

F510 and F525 Residential Front Mowers

**John Deere Horicon Works
TM1475 (23OCT95)**

LITHO IN U.S.A.
ENGLISH

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DISPOSE OF WASTE PROPERLY

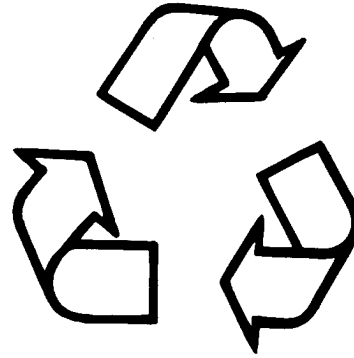
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



DX,DRAIN -19-03MAR93

TS1133 -JUN-26NOV90

LIVE WITH SAFETY

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



DX,LIVE -19-25SEP92

TS231 -19-07OCT88

Group 20—Cylinder Block and Internal Components—Continued

Item	Specification
Support Shaft	
Minimum Shaft O.D.	25.93 mm (1.021 in.)
Nuts Torque	7.3 N·m (65 lb-in.)
Piston	
Maximum Ring Groove Clearance	
Top Ring	0.17 mm (0.007 in.)
Second Ring	0.15 mm (0.006 in.)
Oil Ring	0.20 mm (0.008 in.)
Minimum Ring End Gap	0.18 mm (0.007 in.)
Maximum Ring End Gap	
Compression Rings	0.90 mm (0.035 in.)
Oil Ring Side Rails	1.30 mm (0.051 in.)
Minimum Pin O.D.	21.98 mm (0.865 in.)
Maximum Pin Bore I.D.	22.04 mm (0.868 in.)
Maximum Piston-to-Piston Pin Clearance	0.06 mm (0.002 in.)
Piston O.D.	88.83—88.86 mm (3.4885—3.498 in.)
Piston-to-Cylinder Bore Clearance	0.11—0.15 mm (0.0043—0.0059 in.)
Connecting Rod	
Maximum Crankshaft Bearing I.D.	41.07 mm (1.617 in.)
Maximum Piston Pin Bearing I.D.	22.06 mm (0.868 in.)
Maximum Connecting Rod-to-Piston Pin Clearance	0.08 mm (0.003 in.)
Maximum Connecting Rod-to-Crankpin Clearance	0.14 mm (0.006 in.)
End-Cap Screw Torque	20 N·m (177 lb-in.)
Crankshaft	
Minimum PTO Side Journal O.D.	37.90 mm (1.492 in.)
Minimum Flywheel Side Journal O.D.	34.95 mm (1.376 in.)
Minimum Connecting Rod Journal O.D.	40.93 mm (1.611 in.)
Maximum Crankcase Cover Plain Bearing I.D.	38.06 mm (1.498 in.)
Ball Bearing O.D.-New Part	79.98-80.00 mm (3.149-3.150 in.)
Maximum T.I.R.	0.05 mm (0.002 in.)
End Play	0.09—0.22 mm (0.004—0.009 in.)
Oil Seal Depth	0.50 mm (0.020 in.)
Cylinder Bore	
Standard Cylinder Bore I.D.	88.98—89.00 mm (3.503—3.504 in.)
Maximum Cylinder Bore I.D.	89.08 mm (3.507 in.)
Piston-to-Cylinder Bore Clearance	0.11—0.15 mm (0.0043—0.0059 in.)

Continued on next page

MX,1015CL,6 -19-23OCT95

GASOLINE STORAGE

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IMPORTANT: Keep all dirt, scale, water or other foreign material out of gasoline.

Keep gasoline in a safe, protected area and in a clean, properly marked "UNLEADED GASOLINE" container. DO NOT use de-icers to attempt to remove water from gasoline. DO NOT depend on fuel filters to remove water from gasoline. It is recommended that a water separator be installed in the storage tank outlet.

BE SURE to properly discard unstable or contaminated gasoline.

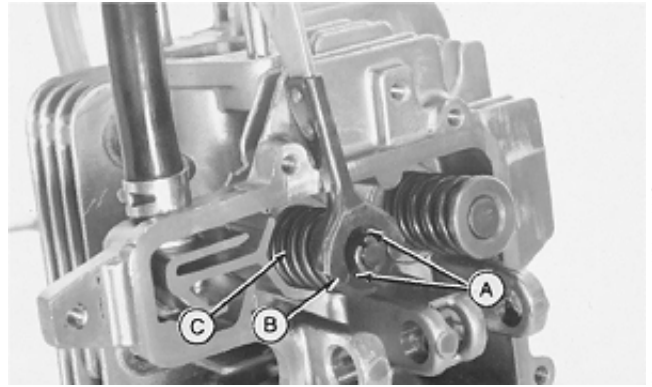
Whether the unit is either stored or used during the winter, it is recommended that you add John Deere Gasoline Conditioner and Stabilizer (TY15977) or an equivalent to the gasoline. BE SURE to follow directions on container and properly discard empty container.

It is recommended that gasoline be stored ONLY in an approved POLYETHYLENE PLASTIC container WITHOUT any metal screen or filter. This will help prevent any accidental sparks from occurring.

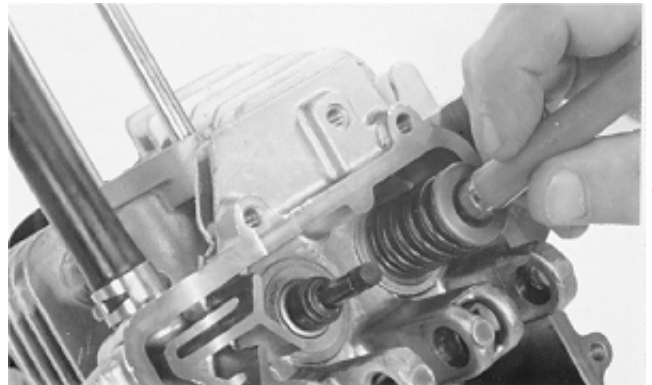
MX,1020CL,2 -19-23OCT95

REMOVE AND INSTALL VALVES AND SPRINGS

1. Remove cylinder head. (See Remove and Install Cylinder Head Assembly in this group.)
2. Compress intake valve spring with JDM70 Valve Spring Compressor and remove collet halves (A).
3. Remove spring retainer (B) and spring (C).
4. Remove exhaust valve rotator with a magnet.
5. Support exhaust valve from below and press down on spring retainer.
6. Remove retainer, spring and valves.
7. Inspect and replace stem seals as necessary. (See Inspect and Replace Stem Seals in this group.)
8. Inspect and analyze valves. (See Inspect Valves in this group.)
9. Inspect springs, valves, guides and seats. (See procedures in this group.)
10. Install valves, springs, and retainers.



M50033 -UN-31AUG88



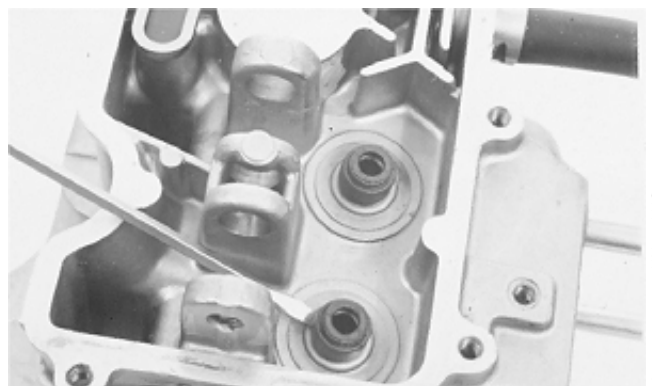
M50034 -UN-31AUG88

MX,2015CL,A6 -19-23OCT95

INSPECT AND REPLACE STEM SEALS

Remove valves and springs. (See Remove and Install Valve and Springs in this group.)

IMPORTANT: Inspect seal. If seal is not damaged, DO NOT remove it. Bottom spring retainer can only be removed with valve stem seal. Removal of retainer or seal damages stem seal. If necessary to replace stem seal, remove with screwdriver.



M50111 -UN-31AUG88

MX,2015CL,A7 -19-23OCT95

SERVICE PARTS KITS

The following kits are available through your parts catalogue.

Camshaft and Tappet Kit

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2 Camshaft Axial Play Shim Kit

2 Piston Ring Kit

Oversized Piston

Oversized Piston Rings

Undersized Connecting Rod

Crankshaft End Play Shim Kit

Cylinder Block

Overhaul Gasket Kit

Short Block Kit

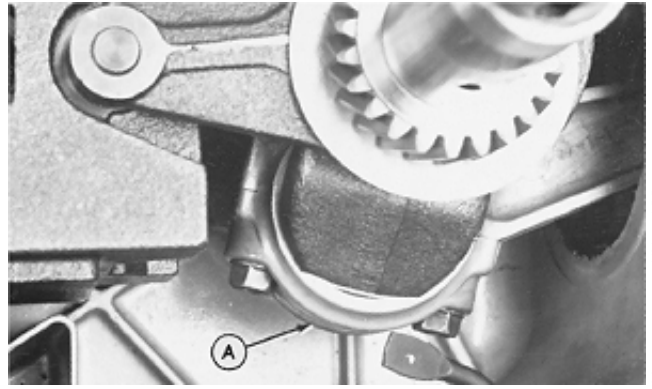
Oil Pump Kit

Governor and Shaft Kit

MX,2020CL,A2 -19-04MAY92

REMOVE AND INSTALL PISTON AND CONNECTING ROD

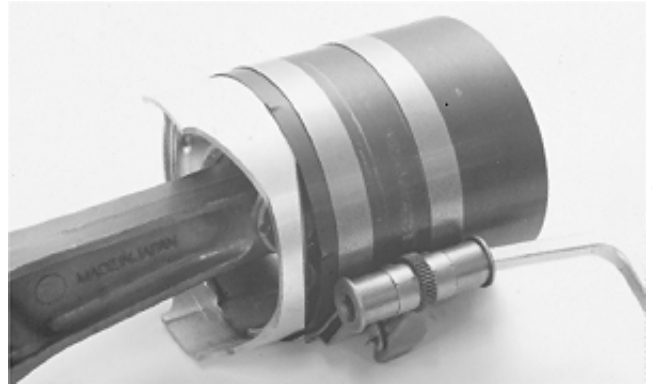
1. Remove cylinder head. (See Remove and Install Cylinder Head Assembly in Group 15.)
2. Remove crankcase cover. (See Remove and Install Crankcase Cover in this group.)
3. Remove carbon and varnish from top of cylinder bore with a ridge reamer.
4. Remove cap screws and connecting rod cap (A).
5. Push piston and connecting rod from cylinder bore.
6. Make repairs as necessary.



M52984
-UN-05APR89

MX,2020CL,A15 -19-23OCT95

7. Deglaze cylinder bore. (See Deglaze Cylinder Bore in this group.)
8. Stagger piston ring end gaps 180° apart, but do not align with oil ring side rail end gaps.
9. Apply a light film of oil to piston and rings. Compress rings with a ring compressor.
10. Apply a light film of oil to cylinder bore, connecting rod bearing surface and cap screws.
11. Install piston assembly in cylinder bore with engraved match mark/arrow on piston head facing flywheel side of engine.
12. Install connecting rod cap and cap screws. Tighten cap screws to **20 N·m (177 lb-in.)**.



