Manual Description

This technical manual is written for an experienced technician and contains sections that are specifically for this product. It is a part of a total product support program.

The manual is organized so that all the information on a particular system is kept together. The order of grouping is as follows:

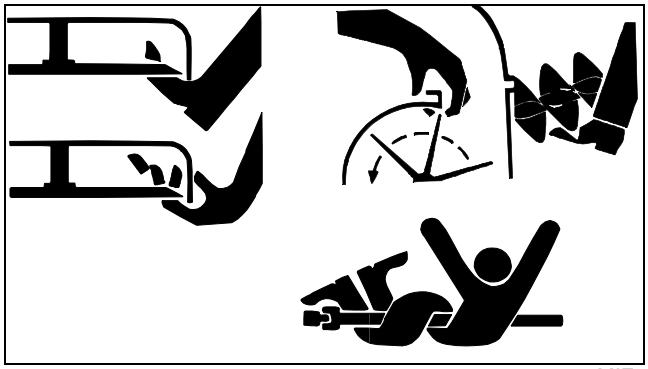
- Table of Contents
- Specifications and Information
- Identification Numbers
- Tools and Materials
- Component Location
- Schematics and Harnesses
- Theory of Operation
- Operation and Diagnostics
- Diagnostics
- Tests and Adjustments
- Repair
- Other

NOTE: Depending on the particular section or system being covered, not all of the above groups may be used.

The bleed tabs for the pages of each section will align with the sections listed on this page. Page numbering is consecutive from the beginning of the Safety section through the last section.

We appreciate your input on this manual. If you find any errors or want to comment on the layout of the manual please contact us.

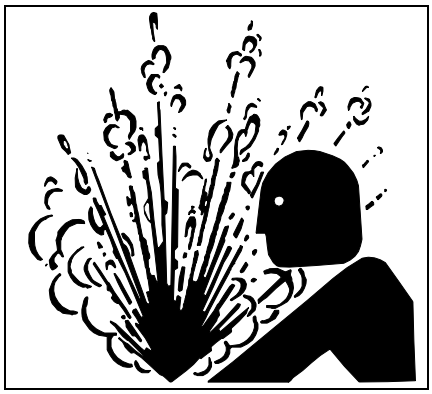
Avoid Injury From Rotating Blades, Augers and PTO Shafts



MIF

Keep hands and feet away while machine is running. Shut off power to service, lubricate or remove mower blades, augers or PTO shafts.

Service Cooling System Safely



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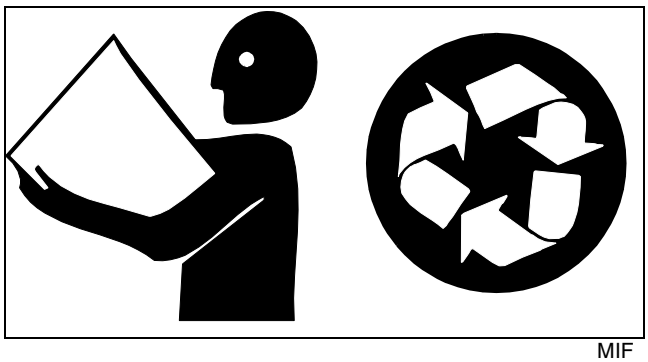
Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off machine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Handle Chemical Products Safely



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Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques. Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

Dispose Of Waste Properly

Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries. Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them. Do not pour waste onto the ground, down a drain, or into any water source. Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.

Live With Safety

MIF

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

Symptom: Exhaust color WHITE under load

No - Replace pistons and rings, bore or hone cylinders. Go to step (9) if problem continues.

(9) Piston rings not broken or seized?

Yes - Go to step (1).

No - Replace rings. Check pistons and cylinders. Go to step (1) if problem continues.

Symptom: Exhaust color BLACK under load

(1) Correct type of fuel?

Yes - Go to step (2).

No - Drain and replace fuel. Go to step (2) if problem continues.

(2) Air filter elements not clogged?

Yes - Go to step (3).

No - Clean or replace air filter elements. Go to step (3) if problem continues.

(3) Exhaust pipe not clogged?

Yes - Go to step (4).

No - Clean exhaust pipe. Go to step (4) if problem continues.

(4) Even volume of fuel being injected?

Yes - Go to step (5).

No - Repair or replace fuel injector pump or fuel injectors. Go to step (5) if problem continues.

(5) Correct volume of fuel being injected?

Yes - Go to step (6).

No - Replace faulty fuel injector pump or fuel injectors. Go to step (6) if problem continues.

(6) Proper spray pattern from injectors?

Yes - Go to step (7).

No - Clean or replace fuel injector nozzles. Go to step (7) if problem continues.

(7) Timing proper between injection pump, intake and exhaust valves?

Yes - Go to step (8).

No - Adjust valve clearance. Go to step (8) if problem continues.

(8) Intake or exhaust valves not leaking compression?

Yes - Go to step (9).

Symptom: Exhaust color BLACK under load

No - Grind valves and seats. Go to step (9) if problem continues.

(9) Intake or exhaust valves not seized?

Yes - Go to step (10).

No - Replace valve and check valve guide. Go to step (10) if problem continues.

(10) Engine being run under high altitude or high temperature conditions?

Symptom: Exhaust temperature too high

(1) Cooling system filled to correct level?

Yes - Go to step (2).

No - Check for leaks and fill system to correct level. Go to step (2) if problem continues.

(2) Engine running cool enough?

Yes - Go to step (3).

No - Check thermostat, replace if faulty. Adjust fan belt tension. Go to step (3) if problem continues.

(3) Exhaust pipe not clogged?

Yes - Go to step (4).

No - Clean exhaust pipe. Go to step (4) if problem continues.

(4) Even volume of fuel being injected?

Yes - Go to step (5).

No - Repair or replace fuel injector pump or fuel injectors. Go to step (5) if problem continues.

(5) Correct volume of fuel being injected?

Yes - Go to step (6).

No - Replace faulty fuel injector pump or fuel injectors. Go to step (6) if problem continues.

(6) Intake or exhaust valve clearance correct?

Yes - Go to step (7).

No - Adjust valve clearance. Go to step (7) if problem continues.

(7) Intake or exhaust valves not leaking compression?

Yes - Go to step (8).

No - Grind valves and seats. Go to step (8) if problem continues.

(8) Piston rings not broken or seized?

Assembling Front Sub-Frame To Machine Tunnel Section

1. Make sure that transmission drive shaft, and clutch release bearing are in place in tunnel section. See “Clutch Removal and Installation” on page 100.

2. Align front sub-frame with tunnel section of machine, making sure throwout bearing and drive shaft in tunnel are at same height as spline in clutch plate.

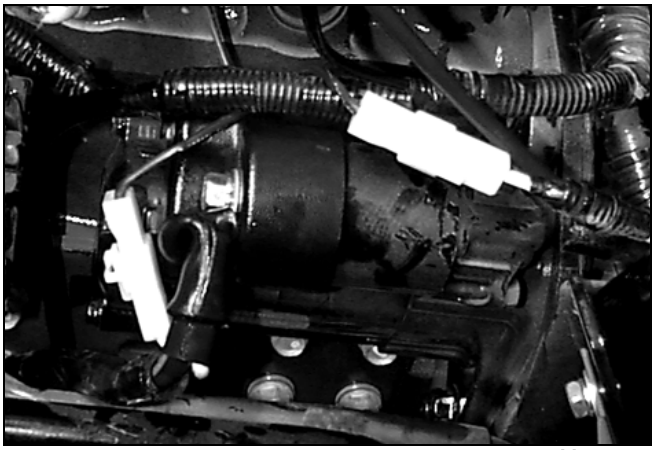
3. Hydrostatic Model: Align steel hydraulic lines on tunnel section to match up with engine mounted hydraulic pumps and oil cooler.

