

# 310G-350 CRAWLER

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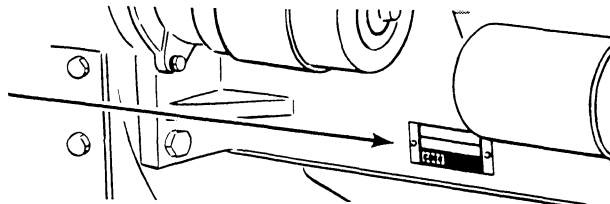
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# Section 1010

## GENERAL ENGINE SPECIFICATIONS 350 CRAWLER

THE MODEL AND ENGINE SERIAL NUMBER IS STAMPED ON A PLATE LOCATED ON THE RIGHT SIDE OF THE ENGINE BELOW THE CRANKING MOTOR.



### General

### 188 DIESEL ENGINES

Type .....	Case Open Chamber, 4 Cylinder, 4 Stroke Cycle, Valve-in-Head
Firing Order .....	1-3-4-2
Bore .....	3-13/16 Inches (96.8mm)
Stroke .....	4-1/8 Inches (104.8mm)
Piston Displacement .....	188 Cubic In. (3 080.8 cm <sup>3</sup> )
Compression Ratio .....	17.5 to 1
No Load Governed Speed .....	2150 RPM
Rated Engine Speed .....	2000 RPM
Engine Idling Speed .....	700 to 750 RPM
*Valve Tappet Clearance (Exhaust) .....	(Hot and Cold) .014 Inch (0.356mm)
(Intake) .....	(Hot and Cold) .012 Inch (0.305mm)

\*Hot Settings Are Made After the Engine Has Operated At Thermostat Controlled Temperature For At Least Fifteen Minutes.

### Piston and Connecting Rods

Rings per Piston .....	3
Number of Compression Rings .....	2
Number of Oil Rings .....	1
Type Pins .....	Full Floating Type
Type Bearing .....	Replaceable Precision, Steel Back, Copper-Lead Alloy Liners

### Main Bearings

Number of Bearings .....	5
Type Bearings .....	Replaceable Precision Steel Back, Copper-Lead Alloy Liners

### Engine Lubricating System

Crankcase Capacity (Without Filter) .....	6 U.S. Quarts (5.7 Litres)
(With Filter Change) .....	7 U.S. Quarts (6.6 Litres)
Oil Pressure .....	50 to 70 PSI (345 to 483 kPa) Eng. Warm and Operating at Rated Eng. Speed
Type System .....	Pressure and Spray Circulation
Oil Pump .....	Gear Type
Oil Filter .....	Full Flow Spin on Type

### Fuel System

Fuel Injection Pump .....	Roosa-Master
Pump Timing .....	8 Degrees Before Top Dead Center
Fuel Injectors (Prior Eng. SN 2726393) .....	Pencil Type (Opening Press. 2800 PSI) (19 306 kPa)
Fuel Injectors (Start'g W/Eng. SN 2726393) ..	Pencil Type (Opening Press. 3200 PSI) (22 064 kPa)
Fuel Transfer Pump .....	Vane Type, Integral Part of Injection Pump
Governor .....	Variable Speed, Fly-Weight Centrifugal Type, Integral Part of Injection Pump
Fuel Filters (Prior Eng. SN 2718490) .....	Replaceable Element Type
Fuel Filters (Starting W/Eng. SN 2718490) .....	Full Flow Spin on Type

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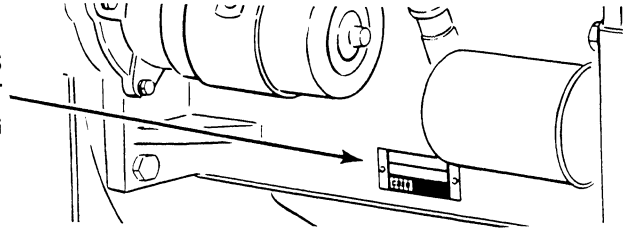
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# GENERAL ENGINE SPECIFICATIONS

## 310 CRAWLER

THE MODEL AND ENGINE SERIAL NUMBER IS STAMPED ON A PLATE LOCATED ON THE RIGHT SIDE OF THE ENGINE BELOW THE CRANKING MOTOR.



### 188 DIESEL ENGINES

#### General

Type .....	Case Open Chamber, 4 Cylinder, 4 Stroke Cycle, Valve-in-Head
Firing Order .....	1-3-4-2
Bore .....	3-13/16 Inches (96.8mm)
Stroke .....	4-1/8 Inches (104.8mm)
Piston Displacement .....	188 Cubic Inches (3 080.8 cm <sup>3</sup> )
Compression Ratio .....	17.5 to 1
No Load Governed Speed .....	2015 RPM
Rated Engine Speed .....	1850 RPM
Engine Idling Speed .....	575 to 675 RPM
*Valve Tappet Clearance (Exhaust) .....	(Hot and Cold) .014 Inch (0.356mm)
(Intake) .....	(Hot and Cold) .012 Inch (0.305mm)

\*Hot Settings Are Made After the Engine Has Operated At Thermostat Controlled Temperature For At Least Fifteen Minutes.

#### Piston and Connecting Rods

Rings per Piston .....	3
Number of Compression Rings .....	2
Number of Oil Rings .....	1
Type Pins .....	Full Floating Type
Type Bearings .....	Replaceable Precision, Steel Back, Copper-Lead Alloy Liners

#### Main Bearings

Number of Bearings .....	5
Type Bearings .....	Replaceable Precision Steel Back, Copper-Lead Alloy Liners

#### Engine Lubricating System

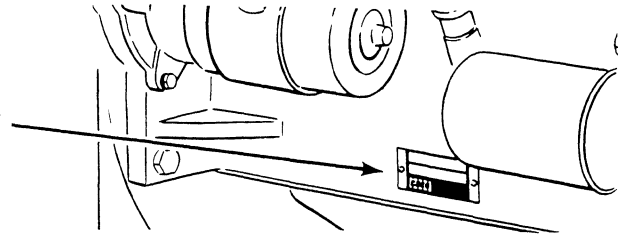
Crankcase Capacity (Without Filter) .....	5 U.S. Quarts (4.7 Litres)
(With Filter Change) .....	6 U.S. Quarts (5.7 Litres)
Oil Pressure .....	50 to 70 PSI (345 to 483 kPa) Eng. Warm and Operating at Rated Eng. Speed
Type System .....	Pressure and Spray Circulation
Oil Pump .....	Gear Type
Oil Filter .....	Full Flow Spin on Type

#### Fuel System

Fuel Injection Pump .....	Roosa-Master
Pump Timing .....	8 Degrees Before Top Dead Center
Fuel Injectors (Prior Eng. SN 2726393) .....	Pencil Type (Opening Press. 2800 PSI (19 306 kPa)
Fuel Injectors (Start'g W/Eng. SN 2726393) ..	Pencil Type (Opening Press. 3200 PSI) (22 064 kPa)
Fuel Transfer Pump .....	Vane Type, Integral Part of Injection Pump
Governor .....	Variable Speed, Fly-Weight Centrifugal Type, Integral Part of Injection Pump
Fuel Filters (Prior Eng. SN 2718490) .....	Replaceable Element Type
Fuel Filters (Starting W/Eng. SN 2718490) .....	Full Flow Spin on Type

# GENERAL ENGINE SPECIFICATIONS 310 CRAWLER

THE MODEL AND ENGINE SERIAL NUMBER IS STAMPED ON A PLATE LOCATED ON THE RIGHT SIDE OF THE ENGINE BELOW THE CRANKING MOTOR.



## 148 SPARK IGNITION ENGINE

### General

Type .....	Case Open Chamber, 4 Cylinder, 4 Stroke Cycle, Valve-in-Head
Firing Order .....	1-3-4-2
Bore .....	3-3/8 Inches (85.7mm)
Stroke .....	4-1/8 Inches (104.8mm)
Piston Displacement .....	148 Cubic Inches (2 425.3mm)
Compression Ratio .....	7.1 to 1
No Load Governed Speed .....	2025 RPM
Rated Engine Speed .....	1850 RPM
Engine Idling Speed .....	575 to 675 RPM
*Valve Tappet Clearance (Exhaust) .....	(Hot) .014 Inch (0.356mm)
	(Cold) .020 Inch (0.508mm)
	(Intake) .....
	(Hot and Cold) .014 Inch (0.356mm)

\*Hot Settings Are Made After the Engine Has Operated At Thermostat Controlled Temperature For At Least Fifteen Minutes.

### Piston and Connecting Rods

Rings per Piston .....	4
Number of Compression Rings .....	3
Number of Oil Rings .....	1
Type Pins .....	Full Floating Type
Type Bearing .....	Replaceable Precision, Steel Back, Copper-Lead or Aluminum Alloy Liners.

### Main Bearings

Number of Bearings .....	3
Type Bearings .....	Replaceable Precision, Steel Back, Copper-Lead or Aluminum Alloy Liners.

### Engine Lubricating System

Crankcase Capacity (Without Filter) .....	5 U.S. Quarts (4.7 Litres)
(With Filter Change) .....	6 U.S. Quarts (5.7 Litres)
Oil Pressure .....	24 to 32 PSI (165 to 221 kPa) with Engine Warm and Operating at Rated Engine Speed
Type System .....	Pressure and Spray Circulation
Oil Pump .....	Gear Type
Oil Filter .....	Full Flow Spin-on Type

### Fuel System

Carburetor .....	Marvel-Schebler No. TSX-957
Main Jet Adjustment .....	Approx. 1-3/4 Turns Open
Idle Jet Adjustment .....	Approx. 1 Turn Open

### Distributor Ignition

Contact Point Gap .....	.020 Inches (0. 508mm)
Dwell Angle .....	42°
Spark Plug Gap (18mm) (Heat Range-8) .....	.025 Inch (0.635mm)

### Engine Timing

Static Timing .....	6° BTDC
Running Timing .....	38° BTDC at Rated Speed

# **Section 2001**

**ENGINE DIAGNOSIS  
188 and 207 Diesel Engines**

## GENERAL INFORMATION

Before making any repairs or adjustments on an engine, a mechanic or technician must properly diagnose the trouble.

Locating the trouble and repairing it is only part of the job, a technician must find and eliminate the cause of the trouble as well. Too many repairs are made with no thought to removing the causes that made the repair necessary.

For any engine to start or perform properly, three main requirements must be present:

1. FUEL
2. COMPRESSION
3. COMBUSTION

When any of these requirements are not present or limited by some mechanical reason, the engine will not start and will fail to operate properly throughout the power range.

**FUEL.** Fuel system problems can be present anywhere from the fuel tank, through the filters and injection pump as well as the injectors. Correct injection pump timing is important in the overall fuel system performance.

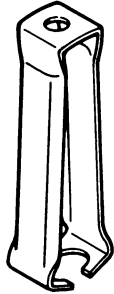
**COMPRESSION.** Compression on an engine is related to the "breathing function". Proper compression is affected by the air cleaner condition, muffler restriction, valve condition and operation including proper valve adjustment, cylinder head gaskets, condition of sleeves, rings, pistons, camshaft, and camshaft timing.

**COMBUSTION.** Combustion is the result of adequate compression to develop enough heat in the air charge on the compression stroke to fire the fuel being injected into the engine cylinders. Proper spray pattern and atomization of the fuel by the injector is very important. Timing the fuel injection pump to the engine to a precise degree BTDC is a vital requirement for proper combustion.

