# John Deere

## Service Manual
## 200, 210, 212, and 214
## Lawn and Garden Tractors
## SM-2105-(Oct-76)

**John Deere Horicon Works**
**SM2105 (Oct-76)**
LITHO IN U.S.A.
**ENGLISH**

# JOHN DEERE 200, 210, 212 AND 214 LAWN AND GARDEN TRACTORS

**Service Manual**
**SM-2105 (Oct-76)**

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





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# INTRODUCTION

This service manual contains service and maintenance information for the John Deere 200, 210, 212 and 214 Lawn and Garden Tractors.

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.

Metric equivalents have been included, where applicable, throughout this service manual.

Specifications and special tools are found in the last group of each section.

This manual can be kept in its own cover or it can be filed in your service manual rack or in your Consumer Products Service Information 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.

**⚠ This safety alert symbol identifies important safety messages in this manual. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows.**

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# Section 10
# GENERAL
## Group 5
# TRACTOR IDENTIFICATION

### CONTENTS



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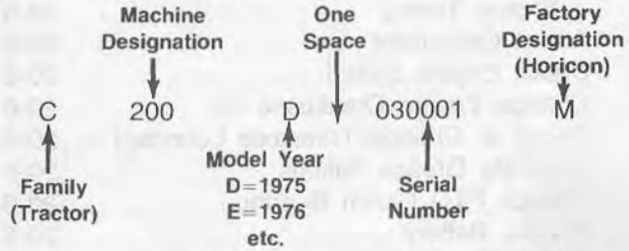
## SERIAL NUMBERS

### Tractor


*Fig. 1-Tractor Serial Number*

The tractor serial number, Fig. 1, is located on the pedestal below the steering wheel.

The first letter indicates the "family of machine"; the next three numbers or letters, the "model or machine designation"; the letter in the fifth position indicates the "model year". This is followed by a space (for computer purposes), and a six-digit serial number and the letter "M" denoting Horicon as the factory of manufacture.




When ordering parts, use only the six-digit serial number. When writing about or filling out warranty claims, use all thirteen numbers, letters and spaces shown on the machine serial number plate.

### Engine


*Fig. 2-Engine Serial Number*

The engine serial number, Fig. 2, is located on the engine shroud.

### Transaxle

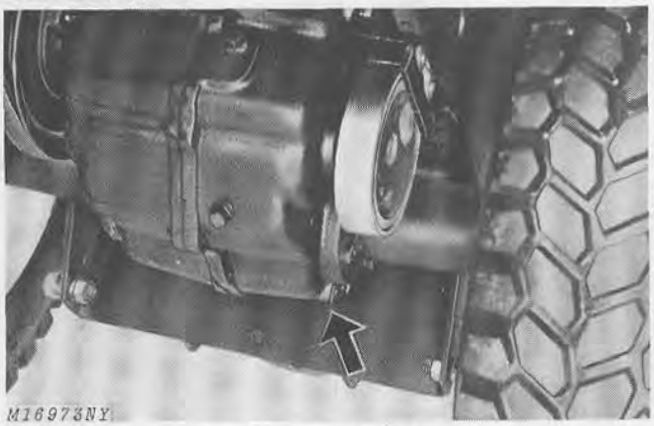



*Fig. 3-Transaxle Serial Number*

The transaxle serial number, Fig. 3, is located on the transaxle case next to the L.H. axle housing.

## IDENTIFICATION CODES

### Tire Codes

John Deere 200, 210, 212 and 214 Tractors are available with four different combinations of tires as follows:

| Tire Code | Size Front | Size Rear | Tread |
|---|---|---|---|
| GT-3 | 16x6.50-8 | 23x8.50-12 | High-Flotation |
| GT-4 | 4.80/4.00-8<br>------ | ------<br>23x8.50-12 | Studded Traction |
| GT-5 | 16x6.50-8 | 23x10.50-12 | High-Flotation |
| GT-8 Bar Tread | 16x6.50-8<br>or 4.80/4.00-8<br>------ | ------<br>23x10.50-12 | High-Flotation Traction |

*NOTE: The 200 Tractor is equipped with GT-3 tires as standard equipment. The 210, 212 and 214 Tractors are equipped with GT-5 tires as standard equipment.*

# Group 10
# SPECIFICATIONS

## ENGINE SPECIFICATIONS

| Item | 200 | 210 | 212 | 214 |
|---|---|---|---|---|
| Engine Model No. | K181QS | K241AQS | K301AQS | K321AQS |
| Manufacturer | Kohler | Kohler | Kohler | Kohler |
| Cylinders | One | One | One | One |
| Stroke/Cycle | Four | Four | Four | Four |
| Bore | 2.94 in. (7.46 cm) | 3.25 in. (8.25 cm) | 3.38 in. (8.58 cm) | 3.50 in. (8.89 cm) |
| Stroke | 2.75 in. (6.98 cm) | 2.88 in. (7.31 cm) | 3.25 in. (8.25 cm) | 3.25 in. (8.25 cm) |
| Displacement | 18.6 cu. in. | 23.9 cu. in. | 29.1 cu. in. | 31.3 cu. in. |
| Speeds (Fast) No Load | 3400 to 3500 rpm | 3400 to 3500 rpm | 3400 to 3500 rpm | 3400 to 3500 rpm |
| Speeds (Idle) | 1700 to 1900 rpm | 1700 to 1900 rpm | 1700 to 1900 rpm | 1700 to 1900 rpm |
| Horsepower* | 8 | 10 | 12 | 14 |
| Normal Compression | 110 to 120 psi | 110 to 120 psi | 110 to 120 psi | 110 to 120 psi |
| Valve Clearance | | | | |
| Intake (Cold) | 0.007 in. (0.178 mm) | 0.010 in. (0.254 mm) | 0.010 in. (0.254 mm) | 0.010 in. (0.254 mm) |
| Exhaust (Cold) | 0.016 in. (0.406 mm) | 0.020 in. (0.508 mm) | 0.020 in. (0.508 mm) | 0.020 in. (0.508 mm) |
| Ignition | Battery | Battery | Battery | Battery |
| Spark Plug | Champion-J-8 or XJ8 AC-45-M or R-46 Prestolite-14-7 or 14-R8 | Champion-H-10 AC-45L Prestolite-14-L7B | Champion-H-10 AC-45L Prestolite-14-L7B | Champion-H-10 AC-45L Prestolite-14-L7B |
| Spark Plug Gap | 0.025 in. (0.635 mm) | 0.035 in. (0.889 mm) | 0.035 in. (0.889 mm) | 0.035 in. (0.889 mm) |
| Breaker Point Gap | 0.020 in. (0.508 mm) | 0.020 in. (0.508 mm) | 0.020 in. (0.508 mm) | 0.020 in. (0.508 mm) |
| Charging System | Alternator | Alternator | Alternator | Alternator |
| Starter | 12-Volt | 12-Volt | 12-Volt | 12-Volt |
| Air Filter | Dry-type | Dry-type | Dry-type | Dry-type |

**The horsepower rating shown is established by the engine manufacturer in accordance with Standard Internal Combustion Engine Institute procedure. It is corrected at 60°F. and 29.22 in. Hg. Barometer and is developed from laboratory test engines equipped with standard air cleaner and muffler.*

## BATTERY SPECIFICATIONS

| Tractor | Battery |
|---|---|
| 200 | John Deere, 12 Volt, (AM30094), BCI Group U1, 135 cold cranking amps at 0°F. (−17°C), 30-minute reserve capacity. |
| 210, 212, 214 | John Deere, 12 Volt, (AM31186), BCI Group 22F, 255 cold cranking amps at 0°F. (−17°C), 55-minute reserve capacity. |

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## TRACTOR SPECIFICATIONS

| Item | 200 | 210, 212, 214 |
|---|---|---|
| CAPACITIES | | |
| Fuel Tank | 3-1/2 U.S. Gallons (13.25 l) | 3-1/2 U.S. Gallons (13.25 l) |
| Crankcase | 2-1/2 U.S. Pints (1.18 l) | 3 U.S. Pints (1.42 l) |
| Transaxle | 3-1/2 U.S. Pints (1.65 l) | 3-1/2 U.S. Pints (1.65 l) |
| Hydraulic System (Optional) | ..... | 2 U.S. Pints (0.94 l) |
| TRANSMISSION | | |
| Type | Transaxle | Transaxle |
| Gear Selections | 4 forward - 1 reverse | 4 forward - 1 reverse |
| TRAVEL SPEEDS - @3400 rpm | | |
| 1st Gear (Variable) | 0.3 to 0.9 mph (.6 to 1.6 kms/hr) | 0.3 to 0.9 mph (.6 to 1.6 kms/hr) |
| 2nd Gear (Variable) | 1.0 to 2.7 mph (2.1 to 4.6 kms/hr) | 1.0 to 2.7 mph (2.1 to 4.6 kms/hr) |
| 3rd Gear (Variable) | 1.8 to 4.7 mph (3.8 to 8.0 kms/hr) | 1.8 to 4.7 mph (3.8 to 8.0 kms/hr) |
| 4th Gear (Variable) | 2.6 to 7.0 mph (5.5 to 11.9 kms/hr) | 2.6 to 7.0 mph (5.5 to 11.9 kms/hr) |
| Reverse (Variable) | 1.4 to 3.7 mph (2.4 to 5.3 kms/hr) | 1.4 to 3.7 mph (2.4 to 5.3 kms/hr) |
| DIMENSIONS | | |
| Wheelbase | 46 in. (1.168 m) | 46 in. (1.168 m) |
| Overall Length | 67-1/2 in. (1.715 m) | 67-1/2 in. (1.715 m) |
| Overall Height | 42 in. (1.067 m) | 42 in. (1.067 m) |
| Overall Width (maximum) | 41-1/2 in. (1.054 m) | 41-1/2 in. (1.054 m) |
| WHEEL TREAD | | |
| Front | 31 in. (78.74 cm) | 31 in. (78.74 cm) |
| Rear (GT-3 Tires) | 27 in. or 33 in. (68.58 cm or 83.82 cm) | 27 in. or 33 in. (68.58 cm or 83.82 cm) |
| (GT-5 Tires) | 28-1/2 in. or 31 in. (72.39 cm or 78.74 cm) | 28-1/2 in. or 31 in. (72.39 cm or 78.74 cm) |
| BRAKES | | |
| Type | Band, pedal-operated | Band, pedal-operated |
| Parking | Hand-lock foot brake | Hand-lock foot brake |
| CLUTCH | V-belt system | V-belt system |
| PTO CLUTCH | Manual | Manual |
| STEERING | Enclosed gear | Enclosed gear |
| LIFT* | Manual, Electric | Manual, Electric, Hydraulic |
| SHIPPING WEIGHT | 691 lbs. (313 kg) | 759 lbs. (344 kg) |