4. Move flywheel into bell housing of tunnel section. Spline of drive shaft should fit into spline of clutch plate. Do not force sub-frame and tunnel section together. Raise or lower splitting stands under engine, or rotate crankshaft pulley on engine until sections fit.

5. Install engine-to-tunnel section mounting bolts.

6. Route wiring harness the in the same path as it was removed. (See “Component Location - LH Side” on page 10 of the Electrical section.) Install fuse block electrical connector.

7. Install ground wire and mounting cap screw to frame under starter.



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8. Install starting motor and mounting bolts. Install battery positive cable to starting motor.

9. Connect upper and lower radiator hoses to engine.

10. Install studs of steering cylinder into mounting holes of front axle and secure with castle nuts and cotter keys.

11. Slide rear of drive shaft onto transmission MFWD output shaft. Align hole on front universal of drive shaft, with hole in front differential spline shaft. Slide universal onto differential spline shaft and secure with inner and outer roll pins. Install snap ring around double roll pin. Slide dust boots up over differential housing in the front and transmission housing in the rear, and secure with clamp.

12. Hydrostatic Models: Install oil lines from oil cooler to steering valve and transaxle.

13. Install hydraulic suction and pressure lines to engine mounted pumps. Tighten 6 mm cap screws holding pressure line flanges to pumps to **8.8 N•m (78 lb-in.)**.

14. Install fuel hose from fuel filter/water separator to fuel transfer pump. Install fuel hose from injection pump to fuel tank. Secure hoses with spring clamps.

15. Route tachometer cable from dashboard to left side of engine, away from exhaust manifold and connect to gear drive on engine front cover. Install tie strap around speedometer cable and alternator wires.

16. Check gasket and install muffler onto exhaust manifold and pipe.

17. Fill engine with proper oil. See “Specifications” on page 27. Engine oil capacity (with filter) is approximately **2.7 L (2.85 qt)**.

18. Install throttle shaft into fuel injection pump lever. Check for full movement of operator’s throttle lever. See “Throttle Adjustment” on page 49. Install flat washer and cotter pin.

19. Install kick panel dashboard and secure with screws.

20. Place plastic tunnel cover over tunnel section and secure with plastic rivets.

21. Install knob onto rockshaft speed control valve stem, and tighten with double nut.

22. Install air cleaner mounting bracket. Install air cleaner and hold-down strap.

23. Install coolant recovery tank and hoses, if removed. Fill cooling system with coolant. See “Specifications” on page 27.

24. Install battery and hold-down.

25. Make sure ignition switch is in OFF position. Install positive battery cable clamp to battery first, then negative clamp.

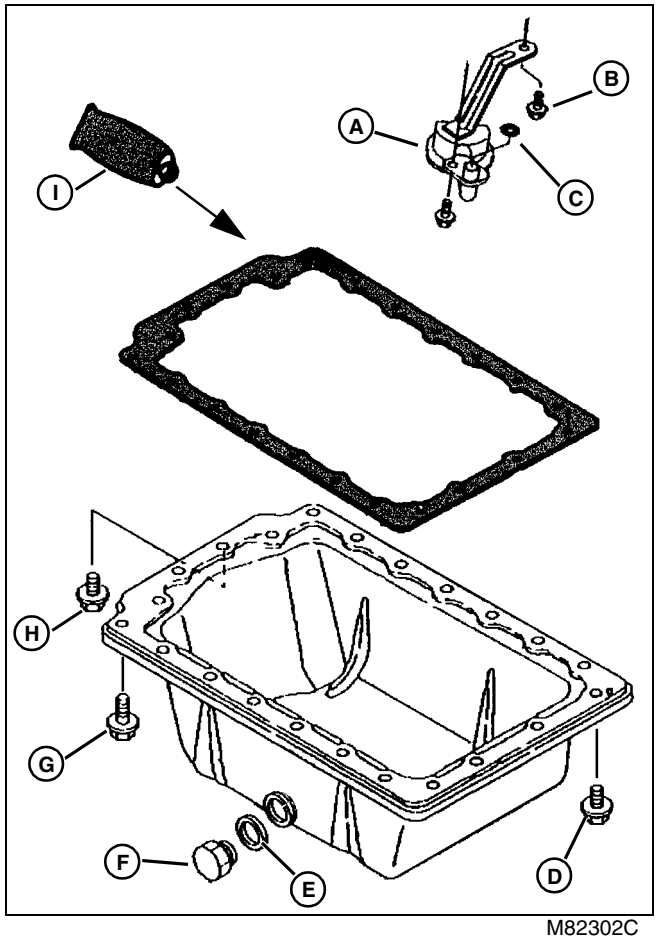
26. Install engine cover onto hinge pins on machine. Install hooked end of prop rod into engine bracket, and other end into bracket on engine cover. Secure prop rod with spring pin, and left hinge with flat washer and spring pin.

27. Install front and side covers.

Oil Pan and Strainer

Removal/Installation

- Crankcase oil capacity is **2.7 L (2.85 qt)**.
- Clean gasket mating surfaces of all old gasket material.
- Apply a thin bead of John Deere Form-In-Place Gasket to oil pan before installation.
- Fill engine with correct engine oil. (See “Specifications” section.)



M82302C

A - Oil Strainer
B - Cap Screw, M6 x 12, 11 N•m (97 lb-in.)
C - O-Ring (replace)
D - Cap Screw, M6 x 12, 9 N•m (80 lb-in.)
E - Washer (replace)
F - Drain Plug
G - Cap Screw, M6 x 12 (Pan-To-Oil Seal Case), 9 N•m (80 lb-in.)
H - Cap Screw, M6 x 8, 11 N•m (97 lb-in.)
I - John Deere Form-in-Place Gasket

Connecting Rod Side Play Check

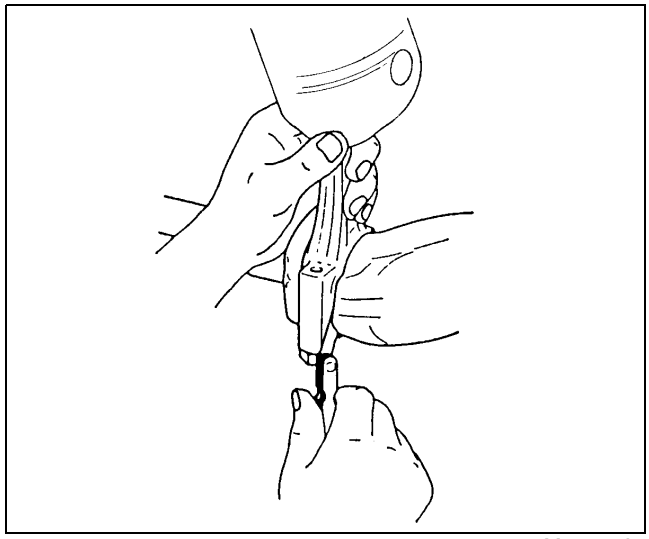
Reason:

To determine proper side clearance between crankshaft and connecting rod.

