HEAVY DUTY LAND CRUISER

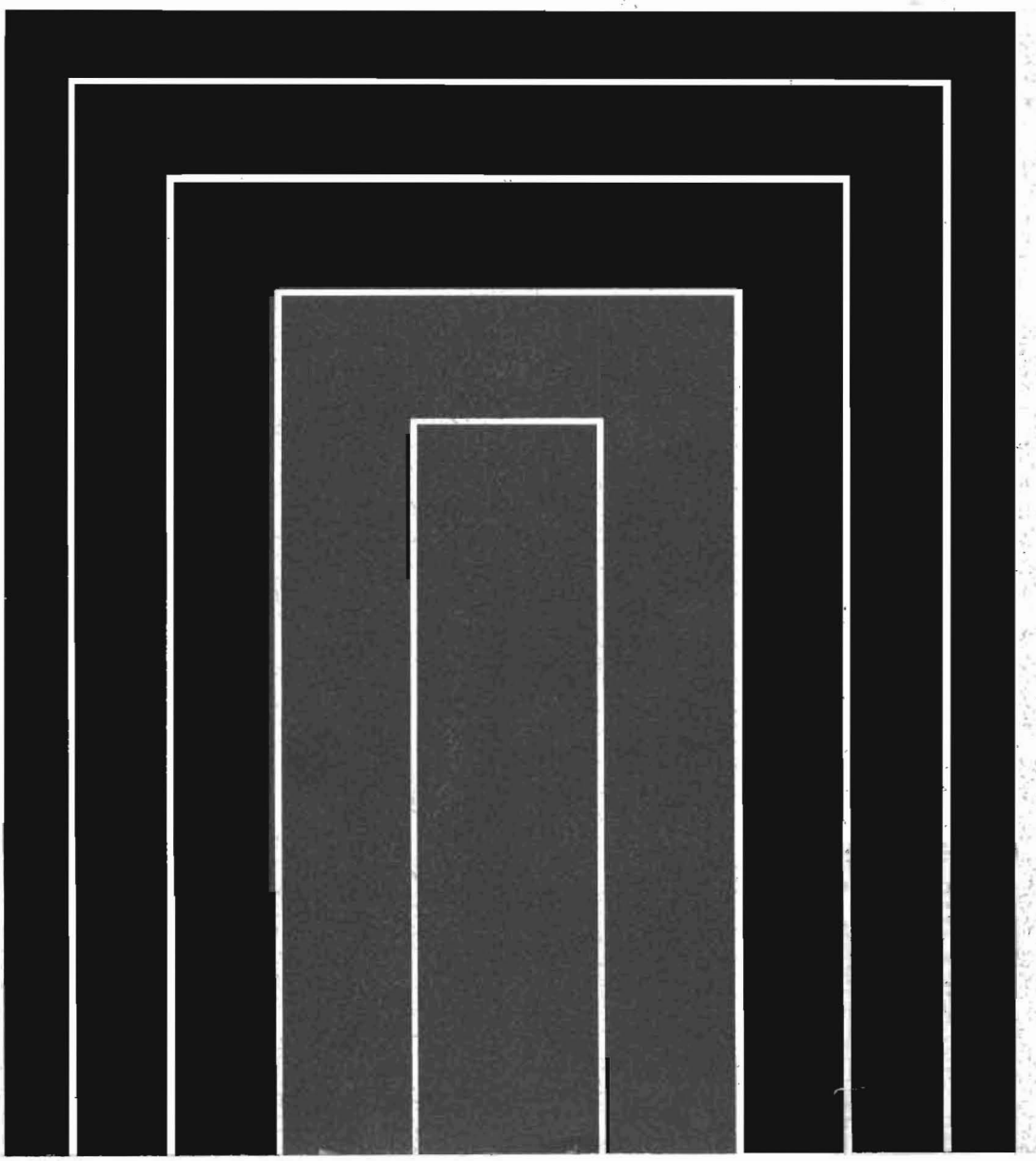
TOYOTA

3F

ENGINE

REPAIR MANUAL

Dec.,1984



1984

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FOREWORD

This repair manual has been prepared to provide information covering general service repairs for the 3F engine equipped on the TOYOTA LAND CRUISER (Heavy-Duty).

Applicable models:
FJ62, 70, 73 and 75 series

All information contained in this manual is the most up-to-date at the time of publication. However, specifications and procedures are subject to change without notice.

TOYOTA MOTOR CORPORATION

TOYOTA 3F ENGINE REPAIR MANUAL

INTRODUCTION

HOW TO USE THIS MANUAL

To assist in finding your way through this manual, the section title and major heading are given at the top of every page.

An **INDEX** is provided on the 1st page of each section to guide you to the item to be repaired.

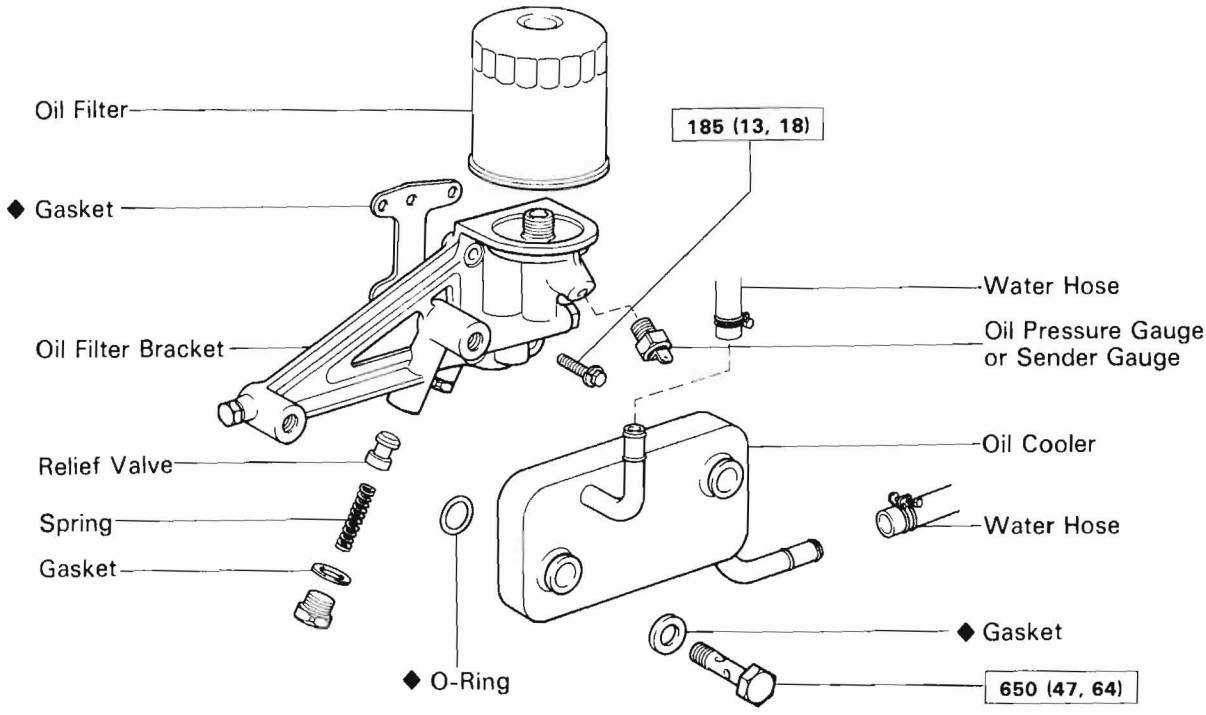
At the beginning of each section, **PRECAUTIONS** are given that pertain to *all* repair operations contained in that section. *Read these precautions before starting any repair task.*

TROUBLESHOOTING tables are included for each system to help you diagnose the system problem and find the cause. The repair for each possible cause is referenced in the remedy column to quickly lead you to the solution.

REPAIR PROCEDURES

Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.

Example:



kg-cm (ft-lb, N·m) : Specified torque

◆ : Non-reusable part

LU0210

The procedures are presented in a step-by-step format:

- The illustration shows *what* to do and *where* to do it.
- The task heading tells *what* to do.
- The detailed text tells *how* to perform the task and gives other information, such as specifications and warnings.

Example:

Illustration: what to do and where

Task heading: what to do

INSTALL OIL COOLER BRACKET

Install a new gasket and the oil filter bracket with the four bolts. Torque the bolts.

Detailed text: how to do task

Torque: 185 kg-cm (13 ft-lb, 18 N·m)

Torque Specification

This format enables the experienced technician to have a FAST TRACK. He can read the task headings and only refer to the detailed text when he needs it. Important specifications and warnings always stand out in bold type.

REFERENCES

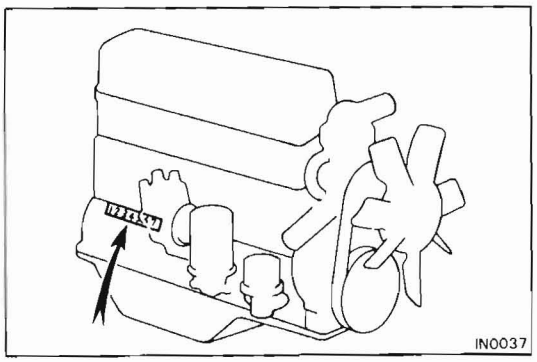
References have been kept to a minimum. However, when they are required you are given the page to go to.

SPECIFICATIONS

Specifications are presented in bold type throughout the text in the applicable step. You never have to leave the procedure to look up your specs. All specifications are also found in Appendix A, specifications for quick reference.

WARNINGS, CAUTIONS, NOTES

- WARNINGS are presented in bold type, and indicate there is a possibility of injury to you or other people.
- CAUTIONS are also presented in bold type, and indicate there is a possibility of damage to the components being repaired.
- NOTES are separated from the text but do not appear in bold. They provide additional information to help you perform the repair more efficiently.



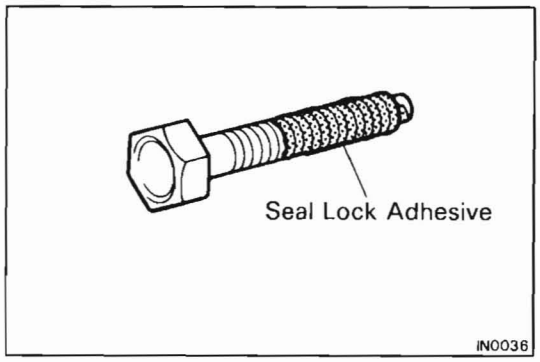
IDENTIFICATION INFORMATION

ENGINE SERIAL NUMBER

The engine serial number is stamped on the right side of the cylinder block.

GENERAL REPAIR INSTRUCTIONS

1. Use fender, seat and floor covers to keep the vehicle clean and prevent damage.
2. During disassembly, keep parts in order to facilitate reassembly.
3. Observe the following:
   (a) Before performing electrical work, disconnect the cable from the battery terminal.
   (b) If it is necessary to disconnect the battery for inspection or repair, always disconnect the cable from the negative (−) terminal which is grounded to the vehicle body.
   (c) To prevent damage to the battery terminal post, loosen the terminal nut and raise the cable straight up without twisting or prying it.
   (d) Clean the battery terminal posts and cable terminal with a shop rag. Do not scrape them with a file or such.
   (e) Install the cable terminal to the battery post with the nut loose and tighten the nut after installation. Do not use a hammer or such to tap the terminal onto the post.
   (f) Be sure the cover for the positive (+) terminal is properly in place.
4. Check all hose and wiring connectors to make sure they are securely and correctly connected.
5. Non-reusable Parts
   (a) Always replace cotter pins, gaskets, O-rings and oil seals, etc. with new ones.
   (b) Non-reusable parts are indicated in the component illustrations by the "◆" symbol.



6. Precoated Parts

   Precoated parts are the bolts, nuts, etc. which are coated with a seal lock adheasive at the factory.

   (a) If a precoated part is tightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.

   (b) Recoating of Precoated Parts

      (1) Clean off the old adhesive from the bolts, nut or installation part threads.

      (2) Dry with compressed air.

      (3) Apply the specified seal lock adhesive to the bolt or nut threads.

   (c) Precoated parts are indicated in the component illustrations by the "★" symbol.

7. When necessary, use a sealer on gaskets to prevent leaks.

8. Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.

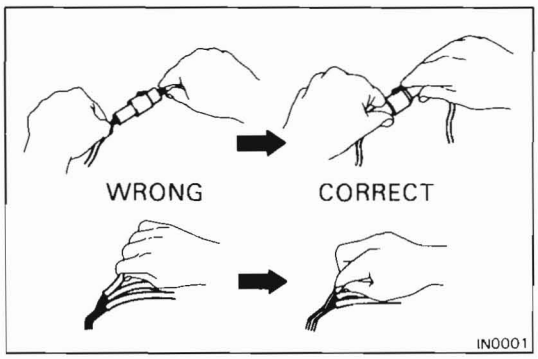
9. Use of special service tools (SST) and special service materials (SSM) may be required depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found at the back of this manual.

10. When replacing fuses, be sure the new fuse is the correct amperage rating. DO NOT exceed the fuse amp rating or use one of a lower rating.

11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.

   (a) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels in order to ensure safety.

   (b) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on one jack alone, even for a small job that can be finished quickly.



12. Observe the following precautions to avoid damage to parts:

   (a) To disconnect vacuum hoses, pull on the end, not the middle of the hose.

   (b) To pull apart electrical connectors, pull on the connector itself, not the wires.

   (c) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.

(d) When steam cleaning an engine, protect the distributor, ignition coil, air filter, and VCV from water.

(e) Never use an impact wrench to remove or install thermo switches or thermo sensors.

(f) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.

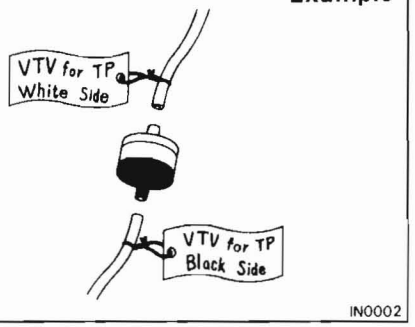
(g) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.

13. Tag hoses before disconnecting them:

(a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.