*Electric and Hydraulic Lifts are dealer installed options.*

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## TIRE SPECIFICATIONS

| Tire Code | Location | Size | Tubeless | Ply-Rating | Tread | Tire Inflation Pressure |
|---|---|---|---|---|---|---|
| GT-3 | Front | 16x6.50-8 | Yes* | 2 | High-Flotation | 6 to 16 psi (41 to 110 kPa) |
| | Rear | 23x8.50-12 | Yes* | 2 | | 5 to 10 psi (34 to 69 kPa) |
| GT-4 | Front | 4.80/4.00-8 | No | 4 | Studded Traction | 12 to 40 psi (82 to 276 kPa) |
| | Rear | 23x8.50-12 | Yes* | 2 | | 5 to 10 psi (34 to 69 kPa) |
| GT-5 | Front | 16x6.50-8 | Yes* | 2 | High-Flotation | 6 to 16 psi (41 to 110 kPa) |
| | Rear | 23x10.50-12 | Yes* | 2 | | 5 to 10 psi (34 to 69 kPa) |
| GT-8 Bar Tread | Front** | 16x6.50-8 | Yes* | 2 | High-Flotation | 6 to 16 psi (41 to 110 kPa) |
| | Rear | 23x10.5-12 | Yes* | 2 | Traction | 5 to 10 psi (34 to 69 kPa) |

**Tubes Available for service. See your parts catalog.*
***Use 4.80/4.00-8 front tires with front-end loaders.*

## REAR WHEEL WEIGHT BOLT SIZE CHART

| Tire/Wheel Option | Wheel Position | No. of Weights | Bolt Size |
|---|---|---|---|
| GT-3 or GT-4 | Narrow | 1 | 1/2 x 5-1/2 |
| GT-3 or GT-4 | Narrow | 2 | 1/2x7-1/2 |
| GT-3 or GT-4 | Wide | 1 | 1/2x5-1/2 |
| GT-3 or GT-4 | Wide | 2 | 1/2x7-1/2 |
| GT-5 | Narrow | 1 | 1/2x5-1/2 |
| GT-5 | Narrow | 2 | 1/2x8 |
| GT-5 | Wide | 1 | 1/2x5-1/2 |
| GT-5 or GT-8 | Wide | 2 | 1/2x7-1/2 |

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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 | | | | | U.S. Regular | |
| Bolt Dia. | U.S. Dec. Equiv. | TORQUE IN FOOT POUNDS | | | 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 | Torque in Inch Pounds | |
|---|---|---|
| | Cup Point | Square Head |
| #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
# FUEL AND LUBRICANTS

## FUEL

Always use fresh, clean "regular grade or non-leaded" gasoline having an octane rating of 85 or higher. We recommend non-leaded gasoline because it reduces cylinder head deposits.

Do not use premium, ethyl or white gasoline. Never use special additives such as carburetor cleaners, de-icers, or moisture-removing liquids in your gasoline.

**IMPORTANT: Do not mix oil with gasoline.**

**IMPORTANT: Do not permit dirt or other foreign matter to enter the fuel system. This could cause hard starting, poor performance and engine damage. Always use clean gasoline storage cans and funnels.**

## LUBRICANTS

### Engine Crankcase

John Deere Torq-Gard Supreme engine oil is recommended because of its superior lubricating qualities. If a different brand of oil is used, it must conform to one of the following specifications.

SPI Service CD/SE, CD/SD, CC/SD or SD MIL-L-46152 or MIL-L-2104C*.

**As further assurance of quality, the oil should be identified as suitable for API Service Designation SD.*

**IMPORTANT: Never put additives in the crankcase oil.**

Depending on the expected prevailing temperature for the fill period, use oil of viscosity shown in the following chart.

| Air Temperature | John Deere Torq-Gard Supreme Oil | Other Oils | |
|---|---|---|---|
| | | Single Viscosity Oil | Multi-Viscosity Oil |
| Above 32°F | SAE 30 | SAE 30 | Not recommended |
| −10° to 32°F −23.3°C to 0°C | SAE 10W-20 | SAE 10W | SAE 10W-30 |
| Below −10°F −23.3°C | SAE 5W-20* | SAE 5W* | SAE 5W-20* |

**Some increase in oil consumption may be expected when SAE 5W-20 or SAE 5W oils are used. Check oil level more frequently.*

### Transaxle

John Deere AM30200 Transmission Lubricant or SAE 90 Gear Lubricant. Also an equivalent SCL Multipurpose-Type Gear Oil.

### Tractor Grease Fittings

John Deere Multipurpose Lubricant SAE (Seasonal Grade) or equivalent Multipurpose-Type Grease.

### Hydraulic System (Optional Equipment)

John Deere All-Weather Hydrostatic Fluid or an equivalent Type "F" Automotive Automatic Transmission Fluid.

## CAPACITIES

| | |
|---|---|
| Fuel Tank | 3-1/2 U.S. gallons (13.25 l) |
| Crankcase: | 2-1/2 U.S. pints (1.18 l) |
| 200, 212, 214 | 3 U.S. pints (1.42 l) |
| Transaxle | 3-1/2 U.S. pints (1.65 l) |
| Hydraulic System (optional equip.) | 2 U.S. pints (0.94 l) |

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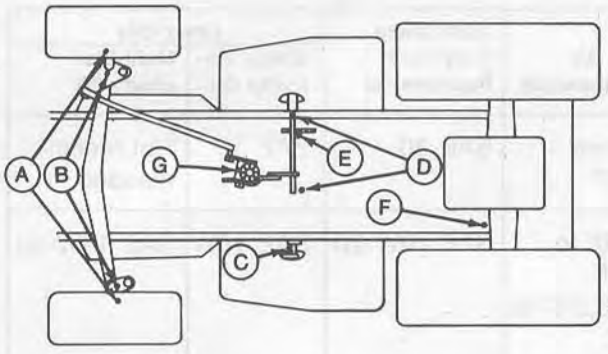
## SERVICE INTERVALS

### Lubricating Grease Fittings

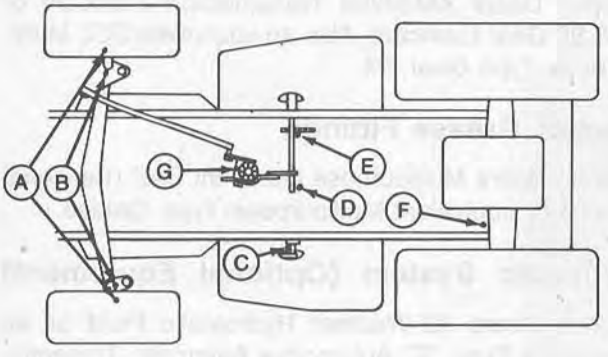
Grease tractor grease fittings in Spring and Fall Season. Tractor grease fitting locations are as follows:




M14459N

**A—Front Wheel Hubs**
**B—Front Axle Spindles**
**C—Brake Pedal Shaft**
**D—Clutch Pedal Shaft**
**E—Primary Lift Shaft**
**F—Rear Brake Shaft**
**G—Steering Gear***

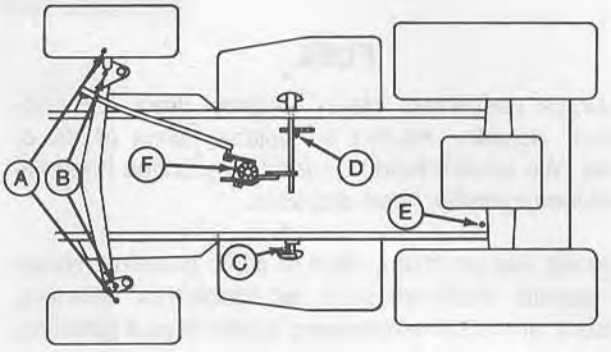
*Fig. 1-Grease Fitting Locations (Serial No. 30,001-55,000)*




M14460N

**A—Front Wheel Hubs**
**B—Front Axle Spindles**
**C—Brake Pedal Shaft**
**D—Clutch Pedal Shaft**
**E—Primary Lift Shaft**
**F—Rear Brake Shaft**
**G—Steering Gear***

*Fig. 2-Grease Fitting Locations (Serial No. 55,001-70,000)*




M14461N

**A—Front Wheel Hubs**
**B—Front Axle Spindles**
**C—Brake Pedal Shaft**
**D—Primary Lift Shaft**
**E—Rear Brake Shaft**
**F—Steering Gear***

*Fig. 3-Grease Fitting Locations (Serial No. 70,001- )*

***IMPORTANT: Do not overlubricate steering column fitting. Only 3 to 4 strokes with a hand grease gun are necessary. Do not use a high-pressure grease gun on this fitting.**

## Changing Engine Crankcase Oil

Change crankcase oil after the first 2 hours of operation and every 25 hours of operation thereafter.

