650 AND 750 TRACTORS
TECHNICAL MANUAL
TM-1242 (MAR-81)

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GENERAL TRACTOR SPECIFICATIONS

	650 TRACTOR	750 TRACTOR
HORSEPOWER		
(Official PTO horsepower)	10.8 kW (14.5 hp) at 2600 rpm	13.4 kW (18.0 hp) at 2400 rpm
ENGINE:		
Type	2-cylinder, in line, valve-in-head, diesel	3-cylinder, in-line, valve-in-head, diesel
Slow idle speed	800 rpm	800 rpm
Working speed range	1825 to 2600 rpm	1650 to 2400 rpm
Bore and stroke	80 x 85 mm (3.15 x 3.35 in.)	80 x 85 mm (3.15 x 3.35 in.)
Displacement	0.9 L (52.0 cu. in.)	1.3 L (78.0 cu. in.)
Compression ratio	22.5 to 1	22.5 to 1
Firing order (No. 1 in rear)	1-2	1-3-2
Valve clearance		
Intake	0.2 mm (0.008 in.)	0.15 mm (0.006 in.)
Exhaust	0.20 mm (0.008 in.)	0.15 mm (0.006 in.)
Injection pump timing	22°BTDC	22°BTDC
Lubrication system	force-feed, pressurized with full-flow filter	force-feed, pressurized with full-flow filter
FUEL SYSTEM:		
Type	precombustion chamber	precombustion chamber
Injection pump type	plunger	plunger
Air cleaner	dry type	dry type
COOLING SYSTEM:		
Type	pressurized with centrifugal pump	pressurized with centrifugal pump
Temperature control	heavy duty thermostat	heavy duty thermostat
CAPACITIES		
Fuel tank	23.5 L (6.2 U.S. gal.)	23.5 L (6.2 U.S. gal.)
Cooling system	3.5 L (3.7 U.S. qt.)	4.2 L (4.4 U.S. qt.)
Crankcase (with filter change)	2.5 L (2.6 U.S. qt.)	4.0 L (4.2 U.S. qt.)
Transmission-hydraulic system	13 L (14 U.S. qt.)	14 L (15 U.S. qt.)
Front-wheel drive axle housing	3.0 L (3.2 U.S. qt.)	6.5 L (6.9 U.S. qt.)
TRANSMISSION:		
Type	2-speed range selector and 4-speed gear selector	2-speed range selector and 4-speed gear selector
Gear selections	8 forward and 2 reverse	8 forward and 2 reverse
Clutch	single-disk, dry	single-disk, dry
POWER TAKE-OFF:		
Type	transmission driven, with overrunning clutch	transmission driven, with overrunning clutch
PTO Speed (engine speed)	540 rpm (2350 rpm)	540 rpm (2300 rpm)
Size	35 mm (1-3/8 in.)	35 mm (1-3/8 in.)
Clutch	uses transmission clutch	uses transmission clutch

Continued

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LUBRICATION SERVICES

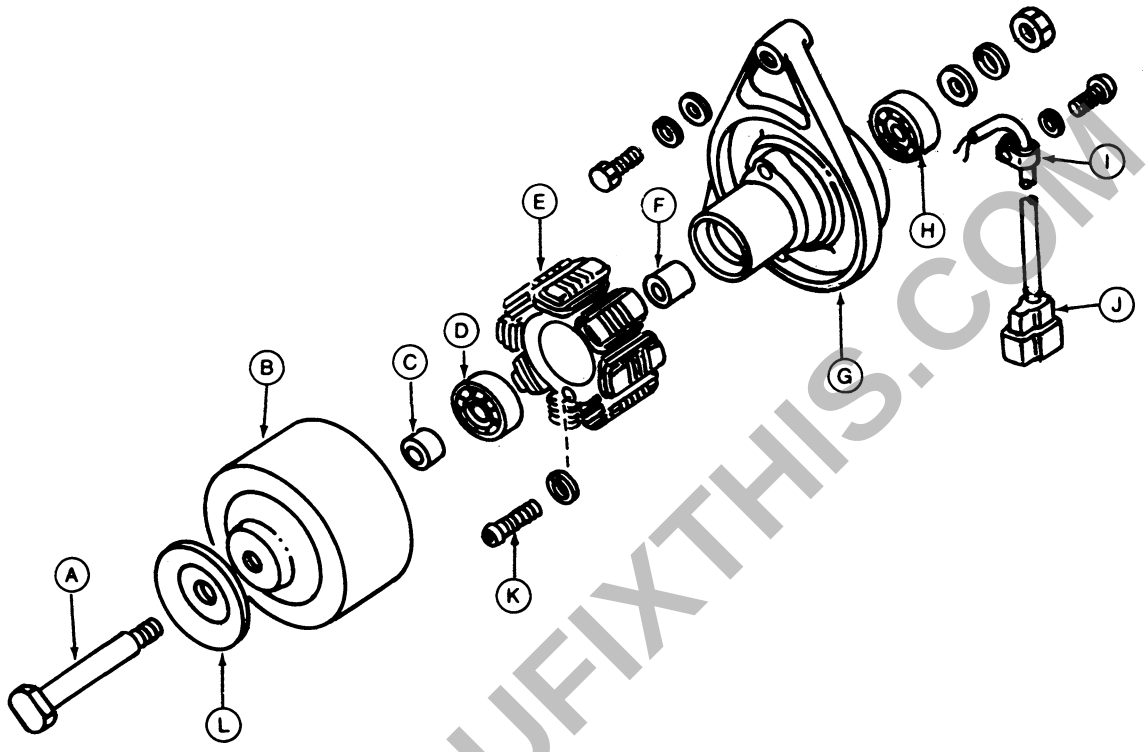
COMPONENT	CAPACITY	LUBRICANT*	SERVICE ITEM	INTERVAL (HOURS)
Engine Crankcase		Engine Oil	Check level	10
650 Tractor	2.5L (2.6 U.S. qt)		Change oil and filter	200
750 Tractor	4.0L (4.2 U.S. qt)		Clean vent system	600
Transmission-Hydraulic System**		Transmission-Hydraulic Oil	Check level	50
			Change oil	200
650 Tractor	13.0L (14.0 U.S. qt)		Clean filter screen	200
750 Tractor	14.0L (15.0 U.S. qt)		Replace screen	600
Transmission-Hydraulic System***		Transmission-Hydraulic Oil	Check level	50
			Replace filter	200
650 Tractor	13.0L (14.0 U.S. qt)		Change oil	600
750 Tractor	14.0L (15.0 U.S. qt)		Clean screen	600
			Replace screen	1200
Front Axle Housing (MFWD Only)		John Deere GL-5 or SAE 90 Gear Lubricant	Check level	50
			Change oil	600
650 Tractor	3.0L (3.2 U.S. qt)			
750 Tractor	6.5L (6.9 U.S. qt)			
Front Wheel Bearings (Without MFWD)		Grease	Repack	600
Grease Fittings		Grease		
Axle Pivot Pin			Lubricate	10
Drag Links			Lubricate	10
Tie Rod Ends			Lubricate	10
Steering Spindles			Lubricate	10
Clutch and Brake			Lubricate	50
Hitch Lift Link			Lubricate	200
Hitch Center Link			Lubricate	200
Front PTO Shaft Bearing			Lubricate	200

**See previous pages for lubricant specifications.*
***Tractors not equipped with power steering or hydraulic filter.*
****Tractors equipped with power steering or hydraulic filter.*

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A—Shaft
B—Flywheel
C—Bushing
D—Ball Bearing
E—Stator
F—Bushing
G—Plate Assembly
H—Ball Bearing
I—Clamp
J—Coupler
K—Screw (2 used)
L—Pulley

(Atlernator Components—Exploded View)

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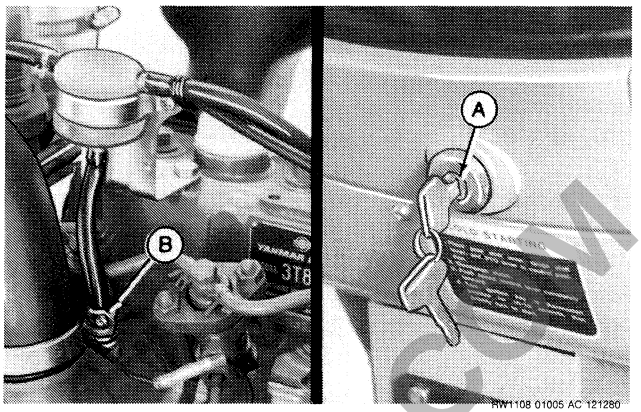
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VERIFY PREDELIVERY SERVICE—Continued

11. Check operation of neutral start switch. Engine should not turn over unless shift lever is in neutral position.

12. Check operation of Thermo-Start. Turn key switch (A) counterclockwise and hold it there 10 or 15 seconds. An electric glow plug (B) ignites a small amount of fuel in the intake manifold. Quickly turn key switch clockwise and start engine.

