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)

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ENGLISH

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SM2088 01NOV69

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.

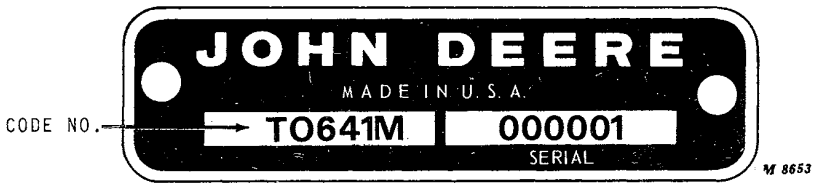
(-0000) When a serial number appears after the dash, the design change was effective up to and including that serial number and is no longer effective.

(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		
WHEEL TREAD	All Purpose Tires (GT-1)	High-Flotation Tires (GT-3)	Traction Tires (GT-4)	High-Flotation Tires (GT-5)
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

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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.

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

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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.

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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

CHANGING CRANKCASE OIL

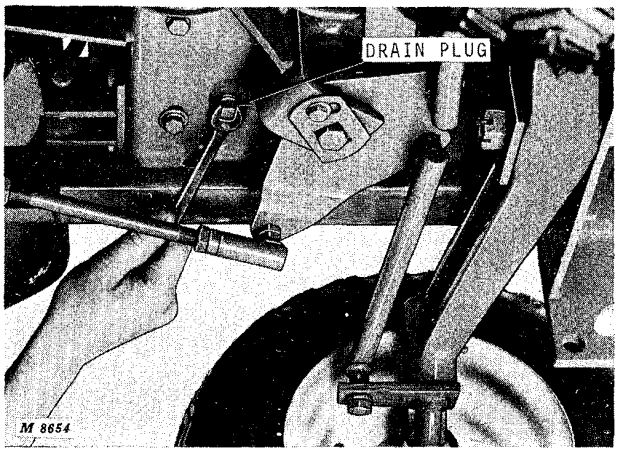

Fig. 1-Draining Oil (K181-HH100)

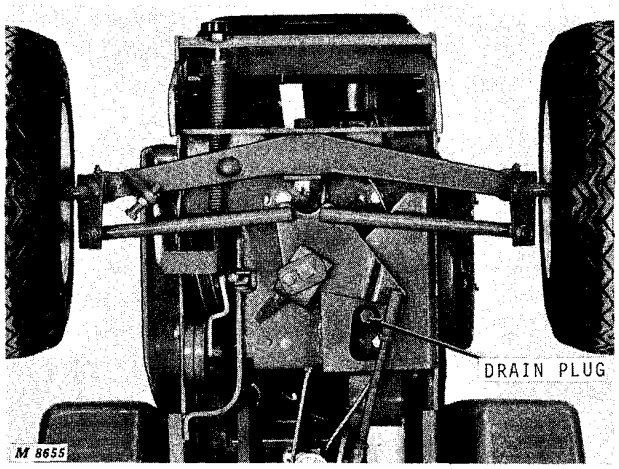

Fig. 2-Draining Oil (K241)

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

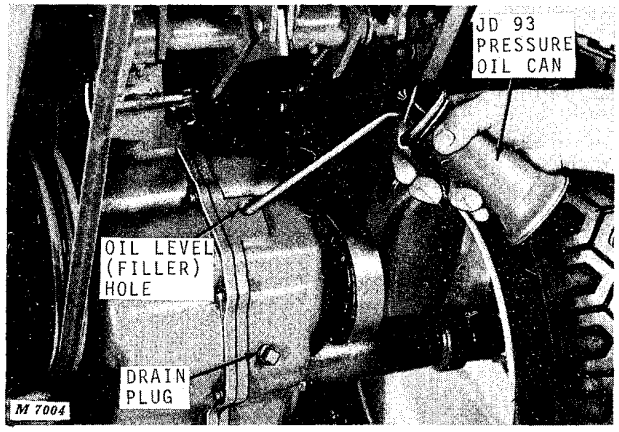

Fig. 3-Adding Oil to Transaxle

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.

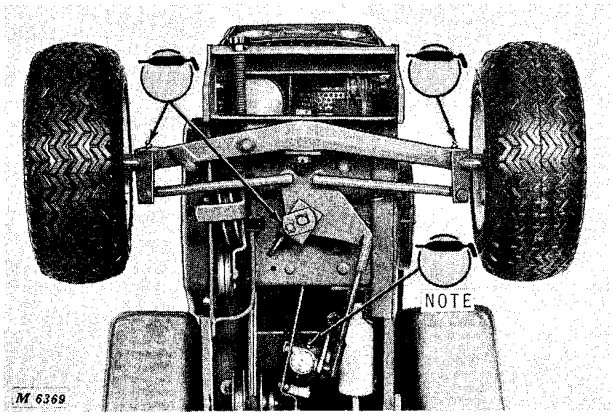

Fig. 4-Fittings on Front Axle, Steering Column and Bearing Cone

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.

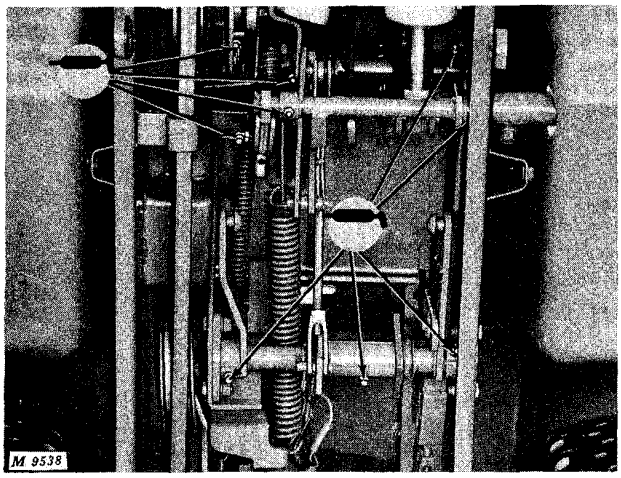

Fig. 5-Fittings on Variator Linkage, Lift Linkage and Rear Lift Shaft

REPACK POWER TAKE-OFF CLUTCH BEARING

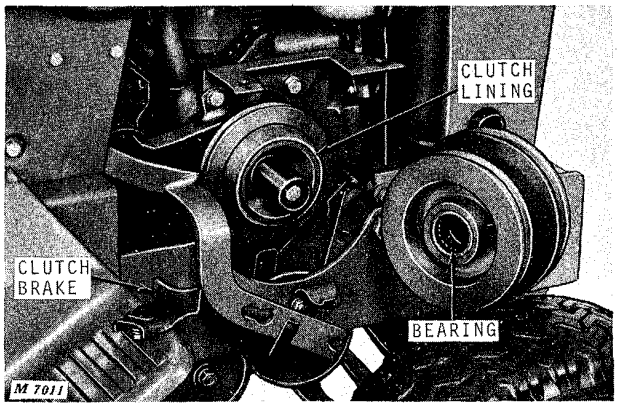

Fig. 6-Checking PTO Clutch

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

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TABLE OF CONTENTS—CONTINUED

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

DESCRIPTION

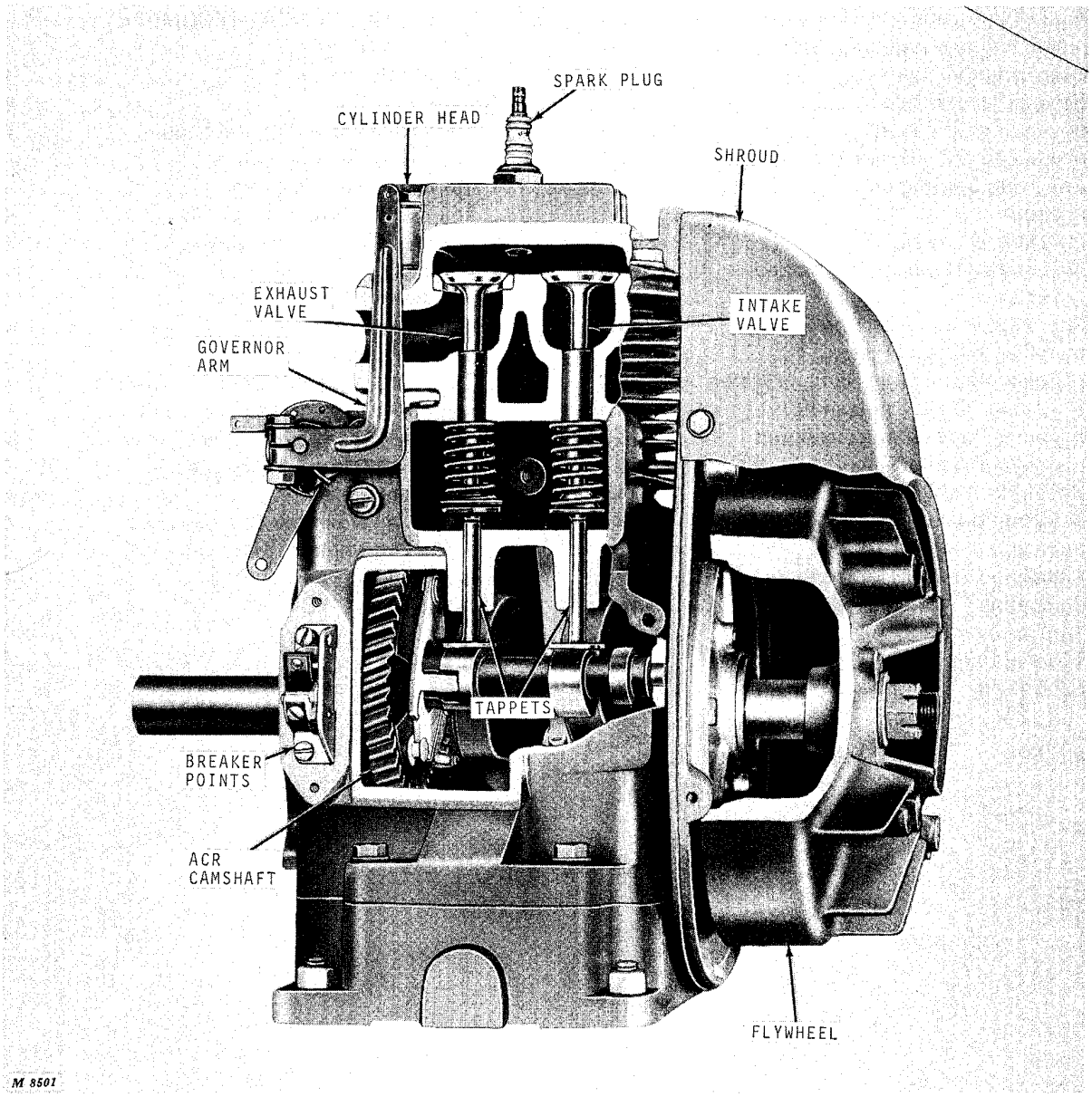

Fig. 1-Cutaway View of Kohler K181S Engine Showing Valves and Tappets

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.

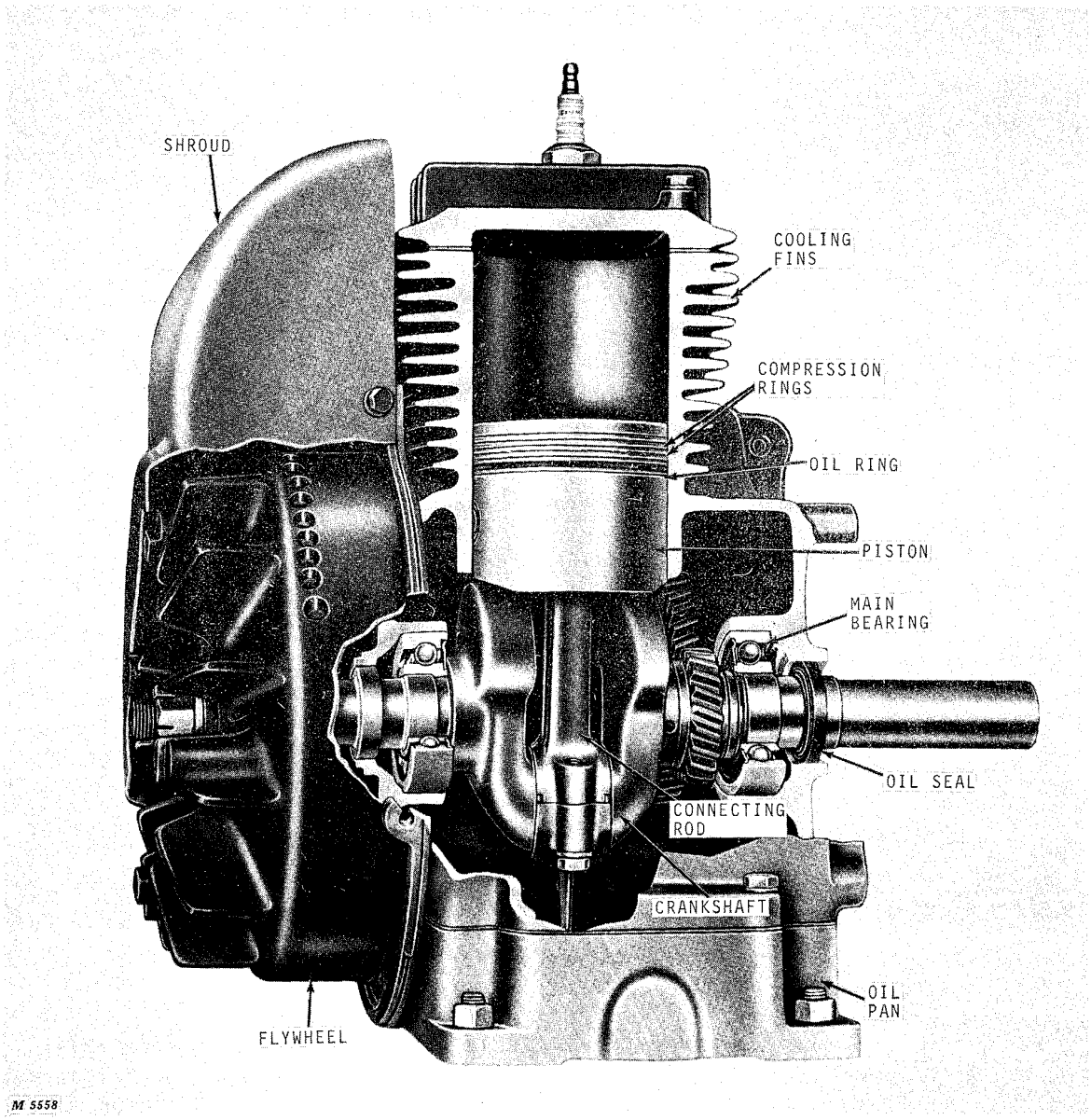

Fig. 2-Cutaway View of Kohler K181S Engine Showing Piston, Crankshaft and Bearings

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.