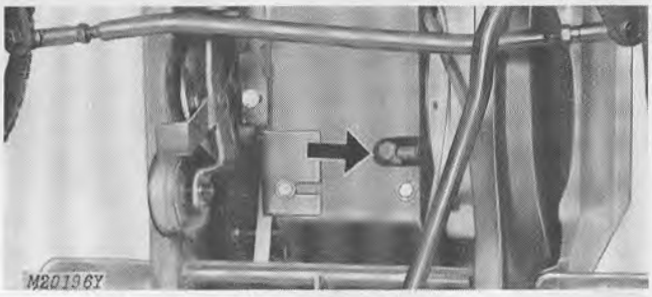



*Fig. 4-Draining Crankcase Oil*

*NOTE: For convenience, a suitable length of 5/8-inch (15.88 mm) garden hose or plastic tubing may be installed on the drain valve to allow oil to drain.*

Open oil drain valve Fig. 4 and allow oil to drain into a container.

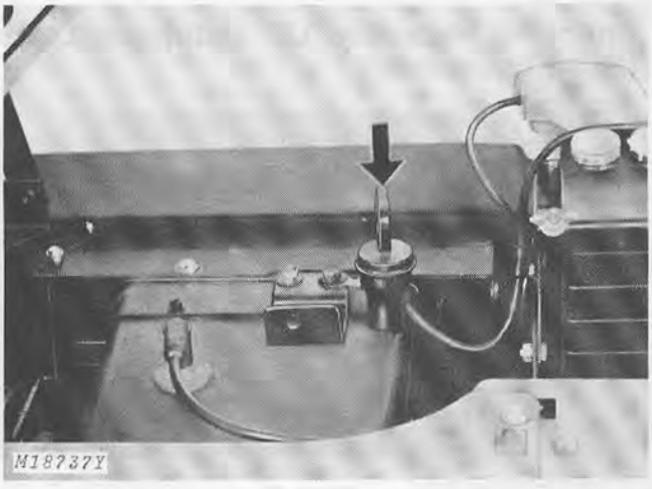
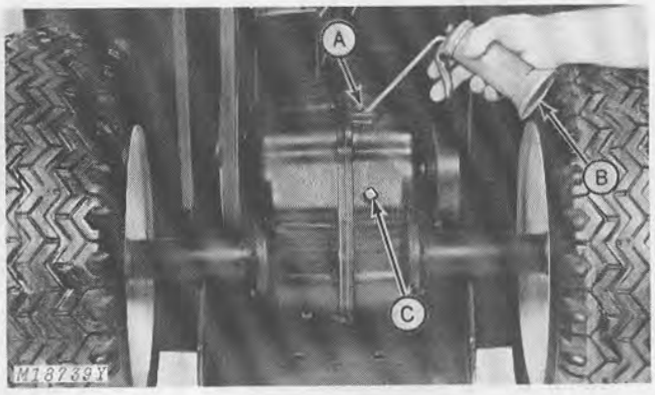



*Fig. 5-Filling Crankcase*

Close oil drain valve. Fill crankcase with oil of the proper viscosity to "F" mark on dipstick Fig. 5 (see page 10-15-1 for crankcase capacity).

## Changing Transaxle Lubricant




**A—Oil Level Filler Hole**
**B—Pressure Oil Can**
**C—Drain Plug**

*Fig. 6-Changing Transaxle Lubricant*

Change transaxle lubricant every 2 years or 500 hours of operation. Remove transaxle drain plug (C) and drain oil. Wipe plug clean and replace it in transaxle.

Remove plug from filler hole (A) and fill transaxle with 3-1/2 U.S. pints (1.65 l) of AM30200 Transmission Lubricant, SAE 90 Gear Lubricant or an equivalent SCL Multipurpose Gear Oil.

## Repacking PTO Clutch Bearing

Repack PTO clutch bearing, each spring and fall.

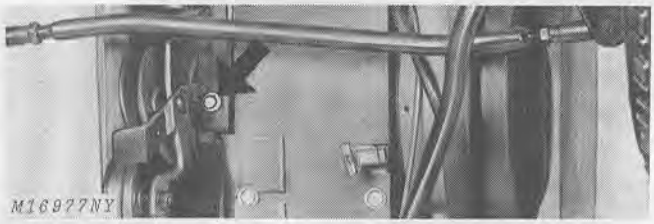



*Fig. 7-PTO Clutch Brake Cap Screw*

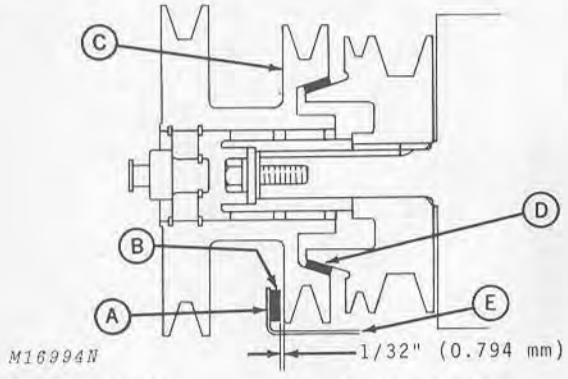
Using a 1/2-inch socket wrench with extension, loosen PTO clutch brake cap screw, Fig. 7, only enough to permit removal of PTO clutch assembly.

Pivot clutch arm clip upward and slide clutch arm to the rear to remove clutch arm from sheave hub.

Slide PTO assembly off the shaft. Check condition of clutch and brake linings. Replace linings as necessary. Use solvent to remove old grease from bearing.

Dry bearing thoroughly and repack it with John Deere High-Temperature grease (AT30408) or its equivalent.

Install PTO assembly on shaft and replace clutch arm. Lock in place with clip.




**A—Clutch Brake**
**B—Brake Lining**
**C—Clutch Cup Sheave**
**D—Clutch Lining**
**E—Brake Shoe**

*Fig. 8-Adjusting Clearance Between Brake and Sheave*

Engage PTO clutch lever (up position). Check distance between the clutch brake (A) and clutch cup sheave (C) for 1/32-inch (0.794 mm) clearance, Fig. 8.

If adjustment is required, use a 1/2-inch socket with extension. Loosen clutch brake cap screw, Fig. 7. Slide brake shoe in slotted hole until proper adjustment is obtained. Tighten cap screw.

## Lubricating Integral Hitch Grease Fitting (Extra Equipment)

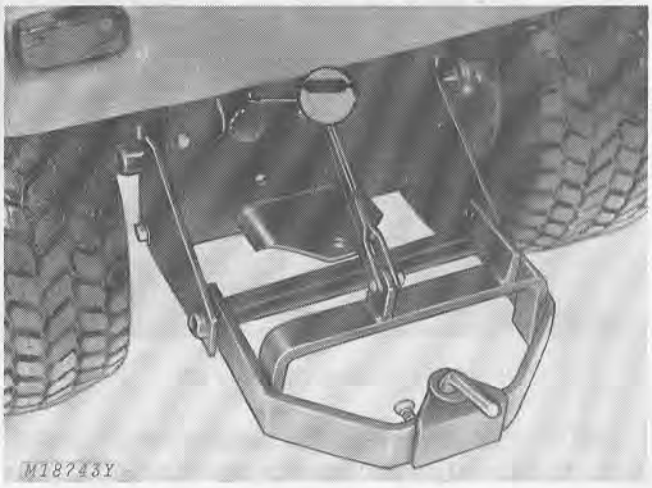



*Figure 9-Integral Hitch (Extra Equipment)*

If the tractor is equipped with an integral hitch (extra equipment) lubricate the rear lift pivot, Figure 9.

## Checking Hydraulic Lift Lubricant Level (Extra Equipment)

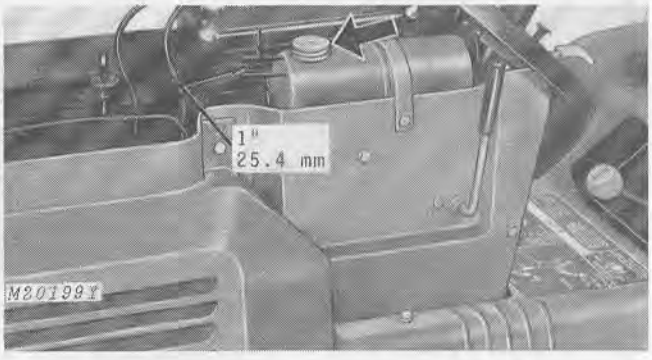



*Figure 10*

Once a week or every 50 hours of operation, check hydraulic fluid level. Park the tractor on a level surface, shut off engine, and set parking brake.

Remove reservoir cap (arrow). The hydraulic fluid level should be within 1 inch (25.4 mm) from top of reservoir. If hydraulic fluid is required, use John Deere All-Weather Hydrostatic Fluid or an equivalent Type "F" automatic transmission fluid.

