110 and 112 Lawn and Garden Tractors Serial No. (100,001 - 250,000)

JOHN DEERE

SERVICE MANUAL

110 and 112 Lawn and Garden Tractors
Serial No. (100,001 - 250,000)

SM2088 (01NOV69) English

John Deere
Lawn & Grounds Care Division
SM2088 (01NOV69)

LITHO IN U.S.A.
ENGLISH

Service Manual
110 AND 112 LAWN AND GARDEN TRACTORS
(Serial No. 100,001-)

CONTENTS

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INTRODUCTION

Service Manual

This service manual contains service and maintenance information for John Deere 110 and 112 Lawn and Garden Tractors (Serial No. 100,001-).

The manual is divided into sections. Each section pertains to a certain component or operational system of the tractor. The information is divided into groups within each section.

Emphasis is placed on diagnosing malfunctions, analysis and testing. Diagnosing malfunctions includes possible troubles, their causes and how to correct them. Under specific components these troubles are analyzed to help you understand what is causing the problem. In this way, you can eliminate the cause rather than just replace parts and have the same problem keep recurring.

Specifications and special tools are found at the end of the Groups for easy reference.

This manual can be kept in its own cover, or it can be removed and filed in your service manual rack or placed behind the service manual tab in your Lawn and Garden Parts and Service Binder.

Whenever new or revised pages are provided, insert them into your manual as soon as you receive them. Your service manual will always be up-to-date and be a valuable asset in your service department.

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Section 10
GENERAL

Group 5
TRACTOR IDENTIFICATION

TABLE OF CONTENTS

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SERIAL NUMBERS

Each lawn and garden tractor is assigned an individual serial number. Serial numbers are written in parentheses throughout this manual for the reasons shown below. All serial number references are tractor serial numbers and not engine specification numbers.

(0000-) When a serial number appears before the dash, the design change was introduced beginning with that serial number and is still current.

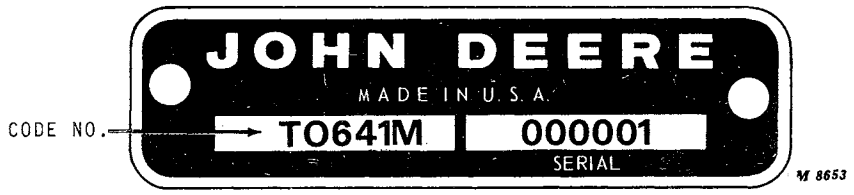
(-0000) When a serial number appears after the dash, the design change was effective up to and including that serial number and is no longer effective.

(0000-0000) When a serial number appears both before and after the dash, the design change was effective with the first serial number, but is no longer effective after the second serial number.

VINTAGE INFORMATION

Year Manufactured	110 Tractor Tractor Serial No.	112 Tractor Tecumseh Tractor Serial No.	112 Tractor Kohler Tractor Serial No.
1968	(100,001-130,000)	(100,001-130,000)	
1969	(130,001-150,000)	(130,001-150,000)	(150,001-160,000)
1970	(160,001-185,000)	(160,001-180,000)	(160,001-225,000)
1971	(185,001-)	(185,001-)	(225,001-)

SERIAL NUMBER PLATE



IDENTIFICATION CODES

The tractor identification code is indicated on tractor serial number plates. See the chart below for tractor identification codes.

Tractor	Manual Lift	Hydraulic Lift	Code No.
110	X		0641M
110		X	0647M
112 (Tecumseh)	X		0651M
112 (Tecumseh)		X	0657M
112 (Kohler)	X		0652M
112 (Kohler)		X	0653M

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Group 10
SPECIFICATIONS

ENGINE SPECIFICATIONS

	110 Tractors	112 Tractors (Tecumseh)	112 Tractors (Kohler)
MODELS			
Manual Lift	110	112	112
Hydraulic Lift	110H	112H	112H
ENGINE			
Manufacturer	Kohler	Tecumseh	Kohler
Model	K 181 S	HH 100	K 241 AS
Cylinders	One	One	One
Cycle	4	4	4
Bore and Stroke	2.94 x 2.75 in.	3.31 x 2.75 in.	3.25 x 2.875 in.
Displacement	18.63 cu. in.	23.75 cu. in.	23.9 cu. in.
Speeds (Fast)	1800-3800 rpm	1800-3800 rpm	1800-3800 rpm
Speeds (Idle)	1200-1700 rpm	1200-1700 rpm	1200-1700 rpm
Horsepower (Engine Manufacturers' Rating)*	8 @ 3600 rpm (*)	10 @ 3600 rpm (*)	10 @ 3600 rpm (*)
Normal Compression	110-120 psi	110-120 psi	110-120 psi
Valve Clearance (intake) cold	0.007 in.	0.010 in.	0.010 in.
Valve Clearance (exhaust) cold	0.016 in.	0.020 in.	0.020 in.
FILTERS			
Air	Dry Filter	Dry Filter	Dry Filter
Gasoline	In-Line Strainer	In-Line Strainer	In-Line Strainer

ELECTRICAL SYSTEM

Battery	12 Volt	12 Volt	12 Volt
Ignition	Magneto	Solid State (* *)	Battery-Coil
Spark Plug Gap	0.025 in.	0.030 in.	0.020 in.
Breaker Point Gap	0.020 in.	Not required (* *)	0.020 in.
Trigger Air Gap	Not required	0.006-0.010 in.	Not required
Charging System	Alternator w/Rectifier	Alternator w/Rectifier	Alternator w/Rectifier
Starter	12 Volt Motor w/Gear Drive	12 Volt Motor w/Gear Drive	12 Volt Motor w/Gear Drive

* *The horsepower ratings shown are established by the engine manufacturer in accordance with standard internal combustion engine institute procedure. They are corrected to 60°F. and 29.9 in. on a mercury barometer and are developed from laboratory test engines equipped with standard air cleaner and muffler.*

* * *Battery-coil ignition beginning with Serial No. 161,772. Breaker point gap 0.020 inch.*

CAPACITIES

Cavities	110 Tractors	112 Tractors (Tecumseh)	112 Tractors (Kohler)
Fuel Tank - U.S. Gallons	1.75	1.75	1.75
Crankcase - U.S. Pints	2.5	2.5 (* * *)	3.0
Transaxle - U.S. Pints	3.5	3.5	3.5
Hydraulic Lift System - U.S. Pints	2.5	2.5	2.0