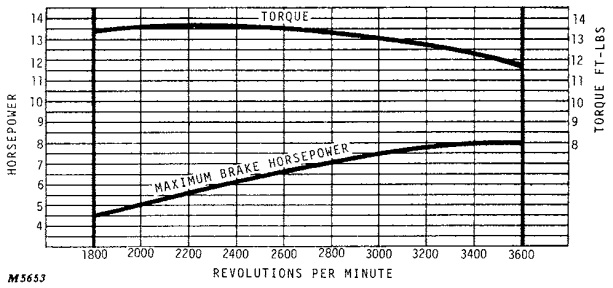

Fig. 3-Torque-Horsepower Chart

DESCRIPTION—Continued

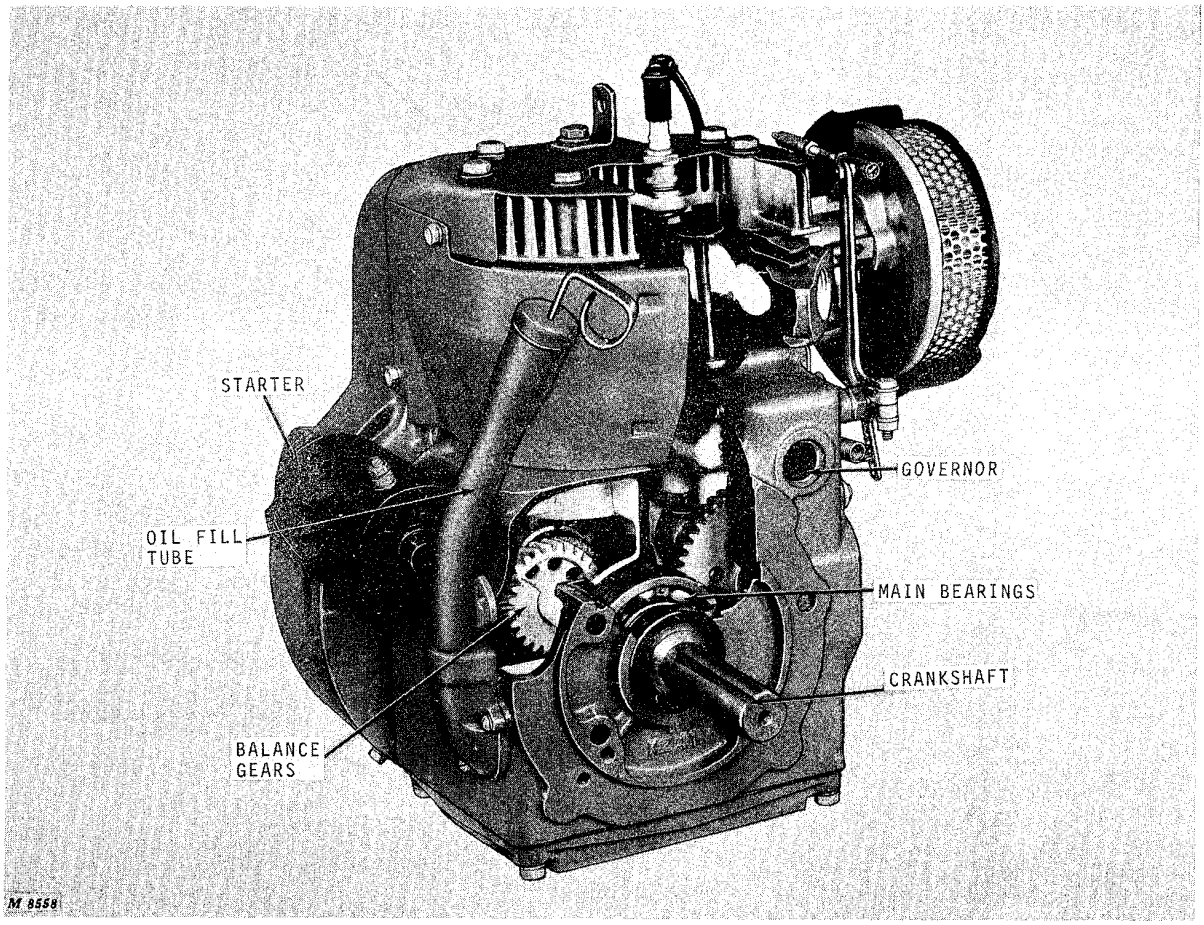

Fig. 4-Cutaway View of Kohler K241AS Engine

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.

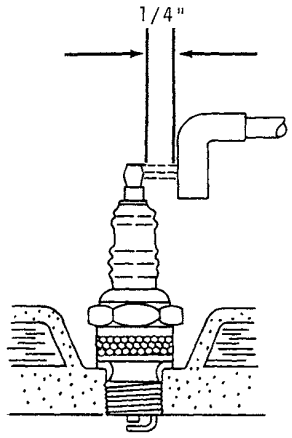

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Fig. 5-Checking Spark At Plug

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.

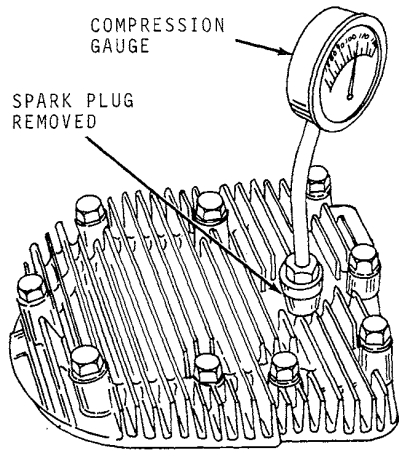

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Fig. 6-Testing Engine Compression

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.

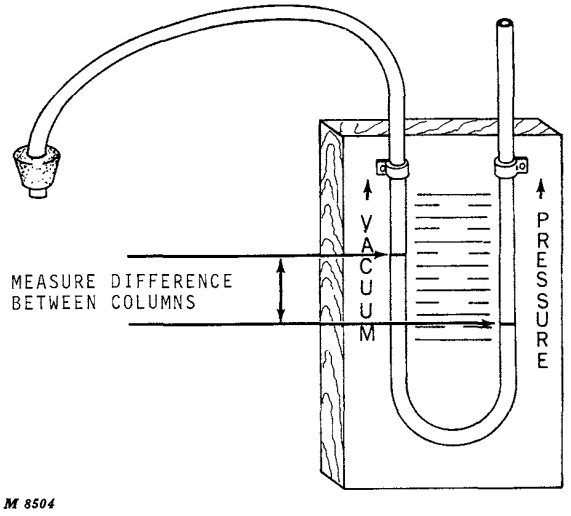


Fig. 7-Checking Crankcase Vacuum

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.

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.

Group 10
CYLINDER HEAD, VALVES AND BREATHER KOHLER ENGINES FOR 110 AND 112 TRACTORS

GENERAL INFORMATION

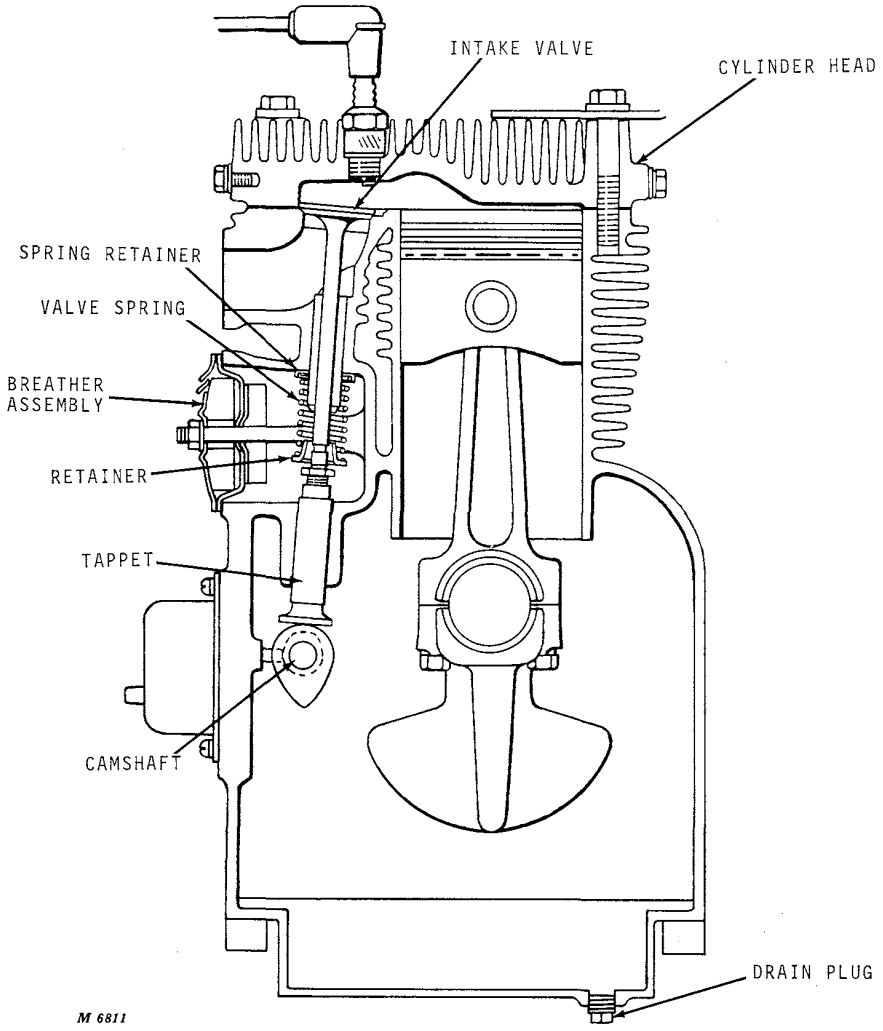


Fig. 1-Schematic View of Valves and Tappets

It is not necessary to remove the engine from the tractor to grind valves and valve seats or to service the breather assembly.

The exhaust valve insert is press fitted into the block and can be replaced. The intake valve seat is machined into the block.

Valve guides can be replaced when wear tolerances are exceeded.

The breather assembly is mounted in front of the valve spring chamber below the carburetor.

VALVE ANALYSIS

Fig. 2-Lead Deposits on Leaky Intake Valve

Lead deposits on the intake valve consist mostly of lead and some metal which comes from the lubricating oil. It is caused by a small amount of exhaust gas leakage into the intake port area. This indicates that the valve is not sealing properly. Grind the valve and reface the seat to correct this condition. *NOTE: Be sure to correct valve-to-tappet clearance after grinding valves. See page 10-8.*

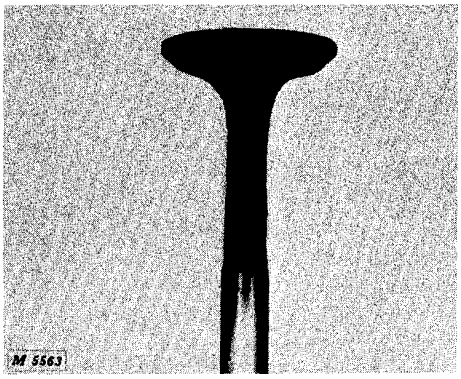


Fig. 3-Valve Stem Corrosion

Valve stem corrosion is caused by moisture finding its way into the engine. Moisture in the fuel-air mixture can condense inside the engine when the engine is stopped prior to warm up.

Valve corrosion can also occur during storage when the engine has been idle for some time. Fogging or pouring oil in the combustion chamber before storing will prevent valve corrosion.

Corroded and pitted valves tend to collect deposits which in turn cause valve sticking. Always replace badly corroded or pitted valves with new valves.

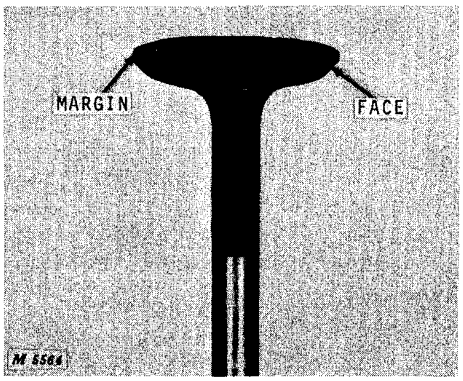


Fig. 4-Exhaust Valve Running Too Hot

Exhaust valves are designed to function in temperatures exceeding 5000° F. However, when operating at this temperature for long periods of time, valve burning occurs, Figure 4. Tell-tale signs of valves running too hot is the dark discoloration of the valve stem down into the area protected by the valve guide. Another indication is distortion of the valve margin and valve face. Valve inserts may also begin to burn away.

