JOHN DEERE
WORLDWIDE COMMERCIAL & CONSUMER EQUIPMENT DIVISION

Compact Utility Tractors
4510, 4610 and 4710

TM1986 NOVEMBER 2002

TECHNICAL MANUAL



JOHN DEERE

North American Version
Litho in U.S.A.

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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.

All information, illustrations and specifications in this manual are based on the latest information at the time of publication. The right is reserved to make changes at any time without notice.

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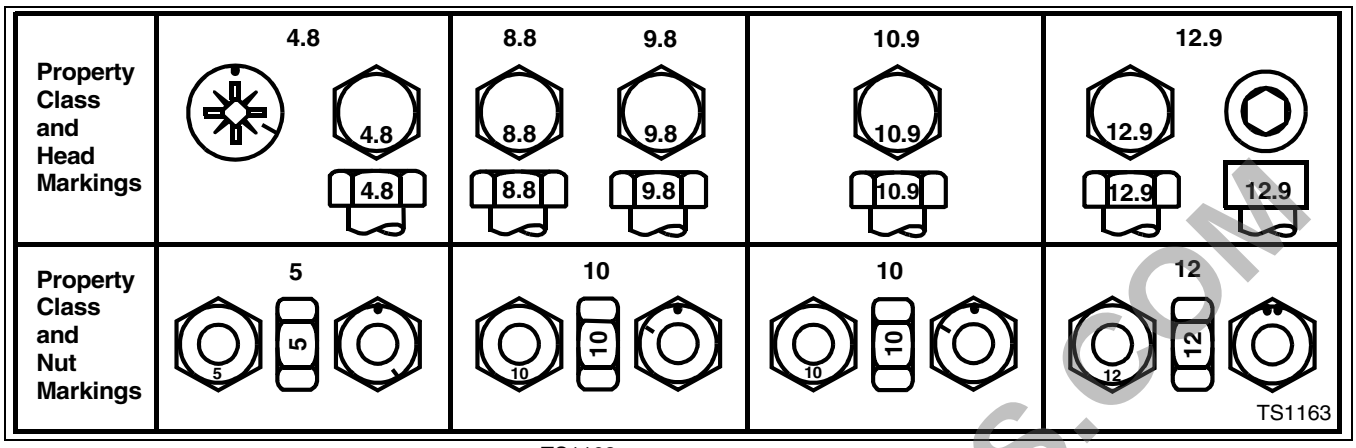
Safety
Specifications and Information
Engine
Electrical
Power Train (Gear)
Power Train (eHydro)
Power Train (ePowrReverser)
Power Train (Final Drive)
Hydraulics
Steering
Brakes
Miscellaneous

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General Specifications

Metric Fastener Torque Values



TS1163

	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
SIZE	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
M6	4.8	3.5	6	4.5	9	6.5	11	8.5	13	9.5	17	12	15	11.5	19	14.5
M8	12	8.5	15	11	22	16	28	20	32	24	40	30	37	28	47	35
M10	23	17	29	21	43	32	55	40	63	47	80	60	75	55	95	70
M12	40	29	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	47	80	60	120	88	150	110	175	130	225	165	205	150	260	190
M16	100	73	125	92	190	140	240	175	275	200	350	225	320	240	400	300
M18	135	100	175	125	260	195	330	250	375	275	475	350	440	325	560	410
M20	190	140	240	180	375	275	475	350	530	400	675	500	625	460	800	580
M22	260	190	330	250	510	375	650	475	725	540	925	675	850	625	1075	800
M24	330	250	425	310	650	475	825	600	925	675	1150	850	1075	800	1350	1000
M27	490	360	625	450	950	700	1200	875	1350	1000	1700	1250	1600	1150	2000	1500
M30	675	490	850	625	1300	950	1650	1200	1850	1350	2300	1700	2150	1600	2700	2000
M33	900	675	1150	850	1750	1300	2200	1650	2500	1850	3150	2350	2900	2150	3700	2750
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2750	4750	3500

- DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a ± 10% variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.
- Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.
- Fasteners should be replaced with the same class. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.
- When bolt and nut combination fasteners are used, torque values should be applied to the **NUT** instead of the bolt head.
- Tighten toothed or serrated-type lock nuts to the full torque value.

[a] **"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.**

Reference: JDS-200

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Specifications

General Specifications

Make	Yanmar
Model 4510 and 4610	4TNE84
Model 4710	4TNE88
Type	4-Cycle Diesel
Gross Power: 4510 @ 2600 rpm	28.6 kW (38.4 hp)
Gross Power: 4610 @ 2600 rpm	31.9 kW (42.8 hp)
Gross Power: 4710 @ 2600 rpm	34.5 kW (46.3 hp)
Torque (at rated speed): 4510 @ 2600 rpm	100.0 N•m (73.7 lb-ft)
Torque (at rated speed): 4610 @ 2600 rpm	110.7 N•m (81.7 lb-ft)
Torque (at rated speed): 4710 @ 2600 rpm	117.0 N•m (86.3 lb-ft)
Torque (maximum): 4510 @ 1700 rpm	125.0 N•m (92.2 lb-ft)
Torque (maximum): 4610 @ 1700 rpm	128.5 N•m (94.8 lb-ft)
Torque (maximum): 4710 @ 1700 rpm	146.4 N•m (108.0 lb-ft)
Number of Cylinders (All)	4
Bore: 4510 and 4610	84 mm (3.31 in.)
Bore: 4710	88 mm (3.46 in.)
Stroke: 4510, 4610 and 4710	90 mm (3.54 in.)
Displacement: 4510 and 4610	1.995 L (121.7 cu in.)
Displacement: 4710	2.189 L (133.6 cu in.)
Firing Order	1 - 3 - 4 - 2
Direction of Rotation	Counterclockwise (viewed from flywheel)
Combustion System	Direct Injection Type
Compression Ratio	18.5 to 1
Cooling	Liquid
Cooling Capacity: 4510	6.06 L (1.6 gal)
Cooling Capacity: 4610 and 4710	6.43 L (1.7 gal)
Oil Capacity	Approximately 4.81 L (5.08 qt)
Governor	Centrifugal
Slow Idle	950 ± 25 rpm
High Idle (All - No Load)	2810 ± 25 rpm

Repair Specifications

Valve Train:	
Rocker Arm Shaft OD	15.97 - 15.98 mm (0.628 - 0.629 in.)
Rocker Arm Shaft Wear Limit	15.95 mm (0.628 in.)
Rocker Arm ID	16.00 - 16.02 mm (0.630 - 0.631 in.)
Wear Limit	16.09 mm (0.633 in.)
Oil Clearance	0.02 - 0.05 mm (0.001 - 0.002 in)
Wear Limit	0.14 mm (0.006 in.)

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Diagnostics

Engine Troubleshooting

CAUTION: Avoid Injury! Engine radiator fluid is extremely hot during operation.

CAUTION: Avoid Injury! The engine may start to rotate at any time. Keep hands away from all moving parts when testing.

Engine System

Symptom: Engine Starting Problems

(1) Engine starts?

No - Battery voltage low - recharge battery.

No - Starting motor defective - repair or replace starting motor.

No - Alternator defective - repair or replace alternator.

No - Open circuit in wiring - repair wiring.

No - Fuel filter clogged - replace fuel filter.

No - Clogged or cracked fuel lines - clean or replace fuel lines.

No - Fuel volume to injection pump low - check or replace fuel transfer pump.

No - Water in fuel - check and repair.

No - Improper engine oil viscosity/type - replace engine oil and filter.

No - Improper intake or exhaust valve clearance - adjust valve clearance.

No - Improper timing between injection pump, intake and exhaust valves - adjust valve clearance. Check valve timing.

No - Seized intake/exhaust valve - replace valve and check valve guide.

No - Broken or seized piston ring - replace rings and check cylinder.

No - Piston ring, piston or cylinder worn - bore or hone cylinder and replace piston.

No - Crankshaft pin or bearing seized - regrind crank and replace bearings.

No - Air entering fuel system - check and repair fuel supply system.

Symptom: Engine Starting Problems

Yes - Engine starting procedure ok. Go to next procedure.

Symptom: Engine Starts But Does Not Continue Running

(1) Exhaust smoke absent?

No - Go to next step.

Yes - Fuel filter clogged - replace fuel filter.

Yes - Clogged or cracked fuel lines - clean or replace fuel lines.

Yes - Water in fuel - check and repair.

Yes - Air entering fuel system - check and repair fuel supply system.

Yes - Fuel volume to injection pump low - check or replace fuel transfer pump.

Yes - Improper engine oil viscosity/type - replace engine oil and filter.

Yes - Improper intake or exhaust valve clearance - adjust valve clearance.

Yes - Crankshaft pin or bearing seized - regrind crank and replace bearings.

Yes - Piston ring end gaps not correct - stagger piston ring gaps.

Yes - Governor not functioning properly - repair or replace governor.

Yes - Improper intake or exhaust valve clearance - adjust valve clearance.

(2) Excess exhaust smoke?

Yes - Clogged air filter - clean or replace air filter.

Yes - Seized intake/exhaust valve - replace valve and check valve guide.

Yes - Seized intake/exhaust valve - replace valve and check valve guide.

Yes - Broken or seized piston ring - replace rings and check cylinder.

Yes - Piston ring, piston or cylinder worn - bore or hone cylinder and replace piston.

Symptom: Low Engine Output

(1) Exhaust color NORMAL?

No - Go to next step.

Yes - Fuel filter clogged - replace fuel filter.

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System: Lubricating Oil

Yes - Seized intake/exhaust valve - replace valve and check valve guide.

Yes - Piston ring, piston or cylinder worn - bore or hone cylinder and replace piston.

(3) Water in crankcase?

No - Go to next step.

Yes - Leaking cylinder head gasket - replace head gasket.

Yes - Cracked water jacket - repair or replace water jacket.

(4) Low oil pressure?

Yes - Oil level low - add oil.

