taper-fit to the pump shaft, and it is keyed to the shaft.
- The lock tab, key, and nut are included with the pump.
- The nut and shaft have a non-standard metric thread. They will not be commonly available.
- An O-ring seal and Ultra-black sealant are used to seal the pump to the front of the transmission.

11.2. The back cover can be removed from the pump by removing the four socket head cap screws. See Figure 11.2.

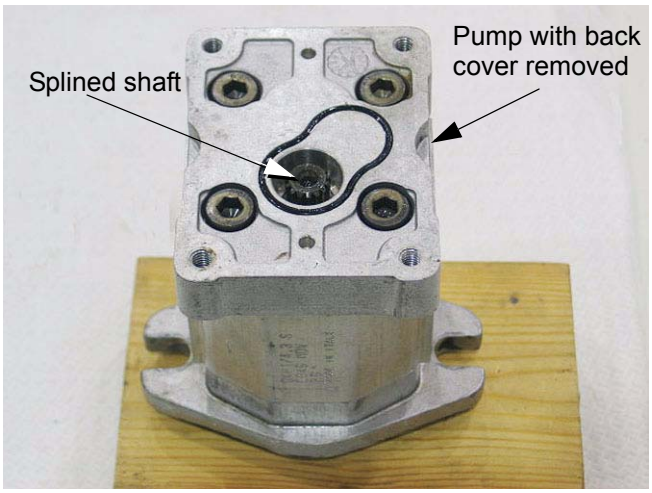

Figure 11.2

11.3. Removing the rear cover reveals an O-ring seal, the splined shaft that transmits power to the tandem pump (when fitted), and four more socket head cap screws.

11.4. The second set of socket head cap screws holds the two housing ends to the body of the pump. See Figure 11.4.

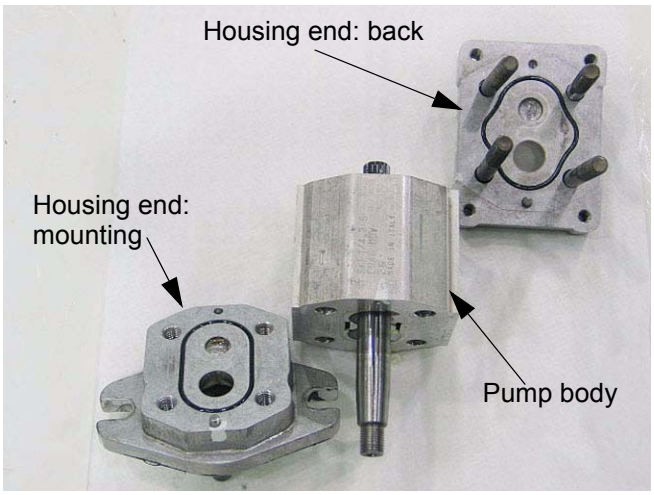

Figure 11.4

11.5. Both ends of the pump have O-ring type seals where they meet the pump body.

11.6. The body contains a simple gear pump.

11.7. There is a cartridge that slides into the pump body. See Figure 11.7.

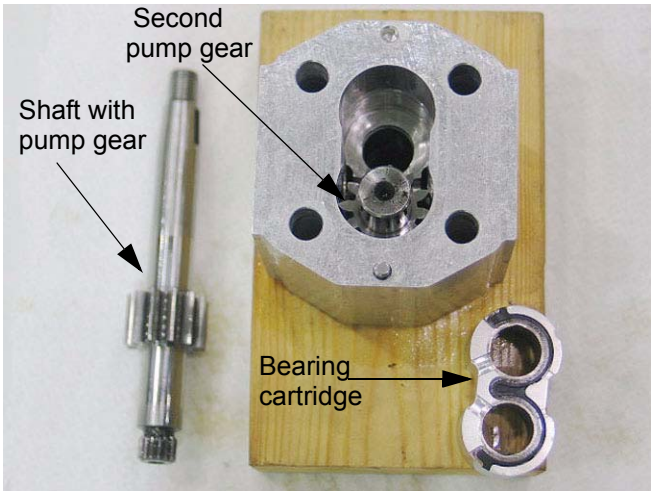

Figure 11.7

- The gears operate within, and are located by the cartridge.
- The cartridge end is partially sealed. Lubrication channels direct a metered amount of pressurized oil to the bearings and thrust surfaces.

12. COMPONENT BREAKDOWN: STEERING UNIT

NOTE: The steering unit is to be replaced as a unit if it fails. Dissassembling it will **VOID the warrantee.** The steering unit has been disassembled here to illustrate how it works.

NOTE: Individual components of the steering unit are not available through Cub Cadet.

12.1. The fittings on the end of the steering unit extend through the first two sections of the body, into the third and largest section. They hold all three sections of the steering unit body together. See Figure 12.1.

Figure 12.1

- O-rings seal the lines to the steering unit.
- O-rings also seal the fittings to the end of the steering unit.
- There are two sizes of fitting: 9/16”-18 and 11/16”-16
- If a 9/16”-18 fitting should come loose, tighten it to a torque of 25 in-lbs. (221 Nm).
- If an 11/16”-16 fitting should come loose, tighten it to a torque of 27 in-lbs (239 Nm).

12.2. With the fittings removed, the three sections of the steering unit can be separated. See Figure 12.2.

Figure 12.2

12.3. The first two sections comprise a gerotor pump and end plate to pressurise the system using steering wheel motion. See Figure 12.3.

Figure 12.3

12.4. The cardan shaft transfers motion from the steering wheel, through the body of the steering unit, to the pump. See Figure 12.4.

Figure 12.4

12.5. The relief valve ball and retaianer live in one of the fittinig bores. Carefully extract tehm with a magnet while the steerin unit is in the upright position. See Figure 12.5.

Figure 12.5

12.6. The spool and sleeve can be easily tapped-out of the housing. A thrust bearing assembly fits between the spool and sleeve assembly and the housing. See Figure 12.6.

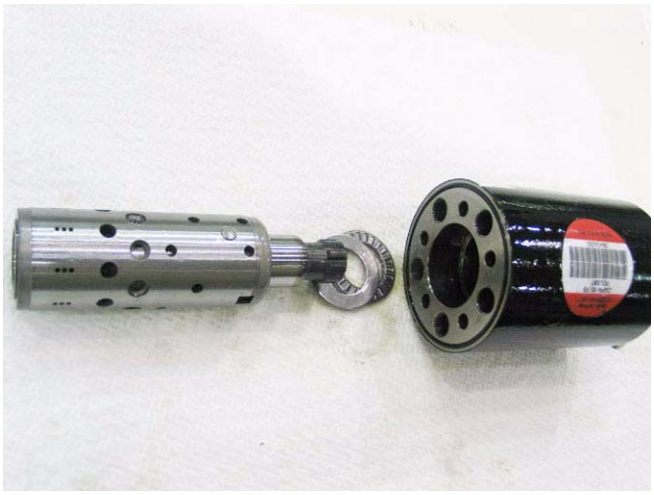

Figure 12.6

12.7. A circular retaioner holds the leaf springs in place. See Figure 12.7.

Figure 12.7

- The leaf springs transmit steering force from the sleeve to the spool.
- The effort it takes to deflect the leaf springs determines the amount of force that must be applied to the steering wheel before hydraulic force is applied to the steering.

Domestic Series 7000 Hydraulics

12.8. A dowell pin connects the spool and sleeve axially, and transmits steering force to the sleeve from the cardan shaft. See Figure 12.8.

Figure 12.8

12.9. Removing the dowel pin allows the spool to separate from the sleeve. See Figure 12.9.

Figure 12.9

12.10. There are two types of leaf spring: flat and bowed. A pair of each goes together, back-to-back. See Figure 12.10.

Figure 12.10

Domestic Series 7000 MFD

ABOUT THIS SECTION:

Early (2002 and 2003) production of the domestic Series 7000 four wheel drive tractors used an MFD (Mechanical Front Drive) sourced from another manufacturer. Beginning with serial number 1B014G20001 (February 1st, 2004) domestic Series 7000 tractors were built using an MFD assembled in Cub Cadet's transmission plant in Leitchfield, KY. It will be found primarily in CAT TM powered tractors.

A similar appearing, but not identical MFD has been used in the Cub Cadet Series 5000 since the start of that models production. It will be mentioned in this section so that it can be distinguished from the unit used in the Series 7000.

Service of the earlier MFD is covered in the 2003 Cub Cadet technical Handbook. This section covers the MFD produced by Cub Cadet. The two MFDs are very similar in appearance and function. Removal and replacement procedures for the two units are not substantially different from one-another, and they are directly inter-changeable in application. The brackets are different. If one is to be used in place of the other, they must be changed complete with the brackets.

Service Policy on the Cub Cadet produced MFDs will be to establish a pool of rotable exchange units that can be ordered by dealers to replace damaged MFDs. This applies to the Cub Cadet produced MFDs only, NOT to the outsourced MFDs that were used in some early production domestic Series 7000 tractors.

For tractors with warrantable repairs required to a Cub Cadet built MFD:

- The complete assembly is to be removed and replaced.
- The core shall be returned to Cub Cadet for rebuilding. It is not to be disassembled in any way.
- The determination as to whether a new or factory rebuilt MFD is to be installed under warranty will be made on a case-by-case basis.
- Outside of warranty, the dealer is free to repair a worn or damaged MFD, replace a worn or damaged MFD with a factory rebuilt unit, or to replace a worn or damaged MFD with a new one.

1. TO IDENTIFY THEM MFD:

1.1. The out-sourced MFD is part number 618-3207. The Cub Cadet built MFD is 618-0484. The out-sourced MFD can be distinguished from the Cub Cadet MFD in the following ways:

1.2. The out-source MFD has numbers embossed on most major components, the Cub Cadet Unit does not. See Figure 1.2.

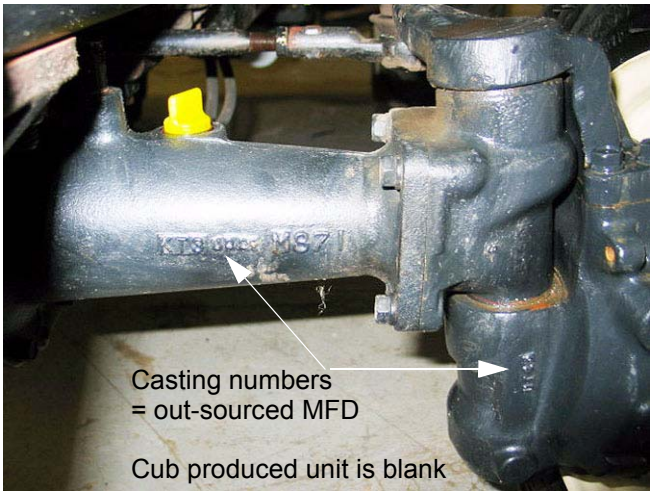

Figure 1.2

1.3. The Octagonal "pumpkin" is roughly 2" wide on the out-sourced MFD. It is roughly 4" wide on the Cub Cadet MFD. See Figure 1.3.

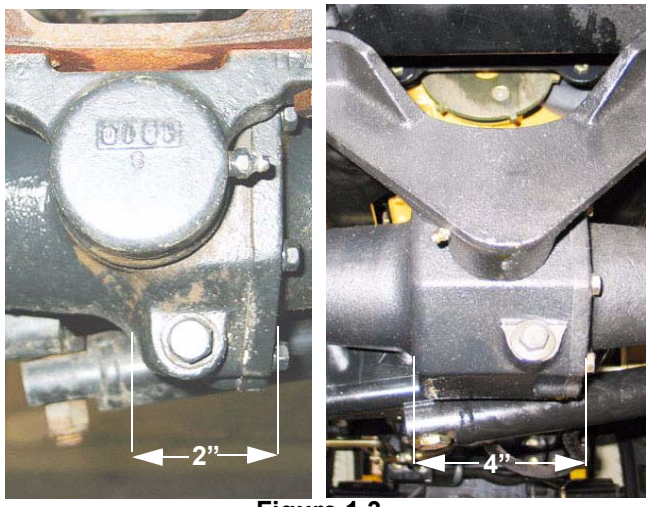

Figure 1.3

Domestic Series 7000 MFD

1.4. The MFD manufactured by Cub Cadet is mounted to two one-piece brackets. See Figure 1.4.

Figure 1.4

1.5. The out sourced MFD is mounted to a pair of two-piece brackets. See Figure 1.5.

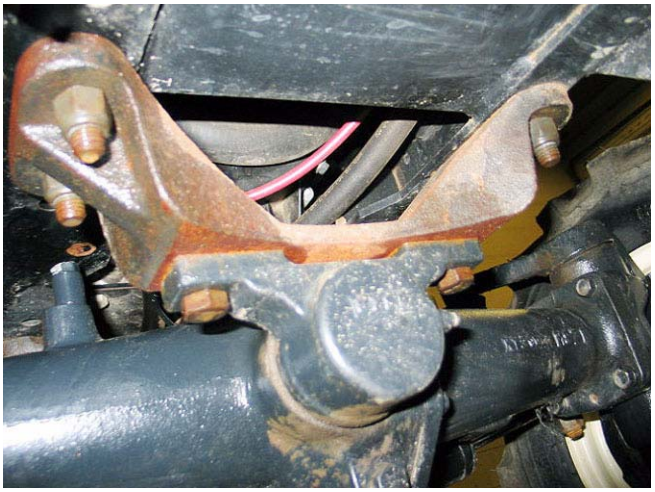

Figure 1.5

1.6. The MFD produced by Cub Cadet for the four wheel drive Series 7000 tractors is part number 618-0484. The Cub Cadet Series 7000 MFD (618-0484) uses many of the same castings as the Cub Cadet Series 5000 MFD (618-0428). The Series 5000 has a different ring and pinion gear orientation and the out-put to the wheels is in the opposite direction.

1.7. To visually distinguish the Series 5000 MFD from the Series 7000 MFD: the Series 5000 unit has four tapped holes or wheel studs on the axle flanges, while the Series 7000 has five tapped bolt holes on the axle flanges.

1.8. The Series 5000 MFD is wider than the Series 7000 MFD. While the main castings are the same, the outside edge (measured at the top) of the axle flanges on the 7000 are 2” (5 cm) out-board of the seam where the axle cover meets the drop axle housing. See Figure 1.8.

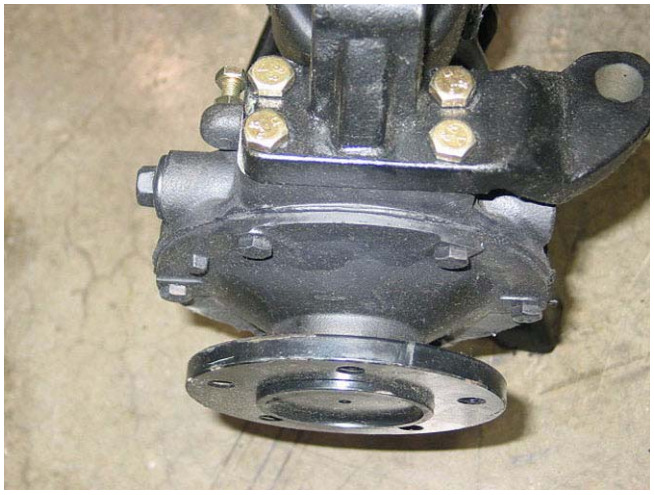

Figure 1.8

1.9. The outside edge (measured at the top) of the axle flanges on the 5000 are 3 1/2” (8.9 cm) out-board of the seam where the axle cover meets the drop axle housing. See Figure 1.9.

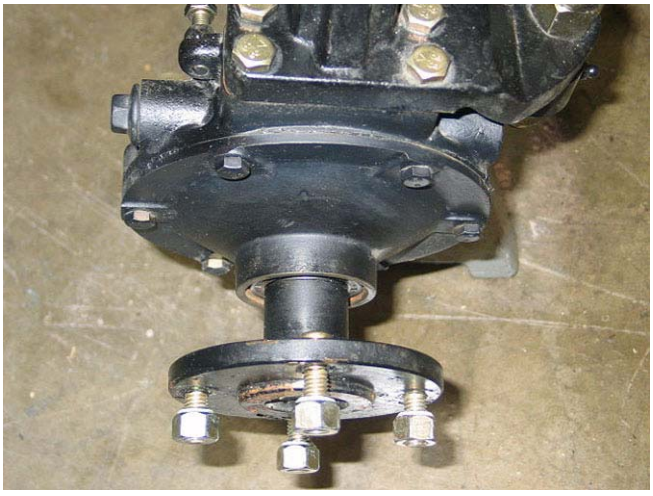

Figure 1.9

1.10. The difference in widths is accounted for by the fact that axle flanges protrude visibly further out of the housing on the 618-0428 (5000 MFD) than they do on the 618-0484 (7000 MFD).

1.11. To mechanically distinguish between a Series 7000 MFD and a Series 5000 MFD, rotate the input (pinion) shaft. Clockwise rotation (looking at the end of the pinion shaft) will result in forward tractor motion on the Series 7000 (618-0484 or 618-3207). Clockwise rotation will result in reverse tractor motion on the Series 5000 (618-0428).

Tractor	7000 Cub	7000 Outsourced	5000 Cub
Part #	618-0484	618-3207	618-0428
Input	Clockwise	Clockwise	C.C.W.
Axle	Stubby	Stubby	Extended
Mounting	1 piece	2 piece	1 piece
Wheel	5 bolt	5 bolt	4 stud

2. MFD REMOVAL: PREPARATION

NOTE: This procedure can be done on tractors that are equipped with cutting decks, front-end loaders, and other attachments. It is not necessary to remove the attachments in order to remove and replace the MFD.

2.1. Park the tractor on a firm level surface. Lower any attachments to the ground.

2.2. Place a drain pan under each final drive housing. Remove the drain plugs using an 11 mm wrench. Remove the fill plugs using a 16 mm wrench. See Figure 2.2.

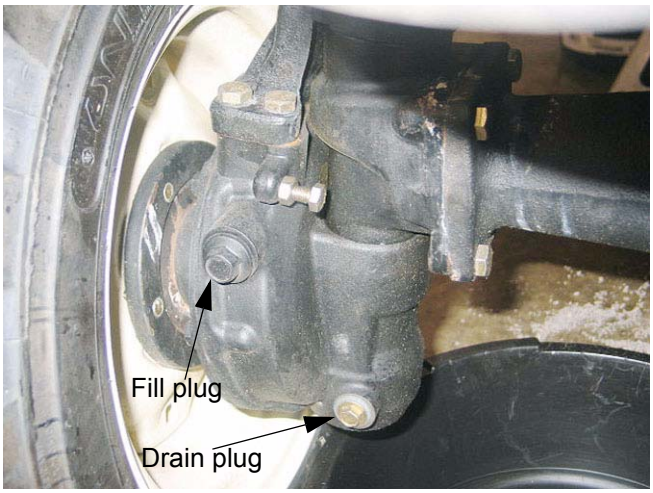

Figure 2.2

2.3. Place a drain pan under the differential housing, and remove the drain plug using a 16 mm wrench. Remove the oil level gauge to allow faster draining. See Figure 2.3.

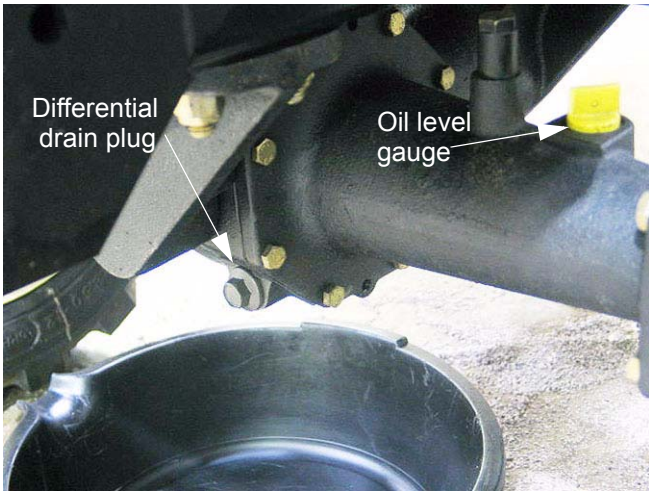

Figure 2.3

3. REMOVAL

3.1. Loosen the set screw that secures the back end of the 4 W.D. drive shaft to the splined output shaft on the front of the transmission. See Figure 3.1.

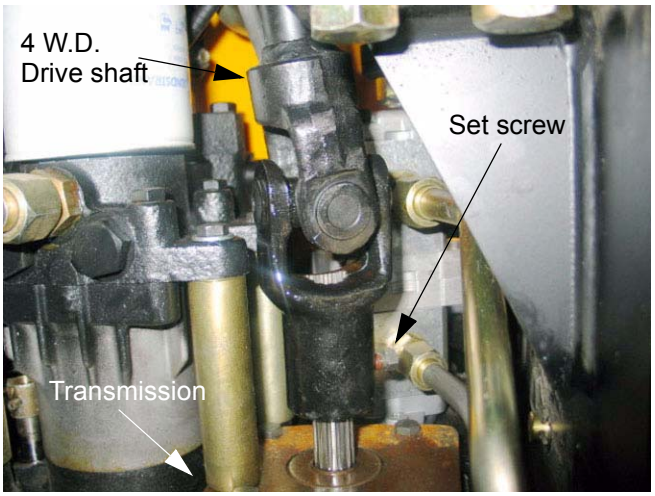

Figure 3.1

3.2. Slip the 4 W.D. drive shaft back to disengage it from the MFD.

3.3. If the tractor is equipped with a cutting-deck, loosen the two nuts on the front of the “U” bar using a 3/4” wrench. Remove the “U” bar.

3.4. Remove the nut that secures the ram of the steering cylinder to the steering cylinder mounting stud using a 24 mm wrench. See Figure 3.4.

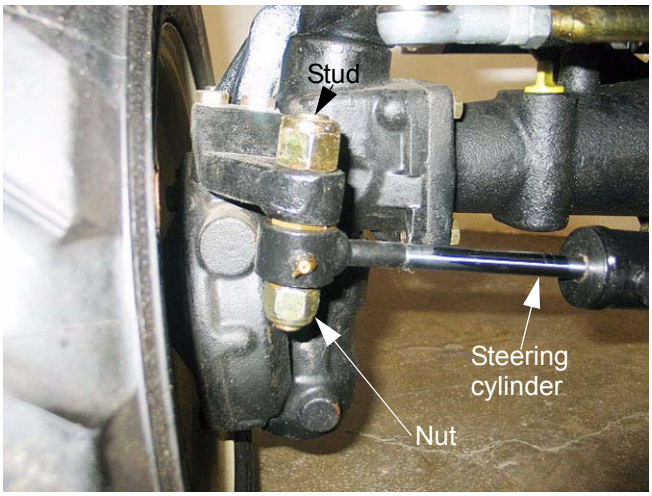

Figure 3.4

3.5. Remove the four bolts holding the steering cylinder bracket to the MFD housing using a 19 mm wrench. See Figure 3.5.

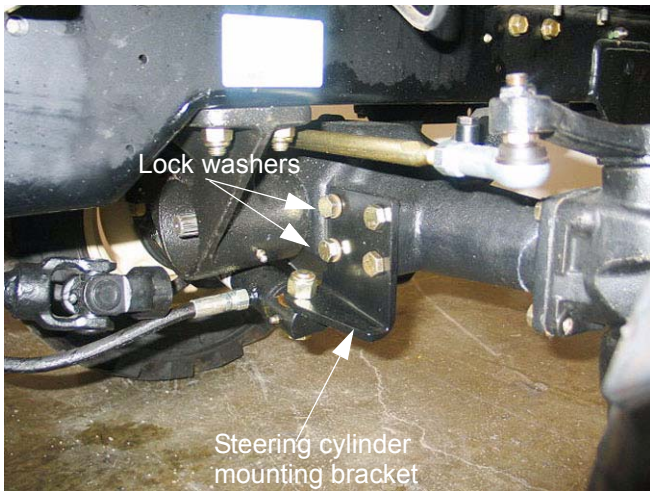

Figure 3.5

NOTE: Only the inner two bolts (closer to the axle mounting bracket) have lock washers.

3.6. Lower the steering cylinder carefully off of the mounting stud, and position it safely out of the way. See Figure 3.6.

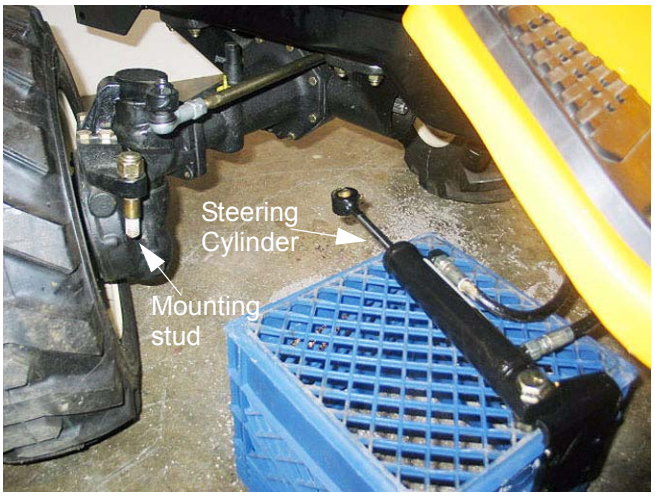

Figure 3.6

NOTE: Do not allow the steering cylinder to hang on the hydraulic hoses.

3.7. Remove the steering cylinder mounting stud using a 1” wrench and a 1 1/16” wrench.

3.8. Lift and support the front of the tractor by the differential housing. Leave the hydraulic jack in place. See Figure 3.8.

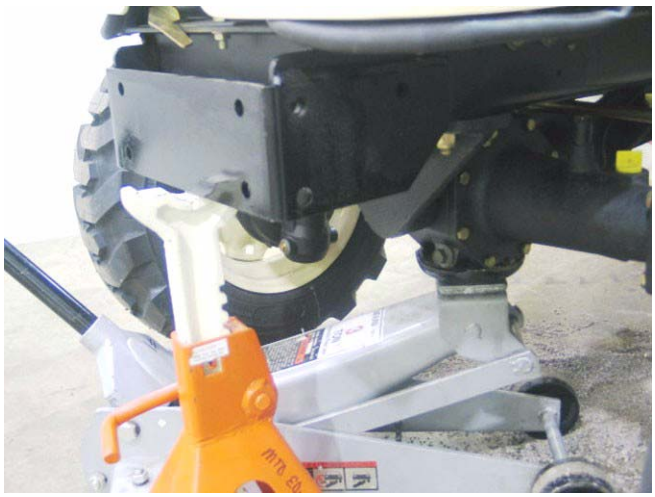

Figure 3.8

NOTE: If the MFD is being replaced because the housing is broken, an alternative jacking point may need to be identified by the technician.

