

# JOHN DEERE 200, 208, 210, 212, 214 AND 216 LAWN AND GARDEN TRACTORS

Service Manual  
SM-2105 (June-81)

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OOA

(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.)

Sample manual. Download All 88 pages at:

<https://www.bobmanualstore.com/downloads/john-deere-200-208-210212214-and-216-lawn-and-garden-tractor-service-repair-technical-manual/>

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## INTRODUCTION

This service manual contains service and maintenance information for the John Deere 200, 208, 210, 212, 214 and 216 Lawn and Garden Tractors and attachments through 1982 model (SN 195,001-).


The manual is divided into sections. Each section pertains to a certain component or operational system of the tractor or attachment. 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 the part.

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

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

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.**

### FOR YOUR CONVENIENCE

Vertical lines appear in the margins of many of the pages. These lines identify new material and revised information that affects specifications, procedures, and other important instructions.

# Group 10 SPECIFICATIONS

## ENGINE SPECIFICATIONS

Item	200	208	210
Engine Model No. ....	K181QS	K181S	K241AQS
Manufacturer .....	Kohler	Kohler	Kohler
Cylinders .....	One	One	One
Stroke/Cycle .....	Four	Four	Four
Bore .....	2.94 in. (74.6 mm)	2.94 in. (74.6 mm)	3.25 in. (82.5 mm)
Stroke .....	2.75 in. (69.8 mm)	2.75 in. (69.8 mm)	2.88 in. (73.1 mm)
Displacement .....	18.6 cu. in.	18.6 cu. in.	23.9 cu. in.
Speeds (Fast) No Load ..	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
Horsepower* .....	8	8	10
Normal Compression .....	110 to 120 psi	110 to 120 psi	110 to 120 psi
Valve Clearance			
Intake (Cold) .....	0.007 in. (0.178 mm)	0.007 in. (0.178 mm)	0.010 in. (0.254 mm)
Exhaust (Cold) .....	0.016 in. (0.406 mm)	0.016 in. (0.406 mm)	0.020 in. (0.508 mm)
Ignition .....	Battery	Battery	Battery
Spark Plug** .....	Champion-J-8 or XJ8 AC-45-M or R-46 Prestolite-14-7 or 14-R8	Champion-RJ8	Champion-H-10 AC-45L Prestolite-14-L7B
Spark Plug Gap .....	0.025 in. (0.635 mm)	0.025 in. (0.635 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)
Charging System .....	Alternator	Alternator	Alternator
Starter .....	12-Volt	12-Volt	12-Volt
Air Filter .....	Dry-type	Dry-type	Dry-type

Item	212	214	216
Engine Model No. ....	K301AQS	K321AQS	K341AQS
Manufacturer .....	Kohler	Kohler	Kohler
Cylinders .....	One	One	One
Stroke/Cycle .....	Four	Four	Four
Bore .....	3.38 in. (85.8 mm)	3.50 in. (88.9 mm)	3.75 in. (95.2 mm)
Stroke .....	3.25 in. (82.5 mm)	3.25 in. (82.5 mm)	3.25 in. (82.5 mm)
Displacement .....	29.1 cu. in.	31.3 cu. in.	35.9 cu. in.
Speeds (Fast) No Load ..	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
Horsepower* .....	12	14	16
Normal Compression .....	110 to 120 psi	110 to 120 psi	110 to 120 psi
Valve Clearance			
Intake (Cold) .....	0.010 in. (0.254 mm)	0.010 in. (0.254 mm)	0.010 in. (0.254 mm)
Exhaust (Cold) .....	0.020 in. (0.508 mm)	0.020 in. (0.508 mm)	0.020 in. (0.508 mm)
Ignition .....	Battery	Battery	Battery
Spark Plug** .....	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 .....	0.035 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)
Charging System .....	Alternator	Alternator	Alternator
Starter .....	12-Volt	12-Volt	12-Volt
Air Filter .....	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.

\*\*In Canada, compliance with radio interference regulations certified. Replace spark plug with resistor-type spark plug only. Use Champion RJ8 for 200 and 208 Tractors. Use Champion RH10 for 210, 212, 214 and 216 Tractors.

### BATTERY SPECIFICATIONS

Tractor	Battery
200, 208	John Deere, 12 Volt, (AM30094), BCI Group U1, 135 cold cranking amps at 0°F (-17°C), 30-minute reserve capacity.
210, 212, 214, 216	John Deere, 12 Volt, (AM31186), BCI Group 22F, 255 cold cranking amps at 0°F (-17°C), 55-minute reserve capacity.

### TRACTOR SPECIFICATIONS

Item	200, 208	210, 212, 214, 216
<b>CAPACITIES</b>		
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)	** (S.N. 30001-95261) 3 U.S. Pts. (1.42 L) *** (S.N. 95262 and up) 4 U.S. Pints (1.89 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)
<b>TRANSMISSION</b>		
Type .....	Transaxle	Transaxle
Gear Selections .....	4 forward - 1 reverse	4 forward - 1 reverse
<b>TRAVEL SPEEDS - @ 3400 rpm</b>		
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)
<b>DIMENSIONS</b>		
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. (10.54 m)	41-1/2 in. (1.054 m)
<b>WHEEL TREAD</b>		
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)
<b>BRAKES</b>		
Type .....	Band, pedal-operated	Band, pedal-operated
Parking .....	Hand-lock foot brake	Hand-lock foot brake
<b>CLUTCH</b>		
PTO CLUTCH .....	V-belt system	V-belt system
STEERING .....	Manual	Manual
STEERING .....	Enclosed gear	Enclosed gear
LIFT* .....	Manual, Electric	Manual, Electric, Hydraulic
<b>SHIPPING WEIGHT</b>		
	200 Tractor - 691 lbs. (313 kg)	759 lbs. (344 kg)
	208 Tractor - 673 lbs. (305 kg)	

\*Electric and Hydraulic Lifts are dealer installed options.

\*\*Aluminum Pan

\*\*\*Steel Pan

## Group 15 FUEL AND LUBRICANTS

### FUEL

Always use fresh, clean "regular grade or non-leaded" gasoline having an octane rating of 87 or higher. We recommend non-leaded gasoline because it reduces cylinder head deposits.

The use of GASOHOL is not recommended.

Do not use gasohol, 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. 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

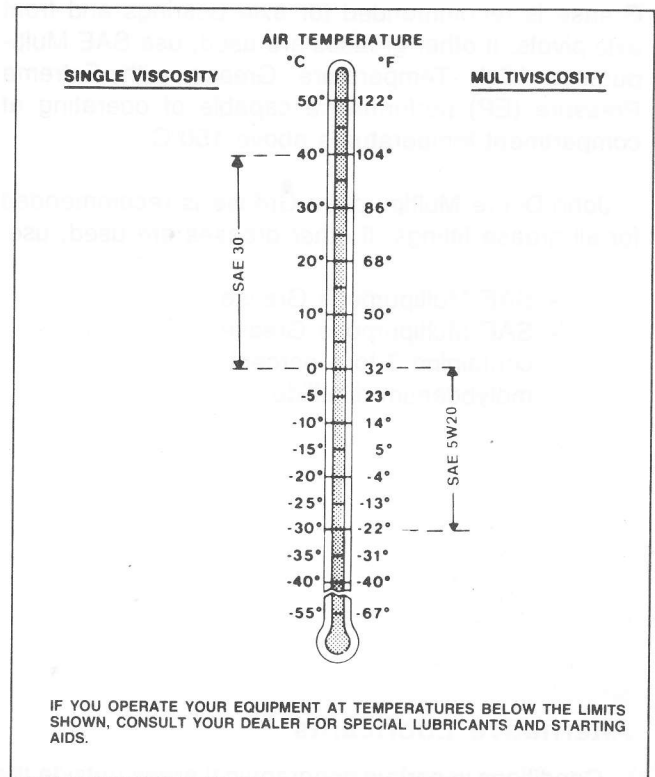
#### Engine Crankcase

**IMPORTANT: During the first 5 hours of break-in operation on a new engine or whenever the engine is overhauled or rebuilt with a new short block, use a good quality single viscosity oil with a service designation no higher than "SB" or "SC". DO NOT use "SD" or "SE" service designation oils during break-in operation. If "SB" or "SC" oils are not available, any single viscosity oil may be used. After the first 5 hours of break-in operation, drain the engine crankcase and refill with fresh oil with a service designation shown below.**

John Deere TORQ-GARD SUPREME™ engine oil is recommended. If other oils are used, they must be premium quality engine oils meeting performance requirements of:

- API Service Classification  
CD/SD
- Military Specification  
MIL-L-2104C

For low temperature operation, where oils meeting the above requirements may not be available in appropriate viscosity grade, oils meeting the performance requirements of API Service Classification CS/SC or Military Specification MIL-L46152 may be used, but at a shorter drain interval.



M27560

Quality engine oils are blended, so additives are neither required nor recommended.

### CAPACITIES

Fuel Tank	3-1/2 U.S. gallons (13.5 L)
Crankcase:	
200, 208	2 U.S. pints (0.946 L)
210, 212, 214 and 216	Aluminum Pan Engine 3 U.S. pints (1.42 L) Steel Pan Engine 4 U.S. pints (1.89 L)
Transaxle	3-1/2 U.S. pints (1.65 L)
Hydraulic System (optional equip.)	2 U.S. pints (0.94 L)

### Grease Fittings

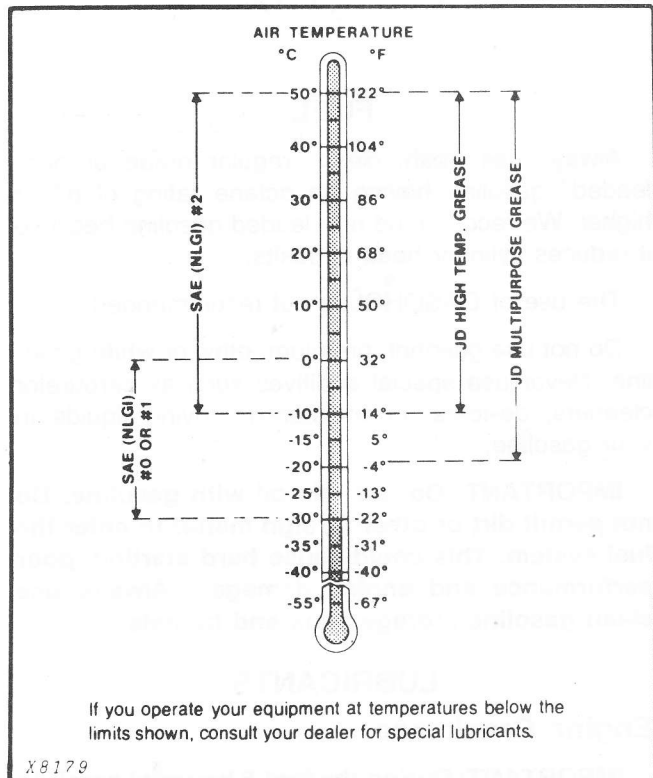
John Deere High Temperature/Extreme Pressure Grease is recommended for axle bearings and front axle pivots. If other greases are used, use SAE Multipurpose High Temperature Grease with Extreme Pressure (EP) performance capable of operating at compartment temperatures above 150°C.

John Deere Multipurpose Grease is recommended for all grease fittings. If other greases are used, use:

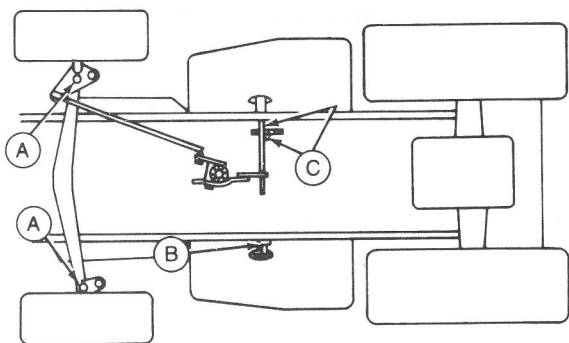
- SAE Multipurpose Grease
- SAE Multipurpose Grease containing 3 to 5 percent molybdenum disulfide.