Yes - Oil filter clogged - replace oil filter.

Yes - Improper engine oil viscosity/type - replace engine oil and filter.

Yes - External/Internal oil leak - repair.

Yes - Crankshaft pin or bearing worn - regrind crank and replace bearings.

Yes - Connecting rod bolt loose - check for damage and re-torque bolts.

Yes - Cracked water jacket - repair or replace water jacket.

Yes - Oil pressure relief valve worn - clean, adjust or replace relief valve.

Coolant

Symptom: Temperature Problems

(1) Overheating?

No - Go to next step.

Yes - Leaking cylinder head gasket - replace head gasket.

Yes - Broken or seized piston ring - replace rings and check cylinder.

Yes - Engine running too hot - check thermostat, fan belt tension.

Yes - Coolant level low - check cooling system for level/leaks.

Yes - Cracked water jacket - repair or replace water jacket.

Yes - Malfunctioning thermostat - check or replace thermostat.

Symptom: Temperature Problems

Yes - Water pump/alternator belt loose - adjust fan belt tension.

Yes - Excessive volume of fuel injected - check fuel injector pump and injectors.

Yes - Engine at high altitude/temperature - use higher output engine.

(2) Low water temperature?

Yes - Engine running too cool - check thermostat.

Yes - Malfunctioning thermostat - check or replace thermostat.

Compression

Symptom: Overall Compression Problems

(1) Low Compression?

Yes - Oil filter clogged - replace oil filter.

Yes - Improper engine oil viscosity/type - replace engine oil and filter.

Yes - Excessive volume of fuel injected - check fuel injector pump and injectors.

Yes - Compression leakage from valve seat - grind valve seat; regrind valves.

Yes - Seized intake/exhaust valve - replace valve and check valve guide.

Yes - Broken or seized piston ring - replace rings and check cylinder.

Yes - Piston ring, piston or cylinder worn - bore or hone cylinder and replace piston.

Yes - Crankshaft pin or bearing seized - regrind crank and replace bearings.

Yes - Piston ring end gaps not correct - stagger piston ring gaps.

Yes - Piston rings installed incorrectly - install piston rings correctly.

Yes - Foreign matter in combustion chamber - remove head and inspect for damage.

Yes - Intake/Exhaust valves worn - check valve guides and stems.

Symptom: Intake Manifold Pressure Problem

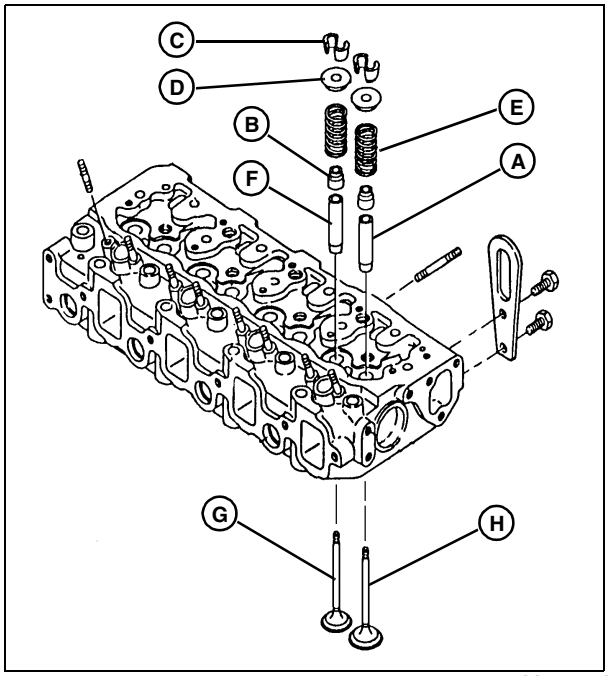
(1) Low pressure?

No - Go to next step.

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Disassembly/Assembly:



M82192A

1. Remove the valve caps from the valves. The valve caps should be installed on the valves they were removed from.

2. Compress the valve springs (E) using a valve spring compressor and remove the collet halves (C), retainer (D), valve spring (E) and valve stem seal (B) for each valve (G,H).

3. The intake and exhaust valve guides (A, F) are press fit. Replace the guides only if necessary. See “Valve Guides:” on page 58.

4. The valve seats are not replaceable. If inspection of the cylinder head reveals worn valve seats or damaged beyond repair, the cylinder head must be replaced. See “Cylinder Head and Valves” on page 55.

5. Inspect all remaining parts for wear or damage. See “Cylinder Head and Valves” on page 55.

IMPORTANT: Avoid damage! Do not reuse stem seals if removed. Used seals will leak.

6. Install new valve stem seals over the valve guides.

7. Apply clean engine oil on intake and exhaust valve stems during assembly.

8. Install the springs with smaller pitch end or paint mark toward cylinder head.

9. Compress valve springs and retainer until collet halves are able to be installed in grooves of valve stem.

10. Carefully release tension on spring compressor.

11. Repeat for remaining valves.

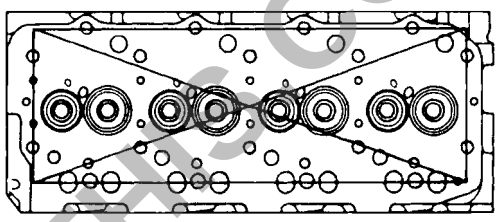
12. Measure valve recession if new valves were installed. See “Valve Seats:” on page 57.

NOTE: After each valve has been assembled, tap on top of valve stem with a plastic hammer to seat the valve retainer and collet halves.

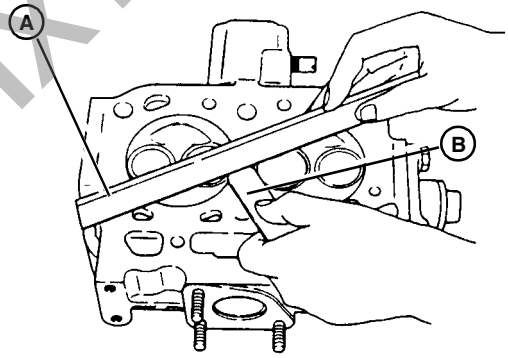
Inspection/Replacement:

Before inspection, thoroughly clean all components of carbon or dirt.

Cylinder Head:



M82027A



M82028A

1. To measure the cylinder head flatness, place a straightedge (A) along each of the four sides and each diagonal. Measure clearance between straight edge and combustion surface with a feeler gauge (B).

   - Standard distortion is **0.05 mm (0.002 in.)** or less.
   - If the distortion exceeds **0.05 mm (0.006 in.)**, but is less than **0.15 mm (0.006 in.)** resurface the cylinder head.
   - If the distortion is **0.15 mm (0.006 in.)** or more, replace the cylinder head.

2. If cylinder head was resurfaced:

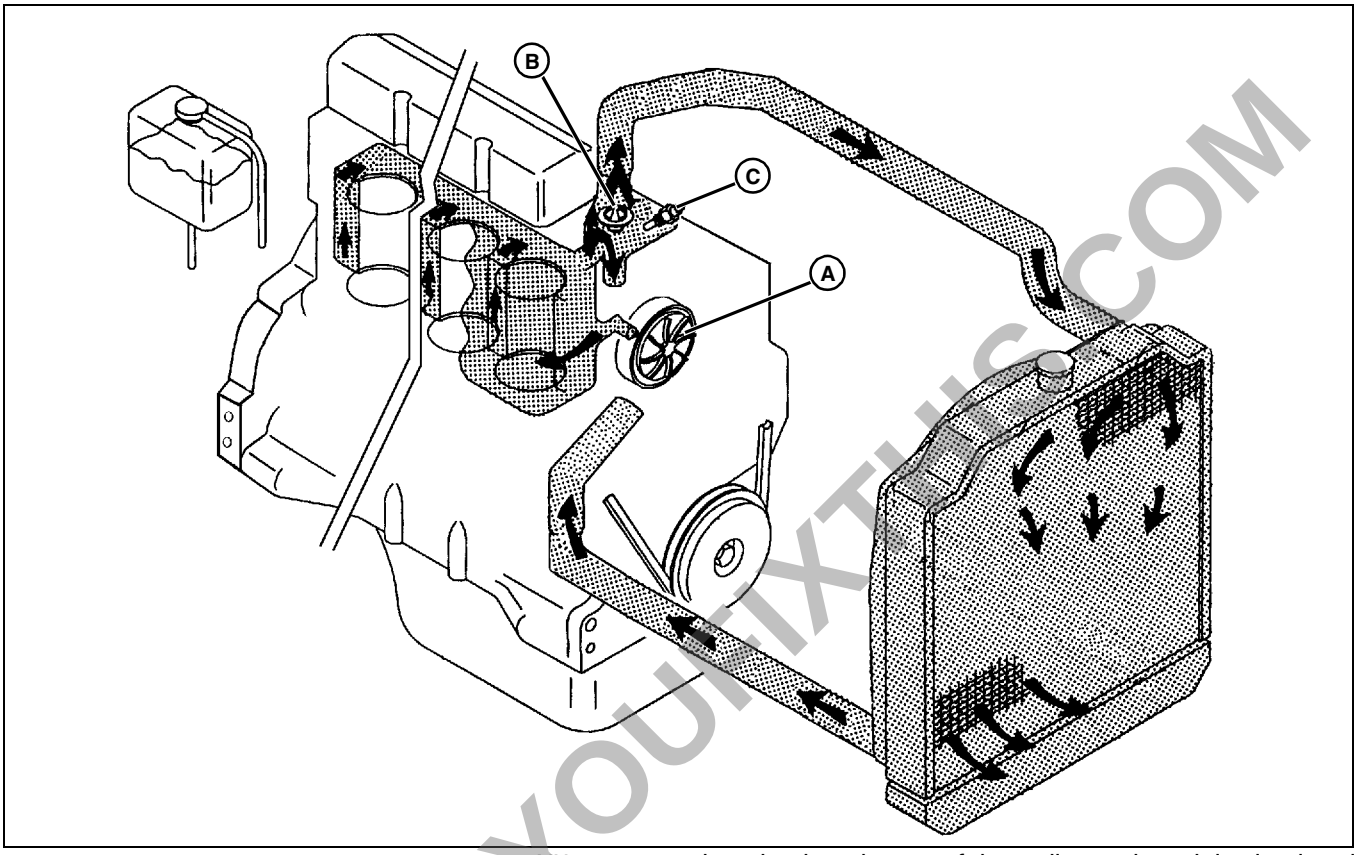
   - Measure piston-to-cylinder head clearance. See “Measure Piston-to-Cylinder Head Clearance:” on page 60.
   - Measure valve recession. See “Cylinder Head and Valves” on page 55.
   - Measure valve seat width. See “Valve Seats:” on page 57.