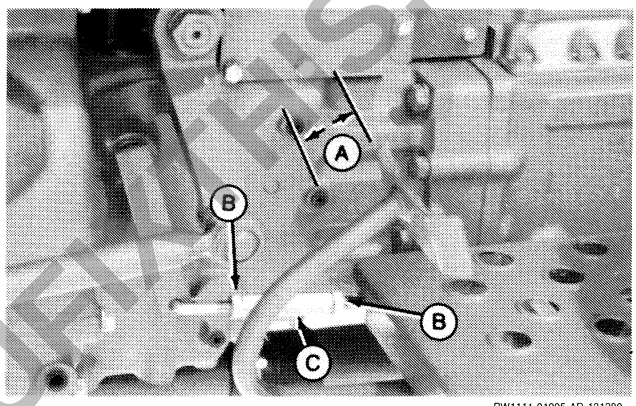


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13. Check clutch pedal adjustment as instructed in the following procedure:

Measure free travel at top of pedal stroke (A). If 650 tractor free travel is 10 mm (3/8 in.) or less, adjust linkage to obtain 16 mm (5/8 in.) travel. If 750 tractor is 16 mm (5/8 in.) or less, adjust linkage to obtain 22 mm (7/8 in.) travel.

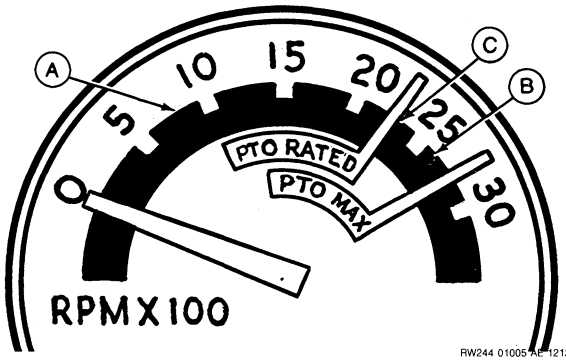
To adjust linkage, loosen lock nuts (B) and rotate turn-buckle (C). Recheck travel and retighten lock nuts.



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14. Check engine slow and fast idle speeds. Slow idle speed should be 800 rpm (A).

Full throttle speed at full load should be 2600 rpm (B) for the 650 tractor and 2400 rpm (C) for the 750 tractor. Use tachometer on dash for checking slow and fast idle speeds.



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15. Check operation of full turn steering.

16. Check operation of brakes-Check with engine running and stopped.

17. Check transmission operation: Operate in all gears. If any problem is found, refer to Section 250.

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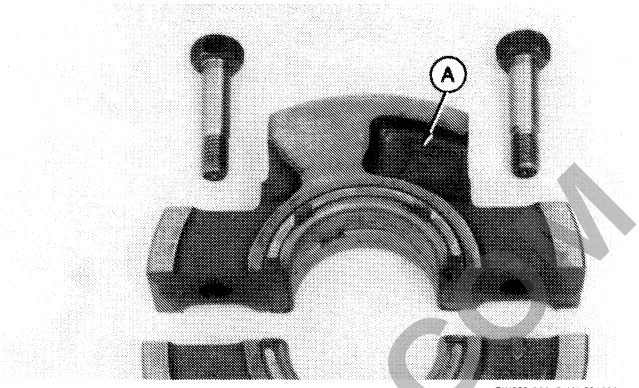
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INSTALL CRANKSHAFT

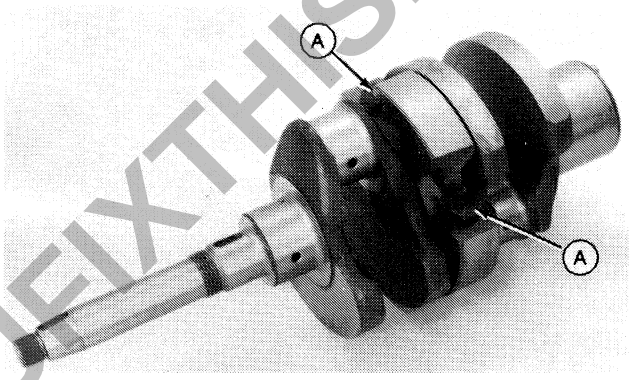
1. Assemble intermediate main bearing housings onto crankshaft. Be sure "F" mark (A) on housing faces flywheel side of crankshaft.

IMPORTANT: On 750 Tractors, be sure housing with thrust bearing is installed on crankshaft journal closest to flywheel.



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2. Torque cap screws (A) to 47 N.m (35 ft-lb).



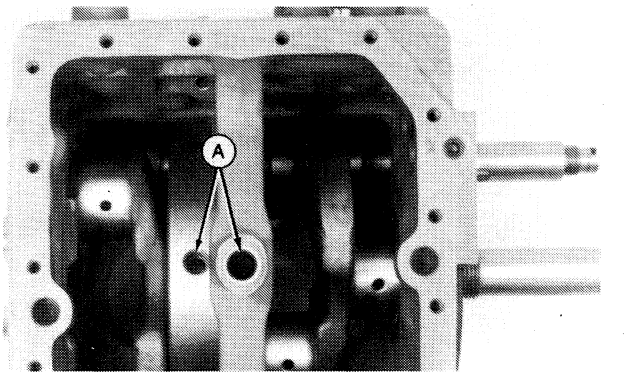
(650 Crankshaft Shown)