### Alternative Lubricants

Conditions in certain geographical areas outside the United States and Canada may require different lubricant recommendations than those printed in the operator's manual. Consult your John Deere dealer to obtain alternative lubricant recommendations.



### LUBRICATING GREASE FITTINGS—Continued

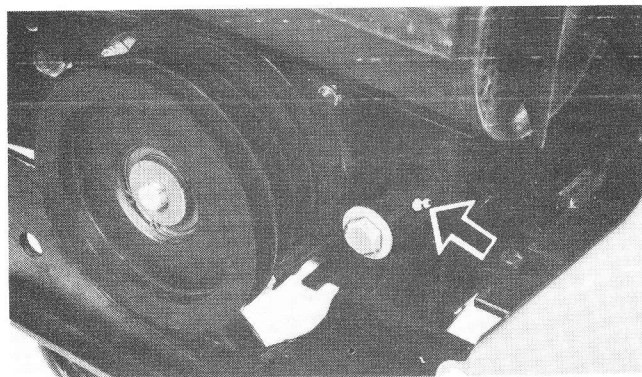


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**A—Front Axle Spindles**  
**B—Brake Pedal Shaft**

**C—Primary Lift Shaft**

Fig. 4-Grease Fitting Locations  
(Serial No. 109,001- )



M28544

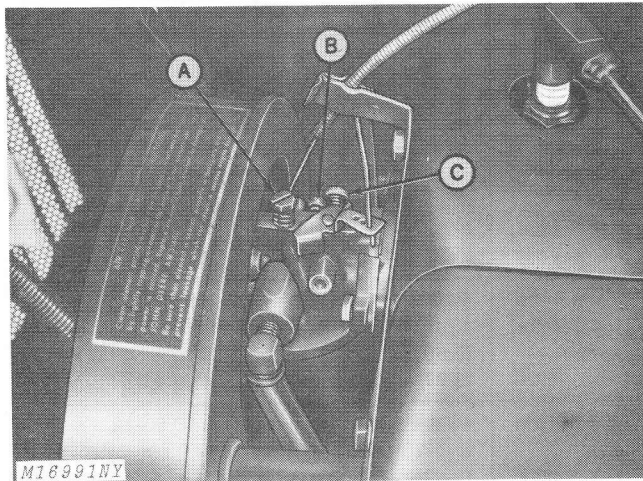
Fig. 5-Hanger Spacer Fitting on 200 Series  
Tractors (Serial No. 190,001- )

## 7. Adjust Carburetor

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

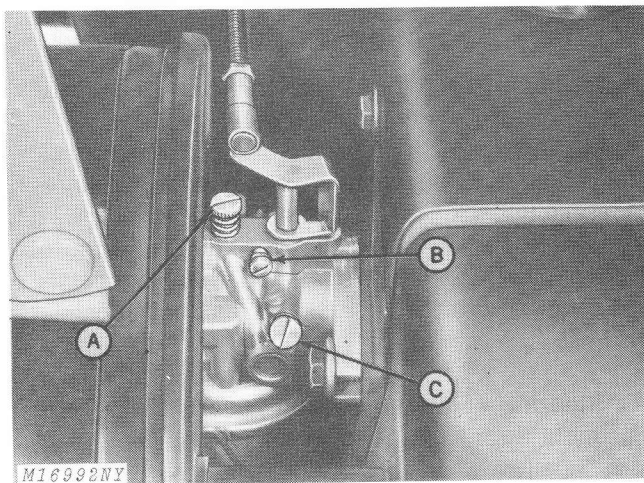
Idle adjustment and high-speed adjustment must be made at the same time as each affects the other.

Adjust carburetor as follows:



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

Fig. 10-200 and 208 Tractor Carburetor



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

Fig. 11-210, 212, 214 and 216 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

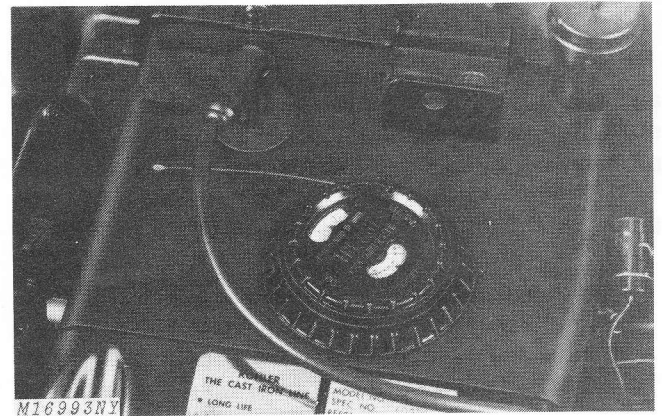


Fig. 12-Checking Engine Speed With Vibration Tachometer

A vibration tachometer, Fig. 12, can be used 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. Service Battery

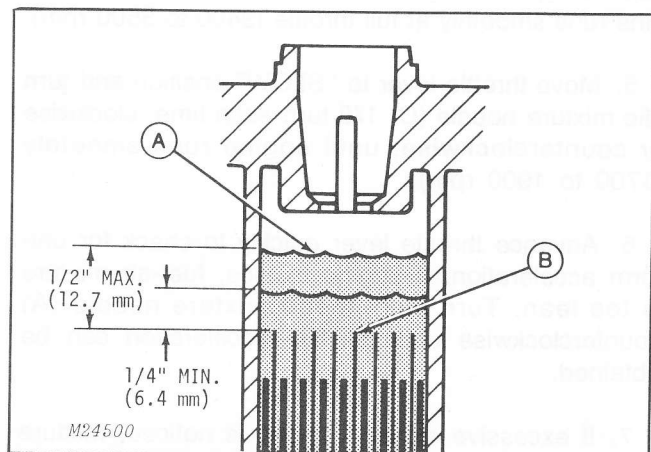


Fig. 13-Battery Electrolyte Level

Check electrolyte every 25 hours of operation.

**CAUTION:** Battery electrolyte is poisonous and corrosive. It can injure eyes, skin, and clothing. Handle it carefully. If electrolyte is spilled, flush immediately with a solution of one part baking soda to four parts water.

Keep shield on positive (+) terminal closed.

1. Remove caps.
2. If necessary, add distilled water until level (A) is 1/4 to 1/2 inch (6.4 to 12.7 mm) above plates (B).

*NOTE: DO NOT fill to bottom ledge of filler tube.*

3. During freezing weather, run engine at least 1 hour to mix water and electrolyte thoroughly.
4. Install caps.

## 13. 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
Regular Equipment Tires on 208 Tractor	4.80 x 4.00-8 (2-ply) 10 to 12 psi (4.13 to 5.65 bar) 4.20 to 5.74 kg/cm <sup>2</sup>	23 x 8.50-12 5 to 10 psi (2.34 to 4.75 bar) (2.38 to 4.83 kg/cm <sup>2</sup> )
High-Flotation Tires (GT-3 Tractor)	16 x 6.50-8 6 to 16 psi (2.82 to 7.58 bar) (2.87 to 7.70 kg/cm <sup>2</sup> )	23 x 8.50-12 5 to 10 psi (2.34 to 4.75 bar) (2.38 to 4.83 kg/cm <sup>2</sup> )
Traction Tires (GT-4 Tractor)	4.80 x 4.00-8 12 to 40 psi (5.65 to 19 bar) (5.74 to 19 kg/cm <sup>2</sup> )	23 x 8.50-12 5 to 10 psi (2.34 to 4.75 bar) (2.38 to 4.83 kg/cm <sup>2</sup> )
High-Flotation Tires (GT-5 Tractor)	16 x 6.50-8 6 to 16 psi (2.82 to 7.58 bar) (2.87 to 7.70 kg/cm <sup>2</sup> )	23 x 10.50-12 5 to 10 psi (2.34 to 4.75 bar) (2.38 to 4.83 kg/cm <sup>2</sup> )
Traction Tires (GT-8 Tractor)	4.80 x 4.00-8 (4-Ply) 12 to 40 psi (5.65 to 19 bar) (5.74 to 19 kg/cm <sup>2</sup> )	23 x 10.50-12 5 to 10 psi (2.34 to 4.75 bar) (2.38 to 4.83 kg/cm <sup>2</sup> )

## 14. 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.

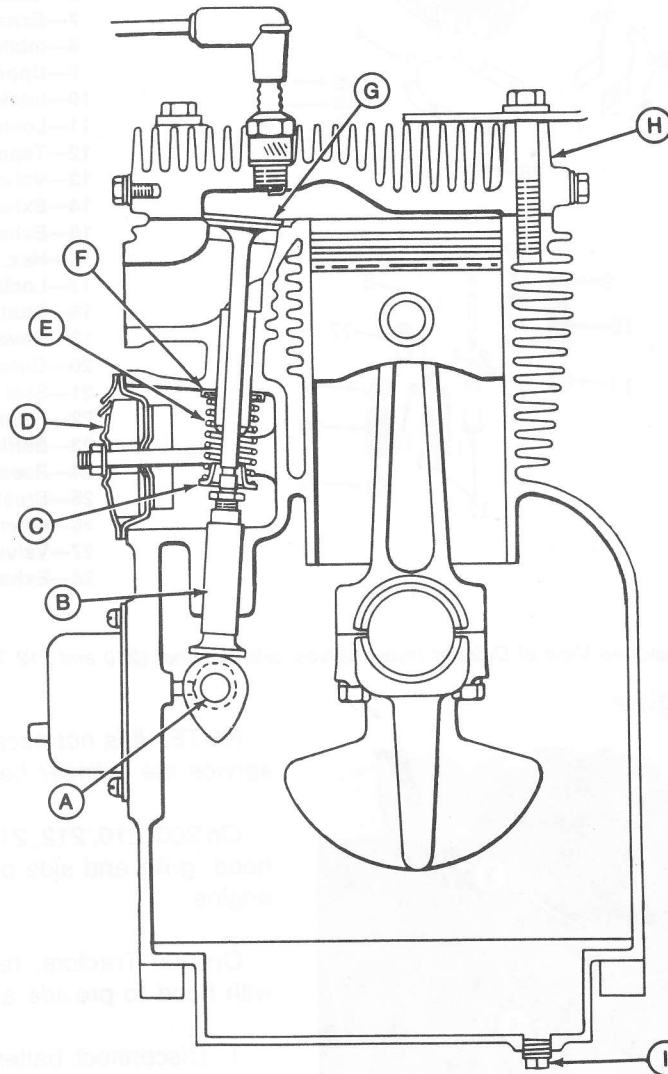
**C. Steering** - Refer to Section 70 for steering gear adjustment if required.

**D. Brakes** - See Section 50 for brake adjustment.

**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.

# Group 10 CYLINDER HEAD, VALVES AND BREATHER

## GENERAL INFORMATION



M16999N

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.

