T1010, T1030, T1110 REPAIR MANUAL COMPLETE CONTENTS

The following pages are the collation of the contents pages from each section and chapter of the T1010, T1030, T1110 Repair manual. Complete Repair part # 87739173.

The sections used through out all New Holland product Repair manuals may not be used for each product. Each Repair manual will be made up of one or several books. Each book will be labeled as to which sections are in the overall Repair manual and which sections are in each book.

The sections listed above are the sections utilized for the T1010, T1030, T1110 Tractors.

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1st Printing

SECTION 10 - ENGINE SYSTEMS

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SECTION 00 - GENERAL INFORMATION

Chapter 1 - General Information

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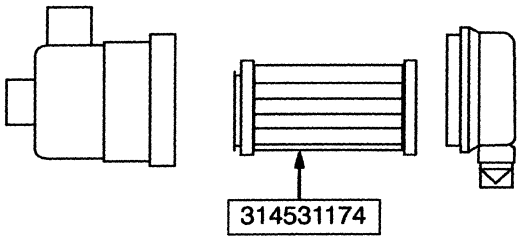
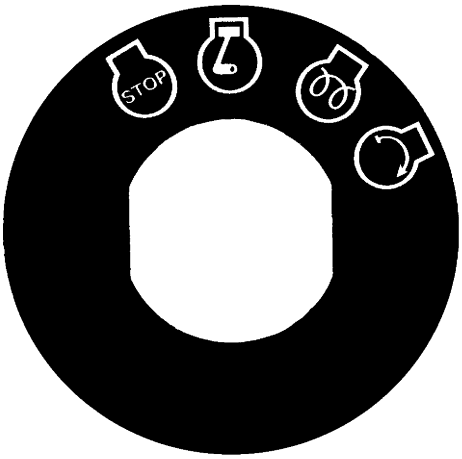
INSTRUCTION DECALS



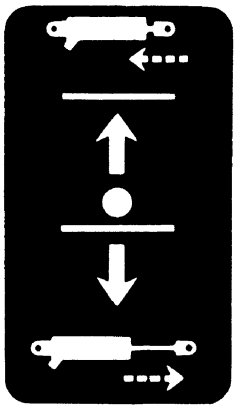
Air Cleaner Servicing
PART NO: SBA390199320
LOCATION: Air Cleaner End Cap



Starter Switch
PART NO: SBA390197280
LOCATION: On the RH of Dash

Auxiliary Power Socket 10 Amp Maximum Fuse
PART NO: SBA390198780
LOCATION: Left Side of Seat Support

Parking Brake
PART NO: SBA390198360
LOCATION: Front of Operator's Above Parking Brake Pedal



LUBRICATION AND MAINTENANCE

Adequate lubrication and maintenance on a regular schedule is vital to maintaining your equipment. To ensure long service and efficient operation, follow the lubrication and maintenance schedules outlined in this manual. The use of proper fuels, oils, grease and filters, as well as keeping the systems clean, will also extend machine and component life.

IMPORTANT: *Always use genuine* ***New Holland*** *replacement parts, oils and filters to ensure proper operation, filtration of engine and hydraulic systems. See your* ***New Holland*** *dealer for additional oil quantities.*

GENERAL INFORMATION

Regular lubrication is the best insurance against delays and repairs. Proper lubrication will extend machine life. Refer to the following charts for lubricants and service intervals.

IMPORTANT: *Failure to complete the required maintenance at the recommended intervals can cause unnecessary downtime.*

The intervals listed in the Lubrication Chart are guidelines to be used when operating in normal conditions. Adjust the intervals for operating in adverse environmental and working conditions. The intervals should be shortened for sandy, dusty and extremely hot operating conditions.

CAUTION

Observe these safety precautions before performing lubrication and maintenance.

1. **Shut off engine.**
2. **Disengage all drives.**
3. **Lower all attachments to the ground or raise and engage all locks**
4. **Close all shields opened and reinstall any shields removed for lubrication and maintenance proposes.**

CAUTION

Some illustrations in this manual show shields opened or removed to show areas being serviced. Replace all shields before operating this machine.

Always clean the area around dipsticks, fill caps, and check plugs when checking fluid levels. Failure to clean these areas may allow contamination to enter the system. Drain, flush and refill the system anytime you suspect it is contaminated.

Grease Fittings

Wipe dirt from fittings before greasing.

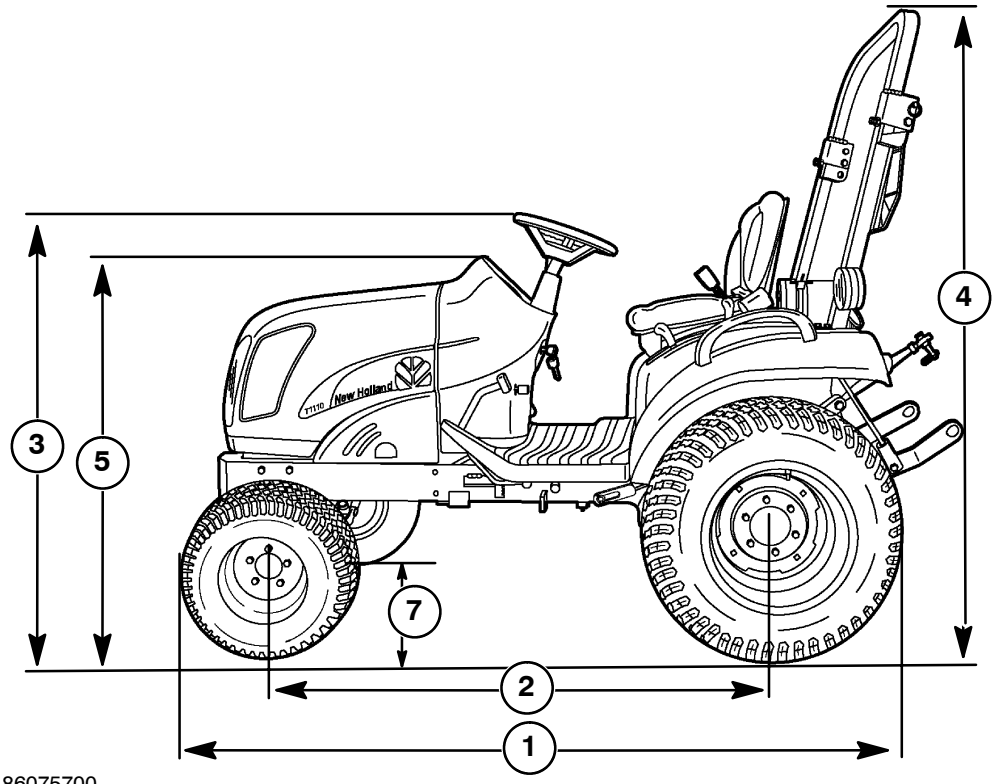
Pump fresh grease into fitting to adequately lubricate the component and force out any contamination from the grease passage.

Wipe off excess grease.

Use a grease gun containing clean high grade of multipurpose grease.

Chains

Stop all drives before lubricating chains.



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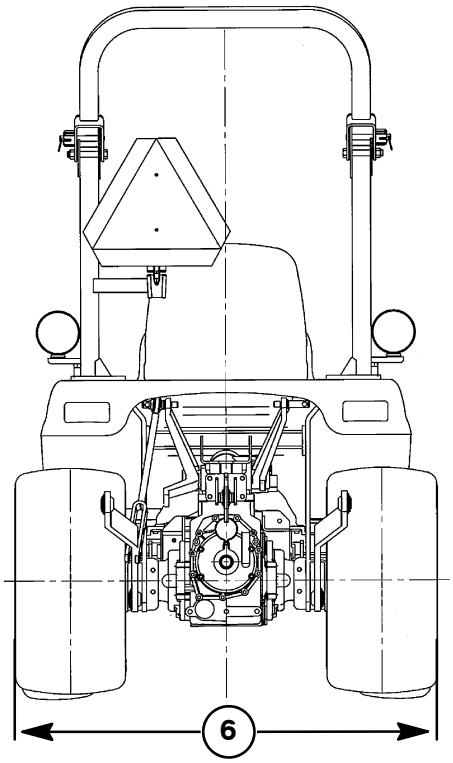

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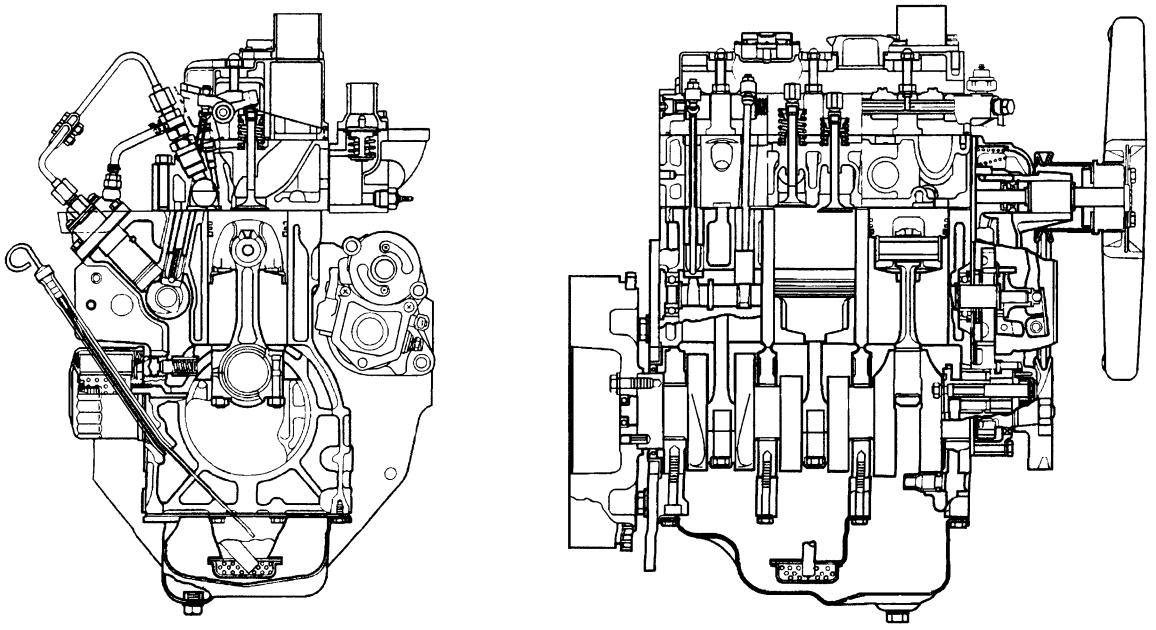
CONNECTING ROD			
Tractor Model	**T1010**	**T1030**	**T1110**
Rod Twist			
Standard	0.08 mm/100 mm (0.003 in./3.937 in.)	0.08 mm/100 mm (0.003 in./3.937 in.)	0.08 mm/100 mm (0.003 in./3.937 in.)
Maximum	0.2 mm/100 mm (0.008 in./3.937 in.)	0.2 mm/100 mm (0.008 in./3.937 in.)	0.2 mm/100 mm (0.008 in./3.937 in.)
Rod Bend			
Standard	0.05 mm/100 mm (0.002 in./3.937 in.)	0.05 mm/100 mm (0.002 in./3.937 in.)	0.05 mm/100 mm (0.002 in./3.937 in.)
Maximum	0.15 mm/100 mm (0.006 in./3.937 in.)	0.15 mm/100 mm (0.006 in./3.937 in.)	0.15 mm/100 mm (0.006 in./3.937 in.)
Crankshaft Side Play			
Standard	0.1 – 0.3 mm (0.004 – 0.012 in.)	0.1 – 0.3 mm (0.004 – 0.012 in.)	0.1 – 0.3 mm (0.004 – 0.012 in.)
Maximum	0.7 mm (0.028 in.)	0.7 mm (0.028 in.)	0.7 mm (0.028 in.)
Crankshaft Bearing Clearance			
Standard	0.035 – 0.083 mm (0.001 – 0.003 in.)	0.035 – 0.083 mm (0.001 – 0.003 in.)	0.035 – 0.083 mm (0.001 – 0.003 in.)
Maximum	0.2 mm (0.008 in.)	0.2 mm (0.008 in.)	0.2 mm (0.008 in.)



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CYLINDER BLOCK ASSEMBLY

The cylinder block assembly contains the pistons, connecting rods, crankshaft, timing gears, and engine oil pump. The engine crankshaft is supported by four main bearings. The front main bearing is a full circle bearing positioned in a bore in the front of the block. The second, third, and fourth main bearings are split liners located in holders bolted to the block. The camshaft is supported by two ball bearings one located on each end of the block. The engines utilize a straight connecting rod and a three ring piston.

FUEL INJECTOR AND GLOW PLUG

Removal

1. Clean all dirt and oil from the injectors and surrounding area.
2. Disconnect the fuel lines, 1, from the injectors and from the injector pump, and remove the lines as an assembly. Cap all openings.
3. Disconnect the electrical connector, 2, joining the wiring harness to the lead from the glow plug connector bar at the #3 (rearmost) injector.
4. Loosen the three hex nuts on the ends of the glow plugs and remove the connector bar, 3, and wiring lead.
5. Disconnect the fuel return hose, 4, from the #3 injector. Plug the hose and cap the connection on the injector.
6. Disconnect the fuel supply hose, 5, from the fuel injection pump. Plug the hose and cap the connection on the injection pump, 6.
7. Loosen and separate the connections on top of all three injectors and on the injector pump, and remove the fuel leak-off line, 7, as a unit.
8. Remove the three fuel injector assemblies, 8.

NOTE: *Ensure that the sealing washer is removed from the seating bore along with each injector assembly.*

NOTE*: Fuel shutoff solenoid has to be removed before injection pump can be removed.*

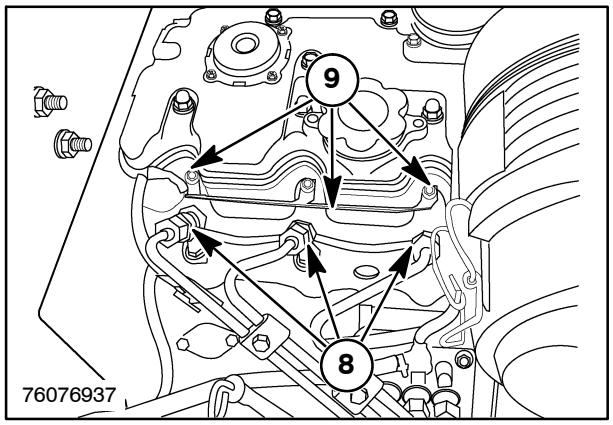
9. Remove the injection pump mounting bolts and nuts, and slide the injection pump away from the engine block far enough to remove the spring pin, 1, and separate the governor link, 2, from the pump control rack, 3.

NOTE: *Separate the mounting bracket for the external oil tube from the upper rear mounting nut on the injection pump cover at this time.*

10. Carefully slide the injection pump out of the engine block and set aside.

NOTE: *If there are shims between the pump mounting flange and the engine block, carefully remove the shims and retain them for installation.*

11. Remove the three glow plugs, (9, Figure 13), from beneath the three injector ports.



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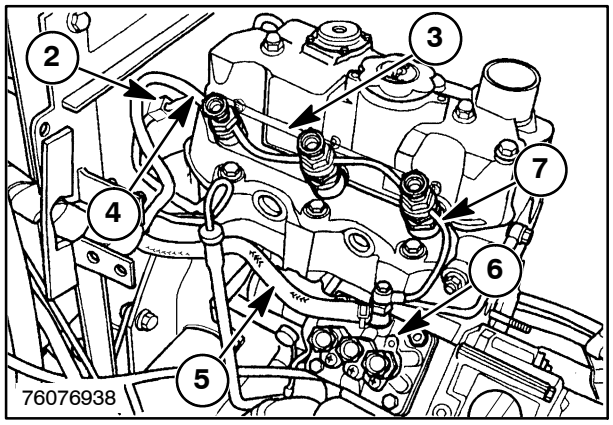

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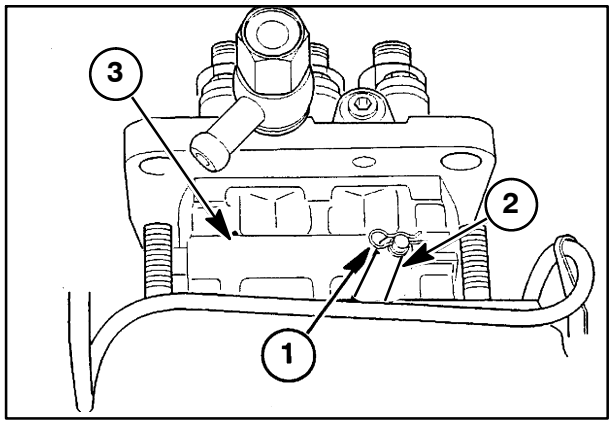

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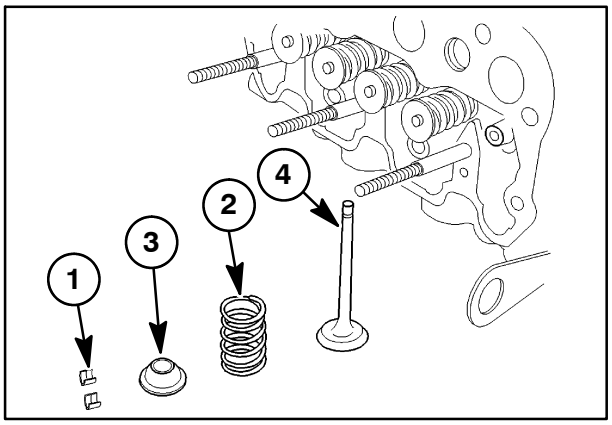
CYLINDER HEAD

Disassembly

1. Clean the cylinder head and remove any carbon deposits from around the heads.
2. Use a valve spring compressor and remove the valve spring retainer locks, 1, spring, 2, and spring retainer, 3, from each valve, 4.
3. Remove the valves and place the valve components together in separately marked containers for re-assembly in their original position.



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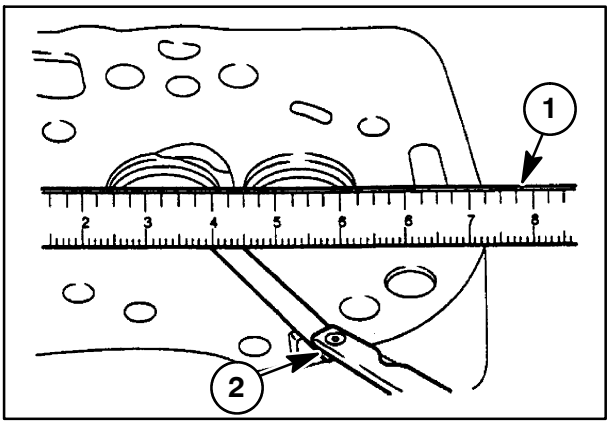
Inspection and Repair

1. Clean all carbon deposits from the combustion chamber and valve ports using a wire brush and scraper.
2. Clean all dirt and residue from the gasket surface using care not to scratch or nick the machined surface.
3. Clean the cylinder head in solvent and air dry.
4. Inspect the head for cracks in the following areas:
   - Valve ports
   - Valve seats
   - Pre-chamber
5. Inspect the gasket surfaces for scratches or nicks, which could cause leakage.
6. Examine the core hole plugs for rust or signs of leakage. If a plug shows signs of damaging rust or leakage, replace all plugs in the head.
7. Using a straight edge, 1, and a feeler gauge, 2, check the cylinder head for warpage lengthwise, crosswise, and diagonally. Resurface or replace the head if the warpage is greater than 0.12 mm (0.005 in.).

NOTE: *If resurfacing requires removal of more than 0.50 mm (0.020 in.) material replace the head.*

8. Inspect the pre-chamber for carbon deposits and looseness. Remove any carbon deposits found. If the pre-chamber is found to be loose, the cylinder head is warped and must be replaced.



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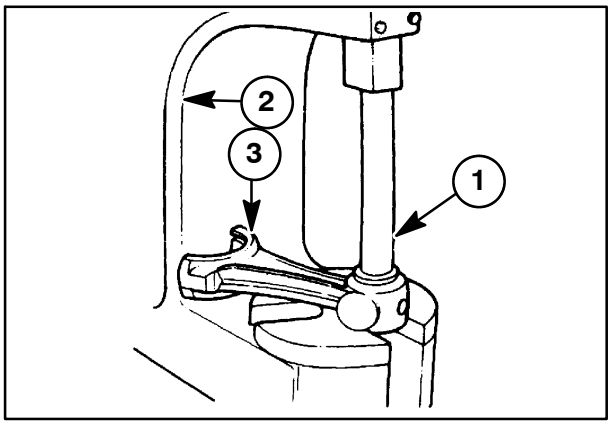
5. Remove and install the connecting rod wrist pin bushings using a suitable driver, 1, and press, 2. Press a new bushing into the rod bore.



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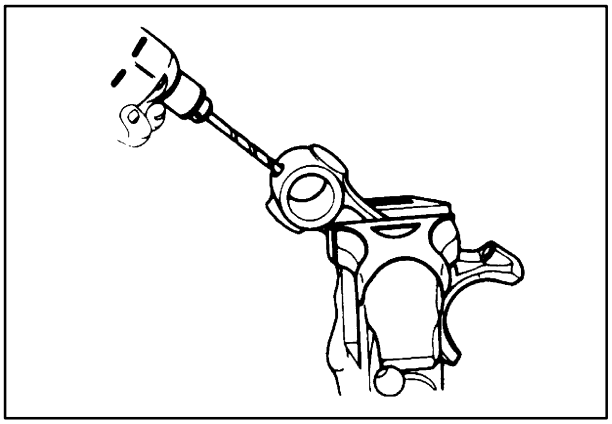
1. Bushing Driver
2. Press
3. Connecting Rod

6. When installing a new wrist pin bushing, use the hole in the rod and drill a lube hole in the new bushing.
7. Ream and hone the bushing to the following finish size:

Standard	Maximum
0.008 – 0.023 mm (0.0003 – 0.0009 in.)	0.08 mm (0.0031 in.)



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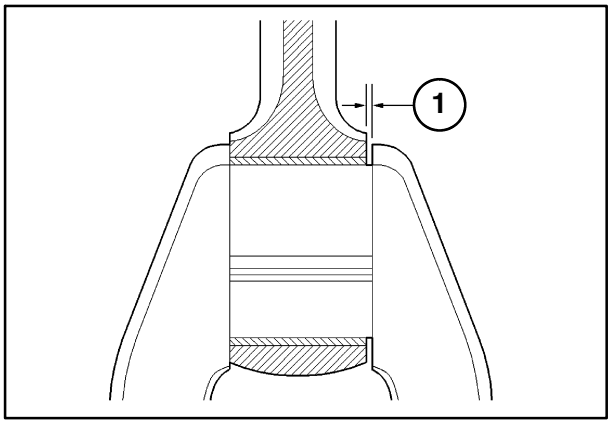
8. Install the connecting rod on the crankshaft, and torque the bolts to 29 – 34 N·m (22 – 25 ft-lbs). Push the rod to one side and measure the clearance with a feeler gauge. If the play is more than 0.7 mm (0.028 in.) at, 1, replace the connecting rod.



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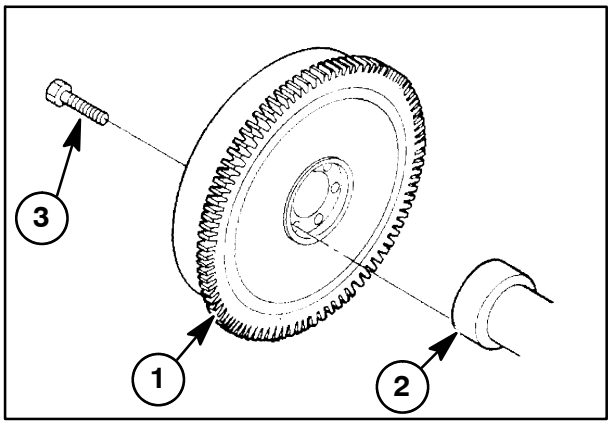
FLYWHEEL

Installation

1. Fit the flywheel, 1, to the crankshaft, 2, and align the bolt holes.
2. Install the flywheel retaining bolts, 3, and torque to 69 – 78 N·m (50.9 – 57.6 ft-lbs).