* * * *3 U.S. pints beginning with Serial No. 161,772.*

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FUEL AND LUBRICANTS

Fuel	Regular Gasoline
Crankcase Lubricant	AM30730 Summer (SAE 30)
	AM30710 Winter (SAE 5W-20)
Transmission Lubricant	AM30200M Lubricant
Hydraulic System	Automatic Transmission Fluid—Type A

TRANSMISSION AND AXLE

TRANSMISSION	
Type	Transaxle
Gear Selections	4 Forward—1 Reverse
TRAVEL SPEEDS (@ 3600 RPM Engine Speed)	
1st Gear	Variable, .4 to 1.0 mph
2nd Gear	Variable, 1.3 to 2.9 mph
3rd Gear	Variable, 2.4 to 5.0 mph
4th Gear	Variable, 3.4 to 7.4 mph
Reverse	Variable, 1.8 to 3.3 mph

BRAKES, CLUTCH AND STEERING

BRAKES	
Type	Drum and shoe, Pedal Operated
Parking	Hand Lock to Foot Brake
CLUTCH	V-Belt System
STEERING	Enclosed Gear
WHEEL BEARINGS	
Front	Tapered Roller
Rear	Sealed Ball

CURB WEIGHTS

	110 Tractor	112 Tractor (Tecumseh)	112 Tractor (Kohler)
Manual Lift—High Flotation Tires (GT-3)	613 lbs.	624 lbs.	640 lbs.
Hydraulic Lift—High Flotation Tires (GT-3)	625 lbs.	636 lbs.	660 lbs.

NOTE: See specific sections for detailed specifications

TIRE SPECIFICATIONS AND TRACTOR DIMENSIONS

	110 Tractor Only	110 and 112 Tractors		
	All Purpose Tires (GT-1)	**High-Flotation Tires (GT-3)**	**Traction Tires (GT-4)**	**High-Flotation Tires (GT-5)**
WHEEL TREAD				
Front	29 in.	30 in.	29 in.	30 in.
Rear	27 or 33 in.	27 or 33 in.	27 or 33 in.	28-1/2 or 31 in.
TIRE SIZES				
Front	4.80/4.00-8, 2-ply	16x6.50-8, 2-ply	4.80/4.00-8, 4-ply	16x6.50-8, 2-ply
Rear	6-12, 2-ply	23x8.50-12, 2-ply	23x8.50-12, 2-ply	23x10.50-12, 2-ply
TIRE INFLATION*				
Front	12 to 30 psi	6 to 16 psi	12 to 40 psi	6 to 16 psi
Rear	6 to 12 psi	5 to 10 psi	5 to 10 psi	5 to 10 psi
DIMENSIONS				
Wheel Base	46 in.	46 in.	46 in.	46 in.
Over-all Length	66-3/4 in.	66-3/4 in.	66-3/4 in.	66-3/4 in.
Over-all Height	41 in.	41 in.	41 in.	41 in.
Over-all Width				
(min)	34-1/2 in.	37 in.	35 in.	39 in.
(max)	39 in.	41-1/2 in.	41-1/2 in.	41-1/2 in.
Turns Outside	36 in. radius	34 in. radius	34 in. radius	33 in. radius

* *Inflation will vary with attachment used.*

NOTE: GT-6 Tire Specifications are the same as GT-3 Front and GT-4 Rear Specifications.

GT-7 Tire Specifications are the same as GT-4 Front and GT-5 Rear Specifications

BOLT TORQUE CHART

Grade of Bolt		SAE-2	SAE-5	SAE-8	
Min. Tensile Strength		64,000 PSI	105,000 PSI	150,000 PSI	
Grade Marking on Bolt					Socket or Wrench Size
U.S. Standard		TORQUE IN FOOT POUNDS			U.S. Regular
Bolt Dia.	U.S. Dec. Equiv.				Bolt Head / Nut
1/4	.250	6	10	14	7/16 / 7/16
5/16	.3125	13	20	30	1/2 / 1/2
3/8	.375	23	35	50	9/16 / 9/16
7/16	.4375	35	55	80	5/8 / 11/16
1/2	.500	55	85	120	3/4 / 3/4
9/16	.5625	75	130	175	13/16 / 7/8
5/8	.625	105	170	240	15/16 / 15/16
3/4	.750	185	300	425	1-1/8 / 1-1/8
7/8	.875	* 160	445	685	1-5/16 / 1-5/16
1	1.000	250	670	1030	1-1/2 / 1-1/2

Multiply Readings by 12 for inch pound values.

** "B" Grade bolts larger than 3/4-inch are sometimes formed hot rather than cold which accounts for the lower recommended torque.*

NOTE: Allow a tolerance of plus or minus 10% on all torques given in this chart.

SET SCREW SEATING TORQUE CHART

Screw Size	Cup Point	Square Head
	Torque in Inch Pounds	
#5	9	--
#6	9	--
#8	20	--
#10	33	--
1/4	87	212
5/16	165	420
3/8	290	830
7/16	430	--
1/2	620	2100
9/16	620	--
5/8	1225	4250
3/4	2125	7700

Divide Readings by 12 for foot pound values
NOTE: Allow a tolerance of plus or minus 10% on all torques given in this chart.

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Group 15
TUNE-UP AND ADJUSTMENT

PRELIMINARY ENGINE TESTING

Operation	Specification	Reference
Cylinder compression	110-120 psi (1000 rpm)	Section 20, Group 5 or 25
Crankcase vacuum	5-10 inches of water column	Section 20, Group 5 or 25

MINOR TUNE-UP GUIDE

Operation	Specification	Reference
Change oil	Summer above 32° F.— SAE 30 (AM 30730) Winter below 32° F— SAE 5W-20 (AM 30710)	Section 10, Group 20
Clean and regap spark plug	Clean electrodes and insulator. Replace gasket Set spark gap at 0.025 in. 110 tractor; 0.030 in. 112 tractor w/Tecumseh engine; 0.020 in. 112 tractor w/Kohler engine	Section 40, Group 15 or 20
Remove air cleaner, inspect and replace if dirty or clogged.	Air cleaner must be clean. (No air flow specifications available.)	Section 30, Group 15
Adjust carburetor	High speed mixture needle Idle mixture needle	Section 30, Group 10
Adjust governor speed	Speed (fast)— 3800 rpm no load; Speed (idle)— 1200-1700 rpm	Section 20, Group 20 or 40
Check and clean fuel tank and fuel shut off strainer.	Regular gasoline only	Section 30, Group 20
Battery hydrometer test	1.260-1.280 sp. gr. 100% charged at 80° F.	Section 40, Group 10

MAJOR TUNE-UP GUIDE

IMPORTANT: Major tune-up should include all items listed for "Minor Tune-Up" on page 15-1 in addition to the following:

Operation	Specification	Reference
Recondition carburetor	Install carburetor kit	Section 30, Group 10
Inspect and clean breather assembly	Replace parts as necessary Install new gaskets. Check crankcase vacuum after assembly	Section 20, Group 10 0r 30
Remove shrouding, clean engine and cylinder head fins	.....	Section 20, Group 10 or 30
Test condenser	Capacity .18-.23 Microfarads Delco No. 1965489 Capacity .13-.16 Microfarads Phelon No. FG-7533	Section 40, Group 15 or 20
Test coil	K181 Kohler Engine Operating 3 amp Max. Ohms 3800 to 6000 K241AS Kohler Engine Operating .55 amp Max. Ohms 5500 to 9500	Section 40, Group 15 or 20
Replace breaker points	Point gap 0.020 in.	Section 40, Group 15 or 20
Retime ignition	"SP" or "S" mark on flywheel at 1200-1800 rpm	Section 40, Group 15 or 20
	112 Tractor with Solid State Ignition	
Test charger coil	400 to 450 Ohms	Section 40, Group 25
Adjusting Ignition Air Gap	.006 to .010 in.	Section 40, Group 25

Group 20
FUEL AND LUBRICANTS

FUEL

Use regular grade gasoline of a recognized brand. Avoid using stale or long-storage gasoline. Stale gasoline does not vaporize properly, thus causing hard starts.

Use of premium grade gasoline (ethyl) is not recommended in small tractor engines. The engine compression ratio is not high enough to require premium grade, which can cause a buildup of lead deposits. These deposits cause a loss of power and shorten engine life.

Do not mix oil with gasoline. Do not use white gas.

LUBRICANTS

Illustrated lubrication instructions have been included in the operator's manual furnished with your customer's machine. Remind your customer to follow these recommendations.

Oil used in the engine crankcase should have an American Petroleum Institute (API)/SAE classification of Service MS. Never fill engine crankcase above full (F) mark on dipstick.

The charts below and on next page indicate the type of lubricant, capacities and service intervals recommended for 110 and 112 tractors.

CAPACITIES

Cavities	110 Tractors	112 Tractors (Tecumseh)	112 Tractors (Kohler)
Fuel Tank - U.S. Gallons	1.75	1.75	1.75
Crankcase - U.S. Pints	* 2.5	* 2.5 (†)	* 3.0
Transaxle - U.S. Pints	3.5	3.5	3.5
Hydraulic Lift System - U.S. Pints	2.5	2.5	2.0

* *Initial fill for new engine or after engine has been disassembled for service. Thereafter 2 pints only (such as periodic oil changes).*

†*3 U.S. pints beginning with Serial No. 161,772.*

Litho in U.S.A.

TYPE OF LUBRICANT
(110 and 112 Tractors)

Crankcase - (API)/SAE Service MS Detergent type	
Summer - Above 32° F	SAE 30 - John Deere AM30730
Winter - Below 32°F	SAE 5W-20 John Deere AM30710
Transaxle	John Deere AM30200M (SAE 90)
Hydraulic Lift	Automatic Transmission Fluid Type A
Tractor Grease Fittings and Front Wheel Bearings	SAE (Seasonal grade) Multipurpose-Type Grease

SERVICE INTERVALS
(110 and 112 Tractors)

Crankcase (Oil change)	
Break-in	First 2 hours
Regular	Every 25 hours
Dusty conditions	Every 8 hours
Transaxle (Oil change)	200 hours or 2 years
Hydraulic Lift System	200 hours or 2 years
Tractor Grease Fittings (See page 20-4 for locations)	Spring and fall season
Front Wheel Bearings (repack)	Each time wheel is removed

Litho in U.S.A.

CHANGING CRANKCASE OIL

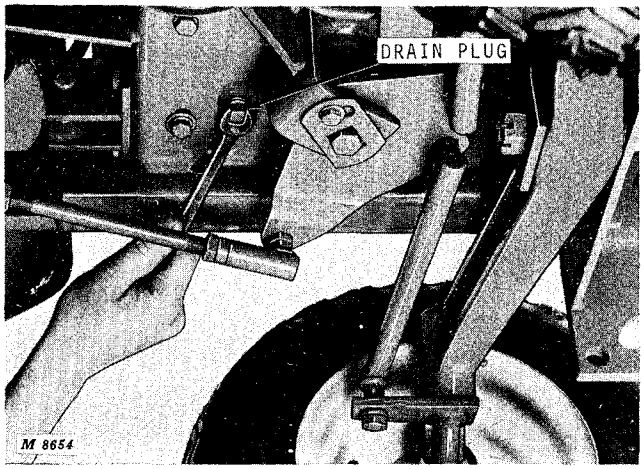

Fig. 1-Draining Oil (K181-HH100)

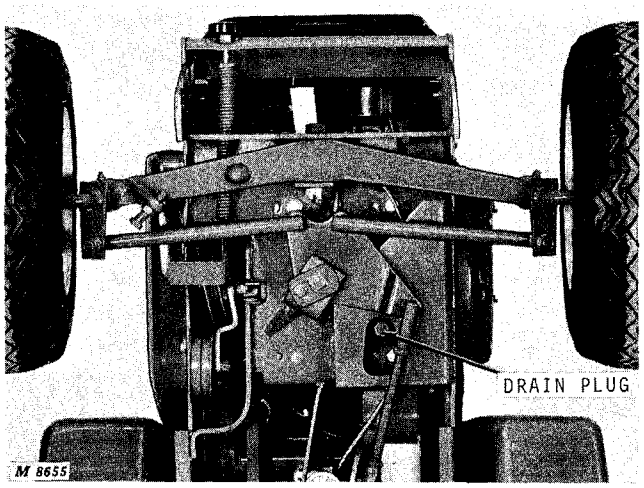

Fig. 2-Draining Oil (K241)

Drain crankcase when oil is hot and all dirt and foreign material is in suspension.

Remove drain plug and allow oil to drain into a container.

Install plug and fill crankcase with oil of the proper viscosity (page 20-2) to "F" mark on dipstick. Crankcase capacity is approximately 2-1/2 pints for 110 Tractors and 112 Tractors with Tecumseh engines. 112 Tractors with Kohler engines and 112 Tractors with Tecumseh engines, beginning with Serial No. 161,772, have a capacity of approximately 3 pints.

IMPORTANT: Check dipstick reading before pouring in the last 1/2 pint. Fill only to "F" mark. Overfilling can cause engine overheating resulting in permanent damage to the engine.