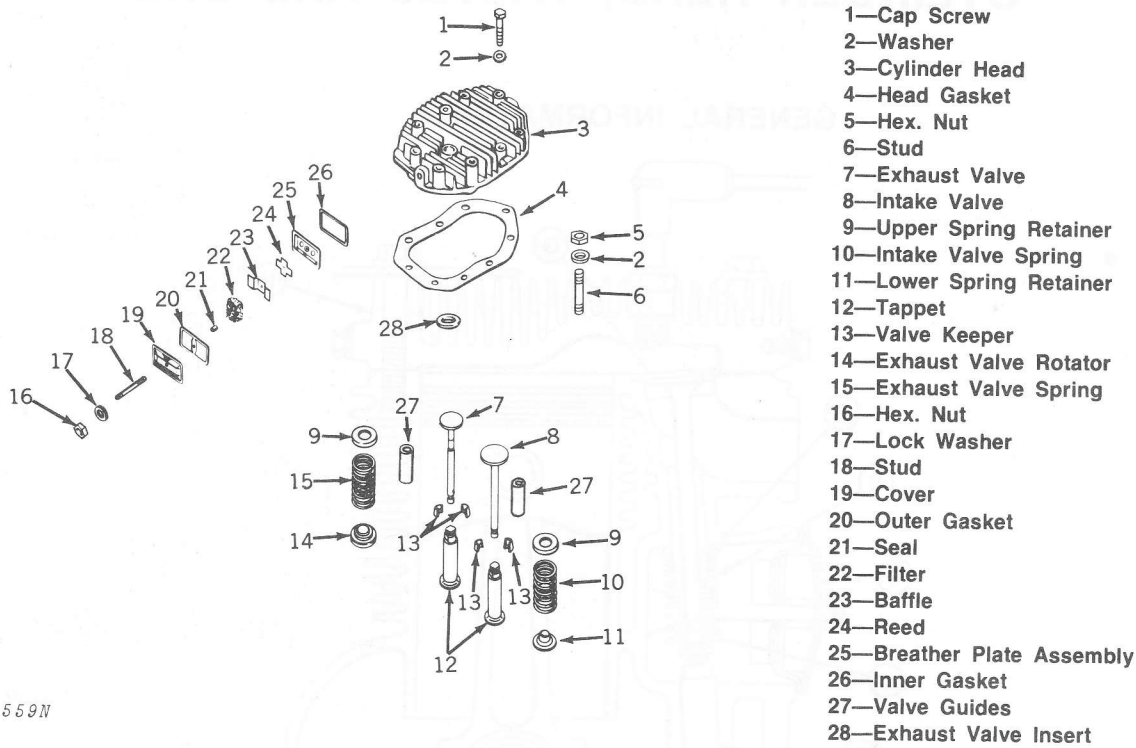
The 210 and 212 Tractors have an exhaust valve rotator. The 214 and 216 Tractors have valve rotators on both intake and exhaust valves. Whenever the valves are removed, be sure that the correct valve spring is used with the rotator on the exhaust valve.

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.

**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

M11559N

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

**Disassembling Engine**

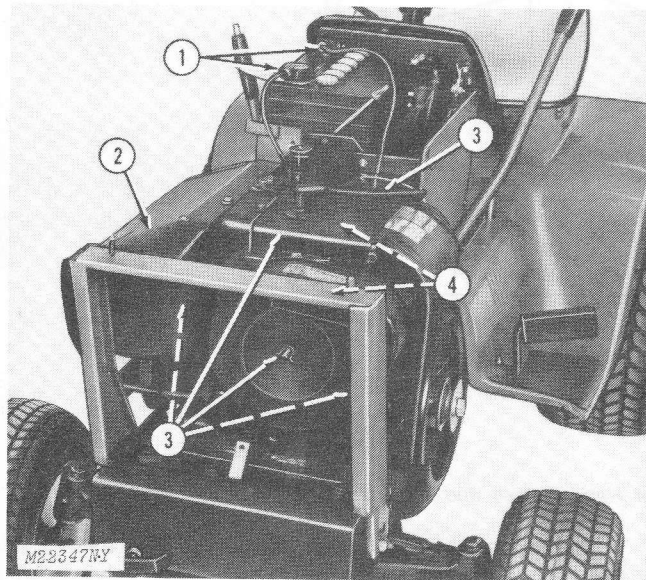


Fig. 3-Disassembling Engine  
 (210 Tractor Illustrated)

**NOTE:** It is not necessary to remove the engine to service the cylinder head, valves or breather.

On 200, 210, 212, 214 and 216 Tractors, remove the hood, grille and side panels to provide access to the engine.

On 208 Tractors, remove grille and hood support with hood to provide access to the engine.

1. Disconnect battery cables, negative cable first, Fig. 3.

2. On 200, 210, 212, 214 and 216 Tractors, remove shroud covering muffler.

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

4. Remove cylinder head, breather assembly and valves.

## Checking Valve Lift

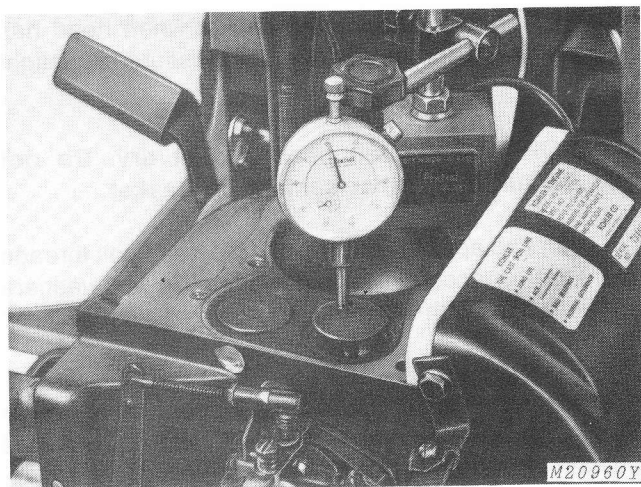


Fig. 22-Checking Valve Lift

Install a dial indicator as shown in Fig. 22. Be sure valve being checked is fully closed when adjusting indicator to zero.

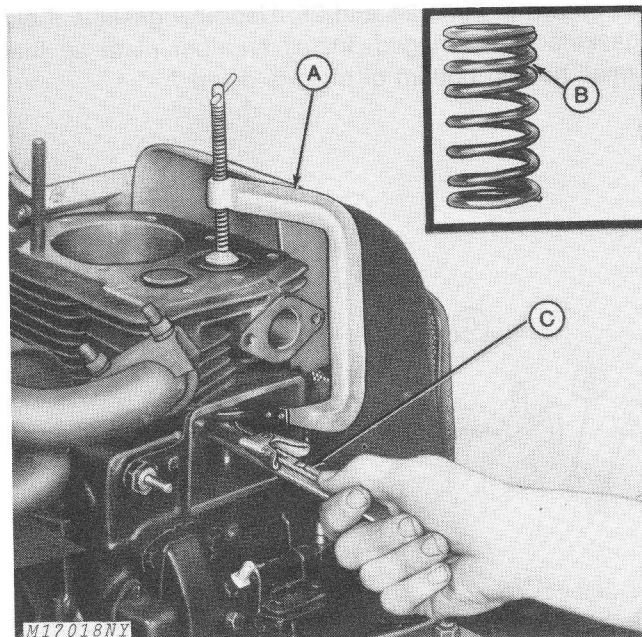
Rotate the crankshaft and observe the maximum valve lift on the dial indicator.

Position the dial indicator on the other valve and repeat rotation of the crankshaft observing the maximum valve lift.

Valve lift for each valve should be 0.250 inch (6.350 mm) or more. If lift is less for either valve, the camshaft lobe is worn and the camshaft must be replaced.

## INSTALLATION

### Installing Valves



A—Valve Spring Compressor  
B—Tight Coils

C—Valve Keeper Tool

Fig. 23-Installing Valve Springs, Retainers and Keepers

Place valve springs with upper and lower retainers in valve spring chamber. Install springs with tight coils (B) up, Fig. 23.

**NOTE:** On K241AQS and K301AQS engines, exhaust valve has a short spring for rotator. On K321AQS and K341AQS engines, both intake and exhaust valves have short springs for rotators. Install rotator in valve spring.

Lubricate stems and install valves in guides. Using a valve spring compressor (A, Fig. 23) compress the springs and install keepers on valve stem with keeper tool, (C). If tool is not available, apply grease to keepers to hold them on the valve stem and insert them by hand.

### Assembling Breather

The breather must be assembled in the correct order as shown in Figs. 24 and 25. Use new gaskets if old gaskets are damaged. Install breather plate so that small hole in bottom of plate is down.

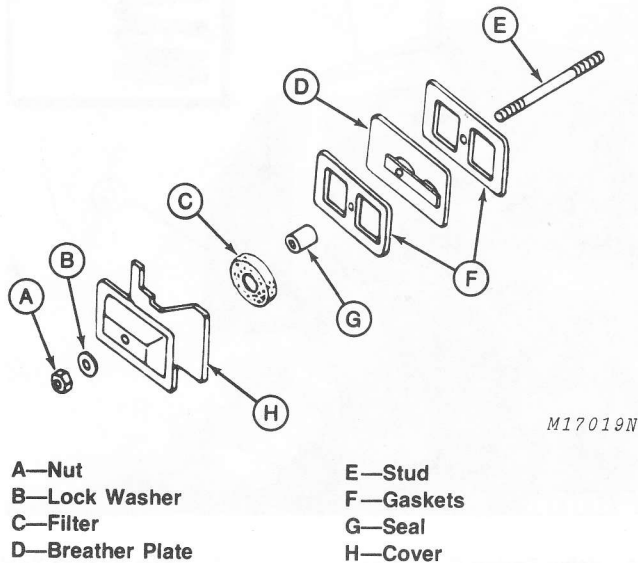


Fig. 24-Breather Parts (200 and 208 Tractor)

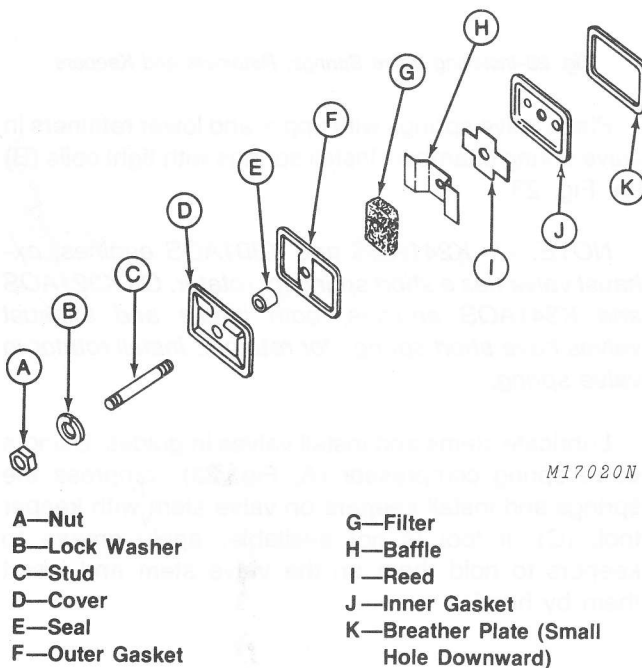


Fig. 25-Breather Parts (210, 212, 214 and 216 Tractors)

### Installing Cylinder Head

Always install a new head gasket when head has been removed for service. This will assure a gastight fit.

**IMPORTANT: Install head gasket dry. Do not use Permatex or other sealant on gasket.**

Clean and apply a light film of oil to head bolt threads to insure an accurate torque reading. Install washers on head bolts with sharp edges down against cylinder head.

It is important to torque all cylinder head bolts evenly and in correct sequence, Figs. 26 and 27, so that uneven stresses will not be set up in the cylinder wall.

*NOTE: Cylinder head for 208 Tractor, Fig. 26, is equipped with a lifting strap at position 1.*

After initial "run-in" period, let engine cool, then retorque head bolts.