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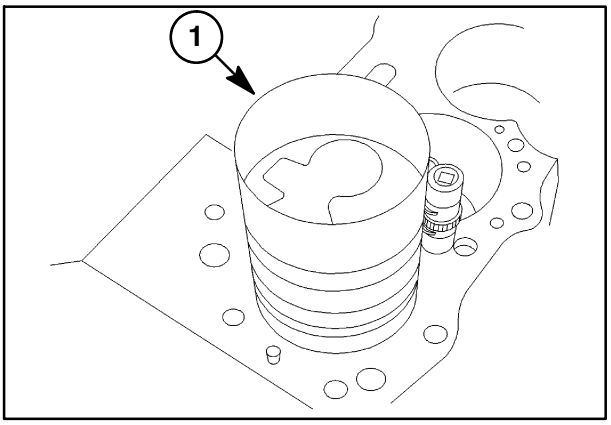
PISTON AND CONNECTING ROD

Installation

1. Coat the bearing faces, pistons, and piston rings with clean engine oil. Slide the piston rings to permit a sufficient amount of oil to be applied in the grooves.
2. Set the piston ring gaps 90° apart from each other. Do not position these gaps toward the piston wrist pin or at a right angle to the pin.
3. Using a piston ring compressor, 1, Insert the pistons in the cylinders with the connecting rod matching marks facing the injection pump.

NOTE: *Install the pistons from the front to the rear in order.*



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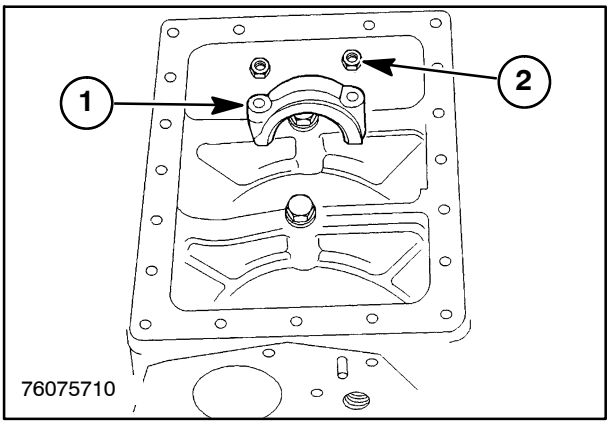
4. Install the connecting rod caps, 1, making sure the rod and cap matching marks align. Tighten the connecting rod capscrews, 2, to 29 – 34 N·m (22 – 25 ft-lbs).

NOTE: *After installation, make sure the crankshaft moves freely. Ensure the axial play is 0.1 – 0.3 mm (0.004 – 0.012 in.).*



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FUEL INJECTION PUMP

Installation

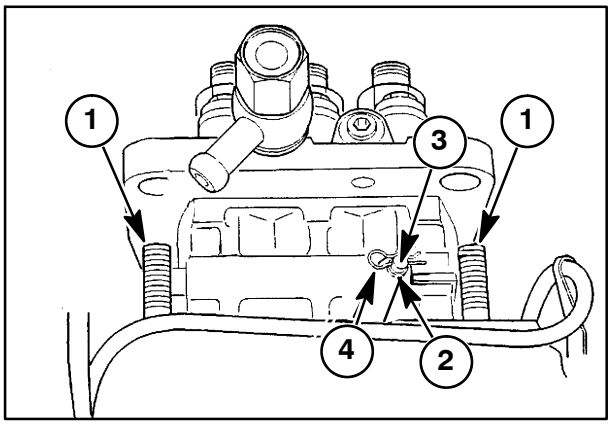
1. Carefully locate the injection pump onto the two projecting mounting studs, 1, on the forward RH side of the engine block, just above the hydraulic pump. Slide the pump onto the studs until the body of the pump enters the engine block, as shown.

NOTE: *Ensure that any shims retained from removal of the injection pump are replaced during installation. If a new pump is being installed, install a new gasket. (See "Injection Pump Removal and Installation" in the FUEL SYSTEM Section that follows this section.*

2. Engage the governor link, 2, which extends from inside the engine block, with the pin, 3, on the injection pump's control rack. Install the retaining pin, 4, to secure this connection. Slide the control lever back and forth to confirm that the control rack is not binding.

NOTE: *Before installing and tightening the rear upper mounting nut on the injection pump, attach the oil transfer tube support bracket to the pump mounting stud.*

3. Carefully slide the injection pump firmly against the engine block, and secure the pump with two mounting bolts and two hex nuts. Torque the mounting hardware to 4.5 – 6.8 N·m (3.3 – 5.0 ft-lbs).



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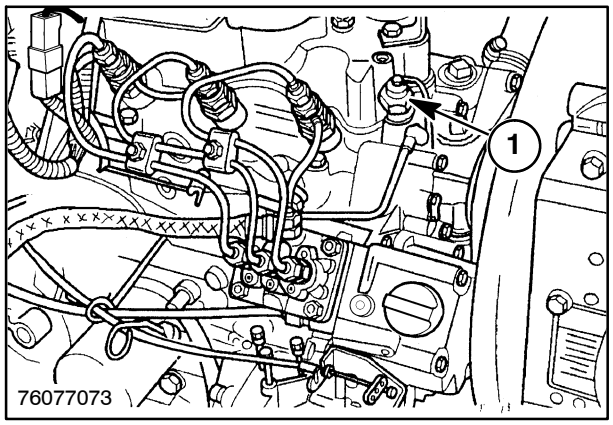
ENGINE OIL PRESSURE CHECK

1. Disconnect the sending lead and remove the oil pressure sending unit, 1.



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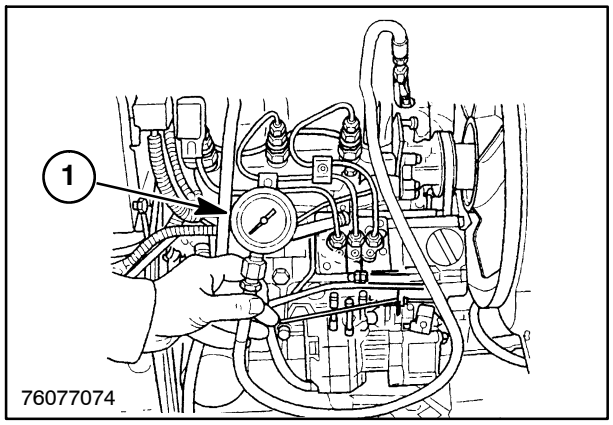
2. Install the oil pressure test fitting tool no. FNH00011 and a 0 – 100 psi pressure gauge, 1. Start the tractor engine and observe gauge indicator. The gauge should indicate between 14.22 – 21.33 psi at low idle and 35.5 – 49.8 psi at high idle.

NOTE: *Pressure test should be accomplished with the engine at normal operating temperature.*

3. If the gauge did not indicate the oil pressure within the specified tolerances at low and high idle, troubleshoot the lubrication system. See “Troubleshooting” discussed later in this section.



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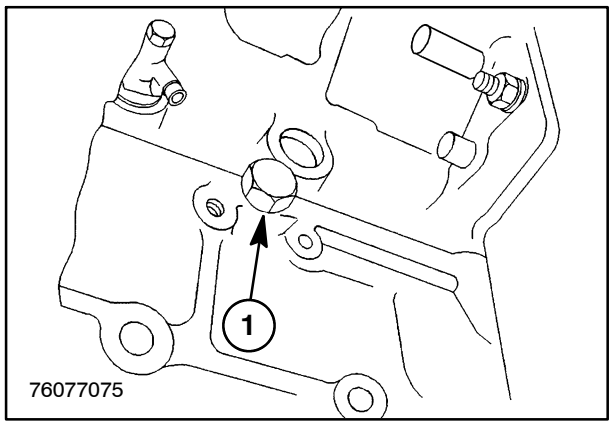
OIL PRESSURE RELIEF VALVE

Removal

1. Unscrew the oil pressure relief valve, 1, and remove from the block.

Installation

1. Install a new O ring seal over the relief valve and screw the valve into the block. Tighten to 58.8 – 68.6 N·m (43.4 – 50.6 ft-lbs).



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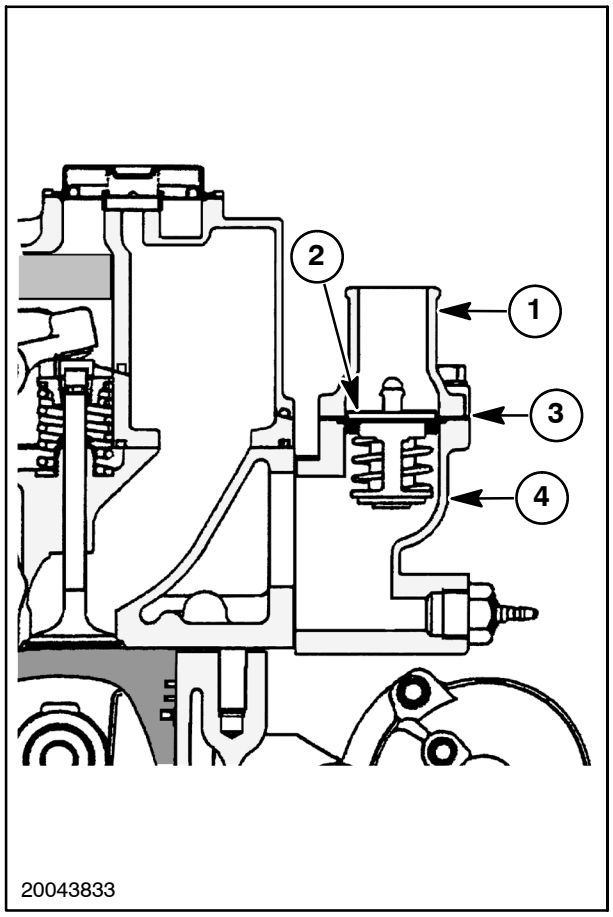
Inspection and Repair

1. Inspect each component of the water pump for cracks, wear, or damage. Components which are damaged must be replaced.
2. Check the impeller for wear or damaged vanes.
3. Check the impeller shaft bearing for roughness. Replace if not in good condition.
4. Check the freeze plug in the front of the engine block. Replace the plug if not in good condition.



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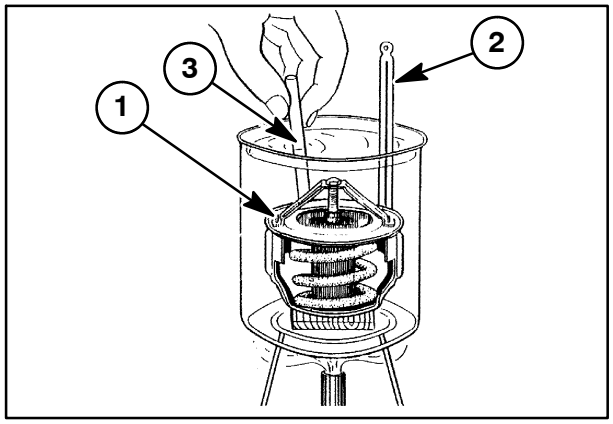
5. Check the thermostat as follows:
   a. Place the thermostat, 1, in a container filled with 50/50 mixture of antifreeze and water. Insulate the thermostat from the bottom of the container.
   b. Place a high temperature thermometer, 2, in the coolant mixture and heat the container.
   c. Use a 0.7 mm (0.030 in.) feeler gauge, 3, to determine when the thermostat begins to open.
   d. Note the coolant temperature at which the thermostat starts to open and when it is fully opened.
   e. Replace the thermostat if it fails to open at the specified temperature.

      Thermostat opening temperature:

      Start to open: 82°C (180°F)

      Fully open: 95°C (203°F)



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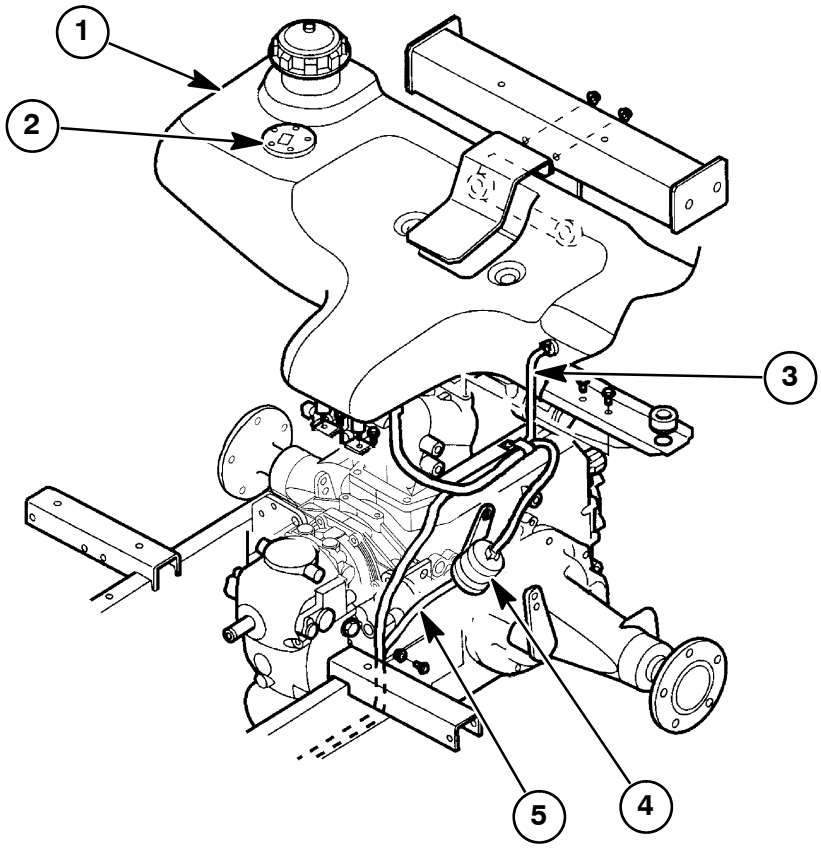

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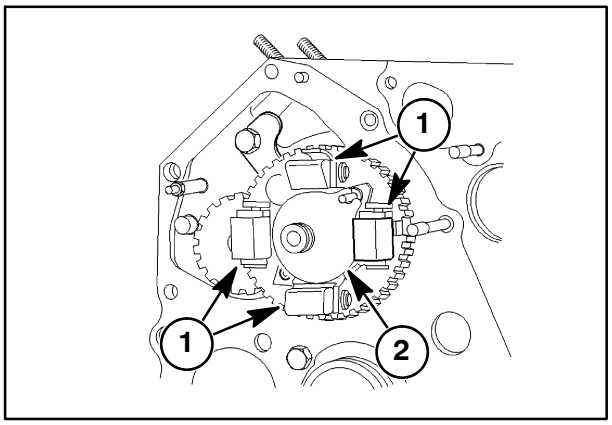
TROUBLESHOOTING – GOVERNOR

CONDITION	CAUSE	REMEDY
Sluggish governor response	Slider cone binding on camshaft	Replace slider cone
	Fuel rack binding in injection pump	Lubricate rack. Repair or replace injection pump
	Governor weights binding on pivot pins	Repair governor assembly
	Linkage arm between governor linkage and injection pump rubbing on cylinder block	Straighten or replace linkage arm assembly
	Binding of throttle arm on pivot shaft	Lubricate or replace throttle arm or shaft
Engine runs away (Excessive Speed)	Slider cone stuck at “in” position	Replace slider cone or check camshaft for binding
	Linkage arm between governor linkage and injection pump stuck	Repair or replace linkage arm assembly
	Fuel rack stuck in full fuel position	Lubricate or repair injection pump
Engine will not develop rated speed	Smoke screw adjusted too far into engine block	Adjust smoke screw outwards or towards for more fuel delivery
	Fuel rack stuck in low fuel position	Lubricate or repair injection pump
Engine speed surging	Broken dampener spring on linkage arm	Replace dampener spring
	Damaged governor Spring	Replace governor spring
	Worn linkage	Inspect and repair linkage as needed

As the engine speed decreases the governor weights, 1, pivot inward allowing the slider cone, 2, to move rearward.



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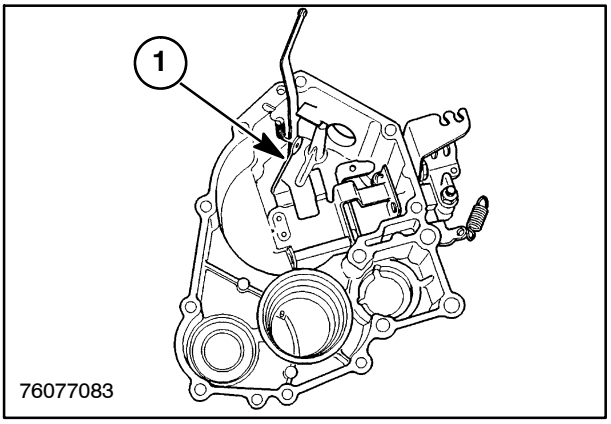
As the slider cone, 2, Figure 30, moves rearward, the governor linkage arm, 1, allows the fuel injection pump rack to move rearward to the full fuel position and the engine speed increases.

Engine speed depends upon several factors. The throttle setting determined by governor spring tension. The pressure exerted by the slider cone on the governor linkage, and positioning of the injection pump rack.

All the governor linkage parts are located inside the engine timing gear cover. To inspect or replace any of the governor linkage parts, the timing gear case and injection pump must be removed from the engine.



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SECTION 25 - FWD

Chapter 1 - Front Axle

CONTENTS

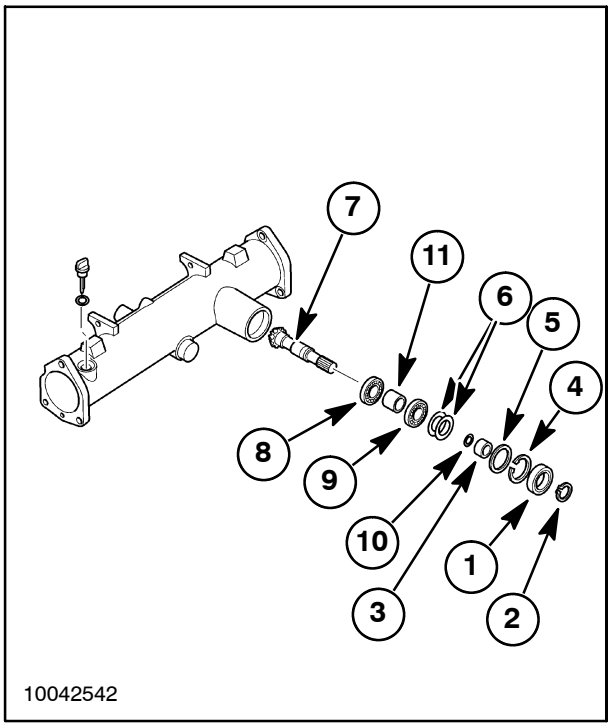
DRIVE PINION

Removal

1. Remove the oil seal, 1, and discard.
2. Remove the snap ring, 2, and collar, 3, from the pinion shaft.
3. Remove the snap ring, 4, spacer, 5, and shims, 6.

NOTE: *Observe the quantity and size of the shims, 6, located between the spacer, 5, and bearing, 9, for assembly. Shim sizes are 0.1 mm (0.004 ″) 0.2mm (0.008 ″).*

4. Remove the drive pinion, 7, bearings, 8, and 9, O-ring, 10, and collar, 11, together.
5. Clean all parts in a suitable cleaner.



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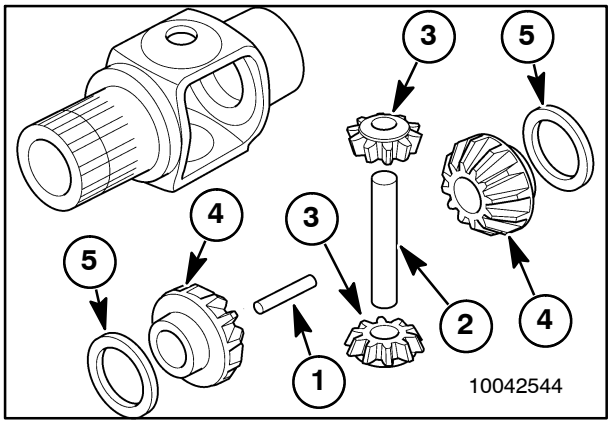
DIFFERENTIAL

Disassembly

1. Remove the clip that holds the ring gear to the differential. Remove the ring gear and bearings.
2. Drive the roll pin, 1, out of the center pin, 2.
3. Remove the center pin, 2, and bevel gears, 3.
4. Remove the differential gears, 4, and thrust washers, 5, from the differential housing, 6.
5. Clean all parts in a suitable solvent.



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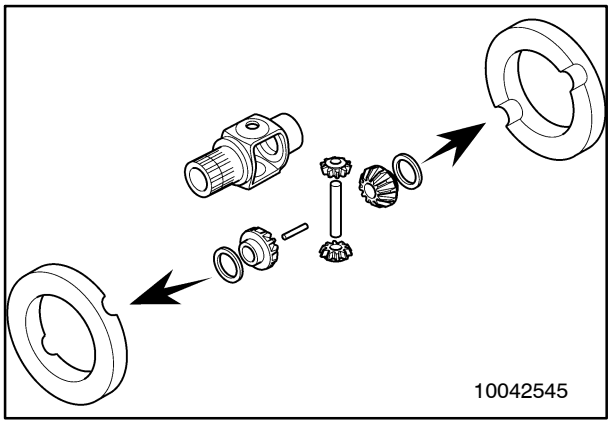
Inspection

1. Inspect the differential housing for cracks.
2. Inspect the gears for missing or chipped teeth.

Assembly

1. Apply a light coating of grease onto the thrust washers. Install the thrust washers, and differential gears into the differential housing.

NOTE: *The oil groove in the thrust washer must face the differential gear.*

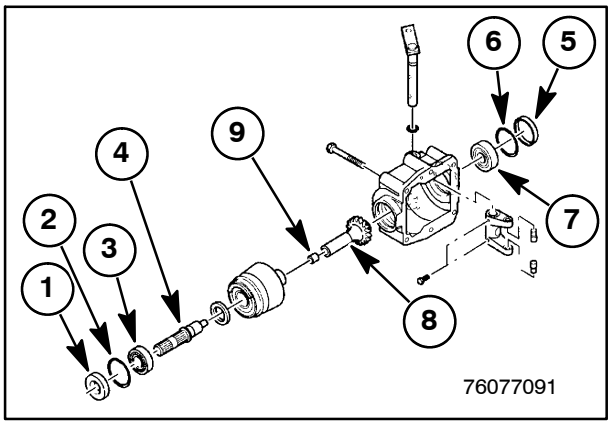


21

AUTO FWD BOX

Disassembly

1. Remove the oil seal, 1, and snap ring, 2, from the front of the take-off box.
2. Remove the front bearing, 3, and drive shaft, 4, from the front of the take-off box as an assembly.
3. Remove the seal cover, 5, snap ring, 6, rear bearing, 7, drive shaft, 8, and bushing, 9, from the rear of the FWD box.