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Theory of Operation

Cooling System Operation



MX1026

Function:

The coolant pump circulates (A) coolant through the cooling system, drawing hot coolant from the engine block, circulating it through the radiator for cooling.

Theory of Operation:

The pressurized cooling system includes the radiator, water pump, fan and thermostat (B).

During the warm-up period, the thermostat remains closed and the impeller type coolant pump draws coolant from the bypass tube. Coolant from the pump flows to the cylinder block water jacket and up through the cylinder head providing a fast warm-up.

Once the engine has reached operating temperature, the thermostat opens and coolant is pumped from the bottom of the radiator via the lower radiator hose into the cylinder block. Here it circulates through the block and around the cylinders.

From the block, coolant is then directed through the cylinder head, and into thermostat housing. With the thermostat open; warm engine coolant passes through the housing into the top of the radiator where it is circulated to dissipate heat.

Specifications:

Start to Open . . . . . 9.5 - 72.5° C (157 - 163° F)

Fully Opened . . . . . 85° C (185° F)

When coolant system pressure exceeds **48 kPa (7 psi)**, a valve in the radiator cap opens to allow coolant to discharge into the coolant recovery tank.

When temperature is reduced, a vacuum is produced in the radiator and coolant is drawn back out of the coolant recovery tank through a valve in the radiator cap.

A coolant temperature sensor (C) informs the operator of the engine coolant temperature and warns of a high temperature condition by lighting a lamp.

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General Information

Reading Electrical Schematics

The schematic is made up of individual circuits laid out in a sequence of related functions. It is formatted with all power wires (A) across the top and all ground wires (B) across the bottom. Current flow is generally from top to bottom through each circuit and component. All components are shown in the OFF position. The diagram does not list connector (C) information unless needed to avoid confusion. If the connector is shown, the number next to it is the terminal pin location (D) in the connector.

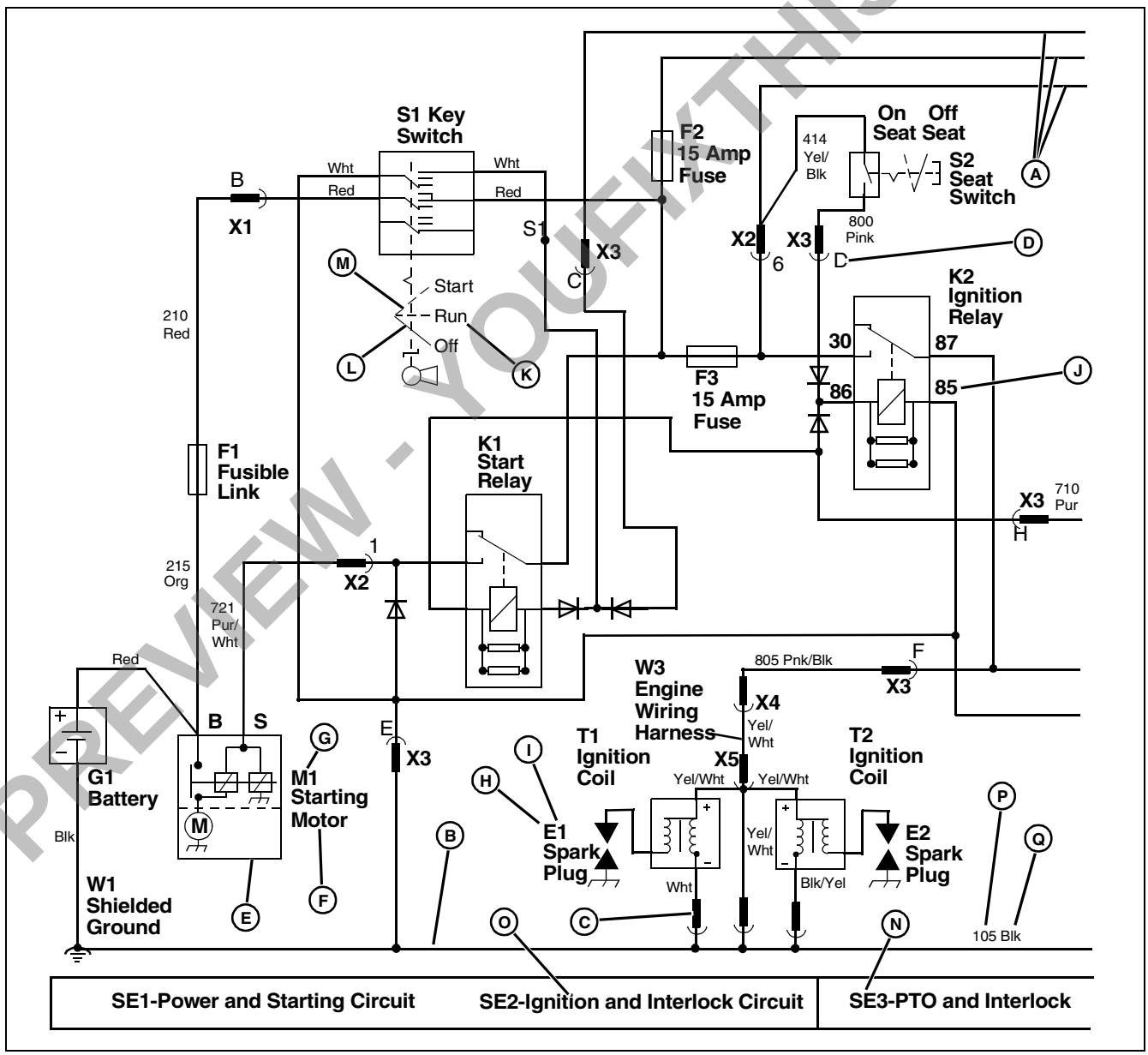
Each component is shown by a symbol (E), its name (F), and an identification code (G). The identification code contains a device identifying letter (H) and number (I).

The identifying letter is always the same for a specific component, but the identifying numbers are numbered consecutively from upper left to lower right. The terminal designation (J) is placed directly outside the symbol next to the connecting wire path. Switch positions (K) are also placed directly outside the symbol. The solid line (L) shows the position the switch is currently in and dash lines (M) represent other switch positions.

Each circuit is identified at the bottom of the drawing by a section number (N) and section name (O).

The circuit number (P) and wire color (Q) of the wires are shown directly next to the wire path.

The same component name and identification code are used consistently on all diagrams in this section. Components can be easily cross-referenced.



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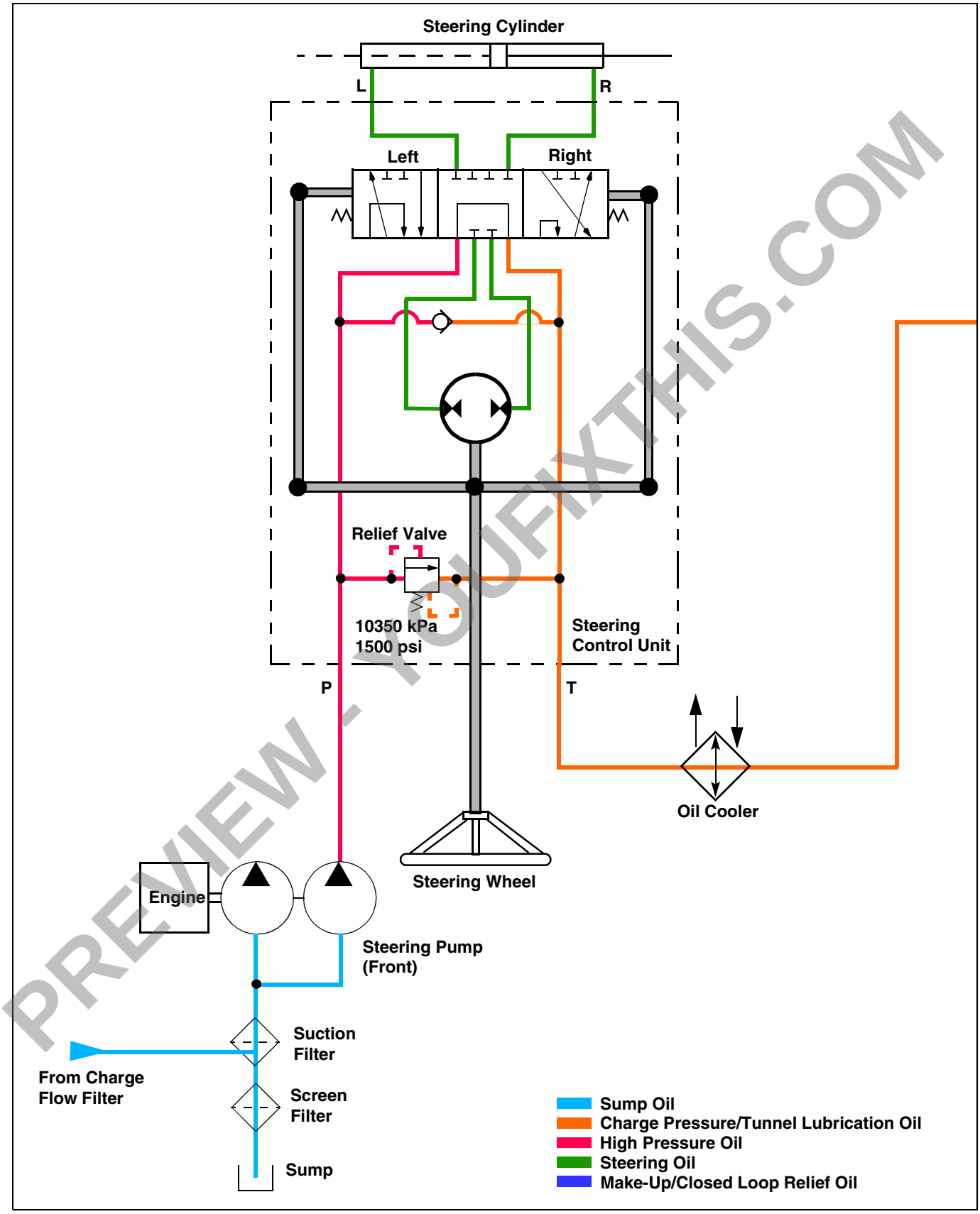
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FAULT CODE	FLASH SEQUENCE	STARTING TEST POINT	FAULT CAUSE	MACHINE RESPONSE	RESET ACTION
1	• - • •	Forward Pedal Potentiometer	Normal Operation:		
			Voltage signal is out of range. Input is not calibrated.	No drive in either direction.	Power recycled through off to clear error status. Sensor has to be re-calibrated.
			Calibration Routine:		
			Voltage signal is out of range.	Calibration routine stops.	Power recycled through off to clear error status. Calibration repeated after signal is back within range.
2	- - • •	Reverse Pedal Potentiometer	Normal Operation:		
			Voltage signal is out of range. Input is not calibrated.	No drive in either direction.	Power recycled through off to clear error status. Sensor has to be re-calibrated.
			Calibration Routine:		
			Voltage signal is out of range.	Calibration routine stops.	Power recycled through off to clear error status. Calibration repeated after signal is back within range.
3	• • • -	Throttle Position Potentiometer	Normal Operation:		
			Voltage signal is out of range. Input is not calibrated.	Load Match is disabled; loss of performance.	Power recycled through off to clear error status. Sensor has to be re-calibrated.
			Calibration Routine:		
			Voltage signal is out of range.	Calibration routine stops.	Power recycled through off to clear error status. Calibration repeated after signal is back within range.

