Specifications

General Specifications

Engine Use	LT150 and LT160
Model	Kohler
Model Number 15 hp (LT150)	CV15S
Model Number 16 hp (LT160)	CV460S
Power:	
LT150	11.2 kW (15 hp)
LT160	11.9 kW (15 hp)
Displacement:	
15 hp (LT150)	426 cm^3 (26.0 cu-in.)
16 hp (LT160)	460 cm^3 (28.1 cu-in.)
Cylinders	1
Stroke/Cycle	4
Valves	Overhead Valves
Bore:	
15 hp (LT150)	90 mm (3.55 in.)
16 hp (LT160)	87 mm (3.43 in.)
Stroke:	
15 hp (LT150)	67 mm (2.64 in.)
16 hp (LT160)	77 mm (3.03 in.)
Compression Ratio	2:1 Cranking - 8.5:1 Running
Compression Release	Automatic/Centrifugal
Crankshaft Type	Vertical (Counterbalanced)
Lubrication	Pressurized Gerotor Pump
Oil Pressure	0 - 413 kPa (0 - 60 psi)
Oil Filter	Single Element, Full Flow, Spin-On Filter
Crankcase Capacity:	
With Filter	1.9 L (2.0 qt)
Without Filter	1.4 L (1.5 qt)
Cooling System	Air Cooled
Air Cleaner	Paper With Outer Foam Element
Muffler	Horizontal, Discharge Below Frame
Slow Idle	1700 ± 75 rpm
Fast Idle (Domestic)	3350 ± 75 rpm
Maximum Angle of Operation (With Full Crankcase):	
Continuous (All Directions)	20°
Intermittent (All Directions)	35°
Fuel Filter	Replaceable (In-Line Type)
Fuel Shut-Off Solenoid (Optional):	Replaceable (Below Carburetor Float Bowl)
Weight (15 hp)	39.5 kg (87 lbs)
Weight (16 hp)	41.9 kg (90 lbs)

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Troubleshooting

Engine Troubleshooting

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

NOTE: To test specific electrical components, see Electrical Section and refer to either Diagnostics or Tests & Adjustments for further guidance.

Symptom: Engine Will Not Crank

(1) Is battery voltage 12.4 volts or higher?

Yes - Go to step 3.

No - Charge battery and perform no-load test. Go to next step.

(2) Is battery voltage 12.4 volts or higher?

Yes - Go to next step.

No - Replace battery.

(3) Does starter solenoid click when ignition switch is turned to start position?

Yes - Check starter motor.

No - Check electrical system.

NOTE: Perform a visual inspection first to determine if battery cables are tight and not corroded and if battery is of sufficient size to turn the engine over at minimum cranking speed of 350 rpm.

Symptom: Engine Cranks But Will Not Start

(1) Is battery voltage 12.4 volts or higher?

Yes - Go to step 3.

No - Charge battery and perform no-load test. Go to next step.

(2) Is battery voltage 12.4 volts or higher?

Yes - Go to next step.

No - Replace battery.

(3) Does fuel shutoff solenoid click when ignition switch is turned to start/run?

Yes - Go to next step.

No - Defective fuel shutoff solenoid, switch or wiring. See Electrical section.

(4) Does engine crank slow?

Symptom: Engine Cranks But Will Not Start

Yes - Remove spark plugs and turn the engine over by hand. Go to next step.

No - Go to step 6.

(5) Is the engine hard to turn over by hand?

Yes - Pistons or other internal components binding.

No - Starter motor defective. Repair or replace as needed.

(6) Is the choke operating properly?

Yes - Go to next step.

No - Adjust choke cable.

(7) Do spark plugs have strong blue spark?

Yes - Go to next step.

No - Possible defective spark plugs, magneto shorted to ground, flywheel magnet weak, or ignition coil air gap not adjusted. See Electrical section.

(8) Are tappets adjusted properly.

Yes - Go to next step.

No - Adjust tappets.

(9) Is engine getting fuel?

Yes - Check air leaner, fuel mixture, contaminated fuel, or possible stuck float needle.

No - Check fuel shutoff valve, fuel lines, fuel pump, and engine vacuum.

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Tests and Adjustments

Throttle Cable Adjustment

Reason:

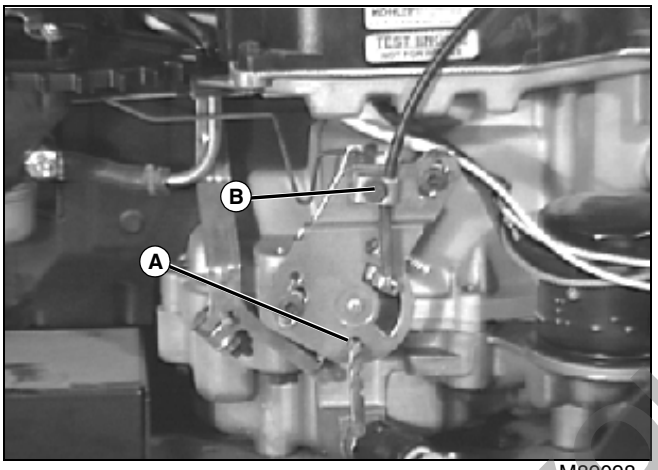
To make sure the throttle cable moves the throttle and choke control lever through its full range of movement.

Equipment:

- 6.4 mm (0.25 in.) Drill Bit

Procedure:

1. Move throttle lever to FAST idle position.



M89098

2. Align hole in throttle control lever with hole (A) in throttle control plate. Put a **6.4 mm (0.25 in.)** drill bit through holes to keep the throttle control lever from moving. Be sure drill bit is perpendicular to the throttle control plate.

3. Loosen cap screw (B) and pull throttle cable housing tight. Tighten cap screw.

4. Remove drill bit.

5. Move throttle lever to the full choke position. Make sure throttle lever is held up against throttle plate. Choke should be fully closed.

6. Move throttle lever through full range to be sure linkage is not binding.

Choke Adjustment

Reason:

To make sure the choke plate is fully closed when the throttle lever is in the full choke position. Correct adjustment also makes sure choke is completely open in the fast idle position.

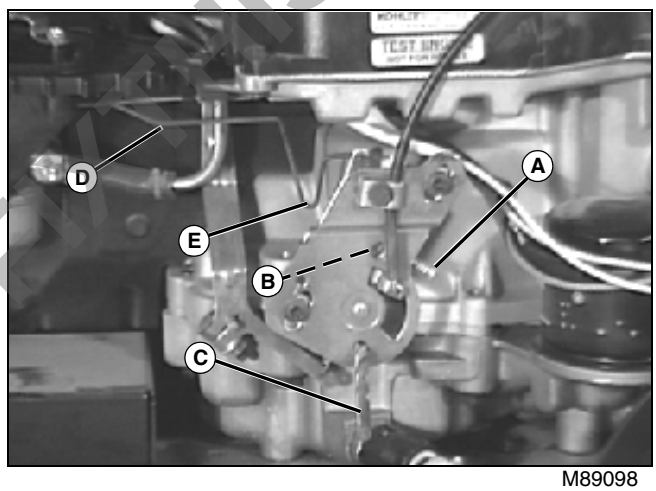
Equipment:

- 6.4 mm (0.25 in.) Drill Bit

Procedure:

NOTE: Adjust throttle cable before adjusting choke.

1. Move throttle lever to CHOKE position then back to FAST idle position.



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2. Align hole in throttle control lever with hole in throttle control plate. Put a **6.4 mm (0.25 in.)** drill bit (C) through holes to keep the throttle control lever from moving. Be sure drill bit is perpendicular to the throttle control plate.

3. Turn screw (A) counterclockwise until screw does not contact the choke control lever (B).

4. Turn screw clockwise until screw just touches the choke control lever.

5. Remove drill bit.

6. Move throttle lever to full choke position.

7. Try to move choke rod (D) forward (choke rod should not move). If the choke rod moves forward, the choke plate is not fully closed. Carefully bend the choke rod at Vee bend (E) until the choke plate is fully closed.