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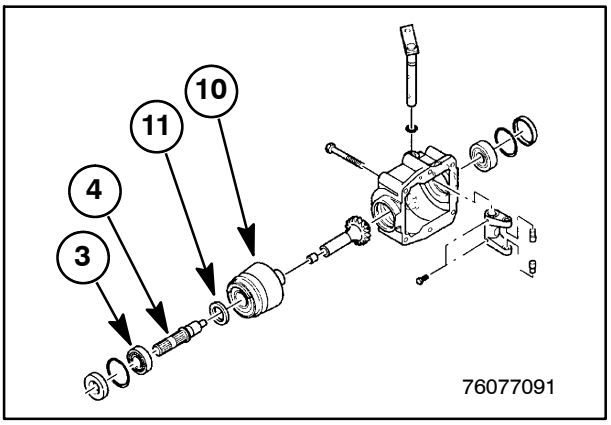
4. Remove the front bearing, 3, from the drive shaft, 4.
5. Remove the two way (Sensitrack®) clutch, 10, and thrust washer, 11, from the FWD box.



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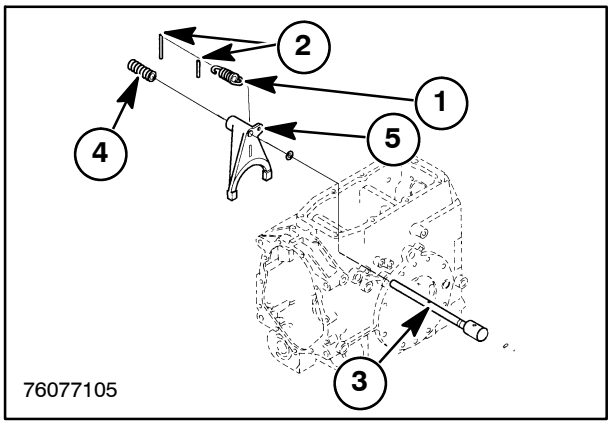
SECTION 27 - DIFFERENTIAL AND REAR AXLES

Chapter 1 - Differential

CONTENTS

10. Remove the differential return spring, 1. Drive out the internal roll pin, 2, from the differential lock shaft, 3, and remove the shaft from the housing. Use caution to retain the spring, 4, and remove the differential fork from the housing.



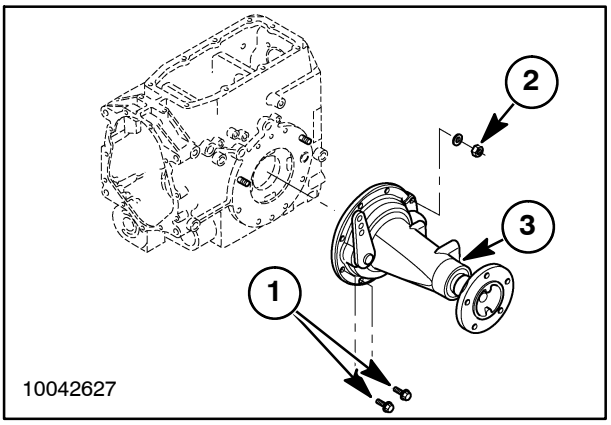
11

11. Remove the axle housing, retaining bolts, 1, and nuts (with lock washers), 2. Using a suitable hoist carefully remove the axle housing, 3, from the tractor.

⚠ WARNING ⚠

To avoid personal injury, use extreme caution when removing axle housing. The axle housing can be difficult to balance.

12. Remove the axle housing from the opposite side, in the same manner.



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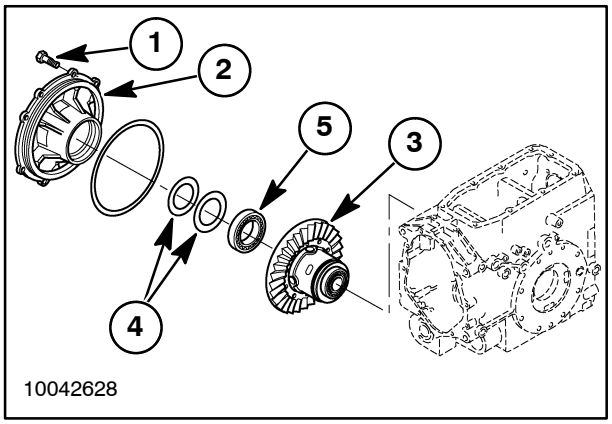
13. Remove the retaining bolts, 1, and the bearing carrier, 2, from the housing. Remove the differential assembly, 3.

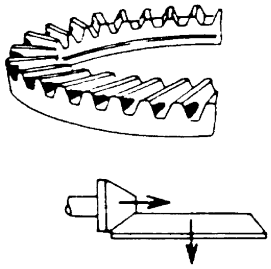
NOTE: *Take note to the quantities and the thickness of the shims, 4, used between bearing carrier, 2, and the bearing, 5.*



13

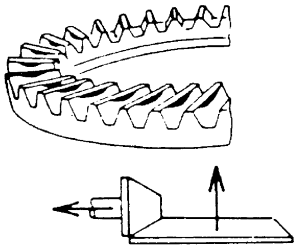
RING GEAR AND PINION GEAR PATTERN SPECIFICATION AND ADJUSTMENT

HEEL CONTACT:

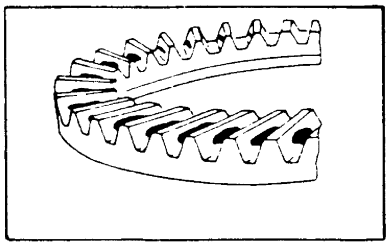


Select the shims so that the drive pinion is out nearer to the ring gear.

FACE CONTACT:

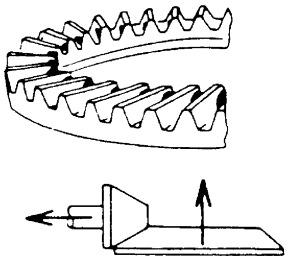


Select the shims so that the ring gear is put nearer to the drive pinion.



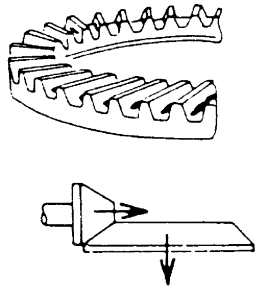
Correct pinion gear to ring gear tooth contact.

TOE CONTACT:



Select the shims so that the drive pinion is put farther from the ring gear.

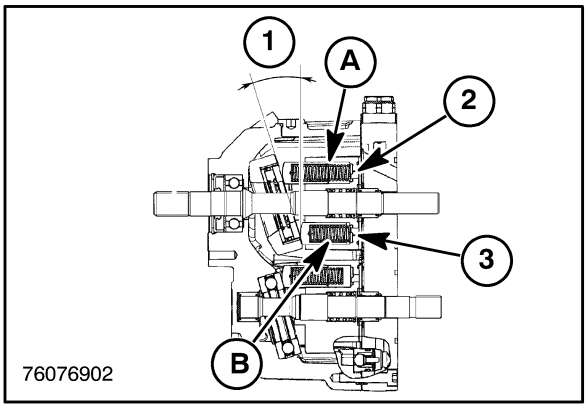
FLANK CONTACT:



Select the shims so that the ring gear is put farther from the drive pinion.

31

When the swash plate is tilted at an angle, 1, fluid in the pistons in position “A” is discharged out through the port, 3, in the port block plate, 2, as the cylinder rotates to position “B”. Maximum fluid flow is obtained when the swash plate is at maximum tilt angle.



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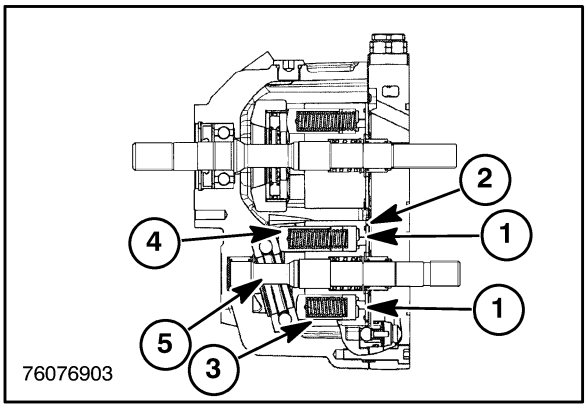
FIXED DISPLACEMENT MOTOR

Operation

Fluid flow from the piston pump enters the fixed displacement motor through one of two ports, 1, in the port block plate, 2, exerting pressure against the inside of the pistons aligned with the fluid entry port. Fluid pressure on the pistons causes the cylinder block, 3, and pistons, 4, to rotate. A drive shaft, 5, splined to the motor cylinder block drives the transmission gearbox.

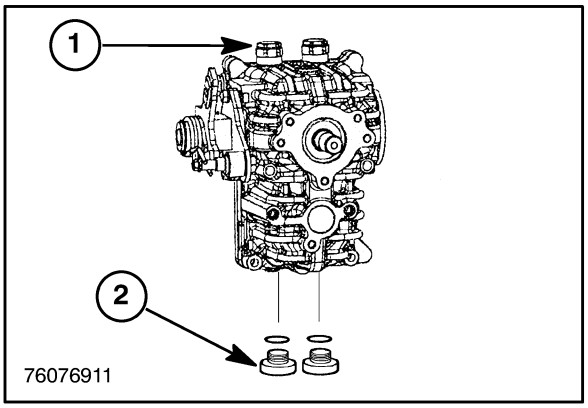


10

7. Stop the engine.
8. If the pressure reading is not at the specified value, replace the forward high pressure relief valve, 1.
9. Tighten the relief valve, 1, to 31.3 - 37.3 N·m (23.1 - 27.6 ft-lbs).

NOTE: *The forward and reverse, high pressure relief valves are not interchangeable.*

10. Remove the gauge and install the port "A" plug, 2.
11. Tighten the plug to 12.2 - 17.2 N·m (9.0 - 12.7 ft-lbs).



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Reverse Testing

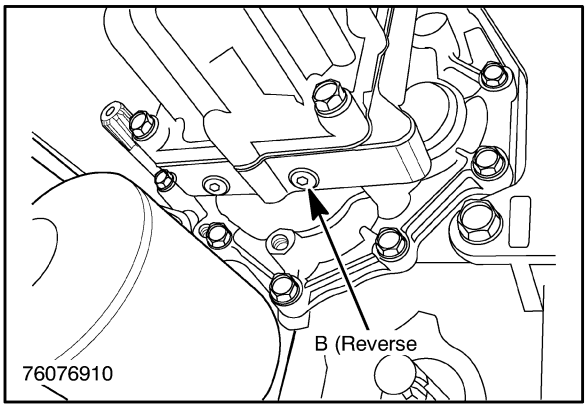
1. Remove the plug from port "B" (reverse) and install test fitting #380002885 and a 0 - 345 bar (0 - 5000 psi) gauge in the port.

NOTE: *Port "B" is used to check the high pressure relief valve for reverse travel of the HST.*

2. Start the engine and place the range control lever in the "High" range position.
3. Apply and hold the master brake pedal.
4. Depress the "Reverse" pedal 1/3 of the way down.
5. Increase the engine speed to full throttle.
6. Observe the pressure gauge. Within 2 - 3 seconds, the pressure reading should be approximately 181 - 211 bar (2574 - 3000 psi).
7. Stop the engine.
8. If the pressure reading is not at the specified value, replace the reverse high pressure relief valve, 1.
9. Tighten the relief valve, 1, to 31.3 - 37.3 N·m (23.1 - 27.6 ft-lbs).

NOTE: *The forward and reverse, high pressure relief valves are not interchangeable.*

10. Remove the gauge and install the port "B" plug, 2.
11. Tighten the plug to 12.2 - 17.2 N·m (9.0 - 12.7 ft-lbs).



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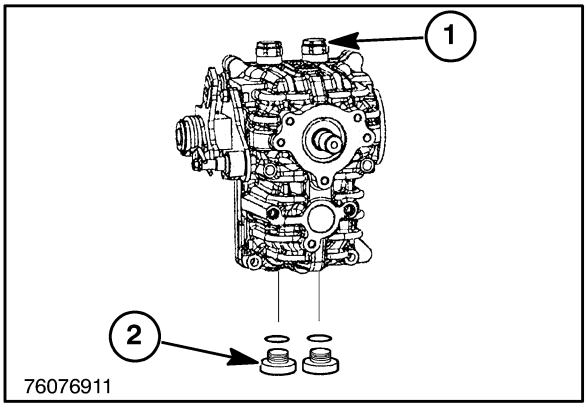

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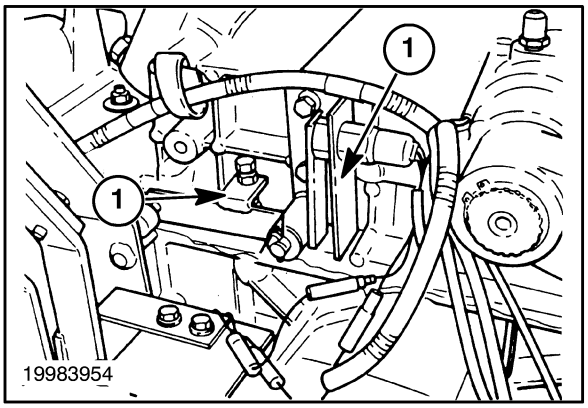
22. Install the safety switch bracket, 1, on the lift cylinder cover.



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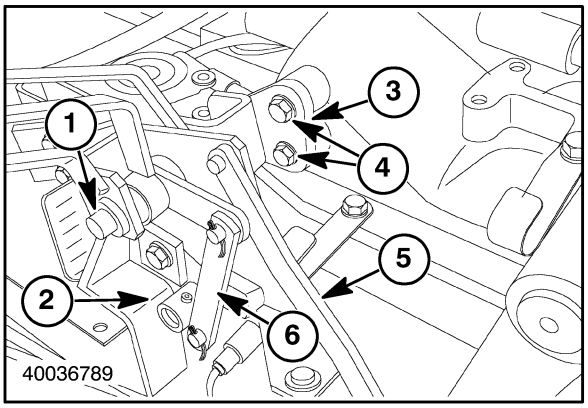
23. Carefully position the LH control levers, common pivot shaft, and mounting bracket, as a unit, against the LH side of the lift cylinder cover.
24. Engage the outer end of the control lever pivot shaft, 1, in the top of the fuel filter support bracket, 2.
25. Align the holes in the mounting bracket, 3, with the pair of tapped holes in the lift cylinder cover, and install the two M10 x 25 mounting bolts, 4.
26. Install the PTO change lever, 5, on its linkage pivot pins as shown. Install two new cotter pins through the pivots to secure the linkage.
27. Install the range gear change lever, 6, on its linkage pivot pins as shown. Install two new cotter pins through the pivots to secure the linkage.



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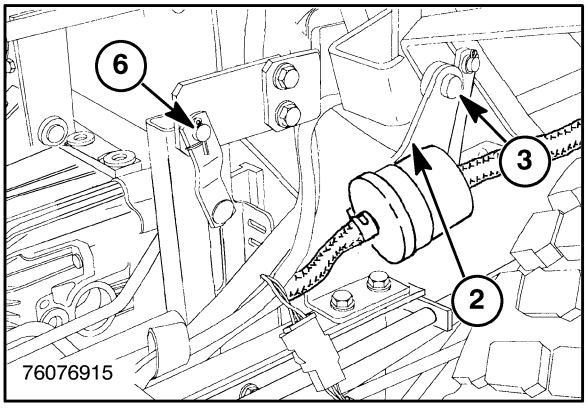
28. Engage the mower cutting-height control lever on its linkage pivot pin, 6, and install a new cotter pin through the pivot to secure the linkage on T1010 and T1030 models.



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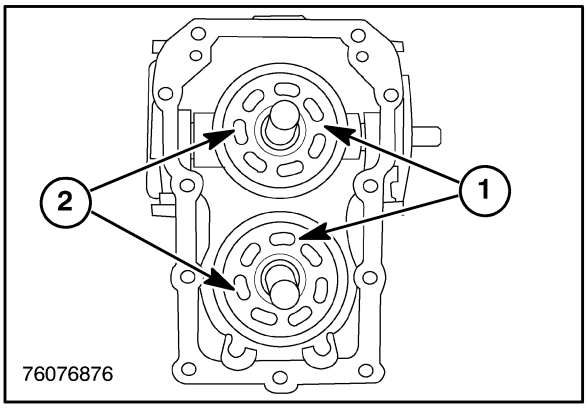
8. Inspect the cylinder blocks valve port surfaces, 1, for wear, discoloration or scoring. Any scratches between any of the ports, 2, that you can catch your finger nail in, will allow oil to channel from port to port. This channeling, will allow oil to flow from the high pressure side to the low pressure side of the cylinder block and result in a power and pressure loss of the HST unit.



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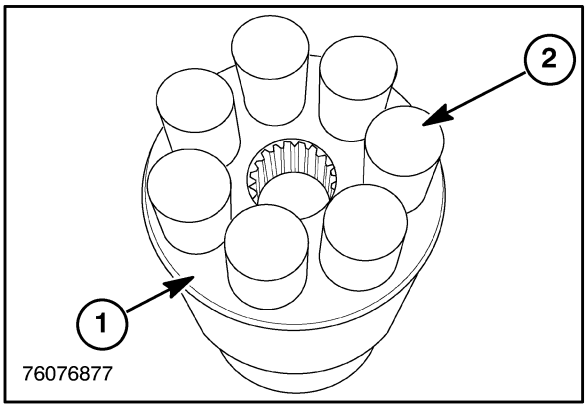
9. Inspect each of the cylinder block bores, 1, for wear, pitting, scoring, or other damage. All surfaces must be free of any defects or damage. Replace the cylinder block assembly if necessary.
10. Inspect the pistons, 2, for excessive wear, pitting, scoring, or other damage. All surfaces must be free of any defects or damage. Replace the cylinder block assembly if necessary.



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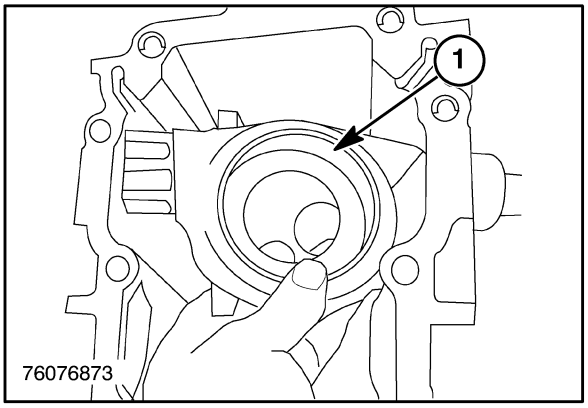
11. Inspect the swash plate, 1, for scoring, nicks, pitting, wear or other damage. Replace as necessary.



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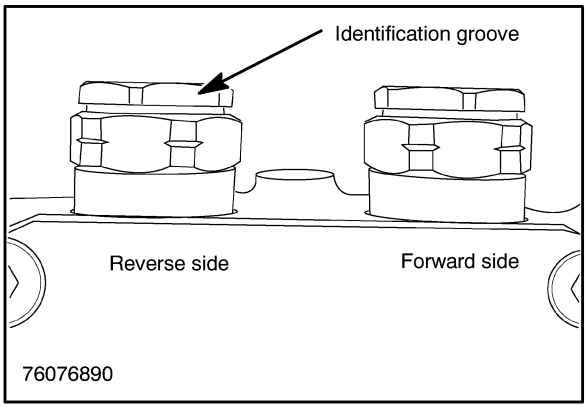
IMPORTANT: *The two relief valves are not interchangeable. The plug end of the reverse valve has an identification groove in it. The forward valve does not.*



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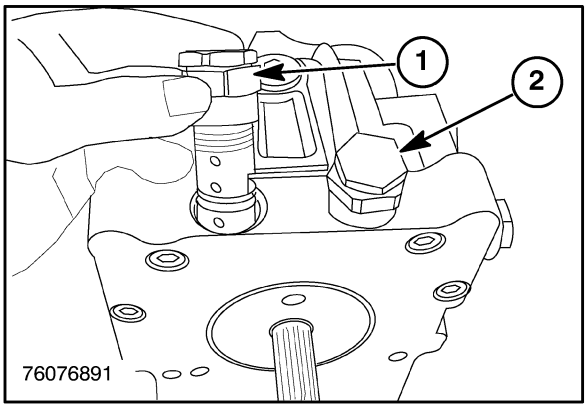
22. Install the reverse relief valve, 1, and the forward relief valve, 2, if they were removed for inspection.
23. Tighten the valves to 35 N·m (25.8 ft-lbs).



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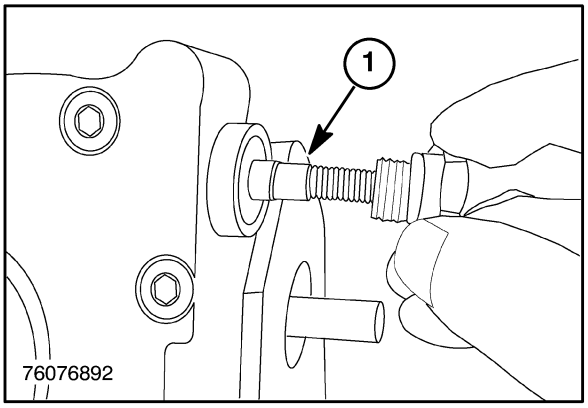
24. Install the charge relief valve, 1, in the side hole of the port block. Insert the valve, spring and plug.
25. Tighten the plug to 25 N·m (18.4 ft-lbs)



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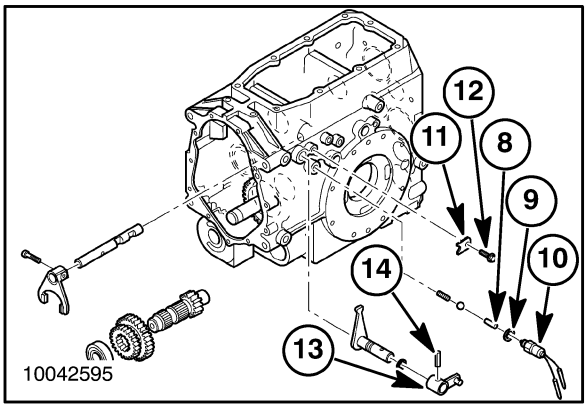
14. Install the pin, 8, into the safety switch bore in the housing.

NOTE: *The round end of the pin faces toward the shift rail.*

15. Install a new seal washer, 9, on the range gear safety switch, 10, and install the safety switch into the housing. Tighten securely.
16. Install the retaining plate, 11, and bolt, 12, to secure the shift shaft in the housing. Tighten the bolt securely.
17. Install the change lever, 13, on the shift shaft.
18. Drive the roll pin, 14, through the change lever, 13, and shift arm.