# Group 20
# TUNE-UP AND ADJUSTMENTS

## PURPOSE OF TUNE-UP AND ADJUSTMENTS

Generally, the customer complaint will reveal which system or component requires checking. However, when dealing with the entire tractor, it is recommended that the step-by-step procedures outlined on the following pages be used.

## VISUAL INSPECTION

Much can be learned about the general condition of the tractor by a thorough visual inspection. For convenience, remove the side panels and hood.

Check the engine, transaxle and hydraulic system (if so equipped) for evidence of oil leakage.

Inspect battery for excessive corrosion, cracked case, proper installation and cable connections. Note general condition of wiring harness. Be sure the harness is not oil-soaked and that it is not frayed or damaged.

## ENGINE TUNE-UP

Engine tune-up is making minor repairs and adjustments in an orderly sequence to improve the overall efficiency and operation of the engine.

Tune-up includes checking, adjusting and servicing the electrical, ignition, air intake, fuel and lubrication systems.

## TRACTOR ADJUSTMENTS

Adjusting tractor components insures that engine horsepower will be utilized in the most efficient manner.

Adjustments to be made on the tractor include: Checking or changing transaxle lubricant, lubricating grease fittings, checking PTO clutch and brake, tractor brakes, belts and equipment.

## TUNE-UP GUIDE

The following guide offers an orderly sequence for servicing a tractor that has been running well.

Also use this guide to explain to your customers what a tune-up includes. Be sure to obtain customer permission before performing these services.

1. Clean Engine Shrouds and Cooling Fins
2. Clean or Replace Air Filter Element
3. Clean Fuel Strainer
4. Check and Clean Engine Crankcase Breather
5. Check Spark Plug Gap
6. Check Ignition Breaker Points and Engine Timing
7. Adjust Carburetor
8. Check Engine Speed
9. Change Engine Crankcase Oil
10. Check or Change Transaxle Lubricant
11. Lubricate Grease Fittings
12. Repack PTO Clutch Bearing
13. Service Battery
14. Check Tire Pressure
15. Check Operation and Condition of:
    (A) Lights
    (B) Lift System
    (C) Steering
    (D) Brakes (PTO Clutch and Tractor)
    (E) Belts and Equipment

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# TUNE-UP AND ADJUSTMENTS

## 1. Clean Engine Shrouds and Cooling Fins

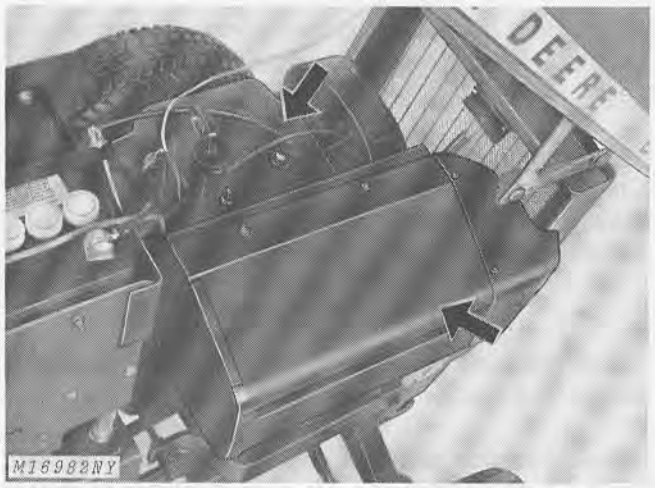



*Fig. 1-Engine Shrouds*

Remove engine shrouds, Fig. 1. Blow out cooling fins with compressed air. Be sure all dirt and debris are removed from the engine.

## 2. Clean or Replace Air Filter Element

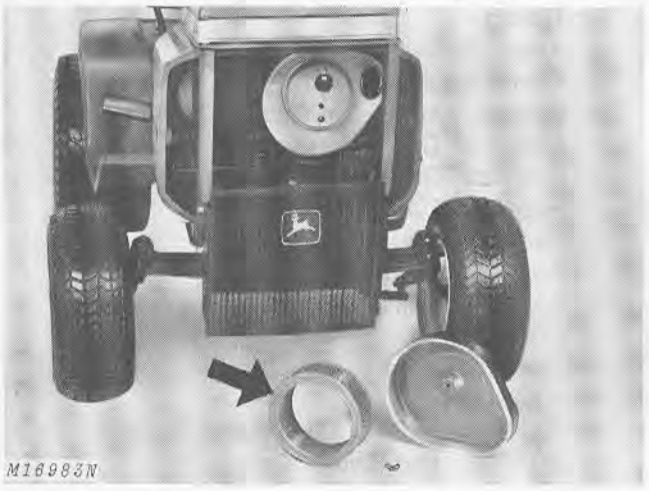



*Fig. 2-Air Filter Element*

Remove the air filter element, Fig. 2. Tap the filter lightly against a flat surface and brush out dust. Do not clean filter with a liquid cleaner or compressed air.

Replace filter if it is bent, crushed, damaged or extremely dirty.

## 3. Clean Fuel Strainer

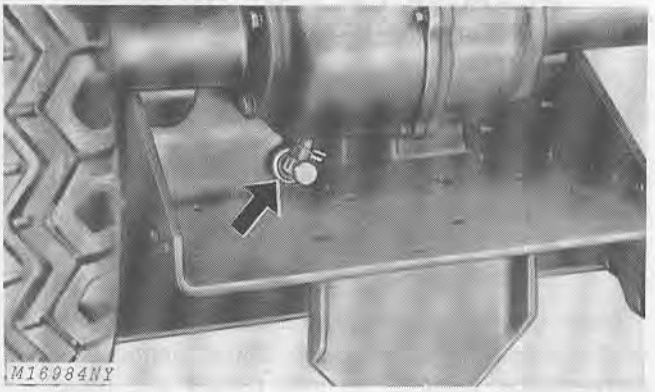



*Fig. 3-Fuel Shut-Off Valve*

Close the fuel shut-off valve, under fuel tank, Fig. 3. Disconnect hose from valve. Attach a 12-inch length of 1/4-inch hose and drain fuel tank into a clean container.

Remove hose from valve. Unscrew shut-off valve with strainer from fuel tank. Thoroughly clean all particles from strainer.

Install shut-off valve and strainer assembly. Close the valve, connect the hose, and fill fuel tank.

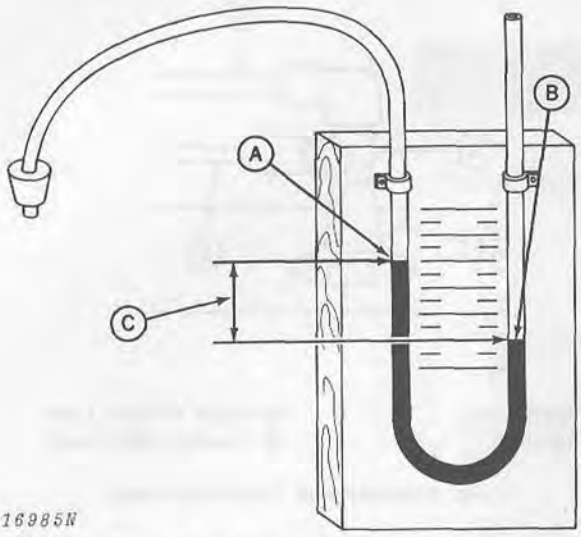
## 4. Check and Clean Engine Crankcase Breather

A clogged crankcase breather can cause positive pressure to build up in the crankcase.

Check crankcase vacuum with a U-tube water manometer.

An engine in good condition and operating at normal temperatures will show a 5 to 10-inch water column on the manometer.

An engine in good condition and operating at normal engine temperatures will show a 5 to 10-inch water column of vacuum or negative pressure on the manometer, (see Fig. 4).




**A—Negative Pressure** **B—Positive Pressure**
**C—Difference Between Columns**

*Fig. 4-U-Tube Water Manometer*

When using manometer, Fig. 4, place stopper into oil fill hole (other end open to atmosphere) and measure difference between columns (C).

If water column is higher in tube connected to engine, vacuum or negative pressure (A) is indicated. If the higher column is on the atmospheric side of manometer, positive pressure (B) is present.

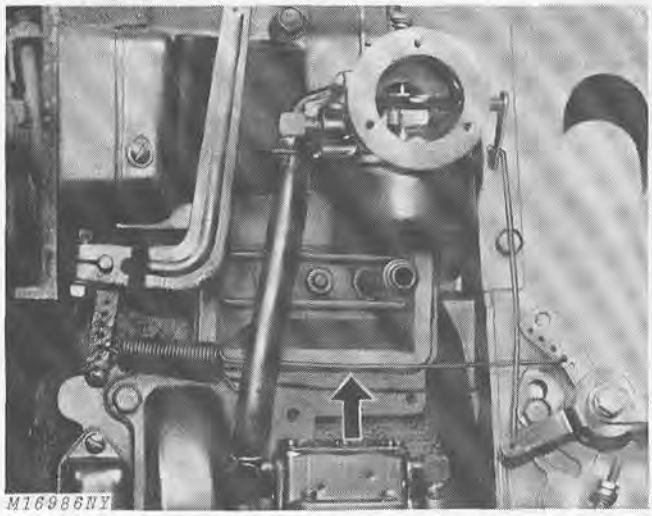



*Fig. 5-Engine Crankcase Breather*

Disassemble breather assembly, Fig. 5, and clean it thoroughly. Reinstall breather assembly and recheck pressure.