RW634 02015 AO 231080

3. Carefully slide crankshaft into block. Be sure to align set screw holes (A) between housings and block.

4. Lightly oil set screw (2 set screws on 750).

5. Install and torque set screw to 70 N.m (52 ft-lb). Be sure crankshaft rotates smoothly.

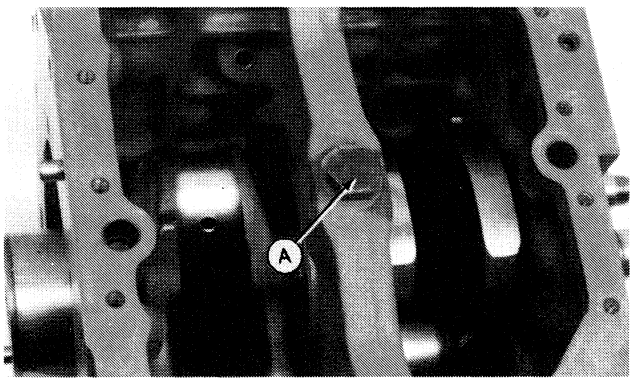


RW670 02015 AP 231080

6. Apply a light coat of clean engine oil to rear main bearing and oil seal.

7. Carefully install bearing housing onto block and install and torque cap screws (B) to 26 N.m (19 ft-lbs).

8. Install backplate and cap screws (A) and torque to 45 N.m (33 ft-lbs).

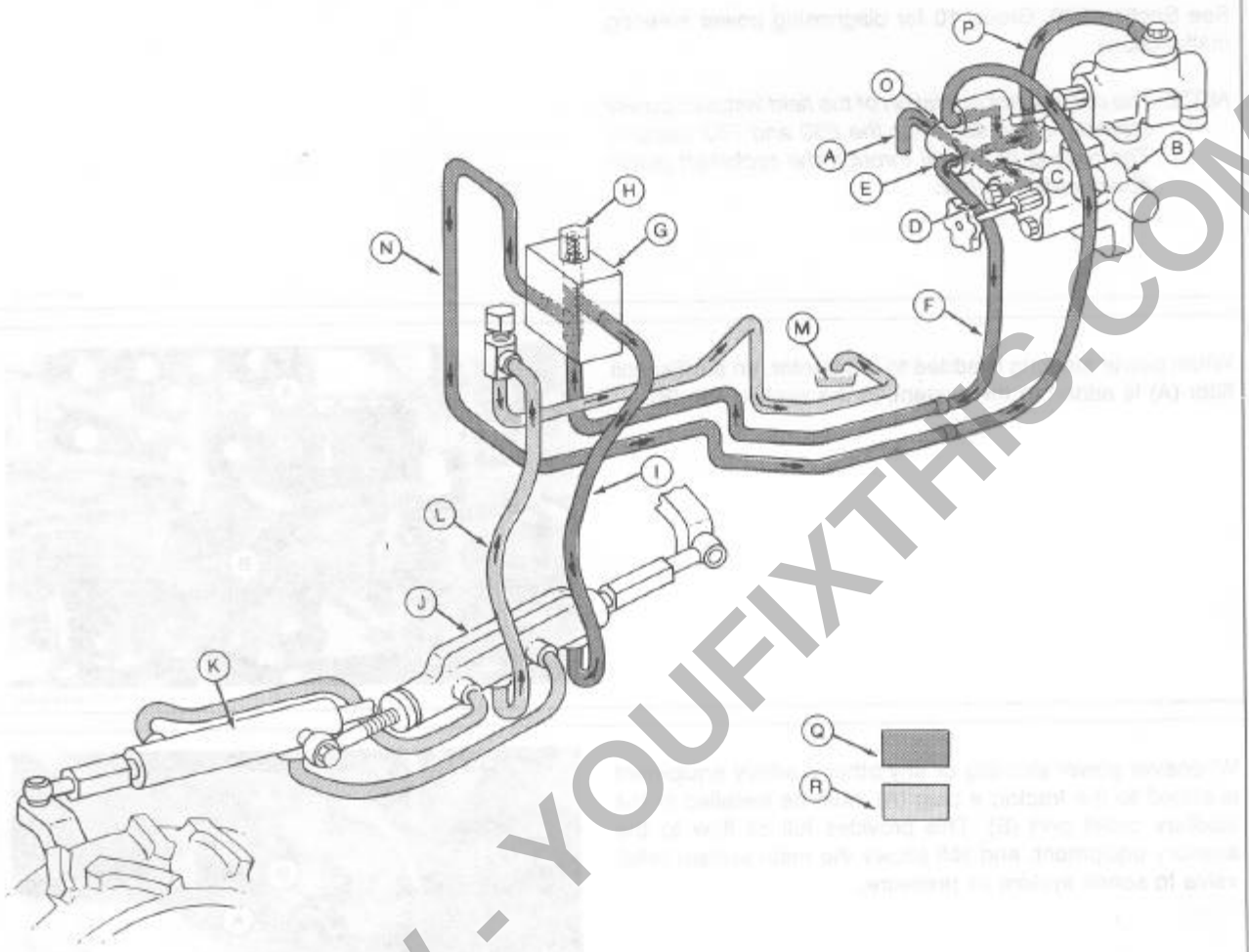


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POWER STEERING OPERATION—Continued



A—From Hydraulic Pump
B—Rockshaft Piston Cover
C—Plug
D—Main System Relief Valve
E—Auxiliary Outlet Port
F—Pressure Feed Line
G—Flow Divider Block
H—Flow Regulator Valve
I—Pressure Line to Steering Valve
J—Steering Control Valve
K—Steering Cylinder
L—Steering Return Line
M—Transmission Case (sump)
N—Pressure Return Line
O—Auxiliary Inlet
P—To Rockshaft Control Valve
Q—Systems Pressure Oil
R—Pressure Free Oil

HYDRAULIC OIL FLOW
(Tractor Equipped With Power Steering Only Shown)

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DIAGNOSE MALFUNCTIONS

WILL NOT START
Operator Error
- Throttle not pushed far enough forward
- Decompression device out of correct adjustment

Basic Engine Problem
- Compression pressure low

Fuel System Malfunction
- Air in fuel pump
- Air in fuel lines
- Clogged filter
- Sticking plunger or delivery valve
- Injection pump roller guide stuck
- Excessive wear on injection lobes
- High pressure fuel line connector loose
- Nozzle valve stuck
- Improper nozzle spray pattern
- Thermo-start operation faulty (cold weather)

ENGINE RUNS IRREGULARLY OR MISSES
Basic Engine Problem
- Basic Engine Problem
- Improper valve clearance
- Compression pressures of cylinders are uneven
- Air in fuel (injection pump and lines)

Fuel System Malfunction
- Improper throttle lever adjustment
- Injection pump contains air
- Defective nozzle
- Faulty injection pump

FREQUENT STALLING
Fuel System Malfunction
- Clogged fuel line
- Clogged fuel filter
- Air in fuel
- Clogged fuel tank air vent

LACK OF POWER
Basic Engine Problem
- Improper valve clearance
- Improper valve seating
- Cylinder head gasket blow-by
- Worn, stuck, or broken piston rings
- Improper decompression device setting
- Injection pump out of adjustment
- Faulty injection nozzle
- Clogged air cleaner or fuel filter

Fuel System Malfunction
- Faulty injection timing
- Low fuel injection rate
- Faulty injection pressure
- Clogged fuel system line
- Clogged air filter element
- Air in fuel
- Water in fuel
- Clogged fuel filter

ENGINE OVERHEATS
Basic Engine Problem
- Loose or broken fan belt
- Faulty thermostat
- Faulty water pump
- Damaged fan blades

Service Problem
- Low coolant level
- Low oil level
- Engine overloaded
- Clogged radiator or front grille screen

Fuel System Malfunction
- Excess fuel delivery
- Improper injection timing

EXCESSIVE OIL CONSUMPTION
Basic Engine Problem
- Excessive piston liner clearance
- Worn, stuck, or damaged piston rings
- Piston ring gaps not staggered
- Faulty valve stem seal

Service Problem
- Oil pressure regulating valve adjusted too high
- Engine oil too thin
- Clogged crankcase ventilation tube

LOW OIL PRESSURE
Basic Engine Problem
- Faulty pressure regulating valve setting
- Excessive main and connecting rod bearing clearance
- Plugged oil pump intake screen
- Worn oil pump

Service Problem
- Low oil level
- Improper viscosity of oil

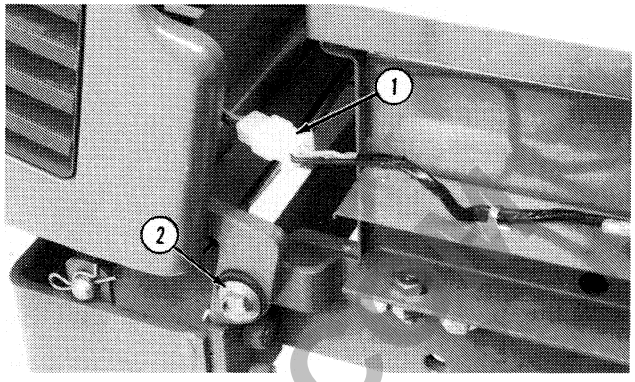
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REMOVE FRONT END

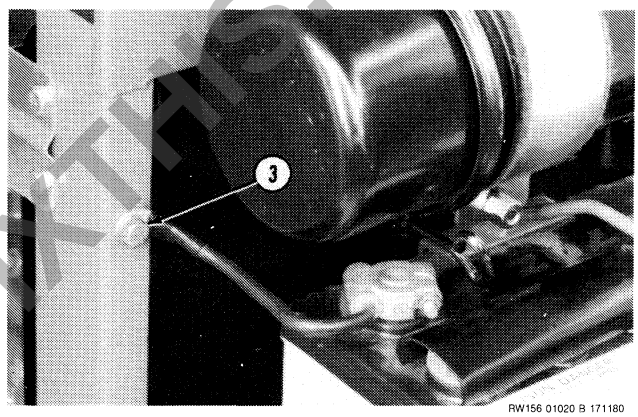
1. Disconnect electrical hook-up and pull harness rearward.

2. Remove hood mounting bolts and remove hood.



A14;RW316 U03;01020 A 171180

3. Disconnect battery ground cable.



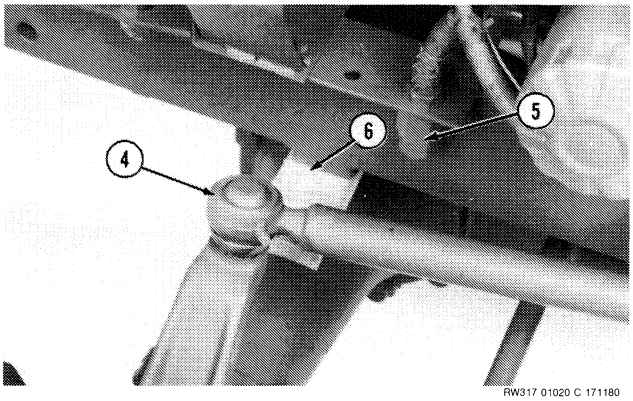
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4. Disconnect pitman arm.