(b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

Example



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ABBREVIATIONS USED IN THIS MANUAL

A/C	Air Conditioner
A/T	Automatic Transmission
ATDC	After Top Dead Center
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
CB	Choke Breaker
EX	Exhaust
Ex.	Except
HAI	Hot Air Intake
HIC	Hot Idle Compensation
IN	Intake
MP	Multipurpose
M/T	Manual Transmission
O/S	Oversize
PCV	Positive Crankcase Ventilation
PS	Power Steering
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
TDC	Top Dead Center
TP	Throttle Positioner
U/S	Undersize
w/	With
w/o	Without

ENGINE MECHANICAL

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty	Troubleshoot cooling system	CO-2
	Incorrect ignition timing	Reset timing	EM-6
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/ hard to start (cranks ok)	No fuel supply to carburetor	Check fuel line	
	Carburetor problems	Troubleshoot fuel system	FU-2
	Ignition problems	Troubleshoot ignition system	IG-2
	Vacuum leaks • HIC line • PCV line • Intake manifold	Replace as necessary	
	Compression low	Check compression	EM-13
Rough idle or stalls	Vacuum leaks • HIC line • PCV line • Intake manifold	Repair as necessary	
	Ignition problems	Troubleshoot ignition system	IG-2
	Carburetor problems	Troubleshoot fuel system	FU-2
	HAI system faulty	Check HAI system	
	Engine overheats	Troubleshoot cooling system	CO-2
	Compression low	Check compression	EM-13
Engine hesitates/ poor acceleration	Ignition problems	Troubleshoot ignition system	IG-2
	Vacuum leaks • HIC line • PCV line • Intake manifold • Carburetor hoses	Repair as necessary	
	Air cleaner clogged	Check air filter	EM-4
	Fuel line clogged	Check fuel line	
	Carburetor problems	Troubleshoot fuel system	FU-2
	Emission control system problem • HAI system always on (hot engine) • AAP system faulty (cold engine)	 Check HAI system Check AAP system	
	Engine overheats	Troubleshoot cooling system	CO-2
	Compression low	Check compression	EM-13
Engine dieseling (runs after ignition switch is turned off)	Carburetor problems	Troubleshoot fuel system	FU-2
	Incorrect ignition timing	Reset timing	EM-6
Muffler explosion (after fire) on deceleration	TP system faulty (M/T only)	Check TP system	EM-12
	Deceleration fuel cut system always off	Check fuel cut system	
Muffler explosion (after fire) all the time	Air cleaner clogged	Check air filter	EM-4
	Choke system faulty	Check choke system	
	Incorrect ignition timing	Reset timing	EM-6

TROUBLESHOOTING (Cont'd)

Problem	Possible cause	Remedy	Page
Engine backfires	Choke valve open (cold engine)	Check choke system	
	Carburetor vacuum leak	Check hoses and repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	FU-2
	Incorrect ignition timing	Reset timing	EM-6
Excessive oil consumption	Oil leak	Repair as necessary	
	PCV line clogged	Check PCV system	
	Piston ring worn or damaged	Check piston rings	EM-52
	Valve stem worn	Check valves and guide bushings	EM-19
	Valve stem oil seal worn or damaged	Check oil seal	
Poor fuel mileage	Fuel leak	Repair as necessary	
	Air cleaner clogged	Check air filter	EM-4
	Ignition problems	Troubleshoot ignition system	IG-2
	Carburetor problems	Troubleshoot fuel system	FU-2
	Compression low	Check compression	EM-13
	Tires improperly inflated	Inflate tires to proper pressure	
	Clutch slips	Troubleshoot clutch	
	Brakes drag	Troubleshoot brakes	

ENGINE TUNE-UP

INSPECTION OF ENGINE COOLANT

(See steps 1 and 2 on page CO-3)

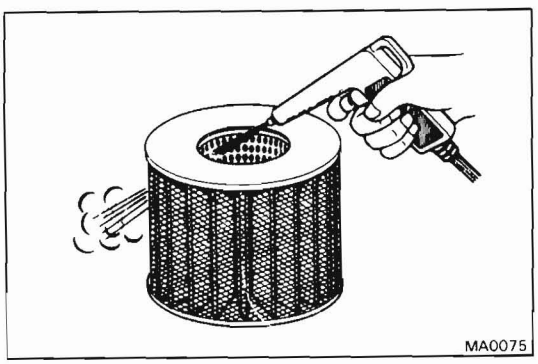
INSPECTION OF ENGINE OIL

(See steps 1 and 2 on page LU-2)

INSPECTION OF BATTERY

(See steps 1 and 2 on page CH-4)

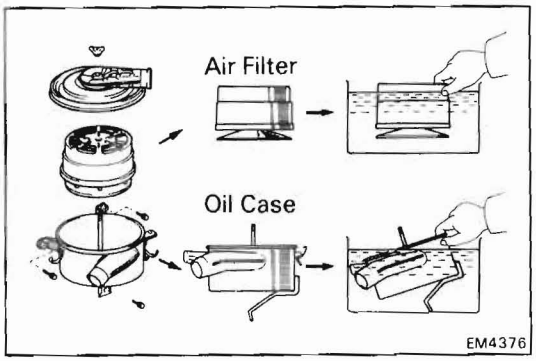
Standard specific gravity:
1.25 — 1.27 when fully charged at 20°C (68°F)



CLEANING OF AIR FILTER
Paper Filter Type

CLEAN AIR FILTER

Clean the element with compressed air, first blowing from the inside thoroughly and then the outside.

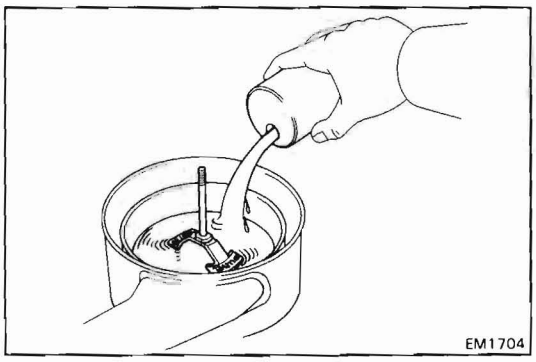


Oil Bath Type

CLEAN AIR FILTER

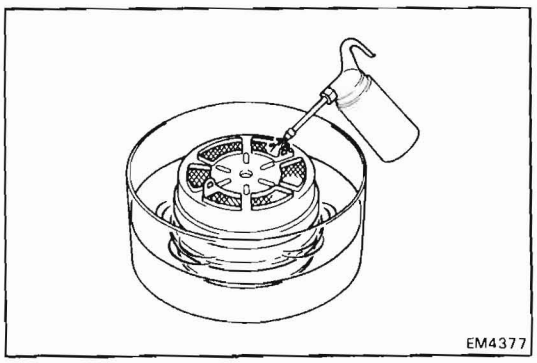
(a) Wash the oil case and air filter in kerosine by agitating and rubbing.

(b) Wipe the oil case and air filter with a clean rag.



(c) Place the oil case on a level work stand.

(d) Pour in clean engine oil until it reaches the "OIL LEVEL" mark.



(e) Place the air filter on a tray.

(f) Saturate the air filter with clean engine oil.

INSPECTION OF HIGH-TENSION CORDS

(See page IG-4)

Maximum resistance: 25 kΩ per cord

INSPECTION OF SPARK PLUGS

(See page IG-4)

Correct electrode gap: 0.8 mm (0.031 in.)

INSPECTION OF ALTERNATOR DRIVE BELT

(See page CH-4)

Drive belt deflection:

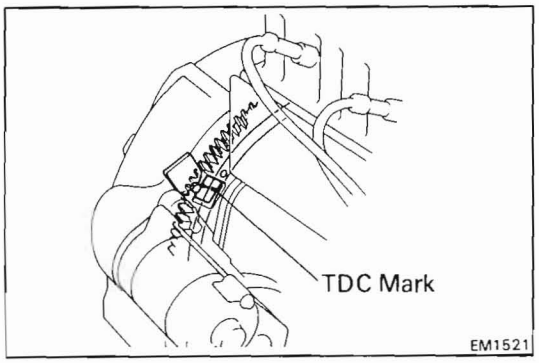
New belt 7.0 – 9.0 mm (0.278 – 0.354 in.)

Used belt 9.0 – 12.0 mm (0.354 – 0.472 in.)

INSPECTION AND ADJUSTMENT OF VALVE CLEARANCES

NOTE: Inspect and adjust the valve clearance after engine has reached normal operating temperature.

1. **REMOVE CYLINDER HEAD COVER (See page EM-15)**

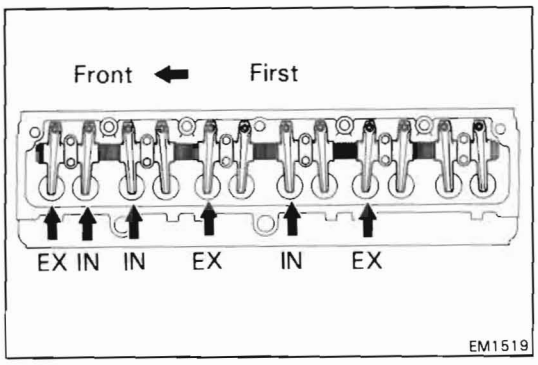


2. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**

(a) Set the No. 1 cylinder to TDC/compression.
Align the TDC mark of the flywheel with the timing pointer by turning the crankshaft clockwise with a wrench.

(b) Check that the rocker arms on the No. 1 cylinder are loose and rocker arms on the No. 6 cylinder are tight.

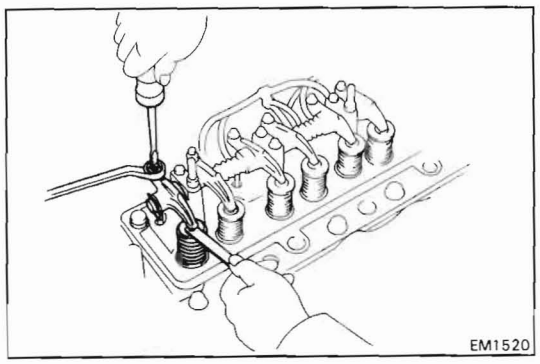
If not, turn the crankshaft one revolution (360°) and align the mark as above.



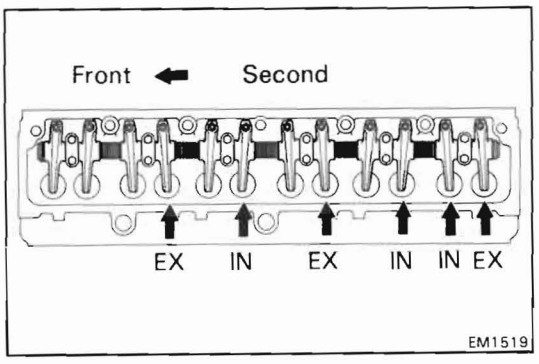
3. **INSPECT AND ADJUST VALVE CLEARANCES**

(a) Measure only those valves indicated by arrows.

Valve clearance (Hot):
Intake 0.20 mm (0.008 in.)
Exhaust 0.35 mm (0.014 in.)

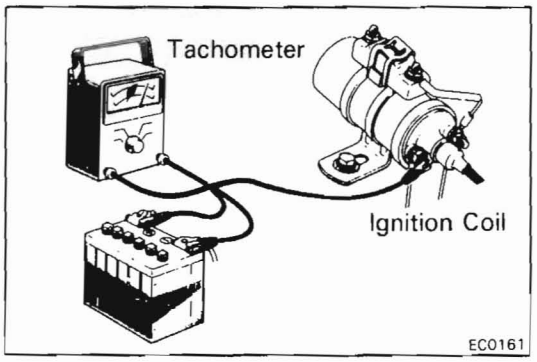


- Using a feeler gauge, measure the valve clearance between the valve stem and rocker arm. Loosen the lock nut and turn the adjusting screw to set the proper clearance. Hold the adjusting screw in position and tighten the lock nut.
- Recheck the valve clearance. The feeler gauge should slide with a very slight drag.



(b) Turn the crankshaft one revolution (360°) and align the mark as above.
Adjust only the valves indicated by arrows.

4. **INSTALL CYLINDER HEAD COVER (See page EM-30)**



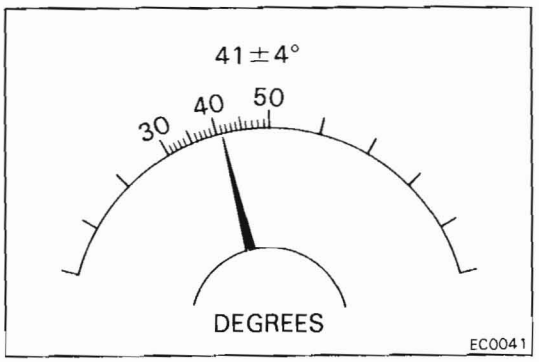
INSPECTION AND ADJUSTMENT OF IGNITION TIMING

1. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the test probe of a tachometer to the ignition coil negative (−) terminal.

CAUTION:

- **NEVER allow the ignition coil terminals to touch ground as it could result in damage to the ignition coil.**
- **It is recommended that you consult with the manufacturer before using a tachometer as some are not compatible with this system.**

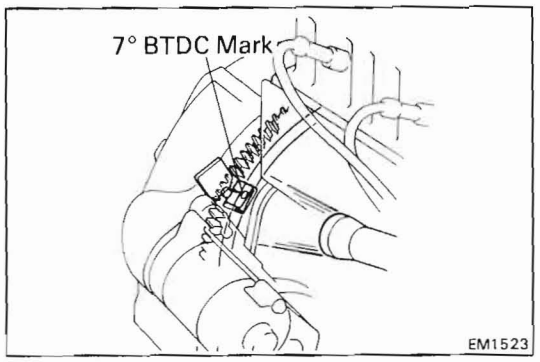


2. INSPECT DWELL ANGLE

Check the dwell angle at the engine idling.

Dweel angle: 41 ± 4°

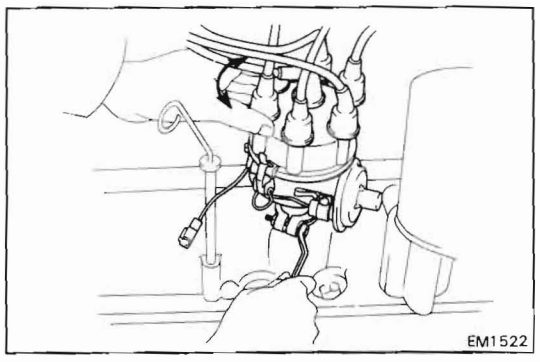
If the dwell angle is not as specified, adjust the rubbing block gap. (See page IG-15 or 25)



3. INSPECT AND ADJUST IGNITION TIMING

(a) Check the ignition timing.

Ignition timing: 7° BTDC @ Max. 900 rpm



(b) Loosen the bolt and nut holding the distributor to the clamp.

(c) Adjust by turning the distributor.

(d) Tighten the bolt and nut, and recheck the ignition timing.

INSPECTION AND ADJUSTMENT OF IDLE SPEED

1. WARM UP ENGINE

2. CONNECT TACHOMETER

3. INSPECT IDLE SPEED

Idle speed: M/T 650 rpm
A/T 750 rpm

If not as specified, adjust according to the following procedure:

CAUTION:

- **Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture adjusting screw in most vehicles if they are in good condition.**
- **If a CO meter is not available and it is absolutely necessary to adjust with the idle mixture adjusting screw, use the alternative method (See page EM-9).**

A. METHOD WITH CO METER

1. VISUALLY INSPECT CARBURETOR

(a) Check for loose screws or a loose mounting to the manifold.