The most common cause of an overheated engine and valves is poor cooling due to dirt or obstructions inside the intake shrouding. Remove and clean shrouding and all cooling fins on the engine if this condition is noticed. *NOTE: Never run engine with shrouding removed.*

Also check for improper valve timing by checking and correcting valve clearance.

Worn valve guides or valve springs can also cause overheated valves.

Valves running hot also can be caused by an improper spark plug or overheated spark plug, which causes pre-ignition, or a lean fuel mixture.

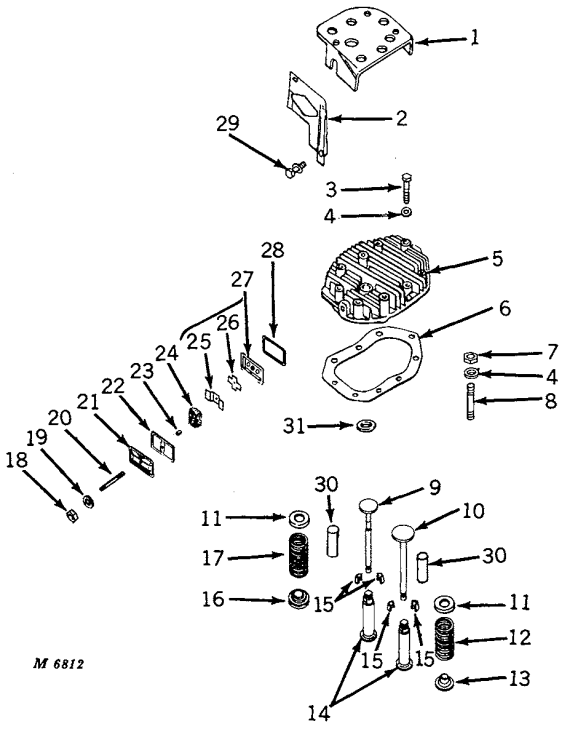
Fig. 5-Gummy Valve Causing Valve to Stick

Using gasoline which has been left in the tank a long time is a common cause of sticking valves.

Sometimes this gummy substance can be seen on the valve. When this condition is found, it is also likely that the carburetor also contains gum deposits and will require a complete cleaning.

Advise customer always to use fresh gasoline and always to drain gas from all fuel lines and carburetor before storing tractor.

REPAIR



1-Head Baffle
2-Side Baffle
3-Cap Screw (7 used)
4-Washer (10 used)
5-Cylinder Head
6-Head Gasket
7-Hex. Nut (2 used)
8-Stud (2 used)
9-Exhaust Valve
10-Intake Valve
11-Upper Spring Retainer
12-Intake Valve Spring
13-Lower Spring Retainer
14-Tappet (2 used)
15-Spring Keeper (4 used)
16-Exhaust Valve Rotator (K241AS)
17-Exhaust Valve Spring
18-Hex. Nut
19-Lock Washer
20-Stud
21-Cover
22-Outer Gasket
23-Seal
24-Filter
25-Baffle
26-Reed
27-Breather Plate Assembly
28-Inner Gasket
29-Cap Screw (4 used)
30-Valve Guides (2 used)
31-Exhaust Valve Insert

Fig. 6-Exploded View of Cylinder Head, Valves and Breather

REPAIR—Continued

It is not necessary to remove the engine from the tractor when servicing the cylinder head, head gasket, muffler, breather assembly, valves and valve seats.

IMPORTANT: On tractors equipped with hydraulic lift, do not disconnect the hydraulic lines. Remove the pump, valve and reservoir unit from the top of the engine and lower it to the ground with the hydraulic lines still attached. This procedure avoids the possibility of dirt entering the system.

Disconnect choke conduit and cable at carburetor. Remove carburetor, breather assembly, head baffle, cylinder head and head gasket.

Removing Valves

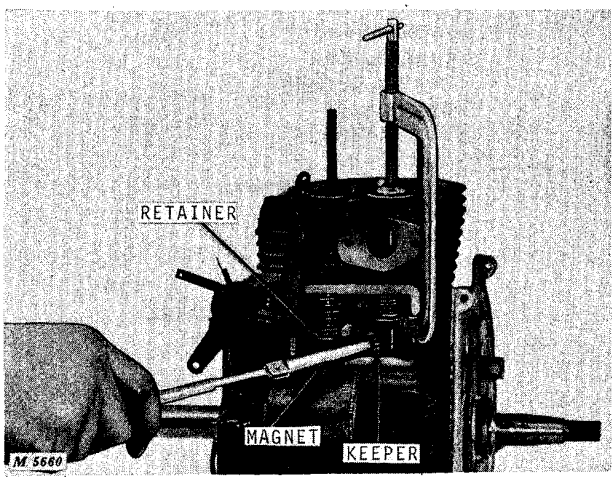


Fig. 7-Removing Valves

Use a valve spring compressor to compress valve springs, Figure 7. Remove keepers from valve stem and lift valves from engine block.

Remove valve spring retainers and valve springs from valve chamber.

Inspecting Cylinder Head

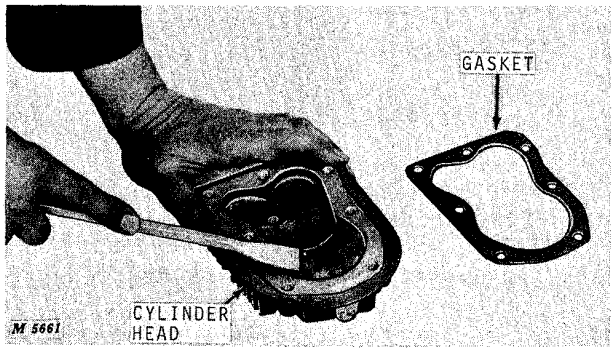


Fig. 8-Cleaning Cylinder Head

Remove all deposits from combustion chamber and gasket surface of head with a scraper and a wire brush.

Be careful not to damage the cylinder head gasket surface. Use a safe cleaning solvent to remove dirt, grease and other deposits.

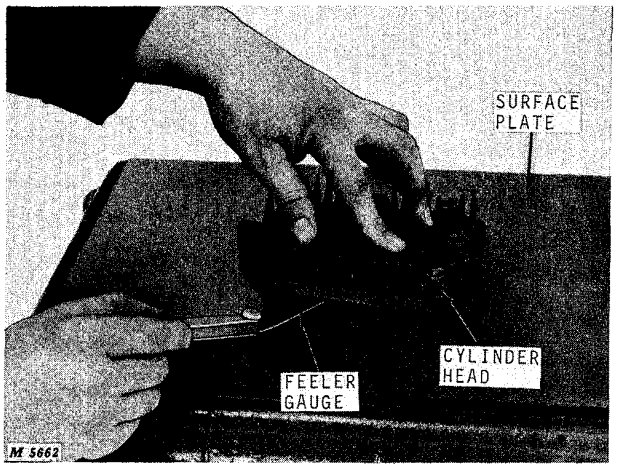


Fig. 9-Checking Surface of Cylinder Head

Check the cylinder head for cracks, broken cooling fins and inspect the gasket surface for burrs and nicks. Replace the head if any of these conditions are found

When replacing a head gasket, always check the cylinder head for warpage. Use a surface plate and a 0.0015-inch ribbon feeler gauge in the manner shown in Figure 9. The feeler gauge should drag at all points when drawn from between the head and surface plate.

NOTE: Whenever the cylinder head is removed, discard the head gasket. Always use a new head gasket when installing the cylinder head.

Inspecting Breather

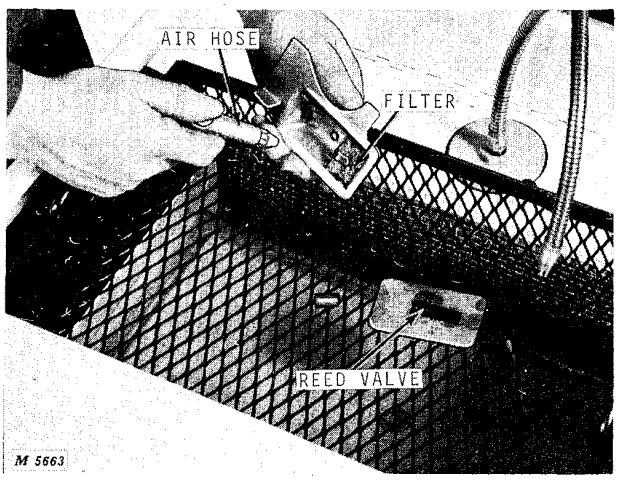


Fig. 10-Cleaning Breather Filter

Clean all breather parts in solvent. Blow out filter contamination with compressed air or replace with new filter as necessary.

Inspect reed valve on breather to be certain it covers all of breather hole. When depressed in the center, the valve should close over the hole with a snap. Replace valve plate having weak tension.

Be sure small drain hole in breather plate is not clogged.

Testing Valve Springs

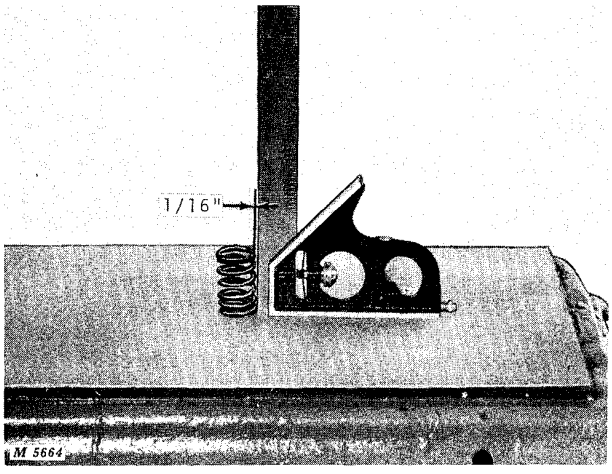


Fig. 11-Valve Spring Squareness

Check valve spring for squareness, using a steel square and a surface plate, Figure 11. Stand the spring and square on end on the surface plate. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring and the square. See Specifications, page 10-11, for out-of-square limits.

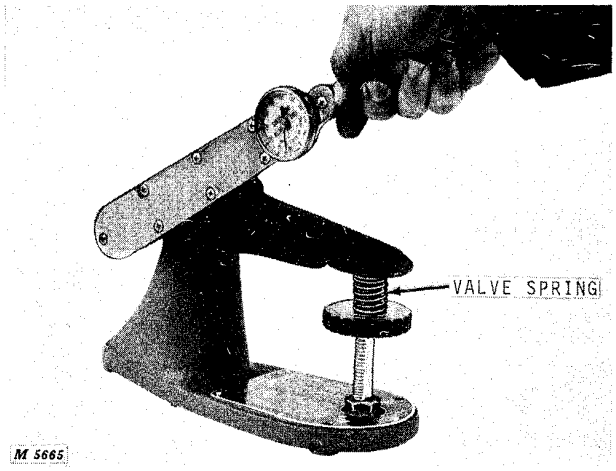


Fig. 12-Valve Spring Tension

Check valve spring for proper pressure, Figure 12. Refer to Specifications, page 10-11, for free length of the spring and the pressure in pounds that the spring should exert when it is compressed to a measured length.

Inspecting Valves

Remove carbon from valve head, face, and stem with a power-operated wire brush. Be sure carbon is removed and not merely burnished. Any carbon left on the stem will affect accurate alignment in the valve refacer collet.

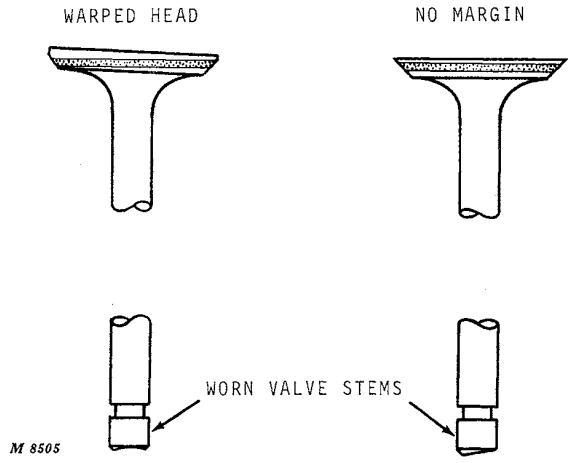


Fig. 13-Faulty Valves

Inspect valve faces, heads and stems for distortion,. pitting, and burning. Recondition valves that appear acceptable. Distorted valves will be evident when refacing operation is performed. Replace all valves with less than 1/32-inch margin or those having a questionable appearance.

Grind valve stems square prior to installation and resetting of valve tappet clearance.

Reconditioning or Replacing Valves

Valve Guides

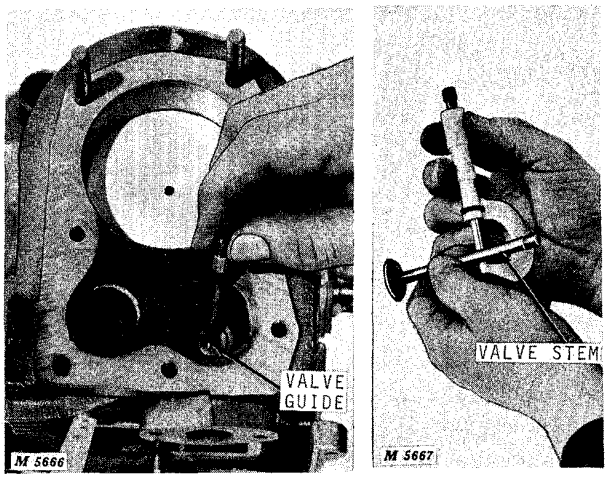


Fig. 14-Measuring Valve Guides and Stems

Clean the valve guides first to assure valve alignment when cutting valve seats.

Use valve guide cleaner to clean inside of valve guide. Then measure I.D. of valve guide, and O.D. of valve stem, Figure 14. Valve to guide clearance is 0.0015 and 0.0020 inch. Replace and ream guides, as necessary. Refer to page 10-11 for additional specifications.