3.9. Support the front cross-member of the tractor frame on one or two jackstands.

3.10. Remove the front wheels using a 19 mm wrench.

3.11. Remove the battery:

- Remove the wing-nuts and hold down bar that secure the battery.
- Disconnect the negative terminal using a 3/8" wrench.
- Disconnect the positive terminal using a 3/8" wrench.
- Carefully lift the battery out of the tractor.

NOTE: Removing the battery yields access to two of the bolts that hold the front MFD bracket.

3.12. Remove the four nuts that secure the front axle bracket to the frame using a pair of 3/4" wrenches. See Figure 3.12.

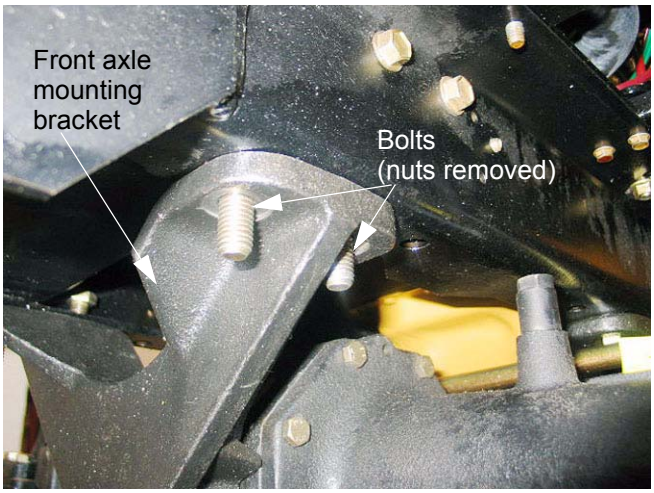

Figure 3.12

3.13. Remove the four nuts that secure the rear axle bracket (of the front axle) to the frame using a pair of 3/4" wrenches. See Figure 3.13.

Figure 3.13

3.14. Lower the MFD to the ground.

3.15. Remove the axle brackets from the MFD, for transfer to the replacement MFD. See Figure 3.15.

Figure 3.15

4. MFD INSTALLATION

4.1. Lubricate the pivot bosses on the new MFD with a good all-purpose grease.

4.2. Confirm that the thrust washers are in place in both front axle brackets. See Figure 4.2.

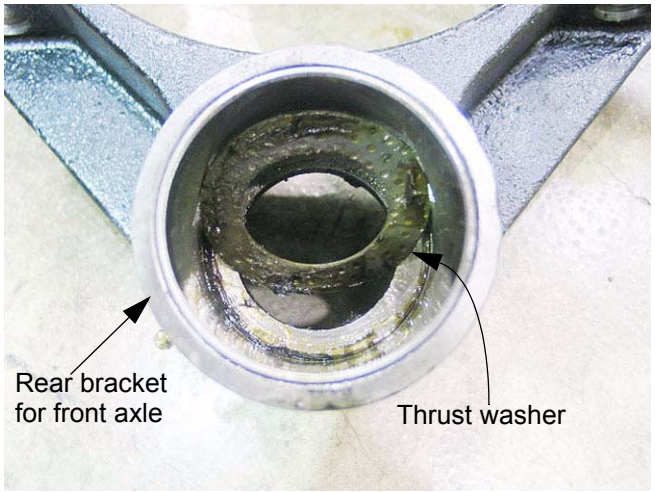

Figure 4.2

NOTE: The flat side of the thrust washers goes into the brackets first, so that the dimpled side faces the pivot boss on the MFD.

4.3. Position the front axle brackets on the replacement MFD.

NOTE: Tie-down straps or heavy cable ties will help hold them in place temporarily.

4.4. Lift the replacement MFD into position. See Figure 4.4.

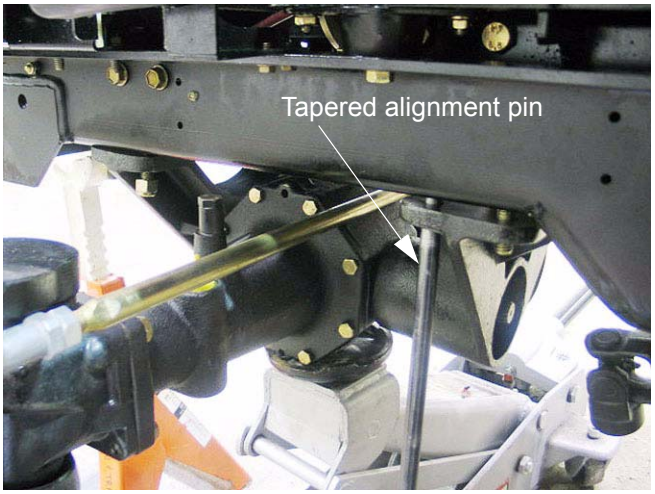

Figure 4.4

NOTE: A tapered pin can be used to help align the brackets with the bolt holes.

4.5. Install the nuts that secure the axle brackets. tighten them to a torque of 75 ft.-lbs. (100 Nm). If the nylon locking ring has worn, replace the nut with a new one, or apply a small amount of thread locking compound such as loctite 242 (blue) to the threads on assembly.

4.6. Install the front wheels.

4.7. Lower the tractor to the ground, and tighten the lugs to a torque of 55 ft.-lbs. (63 Nm). Re-torque the wheels after 10 hours of operation.

4.8. Remove the fill plugs from the final drive housings. Fill each housing to the bottom of the fill plug hole with Cub Cadet 85W140 Gear Lube (P/N: 737-3065 for 1 qt.). Install the fill plugs.

4.9. Remove the oil level gauge from the main housing, and install sufficient Cub Cadet Gear Lube to reach the “FULL”, mark on the oil level gauge.

NOTE: Total lube capacity of the MFD is approximately 82 fl. oz. (2.5 qts.) or (2.37 liters).

4.10. Install the steering cylinder stud in the replacement MFD steering knuckle. Tighten the nut to at torque of 100 ft.-lbs. (136 Nm).

4.11. Install the steering cylinder:

- Lubricate the shoulder of the steering cylinder stud with grease.
- Apply a small amount of thread locking compound such as loctite 242 (blue) to the threads of the four bolts that secure the steering cylinder bracket to the MFD.
- Lift the steering cylinder into position, with the eyelet of the ram seated over the stud.
- Install the four bolts that secure the steering cylinder bracket. Tighten them to a torque of 75 ft.-lbs (100 Nm). The lock washers go on the inboard bolts.
- Install the nut that secures the steering cylinder ram to the stud. Tighten the nut to a torque of 150 ft.-lbs. (200 Nm).

4.12. Connect the 4 W.D. driveshaft:

- Apply a small amount of anti-seize to the splines of the MFD pinion shaft.
- Install the 4 W.D. driveshaft on the pinion shaft of the MFD.
- Position it so that the end of the pinion shaft is even with the rear edge of the front U-joint yoke.
- Tighten the set screw on the rear U-joint to secure the 4 W.D. drive shaft.

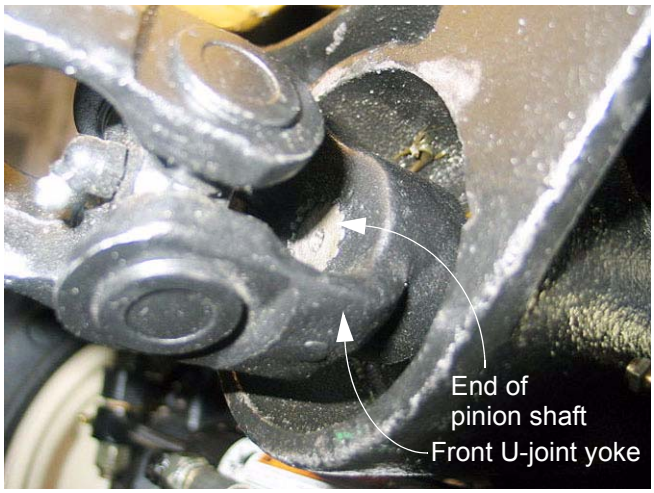

Figure 4.12

5. IN-FRAME REPAIRS: DROP AXLE SERVICE

NOTE: Within the warranty period of the domestic Series 7000 tractor, repairs to the MFD will be accomplished by replacement of the complete assembly. Refer to the **Service Policy** portion of the MFD section of this manual.

NOTE: Repairs to the **drop-axle assembly** are most easily performed without removing the MFD from the tractor.

5.1. Lift and safely support the side that is to be serviced. See Figure 5.1.

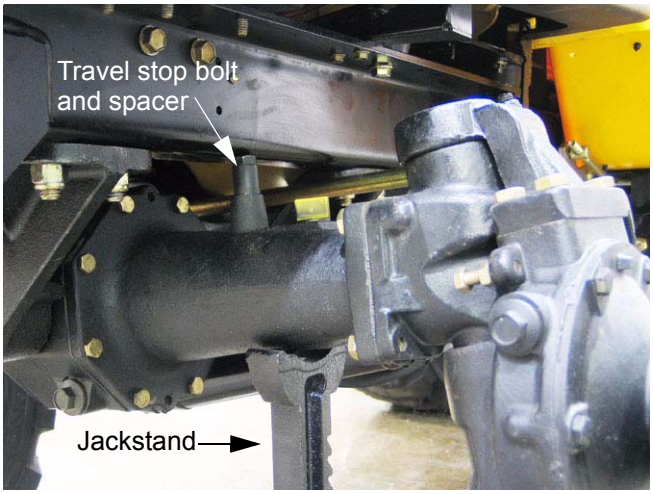

Figure 5.1

NOTE: By lifting the side of the axle to be serviced as far as it can go before the stop hits the frame, the gear lube in the center section will move to the lower side. This will allow the drop axle assembly to be removed with minimal loss of gear lube, without draining the main housing.

5.2. Remove the wheel using a 19 mm wrench.

5.3. Clean the area surrounding the drop axle assembly, and drain the gear lube from it.

- Place a clean catch pan under the drop axle assembly.
- Remove the drain plug using an 11mm wrench.
- Remove the fill plug using a 16 mm wrench.

NOTE: The steps above are preliminary to any in-frame drop axle service. Specific procedures are outlined in the following sections; In-frame repairs: drop axle cover, In-frame repairs: drop axle cover, In-frame repairs: drop axle removal. Bench repairs: kingpin and drop axle housings.

6. IN FRAME REPAIRS: DROP AXLE COVER

6.1. If there is an obvious problem within the drop axle housing, or for purposes of inspection, the axle cover is easily removed.

6.2. Remove the axle cover bolts using a 13 mm wrench. See Figure 6.2.

Figure 6.2

6.3. From this point, the contents of the drop axle housing are visible. See Figure 6.3.

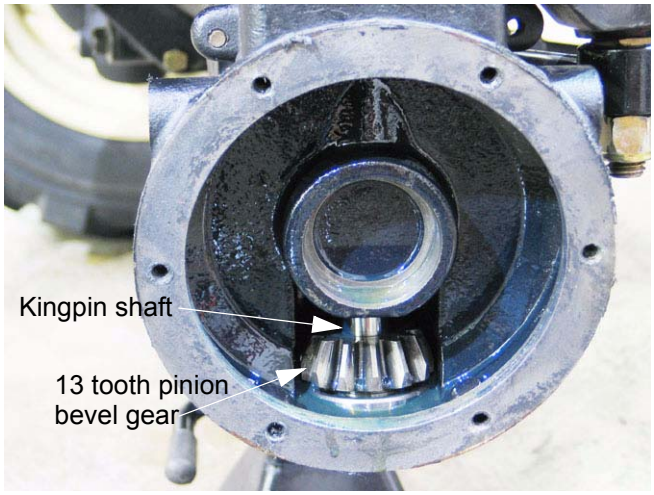

Figure 6.3

6.4. The axle cover assembly may be serviced on the bench.

6.5. The inner axle bearing is a slip fit on the axle. It can be removed with light pressure on the bearing, or (preferably) by lifting the axle bevel gear. See Figure 6.5.

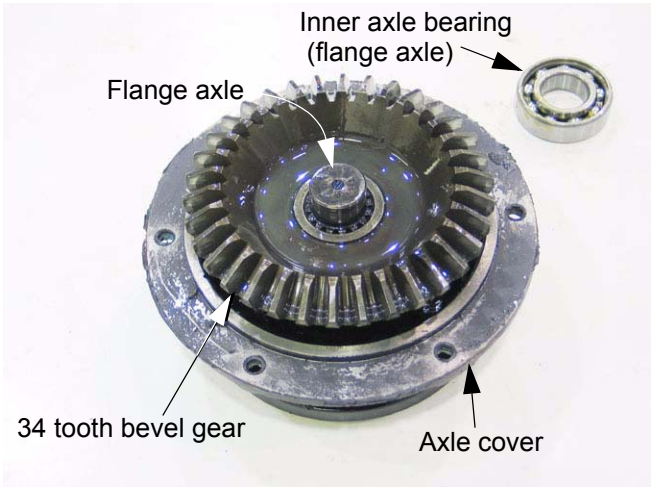

Figure 6.5

6.6. Lift the gear off of the splined portion of the flange axle to gain access to the retaining ring that secures the flange axle and the outer axle bearing to the axle cover. See Figure 6.6.

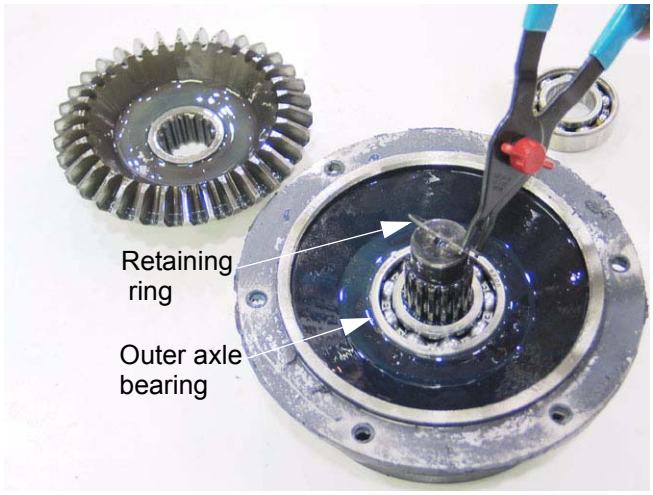

Figure 6.6

6.7. The axle should push out of the bearing and cover with light pressure.

6.8. After the axle is separated from the bearing and cover, the bearing, and the seal that protects it may be easily removed from the cover. See Figure 6.8.

Figure 6.8

6.9. Clean and inspect all of the components and sealing surfaces on mating components: See Figure 6.9.

- Bearings should turn smoothly and freely.
- The splines, wheel mounting flange, bearing journals, lug threads, splines and seal surface of the axle should all be in good condition.
- Check the axle cover for damage.

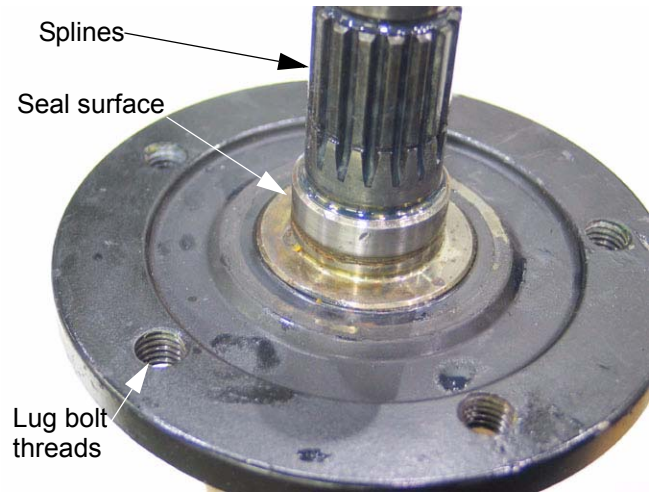

Figure 6.9

6.10. To reassemble the axle cover: See Figure 6.10.

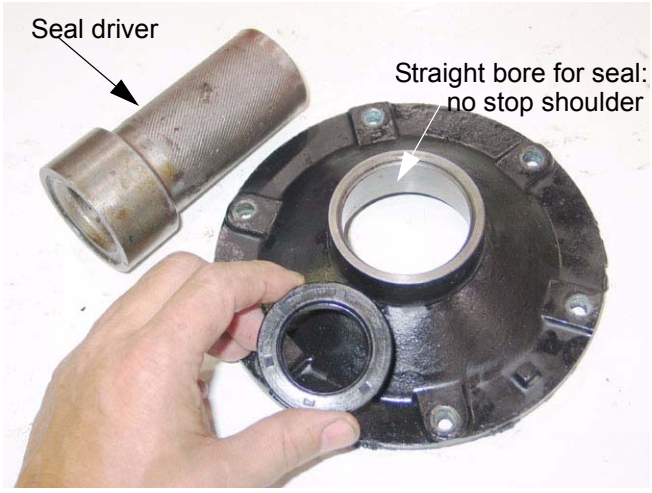

Figure 6.10

- Use a seal driver to install a new seal in the cover. There is no shoulder for the seal to seat against, so it must be driven far enough that the outer edge of the seal is flush with the outer edge of the machined bore that the seal seats in.
- Lubricate the lip of the seal.
- Assemble the axle, bearings, and axle bevel gear to the axle cover. Be certain that the retaining ring is properly seated in its groove on reassembly.

6.11. On installation to the drop axle housing:

- Apply a small bead of sealant such as Black Loctite # 5900 to the mating surfaces.
- Apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the bolts that secure the axle cover.
- Install the cover to the drop axle housing, and tighten the bolts to torque of 160-220 in-lbs. (18-25 Nm). There is an embossed square on the cover, but there is no need to orient it in any specific location.
- Refill the drop axle housing with 85W140 gear lube.

7. IN-FRAME REPAIRS: DROP-AXLE REMOVAL

7.1. The drop axle assembly can also be removed complete.

7.2. If working on the left side drop axle, disconnect the cylinder mounting stud from the steering arm using a 24 mm wrench to hold the bottom nut and a 1 1/16” wrench to turn the top nut.

7.3. Remove the nut from the tie rod end, using a 19 mm wrench for the nut and a 17 mm wrench to hold the stud. See Figure 7.3.

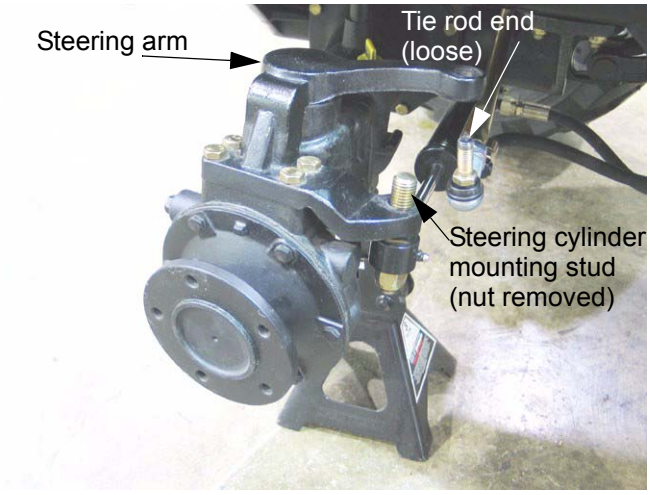

Figure 7.3

7.4. Support the drop axle housing, and remove the four bolts that hold the steering arm to the king pin housing using a 17 mm wrench.
See Figure 7.4.

Figure 7.4

7.5. Lift the steering arm off of the kingpin housing and the stud for the steering cylinder.
See Figure 7.5.

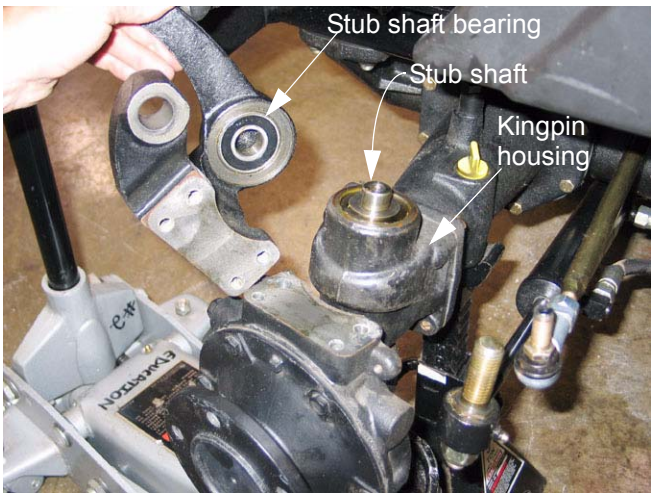

Figure 7.5

7.6. At this point, the most common service procedure will be to remove the kingpin housing and drop axle housing as a unit.

7.7. If there is obvious damage that is isolated to the drop axle housing, it is possible to separate the two at this point without removing the kingpin housing.

7.8. Grip the stub shaft and pull it out of the kingpin housing. It is retained by the friction of a rubber o-ring that also serves as a seal.
See Figure 7.8.

Figure 7.8

7.9. The drop axle housing can then be pushed down off of the kingpin housing with some twisting and light force. See Figure 7.9.

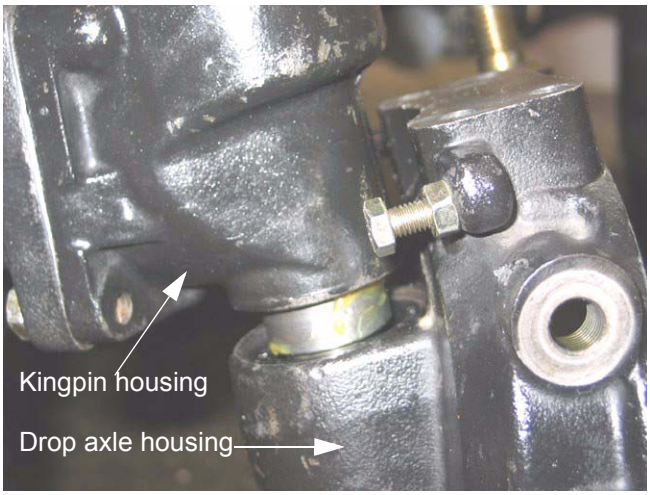

Figure 7.9

7.10. Most service that requires the removal of the drop axle housing is most easily performed by removing the drop axle housing along with the kingpin housing.

7.11. To separate the kingpin housing from the axle housing, loosen all four bolts that secure the two together using a 16 mm wrench. See Figure 7.11.

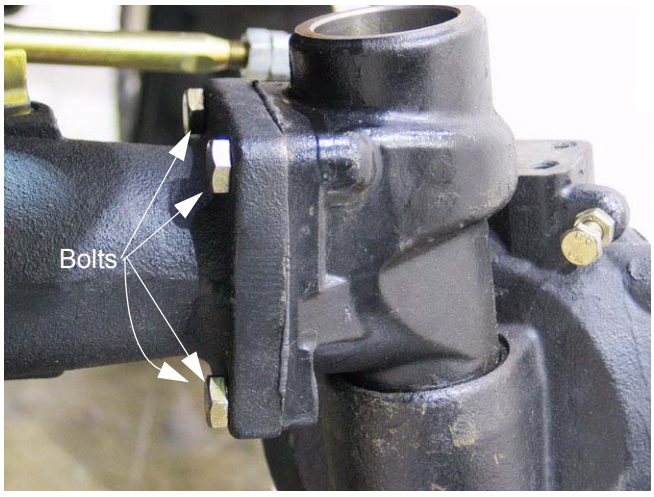

Figure 7.11

NOTE: It may be useful to use the head of a loosened bolt to pry or drive against to loosen the sealant between the two castings.

7.12. Support the drop axle housing, and separate it from the axle housing. See Figure 7.12.

Figure 7.12

7.13. With the kingpin housing removed, access is gained to the bevel gear on the end of the axle shaft, and the bearing that supports the outer end of the axle shaft. See Figure 7.13.

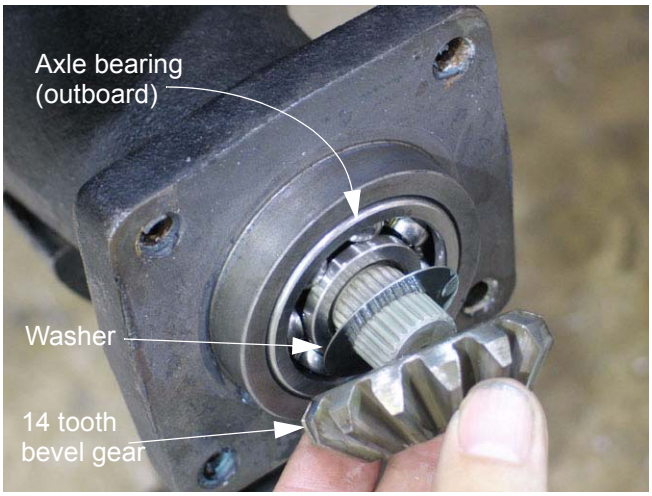

Figure 7.13

7.14. The gear and bearing are easily removed.

7.15. To remove the bearing it may help to slide the axle shaft out roughly 1/4" (6mm). Once sufficient grip is available to withdraw the bearing, push the axle back into place.

NOTE: If the axle shaft is pulled-out too far, the shims that are used to set ring gear component of the differential back-lash may fall out of place. If this happens, the axle housing must be removed from the tractor and separated to repositions the shims.

8. BENCH REPAIRS: DROP AXLE AND KINGPIN HOUSING ASSEMBLIES

8.1. Once on the bench, the drop axle housing and the kingpin housing are easily separated from each other by twisting and pulling.

