

S2048, S2348 and S2554
SCOTTS YARD AND GARDEN TRACTORS



TECHNICAL MANUAL

TM1777 (24Feb00)
Replaces TM1777 (10Mar99)

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
- Component Location
- System Schematic
- Theory of Operation
- Troubleshooting Chart
- Diagnostics
- Tests & Adjustments
- Repair

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

Each section will be identified with a symbol rather than a number. The groups and pages within a section will be consecutively numbered.

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

All information, illustrations and specifications in this manual are based on the latest information available 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 – 20, 23 & 25 HP



Electrical System



Hydrostatic Power Train



Steering



Brakes



Attachments



Miscellaneous





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.

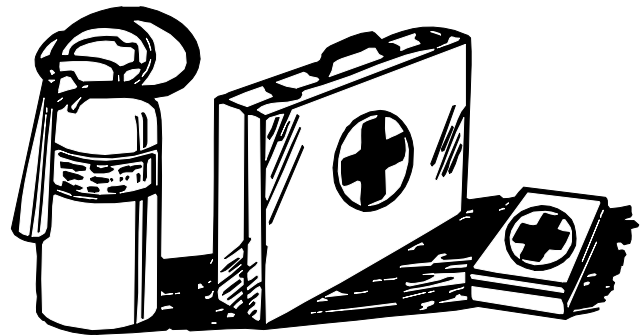
REPLACE SAFETY SIGNS



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

HANDLE FLUIDS SAFELY-AVOID FIRES

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.

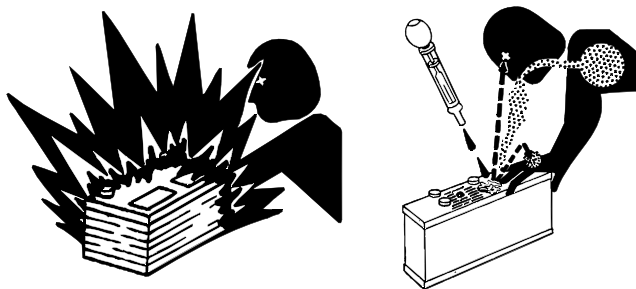
Do not store oily rags; they can ignite and burn spontaneously.

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



Prevent Battery Explosions

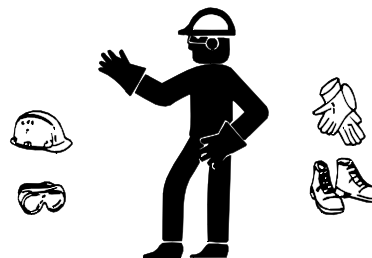
- Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.
- Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.
- Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).

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.

USE SAFE SERVICE PROCEDURES

Wear Protective Clothing

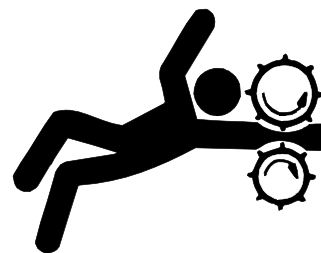


Wear close fitting clothing and safety equipment appropriate to the job.

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.

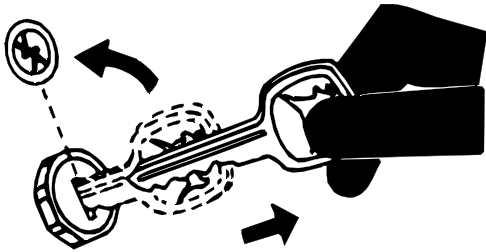
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

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.



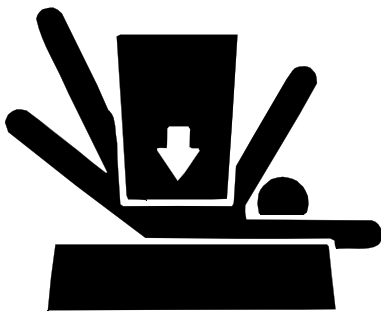
Park Machine Safely



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.

Support Machine Properly And Use Proper Lifting Equipment



If you must work on a lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

Lifting heavy components incorrectly can cause severe injury or machine damage. Follow recommended procedure for removal and installation of components in the manual.

Work In Clean Area

Before starting a job:

1. Clean work area and machine.
2. Make sure you have all necessary tools to do your job.
3. Have the right parts on hand.
4. Read all instructions thoroughly; do not attempt shortcuts.

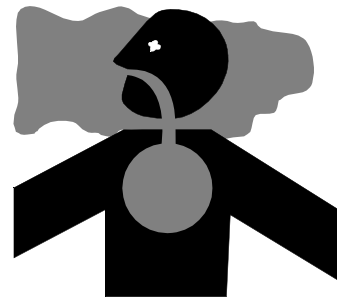
Using High Pressure Washers

Directing pressurized water at electronic/electrical components or connectors, bearings, hydraulic seals, fuel injection pumps or other sensitive parts and components may cause product malfunctions. Reduce pressure and spray at a 45 to 90 degree angle.

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

Work In Ventilated Area



Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

WARNING: California Proposition 65

Warning:

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Gasoline engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Remove Paint Before Welding Or Heating

Avoid potentially toxic fumes and dust. Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch. Do all work outside or in a well ventilated area. Dispose of paint and solvent properly. Remove paint before welding or heating: If you sand or grind paint, avoid breathing the dust. Wear an approved respirator. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos. Keep bystanders away from the area.

SERVICE TIRES SAFELY



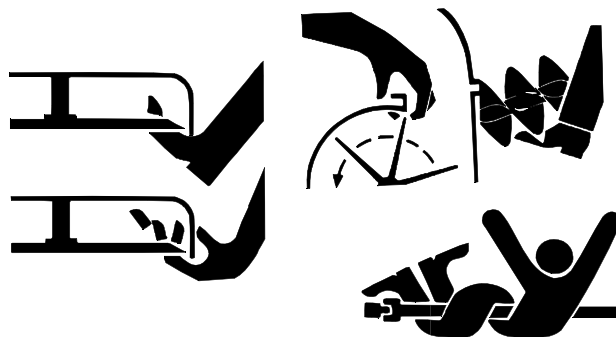
Explosive separation of a tire and rim parts can cause serious injury or death.

Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job. Always maintain the correct tire pressure. Do not inflate the tires above the recommended pressure. Never weld or heat a wheel and tire assembly. The heat can cause an increase in air pressure resulting in a tire explosion. Welding can structurally weaken or deform the wheel.

When inflating tires, use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of or over the tire assembly. Use a safety cage if available.

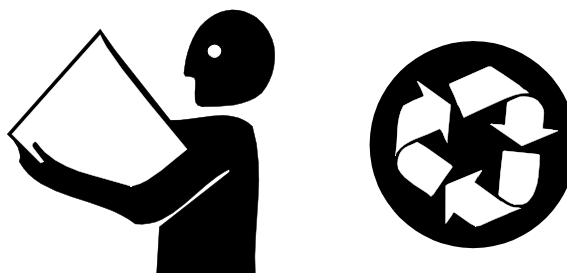
Check wheels for low pressure, cuts, bubbles, damaged rims or missing lug bolts and nuts.

AVOID INJURY FROM ROTATING BLADES, AUGERS AND PTO SHAFTS



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

HANDLE CHEMICAL PRODUCTS SAFELY



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

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

Dispose of Waste Properly

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



LIVE WITH SAFETY



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

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SPECIFICATIONS

ENGINE (2048)

Engine	Kohler
Model Number	CV20S
Horsepower	14.9 kW (20 hp)
Displacement	624 cm ³ (38.1 cu.in.)
Oil Capacity	
w/o oil filter	1.65 L (1.7 qt.)
w/ oil filter	2.0 L (2.1 qt.)
Cylinders	2
Stroke/Cycle	4
Valves	Overhead Valves
Lubrication	Fully Pressurized
Oil Filter	Single Element, Full Flow, Spin-On Filter
Cooling System	Air Cooled
Air Cleaner	Dual Stage
Muffler	Horizontal Discharge Below Frame

ENGINE (2348)

Model Number	CV23S
Horsepower	17.15 kW (23 hp)
Displacement	674 cm ³ (41.1 cu.in.)
Bore	80 mm (3.15 in.)
Stroke	67 mm (2.64 in.)
Oil Capacity	
w/o oil filter	1.65 L (1.7 qt.)
w/ oil filter	2.0 L (2.1 qt.)
Cylinders	2
Stroke/Cycle	4
Valves	Overhead Valves
Lubrication	Fully Pressurized
Oil Filter	Single Element, Full Flow, Spin-On Filter
Cooling System	Air Cooled
Air Cleaner	Dual Stage
Muffler	Horizontal Discharge Below Frame

ENGINE (2554)

Engine	Kohler
Model Number	CV25S
Horsepower	18.6 kW (25 hp)
Displacement	725 cm ³ (44.0 cu.in.)
Oil Capacity	
w/o oil filter	1.65 L (1.7 qt.)
w/ oil filter	2.0 L (2.1 qt.)
Cylinders	2
Stroke/Cycle	4
Valves	Overhead Valves
Lubrication	Fully Pressurized
Oil Filter	Single Element, Full Flow, Spin-On Filter
Cooling System	Air Cooled
Air Cleaner	Dual Stage
Muffler	Horizontal Discharge Below Frame





FUEL SYSTEM

Aspiration Natural
 Fuel Tank Location Rear
 Fuel Tank Capacity 11 L (3 U.S. gal)
 Fuel (minimum octane) Unleaded Gasoline, 87 Octane
 Fuel Delivery Float-Type Side Draft Carburetor
 Fuel Filter Replaceable In-Line

ELECTRICAL

Ignition. Electronic Capacitor Discharge Ignition (CDI)
 Type of Starter. Solenoid Shift
 Charging System. Flywheel Alternator
 Battery Type BCI Group, U1
 Battery Voltage 12 V
 Battery Reserve Capacity at 25 Amp 38 minutes
 Battery Cold Cranking Amps at -18°C (0°F) 295 amps

TRANSAXLE (HYDROSTATIC)

Drive Train Belt Drive Transaxle with foot-controlled variable speed drive
 Transaxle (S2048 and S2348). Tuff-Torq Model K-62C
 Transaxle (S554) Tuff-Torq Model K-66C

PTO DRIVE

Type. V-Belt
 Clutch Type Engine-Mounted, Electric
 Control. Switch on dash

IMPLEMENT LIFT

Lift System Manual with Lift-Assist Spring
 Lift Lever Location Left-hand side of hood

DIMENSIONS-MODEL NUMBER S2048

Overall Height 114.0 cm (44.9 in.)
 Overall Length. 182.9 cm (72 in.)
 Vehicle Weight. 259 kg (570 lb.)

DIMENSIONS-MODEL NUMBER S2348

Overall Height 114.0 cm (44.9 in.)
 Overall Length. 182.9 cm (72 in.)
 Vehicle Weight. 259 kg (570 lb.)