## 5. Check Spark Plug Gap

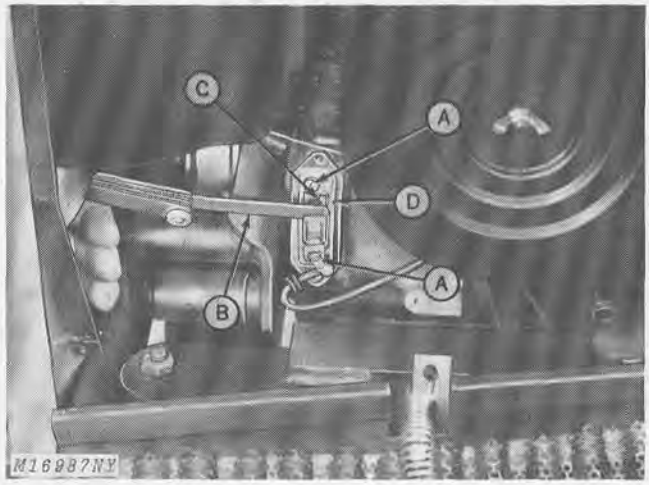
Remove spark plug, check condition and reset gap, page 10-10-1.

Good operating conditions are indicated if plug has light gray or tan appearance. A dead white appearance could indicate overheating. A black (carbon) appearance may indicate an "over-rich" fuel mixture, clogged air cleaner or improper carburetor adjustment.

Do not service a plug in poor condition. Install a new plug and torque it to 18 to 22 ft-lbs (24 to 30 Nm). See page 10-10-1.

## 6. Check Ignition Breaker Points and Engine Timing

Replace badly burned or pitted breaker points. If points are oxidized, rub a piece of coarse cloth across the surfaces. Clean dirty or oily points with a cloth, but make sure no particles of lint are left between the surfaces.




**A—Retaining Screws** **C—Locking Screw**
**B—Feeler Gauge** **D—V-Slot**

*Fig. 6-Replacing and Adjusting Points*

To replace points, remove retaining screws (A), Fig. 6. Be sure lock washers are in place when installing new points.

To adjust breaker points, rotate engine until "T" mark on flywheel lines up with indicator, Fig. 8. Use feeler gauge (B, Fig. 6) to measure gap for 0.020-inch (0.508 mm) clearance when points are fully open.

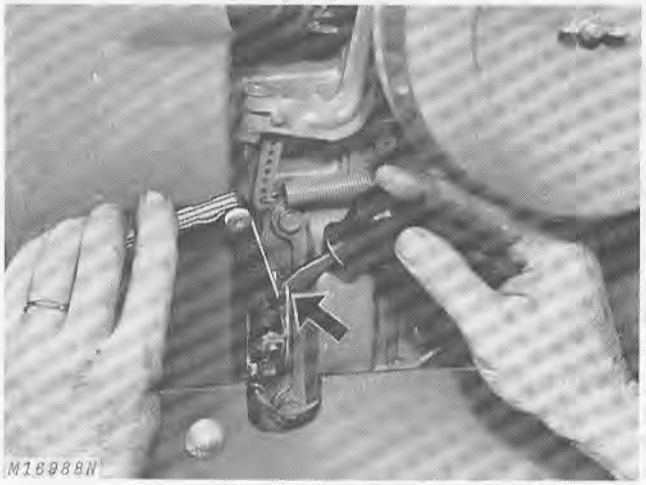
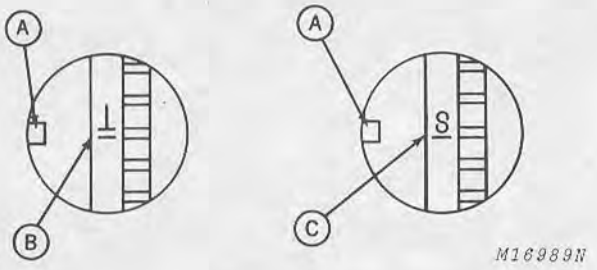



*Fig. 7-Adjusting Points*

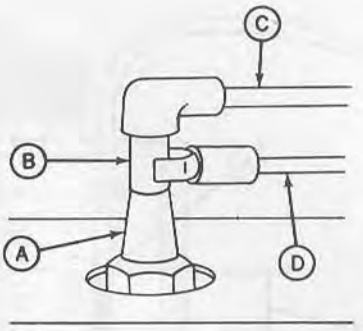
If necessary, loosen locking screw (C, Fig. 6) and move screwdriver in V-slot, Fig. 7, until gap is 0.020-inch (0.508 mm). Gap setting can vary from 0.018 to 0.022-inch (0.457 to 0.588 mm) to achieve smoothest running. Tighten locking screw securely after adjusting gap.




**A—Indicator** **B—"T" Mark** **C—"S" Mark**

*Fig. 8-Timing Sight Hole*

The timing sight hole is in the engine blower housing. Two timing marks are stamped on the flywheel. The "T" mark (B) indicates top dead center (TDC) and the "S" mark (C) indicates the spark point. Line under the timing marks should line up with the indicator (A), Fig. 8.




**A—Spark Plug** **C—High Tension Lead**
**B—Adapter** **D—Timing Light Lead**

*Fig. 9-Adapter and Timing Light Lead*

Remove high tension lead (C) at spark plug (A). Install a spark plug adapter (B) and re-connect high tension lead (C). Connect one timing light lead (D) to the spark plug adapter, Fig. 9.

Connect second timing light lead to the positive battery terminal. See timing light instructions for battery size, wiring, etc.

Connect third timing light lead to ground.

Rotate engine by hand until "S" mark is visible through timing sight hole. Chalk "S" line for easy reading.

Start and run engine at 1700 to 1900 rpm idle speed. The timing light should flash as "S" mark lines up with indicator in timing sight hole.

If timing is off, loosen locking screw and adjust points as shown in Fig. 7 until the "S" mark lines up with indicator in timing sight hole.

Retighten locking screw before replacing breaker point cover.

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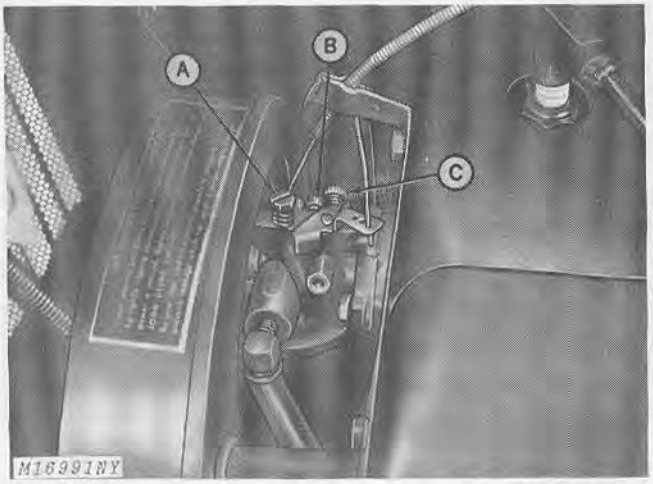
## 7. Adjust Carburetor

**⚠ CAUTION: Prevent burns. Do not touch engine shrouds or muffler shield if engine has been running.**

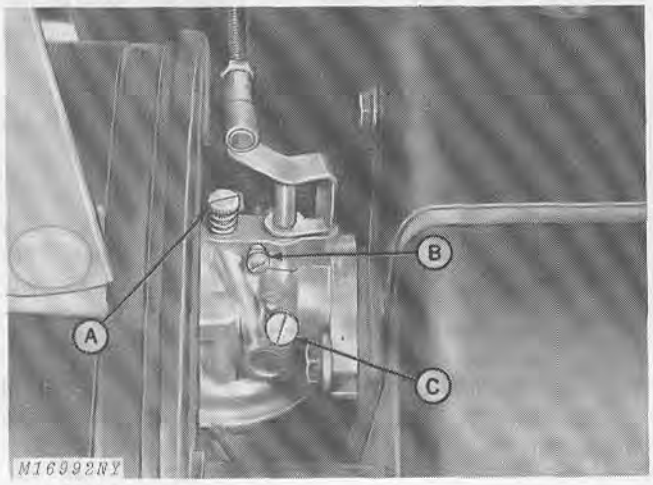
Idle adjustment and high-speed adjustment must be made at the same time as each affects the other.

Adjust carburetor as follows:




**A—High-Speed Mixture Needle**
**B—Idle Speed Screw**
**C—Idle Mixture Needle**

*Fig. 10-200 Tractor Carburetor*




**A—High-Speed Mixture Needle**
**B—Idle Speed Screw**
**C—Idle Mixture Needle**

*Fig. 11-210, 212 and 214 Tractor Carburetor*

1. Turn high-speed mixture needle (A), Figs. 10 or 11, clockwise until lightly seated. Close finger-tight only. Then open 1-1/2 turns.

2. Turn idle mixture needle (C) clockwise until lightly seated. Close finger-tight only. Then open 2 complete turns.

3. Start engine and raise throttle lever on dash panel to "FAST" position. Allow engine to warm up.

4. Turn high-speed mixture needle (A) 1/8 turn each time, clockwise or counterclockwise, until engine runs smoothly at full throttle (3400 to 3500 rpm).

5. Move throttle lever to "SLOW" position and turn idle mixture needle (C) 1/8 turn each time, clockwise or counterclockwise, until engine runs smoothly (1700 to 1900 rpm).

6. Advance throttle lever quickly to check for uniform acceleration. If engine misses, fuel-air mixture is too lean. Turn high-speed mixture needle (A) counterclockwise until positive acceleration can be obtained.