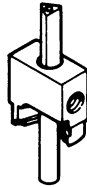
The engine diagnosis contained in the following pages covers many trouble symptoms, the causes, and what will be necessary to repair or eliminate the problem. Under each symptom are listed the most common and reoccurring problems progressing to the not so common problems. Locate your problem symptom in the diagnosis chart and refer to the pages listed for the probable causes and remedies.

# INSTALLATION INSTRUCTIONS FOR M20611 TEFLON VALVE SEAL KIT

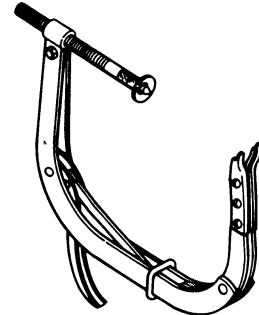
## Special Tools Required



M20624 SEAL INSTALLATION TOOL

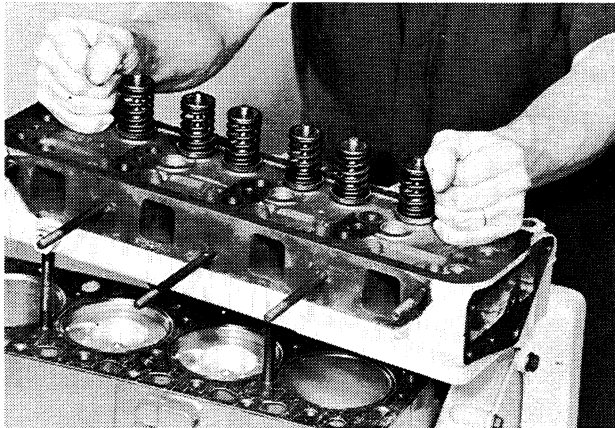


M20615 VALVE GUIDE CUTTING TOOL



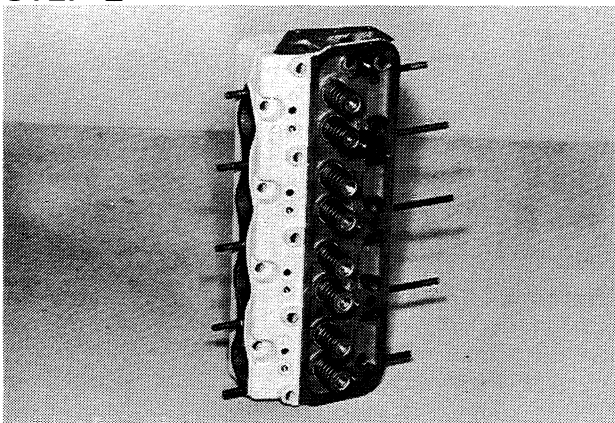
VALVE SPRING COMPRESSOR

### STEP 1



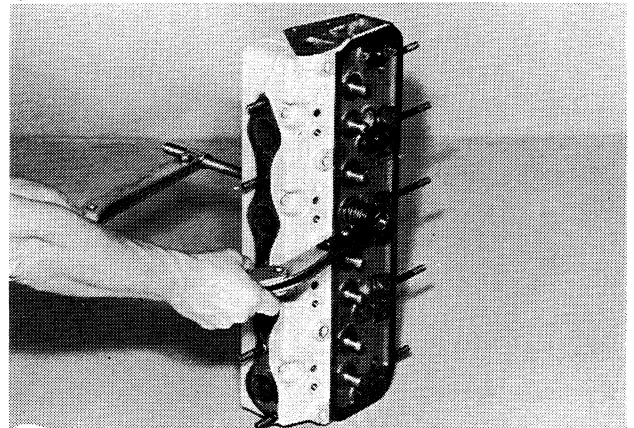
Remove the cylinder head from the engine block. Refer to section 2015 for head removal. **NOTE:** This cylinder head requires two M20611 Kits.

### STEP 2



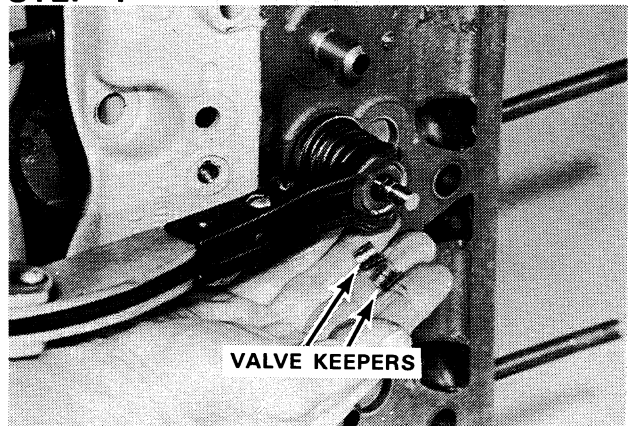
Place cylinder head on work bench.

### STEP 3



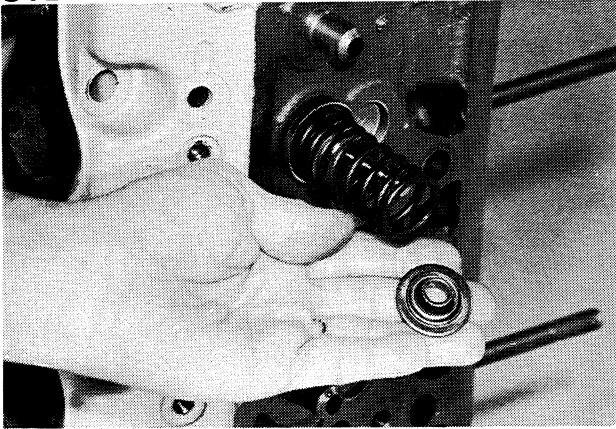
Install a valve spring compressor.

### STEP 4



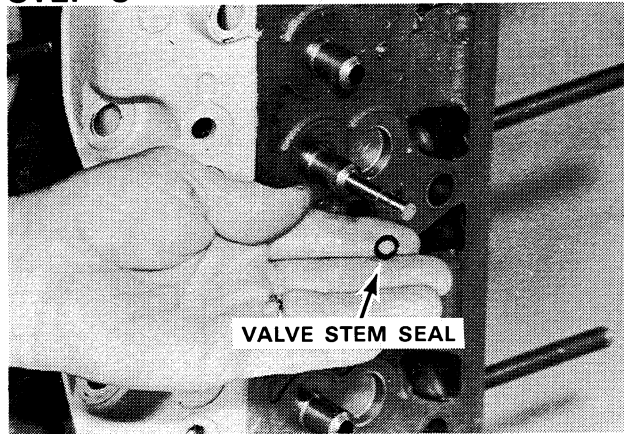
Compress valve spring and remove valve keepers. **IMPORTANT:** Valves and valve keepers should be marked when removed to insure that they will be reinstated in their original location.

**STEP 5**



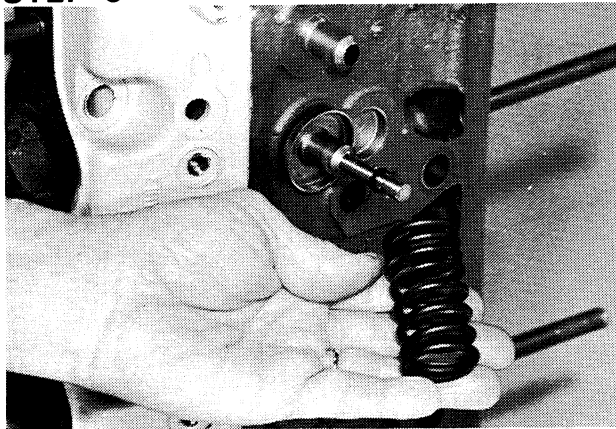
Remove spring retainer.

**STEP 8**



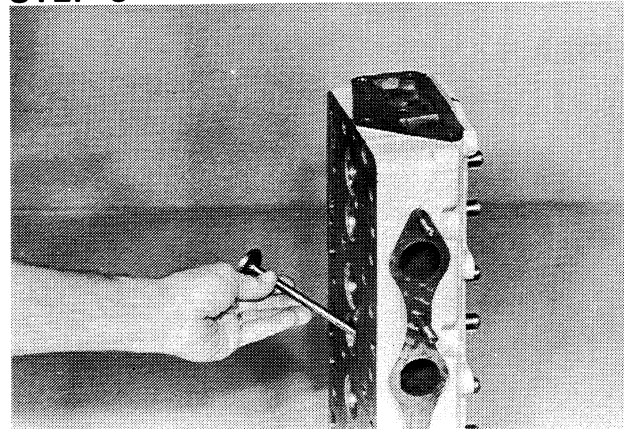
Remove valve stem seal.

**STEP 6**



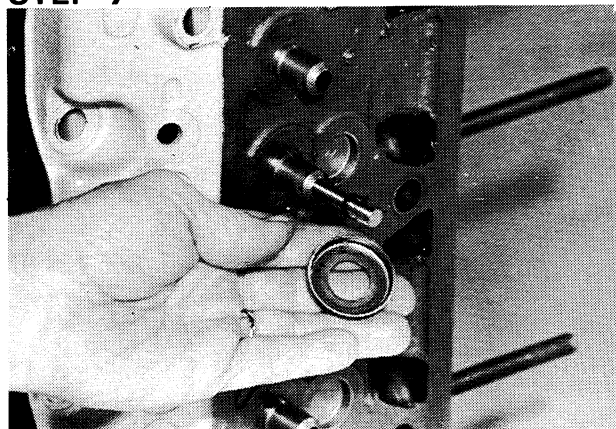
Remove spring.

**STEP 9**



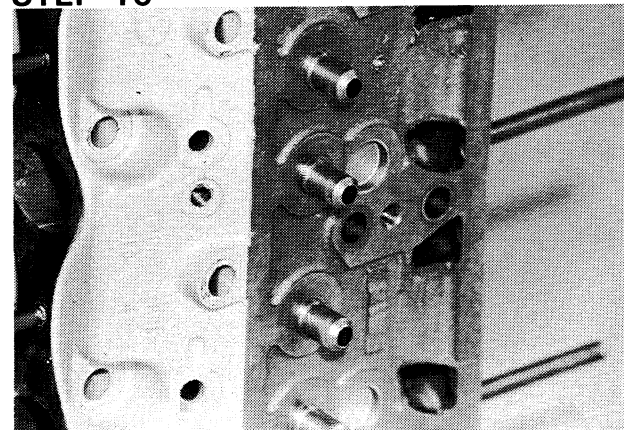
Remove valve.

**STEP 7**

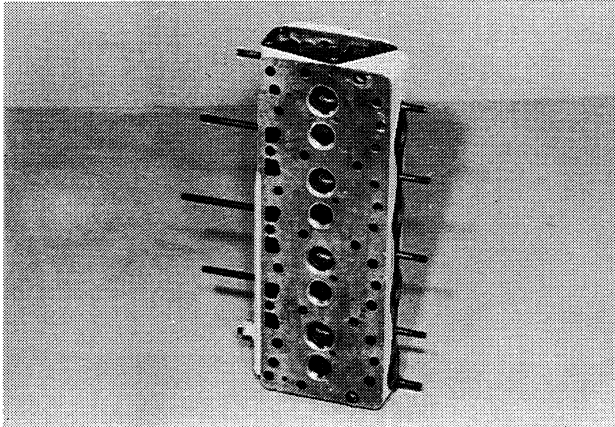


Remove spring seat.