(b) Check for wear in the linkage, missing snap rings or excessive looseness in the throttle shaft. Correct any problems found.

2. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal operating coolant temperature

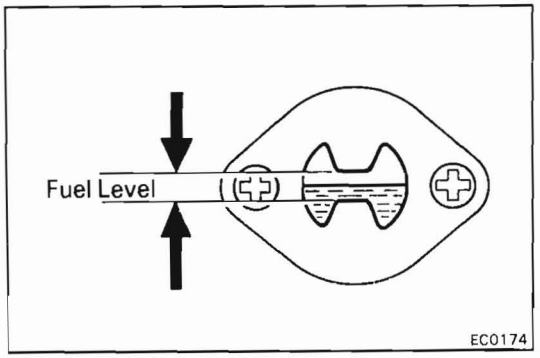
(c) Choke fully open

(d) All accessories switched off

(e) All vacuum lines connected

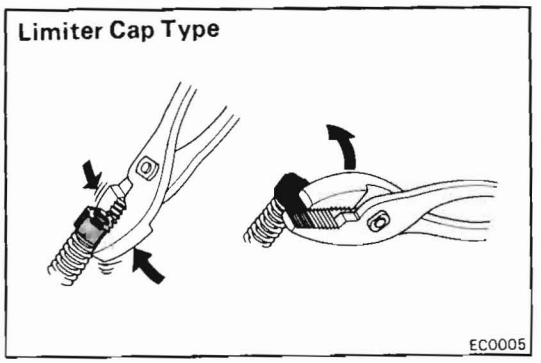
(f) Ignition timing set correctly

(g) Transmission in the "N" range

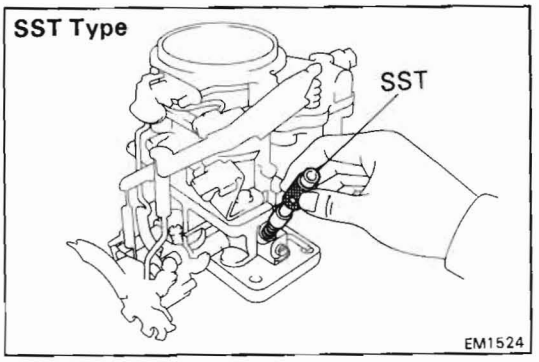


(h) Fuel level should be about even with the correct level in the sight glass

(i) CO meter operates normally

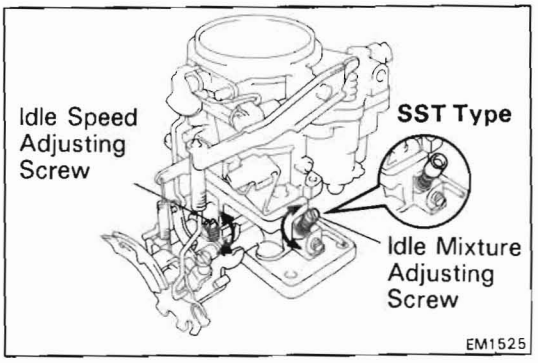


(j) If there is an idle limiter cap on the idle mixture adjusting screw, remove it.



(k) Use SST if necessary.

SST 09243-00020

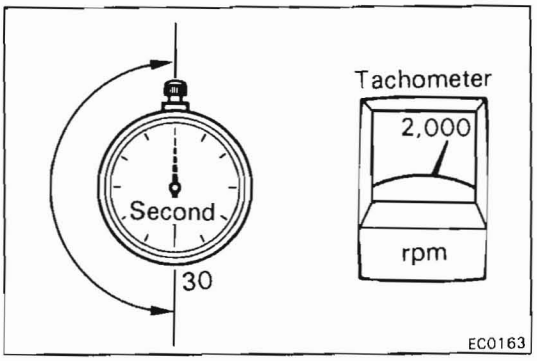


3. ADJUST IDLE SPEED AND IDLE MIXTURE

(a) Start the engine.

(b) Using a CO meter to measure the CO concentration in the exhaust, turn the idle speed and idle mixture adjusting screws to obtain the specified concentration value at idle speed.

Idle speed: M/T 650 rpm
A/T 750 rpm

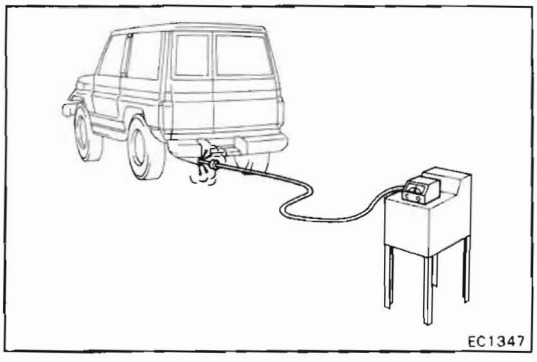


4. INSPECT CO CONCENTRATION

(a) Check that the CO meter is properly calibrated.

(b) Race the engine 30 – 60 seconds at about 2,000 rpm before measuring concentration.

(c) Wait 1 – 3 minutes after racing the engine to allow the concentration to stabilize.



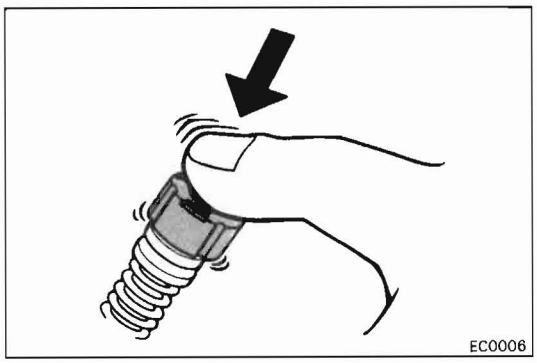
(d) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe, and measure the concentration within a short time.

Idle CO concentration: 1.5 ± 1.0 %

- **If the CO concentration is within specification this adjustment is complete.**
- **If the CO concentration is not within specification, turn the idle mixture adjusting screw to obtain the specified concentration value.**
- **If the CO concentration cannot be corrected by adjusting the idle mixture, see table below for other possible causes.**

TROUBLESHOOTING

HC	CO	Problems	Causes
High	Normal	Rough idle	1. Faulty ignition: ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed ignition wires ● Cracked distributor cap 2. Leaky exhaust valves 3. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leak: ● Vacuum hose ● Intake manifold ● PCV line ● Carburetor base
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty carburetion: ● Faulty choke action ● Incorrect float setting ● Leaking needle or seat ● Leaking power valve



5. (w/ IDLE LIMITER CAP)
INSTALL NEW IDLE LIMITER CAP

After this adjustment is completed, install a new idle limiter cap on the mixture adjusting screw.

CAUTION: After completing adjustment, perform a road test to make certain engine performance has not changed.

B. ALTERNATIVE METHOD

To be used only if CO meter is not available.

1. VISUALLY INSPECT CARBURETOR

(a) Check for loose screws or loose a mounting to the manifold.

(b) Check for wear in the linkage, missing snap rings or excessive looseness in the throttle shaft. Correct any problems found.

2. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal operating coolant temperature

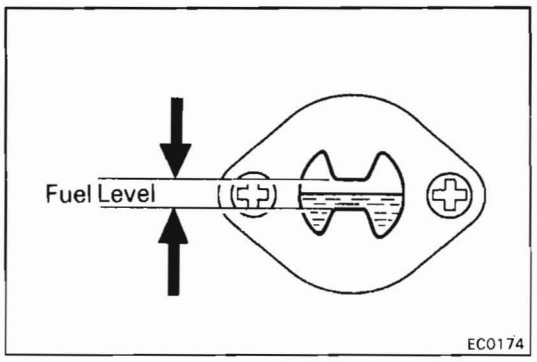
(c) Choke fully open

(d) All accessories switched off

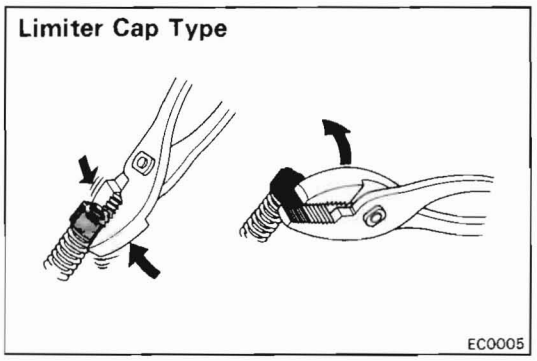
(e) All vacuum lines connected

(f) Ignition timing set correctly

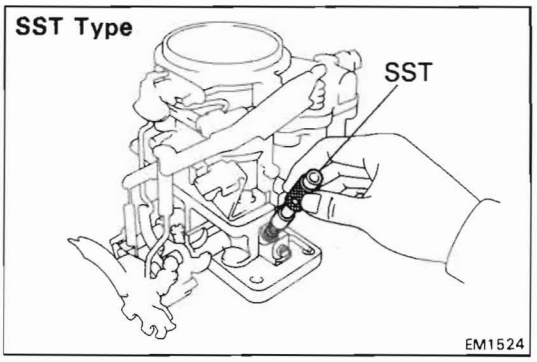
(g) Transmission in the "N" range



(h) Fuel level should be about even with the correct level in the sight glass.

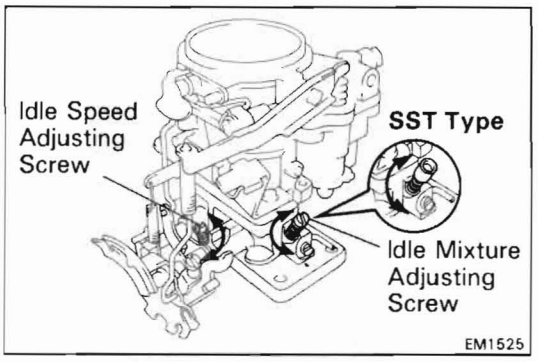


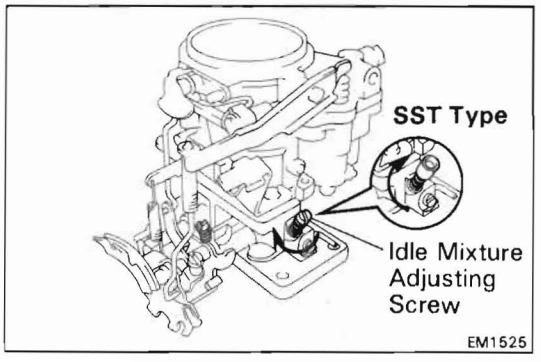
(i) If there is an idle limiter cap on the idle mixture adjusting screw, remove it.



(j) Use SST if necessary.

SST 09243-00020





3. ADJUST IDLE SPEED AND IDLE MIXTURE

(a) Start the engine.

(b) Set to the maximum speed by turning the IDLE MIXTURE ADJUSTING SCREW.

(c) Set to the idle mixture speed by turning the IDLE SPEED ADJUSTING SCREW.

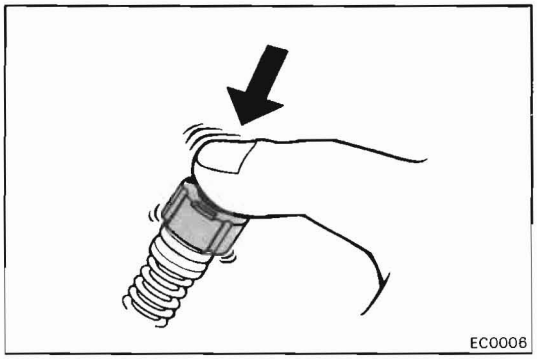
Idle mixture speed: M/T 690 rpm
A/T 790 rpm

(d) Before moving to the next step, continue adjustments (b) and (c) until the maximum speed will not rise any further, no matter how much the IDLE MIXTURE ADJUSTING SCREW is adjusted.

(e) Set to the idle speed by screwing in the IDLE MIXTURE ADJUSTING SCREW.

Idle speed: M/T 650 rpm
A/T 750 rpm

This is the lean Drop Method for setting idle speed and mixture.


EC0006

4. (w/ IDLE LIMITER CAP)
INSTALL NEW IDLE LIMITER CAP

After this adjustment is completed, install a new idle limiter cap on the idle mixture adjusting screw.

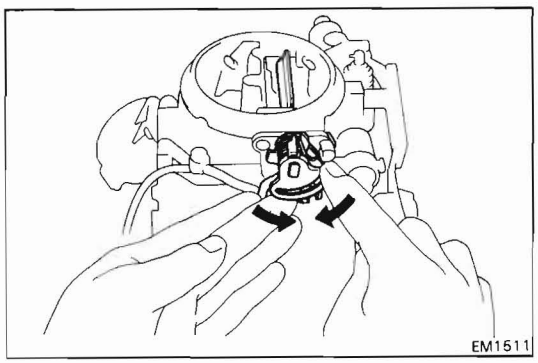
CAUTION: After completing adjustment, perform a road test to make certain engine performance has not changed.

INSPECTION AND ADJUSTMENT OF FAST IDLE SPEED

1. **WARM UP AND STOP ENGINE**

2. **REMOVE AIR CLEANER ASSEMBLY OR AIR INTAKE CONNECTOR FROM CARBURETOR**

3. **CONNECT TACHOMETER**


EM1511

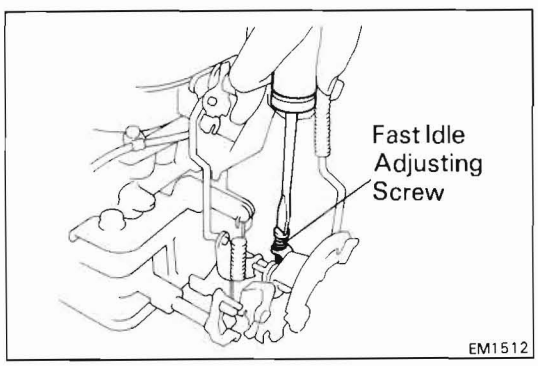
4. **INSPECT AND ADJUST FAST IDLE SPEED**

(a) Start the engine.

(b) Fully turn the choke lever counterclockwise, and fully open the choke valve.

(c) Check the fast idle speed.

Fast idle speed: 1,800 rpm



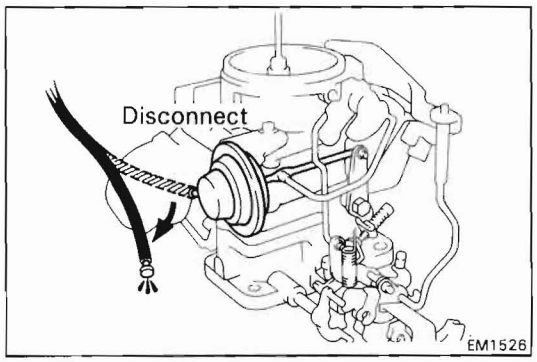
EM1512

(d) Adjust the fast idle speed by turning the FAST IDLE ADJUSTING SCREW.