7. If excessive exhaust smoke is noticed, mixture is too rich. Readjust idle mixture needle (C), until engine idles smoothly at 1700 to 1900 rpm.

## 8. Check Engine Speed


*Fig. 12-Checking Engine Speed With Vibration Tachometer*

Use a vibration tachometer, Fig. 12, to check engine for a slow idle speed of 1700 to 1900 rpm and a full throttle speed of 3400 to 3500 rpm.

If carburetor adjustments do not give correct engine speed, adjust governor linkage. See Section 30, Group 10.

## 9. Change Engine Crankcase Oil

Refer to page 10-15-3.

## 10. Check or Change Transaxle Lubricant

Refer to page 10-15-3. Lubricant level should be level with the filler hole.

## 11. Lubricate Grease Fittings

Refer to page 10-15-2.

## 12. Repack PTO Clutch Bearing

Refer to page 10-15-4.

## 13. Service Battery

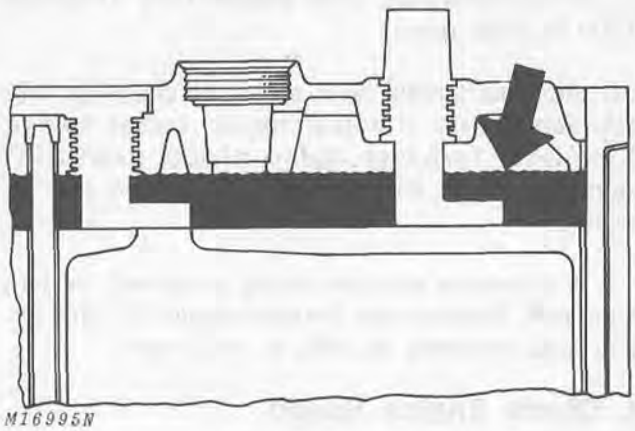



*Fig. 13-Battery Electrolyte Level*

Check electrolyte level of each cell. Cells should be completely covered. If necessary, fill each cell with distilled water to top of split ledge in the filler tube, Fig. 13.

To clean battery remove battery cables (negative cable, first). Use a wire brush to remove corrosion around battery terminals.

Use a solution of one part baking soda to four parts water to clean battery terminals and cables. Do not allow solution to enter battery cells.

Wash entire battery case, platform and hold-down parts with clear water and wipe dry.

Coat battery terminals with petroleum jelly and connect battery cables (positive cable, first). Be sure both cables are tight.

Charge battery as necessary.

**⚠ CAUTION: Hydrogen and oxygen gases in the battery are very explosive. Keep open sparks or flames away from battery at all times, especially when charging the battery. Do not smoke around a charged battery. Keep vent holes in cell caps open.**

## 14. Check Tire Pressure

Inflate tires as shown in chart below.

Use high readings for heavy front loads such as loaders; mid-range readings for blades and snow throwers and low readings for normal lawn use.

| TIRE INFLATION PRESSURES | | |
|---|---|---|
| **Tire** | **Front** | **Rear** |
| High-Flotation Tires (GT-3 Tractor) | 16 x 6.50-8<br>6 to 16 psi<br>(28.7 to 76.6 bar) | 23 x 8.50-12<br>5 to 10 psi<br>(23.9 to 47.8 bar) |
| Traction Tires (GT-4 Tractor) | 4.80 x 4.00-8<br>12 to 40 psi<br>(57.4 to 191.5) | 23 x 8.50-12<br>5 to 10 psi<br>(23.9 to 47.8 bar) |
| High-Flotation Tires | 16 x 6.50-8<br>6 to 16 psi<br>(28.7 to 76.6 bar) | 23 x 10.50-12<br>5 to 10 psi<br>(23.9 to 47.8 bar) |
| Traction Tires (GT-8 Tractor) | 16 x 6.50-8<br>6 to 16 psi<br>(28.7 to 76.6 bar) | 23 x 10.50-12<br>5 to 10 psi<br>(23.9 to 47.8 bar) |

## 15. Check Operation and Condition of:

**A. Lights** - Replace bulbs or wiring as necessary.

**B. Lift System** - Check manual, electric or hydraulic lift for proper function. Once a week or every 50 hours of operation check hydraulic fluid level. Hydraulic fluid level should be within 1 inch (25.4 mm) from top of reservoir. Use John Deere All Weather Hydrostatic Fluid or an equivalent Type "F" Automatic Transmission Fluid.

**C. Steering** - Refer to Section 70 for steering gear adjustment if required.

**D. Brakes (PTO Clutch and Tractor)** - PTO Brake adjustment was covered under Item 12-"Repack PTO Clutch Bearing." For tractor brake adjustments (if required) refer to Section 50.

**E. Belts and Equipment** - Clean belts by wiping them with a clean cloth. Do not use solvents. Solvents will soften the material and cause belts to grab.

# Section 20
# ENGINE
## Group 5
# GENERAL INFORMATION AND DIAGNOSIS

### CONTENTS



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## CONTENTS—Continued



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## DESCRIPTION

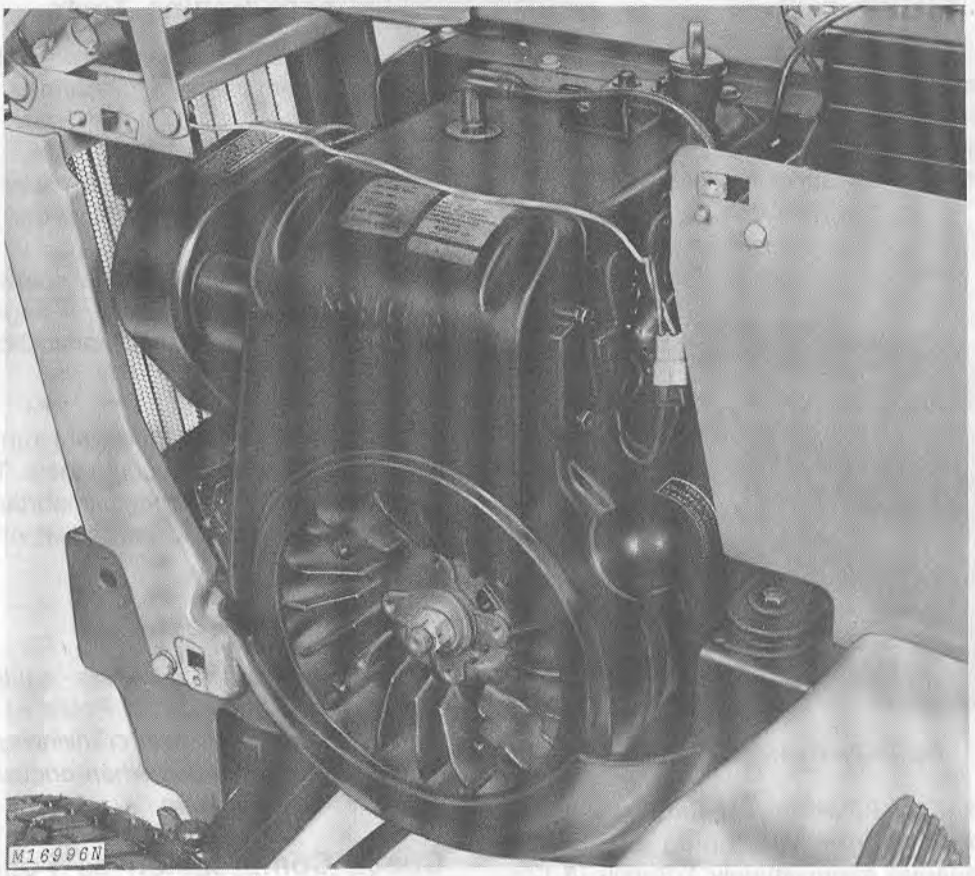


*Fig. 1-Kohler Engine*

Kohler engines, Fig. 1, are used in the 200 Series Tractors. The tractors with their respective engines are as follows:

200 Tractor - K181QS - 8hp
210 Tractor - K241AQS - 10hp
212 Tractor - K301AQS - 12hp
214 Tractor - K341AQS - 14hp

Each of the four-cycle, L-head, single-cylinder, internal combustion engines has a cast-iron block with a large bore and short stroke.

These air-cooled engines feature anti-friction ball bearings, oil bath lubrication, internal flyweight governors, an alternator charging system and battery-coil ignition.

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# ENGINE ANALYSIS

## Preliminary Engine Checks

The majority of engine problems are usually due to electrical or fuel system difficulties. Make the following checks and tests to isolate the engine problem. Refer to "Diagnosing Malfunctions" if the following checks and tests do not solve the problem.

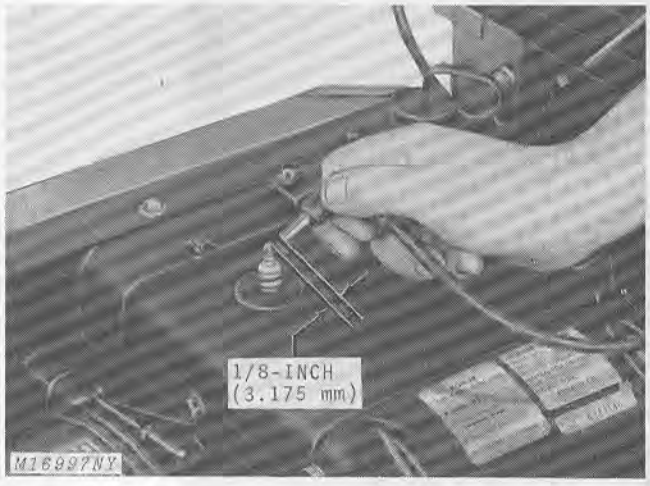


*Fig. 2-Checking Spark*

Check spark, Fig. 2, whenever engine will not start. Remove cable from spark plug and install adapter. Hold adapter approximately 1/8-inch (3.175 mm) away from spark plug terminal while cranking engine.