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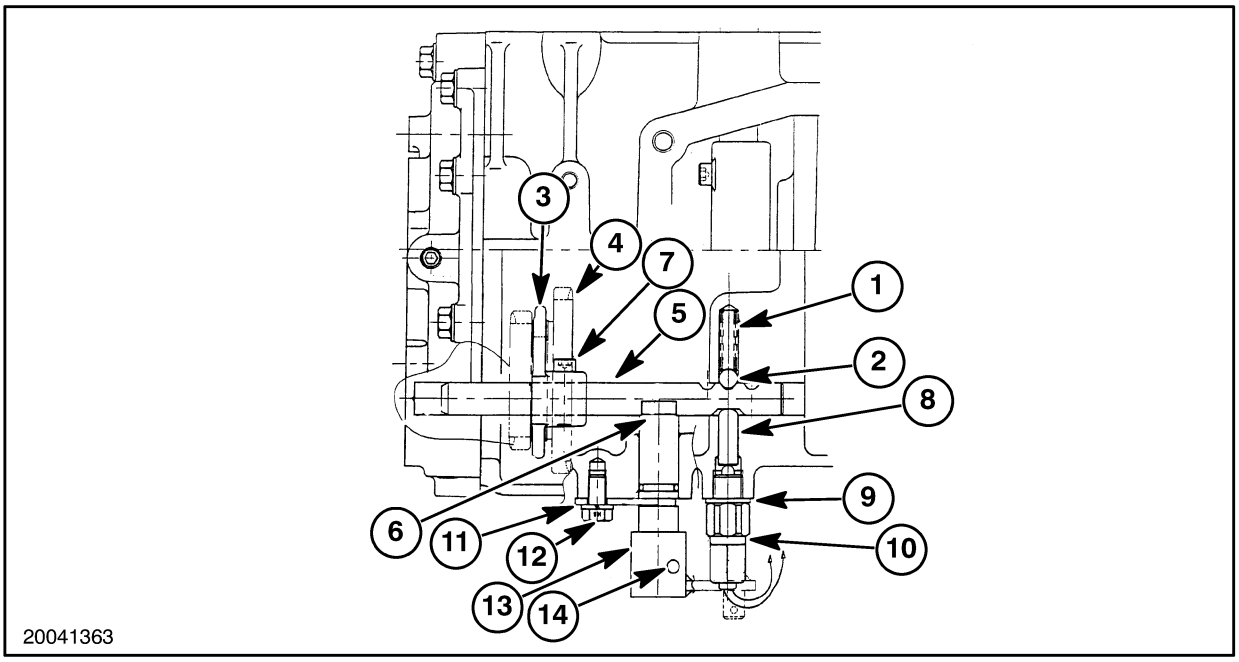

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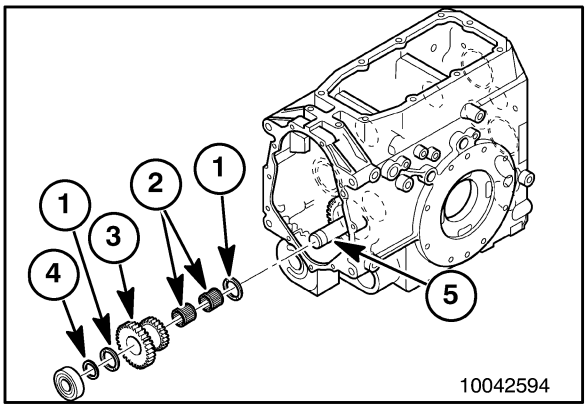
19. Install the thrust washers, 1, needle bearings, 2, counter gear (29T/20T), 3, and snap ring, 4, on the pinion shaft, 5.
20. Install the front cover onto the housing. See Section 31 - PTO, for front cover installation procedure.
21. Install the HST unit onto the front cover.
22. Attach the transmission/differential housing to the tractor. See “Attaching” in this section.



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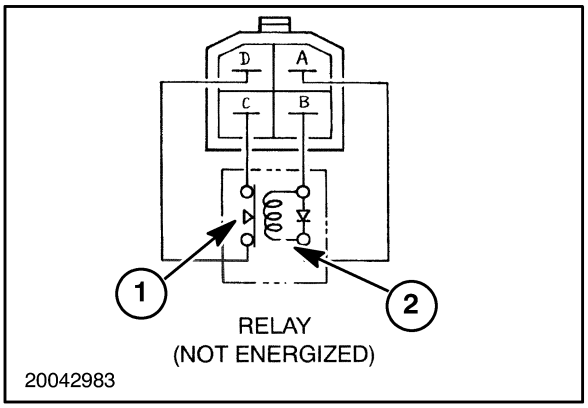
(Normally Closed Relay)

The function circuit, 1, is normally closed when current is not being supplied to the coil, 2. If a circuit with an SPST relay is energized with current on the tractor, the switch, 1, becomes open and the circuit is not completed.



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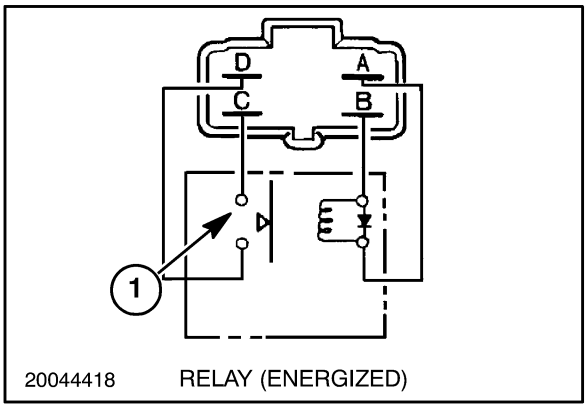

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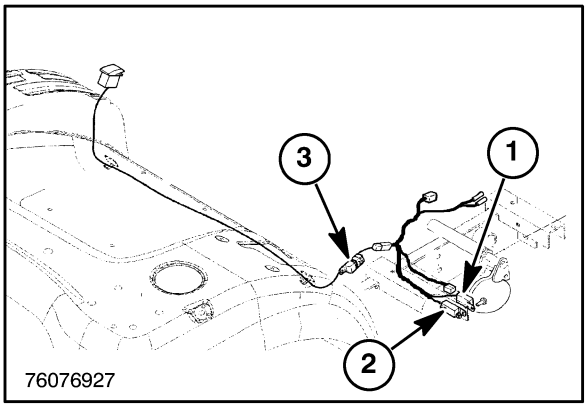
Removal (all)

1. Remove operator's platform.
2. Remove mounting bolt for cruise latch, 1, and brake, 2, relays mounted to platform support bracket.
3. Instrument panel indicator light relay, 3, is taped to cruise harness.
4. Unplug relay from cruise harness connector.



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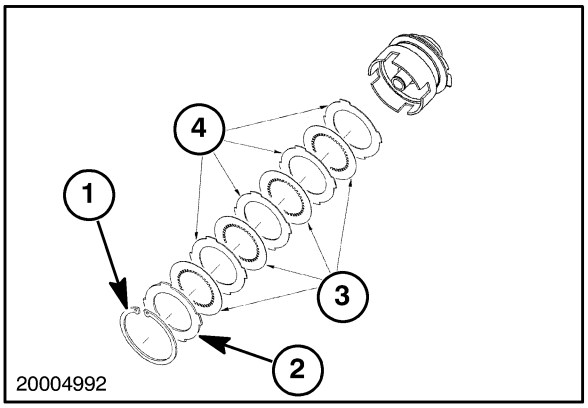
SECTION 31 - PTO

Chapter 1 - PTO

CONTENTS

Disassembly

1. Remove the retaining ring, 1, backing ring, 2, fiber clutch plates, 3, and separator plates, 4, from the clutch housing.



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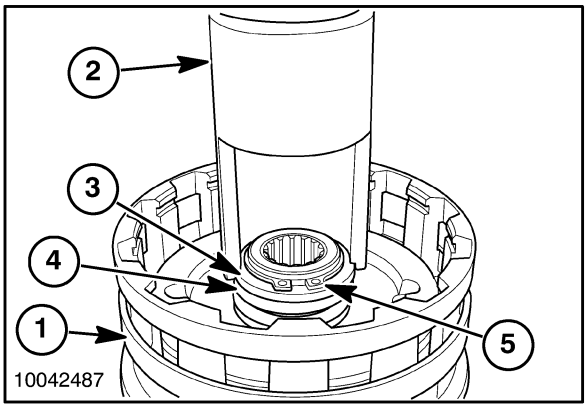
2. Place the clutch housing, 1, in a suitable press.
3. Use the special clutch press tool, 2, (NH01413) to press on the washer, 3, compressing the spring, 4.
4. Carefully remove the snap ring, 5.
5. Release the pressure on the washer slowly. Remove the clutch assembly from the press.



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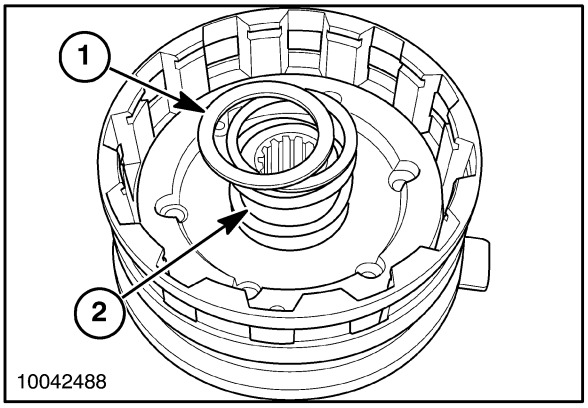
6. Remove the washer, 1, and spring, 2, from the clutch hub.



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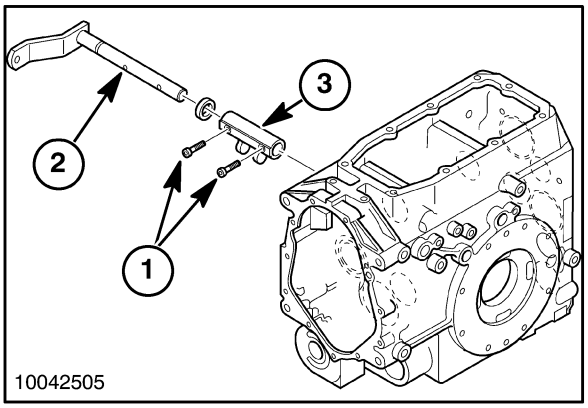
PTO CLUTCH SHAFT

Removal

IMPORTANT: *Heat must be used on the socket head bolts, 1, to soften the thread-locking compound used during assembly. Broken bolts could result from attempting removal without using heat.*

1. Use a propane torch to heat the two socket head bolts, 1.
2. Remove the two socket head bolts, 1.
3. Remove the PTO clutch shaft, 2, from the housing.
4. Remove the clutch fork, 3, from the housing.



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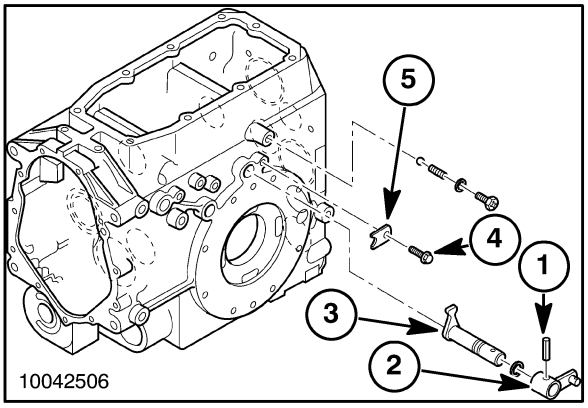
PTO CHANGE LEVER

Removal

1. Drive out the roll pin, 1, and remove the change lever, 2, from the shift arm, 3.
2. Remove the bolt, 4, and retaining plate, 5.



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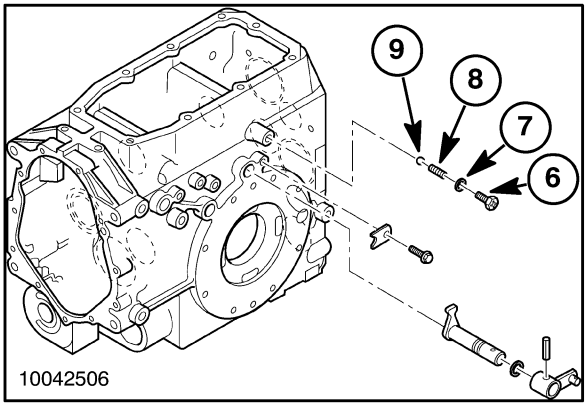
3. Remove the bolt, 6, seal washer, 7, spring, 8, and detent ball, 9, from the housing.



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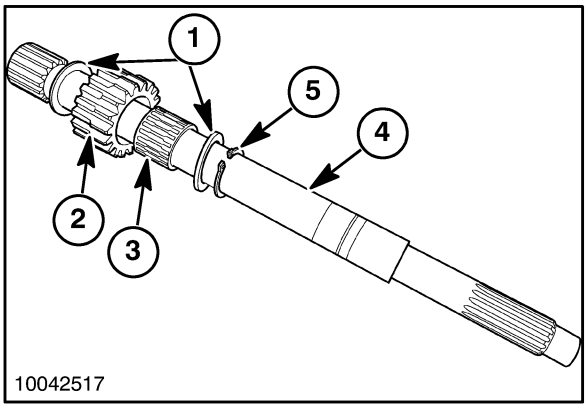
PTO SHIFT ROD AND INPUT SHAFT

Installation

IMPORTANT: *The oil grooves in the thrust washers, 1, must face the counter gear, 2, when assembled.*

1. Install the thrust washers, 1, 18T counter gear, 2, and needle bearing, 3, on the PTO input shaft, 4.
2. Secure the assembly with the snap ring, 5.



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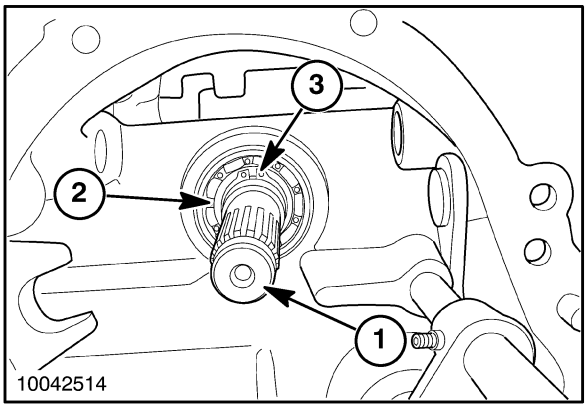
3. Install the PTO input shaft, 1, into the housing from the rear.
4. Install the front bearing, 2, onto the shaft until fully seated.
5. Secure the bearing to the shaft using the snap ring, 3.

NOTE: *Be sure both front and rear bearings are properly seated on the PTO input shaft and in the housing.*



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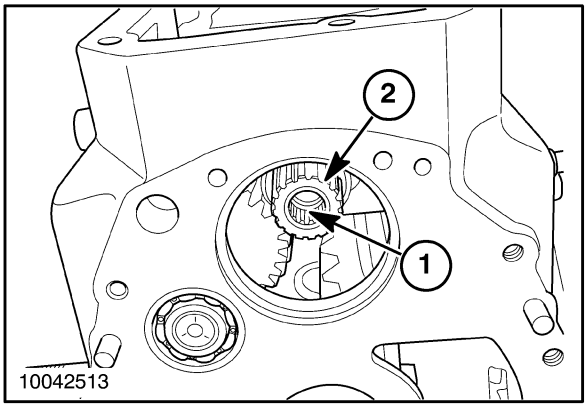
6. Lubricate and install the needle bearing, 1, in the rear of the PTO input shaft, 2.



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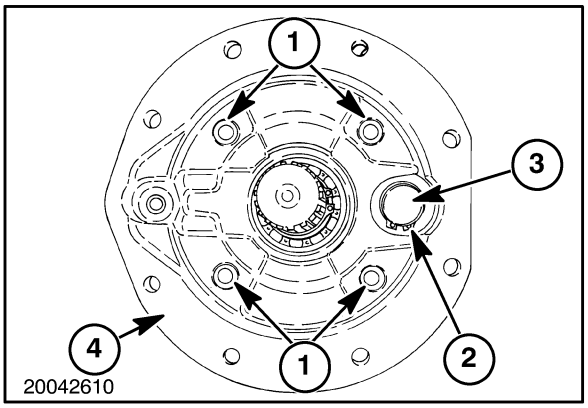
SECTION 33 - BRAKES

Chapter 1 - Brakes

CONTENTS

4. Remove the four steel balls, 1, and the retaining ring, 2, from the brake actuator shaft, 3. Remove the shaft, 3, from the axle housing, 4.



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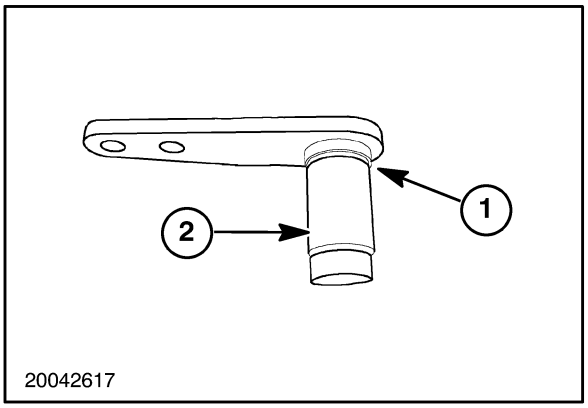
5. Remove and discard the O ring, 1, on the brake actuator shaft, 2.



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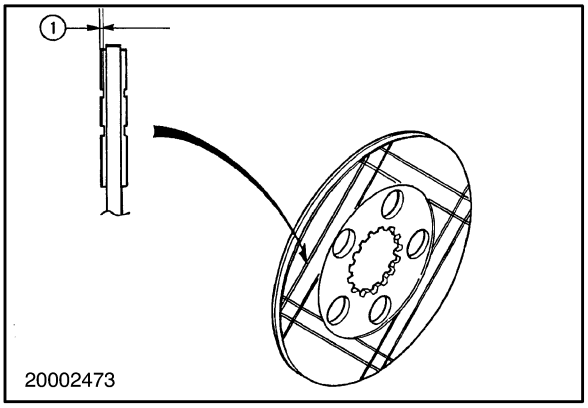
Inspection

1. Inspect the brake discs for excessive wear or damage. Use a micrometer or a digital caliper to measure the brake disc lining groove depth. Replace the brake disc if the lining groove depth is less than 0.05 mm (0.002 in.).



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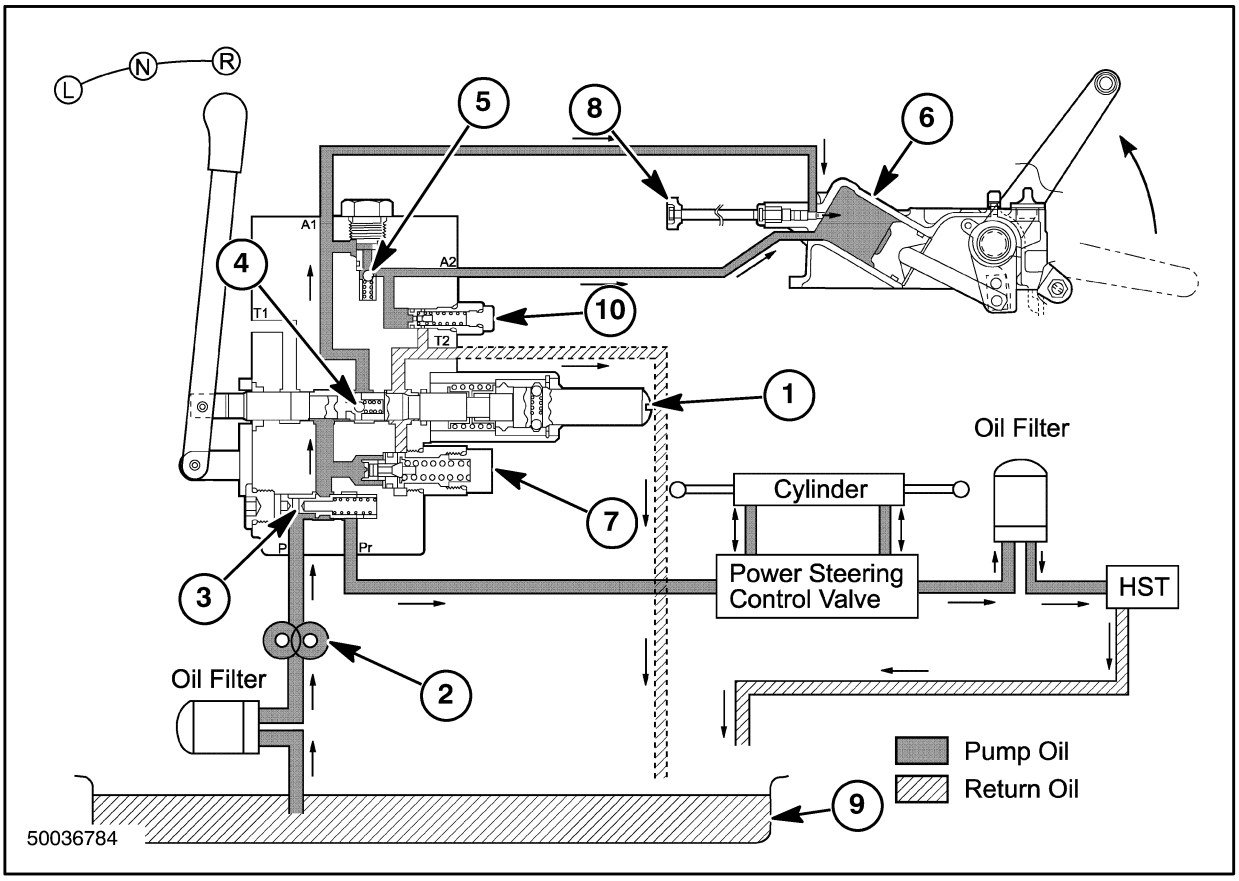


11

1. Control Valve Spool
2. Hydraulic Pump
3. Flow Priority Valve
4. Check Valve
5. Lift Check Valve
6. Hydraulic Cylinder
7. Relief Valve
8. Drop Rate Control Valve
9. Sump
10. Safety Valve

Lifting Position

When the control lever is moved to the "raise" position, the control valve spool, 1, is moved rearward. Pressurized oil from the hydraulic pump, 2, is directed into the valve body and separated by the flow priority valve, 3. The priority flow 7 L/min (1.85 gpm) is directed out the 'Pr' port to the power steering and HST circuits. The remaining oil flow is directed to the control valve spool.

Pressurized oil flows to the front of the check valve, 4. When it overcomes the static pressure in the hydraulic cylinder line (via port 'A1'), the check valve, 5, opens, allowing oil flow to the hydraulic cylinder, 6, through both ports 'A1' and 'A2', to lift the implement.

If oil pressure in the system exceeds 128 bar (1850 psi), the relief valve, 7, opens and diverts the oil to the reservoir via the second tank line ('T2').

TROUBLESHOOTING (T1110)

CONDITION	POSSIBLE CAUSE	CORRECTION
Implement fails to lift when lever is in raised position	Linkage out of adjustment	Adjust position control rod
	Relief valve setting too low	Perform system relief valve pressure test
	Faulty safety valve	Repair or replace safety valve
	O-ring failure on control valve body to cylinder housing	Repair as required
	Excessive fluid leakage past lift cylinder piston seal	Replace seal, piston, or cylinder as required
	Restricted suction filter	Clean or replace as required
	Unload valve does not close	Check unload valve operation
	Lowering valve remains open	Check lowering valve operation
Lift arms cycle up and down when lever is in neutral position	Faulty lowering valve seat	Repair or replace as required
	Faulty check valve and seat	Replace
	Leaking O-rings (lowering valve and seat, cylinder housing, unload valve plug)	Inspect and repair as required
Implement rises too slowly	Suction filter restricted	Clean or replace as required
	Pump capacity too low	Perform flow test and replace pump as required
	Excessive leakage past piston seal	Inspect cylinder and piston, repair as needed
	Faulty relief valve	Repair or replace
	Faulty safety valve	Repair or replace
Implement will not lower	Flow control valve closed	Open valve
Implement does not raise to full height	Position control rod out of adjustment	Adjust position control rod
Relief valve operates when implement is in full raise position	Position control rod out of adjustment	Adjust position control rod
Hydraulic fluid overheats	Faulty pump	Replace pump
	Restricted filter	Clean or replace

LIFT CHECK VALVE

Disassembly

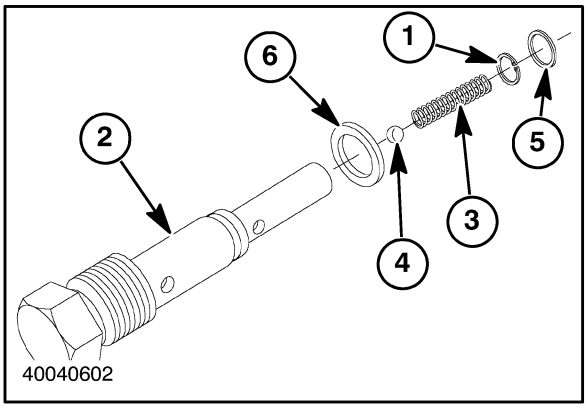
1. Use internal ring pliers to remove the internal retaining ring, 1, from the valve body, 2.
2. Remove the spring, 3, and ball, 4, from inside the valve body, 2.
3. Remove the O-ring, 5, and (larger) sealing O-ring, 6, from the valve body, 2.