DIMENSIONS-MODEL NUMBER S2554

Overall Height 115.7 cm (45.6 in.)
 Overall Length. 183.6 cm (72.3 in.)
 Vehicle Weight. 275 kg (606 lb.)

TIRES

Model Number 2048	
Size Front	16 X 6.50
Size Rear	23 X 10.50
Model Number 2348	
Size Front	16 X 6.50
Size Rear	23 X 10.50
Model Number 2554	
Size Front	16 X 7.50
Size Rear	24 X 12



MOWER DECK (48-INCH)

Blades	3
Cutting Height-Approx.	25–102 mm (1–4 in.)
Blade Length	423 mm (16.6 in.)
Cutting Width	1219 mm (48 in.)

MOWER DECK (54-INCH)

Blades	3
Cutting Height-Approx.	25–102 mm (1–4 in.)
Blade Length	474 mm (18.7 in.)
Cutting Width	1372 mm (54 in.)

STEERING




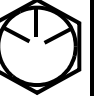







Type	Manual—Pinion/Sector
Axle Pivot Hub	Shim Adjustable
Lubrication	Multipurpose Grease
Lubrication Interval	10 hrs (Maximum)
Toe-In	6 mm (0.24 in.) — Non-Adjustable
Turning Radius	584 mm (23 in.)

PTO DRIVE

Type	V-Belt
Clutch Type	Manual Belt Tensioning
Control Location	Lever on dash

INCH TORQUE VALUES



SAE Grade and Head Markings	1 or 2 ^b No Marks 	5  5.1  5.2 	8  8.2 
	2 No Marks 	5  	8  

Size	Grade 1				Grade 2 ^b				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	
	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft
1/4	3.8	2.8	4.7	3.5	6	4.4	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.7	9.8	7.2	12	9	15.5	11.5	19.5	14.5	25	18.5	28	20.5	35	26
3/8	13.5	10	17.5	13	22	16	27.5	20	35	26	44	32.5	49	36	63	46
7/16	22	16	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

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

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head.




















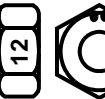
Tighten toothed or serrated-type lock nuts to the full torque value.

^a "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

"Dry" means plain or zinc plated 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.

METRIC TORQUE VALUES

Property Class and Head Markings	4.8		8.8		9.8		10.9		12.9	
										
Property Class and Nut Markings	5		10		10		10		12	
										

Size	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	
	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft
M6	4.7	3.5	6	4.4	9	6.6	11.5	8.5	13	9.5	16.5	12.5	15.5	11.5	19.5	14.5
M8	11.5	8.5	14.5	10.7	22	16	28	20.5	32	23.5	40	29.5	37	27.5	47	35
M10	23	17	29	21	43	32	55	40	63	46	80	59	75	55	95	70
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	225	320	235	400	300
M18	135	100	175	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	108	800
M24	330	245	425	315	650	480	820	600	920	680	115	850	108	800	135	100
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	200	1500
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1700	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

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

Tighten plastic insert or crimped steel-type lock nuts to

approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to 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 without any lubrication.

GASOLINE SPECIFICATIONS

**CAUTION**

Handle fuel with care, it is highly flammable. **DO NOT** refuel machine:

- Indoors. Always fill fuel tank outdoors.
- While you smoke.
- When machine is near and open flame or sparks.
- When engine is running. **STOP** engine.
- When engine is hot. Allow it to cool.

Help prevent fires:

- Fill fuel tank only to bottom of filler neck.
- Clean oil, grease and dirt from machine.
- Clean up spilled fuel immediately.
- Do not store machine with fuel in tank in a building where fumes may reach an open flame or spark.

To prevent fire and explosion caused by static electric discharge while you fill tank:

- Use approved, non-metal fuel container.
- When using a funnel, **MAKE SURE** it is **PLASTIC**.
- Avoid using a funnel which has a metal screen or filter.

IMPORTANT: To avoid engine damage:

- DO NOT mix oil with gasoline
- Use only clean oil and fuel
- Use clean approved containers and funnels.
- Store oil and fuel in an area protected from dust, moisture and other contamination.

Unleaded fuel is recommended because it burns cleaner and leaves less unburned deposits in engine combustion chamber. Regular unleaded gasoline with an anti-knock index of 85 octane or higher may be used. Use of gasohol is acceptable as long as the ethyl alcohol blend does not exceed 11 percent. Do not use gasoline that contains Methanol.

Fill fuel tank at end of each day's operation. Fill only to bottom of filler neck.

GASOLINE STORAGE

Keep fuel in a clean container in a protected area. Do not use deicers to remove water from fuel. Do not depend on fuel filters to remove water.

If possible, install a water separator at the storage tank outlet.

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

If mower is stored for the winter, add gasoline storage stabilizer to the fuel. Follow directions on can.

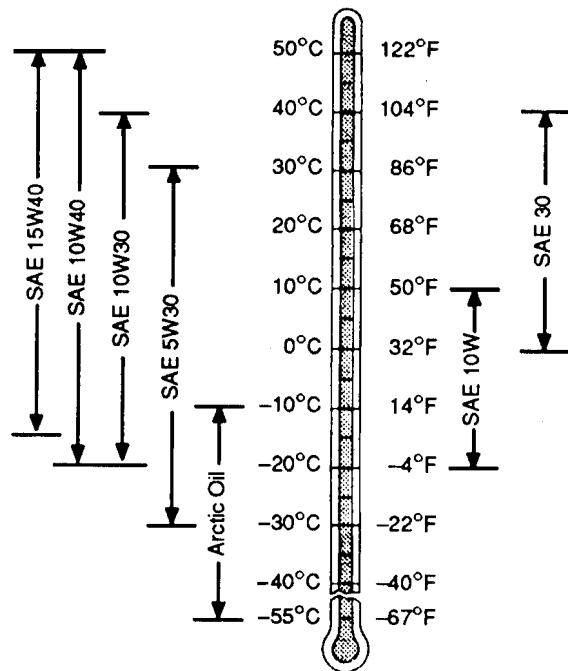
LUBRICANT SPECIFICATIONS

ENGINE OIL

Use oil viscosity based on the expected air temperature range during the period between oil changes.

The following oil is preferred:

- 10W30



Other oils may be used if they meet one of the following:

- API Service Classification SG
- API Service Classification SF
- CCMC Specification G4

Oils meeting Military Specification MIL-L-46167B may be used as arctic oils.

ENGINE BREAK-IN OIL

IMPORTANT: ONLY use a quality break-in oil in rebuilt or remanufactured engines for the **first 5 hours (maximum) of operation**. **DO NOT** use oils with heavier viscosity weights than SAE 5W-30 or oils meeting specifications API SG, SH; or oils meeting CCMC Specification G5. These oils will not allow rebuilt or remanufactured engines to break-in properly.

HYDROSTATIC TRANSMISSION OIL

Use the appropriate oil viscosity based on these air temperature ranges. Operating outside of these recommended oil air temperature ranges may cause premature hydrostatic transmission failure.

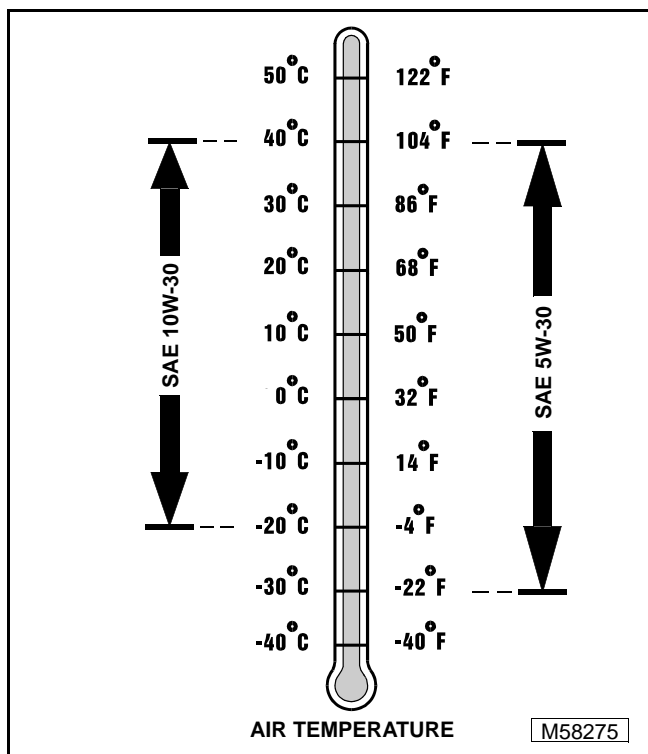
IMPORTANT: ONLY use a quality SAE 5W-30 (2048) or 5W-50 SYNTHETIC (2554) engine oil in this transmission. Mixing of two viscosity grade oils is NOT RECOMMENDED. DO NOT use BIO-HY-GARD® in this transmission.

The following oil is **RECOMMENDED**:

- **S2048 use 5W-30 or 10W-30**
- **S2554 use 5W-50 SYNTHETIC**

Use only oils that meet the following specifications:

- API Service Classifications SG or higher.
- CCMC Specifications G4 or higher.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

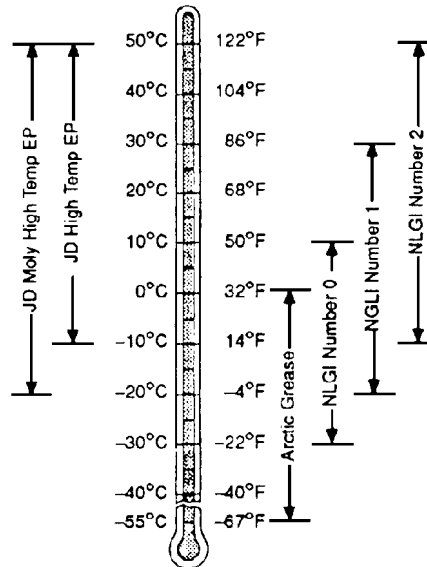
- Module DX, ENOIL2 in JDS-G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

GREASE

Use grease based on the expected air temperature range during the service interval.

The following greases are preferred:

- MOLY HIGH TEMPERATURE EP GREASE
- HIGH TEMPERATURE EP GREASE
- MULTI-PURPOSE GREASE



Other greases may be used if they meet one of the following:

- SAE Multipurpose EP Grease with a maximum of 5% molybdenum disulfide.
- SAE Multipurpose EP Grease

Greases meeting Military Specification MIL-G-10924F may be used as arctic grease.

ALTERNATIVE LUBRICANTS

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

SYNTHETIC LUBRICANTS

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



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

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

OIL FILTERS

Filtration of oils is critical to proper lubrication. Always change filters regularly.

Use filters meeting John Deere performance specification.

LUBRICANT STORAGE

This machine can operate at top efficiency only if clean lubricants are used.