Equipment:

- Feeler Gauge

Procedure:



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1. Insert a feeler gauge, according to specifications, between connecting rod cap and crankshaft.

Connecting Rod Side Play Specifications:

Standard . . . . . 0.20 - 0.40 mm (0.008 - 0.016 in.)

Wear Limit. . . . . 0.55 mm (0.0217 in.)

Results:

- If side play exceeds wear limit, replace connecting rod and connecting rod cap.

Crankshaft End Play Check

Reason:

To determine proper side clearance between crankshaft and engine block.

Equipment:

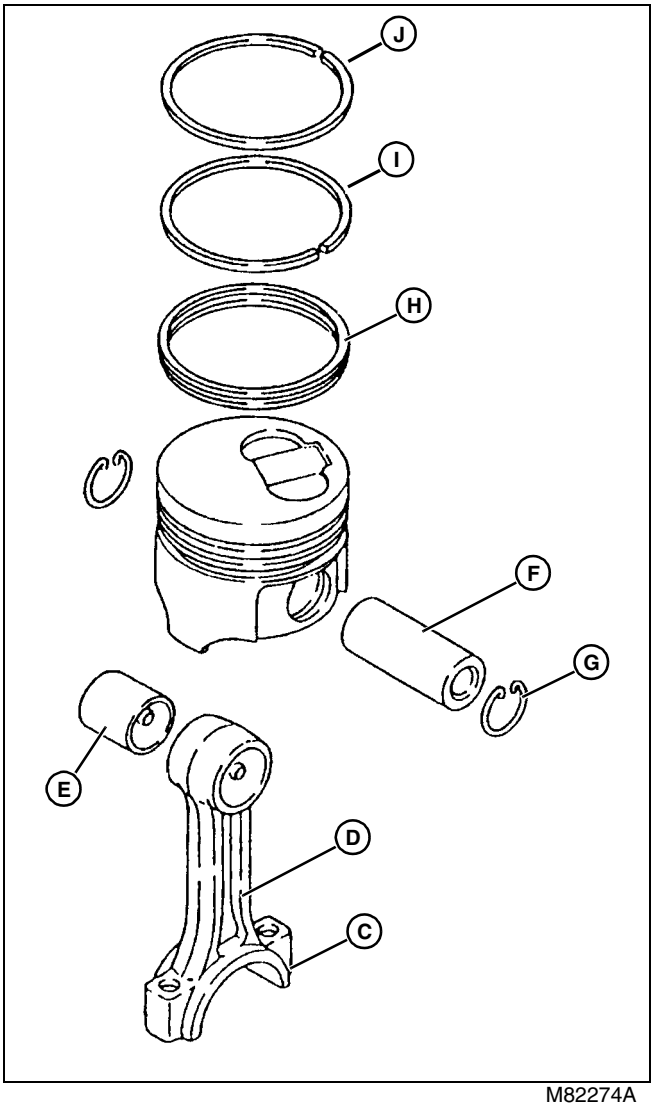
- Dial Indicator

Procedure:

NOTE: Crankshaft end play can be measured at front end or rear end of crankshaft. Procedure is performed from the rear end. The flywheel is removed to show detail.

Disassembly:

IMPORTANT: Avoid damage! Pistons must be installed on the same connecting rod they were removed from.



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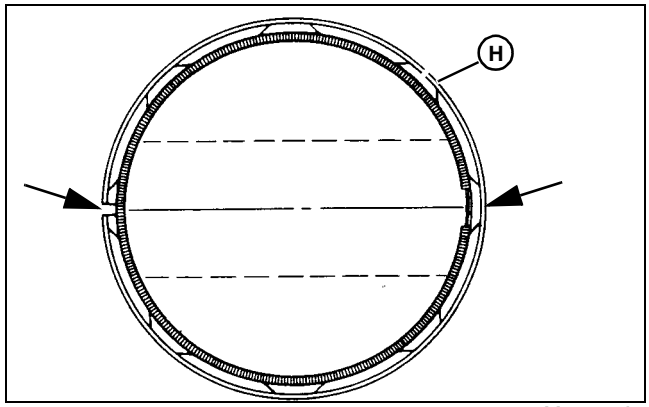
- Put a mark on each piston and connecting rod (D) to aid in assembly.
- Piston pin bushing (E) is press fit in connecting rod. Remove bushing only if replacement is necessary. (See Inspection/Replacement procedures.)
- Inspect all parts for wear or damage. Replace as necessary.

Assembly:

- Apply clean engine oil to all parts during assembly.

IMPORTANT: Avoid damage! Pistons must be installed on the same connecting rod they were removed from.

1. Assemble piston to connecting rod with piston size mark on same side as connecting rod “punched” alignment mark (C). If a new connecting rod is used, assemble piston to connecting rod with piston size mark opposite connecting rod bearing insert groove.
2. Install piston pin (F) and retaining/snap rings (G).



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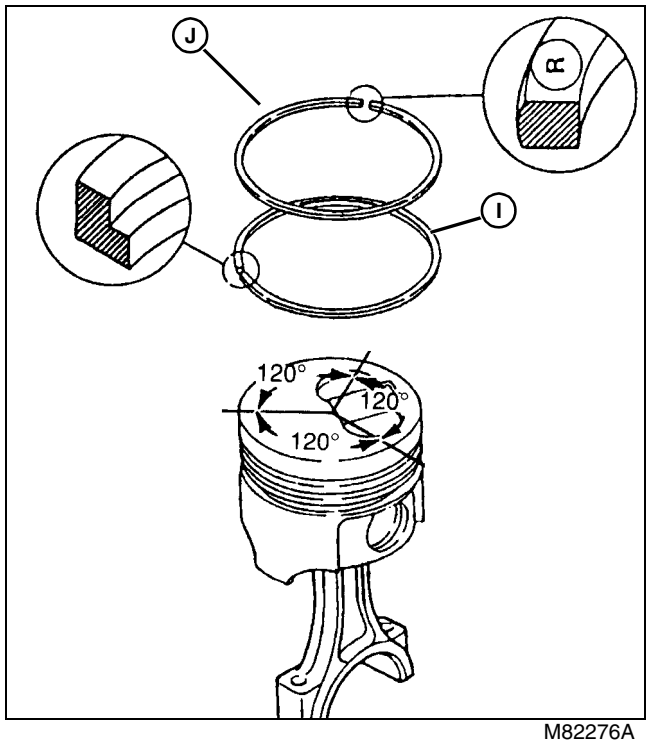
3. Install oil ring expander (H) in bottom ring groove of piston with ends above either end of piston pin.
4. Install oil ring over expander with ring gap opposite (180°) of expander ends.



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Fuel Injection Nozzle Test

CAUTION: Avoid Injury! Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable source. Such information is available from the Deere & Company Medical Department in Moline, Illinois, U.S.A.

