JOHN DEERE
WORLDWIDE COMMERCIAL & CONSUMER EQUIPMENT DIVISION

Tractor Loader Backhoe
110

TM1987 JUN02

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.

Safety
Specifications and Information
Engine
Electrical
Power Train
Hydraulics
Steering
Brakes
Loader
Backhoe
Miscellaneous

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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Recognize Safety Information



MIF

This is the safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

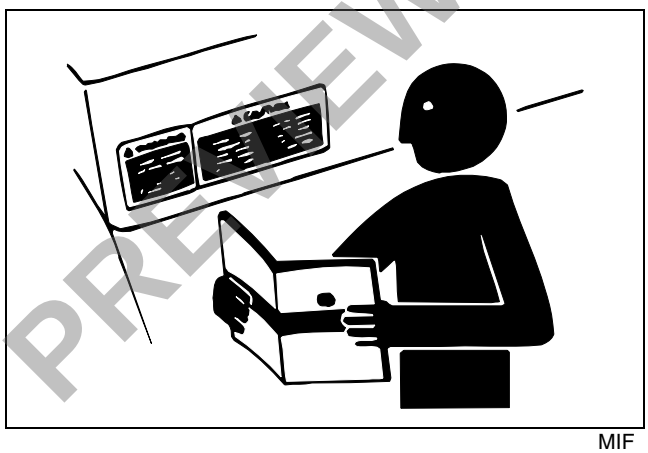
Follow recommended precautions and safe servicing practices.

Understand Signal Words

A signal word - DANGER, WARNING, or CAUTION - is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

Replace Safety Signs



MIF

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

Be Prepared for Emergencies



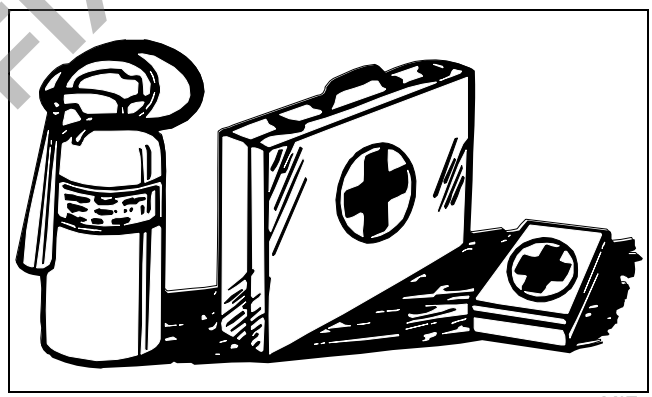
MIF

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.



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Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

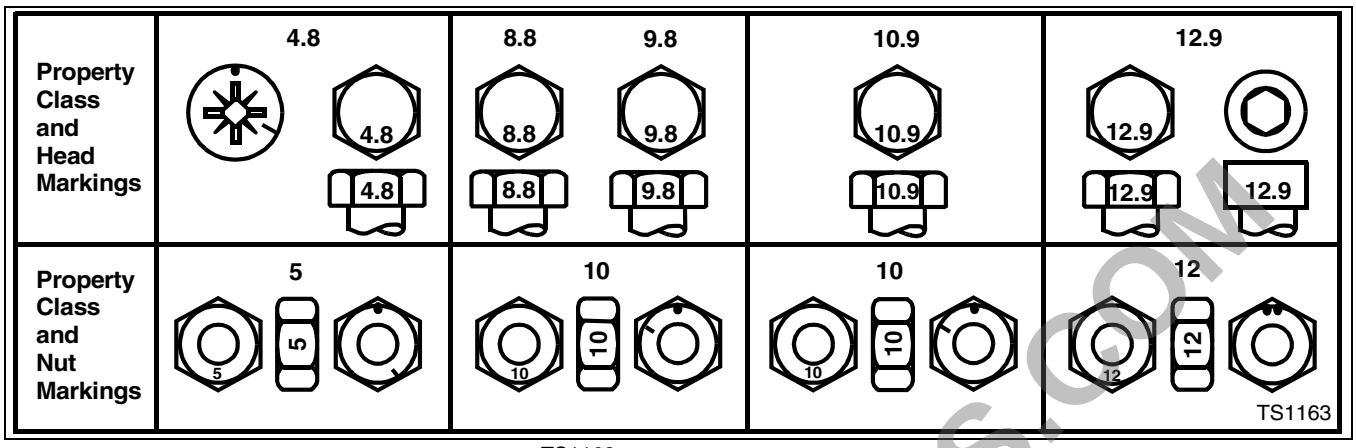
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

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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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OILSCAN®, OILSCAN Plus®, COOLSCAN™, and COOLSCAN PLUS™



T104220

OILSCAN, OILSCAN Plus, COOLSCAN, and COOLSCAN PLUS are John Deere sampling fluid programs to help you monitor machine maintenance and system condition. The objective of a fluid sampling program is to ensure machine availability when you need it and to reduce repair costs by identifying potential problems before they become critical.

Oil and coolant samples should be taken from each system prior to its recommended change interval.

Check with your John Deere dealer on a maintenance program for your specific application. Your dealer has the sampling products and expertise to assist you in lowering your overall operating costs through fluid sampling.

Alternative Lubricants

Conditions in certain geographical areas outside the United States and Canada may require different lubricant recommendations than the ones printed in this technical manual or the operator's manual. Consult with your John Deere Dealer, or Sales Branch, to obtain the alternative lubricant recommendations.

IMPORTANT: Avoid damage! Use of alternative lubricants could cause reduced life of the component.

If alternative lubricants are to be used, it is recommended that the factory fill be thoroughly removed before switching to any alternative lubricant.

Synthetic Lubricants

Synthetic lubricants may be used in John Deere equipment if they meet the applicable performance requirements (industry classification and/or military specification) as shown in this manual.

The recommended air temperature limits and service or lubricant change intervals should be maintained as shown in the operator's manual.

Avoid mixing different brands, grades, or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements. Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Lubricant Storage

All machines operate at top efficiency only when clean lubricants are used. Use clean storage containers to handle all lubricants. Store them in an area protected from dust, moisture, and other contamination. Store drums on their sides. Make sure all containers are properly marked as to their contents. Dispose of all old, used containers and their contents properly.

Mixing of Lubricants

In general, avoid mixing different brands or types of lubricants. Manufacturers blend additives in their lubricants to meet certain specifications and performance requirements. Mixing different lubricants can interfere with the proper functioning of these additives and lubricant properties which will downgrade their intended specified performance.

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Connecting Rod

Large End Bearing ID	51-51.01 mm (2.008-2.008 in.)
Oil Clearance	0.04-0.07 mm (0.002-0.003 in.)

Piston Rings

First Compression Piston Ring Groove Width	2.07-2.08 mm (0.081-0.082 in.)
First Compression Piston Ring Width	1.97-1.99 mm (0.078-0.078 in.)
First Compression Ring Minimum Side Clearance	0.08-0.110 mm (0.003-0.004 in.)
Second Compression Piston Ring Groove Width	2.04-2.05 mm (0.080-0.081 in.)
Second Compression Piston Ring Width	1.97-1.99 mm (0.078-0.078 in.)
Second Compression Piston Ring Minimum Side Clearance	0.05-0.08 mm (0.002-0.003 in.)
Oil Control Piston Ring Groove Width	4.02-4.03 mm (0.158-0.159 in.)
Oil Control Piston Ring Width	3.97-3.99 mm (0.156-0.157 in.)
Oil Control Piston Ring Minimum Side Clearance	0.03-0.06 mm (0.001-0.002 in.)
Piston Ring End Gap	0.20-0.40 mm (0.008-0.016 in.)
Wear Limit	1.50 mm (0.059 in.)

Piston Pin

Piston Pin OD	25.99-26.00 mm (1.023-1.024 in.)
Wear Limit	25.90 mm (1.020 in.)
Piston Pin Bushing ID	26.00-26.01 mm (1.024-1.024 in.)
Wear Limit	26.02 mm (1.024 in.)
Piston Pin-to-Rod Bore Oil Clearance	0.03-0.05 mm (0.001-0.002 in.)
Wear Limit	0.2 mm (0.008 in.)
Piston Pin-to-Piston Oil Clearance	0.00-0.02 mm (0.0-0.001 in.)
Wear Limit	0.12 mm (0.005 in.)

Piston

Standard Piston OD	83.95-83.98 mm (3.305-3.306 in.)
Wear Limit	83.90 mm (3.303 in.)
Oversize Piston OD	84.20-84.23 mm (3.315-3.316 in.)
Wear Limit	84.15 mm (3.313 in.)