8. Move throttle lever to be sure choke linkage is not binding.

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General Information

Reading Electrical Schematics

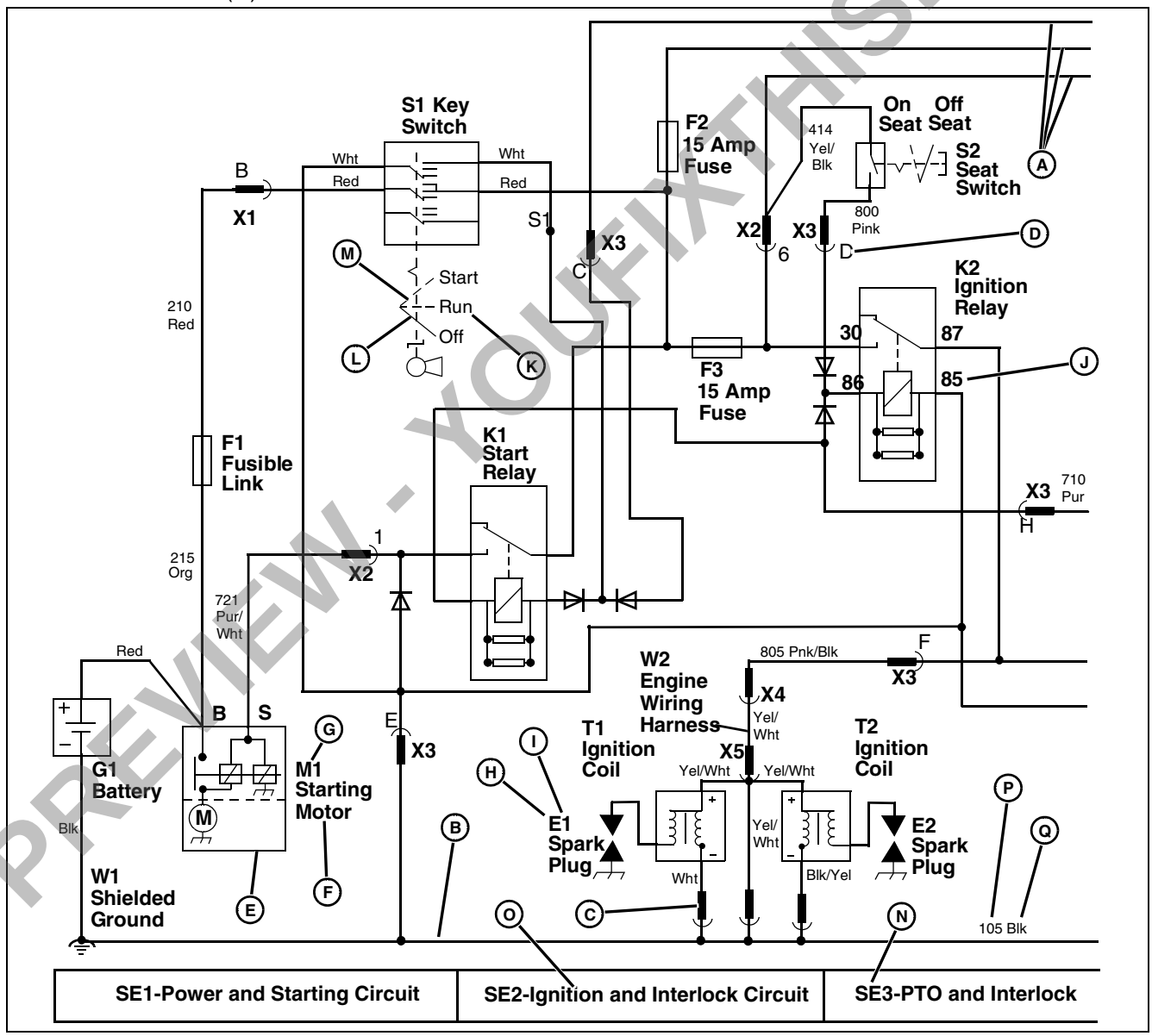
The schematic is made up of individual circuits laid out in a sequence of related functions. It is formatted with all power wires (A) across the top and all ground wires (B) across the bottom. Current flow is generally from top to bottom through each circuit and component. All components are shown in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

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

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

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

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



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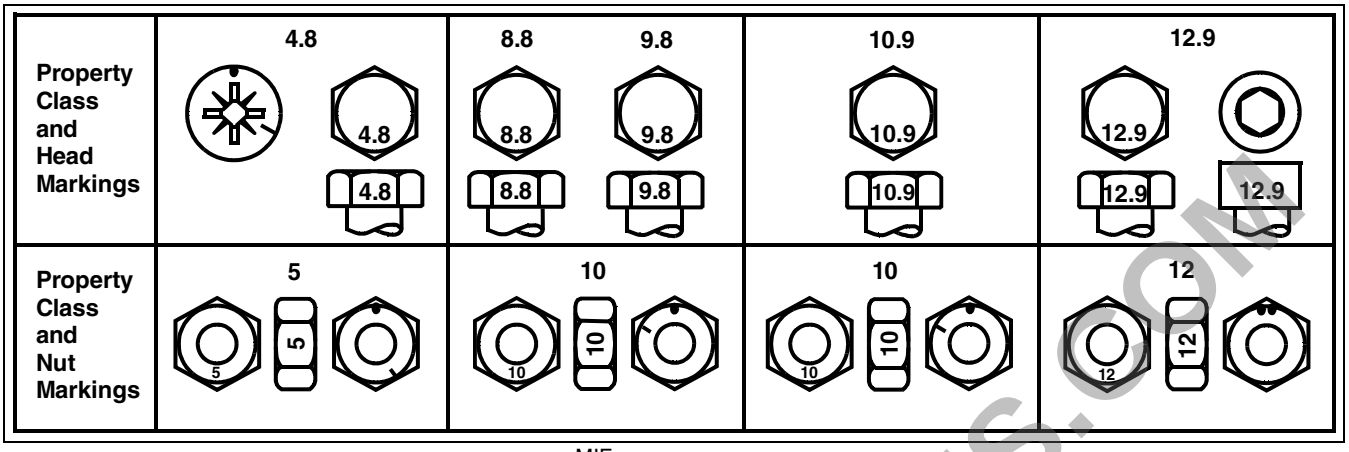
Components can be easily cross-referenced.

The same component name and identification code are used consistently on all diagrams in this section.

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Fastener Torques

Metric Fastener Torque Values



MIF

	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	109
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.

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Tests and Adjustments Specifications

Engine

Spark Plug Gap	1.0 mm (0.040 in.)
Valve Adjustment	None (Hydraulic Lifters)
Oil Pressure (Minimum at 1250 rpm):	124 kPa (18 psi)
Crankcase Vacuum (Minimum At Operating Temp.):	10.2 cm (4 in.) Water Movement
Automatic Compression Release Minimum Lift (Engine Cold)	0.25 mm (0.01 in.)

Fuel/Air System:

Slow Idle Speed	1700 ± 100 rpm
Fast Idle Speed	3350 ± 100 rpm

Repair Specifications

Cylinder Head:

Cylinder Head Flatness (Maximum Warpage)	0.08 mm (0.003 in.)

Valves and Valve Lifters:

Hydraulic Lifter Clearance	0.01 - 0.05 mm (0.001 - 0.002 in.)
Intake Valve-to-Guide Clearance	0.04 - 0.08 mm (0.002 - 0.003 in.)
Intake Valve Stem OD	6.98 - 7.00 mm (0.275 - 0.276 in.)
Exhaust Valve Stem OD	6.97 - 6.99 mm (0.274 - 0.275 in.)
Exhaust Valve-to-Guide Clearance	0.05 - 0.09 mm (0.002 - 0.004 in.)
Intake Valve Guide ID:	
New	7.04 - 7.06 mm (0.277 - 0.289 in.)
Maximum	7.13 mm (0.281 in.)
Exhaust Valve Guide ID:	
New	7.04 - 7.06 mm (0.277 - 0.278 in.)
Maximum	7.16 mm (0.282 in.)
Valve Guide Reamer:	
Standard	7.05 mm (0.278 in.)
Oversize (0.25 mm)	7.30 mm (0.287 in.)
Intake Valve Lift (Minimum - Engine Cold)	8.90 mm (0.353 in.)
Intake Valve Lift (Minimum - Engine Cold)	8.90 mm (0.353 in.)
Exhaust Valve Lift (Minimum - Engine Cold)	9.14 mm (0.360 in.)
Valve Face Angle	45°
Valve Seat Angle	44.5°

Rocker Arms:

Rocker Arm ID:	
New	15.47 - 16.13 mm (0.609 - 0.635 in.)
Wear Limit	15.73 mm (0.619 in.)

Rocker Shaft:

Rocker Shaft OD:	
New	15.47 - 16.13 mm (0.630 - 0.640 in.)
Wear Limit	15.73 mm (0.619 in.)

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Engine Runs Erratically/Loss Of Power

IMPORTANT: Avoid damage! Before proceeding, inspect the mower deck and belts for binding in the spindle assemblies or belts that are too tight/loose. A loose belt like a loose blade can cause a backlash effect that will counteract engine cranking effort. Excessive drive belt tension may cause premature bearing wear or result in bearing seizure. Grass clippings that build up near the cutting blades can cause excessive resistance and heat build-up that causes problems with the engine's ability to turn the blades at a constant speed. Low lubricant levels in the spindles will build-up heat causing excessive resistance for the engine to deal with.

NOTE: To test specific electrical components, see Electrical Section and refer to either Diagnostics or Tests & Adjustments for further guidance

Symptom: Engine Runs Erratically/Loss of Power

(1) Is the spark plug faulty?

Yes - Replace spark plug.

No - Go to next step.

(2) Is the choke adjusted properly? See "Choke Adjustment" on page 24.

Yes - Go to next step.

No - Adjust choke.

(3) Is the engine getting the proper amount of fuel? See "Fuel Flow Test" on page 30.

Yes - Go to next step.

No - Replace fuel pump or hoses as necessary.

(4) Is the governor adjusted properly? See "Governor Adjustment" on page 25.

Yes - Go to next step.

No - Adjust governor.

(5) Is the crankcase vacuum correct? See "Crankcase Vacuum Test" on page 28.

Yes - Go to next step.

No - Replace crankcase reed valve as necessary. See "Breather Inspection" on page 41.

(6) Is the automatic compression working correctly? See "Automatic Compression Release (ACR) Check" on page 27.

Yes - Go to next step.

Symptom: Engine Runs Erratically/Loss of Power

No - Repair as necessary.

(7) Are the head gasket or piston rings defective? See "Cylinder Leakdown Test" on page 27.

Yes - Replace gasket and/or piston rings.

No - Go to next step.