NOTE: Change oil every eight hours when working in extremely dusty conditions.

CHANGING TRANSAXLE OIL

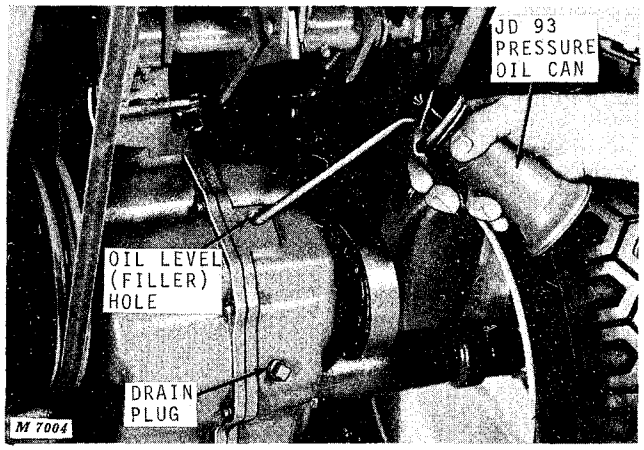

Fig. 3-Adding Oil to Transaxle

Remove oil level (filler) plug from front of transaxle.

When required, use a pressure oil can to add AM30200M Transmission Lubricant through filler hole until oil spills out. Be sure tractor is on a level surface when checking.

Use JD93 pressure oil can or equivalent to fill transaxle as shown above.

Change transmission oil every 200 hours.

NOTE: Refill or add transmission lubricant through fill tube at rear of deck if tractor is so equipped. Oil level (filler) hole must be open to assure correct lubricant level when filling.

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GREASE FITTING LOCATION

Lubricate the grease fittings indicated below using a John Deere Pisto-Luber or hand grease gun containing SAE multipurpose-type grease. Wipe fittings clean before and after lubrication.

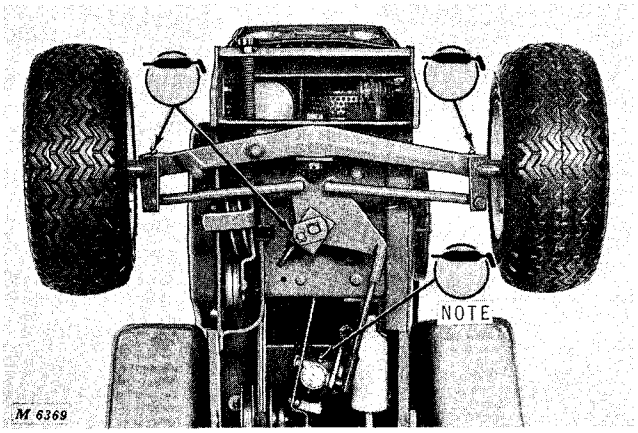

Fig. 4-Fittings on Front Axle, Steering Column and Bearing Cone

NOTE: Do not overlubricate steering column fitting. Only 3 or 4 strokes with hand grease gun or AM31300 Pisto-Luber are necessary. Do not use a high-pressure grease gun on this fitting. The Pisto-Luber is available from your John Deere dealer.

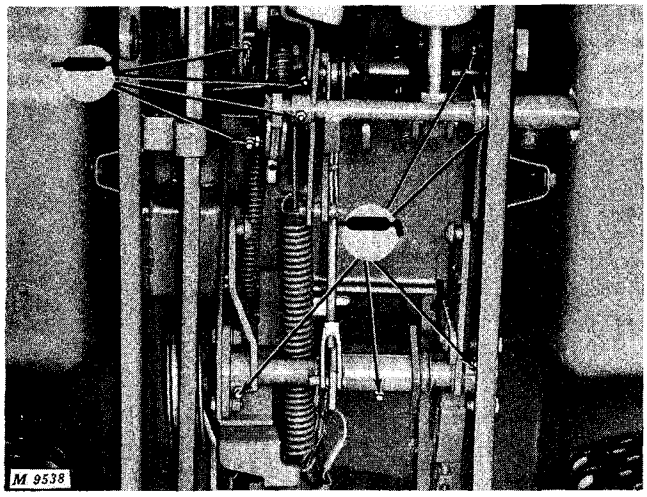

Fig. 5-Fittings on Variator Linkage, Lift Linkage and Rear Lift Shaft

REPACK POWER TAKE-OFF CLUTCH BEARING

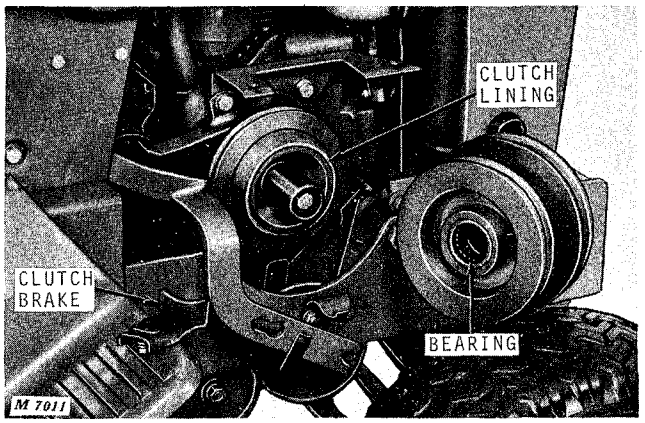

Fig. 6-Checking PTO Clutch

Disconnect the clutch arm and remove the clutch brake. Check PTO clutch to be certain that no dust or dirt has entered the bearing. Also check condition of clutch lining and clutch brake.

Remove old grease from bearing with solvent at the beginning of each spring and fall season or sooner if dirt is found in the bearing. Dry thoroughly and repack bearing with John Deere High Temperature Grease, AT17659T, available in one-pound cans. Connect the clutch arm and reinstall the clutch brake. Adjust the clutch brake so there is 1/16-inch clearance between the brake and clutch cup sheave when the clutch is engaged.

See Section 50, Group 20, for PTO clutch service information.

Section 20
ENGINE

Group 5
GENERAL INFORMATION
KOHLER ENGINES FOR 110 AND 112 TRACTORS

TABLE OF CONTENTS—KOHLER ENGINES

Litho in U.S.A.

TABLE OF CONTENTS—CONTINUED

TABLE OF CONTENTS—TECUMSEH ENGINE (Serial No. 100,001-161,771)

Litho in U.S.A.