No spark or a weak spark between the adapter and spark plug terminal indicates trouble in the electrical system.

Check the battery, spark plug and all electrical connections. If these are in good condition, the trouble is probably with the breaker points or condenser.

Clean or replace points and adjust gap. If breaker points are burned, replace points and condenser.

## Preliminary Engine Tests

If a good spark exists between the adapter and spark plug terminal, the problem is in the fuel system.

Check fuel tank and lines. Be sure shut-off valve is open and that fuel is reaching the carburetor.

Connect spark plug wire to spark plug and crank engine. Choke as necessary. If engine still does not start, refer to "Diagnosing Malfunctions" to check for internal difficulties.

If engine starts but does not run properly, make the compression and vacuum tests. The compression and vacuum tests are very important when the engine runs erratically, loses power, or uses an excessive amount of oil.

## Compression Test

*NOTE: Kohler engines are equipped with ACR (Automatic Compression Release). ACR relieves compression during lower cranking speeds. The ACR mechanism disengages when engine speed reaches approximately 650 rpm.*

## Check Compression as Follows:

1. Depress brake pedal and set parking brake.

2. Check crankcase for proper oil level. Add oil if necessary.

3. Disengage all tractor drives. Run engine until warm, then stop the engine.

4. Remove spark plug and air filter. Removing the air filter gives a more accurate test.

5. Set throttle and choke in wide open positions by raising throttle lever and pulling out the choke knob.

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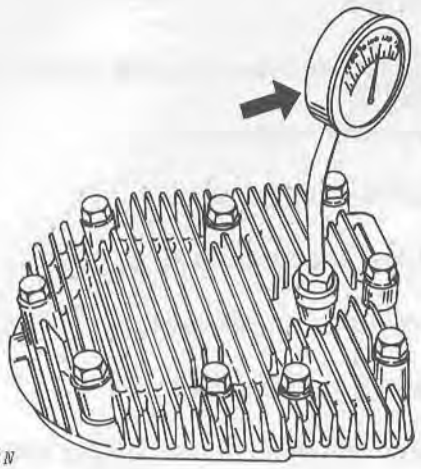



*Fig. 3-Testing Engine Compression*

6. Hold compression gauge firmly in spark plug hole, Fig. 3.

7. Wind a 1/4-inch (6.350 mm) rope around the PTO sheave opposite the direction of engine rotation. Pull rope firmly and observe reading. Repeat this test to obtain a consistent or average reading.

*NOTE: The rope method must be used to check compression. The starter will not turn the engine fast enough (1000 rpm) to overcome the ACR. Turning the engine in the opposite direction of rotation will by-pass the ACR.*

8. Compression pressure should be 110 to 120 psi at approximately 1000 rpm. Pressure above 120 psi indicates excessive carbon deposits in the combustion chamber or on the piston. Pressure below 100 psi indicates leakage at the cylinder head gasket, piston rings or valves. If compression is below 90 psi, recondition the engine.

9. To determine if the rings or valves are at fault, pour about one tablespoon of heavy oil in the spark plug hole. Crank the engine several times to spread the oil.

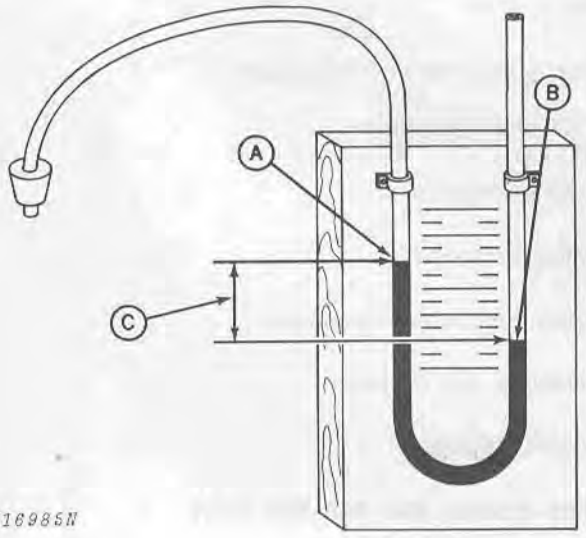
10. Repeat the compression test. If the same compression reading is obtained, the rings are satisfactory, but the valves are leaking or the piston is damaged. If the compression has increased considerably over the original reading, then the rings are bad and must be replaced.

## Crankcase Vacuum Test

The purpose of the vacuum test is to determine if the crankcase breather is maintaining a partial vacuum in the engine crankcase. The engine must be running properly for the breather to function correctly.

Test the engine as follows:

1. Warm up the engine.




**A—Vacuum** **B—Pressurization**
**C—Difference Between Columns**

*Fig. 4-U-Tube Water Manometer*

2. Connect a U-tube water manometer, Fig. 4, to the oil filler tube. Be sure tester is hanging vertically.

3. Start and run the engine at idle speed (1700-1900 rpm). Observe reading on scale.

4. Proper crankcase pressure for the Kohler engines is a 10 to 15-inch water column on the gauge. Follow manufacturer's recommendations and compensations for the effect of altitude on the gauge reading.

5. A low vacuum reading is probably due to a leaking breather valve or improperly assembled breather. Leaky valves, engine blow-by or worn crankshaft oil seals can also cause a low reading.

6. If the crankcase shows pressurization (B) rather than a vacuum (A), the breather plate has probably been assembled backwards or the breather filter is plugged.

7. If the engine shows zero vacuum (A) or a pressurized crankcase (B), oil is being pumped into the combustion chamber or out the breather or oil seals. This is detectable by excessive exhaust smoke, engine overheating or oil leakage.

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## DIAGNOSING MALFUNCTIONS

**Engine Will Not Crank**

Battery discharged or defective.

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

PTO safety start switch out of adjustment or defective.

Seat safety start switch defective.

PTO drive engaged.

Defective starter.

Defective solenoid.

Loose electrical connections.

Defective key switch.

Engine seized.

**Engine Cranks But Will Not Start**

Empty fuel tank.

Restricted fuel tank vent.

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

Clogged, restricted, or air-locked fuel line.

Defective fuel pump.

Breaker points worn or pitted.

Spark plug fouled or pitted.

Loose electrical connections.

Faulty condenser.

Defective ignition coil.

Frayed wire (s) causing ground (s).

**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 fuel tank vent.

Clogged fuel line or air lock.

Broken choke or throttle cable.

Dirt or water in fuel system.

High-speed and idle mixture needles not properly adjusted.

Air leakage at carburetor.

Head gasket leaking.

Low compression.

**Engine Starts But Fails to Keep Running**

Restricted fuel 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 leaky float.

High-tension wire loose at spark plug or coil.

High-tension wire shorted.

Breaker points not properly adjusted.

Loose connections.

Defective head gasket.

Faulty condenser.

Exhaust valve sticking in excessively tight valve guide.

Breaker points push rod sticking.

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**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 or pitted, incorrect gap.

Loose electrical connections.

Carburetor float not properly adjusted or leaky float.

Dirt or water in fuel system.

Wrong valve clearance.

Faulty coil.

Engine shrouding plugged (overheats).

**Engine Misses Under Load**

Spark plug fouled or pitted, incorrect gap.

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.

Idle mixture needle not properly adjusted.

Air leakage at carburetor.

Dirt or water in fuel system.

Restricted fuel tank filler cap.

Spark plug fouled or pitted, incorrect gap.

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 or pitted, incorrect gap.

Linkage misaligned (throttle arm-to-governor).

**Engine Loses Power**

Crankcase low on oil.

Engine shrouding plugged (overheats).

Excessive engine load.

Restricted air filter.

Dirt or water in fuel system.

High-speed and idle mixture needle not properly adjusted.

Air leakage at carburetor.

Spark plug fouled or pitted (incorrect gap).

Too much oil in crankcase.

Low engine compression.

Worn cylinder bore.

Governor defective.

Governor linkage out of adjustment.

**Engine Overheats**

Dirty, plugged, or damaged shrouding or engine fins.

High-speed and idle mixture needles not properly adjusted.

Air leakage at carburetor.

Too much oil in crankcase.

Crankcase low on oil.

Excessive engine load.

Flywheel fins broken or damaged.

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## DIAGNOSING MALFUNCTIONS—Continued

**Engine Knocks**

Engine out of time.

Excessive engine load.

Engine overheated.

**Engine Uses Excessive Amount of Oil**

Clogged or faulty 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.

**Engine Runs Erratically or Surges**

Dirt or water in fuel system.

High-speed and idle mixture needles not properly adjusted.

Idle speed too low.

Spark plug fouled or pitted (incorrect gap).

Poor compression.

Faulty breather causing low crankcase vacuum.

Carburetor leaking at gaskets or at connection.

Restricted fuel tank vent.

Throttle-to-governor linkage improperly adjusted.

Governor defective.

Breaker points out of adjustment, worn or pitted.

**Gasoline in Crankcase**

Carburetor float not properly adjusted or leaking.

Float valve and/or seat leaking.

**Engine Backfires**

High-speed and idle mixture needles not properly adjusted.

Air leakage at carburetor.