5. **INSTALL AIR CLEANER ASSEMBLY OR AIR INTAKE CONNECTOR**

INSPECTION AND ADJUSTMENT OF THROTTLE POSITIONER SETTING SPEED (S.Arabia M/T only)

1. **WARM UP AND STOP ENGINE**
2. **CONNECT TACHOMETER**
3. **START ENGINE**

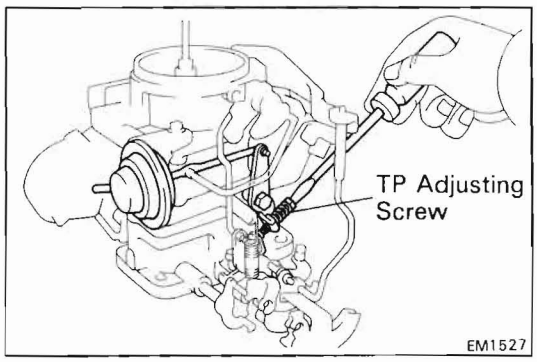


4. **INSPECT AND ADJUST THROTTLE POSITIONER (TP) SETTING SPEED**

(a) Disconnect the vacuum hoses from the TP and plug the hose end.

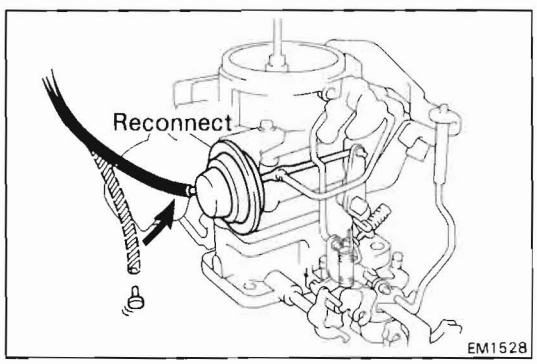
(b) Rev the engine to 2,000 rpm for a few seconds, release the throttle and check the TP setting speed.

TP setting speed: 1,000 rpm



(c) Adjust the TP setting speed by turning the TP ADJUSTING SCREW.

(d) Rev the engine to 2,000 rpm for a few seconds, release the throttle and recheck the TP setting speed.



(e) Reconnect the vacuum hoses to the TP.

COMPRESSION CHECK

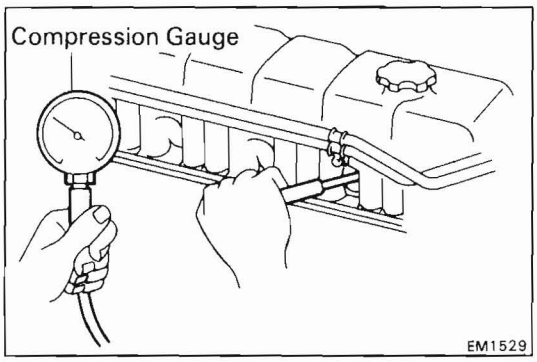
NOTE: If there is lack of power, excessive oil consumption or poor fuel mileage, measure the cylinder compression pressure.

1. **WARM UP AND STOP ENGINE**

2. **REMOVE SIX SPARK PLUGS**

3. **DISCONNECT DISTRIBUTOR CONNECTOR**

4. **CHECK CYLINDER COMPRESSION PRESSURE**



(a) Insert a compression gauge into the spark plug hole.

(b) Fully open the throttle valve.

(c) While cranking the engine with the starter, measure the compression pressure.

NOTE: Always use a fully charged battery to obtain engine revolutions of more than 200 rpm.

(d) Repeat steps (a) through (c) for each cylinder.

Compression pressure:
10.5 kg/cm² (149 psi, 1,030 kPa) or more
Minimum pressure:
8.0 kg/cm² (114 psi, 785 kPa)
Difference between each cylinder:
1.0 kg/cm² (14 psi, 98 kPa) or less

(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) on the cylinder with low compression.

- If adding oil helps the compression, the piston rings and/or cylinder bore may be worn or damaged.
- If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.

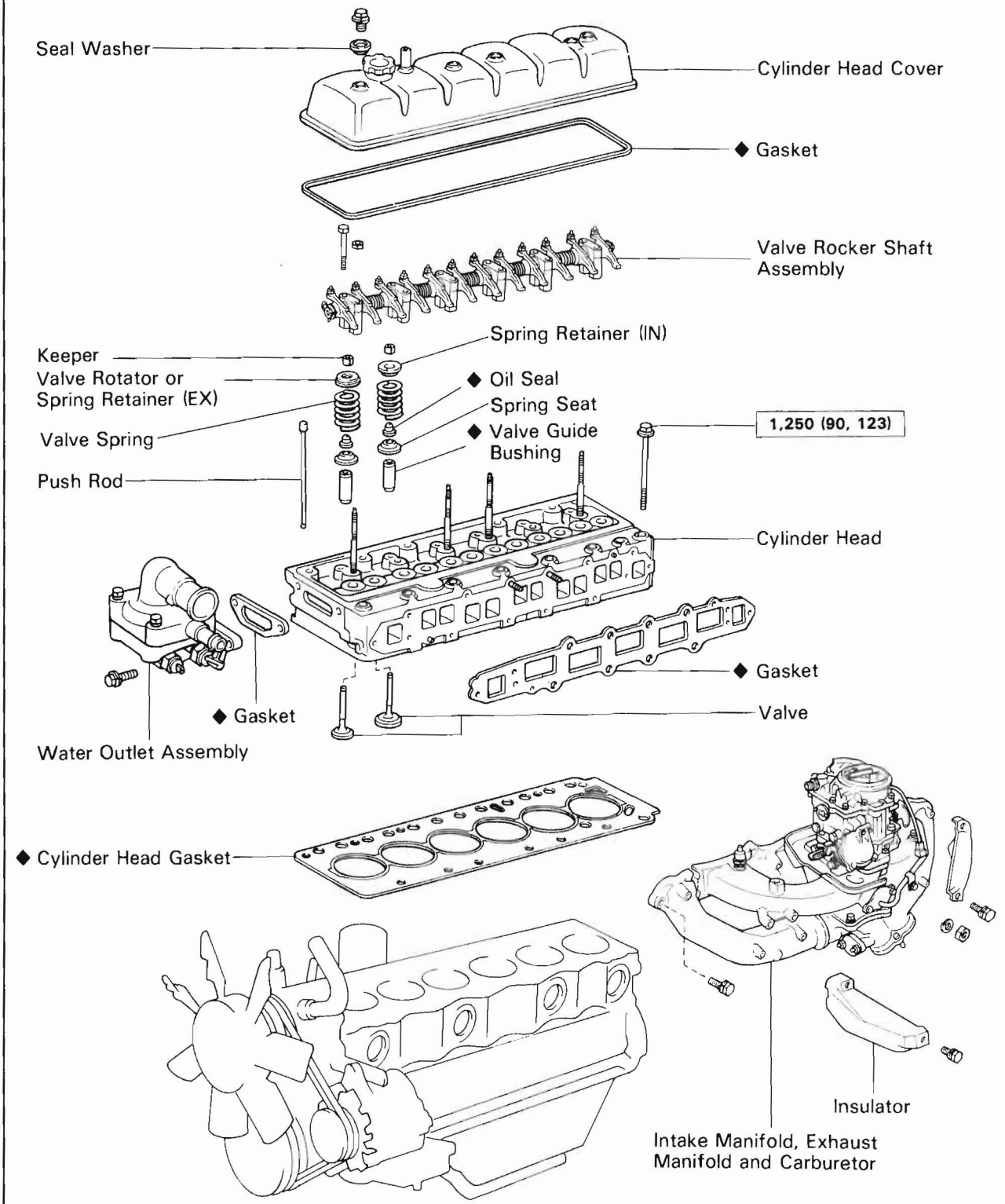
5. **CONNECT DISTRIBUTOR CONNECTOR**

6. **INSTALL SIX SPARK PLUGS**

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

CYLINDER HEAD

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ : Non-reusable part

EM1530

REMOVAL OF CYLINDER HEAD

(See page EM-14)

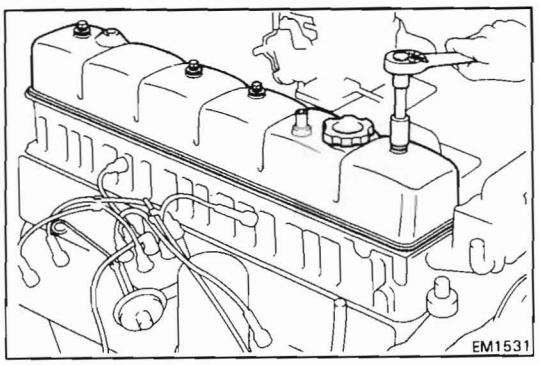
1. **DRAIN ENGINE COOLANT (See page CO-3)**

2. **REMOVE HEATER AND OIL COOLER PIPES**
   (a) Disconnect the hoses from the water outlet, water pump and oil cooler.
   (b) Remove the screws and heater and oil cooler pipes from the cylinder head.

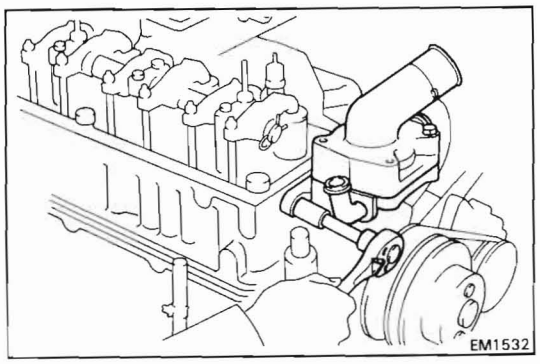
3. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS**

4. **REMOVE SPARK PLUGS**

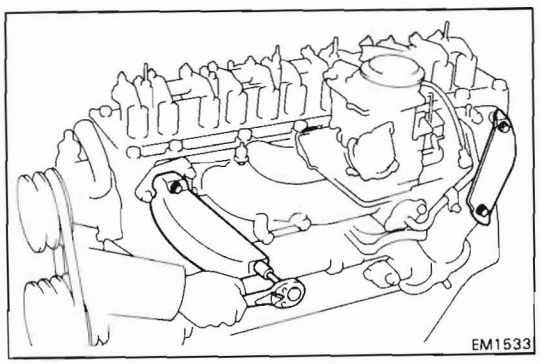
5. **REMOVE FUEL PIPE**
   Remove the fuel pipe connecting the carburetor to the fuel pump.



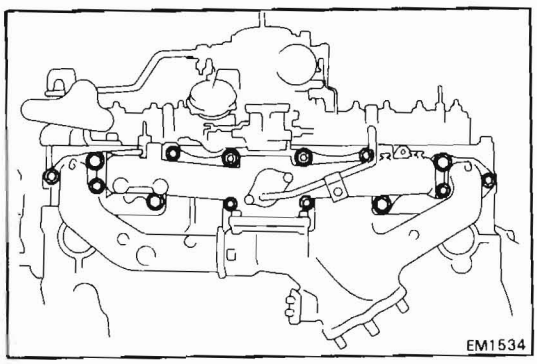
6. **REMOVE CYLINDER HEAD COVER**
   Remove the four cap nuts, seal washers, cylinder head cover and gasket.



7. **REMOVE WATER OUTLET ASSEMBLY**
   (a) Disconnect the water by-pass hose from the water outlet.
   (b) Remove the two bolts holding the water outlet housing to the cylinder head, and remove the water outlet assembly and gasket.

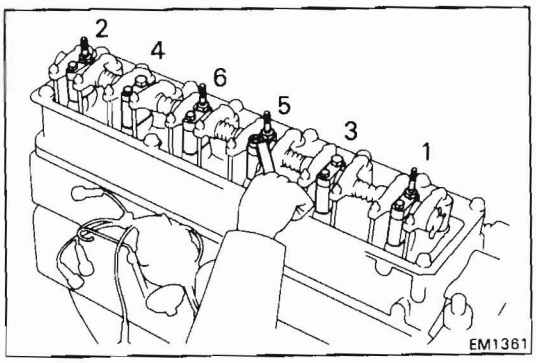


8. **REMOVE INTAKE, EXHAUST MANIFOLDS AND CARBURETOR ASSEMBLY**
   (a) Remove the four bolts and two insulators.



(b) Remove the twelve bolts, two nuts and plate washers holding the manifolds to the cylinder head.

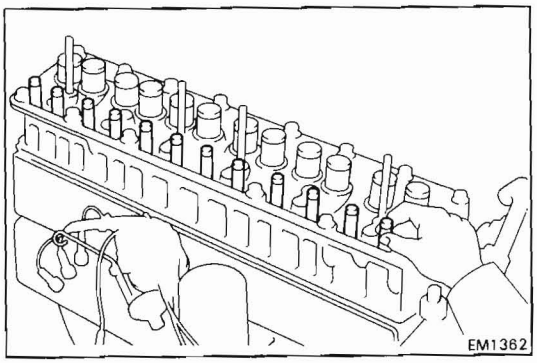
(c) Remove the intake, exhaust manifolds and carburetor assembly and gasket.



9. REMOVE VALVE ROCKER SHAFT ASSEMBLY

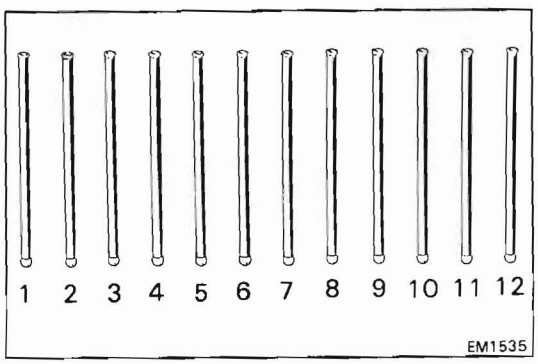
(a) Uniformly loosen and remove the eight bolts and four nuts in several passes, in the sequence shown.

(b) Remove the rocker shaft assembly.

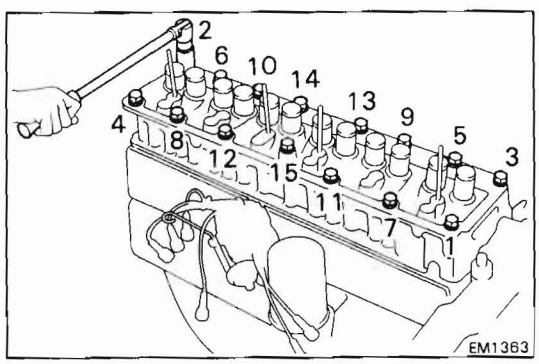


10. REMOVE PUSH RODS

Remove the twelve push rods in order, beginning from the No. 1 push rod.