Cylinder Bore ID

Standard Bore ID	84.00-84.03 mm (3.307-3.308 in.)
Wear Limit	84.20 mm (3.315 in.)
Oversize Bore ID	84.25-84.28 mm (3.317-3.318 in.)
Wear Limit	84.45 mm (3.325 in.)
Cylinder Roundness	0.01-0.01 mm (0-0.0004 in.)
Wear Limit	0.03 mm (0.001 in.)
Cylinder Taper	0.00-0.01 mm (0-0.0004 in.)
Wear Limit	0.03 mm (0.001 in.)
Deglazing	30-40° crosshatch pattern

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Oil Pump

Rotor Shaft OD-to-Side Cover Hole ID Clearance . . . . . 0.01-0.04 mm (0.001-0.002 in.)
Wear Limit . . . . . 0.20 mm (0.08 in.)
Inner Rotor and Outer Rotor-to-Pump Body Side Clearance . . . . . 0.03-0.09 mm (0.001-0.004 in.)
Wear Limit . . . . . 0.15 mm (0.006 in.)
Outer Rotor to Pump Body Clearance . . . . . 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 . . . . . 0.15 mm (0.006 in.)

Tests and Adjustment Specifications

Compression Pressure

Standard . . . . . 3135-3330 kPa (455-485 psi)
Minimum . . . . . 2455-2650 kPa (355-385 psi)
Maximum Difference between Cylinders . . . . . 200-300 kPa (29-44 psi)

Slow Idle Speed . . . . . 1050 ± 50 rpm
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 Bolt Torque . . . . . 44-54 N•m (33-40 lb-ft)
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 End Play (Max). . . . . 0.33 mm (0.013 in.)
Main Bearing Cap Bolts . . . . . 96-100 N•m (71-74 lb-ft)
Main Bearing Clearance . . . . . 0.04-0.07 mm (0.001-0.003 in.)
Main Bearing Clearance (Max). . . . . 0.15 mm (0.006 in.)
Valve Lift . . . . . Same for all valves
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. . . . . 19600-20600 kPa (2843-2990 psi)
Leakage @ 11 032 kPa (1600 psi) . . . . . None

Thermostat Begin to Open Temperature . . . . . 69.5-72.5°C (157-163°F)
Thermostat Fully Open Temperature . . . . . 85°C (185°F)
Thermostat Opening Height (Min). . . . . 8 mm (0.315 in.)

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Tools and Materials

Special Tools

NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

Required Tools

Tool Name	Tool No.	Tool Use
Magnetic Follower Holder Kit	D15001NU	Holds cam followers when removing and installing camshaft.
Nozzle Cleaning Kit	JDF13	Used to clean fuel injection nozzles.
Valve Guide Knurler	D-20019W1	Used to knurl inside diameter of valve guides.
Valve Guide Driver	JDE118	Used to remove and install valve guides in cylinder head.
Valve Guide Reamer	D-20021W1	Used to ream out valve guides.
Belt Tension Gauge	JDG529 or JDST28	Used to measure and adjust belt tension.
Cooling System Pressure Pump	D05104ST	Used to test cooling system for leakage.
Radiator Pressure Test Kit (Adapters)	JDG692	Used in conjunction with D05104ST Cooling System Pressure Pump.
Hand-Held Digital Tachometer	JT05719	Used to adjust engine idle speed.
Compression Gauge Assembly	JT01682	Used to test cylinder compression.
Adapter	JDG560	Used in conjunction with JT01682 Compression Gauge Assembly.

Required Tools

Tool Name	Tool No.	Tool Use
Diesel Fuel Injection Nozzle Tester	D01109AA	Used to test fuel injection nozzles.
Adapter Set	D01110AA	Used with D01109AA Diesel Fuel Injection Nozzle Tester.
Straight Adapter	23622	Used with D01109AA Diesel Fuel Injection Nozzle Tester.
Hose Assembly	JT03017	Used to test engine oil pressure.
690 kPa (100 psi) Pressure Gauge	JT05577	Used to test engine oil pressure.
Connector	JT03349	Used to test engine oil pressure.
Hose Fitting	JT03274	Used to test fuel supply pump pressure.
Female Quick Coupler	JT01609	Used to test fuel supply pump pressure.
0-1034 kPa (0-150 psi) Gauge w/ Male Quick Coupler	JT03115	Used to test fuel supply pump pressure.

Other Materials

Other Material

Part No.	Part Name	Part Use
TY15130 LOCTITE®	John Deere Form-In-Place Gasket	Seals crankcase extension, rear oil seal case and flywheel housing to engine block. Seals oil pan to timing gear housing and engine block.
TY9370 LOCTITE No. 242	Thread Lock and Sealer (Medium Strength)	Apply to threads of crankshaft pulley cap screw.

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Engine Performance

Test Conditions:

- Machine parked on level surface.
- Park brake engaged.
- Key switch in OFF position.

(1) Intake and Exhaust Valves
With engine cold, check valve clearances. (See “Valve Clearance Check and Adjustment” on page 42.) Is valve clearance within specification (engine cold)?
Yes - Go To (2) Injectors on page 40 No - Adjust valve clearance.

(2) Injectors
Perform cylinder compression test. (See “Cylinder Compression Test” on page 40.) Is cylinder compression within specifications? Is pressure difference between cylinders within specification?
Yes - Go To (3) Flywheel and Starting Motor on page 40 No - Perform and follow results of cylinder leakdown test. (See “Cylinder Leakdown Test” on page 52.)

(3) Flywheel and Starting Motor
Perform starter amp draw test. (See “Starting Motor Amperage Draw Test” on page 236..) Is minimum cranking rpm within specification?
No - See results in starting motor amperage draw test.

Tests and Adjustments

Cylinder Compression Test

Reason

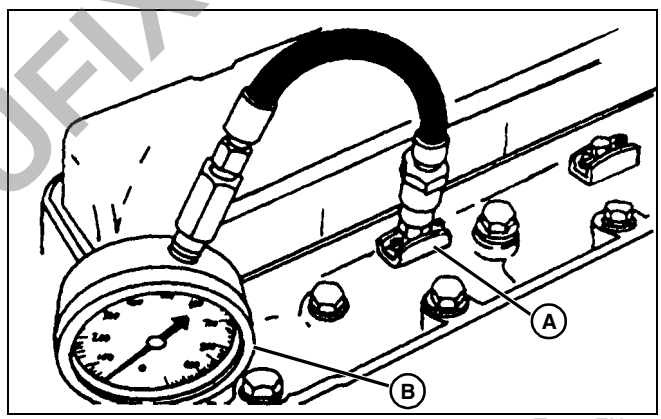
To determine the condition of the pistons, rings, cylinder walls, and valves.

Required Tools

Tool Name	Tool No.	Tool Use
Compression Gauge Assembly	JT01682	Used to measure pressure in each cylinder.
Adapter	JDG560	Used to connect compression gauge assembly to cylinder.

Procedure

1. Remove the injection nozzles.



T6333EU

2. Install the heat protector from end of injector and install JDG560 Adapter (A).

3. Install JT01682 Compression Gauge Assembly (B) and JDG560 Adapter.

4. Disconnect the fuel control solenoid connector.

IMPORTANT: Avoid damage! DO NOT overheat starting motor during test.

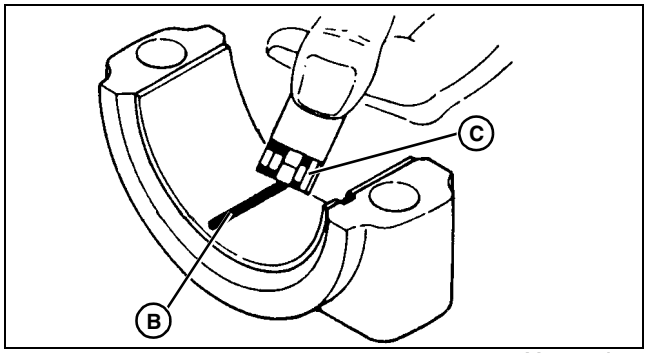
5. Crank the engine for five seconds with the starting motor. Minimum cranking speed is 250 rpm.

6. Record the pressure reading for each cylinder.

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NOTE: The flattened PLASTIGAGE will be found on either the bearing insert or crankshaft journal.



M82117A

8. Use the graduation marks on the envelope (C) to compare the width of the flattened PLASTIGAGE at its widest point. The number within the graduation marks indicates the bearing clearance in inches or millimeters depending on which side of the envelope is used.

9. The bearing clearance must be to specification.

10. Remove the PLASTIGAGE.

Results

If the clearance exceeds specification, replace bearing inserts.

Specifications

Connecting Rod Bolt Torque . 44-54 N•m (33-40 lb-ft)

Connecting Rod Bearing Clearance . . 0.04-0.07 mm (0.002-0.003 in.)