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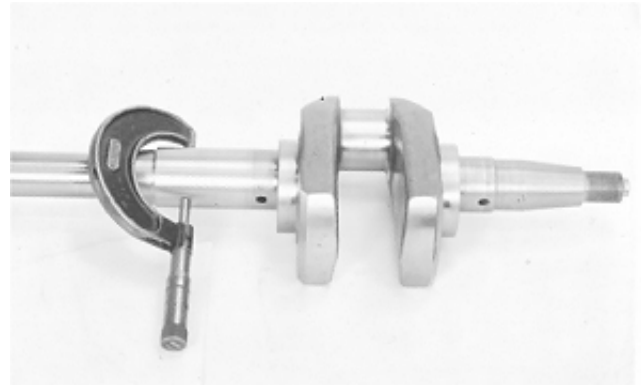
MX,2020CL,A16 -19-23OCT95

REMOVE, INSPECT AND INSTALL CRANKSHAFT

1. Remove camshaft. (See Remove and Install Camshaft in this group.)
2. Remove piston and connecting rod. (See Remove and Install Piston and Connecting Rod in this group.)
3. Remove balancer. (See Remove and Install Reciprocating Balancer in this group.)
4. Remove crankshaft.

IMPORTANT: A bent crankshaft must be replaced; it cannot be straightened.

5. Check crankshaft alignment (TIR). (See Check Crankshaft Alignment (TIR) in this group.)
6. Clean and inspect crankshaft. Replace if parts are scratched or damaged.
7. Analyze crankshaft and connecting rod wear. (See Analyze Crankshaft and Connecting Rod Wear in this group.)
8. Measure crankshaft main bearing journals and connecting rod journal. Replace crankshaft if measurements are less than specifications.



M54495 -UN-09JAN91

JOURNAL SPECIFICATIONS (MINIMUM)

	Main Bearing Journal		Connecting Rod Journal
	PTO Side	Flywheel Side	
PA420A	34.92 mm (1.375 in.)	34.95 mm (1.376 in.)	40.93 mm (1.611 in.)
PA540A	37.90 mm (1.492 in.)	34.95 mm (1.376 in.)	40.93 mm (1.611 in.)

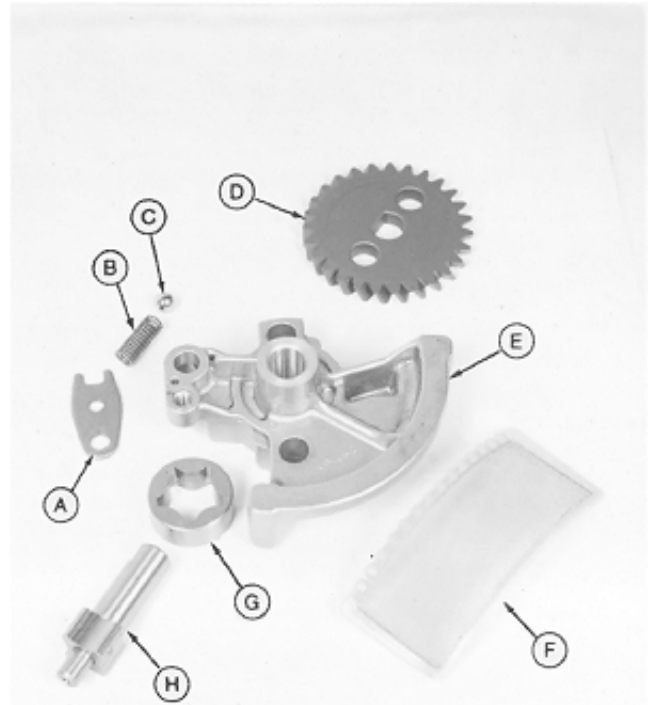
MX,2020CL,A25 -19-23OCT95

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INSPECT OIL PUMP—PA420A

1. Inspect all parts for wear or damage. Replace as necessary.

- A—Plate
- B—Spring
- C—Ball
- D—Gear
- E—Cover
- F—Screen
- G—Outer Rotor
- H—Rotor Shaft With Gear



-JUN-09/JAN91
M80019

MX,2020CL,A39 -19-23OCT95

2. Measure outside diameters of shaft. Replace both shaft and outer rotor if less than specification.

SPECIFICATIONS

Minimum Shaft O.D.	
Large O.D.	12.63 mm (0.497 in.)
Small O.D.	7.94 mm (0.313 in.)



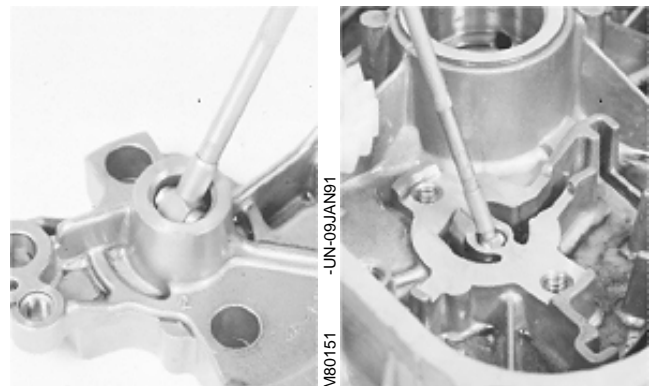
-JUN-09/JAN91
M80150

MX,2020CL,A40 -19-04MAY92

3. Measure rotor shaft bearings. Replace oil pump cover or crankcase cover if greater than specifications.

SPECIFICATIONS

Maximum Rotor Shaft Bearing I.D.	
Oil Pump Cover	12.76 mm (0.502 in.)
Crankcase Cover	8.07 mm (0.318 in.)



-JUN-09/JAN91
M80151

-JUN-09/JAN91
M80152

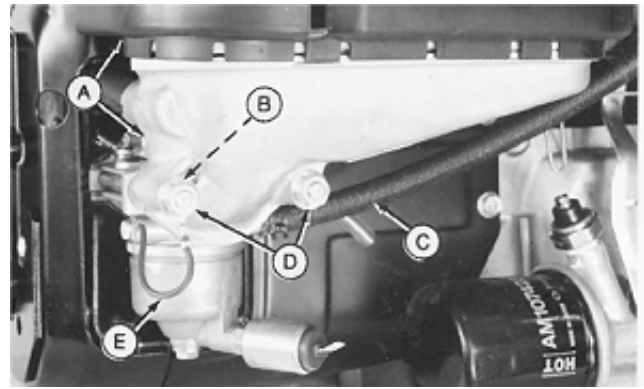
MX,2020CL,A41 -19-04MAY92

REMOVE AND INSTALL CARBURETOR—PA540A

⚠ CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury may result. Wipe-up any spilled fuel IMMEDIATELY. Allow engine to cool completely before working on exhaust or fuel system.

NOTE: Early model shown. Other models similar.

1. Turn fuel shutoff valve to **OFF** position.
2. Disconnect fuel hose (C).
3. Remove two nuts (D) and washer (B).
4. Disconnect wiring lead (E) and fuel shutoff solenoid lead.
5. Remove air cleaner assembly (A).



M54484 -UN-09JAN91

A—Air Cleaner Assembly
B—Washer
C—Fuel Hose
D—Nuts
E—Ground Wiring Lead

MX,3020CL,4 -19-23OCT95

TEST STARTER ARMATURE

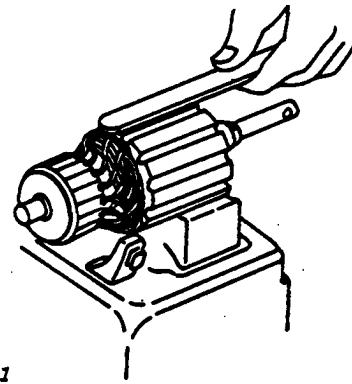
IMPORTANT: DO NOT clean armature with solvent. Solvent can damage insulation on windings. Use only mineral spirits and a brush.

1. Locate short circuits by rotating armature on a growler while holding a hacksaw blade or steel strip on armature. The hacksaw blade will vibrate in area of short circuit.

2. Shorts between bars are sometimes caused by dirt or copper between bars. Inspect for this condition.

IF TEST INDICATES SHORT CIRCUITED WINDINGS; clean the commutator of dust and fillings. Check armature again.

IF TEST STILL INDICATES SHORT CIRCUIT; replace armature.



M24861

M24861 -UN-25AUG88

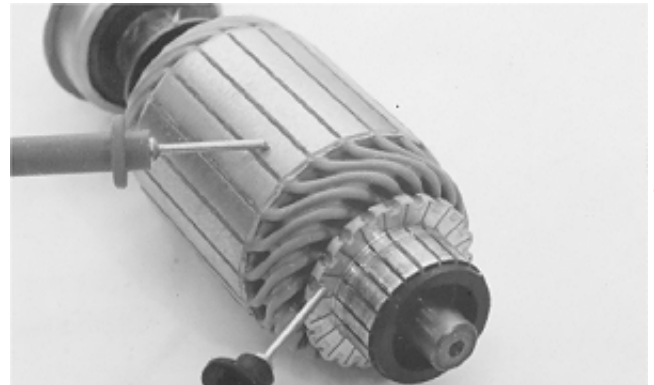
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M98,2030A,K -19-23OCT95

3. Test for grounded windings using an ohmmeter or test light.

NOTE: Armature windings are connected in parallel, so each commutator bar needs to be checked.

IF TEST SHOWS CONTINUITY; a winding is grounded and the armature **must be replaced**.

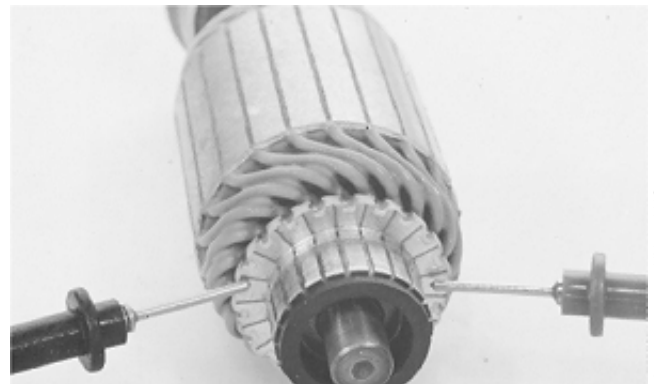


M98,2030A,AH -19-23OCT95

M50112 -UN-31AUG88

4. Test for open circuited windings using an ohmmeter or test light.

IF TEST SHOWS NO CONTINUITY; there is an open circuit and armature **must be replaced**.



M98,2030A,M -19-23OCT95

M50113 -UN-31AUG88

INSPECT CHARGE PUMP

1. Inspect inner (A) and outer (B) rotors and pump housing for wear or damage.
2. Measure outside diameter of outer rotor.
3. Measure thickness of outer rotor.

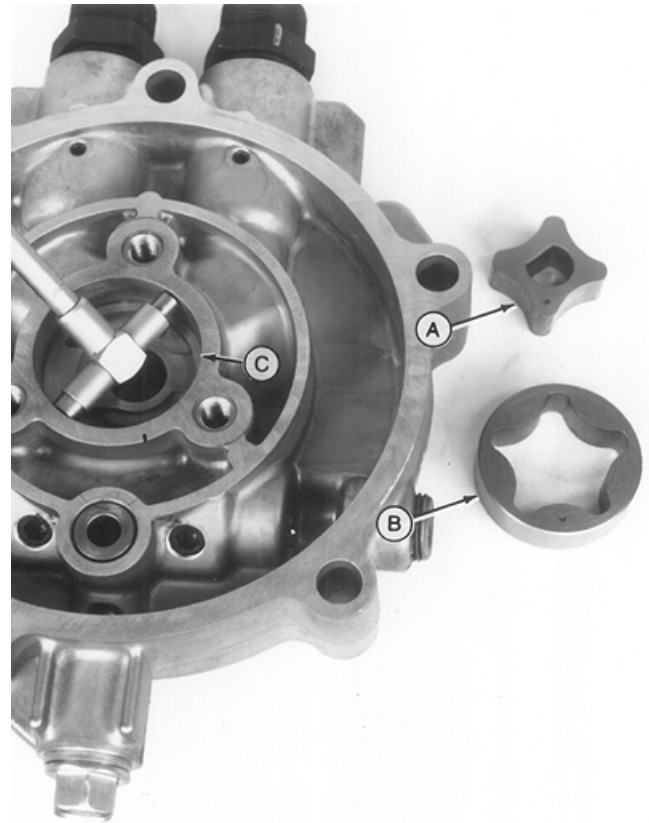
NOTE: Replace rotors as a set if not within specifications.