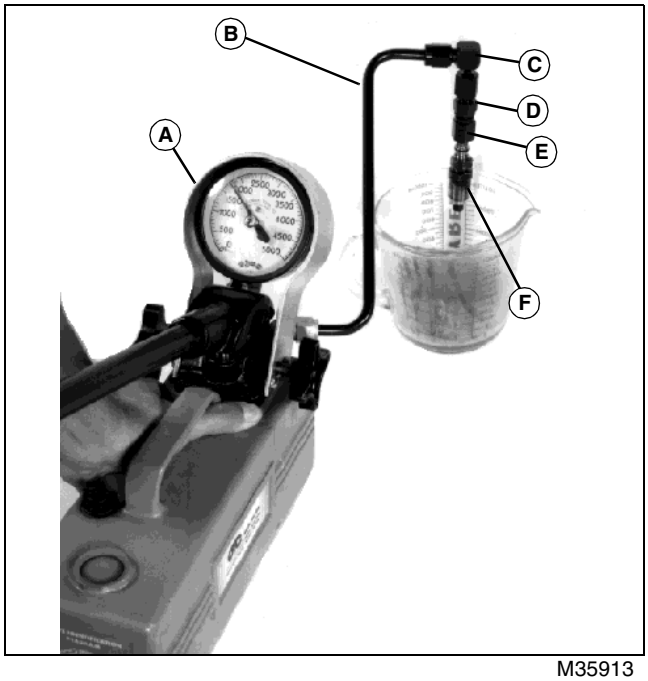
Reason:

To determine opening pressure, leakage, chatter and spray pattern of the fuel injection nozzle.

Equipment:

- D01110AA Adapter Set
- D01109AA Diesel Fuel Injection Nozzle Tester
- 23622 Straight Adapter
- Container

Connections:



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1. Connect the fuel injection nozzle (F) to D01109AA Diesel Fuel Injection Nozzle Tester (A) using parts 36352 (B), 23617 (C), 23621 (D) from D01110AA Adapter Set, and 23622 straight adapter.

IMPORTANT: Avoid damage! Use clean filtered diesel fuel when testing injection nozzles to get best test results.

Procedure 1:

Test the fuel injection nozzle opening pressure following the Nozzle Tester manufacturer's instructions.

The opening pressure is **19600 + 1000/ - 0 kPa (2843 + 145/ - 0 psi)**.

Results:

- If the pressure reading does not meet specification, disassemble the injection nozzle and inspect for contamination or a stuck valve. If necessary, add or remove shims to change opening pressure.

Procedure 2:

Test fuel injection nozzle leakage following the nozzle tester manufacturer's instructions.

1. Dry the nozzle completely using a lint-free cloth.
2. Pressurize the nozzle to **19600 kPa (2843 psi)**.
3. Watch for leakage from nozzle spray orifice.

Results:

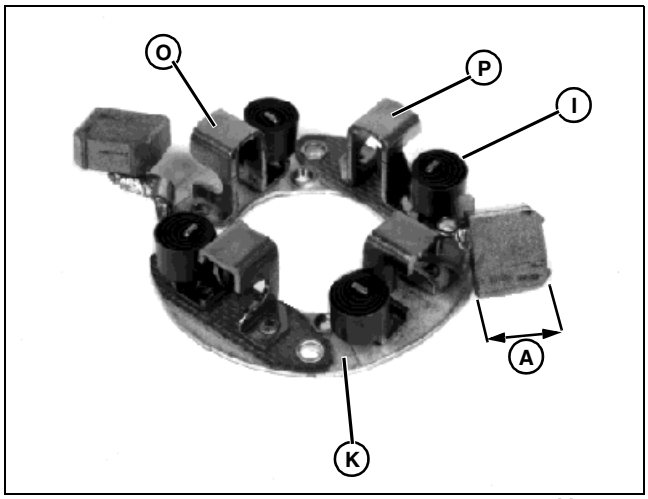
- Fuel should not leak from the nozzle when the nozzle is pressurized.
- If the injection nozzle leaks fuel, disassemble and inspect the nozzle assembly for contamination. Inspect the valve seating surface. Replace the nozzle assembly if necessary.

Procedure 3:

Test the fuel injection nozzle chatter and spray pattern following the nozzle tester manufacturer's instructions.

1. Pressurize nozzle to **19600 kPa (2843 psi)**.
2. With slow hand lever movement there should be a “chatter” sound.
3. With fast hand lever movement the nozzle should exhibit an even, fine atomized spray pattern (G).
4. Place a sheet of white paper **30 cm (12 in.)** below the nozzle. The injection spray should form a perfect circle on the paper.

Starting Motor Inspection and Test



M82234

1. Measure brush lengths (A). Minimum brush length is **8.5 mm (0.335 in.)**. Replace brush if length is below minimum.

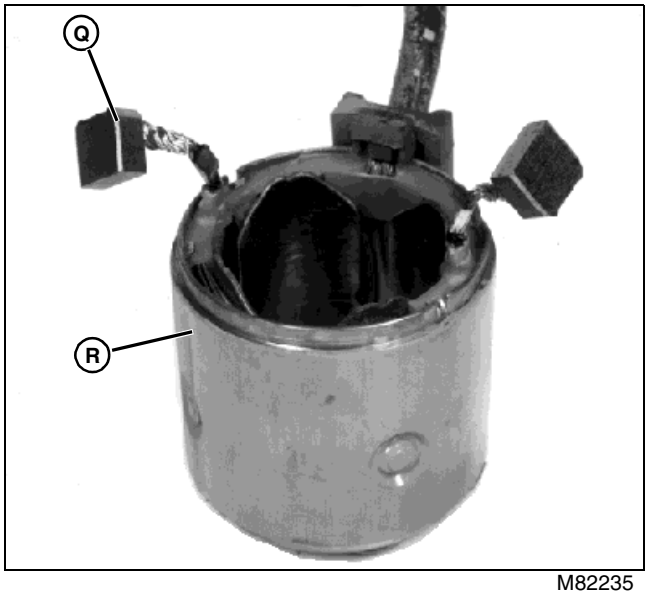
NOTE: Test brush holder using an ohmmeter or test light.

2. Test brush holder (K):

   - Touch one probe of tester to negative brush holder (O) and other probe to field brush holder (P).
   - If there is continuity, replace the brush holder.

3. Inspect springs (I) for wear or damage. Replace if necessary.

NOTE: Test field coil using an ohmmeter or test light.



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4. Test for grounded field winding:

   - Touch one probe of tester to field coil brush (Q) and other probe to field coil housing (R).
   - Be sure the brush lead is not touching the frame. If there is continuity, the coil is grounded and the field coil housing assembly must be replaced.

IMPORTANT: Avoid damage! Do not clean armature with solvent. Solvent can damage insulation on windings. Use only mineral spirits and a soft bristle brush.