Crankshaft End Play Check

Reason

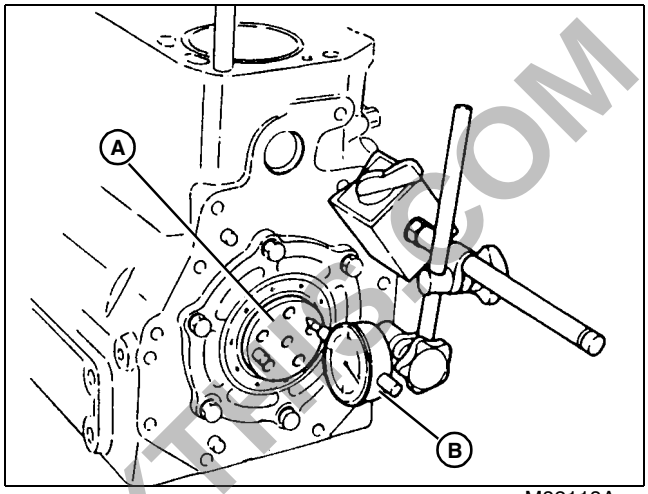
To determine proper side clearance between the crankshaft and the engine block.

Required Tools

Tool Name	Tool No.	Tool Use
Dial Indicator	NA	Used to measure end play.

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.



M82118A

1. Fasten the dial indicator (B) to engine and position indicator tip on end of crankshaft (A).

IMPORTANT: Avoid damage! Do not use excessive force when moving crankshaft to avoid damaging bearings.

2. Push the crankshaft toward rear as far as possible.

3. Zero the dial indicator.

4. Using a bar, gently pry the crankshaft as far forward as possible.

5. Crankshaft end play must be to specification.

Results

If the end play exceeds maximum specification, replace the thrust bearings.

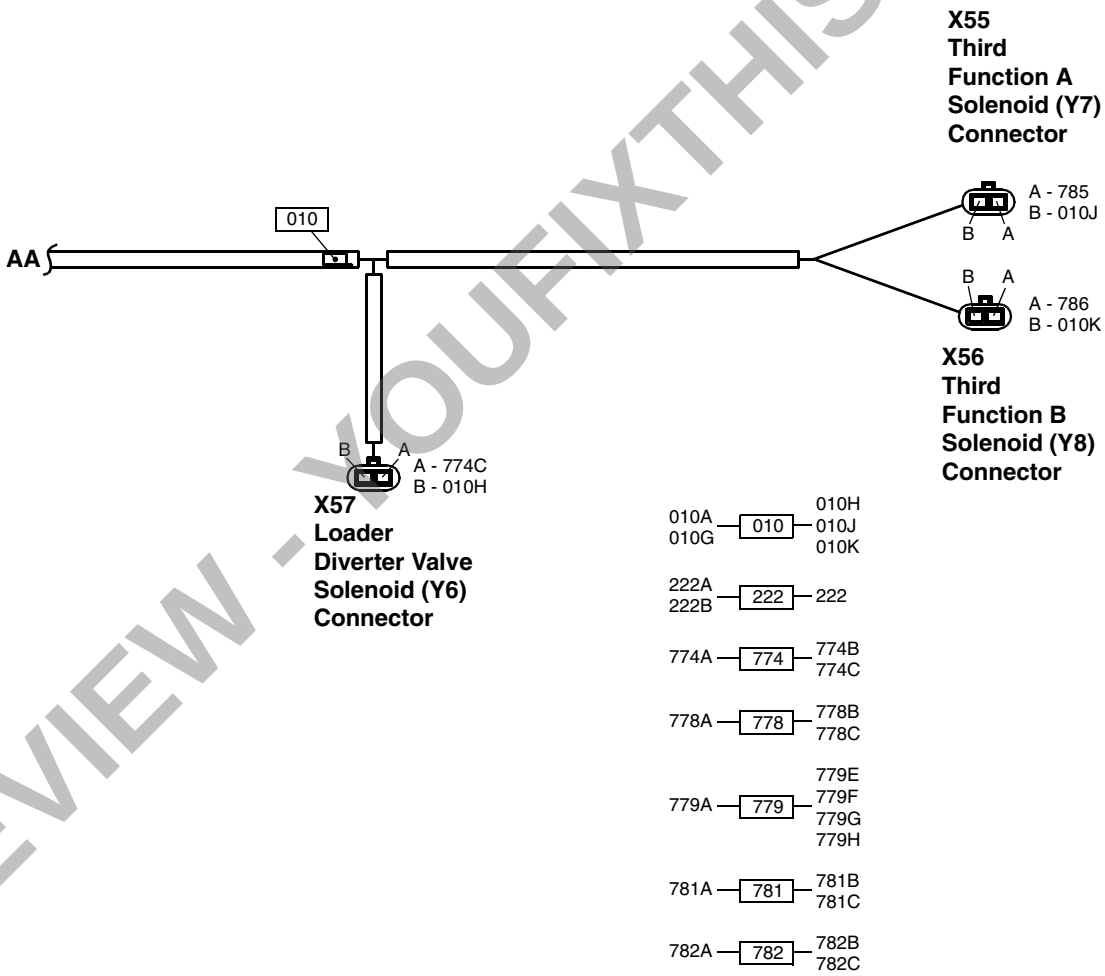
Specifications

Crankshaft End Play . 0.09-0.27 mm (0.004-0.011 in.)

Crankshaft End Play (Max). . . . . 0.33 mm (0.013 in.)

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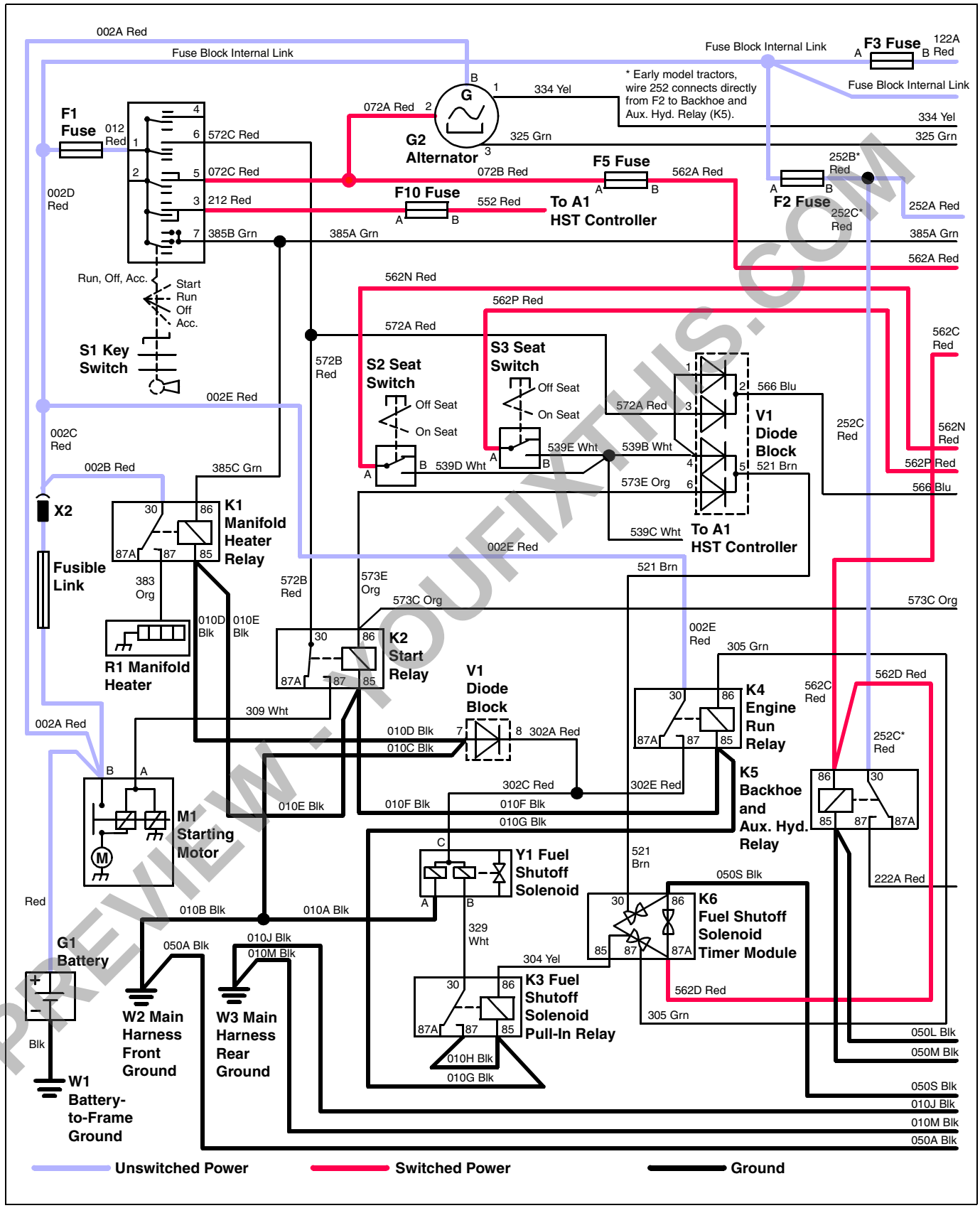