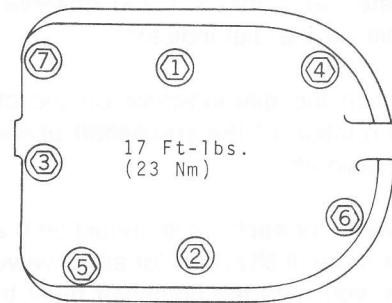


Fig. 26-Cylinder Head Bolt Tightening Sequence (200 and 208 Tractor)

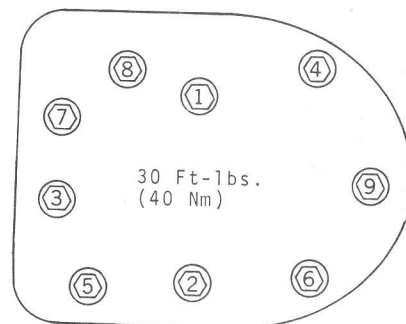


Fig. 27-Cylinder Head Bolt Tightening Sequence (210, 212, 214 and 216 Tractors)

### Installing Carburetor and Governor Linkage

Refer to Section 30, Group 10 for carburetor and governor linkage installation and adjustments.

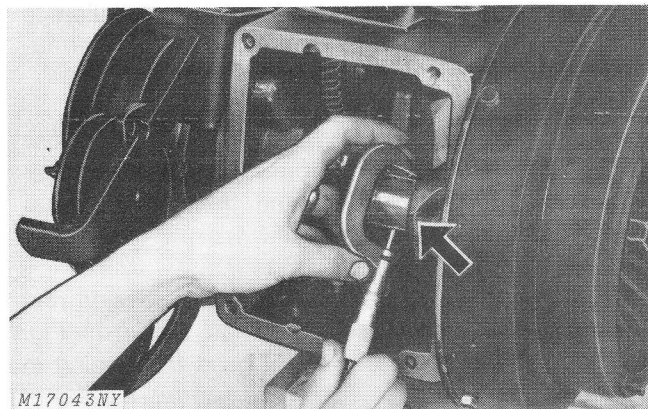


Fig. 22-Measuring Crankshaft

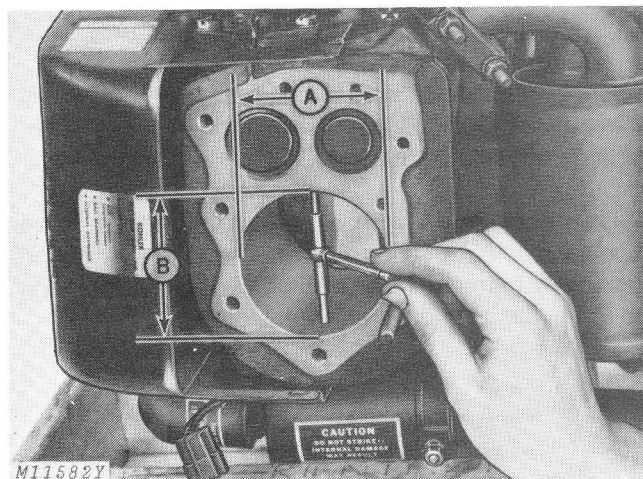
Measure the outside diameter of the crankshaft connecting rod journal, Fig. 22.

Compare the measurements between the connecting rod I.D. and the crankshaft journal O.D. These two measurements will give the proper clearance. See "Specifications," page 20-25-1.

An undersize rod and cap, 0.010-inch (0.254 mm), is available for service.

**NOTE:** Connecting rod and crankshaft journal must be clean and meet specifications or engine failure will occur.

### Inspecting Cylinder



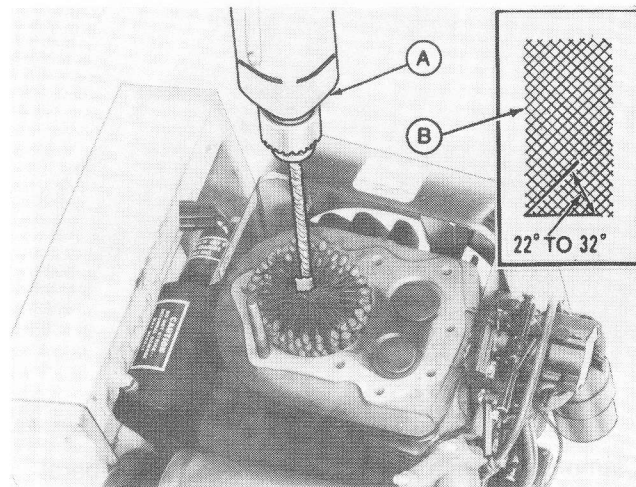
A—Parallel Measurement B—Right-Angle Measurement

Fig. 23-Measuring Cylinder Bore

Using an inside telescoping gauge and micrometer, measure the cylinder bore, Fig. 23, parallel (A) and at right angles (B) to the crankshaft. Measure at both top and bottom of ring travel zone.

If any of the measurements in Fig. 23 exceed "Specifications," reboring is necessary. See Group 20, "Major Engine Recondition" for reboring. If cylinder taper is more than 0.0015 inch (0.0381 mm), reboring is also necessary.

### Deglazing Cylinder



A—Electric Drill

B—Deglazing Hone Pattern

Fig. 24-Deglazing Cylinder Bore

If cylinder is within tolerance and not damaged, lightly deglaze cylinder bore, Fig. 24. Deglazing provides faster, more positive seating of new piston rings, and also helps retain lubrication on cylinder walls during break-in period.

**IMPORTANT:** Cover crankshaft with rags prior to deglazing to keep small particles out of crankshaft bearings and other internal parts.

Operate the deglazing tool in and out vertically to provide a cross-hatch pattern. See Insert, Fig. 24. Follow tool manufacturer's recommendations.

Carefully clean cylinder bore with soap and water after deglazing. Dry thoroughly and apply a light coat of oil to prevent rust.

## ASSEMBLY

### Installing Piston Pin

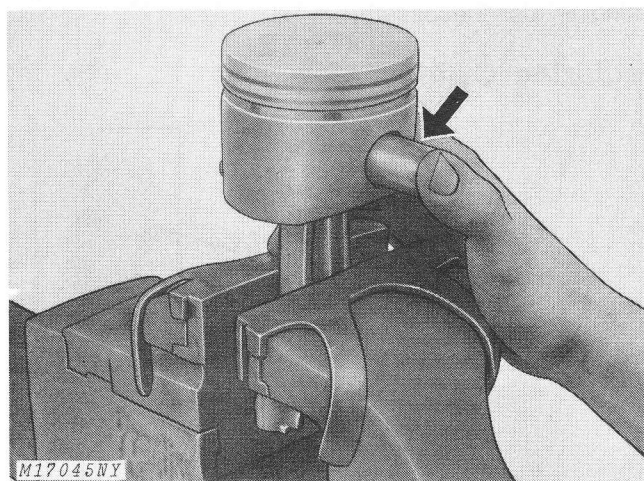
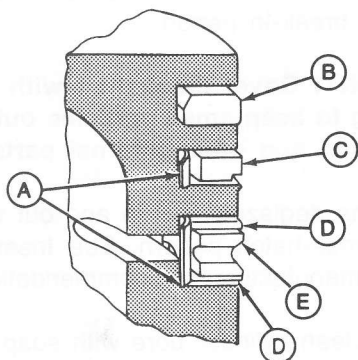


Fig. 25-Installing Piston Pin

Clamp connecting rod in a soft-jawed vise. Liberally coat piston, piston pin and connecting rod with oil.

Push piston pin, Fig. 25, into place and install new retainers. Be certain retainers are properly seated in grooves.

### Installing Piston Rings



- A—Expanders
- B—Chrome Ring (Bevel Up)
- C—Cast Iron Ring (Scraper Groove Down)
- D—Chrome Steel Rails
- E—Cast Iron Spacer

Fig. 26-Piston Ring Assembly

Use a piston ring expander for ring installation to avoid twisting or stretching rings which could permanently distort rings and reduce performance.

Install oil control ring first, starting with expander (A, Fig. 26). Spiral lower chrome rail (D) into place, install cast iron spacer (E), and then spiral upper chrome rail (D) into place.

Install expander (A) behind lower compression ring (C) and install compression rings as shown in Fig. 26. Stagger end gaps to prevent gaps from being in alignment.

### Installing Piston and Connecting Rod

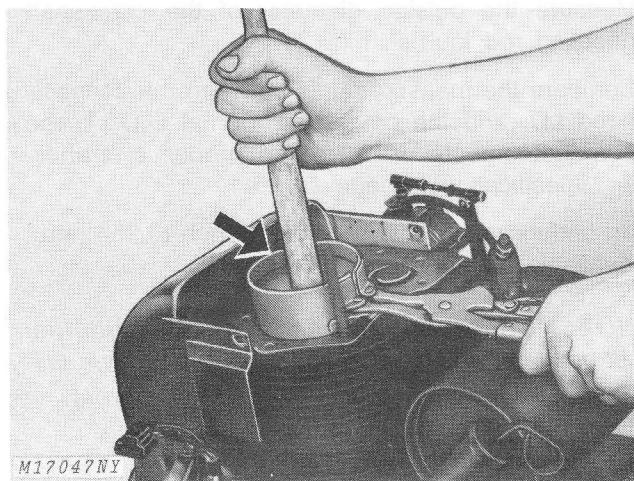


Fig. 27-Installing Piston in Cylinder

Coat piston, rings, and crankshaft journal with oil. Install piston into cylinder with match mark on connecting rod facing flywheel side of engine.

Compress rings with a ring compressor (See "Special Tools," Section 80) and gently push piston down with hammer handle, Fig. 27, until connecting rod is in position on crankshaft journal.

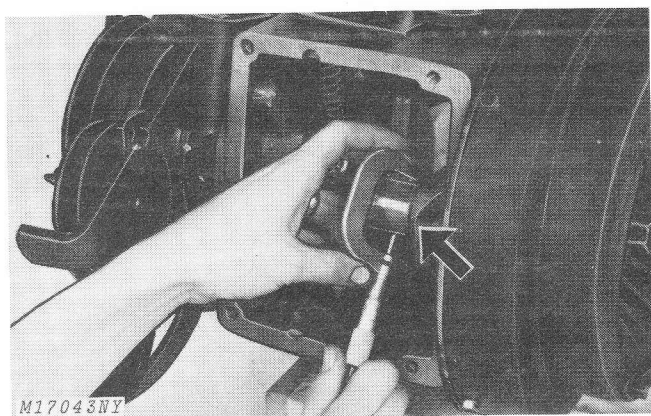


Fig. 18-Measuring Crankshaft

Measure the outside diameter of the crankshaft connecting rod journal, Fig. 18.

Compare the measurements between the connecting rod I.D. and the crankshaft journal O.D. These two measurements will give the proper clearance. See "Specifications," page 20-25-1.

An undersize rod and cap, 0.010-inch (0.254 mm), is available for service.

A competent machine shop can turn the journal down 0.010-inch (0.254 mm).

**IMPORTANT: Always turn the crankshaft journal down when possible and install a new rod. This is the least expensive method of repair.**

### Inspecting and Repairing Cylinder Block

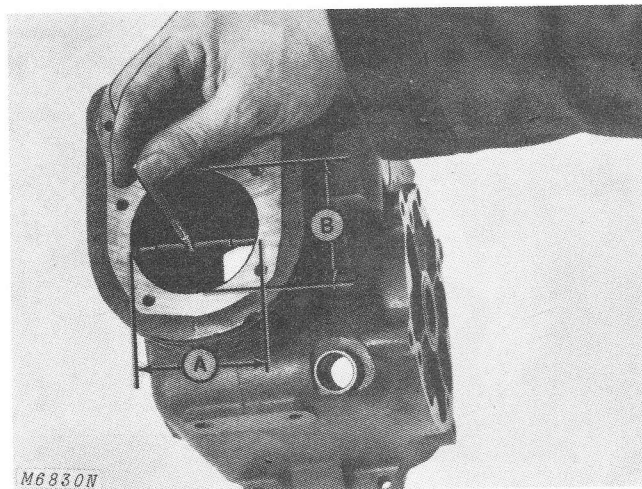
Thoroughly clean the cylinder block and check for cracks.