Inspection

1. Thoroughly wash all components in a suitable cleaning solvent and air dry.
2. Inspect the surfaces of the valve body for scratches, burrs, or excessive wear.
3. Inspect the internal spring and ball for damage.
4. Discard both O-rings after ensuring that the correct replacements are on hand.

Assembly

1. Apply a thin coating of clean hydraulic fluid to all metal parts during assembly. Lightly lubricate all seals and O-rings with petroleum jelly.
2. Slide the ball, 4, and spring, 3, into the valve body, 2.
3. Compress the spring and install the internal retaining ring, 1, in its seating groove inside the open end of the valve body, 2.
4. Replace the (larger) sealing O-ring, 6, in its groove against the hex head of the valve body, 2.
5. Replace the smaller O-ring, 5, in its groove on the valve body, 2.



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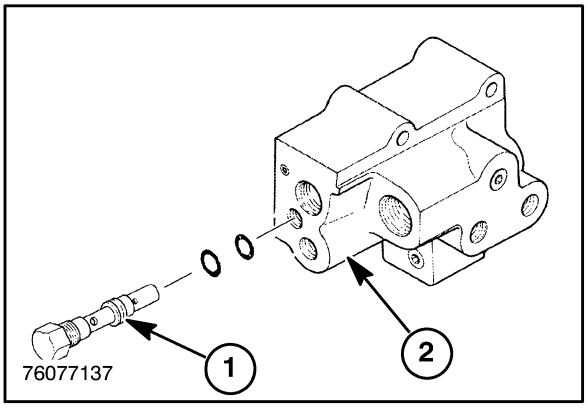
LIFT CHECK VALVE

Inspection

1. Thoroughly wash all the components in a suitable cleaning solvent and air dry.
2. Inspect the surfaces of the valve body for scratches, burrs, or excessive wear.
3. Discard both O-rings after ensuring that the correct replacements are on hand.

Assembly

1. Apply a thin coating of clean hydraulic fluid to all metal parts during assembly. Lightly lubricate all seals and O-rings with petroleum jelly.
2. Install the check valve assembly, 1, in the valve body, 2. Tighten the check valve assembly to 10–15 N·m (7.2–10.8 ft-lbs).



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SAFETY VALVE

Inspection

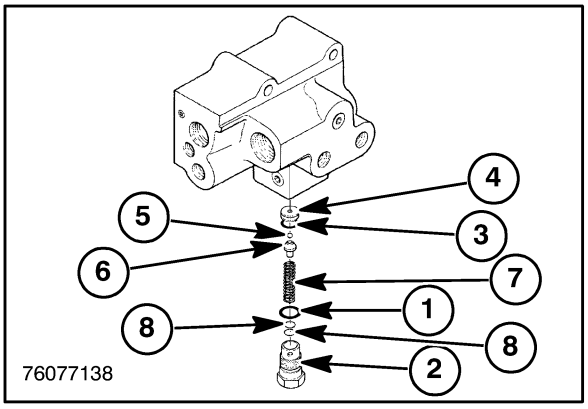
1. Thoroughly wash all components in a suitable cleaning solvent and air dry.
2. Inspect the valve body seat and steel ball for scratches, burrs, or excessive wear.
3. Inspect the internal spring for damage or distortion. Flatten or replace any distorted shims.

NOTE: *The total thickness of the shims removed earlier must be duplicated at assembly.*

4. Discard all O-rings after ensuring that the correct replacements are on hand.

Assembly

1. Apply a thin coat of clean hydraulic fluid to all metal parts during assembly. Lightly lubricate all seals and O-rings with petroleum jelly.
2. Replace the (larger) sealing O-ring, 1, in its groove of the sleeve, 2.
3. Replace the smaller O-ring, 3, in its groove on the valve seat, 4.
4. Replace the valve seat, 4, steel ball, 5, spring seat, 6, spring, 7, and shims, 8, in the sleeve, 2. Tighten the sleeve to 10–15 N·m (7.2–10.8 ft-lbs).



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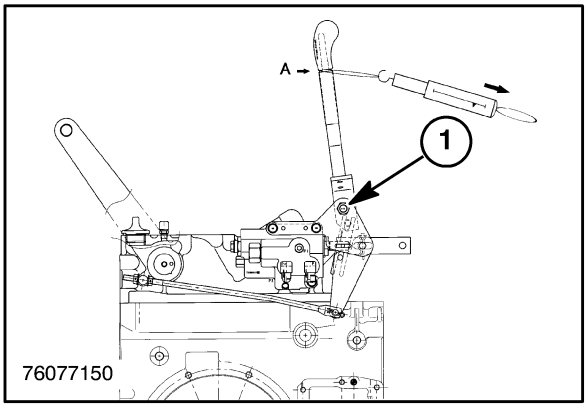
HYDRAULIC CONTROL LEVER PRELOAD

Adjustment (T1110)

1. Adjust the hydraulic control lever preload to the lowering direction with two nuts.
2. Place the lever to the highest position and set the spring balancer on the lever, and inspect the preload. Adjust the preload to 12.4–18.5 N (1.26–1.9 kg) at the position “A” by the two nuts, 1, on the pivot shaft.



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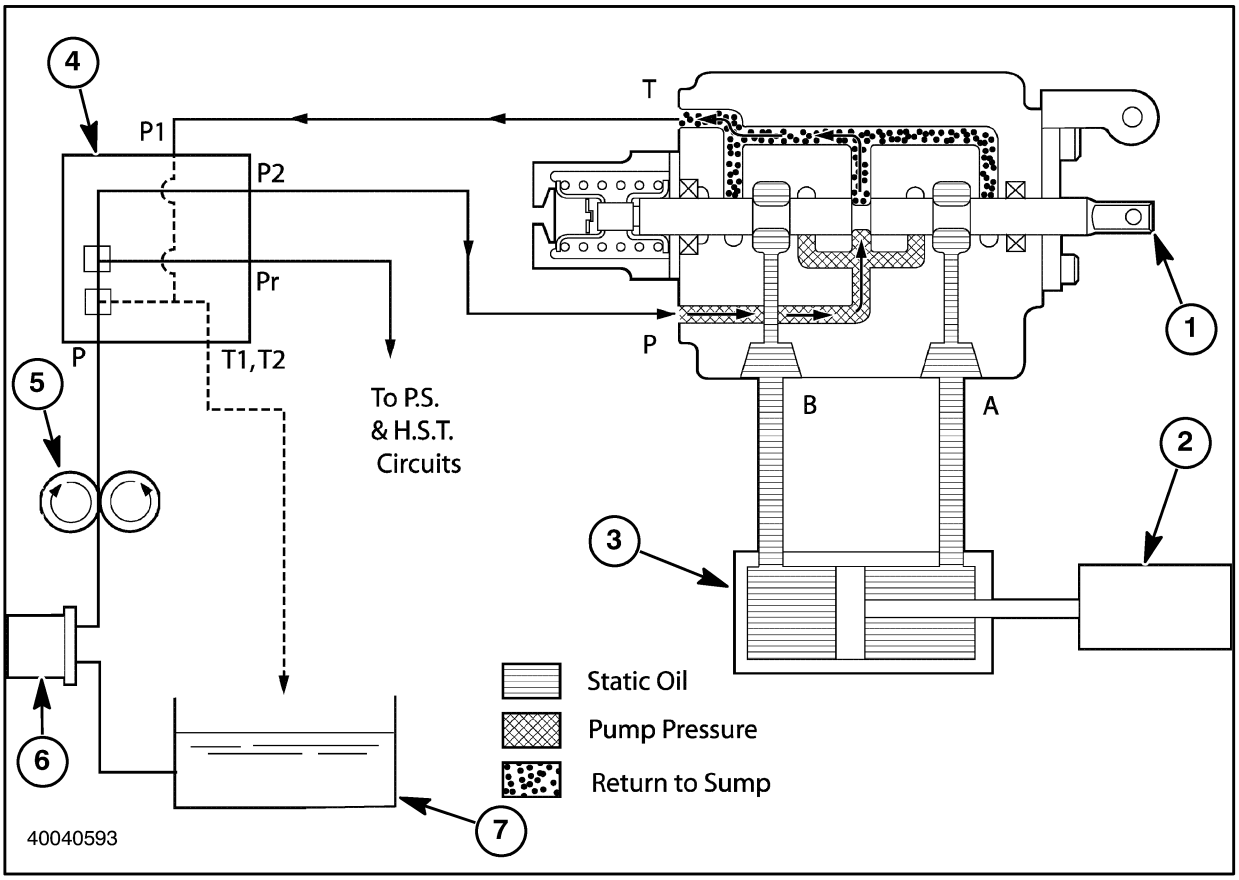
HPL LINKAGE ADJUSTMENTS (T1110)

The length of the position control rod is critical and careful adjustment must be observed for proper operation. If the control rod is adjusted too long, the control valve spool will remain in the raised position when the lift arms have reached their maximum height and the system relief valve will blow. If the control rod is too short, the control valve spool will return to neutral before the lift arms reach their full height. The position control rod should be adjusted any time the link is disconnected for service to the hydraulic system, or any time the relief valve operation is noticed while the lift arms are at the full raise position.



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1. Remote Valve Spool
2. Implement
3. Remote Cylinder
4. Main Control (HPL) Valve
5. Hydraulic Pump
6. Filter
7. Reservoir

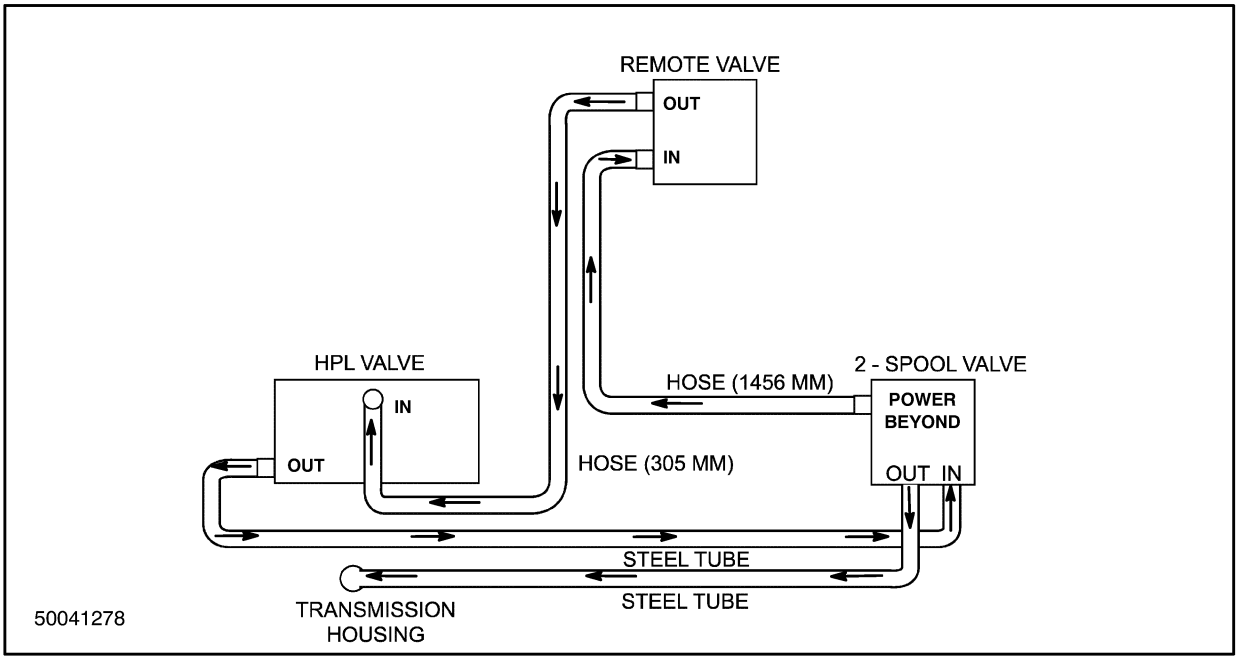
A. To Cylinder (Rod End)
B. To Cylinder (Piston End)
P. Pump Pressure
T. Return to Tank

SINGLE-SPOOL REMOTE CONTROL VALVE - OIL FLOW

Neutral Position

When the remote valve is in the "neutral" position, the valve spool, 1, is centered in the valve body. In this position, passages "A" and "B" to/from the remote cylinder are blocked by the spool, trapping the oil in the remote cylinder and holding the cylinder in a fixed position. Pump pressure oil supplied at "P" flows through the valve open center passage, leaves the remote valve through the tank port "T", and returns to sump via the "P1" port on the main control (HPL) valve.

HYDRAULIC FLUID FLOW WITH REMOTE VALVE AND 2-SPOOL VALVE COMBINATION (T1010, T1030)



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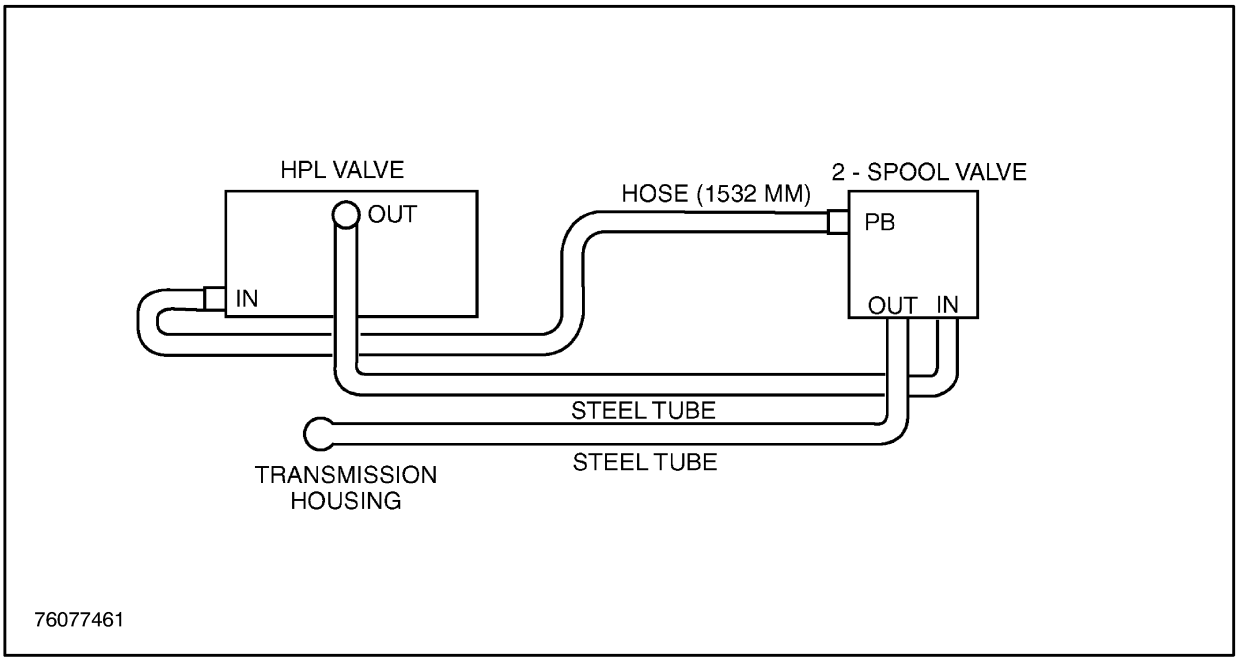
HYDRAULIC FLUID FLOW WITH 2-SPOOL VALVE (T1110)



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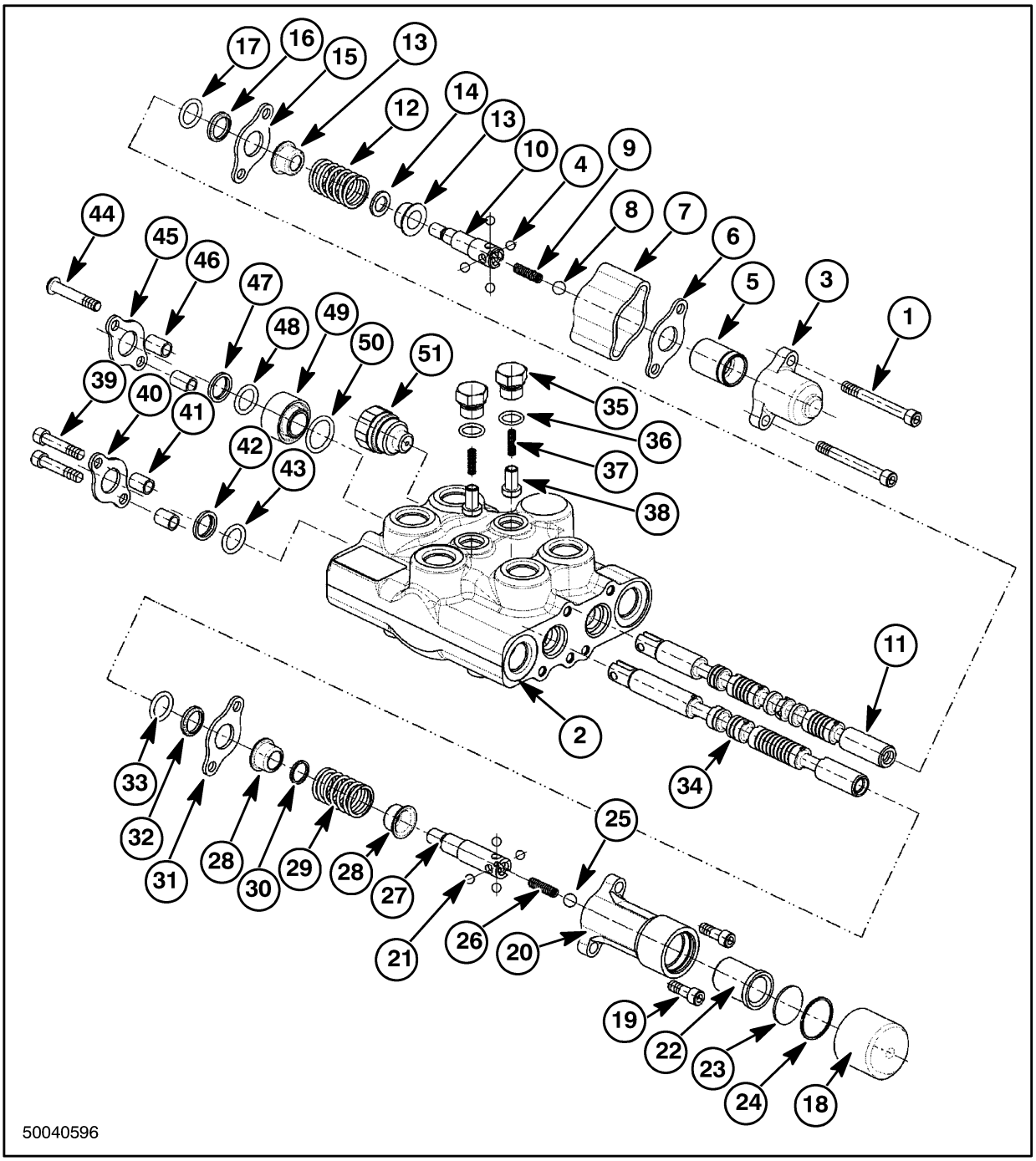
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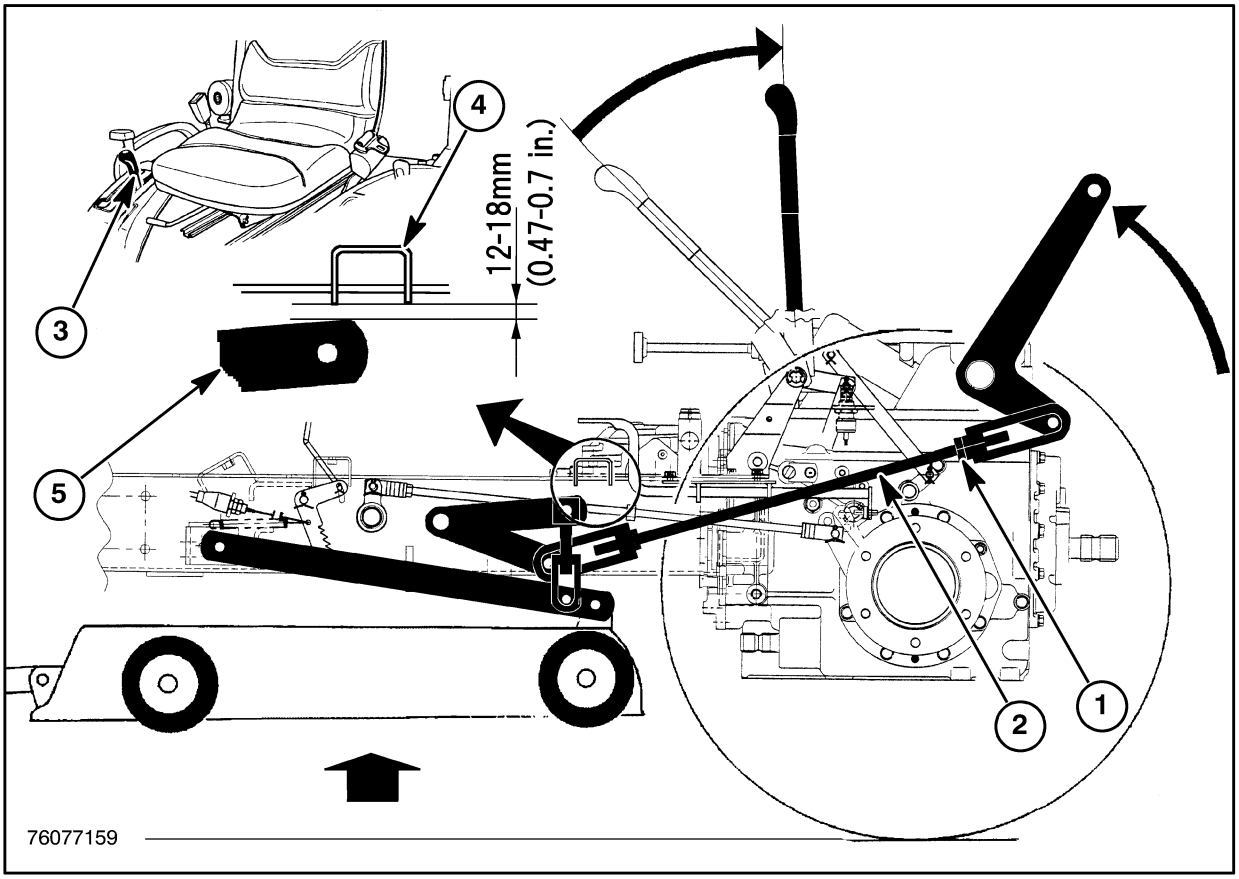
MOWER DECK LIFTING POSITION (ADJUSTMENT) (T1110)

Inspection

Inspect the clearance between the mower lift link arm, 5, and platform support, 4. The clearance should be 12-18 mm (0.47-0.7 in.) at lifting position.

Adjustment

1. Loosen the locknut, 1, on the mower lift rod, 2.
2. Start the engine and move the HPL control lever, 3, to the “raise” position.
3. Stop the engine.
4. Adjust the clearance to 12-18 mm (0.47-0.7 in.) between the lift link arm, 5, and the platform support, 4, by rotating the mower lift rod, 2.
5. Tighten the jam nut, 1.