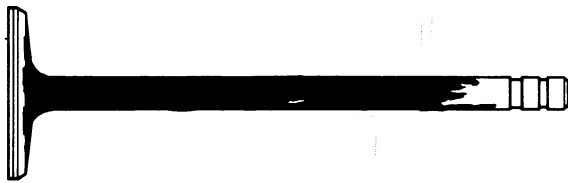
**STEP 10**



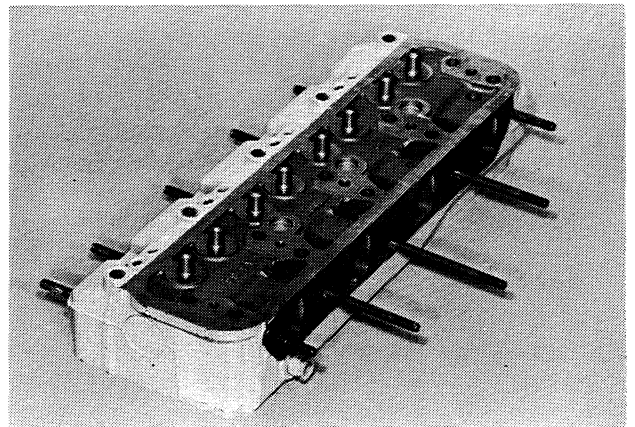
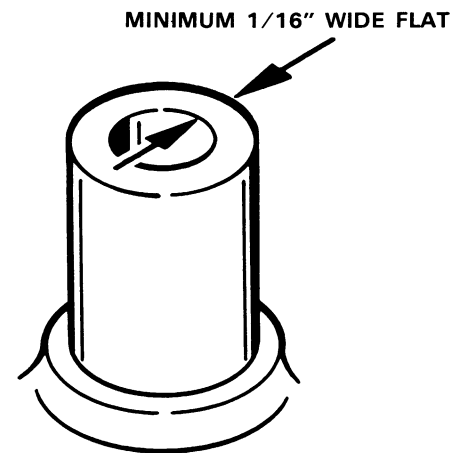
Remove all the valve assemblies.

**STEP 11**

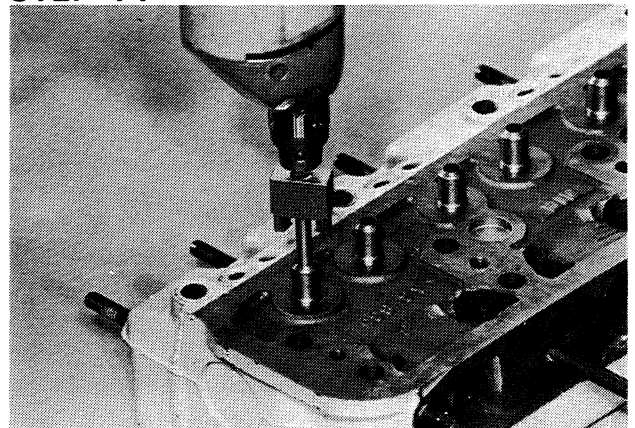
Wash, clean and inspect head. Use a rotary brush to clean around and down into valve ports. Refer to Section 2015 for complete head reconditioning.

**STEP 12**

Clean valves with a fine power drive wire brush, removing all carbon and varnish deposits. Be careful not to scratch valve stems. Refer to Section 2015 for valve inspection.

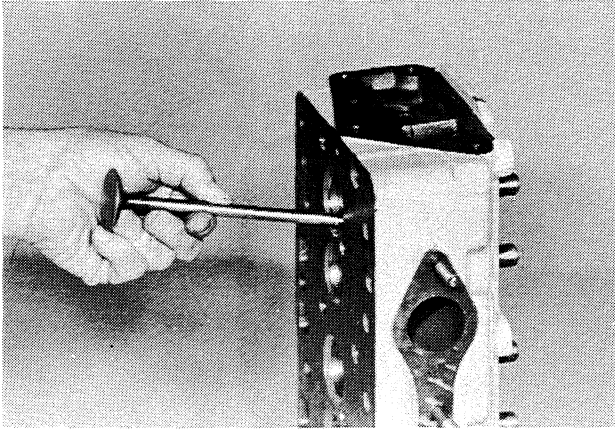
**STEP 13**

Check valve guide top surface. There must be a minimum of a 1/16" wide flat around entire top surface.

**STEP 14**

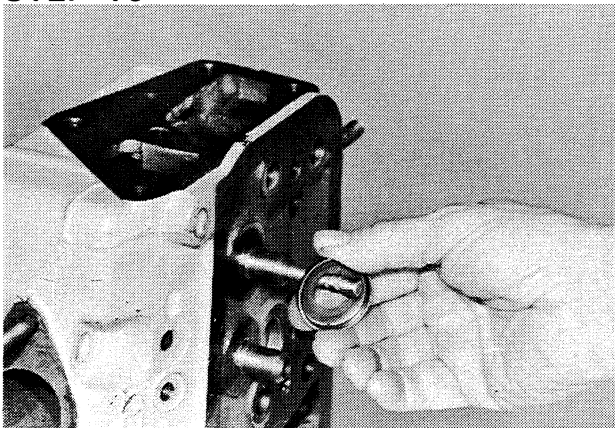
Use M20615 tool in a electric drill (if required) to provide necessary flat area on valve guide. **IMPORTANT:** Do not exceed 450 RPM drill speed when using valve guide cutting tool.

**STEP 15**



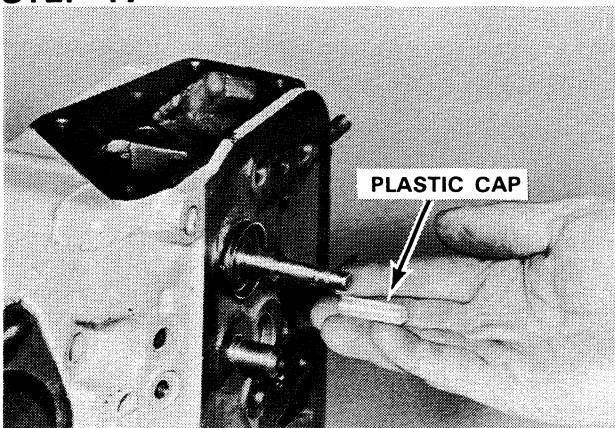
Dip valve stems into HDM #30 oil before assembly in cylinder head.

**STEP 16**



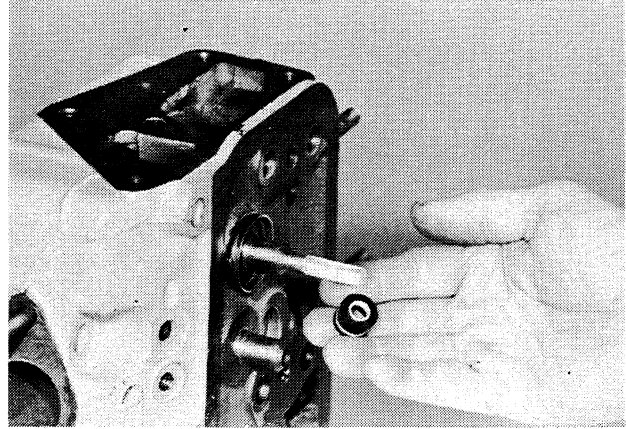
Install spring seat.

**STEP 17**



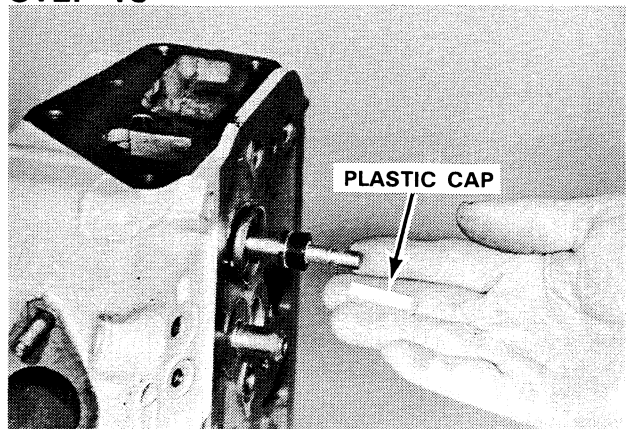
Place plastic installation cap, provided in kit, on the end of the valve stem. **NOTE:** Cap prevents sharp edges on valve stem grooves from cutting valve seal.

**STEP 18**



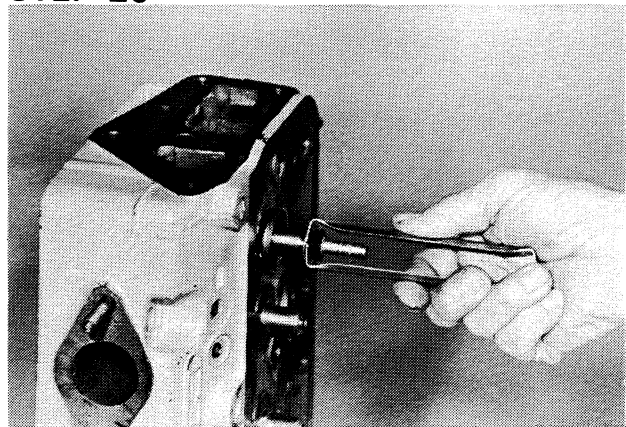
Carefully start valve seal on cap and hold thumb against white seal insert to avoid dislodging it. Push seal down until seal jacket touches top of valve guide.

**STEP 19**



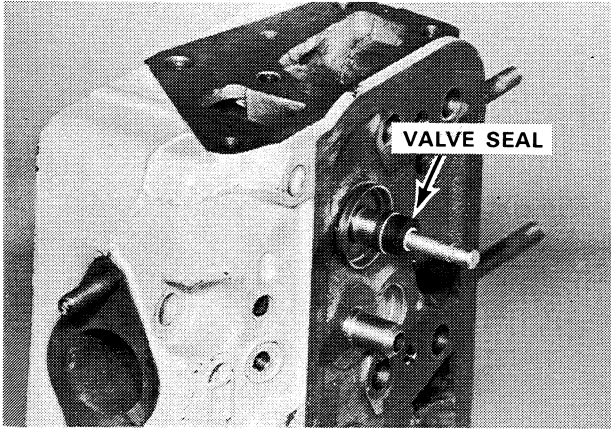
Remove installation cap and save, since it must be reused.

**STEP 20**



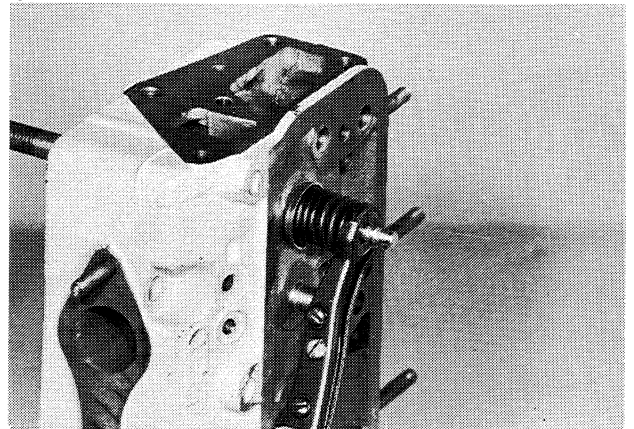
Use M20624 tool and press seal down over valve guide until seal is flush with top of guide.