In any area where cracks may be suspected, coat the area with a mixture of 25 percent kerosene and 75 percent light engine oil.

Wipe the area 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 block if cracked.

NOTE: A short block is available for service.



A—Parallel Measurement      B—Right Angle Measurement

Fig. 19-Measuring Cylinder Bore

To measure cylinder bore, Fig. 19, use a cylinder dial gauge, an inside micrometer or a telescoping gauge and outside micrometer.

Measure cylinder bore as follows:

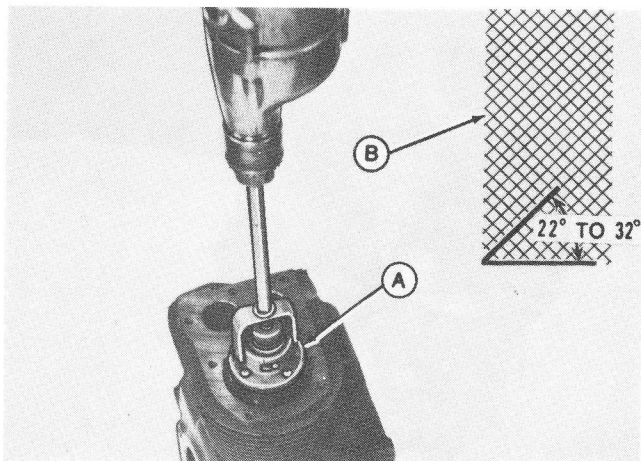
1. Measure the bore parallel (A) to the crankshaft at the top end of ring travel zone.
2. Measure the bore in the same position at the bottom end of ring travel zone.
3. Measure the bore at right angles (B) to the crankshaft at the top end of ring travel zone.
4. Measure the bore in the same position at the bottom end of ring travel zone.

Compare the measurements taken in Steps 1 and 3 above to find the out-of-round wear at the TOP end of the bore.

Compare the measurements taken in Steps 2 and 4 above to find the out-of-round wear at the BOTTOM end of the bore.

Compare the results of measurements taken in Steps 1, 2, 3 and 4 to find out whether or not the bore has worn tapered.

### Deglazing Cylinder Bore



M28640

A—Deglazing Tool

B—Deglazing Honing Pattern

Fig. 20—Deglazing Cylinder Bore

If cylinder is within tolerance and not damaged, lightly deglaze cylinder bore. Deglazing provides faster more positive seating of new piston rings, and also helps retain lubrication on cylinder walls during break-in period.

Operate the deglazing tool vertically to provide a cross-hatch pattern. See insert, Fig. 20. Follow tool manufacturer's recommendations.

### Boring Cylinder Block

Reboring of the cylinder block is necessary when the bore is damaged or not within the specified tolerance.

**NOTE:** Cylinder should be rebored for 0.010 (0.254 mm), 0.020 (0.508 mm) or 0.030 (0.762 mm)-inch oversize pistons. These are the oversizes offered for service.

Use a "hone" for reboring the cylinder. Use coarse honing stones for removing most of the bore and medium honing stones for finishing. Use hones for cast iron. BE SURE the correct hone is used and that stones are not worn.

1. Anchor the cylinder block before reboring.
2. Set the drill press to operate from 450 to 700 rpm.
3. Lower the hone to the point where the lower end extends 1/2 to 3/4-inch (12.70 to 19.05 mm) past the end of the cylinder block.

4. Rotate the adjusting nut on the hone until the stones come in contact with the cylinder wall at the narrowest point.

5. Turn the hone by hand. If you cannot turn it, the hone is too tight. Loosen hone until it can be turned by hand.

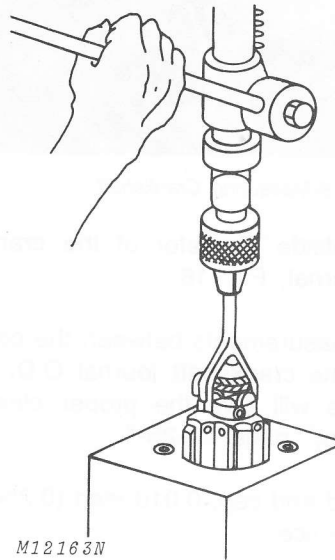


Fig. 21—Honing the Cylinder

6. Start the drill. Move the hone up and down in the cylinder approximately 40 cycles per minute, Fig. 21. Follow the hone manufacturer's recommendations.

**IMPORTANT: Some hones require oil and some will not work with even a small amount of oil on the cylinder wall.**

7. Check the diameter of the cylinder regularly during honing. (Stop the drill before measuring and remove the hone from the cylinder).

8. When the cylinder is approximately 0.002-inch (0.050 mm) within the desired bore specification, change to medium stones and finish the bore. Finish should not be perfectly smooth, but should have a 45 degree cross hatch pattern.

9. Clean the cylinder thoroughly. Use soap, warm water and clean rag. Clean the cylinder wall for a "white glove" inspection. A clean white rag should not show soil from the cylinder wall.

**IMPORTANT: DO NOT use solvent or gasoline because these fluids only wash all the oil from the cylinder wall. They do not remove metal particles produced during honing.**

# Group 25 SPECIFICATIONS

## SPECIFICATIONS

Item	200 Tractor- K181QS Engine 208 Tractor-K181S Engine	210 Tractor K241AQS Engine	212 Tractor K301AQS Engine	214 Tractor K321AQS Engine	Wear Tolerance
Displacement	18.6 cu. in. (304.8 cc)	23.9 cu. in. (391.65 cc)	29.07 cu. in. (476.37 cc)	31.27 cu. in. (528.44 cc)	—
Horsepower	8 @ 3600 rpm	10 @ 3600 rpm	12 @ 3600 rpm	14 @ 3600 rpm	—
Engine compression (1000 rpm)	110 to 120 psi	110 to 120 psi	110 to 120 psi	110 to 120 psi	—
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)	—
Cylinder bore (new)	2.9375 in. (76.21 mm)	3.251 in. (82.57 mm)	3.375 in. (85.73 mm)	3.500 in. (88.9 mm)	0.003 in. (0.0762 mm)
Stroke	2-3/4 in. (69.85 mm)	2-7/8 in. (73.03 mm)	3-1/4 in. (82.55 mm)	3-1/4 in. (82.55 mm)	—
Crankshaft end play	0.002 to 0.023 in. (0.0508 to 0.5842 mm)	0.003 to 0.020 in. (0.076 to 0.508 mm)	0.003 to 0.020 in. (0.076 to 0.508 mm)	0.003 to 0.020 in. (0.076 to 0.508 mm)	—
Crankshaft journal-to-connecting rod side clearance	0.005 to 0.016 in. (0.1270 to 0.4064 mm)	0.007 to 0.016 in. (0.1778 to 0.4064 mm)	0.007 to 0.016 in. (0.1778 to 0.4064 mm)	0.007 to 0.016 in. (0.1778 to 0.4064 mm)	—
Crankshaft journal length (connecting rod)	1.1230 to 1.1265 in. (28.52 to 28.61 mm)	1.179 to 1.181 in. (29.95 to 29.97 mm)	1.1790 to 1.1825 in. (29.95 to 30.04 mm)	1.1790 to 1.1825 in. (29.95 to 30.04 mm)	—
Crankshaft journal diameter connecting rod bearing	1.1855 to 1.1860 in. (30.11 to 30.12 mm)	1.4995 to 1.5000 in. (38.09 to 38.10 mm)	1.4995 to 1.5000 in. (38.09 to 38.10 mm)	1.4995 to 1.5000 in. (38.09 to 38.10 mm)	-0.0015 in. (-0.038 mm)
Main bearings (crankshaft journal)	1.1811 to 1.1814 in. (29.99 to 30.00 mm)	1.5743 to 1.5747 in. (39.98 to 39.99 mm)	1.5745 to 1.5749 in. (39.99 to 40.00 mm)	1.5745 to 1.5749 in. (39.99 to 40.00 mm)	—
Connecting rod bore (large end)	1.1870 to 1.1885 in. (30.14 to 30.16 mm)	1.5010 to 1.5025 in. (38.12 to 38.14 mm)	1.5010 to 1.5025 in. (38.12 to 38.14 mm)	1.5010 to 1.5025 in. (38.12 to 38.14 mm)	—
Connecting rod bore (small end)	0.6255 to 0.6259 in. (15.88 to 15.89 mm)	0.8596 to 0.85975 in. (21.83 to 21.84 mm)	0.8757 to 0.87585 in. (22.24 to 22.25 mm)	0.8757 to 0.87585 in. (22.24 to 22.25 mm)	—
Connecting rod-to-crankshaft journal running clearance	0.001 to 0.002 in. (0.0254 to 0.0508 mm)	0.001 to 0.002 in. (0.0254 to 0.0508 mm)	0.001 to 0.002 in. (0.0254 to 0.0508 mm)	0.001 to 0.002 in. (0.0254 to 0.0508 mm)	0.0035 in. (0.0889 mm)
Connecting rod-to-piston pin clearance	0.0006 to 0.0011 in. (0.0152 to 0.0279 mm)	0.0003 to 0.0008 in. (0.0076 to 0.0203 mm)	0.0003 to 0.0008 in. (0.0076 to 0.0203 mm)	0.0003 to 0.0008 in. (0.0076 to 0.0203 mm)	0.0015 in. (0.0381 mm)
Cylinder head flatness (max.)	—	—	—	—	0.003 in. (0.0762 mm)
Cylinder taper (max.)	.0025	.0015	.0015	.0015	0.0015 in. (0.0381 mm)
Cylinder out-of-round (max.)	.005	.005	.005	.005	0.005 in. (0.127 mm)
Piston diameter (bottom skirt)	2.9332 to 2.9346 in. (74.50 to 74.53 mm)	3.2470 to 3.2480 in. (82.47 to 82.49 mm)	3.3705 to 3.3715 in. (85.61 to 85.63 mm)	3.4971 to 3.4985 in. (88.82 to 88.86 mm)	—
Piston pin-to-piston boss	0.000 to 0.0003 in. (0.000 to 0.0076 mm)	0.000 to 0.0003 in. (0.000 to 0.0076 mm)	0.000 to 0.0003 in. (0.000 to 0.0076 mm)	0.000 to 0.0003 in. (0.000 to 0.0076 mm)	Select to one thumb push fit.
*Piston-to-cylinder bore (top of skirt)	0.006 to 0.008 in. (0.1524 to 0.2032 mm)	0.0075 to 0.0085 in. (0.1905 to 0.2159 mm)	0.0065 to 0.0095 in. (0.1651 to 0.2413 mm)	0.007 to 0.010 in. (0.1778 to 0.2540 mm)	—
Piston pin diameter	0.6247 to 0.6249 in. (15.86 to 15.87 mm)	0.8591 to 0.8593 in. (21.82 to 21.83 mm)	0.8752 to 0.8754 in. (22.23 to 22.24 mm)	0.8752 to 0.8754 in. (22.23 to 22.24 mm)	—
Ring side clearance (top ring)	0.0025 to 0.004 in. (0.0635 to 0.1016 mm)	0.002 to 0.004 in. (0.0508 to 0.1016 mm)	0.002 to 0.004 in. (0.0508 to 0.1016 mm)	0.002 to 0.004 in. (0.0508 to 0.1016 mm)	+0.002 in. (0.508 mm)

\*Measured just below oil ring and at right angles to piston pin.