8.2. To remove the kingpin shaft, bearing, and gear from the kingpin housing, fixture it in a soft-jaw vise.

8.3. Carefully drive the kingpin shaft out the bottom of the kingpin housing. See Figure 8.3.

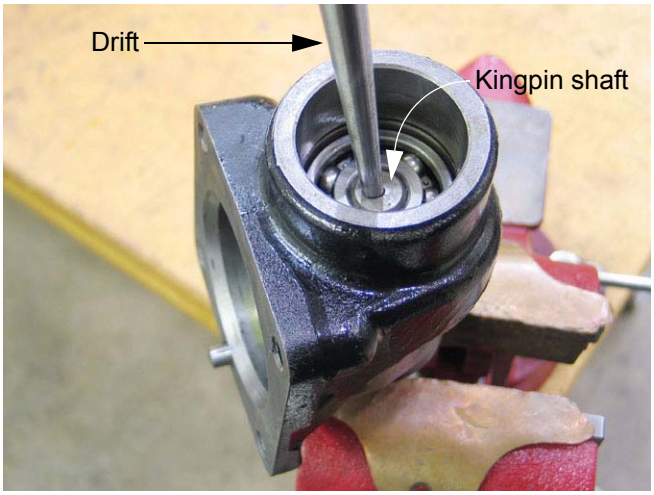

Figure 8.3

NOTE: There is a snap ring in the bore of the kingpin housing that provides a stop for the bottom of the stub shaft, and locates the top of the bearing. Ensure that it is securely in place when reassembling the kingpin housing.

8.4. With the kingpin shaft removed, the 14 tooth bevel gear can be removed. See Figure 8.4.

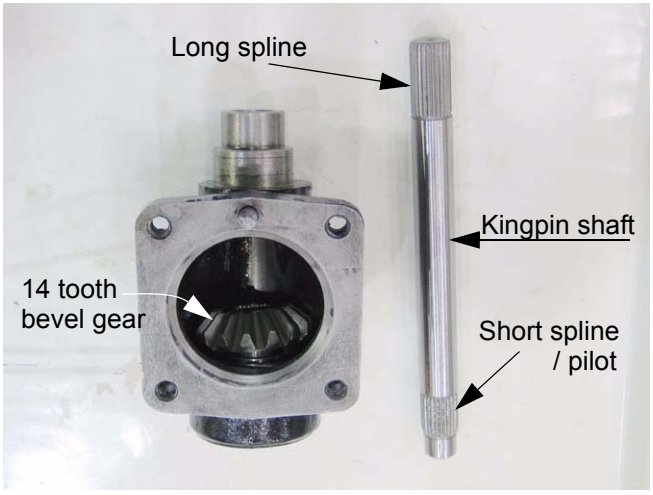

Figure 8.4

8.5. The bearing that supports the top of the kingpin shaft can also be pushed out of the kingpin housing with light pressure. See Figure 8.5.

Figure 8.5

8.6. To disassemble the drop axle housing, fixture it in a soft-jaw vise.

8.7. Remove the axle cover using a 13mm wrench.

8.8. There are two seals to be removed from the top bore of the drop axle housing. See Figure 8.8.

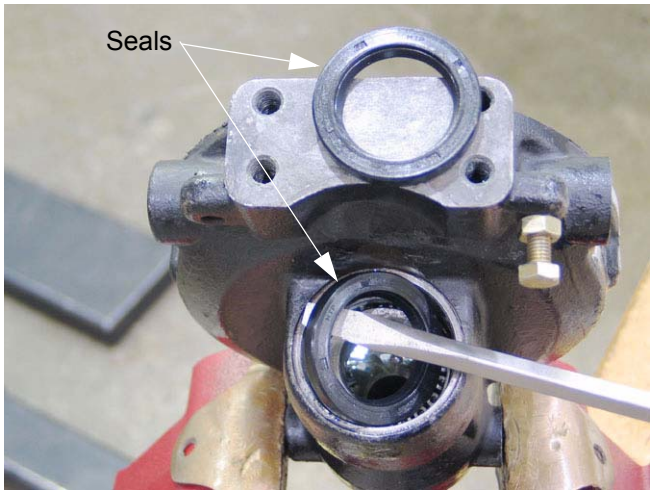

Figure 8.8

NOTE: The lips of both seals face inward.

8.9. After the seals are removed, the tapered roller bearing can be lifted out. See Figure 8.9.

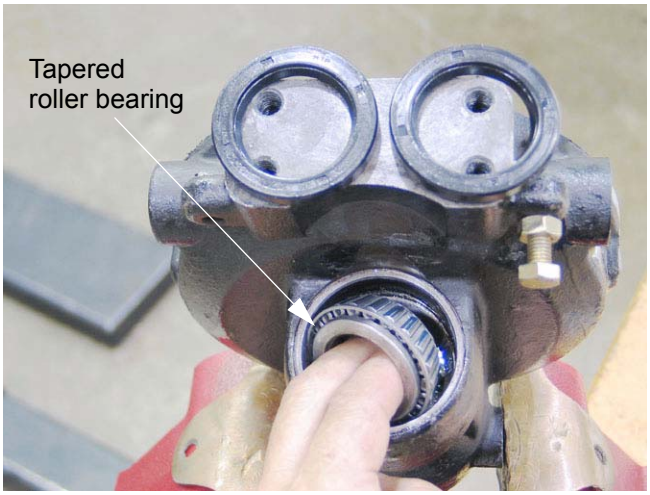

Figure 8.9

8.10. The 13 tooth bevel gear that is driven by the bottom of the kingpin shaft, and the bearing that supports the gear are in the bottom of the drop axle housing.

8.11. Carefully pry the gear and bearing out of the bore at the base of the drop axle housing. See Figure 8.11.

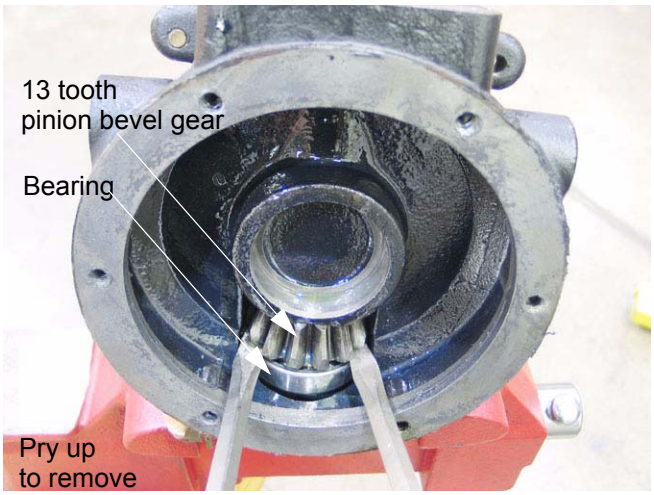

Figure 8.11

8.12. Use a bearing puller to separate the gear from the bearing. See Figure 8.12.

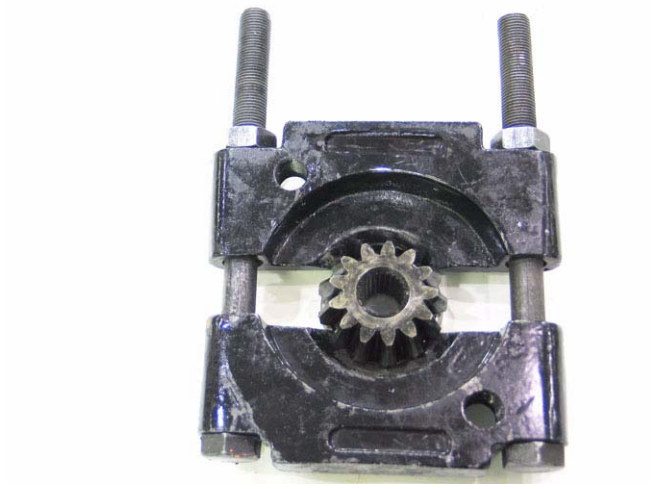

Figure 8.12

8.13. To assemble the drop axle housing:

- Clean and inspect all components-replace any that are suspect.
- If the tapered roller bearing needs to be replaced, drive the outer race of the old bearing out of the drop axle housing.
- Replace all seals and o-rings with new ones.
- Clean all traces of old sealant from sealing surfaces, including those on mating parts (axle housings).

Domestic Series 7000 MFD

8.14. Carefully press the 13 tooth pinion bevel gear into the bearing that carries it. Use care to isolate pressing force to the inner race of the bearing. See Figure 8.14.

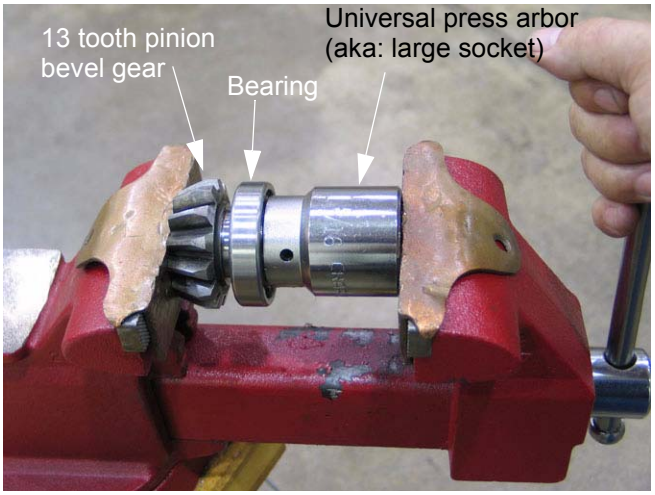

Figure 8.14

8.15. Position the bearing and bevel gear in the base of the bore in the drop axle housing.

8.16. If the tapered roller bearing required replacement, drive or press the outer race of the new bearing into the bore at the top of the drop axle housing using an appropriate tool. See Figure 8.16.

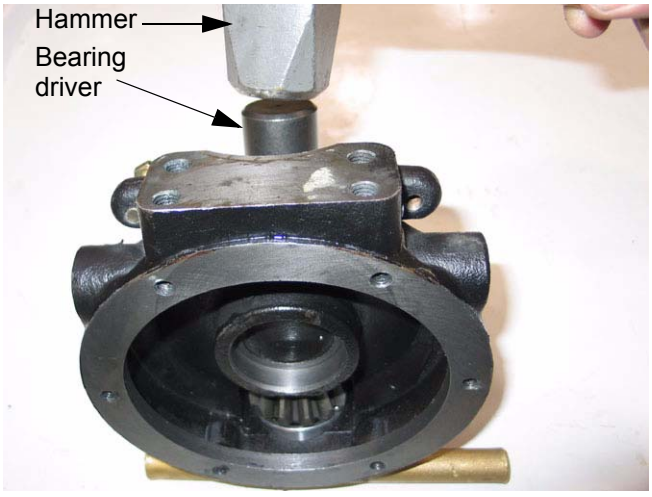

Figure 8.16

8.17. Install the tapered roller bearing in the bearing race.

8.18. Install the two seals above the tapered roller bearing using an appropriate driver. See Figure 8.18.

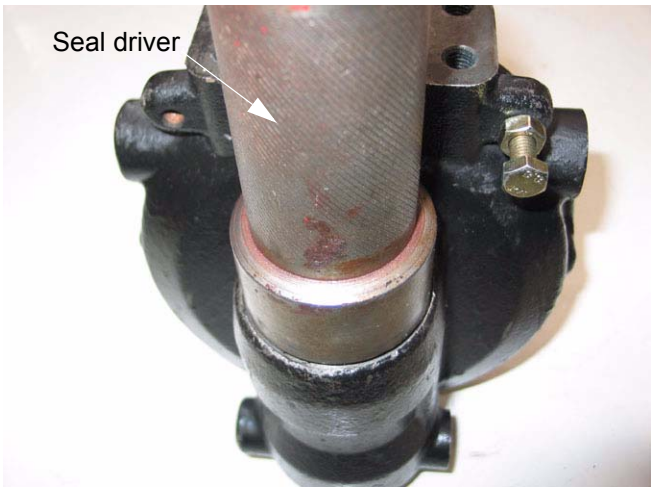

Figure 8.18

NOTE: The “open” side of both seals faces into the casting. The first seal should be driven roughly 1/4” into the machined bore. The second seal should be driven flush with the top of the machined bore. The top edge of the machined bore is beneath the top lip of the casting.

8.19. Confirm that the retaining ring in the kingpin housing is properly seated.

8.20. Install the bearing and 14 tooth bevel gear in the kingpin housing. See Figure 8.20.

Figure 8.20

8.21. Install the kingpin shaft in the kingpin housing. The end of the shaft with the pilot nose should engage the 14 tooth bevel gear.

8.22. Lubricate the shoulder of the kingpin housing that will ride against the seals.

8.23. Slip the kingpin housing and kingpin shaft into the drop axle housing:

- Twisting and light pressure are better than brute force.
- The splines on the bottom end of the kingpin shaft must engage the splines on the 13 tooth bevel gear for the two housings to fully seat.

8.24. Fixture the housings in a soft-jaw vice.

8.25. Install the drop axle cover:

- Apply a small bead of sealant such as Black Loctite # 5900 to the mating surface.
- Apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the bolts that secure the axle cover.
- Install the cover to the drop axle housing, and tighten the bolts to torque of 160-220 in-lbs. (18-25 Nm). There is an embossed square on the cover, but there is no need to orient it in any specific location.

8.26. Install the drop axle assembly to the axle housing:

- Apply a small bead of sealant such as Black Loctite # 5900 to the mating surface.
- Apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the bolts that secure the axle cover.
- Confirm that the axle bearing, washer, and 14 tooth bevel gear, are in place at the end of the axle shaft.
- Position and support the drop axle assembly against the axle housing.
- Install the bolts that joint the kingpin housing to the axle housing, and tighten the bolts to torque of 220-280 in-lbs. (25-34 Nm).
- Lubricate the o-ring seal that fits tin the groove in the plug shaft, and slip it into position on the plug shaft.
- Install the plug shaft in the top of the kingpin housing.
- Position the washer on the plug shaft.
- Apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the bolts that secure the steering arm to the kingpin housing.
- Install the steering arm. Tighten the bolts to a torque of 220-280 in-lbs. (25-34 Nm).

  NOTE: If working on the left steering arm, position the steering cylinder mounting stud in the steering arm before installing the bolts.
- Apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the nut that secures the steering cylinder mounting stud.
- Install the nut using a 1 1/16” wrench to turn the nut and a 24 mm wrench to hold the nut on the bottom of the stud. Tighten the nut to a torque of 150 ft.-lbs (200 Nm).
- Apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the nut that secures the tie-rod end stud.
- Connect the tie-rod end to the steering arm, and tighten the nut to a torque of 49 ft-lbs (66 Nm) using a 19 mm wrench.

8.27. Final assembly:

- Install the drain plug and sealing washer in the drop axle housing using an 11 mm wrench.
- Fill the housing to level with the fill plug with 85W140.
- Install the fill plug using a 16 mm wrench.

8.28. Lower the tractor to the ground, and tighten the lugs to a torque of 55 ft.-lbs. (63 Nm) using a 21 mm wrench. Re-torque the wheels after 10 hours of operation.

8.29. Test the operation of the tractor before returning it to service. Carefully check all serviced items for:

- Leaks
- Looseness
- Unusual noises

9. BENCH REPAIR: AXLES AND DIFFERENTIAL.

9.1. Remove the MFD complete, as described in the “REMOVAL” section of this manual.

9.2. Lift and safely support the MFD on a convenient work surface.

NOTE: Get assistance or use mechanical lifting equipment. The MFD complete weighs roughly 150 lbs. (68 Kg.).

9.3. If not previously done, drain the gear lube from main housing and drop-axle housings, as described in the “REMOVAL” section of this manual. See Figure 9.3.

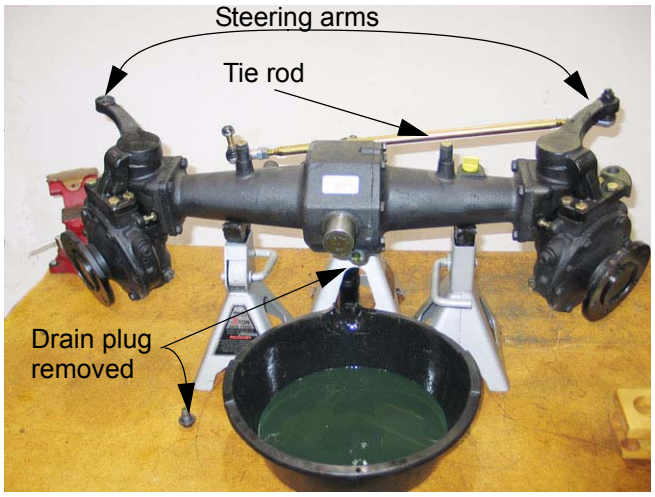

Figure 9.3

9.4. Disconnect the tie-rod ends from both steering arms using a 16 mm wrench and a 17 mm wrench.

NOTE: Drop axle gear lube:

- If the drop axles are to be serviced, or there is a chance that the gear lube they contain is contaminated, drain them as well.
- If the drop axles are undamaged, and the gear lube they contain is not contaminated, they need not be drained for removal.

9.5. Remove both drop-axle housings using a 17 mm wrench. See Figure 9.5.

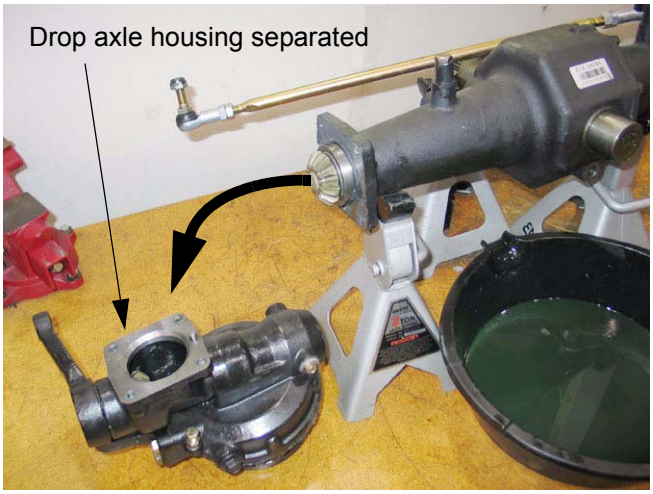

Figure 9.5

9.6. With both drop axle assemblies removed, the MFD can be placed directly on the bench, at the technician’s discretion.

NOTE: alternatively, the drop axles can be taken off of the MFD before it is removed from the tractor.

9.7. The axles, outer axle bearings, 14 tooth bevel gears, and washers can be removed from the MFD at this point. See Figure 9.7.

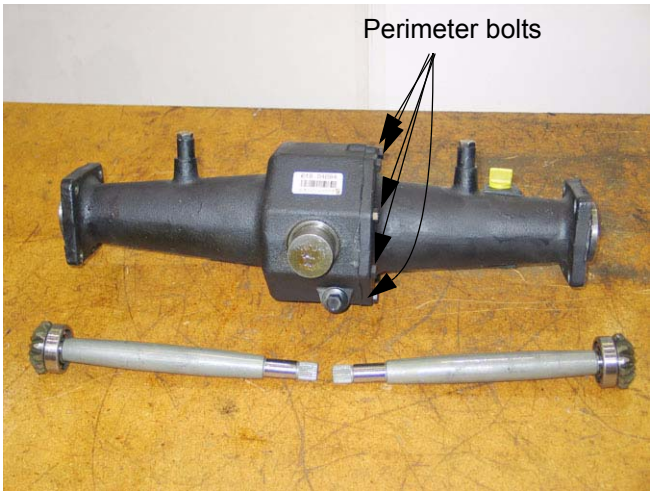

Figure 9.7

9.8. Slightly loosen the perimeter bolts that hold the axle housings together using a 13 mm wrench.

NOTE: The two axle housings are most easily separated in the vertical position.

9.9. Separating the housings is best done in a vertical position. After the sealant between the two housings is broken, securely stand the assembly on-end to remove the bolts and separate the housings. See Figure 9.9.

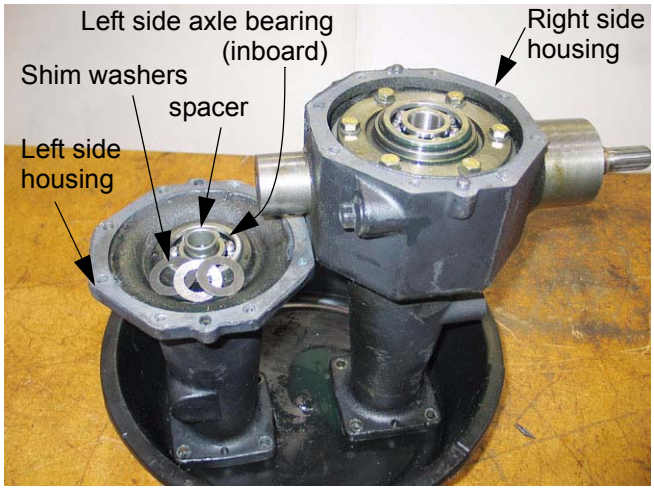

Figure 9.9

9.10. Lift the smaller left housing off of the larger right housing.

NOTE: The left housing at this point contains only an inner axle bearing and a sleeve that fits into that bearing. Both can be removed with light pressure.

NOTE: Washers reside between the inner axle bearing and the differential bearing. Keep track of the size and number of these washers.

9.11. The left side differential bearing can lifted out of the differential housing. See Figure 9.11.

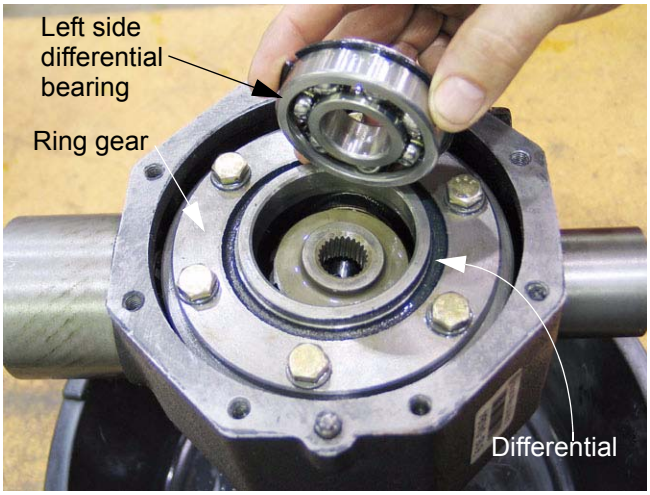

Figure 9.11

9.12. With the differential bearing removed, the 16 tooth miter gear can be lifted out of the differential housing. See Figure 9.12.

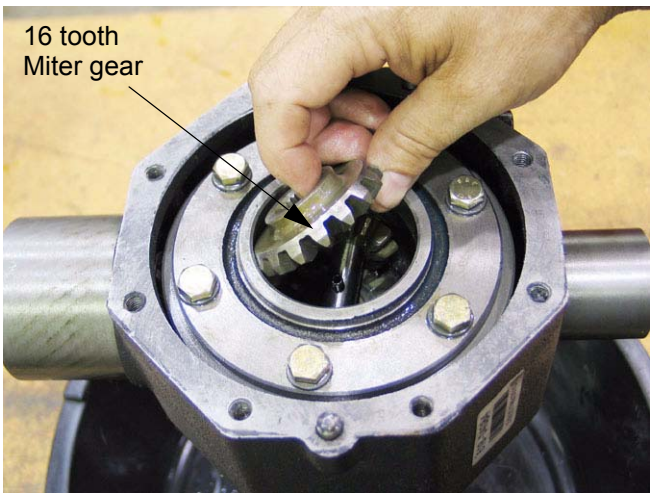

Figure 9.12

9.13. With the 16 tooth miter gear removed, the differential housing can be easily grasped and lifted out of the right side axle housing.
See Figure 9.13.

Figure 9.13

9.14. Beneath the differential housing are more washers, between the right side differential bearing and the right side inner axle bearing.

NOTE: Keep track of the size and number of these washers.

9.15. The shim washers and inner axle bearing can be easily removed from the right side axle housing. See Figure 9.15.

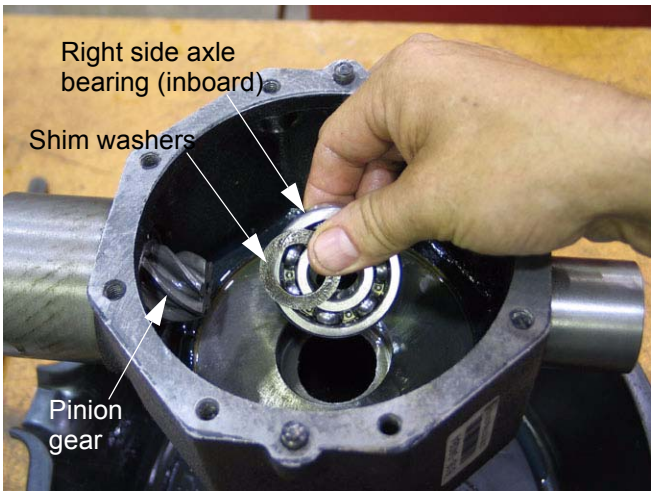

Figure 9.15

9.16. The right side axle housing also contains the pinion gear and bearings.

9.17. The nut that holds the pinion assembly in place is staked into position. The staking must be chiseled-out. See Figure 9.17.

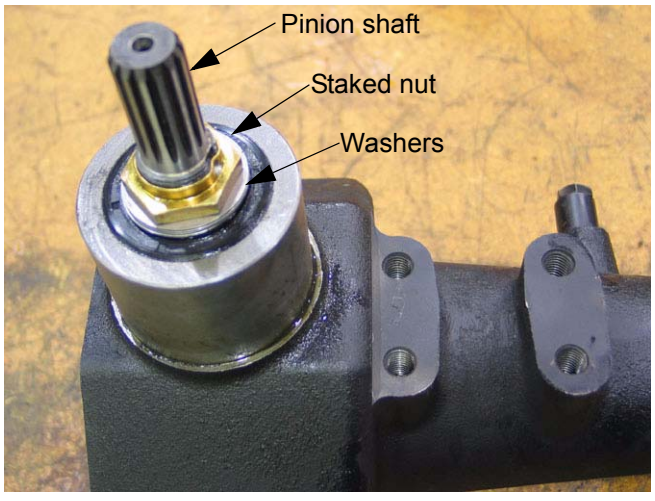

Figure 9.17

9.18. After the nut is de-staked, use the front wheel drive shaft to hold the pinion shaft, while tuning the nut with a 1 1/4" wrench. See Figure 9.18.

Figure 9.18

NOTE: A damaged driveshaft, cut-off to a length of 1' may be kept as a permanent pinion tool.