5. Drain anti-freeze.

6. Insert block between axle and side frame on right and left side.

NOTE: If tractor is equipped with power steering, remove steering control valve and hoses from steering cylinder.

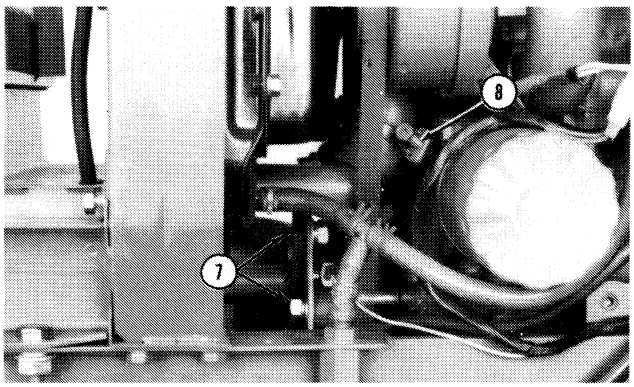


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7. Remove front PTO drive cap screws, if equipped with front PTO.

8. Disconnect lower radiator hose.

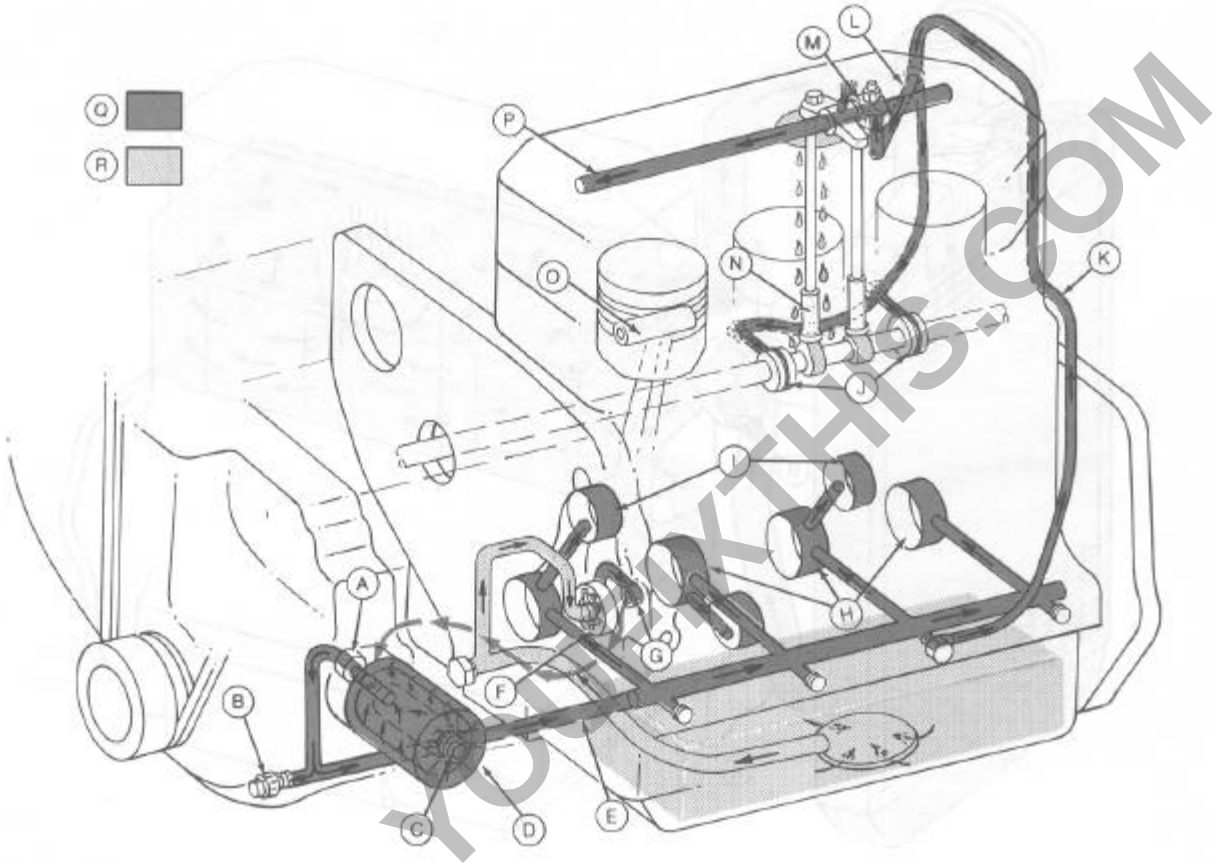
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LUBRICATION SYSTEM



A—Oil Pressure Regulating Valve
B—Oil Pressure Sender Unit
C—Oil Filter By-Pass Valve
D—Oil Filter
E—Main Oil Gallery
F—Oil Pump
G—Oil Pump Outlet
H—Crankshaft Main Bearings
I—Connecting Rod Bearings
J—Camshaft Journals
K—External Oil Line
L—Oil Passage
M—Rocker Arm Support
N—Camshaft Follower
O—Piston Pin Bushing
P—Rocker Arm Shaft
Q—Pressure Oil
R—Non-Pressure Oil

LUBRICATION SYSTEM—750 ENGINE SHOWN

The engine lubrication system consists of a trochoid rotor-type pump (F), oil filter (D), oil pressure regulating valve (A), oil pressure sending unit (B), and oil filter by-pass valve (C) within oil filter.

The pump draws oil from the pan, pumps it through an outlet (G) and into a passage in the timing gear cover where it flows into the filter (D). Once in the filter, oil flows past the by-pass valve (C) and in front of the oil pressure regulating valve. Oil then flows out of the timing gear cover into the main oil gallery (E).

From the main oil gallery, oil is distributed to each of four main bearings (H) (three on 650 engine), through cross-drilled passages in the cranskhaft to the connecting rod bearings (I). An external line (K) is tapped off of the main gallery to lubricate the camshaft rear journals (J). Oil also flows through a passage in the cylinder head (L), through the rocker arm support (M) and through the one-piece rocker arm shaft (P) to lube the rocker arm bushings. Oil run-off from the head splash lubricates the camshaft and followers (N). Piston pin bushings (O) are splash lubricated by crankshaft rotation.

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- Group 30—Selective Control Valve



This tractor is of metric design. All hardware is therefore metric. Make sure you use the specified metric hardware when replacement becomes necessary. For your convenience most specifications are given in metric measurement with customary U.S. measurement following.

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LUBRICATE 3-POINT HITCH

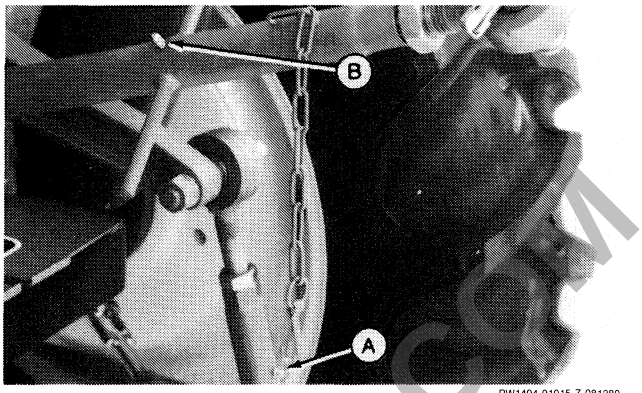
SERVICE INTERVAL: 200 Hours.

Lubricate hitch with grease specified on page 2.

1. Apply several shots of grease to right-hand lift link (A).

2. Rotate center link body counterclockwise to adjust link to shortest length. Apply several shots of grease fitting (B).

3. Readjust link to length desired.



RW1404 01015 Z 081280

LUBRICATE FRONT PTO SHAFT BEARING (If Equipped)

SERVICE INTERVAL: 200 Hours.

CAUTION: To avoid sparks and burns, disconnect battery ground cable before servicing any part of electrical system.