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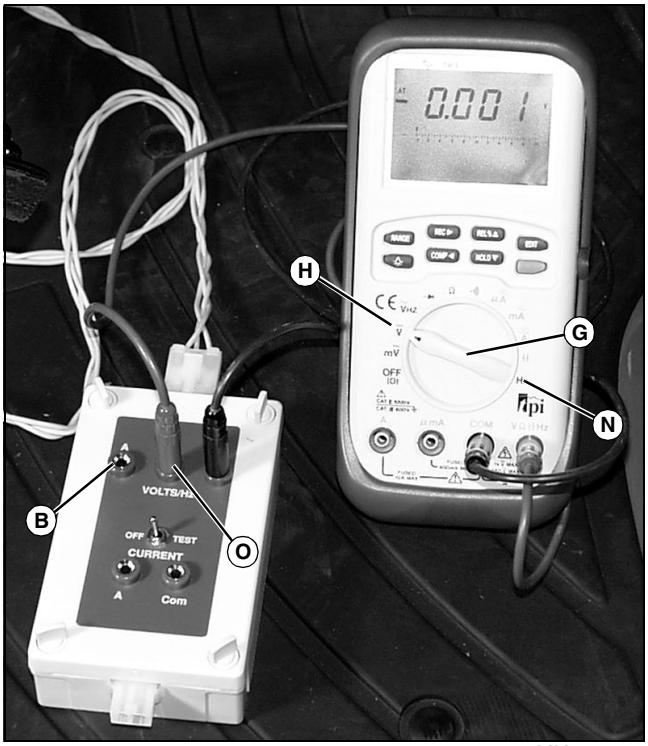
Main Electrical Schematic



MIF (MX14753)

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MX9822

11.Turn the selector (G) on the multimeter from the DCV position (H) to the Hz position (N).

12.Move the red lead on the connector box from the A terminal (B) to the B terminal (O).

13.The frequency reading (B to C signal Hz at slow idle) should be at specification. If not, replace the engine speed sensor.

14.Move the throttle lever to the fast idle position.

15.The frequency reading (B to C signal HZ at fast idle) should be at specification. If not, replace the engine speed sensor.

16.Disconnect the engine speed sensor adapter harness from the tractor wiring harness and the engine speed sensor.

17.Connect the tractor wiring harness to the engine speed sensor.

Specifications

Input Voltage . . . . . 5.0 ± 0.2 volts

B to C Signal Hz at Slow Idle . . . . . 2.2 ± 0.1 Hz

B to C Signal Hz at Fast Idle . . . . . 5.9 ± 0.1 Hz

HST Ground Travel Speed Sensor Test

The Electronic Control Test Kit (JDG1575) can be used to test the ground travel speed sensor. The ground travel speed sensor is tested based upon the proper voltage input and frequency output during a drive function.

Test Conditions

- Tractor on jack stands.
- Operator ON seat.
- Engine RUNNING with throttle at slow idle.
- Forward pedal at BOT position.
- Range selector lever in NEUTRAL position.
- Park brake disengaged.
- Speed sensor adapter connected to ground travel speed sensor and 3-pin extender harness.
- Red lead connected to multimeter and connector box.
- Black lead connected to multimeter and connector box.

Procedure

1. Park machine on level surface with range selector lever in NEUTRAL, key switch turned OFF, and park brake ENGAGED.

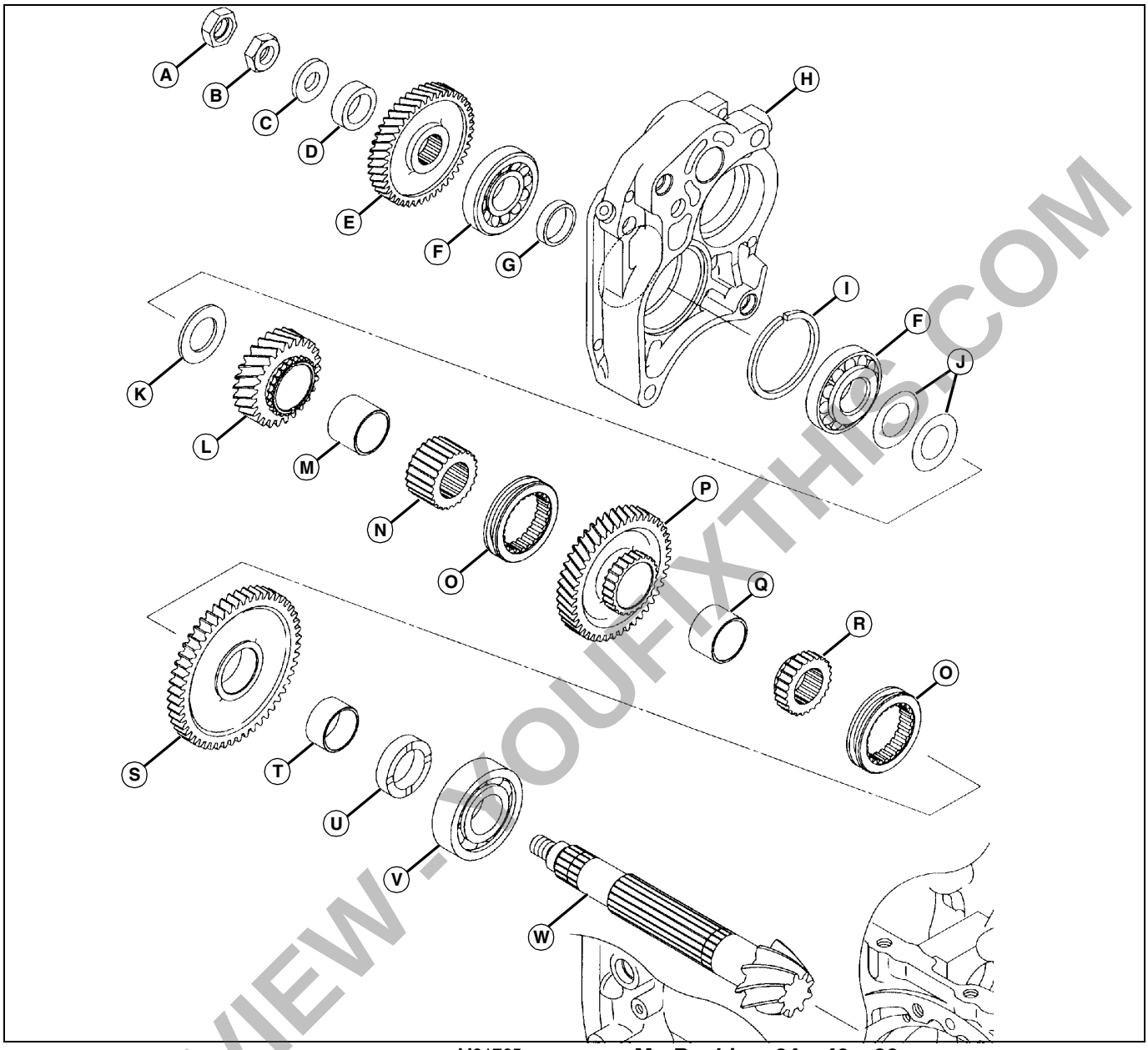
CAUTION: Avoid injury! Position tractor safely on jack stands so that ALL four wheels spin freely.