**STEP 21**



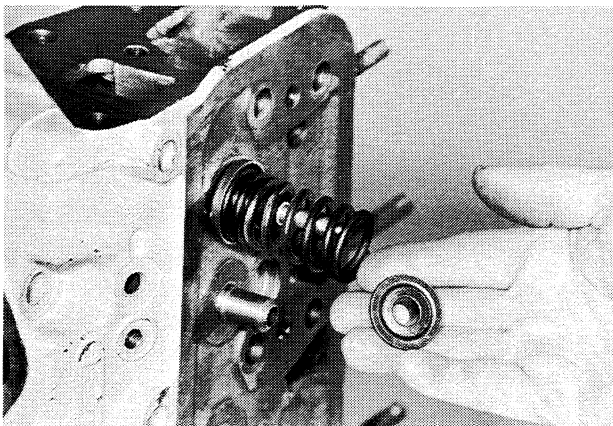
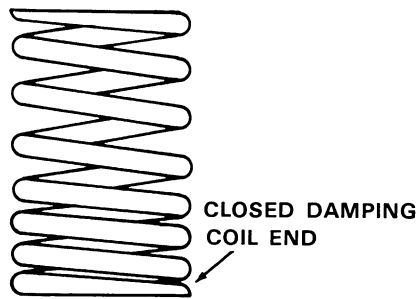
Valve seal installed.

**STEP 23**



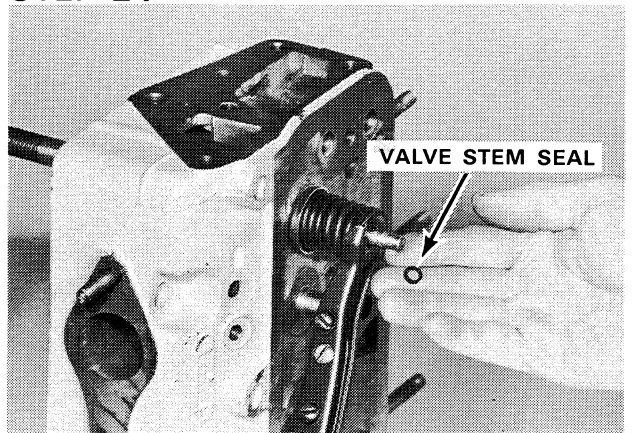
Install valve spring compressor.

**STEP 22**



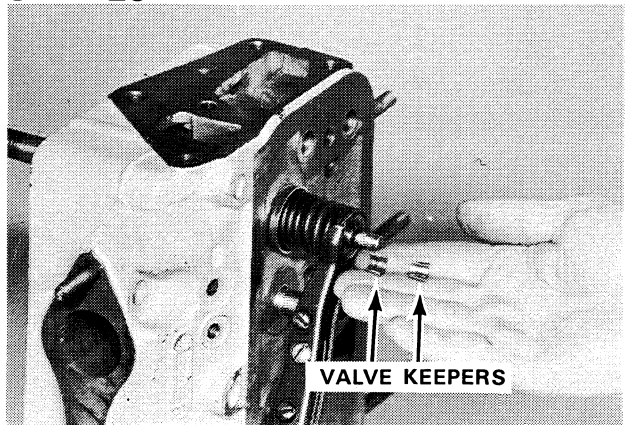
Install spring (damping coil end down) and spring retainer.

**STEP 24**



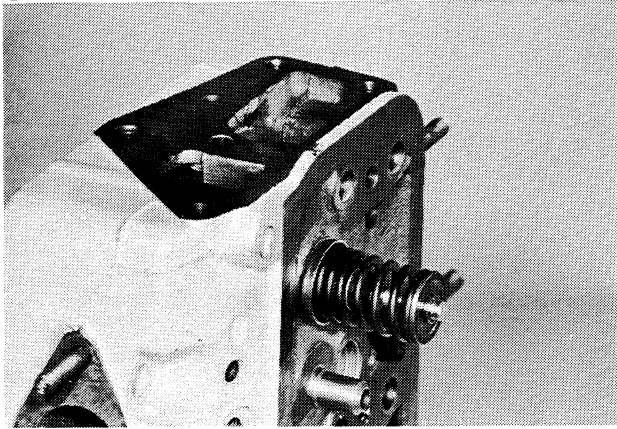
Install stem seal in lower valve stem groove.

**STEP 25**



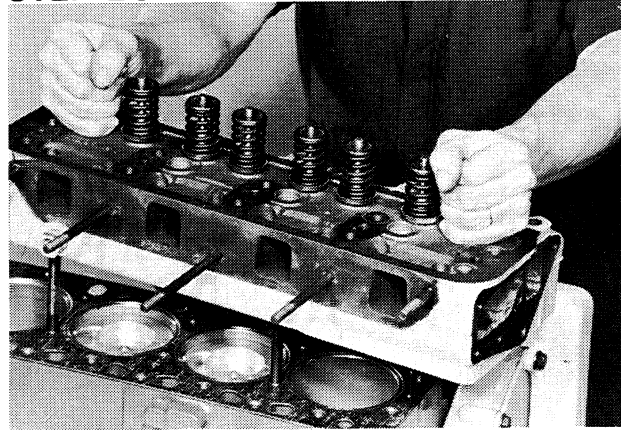
Install valve keepers in outer valve stem groove.

**STEP 26**



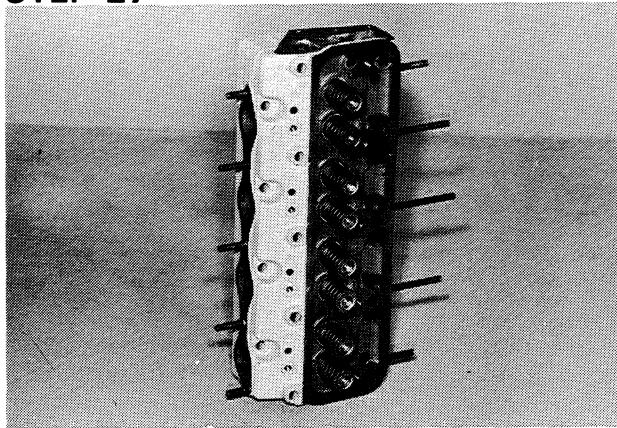
Remove spring compressor and tap valve stem end to seat keepers.

**STEP 28**



Install cylinder head on engine block following procedure outlined in Section 2015.

**STEP 27**



Install teflon seals on the other intake and exhaust valves, following the preceding procedure.

**NOTE:** The Case Corporation reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

## ENGINE TUNE-UP PROCEDURE

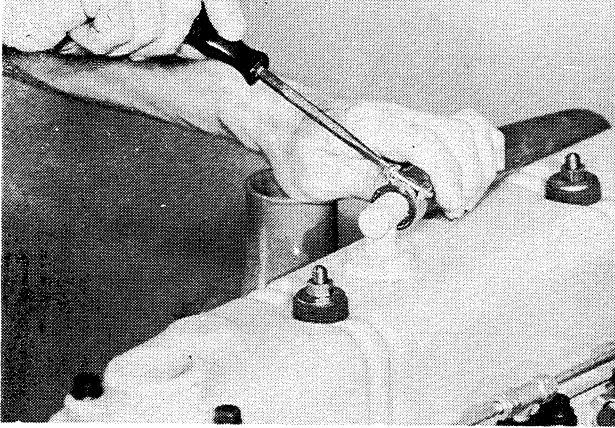
### STEP 1

Service the air cleaner. Refer to your Operator's Manual.

### STEP 2

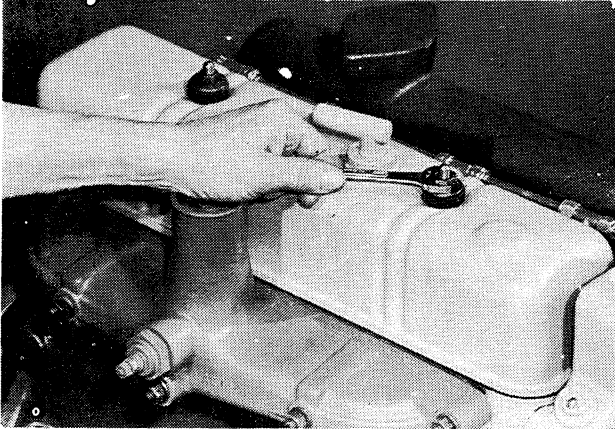
Adjust the belts. Refer to your Operator's Manual.

### STEP 3



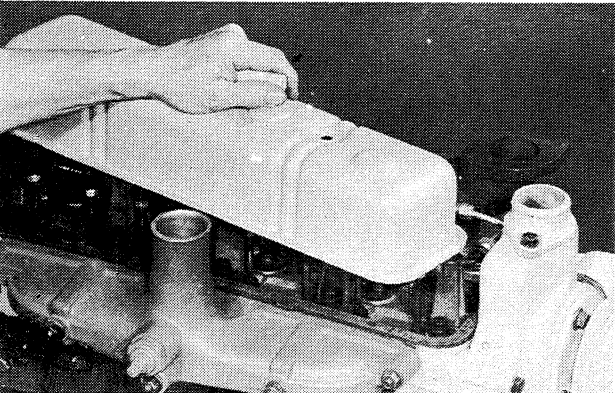
Remove breather tube.

### STEP 4



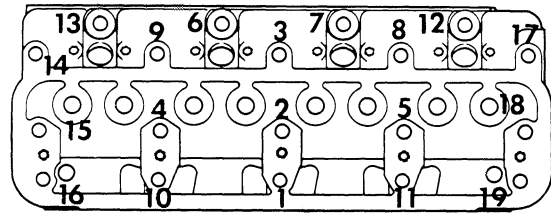
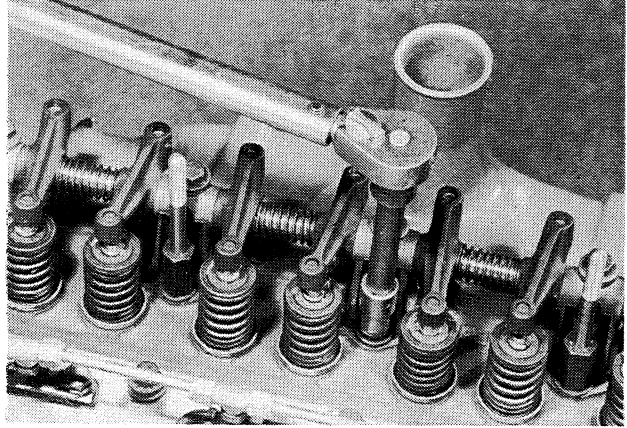
Remove valve cover mounting nuts and grommets.

### STEP 5



Remove valve cover and gasket.