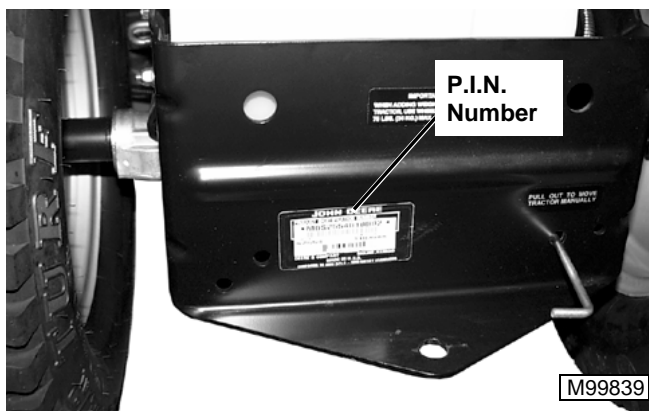
Use clean containers to handle all lubricants. Store them in an area protected from dust, moisture, and other contamination. Store drums on their sides.

SERIAL NUMBER LOCATIONS

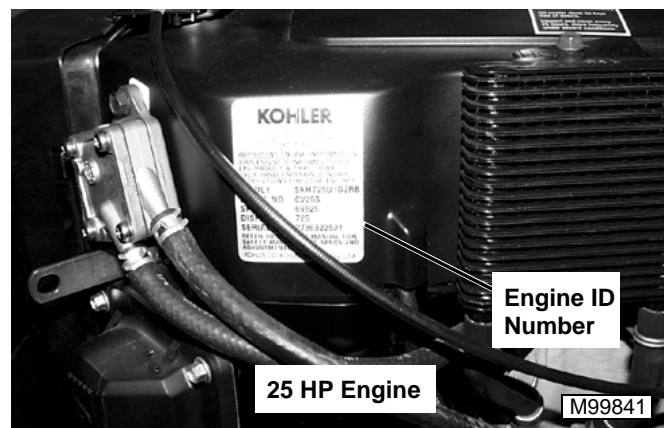
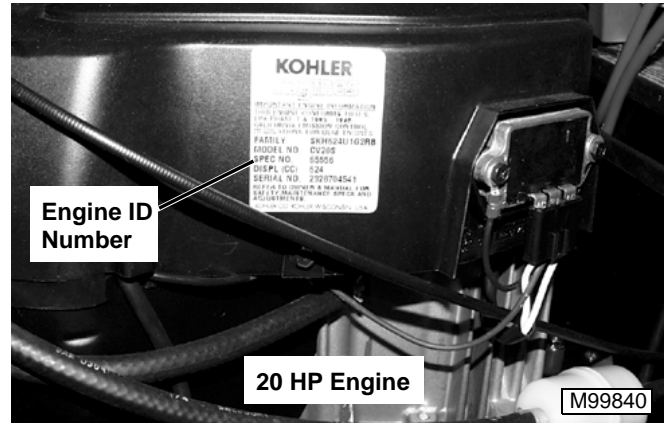
When working on machines or components that are covered by warranty, it is **IMPORTANT** that you include the tractor identification number and the component serial numbers on the warranty claim form.

The location of tractor identification number and component serial numbers are shown below.

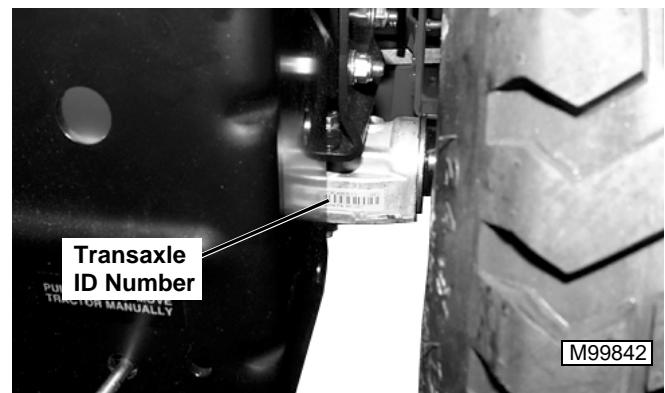
TRACTOR IDENTIFICATION NUMBER



ENGINE SERIAL NUMBER



HYDROSTATIC TRANSMISSION SERIAL NUMBER



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SPECIFICATIONS

GENERAL SPECIFICATIONS

Engine (S2048)

Model Number	CV20S
Horsepower	14.9 kW (20 hp)
Displacement	624 cm ³ (38.1 cu in.)
Bore	77 mm (3.03 in.)
Stroke	67 mm (2.64 in.)
Compression Ratio	8.2:1
Oil Capacity	
w/o oil filter	1.65 L (1.7 qt.)
w/ oil filter	1.9 L (2.0 qt.)

Engine (S2348)

Model Number	CV23S
Horsepower	17.15 kW (23 hp)
Displacement	674 cm ³ (41.1 cu in.)
Bore	80 mm (3.15 in.)
Stroke	67 mm (2.64 in.)
Compression Ratio	8.2:1
Oil Capacity	
w/o oil filter	1.65 L (1.7 qt.)
w/ oil filter	1.9 L (2.0 qt.)

Engine (S2554)

Model	CV25S
Horsepower	18.4 kW (25 hp)
Displacement	725 cm ³ (44.0 cu in.)
Bore	83 mm (3.27 in.)
Stroke	67 mm (2.64 in.)
Compression Ratio	9.0:1
Oil Capacity	
w/o oil filter	1.65 L (1.7 qt.)
w/ oil filter	2.0 L (2.1 qt.)

All Engines¹

Oil Filter	Single Element, Full Flow, Spin-On Filter
Cylinders	2
Stroke/Cycle	4
Valves	Overhead Valves
Lubrication	Fully Pressurized
Cooling System	Air Cooled
Air Cleaner	Dual Stage

1. NOTE: Specifications are for all engines unless otherwise noted.



TEST & ADJUSTMENT SPECIFICATIONS

Engines

Oil pressure sensor activates	21.1 – 35.3 kPa (3 – 5 psi)
Cylinder compression pressure (min)	1125 kPa (160 psi)
Maximum compression pressure variation between cylinders	138 kPa (20 psi)
Slow idle speed	
20 hp Engine	1200 ±75 rpm
23 and 25 hp Engines	1700 ±75 rpm
Fast Idle Speed	3350 ±75 rpm
Spark Plug Type (Champion® or Equivalent)	RC12YC
Spark Plug Gap	0.76 mm (0.030 in.)
Spark Plug Torque	26 N•m (240 lb-in.)
Ignition Module Air Gap	0.2 – 0.3 mm (0.008 – 0.0012 in.)

Fuel Pump

Minimum flow	7.5 L/hr. (2 gph)
Minimum pressure	10 kPa (0.3 psi)

REPAIR SPECIFICATIONS

Camshaft

End Play (With Shim)	0.08 – 0.13 mm (0.003 – 0.005 in.)
Running Clearance	0.03 – 0.06 mm (0.001 – 0.002 in.)
Camshaft Bore ID Case (New)	20.0 – 20.03 mm (0.787 – 0.788 in.)
Camshaft Bore ID Case (Wear Limit)	20.04 mm (0.789 in.)
Camshaft Bore ID Cover (New)	20.0 – 20.03 mm (0.787 – 0.788 in.)
Camshaft Bore ID Cover (Wear Limit)	20.04 mm (0.789 in.)
Camshaft OD (New)	19.96-19.98 mm (0.786 – 0.787 in.)
Camshaft Bore OD (Wear Limit)	19.96 mm (0.786 in.)

Connecting Rod

Crankshaft Bearing ID	34.06 mm (1.341 in.)
Piston Pin ID	17.02 mm (0.670 in.)
Maximum Wear Limit	17.04 mm (0.671 in.)
Rod to Crankpin Side Clearance	.026 – 0.63 mm (0.010 – 0.025 in.)

Crankshaft

Main Journal OD	40.91 – 40.93 mm (1.611 – 1.612 in.)
Maximum Wear Limit	40.84 mm (1.608 in.)
Connecting Rod Journal	35.95 – 35.97 mm (1.4156 – 1.4163 in.)
Maximum Wear Limit	35.94 mm (1.415 in.)
Maximum Total Indicated Runout (TIR)	0.10 mm (0.004 in.)
End Play	0.07 – 0.48 mm (0.003 – 0.019 in.)

Crankshaft Plain Bearings

Crankcase Cover Bearing ID	40.97 – 40.99 mm (1.613 – 1.614 in.)
Crankcase Bearing ID	40.96 – 41.00 mm (1.613 – 1.614 in.)
Wear Limit	41.02 mm (1.615 in.)

Cylinder Bore 20 hp Engine:

Standard ID	77.00 – 77.025 mm (3.0315 – 3.0325 in.)
Maximum Wear Limit	77.063 mm (3.034 in.)
Maximum Out-of-Round	0.12 mm (0.005 in.)
Maximum Taper	0.05 mm (0.002 in.)

Cylinder Bore 23 hp Engine:

Standard ID	80.00 – 80.025 mm (3.1496 – 3.1506 in.)
Maximum Wear Limit	80.065 mm (3.1522 in.)
Maximum Out-of-Round	0.12 mm (0.005 in.)
Maximum Taper	0.05 mm (0.002 in.)

Cylinder Bore 25 hp Engine:

Standard ID	82.99 – 83.01 mm (3.267 – 3.268 in.)
Maximum Wear Limit	83.05 mm (3.270 in.)
Maximum Out-of-Round	0.12 mm (0.005 in.)
Maximum Taper	0.05 mm (0.002 in.)

Piston 20 hp Engine:

Maximum ring groove clearance	
Top Compression Ring	0.04 – 0.08 mm (0.002 – 0.003 in.)
Middle Compression Ring	0.04 – 0.07 mm (0.002 – 0.003 in.)
Oil Control Ring	0.06 – 0.20 mm (0.002 – 0.008 in.)
Top and Center compression ring end gap	
New Bore	0.25 – 0.45 mm (0.010 – 0.018 in.)
Distance from bottom of piston skirt	
Height of piston OD measurement	6 mm (0.236 in.)
Piston OD	
New	76.967 – 76.985 mm (3.030 – 3.031 in.)
Wear Limit	76.840 mm (3.0252 in.)
Piston-to-cylinder bore clearance	0.015 – 0.058 mm (0.0006 – 0.0023 in.)
Piston Pin Bore ID	17.006 – 17.012 mm (0.6695 – 0.6698 in.)
Maximum Wear Limit	17.025 mm (0.6703 in.)
Piston Pin OD New	17.00 mm (0.669)
Maximum Wear Limit	16.99 mm (0.668)

Piston 23 and 25 hp Engines:

Maximum ring groove clearance	
Top Compression Ring	0.03 – 0.05 mm (0.001 – 0.002 in.)
Middle Compression Ring	0.02 – 0.04 mm (0.002 – 0.003 in.)
Oil Control Ring	0.03 – 0.20 mm (0.001 – 0.007 in.)
Top and Center compression ring end gap	
Used Bore (Maximum)	0.75 mm (0.030 in.)
New Bore (Maximum)	0.3 – 0.5 mm (0.012 – 0.020 in.)
Distance from bottom of piston skirt	
Height of piston OD measurement	6 mm (0.236 in.)
23 HP Piston OD	
New	79.963 – 79.979 mm (3.148 – 3.149 in.)
Wear Limit	76.831 mm (3.143 in.)
25 HP Piston OD	
New	83.05 mm (3.270 in.)
Wear Limit	82.99 mm (3.319 in.)
Piston-to-cylinder bore clearance	0.021 – 0.062 mm (0.0008 – 0.0024 in.)
Piston Pin Bore ID	17.006 – 17.012 mm (0.6695 – 0.6698 in.)
Maximum Wear Limit	17.025 mm (0.6703 in.)