DESCRIPTION

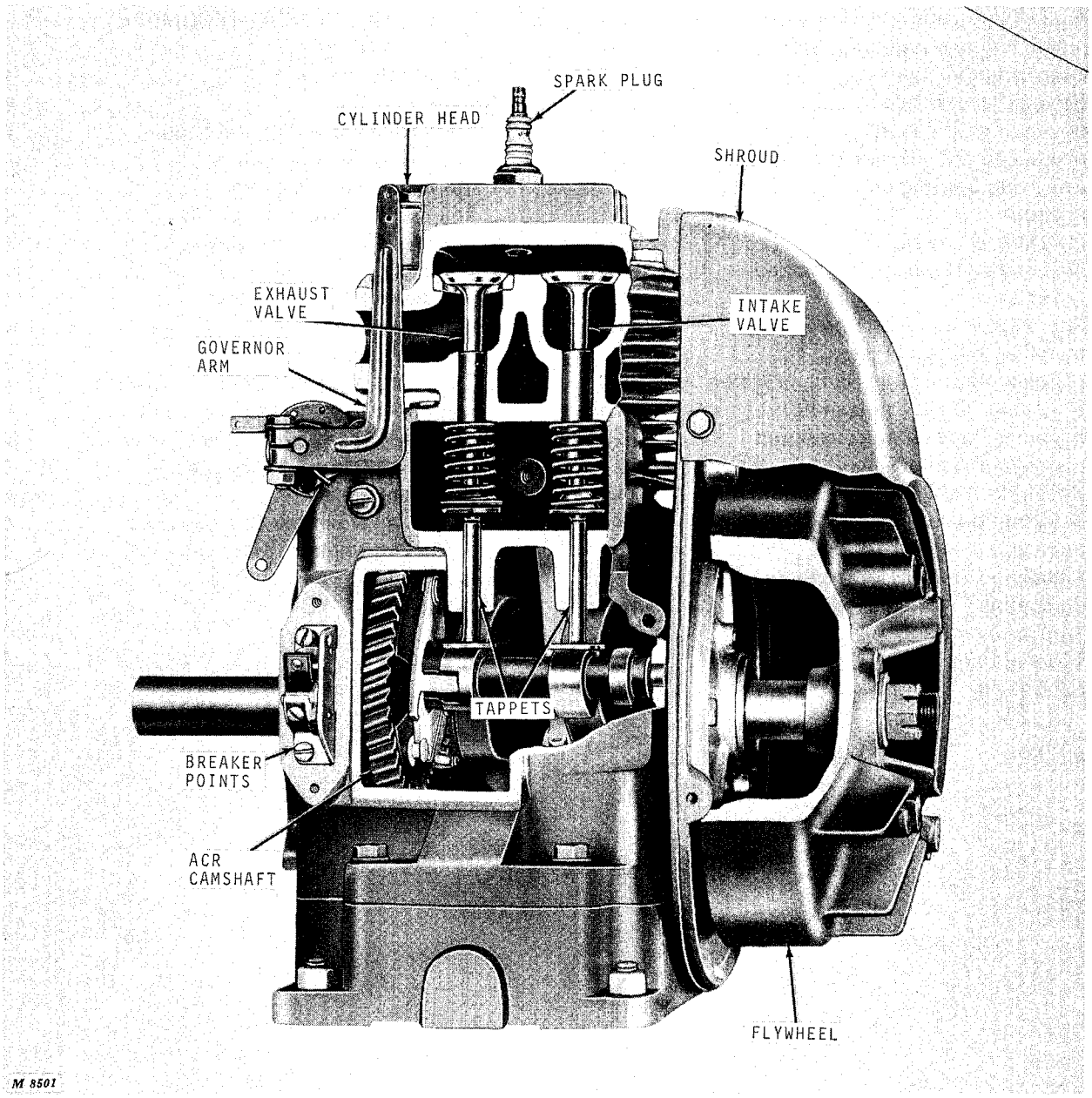

Fig. 1-Cutaway View of Kohler K181S Engine Showing Valves and Tappets

The Kohler K181S Engine powers the 110 Tractor; the Kohler K241AS Engine is optional power for the 112 Tractor. These engines are of a single-cylinder, four-cycle, air-cooled design.

Both engines have cast iron blocks, anti-friction ball bearings, oil bath lubrication, and internal fly-weight governors.

In addition, the Kohler K241AS Engine features a dynamic balance system which consists of two balance gears rotated by the crankshaft in the opposite direction of crankshaft rotation.

Detailed specifications for each engine are covered in Section 10, "General," and at the end of each group in this section.