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Steering/Charge Pump Circuit Schematic, eHydro Transmission



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Theory and Diagnosis

eHydro - e MatchOS Electronic Operating System

Function:

The purpose of the electronic drive operating system is to control both the drive direction and speed of the machine. Additionally the electronic operating system provides for setting a maximum travel speed, cruise control, pedal aggressiveness, and load match to prevent stalling the engine during operation.

Each of these additional functions has the ability to be turned on or off by the operator.

General Theory:

The electronic operating system is a preprogrammed electrical device that allows the operator to control the machine drive direction and speed via the electrical inputs from the forward and reverse foot pedals. Under normal operating conditions, this creates an output to the corresponding directional control valve coil in the transmission.

The output current to the directional valve coil is proportional to the pedal position. The forward and reverse pedals have an adjustable proportional setting. This setting allows for greater control, comfort and smoother operation around neutral. The same proportional setting affects both the forward and reverse command.

The rate of acceleration and deceleration is also controlled by the electronic operating system to smoothly ramp the speed up and down.

Two different settings provide for either quicker or slower acceleration or deceleration. This operation is controlled by the operator placing the motion match switch in either the on or off position. The change in this setting will take effect as soon as the switch is changed.

While the acceleration has one setting with the motion match in either the on or off positions, the deceleration function has three settings.

Deceleration has settings for coasting to a slower speed without stopping or changing direction, coasting back to the neutral position, and stopping when changing directions.

Decelerating to a slower speed in the same direction allows for controlled operation within the direction of travel by reducing the jerking that may occur as a result of pedal movement by the operator as well as simply slowing to a lower rate of speed.

The deceleration to neutral setting allows for a controlled return to the stopped position when the pedal is completely released.

The deceleration for directional change setting allows for the ramping to control the deceleration speed to a stop and then immediately beginning to travel in the opposite direction of travel.

Both the deceleration to neutral and the deceleration to direction change have an immediate or “knee” deceleration before following the ramped pattern back to a stop. The amount of deceleration used for the knee value is based upon a percentage of output being produced. If the knee value is set at 70, then the speed of the machine would be reduced to 70% of the current drive speed almost immediately with the release of the directional pedal being used. The deceleration would then follow the ramped setting back to a stop.

Generally deceleration within a drive direction is the most conservative deceleration with decel to neutral being slightly more aggressive and decel to a direction change being the most aggressive stopping action.

Cruise Control:

The cruise control feature allows the operator to set and hold a speed setting that the operator desires without having to press and hold the forward pedal.



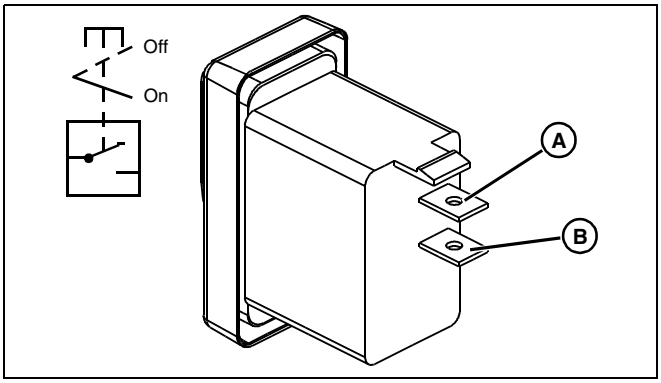
MX10682

Placing the cruise control switch (A) to the on position, enables the cruise control function. Momentarily pressing the Set / - switch (B) will then set the cruise speed at the speed being traveled.

Once set, the electronic operating system monitors the machine speed and varies the current to the transmission forward directional solenoid to maintain travel speed at the set point.

The cruise speed setting can be increased and decreased while the machine is being driven by momentarily pressing either the Res / + switch (C) to increase the maximum speed or the Set / - switch (B) to decrease the maximum speed setting.

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4. Check continuity across switch terminals A and B. There should be no continuity in the off position.

5. Toggle the switch to the on position. Continuity should exist between terminals A and B.

Results:

- If continuity is not correct, replace motion match switch.

Test and Calibration Kit

Function:

To set the initial voltage readings on the potentiometers and test and diagnose the potentiometers, speed sensors, and solenoid coils.

Equipment

- JDG1575 Test Kit

Theory:

The Test and Calibration Kit is intended to be used to both diagnose and set-up the operational components used to engage and control the drive function on eHydro model machines equipped with the e-MatchOS Electronic Operating System.

With the proper jumper wires connected to the test and calibration kit, the following components can be tested and/or set on the eHydro machine:

- Throttle Position Potentiometer, set-up and test for voltage,
- Forward Pedal Position Potentiometer, set-up and test for voltage,
- Reverse Pedal Position Potentiometer, set-up and test for voltage,
- Forward Proportional Solenoid, test for current flow,
- Reverse Proportional Solenoid, test for current flow,
- Flywheel Speed Sensor, test for frequency, and
- MFWD Speed Sensor, test for frequency.

Throttle Potentiometer Test - eHydro

Reason:

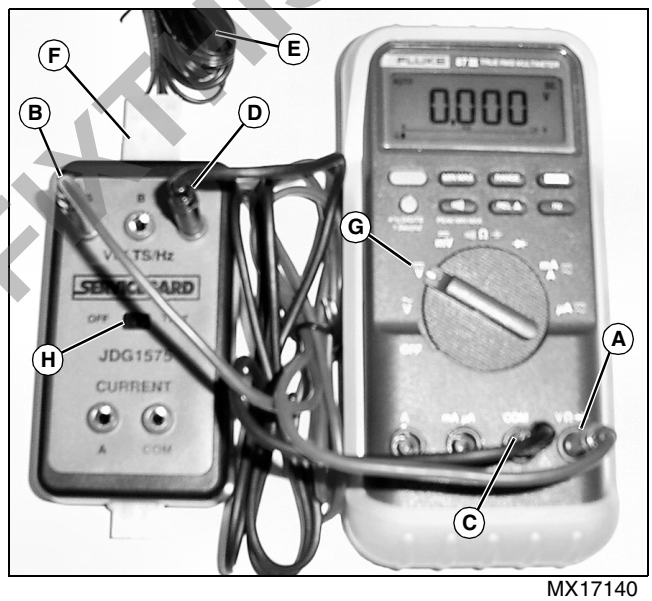
To verify the throttle position potentiometer for proper voltage with the throttle in the low and high idle positions.

Equipment

- JDG1575 Test Kit

Procedure:

1. Park machine safely in neutral with park brake locked.
2. Remove the right side cowl panel.
3. Inspect the linkage between throttle lever and potentiometer for wear, damage or looseness. Repair or replace as needed.



MX17140

4. Connect the red lead to the volt, ohms, Hz input jack (A) of the multimeter and the voltage A terminal (B) of the breakout box.
5. Connect the black lead to the com input jack (C) of the multimeter and the voltage C terminal (D) of the breakout box.
6. Connect the 3 pin extender harness (E) into the 3 pin connector (F) of the breakout box.
7. Set the multimeter to the DCV position (G).
8. Set breakout box switch to off position (H).

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Wear Limit	0.15 mm (0.006 in.)
Outer Rotor to Pump Body Clearance (All)	0.10 - 0.16 mm (0.004 - 0.006 in.)
Wear Limit	0.25 mm (0.010 in.)
Inner Rotor to Outer Rotor Clearance Wear Limit (All)	0.15 mm (0.006 in.)