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Governor Adjustment

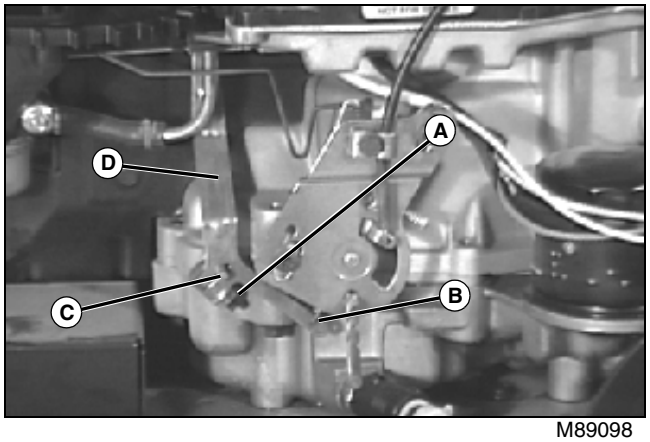
Reason:

To make sure the governor shaft contacts the flyweight plunger when the engine is stopped.

NOTE: Adjust throttle cable before adjusting governor linkage.

Procedure:

1. Move throttle lever to FAST idle position.



M89098

2. Loosen nut (A).

3. Hold top of governor arm (D) toward carburetor. Turn governor shaft (C) counter-clockwise until it stops. Hold governor shaft and tighten nut.

4. Move throttle lever through full range to be sure linkage is not binding.

5. Governor spring (B) should be installed in the hole closest to governor shaft. If governor is not responding properly, replace spring and readjust fast idle speed. If spring did not correct the problem, repair governor.

Fast Idle Speed Adjustment

Reason:

To set engine fast idle rpm.

NOTE: Governor adjustment must be performed before performing this procedure. See "Governor Adjustment" on page 25.

Equipment:

- JTO5719 Photo Tachometer

Procedure:

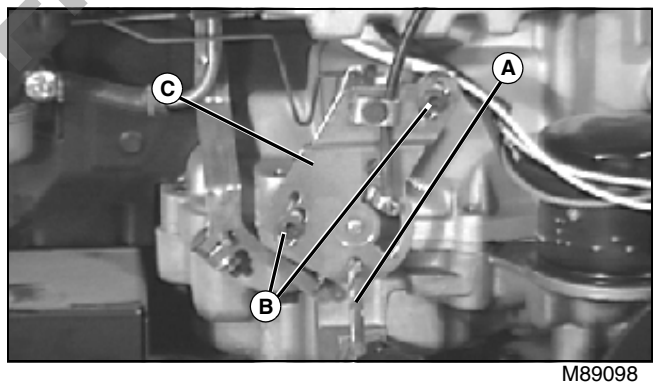
1. Move transaxle shift lever to NEUTRAL position. Engage park brake.

2. Put reflective tape on blower housing screen.

3. Start and run engine at MEDIUM idle for five minutes.

CAUTION: Avoid Injury! Engine will be HOT. Be careful not to burn skin.

4. Move throttle lever to FAST idle position.



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5. Align holes of throttle lever and throttle control plate with **6.4 mm (0.25 in.)** drill bit (A). This keeps the throttle control lever from moving during adjustment. Be sure drill bit is perpendicular to the throttle control plate.

6. Use a photo tachometer to check engine rpm at the blower housing screen.

Specifications:

Fast Idle Speed Setting . . . . . .3350 ± 75 rpm
Control Panel Screw Torque . . . . . 10 N•m (88 lb-in.)

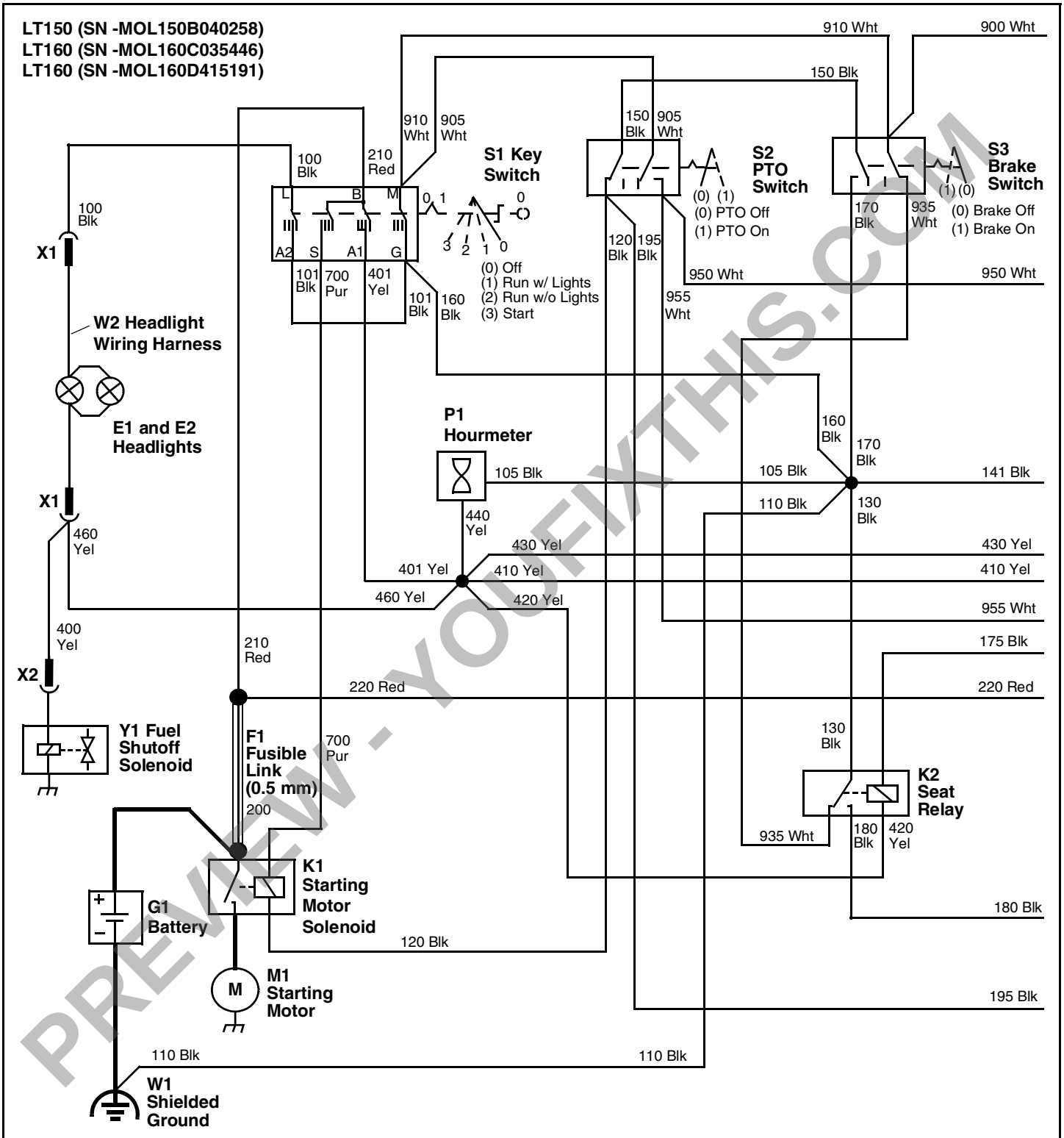
Results:

- If fast idle speed does not meet the specifications, loosen cap screws (B).
- Move throttle control plate (C) upward to increase rpm or downward to decrease rpm.
- Hold the throttle control plate and tighten cap screws.

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Main Electrical Schematic - LT150 and LT160 With Stator Brake



SE 1 - Starting	SE 2 - Magneto Kill & Start Interlock

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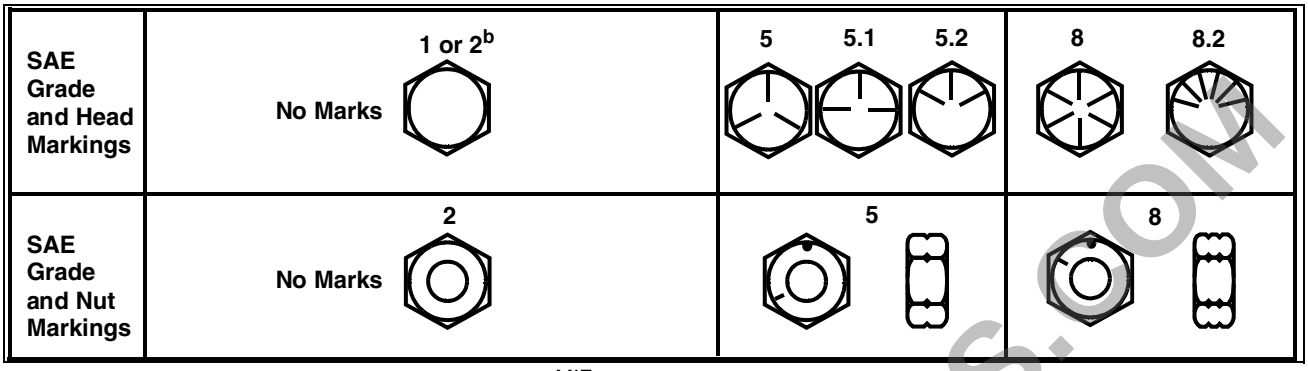
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a *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (Yellow Dichromate - Specification JDS117) without any lubrication.*