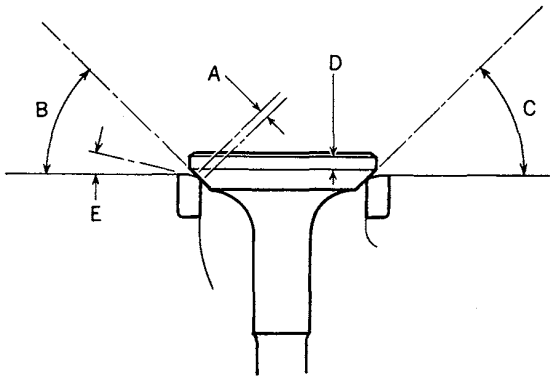
Valve Seats

Replace broken and excessively worn valve seats. Use either stellite or molychrome nickel steel seats. Follow procedure on page 10-8.

The intake valve seat is machined into the cylinder block. When required, an intake valve seat insert may be installed. See page 10-8.

Hold the valve seating surface "A," Figure 15, as close to 1/32 inch as possible. Seats with more than 1/16-inch seating surface should be narrowed (cut back) with 30° cutter, "E," Figure 15.

The valve seat angle "B" depends upon valve face angle "C." New valves have a 45° face. Recondition valve seats with 45° cutters and lap valves. See page 10-7.



A-Valve Seating Surface (1/32 inch)
B-Valve Seat Angle (45°)
C-Valve Face Angle (45°)
D-Valve Margin (1/16 inch)
E-Seat Narrowing Angle (30°)

Fig. 15-Valve Seat and Surface Dimensions

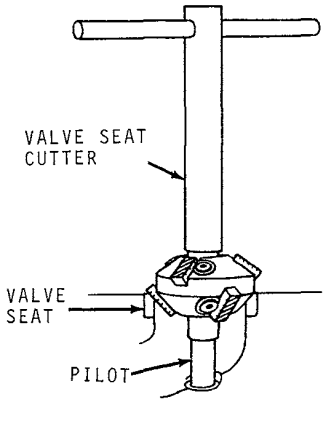


Fig. 16-Valve Seat Cutter

This valve seat cutter will cut a 45° valve seat and narrow the seat to 30°. See Special Tools, page 10-12, for tool number and manufacturer.

When reconditioning valves, be sure there is no more than 1/16-inch and no less than 1/32-inch margin "D" on the valve.

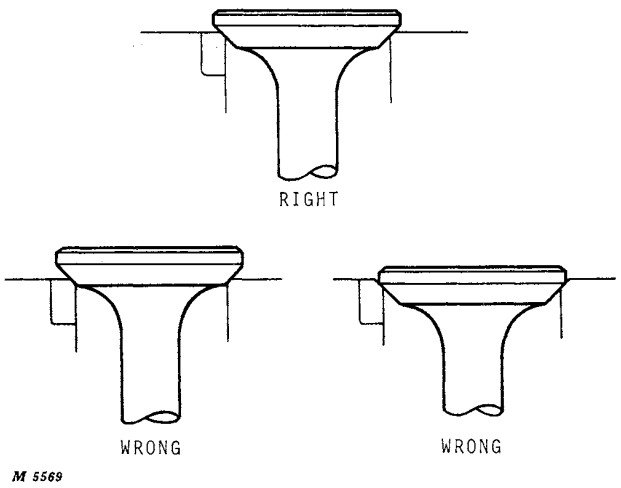


Fig. 17-Valve and Seat Relationship

When matching valves to seats, be sure valve seat is very nearly centered on the valve face. The position of the valve in the seat is clearly evident after lapping the valve, Figure 18.

Valve Lapping

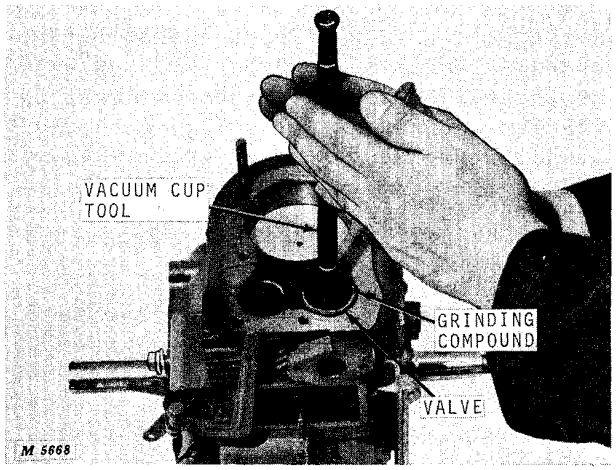


Fig. 18-Lapping Valves

Coat face of valve sparingly with a fine grade of valve grinding compound. Use a vacuum cup tool, Figure 18, to grip top of valve and rotate valve in a circular motion on valve seat.

Lift valve from seat every eight or ten strokes to keep compound equalized on surface of valve seat. Continue valve lapping operation until a uniform lapping ring appears around entire surface of valve face. When a good surface is attained, wash all parts with solvent to remove all traces of lapping compound. Dry parts thoroughly.

Note position of valve seat marked on valve face. The lapping mark made by the seat after lapping should appear on or near the center of the valve face.

Replacing Valve Guides

If valve guide clearance exceeds maximum tolerance, 0.003 inch, replace the guide. See page 10-11.

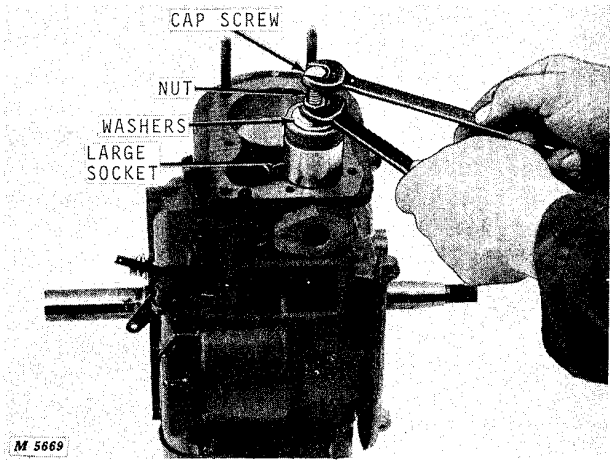


Fig. 19-Removing Valve Guides

Tap the valve guide its full length using a 3/8-inch N.C. tap and tapping compound or oil to prevent tap from breaking off in valve guide.

Thread a 3/8-N.C. x 6-inch cap screw its full length.

Install a nut, washer and spacer on the cap screw; then, turn the cap screw into the valve guide the full length of the valve guide.

Hold cap screw and keep turning nut against washer until valve guide is completely free from cylinder block, Figure 19.

NOTE: Valve guides can also be removed by driving them down into the valve spring chamber and carefully breaking them. Use care not to damage the cylinder block.

Replacing Valve Guides—Continued

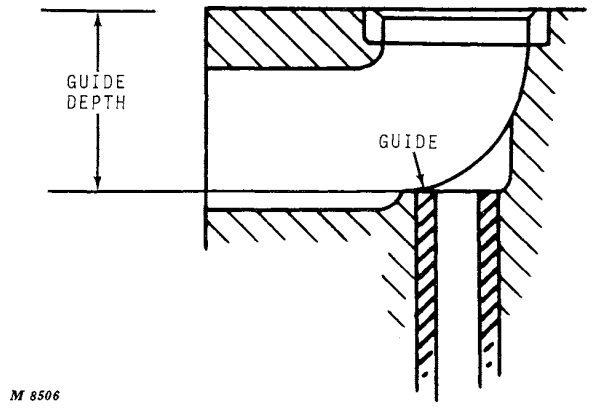


Fig. 20-Installing Valve Guides

Thoroughly clean guide hole in block. Press new guide into place. Guide depth is measured from top of block. Ream guide to correct size. See "Specifications," page 10-11.

Replacing Exhaust Valve Insert

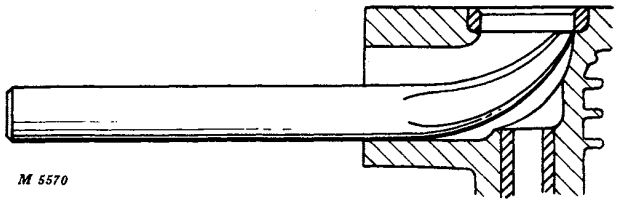


Fig. 21-Removing Exhaust Valve Insert

To remove exhaust seat insert, use extractor, Figure 21 or a valve seat puller. Clean seat area thoroughly before installing new insert. If extractor is not available, break seat with cold chisel and carefully extract broken pieces.

The exhaust valve insert is retained by a press fit only. Chill both the insert and driving tool in dry ice before pressing insert into block.

Installing Intake Valve Insert

If an intake valve seat is burned or worn beyond refacing, an insert can be machined and installed by a competent small engine rebuilder.

Checking Valve Clearance

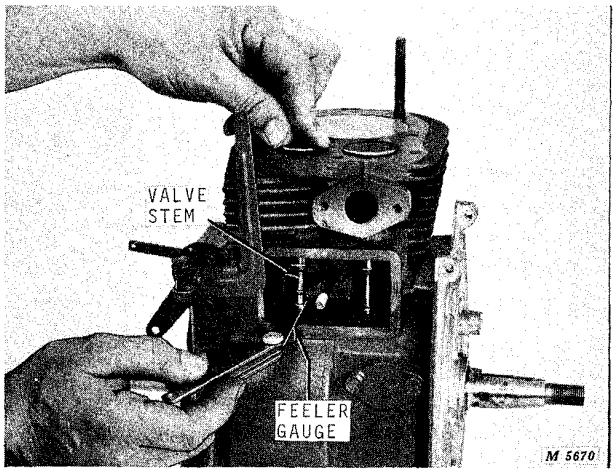


Fig. 22-Checking Valve-to-Tappet Clearance

Valve grinding changes the tappet and valve clearance. After grinding or installing new valves, check clearance as follows:

1. Rotate crankshaft until piston is top dead center (end of compression stroke) and crankshaft keyway is at exactly 12 o'clock (top) position. If breaker points are properly adjusted, they will be opening at this time. It is important that this procedure be followed to insure that the exhaust tappet is NOT riding on the automatic compression release mechanism.

2. Insert valves in their guides and hold valves firmly on seats.

3. Check clearance between bottom of each valve stem and its tappet with a feeler gauge, Figure 22. Refer to "Specifications," page 10-11, for proper valve clearance. On K181S Engines, grind valve stems for correct clearance. The K241AS Engines have adjustable tappets which will take up the additional clearance created by grinding the valve stems.

INSTALLATION

Installing Valve Springs, Retainers and Keepers

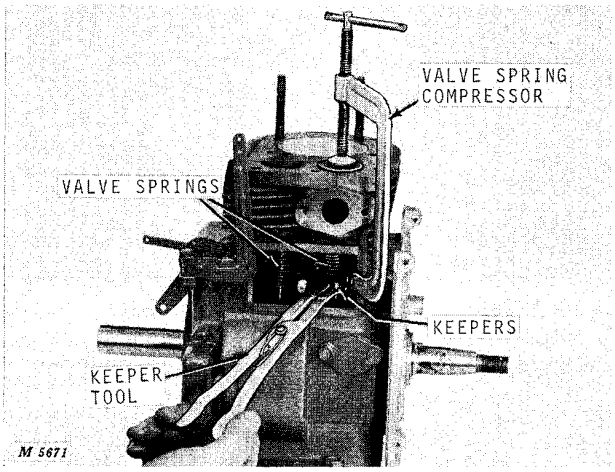


Fig. 23-Installing Valve Springs, Retainers and Keepers

Place valve spring and retainer in valve spring chamber. Install valves in guides working them back and forth to make sure they slip through the guides easily. Using a spring compressor, compress the springs and install keepers on valve stem with keeper tool, Figure 23. If tool is not available, apply grease to keepers to hold them on the valve stem and insert them by hand.

Assembling Breather

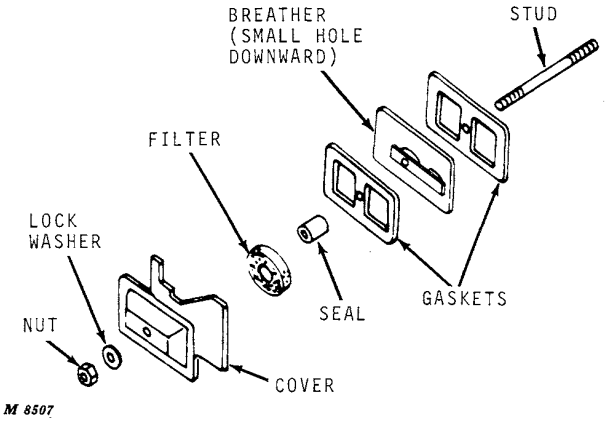


Fig. 24-Breather Parts (K181S Engine)

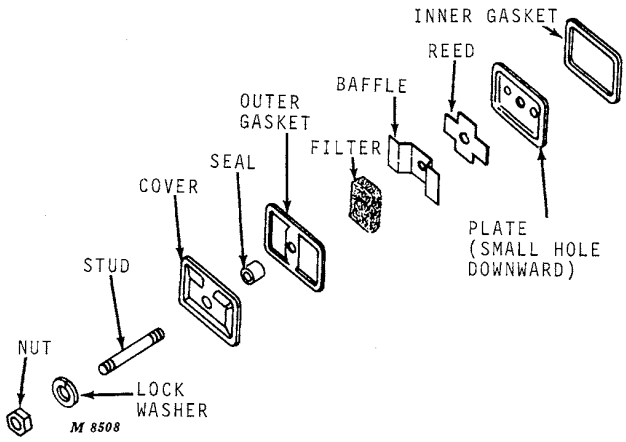


Fig. 25-Breather Parts (K241AS Engine)

The correct order of breather assembly is very important. For correct assembly, refer to Figures 24 and 25. Always use new gaskets. Place breather plate so that reed is facing away from engine, and small hole at bottom of plate is down. If breather plate is reversed, engine will pump oil out of the breather chamber and engine damage will soon occur.