1. Disconnect battery ground cable.

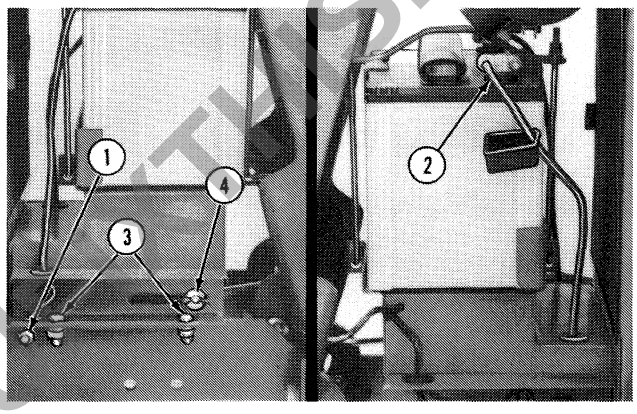
2. Remove battery positive cable.

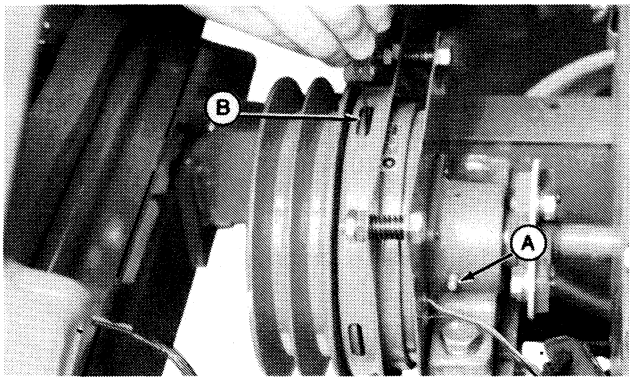
3. Remove bolts securing battery support to tractor.

4. Disconnect hood retainer, then remove battery and support from tractor.

5. Lubricate PTO shaft bearing fitting (A) with several shots of grease specified on page 2.

6. Check and adjust PTO brake clearance (B) as instructed in Section 50, Group 35.





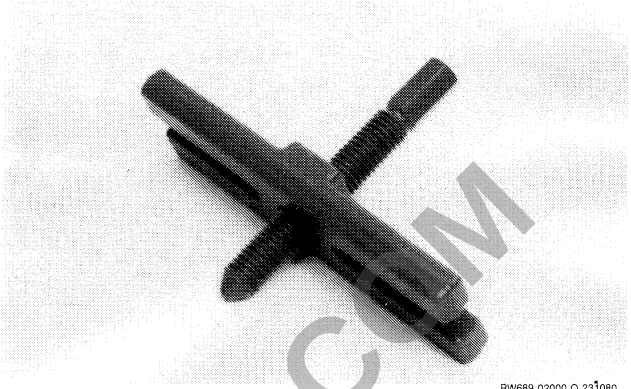
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FLYWHEEL,CRANKSHAFT AND MAIN BEARINGS

TOOL	USE
No. 515 Puller	Remove crankshaft pulley and gear



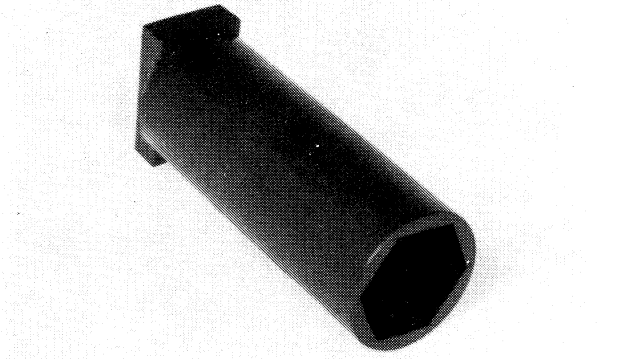
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TOOL	USE
No. 28253 Blind Hole Puller	Remove clutch shaft pilot bushing



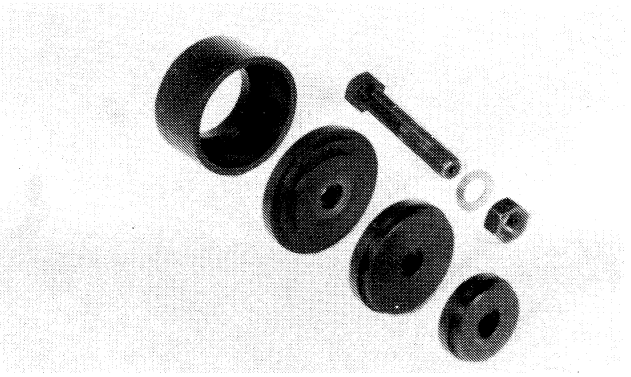
RW690 02000 P 231080

TOOL	USE
JDE-155 Deep Well Socket	Remove and install crankshaft gear retaining nut



RW691 02000 Q 231080

TOOL	USE
JDE-153 Main Bearing Service Tools	Remove and install main bearings



RW692 02000 R 231080

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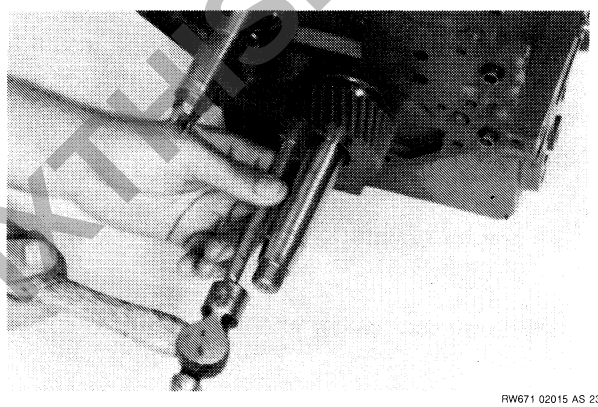
9. Install flywheel and torque NEW cap screws to 70 N.m (52 ft-lbs).

10. Install clutch assembly as instructed in Section 50, Group 05 (650 Tractor) or Section 55, Group 05 (750 Tractors).

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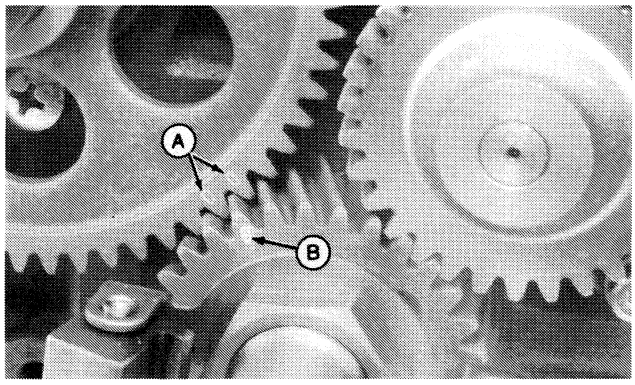
11. Install key in crankshaft and position gear onto crankshaft.

12. Install gear onto crankshaft using hammer and brass drift. Drive gear on until it bottoms on crankshaft shoulder.



RW671 02015 AS 231080

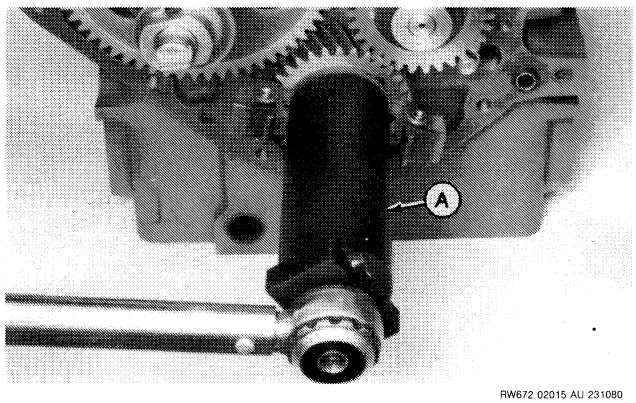
13 Be sure to align timing marks on camshaft gear (A) with timing mark (B) on crankshaft gear.



RW560 02015 AT 231080

14. Install governor flyweight assembly and crankshaft gear retaining nut.

15. Torque nut to 70 N.m (52 ft-lb) using JDE-155 socket (A).



RW672 02015 AU 231080

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FUSE BLOCK

All lighting circuits are protected by fuses located in the fuse block mounted on the control support cover.

The fuse block cover identifies size and function of fuses.