Reference: JDS - G200

Inch Fastener Torque Values



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	Grade 1				Grade 2b				Grade 5, 5.1 or 5.2				Grade 8 or 8.2			
	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
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.5	10	7	12	9	15	11	20	15	25	18	28	21	35	26
3/8	14	10	17	13	22	16	27	20	35	26	44	33	50	36	63	46
7/16	22	16	28	20	35	26	44	32	55	41	70	52	80	58	100	75
1/2	33	25	42	31	53	39	67	50	85	63	110	80	120	90	150	115
9/16	48	36	60	45	75	56	95	70	125	90	155	115	175	130	225	160
5/8	67	50	85	62	105	78	135	100	170	125	215	160	215	160	300	225
3/4	120	87	150	110	190	140	240	175	300	225	375	280	425	310	550	400
7/8	190	140	240	175	190	140	240	175	490	360	625	450	700	500	875	650
1	290	210	360	270	290	210	360	270	725	540	925	675	1050	750	1300	975
1-1/8	470	300	510	375	470	300	510	375	900	675	1150	850	1450	1075	1850	1350
1-1/4	570	425	725	530	570	425	725	530	1300	950	1650	1200	2050	1500	2600	1950
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2150	1550	2700	2000	3400	2550
1-1/2	1000	725	1250	925	990	725	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

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 grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

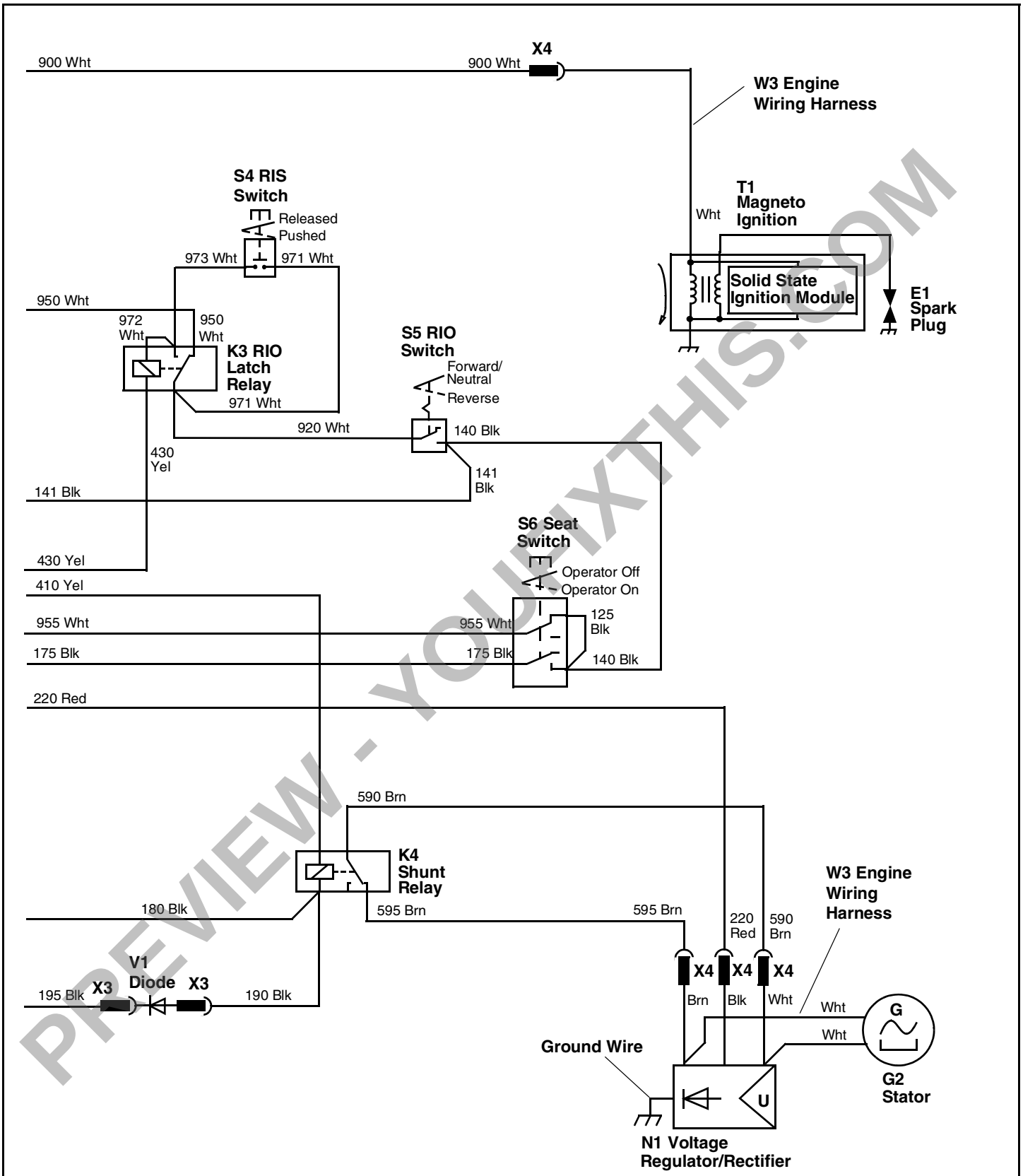
When bolt and nut combination fasteners are used, torque values should be applied to the NUT instead of the bolt head.

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 -*

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SE 2 - Magneto Kill & Start Interlock	SE 3 - Engine Ignition / Charging

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Specification JDS117) without any lubrication.

b *"Grade 2" applies for hex cap screws (Not Hex Bolts) up to 152 mm (6 in.) long. "Grade 1" applies for hex cap screws over 152 mm (6 in.) long, and for all other types of bolts and screws of any length.*

Reference: JDS-G200

Metric Fastener Torque Value - Grade 7

Size	Steel or Gray Iron Torque		Aluminum Torque	
	N•m	lb-ft	N•m	lb-ft
M6	11	8	8	6
M8	24	18	19	14
M10	52	38	41	30
M12	88	65	70	52
M14	138	102	111	82
M16	224	165	179	132

General Information

Gasoline

4 - Cycle Engines

CAUTION: Avoid Injury! Gasoline is HIGHLY FLAMMABLE, handle it with care. DO NOT refuel machine while: indoors, always fill gas tank outdoors; machine is near an open flame or sparks; engine is running, STOP engine; engine is hot, allow it to cool sufficiently first; smoking.
Help prevent fires: fill gas tank to bottom of filler neck only; be sure fill cap is tight after fueling; clean up any gas spills IMMEDIATELY; keep machine clean and in good repair - free of excess grease, oil, debris, and faulty or damaged parts; any storage of machines with gas left in tank should be in an area that is well ventilated to prevent possible igniting of fumes by an open flame or spark, this includes any appliance with a pilot light. To prevent fire or explosion caused by STATIC ELECTRIC DISCHARGE during fueling:•ONLY use a clean, approved POLYETHYLENE PLASTIC fuel container and funnel WITHOUT any metal screen or filter.

To avoid engine damage:

- DO NOT mix oil with gasoline;
- **ONLY use clean, fresh unleaded gasoline with an octane rating (anti-knock index) of 87 or higher**;
- fill gas tank at the end of each day's operation to help prevent condensation from forming inside a partially filled tank;
- keep up with specified service intervals.

Use of alternative oxygenated, gasohol blended, unleaded gasoline is acceptable as long as:

- the ethyl or grain alcohol blends DO NOT exceed 10% by volume or
- methyl tertiary butyl ether (MTBE) blends DO NOT exceed 15% by volume

RFG (reformulated) gasoline is acceptable for all machines designed for use of regular unleaded fuel. Older machines (that were designed for leaded fuel) may see some accelerated valve and seat wear.

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Manual Description

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

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

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

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

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

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

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

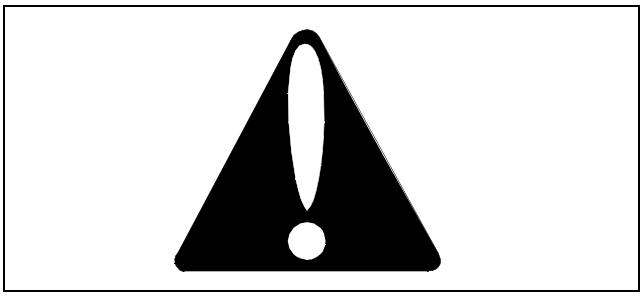
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Safety
Specifications and Information
Engine (Kohler)
Engine (Briggs & Stratton)
Engine (Kawasaki FH500V)
Engine (Kawasaki FH580V)
Electrical
Power Train (Gear)
Power Train (Hydro)
Steering
Brakes
Attachments
Miscellaneous

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Recognize Safety Information



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.

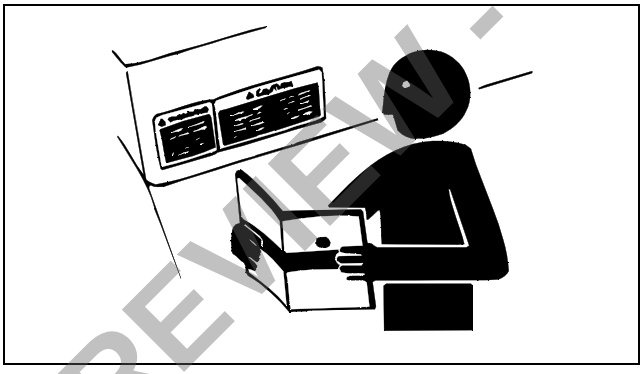
Follow recommended precautions and safe servicing practices.