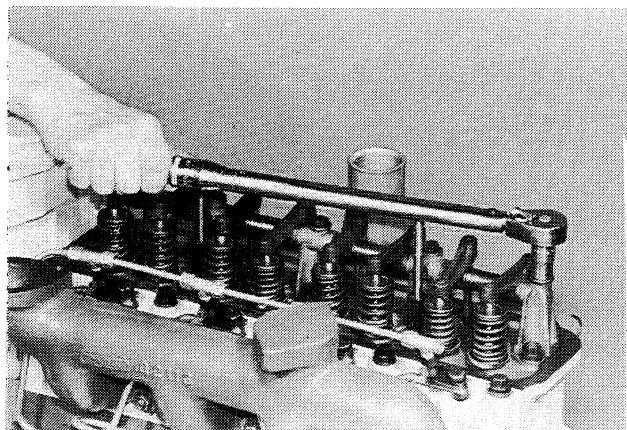
### STEP 6



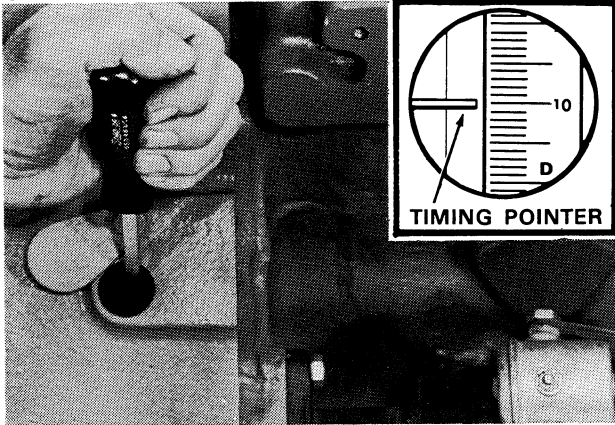
FAN 

Loosen each cylinder head bolt or nut approximately 1/4 turn and then tighten bolt or nut to the specified torquing procedure as listed below and in sequence as shown above. **NOTE:** Do not loosen all nuts or bolts simultaneously but loosen and tighten each individual bolt and nut in the prescribed sequence. The bolt or nut is backed off 1/4 turn to break the set of the threads caused by heat, high stress and oxidation. If this is not done, a false reading is obtained.

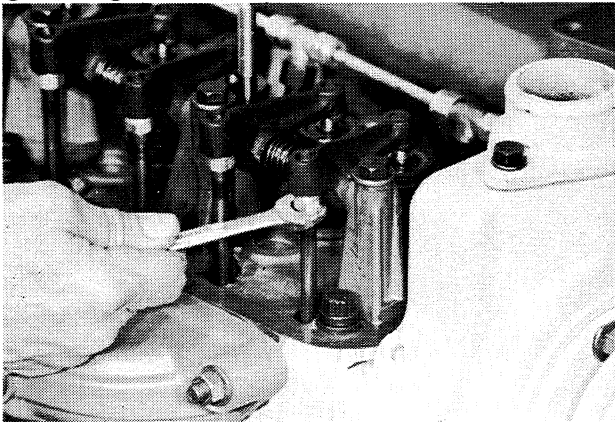
1. Nuts w/hardened washers - torque 95-105 ft.lbs.
2. Grade 8, 12 pt. hd. bolts - torque 110-115 ft. lbs.
3. Flanged nuts - torque 90-100 ft. lbs.



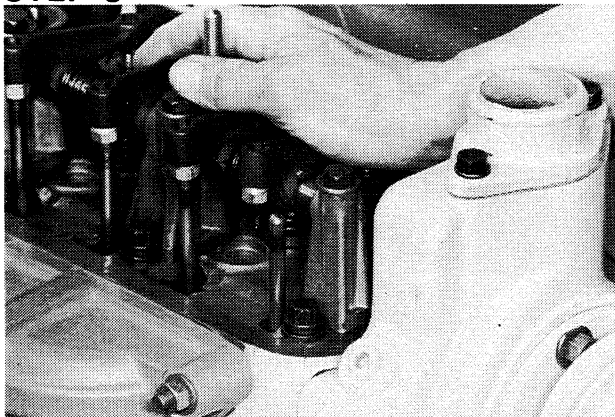
Torque rocker arm mounting bracket bolts to insure that the bolts have retained 25 to 30 ft. lbs. torque.

**STEP 7**

Crank engine by inserting a screwdriver into the timing hole in the flywheel housing or torque tube, and by engaging the ring gear teeth with the screwdriver, align the timing pointer with the 10° BTDC mark on the flywheel.

**STEP 8**

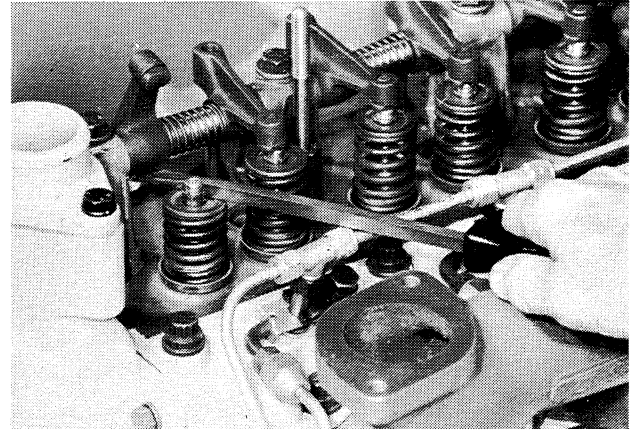
Turn the rocker arm adjusting screw on number one cylinder intake valve inwards to take pressure off the push rod.

**STEP 9**

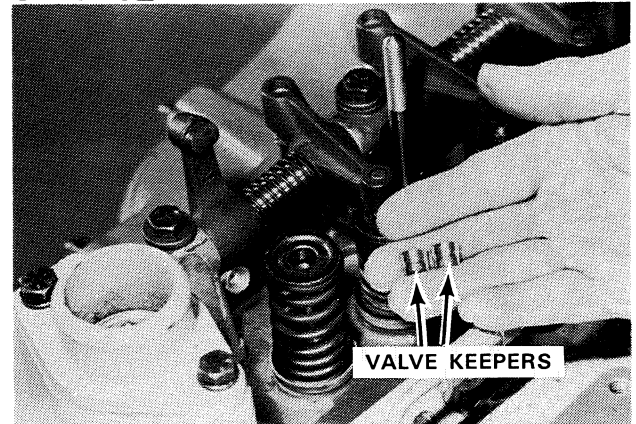
Push down on the number one cylinder intake valve spring and at the same time push the rocker arm assembly rearwards.

**STEP 10**

Remove the push rod.

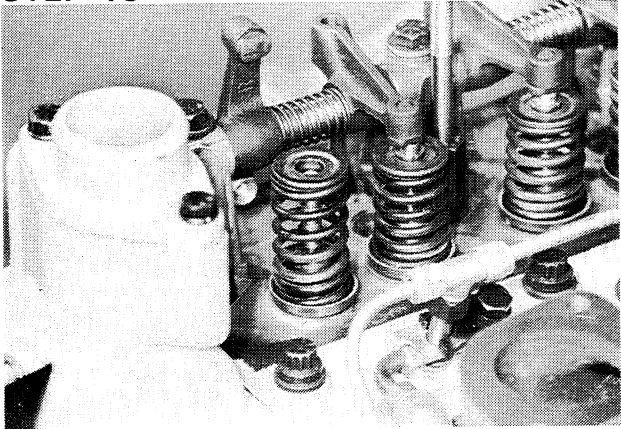
**STEP 11**

Compress exhaust valve spring on number one cylinder by using a screwdriver.

**STEP 12**

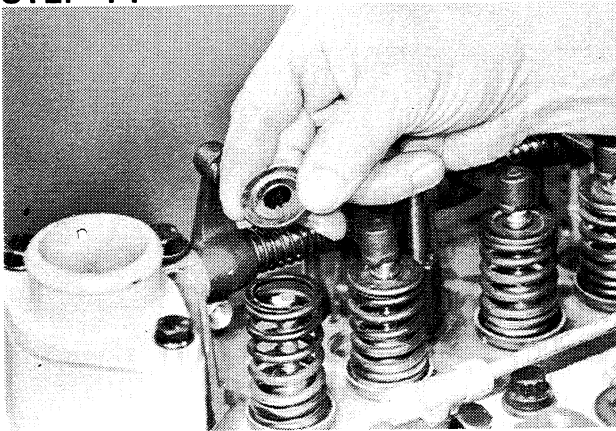
Remove the valve keepers.

**STEP 13**



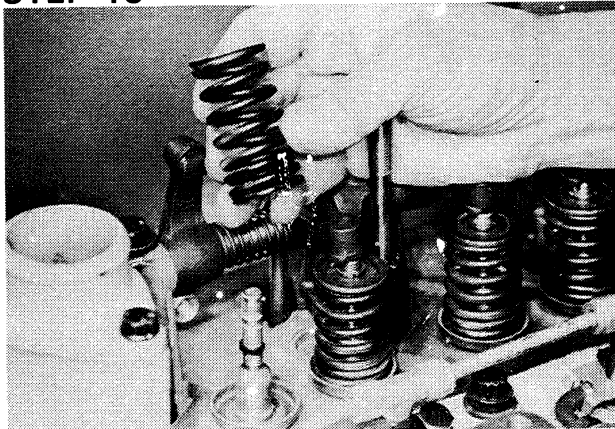
Valve keepers removed.

**STEP 14**



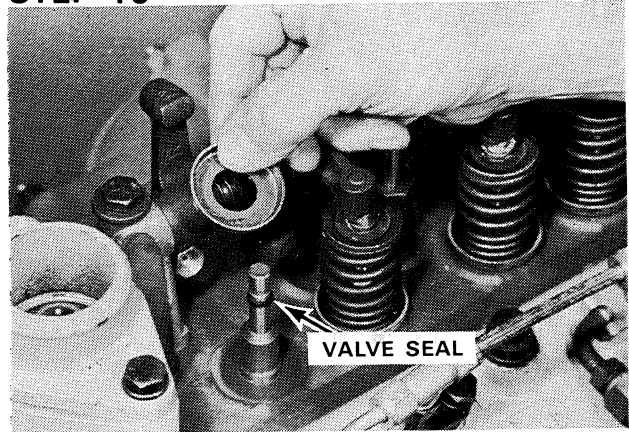
Remove valve spring retainer.

**STEP 15**



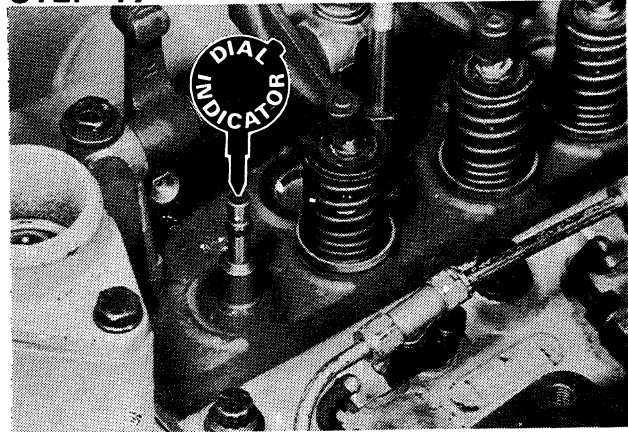
Remove valve spring.

**STEP 16**



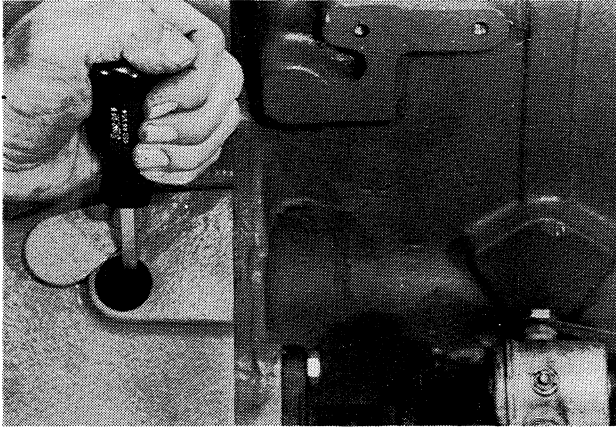
Remove valve spring seat. *NOTE:* Keep valve seal in place to prevent valve from falling through valve guide if the piston is moved too far.