Piston Pin OD 16.995 – 17.00 mm (0.6691 – 0.6693)
 Maximum Wear Limit. 16.994 mm (0.6691)

Cylinder Head

Cylinder Head Flatness (Maximum) 0.076 mm (0.003 in.)
 Valve guide ID (New) 7.04 – 7.06 mm (0.277 – 0.278 in.)
 Valve guide ID (Wear limit-Intake) 7.13 mm (0.281 in.)
 Valve guide ID (Wear limit-Exhaust) 7.16 mm (0.282 in.)
 Valve Stem-to-Valve Clearance (Intake) 0.04 – 0.08 mm (0.001 – 0.003 in.)
 Valve Stem-to-Valve Clearance (Exhaust) 0.05 – 0.09 mm (0.002 – 0.003 in.)
 Valve Guide Reamer Size
 Standard 7.05 mm (0.277 in.)
 0.25 mm Over Size 7.3 mm (0.287 in.)
 Valve Stem Diameter
 Intake. 6.982 – 7.000 mm (0.275 – 0.276 in.)
 Exhaust 6.970 – 6.988 mm (0.274 – 0.275 in.)
 Intake Valve Minimum Lift 8.07 mm (0.318 in.)
 Exhaust Valve Minimum Lift 8.07 mm (0.318 in.)
 Standard valve seating surface 0.80 mm (0.031 in.)
 Valve seat angle 44.5°
 Valve face angle 45°
 Valve Spring Squareness Tolerance 2.39 mm (0.090 in.)
 Minimum Length 41.1 mm (1.63 in.)



Governor Gear Shaft Specifications:

Height (Top of Shaft to Case) 34.0 – 33.5 mm (1.338 – 1.319 in.)
 Diameter 6.0 mm (0.236 in.)

TORQUE SPECIFICATIONS

Blower Housing and Sheet Metal

M5 Fasteners	4.0 N•m (35 lb-in.)
M6 Fasteners	6.8 N•m (60 lb-in.)
Rectifier Fasteners	4.0 N•m (35 lb-in.)

Carburetor And Intake Manifold

Intake Manifold Fasteners	9.9 N•m (88 lb-in.)
Carburetor Mounting Fasteners	9.9 N•m (88 lb-in.)
Air Cleaner Nuts	9.9 N•m (88 lb-in.)
Spark Plug Torque	24.4 – 29.8 N•m (216 – 264 lb-in.)

Connecting Rod Cap Fasteners

8 mm straight shank	22.7 N•m (200 lb-in.)
8 mm step-down	14.7 N•m (130 lb-in.)
6 mm straight shank	11.3 N•m (100 lb-in.)

Crankcase

Cover (Oil Pan) Cap Screw	24.4 N•m (216 lb-in.)
Drain Plug	13.6 N•m (120 lb-in.)
Oil Pressure Switch	4.5 N•m (40 lb-in.)
Breather Cover	7.3 N•m (65 lb-in.)
Oil Pump to Oil Pan	
First Time Installation	10.7 N•m (95 lb-in.)
All Reinstallations	6.7 N•m (60 lb-in.)

Cylinder Head

Fastener— initial torque, in sequence	20 N•m (180 lb-in.)
Fastener— final torque, in sequence	40.7 N•m (30 lb-ft)
Rocker Pivot	11.3 N•m (100 lb-in.)
Valve Cover	
With Gasket	3.4 N•m (30 lb-in.)
With O-Ring	7.9 N•m (70 lb-in.)

Flywheel

Fan Fastener	9.9 N•m (88 lb-in.)
Flywheel Retaining Screw	66.4 N•m (49 lb-ft)
Stator Mounting Screws	4.0 N•m (35 lb-in.)

Miscellaneous Fasteners

Engine Mounting Screws	32 N•m (24 lb-ft)
Drive Sheave Cap Screw to Crankshaft	115 N•m (85 lb-ft)
Fuel Pump Mounting Flange Screws	2.3 N•m (20 lb-in.)
Governor Control Lever Fastener	9.9 N•m (88 lb-in.)
Speed Control Bracket Assembly Fasteners	7.3 – 10.7 N•m (65 – 95 lb-in.)
Muffler Nuts	24.4 N•m (216 lb-in.)
Ignition Module Fastener	4.0 – 6.2 N•m (35 – 55 lb-in.)
Electric Starting Motor Mounting Screws	15.3 N•m (135 lb-in.)



THEORY OF OPERATION

GENERAL

The power plant for this unit is a air cooled four stroke two cylinder vertical shaft gasoline fueled normally aspirated engine. Fuel is provided by a pulse type fuel pump from the fuel tank to a non-adjustable carburetor. Speed is controlled by a fly-weight type governor. Ignition is provided by a capacitive discharge (CD) ignition module (20 hp engines) with fixed timing; and a capacitive discharge (CD) ignition module (25 hp engines) controlled by a electronic spark advance module (Smart Spark™). A 15 Amp regulated charging system with externally mounted rectifier regulator provides operating current. Starting is by electric starting motor. No provision is provided for manual (pull) starting.



COOLING SYSTEM

A fan, mounted on the engine flywheel, draws air through the intake screen as the engine rotates. Air flow is directed under the engine shroud and over the engine cooling fins.

It is important that the intake screen remains open for proper air flow. The engine shroud should never be altered or removed, as cooling capacity will be affected. Cylinder block and cylinder head cooling fins must remain clean and open to properly dissipate heat. Engines must never be overloaded or operated beyond the intended power range or rpm or overheating will occur.

CRANKCASE BREATHER SYSTEM

The crankcase breather assembly allows excess crankcase pressure to pass from the crankcase to the carburetor and be burned in the engine. The breather system consists of a reed valve, oil separator, and supply tube to intake manifold. A reed valve is located in each cylinder head and allows pressure out of the crankcase, but does not allowing air back in. A properly functioning reed valve maintains a partial vacuum in the crankcase. This prevents oil from being forced out of the crankcase oil seals. The oil separator is located on one of the valve covers and separates oil from the air before it enters the air cleaner.

LUBRICATION SYSTEM

The engines utilizes a fully pressurized lubrication system. A gear driven Gerotor oil pump is located in the engine sump and provides oil under pressure to all major engine components. A external spin on type

oil filter is provided to keep the oil clean. A externally mounted oil cooler is located on the blower housing for the 25 hp engines.

FUEL SYSTEM

These engines are equipped with an external mounted pulse operated fuel pump. The pumping action is created by the oscillation of positive and negative pressures within the crankcase. this pressure is transmitted to the fuel pump through a rubber hose connected between the pump and crankcase. the pumping action caused the diaphragm on the inside of the pump to pull fuel in on its downward stroke and to push it into the carburetor on its upward stroke. Two check valves prevent fuel from going backward through the pump.

CARBURETOR

Provides the correct air/fuel mixture to allow the engine to run at maximum efficiently under a wide variety of temperature and load conditions. The carburetor has a electrically operated fuel shut off solenoid mounted externally on the fuel bowl that interrupts the fuel flow to the main jet when the operator turns of the ignition switch. The carburetor contains no serviceable components.

AIR INTAKE SYSTEM OPERATION

Consists of a dual element air filter. The outer, foam, element is removable and can be cleaned and reused. the inner, paper, element is replaceable.

Air enters the air filter from the opening in the cover and is filtered. Clean air is drawn into the carburetor and the engine for combustion.

GOVERNOR OPERATION

Controls the maximum speed of the engine to a specified limit, and maintains a "set" engine speed.

Throttle valve position (and engine speed) is controlled by the engine governor. The governor lever is being acted on by two forces, in opposite directions; in one direction the pull of the throttle control lever and cable, in the other direction the centrifugal force of the governor flyweights inside the engine. The governor flyweights will always override the pull of the throttle control spring once the engine reaches maximum governed speed.

The governor gear and flyweights are located inside the crankcase and driven by the camshaft gear. As engine speed is increased, the flyweights are pushed outward by centrifugal force. As the flyweights move outward they push on the plunger, which contacts the governor arm. The governor arm passes through the crankcase housing, and has the governor lever mounted on it's end. The governor lever is connected

by a link to the throttle shaft, and will pull the throttle valve closed when the engine reaches maximum governed speed.

When operating the engine under varying loads with a fixed throttle control lever position, the governor has the effect of maintaining a constant engine speed as the load increases. This is because as the engine speed decreases because of the load, the governor flyweights move in, and the governor linkage allows the throttle valve to open, speeding up the engine. This will occur until the engine reaches maximum load, at which time the throttle is wide open.

The high idle limiter screw determines the amount of travel the throttle control lever can move, and amount of tension the governor spring can exert on the governor lever. This determines the governed high idle speed.

IGNITION

Ignition is provided by a capacitive discharge (CD) ignition module (20 hp engines) with fixed timing; and a capacitive discharge (CD) ignition module (25 hp engines) controlled by a electronic spark advance module (Smart Spark™).

Capacitance Discharge Ignition (CDI) – 21 and 23 HP Engines

As the flywheel rotates, the magnet grouping passes the input coil. The corresponding magnetic field induces energy into the input coil. The resultant pulse is rectified and charges a capacitor.

As the magnet assembly completes its pass, it activates the triggering device which causes a semiconductor switch (SCS) to turn on. With the device switch ON, the charging capacitor is directly connected across the primary coil of the output transformer.

As the capacitor discharges, the current initiates a fast rising flux field in the transformer core.

A high voltage pulse is generated from this action into the secondary winding of the transformer. This pulse is delivered to the spark plug. Ionization of fuel-air mixture in the spark plug gap occurs, resulting in an ark between the plug electrodes. This spark ignites the fuel-air mixture in the combustion chamber.

Smart Spark™ – 25 HP Engine

As the flywheel rotates, the magnet grouping passes the input coil. The corresponding magnetic field induces energy into the input coil. The resultant pulse is fed to the input of the conditioning circuit. The conditioning circuit shapes this pulse, putting it in a usable form for the additional circuits.

This pulse starts the charge pump, which charges a capacitor in a linear fashion that can be directly related to the engine speed. At the same time the pulse resets the delay circuit for length of the pulse width. The

comparator is off during this period and no output is generated. As soon as the original pulse drops back to zero (magnet clearing the coil), the capacitor in the delay circuit begins to charge.