Understand Signal Words

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

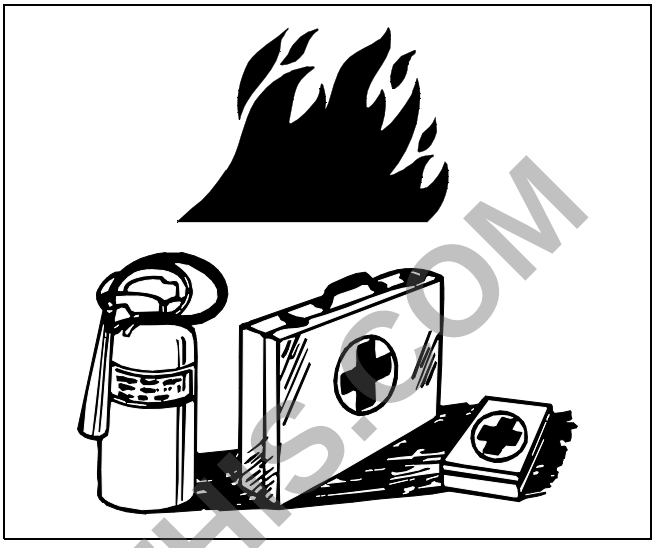
DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

Replace Safety Signs



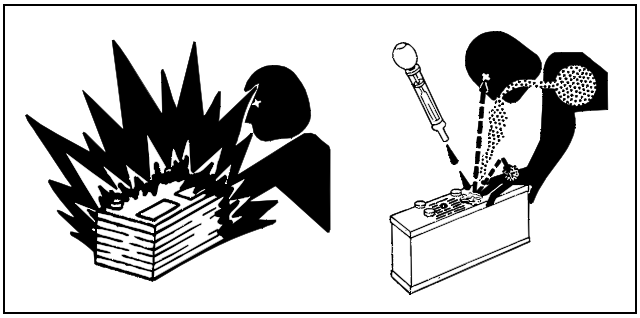
Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

Be Prepared for Emergencies



- 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.
- 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.

Use Care In Handling and Servicing Batteries



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Prevent Battery Explosions

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

Prevent Acid Burns

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

Avoid acid burns by:

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

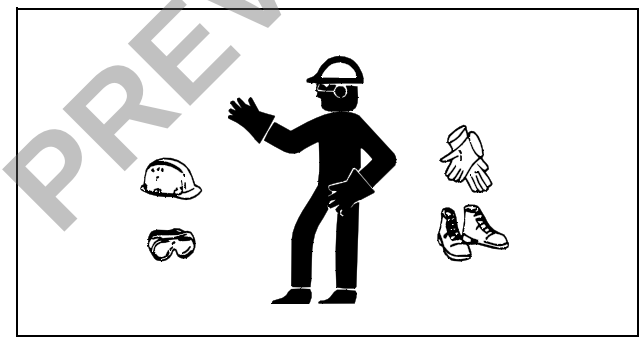
If you spill acid on yourself:

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

If acid is swallowed:

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

Wear Protective Clothing

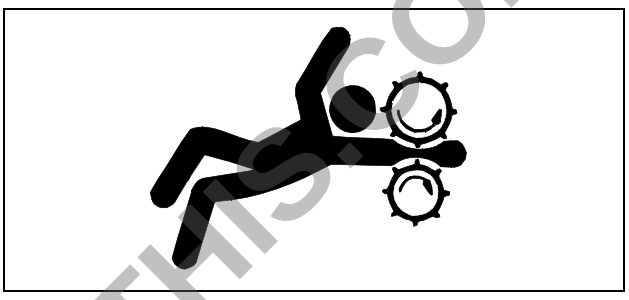


Wear close fitting clothing and safety equipment appropriate to the job.

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

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

Service Machines Safely



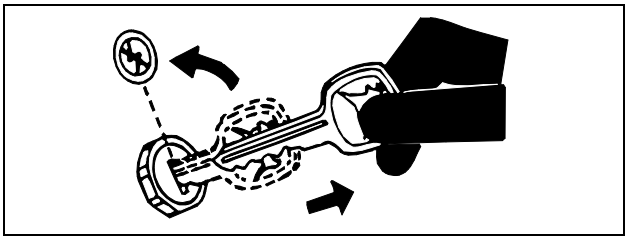
Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

Use Proper Tools

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards. Use power tools only to loosen threaded parts and fasteners. For loosening and tightening hardware, use the correct size tools. **DO NOT** use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches. Use only service parts meeting John Deere specifications.

Park Machine Safely



Before working on the machine:

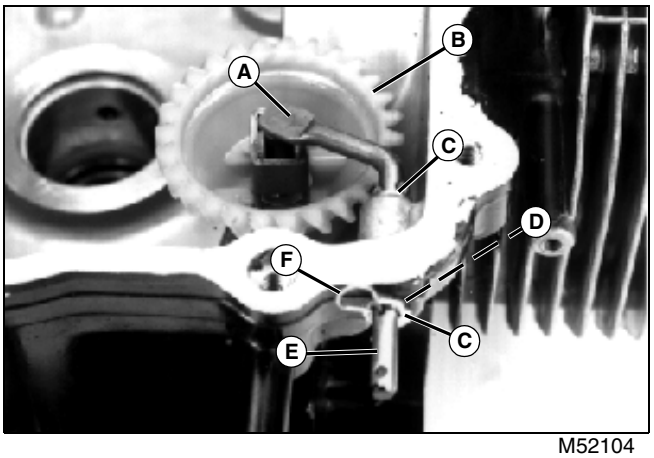
1. Lower all equipment to the ground.
2. Stop the engine and remove the key.
3. Disconnect the battery ground strap.
4. Hang a “DO NOT OPERATE” tag in operator station.

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Governor Removal and Installation

Procedure:



M52104

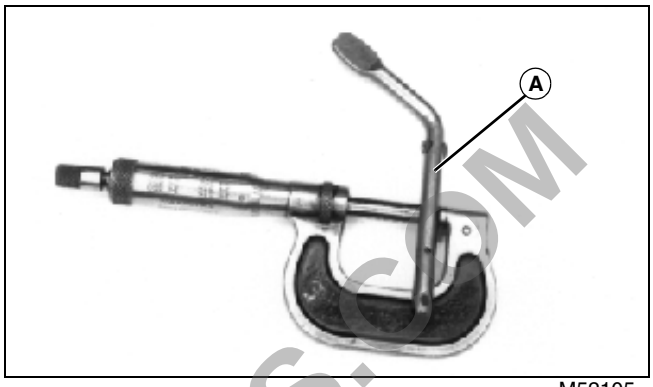
1. Remove governor lever (not shown) from end of control arm (E).
2. Remove spring clip (F), washers (C), and governor control arm (A) from inside of crankcase.
3. Remove and discard seal (D).

NOTE: Check governor shaft/gear assembly, if plastic gear, flyweight assembly, flyweight cap, and/or shaft are damaged, the complete assembly must be replaced.

4. Inspect governor shaft/gear assembly (B), replace as necessary. See “Governor Removal and Installation” on page 47.
5. Install governor shaft/gear assembly.
6. Install new seal (D) using suitable driver.
7. Install control arm, washers, and clip.
8. Install lever (not shown).

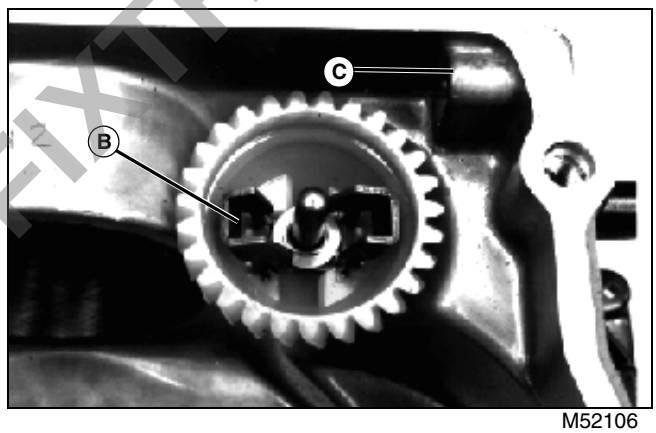
Governor Inspection

Procedure:



M52105

1. Measure outside diameter of control arm shaft (A). Replace if not within specification.

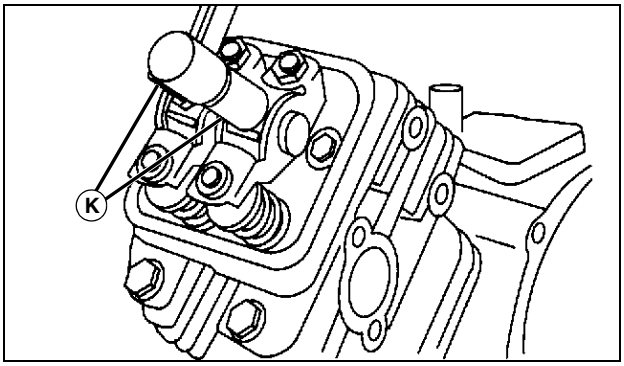


M52106

2. Measure inside diameter of crankcase bore (C).
3. Determine governor control arm shaft-to-bore clearance. Replace governor shaft/gear assembly as necessary.
4. Inspect flyweights (B) for proper operation and free movement. Replace governor shaft/gear assembly as necessary.