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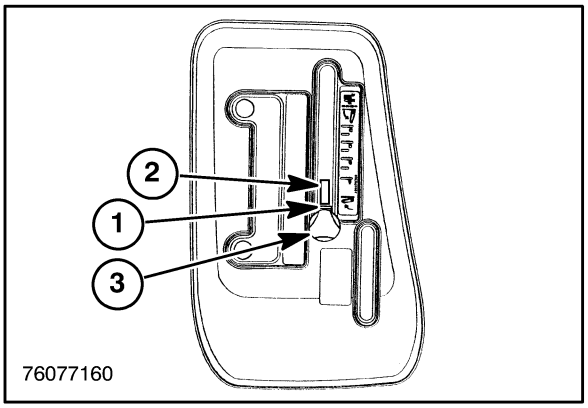
LOWERING POSITION ADJUSTMENT (T1110)

1. Slide the stopper, 1, to the lowest position.
2. To establish a cutting height, move the position control lever, 2, to the desired position.
3. Slide the stopper, 1, until it contacts the position control lever and tighten the grip, 3, securely by hand.



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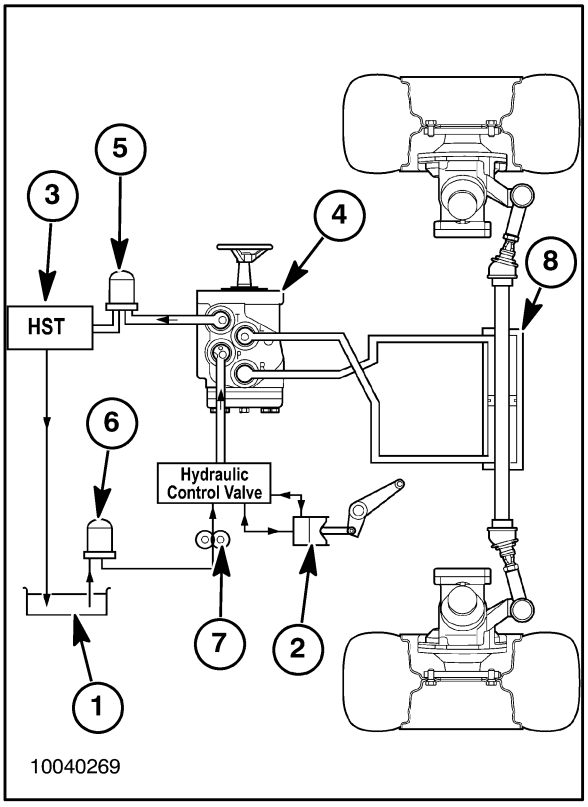
DESCRIPTION OF OPERATION

The power steering system is standard equipment. The system consists of a power steering control valve, pump, reservoir, cylinder assembly and tubing. Fluid drawn from the transmission reservoir (sump), 1, is pressurized by the oil pump, The fluid flows from the oil pump to the HPL (Hydraulic Power Lift) control valve, 2, and is directed to the power steering and HST circuit, 3, with the remaining oil flow returned to the reservoir or directed to the hydraulic cylinder via the control valve spool. Fluid flows from the power steering control valve, 4, to the HST system, 3, via the oil filter, 5, then to the feed (check) valve in the high-pressure relief valve and then returns to the sump via the low-pressure relief valve in the HST unit.



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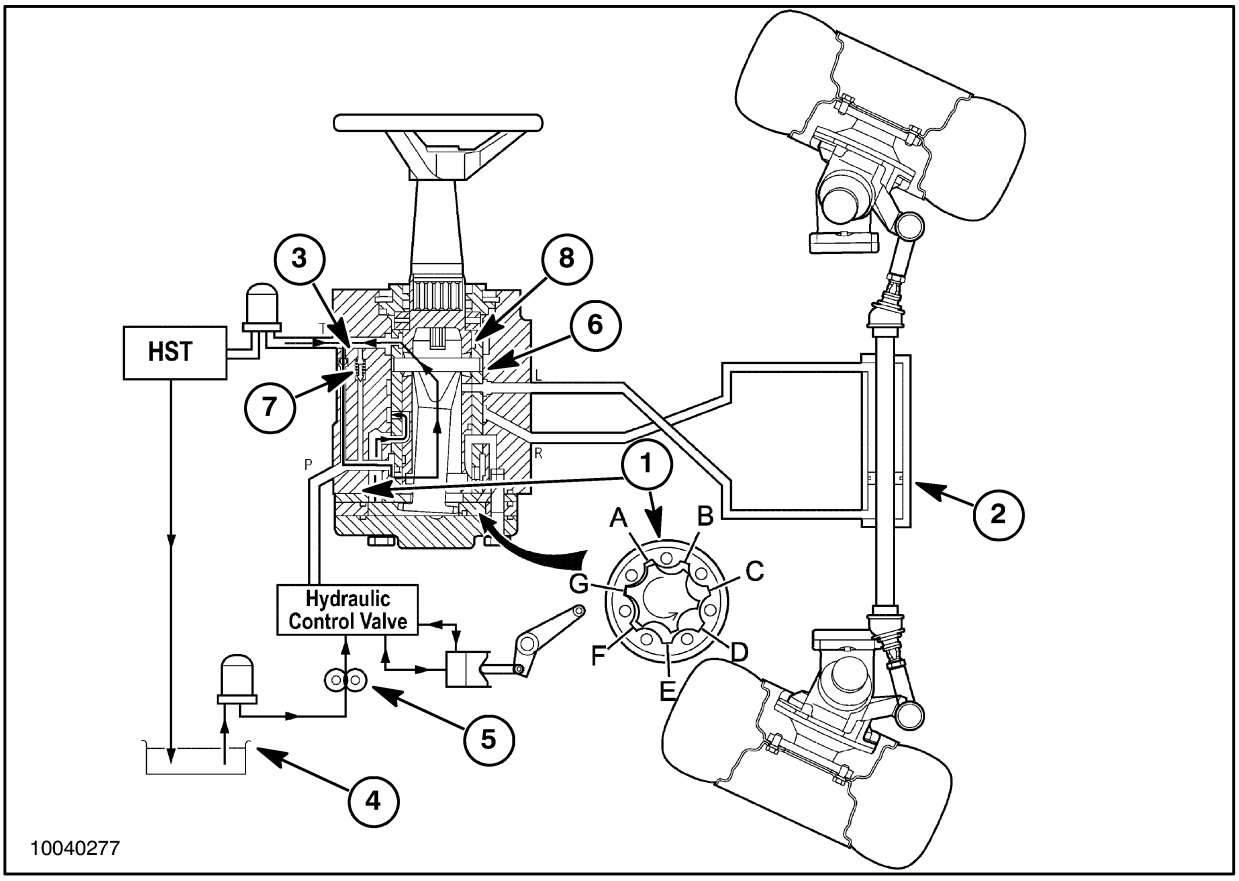
1. Sump
2. Hydraulic Cylinder (HPL)
3. HST Unit
4. Power Steering Control Valve
5. HST Oil Filter
6. Oil Filter
7. Oil Pump
8. Power Steering Cylinder



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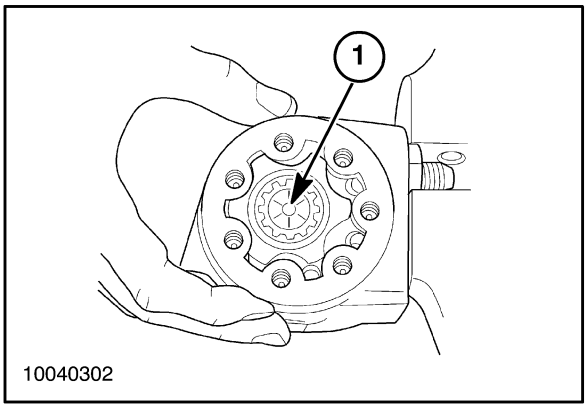
1. Gerotor Gear Pump
2. Cylinder
3. Check Valve
4. Reservoir
5. Power Steering Pump
6. Sleeve
7. Relief Valve
8. Spool

MANUAL OPERATION

In the event of power steering pump failure or engine shut down, the steering system can be operated manually. Turning the steering wheel drives the gerotor pump, 1, in the control valve assembly to force fluid to the power steering cylinder, 2, according to the direction that the steering wheel is being turned. Fluid from the opposite side of the cylinder returns to the control valve. A check valve, 3, is located in the connecting passage between ports “T” and “P”. It unseats, allowing the fluid and any reservoir fluid that may be required, to flow through the check valve and connecting passage to the “P” port passage. It supplies the fluid required for the pressure side of the system. A right turn is depicted in the figure.

16. Position the rotor and stator on the steering valve with the rotor seal side up. Visually align the holes in the spacer plate and stator while doing so. Before engaging the drive shaft splines with the rotor, align the mark, 1, on the end of the drive shaft so that if the line were extended across the rotor and stator, the line would cut across two of the valleys of the rotor.



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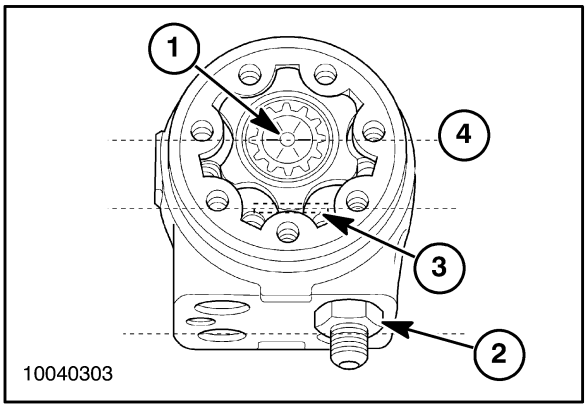
NOTE: *When the rotor is positioned correctly, the tip of one rotor lobe is resting halfway between the valleys, 1, in the stator, directly above the port face side of the steering valve, 2, and on the opposite side, a lobe is resting in the bottom of the stator valley.*

17. When the steering valve is assembled correctly, the following areas should be aligned: (a) The port face, 2, of the steering valve; (b) the pin, 3, through the spool and sleeve; (c) The line, 1, drawn on the drive shaft and (d) the middle of the two valleys, 4, in the rotor.

    If any of these areas are not aligned as instructed, the steering valve will not operate properly.



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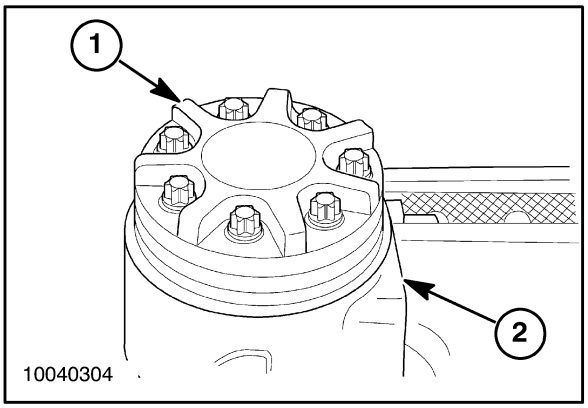
18. Using a new O-ring, position the end cap, 1, on the steering valve, 2, aligning its bolt holes with those on the stator. Install the seven end cap retainer bolts finger tight.



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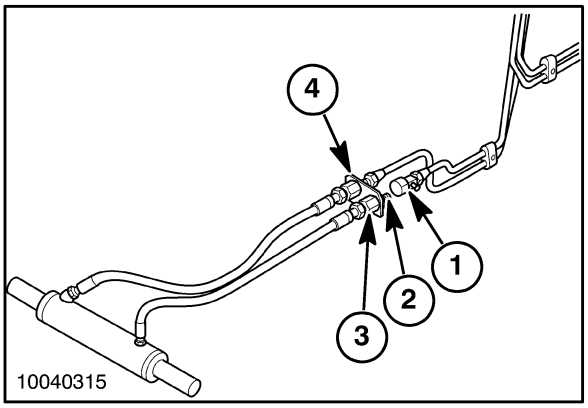
PRESSURE TESTING

PUMP, STEERING VALVE AND RELIEF VALVE

Testing

1. With the tractor engine stopped, disconnect one of the hydraulic lines, 1, that run to the steering cylinder. Access to these lines are from the left side of the tractor, and behind the side panel below the cowl. For best access, remove the bulkhead connector nut, 2, and remove the bulkhead fitting, 3, from its mounting bracket, 4, to attach the test fittings and pressure gauge.



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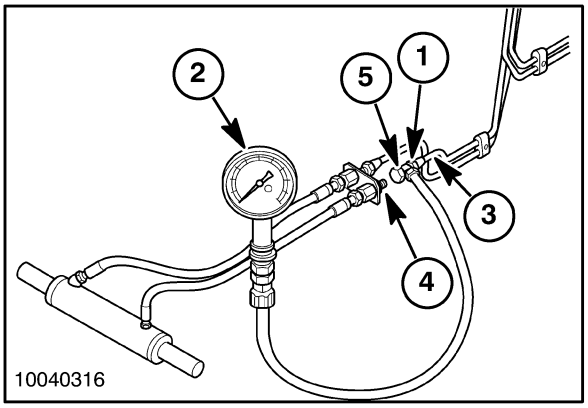
2. Connect a tee fitting, FNH11451, 1, and a 0 - 3000 psi pressure gauge, 2, to the end of the line from the steering control valve, 3, and cap the line to the steering cylinder with cap, 4, FNH00010.
3. Install a male end cap, 5, FNH0009, into the open end of the tee.
4. Start the tractor engine, and set engine speed to 3000 rpm. Observe the pressure gauge. It should indicate a 0 psi reading.
5. Turn the steering wheel so the line that the gauge is connected to receives steering pump fluid pressure intended for the steering cylinder. For example, if the gauge is connected to the left side of the cylinder, as viewed from the operator's seat, turn the wheel to the right. Observe the gauge and the following:



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Test Results

1. If the pressure gauge reading rises before the steering wheel is turned, it indicates that the steering valve is not functional and must be disassembled and inspected.
2. If the pressure gauge reading is near the relief valve setting of 95 - 100 bar (1377 - 1450 psi), when the steering wheel is turned, the steering valve relief valve is working properly.
3. If the pressure gauge reading is below the relief valve setting, it may indicate that the relief valve is not working properly, or relief setting is not correct.
4. Stop the tractor engine.
5. If relief valve setting is incorrect refer to adjustment procedure on page 33.

TRACTOR WEIGHTING

For sufficient traction and maximum performance in heavy draft operations, and to counterbalance rear-mounted equipment, weight should be added to the tractor in the form of liquid ballast, cast iron weights, or a combination of both. Only enough weight should be added to provide good traction and stability. Adding more weight than is needed results in unnecessary soil compaction, increased rolling resistance, and higher fuel consumption.

NOTE: *When adding weight to the tractor, tire pressures may need to be increased. Refer to the Tire Inflation Pressure chart found in this manual.*

WEIGHTING FOR STABILITY

Front end ballast may be required for stability and steering control when weight is transferred from the front wheels to the rear wheels as an implement is raised by the tractor three-point hitch.

As a general guide:

Ballast the tractor (less implement) so that approximately one-third of the tractor weight is on the front wheels. For optimum traction, tractors equipped with front-wheel drive should be ballasted so that 40-45% of machine weight is on the front wheels.

When a mounted implement is raised to the transport position, the front wheel reaction should be at least 20% of tractor weight.

Add additional front end ballast as required for stability during operation and transport. Tractor front end ballast may not always maintain satisfactory stability if the tractor is operated at high speed on rough terrain. Reduce tractor speed and exercise caution under these conditions.

When using front-mounted equipment, add weight to the rear axle of the tractor to maintain good traction and stability. Front-mounted equipment varies in weight. Refer to equipment manual for ballasting.

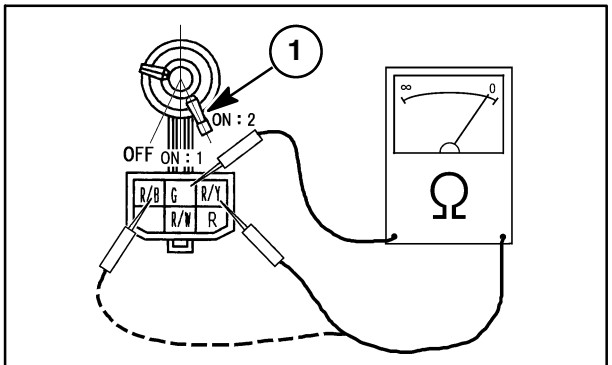
WEIGHTING LIMITATIONS

The weighting limitations that follow are limitations only. They do not imply that the tractor should be weighted to attain the weights given. Use only enough weight to obtain good performance.

19. **Taillights** – Located on the rear fenders of the tractor; provides warning to rearward motorists during transport.
20. **Hazard Lights** – Located on both sides of the tractor roll bar; these amber-colored lights provide warning during transportation and emergency.
21. **Seat Safety Switch** – Built into the operator seat; controls the ground path for the control circuit of the seat safety switch timer. When the operator leaves the seat, the seat safety switch timer deactivates after a two-second delay. The fuel shutoff relay then stops the engine. The tractor will continue to run with the seat unoccupied, as long as the parking brake is applied, the PTO is disengaged, and the transmission range is in neutral.
22. **Transmission Range Safety Switch** – Located on the transmission range linkage behind the left rear fender. The Transmission Range Safety Switch is part of the START and Safe Operation circuits. The tractor will not start unless the Transmission Range Safety Switch is closed (range shifted into a NEUTRAL position). The tractor will continue to run with the operator out of the seat, provided the parking brake is applied, the transmission is in a neutral position and the PTO is in the "OFF" position (control lever pushed down).
23. **PTO Safety Start Switch** – Located under the right fender and allows the tractor to start with the range gear and PTO disengaged, when the brake is engaged.
24. **Park Brake Safety Switch** – Located on the park brake linkage found under the right-side floor panel. The Park Brake Safety Switch is part of the START and Safe Operation circuits. The tractor will start with the operator out of the operator seat, providing the park brake is applied, the transmission is in a neutral position and the PTO is in the "OFF" position (control lever pushed down).
25. **Accessory Socket** – Located under the left side of driver seat; current flows from fuse block with key switch.
26. **Fuel Pump** – Located under the steering column in the dashboard; controls the fuel delivery to fuel filter and injection pump.
27. **Rear PTO Safety Switch** – Located on the left side of the transmission; engine will run when the range gear is in the neutral position, parking brake engaged and PTO change lever is in the rear PTO engaged position.
28. **Safety Controller** – Located on the firewall box, the controller, controls the safety start system, glow plug, park brake, PTO indicator lights, fuel shutoff solenoid and the safety alarm.
29. **Safety Alarm (Buzzer)** – Located under the dashboard cowling, on left side of mainframe. Buzzer alarms when an unsafe operation occurs, warning the operator.

Testing

1. Move the headlights lever, 1, to the first position for illumination of the instrument panel and tail lamps. Using an ohmmeter, connect test leads to the R/Y and G terminals. Observe the ohmmeter reading. There will be little or no resistance indicating continuity in the switch. If there is high resistance, the switch is defective and must be replaced.
2. Move the headlights lever to the second position.
3. Using an ohmmeter, connect the test leads to R/Y, R/B and G terminals and observe the ohmmeter reading. There will be little or no resistance indicating continuity in the switch. If there is high resistance, the switch is defective and must be replaced.
4. Move the work lights switch lever, 2, to the “ON” position.
5. Using an ohmmeter connect test leads to the R and R/W terminals and observe the ohmmeter reading. There will be little or no resistance indicating continuity in the switch. If there is high resistance, the switch is defective and must be replaced.



40040372 Switch Position ON : 2

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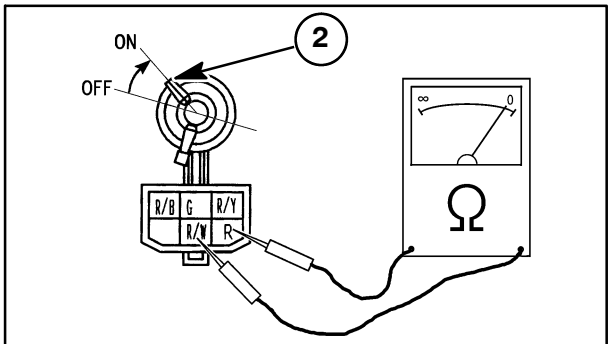

40040373 Work-lamp Switch “ON” Position

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Installation

1. Insert the switch in the dash panel, pushing it in until the tabs lock it in place.
2. Reconnect the wiring connectors and tachometer shaft to the dashboard.
3. Reinstall the dashboard with the hardware removed earlier.
4. Reinstall the steering wheel.
5. Connect the negative (-) battery cable to the battery.

Installation

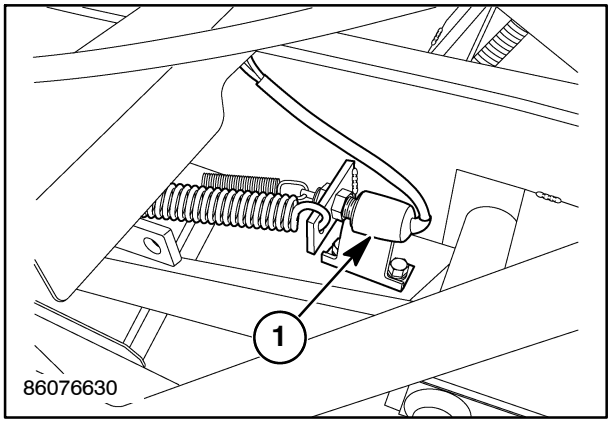
1. Install the park brake safety switch by using the adjusting nut.
2. Connect the spring. Connect the two switch leads to the tractor wire harness.
3. Connect the negative (-) battery cable to the negative (-) battery terminal.

Adjustment

With the brake pedal at “FULL” travel, adjust the switch with jam nuts so plunger is fully pulled out in the “ON” position. Tighten jam nuts to secure switch at this position.

HST CRUISE BRAKE RELEASE SWITCH (OPTIONAL)

The HST cruise brake release switch, 1, is a single pole, pull out plunger – type switch, located on the right side of the tractor, underneath the operator’s platform. The brake pedal and switch are connected by a spring and the switch is located in front of the pedal pivot point on the frame. When the brake pedal is depressed, the switch contacts close, sending current to the cruise brake relay, 2 (fig. 44).



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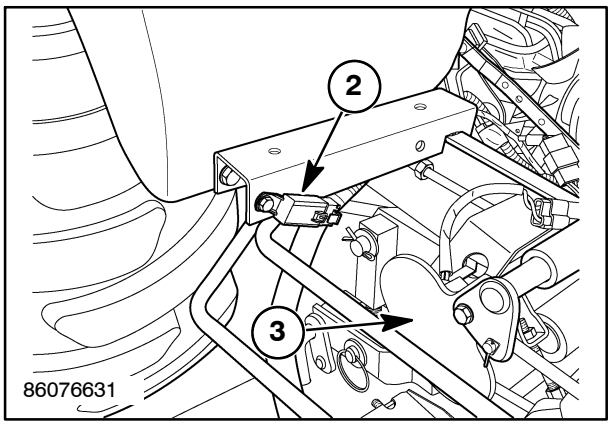
The cruise brake relay, 2, is normally closed when no current is being supplied. When the relay is energized with current, the switch becomes open and the HST cruise control magnet, 3, becomes disabled.