Installing Cylinder Head

Always install a new head gasket when the head has been removed for service. This will assure a gas-tight fit.

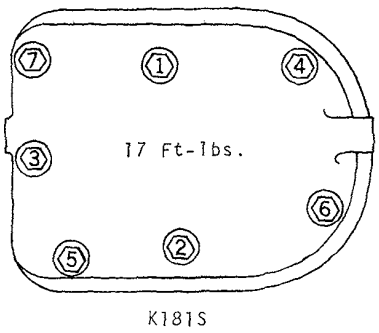


Fig. 26-Cylinder Head Bolt Tightening Sequence (K181S Engine)

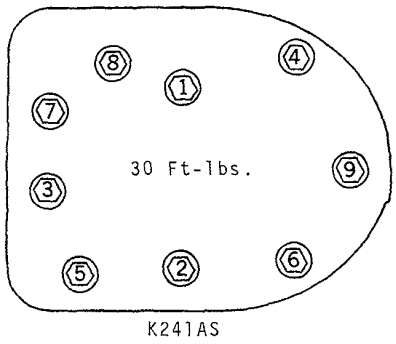


Fig. 27-Cylinder Head Bolt Tightening Sequence (K241AS Engine)

It is important to tighten all cylinder head bolts with an even pressure and in their correct sequence, Figure 26 or 27, so that uneven stresses will not set up in cylinder wall. Refer to "Specifications," page 10-11, for proper cylinder head bolt torque.

Installing Carburetor

K181S Engine

Connect throttle linkage in proper holes on governor arm and throttle shaft arm, Figure 28. Using new gasket, mount carburetor to engine block and tighten bolts firmly. Connect fuel line to carburetor and install head baffle.

K241AS Engine

Mount carburetor, Figure 29, to engine block using a new gasket, tighten bolts firmly. Connect fuel line to carburetor and install head baffle. Install adjustable throttle linkage. Basic overall length of throttle linkage is 3-5/8 inches. To obtain this dimension, loosen lock nuts and turn adjustable ends on or off threaded link.

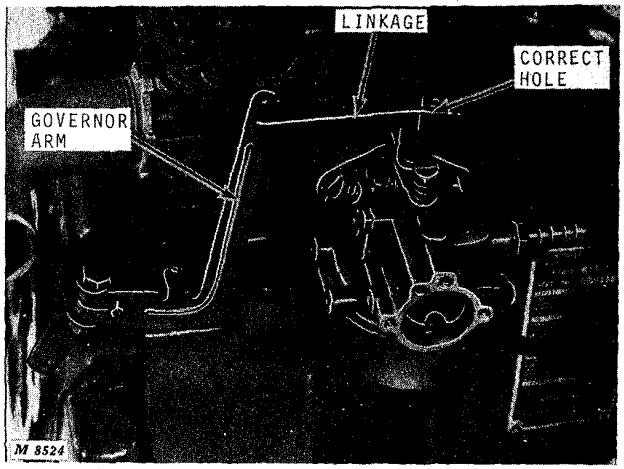


Fig. 28-Carburetor Assembly (K181S Engine)

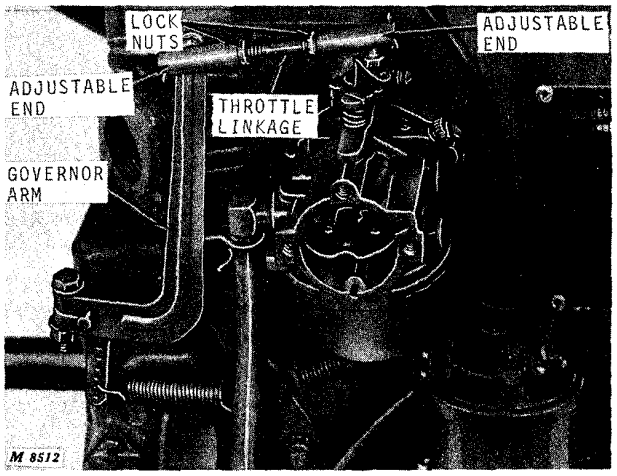


Fig. 29-Carburetor (K241AS Engine)

Checking Air Filter

Be sure air filter is clean. Remove filter and tap out dust or replace if necessary. See Section 30, Group 15.

Checking Spark Plug Gap

Refer to "Specifications," page 10-11, for proper spark plug gap. See Section 40, "Electrical System," for spark plug testing.

Checking Breaker Point Gap

Refer to Section 40, "Electrical System," and set breaker point gap.

SPECIFICATIONS

Kohler K181S and K241AS Engines

Component	New Part Dimension	Wear Tolerance
Valve guide, inside diameter	0.312 to 0.313 inch	.....
Valve guide depth (K181S)	1-5/16 inch	.....
Valve guide depth (K241AS)	1-15/32 inch	.....
Valve stem diameter—Intake	0.3105 to 0.3110 inch	.....
Exhaust	0.3090 to 0.3095 inch	.....
Valve seat width	1/32 inch	5/64 inch
Valve face width	3/32 inch	.....
Valve margin	1/16 inch	1/32 inch
Valve spring squareness	1/32-1/16 inch	3/32 inch
Valve spring compressed tension (intake or exhaust) (K181S)	18 to 22 lbs. at 1-15/16-inch length	.....
Valve spring compressed tension (intake) (K241AS)	43 to 49 lbs. at 1-5/16-inch length	.....
Valve spring compressed tension (exhaust) with rotator (K241AS)	43 to 49 lbs. at 1-5/16-inch length	.....
Valve spring free length (intake or exhaust) (K181S)	1-3/4 inch	1/32 inch
Valve spring free length (intake) (K241AS)	1-13/16 inch	1/32 inch
Valve spring free length (exhaust) with rotator (K241AS)	1-7/8 inch	1/32 inch
Cylinder head flatness	Contact at all points	Replace if warped

Table of Clearances

Item	Clearances
Intake valve stem in guide	0.0010 to 0.0025 inch
Exhaust valve stem in guide	0.0025 to 0.0040 inch
Valve clearance—intake (cold) (K181S)	0.006 to 0.008 inch
Valve clearance—intake (cold) (K241AS)	0.008 to 0.010 inch
Valve clearance—exhaust (cold) (K181S)	0.015 to 0.017 inch
Valve clearance—exhaust (cold) (K241AS)	0.017 to 0.020 inch

Torques For Hardware

Location	Torque
Cylinder head bolts (K181S)	17 ft-lbs
Cylinder head bolts (K241AS)	30 ft-lbs
Spark plug (cold)	27 ft-lbs

Tune-Up Data

Item	Specifications
Engine compression	110 to 120 psi
Spark plug gap (K181S)	0.025 inch
Spark plug gap (K241AS)	0.020 inch
Valve face angle	45°, see page 10-6
Valve seat angle	45°, see page 10-6
Crankcase vacuum (A) U-tube manometer	5-10 inches water column

Litho in U.S.A.

SPECIAL TOOLS

Name	Part No.	Use
Extractor	K.O. LEE R95	To remove exhaust valve seat insert.
Valve Spring Tester	STURTEDANT Model SPT	To check valve spring pressure.
Adjustable Reamers	QUICK SET 43	Ream valve guides after installation.
Valve Grinding Compound	B-K 1896	To lap valve seat and valve face.
Valve Keeper Replacer	KD 608	To install keepers on valve stem.
Valve Lifter	SNAP ON CF19	To compress valve springs
U-Tube Manometer	DWYER Model 1211-24	Check crankcase vacuum.
Valve Seat Cutter Kit for Kohler Engines	NEWAY No. 102S Kit, NEWAY Sales Inc., Corunna, Michigan	Recondition valve seat.

Group 15
PISTON, CRANKSHAFT, MAIN BEARINGS AND FLYWHEEL KOHLER ENGINES FOR 110 AND 112 TRACTORS

GENERAL INFORMATION

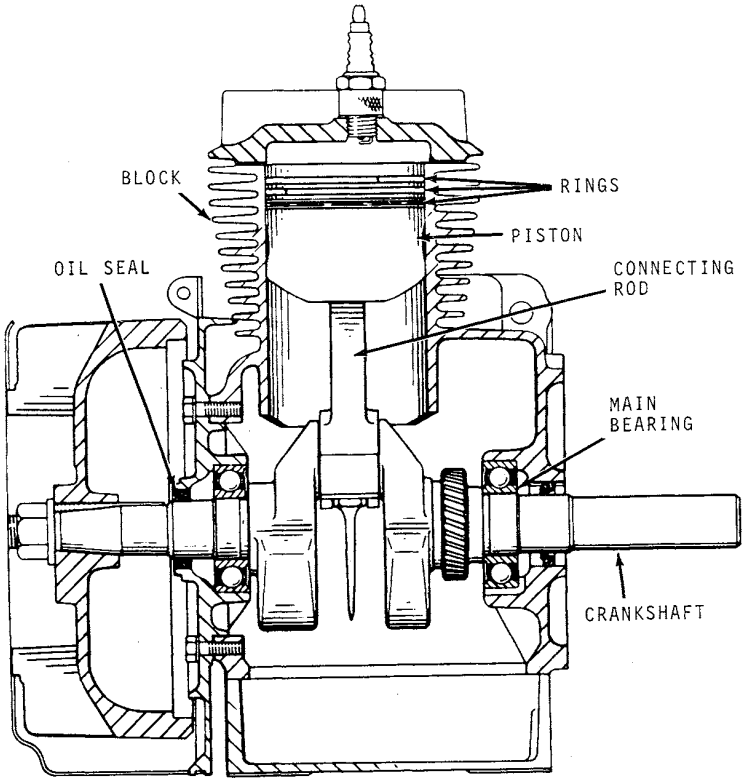


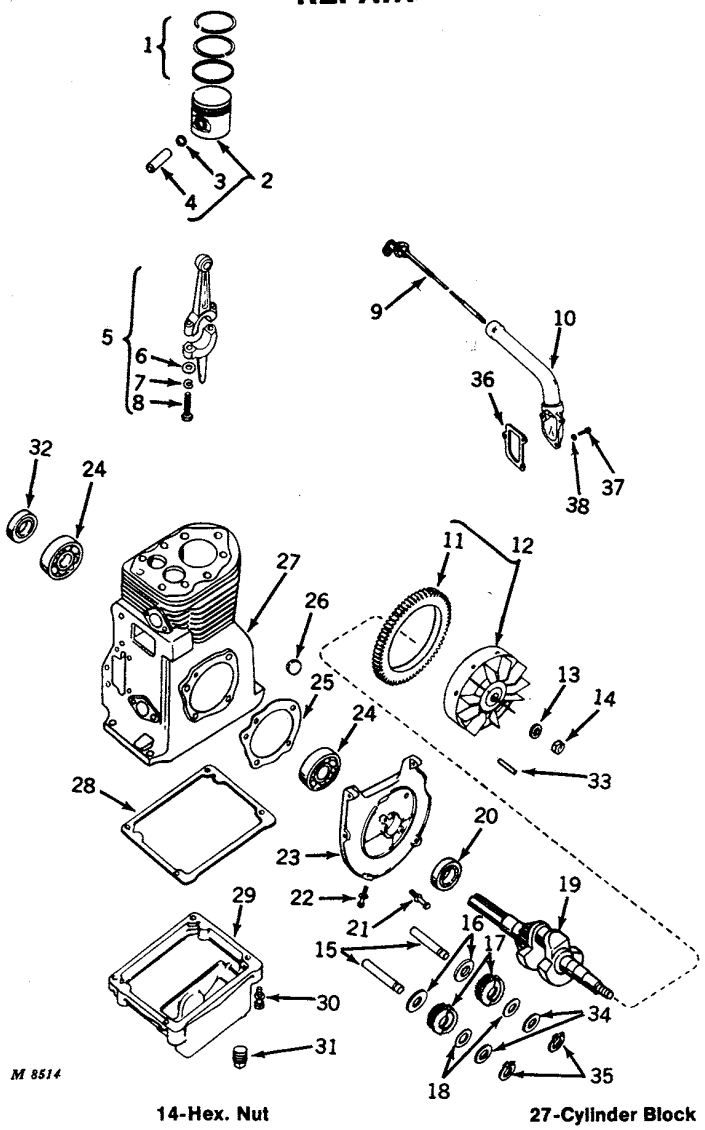
Fig. 1-Cutaway View of Kohler K181S Engine

Oversize pistons and rings are available for K181S and K241AS Kohler Engines. One undersize connecting rod is also available for each engine.

A short block assembly is available. It is complete with cylinder block, crankshaft, bearings and seals, connecting rod with piston, internal governor parts with regulating disk, bearing plate, stellite exhaust valve, compression release camshaft and head studs.

The short block for the Kohler K241AS Engine includes the dynamic balance gears in addition to the above parts.