4. Measure inside diameter (C) of pump housing.
5. Measure depth of pump housing.

Replace housing if not within specifications.

SPECIFICATIONS

Outer Rotor O.D. (Minimum)	40.45 mm (1.593 in.)
Outer Rotor Thickness (Minimum)	12.95 mm (0.510 in.)
Pump Housing I.D. (Maximum)	40.80 mm (1.606 in.)
Pump Housing Depth (MAX)	13.15 mm (0.518 in.)



-UN-19JUN95

M53014

MX,5010CL,A38 -19-23OCT95

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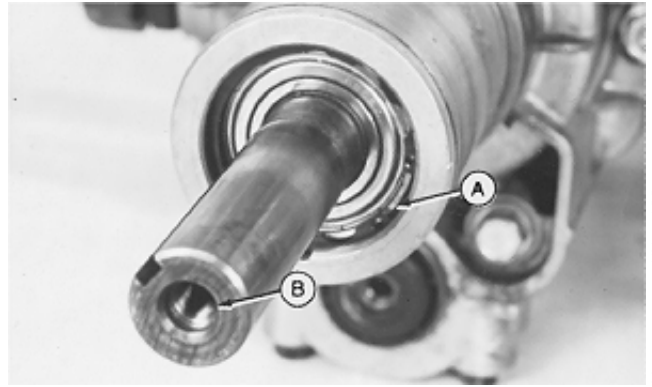
REMOVE AND INSTALL AXLE ASSEMBLIES

NOTE: Axle assemblies can be removed without disassembling transaxle.

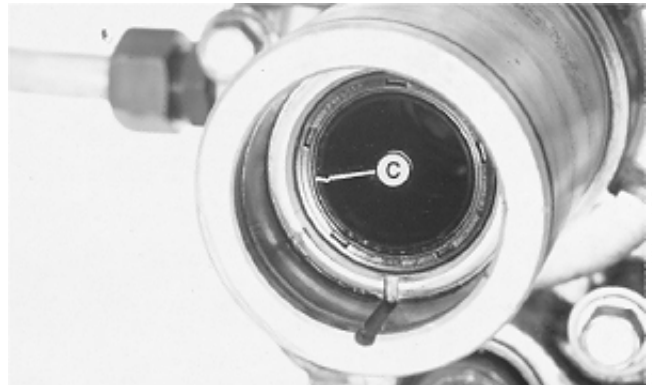
1. Remove snap ring (A).
2. Install puller in threaded axle hole (B). Remove axle/bearing assembly carefully to avoid seal damage.

NOTE: Seal removal from right side of differential housing requires differential disassembly. (See Disassemble Differential in this group.)

3. Remove seal (C), if necessary.
4. Install seal **2 mm (0.079 in.) below ball bearing shoulder**. Flat side of seal faces out.
5. Install axle/bearing assembly until bearing bottoms in housing.
6. Install snap ring.



M52985 -UN-05APR89



M52986 -UN-05APR89

MX,5010CL,A1 -19-23OCT95

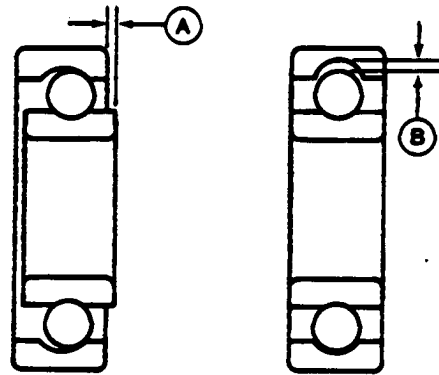
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INSPECT AXLE ASSEMBLY

IMPORTANT: Dry parts with compressed air. Lint from cloth rags can damage transmission.

CAUTION: Do not allow compressed air to spin dry bearings. Bearing can shatter causing injury.

1. Clean ball bearing with solvent and dry with compressed air, **while keeping the bearing from spinning**.
2. Check ball bearing for axial (A) and radial (B) free play. Rotate bearing slowly. Replace if free play is excessive or bearing does not operate smoothly.



M38073 -UN-29AUG88

MX,5010CL,A2 -19-23OCT95

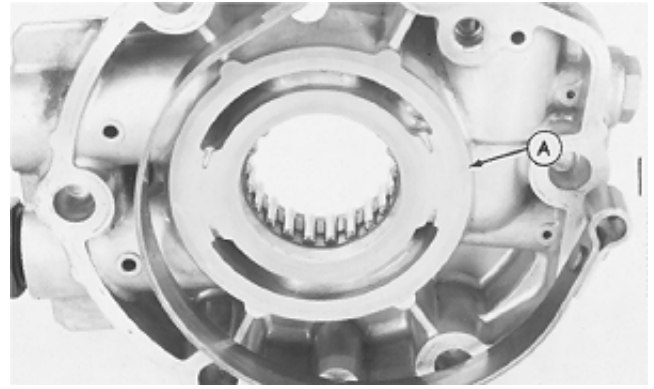
ASSEMBLE FIXED DISPLACEMENT MOTOR

1. If new needle bearing is being installed, place housing on surface plate with sealing surface (A) **face down**. Press bearing in and install snap ring.

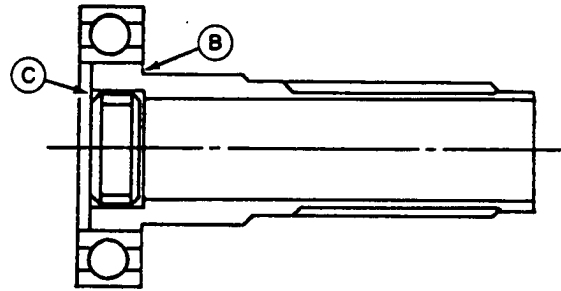
2. Install ball bearing **flush** with inside face (B) of eccentric.

NOTE: Needle bearing is not used in PA420A/PA540A-AS01 and AS02 motors.

3. For PA420A/PA540A-AS00 and BS00 motors, install needle bearing **flush** with outside face (C) of eccentric.



M52996 -UN-05APR89



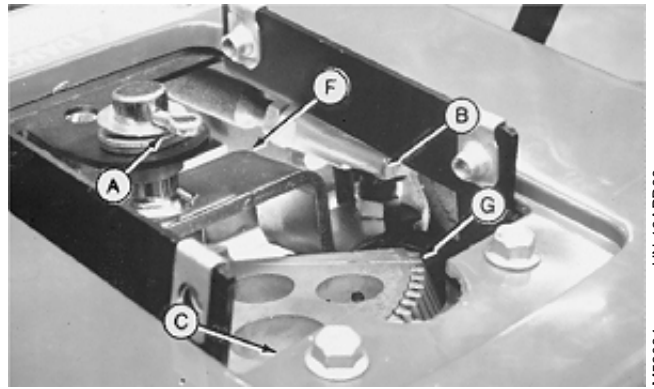
M53001 -UN-05APR89

MX,5010CL,A19 -19-23OCT95

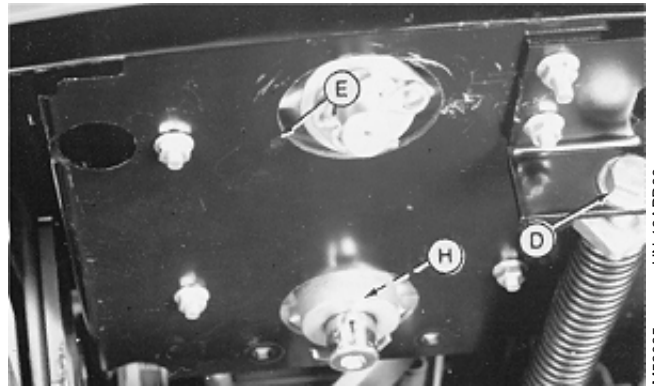
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8. Remove cotter pin, washers and bushing (A).
9. Disconnect drag link (B) from lever.
10. Remove cap screws attaching foot rest (C) to frame.
11. Loosen spring by backing out cap screw (D).
12. Remove cap screws attaching bracket (E) to frame.
13. Remove gear assembly.
14. Disassemble arm (F), gear (G) and bushing (H).

- A—Bushing
- B—Drag Link
- C—Foot Rest
- D—Cap Screw
- E—Bracket
- F—Steering Arm
- G—Sector Gear
- H—Bushing



M53084 -UN-13APR89



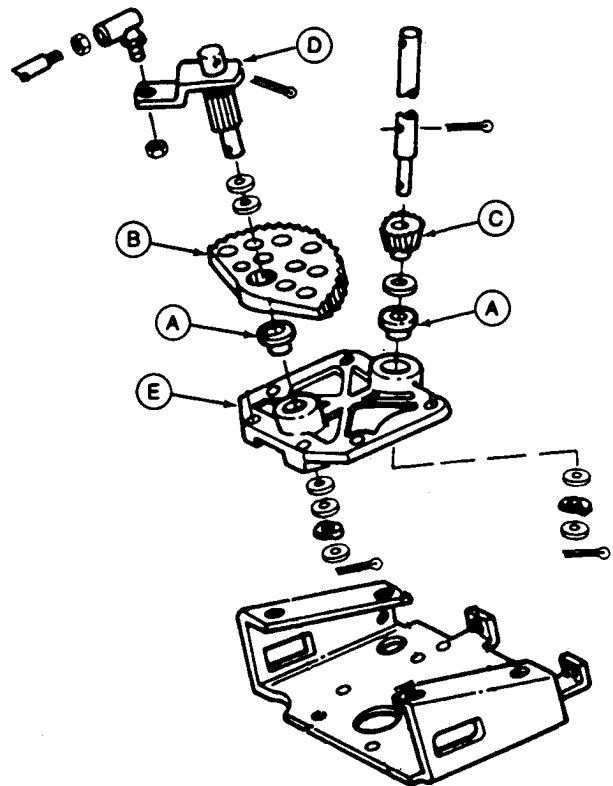
M53085 -UN-13APR89

MX,6005CL,A5 -19-04MAY92

INSPECT STEERING SHAFT AND GEARS

1. Inspect bushings (A) for wear.
2. Inspect gears (B) and (C) for cracks, damage or wear.
3. Inspect arm (D) spline for damage.
4. Inspect plate (E) for cracks or damage.
5. Replace any worn or damaged parts.
6. Tighten draglink rod to ball joint nut to **34 N·m (25 lb-ft)**.