Tests and Adjustment Specifications

Valve Clearance	0.15 - 0.25 mm (0.006 - 0.010 in.)
Connecting Rod Side Play	0.2 - 0.4 mm (0.008 - 0.016 in.)
Connecting Rod Bearing Clearance	0.04 - 0.07 mm (0.002 - 0.003 in.)
Crankshaft End Play	0.09 - 0.27 mm (0.004 - 0.011 in.)
Crankshaft Main Bearing Clearance	0.04 - 0.07 mm (0.001 - 1.003 in.)
Camshaft End Play	0.05 - 0.25 mm (0.002 - 0.010 in.)
Timing Gear Backlash: All Except Oil Pump Gear	0.07 - 0.15 mm (0.003 - 0.005 in.)
Oil Pump Gear	0.11 - 0.19 mm (0.004 - 0.008 in.)
Fuel Injection Nozzle: Opening Pressure	19600 + 1000/ - 0 kPa (2843 + 145/ - 0 psi)
Leakage at 11032 kPa (1600 psi)	None for a minimum of 10 seconds
Fuel Injection Pump Timing: 4510 and 4610	12° ± 1° BTDC
Fuel Injection Pump Timing: 4710	11° ± 1° BTDC

Operational Tests

Cooling System Test Pressure	88 ± 15 kPa (12.8 ± 2.2 psi)
Thermostat Opening Temperature	69.5 - 72.5° C (157 - 163° F)
Minimum Lift Height above 85° C (185° F)	8.0 mm (0.135 in.)
Radiator Cap Opening Pressure (All)	0.9 ± 0.15 kg/cm^2 88 ± 15 kPa (12.8 ± 2.2 psi)
Cylinder Compression Pressure @250 rpm (All)	3233 ± 97 kPa (469 ± 14psi)
Cylinder Compression Pressure @250 rpm (Minimum)	2551 kPa (370 psi)
Difference Between Cylinders (Maximum - All)	248 ± 48 kPa (36 ± 7 psi)
Oil Pressure (All)	338 ± 50 kPa (49 ± 7.2 psi)
Slow Idle (All - Minimum)	60 kPa (8.7 psi)
Oil Relief Valve Opening Pressure (All)	294 - 392 kPa (43 - 57 psi)
Oil Pressure Switch Opening Pressure (All)	41 - 62 kPa (6 - 9 psi)

Torque Values, Non-Standard Fasteners

Cylinder Head Bolts (Lubricating Oil Applied)	85 - 91 N•m (62 - 67 lb-ft)
Connecting Rod Bolts (Lubricating Oil Applied)	44 - 54 N•m (33 - 40 lb-ft)
Flywheel Mounting Bolts (All - Lubricating Oil Applied)	83 - 88 N•m (62 - 65 lb-ft)
Main Bearing Bolts (Lubricating Oil Applied)	96 - 100 N•m (71 - 74 lb-ft)
Crankshaft Pulley Bolt (All - Lubricating Oil Applied)	113 - 122 N•m (83 - 90 lb-ft)
Fuel Injector Nozzle Nut (All)	6.8 - 8.8 N•m (60 - 78 lb-in.)
Governor Weight Support Nut (All)	44 - 49 N•m (33 - 36 lb-ft)
Starting Motor Mounting Bolts	88 N•m (65 lb-ft)

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Push Rod Bend	0.0 - 0.03 mm (0.0 - 0.001 in.)
Cylinder Head and Valves:	
Cylinder Head Distortion	0.0 - 0.05 mm (0.0 - 0.002 in.)
Wear Limit	0.15 mm (0.006 in.)
Intake Valve Seat Width (All)	1.07 - 1.24 mm (0.042 - 0.049 in.)
Wear Limit	1.74 mm (0.069 in.)
Exhaust Valve Seat Width (All)	1.24 - 1.45 mm (0.049 - 0.057 in.)
Wear Limit	1.94 mm (0.076 in.)
Intake and Exhaust Valve Stem OD (All)	7.96 - 7.98 mm (0.313 - 0.314 in.)
Wear Limit	7.9 mm (0.311 in.)
Valve Head Thickness (All): Intake	1.24 - 1.44 mm (0.049 - 0.057 in.)
Valve Head Thickness (All): Exhaust	1.35 - 1.55 mm (0.053 - 0.061 in.)
Wear Limit	0.50 mm (0.020 in.)
Valve Recession (All)	0.30 - 0.50 mm (0.012 - 0.020 in.)
Wear Limit	1.00 mm (0.039 in.)
Exhaust Valve Recession (All)	0.31 - 0.51 mm (0.012 - 0.020 in.)
Wear Limit	1.00 mm (0.039 in.)
Valve Guide Stem-To-Guide Oil Clearance: Intake (All)	0.04 - 0.07 mm (0.001 - 0.003 in.)
Exhaust (All)	0.05 - 0.08 mm (0.002 - 0.003 in.)
Wear Limit	0.20 mm (0.008 in.)
Valve Guide ID (All)	8.01 - 8.03 mm (0.315 - 0.316 in.)
Wear Limit	8.10 mm (0.319 in.)
Valve Guide Projection (All)	15 mm (0.591 in.)
Valve Spring Free Length (All)	42.0 mm (1.654 in.)
Maximum Spring Inclination (All)	1.10 mm (0.044 in.)
Valve Spring Tension (Measured With Spring Compressed 1.0 mm (0.039 in.):	2.36 - 3.10 kg (5.20 - 6.83 lb)
Valve Seat Surface Angle (All): Exhaust Valve	45°
Intake Valve	30°
Valve Timing (All): Intake Valve Opens	10° - 20° BTDC
Intake Valve Closes	40° - 50° ABDC
Exhaust Valve Opens	51° - 61° BBDC
Exhaust Valve Closes	13° - 23° ATDC
Piston-to-Cylinder Head Clearance (All)	0.66 - 0.78 mm (0.026 - 0.031 in.)
Connecting Rod	
Large End Bearing ID (All)	51 - 51.01 mm (2.008 - 2.008 in.)
Oil Clearance (All)	0.04 - 0.07 mm (0.002 - 0.003 in.)
Piston Rings	
First Compression Piston Ring Groove Width (All)	2.07 - 2.08 mm (0.081 - 0.082 in.)
First Compression Piston Ring Width (All)	1.97 - 1.99 mm (0.078 - 0.078 in.)
First Compression Ring Minimum Side Clearance (All)	0.08 - 0.110 mm (0.003 - 0.004 in.)
Second Compression Piston Ring Groove Width (All)	2.04 - 2.05 mm (0.080 - 0.081 in.)

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Prevent Battery Explosions

- Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.
- Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.
- Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).

Prevent Acid Burns

- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid acid burns by:

1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

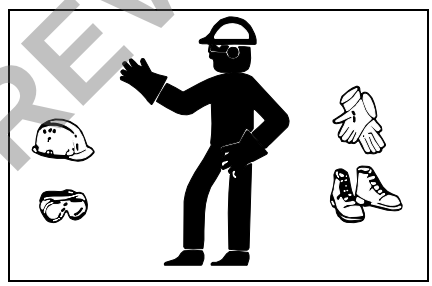
If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10 - 15 minutes.
4. Get medical attention immediately.

If acid is swallowed:

1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.

Wear Protective Clothing



MIF

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

Use Care Around High-pressure Fluid Lines

Avoid High-Pressure Fluids



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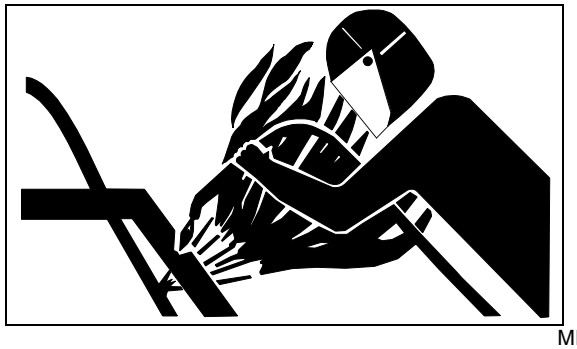
Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid injury from escaping fluid under pressure by stopping the engine and relieving pressure in the system before disconnecting or connecting 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 medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.

Avoid Heating Near Pressurized Fluid Lines



MIF

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.

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6. Inspect the piston (large) part of nozzle valve (Q) to see that it is not scratched or scored and that lower (tip) end of valve is not broken. If any of these conditions are present, replace the nozzle assembly.

7. Further inspect the nozzle assembly by performing a slide test. Use the following procedure:

- Dip the nozzle valve (P) in clean diesel fuel. Insert valve in nozzle body (Q).
- Hold nozzle vertical, and pull valve out about 1/3 of its engaged length.
- Release valve. Valve should slide down to its seat by its own weight.

Replace nozzle assembly if the valve does not slide freely to its seat.

Fuel Filter Assembly

IMPORTANT: Avoid damage! Replace all copper washers. Damaged or used washers may leak.

1. Remove the retaining ring from mounting base while holding on to filter cover.

2. Remove the filter cover from mounting base.

3. Remove and replace the O-rings and filter element.

4. Be sure the spring is in the filter cover and place the filter element in the filter cover.

5. Before installing the filter cover and element in the mounting base, verify the O-ring is in the groove inside the mounting base.

6. Install the filter cover and the element in the mounting base.

IMPORTANT: Avoid damage! Tighten only enough to keep filter assembly from leaking. Overtightening the retaining nut may damage the filter cover or retaining ring.

7. Place the retaining ring over filter cover and screw on the mounting base to retain filter cover to mounting base.

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Engine Shutoff Circuit Diagnosis

Test Conditions:

- Key switch in off position

Test/Check Point	Normal	If Not Normal
1. K4 Engine run relay	Battery voltage	Test Fusible link. Test battery.
2. Key switch	Battery voltage	Test F1 fuse. Test Fusible link. Test battery.