REPAIR



1-Ring Set
2-Piston Assembly
3-Retainer (2 used)
4-Piston Pin
5-Rod Assembly
6-Washer (2 used)
7-Lock Washer (2 used)
8-Screw (2 used)
9-Dipstick
10-Oil Fill Tube
11-Ring Gear
12-Flywheel with Ring Gear
13-Washer
14-Hex. Nut
15-Shaft, Stub (2 used)
16-Spacer (2 used)
17-Gear, Balance (2 used)
18-Shim (2 used)
19-Crankshaft
20-Oil Seal, 2″O.D.
21-Cap Screw (8 used)
22-Cap Screw (6 used)
23-Bearing Plate
24-Ball Bearing (2 used)
25-Bearing Plate Gasket
26-Plug Button
27-Cylinder Block
28-Oil Pan Gasket
29-Oil Pan
30-Cap Screw (4 used)
31-Pipe Plug
32-Oil Seal, 2-3/8″O.D.
33-Key, 1/4″ x 3/16″ x 1-3/8″
34-Spacer (2 used)
35-Ring, Snap (2 used)
36-Gasket, Fill Tube
37-Screw, Machine, 10-24 x 1/2″ (3 used)
38-Washer, Lock, No. 10

Fig. 2-Exploded View Showing Piston, Connecting Rod, Crankshaft, Flywheel, Main Bearings and Oil Seals

Removing Engine from Tractor

1. Drain crankcase oil.

2. Remove tractor hood.

3. Remove front grille.

4. Shut off gas at fuel shut-off valve. Remove gas line from carburetor and drain. Remove gas tank.

5. Disconnect ground wire on engine and coil wire.

6. Disconnect choke and throttle control cables at the engine.

7. Remove hydraulic pump and bracket if tractor is so equipped. *NOTE: Do not disconnect hydraulic lines unless hydraulic system is to be repaired.*

8. Remove shielding from right-hand side of tractor and remove four engine base bolts. Lift out engine.

Disassembling Kohler K181S Engine

Remove engine shrouding, starter motor, coil and carburetor.

Remove cylinder head, breather assembly and valves. See Group 10 of this section.

Break flywheel nut loose with a shock tool or use a long handle nut spinner and a strap wrench. The flywheel is mounted on a tapered shaft and should be removed with a puller, Figure 3.

Remove oil pan and dipstick. Turn engine upside down and remove connecting rod, cap screws, lock and rod cap.

IMPORTANT: Use proper type tools to prevent oil slinger damage when removing rod cap screws.

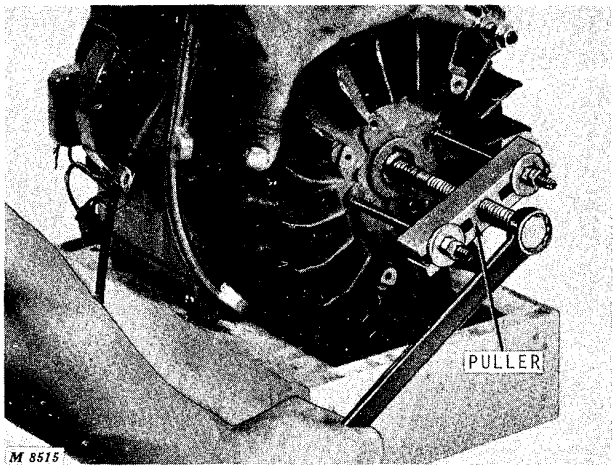


Fig. 3-Removing Flywheel

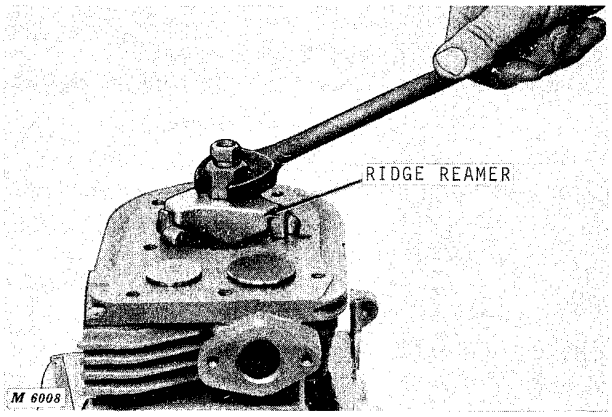


Fig. 4-Removing Ridge with Ridge Reamer

Before removing piston, check for carbon or ridge at top of cylinder bore. Remove carbon and ridge with ridge reamer, Figure 4. Push piston and rod out top of block.

Remove bearing plate (23, Figure 2). Be sure key is removed from end of crankshaft before removing plate.

Remove crankshaft by using a press or a soft metal mallet.

Disassembling Kohler K241AS Engine

Remove engine from tractor. Drain oil. Remove blower housing, flywheel, bearing plate, and oil pan.

Disassembling Kohler K241AS Engine—Continued

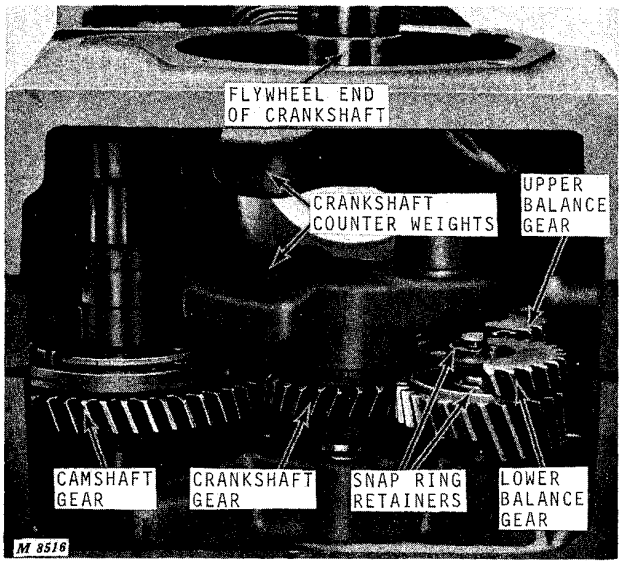


Fig. 5-Removing Balance Gears

Remove connecting rod cap and piston. Using a small snap ring pliers, remove snap ring from lower balance gear. Be careful not to lose spacer washers. Remove lower balance gear.

Remove crankshaft. Remove snap ring, spacer washers and upper balance gear (Figure 5). If stub shafts are scored or damaged they may be pressed out of block. Needle bearings are serviceable and can be pressed from balance gears.

Inspecting Balance Gear Stub Shaft

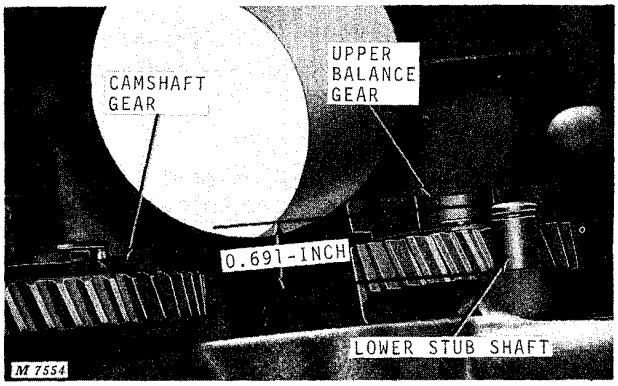


Fig. 6-Installing Stub Shafts

If new stub shafts are required, press old shafts from the outside in. To install new shafts, press into place from the inside out until 0.691 inch of shaft remains, Figure 6.

If camshaft or governor must be removed, see Group 20 of this section.

Inspecting Balance Gear and Bearing

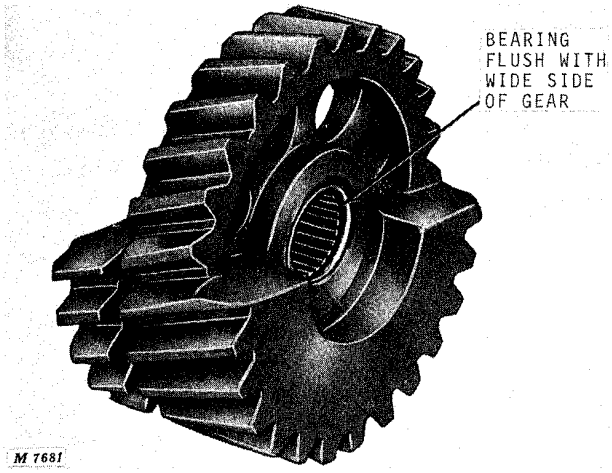


Fig. 7-Installing Needle Bearing in Gear

Inspect balance gear and bearing for wear or damage. If either condition exists, replace as required.

Balance gear bearings are replaceable and may be pressed into gear as shown in Figure 7.

Removing Piston Rings

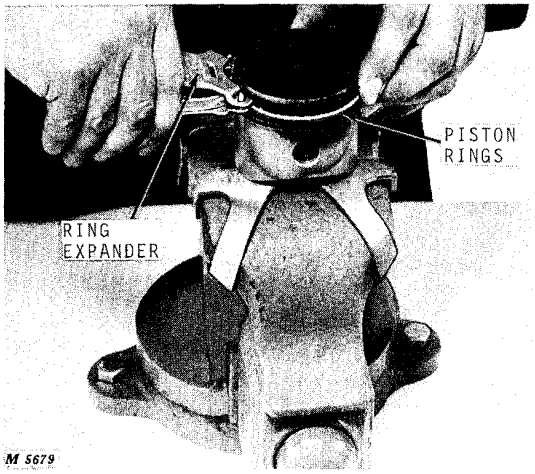


Fig. 8-Removing Piston Rings

Clamp the connecting rod in a vise that has soft metal jaws. *IMPORTANT: Tighten vise just enough to hold rod assembly. Excessive tightening will bend connecting rod.*

Use ring extractor to remove rings, Figure 8. Discard old rings.

Remove retainers from each end of piston pin and push pin out of piston and connecting rod.

Analyzing Piston Ring Wear

Light scuffing or scoring of both rings and piston occurs when unusually high friction and combustion temperatures approach the melting point of the piston material, Figure 9.

When this condition is found check and correct the following probable causes:

1. Dirty cooling shroud and cylinder head.
2. Lack of cylinder lubrication.
3. Improper combustion.
4. Wrong bearing or piston clearance.
5. Too much oil in crankcase causing fluid friction.

Fig. 9-Scored Piston and Rings

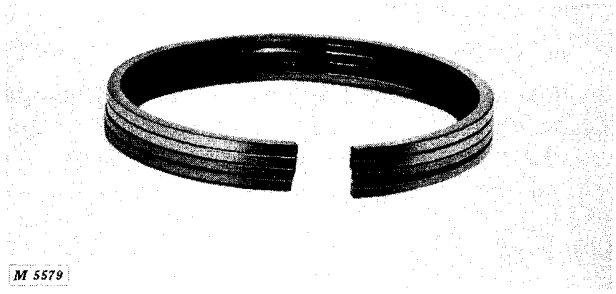


Fig. 10-Piston Rings with Improper End Gap

Rings of the wrong size or rings having improper end gap, Figure 10, cannot conform to the shape of the cylinder. This results in high oil consumption and excessive blowby. This could also be caused by end gaps being in alignment.

Ring end gaps should be staggered on the piston during installation.

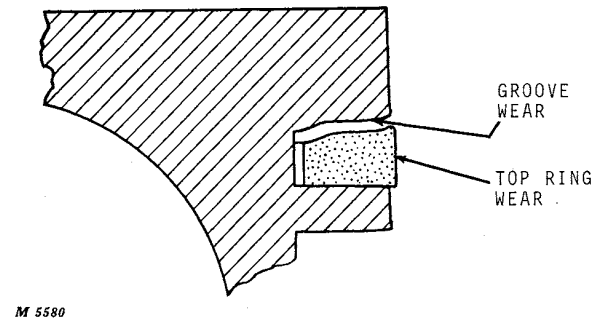


Fig. 11-Top Ring and Groove Side Wear

Check wear of ring grooves carefully, especially the top groove. The top ring and groove is exposed to combustion temperature and pressure as well as airborne abrasives which enter the combustion chamber.

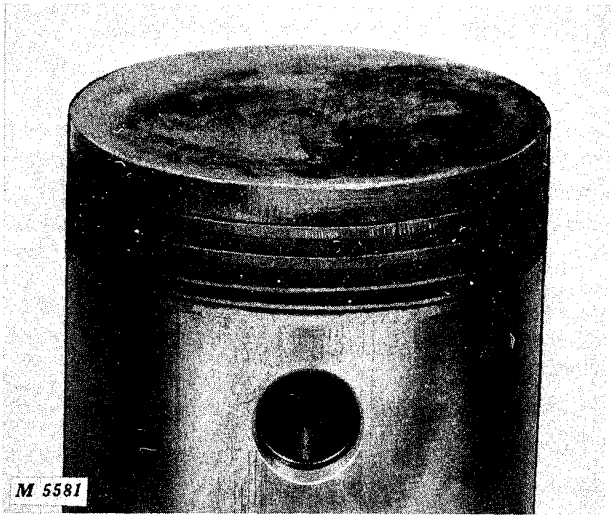


Fig. 12-Piston Rings Stuck and Broken Because of Lacquer, Varnish and Carbon Build-Up

Any condition which causes the engine to operate at abnormally high temperatures may cause varnish and lacquer gum deposits as well as carbon deposits to form in the piston grooves causing the rings to stick. When this happens excessive oil consumption and compression loss will occur.

Engine heating and ring sticking are most often caused by:

1. Overloading.
2. Pre-ignition detonation.
3. Incorrect fuel mixture.
4. Dirty cooling fins.
5. Incorrect oil.
6. Low oil supply.
7. Stale fuel.

Analyzing Piston Ring Wear—Continued

Fig. 13-Scratched Ring Faces Caused by Abrasives in the Engine

Vertical scratches across the faces of piston rings are the result of an abrasive entering the engine. Abrasives may be airborne, may have been left in during overhaul, or are loose lead and carbon deposits.

When this condition is found, always check and correct the source of abrasives to prevent premature ring failure.

Common causes for abrasives in the engine are:

1. Damaged, collapsed or improperly installed air filter.
2. Loose connection or damaged gasket between air filter and carburetor.
3. Air leak around carburetor to block gasket.
4. Air leakage around throttle shaft.
5. Failure to properly clean cylinder bore after reconditioning engine.