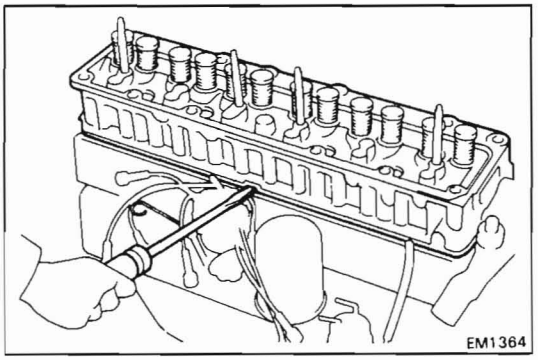
NOTE: Arrange the push rods in correct order.



11. REMOVE CYLINDER HEAD

(a) Uniformly loosen and remove the fifteen head bolts in several passes, in the sequence shown.

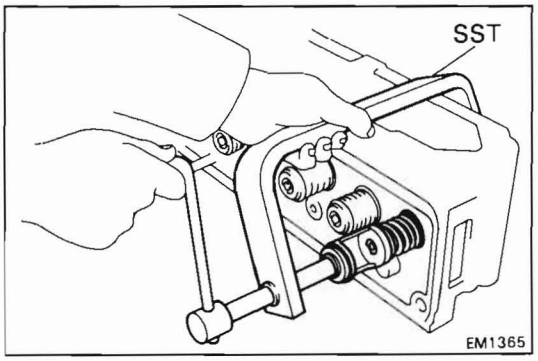
CAUTION: Head warpage or cracking could result from removing out of sequence.



(b) Lift the cylinder head from the dowels on the cylinder block and place the head on wooden blocks on a bench.

NOTE: If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and block saliences.

CAUTION: Be careful not to damage the cylinder head or block surface on the cylinder and head gasket sides.



DISASSEMBLY OF CYLINDER HEAD

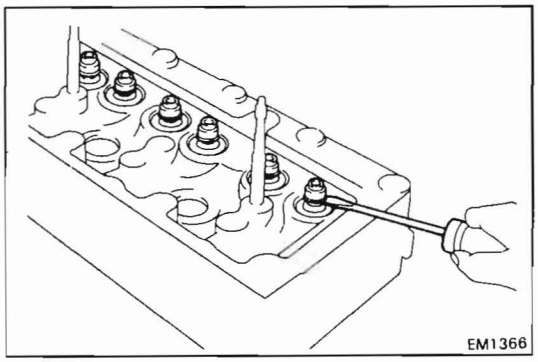
(See page EM-14)

REMOVE VALVES

(a) Using SST, press the valve spring and remove the two keepers.

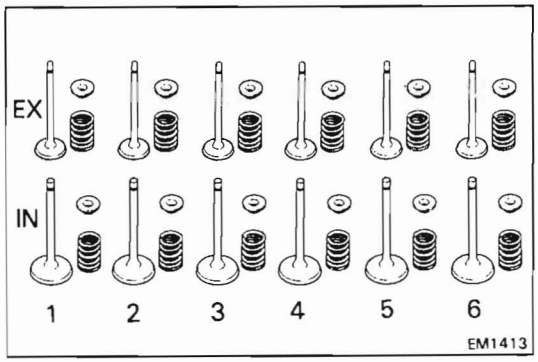
SST 09202-43013

(b) Remove the spring retainer (or valve rotator), valve spring and valve.

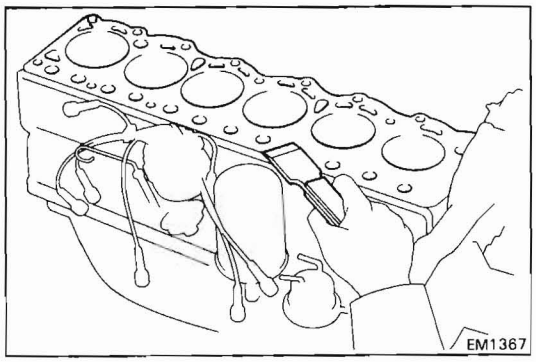


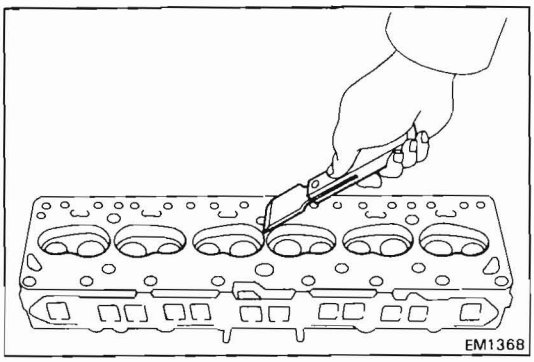
(c) Using a screwdriver, pry out the oil seal.

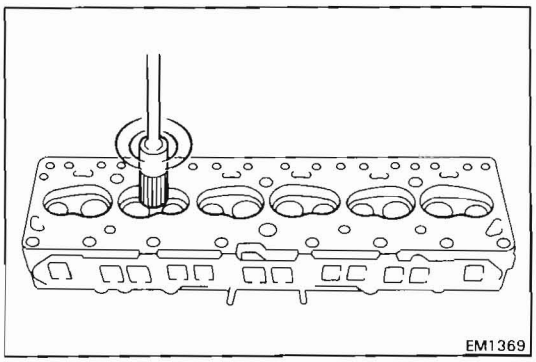
(d) Remove the spring seat.

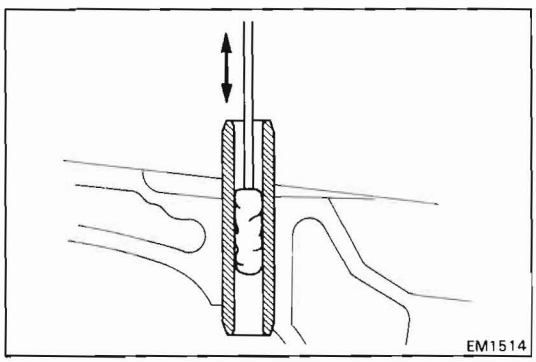


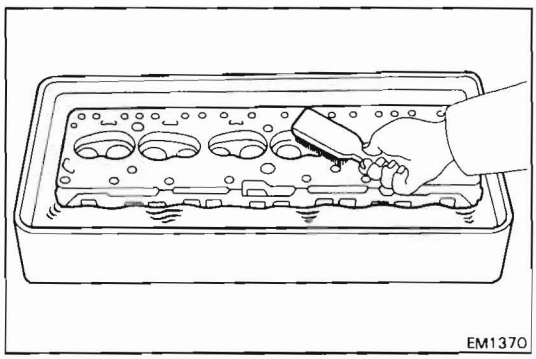
NOTE: Arrange the valves, valve springs and spring retainers (or valve rotators) in the correct order.











INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP OF PISTONS AND TOP OF BLOCK

(a) Turn the crankshaft and bring each piston to top dead center. Using a gasket scraper, remove all the carbon from the piston top.

(b) Remove all the gasket material from the top of the block.

(c) Blow carbon and oil from the bolt holes.

WARNING: Protect your eyes when using high pressure air.

2. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all the gasket material from the manifold and head surface.

CAUTION: Be careful not to scratch the surfaces.

3. CLEAN COMBUSTION CHAMBERS

Using a wire brush, remove all the carbon from the combustion chambers.

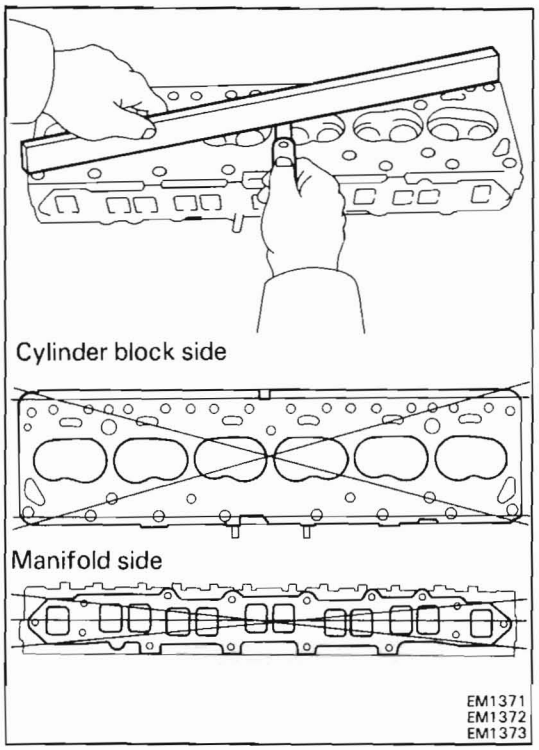
CAUTION: Be careful not to scratch the head gasket contact surface.

4. CLEAN VALVE GUIDE BUSHINGS

Using a valve guide bushing brush and solvent, clean all the guide bushings.

5. CLEAN CYLINDER HEAD

Using a soft brush and solvent, thoroughly clean the head.



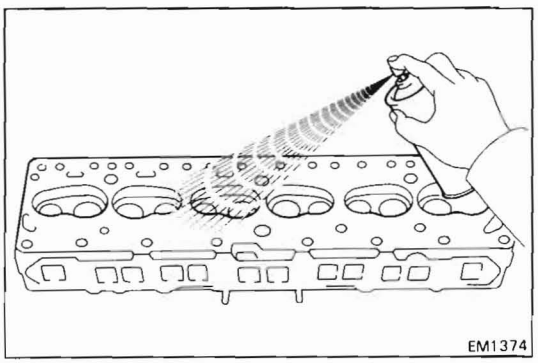
6. INSPECT CYLINDER HEAD FOR FLATNESS

Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and manifolds for warpage.

Maximum warpage:

Cylinder block side	**0.15 mm (0.0059 in.)**
Manifold side	**0.10 mm (0.0039 in.)**

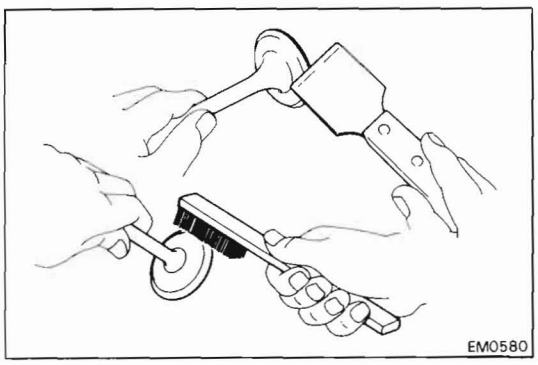
If warpage exceeds maximum, replace the head.



7. INSPECT CYLINDER HEAD FOR CRACKS

Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and the top of the head for cracks.

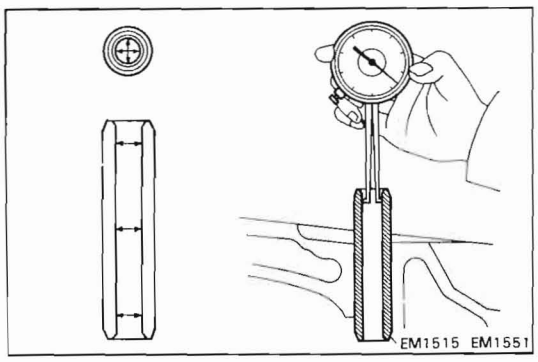
If cracked, replace the head.



8. CLEAN VALVES

(a) Use a gasket scraper, chip any carbon from the valve head.

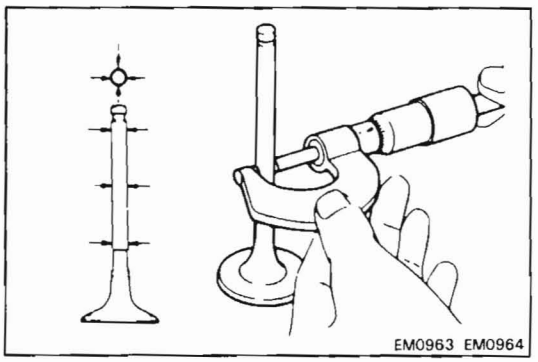
(b) Using a wire brush, thoroughly clean the valve.



9. INSPECT VALVE STEM AND VALVE GUIDE BUSHING

(a) Using a caliper gauge or telescoping gauge, measure the inside diameter of the valve guide bushing.

Bushing inside diameter:
8.010 – 8.030 mm (0.3154 – 0.3161 in.)


EM0963 EM0964

(b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

Intake	**7.970 – 7.985 mm (0.3138 – 0.3144 in.)**
Exhaust	**7.960 – 7.975 mm (0.3134 – 0.3140 in.)**

(c) Subtract the valve stem diameter measurement from the bushing inside diameter measurement.

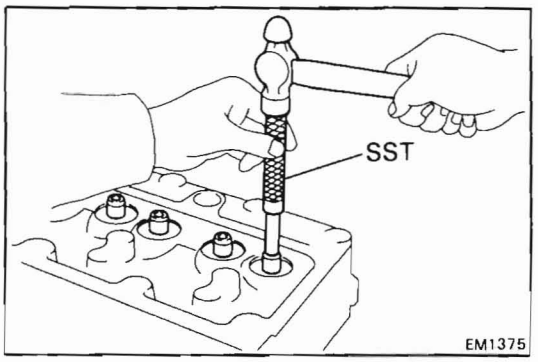
Standard stem oil clearance:

Intake	**0.025 – 0.060 mm (0.0010 – 0.0024 in.)**
Exhaust	**0.035 – 0.070 mm (0.0014 – 0.0028 in.)**

Maximum stem oil clearance:

Intake	**0.10 mm (0.0039 in.)**
Exhaust	**0.12 mm (0.0047 in.)**

If the clearance exceeds maximum, replace the valve and valve guide bushing.

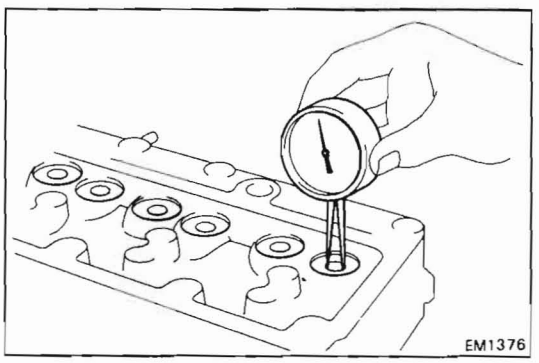


EM1375

10. IF NECESSARY, REPLACE VALVE GUIDE BUSHING

(a) Using SST and a hammer, tap out the valve guide bushing.