**STEP 17**

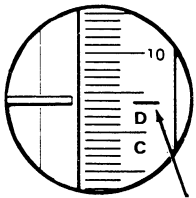


Install dial indicator on end of valve stem with valve resting on top of piston.

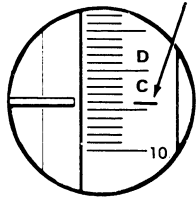
**STEP 18**



Crank engine clockwise until dial indicator hand stops moving. Reset indicator to zero.

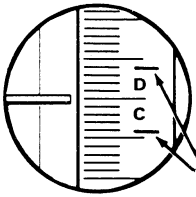


Crank engine clockwise until .010" shows on the dial indicator. Scribe a mark on the flywheel in line with timing pointer.



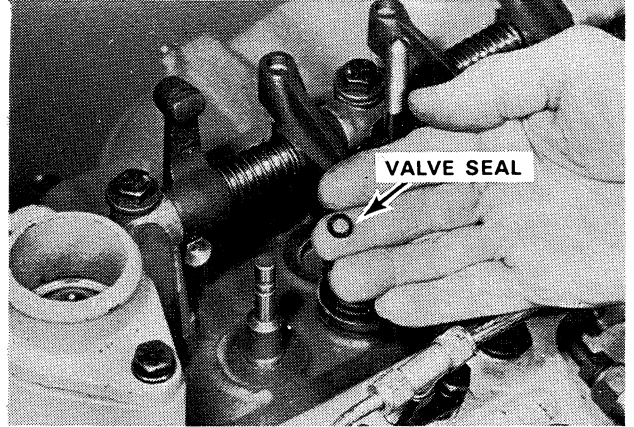
Crank engine counter-clockwise past zero mark on indicator until .010" shows on the dial indicator. Again, scribe a mark on the flywheel in line with timing pointer.

**STEP 19**



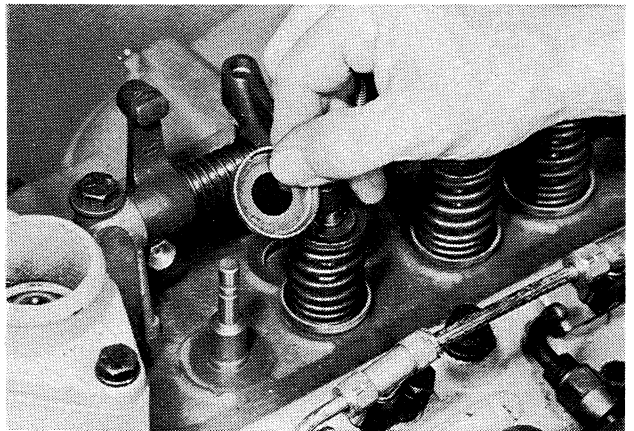
Half the distance between these two scribe marks on the flywheel will be the top dead center (TDC).

**STEP 20**



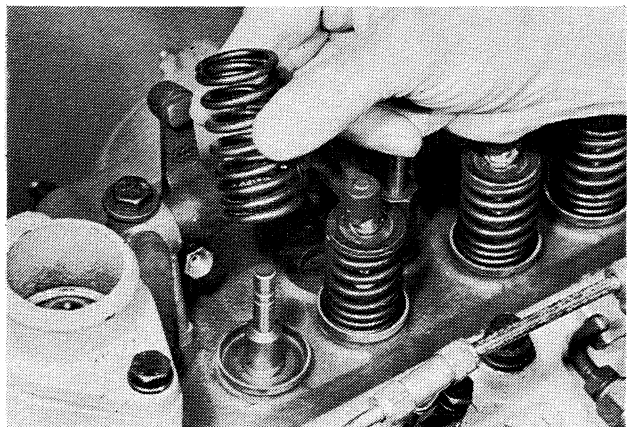
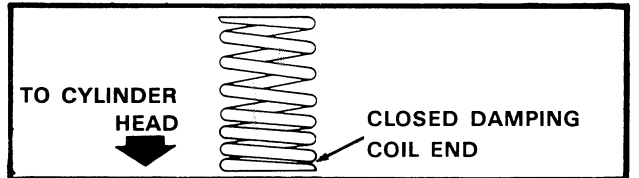
Remove valve stem seal from lower valve stem groove.

**STEP 21**



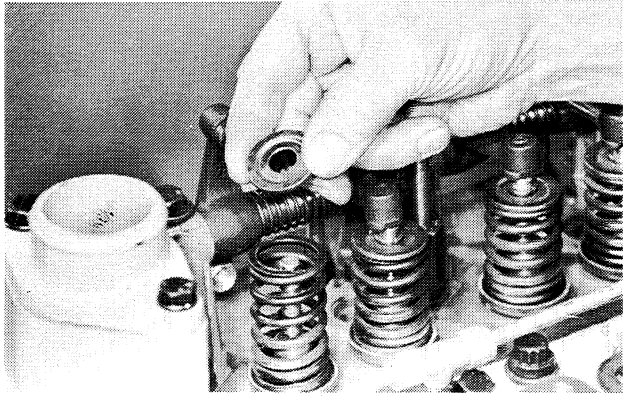
Install the spring seat.

**STEP 22**



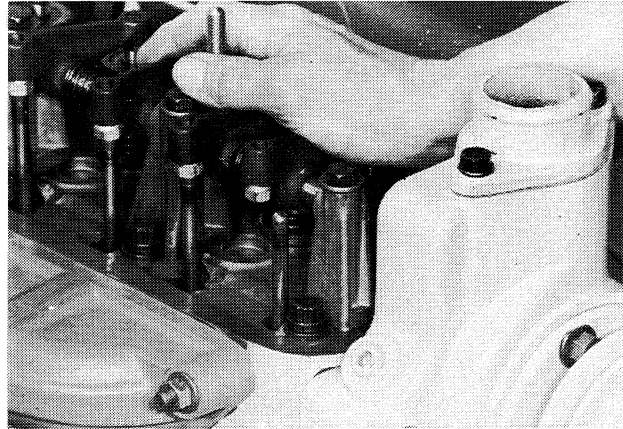
Install the spring with the damping coil end on top of the cylinder head. See inset above.

**STEP 23**



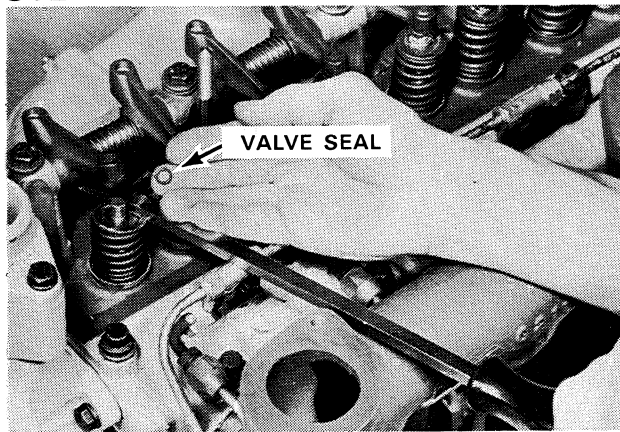
Install the spring retainer.

**STEP 26**



Push back the rocker arm assembly.

**STEP 24**



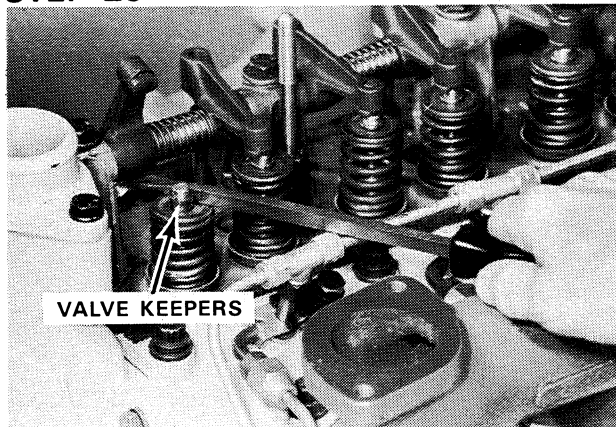
Compress valve spring using a screwdriver and install a new valve stem seal in the lower groove.

**STEP 27**



Install the push rod.

**STEP 25**



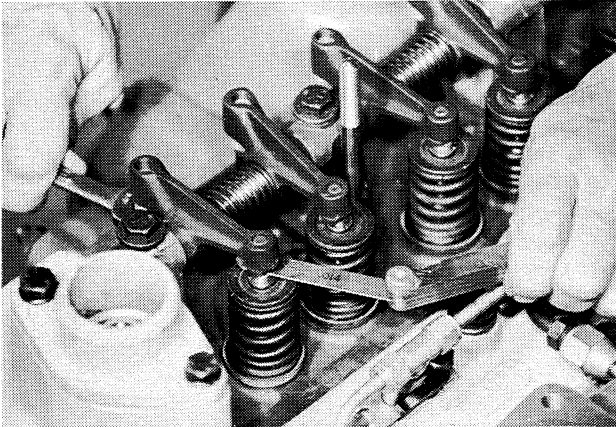
Keeping the valve spring compressed, install the valve keepers in the upper valve stem groove. Remove screwdriver and tap end of valve stem to seat keepers.

**STEP 28**



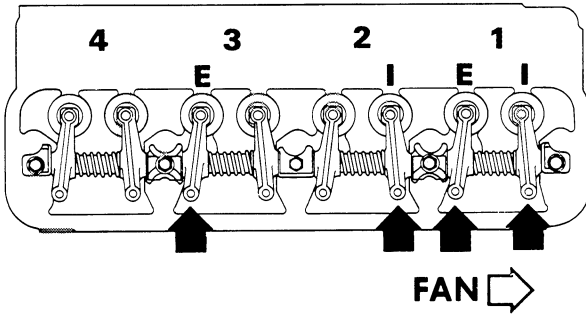
Release rocker arm assembly and position push rod beneath rocker arm adjusting screw.

**STEP 29**



Check and adjust the intake and exhaust valves as pointed out by the arrows below.

**Tappet Clearance** - Intake Valves .012"  
Exhaust Valves .014"

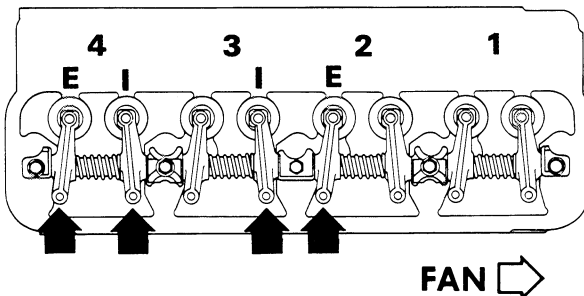


NO. 1 TDC COMPRESSION STROKE

Crank the engine one complete revolution and align the timing pointer with the TDC mark on the flywheel.

Check and adjust the intake and exhaust valves as pointed out by the arrows below.