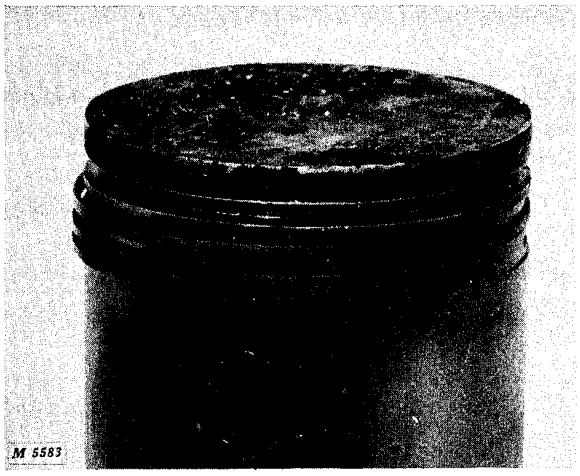


Fig. 14-Worn Oil Rings Which Cannot Provide Oil Control

Rails of the oil ring are worn down to the oil drain holes. This can only come from cylinder wall contact after much use and possible entry of abrasives. Compression rings will also be worn thin.

Badly worn oil rings will have:

1. Extra large gap.
2. Low tension.

Inspecting Piston

Remove deposits from piston surfaces. Clean gum and varnish from the piston skirt.

Do not use a caustic cleaning solution or a wire brush to clean pistons.

Be sure the oil ring drain holes in piston are clean.

Clean carbon from piston ring grooves with a ring groove cleaner. If cleaning tool is not available, break an old ring and use it to clean groove, Figure 15.

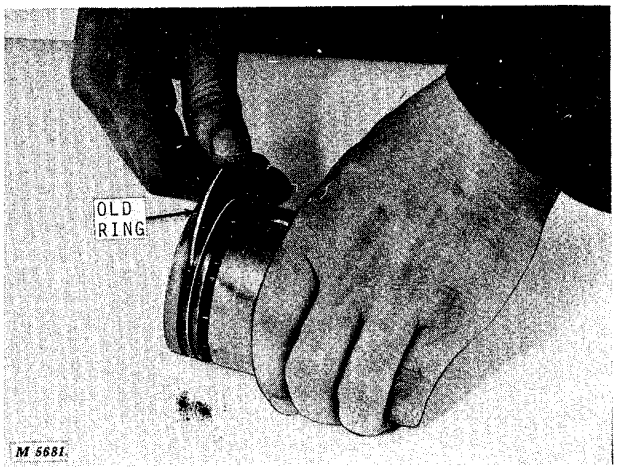


Fig. 15-Cleaning Ring Grooves

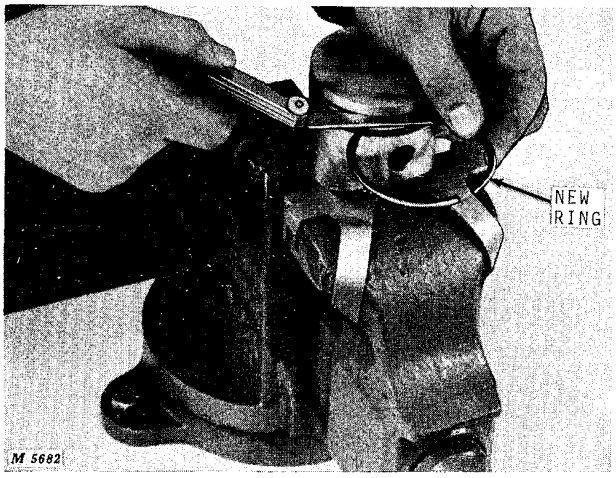


Fig. 16-Measuring Ring Clearance

Check ring grooves for excessive wear by inserting a **new** ring in the proper groove at several points around the piston. Measure clearance between ring and groove with a feeler gauge, Figure 16. Refer to "Specifications," page 15-21, for ring groove side clearance. Replace piston having ring clearance beyond wear limits.

Inspect piston for fractures at the ring lands, skirts and ring bosses and for rough or scored skirts.

Analyze the condition of the piston by studying the illustrations beginning on page 15-8. Replace faulty pistons.

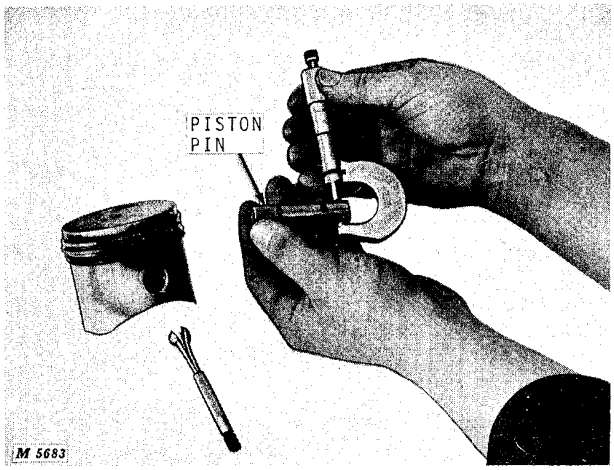


Fig. 17-Measuring Piston Pin and Piston

Measure piston pin-to-piston clearance with a micrometer. Ream out piston and rod and install oversize piston pins when necessary. See "Specifications," page 15-21. Oversize piston pins are available for service.

Fig. 18-Measuring Piston

Check the piston-to-cylinder bore clearance by measuring the piston and bore diameters, Figures 18 and 23.

Measure the outside diameter of the piston with a micrometer at the centerline of the piston pin bore and at 90° to the pin bore axis.

If piston-to-cylinder bore clearance is 0.005-inch or less, deglaze the cylinder walls and install a set of heavy-duty rings.

Inspecting Piston—Continued

If cylinder-to-bore clearance is more than 0.005-inch, the cylinder will have to be rebored and oversize piston and rings installed.

Oversize pistons and rings are available in 0.010-inch, 0.020-inch and 0.030-inch sizes for service.

See page 15-10 for deglazing and boring information.

Analyzing Piston Wear

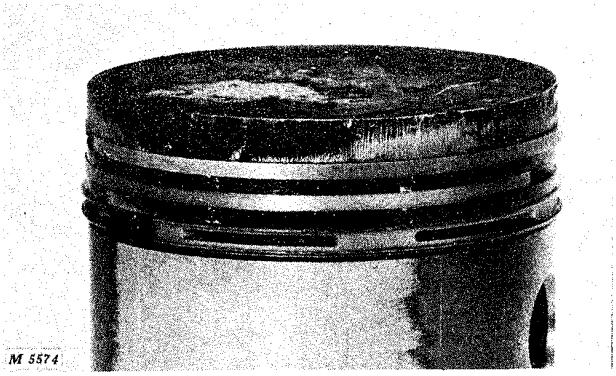


Fig. 19-Piston Top Land Burning Caused by Detonation

Detonation is a form of abnormal combustion causing excessive temperature and pressure in the combustion chamber. Commonly called carbon knock, spark knock or timing knock, detonation occurs as compressed air-fuel mixture ignites spontaneously to interrupt the normal ignition flame front. When detonation is detected check and correct the following possible causes:

1. Lean fuel mixtures.
2. Low octane fuels.
3. Over-advanced ignition timing.
4. Engine lugging.
5. Build-up of carbon deposits on piston and cylinder head causing excessive compression.
6. Wrong cylinder head or milling of head increasing compression ratio.

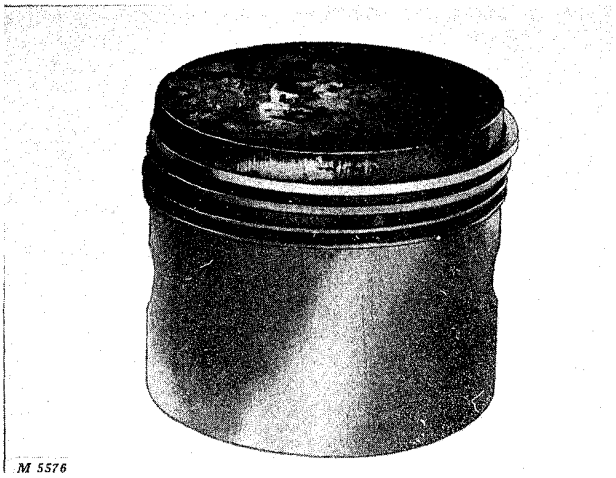


Fig. 20-Diagonal Piston Wear Pattern Caused by Bent or Twisted Connecting Rod

Check rod and piston alignment when a piston shows a diagonal wear pattern extending across the skirt of the piston. Contact with cylinder wall shows on bottom of skirt at left and ring lands on the right.

A cylinder bored at an angle to the crankshaft could also cause improper ring contact with the cylinder wall.

This condition can cause:

1. Rapid piston wear.
2. Uneven piston wear.
3. Excessive oil consumption.

Fig. 21-Hole Burned in Piston Caused by Pre-Ignition

Pre-ignition is the igniting of the fuel-air mixture prior to the regular ignition spark. Pre-ignition causes severe internal shock resulting in pings, vibration, detonation and power loss. Severe damage to piston, rings and valves results from pre-ignition.

When pre-ignition is suspected and detected, check and correct the following possible causes:

1. Internal carbon deposits which remain incandescent.
2. Incorrect spark plug (high heat range).
3. Broken ceramic in spark plug.
4. Sharp edges on valves or elsewhere in the combustion chamber.

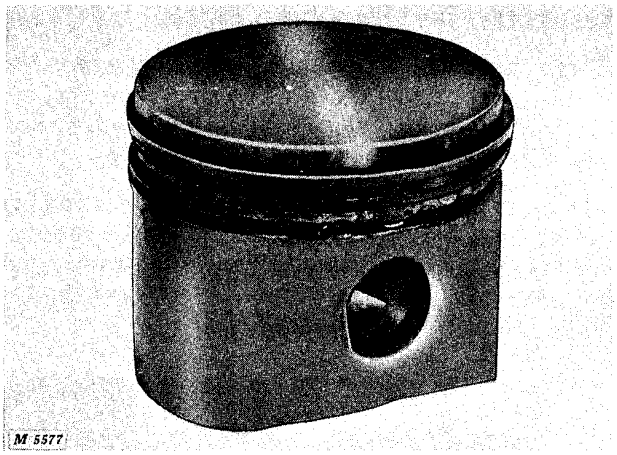


Fig. 22-Piston Damage Caused by Piston Pin Retainer Coming Loose

In the above illustration a piece of the retainer found its way into the oil ring.

Pin retainers loosen or break due to:

1. Rod misalignment.
2. Excessive crankshaft end play.
3. Crankshaft journal taper.
4. Weak pin retainers.
5. Pin retainers incorrectly installed.

Inertia can cause a pin retainer or loose object inside the piston pin to fly around and damage both the piston and cylinder wall.

Inspecting and Repairing Block

After thoroughly cleaning the block, check it for cracks. Cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25% kerosene and 75% light engine oil.

Wipe the part dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If a crack is present, the coating will become discolored at the defective area. Replace the block if cracked. *NOTE: A short block is available for service.*

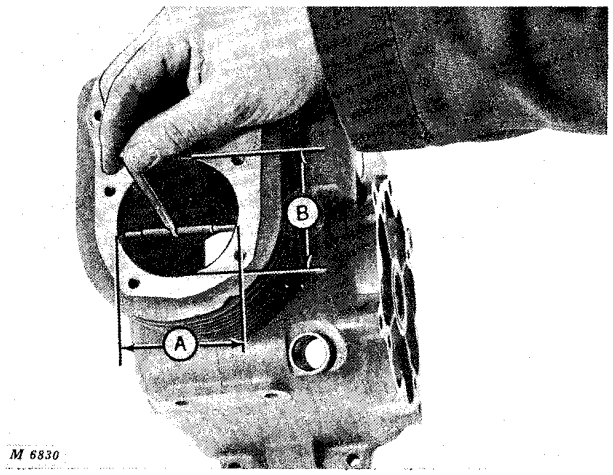


Fig. 23-Measuring Cylinder Bore

Use a telescoping gauge and micrometer to measure bore in two places at top and bottom of ring travel area, Figure 23. Out-of-round dimension is the difference between dimensions A and B. Cylinder wall taper is the difference between dimension A at the top and dimension A at the bottom of cylinder bore. See "Specifications," page 15-21, for wear tolerance.

Deglazing Cylinder Bore

Deglazing is not intended to remove any appreciable amount of metal from the bore, but rather to clean up and provide the proper surface. A proper bore surface feels smooth but has a cross-hatch pattern of micro-scratches which can be seen. This finish will allow the new rings to seat or run-in properly. This finish also retains a small film of oil to provide ring lubrication for the ring surface and prevents scoring.

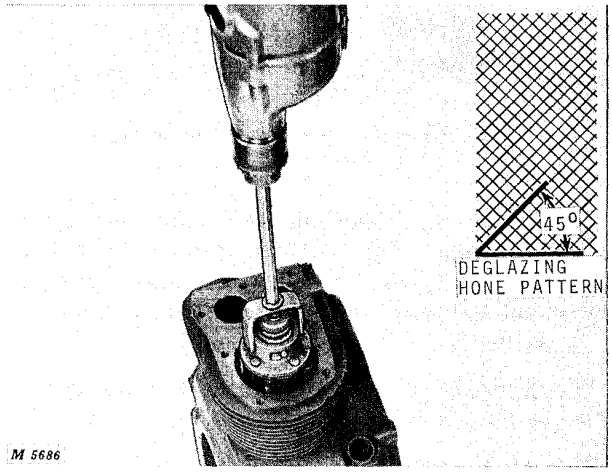


Fig. 24-Deglazing Cylinder Bore

Use a deglazing tool to break glaze, Figure 24. Follow manufacturers recommendations.

A 200-280 grit tool is generally preferred for deglazing. A cross hatch pattern of approximately 45 degrees should be obtained while operating the tool vertically during deglazing.