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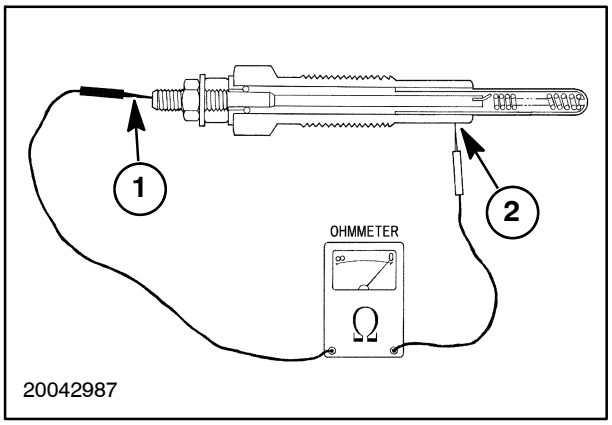
Testing

1. Clean any carbon from the sheath end of the glow plug.

NOTE: *Do not test resistance using the glow plug sheath.*

2. Using an ohmmeter, touch one test probe to the glow plug electrode, 1. Touch the other test probe to the glow plug body, 2.
3. Observe the ohmmeter. A resistance reading of 1.0 ohm maximum is normal for the glow plug. If the resistance is too high, the glow plug is defective and must be replaced.



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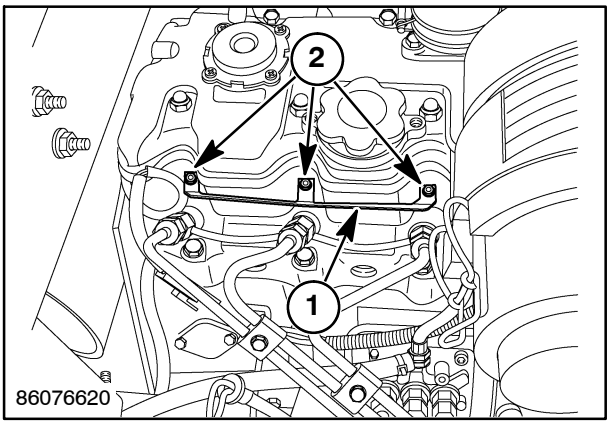
Installation

1. Thread the glow plugs into the engine cylinder head. Torque each glow plug to 15–20 N·m (11-15 ft-lbs).
2. Install the electrode bar, 1, and the washers onto the glow plugs. Secure the bar with the three nuts, 2.
3. Connect the negative (–) battery cable to the battery.



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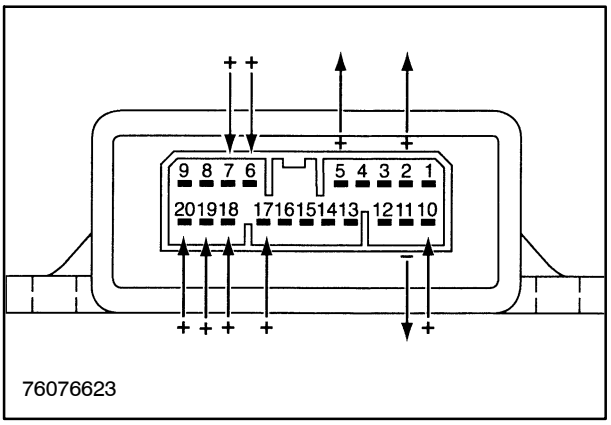
TESTING SAFETY START CIRCUIT

Using a 12 volt power supply and a volt meter test output current at indicated terminals.

Operator NOT in Seat

Input (+)	Terminal #s 6, 7, 10, 17, 18, 19, 20
Ground (-)	Terminal #s 11
Output (+)	Terminal #s 2, 5



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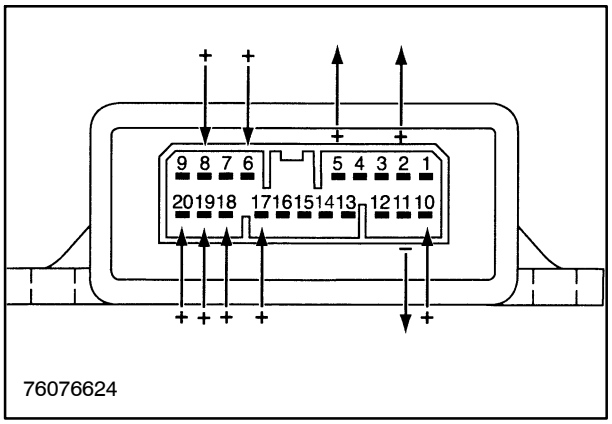
Operator in Seat

Input (+)	Terminal #s 8, 10, 17, 18, 19 ,20
Ground (-)	Terminal #s 11
Output (+)	Terminal #s 2, 5



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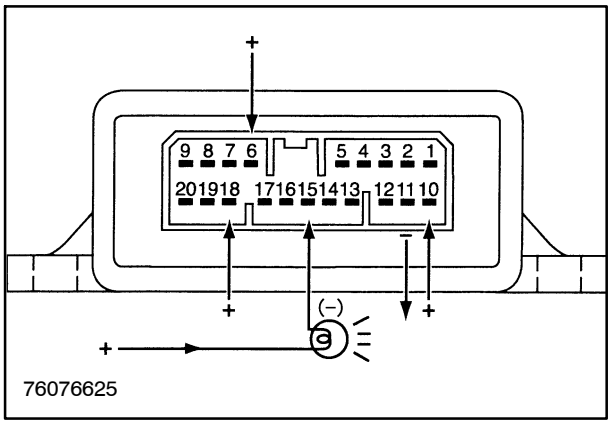
TESTING GLOW PLUG INDICATOR LIGHT CIRCUIT

This test will simulate the glow plug indicator lights circuit being activated for 4-5 seconds with key switch in the “HEAT” position.

Key Switch in “HEAT” Position

Input (+)	Terminal #s 6, 10, 18,
Ground (-)	Terminal #s 11
Input (-)	Terminal #s 15

This test will simulate the glow plug indicator lights circuit being activated with key switch in the “START” position.



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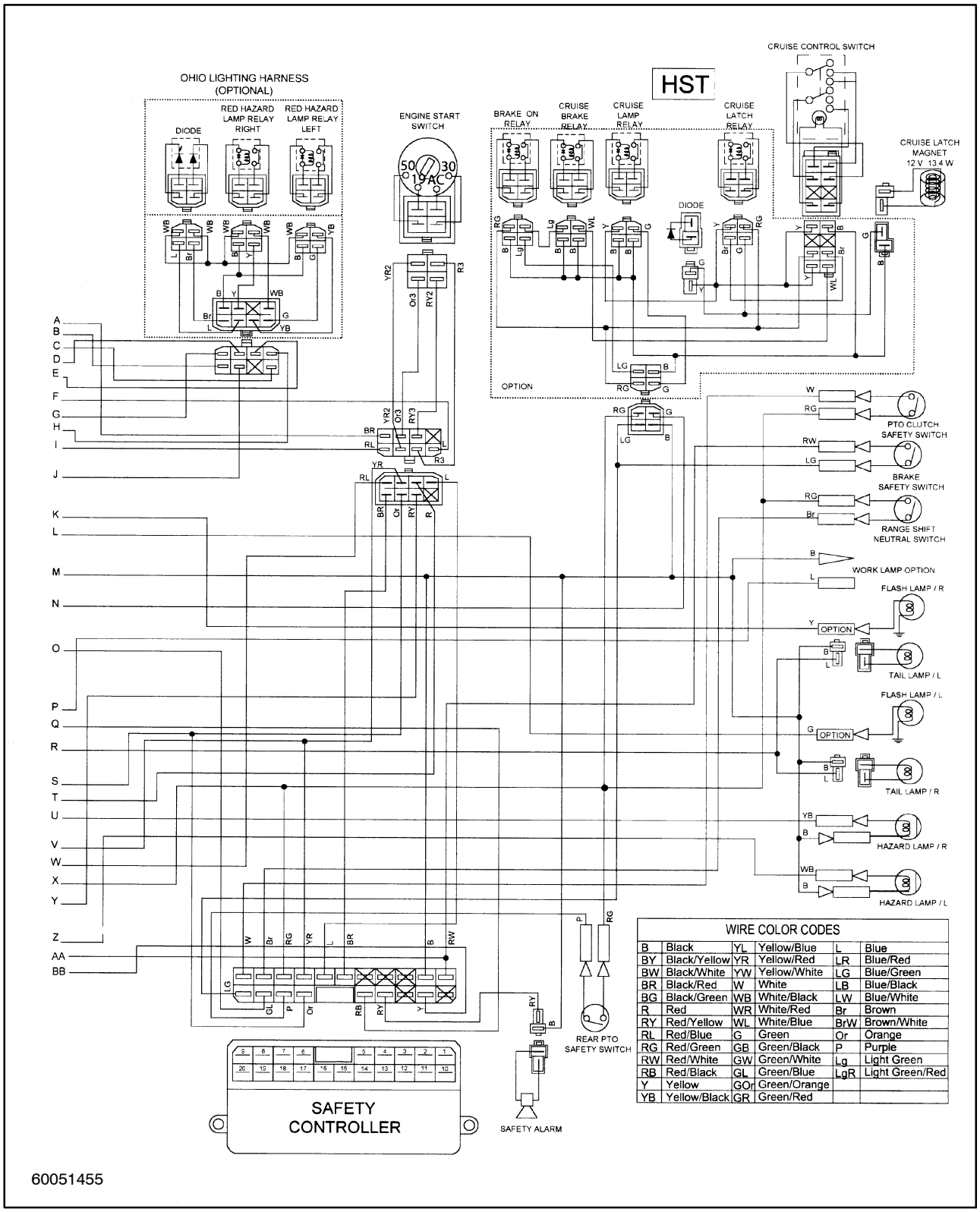
COMPLETE CIRCUIT DIAGRAM - T1010, T1030, T1110



WIRE COLOR CODES					
B	Black	YL	Yellow/Blue	L	Blue
BY	Black/Yellow	YR	Yellow/Red	LR	Blue/Red
BW	Black/White	YW	Yellow/White	LG	Blue/Green
BR	Black/Red	W	White	LB	Blue/Black
BG	Black/Green	WB	White/Black	LW	Blue/White
R	Red	WR	White/Red	Br	Brown
RY	Red/Yellow	WL	White/Blue	BrW	Brown/White
RL	Red/Blue	G	Green	Or	Orange
RG	Red/Green	GB	Green/Black	P	Purple
RW	Red/White	GW	Green/White	Lg	Light Green
RB	Red/Black	GL	Green/Blue	LgR	Light Green/Red
Y	Yellow	GOr	Green/Orange		
YB	Yellow/Black	GR	Green/Red		

SAFE OPERATION CIRCUIT (OPERATOR PRESENT) T1010, T1030, T1110

The following explains the safety switch and safety controller functions for current flow. When the operator is seated on the tractor and the key switch is placed in the “AC/RUN” position.

1. Current flows from the positive (+) battery terminal, through the positive (+) battery cable to the starter.
2. From the starter, current flows through the 40-amp fuse to reach terminal “30” of the key switch.
3. Current is supplied to the 5-amp fuse of the fuse block, the 5-amp fuse supplies current to terminal # 10 of the safety controller.
4. When the key switch is in the “AC/RUN” position, current crosses from terminal “30” to the “AC terminal.

Key Switch Terminal “AC”

1. Current travels from the “AC” terminal of the key switch to reach the 25 amp fuse, within the fuse block The 25 amp fuse supplies current to:
   - Seat Safety Switch
   - Electric Fuel Transfer Pump
   - Terminal #18 of Safety Controller

Safety Switches Functions

1. When the operator is on the seat, the safety switch close, sending current to terminal #8 of the safety controller.

Ground Circuits

1. Ground source is provided by the steering column ground terminal to:
   - Terminal #11 of the safety controller

Safety Controller Functions

1. Input current is supplied to terminals:
   - 8, 10, 18
2. Ground source supplied to terminal:
   - 11
3. When current and ground source is supplied the safety controller is activated, sending output current from terminal:
   - Terminal 5, to fuel shutoff solenoid
4. Terminal #5 sends current to the fuel shutoff solenoid, this allows the solenoid to remain energized, with the solenoid energized, the solenoid plunger retracts to permit the fuel injection pump to deliver fuel to the injectors allowing the engine to remain operating.

TROUBLESHOOTING SAFE OPERATION CIRCUIT (OPERATOR PRESENT)		
CONDITION	**POSSIBLE CAUSE**	**REMEDY**
Engine does not continue to run while operator is seated	Defective seat safety switch	Test seat safety switch and replace as necessary
	Defective safety controller	Test controller and replace as necessary
	Malfunctioning fuel shutoff solenoid	Test fuel shutoff solenoid and replace as necessary
	Blown 25-amp fuse	Inspect fuse and replace as necessary
	Open wiring in safe operation circuit	Check for loose connectors, grounds, and wiring damage

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ENGINE OIL PRESSURE CIRCUIT (ALL TRACTORS)

1. Current flow starts at the battery positive (+) terminal and is transferred to the starter battery terminal by the positive (+) battery cable.
2. From the starter, current flows to the 40-amp main slow blow fuse. The slow blow fuse supplies current to terminal 30 on the engine start switch.
3. When the engine start switch is in the ON position, current is transferred from terminal 30 to the AC terminal of the engine start switch.
4. From the AC terminal of the engine start switch, current flows to the 25-amp fuse.
5. The 25-amp fuse provides current to terminal 3 of the instrument panel connector. The current illuminates the oil pressure indicator light on the instrument panel.
6. The ground circuit is completed from terminal 2 of the instrument panel connector, through the oil pressure sender switch when closed, then to the ground at the engine block. The oil pressure sender switch closes when oil presser fall below 6 PSI (87 Bar).

TROUBLESHOOTING ENGINE OIL PRESSURE CIRCUIT		
CONDITION	**POSSIBLE CAUSE**	**REMEDY**
Engine oil pressure indicator light will not illuminate	Faulty bulb	Check and replace bulb
	Blown 25-amp fuse	Replace 25-amp fuse
	Loose Connections	Check connectors
	Faulty engine oil pressure switch	Check and replace switch if necessary
Engine oil pressure indicator light stays illuminate constantly	Faulty engine oil pressure switch	Check and replace switch if necessary
	Wire harness from switch to bulb shorted to ground	Check wire harness for damage repair as necessary
	Low engine oil pressure	Check engine oil pressure

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SECTION 55 - ELECTRICAL SYSTEM

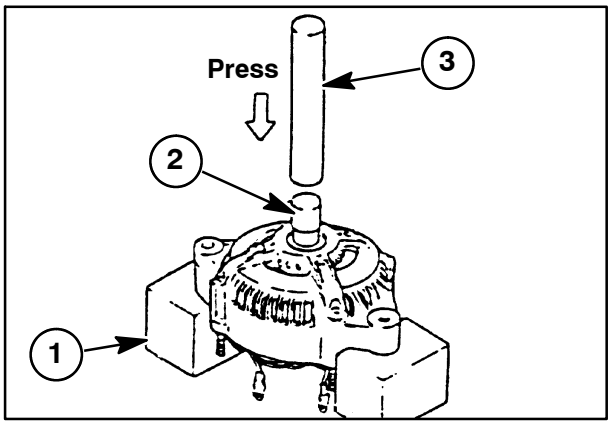
Chapter 4 - Alternator and Starter

CONTENTS

Bearing Removal (Drive End Side)

Support the drive end frame horizontally with two blocks, 1,. Place a jig, 2, on the bearing and remove the bearing with a press, 3.

NOTE: *The two bearings used in this alternator are for high-speed revolution. Whenever they must be replaced, a genuine part (with Denso's part number inscribed) must always be used. Do not subject the bearing to a shock load.*



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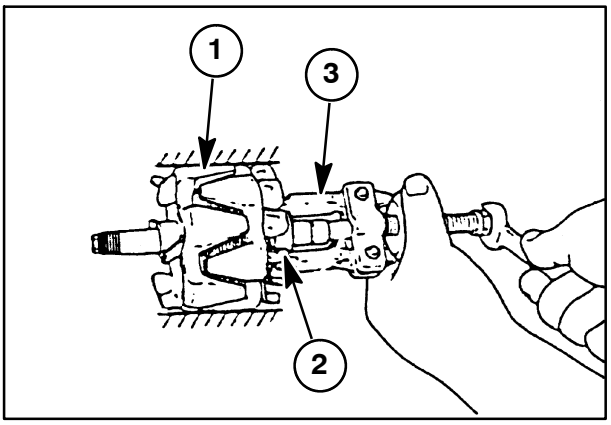
Bearing Removal (Slip Ring Side)

Place the rotor carefully into a vise, 1. Remove the bearing, 2, using a suitable puller, 3.



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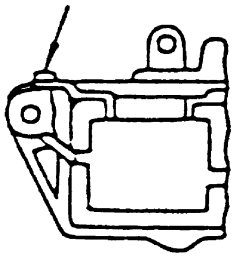
NOTE: *IC regulator testing MUST be done in the sequence outlined above. If testing is done in the wrong sequence, the IC regulator will be performing the incorrect function and the correct test will not be done. If this happens, turn off the electric source immediately, and then start over in the sequence shown above. The fin (heat sink) on the IC regulator is not the "E" terminal. The "E" terminal is to be connected to the terminal that contacts the alternator frame. Use care in forming the wiring circuit as if the "L" terminal is connected wrong to the source, Tr_2 may be destroyed.*

E terminal is located on the back of the IC regulator.



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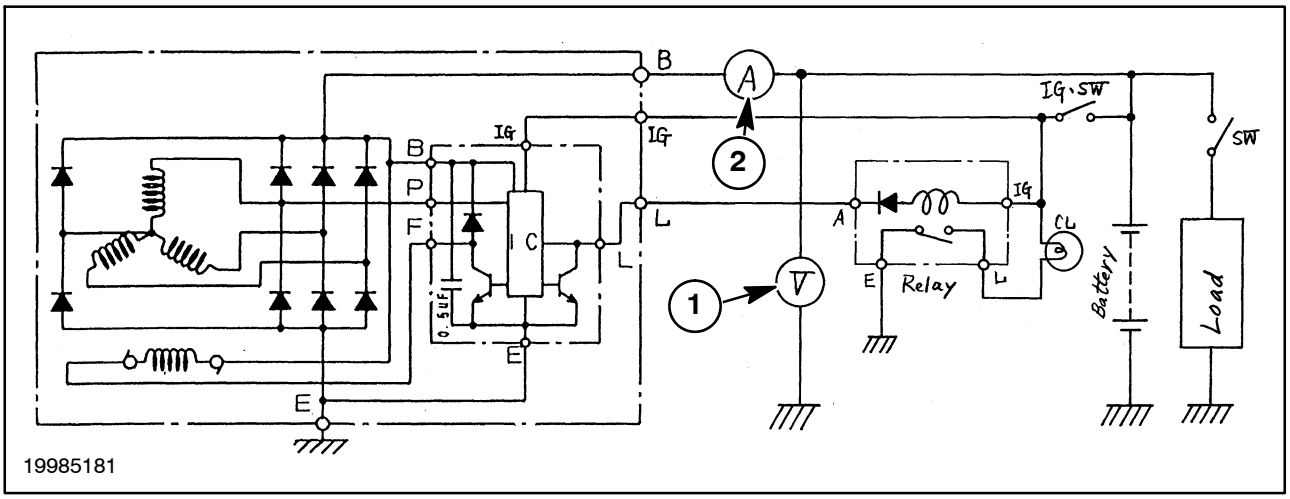

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MEASUREMENT ON THE VEHICLE

Regulated Voltage Check (IC Regulator)

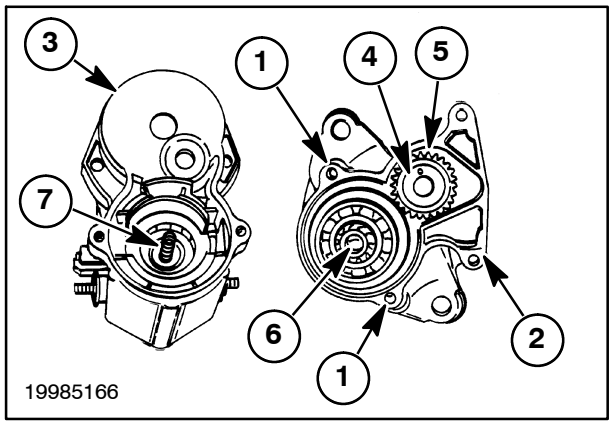
1. Connect the voltmeter, 1, and ammeter, 2, in the manner shown in the figure above. Turn on the ignition switch. Check that the charge lamp is turned on.
2. Check if the charge lamp is turned off when the engine is started.
3. Maintain an engine speed of 2000 RPM, and check battery voltage for an output current of 10 amps. [Check the regulator voltage; standard voltage is 14.2-14.8 volts (A-type IC regulator)].

NOTE: *The standard temperature for an IC regulator is 25 °C (77 °F) and, therefore, the voltage reading should be taken quickly. The maintenance standard for each regulator type must be followed.*

Check for Alternator Output Current

Apply the parking brake and start the tractor engine. Turn on all 12-volt powered accessories such as the headlights and indicator lights. Increase the engine speed to at least 2000 RPM's and record the maximum value indicated on the ammeter. If the amperage value is more than 70% of the nominal alternator output as described in alternator specifications, the alternator is considered to be working satisfactorily.

7. Remove the two screws, 1, and remove the front housing, 2, from the starter body, 3.



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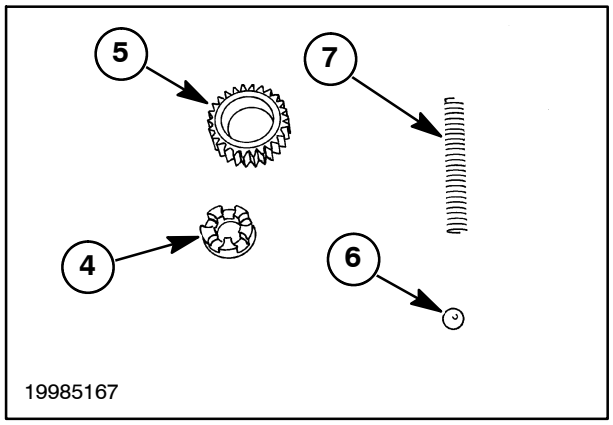
8. Remove the retainer, 4, idler gear, 5, and steel ball, 6, from the front cover. Remove the spring, 7, from the starter body.



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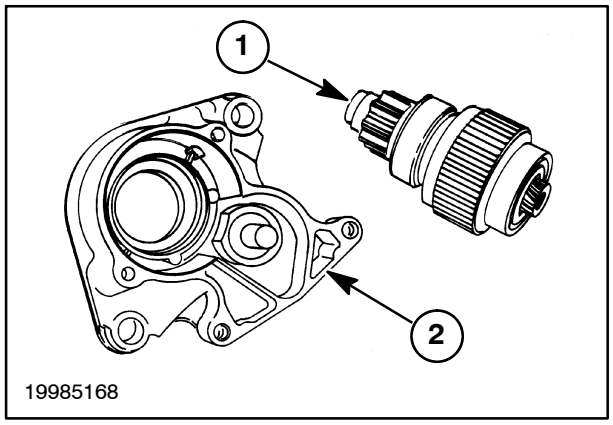
9. Remove the clutch, 1, from the housing, 2. The clutch assembly is non-repairable and if found defective, must be replaced.