9.19. Remove the nut and washers from the pinion shaft. keep track of the size, quantity, and position of the washers. See Figure 9.19.

Figure 9.19

9.20. Drive the pinion gear into the inside of the differential using a soft hammer or drift.

9.21. Remove the spacer that fits between the pinion shaft and the seal. See Figure 9.21.

Figure 9.21

9.22. Pry out the pinion seal. The outer pinion bearing will come out when the seal is removed. See Figure 9.22.

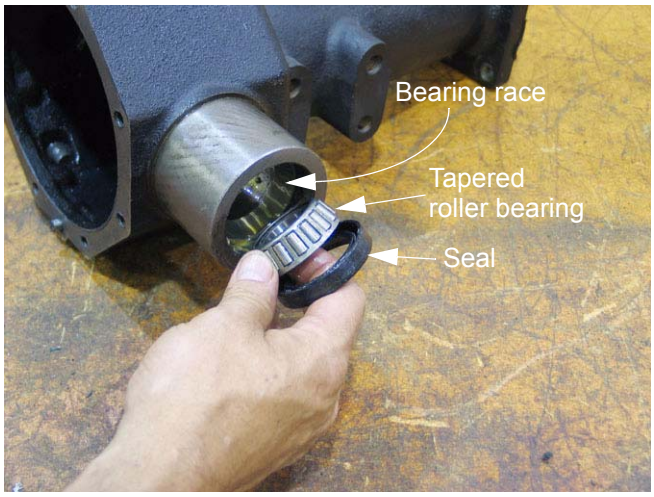

Figure 9.22

9.23. If the pinion bearings are suspect, drive the outer races from the pinion bore as well. Keep the races associated with the same bearings that originally ran in them. See Figure 9.23.

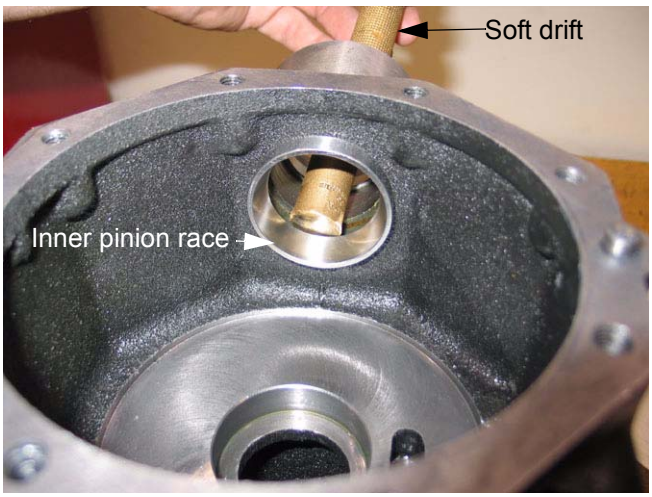

Figure 9.23

9.24. To disassemble the differential, fixture the differential assembly in a soft-jaw vice.

9.25. Drive the roll pin from the cross pin that the miter gears ride on using a flat-nosed drift. See Figure 9.25.

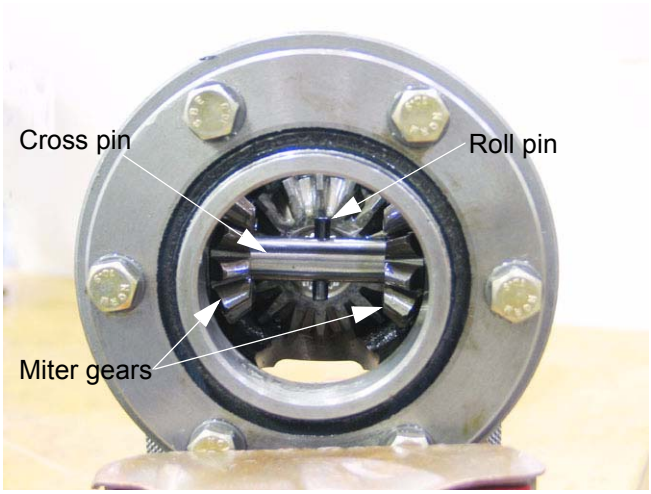

Figure 9.25

9.26. When the roll pin is out, the cross pin can be withdrawn through the side of the differential housing.

9.27. With the cross pin removed, the 10 tooth miter gears, and the spherical thrust bearings that fit behind them can be removed. See Figure 9.27.

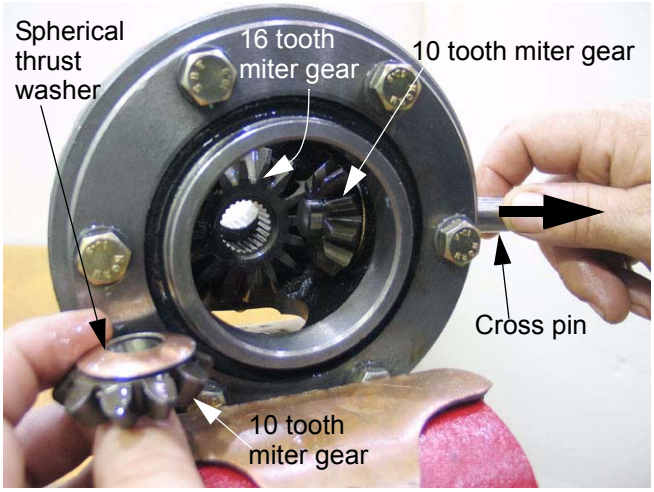

Figure 9.27

9.28. The second 16 tooth miter gear can be removed, along with the second differential bearing (right side), after the 10 tooth miter gears are out. See Figure 9.28.

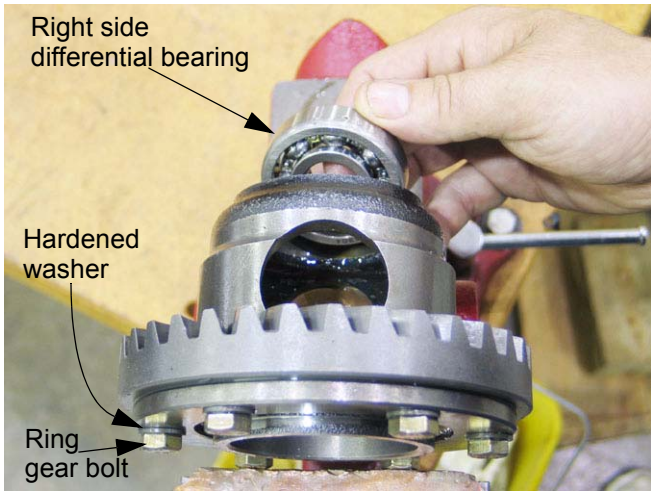

Figure 9.28

9.29. The ring gear bolts can be removed using a 13 mm wrench.

9.30. Clean and inspect all components.

- Replace all of the seals and o-rings.
- Replace the stake nut that goes on the pinion shaft.
- If the bearings show signs of damage, wear, or roughness, replace them.

  NOTE: Do not spin bearings with an air gun to dry them.
- Replace any components that show wear or damage.
- Replace the ring and pinion gears as a set if either shows signs of wear or damage.
- Replace the miter gears as a complete set of any show wear or damage.

9.31. To assemble the differential:

- Install the ring gear to the differential housing. Apply a small amount of thread locking compound such as Loctite 242 (blue), and tighten the bolts to a torque of 160-220 in-lbs. (18-25 Nm).
- Install the differential bearing and 14 tooth miter gear that go in the back of the housing, behind the 10 tooth miter gears.
- Install the two 10 tooth miter gears (flanking the 14 tooth miter gear), spherical thrust washers, and cross shaft.
- Secure thrust shaft by driving in the roll pin with a flat-nosed drift.

9.32. Install the pinion assembly: gear, washers, bearings, spacer, o-ring.

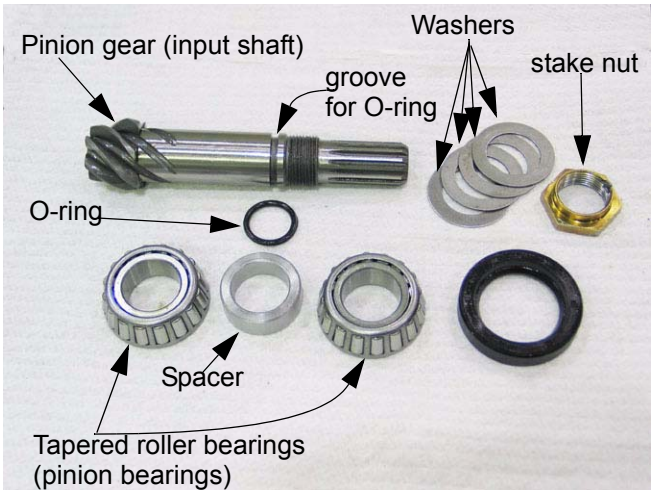

Figure 9.32

9.33. Drive new outer races into place if the pinion bearings have been replaced.

9.34. Install the inner pinion bearing on the pinion shaft, and install the shaft from the inside of the right axle housing.

9.35. Slip the outer pinion bearing onto the pinion shaft.

9.36. Lubricate the new o-ring, and slide it into position on the pinion shaft.

9.37. Twist and push the spacer over the o-ring. The o-ring forms the seal between the O.D. of the pinion shaft and the I.D. of the spacer.

9.38. Install the washers and pinion nut onto the pinion gear.

9.39. Tighten the pinion nut until the pinion gear is subject to 25-30 in-lbs (2.825-3.40) of drag. To measure pinion drag: See Figure 9.39.

Figure 9.39

- Slip a shop towel over the splines on the pinion shaft.
- Use a 19 mm 12 point socket, on a torque wrench to turn the pinion shaft.
- Read the pinion drag on the scale of the torque wrench.
- Tighten the nut to increase drag, loosen the nut to decrease drag.
- Mark the position of the nut in relation to the shaft once the correct drag is achieved. This can be done with a paint marker or marker pen.

9.40. Install the axle shaft, inner and outer axle bearings, washer, and 14 tooth bevel gear, into the right side axle housing. See Figure 9.40.

Figure 9.40

9.41. Install the right side drop axle assembly to the right side axle housing. See Figure 9.41.

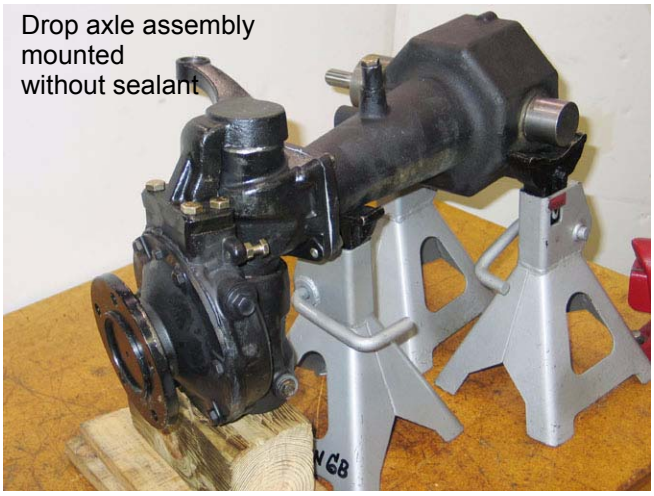

Figure 9.41

- It is not necessary to use thread locker or sealant at this point, but they must be applied before the tractor is returned to service.
- For the sake of orientation: the stop bolts are on the top of the axle housing, the drive shaft enters from the rear of the housing, and the steering arms extend to the rear of the drop axle housings.

9.42. The final assembly is easiest to perform with the axle housing in a vertical position. See Figure 9.42.

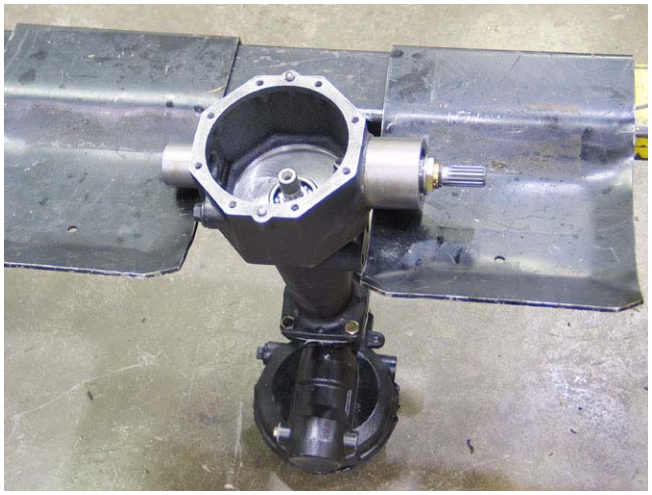

Figure 9.42

NOTE: Any number of means can be improvised to suspend the axle housing by the pivot journal, with the drop axle housing on the ground for stability.

9.43. Install the washers originally removed from between the right differential bearing and the right inner axle bearing. See Figure 9.43.

Figure 9.43

NOTE: If no major components have been replaced, this is likely to result in the correct ring and pinion gear back-lash setting. Otherwise, some adjustment may be necessary.

9.44. Place the differential assembly into the right side axle housing. See Figure 9.44.

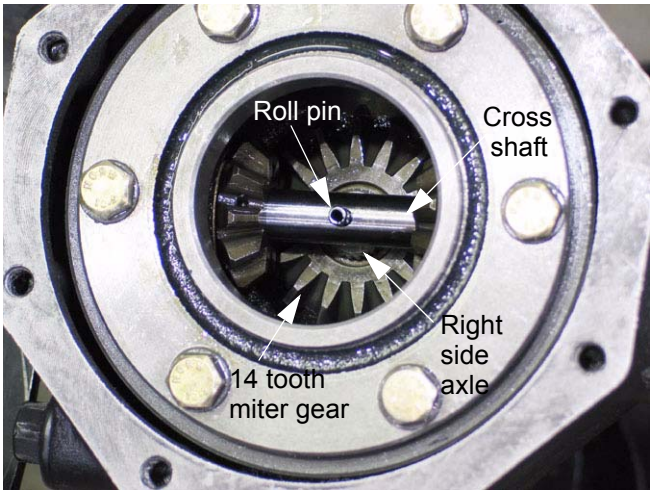

Figure 9.44

- The 14 tooth miter gear in the differential must seat over the splined end of the axle shaft.
- The roll pin in the differential cross pin must seat into the bore in the end of the axle shaft.

9.45. Install the left side differential bearing wrong-way-around in the differential housing: the narrow margin of the outer bearing race should be seated in the differential, with the wide margin facing up. See Figure 9.45.

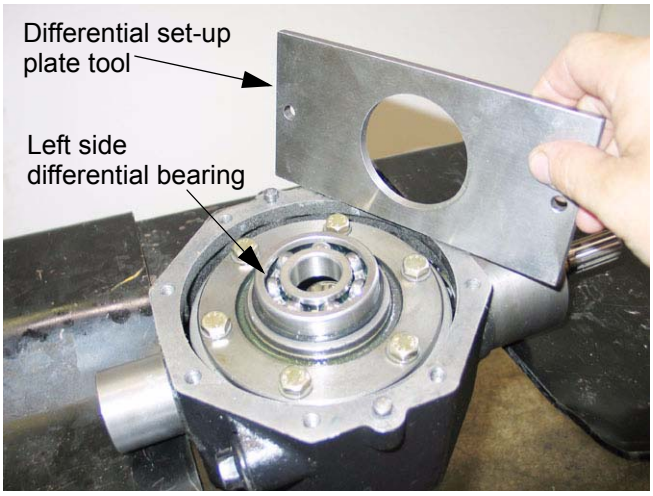

Figure 9.45

9.46. Position the differential set-up plate tool over the dowel pins and differential bearing. See Figure 9.46.

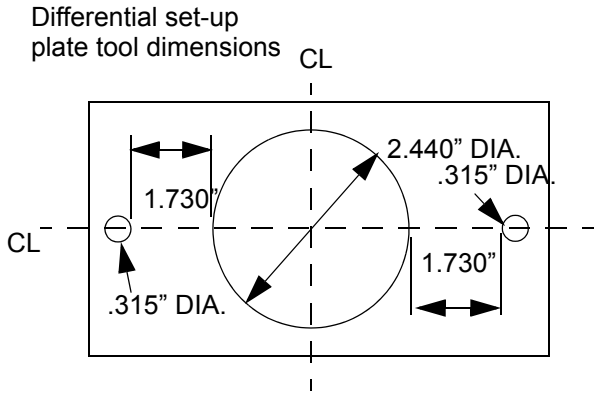

Figure 9.46

9.47. Set-up a dial indicator to read the rotational movement of one of the ring gear bolts. See Figure 9.47.

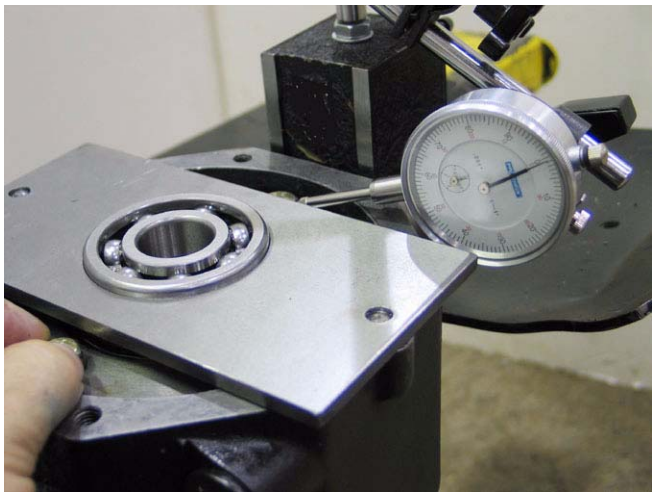

Figure 9.47

9.48. Holding the input pinion stationary, wiggling the ring gear lightly back and forth to find the amount of play between the teeth of the two gears should produce a backlash reading on the dial indicator of .005”-.015” (.127-.381 mm).

- If the dial indicator reads less, add washers beneath the differential, and re-measure.
- If the dial indicator reads more, remove washers from beneath the differential, and re-measure.

9.49. If it is necessary to remove the differential to add or remove washers, the axle shaft must be held down until it the 14 tooth miter gear is clear of the axle. See Figure 9.49.

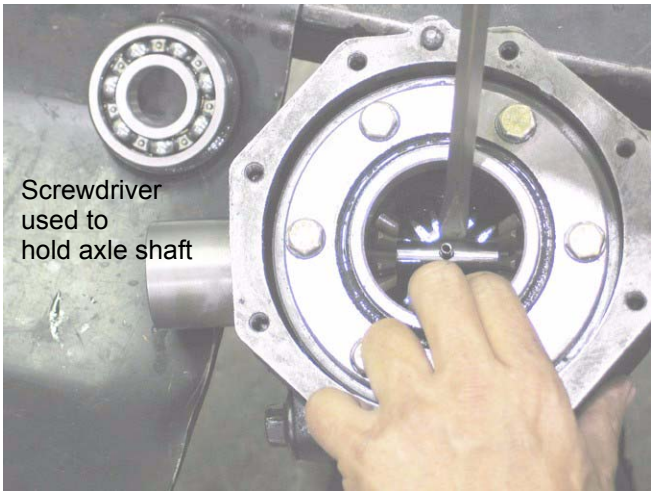

Figure 9.49

NOTE: If the differential draws the axle shaft up with it, the far end of the axle may slip out of the splines on the 14 tooth bevel gear that transmits power to the drop axle. If this happens, the washer behind the gear will slip out of place, and it will be necessary to remove the drop axle assembly to reposition it.

9.50. Once the back-lash is set, then the correct amount of shimming can be determined for the left side of the differential. See Figure 9.50.

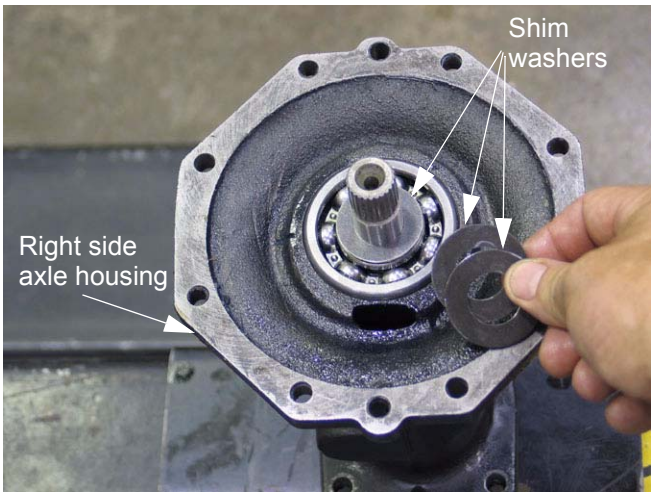

Figure 9.50

NOTE: For the previous measurement, the right side differential bearing was to be installed upside down. Correct it before proceeding.

9.51. To determine the amount of shimming necessary to maintain .003”-.010” (.076-.254 mm) end play, it is necessary to intentionally over-shim, creating a gap between the left and right housings. See Figure 9.51.

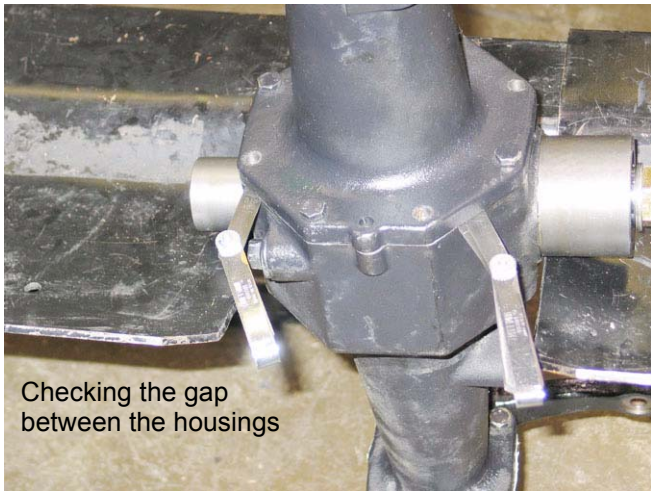

Figure 9.51

- Position the shims, bearings, and left side (small) axle housing as they would be for final assembly.
- Start 4 of the 8 bolts that hold the two housings together. Tighten them far enough to obtain an even gap between the two housings. Do not exceed 20 in-lbs. of torque at this stage.
- Measure and record the gap between the housings with a feeler gauge.
- Carefully remove the bolts, left side axle housing, bearings, and washers.
- From the shim washers between the left side axle bearing and the right side axle bearing, remove an amount of washers having a total thickness equal to the gap between the housings plus .003”-.010” (.076-.254 mm).

9.52. Install the correct amount of shim washers to achieve the specified end play.

9.53. Position the left side axle bearing and axle in the differential. The shim washers should be between the differential bearing and the bearing that supports the inboard end of the axle. See Figure 9.53.

Figure 9.53

NOTE: Confirm that the axle shaft is fully seated in the differential assembly, with the roll pin in the bore in the end of the axle.

9.54. Apply small bead of sealant such as Loctite 5900 to the mating surfaces where the left and right axle housings join.

9.55. Place the axle housing over the axle shaft and bearing. The stop bolts on the top of each housing can be used to confirm correct orientation.

9.56. Install the bearing that supports the outboard end of the axle shaft. See Figure 9.56.

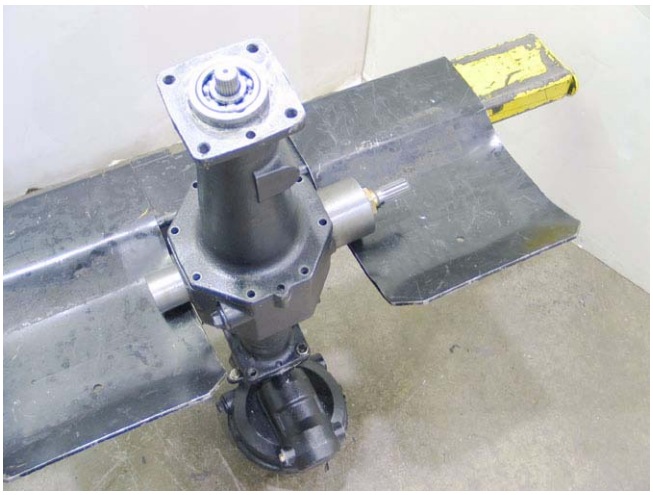

Figure 9.56

9.57. Apply a small amount of threadlocking compound such as Loctite 242 (blue) to the threads of the 8 bolts used to fasten the left and right axle housings together.

9.58. Install the bolts, and tighten them to a torque of 160-220 in-lbs. (18-25 Nm) using a 13 mm wrench.

9.59. Install the washer and 14 tooth bevel gear on the end of the axle shaft. See Figure 9.59.

Figure 9.59

9.60. Apply a thin bead of sealant to the mating surface where the drop axle assembly meets the left axle housing.

9.61. Apply a small amount of threadlocking compound such as Loctite 242 (blue) to the threads of the 4 bolts used to fasten the drop axle housing to the left axle housing.

9.62. Install the drop axle and secure it with the four bolts. Tighten the bolts to a torque of 220-280 in-lbs. (25-34 Nm) using a 16 mm wrench. See Figure 9.62.

Figure 9.62

NOTE: Orientation: the steering arms should extend to the rear. The drop axle should extend downward. The input shaft on the axle points to the rear, and the travel stop bolts are on the top of the axle housings. There is a dowel pin at the bottom mating surface of the axle housing. The drop axle housings will only fit in the correct direction if they are on the correct sides of the axle assembly.

9.63. Position the MFD assembly so that the right side drop axle housing is up.

9.64. Remove the right side drop axle housing using a 16 mm wrench.

9.65. Apply sealant to the mating surface, apply threadlocking compound to the bolt threads, and install the right side drop axle housing in the same manner as the left side drop axle housing.

9.66. To install the pinion seal, position the MFD so that the pinion shaft is easily accessible, and the MFD is supported in a safe and stable position.

9.67. Use the front wheel drive shaft to hold the pinion shaft, while using a 1 1/4” wrench to loosen the nut from the pinion shaft. See Figure 9.67.