When the charge on the delay capacitor exceeds the charge on the charge pump capacitor the comparator changes state, activating the pulse generator. This pulse turn "ON" the CD ignition module semiconductor. Energy is then transferred to the primary of the output transformer. As the capacitor discharges, the current initiates a fast rising flux field in the transformer core.

A high voltage pulse is generated from this action into the secondary winding of the transformer. This pulse is delivered to the spark plug. Ionization of fuel-air mixture in the spark plug gap occurs, resulting in an ark between the plug electrodes. This spark ignites the fuel-air mixture in the combustion chamber. As the trigger pulse is generated, all associated circuits are reset, their capacitors discharged. The longer it takes the delay circuit to surpass the charge pump capacitor voltage, the later the trigger pulse will occur, retarding the timing accordingly.

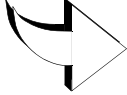



ENGINE TROUBLESHOOTING CHART



Problem or Symptom 	Check or Solution 											
	Engine cranks but will not start	Engine won't stay running or runs rough	Engine stalls frequently	Engine backfires	Engine surges—has uneven rpm	Engine misses	Engine has low power under load	Engine has no spark	Exhaust smoke black, engine floods	Exhaust smoke blue or uses oil	Engine overheats	Excessive engine noise or vibration
Spark Plug Fouled, Or Gap Not Correct. Wrong Spark Plug	●	●	●	●		●	●				●	
Spark Advance Module Ground Wire Shorted To Ground	●	●	●	●	●	●	●	●				
Low Voltage Supply to Spark Advance Module	●	●	●			●	●	●				
Ignition Module Bad	●	●	●	●	●	●	●	●				
Tank Outlet Screen or Fuel Line Restricted. Fuel Stale, Contains Water, or Wrong Type	●	●	●	●	●	●	●				●	
Air filter element plugged, oil soaked, or restricted	●	●	●		●	●	●		●	●		●
Choke, or Governor Linkage Worn or out of adjustment	●	●	●		●	●	●		●		●	●
Carburetor Dirty or Shafts Worn	●	●	●	●	●		●		●		●	●
Carburetor, Intake Manifold, or Cylinder Head Gaskets Leaking	●	●	●	●	●	●	●				●	●
Low Compression from Worn Piston, Rings, Cylinder, Valves or Warped Head	●	●	●		●	●	●				●	●
Valve Clearance Incorrect. Burned or Warped Valves and Seats. Defective Springs	●	●	●	●	●	●	●		●		●	●
Engine Oil Type or Level Wrong	●						●			●	●	●
Engine Gaskets or Seals Leaking	●	●	●	●	●	●	●			●	●	
Crankcase Breather Restricted, Reed Valve Damaged, Clearance Incorrect, or Drain Hole Plugged					●	●	●			●		●
Valve Guides or Stems Worn				●		●				●	●	
Worn, Stuck, Broken Piston Rings. Cylinder Worn. Check Compression and Vacuum	●	●	●	●	●	●	●		●	●	●	●
Connecting Rod/Crankshaft Worn												●
Engine Mounting Hardware Loose, Broken, or Missing												●

CARBURETOR TROUBLESHOOTING CHART

  Problem or Symptom	Hard Starting	Fuel Leak at Carburetor	Engine Floods	Will Not Idle	Rich Idle	Hunts / Erratic Idle	Idles Fast—Won't Adjust	Will Not Accelerate	Over Rich Acceleration	Hesitates	Will Not Run At High Speed	Low Power	Hunts at High Speed	Runs With High speed needle Closed	Engine Over Speeds
Plugged Air Filter	●		●	●	●			●	●	●	●	●		●	
Leaky Manifold Gasket	●			●		●	●			●			●		●
Throttle / Choke Shaft Worn	●			●		●	●			●		●	●		●
Choke Not Closing	●			●				●		●	●	●	●		
Choke Not Opening	●		●	●	●			●	●	●	●	●	●	●	
Plugged Bowl Vent				●		●		●		●	●	●	●		
Air Bleed Restricted				●		●		●		●	●	●	●		
Leaky Bowl Gasket		●											●		
Plugged Tank Filter Screen Or Cap Vent	●			●				●		●	●	●			
Fuel Pump Not Providing Enough Fuel	●			●				●		●	●	●			
Incorrect Float Height	●	●	●	●	●	●		●	●	●	●	●	●	●	
Main Nozzle Restricted	●					●		●	●		●	●	●		
Dirty or Stuck Float Needle and Seat	●	●	●	●	●	●		●	●	●	●	●	●	●	
Fuel Inlet Plugged	●			●				●		●	●	●			
Adjust Governor Linkage															●



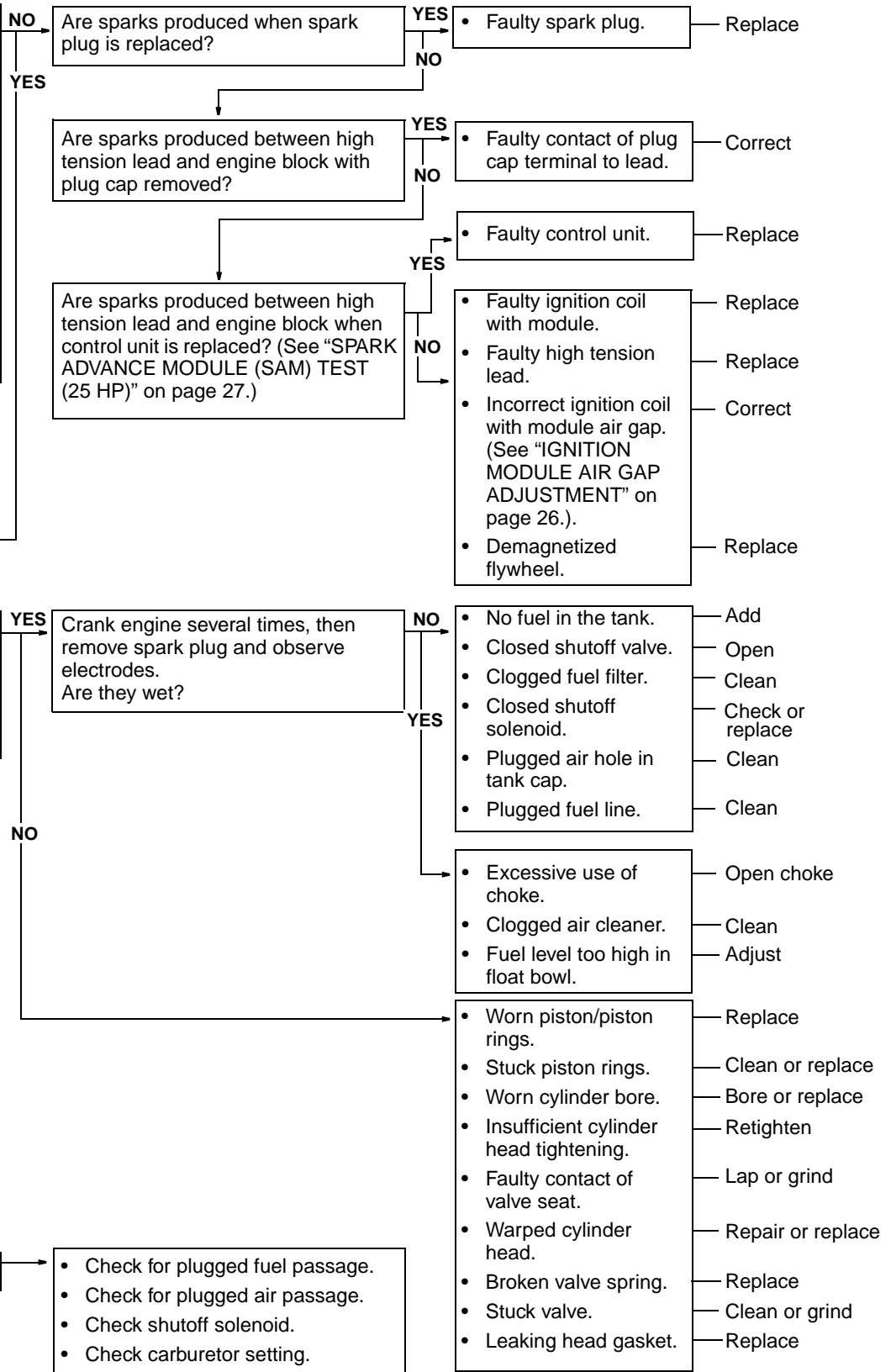
ENGINE TROUBLESHOOTING GUIDE

ENGINE HARD TO START



Remove spark plug and check spark by cranking engine while having the plug grounded against engine block. Install spare plug to avoid fuel spitting from the hole. (See "SPARK TEST" on page 24.)

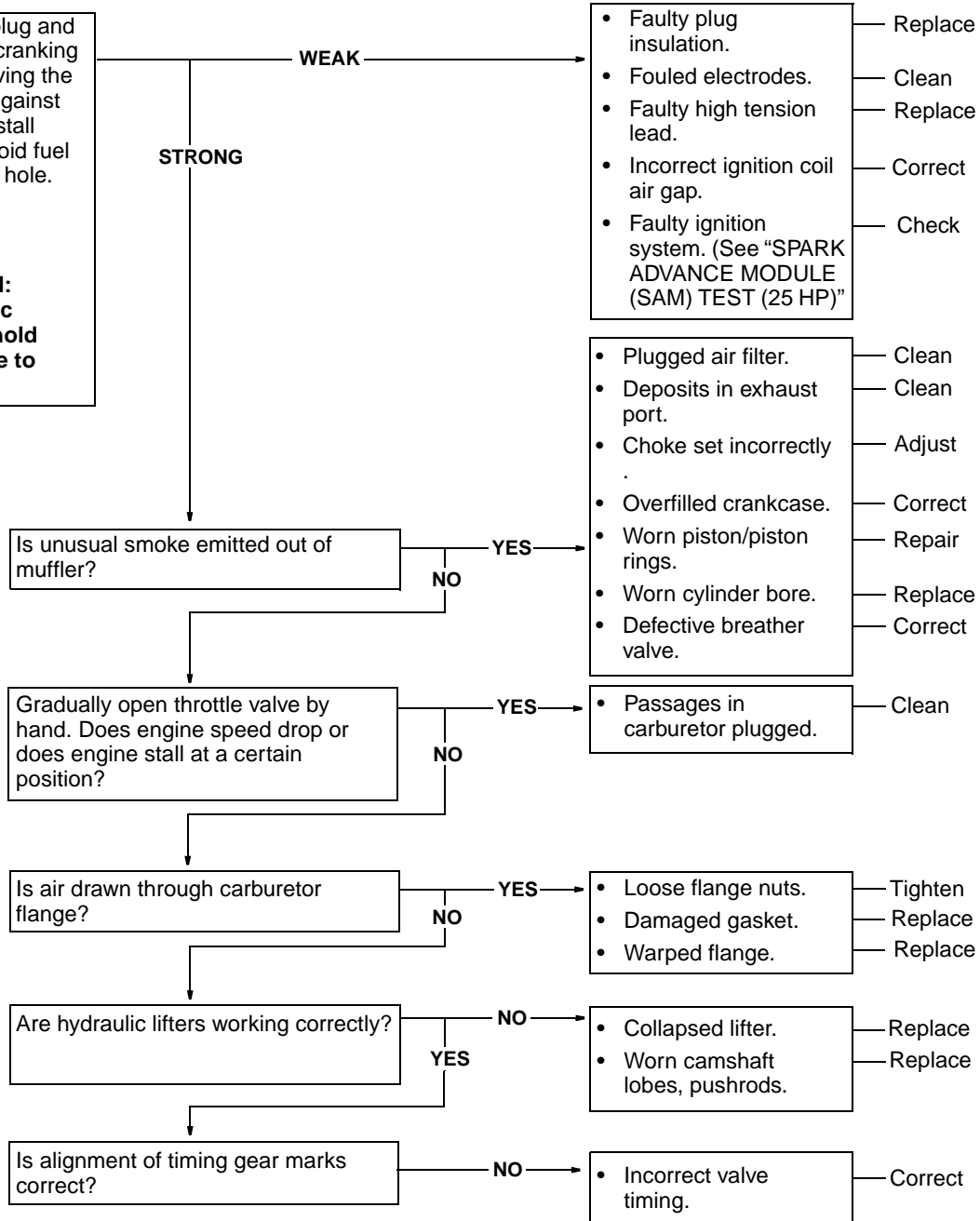
CAUTION:
To avoid electric shock, do not hold plug. Make sure to hold plug cap.