SST 09201-60011


EM1376

(b) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Both intake and exhaust

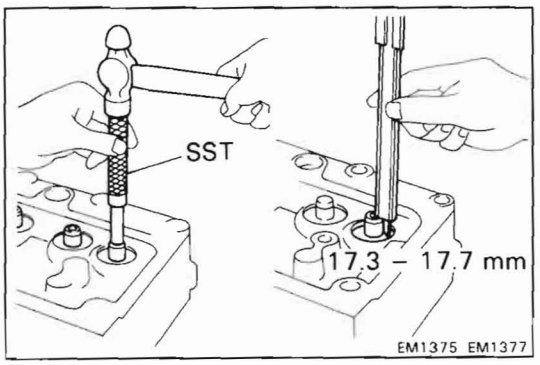
Bushing bore diameter mm (in.)	Bushing size
14.000 – 14.018 (0.5512 – 0.5519)	Use STD
14.050 – 14.068 (0.5531 – 0.5539)	Use O/S 0.05

(c) Select a new valve guide bushing. (STD size or O/S 0.05)

If the bushing bore diameter of the cylinder head is more than 14.018 mm (0.5519 in.), machine the bore to the following dimension.

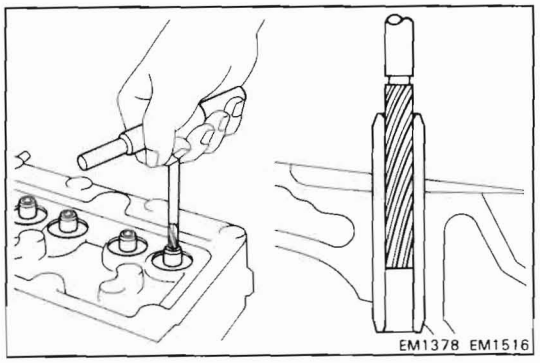
Rebored cylinder head bushing bore dimension:
14.050 – 14.068 mm (0.5531 – 0.5539 in.)

If the bushing bore diameter of the cylinder head exceeds 14.068 mm (0.5539 in.), replace the cylinder head.

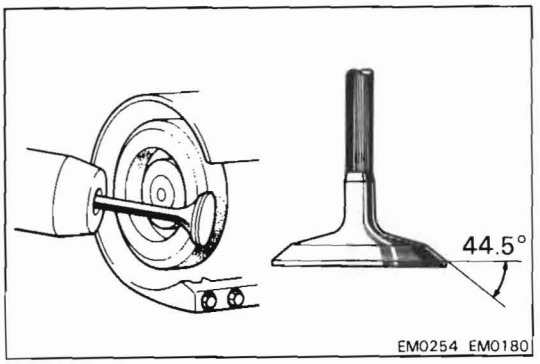


(d) Using SST and a hammer, tap in a new valve guide bushing to where there is 17.3 – 17.7 mm (0.681 – 0.697 in.) protruding from the cylinder head.

SST 09201-60011



(e) Using a sharp 8.0 mm reamer, ream the valve guide bushing to obtain the standard specified clearance (See page EM-20) between the valve guide bushing and new valve stem.

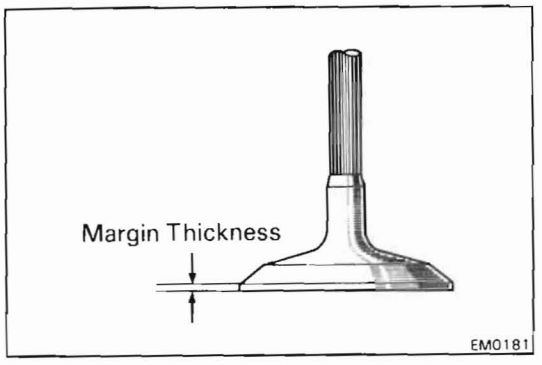


11. INSPECT AND GRIND VALVES

(a) Grind the valve only enough to remove pits and carbon.

(b) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°

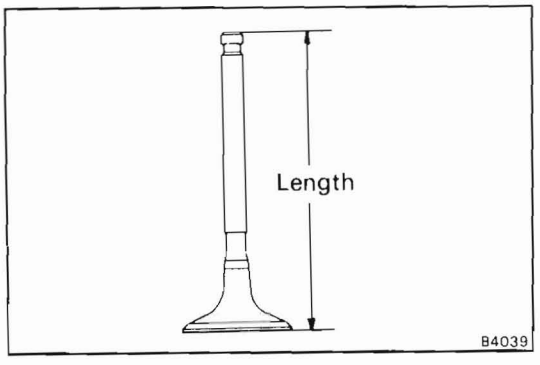


(c) Check the valve head margin thickness.

Standard margin thickness
Intake 1.5 – 2.1 mm (0.059 – 0.083 in.)
Exhaust 1.7 – 2.3 mm (0.067 – 0.091 in.)

Minimum margin thickness:
Intake 1.0 mm (0.039 in.)
Exhaust 1.2 mm (0.047 in.)

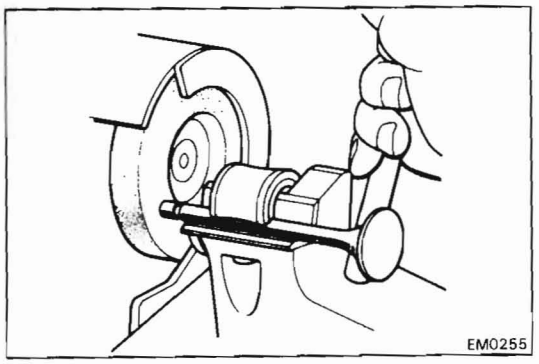
If the valve head margin thickness is less than minimum, replace the valve.



(d) Check the valve overall length.

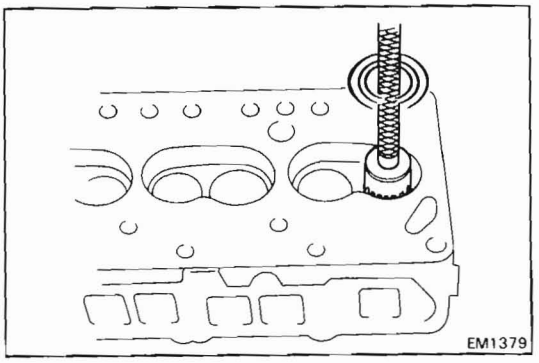
Standard overall length:
Intake 124.8 mm (4.913 in.)
Exhaust
w/ Spring retainer
125.0 mm (4.921 in.)
w/ Valve rotator
128.0 mm (5.039 in.)

Minimum overall length:
Intake 124.3 mm (4.894 in.)
Exhaust
w/ Spring retainer
124.5 mm (4.902 in.)
w/ Valve rotator
127.5 mm (5.020 in.)



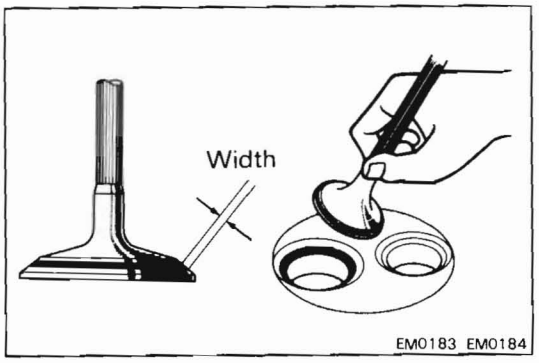
(e) If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

CAUTION: Do not grind off more than the minimum amount.



12. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



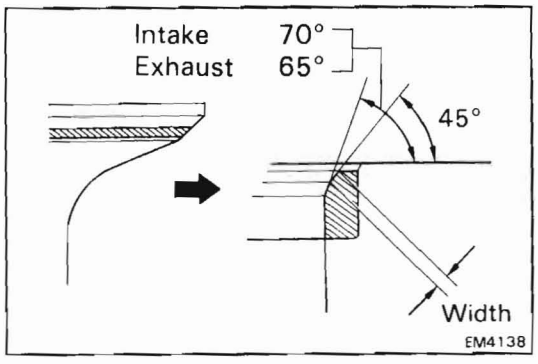
(b) Check the valve seating position.

Apply a thin coat of prussian blue (or white lead) to the valve face. Install the valve. Lightly press the valve against the seat. Do not rotate the valve.

(c) Check the valve face and seat for the following:

- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and seat are concentric. If not, resurface the seat.
- Check that the seat contact is on the middle of the valve face with the following width:

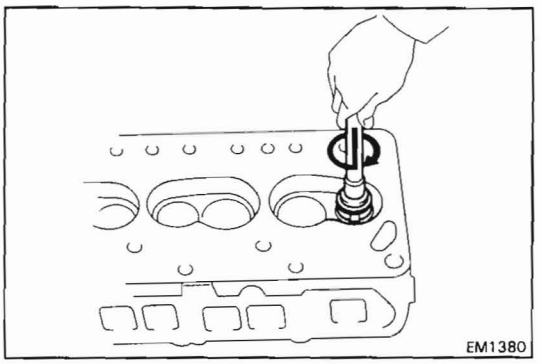
Intake 1.1 – 1.7 mm (0.043 – 0.067 in.)
Exhaust 1.4 – 2.0 mm (0.055 – 0.079 in.)



If not, correct the valve seat as follows:

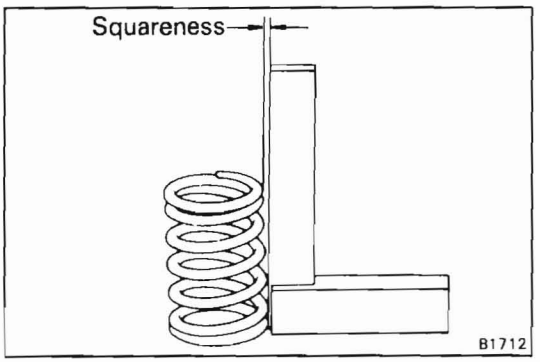
(1) (Intake)
If the seating is too low on the valve face, use 70° and 45° cutters to correct the seat.

(2) (Exhaust)
If the seating is too low on the valve face, use 65° and 45° cutters to correct the seat.



(d) Hand-lap the valve and valve seat with an abrasive compound.

(e) After hand-lapping, clean the valve and valve seat.

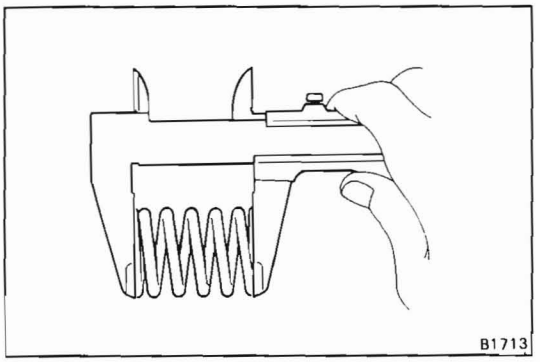


13. INSPECT VALVE SPRINGS

(a) Using a steel square, check the squareness of the valve spring.

Maximum squareness: 1.8 mm (0.071 in.)

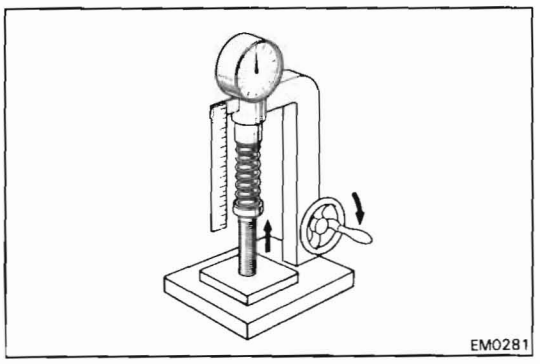
If squareness exceeds maximum, replace the valve spring.



(b) Using calipers, measure the free length of the valve spring.

Free length: 51.5 mm (2.028 in.)

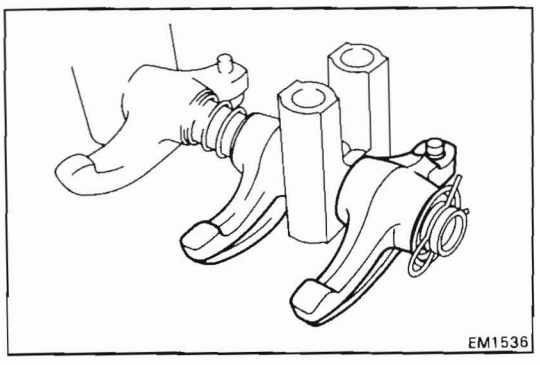
If the free length is not as specified, replace the valve spring.



(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

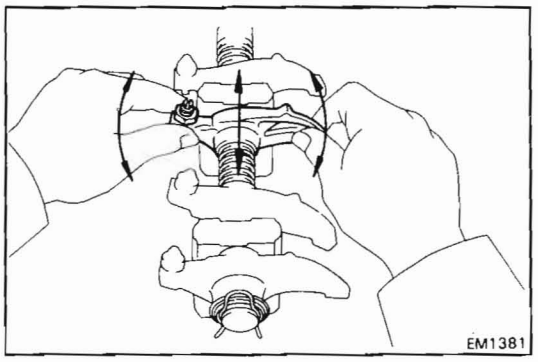
Standard installed tension:
32.5 kg (71.6 lb, 319 N) at 43.0 mm (1.693 in.)
Minimum installed tension:
27 kg (59.5 lb, 265 N) at 43.0 mm (1.693 in.)

If the installed tension is less than minimum, replace the valve spring.



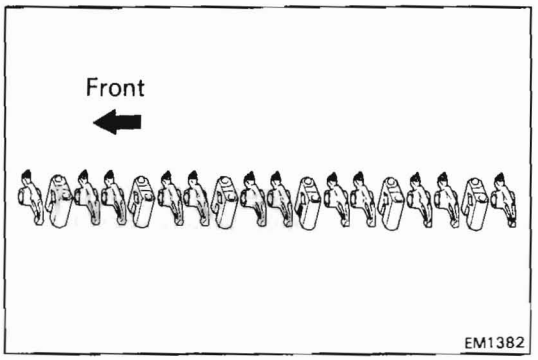
14. INSPECT ROCKER ARM AND SHAFT

(a) Inspect the valve contacting surface of the rocker arm for wear.



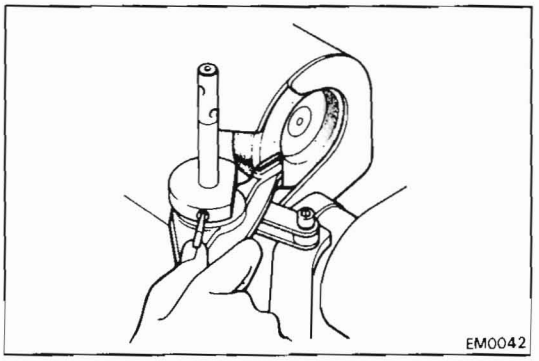
(b) Inspect the rocker arm-to-shaft clearance by moving each rocker arm as shown in the figure.

If movement is felt, disassemble and inspect.