2. Install jack stands under tractor so that ALL wheels are off the ground and are free to spin.

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Differential Pinion Shaft



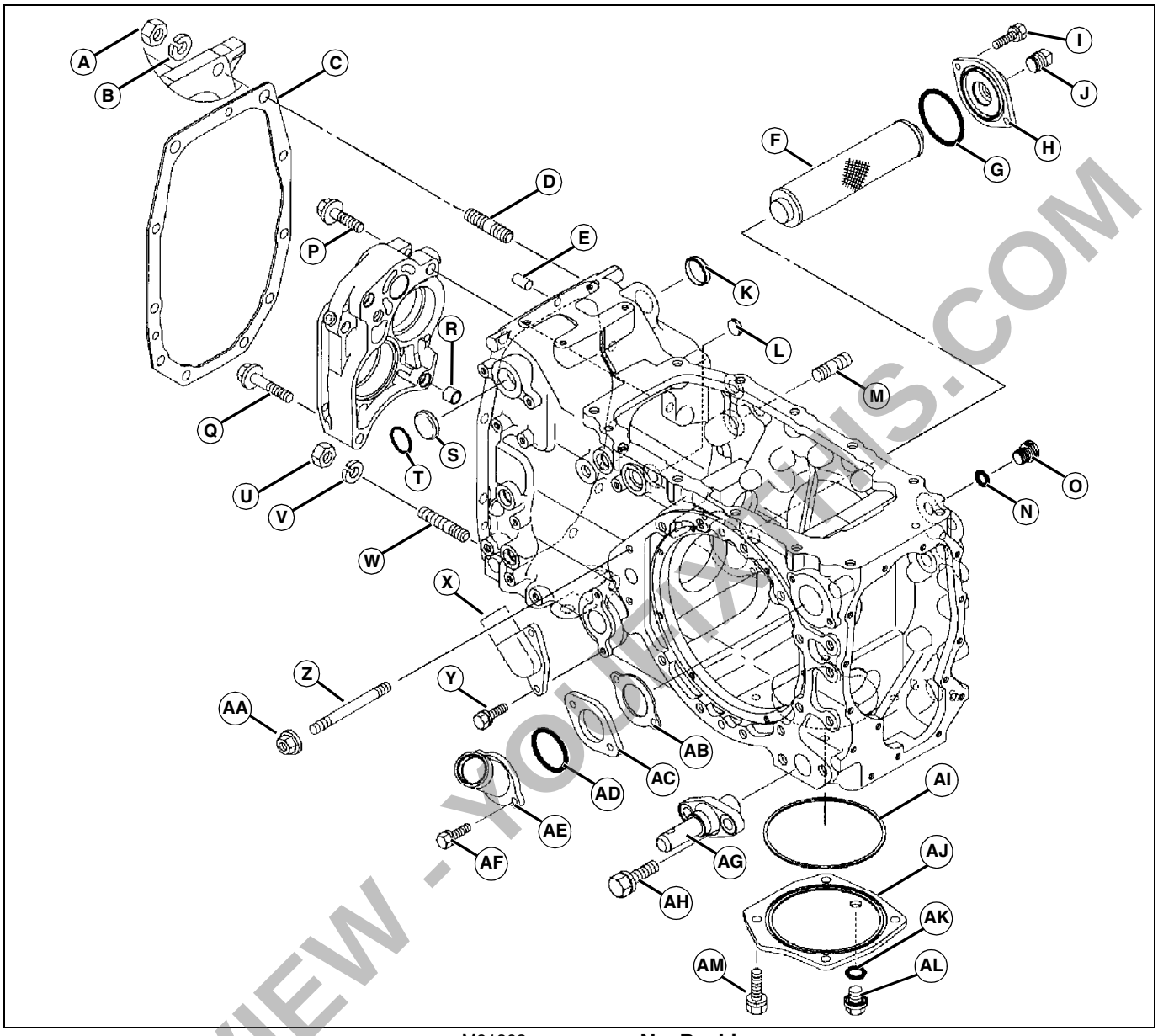
M91765

A - Nut, Upper
B - Nut, Lower
C - Washer, 16 x 38 x 4.5
D - Bushing, 25 x 38 x 12
E - Pinion, Drive, 44T
F - Bearing, Roller
G - Spacer, 30 x 4.5
H - Housing, Bearing
I - Ring, 75
J - Shim(s), 30 x 45 x 0.1*
K - Washer, 30 x 45 x 3
L - Gear, Counter, 26T
M - Bushing, 34 x 40 x 30
N - Sleeve, Splined
O - Shifter
P - Gear, Counter, 45T
Q - Bushing, 34 x 40 x 26
R - Sleeve, Splined
S - Gear, Counter, 49T
T - Bushing, 35 x 40 x 19
U - Spacer, 35 x 50 x 12
V - Bearing
W - Shaft, Pinion

*NOTE: Shims may vary in number for pinion shaft adjustment. (See “Differential Pinion Shaft Adjustment” on page 308.)

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Transmission Housing



M91803

A - Nut
B - Lock Washer
C - Gasket
D - Stud, 16 x 45
E - Pin, 10 x 18
F - Screen, Suction
G - Packing
H - Cover, Screen
I - Screw, w/Washer
J - Plug
K - Cap, Seal
L - Cap, Seal
M - Stud, 16 x 35
N - Packing
O - Plug, 9/16
P - Bolt
Q - Cap Screw
R - Bushing, 13 x 17 x 14
S - Cap, Seal
T - O-Ring
U - Nut
V - Lock Washer
W - Stud, 12 x 45
X - Flange, Pipe
Y - Screw w/Washer
Z - Stud, 10 x 90
AA- Nut

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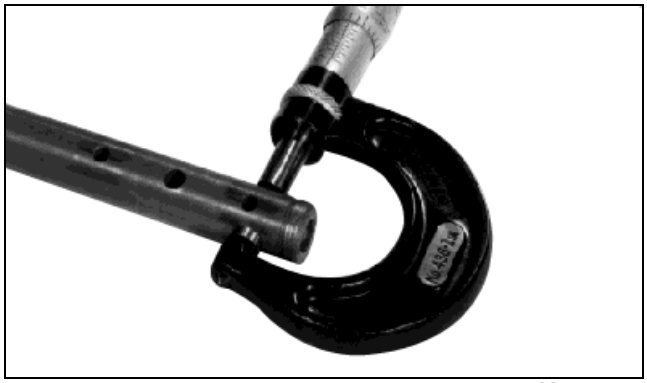
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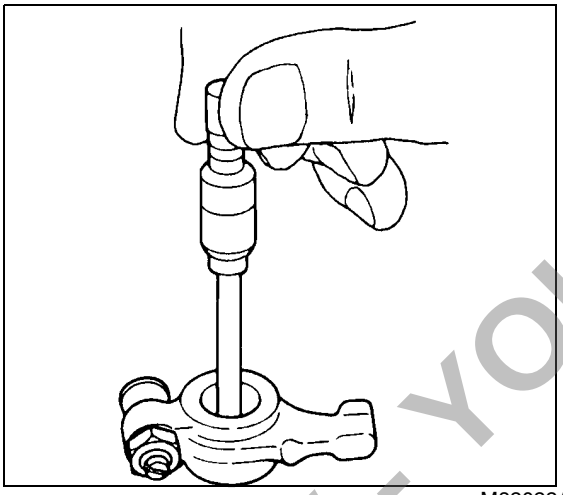
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Inspection



M35262

1. Measure the outer diameter of the rocker arm shaft. Replace rocker arm shaft if OD is less than specification.

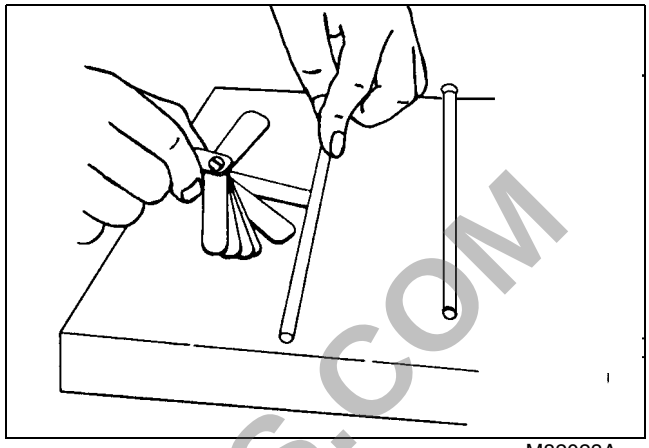


M82022A

2. Measure the inner diameters of the rocker arms and supports. Replace rocker arms or supports if ID is greater than specification.

3. Measure the rocker arm shaft to rocker arm bushing oil clearance. Oil clearance is the difference between the OD of the rocker arm shaft and the ID of the rocker arms. Replace rocker arm shaft if clearance exceeds specification.

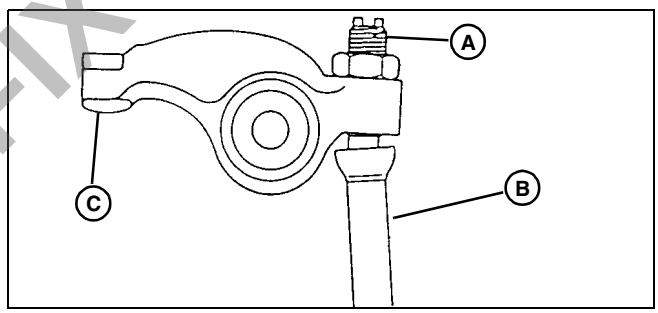
Measure Bending of Push Rod



M82023A

Place the push rod on a flat surface. Use a feeler gauge to measure gaps between the push rod and flat surface. Replace push rod if bend exceeds specification.

Inspect Rocker Arm Contact Surfaces



M76398

1. Check the surface of the adjusting screw (A) that contacts the push rod (B) for wear. Replace the push rod or adjusting screw if the surface of either is worn and peeled.

2. Check the surface that comes in contact with the valve cap (C) for wear. Replace rocker arm if necessary.

Specifications

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.)

Push Rod Bend . . . . . 0.0-0.03 mm (0.0-0.001 in.)