**Tappet Clearance** - Intake Valves .012"  
Exhaust Valves .014"



NO. 4 TDC COMPRESSION STROKE

**STEP 30**



Remove and check each fuel injector. Refer to Section 3013.

**STEP 31**

Perform a compression test on each cylinder before installing fuel injector.

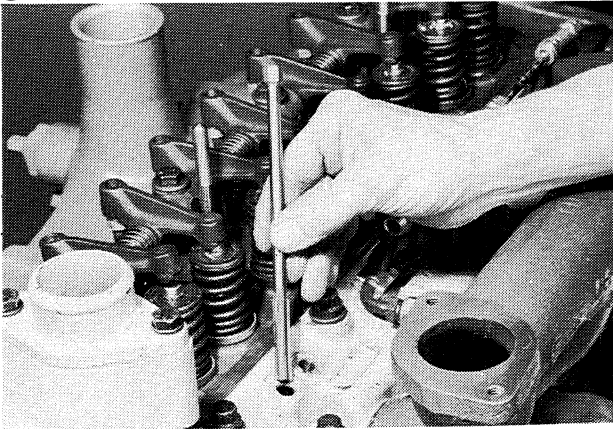
There are two methods of checking compression pressure - the cranking method and the engine running method. The engine must be at operating temperature for either method used.

**A. CRANKING METHOD** - Remove all fuel injectors.

**B. RUNNING METHOD** - Disconnect high pressure fuel line and leak-off line from No. 1 injector. Route fuel from these lines back to fuel tank or clean container. Repeat for each cylinder.

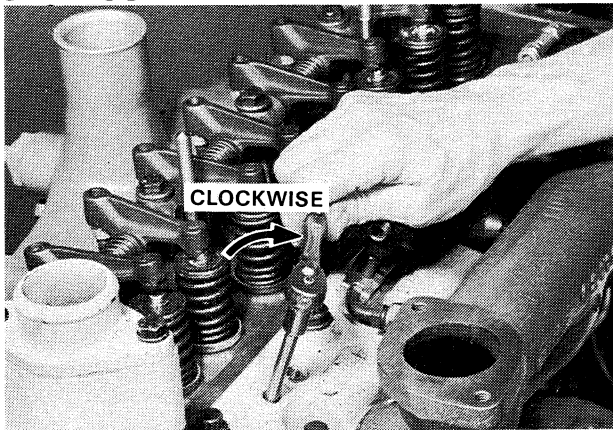
**CAUTION** Before cranking engine, make sure all operating controls are in neutral, brakes are set and wheels are securely blocked.

### STEP 32



Clean cylinder head injector bore using bore cleaning tool A43277.

### STEP 33



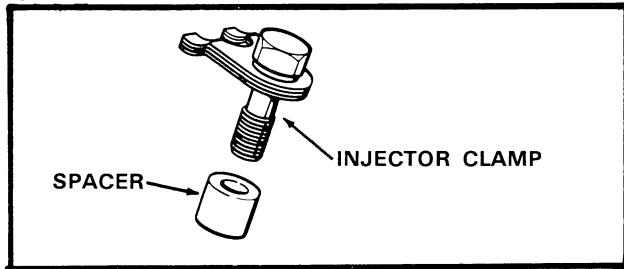
Always turn tool clockwise. Counter-clockwise rotation dulls tool. Blow out with compressed air.

### STEP 34



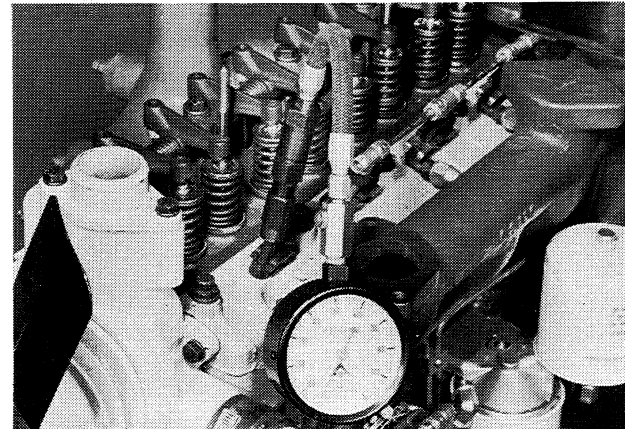
Install Bacharach 70-314 (D-558) compression gauge adapter.

### STEP 35



Secure gauge adapter with an original injector clamp assembly and spacer.

### STEP 36



Connect Case No. CD-504 compression gauge to adapter. *NOTE:* Take several compression readings on each cylinder using vent valve button to relieve gauge pressure.

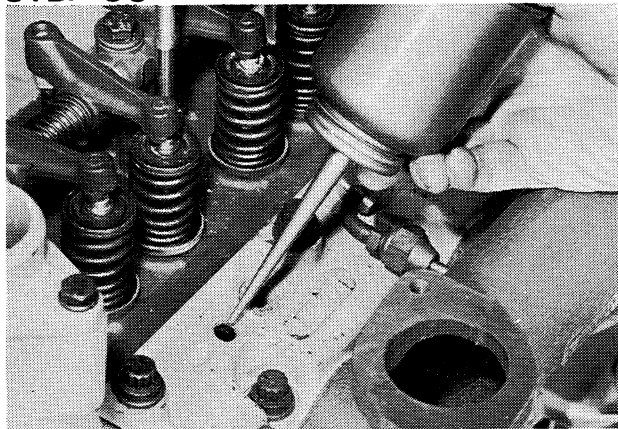
**STEP 37**

It is very important that all cylinder pressures be approximately the same. See chart for allowable compression pressure variation.

If compression is greater than normal, carbon deposits are indicated. If reading is below normal, leaking valves or excessive ring clearance is indicated.

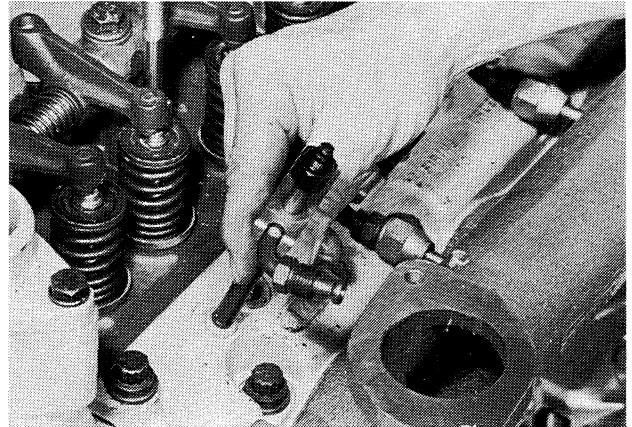
*NOTE:* To make a simple test when a compression leak is indicated, squirt a teaspoon of oil into cylinder and recheck compression. If pressure rises to near normal, compression loss is past the rings. Very little change in compression indicates leakage past the valves.

**STEP 38**



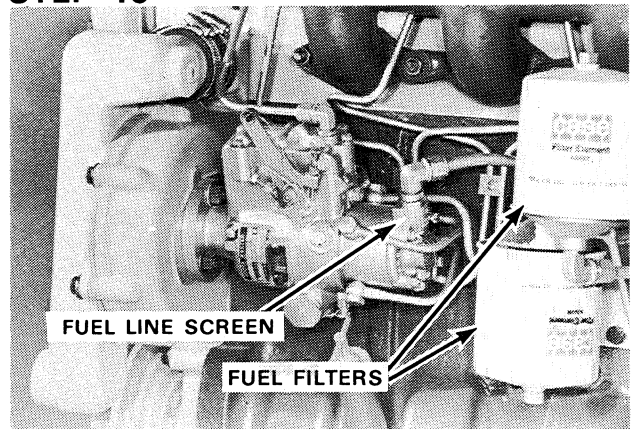
Squirt a few drops of clean engine oil in each cylinder head injector hole to provide lubricant for carbon dam at lower end of injector when being installed.

**STEP 39**



Install fuel injectors. Refer to Section 3013.

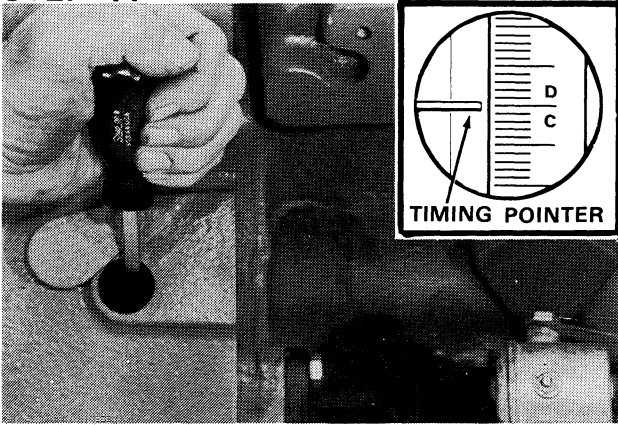
**STEP 40**



Refer to Section 3010 & 3012 for cleaning and servicing the fuel filters and system.

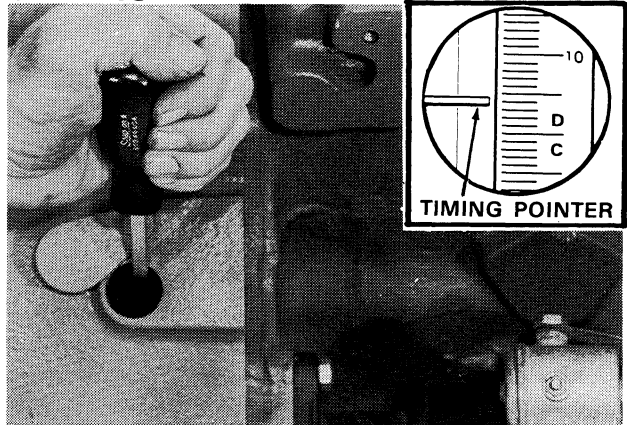
	ENGINE SPEED	NORMAL COMPRESSION PRESSURE	ALLOWABLE VARIATION BETWEEN CYLINDERS
<b>CRANKING</b>	APPROXIMATELY 200 RPM	400 PSI*	25 PSI
<b>RUNNING</b>	800 RPM	480 PSI*	20 PSI
*NOTE: A 4% REDUCTION IN PSI MUST BE ALLOWED FOR EVERY 1000 FT. ABOVE SEA LEVEL.			

**STEP 41**



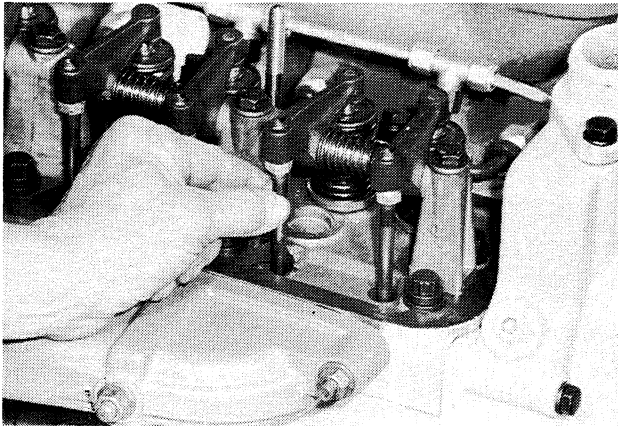
Crank engine clockwise until TDC mark on flywheel is in line with timing pointer as seen through the flywheel housing timing hole.