Loose cylinder head or blown head gasket.

Intake valve sticking in guide.

Ignition out of time.

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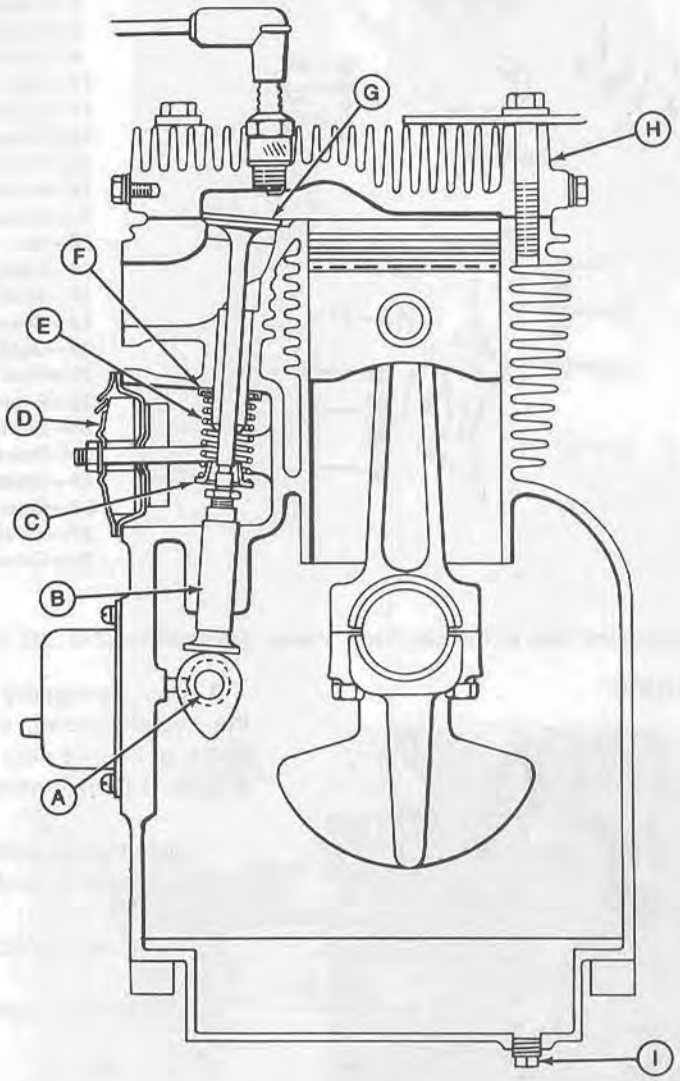
# Group 10
# CYLINDER HEAD, VALVES AND BREATHER

## GENERAL INFORMATION

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**A—Camshaft**
**B—Tappet**
**C—Retainer**
**D—Breather Assembly**
**E—Valve Spring**
**F—Spring Retainer**
**G—Intake Valve**
**H—Cylinder Head**
**I —Drain Plug**

*Fig. 1-Schematic View of Cylinder Head, Valves and Breather*

It is not necessary to remove the engine to lap or grind valves, valve seats or service the breather.

The 210, 212 and 214 Tractors have an exhaust valve rotator. Whenever the valves are removed, be sure that the correct valve spring is used with the rotator on the exhaust valve.

The exhaust valve insert, which is a press fit into the block, can be replaced. The intake valve seat is machined into the block.

Valve guides can be replaced when wear tolerances are exceeded.

Exterior governor linkage can be adjusted for high-speed setting and sensitivity.

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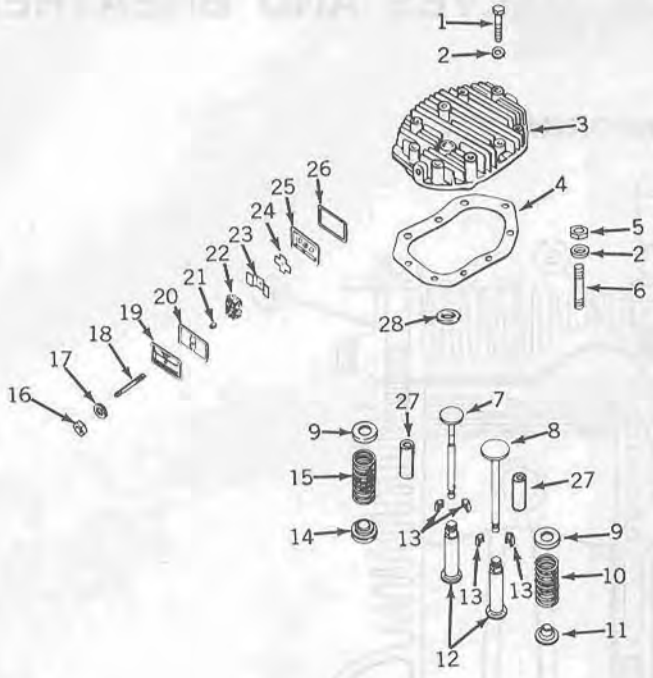
## DISASSEMBLY




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

*Fig. 2-Exploded View of Cylinder Head, Valves, and Breather (210, 212 and 214 Tractors)*

### Disassembling Engine

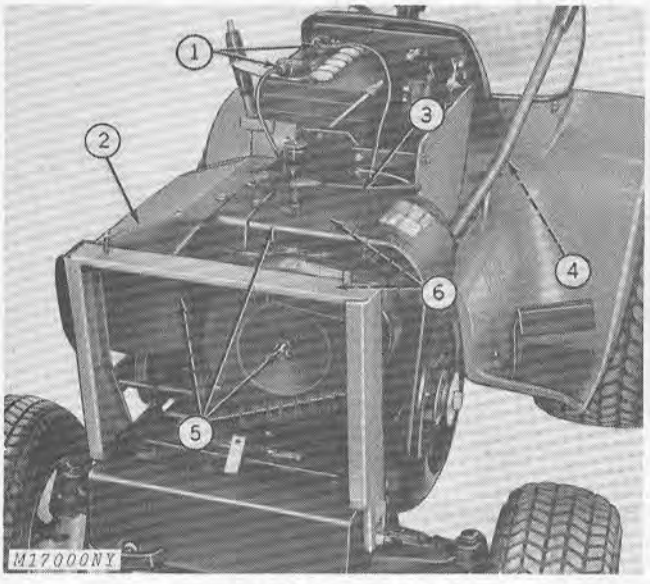



*Fig. 3-Disassembling Engine*

It is not necessary to remove the engine to service the cylinder head, valves or breather. Remove the hood, grille and side panels to provide access to the engine. Clean engine exterior prior to disassembly.

1. Disconnect battery cables, negative cable first. Remove battery and battery box.

2. Remove shroud covering muffler.

3. Disconnect wiring from coil to wiring harness.

4. Shut off fuel.

5. Remove engine shrouding, coil, carburetor, governor linkage and muffler.

6. Remove cylinder head, breather assembly and valves.

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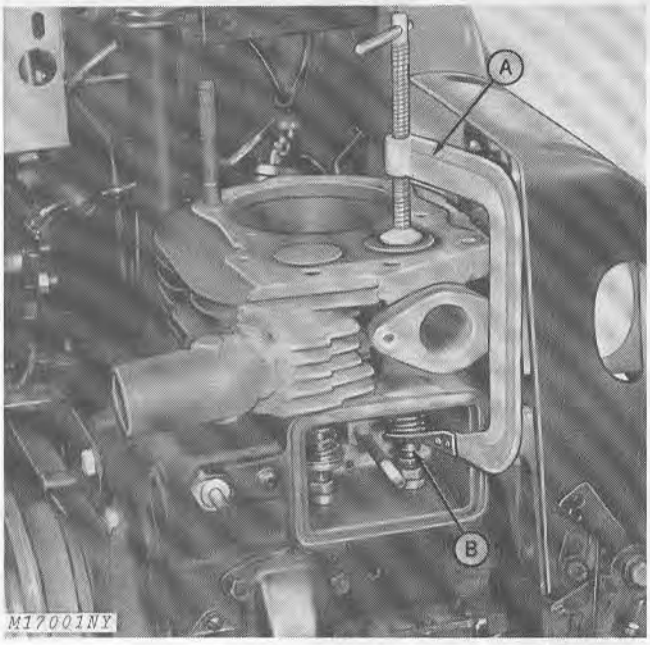
## Removing Valves




**A—Valve Spring Compressor** **B—Valve Keepers**

*Fig. 4-Removing Valves*

Use a valve spring compressor (A) to compress valve springs, Fig. 4. Remove valve keepers (B) from valve stems with a magnet. Remove valves.

Remove valve spring retainers and valve springs from valve chamber. Note the rotator-type retainer on the exhaust valve spring of the K241AQS, K301AQS and K321AQS engines. This spring is shorter than the intake valve spring.

## VALVE ANALYSIS

Analyze valve condition before cleaning, grinding or discarding.

Lead deposits on the intake valve, Fig. 5, consist of lead and metal from the lubricating oil. These deposits are caused by a small amount of exhaust gas leakage into the intake port area. This indicates the valve is not seating properly. Grind the valve and reface the seat to correct this condition.

*NOTE: Be sure to readjust valve clearance after grinding valves. See page 20-10-8.*


*Fig. 5-Lead Deposits on Leaky Intake Valve*


*Fig. 6-Valve Stem Corrosion*

Valve stem corrosion, Fig. 6, is caused by moisture entering the engine. Moisture in the fuel-air mixture will condense inside the engine when the engine is stopped prior to warm up.

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

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



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