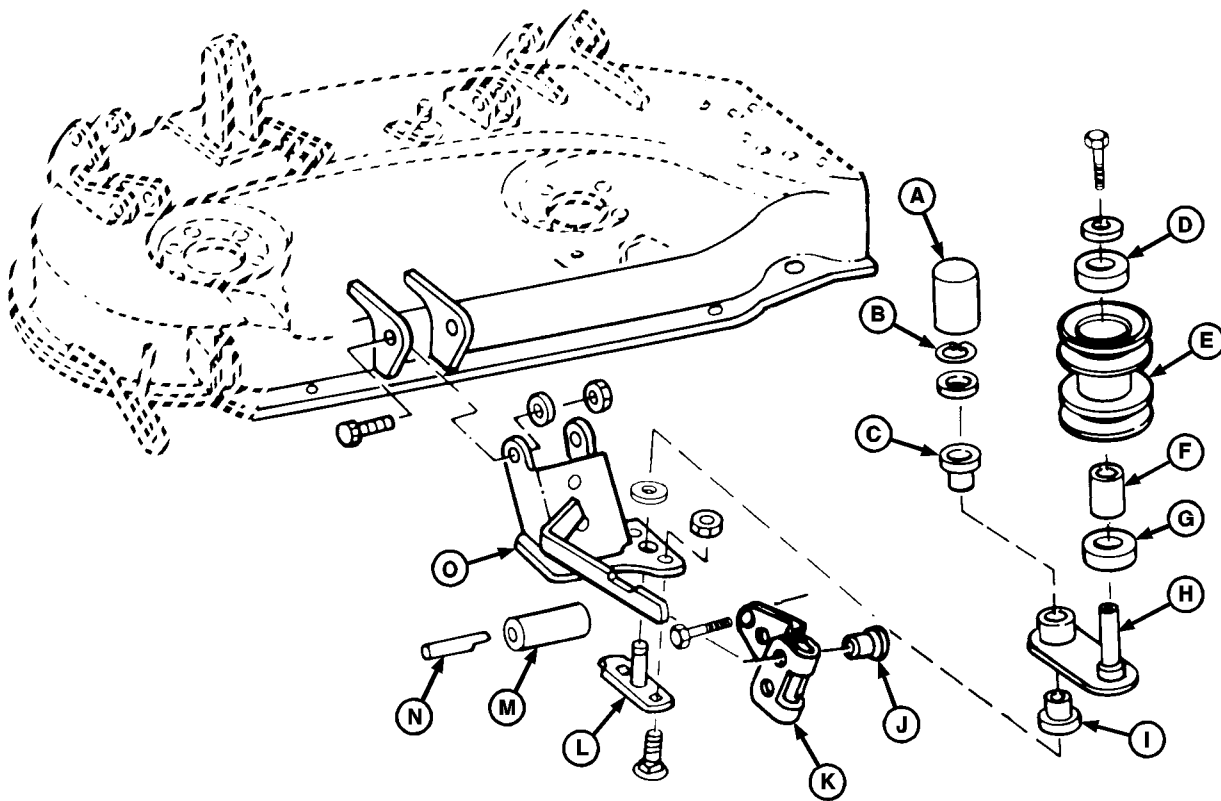
- A—Bushing
- B—Sector Gear
- C—Pinion Gear
- D—Steering Arm
- E—Gear Plate



M53092 -UN-20APR89

MX,6005CL,A5A -19-23OCT95

REPAIR PIVOTING JACKSHEAVE ASSEMBLY—F510 (S.N. 130001—)



A—Cap
B—Snap Ring
C—Bushing
D—Ball Bearing

E—Sheave
F—Spacer
G—Ball Bearing
H—Arm

I—Bushing
J—Pin (2 used)
K—Bracket
L—Pivot

M—Roller
N—Pin
O—Bracket

NOTE: Remove bearings (D) and (G) only if being replaced.

1. Jack sheave ball bearings (D) and (G) are seated against a shoulder.
2. Using a brass drift, drive spacer (F) against lower bearing (G) to remove. Use a punch to remove upper bearing (D).

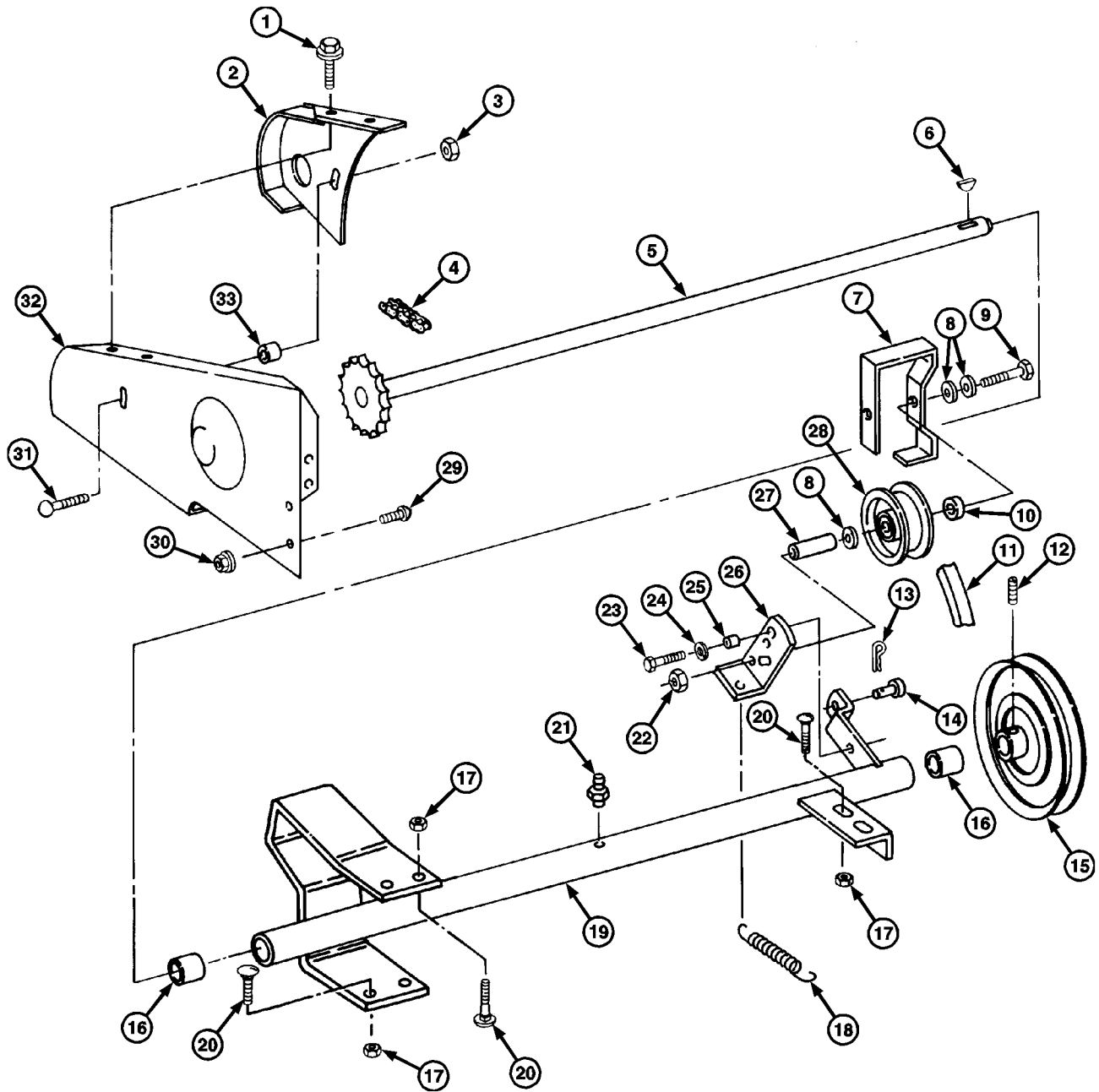
3. Replace worn bushings (C) and (I).
4. Inspect parts for wear or damage. Replace damaged parts.
5. Press bearings (D) and (G) until seated against shoulders in sheave.

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M81629 -JUN-12/MAY95

MX,8010FS,A7E -19-23OCT95

REPAIR SNOWTHROWER DRIVE SHAFT ASSEMBLY

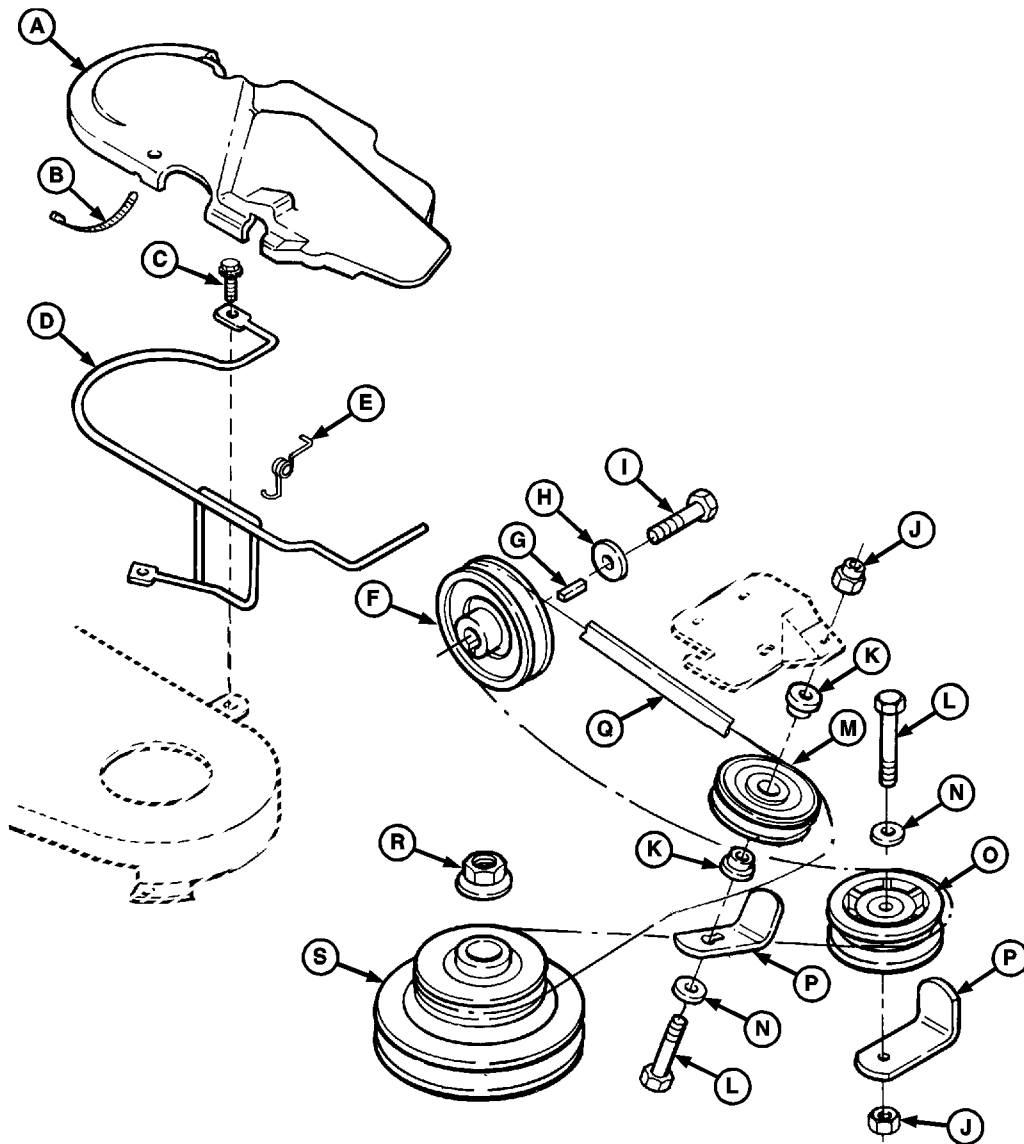


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|-------------------|-----------------------|------------------------|------------------|
| 1—Screw | 10—Bushing | 18—Spring | 26—Bracket |
| 2—Guard | 11—Belt | 19—Housing | 27—Spacer |
| 3—Nut | 12—Set Screw | 20—Bolt (6 used) | 28—Idler |
| 4—Chain | 13—Spring Locking Pin | 21—Lubrication Fitting | 29—Bolt (2 used) |
| 5—Shaft | 14—Pin | 22—Lock Nut | 30—Nut (2 used) |
| 6—Key | 15—Sheave | 23—Screw | 31—Bolt |
| 7—Retainer | 16—Bushing (2 used) | 24—Washer | 32—Guard |
| 8—Washer (3 used) | 17—Nut (6 used) | 25—Washer | 33—Spacer |
| 9—Cap Screw | | | |

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15
4

M58386 -UN-09AUG95

REPAIR JACKSHEAVE AND IDLERS (48-INCH MOWER DECK)



A—Shield
 B—Tie Wrap
 C—Screw
 D—Support
 E—Torsion Spring

F—Sheave
 G—Key
 H—Washer
 I—Bolt
 J—Lock Nut (2 used)