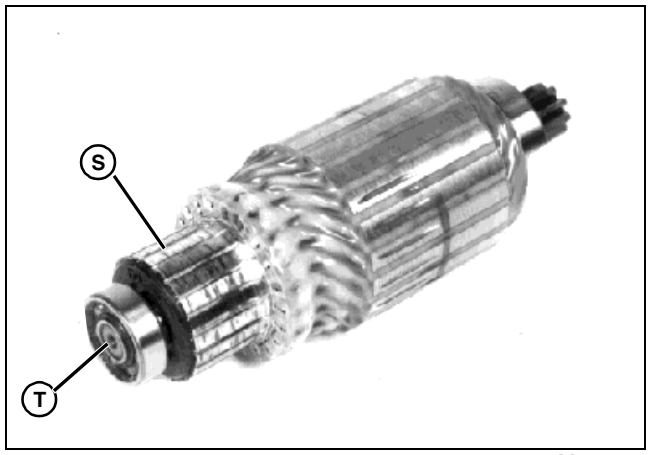
5. Test for open field coil:

   - Touch one probe of tester to each field coil brush.
   - If there is no continuity, the field coil is open and the field coil housing assembly must be replaced.

6. Inspect armature. Look for signs of dragging against pole shoes.

7. Inspect commutator. Look for roughness, burned bars, or any material which might cause short circuits between bars. If necessary, clean and touch up with 400 sandpaper. NEVER use emery cloth. Clean all dust from armature when finished.

NOTE: Test armature windings using an ohmmeter or test light.



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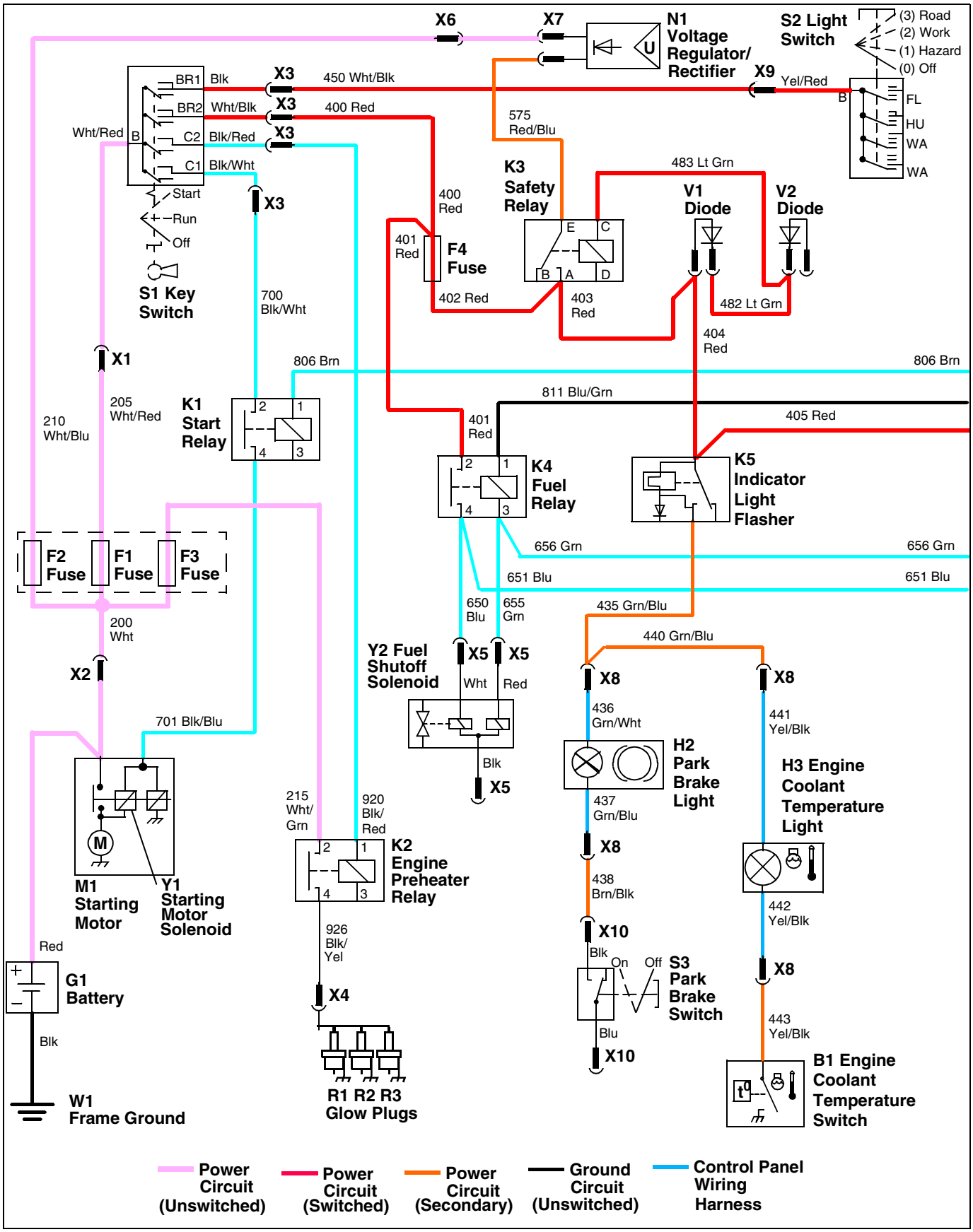
8. Test for grounded windings:

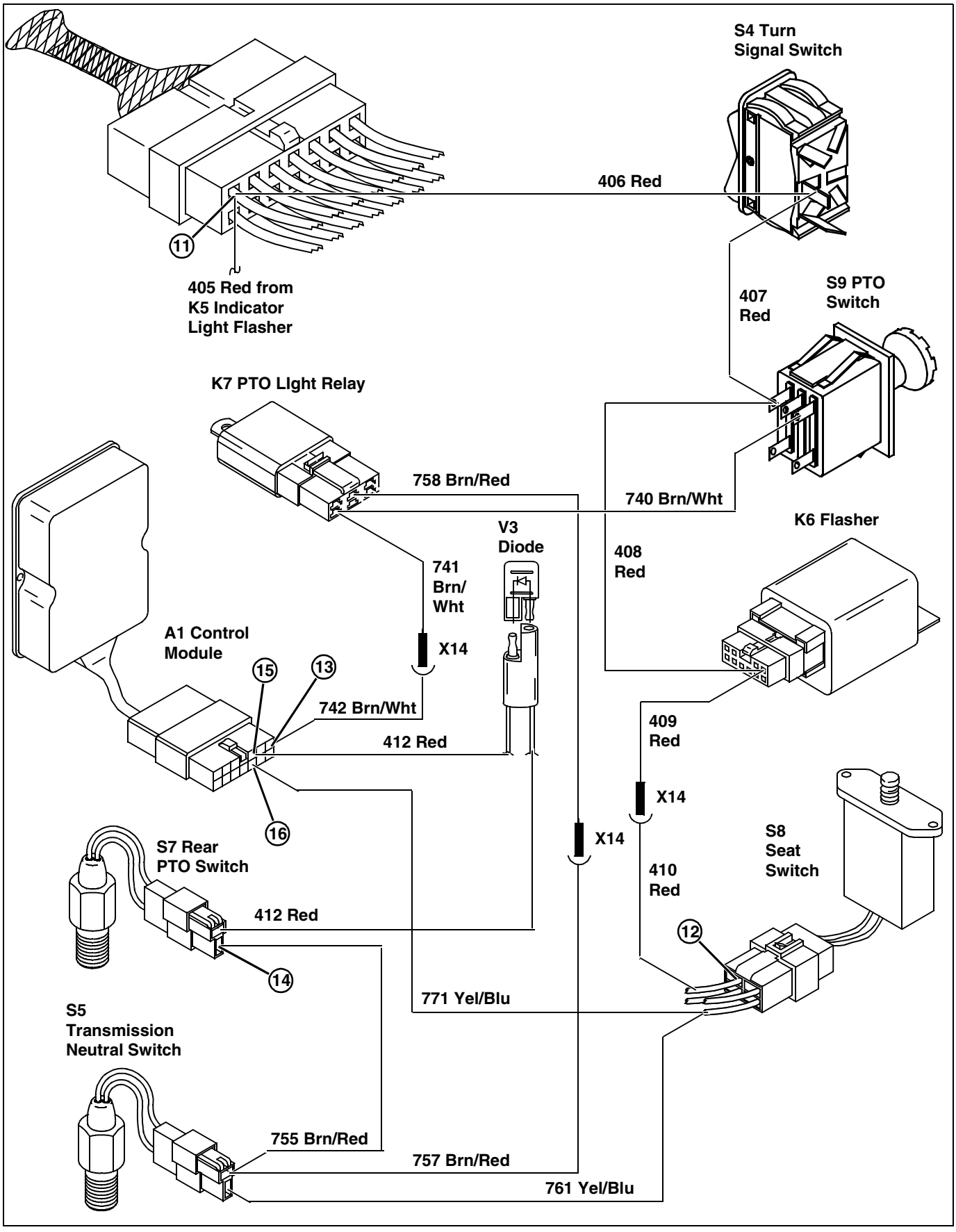
   - Touch probes on one commutator bar (S) and armature shaft (T). Armature windings are connected in series, so only one commutator bar needs to be checked.
   - If test shows continuity, a winding is grounded and the armature must be replaced.