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System Schematics

Schematic and Wiring Harness Legend

Components

A1 - Hydrostatic Transmission (HST) Controller

B1 - Air Filter Restriction Switch

B2 - Hydraulic Oil Temperature Sensor

B3 - Engine Oil Pressure Switch

B4 - Engine Coolant Temperature Sensor

B5 - Engine Speed Sensor (at flywheel)

B6 - Ground Travel Speed Sensor (at MFWD gear)

E1 - Right Rear Turn Light

E2 - Right Tail Light

E3 - Right Brake Light

E4 - Left Rear Turn Light

E5 - Left Tail Light

E6 - Left Brake Light

E7 - Right Front Turn Light

E8 - Left Front Turn Light

E9 - Right Headlight

E10 - Left Headlight

E11 - Right Rear Work Light

E12 - Left Rear Work Light

E13 - Instrument Panel Light

E14 - Instrument Panel Light

F1 - Key Switch Fuse 30A

F2 - Accessory Fuse 20A

F3 - Lights and Turn Signals Fuse 30A

F4 - Brake Lights Fuse 10A

F5 - Interlock, Backhoe, Auxiliary Hydraulics Fuse 20A

F6 - Work Lights Fuse 20A

F7 - Headlights Fuse 20A

F8 - Tail Lights Fuse 10A

F9 - Not Used

F10 - HST Controller Fuse 10A

F11 - Storage Position for Fuse F12

F12 - HST Controller Calibration Fuse 10A (for controller calibration only; fuse stored in F11 location during normal operation)

G1 - Battery

G2 - Alternator

H1 - PTO Light

H2 - Park Brake Light

H3 - Loader Hydraulics Enabled Light

H4 - Optional Rear SCV Hydraulics Enabled Light

H5 - Air Filter Restriction Light

H6 - Cold Start Light

H7 - Discharge Light

H8 - Right Turn Light

H9 - Left Turn Light

H10 - HST Status Light

H11 - Engine Oil Pressure Light

H12 - Backup Alarm

K1 - Manifold Heater Relay

K2 - Start Relay

K3 - Fuel Shutoff Solenoid Pull-In Relay

K4 - Engine Run Relay

K5 - Backhoe and Auxiliary Hydraulics Relay

K6 - Fuel Shutoff Solenoid Timer Module

K7 - PTO Interlock Relay

K8 - PTO Interlock Relay

K9 - Neutral Relay

K10 - Backhoe Diverter Valve Relay

K11 - Brake Lights Relay

K21 - Not Used

K22 - Auxiliary Hydraulics Latching Relay (optional)

K23 - Third Function A Control Relay (optional)

K24 - Third Function B Control Relay (optional)

K25 - Third Function A Lockout Relay (optional)

K26 - Third Function B Lockout Relay (optional)

K27 - Loader Diverter Valve Control Relay (optional)

K28 - Loader Diverter Valve Control Module (optional)

M1 - Starting Motor

P1 - Engine Tachometer

P2 - Hour Meter

P3 - Hydraulic Oil Temperature Gauge

P4 - Engine Coolant Temperature Gauge

R1 - Manifold Heater

R2 - Forward Pedal Potentiometer

R3 - Throttle Position Potentiometer

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Turn Signals Circuit Operation

Function

Provides pulsing current to front/rear turn lights and turn signal indicator lights.

Operating Conditions

- Light switch in the OFF position.

Theory of Operation

The power circuit (See “Power Circuit Operation - Unswitched” on page 148.) provides voltage to turn signal switch (S8) terminal 2.

When turn signal switch (S8) is in either left-turn or right-turn position, the internal circuits of turn signal switch (S8) provide pulsing current to the corresponding front and rear turn lights and turn signal indicator lights, causing these lights to flash. At the same time, switch (S8) provides continuous current to the opposite set of turn lights, causing these lights to stay on steady.

When turn signal switch (S8) is in the left-turn position, pulsing current flows from switch (S8) terminal 3 to the following:

- Green wires 125A and 125B
- Left Turn Light (H9)
- Green wire 125C
- Main Harness-to-Lights Harness Connector (X23), green wire 125A
- Green wire 125C
- Left Rear Turn Light Connector (X44), terminal D
- Left Rear Turn Light (E4)
- Green wire 125B
- Left Front Turn Light Connector (X46), terminal A
- Left Front Turn Light (E8)

With the turn signal switch (S8) in the left-turn position, current flows from switch (S8), terminal 4 to the following:

- Green wires 115A and 115B
- Right Turn Light Indicator (H8)
- Green wire 115C
- Main Harness-to-Lights Harness Connector (X23), green wire 115A
- Green wire 115B
- Right Rear Turn Light Connector (X43), terminal D
- Right Rear Turn Light (E1)
- Green wire 115C
- Right Front Turn Light Connector (X45), terminal A
- Right Front Turn Light (E7)

When turn signal switch (S8) is in the right-turn position, pulsing current flows from switch (S8), terminal 4 to the following:

- Green wires 115A and 115B
- Right Turn Light Indicator (H8)
- Green wire 115C
- Main Harness-to-Lights Harness Connector (X23), green wire 115A
- Green wire 115B
- Right Rear Turn Light Connector (X43), terminal D
- Right Rear Turn Light (E1)
- Green wire 115C
- Right Front Turn Light Connector (X45), terminal A
- Right Front Turn Light (E7)

With the turn signal switch (S8) in the right-turn position, current flows from switch (S8), terminal 3 to the following:

- Green wires 125A and 125B
- Left Turn Light (H9)
- Green wire 125C
- Main Harness-to-Lights Harness Connector (X23), green wire 125A
- Green wire 125C
- Left Rear Turn Light Connector (X44), terminal D
- Left Rear Turn Light (E4)
- Green wire 125B
- Left Front Turn Light Connector (X46), terminal A
- Left Front Turn Light (E8)

NOTE: Ground is provided to light circuits by lights harness ground (W4), wire 010A. Connections must be in good condition for the light circuit to operate correctly.

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Results

- If current gun amp reading is BELOW specification, test for unregulated voltage output. If unregulated voltage output test meets specifications and you have verified voltage to ground to regulator/rectifier, replace regulator/rectifier.
- If at any time voltage increase exceeds **14.8 VDC**, replace regulator/rectifier.

Specifications

Fast Idle Voltage . . . . . 14.2-14.8 VDC
Minimum Fast Idle Amperage . . . . . 13.5 Amps

Starting Motor Solenoid Test

Reason

To determine if the starting motor is defective.

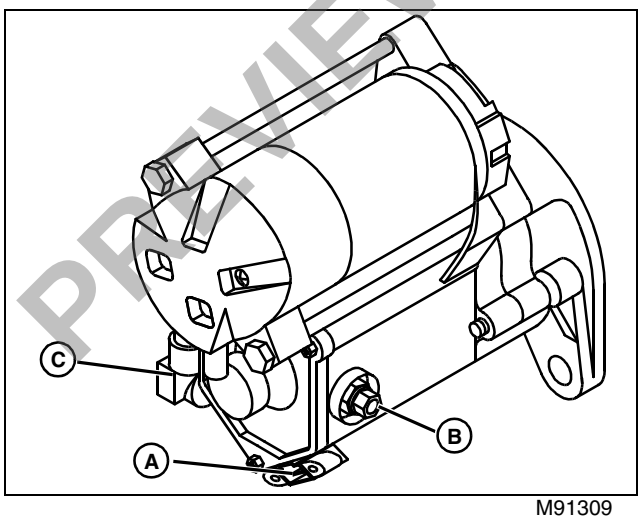
Equipment

- Jumper wire

CAUTION: Avoid injury! This test will cause engine to turn over. Engine may start. Ensure fuel shutoff solenoid is DISCONNECTED, transmission is in NEUTRAL and PTO is DISENGAGED.

Procedure

1. Park machine safely in NEUTRAL with park brake ENGAGED.
2. Raise hood and remove engine side covers.
3. Disconnect fuel shutoff solenoid wire connector.



M91309

4. Disconnect 309 white wire from starting motor solenoid terminal (A).
5. Connect jumper wire to positive (+) battery terminal and briefly jump to starting motor solenoid terminal (A).

Results

- Starting motor runs: solenoid is good, test cranking circuit wiring.
- Starting motor DOES NOT run: go to next step.

1. Remove rubber boot from terminal (B).
2. Remove plastic cover from terminal (C).
3. Connect jumper wire between starting motor solenoid large terminals (B and C).

Results

- Starting motor runs: replace starter.
- Starting motor DOES NOT run: check battery cables, then replace starting motor.

Starting Motor Amperage Draw Test

Reason

To determine the amperage required to crank the engine and check starter motor operation under load.