K—Bushing (2 used)
 L—Cap Screw (2 used)
 M—Sheave
 N—Washer (12 used)
 O—Idler

P—Bracket (2 used)
 Q—Belt
 R—Flange Nut
 S—Sheave

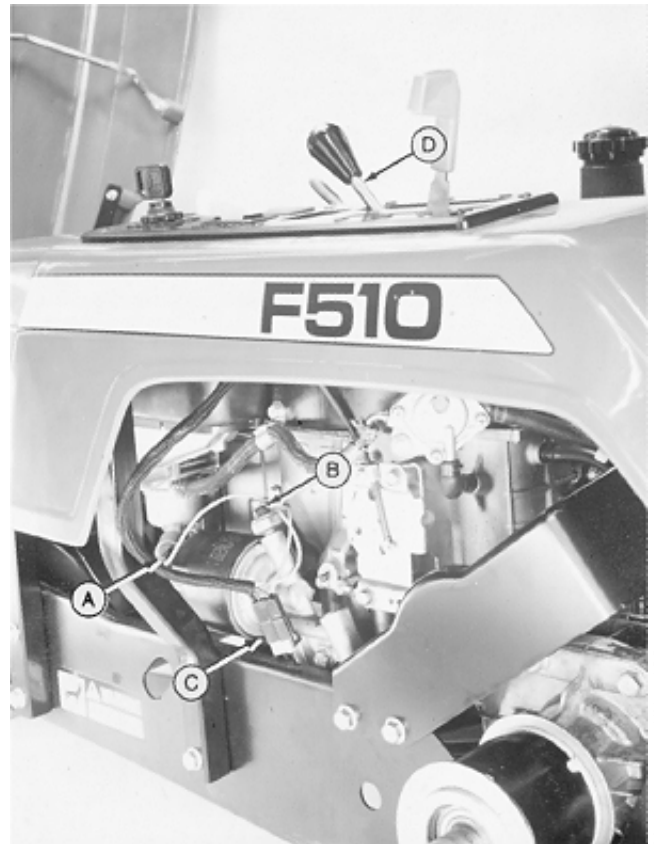
1. Inspect parts for wear or damage. Replace damaged parts as necessary.

2. Inspect belt (Q) for sign of wear or stretching. Replace if necessary.

RIGHT FENDER—SERVICE REMOVAL

1. Disconnect throttle cable at carburetor.
2. Remove cap screws. (See Fender Replacement in this group.)
3. Disconnect wire harness at (A), (B) and (C).
4. Disconnect lever (D).
5. Position fender away from service area.
6. Install fender.
7. Connect lever (D).
8. Connect wire harness at (A), (B) and (C).
9. Install cap screws. (See Fender Replacement in this group.)

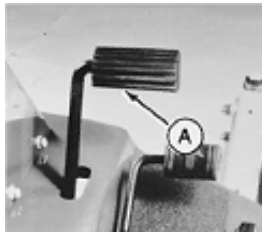

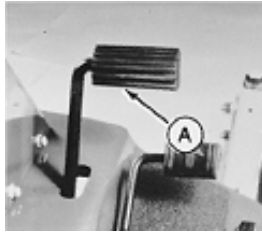

A—Fuel Solenoid Connector
B—Oil Switch Terminal
C—PTO Connector
D—Park Brake Lever



M53079
-JUN-13APR89

MX,7020CL,A4 -19-23OCT95

Operational Checkout Procedure/Brake Switch Safety Circuit Check

<p>5 STARTING CIRCUIT CHECKS</p>	<p>Seat switch ON (Operator on seat). Put PTO switch in OFF position.</p>	 <p>M53161 -UN-21AUG89</p>	<p>Fully depress or lock master brake pedal (A) (brake switch ON). Turn key switch to start position. <i>LISTEN: Starter must crank engine. Engine must start (use choke as needed).</i></p>	<p>OK: GO TO 6</p> <p>NOT OK: Engine will not crank. See Cranking Circuit Test Points in Section 240, Group 15.</p> <p>NOT OK: Engine will crank but will not start. See Engine Cranks But Will Not Start in Section 220, Group 15.</p>
<p>6 INDICATOR LAMP RUNNING CHECK</p>	<p>Lock master brake. Put PTO switch in OFF position. Start engine and run at full throttle.</p>	 <p>M53164 -UN-21AUG89</p>	<p><i>LOOK: Battery discharge lamp must be OFF.</i> Oil pressure lamp must be OFF. Engine oil must not leak from oil filter or manifold gaskets.</p>	<p>OK: GO TO 8</p> <p>NOT OK: Oil pressure lamp ON. Test engine oil pressure. See Oil Pressure Test in Section 220, Group 15).</p> <p>Oil pressure OK: See Hourmeter, Low Fuel And Oil Pressure Light Test Points in Section 240, Group 15.</p> <p>Discharge light ON: See Charging And Discharge Light Circuit Test Points in Section 240, Group 15.</p>
<p>7 SEAT SWITCH CHECK WITH ENGINE RUNNING</p>	<p>Seat switch ON (Operator on seat). Lock master brake.</p>	 <p>M53161 -UN-21AUG89</p>	<p>Release master brake pedal (A). Raise up off seat. <i>LISTEN: Engine must stop.</i></p>	<p>OK: GO TO 8</p> <p>NOT OK: See Ignition Power Circuit Test Points in Section 240, Group 15.</p>
<p>8 BRAKE SWITCH SAFETY CIRCUIT CHECK</p> <p>⚠ CAUTION: If brake switch circuit is defective, engine could start.</p>	<p>Engine OFF. Put PTO switch in OFF position. Master brake pedal released.</p>	 <p>M53167 -UN-21AUG89</p>	<p>Turn key to start position. <i>LISTEN: Starter must NOT crank engine.</i></p>	<p>OK: GO TO 10</p> <p>NOT OK: See Brake Switch Test And Adjustment in Section 240, Group 15.</p>

210
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ENGINE LUBRICATION CIRCUIT

A—Engine Lubrication Circuit

B—High Pressure Oil

C—Return/Pressure-Free Oil

D—Oil Filter

E—Engine Oil Pressure

Relief

F—Engine

G—Oil Pump

H—Oil Pump Screen

I—Sump

J—Transaxle

The F510 (PA420A) and F525 (PA540A) engines utilize a common sump (I) supplying oil for engine and hydrostatic transaxle needs. The sump is an

integral part of the transaxle casting. (See Lubrication System Operation in this section for further information.)

MX,22010CL,7 -19-23OCT95

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ENGINE CRANKS BUT WILL NOT START

Conditions:

- Transmission in neutral
- Park brake engaged
- PTO disengaged
- Key switch in "START" position

Test Location	Normal	If Not Normal
1. Spark plug	Fuel check - spark plug dry	See Engine Flooding tests in this group.
2. Spark plug	Spark test indicates steady blue spark	See Ignition Circuit Test Points in Section 240, Group 15.
3. Carburetor drain screw	Fuel present in float bowl when screw is opened	See Lack of Fuel in Carburetor tests in this group.
4. Fuel shut-off solenoid (key switch-run position)	Solenoid must click or with solenoid removed, plunger must retract	Test fuel shut-off solenoid.
5. Carburetor choke plate and choke linkage	Choke adjustment - choke plate fully closed with throttle lever in full choke position	Adjust choke.
	Choke linkage must move freely	Repair choke linkage.
6. Cylinder - spark plug hole	Minimum compression 483 kPa (71 psi)	Perform Compression Leak Check.
7. Intake and exhaust valve	Valve clearance - 0.15 mm (0.006 in.)	Adjust valve clearance.
8. Starter	Minimum cranking rpm - 350 rpm	Perform Automatic Compression Release (ACR) Check.
	Maximum starter amp draw: PA420A - 60 amps at 500 rpm PA540A - 85 amps at 500 rpm	Perform Starter No-Load Average and RPM Test in Section 240, Group 15.
9. Internal components	Components move freely, bearings and bushings not damaged	Repair internal components.

ENGINE BACKFIRES THROUGH CARBURETOR

Conditions:

- Transmission in neutral
- Park brake engaged
- PTO disengaged

Test Location	Normal	If Not Normal
1. Spark plug	Spark test indicates steady blue spark, spark plug not fouled	Replace spark plug then see Ignition Circuit Tests in Section 240, Group 15.
2. Carburetor choke plate and choke linkage	Choke plate fully open with throttle arm in fast idle position - throttle control arm screw/choke arm gap - 0.25—3 mm (0.01—0.12 in.)	Adjust choke.
	Choke linkage must move freely	Repair linkage.
3. Carburetor - check low idle mixture	Smooth idle at 1450 ±100 rpm	Adjust idle mixture screw.
4. Intake and exhaust valves	Valve clearance - 0.15 mm (0.006 in.)	Adjust valve clearance.
	Valves not sticking	Check valve guides and stems.
5. Valves - check valve lift	Both open same amount	Replace camshaft.
6. Ignition coil	Air gap - 0.3 mm (0.012 in.)	Adjust ignition coil air gap.
7. Flywheel - inspect key	Nut tightened to 86 N·m (63 lb-ft)	Tighten nut.
	Key and keyways not damaged	Replace key or other damaged components.

MX,22015CL,12 -19-23OCT95

ENGINE HAS BLUE EXHAUST SMOKE OR OIL IN AIR FILTER HOUSING

Conditions:

- Transmission in neutral
- Park brake engaged
- PTO disengaged

Test Location	Normal	If Not Normal
1. Dipstick oil level	At or below full mark on dipstick	Drain oil (make sure fuel hasn't leaked into crankcase).
2. Dipstick O-ring seal, tube and cap	Not cracked, cut or leaking	Replace seal or components.
3. Dipstick tube, breather tube, and air cleaner	Minimum crankcase vacuum - 25 cm (10 in. water) at 3350 ±75 rpm	Check breather valve. Check engine seals and gaskets. Check engine compression.
	No oil visible in breather tube or air cleaner	Check breather oil return passage.
4. Intake screen, blower housing, and cooling fins	Not plugged with debris or cracked	Clean or replace components.
5. Breather valve	Maximum air gap - 1—2 mm (0.04—0.08 in.)	Replace breather reed valve.
	Reed valve and seat not cracked, distorted, or worn	Replace breather reed valve, cylinder head or block.
6. Breather valve passage	Passage not plugged or cracked	Clean or replace cylinder block or head.
7. Breather oil return passage - cylinder head and block	Not plugged or cracked	Clean or replace cylinder block or head.
8. Cylinder - spark plug hole	Minimum compression - 483 kPa (71 psi)	Perform Compression Leak Check.
9. Piston rings and cylinder bore	Wear within specifications no damage	Replace rings, piston or cylinder block.
10. Valve guides and seals	Wear within specifications no damage	Repair valve guides or seals.

SLOW IDLE SPEED ADJUSTMENT—F510 (100204—) AND F525 (100393—)

Reason:

To set engine slow idle mixture and rpm.

Equipment:

- JTO5719 Photo Tachometer

Procedure:

1. Move key switch to **OFF** position.
2. Put transaxle/transmission in **neutral**.
3. Engage park brake.
4. Raise and lock seat platform.
5. Raise rear shroud.

IMPORTANT: Forcing the slow idle mixture screw tight will damage the needle and seat.