9. Test for open circuit windings:

   - Touch probes on two different commutator bars.
   - If test shows no continuity, there is an open circuit and the armature must be replaced.

Power Circuit Electrical Schematic - Gear




S4 Turn
Signal Switch
406 Red
11
405 Red from
K5 Indicator
Light Flasher
407
Red
S9 PTO
Switch
K7 PTO LIght Relay
758 Brn/Red
740 Brn/Wht
V3
Diode
741
Brn/
Wht
X14
K6 Flasher
408
Red
A1 Control
Module
15
13
742 Brn/Wht
412 Red
409
Red
X14
X14
16
S7 Rear
PTO Switch
S8
Seat
Switch
410
Red
412 Red
12
14
771 Yel/Blu
S5
Transmission
Neutral Switch
755 Brn/Red
757 Brn/Red
761 Yel/Blu

Engine Shutoff Circuit Diagnosis - Hydro

Test Conditions:

- Park brake LOCKED
- Key switch in RUN position (engine OFF)
- Seat switch in ON position
- Gear range lever in NEUTRAL position
- PTO switch in OFF position

Test/Check Point	Normal	If Not Normal
1. K4 Fuel relay	Battery voltage	Check 400 and 401 Red wires and connections. If OK, replace key switch.
2. Seat switch	Battery voltage	Test F4 fuse. Check 402, 403, 404, 405, 406, 407, 408, 409, and 410 Red wires and connections. If OK, replace key switch.
3. A1 Control module	Battery voltage	Check 800 Yel/Grn wires and connections. If OK, replace seat switch.
4. A1 Control module	Battery voltage	Check 740, 741, and 742 Brn/Wht wires and connections. If OK, replace PTO switch.
5. Rear PTO switch	Battery voltage	Check 758, 757, and 755 Brn/Red wires and connections. If OK, replace PTO light relay.
6. A1 Control module	Battery voltage	Test V3 diode. Check 412 Red wire and connections. If OK, replace rear PTO switch.
7. A1 Control module	Battery voltage	Check 761 and 771 Yel/Blu wires and connections. If OK, replace transmission PTO switch.
8. A1 Control module	Continuity to ground	Check 175 and 150 Blk wires and connections.
9. Fuel shutoff solenoid	Battery voltage	Check 657, 656, and 655 Grn wires and connections. If OK, replace control module.

Test Conditions:

- Park brake LOCKED
- Key switch in RUN position (engine OFF)
- Seat switch in ON position then RELEASE seat switch plunger for test.
- Gear range lever in LO or HI RANGE position
- PTO switch in OFF position

* The NORMAL results will only exist for approximately 0.5 seconds. Have test equipment connected and ready to display the results before each test.

Test/Check Point	Normal	If Not Normal
10. A1 Control module	Less than 0.2 volts once seat switch is released.	Test seat switch. If OK, replace control module.
11. Fuel shutoff solenoid	Battery voltage for 0.5 seconds, then less than 0.2 volts.	Replace control module.

Fuel Gauge Sensor Test

Reason:

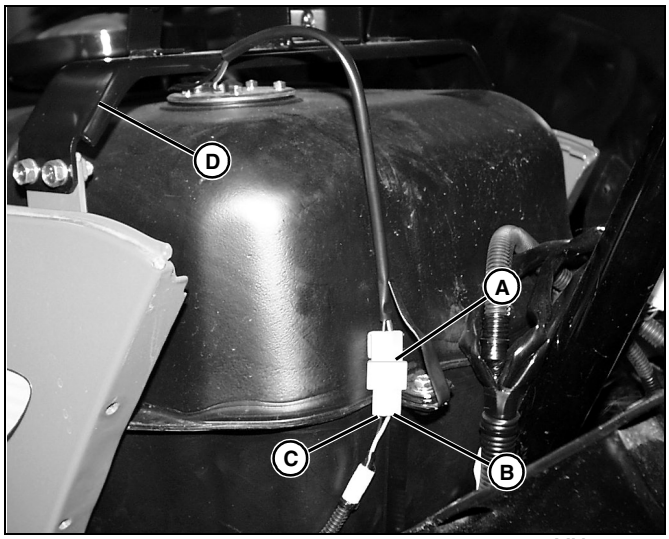
To verify that the fuel gauge sensor is operating properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine safely in NEUTRAL with park brake LOCKED.
2. Raise hood.
3. Remove plastic kick panel from below steering column support and move away enough to access fuel gauge connector.
4. Turn key switch to ON position.



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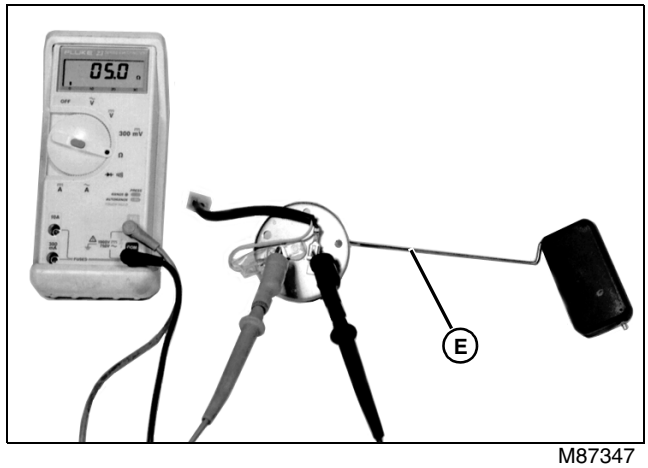
5. Unplug connector (A). The fuel gauge must drop to EMPTY. If not, Short the Yel/Wht wire (B) to the black wire (C) connector on the fuel sensor. The gauge must rise to FULL. If not, test the fuel sensor ground circuit.
6. If the gauge does not correctly indicate fuel levels based on the two tests above, proceed to step 10.
7. Remove the upper dash cowl, hood and upper support bracket (D).
8. Disconnect fuel gauge sensor wires.
9. Remove fuel gauge sensor from fuel tank.