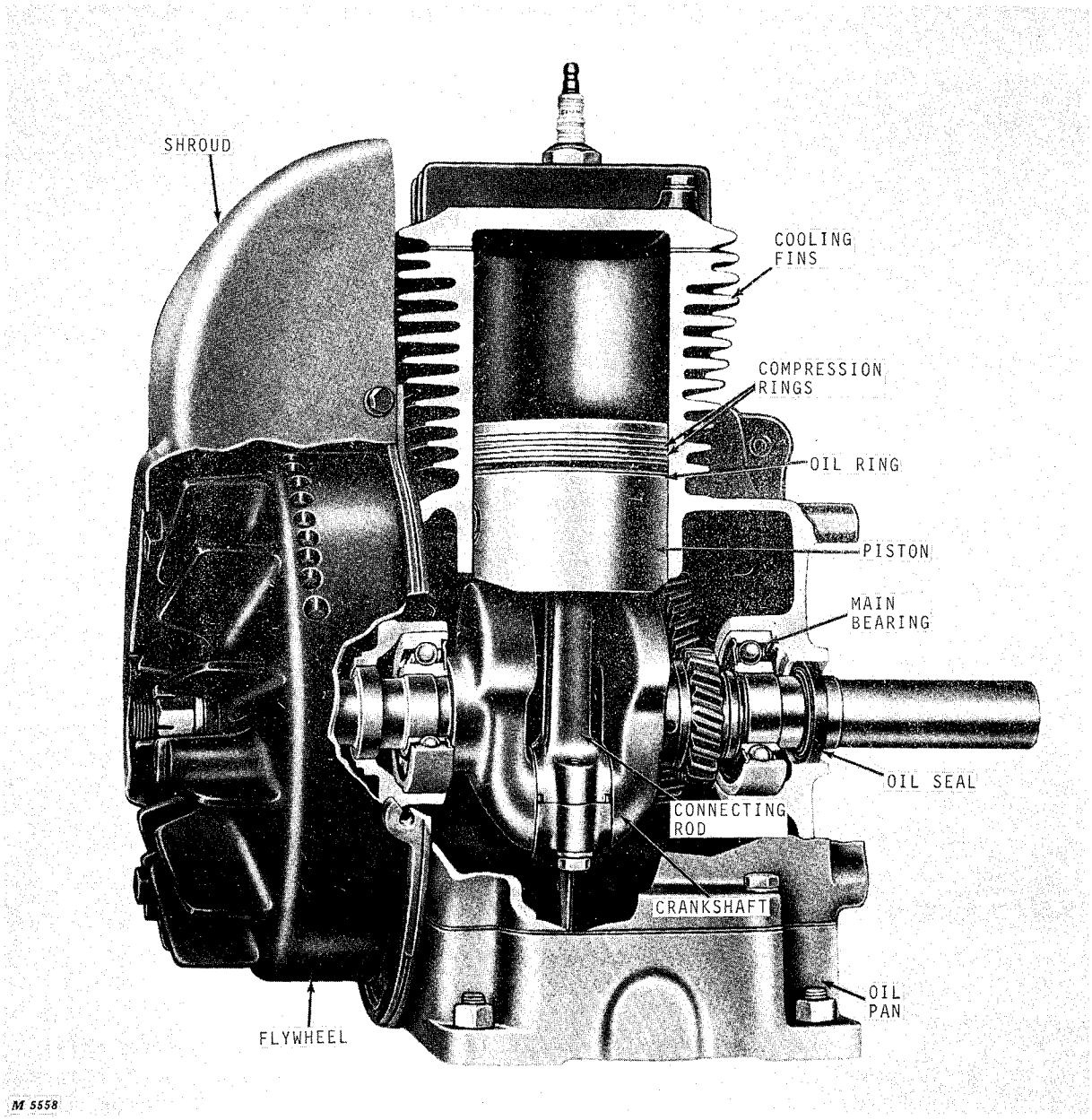

Fig. 2-Cutaway View of Kohler K181S Engine Showing Piston, Crankshaft and Bearings

The maximum brake horsepower curve shows the performance of laboratory engines equipped with standard air cleaner, muffler and flywheel corrected to sea level barometer and with free air temperature of 60° F. Horsepower decreases 3-1/2% for each 1000 feet above sea level, and 1% for each 10° F. above 60° F.

Horsepower ratings are established in accordance with Society of Automotive Engineers - Small Engine Test Code - J 607.

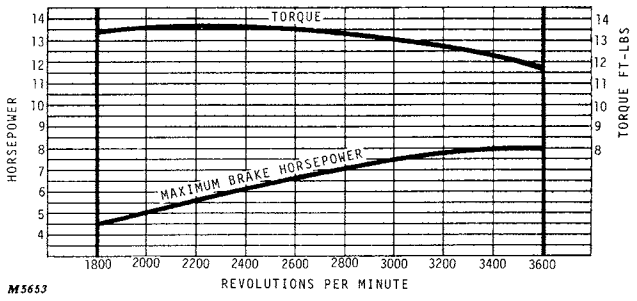

Fig. 3-Torque-Horsepower Chart

DESCRIPTION—Continued

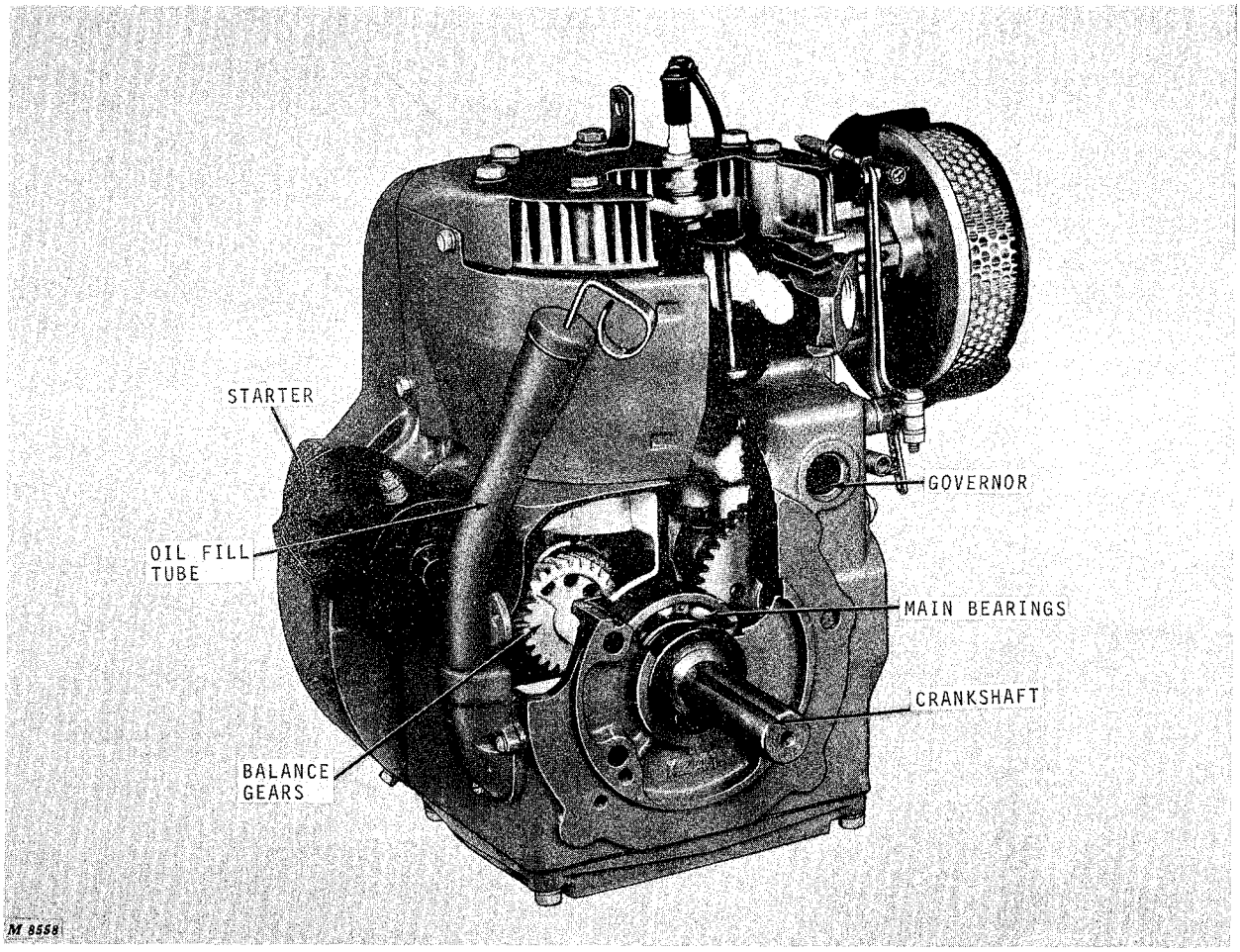

Fig. 4-Cutaway View of Kohler K241AS Engine

The Kohler K241AS Engine is a four-cycle, air-cooled, internal combustion engine. It has a cast iron cylinder block, anti-friction crankshaft bearings, and a dynamic balance system.