6. Put reflective tape on blower housing.

MX,22015CL,30A -19-23OCT95

8. Disconnect and plug fuel pump outlet hose (A).
9. Connect JDG356 Pressure Gauge (B) hose to fuel pump spigot.

Procedure:

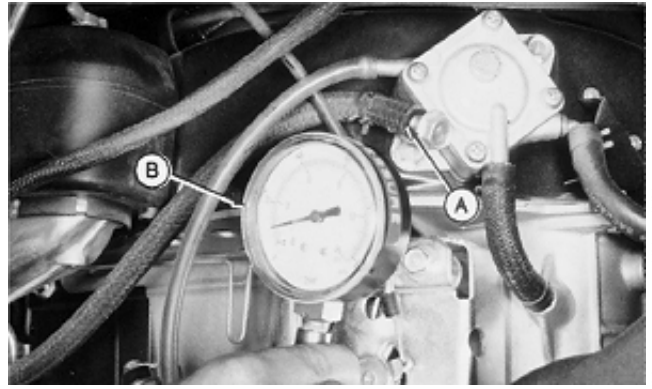
1. Start and run engine at **fast idle** for 15 seconds, then record pressure reading.
2. Stop engine.
3. Remove pressure gauge hose and connect fuel pump outlet hose (A).
4. Disconnect fuel pump outlet hose (C) from carburetor and put it in a graduated container.
5. Start and run engine at **fast idle** for 15 seconds, then stop the engine and record container measurement.

Specifications:

- **Minimum pressure .. 6.12 kPa (0.9 psi)**
- **Minimum flow:**
 - PA420A .. 80 mL/15 seconds (2.7 oz/15 seconds)
 - PA540A .. 90 mL/15 seconds (3 oz/15 seconds)
- **Engine speed .. FAST IDLE**

Results:

- If fuel pump pressure or flow DOES NOT meet the specifications, check the following:
- fuel lines, filter, shut-off valve, and fuel tank cap for restrictions
 - check crankcase vacuum
 - repair or replace fuel pump



M45943 -UN-11JUN91



M45944 -UN-11JUN91

FLOAT AND MAIN JET CIRCUIT OPERATION

A—Choke Valve	G—Venturi	M—Fuel Shut-Off Solenoid
B—Main Air Jet	H—Main Nozzle	N—Float Bowl
C—Throttle Valve	I—Needle Seat	O—Float
D—Pressurized Fuel	J—Inlet Needle	P—Main Air Jet Passage
E—Air	K—Bleed Holes	Q—Pilot Jet
F—Fuel/Air Mixture	L—Main Jet	R—Float Bowl Vent Hole Only
		F510 (—100203) and F525 (—100392) Sleeve and Tube
		F510 (100204—) and F525 (100393—)

Function:

Float - control the amount and level of the fuel in the float bowl.

Main jet - supply the correct fuel/air mixture during the time that the engine is being run under partial or full load.

Major Components:

- Inlet Needle
- Needle Seat
- Float
- Float Bowl
- Main Jet (Location varies with model)
- Main Nozzle
- Bleed Holes
- Main Air Jet
- Shut-Off Solenoid (Location varies with model)

Theory of Operation:

Pressurized fuel (D) flows from the tank to the fuel inlet, past the inlet needle (J) and needle seat (I) into the float bowl (N) of the carburetor. The inlet needle is connected to the float (O). As the fuel level and the float rise, the inlet needle rises and starts to restrict the flow of fuel into the float bowl. As the engine runs and draws fuel through the main (L) and pilot (Q) jets, the level in the float bowl lowers which also pulls the inlet needle off its seat. This allows an increase in the flow of fuel past the inlet needle and seat and the float again rises. Therefore, under all operating conditions, the fuel in the float bowl stays at the constant level that is needed for proper operation.

The main jet circuit on this carburetor is a fixed-jet design. It cannot be adjusted, but different sized jets

can be installed to give proper operation at various altitudes. The main jet (L) meters the amount of pressurized fuel (D) that will be drawn into the engine. The main air jet (B) meters the amount of air (E) that will be mixed with the fuel before being drawn into the engine. The main jet circuit starts to control the fuel supply as a load is applied to the engine at any throttle setting. When a load is applied, the governor starts to open the throttle valve (C). As the throttle valve opens, air flow past the venturi (G) increases and a low pressure is created. For F510 (—100203) and F525 (—100392), the float bowl vent (R) is a hole located on top of the carburetor. For F510 (100204-) and F525 (100393-), the float bowl vent (R) located on the top of the carburetor uses a pressed in sleeve and plastic tube to help prevent debris from entering the float bowl. The air from the float bowl vent that is above the fuel in the float bowl is at atmospheric pressure so the pressure difference forces fuel through the main jet up the main nozzle (H). The bleed holes (K) in the main nozzle mix a small amount of air with the fuel to help atomize the fuel. At the venturi, this fuel-rich mixture is mixed with the intake air to give the correct fuel/air (F) mixture for engine operation. A small amount of fuel/air mixture is also supplied by the idle circuits during load operation. The main jet circuit is capable of supplying the correct fuel/air mixture for all load conditions.

The fuel shut-off solenoid (M) is in the carburetor to minimize the occasional backfire that can occur when the engine is turned off. It closes off the main jet circuit to stop fuel from flowing into the engine during the time that the engine comes to a stop. This does not allow a combustible fuel/air mixture to flow into the hot muffler.

AIR INTAKE SYSTEM

A—Intake Screen
B—Air Cleaner Housing
C—Paper Element

D—Foam Element
E—Air Cleaner Base

F—Housing Expulsion Slot
G—Carburetor

H—Blower Housing
I—Flywheel Fan

Function:

To provide filtered air for carburetion.

Major Components:

- Intake Screen
- Flywheel Fan
- Blower Housing
- Air Cleaner Housing
- Paper Element
- Foam Element

Theory of Operation:

A two stage filtration system, consisting of a foam and paper element, is used to filter carburetor inlet air. The carburetor (G) uses cooling air flow provided by a fan (I) that is part of the flywheel. During operation, the flywheel fan draws air in through the intake screen (A). The intake screen rotates and cuts

debris into small pieces to help prevent plugging the intake system. The blower housing (H) directs air from the fan to the air cleaner housing (B) and the engine cooling fins. The air cleaner housing design forces debris to the outside of the housing and then out through an expulsion slot (F) in the housing. The air is filtered by a foam element (D) and a paper element (C) before entering the carburetor.

Since the same air flow is used for both carburetion and cooling, it is important to keep the air intake clean. Also the engine covers should not be removed or altered. Debris build-up in the intake screen or cooling fins will affect the volume of air to the carburetor. Debris plugging the cooling fins will result in engine overheating. If the cooling air cannot flow over the cooling fins, it will be forced into the carburetor resulting in a lean fuel condition.

MX,23010CL,14 -19-23OCT95

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IGNITION SYSTEM OPERATION—OPERATOR OFF SEAT—510 (011958—) AND F525 (012520—)

A—Ignition System Operation
F510 (011958—) and
F525 (012520—)
(Operator Off Seat/
PTO OFF/
Brake Applied)
B—Battery
C—Starter Motor
D—Starter Solenoid

E—Fusible Link
F—Ignition Switch
G—START
H—RUN
I—OFF
J—Neutral Start Fuse
K—Engine/PTO Fuse
L—PTO Switch
M—Brake Switch

N—ON
O—PTO Relay
P—Ignition Relay
Q—Seat Switch
R—Fuel Shutoff Solenoid
S—Ignition Module
T—Ignition Coil
U—Flywheel Magnet
V—Spark Plug

W—Power Circuit
X—Seat Switch Circuit
Y—Ground Circuit
Z—Fuel Shutoff Solenoid
Circuit
AA—Safety/Neutral Start
Circuit
AB—Ignition Circuit

**Ignition Circuit:
(Operator off the seat/PTO OFF/Brake applied)**

Current flows from the battery (B), through a fusible link (E), to the ignition switch (F). With the ignition switch in RUN position (H), current flows through the Safety/Neutral Start fuse (J) to the PTO switch (L). With the PTO switch OFF current flows through the brake switch (brake applied), to the ignition relay terminal 87, and then through terminals 86 and 85 of the ignition relay, energizing the relay. The energized ignition relay breaks contact between relay terminals 87A and 30, thus preventing grounding of the ignition coil.

If the PTO switch is ON or the brake released with the operator off the seat (seat switch open), current

to the ignition relay is interrupted. With the ignition relay in a non-energized state, terminals 87A and 30 are connected which provides a path to ground the ignition coil shutting off the engine.

For the engine to start and run, the fuel shutoff solenoid must be energized. Current flows from the safety start fuse to the solenoid whenever the ignition switch is in the START or RUN position. The solenoid is grounded through the carburetor.

When the key switch is moved to the OFF position, the ignition coil is grounded through the key switch, shutting off the engine.

MX,24010CL,A6A -19-23OCT95

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FUSE BLOCK

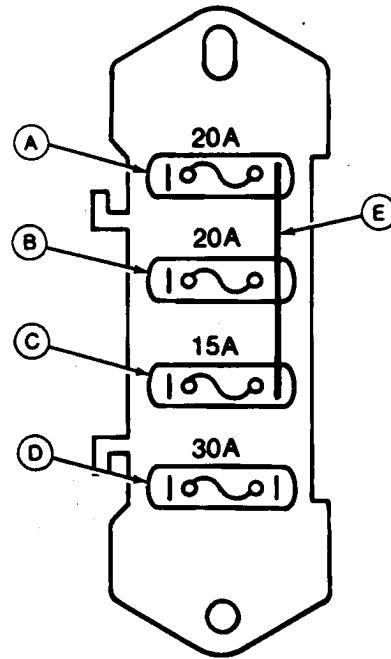
A—Headlight Fuse (20 Amp)—Protects Light Switch and Headlights

B—Neutral Start Fuse (20 Amp)—Protects PTO switch, brake switch, ignition relay, fuel shutoff solenoid, low fuel light and sensor, oil pressure light and sensor, regulator/rectifier, hourmeter.

C—PTO Fuse (15 Amp)—Protects PTO relay, seat switch, ignition relay, PTO switch, PTO clutch and brake switch.

D—Charge Fuse (30 Amp)—Protects regulator/rectifier.

E—Bussbar—Connects the top three fuses to hot side of power circuit.



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MX.24015CL.A1A -19-23OCT95

M53493 -JUN-25AUG89

IGNITION POWER CIRCUIT TEST POINTS—OFF SEAT—F510 (011958—) AND F525 (012520—)

When diagnosing an ignition problem, isolate the magneto circuit from the power and ground circuit by separating the engine connector (white wire). Check for spark using D05351ST Spark Tester. If no spark, check the magneto circuit. If spark is present, check the ground and power circuit. If the engine will not shut off, check the ground circuit. Remember the engine is stopped by grounding the ignition coil through either the key switch or the ignition relay. The ignition relay must be energized to prevent the ignition coil from being grounded.

Conditions:

- Transmission in neutral
- Park brake engaged
- PTO disengaged
- Operator OFF seat
- Ignition switch in RUN position
- Meter negative (—) lead on battery negative (—) terminal
- Meter positive (+) lead on numbered test point

Test Location	Normal	If Not Normal
1. Battery positive (+) terminal	11.8—13.2 volts	Test battery.
2. Ignition switch terminal B	Battery voltage	Check battery cable connection, starter tie point, harness connector, fusible link, and red wire to ignition switch.
3. Ignition switch terminal A	Battery voltage	Test ignition switch.
4. 20 amp fuse	Battery voltage	Check yel/red wire.
5. 20 amp fuse	Battery voltage	Check fuse.
6. PTO switch	Battery voltage	Check yel and yel/red wires.
7. PTO switch	Battery voltage	Test PTO switch.
8. Brake switch	Battery voltage	Check pur wire.
9. Brake switch	Battery voltage	Test brake switch.
10. Ignition relay terminal 87	Battery voltage	Check pur wire.
11. Ignition relay terminal 86	Battery voltage	Check diode wire*.
12. Ignition relay terminal 85	Greater than 0 - less than 0.2 volts	0 volts-test ignition relay. Greater than 0.2 volts-check ignition and PTO relay ground circuit.

* On later harnesses with plug-in diodes, wire color may be purple or purple/white.