ENGINE MALFUNCTIONS AT LOW SPEED

Remove spark plug and check spark by cranking engine while having the plug grounded against engine block. Install spare plug to avoid fuel spitting from the hole.

CAUTION:
To avoid electric shock, do not hold plug. Make sure to hold plug cap.



ENGINE RUNS ERRATICALLY



Problem in fuel system (lack of fuel).

- Fuel pump not functioning. (See "FUEL PUMP TEST" on page 24.).
- Dust or water in fuel pipe or fuel filter.
- Air or vapor lock in fuel line.
- Plugged air vent in fuel tank cap.
- Plugged air/fuel passages in carburetor.
- Too little opening of carburetor pilot air screw.

- Test
- Clean
- Remove
- Clean
- Clean
- Correct

Problem in governor system.

- Incorrect governor linkage adjustment. (See "GOVERNOR ADJUSTMENT" on page 16.).
- Faulty governor spring.
- Governor gear assembly malfunction.

- Correct
- Replace
- Check

Engine knocks.

- Stale fuel.
- Excessive carbon deposit in engine.
- Excessive engine load.
- Engine overheating.

- Change
- Clean
- Adjust
- See **Has Low Power**

OIL CONSUMPTION IS EXCESSIVE

Is compression sufficient? (See "CYLINDER COMPRESSION PRESSURE TEST" on page 19.)

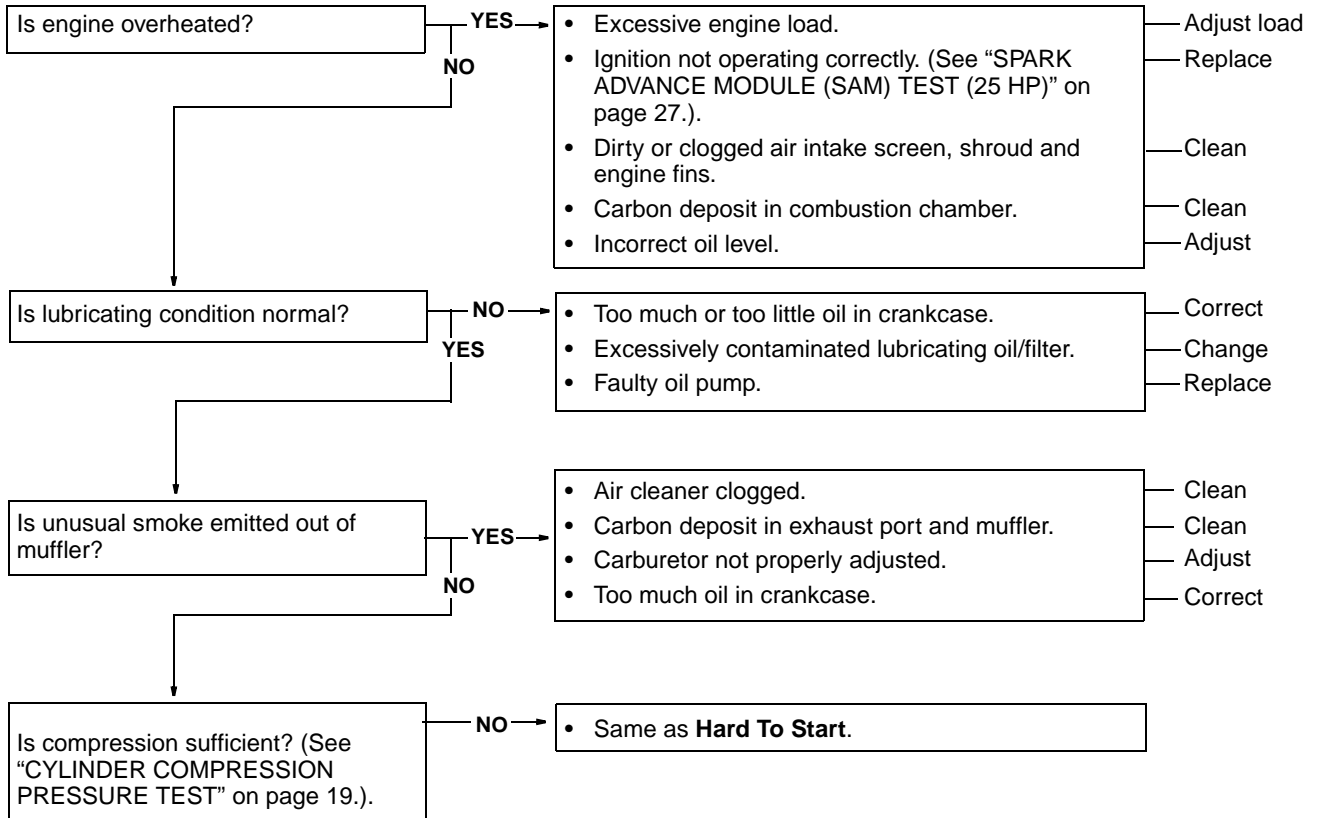
YES
NO

- Plugged oil ring groove.
- High oil level.
- Worn valve stems and valve guides.
- Oil leakage along
- Governor Shaft Oil seals leaking.
- Head gasket leaking.
- Drain plug leaking.
- Breather valve clogged.
- Drainback hole in tappet chamber plugged.
- Incorrect oil viscosity.

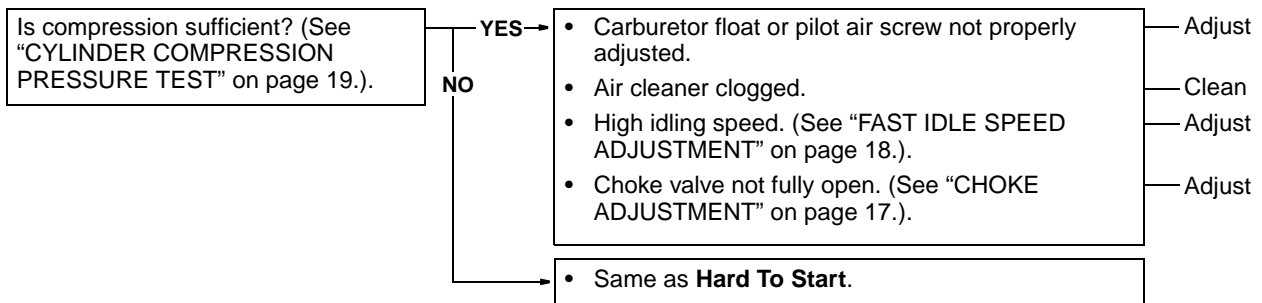
- Clean
- Adjust
- Replace
- Replace
- Replace
- Replace
- Retighten or replace
- Clean
- Clean
- Change

• Same as **Hard To Start**.

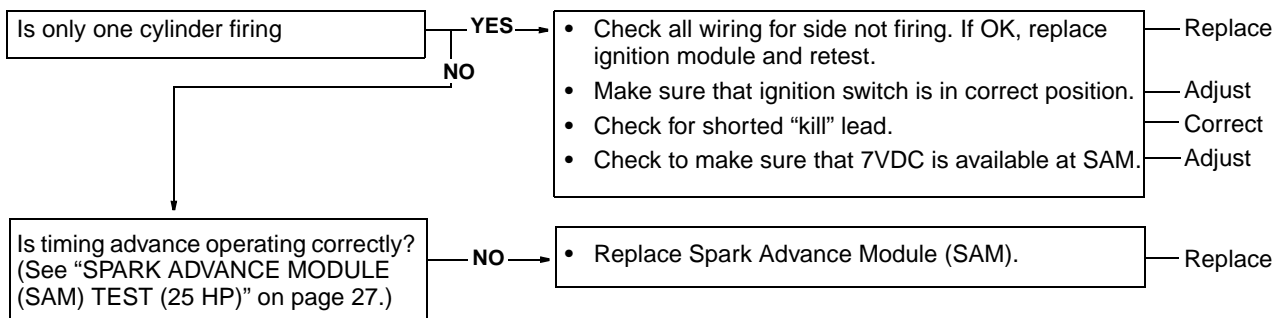
ENGINE HAS LOW POWER



FUEL CONSUMPTION IS EXCESSIVE



IGNITION SYSTEM



TESTS AND ADJUSTMENTS

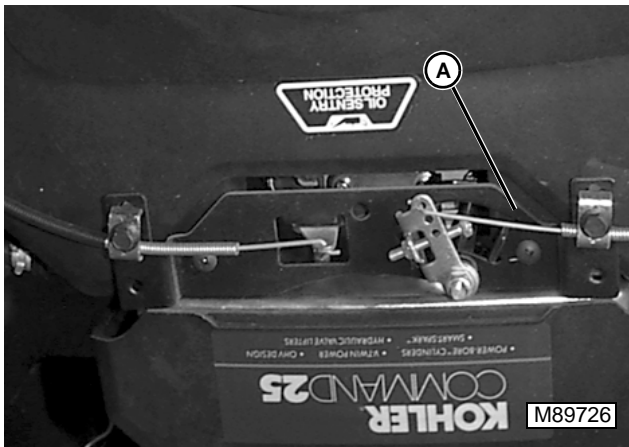
GOVERNOR ADJUSTMENT

Reason:

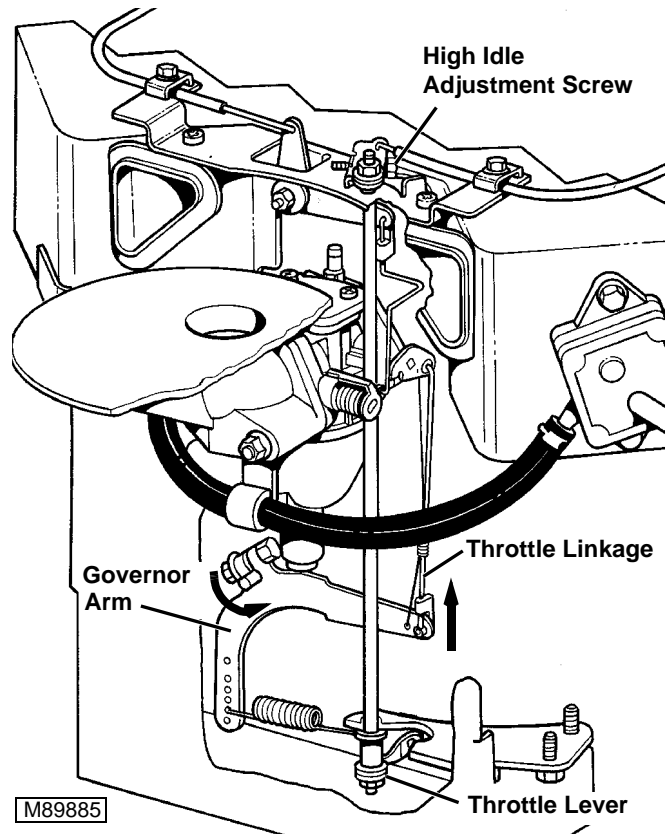
To make sure the governor is operating correctly.