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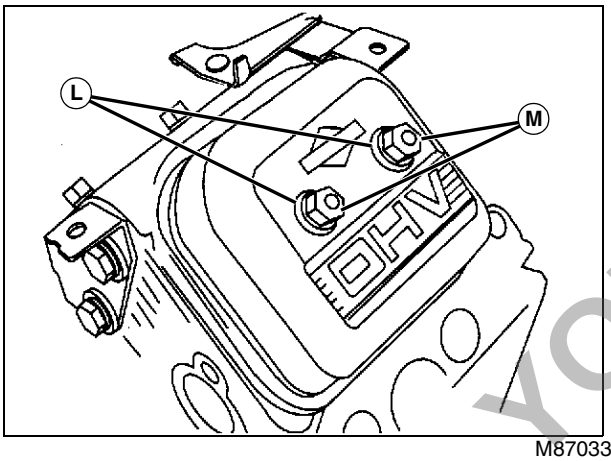


M87031

7. Assemble rocker arms, shaft, supports and studs (K) and install on cylinder head.

8. Tighten studs to **11 N•m (100 lb-in.)**.

9. Adjust valves. See “Valve Installation” on page 97.



M87033

10.Install gasket and valve cover. Place seal washers (L) and nuts (M) on studs.

11.Install intake and exhaust manifold, governor control bracket, cylinder air guides, valley cover, blower housing and air cleaner assembly.

12.Install and tighten spark plugs to **20 N•m (180 lb-in.)**.

13.Install spark plug leads.

Cylinder Head Inspection and Repair

Procedure:

1. Remove combustion chamber deposits from combustion chamber and around valves using a soft, hand wire brush or scraper. With piston at top dead center, remove combustion chamber deposits from top of piston.

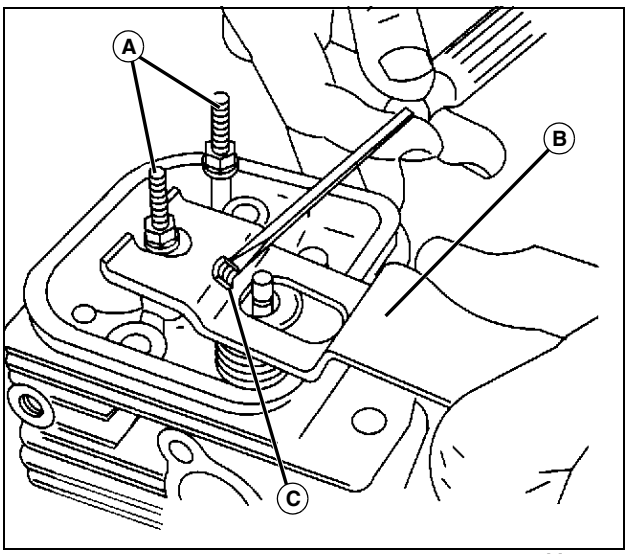
IMPORTANT: Avoid damage! Use care to prevent combustion chamber deposits from entering push rod or oil return cavity in cylinder. Take care not to damage cylinder, top of piston, cylinder head and cylinder head gasket surfaces. Remove only the combustion chamber deposits. It is not necessary to remove the discoloration marks on the piston, valves and cylinder head. These marks are normal and will not affect engine operation.

2. Inspect cylinder head for broken fins or cracks. Repeat procedure for other cylinder head and cylinder.

Valve Removal

Procedure:

1. Remove the rocker studs and rocker arms, place cylinder on workbench with support to hold valves in place.



M87025

2. Reinstall rocker studs (A) into cylinder head. Do not tighten. Slip end of valve spring compressor (B) under stud of valve spring. Press down on tool handle to compress valve spring and remove split retainers (C).

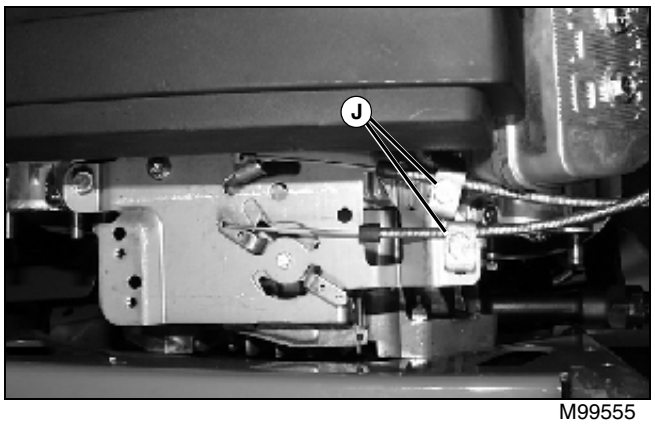
3. Release pressure and remove retaining washer and spring. Remove valves.

4. Remove rocker studs.

5. Repeat procedure on other cylinder head.

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M99555

15.Loosen cap screws securing throttle and choke cable clamps (J). Remove cable ends from engine.

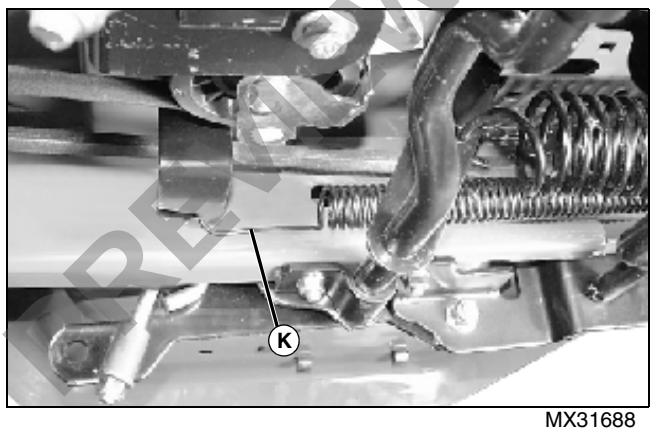
CAUTION: Avoid Injury! Gasoline is explosive. DO NOT expose to flame or spark. Serious injury can result. Store in a properly marked, safe container. Wipe-up any spills IMMEDIATELY.

16.Disconnect fuel line from fuel pump. Plug fuel line end.

17.Drain engine oil. Capacity with filter is approximately **1.8 L (1.9 qt)**.

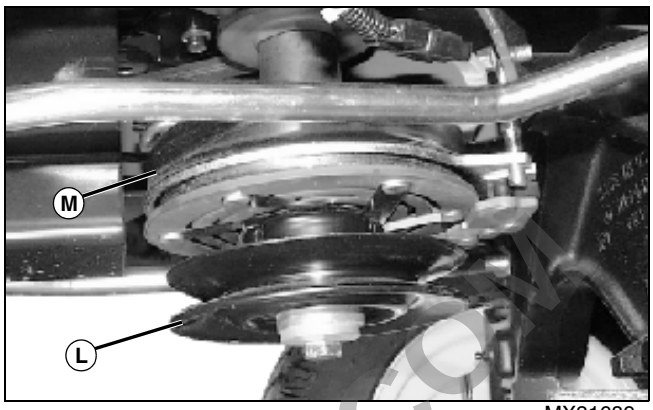
18.Remove electric PTO clutch. See “Electric PTO Clutch Removal and Installation” on page 374.

CAUTION: Avoid Injury! The drive belt tension spring is under high tension when installed. Do not remove spring without wearing face and hand protection.



MX31688

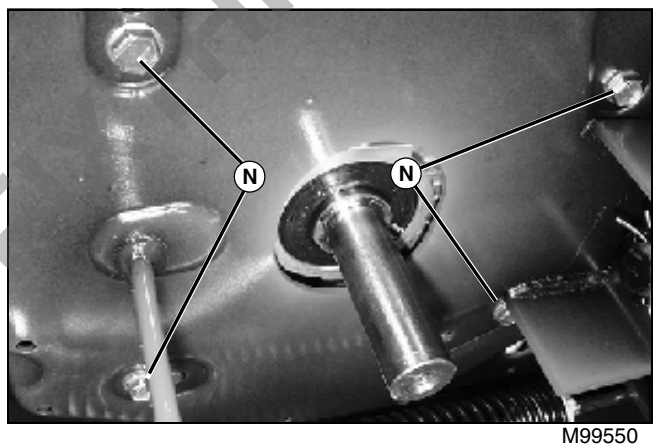
19.Disconnect drive belt tension spring (K).



MX31689

20.Remove drive pulley (L).

21.Disconnect electrical connector and remove clutch (M) and clutch spacer from crankshaft.



M99550

22.Remove four cap screws (N) and lock nuts securing engine to frame.

23.Obtain the help of an assistant and remove engine from machine.

Installation:

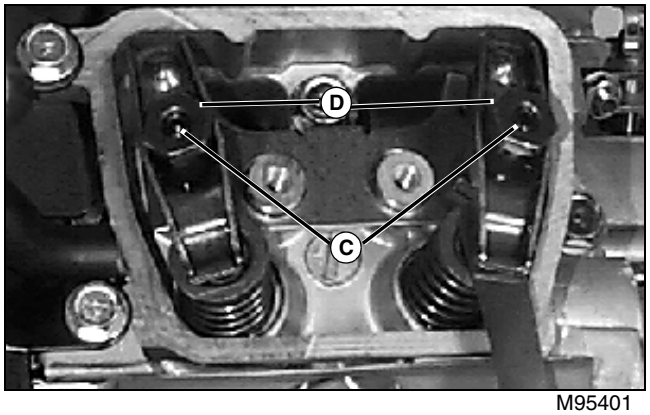
Installation is performed in the reverse order of removal.