In addition, the engine features a battery-ignition system, gear-driven flyweight governor, oil bath lubrication, and a fuel pump for positive fuel delivery at all speeds.

The engine is rated at 10 horsepower at 3600 rpm.

ENGINE ANALYSIS

PRELIMINARY ENGINE CHECKS

A complete diagnosis guide of engine malfunctions begins on page 5-9. However, the majority of engine trouble reports are of a minor non-chronic nature and are usually due to electrical or fuel system difficulties. First make the checks listed below to isolate the majority of engine problems.

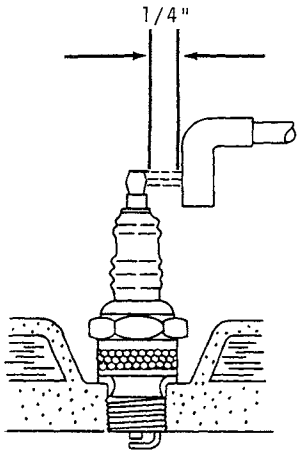

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Fig. 5-Checking Spark At Plug

Check spark, Figure 5, whenever engine will not start. If engine will not crank, follow diagnosis procedure on page 5-9.

Remove ignition cable from spark plug and install adaptor or ordinary paper clip. Hold approximately 1/4 inch away from spark plug terminal while cranking the engine.

If there is good spark between the adaptor and the spark plug terminal, the problem is in the fuel-air system. If gas tank is full, check shut-off valve under gas tank and gas lines to carburetor to be certain gas is getting to carburetor. Connect high tension wire to spark plug and crank engine. Choke as necessary. If engine still does not start, refer to "Diagnosing Malfunctions" guide to check for internal difficulties.

If there is no spark at the adaptor or a weak spark, the trouble is in the electrical system. If the battery and spark plug are good and all electrical connections are tight, the trouble most likely is in the breaker points or condenser. Clean or replace points and adjust gap. If breaker points are burned, replace the condenser also.

If the engine still does not start, or starts but does not run properly, make the compression test on this page and the vacuum test on page 5-8.

PRELIMINARY ENGINE TESTS

The following preliminary engine tests are recommended to detect and isolate possible malfunctions before proceeding with further diagnosis. These tests are especially important when the engine is burning oil, losing power or running erratically and when carburetion and ignition adjustments do not correct the condition.

Compression Test

Kohler engines on tractors (Serial No. 100,001-) have ACR (Automatic Compression Release Camshaft). Because ACR relieves compression pressure during lower cranking speeds, it is important to crank the engine at 1000 rpm or more to obtain an accurate test. ACR mechanism is disengaged when engine speed reaches approximately 650 rpm.

When the engine is operable in the tractor, check compression as follows.

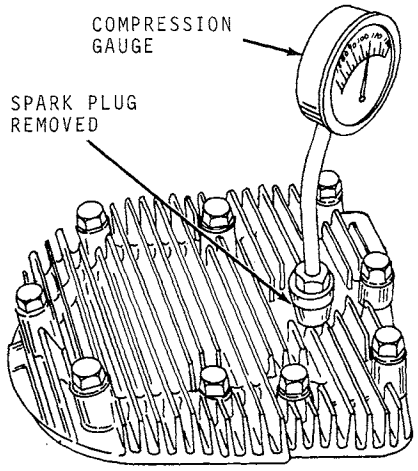

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Fig. 6-Testing Engine Compression

Depress clutch-brake pedal and set parking brake. Be sure oil in crankcase is at proper level and battery is properly charged.

NOTE: Be sure tractor drives are all disengaged. Run engine until warm, then stop the engine.

Remove spark plug. Also remove air filter for most accurate test.

Compression Test—Continued

Set throttle and choke valve in wide open position by raising throttle lever, and lowering choke lever.

Hold compression gauge firmly in spark plug opening, Figure 6. Crank engine at 1000 rpm and observe reading. Repeat test to verify readings.

A starter rope can be used if 650 rpm or more cannot be reached by using the electric starter.

To use starter rope procedure, wind a number of turns of 1/4-inch rope around PTO sheave opposite the direction of engine rotation. Pull rope firmly and observe reading. Repeat test until readings are consistent.

Test Conclusions

An engine in top operating condition will read 110 to 120 psi when engine is cranked approximately 1000 rpm.

A compression test above 120 psi, indicates excessive carbon deposits in the combustion chamber or on the piston.

A reading lower than 100 psi indicates leakage at the cylinder head gasket, piston rings or valves. *The engine should be reconditioned if compression falls below 90 psi.*

To determine whether the rings or the valves are at fault, pour about one tablespoonful of heavy oil into the spark plug hole. Crank the engine several revolutions to spread the oil and repeat the compression test.

The oil will temporarily seal leakage around the piston rings. If the same approximate compression reading is obtained, the rings are satisfactory, but the valves are leaking or the piston is damaged. If the compression has increased considerably over the original readings, there is leakage past the rings.

Crankcase Vacuum Test

The crankcase breather maintains a partial vacuum in the crankcase when the engine is operating properly.

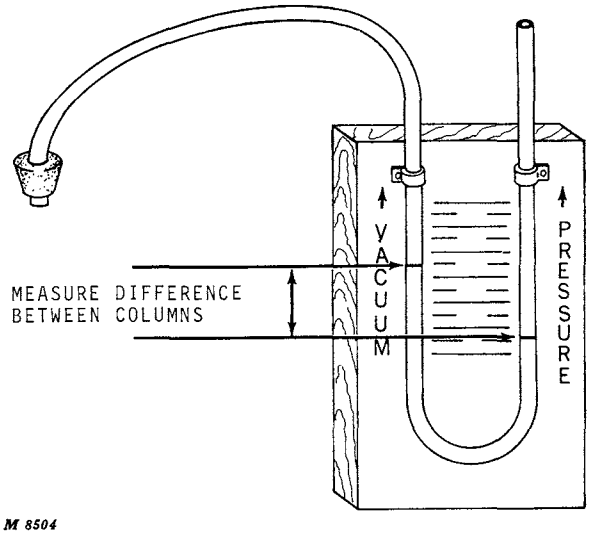

Fig. 7-Checking Crankcase Vacuum

Connect a water U-tube manometer, Figure 7, to cylinder block oil filler tube. Tester must hang vertically. Start and run engine at 1200 to 1700 rpm. Allow engine to warm up and observe reading on scale. Follow manufacturer's recommendations for installation, testing and compensation for the effect of altitude on the gauge reading.