Figure 9.67

9.68. Remove the nut and washers from the pinion shaft.

9.69. Lubricate the lip of the seal, and install it in the housing. See Figure 9.69.

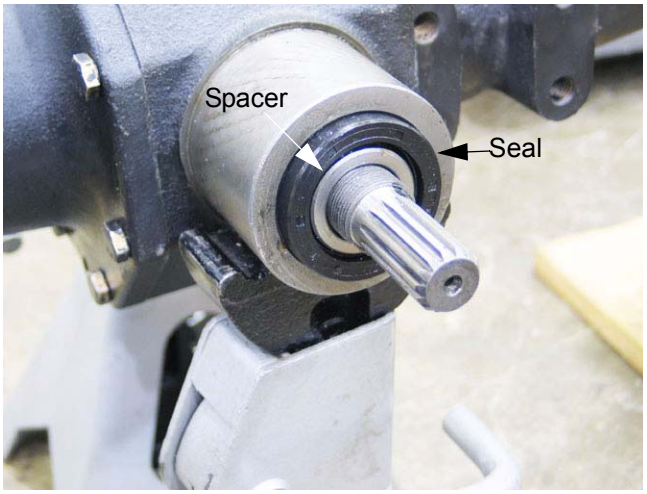

Figure 9.69

NOTE: It may be easier to get the lip positioned correctly if the pinion spacer is pulled-out slightly.

NOTE: Use a seal driver that applies force to the outer edge of the seal to seat it into the housing.

9.70. Install the washers and nut. tighten them until the match marks made previously align.

9.71. Stake the nut so that it does not loosen. See Figure 9.71.

Figure 9.71

9.72. Install the tie rod. See Figure 9.72.

Figure 9.72

- Use a 17 mm wrench to turn the tie rod end nuts, and a 16 mm wrench to keep the studs from turning in the tie rod ends.
- Tighten the nuts to a torque of and tighten the nut to a torque of 264-312 in.-lbs (30-35 Nm) using a 3/4” wrench.

  NOTE: If the nylon locking ring on the tie-rod end nuts is worn, replace the nuts or apply a small amount of threadlocking compound such as Loctite 242 (blue) before installation.

9.73. Install the MFD in the tractor as described in the MFD INSTALLATION section of this manual.

10. TORQUE SPECIFICATIONS

Item	Torque SAE	Torque Metric	Loctite
Ring Gear Bolts	160-220 in-lbs	18-25 Nm	242 blue
Perimiter Bolts (axle housing)	160-220 in-lbs	18-25 Nm	242 blue
Kingpin Housing to Axle Housing	220-280 in-lbs	25-34 Nm	242 blue
Axle Cover	160-220 in-lbs	18-25 Nm	242 blue
Stop Bolts (top of axle housings)	220-280 in-lbs	25-34 Nm	242 blue
Steering Arm to Kingpin Housing	220-280 in-lbs	25-34 Nm	242 blue
Tie Rod End Nuts	49 ft-lbs	66 Nm	242 blue *
Tie Rod End Jam Nuts	360-420 in-lbs	488-570 Nm	242 blue *
Steering Cylinder Stud to Housing	267 ft-lbs	362 Nm	242 blue *
Steering Cylinder Stud Nut	150 ft-lbs	136 Nm	242 blue *
Steering Cylinder Mounting Bracket	75 ft-lbs	100 Nm	242 blue
Axle Mounting Bracket	75 ft-lbs	100 Nm	242 blue
Fill Plug	220-280 in-lbs	25-34 Nm	no
Drain Plug	220-280 in-lbs	25-34 Nm	no
Pinion Drag (Not tightening troque)	25-30 in-lbs	2.825-3.4 Nm	stake
Lug Nuts	55 ft-lbs	63 Nm	re-torque*

Notes:
242 blue*: Loctite may be applied if
nylon locking feature is worn.
Replacement preferred.
re-torque*: Re-torque after 10 hrs. of operation.

Domestic Compact Dash and Steering Pump

ABOUT THIS SECTION:

The parking brake linkage, throttle lever and cable, power steering pump, and portions of the electrical system are accessible by removing the dash panel. It may be possible to service these systems without removing the dash panel. Removing the dash is a relatively simple procedure, and the ease of access provided by doing so will save time.

1. DASH PANEL REMOVAL

1.1. Park the tractor on a firm level surface, open the hood, and disconnect the negative battery cable.

1.2. Removing the two phillips head screws at the top of the insert panel will allow the panel to be tilted back and lifted out of the dash panel. See Figure 1.2.

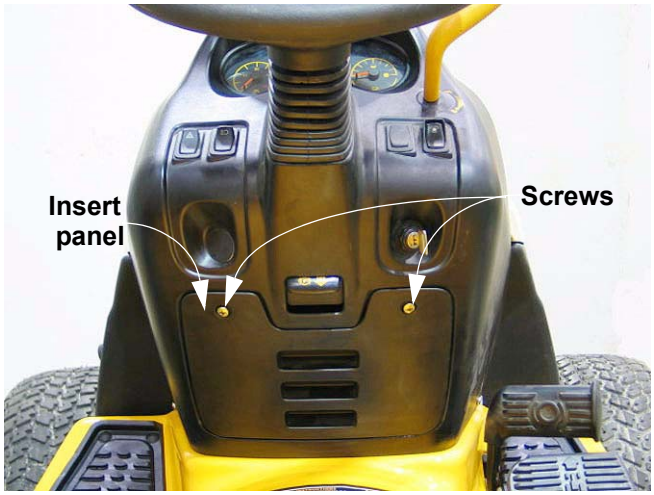

Figure 1.2

1.3. With the insert panel removed, the fuse and relay center can be easily reached in the lower right corner of the dash.

1.4. The switches can be removed by squeezing the tabs on the short sides of the switch body, and pushing them up through the dash panel. See Figure 1.2.

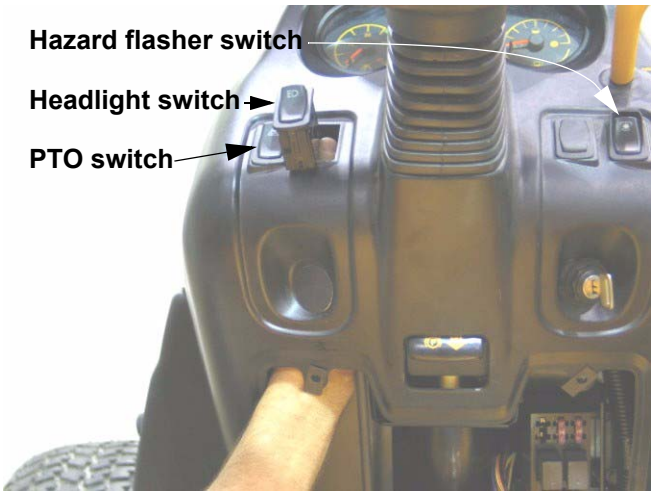

Figure 1.4

NOTE: It is not necessary to disconnect or remove the switches to remove the dash panel.

1.5. Disconnect the wiring harness from the instrument panel. The plug can be reached from under the hood. See Figure 1.5.

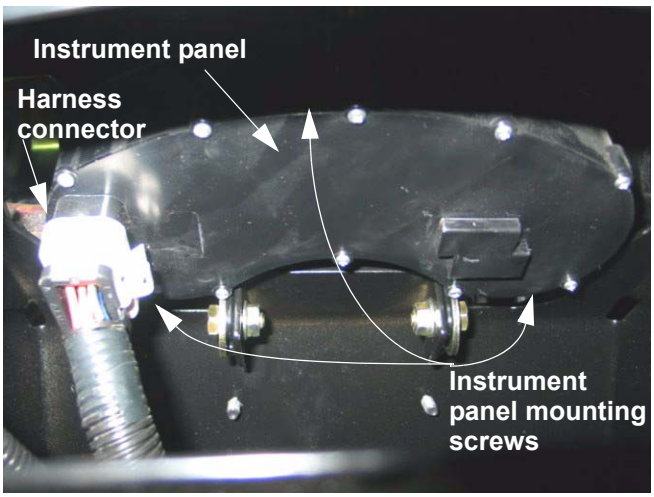

Figure 1.5

NOTE: If the instrument panel is to be removed, the three screws that secure it can be removed using a 7/16” wrench.

Domestic Compact Dash and Steering Pump

1.6. Use a pair of 1/2” wrenches to loosen the bolts flanking the instrument panel on the inside of the dash panel. The mounting holes in the dash panel are slotted, so the bolts need not be completely removed.

1.7. There are tabs on the perimeter of the steering wheel cover that clip into each spoke of the steering wheel. Depress these tabs and pry off the cover. See Figure 1.7.

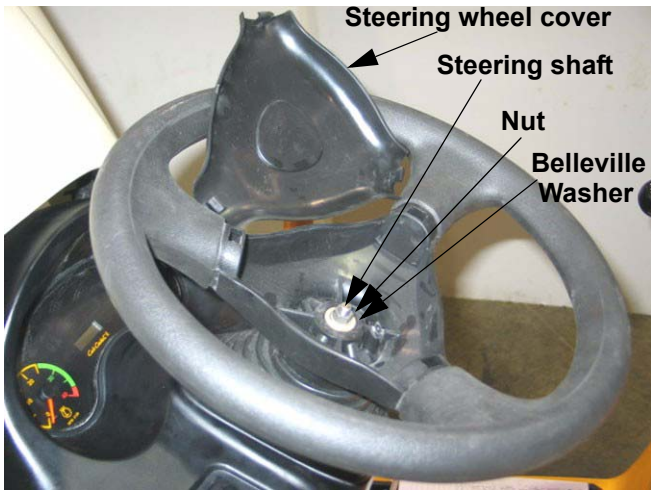

Figure 1.7

1.8. The nut and belleville washer that secure the steering wheel can be removed using a 1/2” wrench.

1.9. Remove the steering wheel. It may be necessary to drive the steering wheel off of the splined steering shaft using a soft dead-blow hammer.

1.10. The bottom lip of the steering shaft boot can be easily separated from the dash panel.

1.11. There is a shoulder bushing and flat washer on the steering shaft. They provide support for the steering shaft boot, and reduce friction between it and the steering shaft. Remove them. See Figure 1.11.

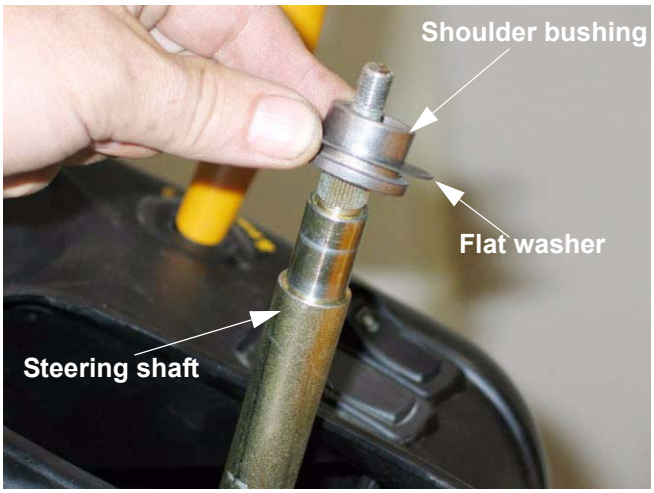

Figure 1.11

1.12. Remove the side panels from the engine compartment.

1.13. Disconnect the throttle cable from the injector pump on diesel powered tractors. On Caterpillar engines, the cable is connected to the pump with a hairpin clip and clevis pin. Use a 5/16” wrench and a 3/8” wrench to loosen the cable clamp. See Figure 1.13.

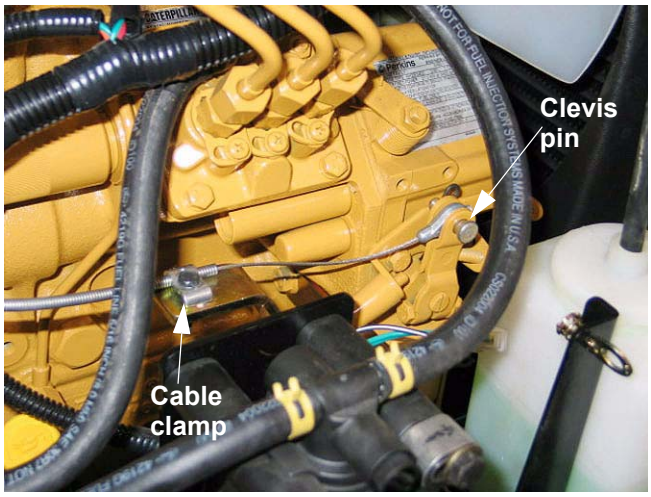

Figure 1.13

1.14. On Briggs & Stratton / Daihatsu engines, a Z-fitting connects the cable to the pump. An 8mm wrench will fit the screw on the cable clamp. See Figure 1.14.

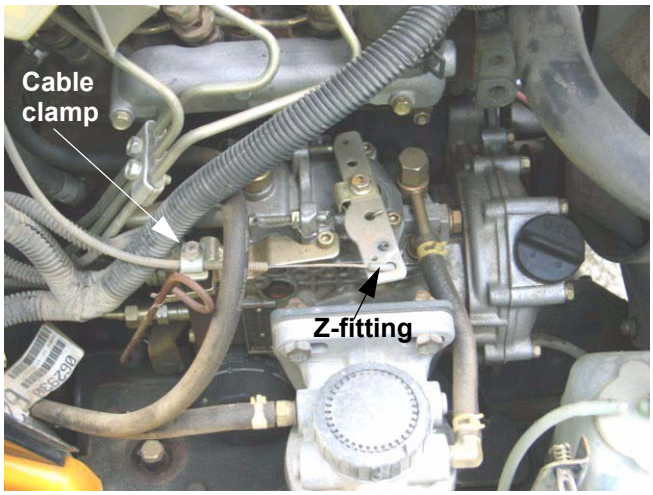

Figure 1.14

1.15. On gasoline powered tractors, the choke cable must also be disconnected. Use an 8mm wrench to loosen the cable clamps, then unhook the z-fittings. See Figure 1.15.

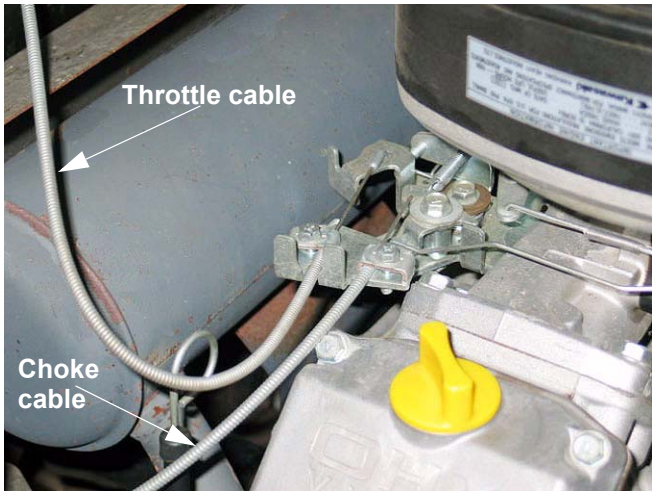

Figure 1.15

1.16. Remove the two phillips head screws that secure the lower rear corners of the dash panel. See Figure 1.16.

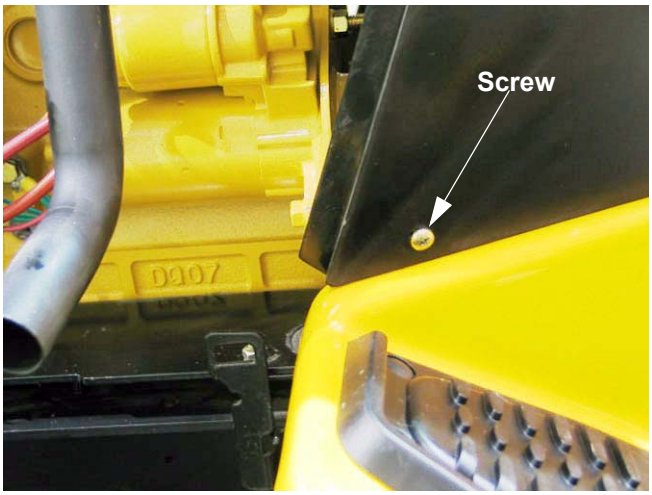

Figure 1.16

1.17. Disconnect the dash wiring harness from the main wiring harness by unplugging the connector that is near the fuse / relay center.

1.18. Use a 1/2” wrench to remove the two screws holding the base of the dash panel to the pedestal. See Figure 1.18.

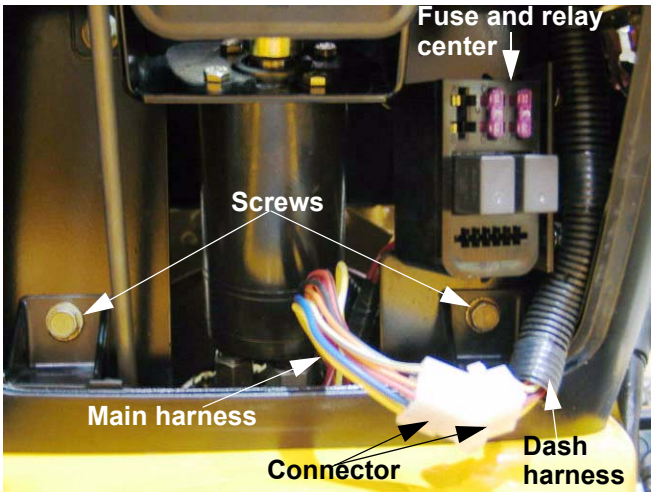

Figure 1.18

1.19. Close the hood.

Domestic Compact Dash and Steering Pump

1.20. Carefully lift the dash panel and remove it from the tractor. Confirm that the wiring harness and control cables do not snag as they pull out with the dash panel. See Figure 1.20.

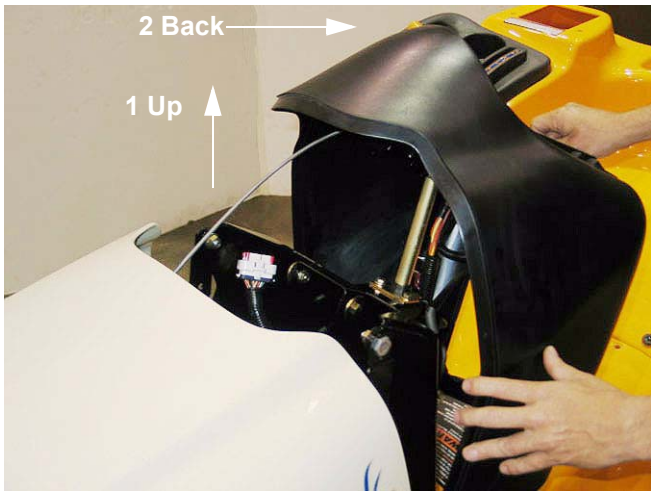

Figure 1.20

1.21. Dash panel installation is essenitally the the reverse of the removal process. The following tips may ease the installation:

1.22. Route the control cables as the dash panel is lowered into place. The throttle cable passes through the grommeted hole at the top right corner of the lower heat shield. See Figure 1.22.

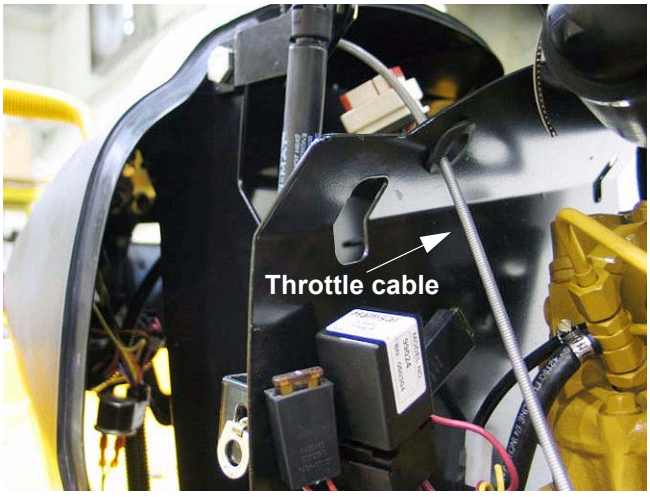

Figure 1.22

1.23. The choke cable on gasoline engined tractors passes through the large opening in the pedestal, below and to the left of the steering column bracket. See Figure 1.23.

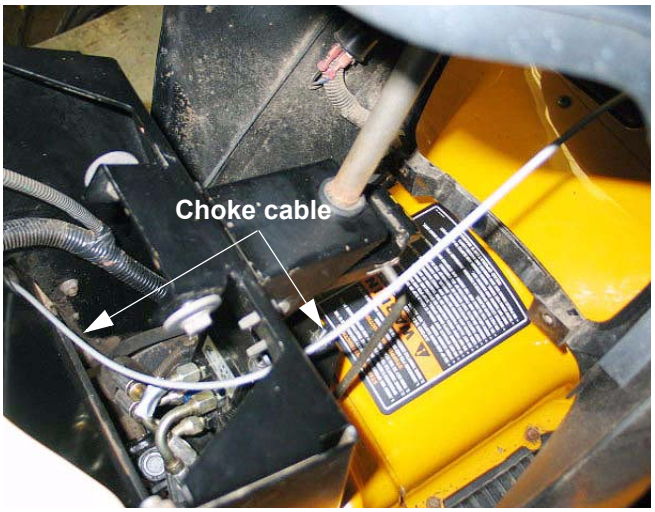

Figure 1.23

1.24. The choke cable then passes through the grommeted hole at the lower right corner of the lower heat shield. See Figure 1.24.

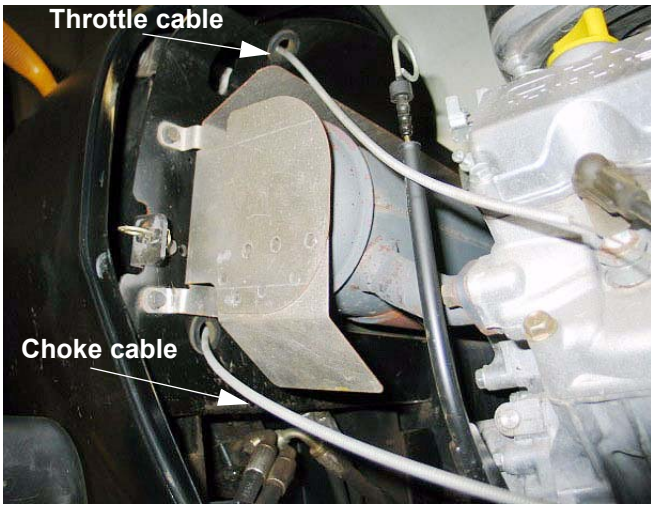

Figure 1.24

1.25. Lower the dash panel into positon, so that the slotted holes flanking the instrument panel slip over the bolts between the heavy flat washers and the pedestal.

1.26. Confirm that the lower rear cornerof the dash panel has cleared the brake pedal.

1.27. Confirm that the lower right mounting point has cleared the fuse and relay center.

1.28. Connect the choke and throttle control cables in the slack position.

1.29. On gasoline powered tractors:

- Apply full choke, confirm that the choke plate is fully closed, tighten the choke cable clamp.
- Release the choke, confirm that the choke plate in the carburetor opens fully.

NOTE: If the choke does not fully close, the tractor will be extremely difficult to start when the engine is cold.

1.30. Adjust the throttle cable so that the wide open throttle travel stop on the injector pump or carburetor coincides with the full throttle travel stop on the control lever.

1.31. Tighten the throttle cable clamp.

1.32. If the throttle lever has been disassembled, confirm that sufficient friction exists to maintain a throttle setting. Do not apply so much friction that the throttle lever becomes difficult to move.

1.33. If throttle tension needs to be adjusted, do so before the dash panel is fastened down. It will be necessary to lift the dash panel to reach the adjustment nut with a 9/16" wrench.
See Figure 1.33.

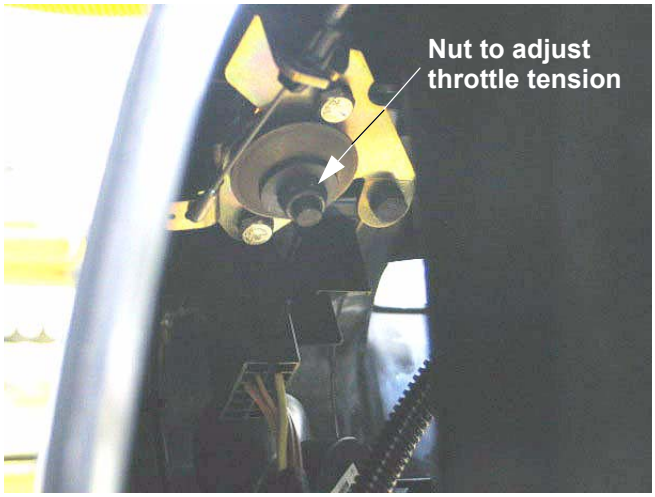

Figure 1.33

2. THE DASH PANEL

2.1. The primary reason to remove the dash panel would be to gain access to the following items:

- parking brake linkage, mounted to the pedestal
- steering shaft & pump, mounted to the pedestal
- throttle assembly, mounted to the dash panel

2.2. There are electrical components (instrument panel, key switch, dash panel wire harness, PTO switch , hazard flasher switch, headlight switch, hazard flasher relay) mounted to the dash panel. It is not necessary to remove the dash panel to service any of these components.
See Figure 2.2.