Test Conditions:

- Key switch in to run position
- Operator on seat
- Transmission(s) in neutral
- Rear PTO on
- Park brake unlocked
- Fuel shutoff solenoid disconnected

Test/Check Point	Normal	If Not Normal
3. Seat switch	Battery voltage	Test F5 fuse. Check 072B, 072C Red, 562D and 562E Red wires and connections. If ok, replace key switch.
4. K6 fuel solenoid timer module	Battery voltage	Test V1 diode block. Check 539D, 539B Wht, 521 Brn wires and connections. If ok, replace seat switch.
5. K4 Engine run relay	Battery voltage	Check 305 Dk Grn, 521 Brn, and 303 Lt Blu wires and connections. If ok, replace K6 timer module.
6. X2 connector	Battery voltage	Check 302C and 302B Red wires and connections. If ok, replace K4 engine run relay.
7. X2 connector	Continuity to ground	Check 010N and 010P Blk wires and connections.

Test Conditions:

- Key switch in to run position
- Operator off seat
- Transmission(s) in neutral
- PTO off
- Park brake unlocked
- Fuel shutoff solenoid disconnected

Test/Check Point	Normal	If Not Normal
8. Rear PTO switch	Battery voltage	Test F5 fuse. Check 072B, 072C Red, 562D, 562F and 562G Red wires and connections. If ok, replace key switch.
9. X4 connector	Battery voltage	Check 573B and 573A Org wires and connections. If ok, replace rear PTO switch.

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6. The fault light (N) should display the 3 short and 1 long flash (• • • -) fault code.

7. Wait 5 seconds then move the throttle lever to the high idle position.

8. After 5 seconds the fault light should turn off.

9. When the flash code ends the throttle position potentiometer is calibrated.

10.Install the right side cowl panel.

Drive Pedal Potentiometer Test - eHydro

Reason:

To verify the drive pedal potentiometers for proper voltage input and output with the pedal in the released or Top of Travel (TOT) and pressed in or Bottom of Travel (BOT) positions.

Equipment

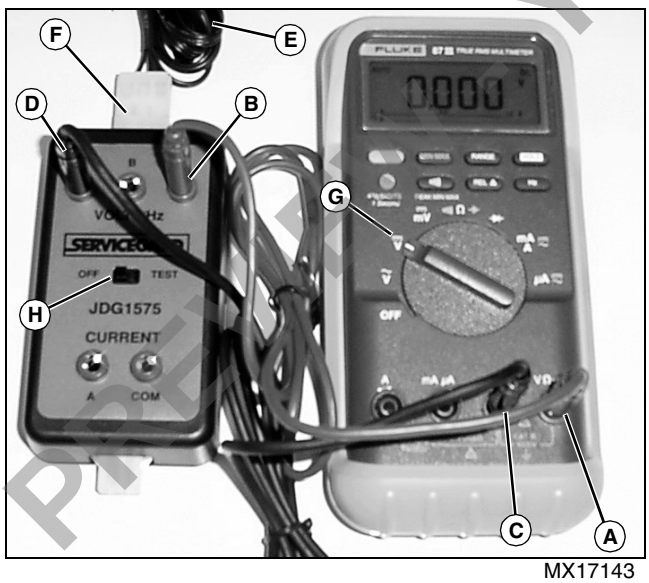
- JDG1575 Test Kit

Procedure:

1. Park machine safely in neutral with park brake locked.

2. Remove cover from forward and reverse pedal bracket located under operator's floor platform.

3. Inspect the linkage between the drive pedals and potentiometers for wear, damage or looseness. Repair or replace as needed.



MX17143

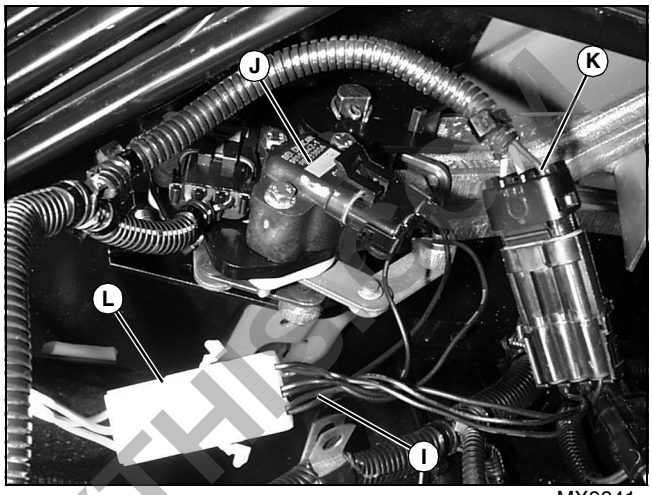
4. Connect the red lead to the volt, ohms, Hz input jack (A) of the multimeter and the voltage C terminal (B) of the breakout box.

5. Connect the black lead to the com input jack (C) of the multimeter and the voltage A terminal (D) of the breakout box.

6. Connect the 3 pin extender harness (E) into the 3 pin connector (F) of the breakout box.

7. Set the multimeter to the DCV position (G).

8. Set breakout box switch to off position (H).



MX9841

Picture Note: Reverse potentiometer shown.

9. Connect the position sensor Y connector (I) between the drive potentiometer (J) being tested, the machine wiring harness (K), and the extender harness (L).

10.Turn the key switch to the run position.

11.The input voltage should be within specification. If not, See "Power Circuit Operation" on page 139.

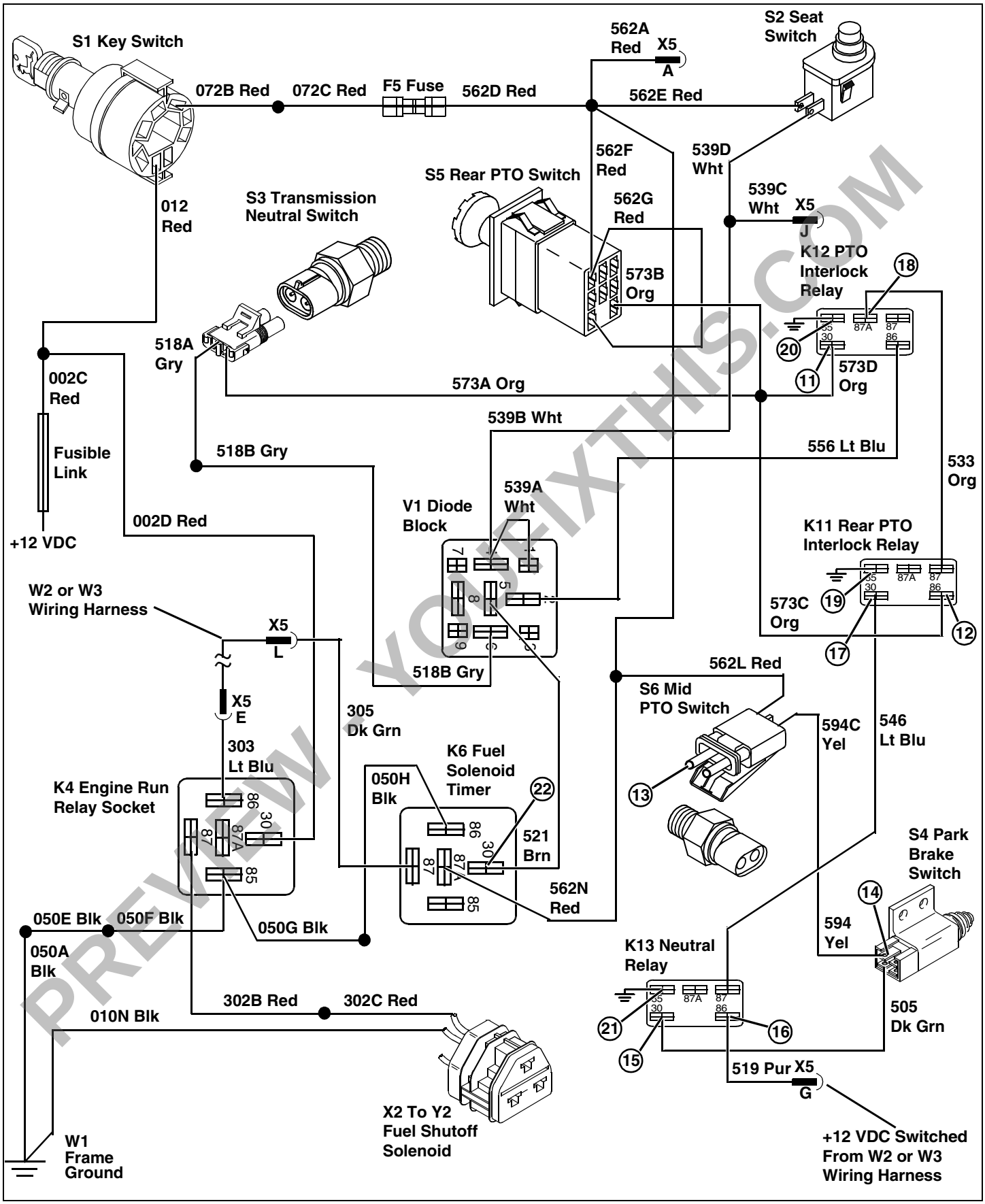


MX17144

12.Move the red lead on the breakout box from the C terminal to the B terminal (M).

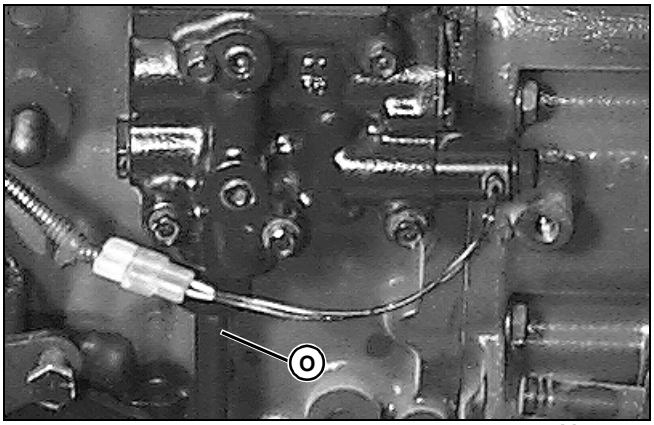
13.Verify pedal is released and at the top of travel (TOT) position.