**SPECIFICATIONS—Continued**

Item	216 Tractor K341AQS Engine	Wear Tolerance
Displacement	35.89 cu. in. (588.24 cc)	—
Horsepower	16 @ 3600 rpm	—
Engine compression (1000 rpm)	110 to 120 psi	—
Spark plug gap	0.035 (0.635 mm)	—
Cylinder bore (new)	3.750 in. (95.2 mm)	0.003 in. (0.0762 mm)
Stroke	3-1/4 in. (82.55 mm)	—
Crankshaft end play	0.003 to 0.020 in. (0.076 to 0.508 mm)	—
Crankshaft journal-to-connecting rod side clearance	0.007 to 0.016 in. (0.1778 to 0.4064 mm)	—
Crankshaft journal length (connecting rod)	1.1790 to 1.1825 in. (29.95 to 30.04 mm)	—
Crankshaft journal diameter connecting rod bearing	1.4995 to 1.5000 in. (38.09 to 38.10 mm)	-0.0015 in. (-0.038 mm)
Main bearings (crankshaft journal)	1.5745 to 1.5749 in. (39.99 to 40.00 mm)	—
Connecting rod bore (large end)	1.5010 to 1.5025 in. (38.12 to 38.14 mm)	—
Connecting rod bore (small end)	0.8757 to 0.87585 in. (22.24 to 22.25 mm)	—
Connecting rod-to-crankshaft journal running clearance	0.001 to 0.002 in. (0.0254 to 0.0508 mm)	0.0035 in. (0.0889 mm)
Connecting rod-to-piston pin clearance	0.0003 to 0.0008 in. (0.0076 to 0.0203 mm)	0.0015 in. (0.0381 mm)
Cylinder head flatness (max.)	—	0.003 in. (0.0762 mm)
Cylinder taper (max.)	.0015	0.0015 in. (0.0381 mm)
Cylinder out-of-round (max.)	.005	0.005 in. (0.127 mm)
Piston diameter (bottom skirt)	3.4971 to 3.4985 in. (88.82 to 88.86 mm)	—
Piston pin-to-piston boss	0.000 to 0.0003 in. (0.000 to 0.0076 mm)	Select to one thumb push fit.
*Piston-to-cylinder bore (top of skirt)	0.007 to 0.010 in. (0.1778 to 0.2540 mm)	—
Piston pin diameter	0.8752 to 0.8754 in. (22.23 to 22.24 mm)	—
Ring side clearance (top ring)	0.002 to 0.004 in. (0.0508 to 0.1016 mm)	+0.002 in. (0.508 mm)

\*Measured just below oil ring and at right angles to piston pin.

## SPECIFICATIONS

Item	200 Tractor K181QS Engine 208 Tractor-K181S Engine	210 Tractor K241AQS Engine	212 Tractor K301AQS Engine	214, 216 Tractor K321AQS, K341AQS Engine	Wear Tolerance
Ring side clearance (middle ring)	0.0025 to 0.004 in. (0.0635 to 0.1016 mm)	0.0015 to 0.003 in. (0.0381 to 0.0762 mm)	0.002 to 0.004 in. (0.0508 to 0.1016 mm)	0.002 to 0.004 in. (0.0508 to 0.1016 mm)	+0.002 in. (0.508 mm)
Ring side clearance (oil ring)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	0.001 to 0.003 in. (0.0254 to 0.0762 mm)	0.001 to 0.003 in. (0.0254 to 0.0762 mm)	0.001 to 0.003 in. (0.0254 to 0.0762 mm)	+0.002 in. (0.508 mm)
Ring end gap (new bore maximum)	0.007 to 0.017 in. (0.1778 to 0.0431 mm)	0.010 to 0.020 in. (0.2540 to 0.5080 mm)	0.010 to 0.020 in. (0.2540 to 0.5080 mm)	0.010 to 0.020 in. (0.2540 to 0.5080 mm)	+0.010 in. (0.254 mm)
Camshaft pin-to-camshaft clearance	.005/.003	0.001 to 0.0035 in. (0.0254 to 0.0889 mm)	0.001 to 0.0035 in. (0.0254 to 0.0889 mm)	0.001 to 0.0035 in. (0.0254 to 0.0889 mm)	—
Camshaft pin-to-block (bearing plate end)	0.0005 to 0.002 in. (0.0127 to 0.0508 mm)	0.0005 to 0.002 in. (0.0127 to 0.0508 mm)	0.0005 to 0.002 in. (0.0127 to 0.0508 mm)	0.0005 to 0.002 in. (0.0127 to 0.0508 mm)	—
Camshaft pin-to-block (PTO end)	0.0015 to 0.003 in. (0.0381 to 0.0762 mm)	0.0015 to 0.003 in. (0.0381 to 0.0762 mm)	0.0015 to 0.003 in. (0.0381 to 0.0762 mm)	0.0015 to 0.003 in. (0.0381 to 0.0762 mm)	—
Camshaft pin-to-breaker cam	0.001 to 0.0035 in. (0.0254 to 0.0889 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	—
Camshaft end play	0.005 to 0.010 in. (0.127 to 0.254 mm)	0.005 to 0.010 in. (0.127 to 0.254 mm)	0.005 to 0.010 in. (0.127 to 0.254 mm)	0.005 to 0.010 in. (0.127 to 0.254 mm)	—
Valve stem clearance in guide (intake)	0.001 to 0.0025 in. (0.025 to 0.063 mm)	0.001 to 0.0025 in. (0.025 to 0.063 mm)	0.001 to 0.0025 in. (0.025 to 0.063 mm)	0.001 to 0.0025 in. (0.025 to 0.063 mm)	0.0045 in. (0.1143 mm)
Valve stem clearance in guide (exhaust)	0.0025 to 0.0040 in. (0.0635 to 0.1016 mm)	0.0025 to 0.0040 in. (0.0635 to 0.1016 mm)	0.0025 to 0.0040 in. (0.0635 to 0.1016 mm)	0.0025 to 0.0040 in. (0.0635 to 0.1016 mm)	0.0065 in. (0.1651 mm)
Valve guide in block (interference)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	—
Valve seat in block (exhaust) (interference)	0.002 to 0.004 in. (0.0508 to 0.1016 mm)	0.003 to 0.005 in. (0.0762 to 0.1524 mm)	0.003 to 0.005 in. (0.0762 to 0.1524 mm)	0.003 to 0.005 in. (0.0762 to 0.1524 mm)	—
Valve clearance (intake) (cold)	0.006 to 0.008 in. (0.1524 to 0.2032 mm)	0.008 to 0.010 in. (0.2032 to 0.2540 mm)	0.008 to 0.010 in. (0.2032 to 0.2540 mm)	0.008 to 0.010 in. (0.2032 to 0.2540 mm)	—
Valve clearance (exhaust) (cold)	0.015 to 0.017 in. (0.3810 to 0.4318 mm)	0.017 to 0.020 in. (0.4318 to 0.5080 mm)	0.017 to 0.020 in. (0.4318 to 0.5080 mm)	0.017 to 0.020 in. (0.4318 to 0.5080 mm)	—
Valve seat angle	45°	45°	45°	45°	—
Valve face angle	45°	45°	45°	45°	—
Valve seat width	1/32 in. (0.794 mm)	1/32 in. (0.794 mm)	1/32 in. (0.794 mm)	1/32 in. (0.794 mm)	1/16 in. (1.588 mm)
Valve tappet clearance in block	0.005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.008 to 0.0023 in. (0.0203 to 0.0584 mm)	0.0008 to 0.0023 in. (0.0203 to 0.0584 mm)	0.0008 to 0.0023 in. (0.0203 to 0.0584 mm)	—
Minimum valve lift (zero lash)	0.2542	0.324	0.324	0.324	—
Valve guide, I.D.	0.312 to 0.313 in. (7.924 to 7.950 mm)	0.312 to 0.313 in. (7.924 to 7.950 mm)	0.312 to 0.313 in. (7.924 to 7.950 mm)	0.312 to 0.313 in. (7.924 to 7.950 mm)	0.315 in. (8.001 mm)
Valve guide, depth	1-5/16 in. (33.34 mm)	1-15/32 in. (37.31 mm)	1-15/32 in. (37.31 mm)	1-15/32 in. (37.31 mm)	—
Valve stem, O.D. (intake)	0.3105 to 0.3110 in. (7.8867 to 7.8994 mm)	0.3105 to 0.3110 in. (7.8867 to 7.8994 mm)	0.3105 to 0.3110 in. (7.8867 to 7.8994 mm)	0.3105 to 0.3110 in. (7.8867 to 7.8994 mm)	0.3090 in. (7.8486 mm)
Valve stem, O.D. (exhaust)	0.3090 to 0.3095 in. (7.8486 to 7.8613 mm)	0.3090 to 0.3095 in. (7.8486 to 7.8613 mm)	0.3090 to 0.3095 in. (7.8486 to 7.8613 mm)	0.3090 to 0.3095 in. (7.8486 to 7.8613 mm)	3.3080 in. (7.8232 mm)
Valve face width	1/32 in. (0.794 mm)	1/32 in. (0.794 mm)	1/32 in. (0.794 mm)	1/32 in. (0.794 mm)	1/16 in. (1.588 mm)
Valve spring squareness	1/16 in. (1.588 mm)	1/16 in. (1.588 mm)	1/16 in. (1.588 mm)	1/16 in. (1.588 mm)	1/32 in. (0.794 mm)
Valve spring compressed (intake)	18 to 20 lbs. at 1-5/16 in. length (8.16 to 9.98 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	—

### SPECIFICATIONS—Continued

Item	200 Tractor- K181QS Engine 208 Tractor-K181S Engine	210 Tractor K241AQS Engine	212 Tractor K301AQS Engine	214, 216 Tractor K321AQS, K341AQS Engine	Wear Tolerance
Valve spring compressed (exhaust)	18 to 22 lbs. at 1-5/16 in. length (8.16 to 9.98 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	—
Valve spring free length (intake)	1-3/4 in. (44.45 mm)	1-13/16 in. (46.04 mm)	1-13/16 in. (46.04 mm)	1-13/16 in. (46.04 mm)	—
Valve spring free length (exhaust)	1-3/4 in. (44.45 mm)	1-7/8 in. (47.63 mm)	1-7/8 in. (47.63 mm)	1-7/8 in. (47.63 mm)	—
Governor bushing-to-governor cross shaft clearance	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	—
Governor gear-to-governor shaft	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	—
Ball bearing-to-cylinder block (interference)	0.0014 to 0.0029 in. (0.0355 to 0.0736 mm)	0.0006 to 0.0022 in. (0.0152 to 0.0558 mm)	0.0006 to 0.0022 in. (0.0152 to 0.0558 mm)	0.0006 to 0.0022 in. (0.0152 to 0.0558 mm)	—
Ball bearing-to-bearing plate (interference)	0.0014 to 0.0029 in. (0.0355 to 0.0736 mm)	0.0012 to 0.0028 in. (0.0304 to 0.0711 mm)	0.0012 to 0.0028 in. (0.0304 to 0.0711 mm)	0.0012 to 0.0028 in. (0.0304 to 0.0711 mm)	—
Ball bearing-to-crankshaft (interference too loose)	0.0002 to 0.0005 in. (0.0050 to 0.0127 mm)	0.0004 to 0.0005 in. (0.0101 to 0.0127 mm)	0.0004 to 0.0005 in. (0.0101 to 0.0127 mm)	0.0004 to 0.0005 in. (0.0101 to 0.0127 mm)	—