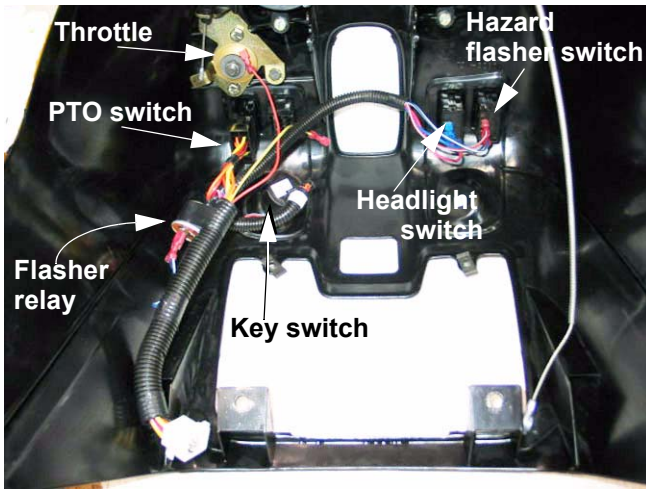

Figure 2.2

2.3. When in position on the tractor, access to the throttle assembly is blocked by the heat shield.

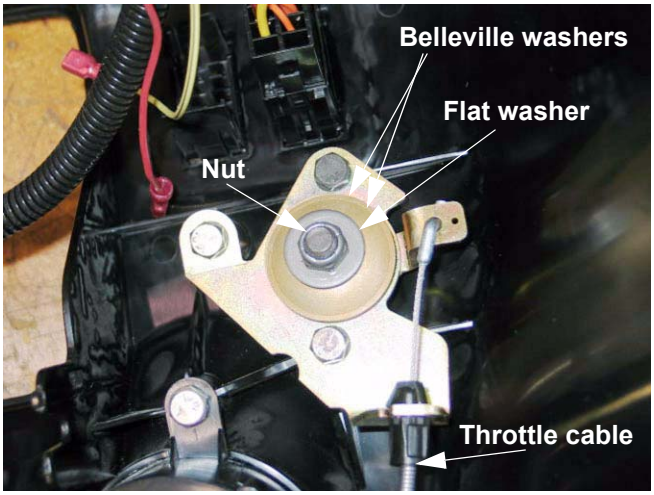

Figure 2.3

Domestic Compact Dash and Steering Pump

2.4. The throttle cable can be removed from the throttle assembly by squeezing the barbs on the cable end.

2.5. The lock nut, flat washer and two bellville washers can be removed from the base of the throttle lever, using a 9/16” wrench. See Figure 2.5.

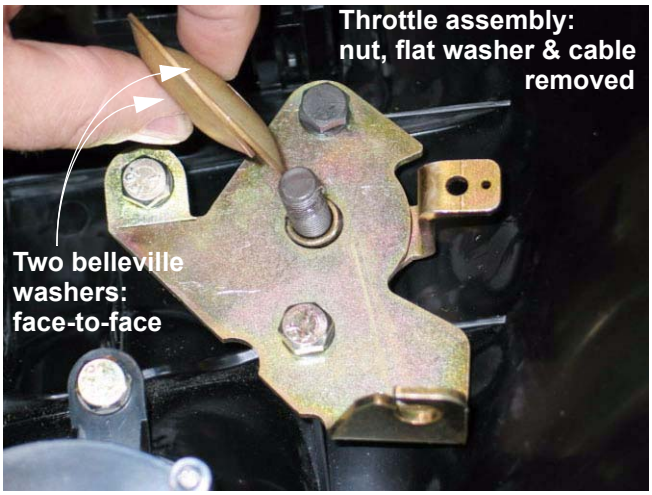

Figure 2.5

2.6. The throttle lever can then be removed from the throttle assembly. See Figure 2.6.

Figure 2.6

2.7. The throttle assmebly can be unbolted fromt he dash panel using a 7/16” wrench. See Figure 2.7.

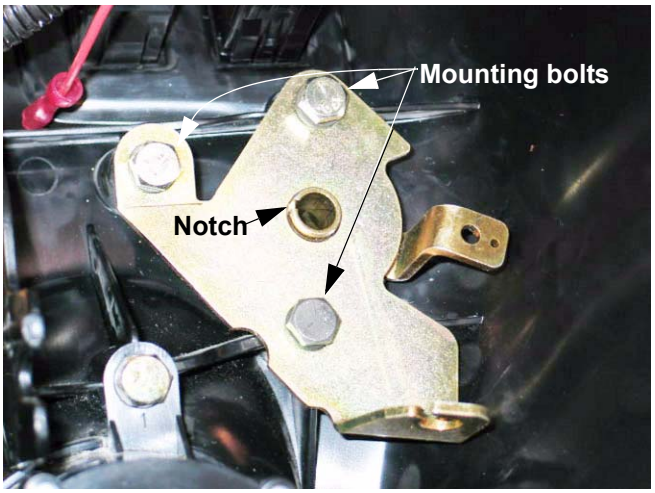

Figure 2.7

2.8. The correct order of assembly for the throttle is: throttle tab, friction washer, mounting plate, two bellville washers (face-to-face), flat washer , locking nut. The throttle lever passes through all of these parts, with the ears on the lever engaging the slots in the throttle tab. See Figure 2.8.

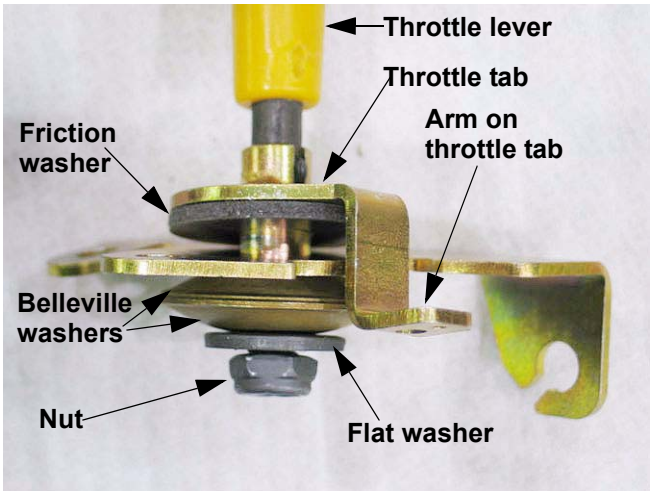

Figure 2.8

NOTE: The throttle lever should be extend in the same direction as the arm on the throttle tab. The ears on the throttle lever allow it to be installed in one of two positions: aligned with the arm, or 180 out, facing the opposite direction.

3. STEERING SHAFT AND PUMP: SAUER

3.1. **Identification:** Series 7000 tractors built before the 2004 model year are equipped with a Sauer steering pump. The body of the Sauer pump is round in cross-section. O-ring fittings for the hydraulic lines are located on the bottom surface of the pump. See Figure 3.1.

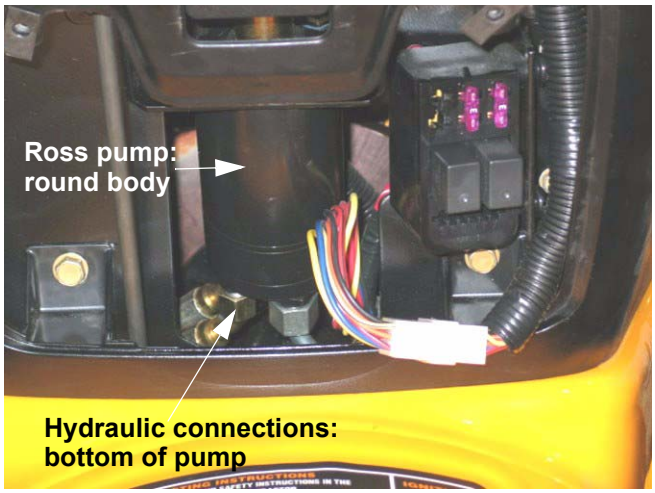

Figure 3.1

3.2. To access the steering shaft and pump, remove the dash panel as described in the dash panel removal section.

3.3. Remove the hairpin clips and spring that secure the parking brake rod to the brake lever bracket. See Figure 3.3.

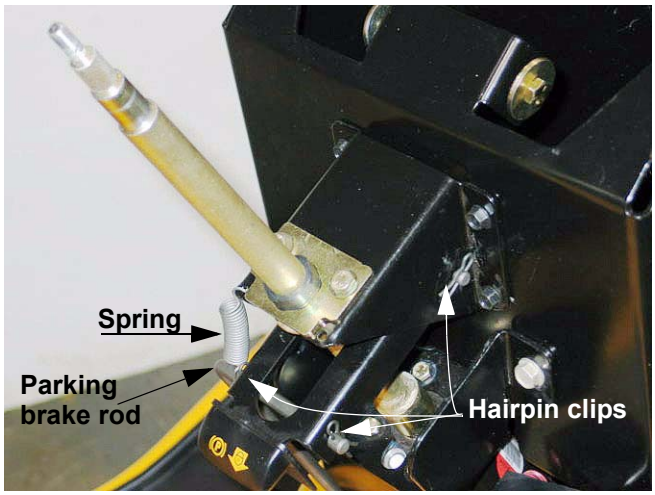

Figure 3.3

3.4. Remove the hairpin clip and clevis pin that secure the brake lever bracket to the steering column bracket. The steering shaft passes through the brake lever bracket.

3.5. Remove the four bolts that hold the steering column bracket to the pedestal using a 3/8” wrench. See Figure 3.5.

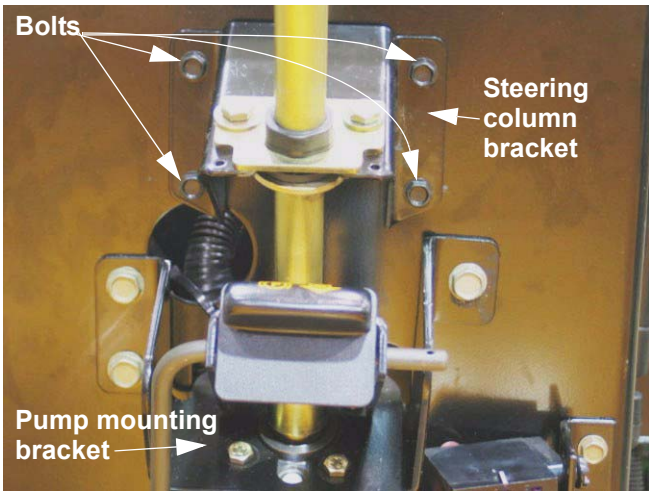

Figure 3.5

3.6. Lift the steering column bracket and steering shaft off of the pedestal.

3.7. Slide the brake lever bracket to the right to remove it from the parking brake rod.

NOTE: If the plastic parking brake lever needs to be replaced, it is not necessary to remove the brake lever bracket.

3.8. Clean the area surrounding the steering pump hydraulic connections and mark the hydraulic lines connected to the steering pump to ease installation:

- The small hose on the front left side of the steering pump (“L” port) goes to the shaft end of the steering cylinder.
- The small hose just behind the front left hose (“R” port) goes to the base end of the steering cylinder.
- Large hose at the rear of the pump (“E” port) goes to the bottom port on the hydraulic control valve.
- The large hose at the front of the pump (“P” port) goes to the top fitting on the hydraulic pump.
- The small hose on the right side of the pump (“T” port) goes to the forward-facing elbow on the return manifold.

Domestic Compact Dash and Steering Pump

3.9. Place a drain pan under the steering pump.

3.10. Working from back to front, disconnect the hydraulic lines fromthe steering pump. Cap the lines as they are removed. See Figure 3.10.

- On the large lines, use a 13/16” wrench to turn the fitting while holding the adaptor with a 3/4” wrench.
- On the small lines, use an 11/16” wrench to turn the fitting while holding the adaptor with a 5/8” wrench.
- After the front-most line is loosened, it may be easiest to unbolt the pump before the line is removed completely.

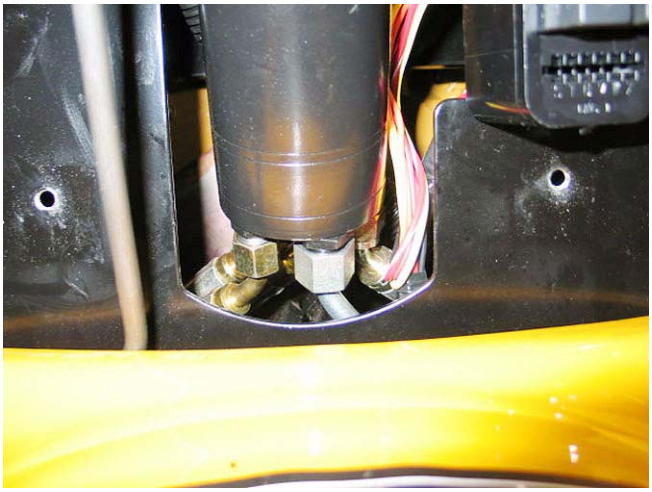

Figure 3.10

3.11. Unbolt the steering pump from the pump mounting bracket using and 10mm wrench. See Figure 3.11.

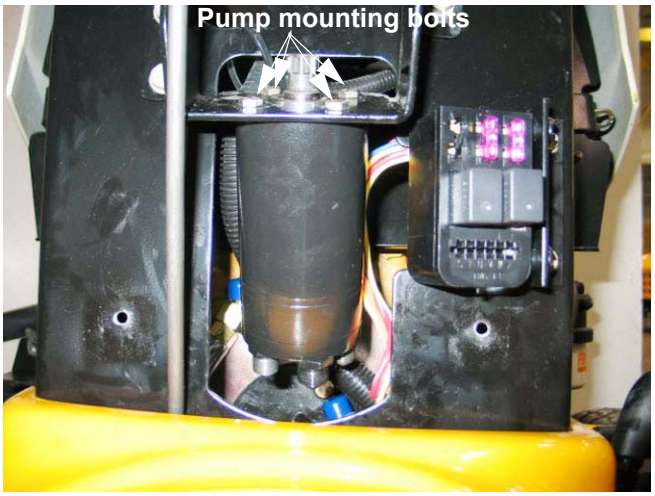

Figure 3.11

3.12. The ports are labeled on the bottom of the steering pump. See Figure 3.12.

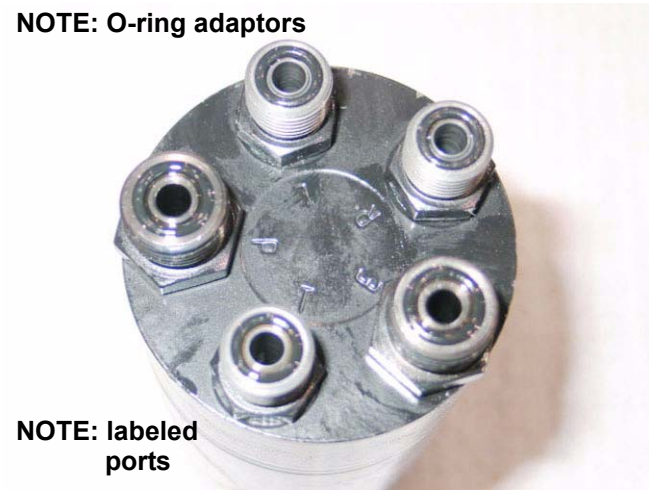

Figure 3.12

3.13. Intallation is the reversal of the removal process. The following are notes on installation:

- Attach the steering pump to the pump mounting bracket. Tighten the bolts to a torque of 10 ft.-lbs.
- Position the steering shaft and steering coulmn bracket as an assembly, connecting the parking brake lever and parking brake rod in the process. It will be neccesssary to rotate the steering shaft until the base of the shaft engages the steering pump
- Bolt the steering column bracket to the pedestal.
- Connect all of the hydraulic fittings previously removed from the the pump.
- Install the dash panel and steering wheel on the tractor, but do not fasten the dash panel in place.
- Connect the main wire harness to the dash panel wire harness and the instrument panel.
- Test run the tractor in a safe area to check the operation of the steering and to confirm that there are no hydraulic leaks. Repair any problems that are identified.
- After successful testing, complete final assembly.

4. STEERING SHAFT AND PUMP: ROSS

4.1. Series 7000 tractors built during and after the 2004 model year, and all 5000 series tractors are equipped with a Ross steering pump. The body of the Ross pump is square in cross section. Flare fittings that connect to the hydraulic lines are located on the bottom end of the pump. See Figure 4.1.

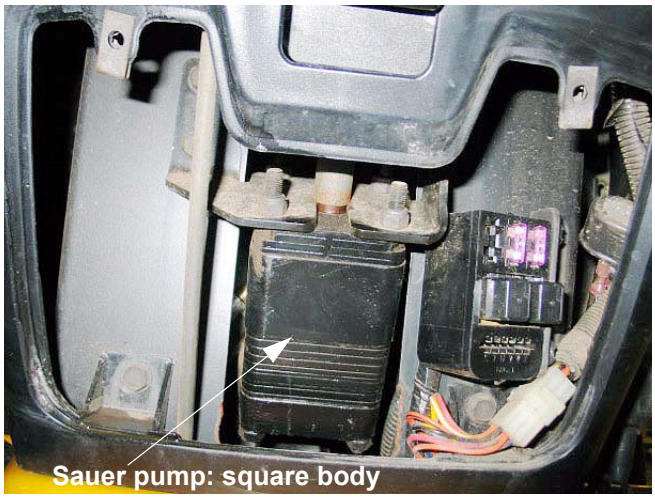

Figure 4.1

4.2. To access the steering shaft and pump, remove the dash panel as described in the dash panel removal section.

4.3. Remove the hairpin clips that secure the parking brake rod to the brake lever bracket. See Figure 4.3.

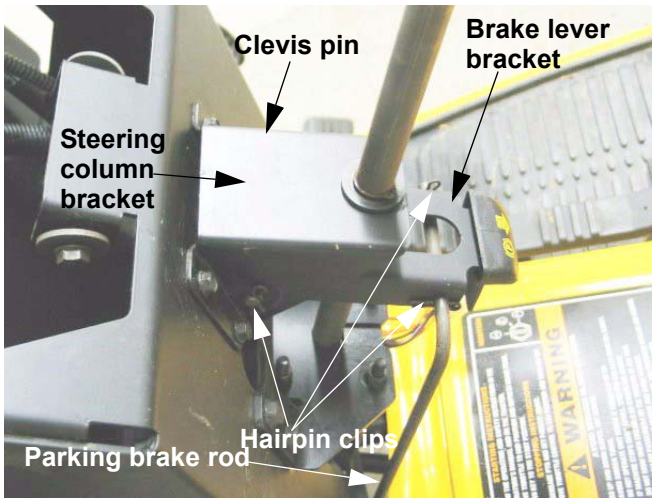

Figure 4.3

4.4. Remove the hairpin clip and clevis pin that secure the brake lever bracket to the steering column bracket. The steering shaft passes through the brake lever bracket.

4.5. Remove the four bolts that hold the steering column bracket to the pedestal using a 3/8” wrench.

4.6. Clean the area surrounding the steering pump hydraulic connections and mark the hydraulic lines connected to the steering pump to ease installation: See Figure 4.6.

- The hose at the top left side of the steering pump (“RT” port) goes to the base end of the steering cylinder.
- The hose at the top right side of the steering pump (“LT” port) goes to the shaft end of the steering cylinder.
- The hose beneath the “RT” port of the steering pump (“IN” port) goes to the top fitting on the hydraulic pump.
- The hose beneath the “LT” port of the steering pump (“OUT” port) goes to the forward-facing elbow on the return manifold.
- The hose beneath all of the others (“AUX” port) goes to the bottom port on the hydraulic control valve.
- An 11/16” wrench will fit the fittings and the adaptors.

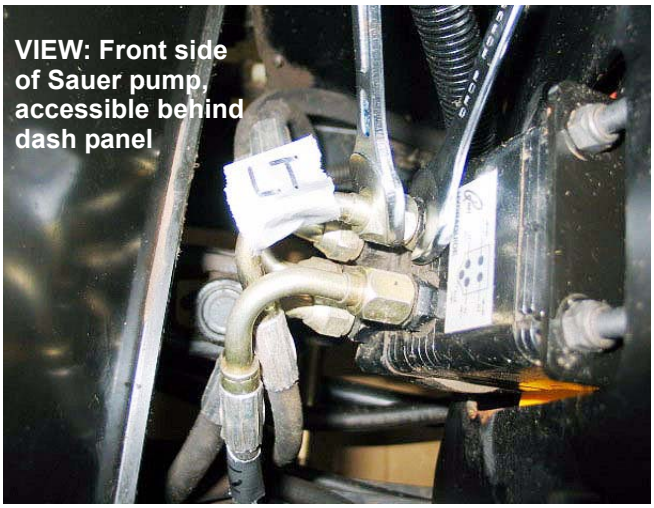

Figure 4.6

NOTE: There is a port diagram on the steering pump.

Domestic Compact Dash and Steering Pump

4.7. After the lines are disconnected, and the lines and fittings are capped, remove the nuts that secure the steering pump to the pump mounting bracket using a 1/2 wrench.

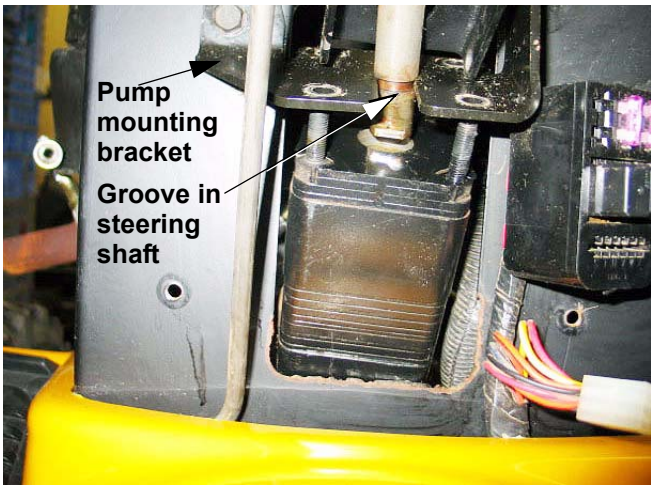

Figure 4.7

4.8. As the pump is lowered away from the bracket, it will separate from the steering shaft.

- The steering shaft has a “Double-D” section at the end of the shaft that engages the pump.
- A groove in the steering shaft engages the pump bracket. The steering shaft cannot be removed until the pump is lowered.

4.9. Once the pump is separated from the shaft, the pump can be removed from the tractor.

4.10. The steering shaft can be lifted out of the tractor along with the steering coumn bracket. See Figure 4.10.

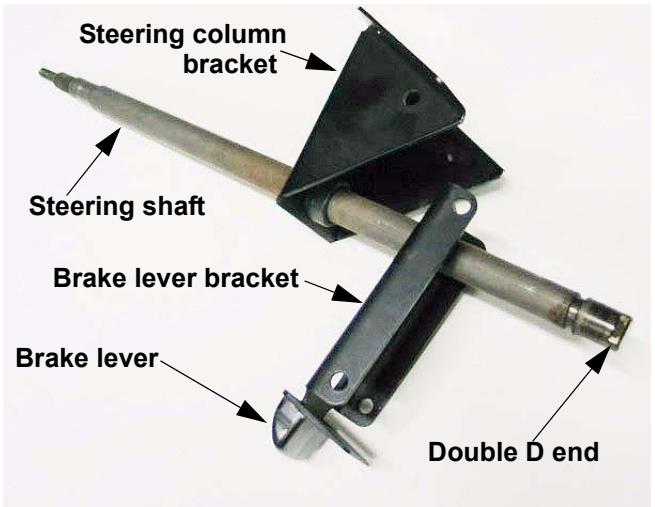

Figure 4.10

4.11. At the technician’s discretion, the retaining ring securing the steering shaft to the steering column bracket can be removed, and the two parts separated before this stage, but it is not essential to removing the steering pump or shaft.

4.12. Intallation is the reversal of the removal process. The following are notes on installation:

- Position the steering shaft and steering coulmn bracket as an assembly.
- Attach the steering pump to the pump mounting bracket, connecting the parking brake lever and parking brake rod in the process . It will be neccesssary to rotate the steering shaft until the base of the shaft engages the steeering pump before the nuts that secure the pump can be tightened.
- If the nylon locking feature of the nuts has worn-out, replace them with new nuts or apply a small amount of threadlocking compound such as Loctite 242 (blue) to the threads. Tighten the nuts to a torque of 17 ft.-lbs.
- Bolt the steering column bracket to the pedestal.
- Connect all of the hydraulic fittings previously removed from the the pump.
- Install the dash panel and steering wheel on the tractor, but do not fasten the dash panel in place.
- Connect the main wire harness to the dash panel wire harness and the instrument panel.
- Test run the tractor in a safe area to check the operation of the steering and to confirm that there are no hydraulic leaks. Repair any problems that are identified.
- After successful testing, complete final assembly.

Domestic Series 7000 Damped Driveshaft

ABOUT THIS SECTION:

Domestic Cub Cadet Series 7000 tractors equipped with the Caterpillar diesel engine may exhibit an objectionable level of driveline vibration at low engine speeds.

Introducing a flexible coupling in the driveshaft between the engine and the transmission damps the power pulses transmitted through the driveshaft. This lowers the frequency of the vibrations to a level that does not correspond with the frequency of resonance of other tractor components.

1. PREPARATION:

1.1. Park the tractor on firm, level ground so that no hazard will exist from the tractor rolling.

1.2. Open the hood and remove the side panels from the engine compartment. See Figure 1.2.

Figure 1.2

1.3. Disconnect the negative battery cable using a 3/8" wrench.

1.4. Remove the fender cover using a 1/2" wrench and a phillips head screwdriver.

NOTE: It will be necessary to lift the inside edges of the black floor pads.

1.5. Remove the hose from the radiator over-flow bottle.

1.6. Lift the over-flow bottle off of its bracket, and remove it from the tractor.

2. DRIVESHAFT REMOVAL

2.1. Loosen the two clamp bolts on the rear driveshaft yoke using a pair of 9/16" wrenches. See Figure 2.1.

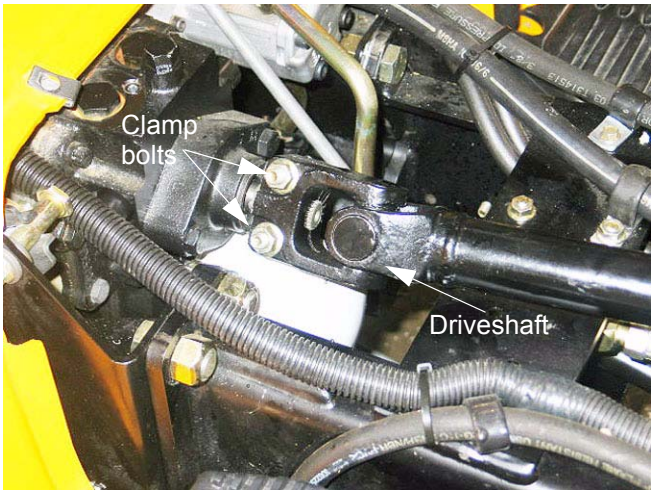

Figure 2.1

2.2. Remove the three bolts that fasten the drive flange at the front of the driveshaft to the flywheel, using a 16 mm wrench and a long extension. See Figure 2.2.