Fuse (A) is a 15-amp fuse that protects the low-beam head lamps.

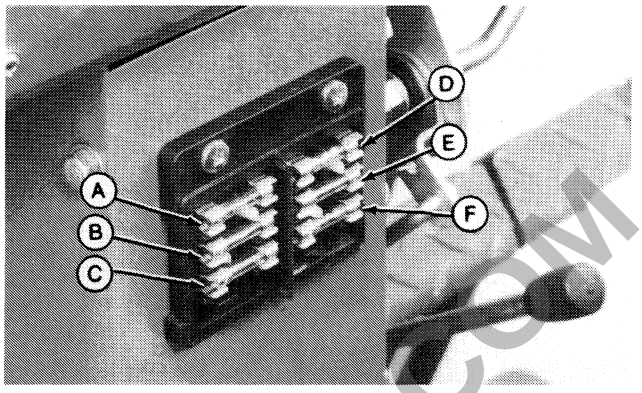
Fuse (B) is a 15-amp fuse that protects the high-beam head lamps.

Fuse (C) is a 10-amp fuse that protects the indicator lamps.

Fuse (D) is a 15-amp fuse that protects the warning lamps and flasher circuit.

Fuse (E) is a 10-amp fuse that protects the flood lamp circuit.

Fuse (F) is a 5-amp fuse that protects the tail lamp circuit.

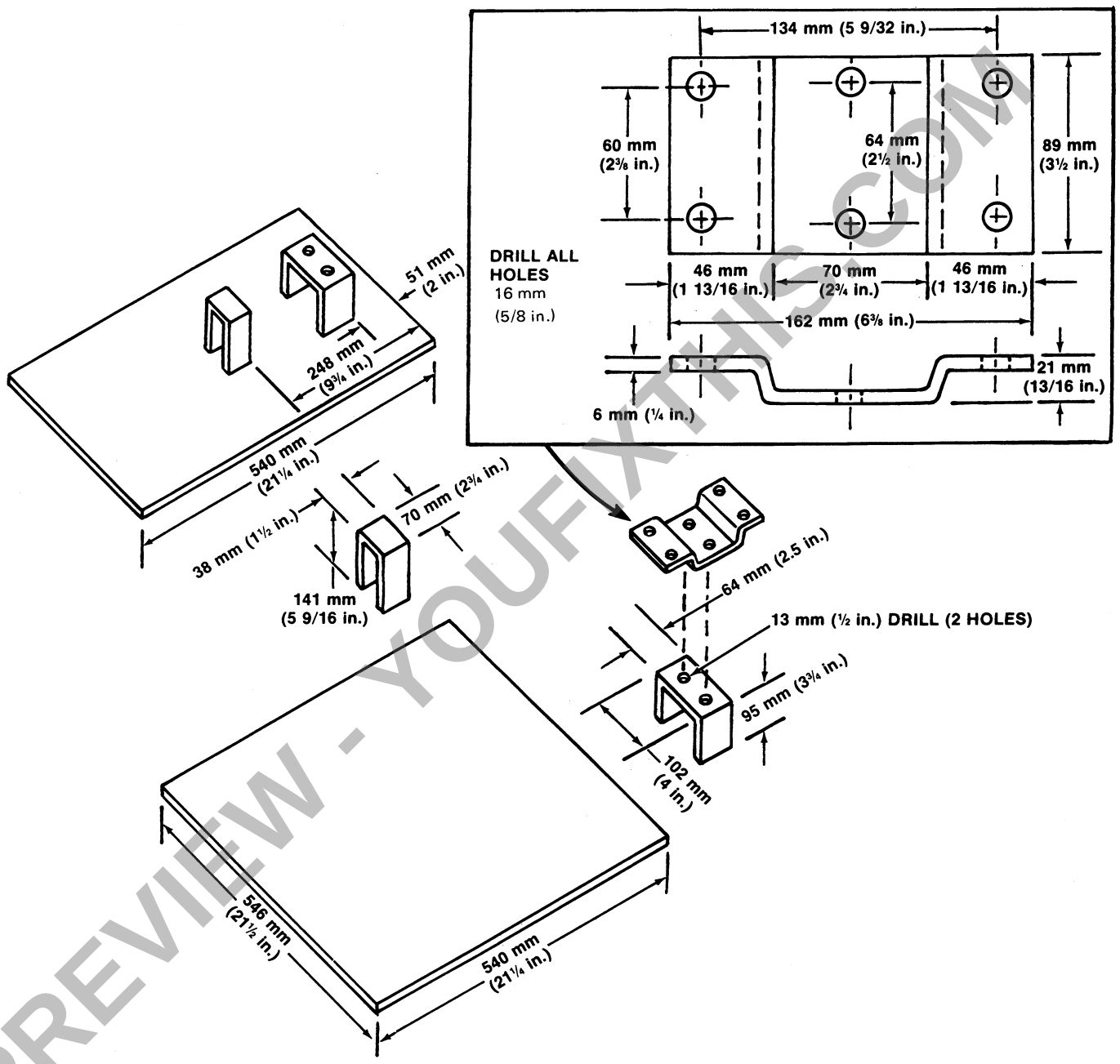


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MAKING SPECIAL TOOLS



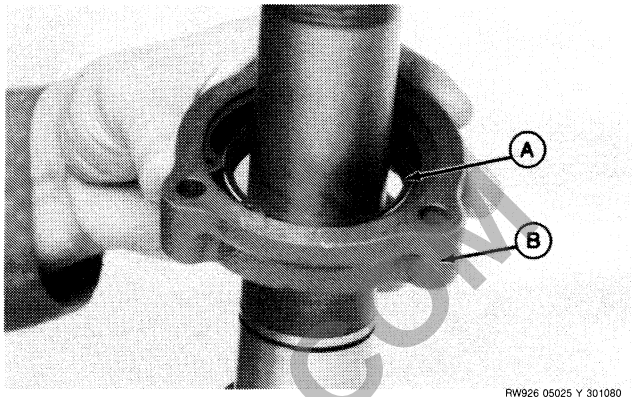
TRANSMISSION DISASSEMBLY STAND

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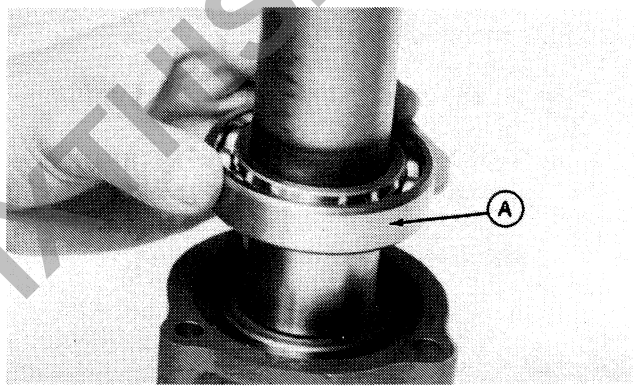
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5. Coat I.D. of oil seal (A) with grease, and install retainer (B) with seal on axle.