### TORQUES FOR HARDWARE

Location	Torque	
	200 and 208 Tractor	210, 212, 214, 216 Tractors
Cylinder head bolts	15-20 ft-lbs (20 to 27 N·m)	25-30 ft-lbs (34 to 41 N·m)
Connecting rod cap screws	200 in-lbs (22.6 N·m)	300 in-lbs (34 N·m)
Flywheel nut	45-55 ft-lbs (68 to 75 N·m)	50-60 ft-lbs (68 to 81 N·m)
Spark plug (cold)	18-22 ft-lbs (24 to 30 N·m)	18-22 ft-lbs (24 to 30 N·m)

**SPECIFICATIONS—Continued**

Item	200 Tractor- K181QS Engine 208 Tractor-K181S Engine	210 Tractor K241AQS Engine	212 Tractor K301AQS Engine	214, 216 Tractor K321AQS, K341AQS Engine	Wear Tolerance
Valve spring compressed (exhaust)	18 to 22 lbs. at 1-5/16 in. length (8.16 to 9.98 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	43 to 49 lbs. at 1-5/16 in. length (19.50 to 22.23 kg at 49.21 mm length)	—
Valve spring free length (intake)	1-3/4 in. (44.45 mm)	1-13/16 in. (46.04 mm)	1-13/16 in. (46.04 mm)	1-13/16 in. (46.04 mm)	—
Valve spring free length (exhaust)	1-3/4 in. (44.45 mm)	1-7/8 in. (47.63 mm)	1-7/8 in. (47.63 mm)	1-7/8 in. (47.63 mm)	—
Governor bushing-to-governor cross shaft clearance	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	0.001 to 0.0025 in. (0.0254 to 0.0635 mm)	—
Governor gear-to-governor shaft	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	0.0005 to 0.0020 in. (0.0127 to 0.0508 mm)	—
Ball bearing-to-cylinder block (interference)	0.0014 to 0.0029 in. (0.0355 to 0.0736 mm)	0.0006 to 0.0022 in. (0.0152 to 0.0558 mm)	0.0006 to 0.0022 in. (0.0152 to 0.0558 mm)	0.0006 to 0.0022 in. (0.0152 to 0.0558 mm)	—
Ball bearing-to-bearing plate (interference)	0.0014 to 0.0029 in. (0.0355 to 0.0736 mm)	0.0012 to 0.0028 in. (0.0304 to 0.0711 mm)	0.0012 to 0.0028 in. (0.0304 to 0.0711 mm)	0.0012 to 0.0028 in. (0.0304 to 0.0711 mm)	—
Ball bearing-to-crankshaft (interference too loose)	0.0002 to 0.0005 in. (0.0050 to 0.0127 mm)	0.0004 to 0.0005 in. (0.0101 to 0.0127 mm)	0.0004 to 0.0005 in. (0.0101 to 0.0127 mm)	0.0004 to 0.0005 in. (0.0101 to 0.0127 mm)	—

**TORQUES FOR HARDWARE**

Location	Torque	
	200 and 208 Tractor	210, 212, 214, 216 Tractors
Cylinder head bolts	15-20 ft-lbs (20 to 27 N·m)	25-30 ft-lbs (34 to 41 N·m)
Connecting rod cap screws	200 in-lbs (22.6 N·m)	300 in-lbs (34 N·m)
Flywheel nut	45-55 ft-lbs (68 to 75 N·m)	50-60 ft-lbs (68 to 81 N·m)
Spark plug (cold)	18-22 ft-lbs (24 to 30 N·m)	18-22 ft-lbs (24 to 30 N·m)

# Section 40

# ELECTRICAL SYSTEM

## Group 5

## GENERAL INFORMATION

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(200 TRACTORS SERIAL  
NO. 190,001 AND ABOVE)

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### WIRING DIAGRAMS

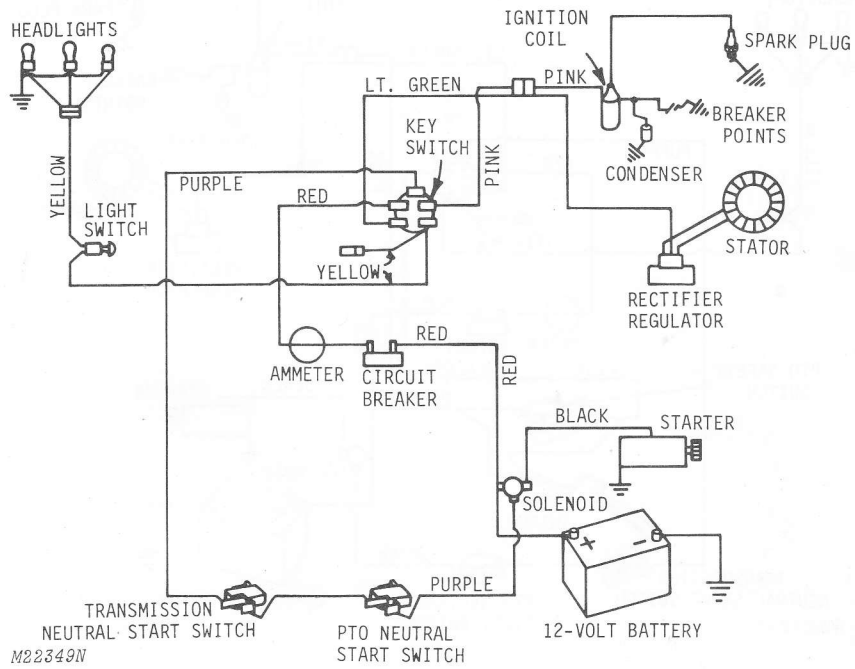


Figure 1-Wiring Diagram For 200, 210, 212 and 214 Tractors  
(Serial No. 30,001-70,000)

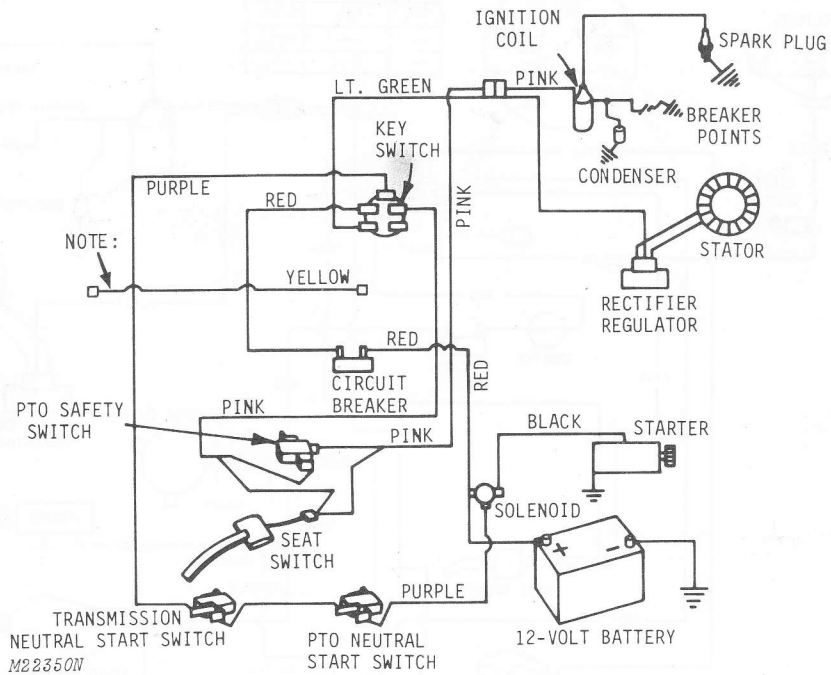


Figure 2-Wiring Diagram For 208 Tractor

WIRING DIAGRAMS—Continued

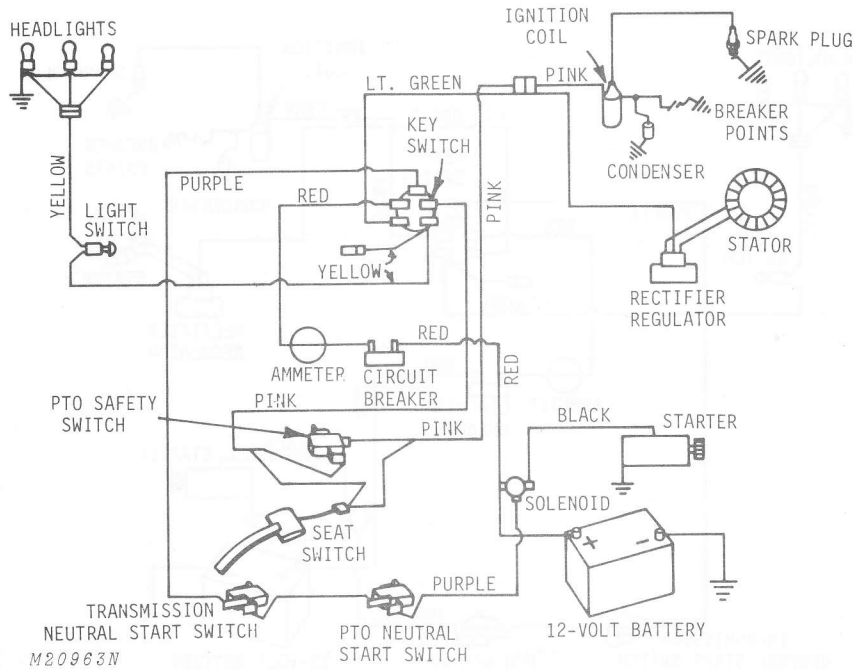


Fig. 3-Wiring Diagram For 210, 212, 214 and 216 Tractors  
(Serial No. 70,001-190,000)

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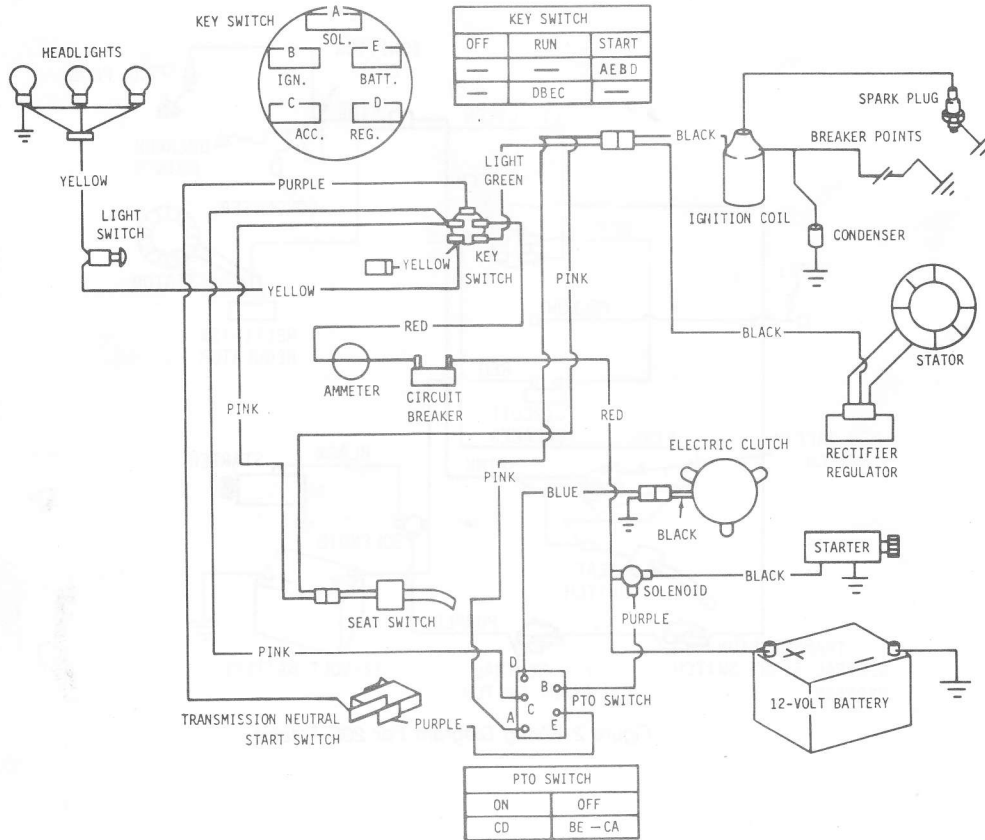


Fig. 4-Wiring Diagram For 210, 212, 214 and 216 Tractors  
(Serial No. 190,001- )

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## DESCRIPTION

The 200 Series Tractors all have a 12-volt electrical system. The electrical system consists of the cranking, ignition and charging systems, plus the accessory circuit.