Boring Cylinder Block

If block is to be bored as determined on page 15-8, clean and dry block thoroughly. Boring can be done by machining at a reliable automotive repair shop or by using an electric drill and honing tool. See "Special Tools," page 15-22.

Honing to 0.010-inch oversize to accommodate oversize piston and rings can also be done with a coarse stone in the deglazing tool, Figure 24, and finishing with finer grit stone(s). *IMPORTANT: If block is jigged in a drill press for honing, be sure honing tool and block are in alignment.*

Inspecting Crankshaft

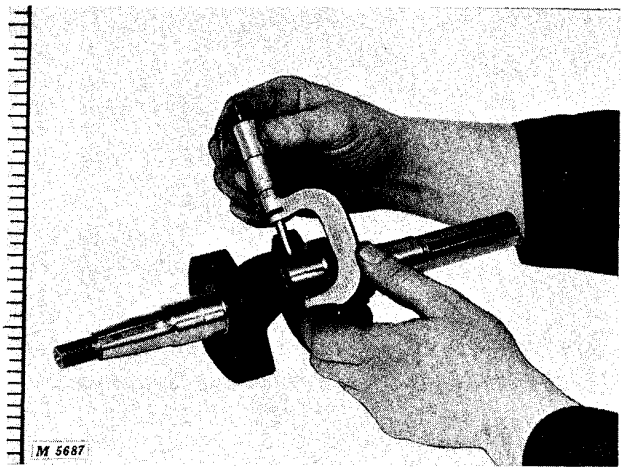


Fig. 25-Measuring Crankshaft Journal

Wipe crankshaft dry and check journal condition. Clean up threads on end of shaft if necessary. If crankshaft journal indicates wear, Figure 25, beyond specified limits or if journal is scored, take the crankshaft to a competent machine shop to turn the journal down 0.010-inch. An undersize connecting rod and cap must then be installed. THIS IS IMPORTANT. Do not just replace a crankshaft having a bad journal. Turning down the journal and installing a new rod will likely be the least expensive method of repair.

Analyzing Connecting Rod and Cap Wear

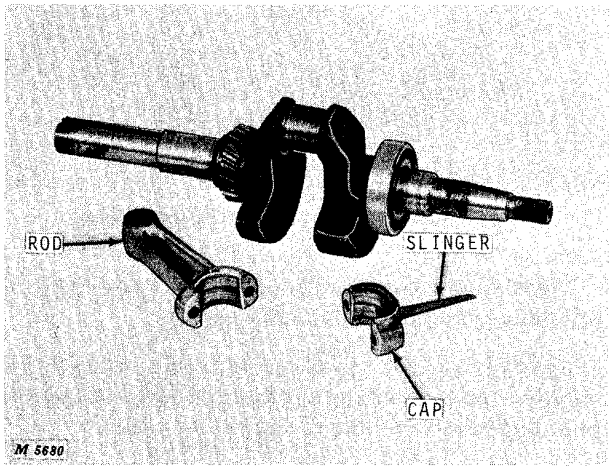


Fig. 26-Crankshaft Connecting Rod and Cap

After cleaning and drying parts, check rod, Figure 26, and cap for signs of bending, cracking or unusual wear patterns.

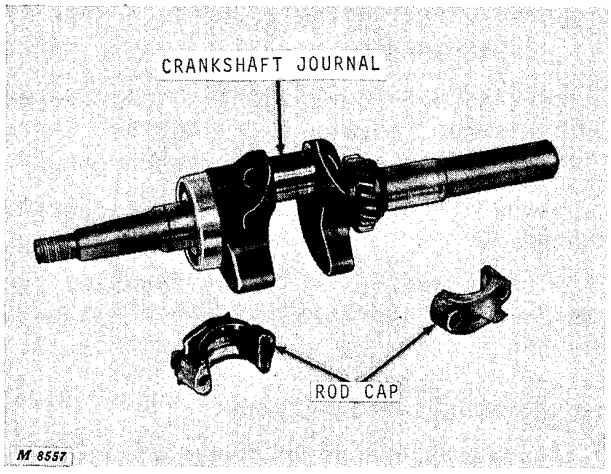


Fig. 27-Scored and Galled Crankshaft Journal and Rod Cap Caused by Lack of Lubrication

Lack of lubrication or improper lubrication, Figure 27, can cause the connecting rod and cap to seize to the crankshaft and may even cause rod particles to become imbedded in the hardened steel crankshaft. When the rod and cap seize to the crankshaft, the connecting rod and piston may both break with shattering force causing other interior damage. When this happens inspect block carefully for cracks and breakage before rebuilding engine.

Crankshaft and connecting rod damage can result from:

1. Engine run low on oil or without oil.
2. Oil slinger broken off bearing cap.
3. Oil hole in connecting rod plugged.
4. Oil not changed regularly.
5. Bearing cap installed incorrectly.

Note especially the condition of the rod and cap bearing area. Evidence of score marks on these areas indicates impurities in the oil or engine run without oil. Replace rod showing scratch marks or deep scores in the bearing area. Bent rods can be straightened with a rod aligner. Be sure slinger on rod cap is intact - not cracked, bent or chipped. This is important. *NOTE: New rods and caps are available only as a matched set for service. If either is damaged, both must be replaced.*

Analyzing Connecting Rod and Cap Wear — Continued

Measure fit of rod and cap to crankshaft journal. Also measure fit of piston pin in piston and rod. See "Specifications," page 15-21, for wear tolerances.

An undersize rod and cap (0.010-inch) is available for service.

NOTE: Connecting rod and crankshaft journal must be clean and meet specifications or a failure will reoccur.

Inspecting Main Bearings

Main bearings turn in an oil mist and will not normally require replacing. Check for unusual signs of wear such as race turning with bearing or bearing deflection caused by excessive engine lugging. Refer to "Bearing Analysis" below.

Analyzing Bearing Wear

The causes of bearing failure must be identified and understood in order to apply the proper corrective measures.

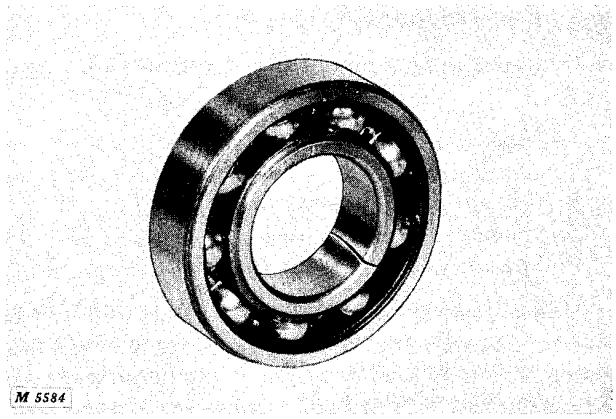


Fig. 28-Broken Races Caused by Misaligned Bearing During Installation

Bearings allowed to cock while inserting or pressing them over a burr may cause the bearing to crack, Figure 28. Always use a bearing driver tool and remove burrs before installing bearings.

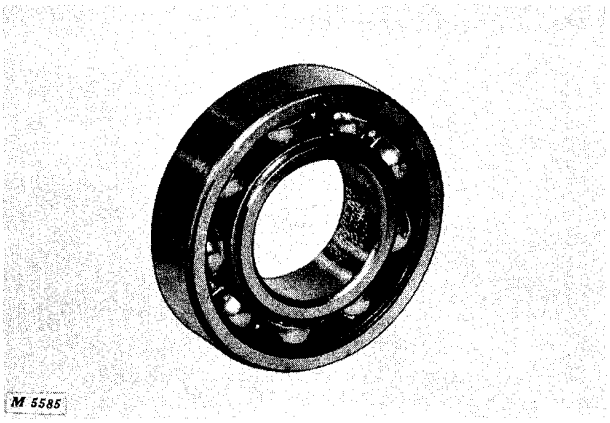


Fig. 29-Bearing Wear Caused by Crack or Looseness on Shaft

If inner ring is a loose fit on the rotating shaft, rotation of the shaft within the inner ring can scuff loose small particles of metal. These eventually get into the bearing causing wear on the balls and races. This makes for noisy operation and shortened bearing life and failure. The condition is easily identified by scoring or abrasion on the bore of inner ring, Figure 29.

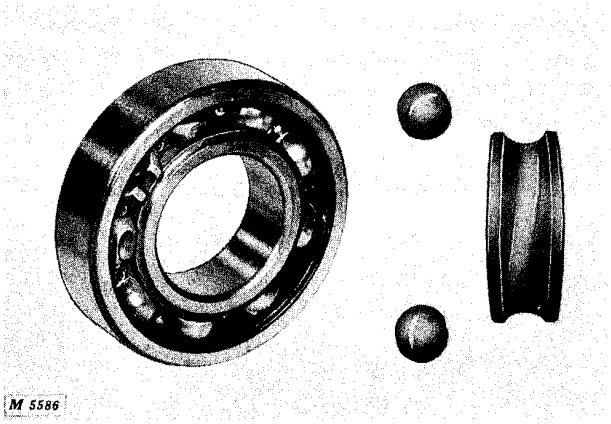


Fig. 30-Bearing Wear Caused by Misalignment

Misaligned bearings cause undue wear, heat by friction and eventual failure, Figure 30.

Note the crooked ball paths in the raceways and the oval appearance of the balls and wear on the separator caused by rubbing against the race.

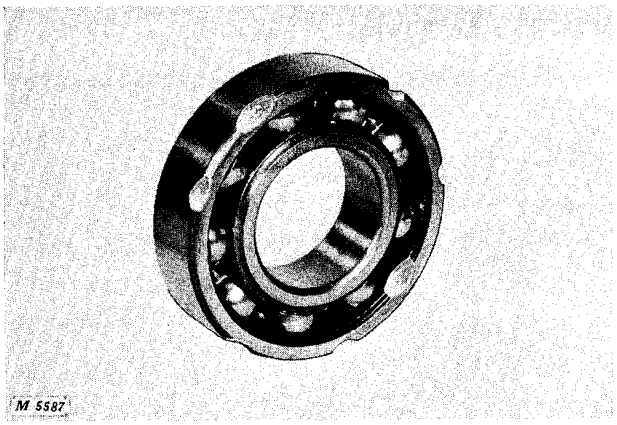


Fig. 31-Nicks in Outer Race Caused by Using Chisel or Driftpin to Remove or Install Bearing

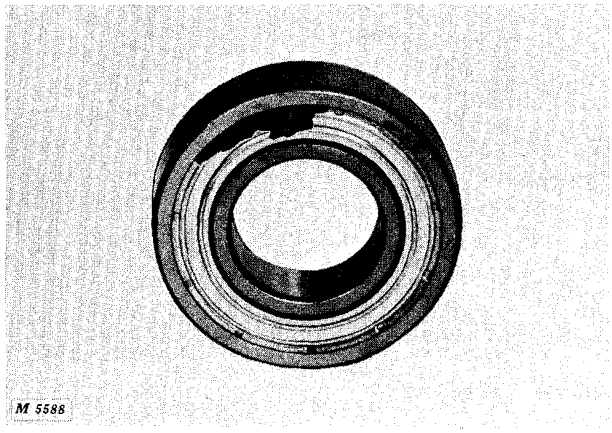


Fig. 32-Oil Seal Damage Caused by Careless Installation with Sharp Tool

Inspecting Camshaft

Check camshaft for broken or cracked gear teeth. Check operation of ACR assembly making sure all parts are intact and operate freely. Check condition of flyweight springs. If camshaft needs attention, see Group 20 for camshaft and governor service.

INSTALLATION

Installing Balance Gears

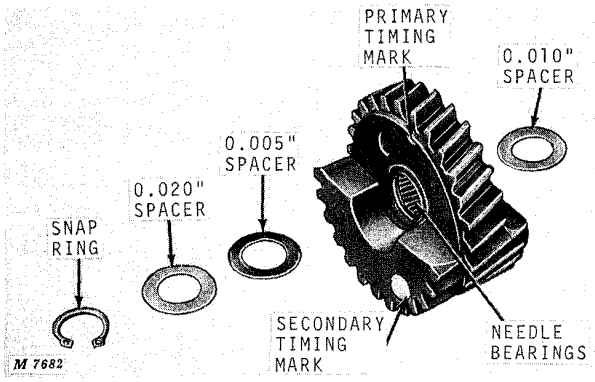


Fig. 33-Balance Gear Assembly

Slip one 0.010-inch spacer on upper stub shaft and install upper balance gear. Be sure timing marks are toward flywheel side of engine. Next place a 0.010-inch spacer on stub shaft, followed by a 0.005 and 0.020-inch spacer, and install snap ring, Figure 33.

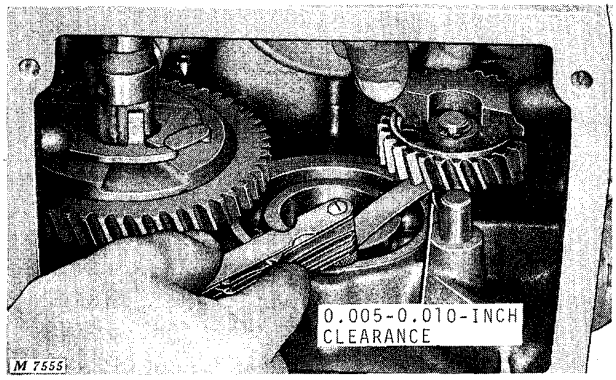


Fig. 34-Checking Balance Gear End Play

Check end play of balance gear and adjust to 0.005 to 0.010 inch by adding or removing 0.005-inch spacers, Figure 34.

NOTE: If you are going to use a timing tool when installing the crankshaft, page 15-14, install both upper and lower balance gears prior to installing crankshaft. If you are not going to use a timing tool when installing the crankshaft, page 15-15, install only the upper balance gear at this time.