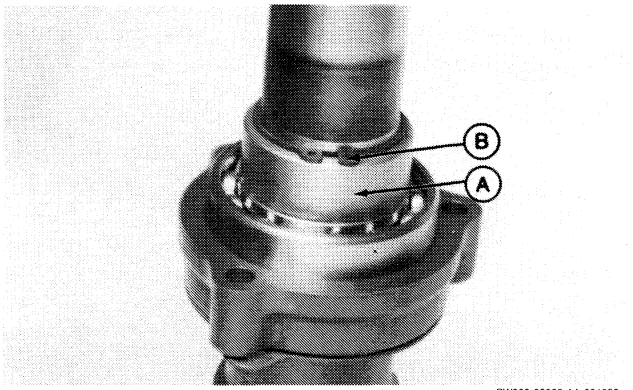
RW926 05025 Y 301080

6. Install bearing (A).



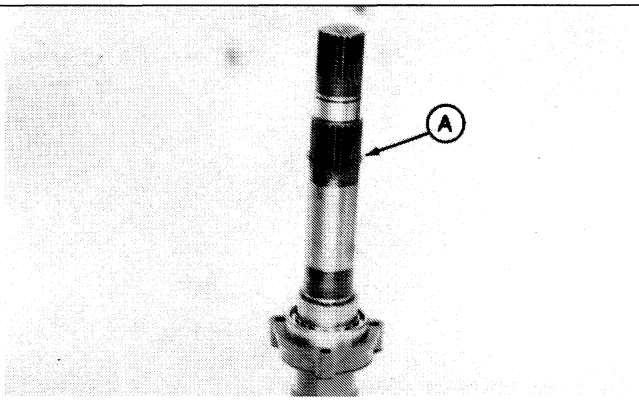
RW927 05025 Z 301080

7. Install spacer sleeve (A) and snap ring (B).



RW928 05025 AA 301080

8. Install snap ring (A).



RW929 05025 AB 301080

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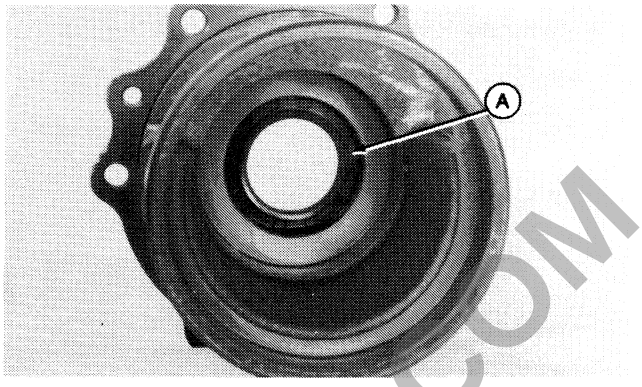
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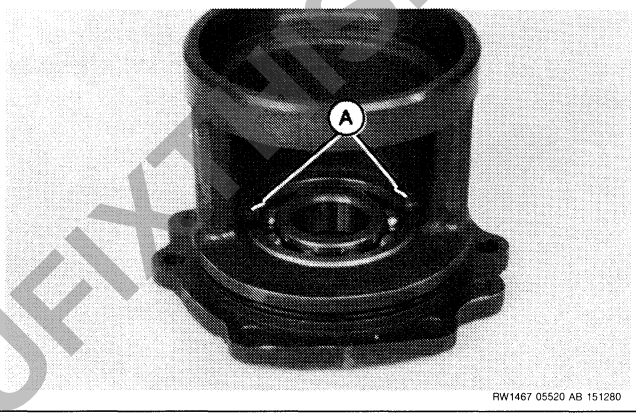
ASSEMBLE QUILLS

1. Install oil seal (A) from outside of quill. Drive in seal until it bottoms in bore in quill.



RW1468 05520 AA 151280

2. Install pinion shaft bearing and double spring pins (A) to secure bearing. Make sure splits in pins are opposite (180°) from one another in a vertical plane.



RW1467 05520 AB 151280

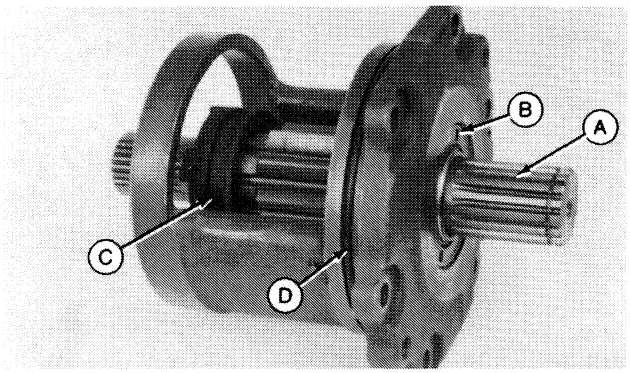
3. Install pinion shaft (A) from inside of quill until teeth on pinion bottom against bearing.

4. Coat I.D. and O.D. of oil seal wear sleeve with oil. Carefully slide oil seal wear sleeve (B) on shaft until it bottoms against bearing.

5. Install jaw clutch (C) on left-side pinion shaft as shown.

6. Install O-ring (D) and coat with oil.

A—Pinion Shaft
B—Oil Seal Wear Sleeve
C—Jaw Clutch
D—O-ring



RW1479 05520 AC 151280

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Section 60
STEERING/BRAKES REPAIR

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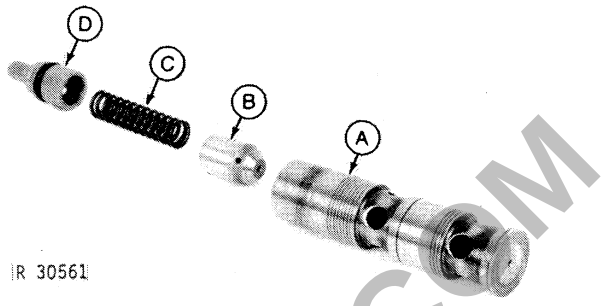
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5. Inspect spool valve (A) for scoring or excessive wear. The control valve housing and the spool valve are a matched set and must be replaced as a unit.

6. Examine poppet valve (B) and poppet seat in spool valve for wear or damage.

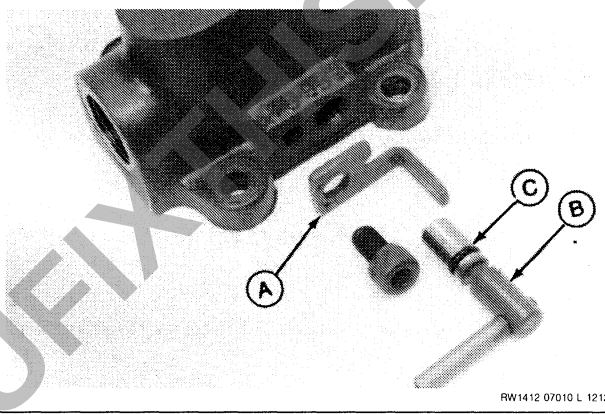
7. Check poppet spring (C) for damage and correct compression. Working load is 18.0 mm at 58 N (0.71 in. at 13 lbs).



R30561 07010 K 121280

8. Remove allen screw, retainer (A) and rate of drop valve (B). Inspect valve for damage and replace O-ring (C) as necessary. Rate of drop valve O.D. is 9.92 to 9.95 mm (0.391 to 0.393 in.).

9. Reinstall valve, retainer and allen screw tighten screw to 23.30 N.m (17-22 ft-lbs).

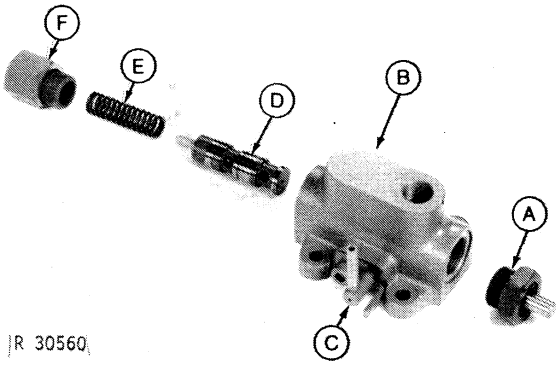


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10. Examine oil seal in push rod holder (A) for damage or leakage. Replace as necessary.

11. Check spool valve return spring (E) for correct compression. Working load is 34 mm at 196 N (1.34 in. at 44 lbs).

A—Push Rod Holder
B—Control Valve Housing
C—Rate of Drop Valve
D—Spool Valve
E—Return Spring
F—Plug

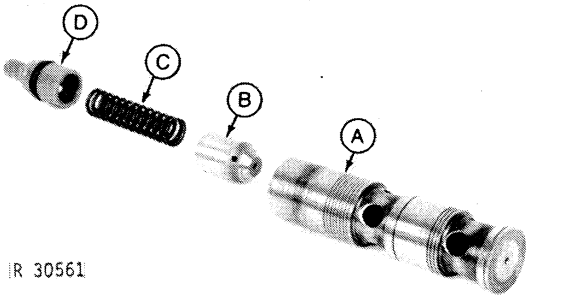


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ASSEMBLY AND INSTALL ROCKSHAFT CONTROL VALVE

1. Install poppet valve (B), spring (C) and retainer (D) into spool valve (A). Compress and secure assembly with retaining wires.