The cranking system for 200, 210, 212 and 214 Tractors (Serial No. 30,001-70,000), Fig. 1, consists of a battery, solenoid, circuit breaker, key switch, two neutral-start safety switches and a permanent magnet starter motor. See Group 10 for detailed information.

The cranking system for 208, 210, 212, 214 and 216 Tractors (Serial No. 70,001- ), Figs. 2, 3 and 4 consists of a battery, solenoid, circuit breaker, key switch, three neutral-start safety switches and a permanent magnet starter motor. See Group 10 for detailed information.

200 Series Tractors (Serial No. 190,001 and up) are equipped with an electric PTO clutch. The clutch draws current from the battery and is activated by a switch on the dash.

All 200 Series Tractors are equipped with a battery-coil ignition system consisting of a battery, ignition switch, safety neutral-start and interlock switches, ignition coil, breaker points and condenser. See Group 15 for additional information.

The battery is charged with a 15-amp alternator. A solid-state rectifier-regulator converts AC current from the alternator into DC current and also controls the rate of charging current to the battery. See Group 20 for further information.

Electric lift is available for 200 Series Tractors. The electric lift is position-responsive in that it reacts directly to control lever movement. Detailed information can be found in Group 30.

*NOTE: On 208 Tractors the yellow lead wire for extra equipment headlights is removed from the ignition switch accessory terminal and taped to the wiring harness, Fig. 2. If the lead is used, be careful to keep lead away from heat or moving parts.*



**PRINCIPLE OF OPERATION—Continued**  
208, 210, 212, 214 and 216 Tractors (Serial No. 70,001-190,000)

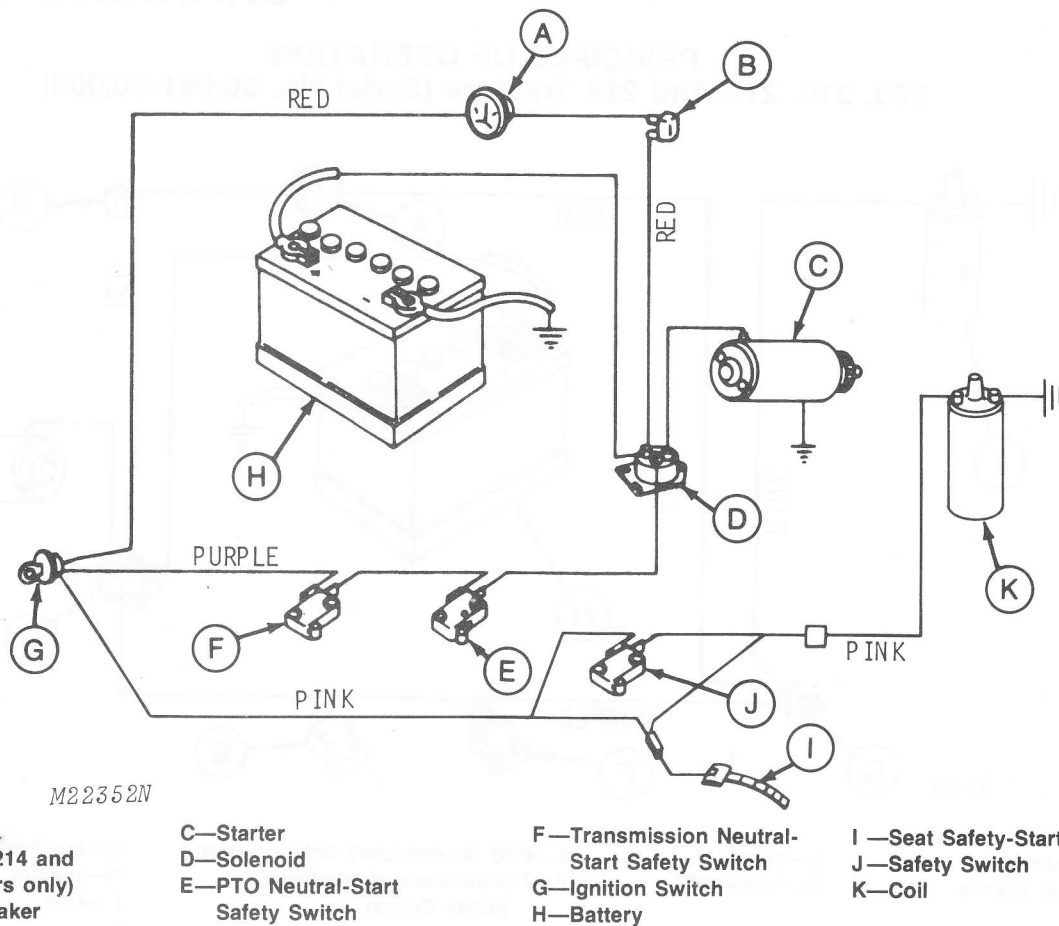


Fig. 2-Cranking System Components

The cranking system on 208, 210, 212, 214 and 216 Tractors (Serial No. 70,001-190,000), Fig. 2, consists of a 12-volt battery (H), solenoid (D), circuit breaker (B), key switch (G), three neutral-start safety switches (E, F, and I), and a permanent magnet starter motor (C).

The ignition switch (G) and neutral-start safety switches (E and F) must be closed before the solenoid will activate the starting motor. For engine to continue running, the safety switch (J) or seat switch (I) must be closed to activate the coil (K).

The storage battery is of the lead-acid variety. Lead is used in the construction of the cell plates and a sulfuric acid solution serves as the electrolyte.

Tractors are shipped from the factory with dry-charged batteries. This means the plates are charged, but electrolyte must be added just before using.

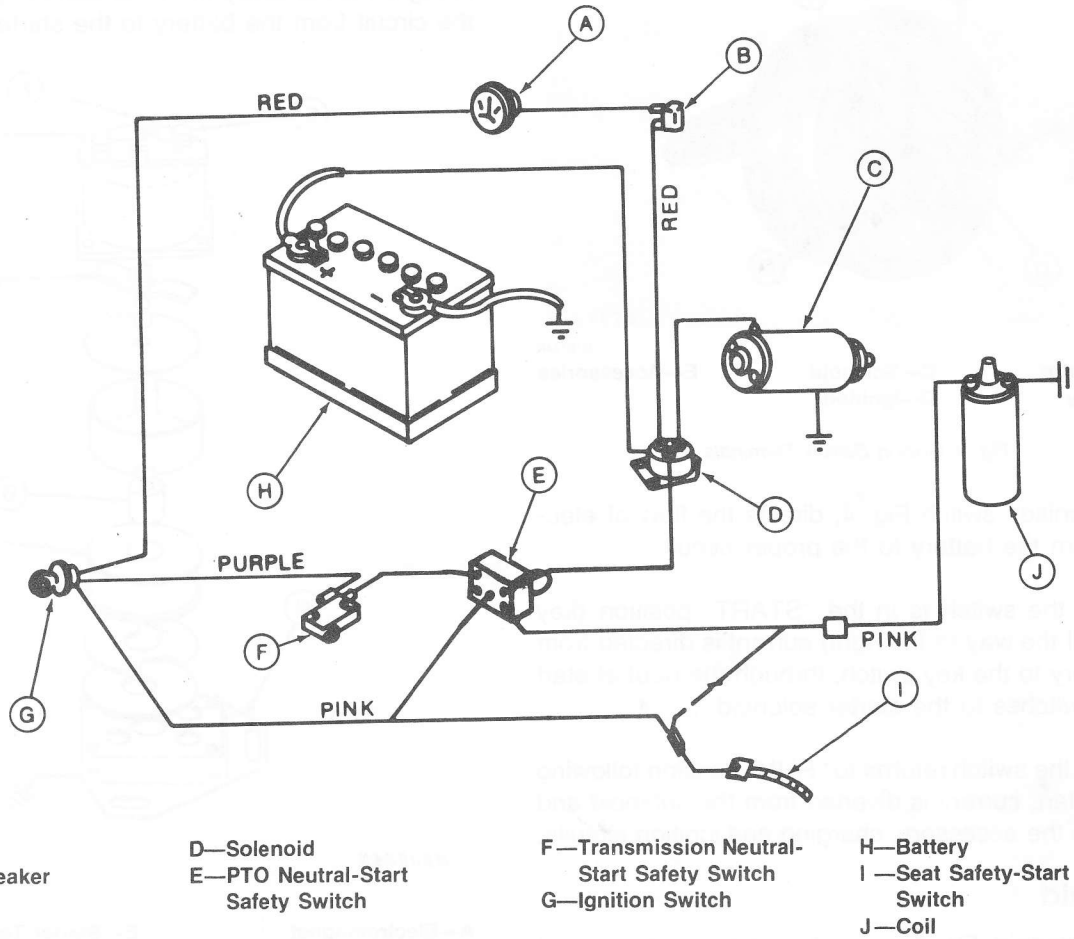
The 12-volt battery has a hard rubber case with six individual cells. Each cell contains a specific number of sets of negative and positive plates.

All plates of like charge are interconnected so that the accumulative charges are present at the positive and negative battery terminals.

As a battery discharges and the energy is not replenished, the sulfuric acid is withdrawn from the electrolyte and the lead sulfate deposits build up on the plates. This causes the specific gravity of the electrolyte to diminish. Charging the battery reverses the chemical reaction, restoring the electrolyte to original potential.

**IMPORTANT: Avoid battery damage by charging at the manufacturer's recommended ampere-hour charging rate.**

**PRINCIPLE OF OPERATION—Continued**  
 210, 212, 214 and 216 Tractors (Serial No. 190,001- )



- A—Ammeter
- B—Circuit Breaker
- C—Starter
- D—Solenoid
- E—PTO Neutral-Start Safety Switch
- F—Transmission Neutral-Start Safety Switch
- G—Ignition Switch
- H—Battery
- I—Seat Safety-Start Switch
- J—Coil

Fig. 3-Cranking System Components

The cranking system on 210, 212, 214 and 216 Tractors (Serial No. 190,001 and above), Fig. 3, consists of a 12-volt battery (H), solenoid (D), circuit breaker (B), key switch (G), three neutral-start safety switches (E, F, and I), and a permanent magnet starter motor (C).

The ignition switch (G) and neutral-start safety switches (E and F) must be closed before the solenoid will activate the starting motor. For engine to continue running, the PTO Neutral-Start switch (E) or seat switch (I) must be closed to activate the coil (J).

The storage battery is of the lead-acid variety. Lead is used in the construction of the cell plates and a sulfuric acid solution serves as the electrolyte.

Tractors are shipped from the factory with dry-charged batteries. This means the plates are charged, but electrolyte must be added just before using.

The 12-volt battery has a hard rubber case with six individual cells. Each cell contains a specific number of sets of negative and positive plates.

All plates of like charge are interconnected so that the accumulative charges are present at the positive and negative battery terminals.

As a battery discharges and the energy is not replenished, the sulfuric acid is withdrawn from the electrolyte and the lead sulfate deposits build up on the plates. This causes the specific gravity of the electrolyte to diminish. Charging the battery reverses the chemical reaction, restoring the electrolyte to original potential.

**IMPORTANT: Avoid battery damage by charging at the manufacturer's recommended ampere-hour charging rate.**