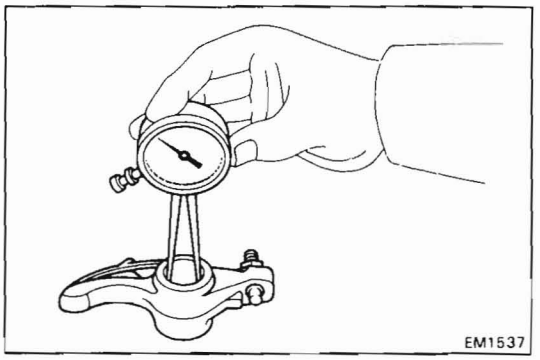


(c) Disassemble the valve rocker shaft assembly.

NOTE: Arrange the rocker arms and rocker supports in correct order.



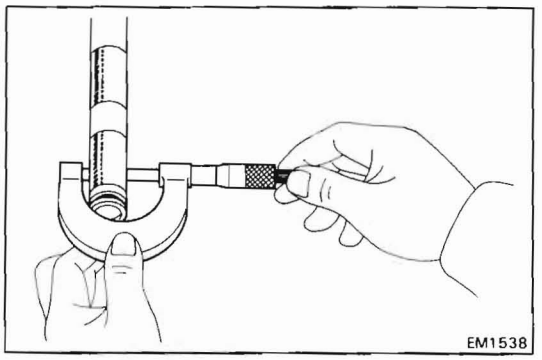
If the contacting surface of the rocker arm is worn, resurface it with a valve refacer and oil stone or replace the rocker arm.



(d) Inspect the oil clearance between the rocker arm and shaft.

- Using a caliper gauge, measure the inside diameter of the rocker arm.

Rocker arm inside diameter:
18.494 – 18.515 mm (0.7281 – 0.7289 in.)



- Using a micrometer, measure the diameter of the rocker shaft.

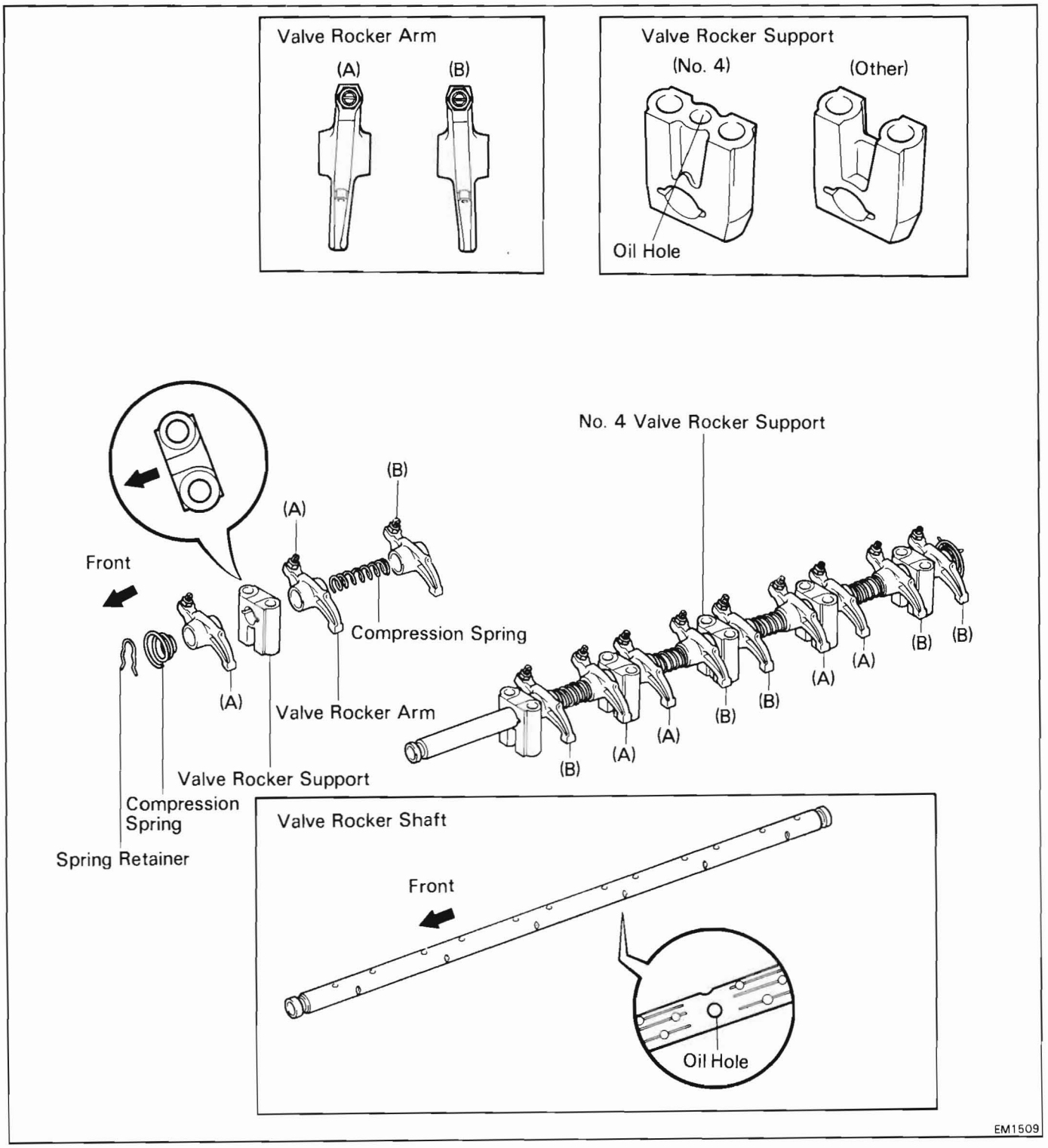
Rocker shaft diameter:
18.464 – 18.485 mm (0.7269 – 0.7278 in.)

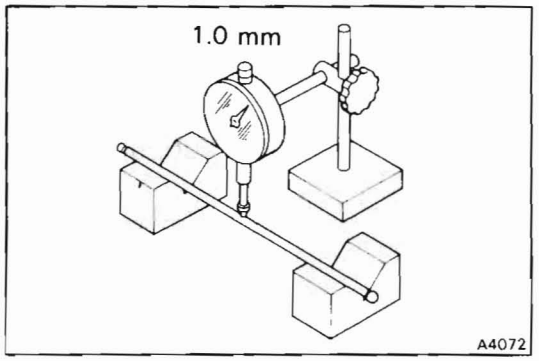
- Subtract the rocker shaft diameter measurement from the inside diameter measurement of the rocker arm.

Standard oil clearance: **0.009 – 0.051 mm (0.0004 – 0.0020 in.)**
Maximum oil clearance: **0.08 mm (0.0031 in.)**

If the clearance exceeds maximum, replace the rocker arm and chaft.

(e) Assemble the valve rocker shaft assembly as shown.





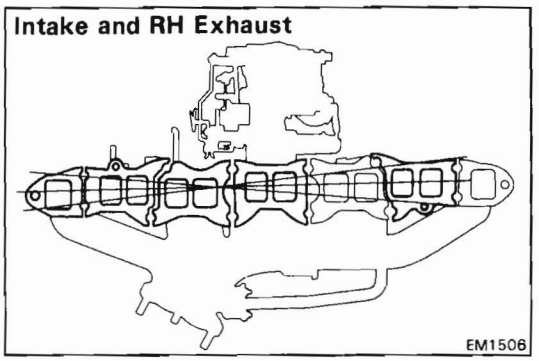
15. INSPECT PUSH RODS

(a) Place the push rod on V-blocks.

(b) Using a dial indicator, measure the circle runout at the center of the push rod.

Maximum circle runout: 1.0 mm (0.039 in.)

If the circle runout exceeds the maximum, replace the push rod.



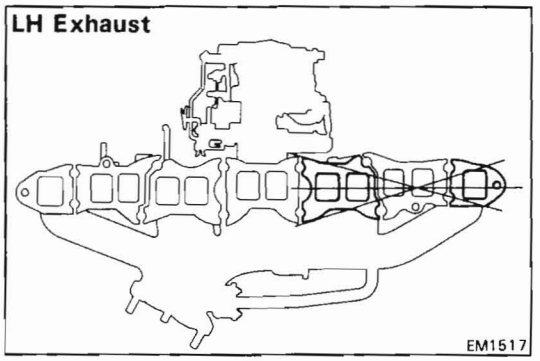
16. INSPECT INTAKE AND EXHAUST MANIFOLDS

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:

Intake with RH exhaust
0.50 mm (0.0197 in.)
LH exhaust 0.30 mm (0.0118 in.)

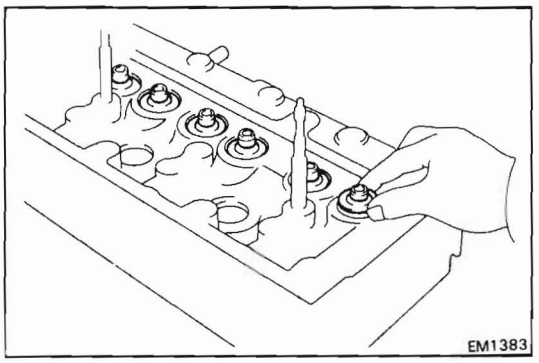
If warpage exceeds maximum, separete and inspect the intake and exhaust manifold. If necessary, replace the manifold.



ASSEMBLY OF CYLINDER HEAD

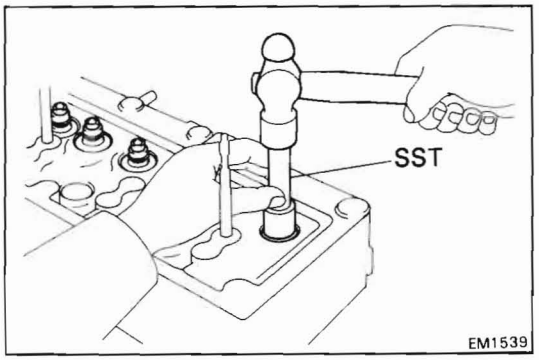
(See page EM-14)

NOTE:
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



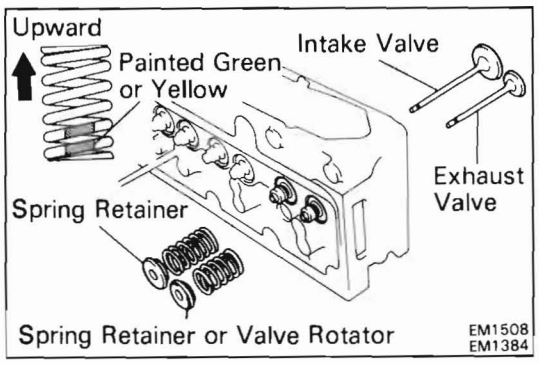
INSTALL VALVES

(a) Place the spring seat on the cylinder head.

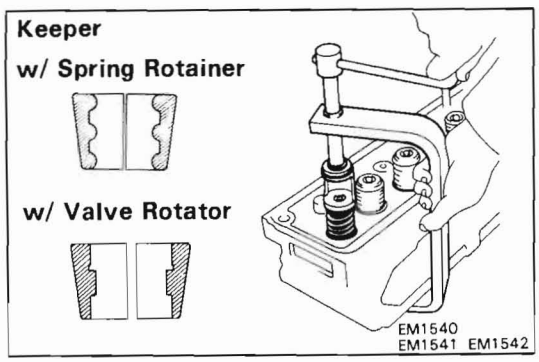


(b) Using SST and a hammer, tap in a new oil seal.

SST 09201-31010

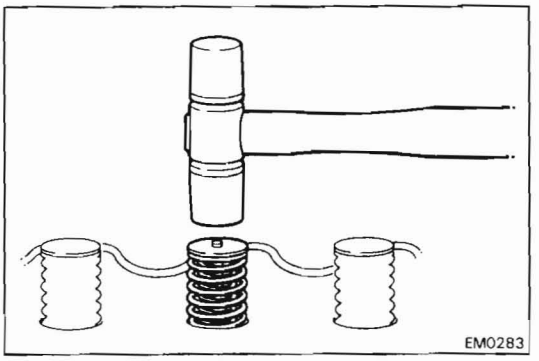


(c) Install the valve, valve spring and spring retainer (or valve rotator).

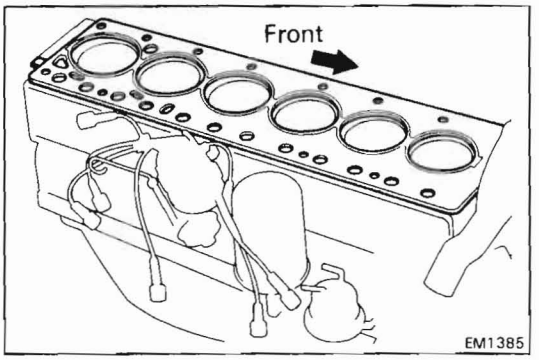


(d) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-43013



(e) Using a plastic-faced hammer, lightly tap the valve stem to assure proper fit.



INSTALLATION OF CYLINDER HEAD

(See page EM-14)

1. INSTALL CYLINDER HEAD

(a) Place a new cylinder head gasket on the cylinder block.

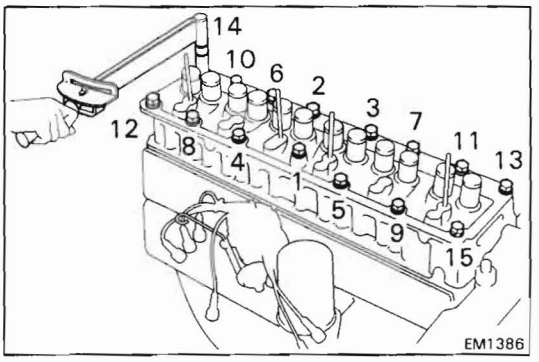
CAUTION: Be careful of the installation direction.

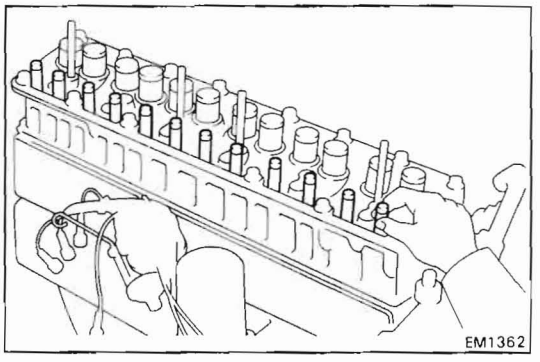
(b) Place the cylinder head on the cylinder head gasket.

(c) Apply a light coat of engine oil on the threads and under the cylinder head bolts.

(d) Install and uniformly tighten the fifteen cylinder head bolts in several passes, in the sequence shown.