A—Spool Valve
B—Poppet Valve
C—Spring
D—Retainer



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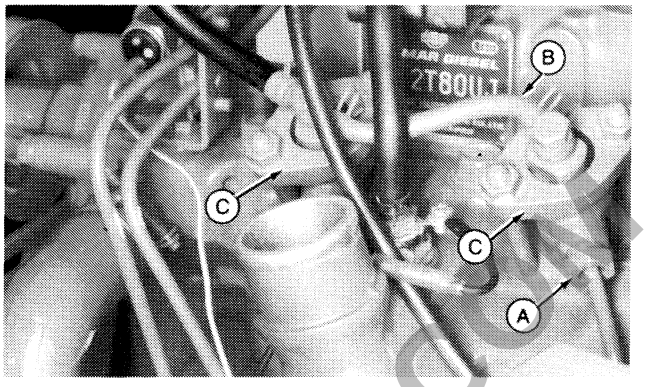
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TEST COMPRESSION PRESSURE

1. Before checking compression, be sure battery is fully charged.

2. Thoroughly clean area around injection lines and nozzles.

3. Remove injection lines (A), leak-off lines (B) and nozzle retainers (C).

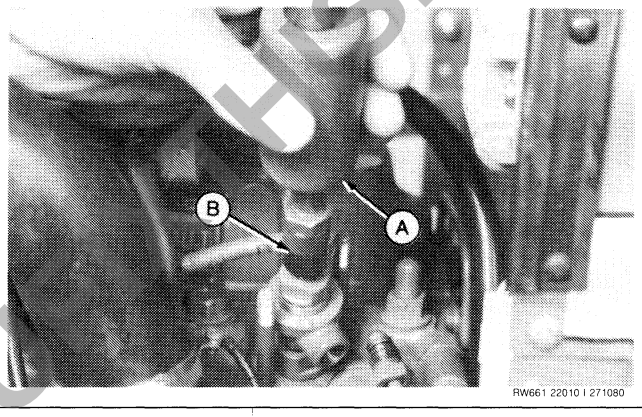


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4. Remove nozzles from bores.

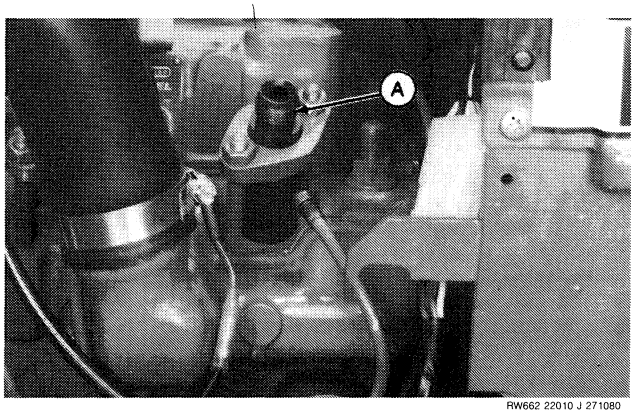
5. If nozzles cannot be removed by hand, remove using JDE-38-Nozzle Puller (A) and JDE-122 Adapter (B) as illustrated.

6. Remove precombustion chambers from bores of cylinders not being tested.



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7. Install JDF-31 Compression Tester Adapter (A) and reinstall nozzle retainer and tighten securely.



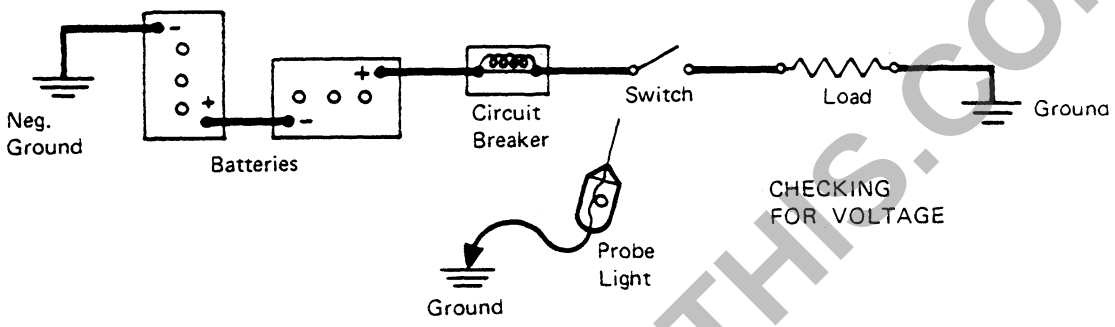
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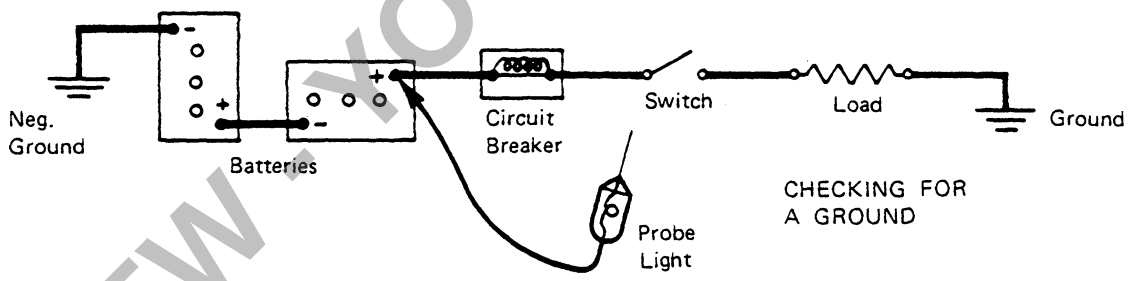
USING A PROBE LIGHT TO CHECK VOLTAGE FROM BATTERY

The following examples show how to connect a probe light to check a circuit for voltage or continuity to ground. When checking a circuit for battery voltage, connect the probe light clip to ground as shown:



USING A PROBE LIGHT TO CHECK CONTINUITY TO GROUND

When checking a circuit for continuity to ground connect the probe light clip to a known source of battery voltage as shown:



The controlling switches MUST BE "ON" and the circuit connected to the component to locate low resistance (0.5 to 5.0 ohms) in the load circuit or ground circuit of a component.

The following seven steps can be used to locate opens, grounds, high resistance or faulty components with the use of the fold-out color electrical wiring diagram.* The simple circuit can be used as a reference for each step but you must relate to the color wiring diagram for additional components that may be connected in parallel.

You may want to start at step (6) as your first step for diagnosing any manfunctioning circuit where the component is easily accessible. **If battery voltage is not present at step (6), it will be necessary to go to step (1) to isolate the malfunction.**

*IMPORTANT - This sequence is not to be used in a circuit that is functioning properly.

NOTE: After any repair, always return to Operational Check, Section 2, to be certain another circuit has not been affected during the repair.

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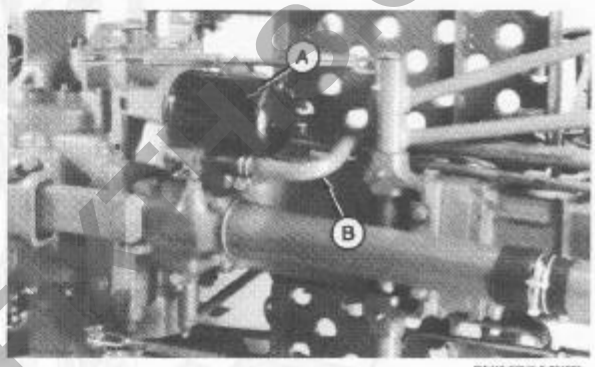
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POWER STEERING OPERATION

See Section 270, Group 10 for diagnosing power steering malfunctions.

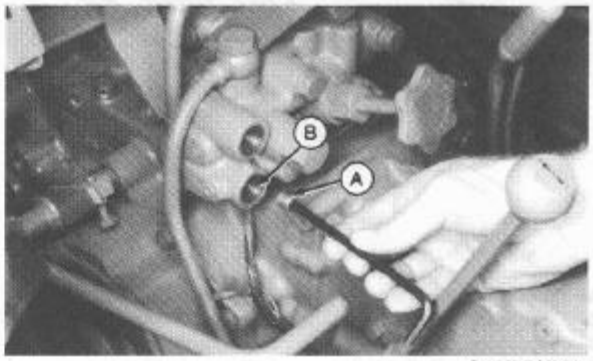
NOTE: The component operation of the field installed power steering is the same for the 650 and 750 tractors. The routing of the oil through the rockshaft piston cover varies slightly.

When power steering is added to the tractor, an auxiliary oil filter (A) is added to the system, in the suction line (B).



Whenever power steering or any other auxiliary equipment is added to the tractor, a plug (A) must be installed in the auxiliary outlet port (B). This provides full oil flow to the auxiliary equipment, and still allows the main system relief valve to sense system oil pressure.

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