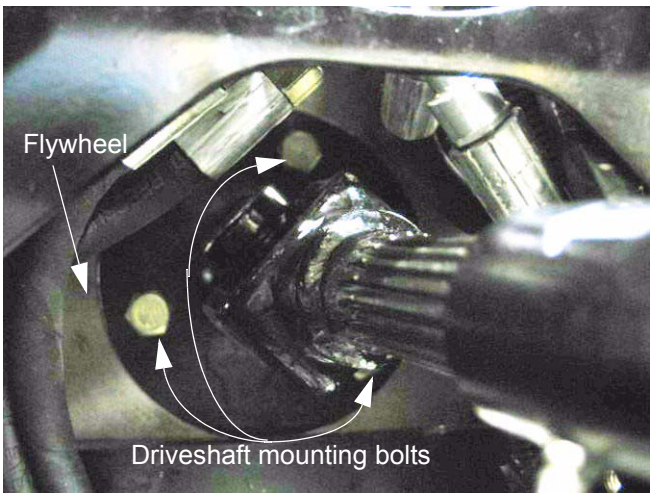

Figure 2.2

Domestic Series 7000 Damped Driveshaft

2.3. Slide the back end of the driveshaft off of the splined input shaft on the hydrostatic drive, and remove the driveshaft.

NOTE: The original driveshaft is a two-piece assembly. At the technician's discretion, it may be removed intact, or separated then removed.

2.4. Remove the four bolts, nuts, and large flat washers that are used to secure the engine compression mounts to the tractor frame. This can be done using a pair of 9/16" wrenches. See Figure 2.4.

Figure 2.4

2.5. Of the four bolts, the one at the right front corner of the engine also holds the negative battery cable. The cable will come off when the nut is removed, and there is a star-type lock-washer between the cable eyelet and the frame to ensure good electrical contact. See Figure 2.5.

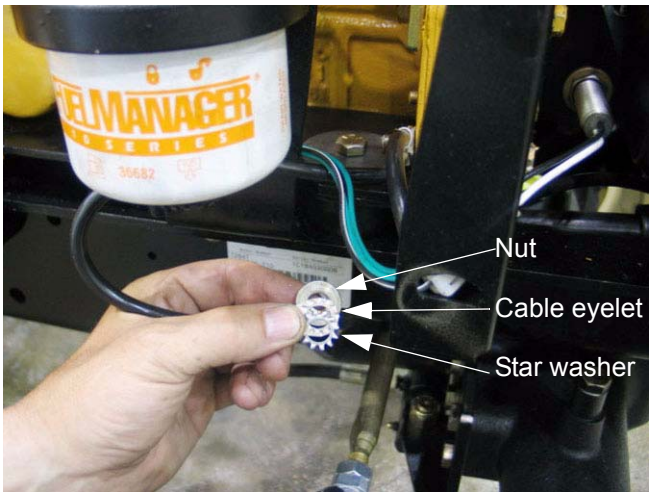

Figure 2.5

2.6. Slide the engine as far forward as possible. The left side of the engine goes slightly farther than the right side because of interference between the engine speed sensor and the fan shroud on the right side. See Figure 2.6.

Figure 2.6

2.7. On the left side, the engine can be pushed forward until the engine RPM plate (tone ring) nearly touches the fan shroud. See Figure 2.7.

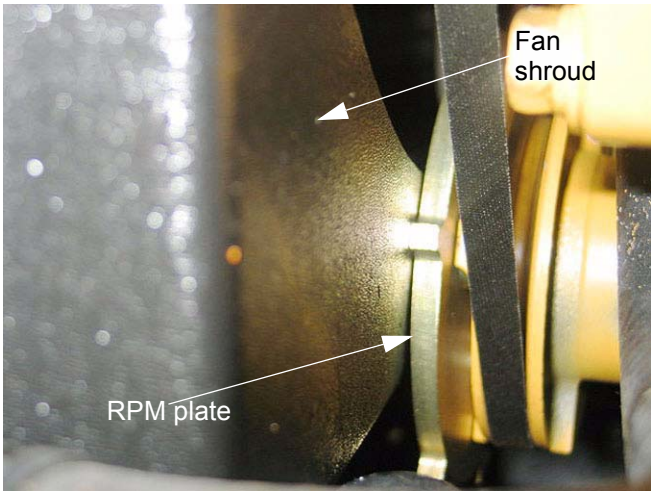

Figure 2.7

2.8. Apply a small amount of anti-seize compound to the splined input shaft on the hydrostatic drive.

2.9. Apply a small amount of threadlocking compound such as Loctite 242 (blue) to the clean threads of the three bolts that hold the flange on the front to the replacement driveshaft to the flywheel.

2.10. Slide the replacement driveshaft into position. the flange should nest into the recess in the flywheel.

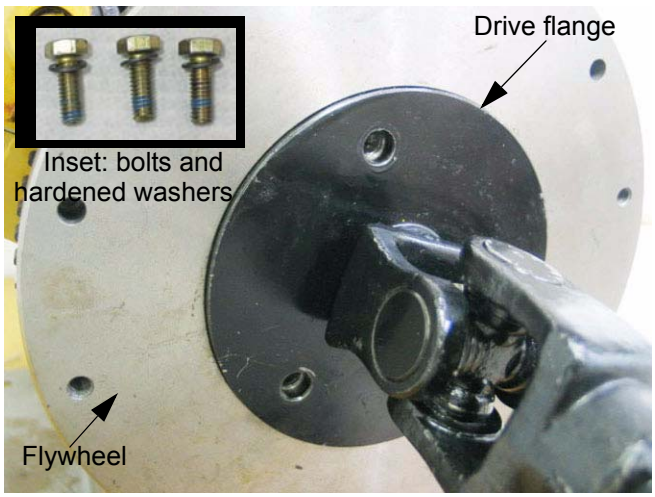

Figure 2.10

2.11. Fasten the driveshaft to the flywheel using the three loctited bolts with hardened washers.

2.12. Slip the back end of the driveshaft onto the splined input shaft on the hydrostatic drive. See Figure 2.12.

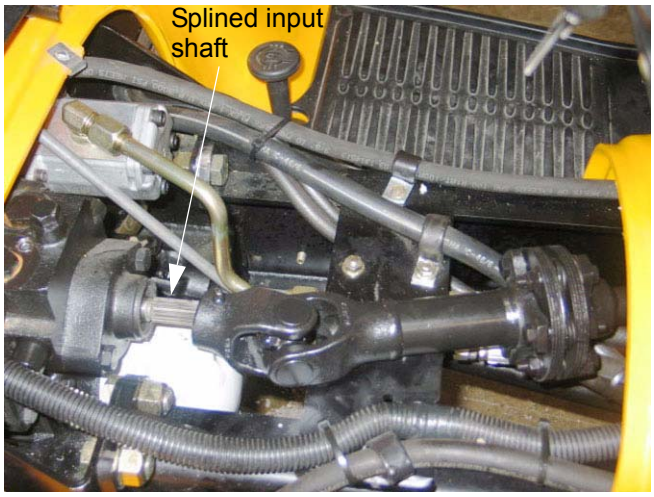

Figure 2.12

2.13. Slide the engine back into position, so that the mounting holes in the frame align with the holes in the engine compression mounts.

NOTE: This will bring the rear yoke on the driveshaft into full engagement on the splines of the hydrostatic drive.

2.14. Prevent the flywheel from turning using a flywheel tool or by blocking the driveshaft, and tighten the flange-to-flywheel bolts to a torque of 27-33 ft.-lbs (37-45 Nm).

2.15. Make the final alignment of the engine so that the engine mount bolts can be installed. A tapered alignment pin is extremely useful for this. See Figure 2.15.

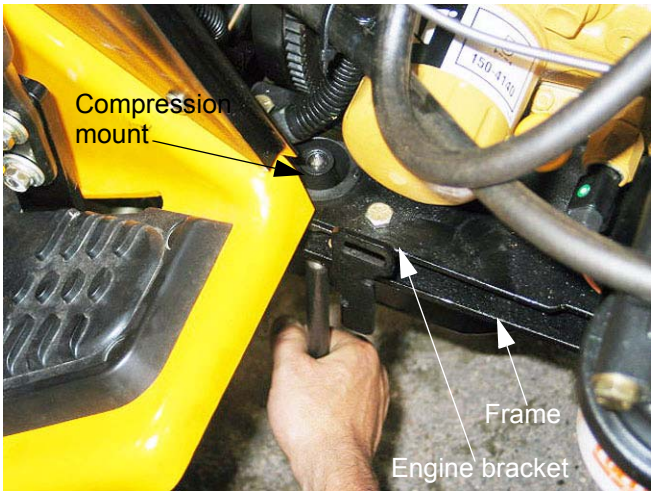

Figure 2.15

2.16. Secure the engine compression mounts to the frame using the nuts, bolts, and large flat washers previously removed. Tighten the nuts to a torque of 23-31 ft.-lbs (31-40 Nm).

NOTE: If the locking feature on the nuts has worn and they turn easily, replace them with new ones, or apply a small amount of threadlocking compound such as loctite 242 (blue) to the threads.

NOTE: Do not forget the ground cable and star-type lock washer on the right front mounting bolt.

2.17. Install the new fender cover that provides additional clearance for the flexible coupling on the new driveshaft.

2.18. Connect the negative battery cable to the battery.

2.19. Install the over-flow bottle and hose.

2.20. Install the engine compartment side covers.

2.21. Close the hood.

2.22. Run and test the tractor in a safe area before returning it to service.

Domestic Series 7000 Damped Driveshaft

Domestic Compact Electrical Systems

About this section:

This part of the manual provides verbal descriptions of the function of each electrical component in the system. It is best used to compliment the Cub Cadet Wiring Schematics found on disc 772-9085A-CD, available through Cub Cadet.

The intent is to help orient the skilled but unfamiliar technician with the electrical system on these Cub Cadet tractors.

1. SIMILARITIES AND DIFFERENCES BETWEEN SYSTEMS:

1.1. Series 5000, series 6000, and domestic series 7000 tractors have similar electrical systems. They share a common dash panel and instrument cluster, and are similar in operation.

1.2. The instrument cluster contains a logic board that monitors and controls safety and operating circuits.

1.3. Because the instrument cluster contains circuits that may be over-loaded by a standard test light, it is recommended that a high-impedance test light, or DVOM be used in diagnosing most electrical circuits on the domestic Cub Cadet compact tractors.

NOTE: Typical of these is Thexton part #125 High Impedance Computer Circuit Tester. This tool is available at reasonable cost through many truck vendors, and auto-parts stores such as NAPA.

1.4. Early versions of the Series 7000 used a hall-effect sensor mounted in the transmission to send a tachometer signal.

1.5. There are variations between models and within model lines, primarily according to the engine that is used. Various gas and diesel engines have been sourced from Briggs& Stratton-Daihatsu, Caterpillar, Kawasaki, and Kohler.

1.6. Current gasoline-powered domestic compact tractors get a tachometer signal from the ignition system.

1.7. Current diesel powered domestic compact tractors get a tachometer signal from a hall-effect sender on the crankshaft.

1.8. Gasoline engines will have a magneto ground and after-boom solenoid power-off to turn-off the engine.

1.9. Diesel engines will have a stop solenoid on the injector pump to shut-off the fuel supply and turn-off the engine. See Figure 1.9.

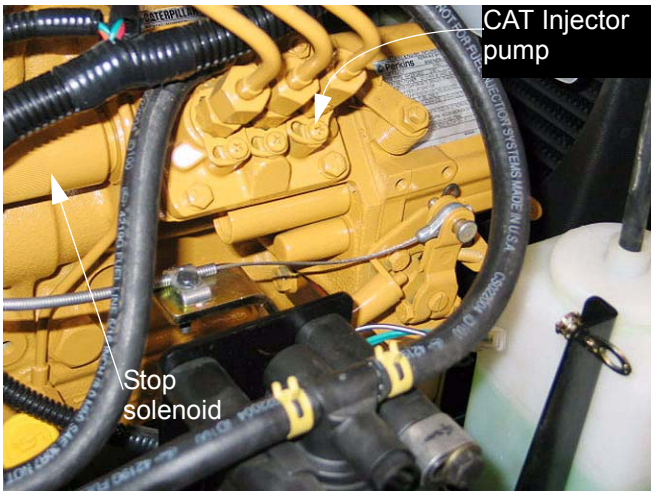

Figure 1.9

1.10. Charging systems differ between the engines: the diesel engines have stand-alone alternators with integrated voltage regulator-rectifiers. See Figure 1.10.

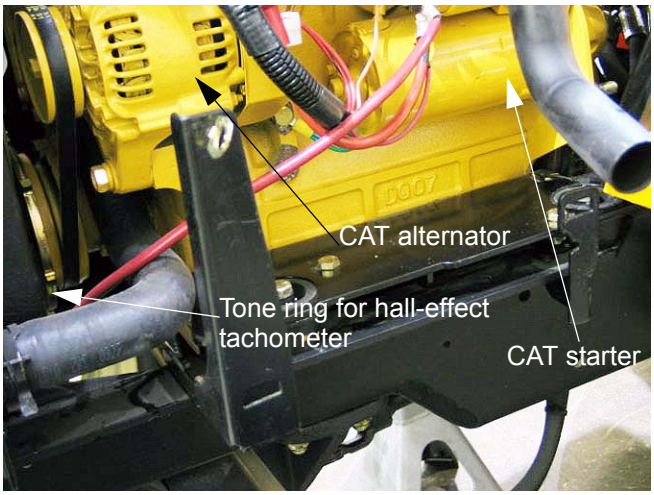

Figure 1.10

Domestic Compact Electrical Systems

1.11. The gasoline engines use flywheel mounted rotors and engine mounted stators to generate A.C. current. The current is processed through regulator-rectifier modules before being passed to the main harness of the tractor. See Figure 1.11.

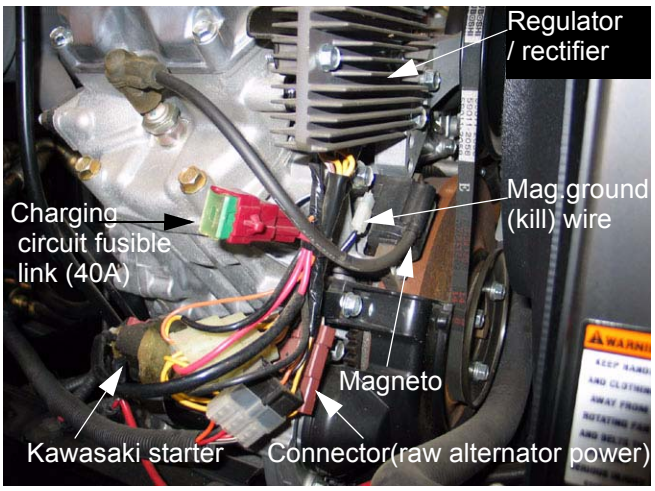

Figure 1.11

1.12. Systems vary slightly between engine manufacturers, but principles of operation are comparable. See Figure 1.12.

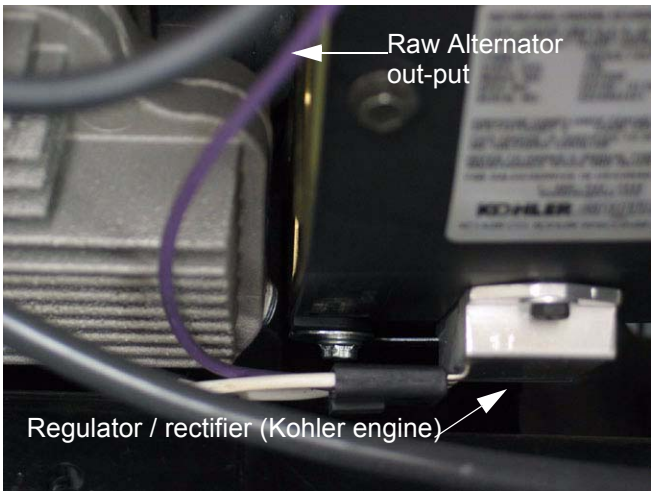

Figure 1.12

1.13. Charging system diagnosis: Flywheel charging systems can be diagnosed using the Briggs & Stratton shunt (B & S part # 19468) or inductive ammeter and DVOM. Charging systems on the diesel engines are similar enough to automotive designs that an automotive type AVR tester (eg. Snap-On MT3750) can be a feasible alternative

1.14. As with all electrical systems, do not neglect the basics: clean connections and good ground paths. See Figure 1.14.

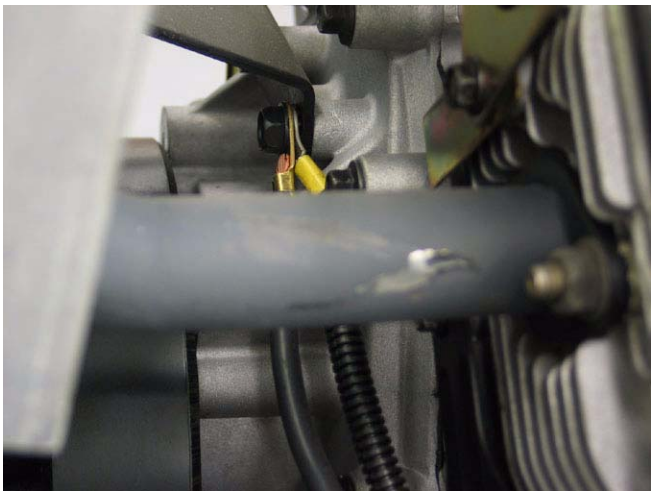

Figure 1.14

2. COMPONENTS

2.1. The heart of the electrical system is in the dash panel. It is some components are accessible from beneath the hood, others may be reached by removing the access panel. See Figure 2.1.

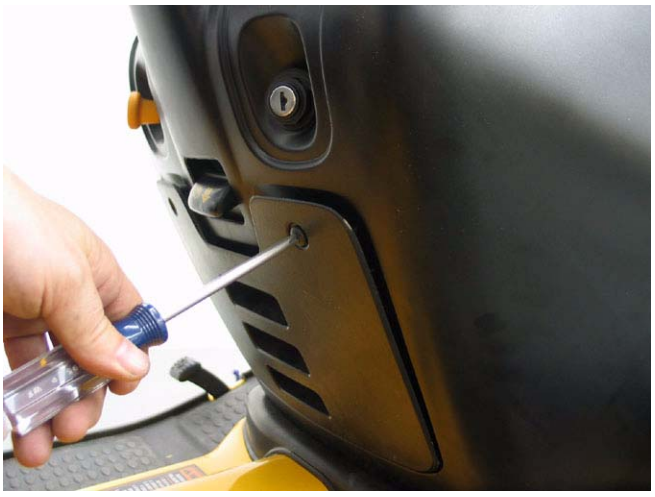

Figure 2.1

2.2. Behind the access panel is a fuse center. See Figure 2.2.

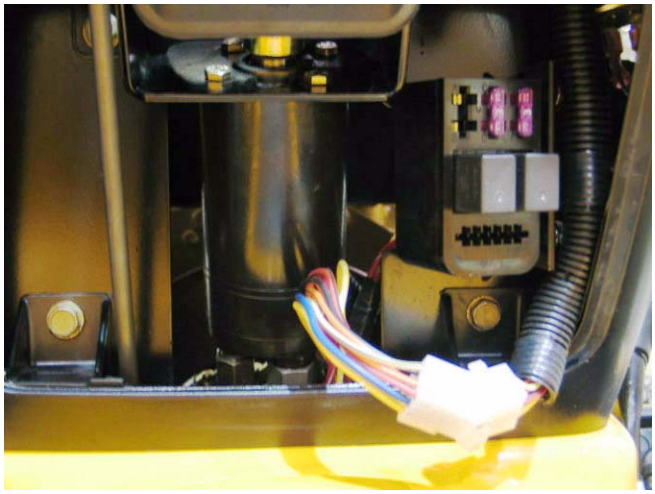

Figure 2.2

- The two fuses (3A) in the right side positions at the top of the center protect the instrument panel.
- The left-most position is empty.
- The right relay, below the fuses, controls the PTO. (P/N: 725-1648)
- The left relay, below the fuses, controls the starter circuit. (P/N: 725-1648)
- Below the relays are unused positions for additional fuses.

2.3. Taped to the harness, just above the fuse center is the flasher relay, in the hazard light circuit. See Figure 2.3.

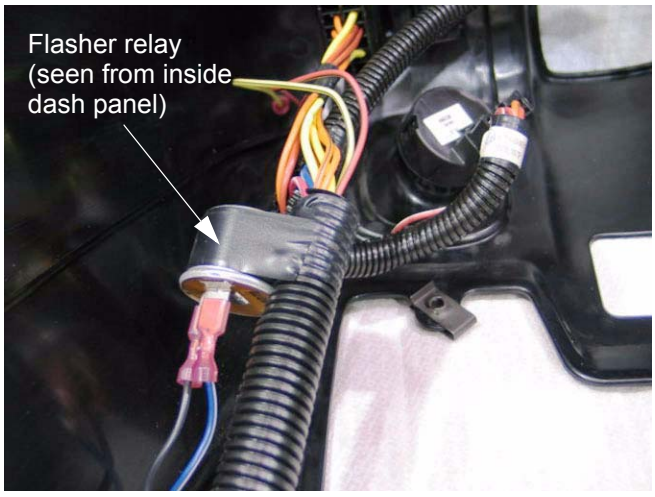

Figure 2.3

2.4. Diesel powered tractors will have the following components at the right rear corner of the engine bay:

- A single relay to power the glow-plug circuit. (P/N: 725-04164)
- A glow-plug timer that supplies power to the windings of the glow plug relay during the pre-start cycle. Caterpillar and Briggs & Stratton - Daihatsu each use different glow-plug timers.
- A main fuse (30A)
- A glow-plug timer fuse (5A)

2.5. Kawasaki powered tractors will have a single relay and main fuse (30A) at the right rear corner of the engine bay. See Figure 2.5.

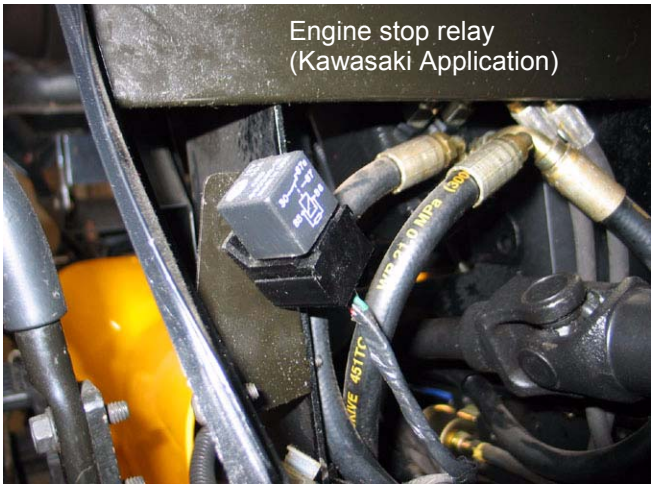

Figure 2.5

- The windings of the relay are energized by the after-fire solenoid circuit.
- When the key switch is turned to the OFF position, power to the after-fire solenoid circuit is cut, de-energizing the relay as well.
- The relay common connection (ground) and the normally closed contact (held open when the windings are energized) connect when power is taken from the windings.
- The normally closed contact leads to the magneto primary windings. When it is grounded, the magneto stops producing sparks.

2.6. Kohler powered tractors use a similar engine kill relay arrangement. See Figure 2.6.

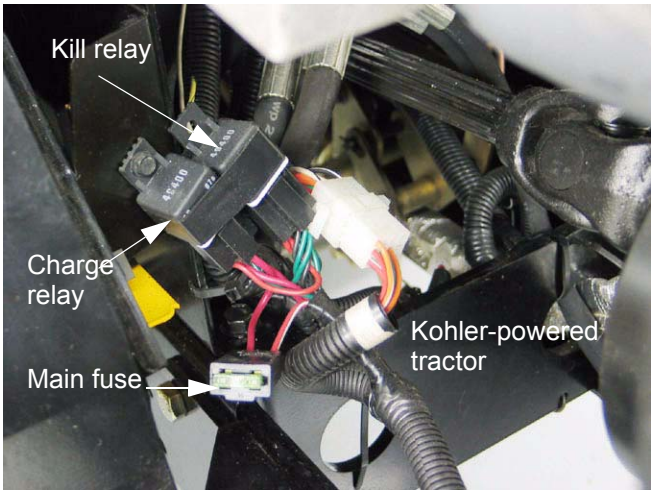

Figure 2.6

- Engine kill relay has red, green, and black wires.
- When the red wires are hot, the relay is energized, pulling the normally closed contact open, breaking the path that grounds-out the magneto.
- When power is taken away from the red wire by turning the key switch to OFF, the relay de-energizes, and the magneto is grounded when the normally closed contact (magneto primary windings) connects with the common contact (ground)
- A second relay controls the charge circuit and after-fire solenoid (red wires, and red wires with white trace).
- When the key is ON, regulator out-put and the after-fire solenoid are connected to the battery: charging the battery and powering the solenoid.
- When the key is OFF, the relay is de-energized, breaking contact with the battery. With the after-fire solenoid receiving power only from the regulator, the fuel flow stops when the rotor (flywheel) stops turning.

2.7. Located on the dash panel are the hazard flasher switch, light switch, PTO switch, Key switch, and instrument panel. See Figure 2.7.

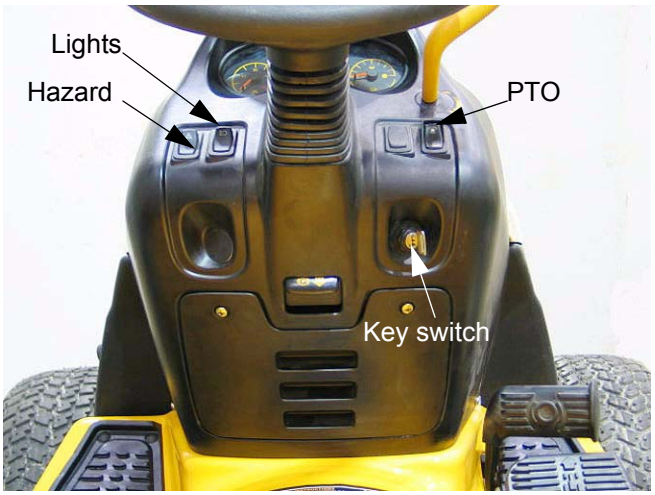

Figure 2.7

2.8. With the access panel removed, any of the rocker switches can be taken out of the dash panel by squeezing the retaining tabs. See Figure 2.8.