Test Conclusions

Proper crankcase vacuum for the K181S and K241AS engines is a 5 to 10-inch water column on the manometer gauge.

A crankcase vacuum reading lower than specified is most likely due to a leaking breather valve or improperly assembled breather. See page 10-9 of this Section and carefully reassemble all breather parts. A low vacuum reading may also be caused by leaky valves, engine blow-by or worn crankshaft oil seals.

If the crankcase is found to be pressurized rather than have a vacuum, chances are that the breather plate has been assembled backwards or the breather filter is plugged.

Engines with zero vacuum or a pressurized crankcase will likely be pumping oil into the combustion chamber or out the breather or oil seals. This can be detected by watching for excessive exhaust smoke, engine overheating or oil leakage outside the engine.

DIAGNOSING MALFUNCTIONS

Engine

Engine Will Not Crank

Transaxle not in neutral.

Battery discharged or defective.

Neutral-start switch and bracket loose or not properly adjusted.

PTO drive engaged.

Defective safety switch(es).

Defective starter.

Defective solenoid.

Loose electrical connections.

Defective key switch.

Engine seized.

Engine Starts Hard

Spark plug pitted or fouled.

Breaker points worn, pitted or out of adjustment.

High tension wire shorted.

High tension wire loose at spark plug or coil.

Loose electrical connections.

Restricted gas tank vent.

Clogged fuel line or air lock.

Broken choke cable.

Throttle cable not properly adjusted.

Dirt or water in fuel system.

High speed and idle mixture needles not properly adjusted.

Wrong valve clearance.

Leaking head gasket.

Restricted exhaust system.

Low compression.

Engine Starts But Fails To Keep Running

Restricted gas tank vent.

High speed and idle mixture needles not properly adjusted.

Broken choke cable.

Dirt or water in fuel system.

Carburetor float not properly adjusted or float valve leaking.

High tension wire loose at spark plug or coil.

High tension wire shorted.

Breaker points not properly adjusted.

Loose electrical connections.

Faulty condenser.

Excessive engine load.

Engine Cranks But Will Not Start

Empty gas tank.

Restricted gas tank vent.

Fuel shut-off valve closed (valve below gas tank).

Clogged, restricted or air-locked fuel line.

Defective ignition module (Tecumseh HH100 engine).

Breaker points worn or pitted.

Spark plug fouled or pitted.

Incorrect spark plug.

Battery not fully charged.

Loose electrical connections.

High speed and idle mixture needles not properly adjusted.

Faulty condenser.

Defective ignition coil.

Dirt in fuel system.

Frayed electrical wire(s) causing ground(s).

DIAGNOSING MALFUNCTIONS—Continued

Engine Runs But Misses

High tension wire loose from spark plug or coil.

Breaker points out of adjustment or worn and pitted.

Spark plug fouled, pitted or gap incorrect.

Incorrect spark plug.

Loose electrical connections.

Carburetor float not properly adjusted or float valve leaking.

Dirt or water in fuel system.

Wrong valve clearance.

Faulty coil.

Engine Misses Under Load

Spark plug fouled, pitted or gap incorrect.

High speed and idle mixture needles not properly adjusted.

Incorrect spark plug.

Breaker points out of adjustment or worn and pitted.

Ignition out of time.

Dirt or water in fuel system.

Stale fuel.

Engine Will Not Idle

Idle speed too low.

High speed and idle mixture needles not properly adjusted.

Dirt or water in fuel system.

Restricted gas tank vent.

Spark plug fouled, pitted or gap incorrect.

Wrong valve clearance.

Low engine compression.

Engine Misses When Advancing Throttle

Cold engine.

High speed and idle mixture needles not properly adjusted.

Spark plug fouled, pitted or gap incorrect.

Linkage misaligned (throttle arm-to-governor).

Engine Loses Power

Crankcase low on oil.

Engine shrouding plugged.

Excessive engine load.

Restricted air filter.

Dirt or water in fuel system.

High speed and idle mixture needle not properly adjusted.

Spark plug fouled, pitted, or gap incorrect.

Too much oil in crankcase.

Low engine compression.

Worn cylinder bore.

Engine Overheats

Dirty or plugged shrouding and engine fins.

High speed and idle mixture needles not properly adjusted.

Too much oil in crankcase.

Worn valve stem and/or guides.

Crankcase low on oil.

Excessive engine load.

Faulty breather causing low crankcase vacuum.

Litho in U.S.A.

Engine Knocks

Engine out of time.

Excessive engine load.

Crankcase low on oil.

Engine Backfires

High speed and idle mixture needles not properly adjusted (lean mixture).

Loose cylinder head or blown head gasket.

Intake valve sticking in guide.

Ignition out of time.

Engine Low On Power At Full Throttle

Restricted air filter.

Spark plug fouled, pitted or gap incorrect.

Incorrect spark plug.

Restricted exhaust.

Breaker points out of adjustment, worn and pitted.

Clogged fuel line or air lock.

Broken choke cable.

Clogged breather assembly.

Defective ignition coil.

Governor malfunctioning.

Engine Does Not Maintain Constant Speed (Surges)

High speed and idle mixture needles not properly adjusted.

Spark plug gap incorrect.

Throttle-to-governor linkage not properly assembled.

Breaker points out of adjustment, worn or pitted.

Dirt or water in fuel system.

Sensitive governor.

Engine Uses Excessive Amount Of Oil

Clogged breather assembly.

Breather not assembled properly.

Worn or broken piston rings.

Worn cylinder bore.

Clogged oil holes in piston.

Wrong size piston rings.

Worn valve stems and/or valve guides.

Incorrect oil viscosity.

Faulty breather causing low crankcase vacuum.

Engine Runs Erratically

Dirt or water in fuel system.

High speed and idle mixture needles not properly adjusted.

Idle speed too low.

Spark plug fouled, pitted, or gap incorrect.

Poor compression.

Faulty breather causing low crankcase vacuum.

Carburetor leaking at gaskets or at fuel connections.

Restricted gas tank vent.

Throttle-to-governor linkage incorrectly assembled.

Sensitive governor.

Gasoline in Crankcase

Carburetor float not properly adjusted or leaking.

Worn float valve and/or seat.

Litho in U.S.A.