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12

FUEL SHUT-OFF SOLENOID TEST POINTS

Conditions:

- Transmission in neutral
- Park brake engaged
- PTO disengaged
- Ignition switch in RUN position
- Meter negative (—) lead on battery negative (—) terminal
- Meter positive (+) lead on numbered test point

240
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22

Test Location	Normal	If Not Normal
1. Battery positive (+) terminal	11.8—13.2 volts	Test battery.
2. Key switch terminal B	Battery voltage	Test red wire, fusible link, connector, starter tie points and battery connections.
3. Key switch terminal A	Battery voltage	Test key switch.
4. 20 amp fuse	Battery voltage	Test yel/red wire.
5. 20 amp fuse	Battery voltage	Test fuse, fuse holder.
6. Fuel shut-off solenoid	Battery voltage	Check yel and pnk/blk wires.
7. Fuel shut-off solenoid ground	Greater than 0 - less than 0.2 volts	Greater than 0.2 volts - check fuel shut-off solenoid black ground wire (between carburetor and engine block) and engine ground circuit. 0 volts - replace fuel shut-off solenoid.

MX,24015CL,A8 -19-23OCT95

CHARGING AND DISCHARGE LIGHT CIRCUIT TEST POINTS

Conditions:

- Transmission in neutral
- Park brake engaged
- PTO disengaged
- Ignition switch in RUN position

- Meter negative (—) lead on battery negative (—) terminal
- Meter positive (+) lead on numbered test point
- Battery acid level 6 mm (0.25 in.) above plates
- Maximum voltage drop at test connections-0.2 volts

Test Location	Normal	If Not Normal
1. Battery positive (+) terminal	11.8—13.2 volts	Test battery.
2. Ignition switch terminal B	Battery voltage	Check starter connection, fusible link, and red wires.
3. Ignition switch terminal A	Battery voltage	Check ignition switch.
4. 30 amp fuse	Battery voltage	Check red wire.
5. 30 amp fuse	Battery voltage	Check fuse.
6. 20 amp fuse	Battery voltage	Check yel/red wire.
7. 20 amp fuse	Battery voltage	Check fuse.
8. Regulator/rectifier	Battery voltage	Check red wire.
9. Regulator/rectifier	Battery voltage	Check yel wires.
10. Regulator/rectifier	Greater than 0 - less than 0.2 volts	Greater than 0.2 volts - check regulator/rectifier ground circuit. 0 volts - replace regulator/rectifier.
11. Regulator/rectifier	Battery voltage	Replace regulator/rectifier.
12. Discharge light	Battery voltage	Check brown wire.
13. Discharge light	Greater than 0- less than 0.2 volts	Greater than 0.2 volts - check discharge light ground circuit. 0 volts - check bulb.

240
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32

Continued on next page

MX,24015CL,A16 -19-23OCT95

HEADLIGHT CIRCUIT TEST POINTS—OPTIONAL

Conditions:

- Transmission in neutral
- Park brake engaged
- PTO disengaged
- Ignition switch in RUN position

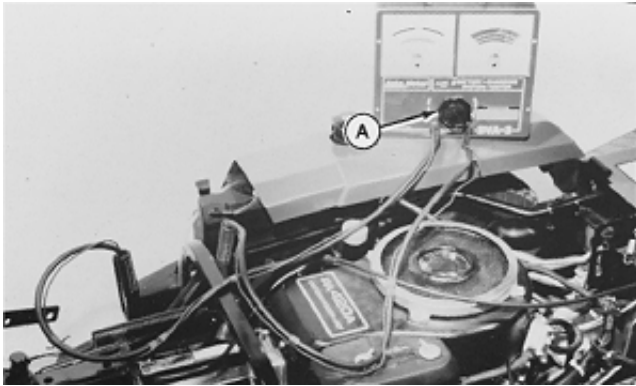
- Headlight switch in on position
- Meter negative (—) lead on battery negative (—) terminal
- Meter positive (+) lead on numbered test point
- Maximum voltage drop at test connections-0.2 volts

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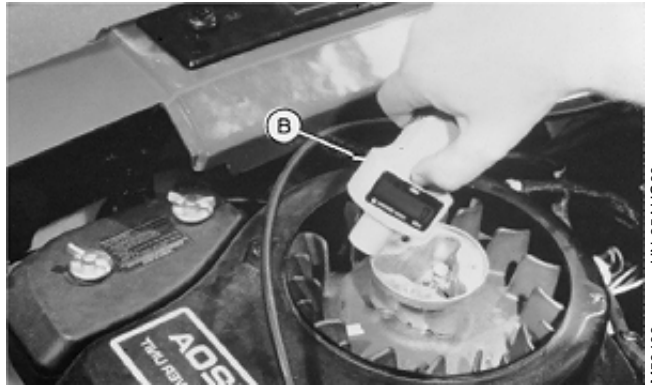
Test Location	Normal	If Not Normal
1. Battery positive (+) terminal	11.8—13.2 volts	Test battery.
2. Ignition switch terminal B	Battery voltage	Check battery cable connection, starter tie point, harness connector, fusible link, and red wire to switch.
3. Ignition switch terminal A	Battery voltage	Test ignition switch.
4. 20 amp fuse	Battery voltage	Check yel/red wire.
5. 20 amp fuse	Battery voltage	Check fuse.
6. Headlight switch	Battery voltage	Check yel/blk wire.
7. Headlight switch	Battery voltage	Test headlight switch.
8. Headlight	Battery voltage	Check yel/wht wire.
9. Headlight	Greater than 0 - less than 0.2 volts	Greater than 0.2 volts - check headlight ground circuit. 0 volts - replace light.
10. Headlight	Greater than 0 - less than 0.2 volts	Greater than 0.2 volts - check headlight and discharge light ground circuit. 0 volts - replace light.

MX,24015CL,A19 -19-23OCT95

STARTER AMP DRAW TEST



M53495 -UN-25AUG89



M53496 -UN-25AUG89

Reason:

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

Equipment:

- JTO5685 Battery Tester
- Photo Tachometer

Connections:

1. Put transmission in **neutral**.
2. Engage park brake.
3. Test system ground connections. (See Ground Circuit Test in this group.)
4. Test battery. (See Battery Test in this group.)
5. Turn knob (A) of battery tester counter-clockwise to **OFF**.
6. Connect red clamp of battery tester to positive (+) terminal of battery and black clamp of tester to negative (—) terminal of battery.
7. Install tachometer reflective tape on flywheel.
8. Remove spark plug high tension lead and ground to engine.

Procedure:

1. Crank engine and read voltage on DC voltage scale of battery tester and check engine rpm using the photo tachometer (B).

2. Turn key switch to **OFF** position.

IMPORTANT: Perform the following procedure within 15 seconds to prevent electrical damage to components.

3. Turn knob of battery tester clockwise until the DC voltage is the same as when cranking.

4. Read DC amperage on battery tester.

5. Turn load knob fully counterclockwise.

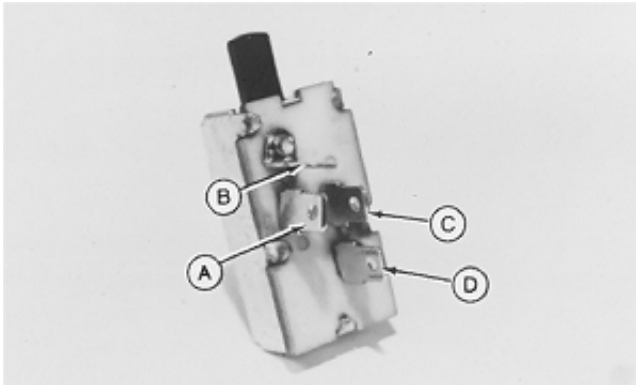
Specifications:

- **Maximum starter amp draw - PA420A ..60 amps at 500 rpm**
- **Maximum starter amp draw - PA540A ..85 amps at 500 rpm**

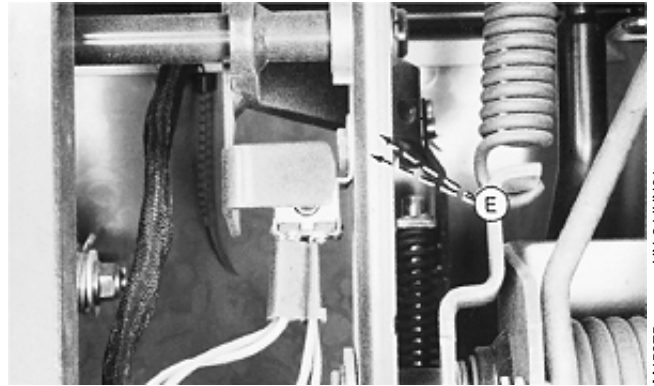
Results:

- If amperage is above specification, or rpm is low, see Starter No-Load RPM And Amperage Test in this group to determine if starter is binding or damaged.
- If starter is good, check internal engine, traction or PTO drive for binding or damage.

BRAKE SWITCH TEST AND ADJUSTMENT



M53140 -UN-25AUG89



M45975 -UN-24JUN91

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62

Reason:

To make sure the brake switch has continuity when the brake pedal is depressed.

Equipment:

- Ohmmeter or continuity tester

NOTE: The brake switch is located under the center of the foot platform.

Connections:

1. Turn key switch to **OFF** position.
2. Put transmission in **neutral**.



CAUTION: Block wheels to prevent unit from moving during test.

3. Disconnect brake switch connector.

Procedure:

1. Connect meter leads to brake switch terminals (A and B).
2. Depress brake pedal and read meter.
3. Release brake pedal and read meter.
4. Connect meter leads to brake switch terminals (C and D).

5. Depress brake pedal and read meter.

6. Release brake pedal and read meter.

Specifications:

- **Brake pedal depressed:**
Terminals A and B .. **no continuity**
Terminals C and D .. **continuity**
- **Brake pedal released:**
Terminals A and B .. **continuity**
Terminals C and D .. **no continuity**

Results:

- If the brake switch terminal continuity is not correct, adjust the brake switch.
 1. Depress brake pedal and engage park brake lock lever.
 2. Loosen nuts (E).
 3. Move the brake switch downward until terminals C and D have continuity.
 4. Hold brake switch in position and tighten nuts.
- If the continuity is still not correct, replace the brake switch.

RELAY TEST

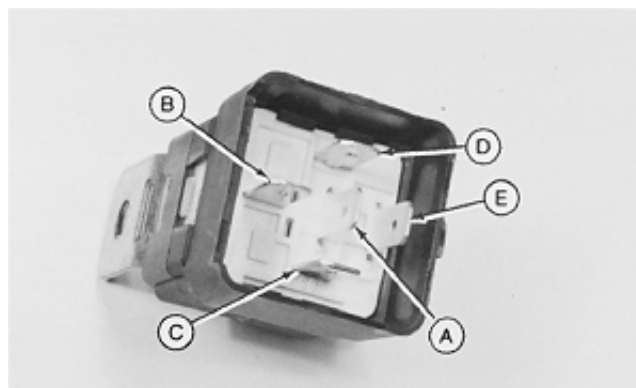
Reason:

To check relay terminal continuity in the energized and de-energized condition.

Equipment:

- Ohmmeter or continuity tester
- Jumper wire

NOTE: Relays are mounted to the frame cross-member in front of the engine.



M48376 -UN-25OCT89

Procedure:

1. Put transmission in **neutral**.
2. Disengage PTO.
3. Engage park brake.
4. Turn key switch to **OFF** position.
5. Raise and lock seat platform.
6. Disconnect relay connector.
7. Check terminal continuity using an ohmmeter or continuity tester.

Specifications:

- There should be continuity between relay terminals 87A-30 (A and B) and 85-86 (C and D). There should be no continuity between relay terminals 87-30 (E and B).

8. Connect a jumper wire from battery positive terminal to relay terminal 85 (C). Connect a jumper wire from relay terminal 86 (D) to battery negative terminal.

Specifications:

- There should be continuity between relay terminals 87-30 (E and B).

Results:

- If continuity is not correct, replace relay.