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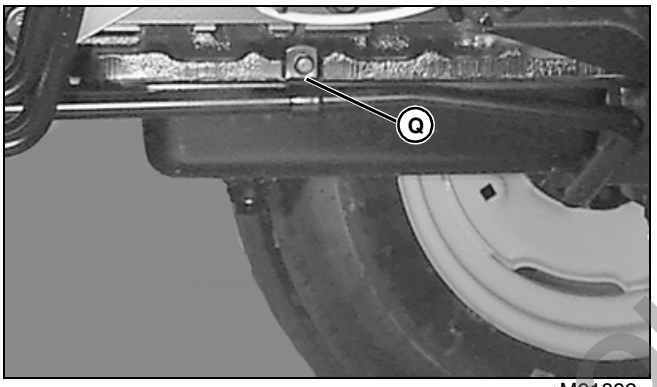
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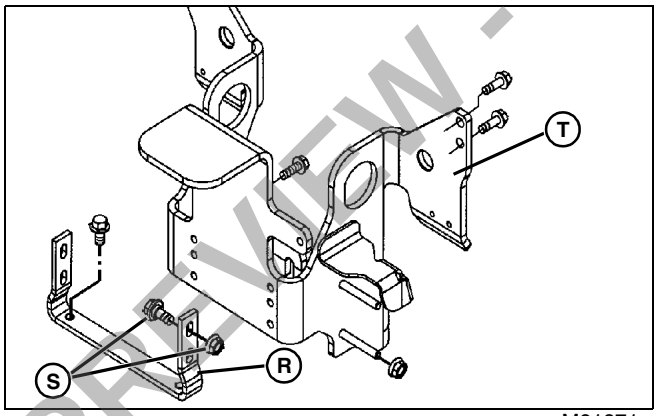
M91389

13.Connect PTO pressure tube (O) to bottom of PTO valve. Tighten nut to **40 - 57 N•m (30 - 43 lb ft)**.

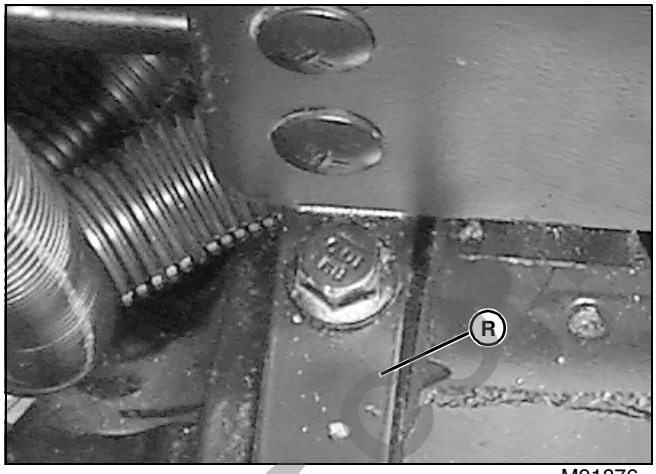


M91882

14.On right side of machine, Secure tube clamp (Q) attaching PTO pressure tube to frame.

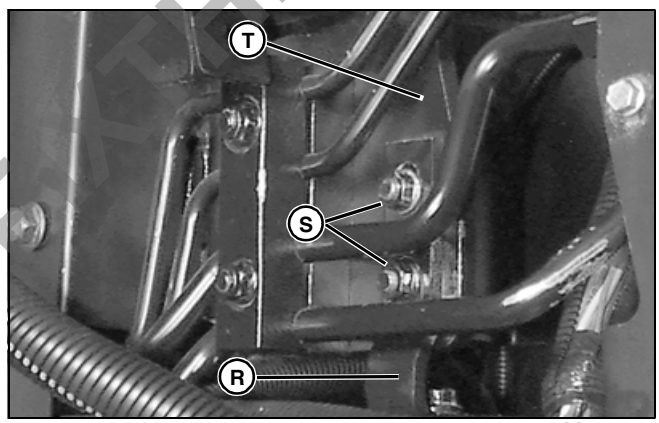


M91871



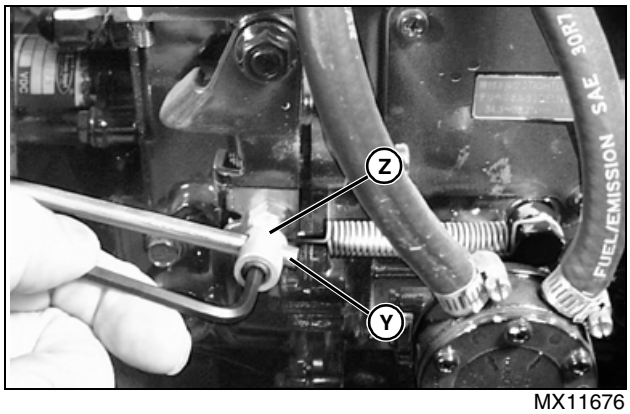
M91876

15.Install U-shaped bracket (R) to transmission tunnel, retain with two cap screws. Tighten cap screws.



M91873

16.Install four carriage bolts (S) and nuts attaching U-shaped bracket (R) to pedal support frame (T) and tighten.



MX11676

17.Connect throttle linkage (Y) to throttle lever (Z) on fuel injection pump.

18.Route electrical harness on rear half of machine. Connect all electrical connectors attaching wiring harness to switches and lights on rear half of machine. Fasten wiring harness to cable clips. Replace any plastic tie bands removed during disassembly.

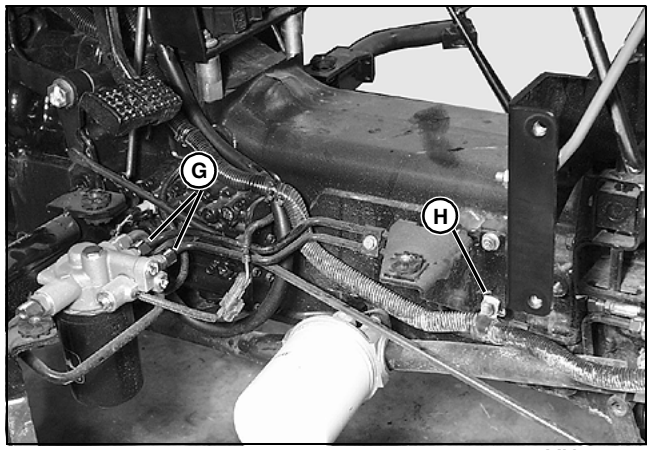
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12.Connect hydraulic oil line to fitting on top of rockshaft (D).

13.Connect hoses from MFWD cylinder to hydraulic lines (E).

14.Install shift lever and cap screws (F).



MX11985

15.Connect front end of oil lines (G) to filter base. Attach wiring harness clamp to bottom cap screw of rear foot platform support (H).

16.Route electrical harness on rear half of machine. Connect all electrical connectors attaching wiring harness to switches and lights on rear half of machine. Fasten wiring harness to cable clips. Replace any plastic tie bands removed during disassembly.

17.Install operator's platform. See "Operator's Platform Removal and Installation" on page 769 in Miscellaneous Section.

18.Install seat closeout. See "Seat Closeout Removal and Installation" on page 766 in Miscellaneous Section.

19.Install seat and seat support. See "Seat And Seat Support Removal and Installation" on page 766 in Miscellaneous Section.

20.Install rear fenders. See "Rear Fenders Removal and Installation" on page 767 in Miscellaneous Section.

21.Install floor mat.

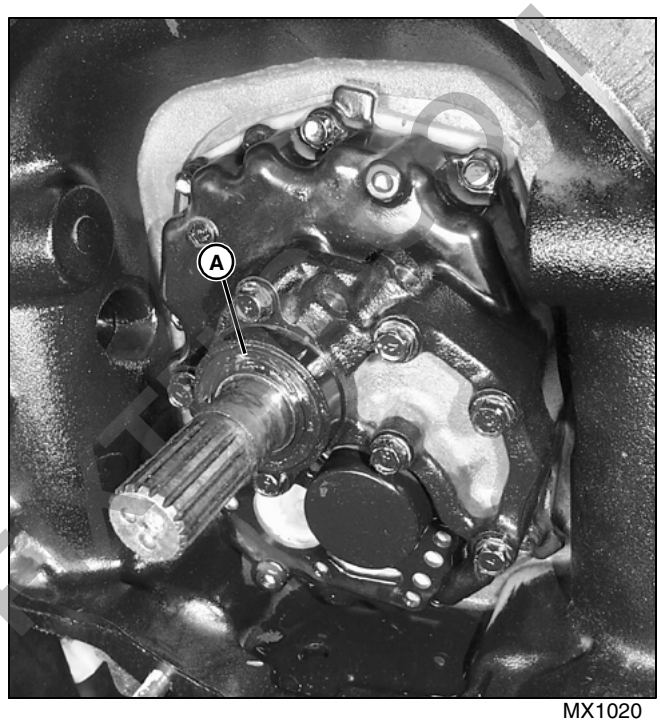
22.Install fuse panel cover.

23.Connect battery negative terminal.

Reverse Case Seal Replacement

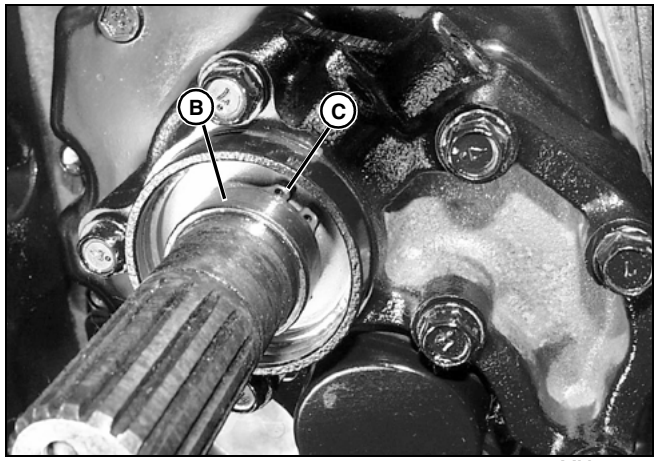
1. Split the machine front end from the transmission case at the engine flywheel / transmission case connection. See "Machine Splitting (Front)" on page 511.