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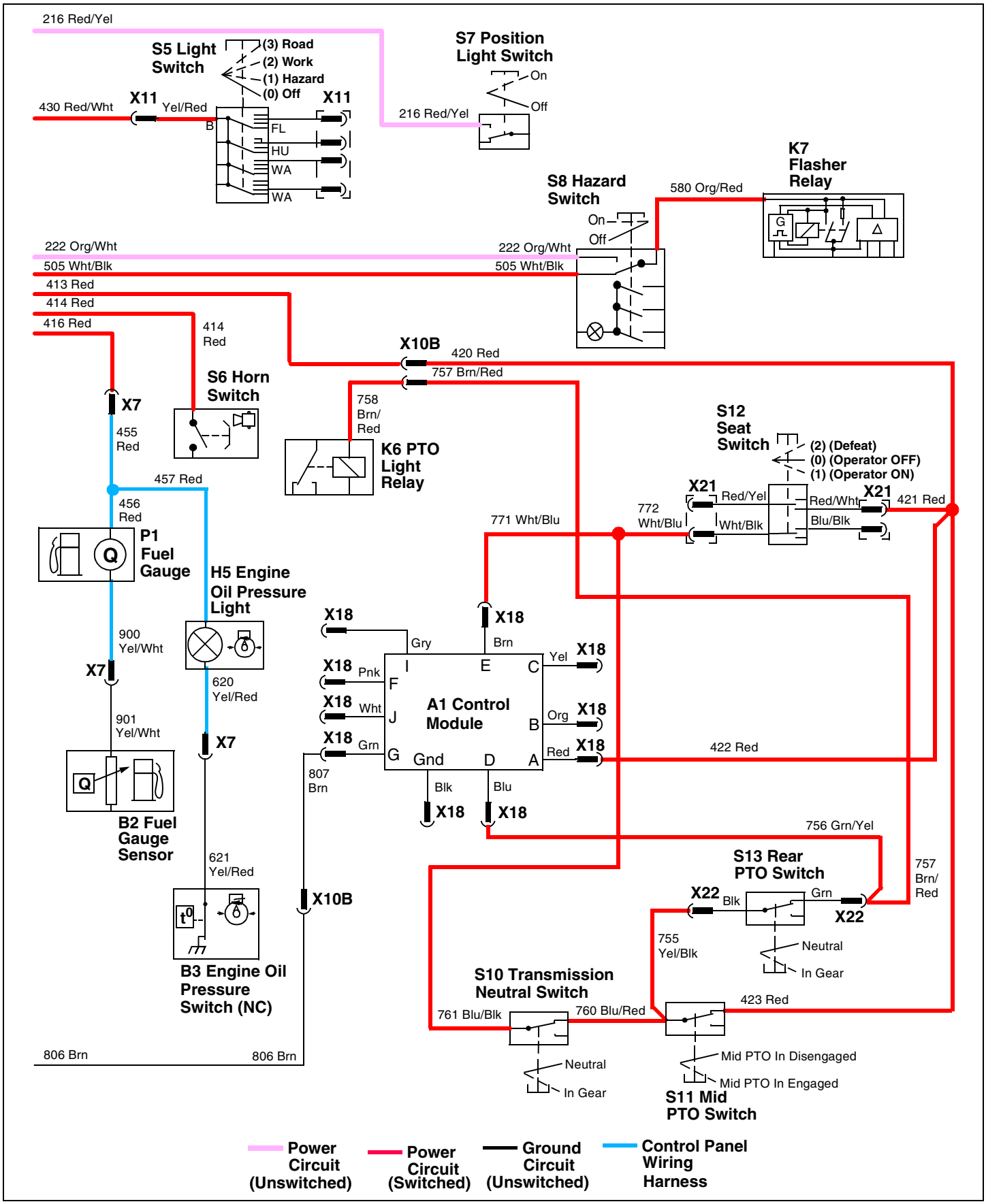
10. Using an ohmmeter connected to fuel gauge sensor contacts, check if continuity exists between terminals. If continuity exists, measure resistance across terminals as float and float arm (E) are moved through full range of motion.

Fuel Gauge Sensor Continuity:

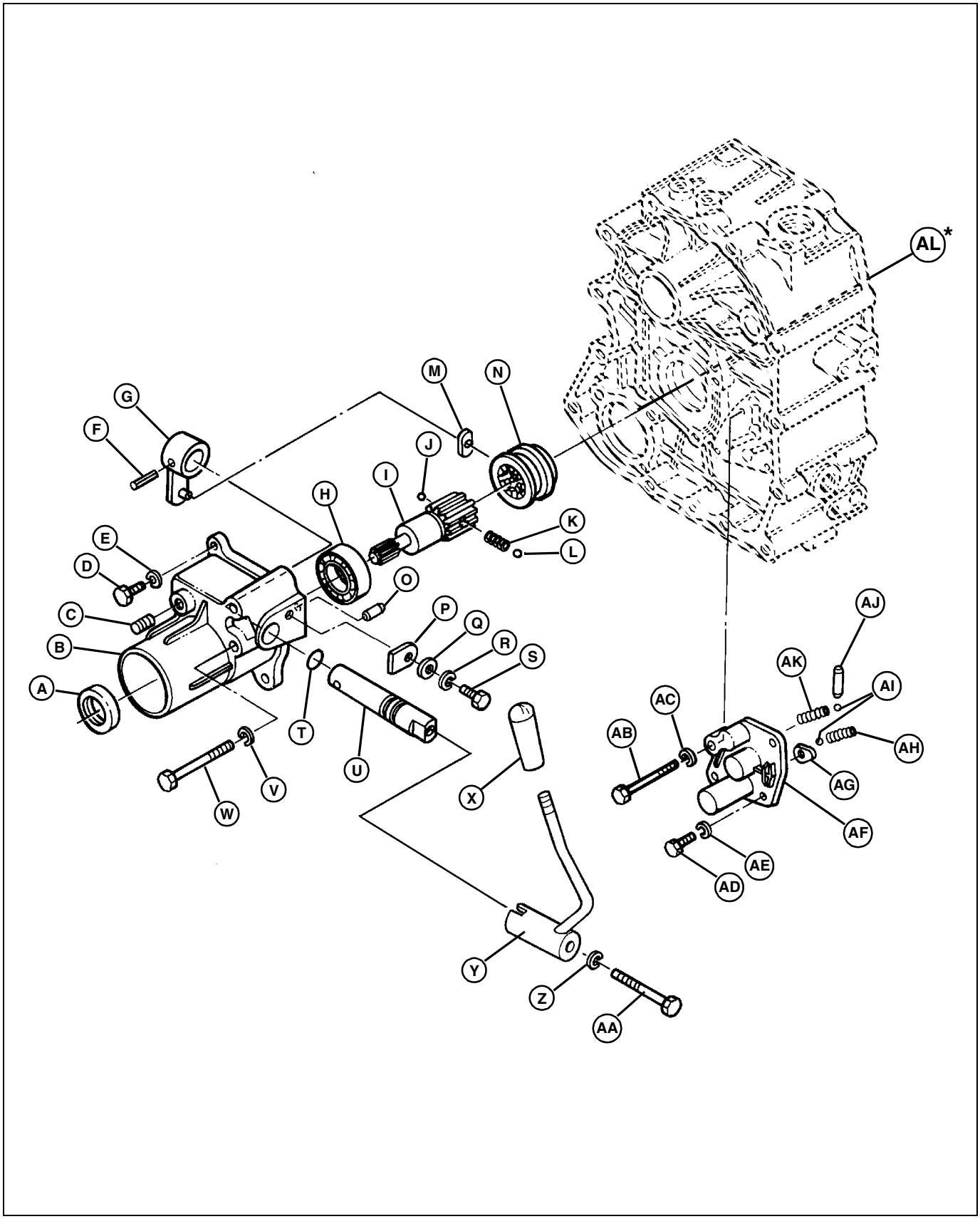
Variable Resistance . . . . . 5 - 110 ohms