- Tighten engine mounting cap screws to specification.
- Install drive pulley, drive belt and tension spring.
- Install muffler. Tighten muffler lock nuts to specification.
- Connect fuel line.
- Connect throttle and choke cables to engine.
- Connect engine wiring harness to main wiring harness. Secure ground wire to engine.
- Connect wiring harness spade and lug connectors to starting motor and starting solenoid.
- Fill engine with oil.
- Connect battery positive (+) cable and then battery negative (-) cable.

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Results:



M95401

1. If valve clearance does not meet the specifications, loosen lock screws (C). Turn adjusting nut (D) to adjust valve clearance to specifications.

2. Hold adjusting nut and tighten lock screw to **6.9 N•m (61 lb-in.)**. Check clearance again.

Specifications:

Intake and Exhaust Valve Clearance (cold) . . . . . 0.10 - 0.15 mm (0.004 - 0.006 in.)

Jam Nut (C) Torque. . . . . 6.9 N•m (61 lb-in.)

Valve Cover Cap Screw Torque . . . . . 6.9 N•m (61 lb-in.)

Spark Plug Torque . . . . . 22 N•m (195 lb-in.)

Cylinder Compression Pressure Test

Reason:

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

Test Equipment:

- JDM59 Compression Gauge

Procedure:

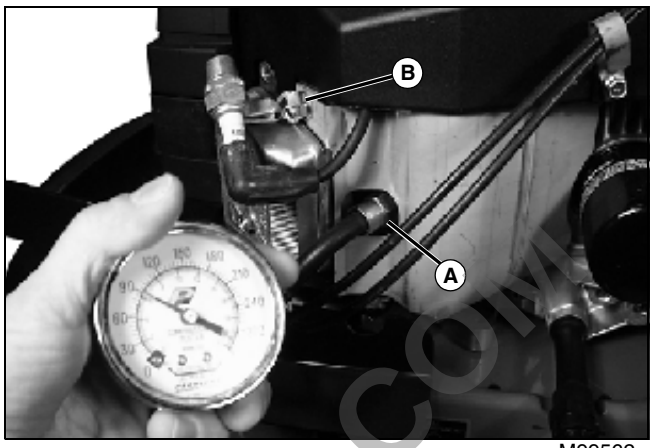
1. Valve clearance must be adjusted properly before doing a compression test.

2. Run engine for five minutes to bring engine to operating temperature.

3. Park machine on level surface and turn key switch OFF.

4. Move forward/reverse pedals to NEUTRAL position.

5. Lock parking brake, raise hood and remove spark plugs.



M99562

6. Install JDM59 compression gauge (A) in one spark plug hole.

7. Ground high tension leads (B) or disconnect positive lead from ignition coil.

8. Move throttle control lever to FAST idle position.

9. Check that choke is fully open and that air filter is clean.

IMPORTANT: Avoid damage! DO NOT overheat starting motor during test. Starter duty cycle is 5 seconds ON, 10 seconds OFF.

10. Crank engine for three to five compression strokes.

11. Record pressure reading.

12. Repeat test with other cylinder.

Specifications:

Minimum Compression . . . . . 390 kPa (57 psi)

Maximum difference between cylinders . 41 kPa (6 psi)

Results:

NOTE: Above specifications are for an engine that has sufficient time to allow rings to fully seat.

Compression that is lower than specifications on low hour machines (but relatively equal on both cylinders) probably does not indicate a problem.

- If above specification, adjust valves and check fuel and air intake systems. Check exhaust for restriction.
- If below specification, squirt clean engine oil into cylinder and repeat test.
- If compression pressure does not increase after retest: check for leaking valves, valve seats, or cylinder head gaskets.
- If compression pressure increases after retest: check rings, pistons, and cylinder bores for broken rings, scoring, wear or damage. Replace as necessary.

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Cranking Circuit Diagnosis - LT150 and LT160 With Stator Brake

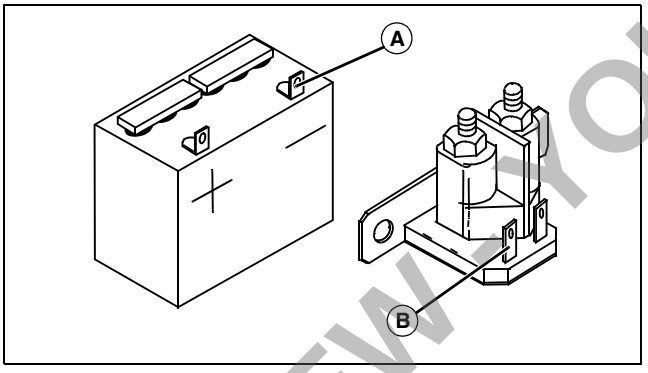
Test Procedure A

CAUTION: Avoid Injury! To help prevent starting of engine during this test procedure: Disconnect fuel shutoff solenoid connector (X2) located near voltage regulator/rectifier. Stay clear of parts that may rotate on the starting motor and engine.

Test Conditions:

- Machine parked safely. See "Park Machine Safely" in the Safety section.
- Key switch in off position.
- Park brake locked.
- Battery fully charged.
- PTO off.

System: Cranking Circuit Ground



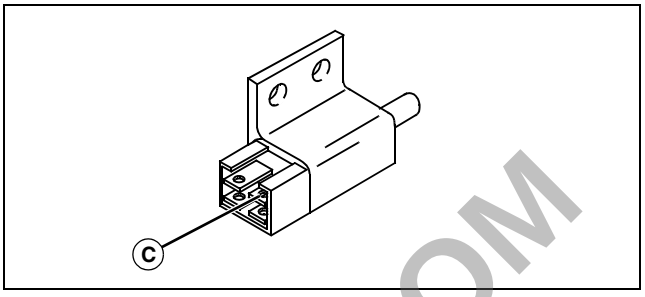
(1) 0.2 ohms resistance or less between starting motor solenoid Blk wire (B) and battery negative post (A)?

Yes - Go to next step to continue test.

No - Ensure that the brake is locked and the PTO is off and retest. Go to next step to continue test.

No - Check 120 Blk wire and connections and retest.

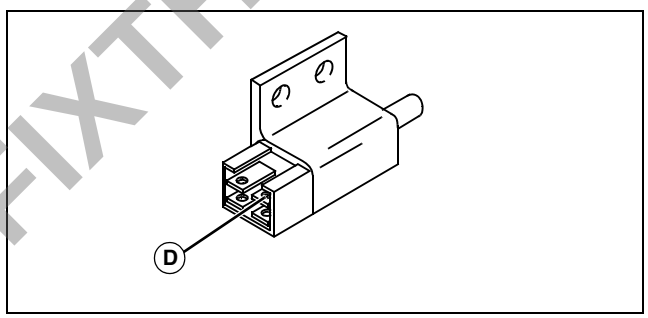
System: Cranking Circuit Ground



(2) Continuity to ground at brake switch, 170 Blk wire (C)?

Yes - Go to next step to continue test.

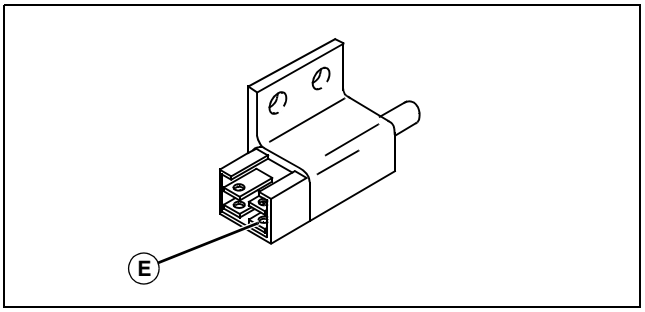
No - Check 110 and 170 Blk wires and connections and retest. Go to next step to continue test.



(3) Continuity to ground at PTO switch, 150 Blk wire (D)?

Yes - Go to next step to continue test.

No - Check 150 Blk wire and connections. If ok, replace brake switch and retest. Go to next step to continue test.



(4) Continuity to ground at PTO switch, 120 and 195 Blk wires (E)?

Yes - Go to step (1) of test procedure B.

No - Replace PTO switch and retest. Go to step (1) of test procedure B to continue test.

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PTO with RIO Circuit Operation - LT170 and LT180

Function:

To provide a safety interlock when the machine is being operated in reverse while the PTO is on. This is accomplished by providing a ground path for either the ignition coil (to stop the engine); or, the Reverse Implement Option (RIO) latch relay (to open its contacts) to provide an ignition ground path and a ground path to latch itself in the energized state and keep the engine running. An operator who deems it necessary, and chooses to keep the PTO on while backing up, must take a deliberate action to actuate the Reverse Implement Switch (RIS), by pushing the button momentarily while pressing the reverse pedal.

RIO Operating Conditions:

The key switch must be in the run position, engine running, the operator must be on the seat, the PTO on, and the RIS switch must be pressed (momentary) while starting operation in reverse.

Theory of Operation:

The Reverse Implement Option (RIO) is controlled by a relay and two switches wired in a circuit with the ignition coil. This combination of components provide for control of three different functional situations:

- PTO off with any drive function.
- PTO on and operating in reverse without activating the RIO circuit.
- PTO on and operating in reverse while activating the RIO circuit.