Procedure:



MX1020

1. Remove seal (A) from drive shaft.



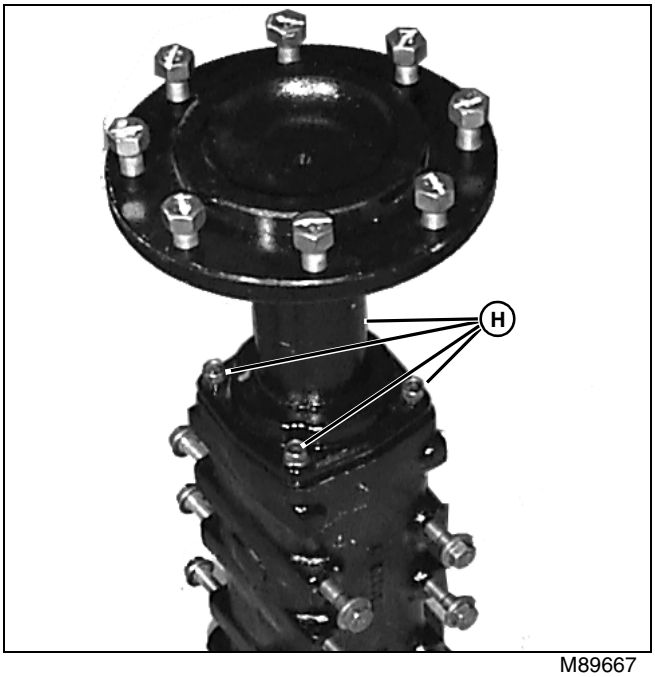
MX1019

2. Remove wear sleeve (B) and snap ring (C). Remove cap screws securing reverse case to front cover.

3. Remove cap screws and lock washers securing reverse case to clutch housing tunnel. Remove reverse case and gasket.

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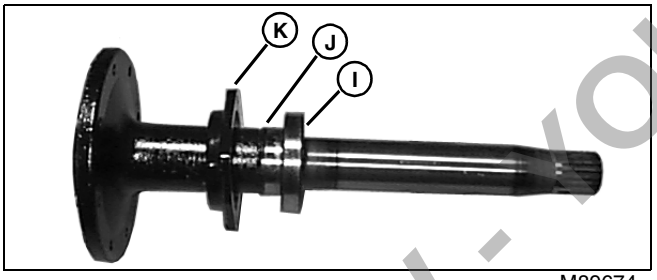
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M89667

6. Remove cap screws (H) securing oil seal housing to end of rear axle housing.

7. Drive axle from bearings in rear axle housing.



M89674

8. Remove bearings (I) from axle and/or rear axle housing.

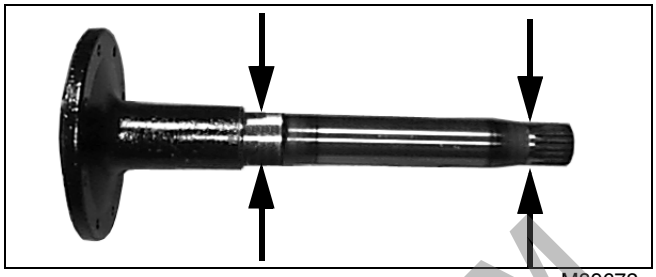
9. Remove seal sleeve (J) from axle. Remove oil seal housing (K) from axle.

10.Replace oil seal in oil seal housing.

IMPORTANT: Avoid damage! DO NOT spin bearing using compressed air. Damage to bearing balls, cage, and races could result.

11.Clean bearings in a suitable solvent. Dry with compressed air.

12.Inspect bearings for discolored, burned, balls and/or races. Check balls and races for spalling or cracking. Roll bearing by hand to check for rough turning or excessive looseness or play between balls and races. Replace bearings as required.


M89672

13.Inspect rear axle splines for damage. Inspect bearing areas of axle. If worn or damaged, replace axle.

14.Inspect bearing areas in rear axle housing. Bearings should be a snug fit. If bearings are loose in housing, replace rear axle housing.

Specifications:

Brake Arm Bushing OD
. . . . . 45.041 - 45.08 mm (1.773 - 1.775 in.)

ID . . . . . 30.07 - 30.091 mm (1.183 - 1.185 in.)

Brake Arm OD. . . . . 29.95 - 30 mm (1.179 - 1.181 in.)

Final Drive Case Brake Arm Bore ID
. . . . . 45.08 - 45.18 mm (1.775 - 1.779 in.)

Assemble:

Assembly of the final drive is the reverse of disassembly.

- Always use a new axle seal, in oil seal housing, whenever the axle has been removed.
- If seal sleeve has been removed, use new seal sleeve. Be sure to install seal sleeve before installing outer bearing.
- Place oil seal housing on axle and press outboard bearing on axle. Install axle in rear axle housing. Support end of axle and press inner bearing on axle and into rear axle housing.
- Insure that heavy washer is installed in planetary pinion carrier before installing planetary pinions. Install wire ring in planetary pinion grooves after pressing them in place.
- Be sure to install lock plate on planetary pinion carrier bolt after tightening bolt to **103 - 132 N•m (76 - 98 lb-ft)**.
- Be sure to install spring hooks on two cap screws when installing differential carrier. Tighten all internal gear cap screws to **44 - 59 N•m (33 - 43 lb-ft)**.
- When assembling brake cam to brake arm be sure to align match marks.
- Align machined slot in brake plate with brake cam.

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Rockshaft Assembly

Removal:

1. Remove seat and seat support. See “Seat And Seat Support Removal and Installation” on page 766 in Miscellaneous section.

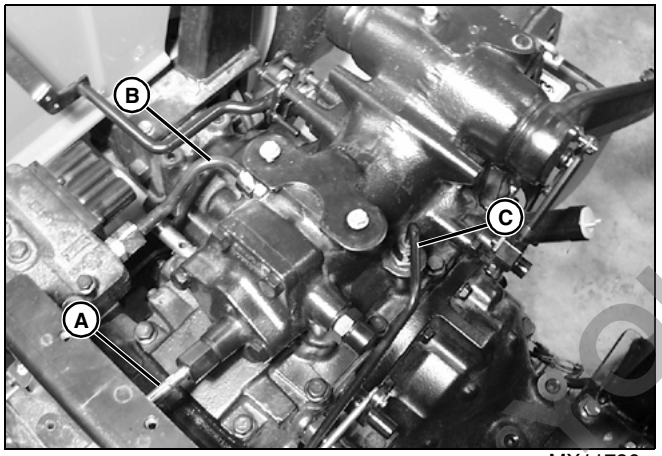
2. Remove closeout panel. See “Seat Closeout Removal and Installation” on page 766 in Miscellaneous section.

3. Remove three point hitch. See “Three Point Hitch Removal and Installation” on page 765 in Miscellaneous section.

4. Remove seat platform. See “Seat Closeout Removal and Installation” on page 766 in Miscellaneous section.

5. Disconnect wiring harness connections.

6. Move wiring harness clear of rockshaft housing.

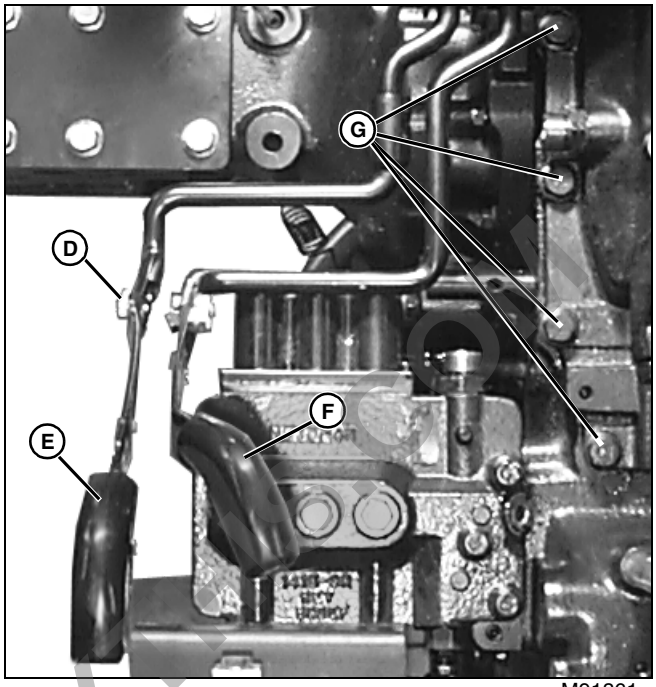


MX11736

7. Use two open end wrenches on the flats on the rate of drop control shafts (A) to separate shaft.

8. Remove hydraulic tube (B) from SCV to rockshaft housing.

9. Disconnect hydraulic tube (C) from rockshaft housing.



M91361

10. Remove two cap screws (D). Remove lift control lever (E).

11. If equipped: Remove two cap screws and draft sensing control lever (F).

12. Remove all cap screws (G) securing rockshaft housing to transmission. Gently pry up around edge of rockshaft cover to loosen.

CAUTION: Avoid Injury! The approximate weight of the rockshaft assembly is 68 kg (150 lb). Do not attempt to remove rockshaft assembly without an assistant or overhead crane.

13. Remove rockshaft housing from transmission.

Installation:

NOTE: Installation is reverse of removal.

- Install a new bead of sealant (TY16021) to transaxle rockshaft mounting surface.
- Tighten cap screws to **140 N•m (105 lb-ft)**.

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