NOTE: *Do not damage the clutch bearing. Never disassemble the solenoid coil. If the coil is found to be defective, replace as an assembly. Never loosen the nut at the solenoid coil terminal bolt.*



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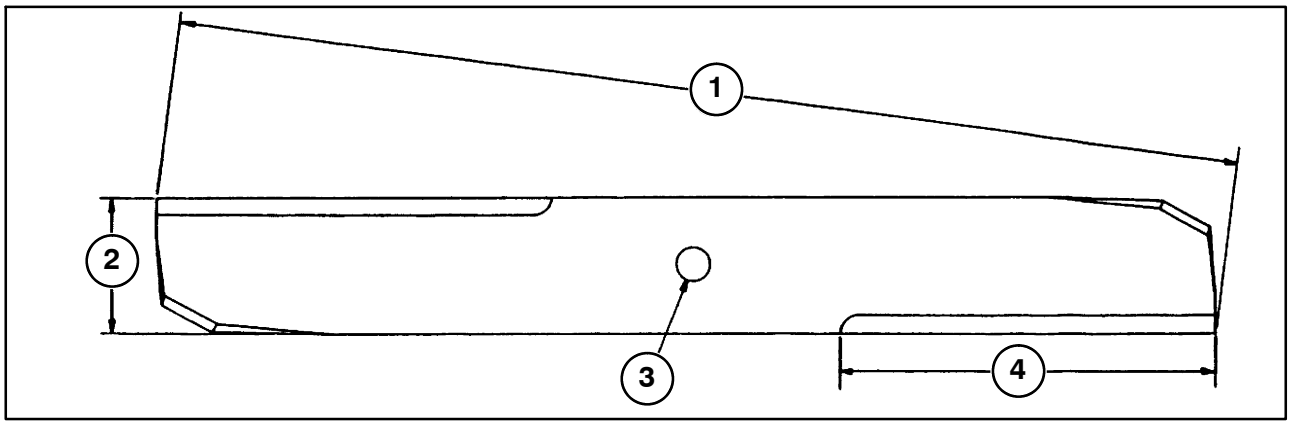
SPECIFICATIONS

230GM (60″) Side Discharge Mower Deck

SPECIFICATIONS	230GM
Tractor Required	T1010, T1030, T1110
Cutting Width (Actual)	1524 mm (60″)
Overall Width	1870 mm (73.6″)
Cutting Height (7 positions)	1″, 1.5″, 2″, 2.5″, 3″, 3.5″, 4″
Spindle Speed @ Engine Rated Speed (3000 rpm)	2869 rpm
Blade Tip Speed	4710 m/m (15,450 fpm)
	78.5 m/s (257.5 f/s)
Number Of Blades	3
Blade Length	523 mm (20.6″)
Blade Width	60 mm (2.36″)
Blade Thickness	7 mm (0.27″)
Shipping Weight	120 kg (264.6 lbs.)
Deck thickness	3.6 mm (0.142″)



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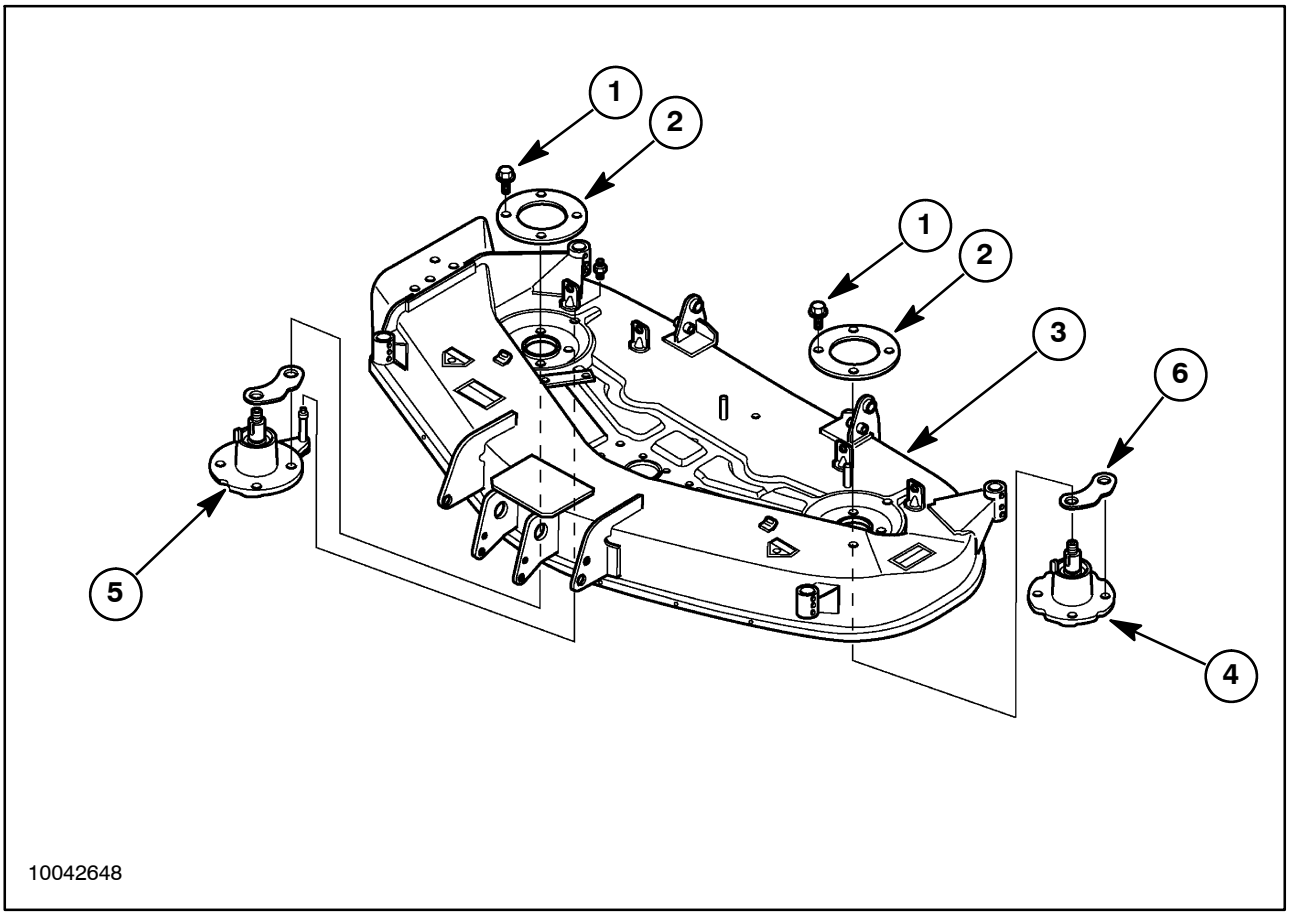
1. Overall Length
2. Width
3. Mounting Hole Diameter
4. Cutting Edge Length

Blade Measurements

Deck Size	Deck Type	Overall Length	Width	Mounting Hole Diameter	Cutting Edge Length
60″	Side Discharge	520.7 mm 20.5″	60 mm 2.36″	28.5 mm 1.12″	133 mm 5.24″

14. Remove bolts, 1, and holders, 2, from the deck top, 3. Remove the spindle assemblies, 4, 5, and shims, 6, (if equipped), from underneath the deck.



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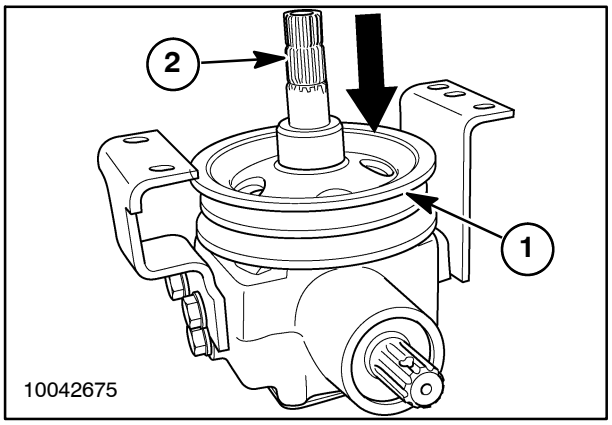
12. Press the pulley, 1, onto the bevel gear shaft, 2.



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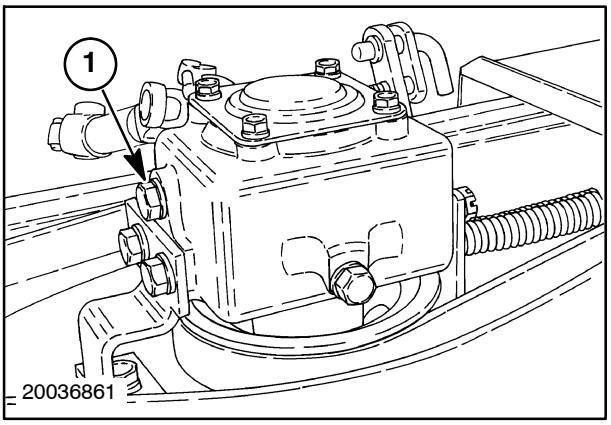
13. Refill the gearbox with oil, remove the check fill plug, 1, and add oil until excess exits the check hole. Use only 80-90 W gear oil.



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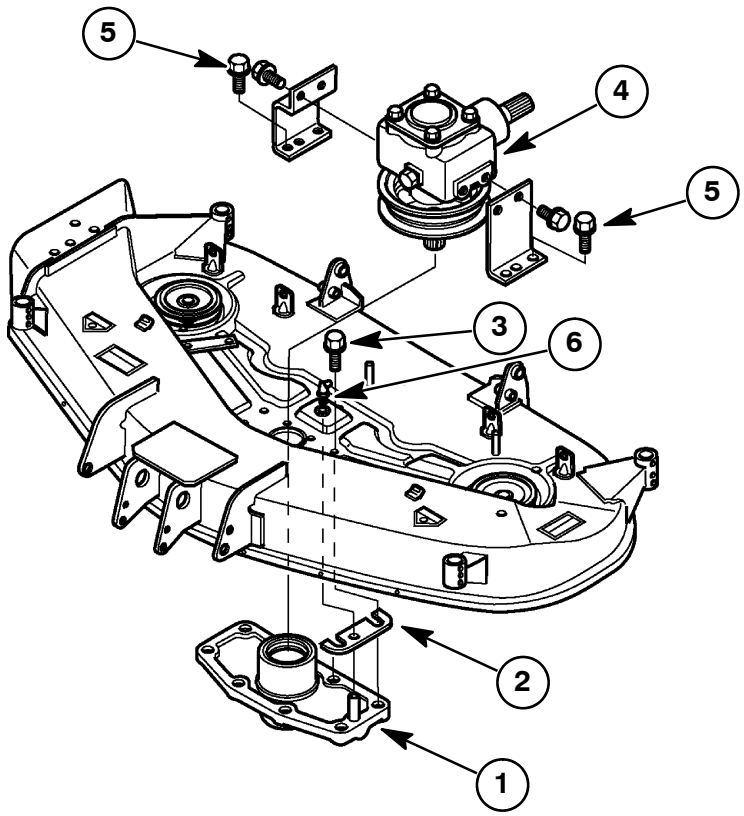
3. Place center pulley holder, 1, and shims, 2, (if equipped) in position from underside of mower deck. Fasten with bolts, 3. Torque bolts, 3, to 90 N·m (65 ft-lbs).

***NOTE**: Bolts, 3, are M12 x 1.25 x 30 mm (fine threads).*

4. Wrap belt around gearbox pulley.
5. Insert gearbox, 4, and belt through deck, into center pulley holder, 1.
6. Fasten gearbox, 4, center pulley holder, 1, and deck together with bolts, 5. Torque bolts to 77 – 90 N·m (57 – 65 ft-lbs). Install grease fitting, 6.



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LUBRICATION

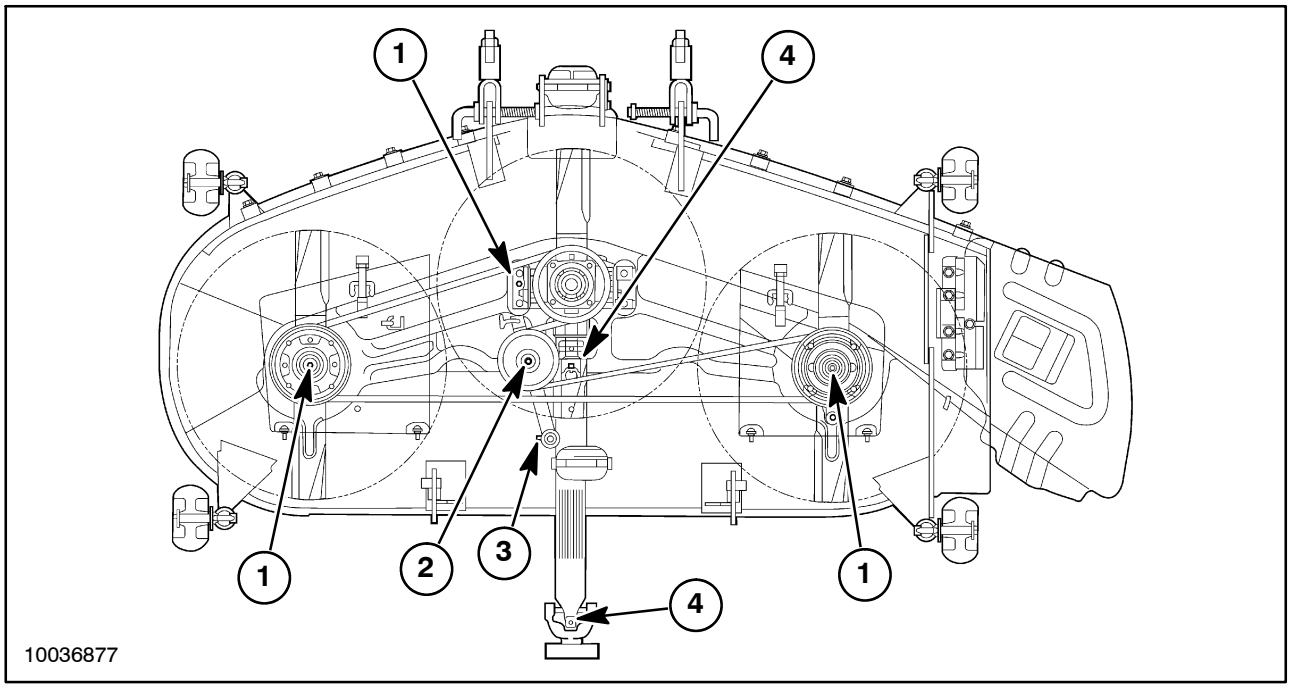
Before operating the 230GM mower, make sure all indicated lubrication points have been properly lubricated according to the diagram.

Always wipe the fitting to be lubricated with a clean cloth before using a grease gun. Dirt injected through the grease fitting will damage closely machined parts.

Use SAE multi-purpose lithium base grease on all lubrication points. Do not allow excess grease buildup on or around parts, especially when the mower is used in sandy areas.

Lubricate all grease points every 25 hours.

REF. NO.	DESCRIPTION	25 HRS.
1	Blade Spindle (3)	•
2	Idler Pulley Shaft (1)	•
3	Idler Arm Shaft (1)	•
4	Driveline U-Joint (2)	•



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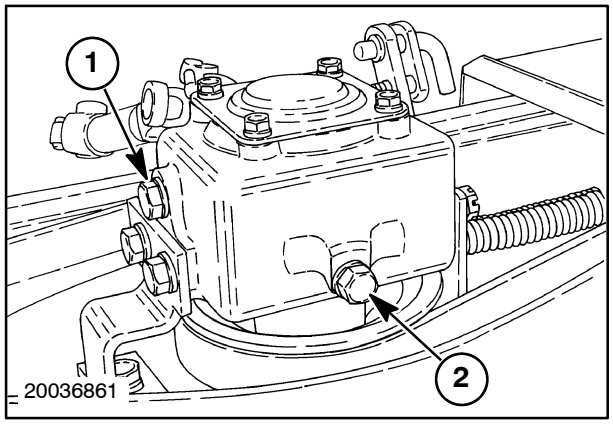
Gearbox

Check the oil in the gearbox weekly. To check oil level, remove the oil level check/fill plug, 1, from the gearbox. Oil should be at that level. If necessary to add oil, use only SAE 80-90W gear oil.

To fill gearbox with oil, remove the check/fill plug, 1, and add oil until excess exits the check hole.

Gearbox oil level should be checked daily. The oil must be changed at 50 hours of service. Change the gearbox oil every 150 hours after the initial oil change at 50 hours. Loosen and remove the drain plug, 2, to drain the oil from the gearbox.



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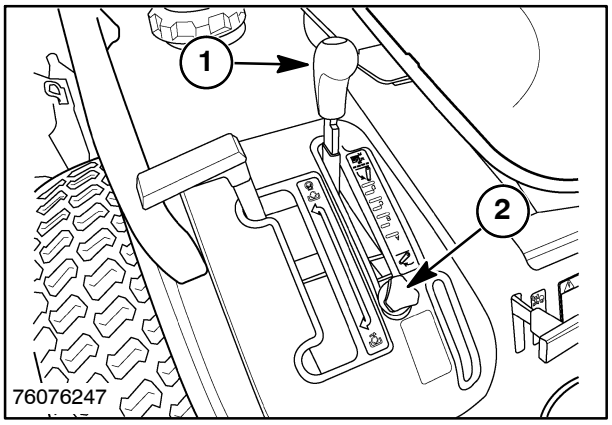
CUTTING HEIGHT ADJUSTMENT

T1110

Cutting height is controlled by the HPL control lever, 1, and adjustable stop, 2. The cutting height can be adjusted to seven different heights.

To set cutting height, place HPL control lever, 1, in the "full up" position. Loosen adjustable stop, 2, and place stop at corresponding position on the HPL control decal. Move control handle forward until handle contacts the stop.



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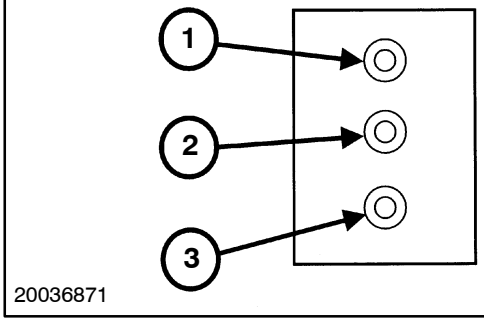
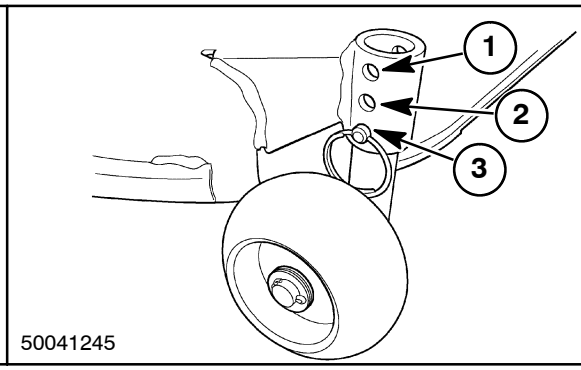
Decal Position	Cutting Height of Mower
A	1.0
A-	1.5
B	2.0
B-	2.5
C	3.0
C-	3.5
D	4.0

IMPORTANT: When the anti-scalp wheels are properly adjusted, wheels will NOT contact the ground! *Anti-scalp wheels are* ***NOT*** *meant to continuously contact the ground, the wheels act as anti-scalp rollers on the four corners of the deck. A minimum of 6 mm (1/4 in) clearance should exist between the wheels and the ground. If wheels continuously contact the ground, rapid wheel wear will occur.*

Anti-scalp wheels must be adjusted according to the cutting height setting. Use the following chart for wheel position.

Cutting Height Position (On HPL Lever)	Front and Rear Wheel Height (Ground to Center of Wheel)	Hole Position
(A) - 1.0 inch	66 mm (2-5/8 in)	1
(A-) - 1.5 inches	78 mm (3-1/8 in)	1
(B) - 2.0 inches	91 mm (3-5/8 in)	1
(B-) - 2.5 inches	104 mm (4-1/8 in)	1
(C) - 3.0 inches	97 mm (3-3/4 in)	2
(C-) - 3.5 inches	89 mm (3-1/2 in) 109 mm (4-1/4 in)	3 2
(D) - 4.0 inches	102 mm (4.0 in)	3





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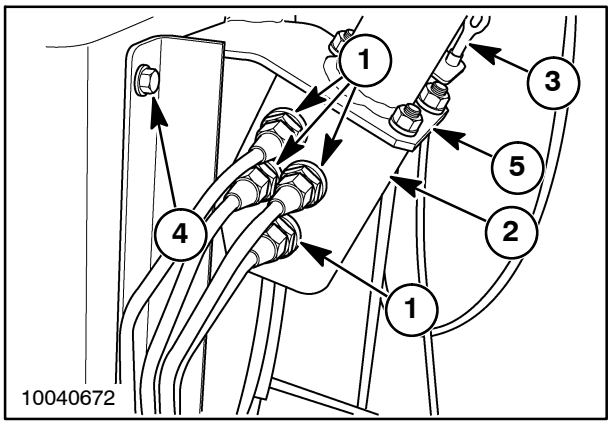
7. Disconnect the hydraulic oil lines, 1, from the power steering control valve, 2. Plug the lines and the fittings in the valve.
8. Remove the split pin, washer, and throttle cable, 3, from the lever.
9. Remove the four bolts securing the steering column to the rear of the firewall box, 4, the four bolts securing the base of the column to the tractor frame, and remove the steering column structure, 5, from the frame.



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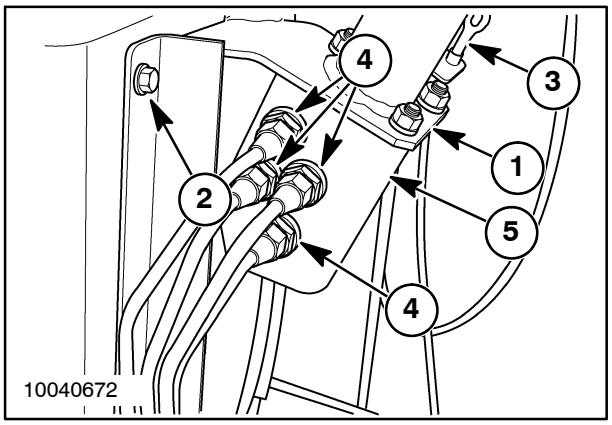
Installation

1. Place the steering column, 1, in position on the tractor frame. Align the four mounting holes in the base of the column with the corresponding tapped holes in the frame crossmember, and the four mounting holes in the uprights with the corresponding tapped holes in the rear of the firewall box, 2.
2. Install the eight mounting bolts and torque to 22.6 – 28.4 N·m (16.7 – 21.0 ft-lbs) to secure the steering column.
3. Install the split pin, washer, and throttle cable, 3, on the lever.
4. Uncap and clean the fittings on the hydraulic lines, 4, and steering control valve, 5. Attach the lines to the valve and tighten the fittings.
5. Install the two mounting bolts, 1, securing the fuel pump, 2, to the vertical crossmember on the steering column.
6. Connect the electrical connector, 3, joining the fuel pump wiring to the main wiring harness.
7. Connect the fuel hoses, 4, to the fuel pump.
8. Install the main cowling on the tractor, as described earlier in this section.
9. Install the tractor hood, as described earlier in this section.
10. Connect the positive and negative battery cables to the battery terminals.



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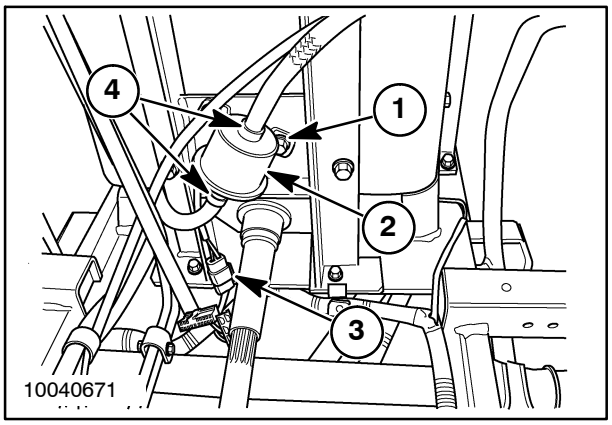

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ENGINE REMOVAL & INSTALLATION

(This procedure is described in Section 10 – Engine Systems, under "Engine – Removal/ Disassembly/ Assembly/Installation").