PTO OFF:

When the PTO is off, the machine will operate in both forward and reverse without activating any other switch(es)). The PTO switch is pressed in and breaks (opens) the ground path interlock with the RIO circuit switches for the ignition coil and the engine will continue to run normally.

PTO ON and operating in reverse without activating the RIO circuit:

During this condition when the PTO is on and the machine is operated in reverse without activating the RIO circuit, there is a ground path created for the ignition coil through 110 and 130 Blk wires, S5 RIO switch contacts (normally open), 970 Wht wire, RIO latch relay contacts (normally closed), 950 Wht wire, S2 PTO switch, 960, 910, and 900 Wht wires, to the ignition coils. This will ground the ignition coils and cause the engine to stop.

PTO ON and operating in reverse while activating the RIO circuit:

During this condition, when the PTO is on and the machine is operated in reverse, there is a ground path created for the RIO latch relay, both momentary and continuous. The momentary ground path allows the RIO latch relay to pull in, closing the contacts between the common and normally open contacts of the relay.

The momentary path is connected into the continuous path when the RIS switch is pushed and closes its contacts to connect wires 972, 973 Wht to 971 and 970 Wht wires. This energizes the K3 RIO latch relay.

The continuous path is through wire 110 and 130 Blk, RIO switch contacts (normally open), 970 Wht wire, RIO latch relay contacts (normally open), and 972 Wht wire.

When the operator places the foot pedal(s) back to neutral or forward, the S5 RIO switch returns to its normal (static) condition, breaking the ground path that holds the K2 RIO latch relay in the on condition. This allows the circuit to be self reset and ready for the next reverse operation with PTO on.

Seat circuit:

The seat switch creates a path to ground for the magneto coil any time the operator is off the seat (seat switch closed) without having the brakes locked or by having the PTO on.

If the PTO is on when the operator leaves the seat the ground path would be created from the magneto Wht wire, 900, 910, and 960 Wht wires, PTO switch contacts, 950 and 980 Wht wires, seat switch contacts (normally closed), 140 and 110 Blk wires.

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Specifications

General Specifications

Dimensions:

Axle Width (Groove-to-Groove) . . . . . 782.96 mm (30.825 in.)
Overall Case Width . . . . . 541.30 mm (21.31 in.)
Overall Case Length (Front-to-Rear) . . . . . 272.03 mm (10.710 in.)
Overall Height (Top Of Input Shaft-to-Bottom Case) . . . . . 183.40 mm (7.220 in.)
Overall Case Height (Top Case-to-Bottom Case) . . . . . 154.18 mm (6.070 in.)

Lubrication:

Capacity (Multipurpose Grease) . . . . . 638 g (1.4 lbs)
Overall Weight (With Grease) . . . . . 14.2 kg (31.2 lbs)

Rear Axle Loading:

Maximum . . . . . 204 kg (450 lbs)

Torque Specifications

Gear Shift Arm/Trans . . . . . 16 N•m (140 lb-in.)
Shift Link To Shift Lever . . . . . 13 N•m (120 lb-in.)
Gear Trans Hitch . . . . . 34 N•m (25 lb-ft)
Jacksheave/Crank . . . . . 75 N•m (55 lb-ft)
Transaxle Mounting Cap Screws to Hanger Bracket (Front) . . . . . 34 N•m (25 lb-ft)
Transaxle Mounting Cap Screws to Frame (Rear) . . . . . 34 N•m (25 lb-ft)
Brake Assembly Screws (2) . . . . . 20 N•m (180 lb-in.)

Other Materials

Other Material

Part No.	Part Name	Part Use
TY9374/ TY9375/ LOCTITE 592[a]	Pipe Sealant with TEFLON®[b]	Seal pipe plug
TY16285/ LOCTITE 7649	Clean and Cure Primer	Clean transaxle case mating surfaces
TY15130/ LOCTITE 595	Flexible Sealant	Seal transaxle case

a. LOCTITE® is a registered trademark of the Loctite Corp.
b. TEFLON® is a registered trademark of the DuPont Co.

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Specifications

General Specifications

Steering:

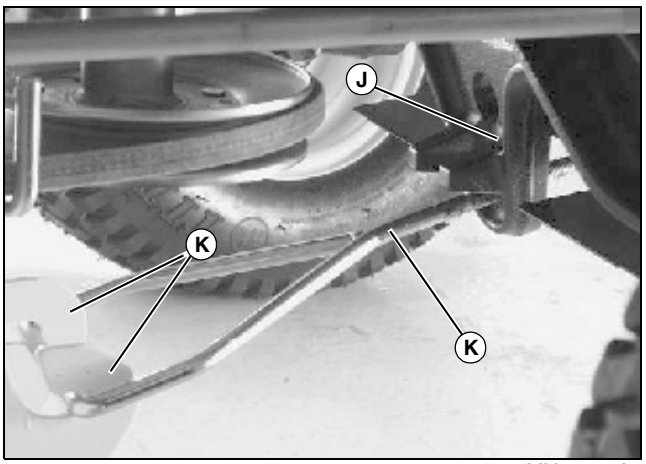
Type	**Sector and Pinion**

Torque Specifications

Front Axle Pivot	**68 N•m (50 lb-ft)**
Muffler Bracket to Front Frame	**16 N•m (12 lb-ft)**
Muffler to Engine Nuts	**24 N•m (18 lb-ft)**
Tie Rod Ball Joint to Front Axle Steering Arm	**60 N•m (44 lb-ft)**
Ball Joint Jam Nut	**50 N•m (37 lb-ft)**
Toe-In	**20 mm (0.79 in.)**

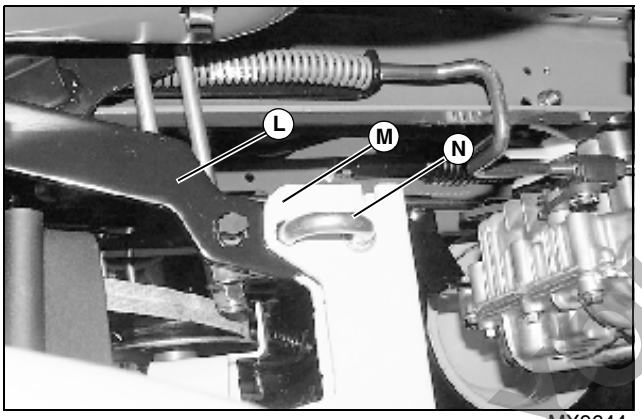
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MX11178A

12.Remove front draft rod (I) from hole in machine bracket (J) and from mower brackets (K).



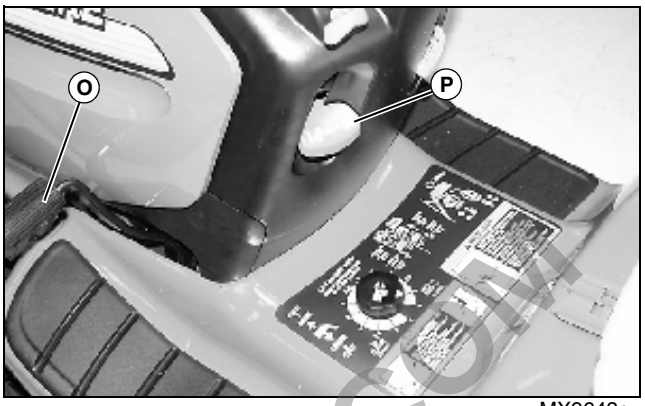
MX9644

13.Pull and rotate J-pin (N) to release and move draft arm (L) away from deck bracket (M). Repeat on other side.

CAUTION: Avoid injury! If lift pedal is spring-assisted, it can snap back when deck is removed.

Hold lift pedal securely when releasing from lock (lower) position.

14.Raise draft arms to transport position:



MX9643a

a. Pull back and hold attachment lift pedal (O) by hand.

b. Push attachment lift lever (P) down to unlock.

c. Push down and hold lift pedal.

d. Pull up latch handle to lock draft arms in transport position.

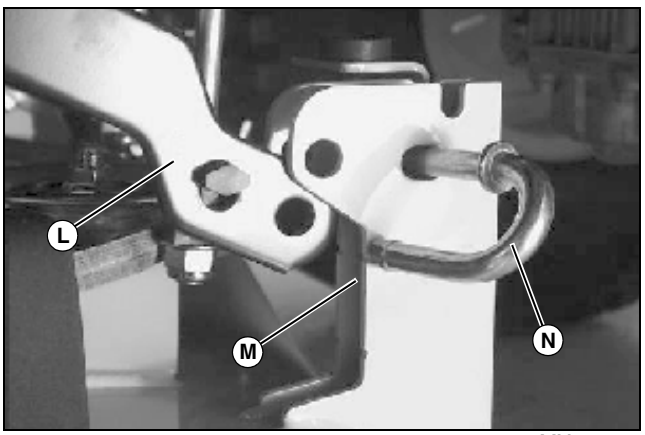
15.Remove wood blocks from both sides of machine, and slide mower deck out from under the machine.

Installation:

1. Park machine safely. Stop engine and set parking brake. See "Park Machine Safely" in the Safety section.
2. Turn engine off.
3. Allow engine and muffler to cool completely.
4. Adjust mower cutting height to lowest position.

CAUTION: Avoid injury! Rotating blades are dangerous. Before adjusting or servicing mower:

- **Disconnect spark plug wire(s) to prevent engine from starting accidently.**
- **Always wear gloves when handling mower blades or working near blades.**



MX11141

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