Initial Adjustment:

1. Park tractor and engage parking brake.
2. Disconnect headlight wiring harness and remove hood.



3. Loosen the throttle cable clamp (A) enough to allow the throttle cable to slide freely through the clamp.
4. Move throttle control lever, on the operators control panel, to FAST idle position. A solid "detent" should be felt to assure that the control lever is in the FAST idle position.
5. Rotate fast idle control arm until fast idle screw head contacts fast idle stop. Clamp throttle cable in this position.



6. Make sure the throttle linkage is connected to the governor arm and the throttle lever on the carburetor.
7. Loosen the nut holding the governor arm to the governor shaft. Move the governor arm towards the carburetor as far as it will move and hold.
8. Insert a pin or small punch into the hole on the governor shaft and rotate the shaft counterclockwise as far as it will turn, then tighten nut. Remove the pin or punch.
9. Replace air filter backing plate.

⚠ CAUTION

DO NOT run engine without replacing air filter backing plate, or using nuts to secure carburetor to manifold!

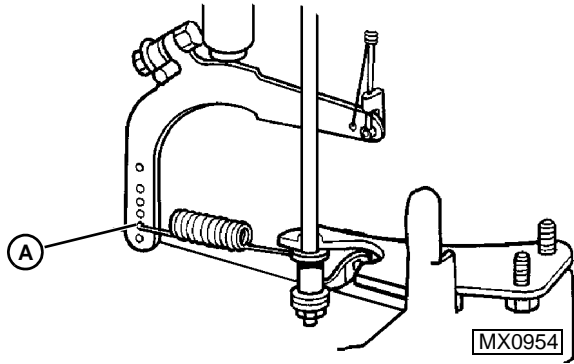
10. Start engine and use fast idle screw to adjust fast idle to specification.

Specification:

All Engines 3350 ±75 rpm

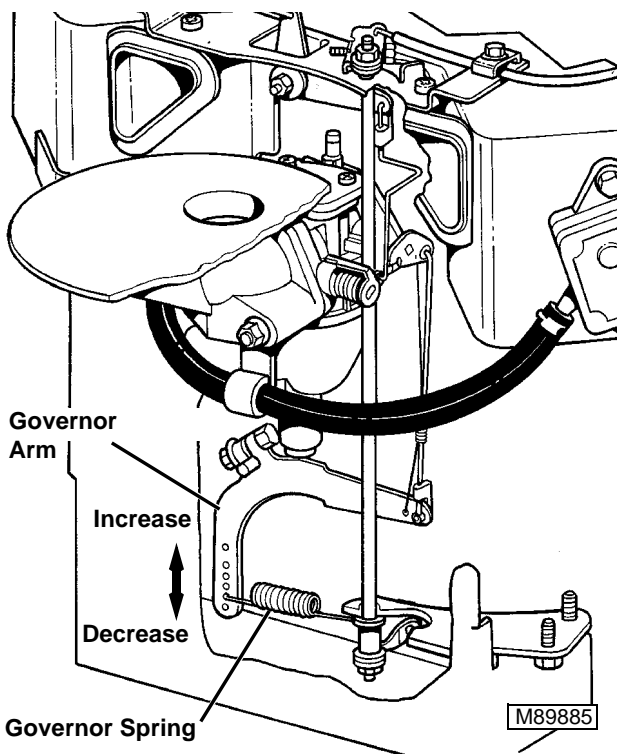
11. Perform sensitivity adjustment.

Governor Spring Settings:



High Idle RPM	Hole	Spring Color Code
3350 ± 75	A	Silver

Sensitivity Adjustment:



Governor sensitivity is adjusted by repositioning the governor spring in the holes on the governor arm. If speed surging occurs with a change in engine load the governor is set to sensitive. If a big drop in speed occurs when normal load is applied, the governor should be set for greater sensitivity follows:

- To INCREASE sensitivity - move the spring closer to the governor lever pivot point.
- To DECREASE sensitivity - move the spring further from the governor lever pivot point.

Readjust fast idle to specification.

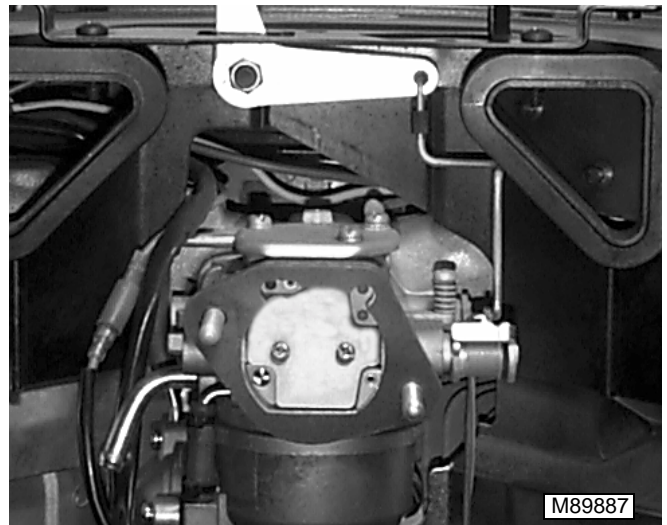
CHOKE ADJUSTMENT

Reason:

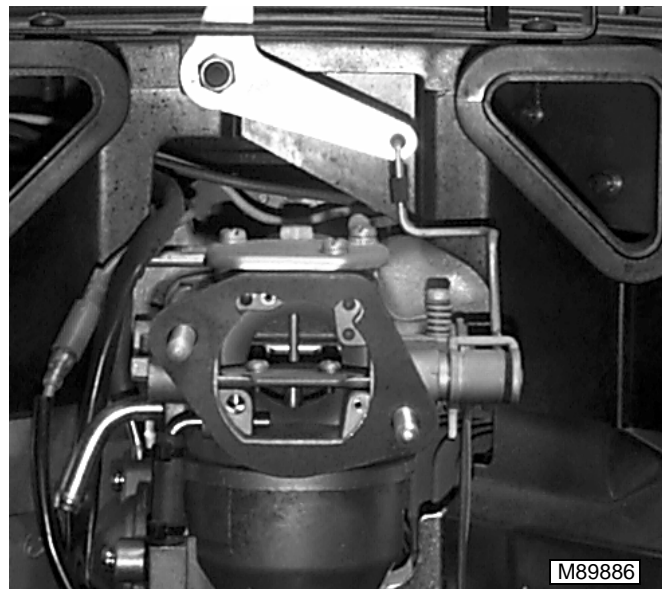
To make sure that the choke plate is fully closed when the choke control is retracted and fully open when choke control is fully depressed.

Test Procedure:

1. Park tractor and set parking brake.
2. Disconnect headlight wiring harness and remove hood.
3. Remove air cleaner.



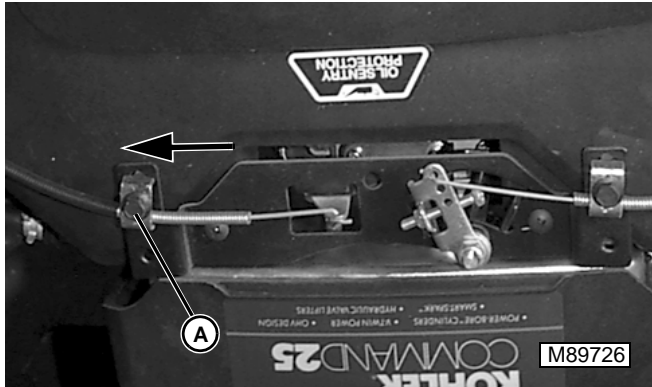
4. Retract choke lever, on operators control panel, to full CHOKE ON position.
5. Look in carburetor to make sure that choke is closed.



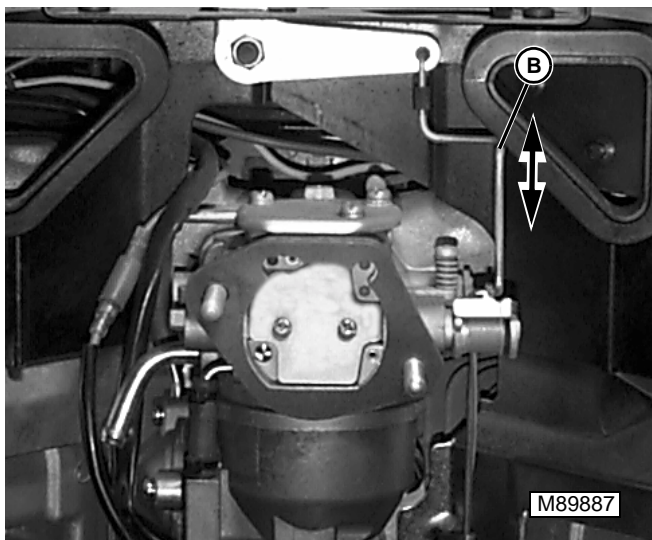
6. Depress choke lever, on operators control panel, to full CHOKE OFF position.
7. Look in carburetor to make sure that choke is fully open.

Adjustment Procedure:

1. Depress choke lever, on operators control panel, to full CHOKE OFF position.



2. Loosen screw (A) securing choke cable and slide cable away from engine as far as it will go. Tighten screw.
3. Look in carburetor to make sure that choke is fully open. If not, inspect linkage and choke plate for damage, replace parts as required.



4. Retract choke lever, on operators control panel, to full CHOKE ON position.
5. Look in carburetor to make sure that choke is closed. If not, slightly bend choke linkage (B) slightly until choke is closed. DO NOT overbend.
6. Re-check open position.