**STEP 43**



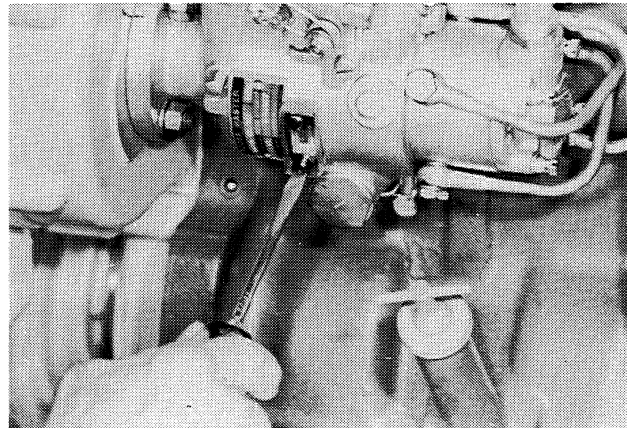
Crank engine counter-clockwise (as viewed from the flywheel end) past the specified pump timing; then crank engine clockwise until the timing pointer is in line with the specified pump timing mark on the flywheel. This procedure will remove the slack from the valve train and will insure correct pump timing. *NOTE:* Refer to engine data decal on engine valve cover or Operator's Manual for specified fuel pump timing.

**STEP 42**



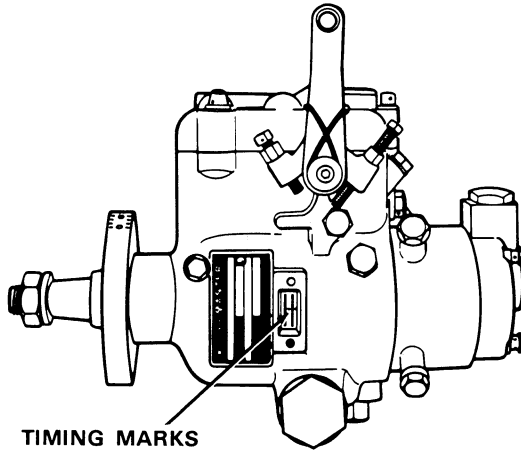
Both push rods of No. 1 cylinder should be loose when No. 1 cylinder is on TDC of compression stroke. If both push rods are tight, crank engine 360° and again check push rods.

**STEP 44**



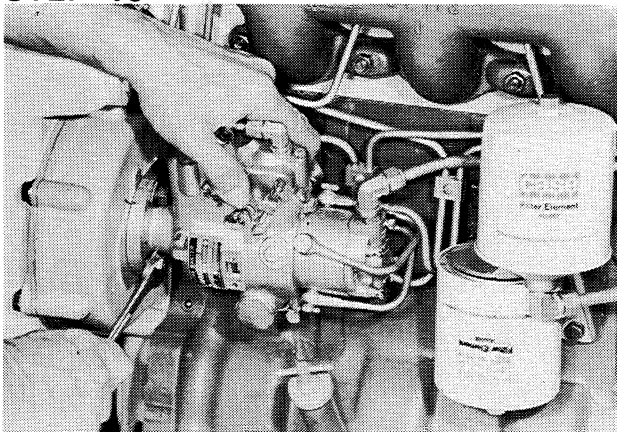
Remove the timing window cover from injection pump.

**STEP 45**



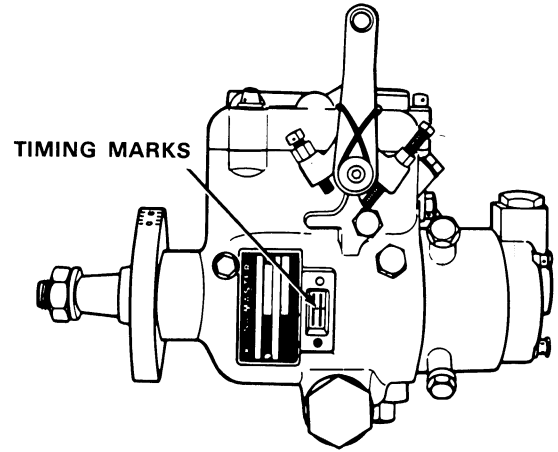
Check timing marks in timing window of injection pump. If marks are not aligned, proceed to next step. If marks are in line, the pump is in time.

**STEP 46**



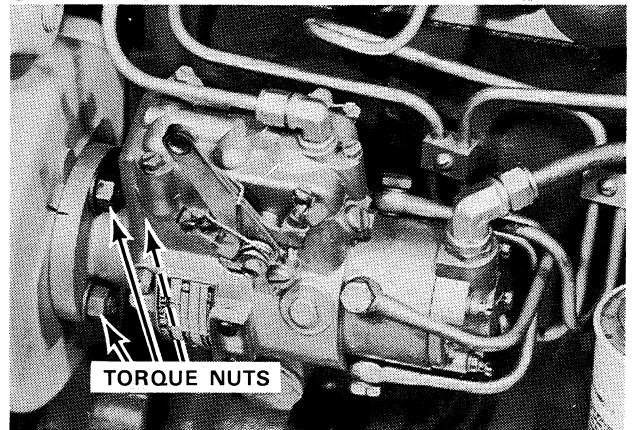
Loosen pump mounting nuts. Move pump toward or away from engine until timing marks are aligned. **NOTE:** To advance timing, move top of pump away from engine. To retard pump timing, move top of pump toward engine.

**STEP 47**



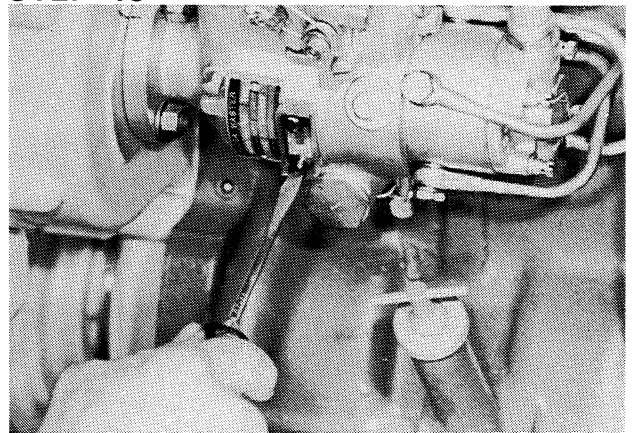
Timing marks aligned for proper timing.

**STEP 48**



Torque pump mounting nuts 35 to 42 ft. lbs.

**STEP 49**



Install timing window cover on injection pump.



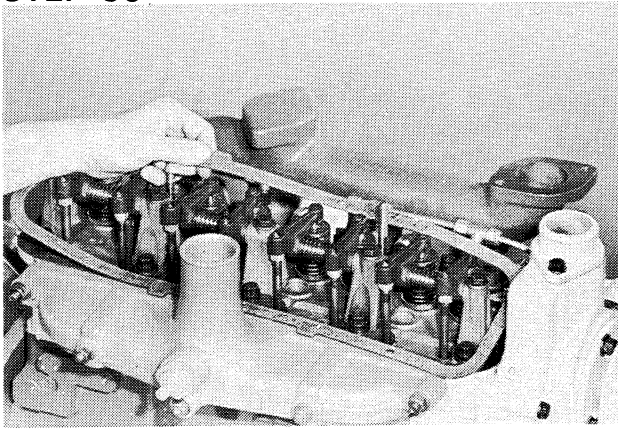
**Suggest:**

**If the above button click is invalid.**

**Please download this document first, and then click the above link to download the complete manual.**

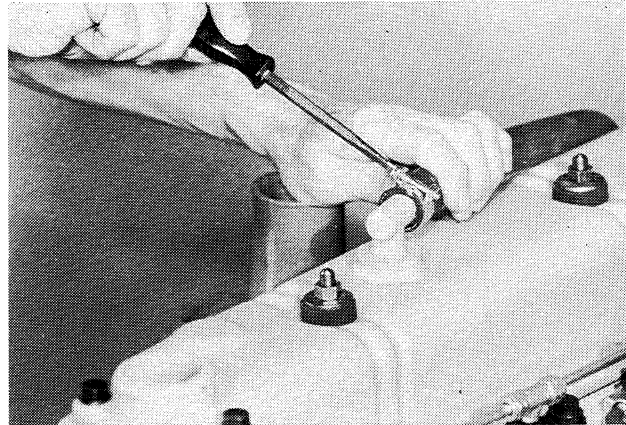
**Thank you so much for reading**

**STEP 50**



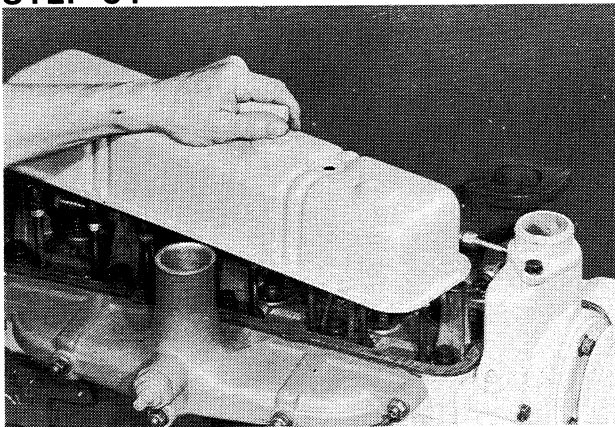
Install valve cover gasket.

**STEP 53**



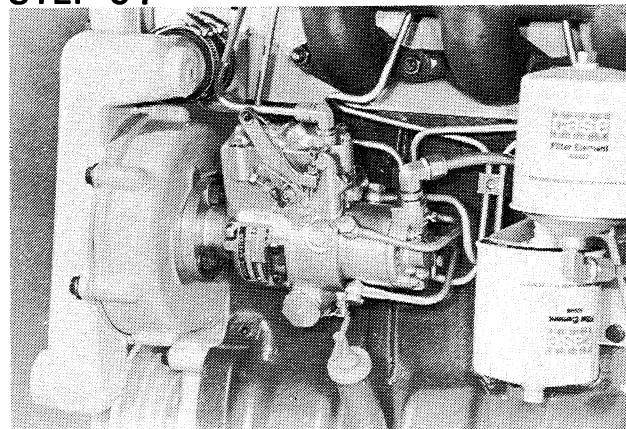
Install the breather hose.

**STEP 51**



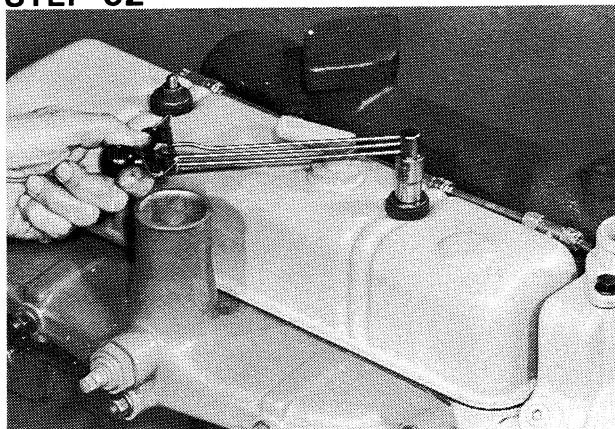
Install valve cover.

**STEP 54**



Check and adjust the engine governed speed as outlined in Section 3012.

**STEP 52**



Torque retaining nuts 4 to 6 ft. lbs.

**NOTE:** The Case Corporation reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

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