Equipment

- JT05685 Battery Tester

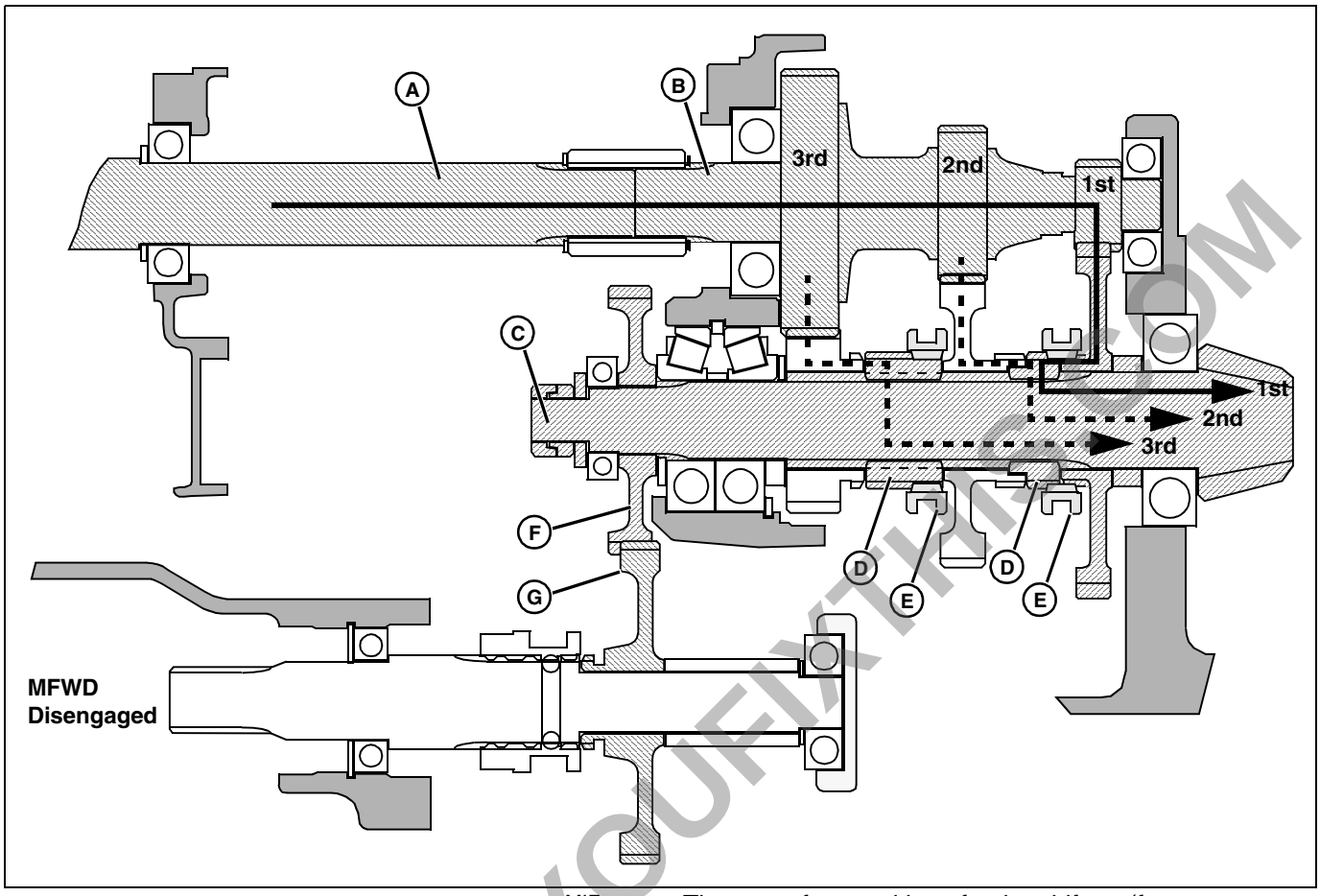
Procedure

1. Park machine safely in NEUTRAL with park brake ENGAGED.
2. Raise hood and remove engine side covers.
3. Disconnect fuel shutoff solenoid wire connector.

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Range Transmission



MIF

Operation

When the transmission is engaged, power from the driven shaft (A) is transferred to reduction shaft (B) through a splined collar. There are three gears on the reduction shaft that are continuously engaged to three gears on the pinion shaft (C).The three gears on the pinion shaft spin freely on the shaft.

Between the three gears on the pinion shaft there are two splined sleeves (D). There are two shifters (E) that slide forward and rearward on the splined sleeves.

The forks secured to the range shift linkage fit into the two shifters (E) and selection of the range shifter moves the forks and shifters forward and rearward. The shifters lock (only one at a time) the gears on the pinion shaft to one of the splined sleeves (D).

The diagram below shows the shifters in the rearmost (1st gear) position. Power flow is shown with the solid arrow. Power flow for 2nd and 3rd gear are shown with dashed arrows.

There are four positions for the shifters (from rear to front):

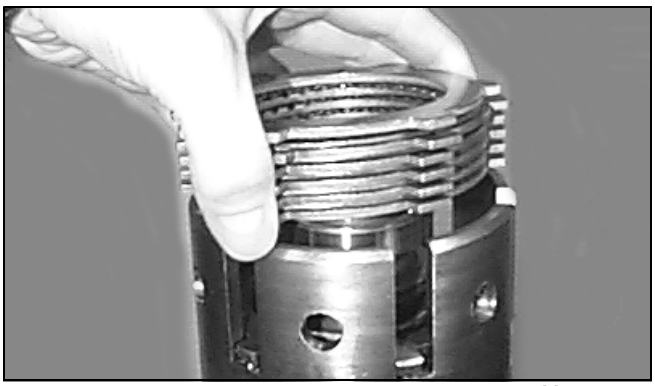
- Rearmost - 1st
- Next forward - Neutral (no gear locked to sleeves)
- Next forward - 2nd
- Most forward - 3rd

MFWD Drive

When the pinion shaft is powered, a splined gear (F) provides power to the front drive gear (G) on the front drive shaft. The gear is shown disengaged. (See “MFWD Power Operation” on page 299.)

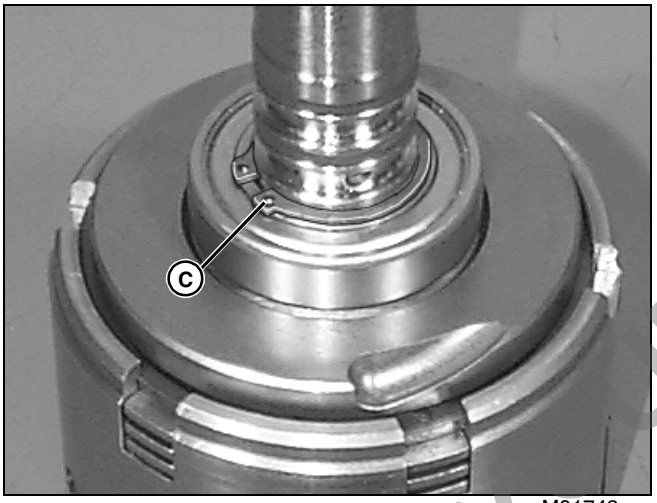
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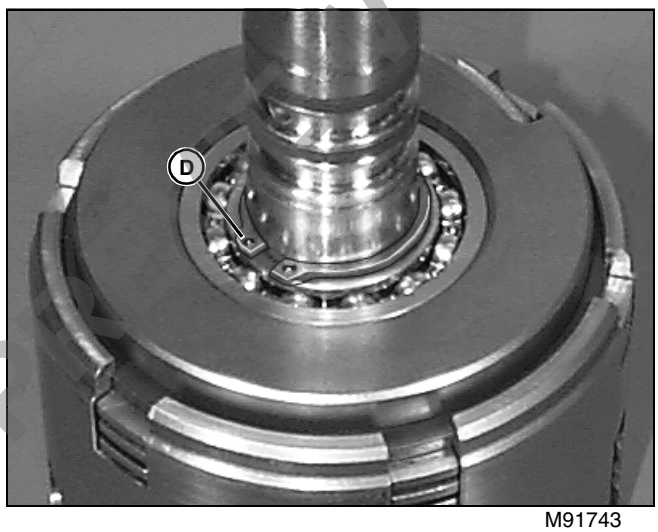
4. Remove clutch plates and disks from clutch cylinder.



M91742

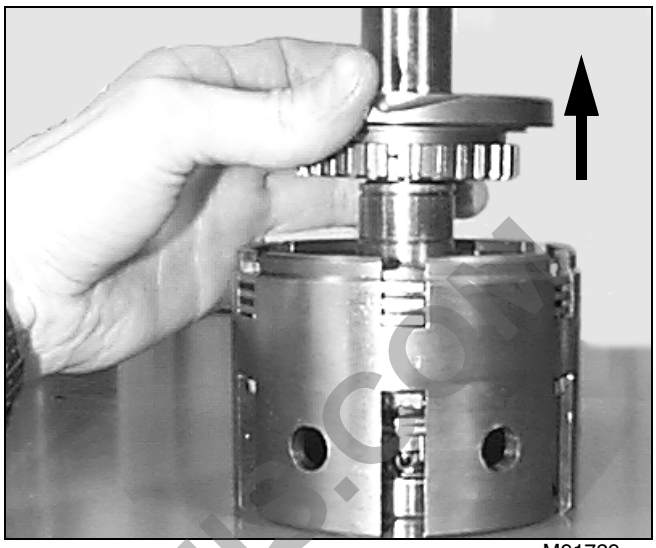
5. Remove snap ring (C) retaining bearing to PTO shaft.