FAST IDLE SPEED ADJUSTMENT

Reason:

To set engine FAST idle speed.

Equipment:

- JT07270 Digital Pulse Tachometer

Procedure:

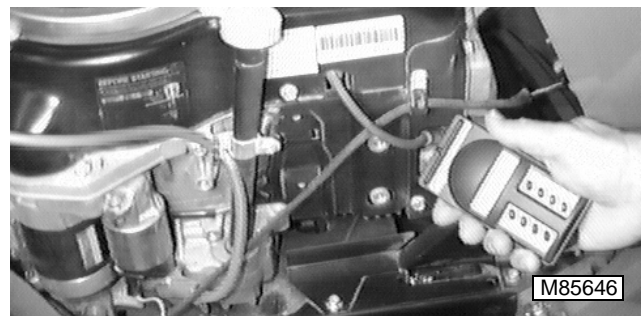
1. Park machine on level surface.
2. Turn key switch OFF.
3. Disconnect headlight wiring harness and remove hood.
4. Start and run engine at MEDIUM idle for 5 minutes to warm engine to normal operating temperature.



CAUTION

Engine will be HOT. Be careful not to burn hands.

5. Move throttle control lever to FAST idle position.



6. Use a JT07270 Digital Pulse Tachometer at spark plug wire to set engine FAST idle speed at specification.

Specification:

Specification:

All Engines 3350 ±75 rpm

Results:

If FAST idle speed DOES NOT meet specifications:

- Use fast idle screw to adjust fast idle to **3350 rpm ±75 rpm**.

SLOW IDLE SPEED ADJUSTMENT

Reason:

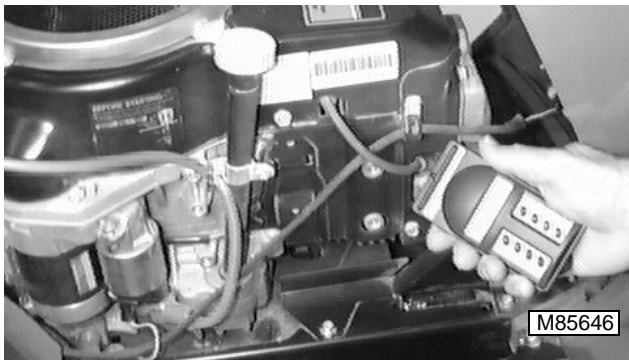
To set engine SLOW idle speed.

Equipment:

- JT07270 Digital Pulse Tachometer

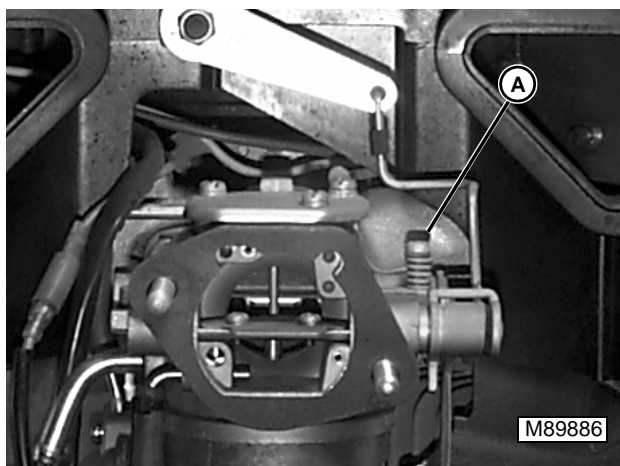
Procedure (All Engines):

1. Park machine on level surface.
2. Turn key switch OFF.
3. Disconnect headlight wiring harness and remove hood.
4. Start and run engine at MEDIUM idle for five minutes to warm engine to normal operating temperature.
5. Move throttle control lever to SLOW idle position.



6. Use a JT07270 Digital Pulse Tachometer at the spark plug wire to check engine rpm.

NOTE: Do not remove the air intake filter. Filter shown removed for clarity.



7. Adjust carburetor SLOW idle stop screw (A) to set carburetor SLOW idle speed to specification.

Specification:

- 20 hp 1200 ±75 rpm
- 23 and 25 hp 1700 ±75 rpm

Procedure for Slow Idle Mixture (20 HP Only):



1. Turn the slow idle fuel mixture screw (B) in (slowly) until engine speed decreases and then back out approximately 3/4 turn to obtain the best slow idle speed performance.
2. Recheck the slow idle speed using a Digital Pulse Tachometer at the spark plug wire. Readjust slow idle stop screw as necessary to obtain slow idle speed of 1200 ±75 rpm.

CYLINDER COMPRESSION PRESSURE TEST

Reason:

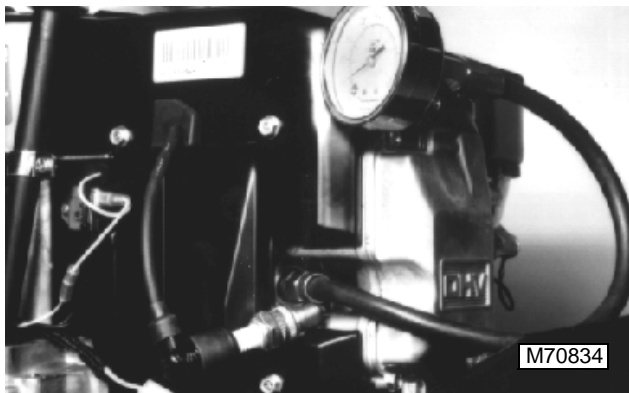
To determine if the engine is developing adequate cylinder compression.

Test Equipment:

- JDM59 Compression Gauge
- JDM-74A-5 Ignition Test Plug

Procedure:

1. Park machine on level surface and turn key switch OFF.
2. Raise or remove (optional) engine hood.



IMPORTANT: Spark Plug wire must be grounded or electronic ignition could be damaged.

3. Remove BOTH spark plugs and ground spark plug leads to engine using JDM-74A-5 Ignition Test Plug.
4. Install JDM59 Compression Gauge.
5. Move throttle control lever to FAST idle position – throttle and choke plates must be fully open to obtain an accurate reading.

IMPORTANT: DO NOT overheat starting motor during test. Starter duty cycle is 5 seconds ON, 10 seconds OFF. Battery must be at a full state of charge to perform test. Charge battery first, if necessary.

6. Crank engine until gauge needle settles out at its highest position.
7. Record pressure reading. **Minimum compression should be 1125 kPa (160 psi).**

Results:

- If compression is **below** minimum specification, perform cylinder leak test to better determine the state of engines condition.

CYLINDER LEAK TEST

Required Tools:

- JTO3502 Cylinder Leak Tester
- Breaker Bar & 30 mm Socket

NOTE: If the directions that come with the tester being used are different than the following, use the directions that came with the tester.

1. The engine should be run for at least 5 minutes to bring the engine to operating temperature.

CAUTION

With spark plugs removed, the magnetos must be grounded to the engine to prevent a spark that could ignite anything combustible.

2. Remove BOTH spark plugs and ground spark plug leads to engine using JDM-74A-5 Ignition Test Plug.

IMPORTANT: The piston must be positioned at Top Dead Center (TDC) to ensure that the intake valves are away from the compression relief balls. If not, the intake valve will be open and the leak test will be invalid.

3. Remove valve covers.
4. Turn crankshaft until piston is at Top Dead Center (TDC), on the compression stroke (Both Valves Closed).
5. Screw the adaptor into the spark plug hole but do not attach it to the tester at this time.



6. Pull back the locking ring and rotate the regulator knob fully counterclockwise. Connect an air line to the tester.

IMPORTANT: The air supply must have enough supply pressure to calibrate the tester (Usually 85 – 95 psi).

7. Pull back the locking ring and rotate the regulator knob clockwise until the gauge needle rests in the SET range of the gauge. Push the locking ring towards the tester to lock it.



8. Connect the adaptor hose to the tester and record the needle position while holding the flywheel in position with a breaker bar.

NOTE: A small amount of air escaping from the crankcase breather is normal.

Results:

- Excessive air escaping from the crankcase breather indicates worn piston rings or cylinder wall
- Air escaping from the carburetor indicates a worn intake valve or seat
- Air escaping from the exhaust pipe indicates a worn exhaust valve or seat
- Gauge reading in the Green (low) area indicates good compression. (Less Than 25% Is Considered Normal)
- Gauge reading in the Yellow (Moderate) area indicates borderline compression. The engine is still usable but an overhaul or replacement should be considered
- Gauge reading in the Red (High) area indicates excessive compression loss and engine reconditioning or replacement is necessary

FUEL SHUTOFF SOLENOID TEST

Reason:

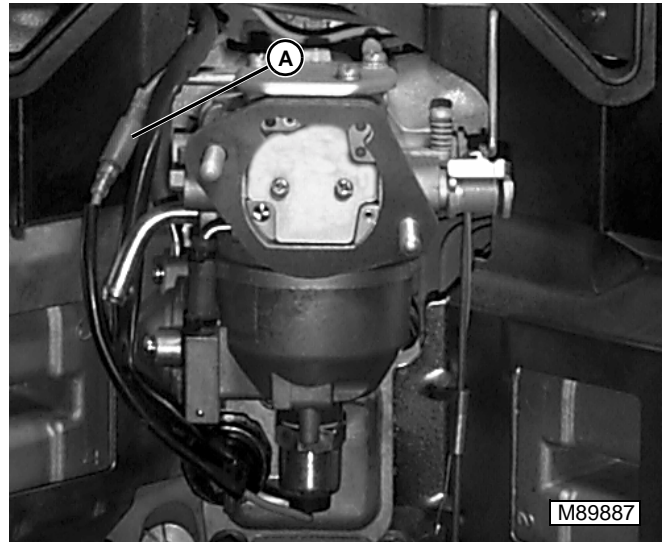
To test proper operation of fuel shutoff solenoid.

Required Tools:

- Jumper wire

Procedure:

1. Remove air cleaner assembly, and base.



2. Listen for an audible click from solenoid when ignition switch is turned from OFF to ON.

NOTE: If battery voltage drops below 9 volts when cranking engine or while engine is running, the solenoid will not function.

Results:

- If solenoid clicks, solenoid is good and vehicle wiring is good.
- If solenoid does not click, solenoid could be bad or problem could be in equipment wiring. Proceed with following tests:
 1. Disconnect solenoid wire at connector (A).
 2. Momentarily place a jumper wire from solenoid wire to battery positive terminal.
 3. If solenoid now clicks, the solenoid is working properly.

Results:

- If solenoid does not perform properly, replace solenoid.
- If solenoid activates when jumpered, but not when connected to the vehicle wire harness, repair wire harness. (See ELECTRICAL Section.)

CRANKCASE VACUUM TEST

Reason:

To measure the amount of crankcase vacuum, which ensures the crankcase is not pressurized. A pressurized crankcase will force oil past the seals and gaskets and through the breather into the carburetor.

**Thank you very much
for your reading.**

Please Click Here

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Information.**