MX,24015CL,54 -19-23OCT95

240
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72

F510 (—011957) AND F525 (—012519) WIRING HARNESS LEGEND

A—Battery At Starter
B—Fuse Link
C—Starter Solenoid
D—Brake Switch
E—Engine/PTO Fuse
F—Headlight Fuse
G—Neutral/Start Fuse

H—PTO Switch
I—PTO Clutch
J—PTO Relay
K—Ignition Relay
L—Seat Switch
M—Oil Pressure Sensor

N—Fuel Sensor
O—Oil Pressure Light
P—Headlights
Q—Light Switch
R—Low Fuel Light
S—Fuel Shutoff Solenoid

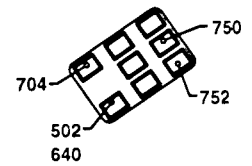
T—Hourmeter
U—Ignition Switch
V—Charge Fuse 30 Amp
W—Regulator/Rectifier
BB—Discharge Light
DD—Engine Ground

MX,24020CL,4 -19-23OCT95

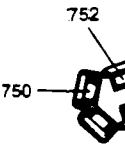
240
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5

CIR NUM	WIRE SIZE mm2	COLOR
100	2.0	blk
102	1.0	blk
104	1.0	blk
106	0.8	blk
108	1.0	blk
110	1.0	blk
112	0.8	blk
113	0.8	blk
114	0.8	blk
130	2.0	blk
140	1.0	blk
141	0.5	diode
200	1.0	red
205	3.0	red
210	3.0	red
215	2.0	red
400	3.0	yel/red
410	1.0	yel/blk
450	1.0	yel/wht
451	0.8	yel/wht
452	0.8	yel/wht
500	2.0	yel
502	1.0	yel/red
504	1.0	yel
508	0.8	yel
510	0.8	yel
550	1.0	yel
552	1.0	yel
590	3.0	brn/yel
595	3.0	brn/wht
600	0.8	brn
620	0.8	tan
640	0.8	yel
650	1.0	pnk/blk
700	1.0	pur
702	1.0	pur
704	1.0	pur
706	1.0	pur/blk
707	0.5	diode
708	1.0	pur/wht
709	0.8	diode
750	1.0	blu
752	1.0	blu/wht
753	1.0	blu
756	1.0	blu/wht
757	0.8	diode
800	1.0	pnk
900	0.8	blk/wht
940	1.0	wht
942	1.0	wht/blk

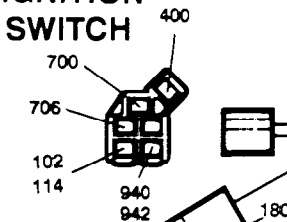
(H)
PTO SWITCH
(SN 120001-)



PTO
(SN



(U)
IGNITION
SWITCH



640
114
HOUR
METER (T)

410
LIGHT
SWITCH
(Q)

HYDROSTATIC CIRCUIT OPERATION

A—Reduction Gear Assembly
 B—Hydrostatic Motor
 C—Charge Relief Valve
 D—Directional Check Valves
 E—Free-Wheel Valve

F—Gerotor Charge Pump
 G—External High Pressure Lines
 H—Hydrostatic Pump
 I—Engine

J—Engine Sump
 K1—External Suction Line (—110000)
 K2—Internal Suction Passage (110001—)

L—Filter Screens
 M—Charge Pump Sump
 N—Anti-Cavitation Check Valve
 O—External Return Line

Function:

The hydrostatic circuit transfers power from the gerotor charge pump (F) to the variable displacement hydrostatic pump (H) to the fixed displacement hydrostatic motor (B). The motor transfers power to the input shaft of the reduction gear assembly, allowing infinitely variable speeds in forward and reverse.

Theory of Operation:

The hydrostatic circuit consists of the following components:

A—Reduction Gear Assembly - Transfers power from the hydrostatic motor to the differential.

B—Hydrostatic Motor - Transmits power to the gear reduction assembly. The motor is a bi-directional, fixed displacement, axial piston motor.

C—Charge Relief Valve - Maintains a charge pressure of 193—490 kPa (28—71 psi), also maintains needed pressure for make-up oil and lubrication. Excessive charge pressure oil is relieved to the hydrostatic pump side of the common sump.

D—Directional Check Valve - These one-way valves perform two functions in the closed-loop circuit:

1. On the high pressure side the valve prevents high-pressure oil from flowing to the low-pressure side.
2. On the low-pressure side the valve allows charge pump oil to replenish and lubricate the components of the closed loop.

E—Free-wheel Valve - This valve allows oil to bypass the hydrostatic pump (H) when the unit is moved without the engine running. The freewheel valve connects both sides of the closed loop to prevent pressure build up from the hydrostatic motor (B) as it is turned by the differential when unit is being pushed.

F—Gerotor Charge Pump - Supplies charge (make-up) oil to the hydrostatic closed loop to prevent cavitation of the hydrostatic pump (H). The charge

pump is a gerotor type, fixed displacement pump. It continually pumps oil whenever the engine is running.

G—External High Pressure Lines - These external closed loop lines connect the hydrostatic pump (H) to the motor (B).

H—Hydrostatic Pump - This pump supplies high pressure oil to the hydrostatic motor (B). It is a variable displacement, axial piston pump. The output of the pump (speed and direction) is varied by moving the swash plate via the pedal shift linkages.

I—Engine - Supplies power to the hydrostatic pump input shaft via the second gear on the camshaft.

J—Engine Sump - Oil reservoir for the hydrostatic transmission.

K1—External Suction Line (—110000) - The suction line is an external line that supplies and cools oil to the charge pump sump.

K2—Internal Suction Passage (110001—) - The internal suction passage replaces the external line that supplies oil to the charge pump sump. The internal passage is located in the bottom of the case cover and travels through the hydrostatic pump housing to the charge pump sump (M).

L—Filter Screens - Remove debris from the oil prior to entering the engine and hydrostatic gerotor charge pumps.

M—Charge Pump Sump - Oil reservoir for the charge pump (F).

N—Anti-Cavitation Check Valve - Allows oil to enter the closed loop through the charge circuit to replace oil lost from motor (B) leakage when the freewheel valve (E) is used. This prevents the hydrostatic pump (H) from cavitating at initial startup.

O—External Return Line - Allows excess oil inside the motor housing (B) to flow to the engine sump. This oil is used to cool and lubricate the rotating groups of the reduction gear assembly (A).

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FREEWHEEL VALVE OPERATION—PRE-ENGAGEMENT

A—Reduction Gear Assembly	G—External High Pressure Lines	K2—Internal Suction Passage (110001—)	O—External Return Line
B—Hydrostatic Motor	H—Hydrostatic Pump	L—Filter Screens	P—Low Pressure Oil
C—Charge Relief Valve	I—Engine	M—Charge Pump Sump	Q—Trapped Oil
D—Directional Check Valves	J—Engine Sump	N—Anti-Cavitation Check Valve	
E—Free-Wheel Valve	K1—External Suction Line (—110000)		
F—Gerotor Charge pump			

When the engine is off, the pump shaft keeps the hydrostatic pump (H) cylinder block from rotating even with pressure applied to the pump pistons. If the unit is pushed, the differential will cause the hydrostatic motor (B) to rotate. Since the motor plate has a fixed incline, the motor becomes a pump momentarily,

building pressure between the motor and the pump. This immediate pressure closes the directional check valves (D) and because the pump cannot rotate, the pressure oil becomes trapped oil (Q) and the unit cannot be pushed (locks-up).

250
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MX,25010CL,16 -19-23OCT95

LACK OF DRIVE OR LIMITED SPEED IN BOTH DIRECTIONS

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Swash plate movement	Full arm movement and splines in good shape	Check linkage, swash plate arm and connection. Replace stripped splined components.
2. Brake arm	Snaps back when released	Check brake and brake linkage.
3. Engine dipstick	Normal oil level	Fill/delete oil.
4. Freewheel valve	Pops up fully when engine is running and actuating lever disengaged fully	Remove, inspect, and repair freewheel valve and actuating lever.
5. Suction line	No air leaks	Replace line.
6. Sump screen	Clean	Remove debris.
7. Pump drive shaft	Gear and shaft intact	Replace drive shaft and possibly camshaft.
8. Charge pump -tip and side clearance	Components intact and within specification	Replace pump components.
9. Anti-Cavitation valve	Valve and seat intact and valve free	Replace valve and seat.
10. Charge relief valve and relief valve spring	Valve and seat intact and to specification	Replace valve and/or housing. Replace spring.
11. Directional control valves and springs	Valve/seat intact, free and to specification	Replace valves, and/or housing. Replace springs.
12. Hydrostatic pump rotating group	No damage or wear	Replace rotating group.
13. Hydrostatic pump tension spring	Intact and to specification	Replace spring.
14. Pump to motor lines	No damage or leaks	Replace lines.
15. Hydrostatic motor rotating group	No damage or wear	Replace rotating group.
16. Hydrostatic motor tension spring	Intact and to specification	Replace spring.
17. Final drive components -Motor output shaft -Gear reduction set -Differential drive shaft -Differential	Intact, functional and within specification	Replace components.

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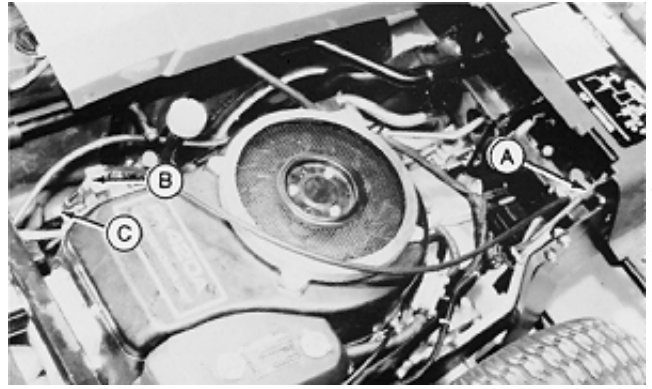
DIRECTIONAL PEDAL TRAVEL ADJUSTMENT

Reason:

To ensure full travels speed in forward and reverse directions. This also ensures that the transmission swashplate does not act as a mechanical stop for the pedal linkage.

Procedure:

1. Put transmission in **neutral**. Disengage PTO. Engage park brake.
2. Turn key switch to **OFF** position.
3. Raise and lock seat platform.
4. Raise rear shroud.
5. Pedal travel is adjusted at (A), (B) and (C).
6. Adjustment point (A) adjusts pedal travel.
7. Adjustment points (B) and (C) adjust swash plate lever travel.
8. Adjust cable so full forward and reverse swash plate travel is achieved **prior to bottoming out the pedal**.



M53307 -UN-25AUG89

250
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MX,25015CL,A2 -19-23OCT95

260
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2

265
10
2

280
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2

SPOUT ADJUSTMENT

Reason:

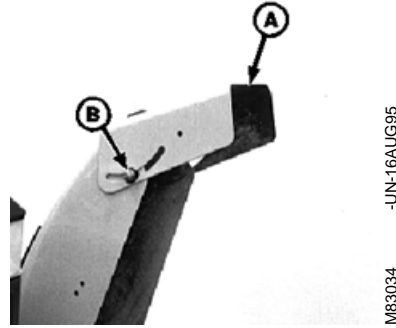
To make sure that the spout holds position when blowing snow.

Procedure:



CAUTION: Before adjusting spout:

- **STOP** snowthrower.
- **STOP** engine.
- **Lower** snowthrower to ground.
- **LOCK** parking brake.
- **Remove** key.
- **Wait** for auger to **STOP**.



-UN-16AUG95

M83034

1. Turn engine **OFF**.
2. Lower snowthrower to ground.

*NOTE: Spout **MUST BE** tight enough to stay in position when snow from auger hits it, but also loose enough to move by hand.*

3. Grasp spout (A) and move to desired position, resistance should be felt.
4. If resistance is not felt or if spout does not hold position when in use, tighten lock nuts (B).

280
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6

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