Results:

- If resistance does not meet specifications, replace fuel gauge sensor.


216 Red/Yel
S5 Light Switch
(3) Road
(2) Work
(1) Hazard
(0) Off
430 Red/Wht
X11
Yel/Red
B
FL
HU
WA
WA
X11
S7 Position Light Switch
On
Off
216 Red/Yel
S8 Hazard Switch
On
Off
580 Org/Red
K7 Flasher Relay
G
222 Org/Wht
505 Wht/Blk
222 Org/Wht
505 Wht/Blk
413 Red
414 Red
416 Red
414 Red
X10B
420 Red
757 Brn/Red
S6 Horn Switch
758 Brn/ Red
K6 PTO Light Relay
X7
455 Red
457 Red
456 Red
P1 Fuel Gauge
Q
H5 Engine Oil Pressure Light
900 Yel/Wht
X7
620 Yel/Red
901 Yel/Wht
X7
B2 Fuel Gauge Sensor
621 Yel/Red
B3 Engine Oil Pressure Switch (NC)
X10B
806 Brn
806 Brn
S12 Seat Switch
(2) (Defeat)
(0) (Operator OFF)
(1) (Operator ON)
X21
Red/Yel
Wht/Blk
X21
Red/Wht
Blu/Blk
421 Red
772 Wht/Blu
771 Wht/Blu
X18
Gry
X18
Brn
X18
Pnk
X18
Wht
X18
Grn
A1 Control Module
I
E
C
F
J
G
Gnd
D
A
B
Yel
X18
Org
X18
Red
X18
422 Red
807 Brn
Blk
Blu
X18
X18
756 Grn/Yel
S13 Rear PTO Switch
X22
Blk
Grn
X22
757 Brn/ Red
755 Yel/Blk
Neutral
In Gear
S10 Transmission Neutral Switch
761 Blu/Blk
760 Blu/Red
423 Red
Neutral
In Gear
Mid PTO In Disengaged
Mid PTO In Engaged
S11 Mid PTO Switch
Power Circuit (Unswitched)
Power Circuit (Switched)
Ground Circuit (Unswitched)
Control Panel Wiring Harness

MFWD Output Shaft Component Location - Gear



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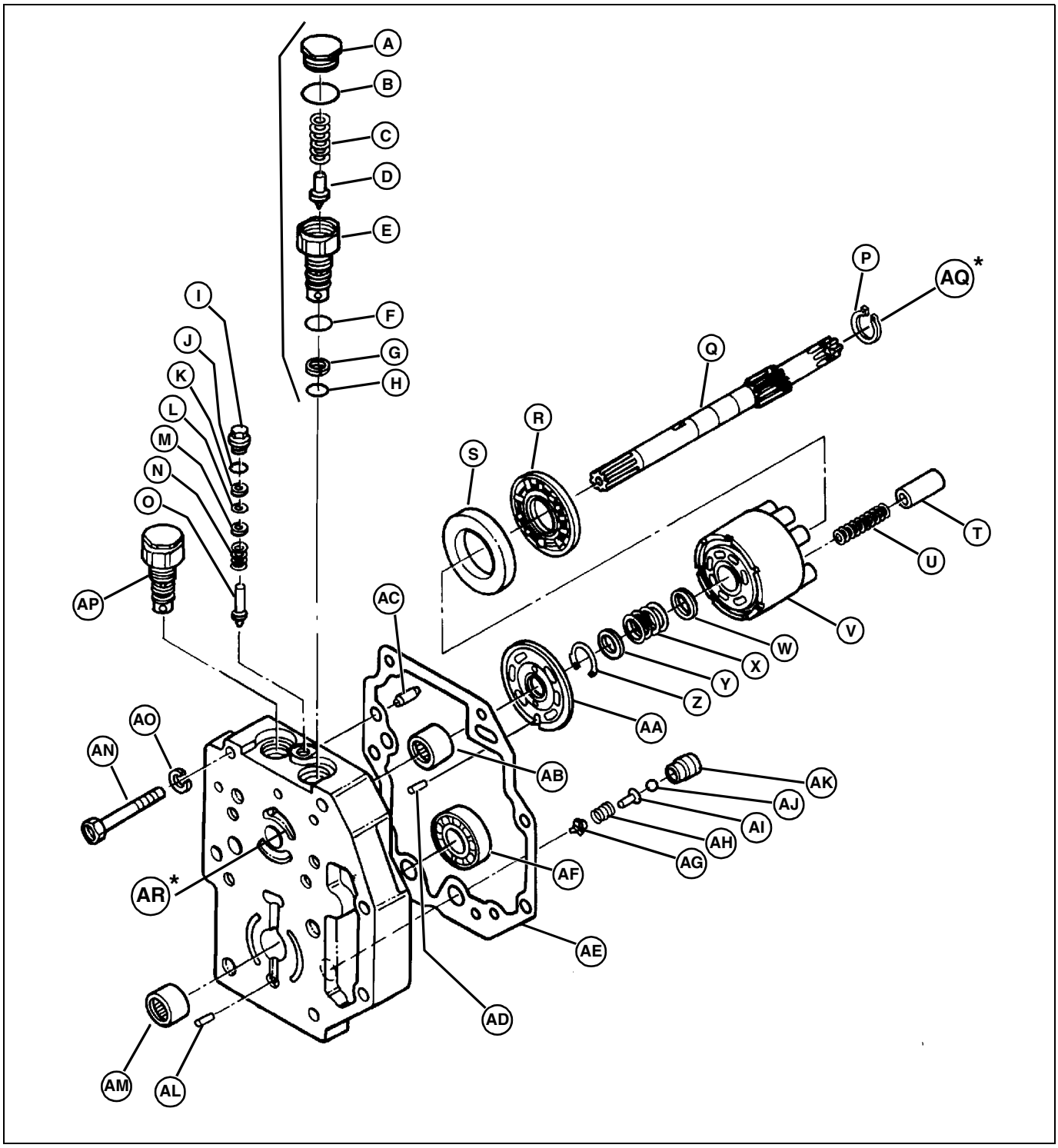
Hydrostatic Pump Component Location - HST



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