Figure 2.8

2.9. The hazard flasher draws constant hot through the red wire with white trace. See Figure 2.9.

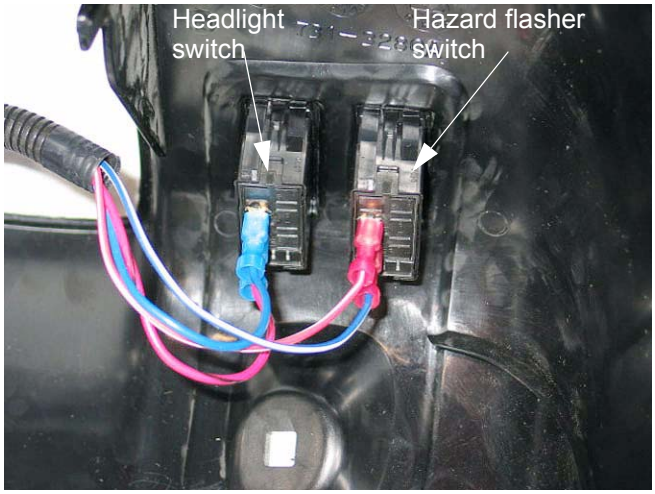

Figure 2.9

- When the contacts are closed (hazard switch ON), power is passed to the hazard lights via flasher relay through the blue wire with white trace.
- The hazard circuit extends beyond the lights, back to the instrument panel, illuminating arrows: pin #10 = left arrow Pin #21 = right arrow.
- The headlight switch gets power from the red wire with black trace when the key switch is ON.
- When the contacts are closed (headlight switch ON), power is passed to the headlights through the blue wire.
- The headlight circuit extends beyond the lights, to the instrument panel (pin # 3) where it illuminates a headlight indicator.
- Not all Series 5000 tractors are equipped with hazard flashers.
- The female spade connectors are color coded: Red for the Hazard circuit and Blue for the Headlight circuit.

2.10. The PTO switch is more complex. See Figure 2.10.

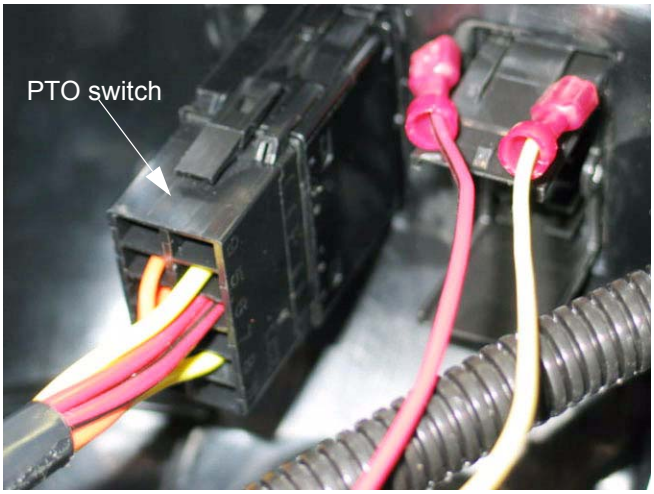

Figure 2.10

- The PTO switch contains two sets of contacts: one in the starter circuit, and the other in the engine shut-down and PTO circuits.
- The orange wire (starter circuit) brings power form the key switch in the START position.
- If the PTO switch is turned OFF, the contacts close, passing power to the orange and black wire.
- The orange and black wire conducts power to the brake switch.
- The red wires with black traces conduct power to the second set of contacts within the PTO switch when the key switch is ON.
- If the PTO switch is ON, contact is made to the yellow wire with white trace, providing power to the common terminal on the PTO relay
- If the PTO switch is OFF, contact is made to the plain yellow wire, leading to the brake switch.

2.11. The key switch has four spade terminals. See Figure 2.11.

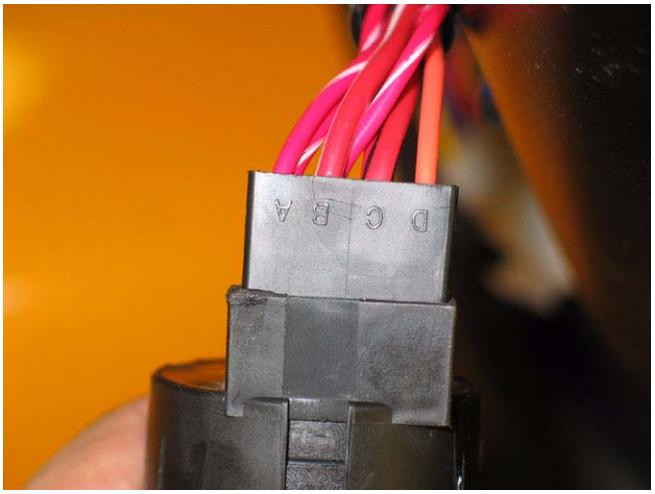

Figure 2.11

- The red wires with white trace (terminal A & B) are fused constant hot-leads.
- In the OFF position, no terminals are connected.
- In the RUN position, only terminals B and C are connected to, sending power through the red wire with black trace to the lighting and accessory circuits and pin # 18 (run input) on the instrument panel.
- The START position makes the “RUN” contacts, and A terminal and D terminal are connected to each other, sending power through the orange wire to pin #16 (start input) on the panel.

2.12. The instrument panel is easily unplugged or removed with the hood open. See Figure 2.12.

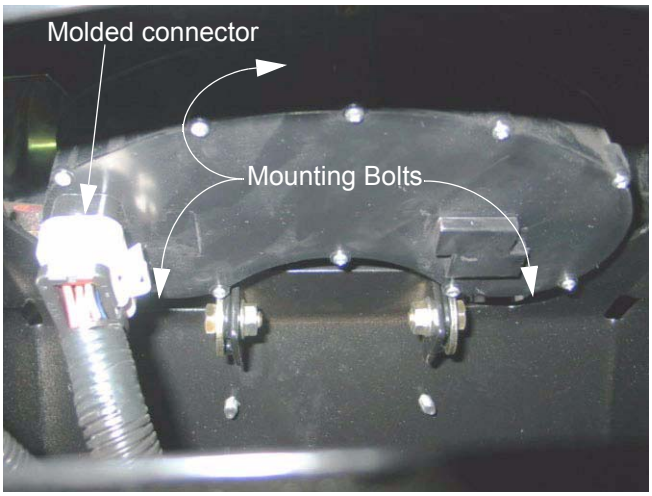

Figure 2.12

2.13. The pin numbers are indicated on the molded connector. See Figure 2.13.

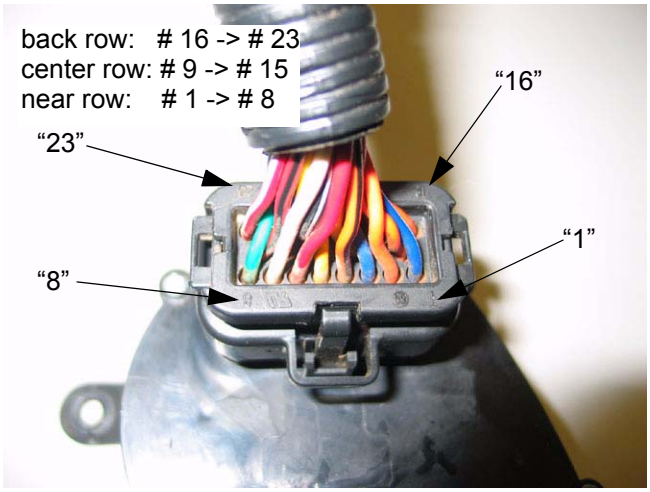

Figure 2.13

2.14. Each number corresponds to a pin position on the instrument panel. See Figure 2.13.

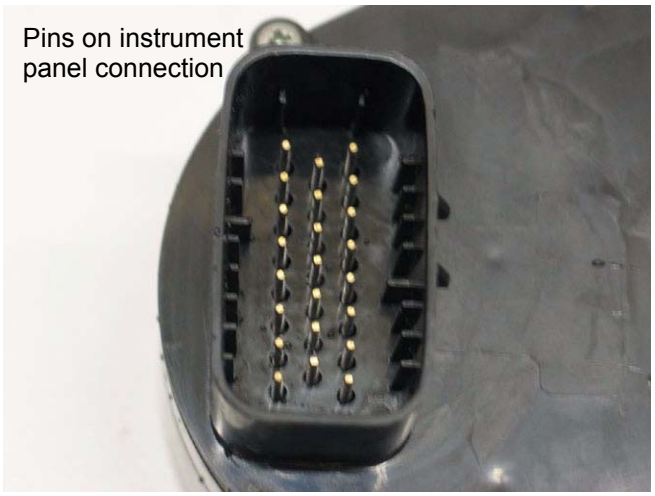

Figure 2.14

2.15. The pin identities are as follows: See Figure 2.15.

Pin-out chart	
Pin	**Signal**
1	Cruise Control Input
2	Oil pressure
3	Headlights
4	Reverse over-ride
5	PTO ON
6	PTO relay
7	Fuel Gauge unit
8	Ground, -
9	Reverse
10	Left arrow
11	Glow plugs
12	Tachometer sending unit
13	Magneto
14	Cruise control magnet
15	12 volts, +
16	Start input
17	Temp sender unit
18	Run input
19	Open
20	Brake on
21	Right arrow
22	Open
23	Open

Figure 2.15

2.16. The reverse over-ride switch is located on the rear fender. On all Series 5000, 6000 and domestic 7000 tractors, the fenders must be removed to reach the switch. See Figure 2.16.

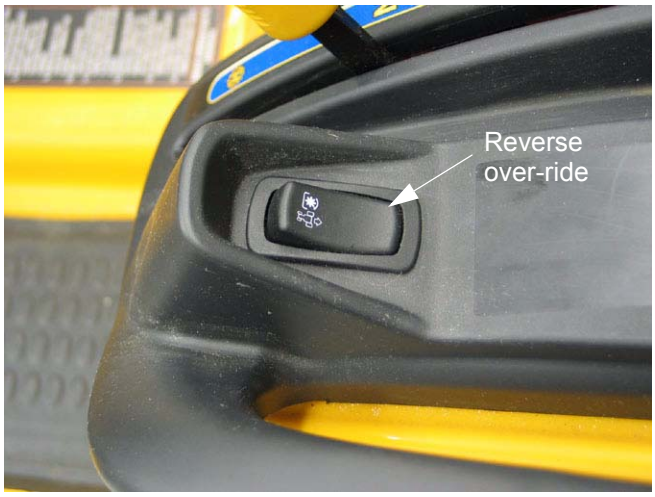

Figure 2.16

2.17. On Series 6000 and domestic Series 7000, there are four wires to the switch. See Figure 2.17.

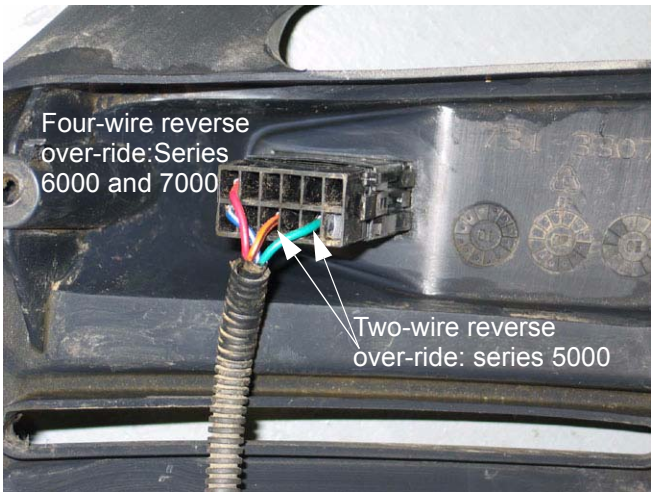

Figure 2.17

- There are two sets of contacts in the reverse over-ride switch on the series 7000 tractor: one set normally open, and one set normally closed
- Engaging the reverse over-ride sends a ground-signal to the instrument panel through the orange and black wire by closing contacts that connect it to the green ground wire.
- Engaging the reverse over-ride breaks the second set of contacts, between red wire with black trace (auxiliary power) the blue wire with white trace (pin #1 on instrument panel). This shuts-off power to a cruise control feature that was facilitated in the wiring harness but did not go into production.

2.18. On series 5000 tractors, only the orange wire with black trace and the green wire are present. Engaging the reverse over-ride sends a ground-signal to the instrument panel through the orange and black wire by closing contacts that connect it to the green ground wire.

Domestic Compact Electrical Systems

2.19. The fuel tank sender unit also lives under the fender, on the left hand side. It is basically a potentiometer actuated by a float. It creates more or less resistance between the white wire leading to pin #7 on the instrument panel and a ground circuit. See Figure 2.19.

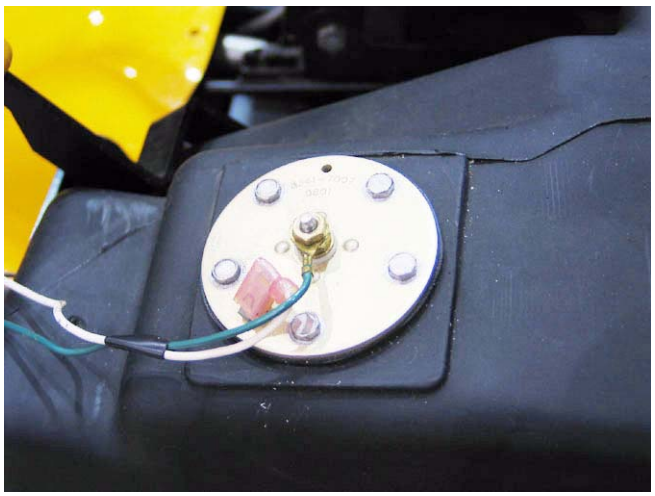

Figure 2.19

2.20. The seat switch contains a set of normally open contacts. When the seat is occupied, power is sent to the PTO relay windings. When the seat is empty, the PTO relay is de-energized, braking the contact that provides power to the PTO. We never want the PTO running with the seat empty. See Figure 2.20.

Figure 2.20

2.21. The reverse switches differ between the Series 5000 tractor and the other domestic compact tractors. See Figure 2.21.

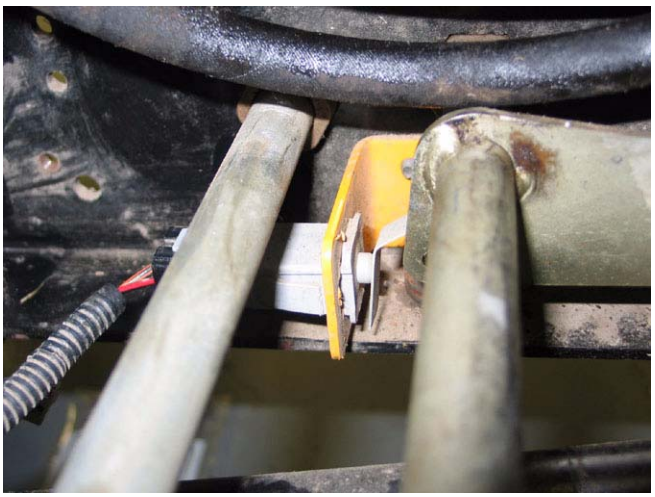

Figure 2.21

- The series 5000 reverse switch is located on the right hand side frame channel, just in front of the pedal linkage.
- There are two sets of contacts in the switch, but only one is used: normally closed.
- When the plunger is depressed (in reverse), the contacts connecting the red wire with black trace (power) and the orange wire with black trace (pin # 9 on the instrument panel) are broken.
- When the instrument panel sees no power signal from the reverse switch and sees no ground signal from the reverse over-ride, it breaks the ground path for the windings on the PTO relay (pin # 6). This de-energizes the relay, breaking the contacts that provide power to the PTO clutch.

2.22. The reverse switch on the series 6000 and 7000 tractors operates in the same manner to control the PTO clutch. See Figure 2.22.

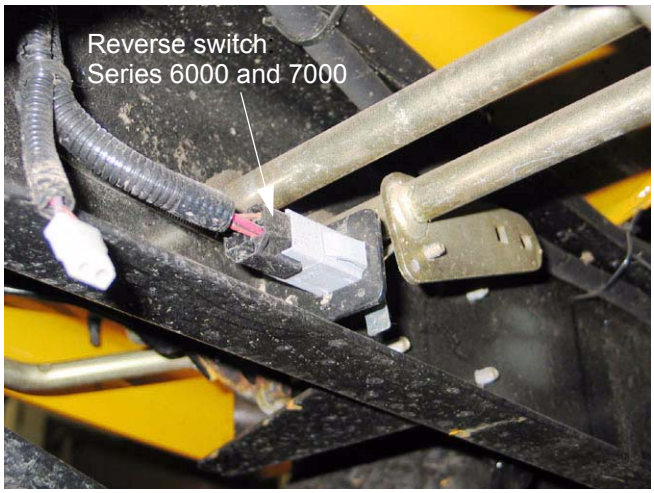

Figure 2.22

- The reverse switch on Series 6000 and Series 7000 domestic compact tractors is located on the right side frame channel, just ahead of the pedal linkage.
- The second set of contacts in the switch is normally open.
- When the plunger is depressed (in reverse), the contacts close, enabling power to pass form the red wire with black trace (power) to the white wire that feeds power to the back-up lights.

2.23. The brake switch for the Series 5000 compact tractor is located on the left hand side frame channel, just in front of the pedal linkage, with the plunger vertical (up). See Figure 2.23.

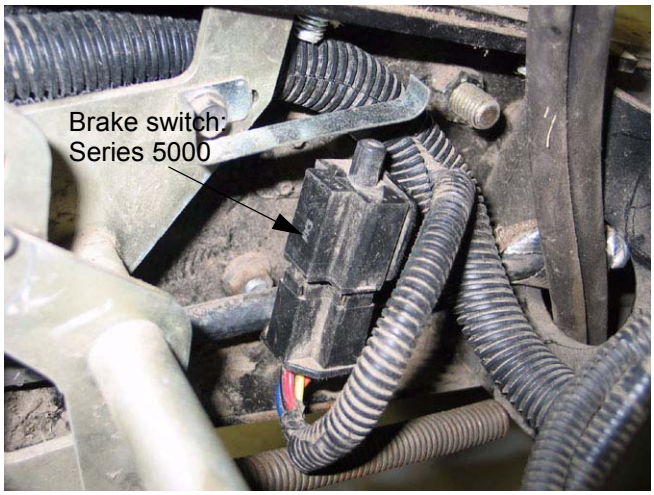

Figure 2.23

2.24. The brake switch on the Series 5000 tractor contains three sets of contacts. See Figure 2.24.

Figure 2.24

- All three sets are normally open: when the brake is not applied, the plunger is up, and none of the circuits connected to the switch have continuity through the switch.

2.25. Depressing the plunger (brake applied) closes all three sets of contacts. See Figure 2.25.

Figure 2.25

- With the plunger depressed, each pair of spade terminals that are adjacent to one another (flat side to flat side) will have continuity.

2.26. The circuits completed by the closing of the three sets of contacts in the Series 5000 domestic compact are as follows:

- The red wire with black trace connects to the blue wire, sending power to the instrument panel (pin # 20) telling it that the brake is on. This illuminates a “brake” lamp in the panel.
- The starter circuit (orange wire with black trace) connects from the PTO switch (PTO OFF), through the brake switch contacts, to the orange wire with white trace that energizes the windings of the starter relay. Energizing the starter relay passes power to the other orange and white wire on the relay, triggering the starter solenoid and motor.
- The yellow wire gets power from the PTO switch when the PTO is off. When the brakes are applied, the power passes to the red wire on the brake switch. The red wire takes power to the after-fire solenoid.
- If this circuit is broken, the engine will stop from lack of fuel.
- The seat switch feeds this circuit between the brake switch and the after-fire solenoid. Either the seat most be occupied -or- the brake must be applied -and- the PTO must be off to keep the after-fire solenoid energized.

2.27. The Series 6000 and Series 7000 brake switch has two sets of contacts. It is mounted to the right hand side frame channel, in front of the pedal linkages. See Figure 2.27.

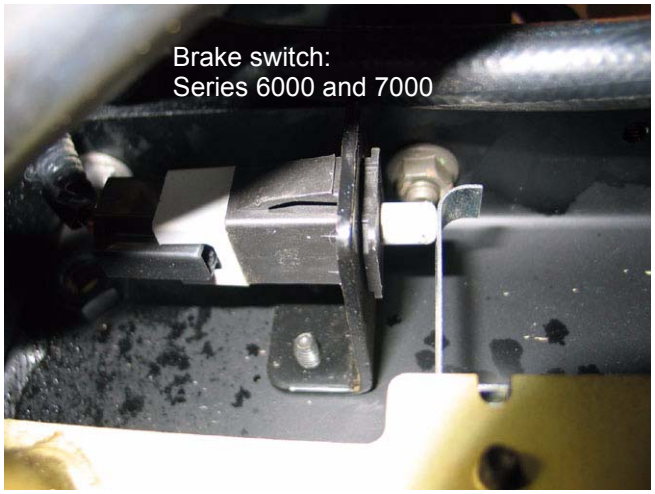

Figure 2.27

2.28. The circuits completed by the closing of the three sets of contacts in the Series 5000 domestic compact are as follows:

- The Starter circuit (orange wire with black trace) delivers power from PTO switch (PTO OFF) through the brake switch contacts, to the orange wire with white trace. This sends power to trigger the starter solenoid and to the instrument panel (pin # 20) telling it that the brake is on. This illuminates a “brake” lamp in the panel.
- The yellow wire gets power from the PTO switch when the PTO is off. When the brakes are applied, the power passes to the red wire on the brake switch. The red wire takes power to the after-fire solenoid.
- If this circuit is broken, the engine will stop from lack of fuel.
- The seat switch feeds this circuit between the brake switch and the after-fire solenoid. Either the seat most be occupied -or- the brake must be applied -and- the PTO must be off to keep the after-fire solenoid energized.

3. ELECTRIC CLUTCH AND FUEL PUMP

3.1. The electric PTO clutch on the Series 6000 and domestic Series 7000 compact tractors is contained inside the transaxle. The wire that provides power to it enters the transaxle housing through a notch in the top edge of the right side of the housing. See Figure 3.1.

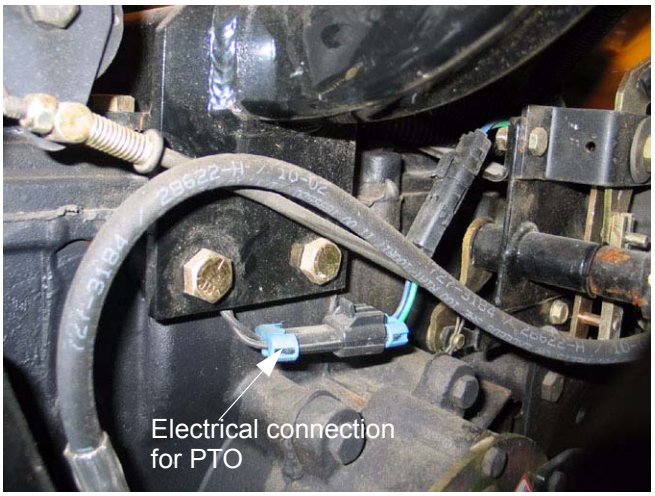

Figure 3.1

3.2. The Electric PTO clutch on Series 5000 compact tractors is external, but requires some transaxle disassembly to remove. See Figure 3.2.

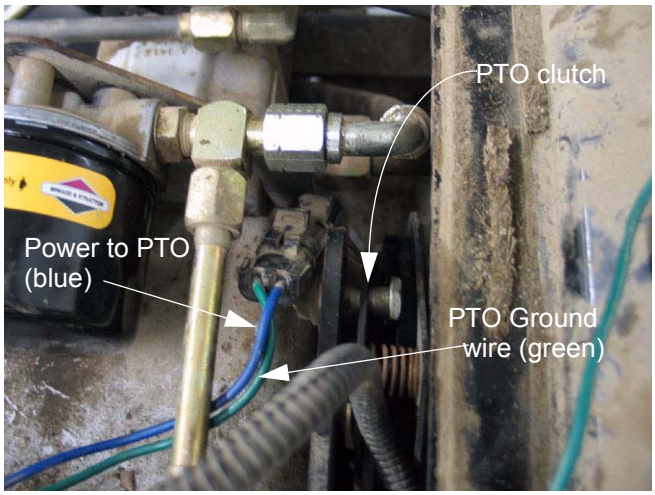

Figure 3.2

- It is possible to set the clutch air-gap in-situ, without removing the fenders.
- R&R instructions are contained in the 2004 Cub Update material.

3.3. The electric fuel pump is mounted to the left hand side frame channel on all gasoline powered domestic compact tractors. See Figure 3.3.

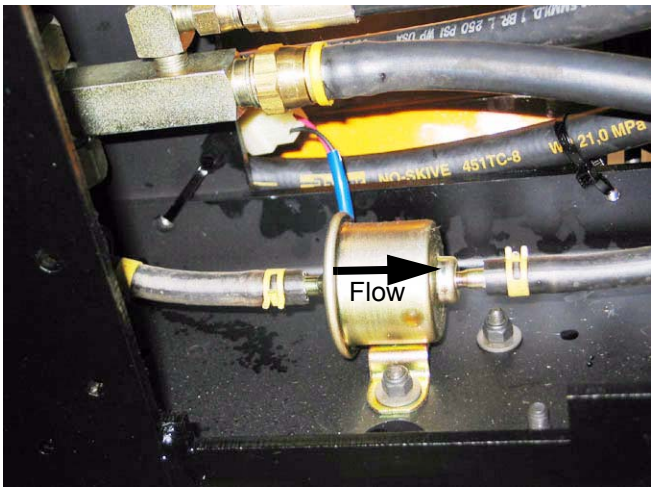

Figure 3.3

- Diesel powered tractors in the Series 5000, 6000, and domestic 7000 line do not have electric fuel pumps.
- Caterpillar engines have a mechanical lift pump feeding the high-pressure injector pump, and Briggs & Stratton Daihatsu pumps are able to self-feed.
- The electric fuel pump is powered whenever the key switch is ON. When they run there is an audible clatter. The noise is louder when there is air in the system, and quiets-down as the system fills with gasoline. This may take 10-15 seconds after the key switch is turned-on.