6. Remove bearing.



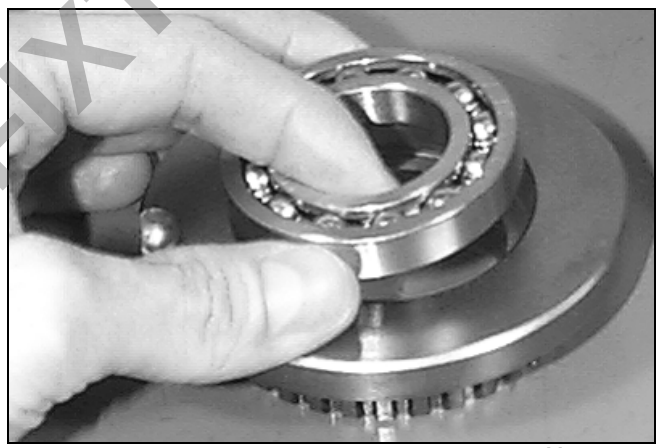
M91743

7. Remove snap ring (D) retaining clutch assembly to PTO shaft.



M91729

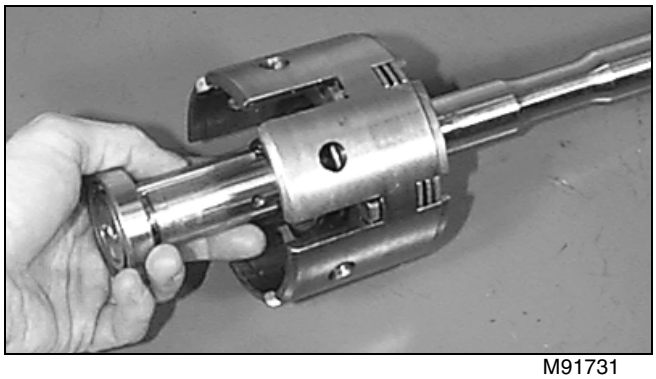
8. Remove brake hub and bearing from clutch cylinder and PTO shaft.



M91730

9. Remove bearing from brake hub.

10. Inspect bearing for smooth operation, damage, or wear. If necessary, replace bearing.



M91731

11. Remove PTO shaft and bearing from clutch cylinder as an assembly.

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Rockshaft Leakage Test

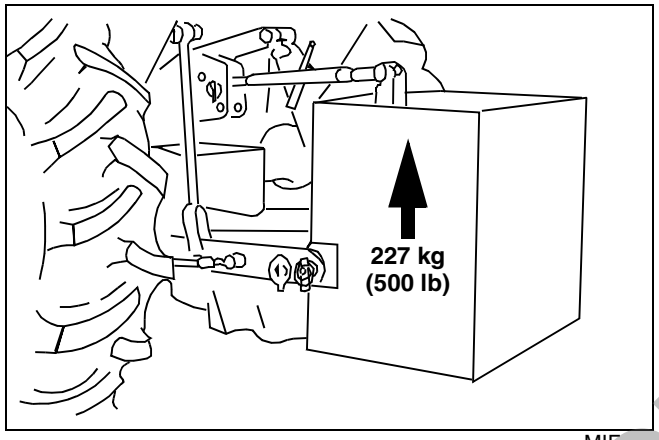
Reason

To ensure that hydraulic system is functioning correctly and capable of lifting rated load.

Required Tools

Tool Name	Tool No.	Tool Use
Ballast Box	BW13586	Used to supply weight to rockshaft.

Procedure



MIF

1. Park tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL.
3. Install BW13586 Ballast Box or approximately 227 kg (500 lb) to the three-point hitch.
4. Start engine and run at fast idle.
5. Put lift control lever in full UP position.
6. Raise weight as high as it will go.
7. Close rate of drop/stop valve.
8. Shut off engine.
9. Measure distance weight drops in 5 minutes.
10. Restart engine, open rate of drop/stop valve fully and raise weight to full UP position.
11. Shut off engine.
12. Measure distance weight drops in 5 minutes.

Results

- If the weight drops farther than specified distance with the rate of drop/stop valve closed (first test) there may be leakage in the cylinder, relief valve or rate of drop/stop valve.
- If the weight drops farther with the rate of drop/stop valve open (second test) than it did in the first test, there may be leakage in the rockshaft control valve.

Specifications

Maximum Drop in 5 Minutes . . . . . 51 mm (2 in.)

Rockshaft Position Feedback Linkage Adjustment

Reason

To ensure that draft arms rise to maximum lift height without engaging relief valve.

Procedure

1. Position tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL position.
3. Position lift control lever at full forward (down) position and provide enough weight on lift arms to allow self lowering.
4. Start engine.
5. Move lift control lever to full raise position (back).
6. Measure from the top of the PTO shield to center of pin in end of lift arm. Lift arm should rise to specification.

Results

If specification is not met, shorten the lift arm position feedback rod to increase, or lengthen to reduce, the maximum height until within specification.

Specifications

Lift Arm Height . . . . . 409 mm (16.1 in.)

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4. Install center cap steering wheel.

Specifications

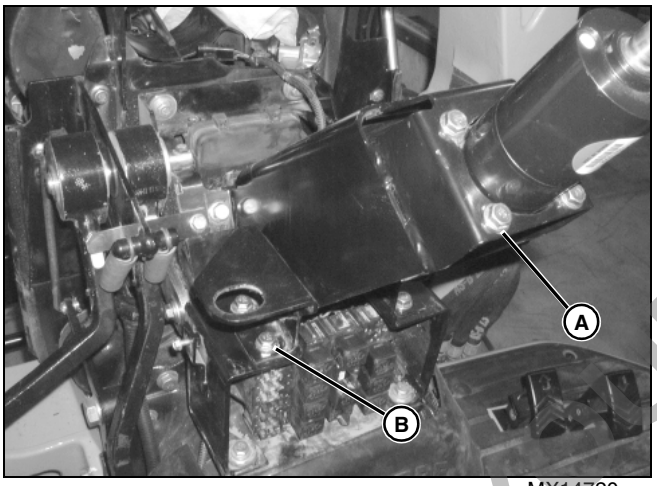
Steering Wheel Nut Torque . . 39-49 N•m (29-36 lb-ft)

Steering Control Unit (SCU) Removal/ Installation

Removal

1. Remove the steering wheel. (See “Steering Wheel Removal/Installation” on page 472.)

2. Remove fuel tank. (See “Fuel Tank Removal/ Installation” on page 521.)



MX14720

3. Remove four cap screws (A) retaining steering control unit to steering column.

4. Remove six cap screws (B) retaining steering column. Remove steering column from tractor.

IMPORTANT: Avoid damage! Cap or plug all lines to prevent contamination.

NOTE: The SCU has no serviceable components. If the SCU does not meet specifications, the unit must be replaced.

5. Label and disconnect the four hydraulic lines. Remove steering control unit. Cap or plug all lines to prevent contamination.

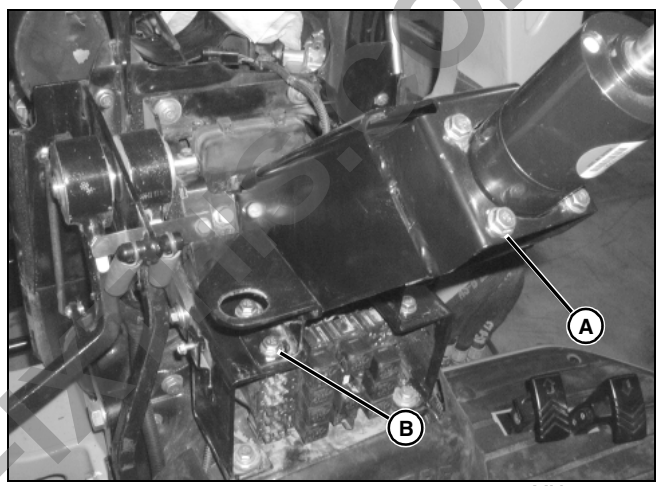
Installation

1. Replace O-rings in adapter fittings.

2. Install adapter fittings to the steering control unit ports. Tighten to specification.

NOTE: Align steering control unit so it can be assembled to steering column without twisting the steering lines.

3. Install the steering control unit to the steering lines.



MX14720

4. Install steering column with six cap screws (B).

NOTE: Unevenly or improperly torquing cap screws attaching SCU to tractor can result in distortion of the valve body and premature failure of the SCU.

5. Install steering control unit to steering column with four cap screws (A). Tighten cap screws to specification.

6. Install fuel tank.

7. Install steering wheel.

8. Fill the hydraulic system to the proper level; bleed the system if required.

Specifications

SCU Adapter Fitting Torque . 14-19 N•m (124-168 lb-in.)

SCU Mounting Cap Screw Torque . 30-38 N•m (22-28 lb-ft)

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