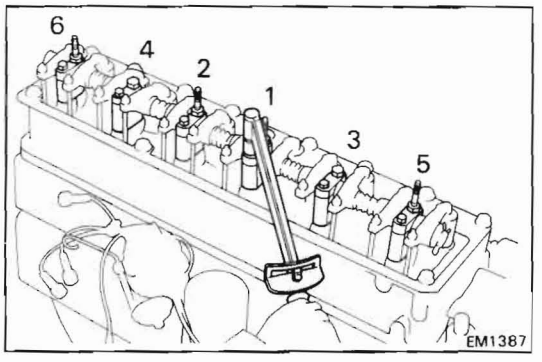
Torque: 1,250 kg-cm (90 ft-lb, 123 N·m)





2. INSTALL PUSH RODS

Install the twelve push rods.



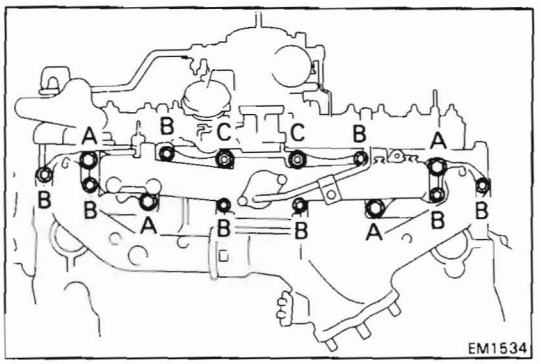
3. INSTALL VALVE ROCKER SHAFT ASSEMBLY

(a) Place the rocker shaft assembly on the cylinder head.

(b) Install and uniformly tighten the eight bolts and four nuts in several passes, in the sequence shown.

Torque:

12 mm bolt head 240 kg-cm (17 ft-lb, 24 N·m)
14 mm bolt head and nut 340 kg-cm (25 ft-lb, 33 N·m)

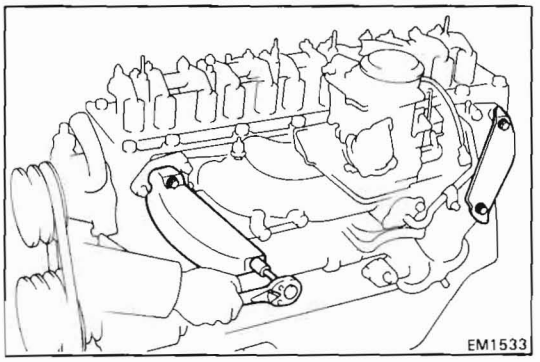


4. INSTALL INTAKE, EXHAUST MANIFOLDS AND CARBURETOR ASSEMBLY

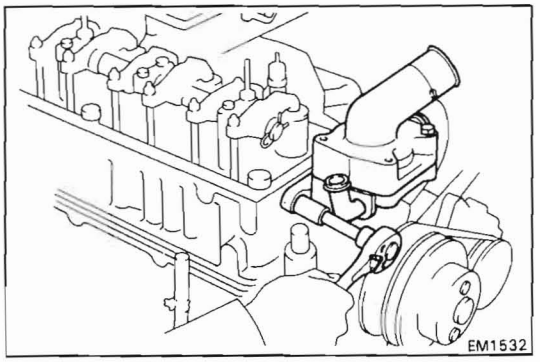
(a) Install a new gasket, the intake, manifolds and carburetor assembly with the twelve bolts, two plate washers and nuts. Torque the bolts and nuts.

Torque:

17 mm bolt (A)	**700 kg-cm (51 ft-lb, 69 N·m)**
14 mm bolt (B)	**510 kg-cm (37 ft-lb, 50 N·m)**
Nut(C)	**570 kg-cm (41 ft-lb, 56 N·m)**



(b) Install the two insulators with the four bolts.

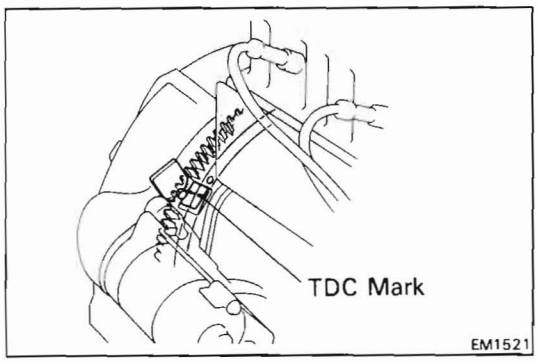


5. INSTALL WATER OUTLET ASSEMBLY

(a) Install a new gasket and the water outlet assembly with the two bolts. Torque the bolts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

(b) Connect the water by-pass hose.

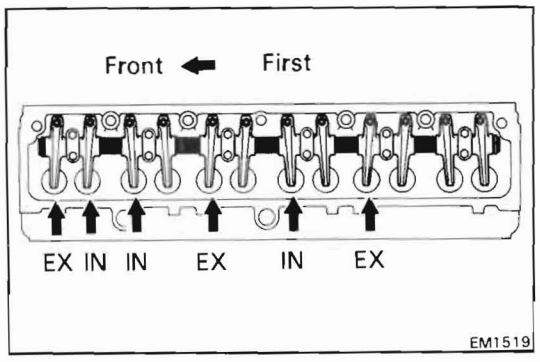


6. ADJUST VALVE CLEARANCES

(a) Set the No. 1 cylinder to TDC/compression.
Align the TDC mark of the flywheel with the timing pointer by turning the crankshaft clockwise with a wrench.

(b) Check that the rocker arms on the No. 1 cylinder are loose and rocker arms on the No. 6 cylinder are tight.

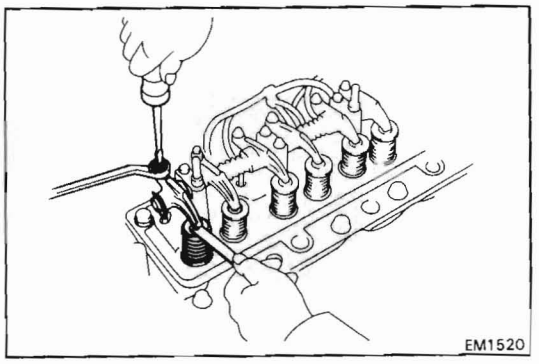
If not, turn the crankshaft one revolution (360°) and align the mark as above.



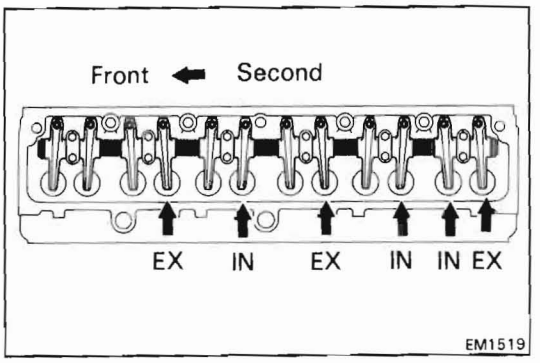
(c) Adjust only those valves indicated by arrows.

Valve clearance (Hot):

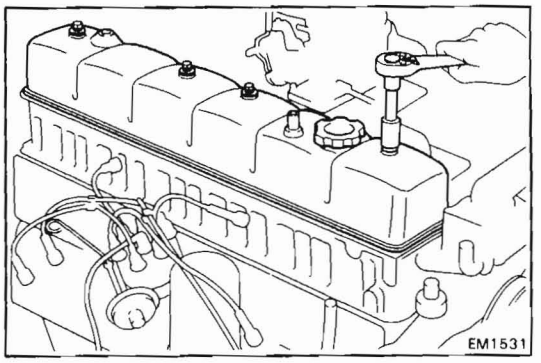
Intake	**0.20 mm (0.008 in.)**
Exhaust	**0.35 mm (0.014 in.)**



- Using a feeler gauge, measure the valve clearance between the valve stem and rocker arm. Loosen the lock nut and turn the adjusting screw to set the proper clearance. Hold the adjusting screw in position and tighten the lock nut.
- Recheck the valve clearance. The feeler gauge should slide with a very slight drag.



(d) Turn the crankshaft one revolution (360°) and align the mark as above.
Adjust only the valves indicated by arrows.



7. INSTALL CYLINDER HEAD COVER

(a) Install a new gasket to the cylinder head cover.

(b) Install the cylinder head cover with the four seal washers and cap nuts.

Torque: 90 kg-cm (78 in.-lb, 8.8 N·m)

8. INSTALL FUEL PIPE

9. INSTALL SPARK PLUGS

10. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

11. INSTALL HEATER AND OIL COOLER PIPES

(a) Install the heater and oil cooler pipes with the screws.

(b) Connect the hoses to the water outlet, water pump and oil cooler.

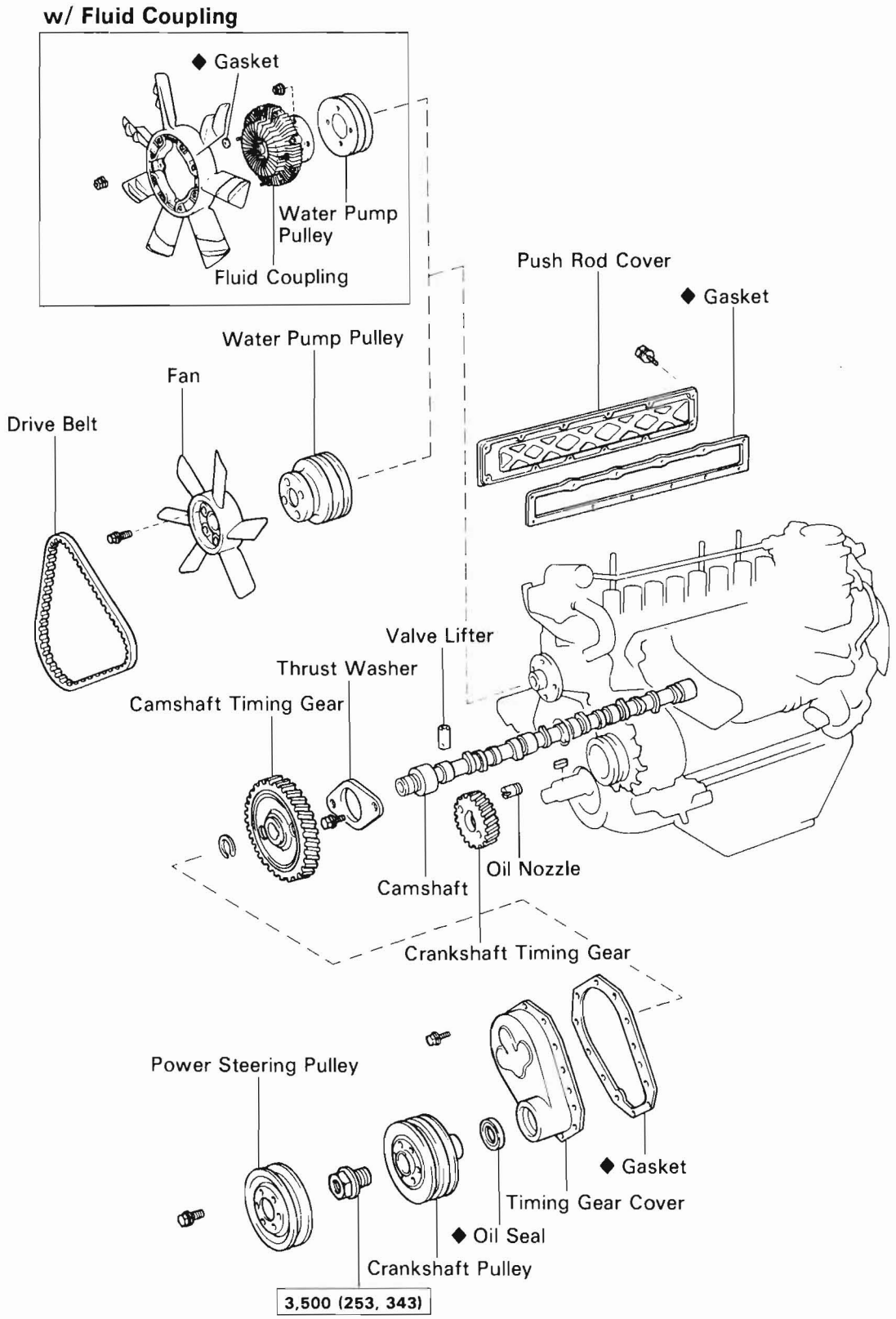
12. FILL WITH ENGINE COOLANT (See page CO-3)

13. START ENGINE AND CHECK FOR LEAKS

14. CHECK ENGINE OIL LEVEL (See page LU-3)

TIMING GEARS AND CAMSHAFT

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ : Non-reusable part

EM1543

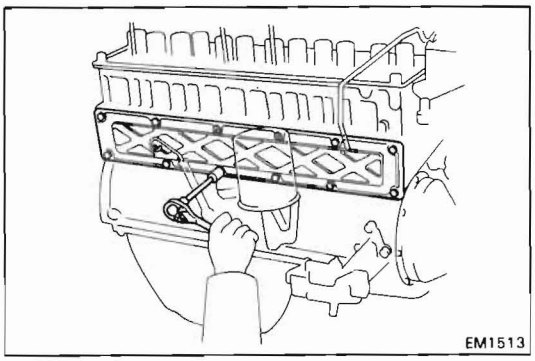
REMOVAL OF TIMING GEARS AND CAMSHAFT

(See page EM-31)

1. **REMOVE DISTRIBUTOR**

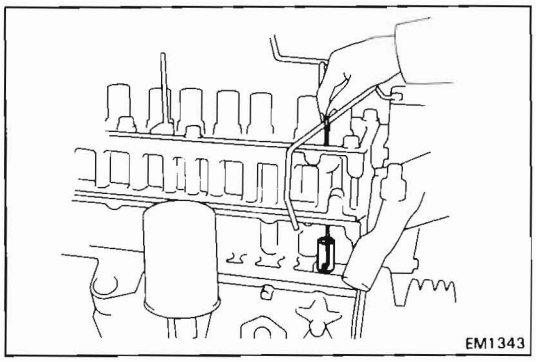
2. **REMOVE FUEL PUMP (See page FU-24)**

3. **REMOVE VALVE ROCKER SHAFT ASSEMBLY (See steps 5, 6, 9 and 10 on pages EM-15 and 16)**


EM1513

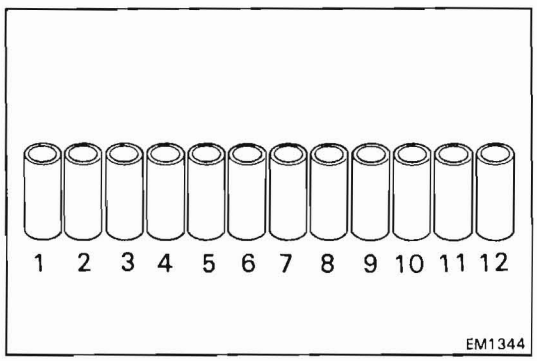
4. **REMOVE PUSH ROD COVER**

   Remove the ten bolts, two nuts, push rod cover and gasket.


EM1343

5. **REMOVE VALVE LIFTERS**

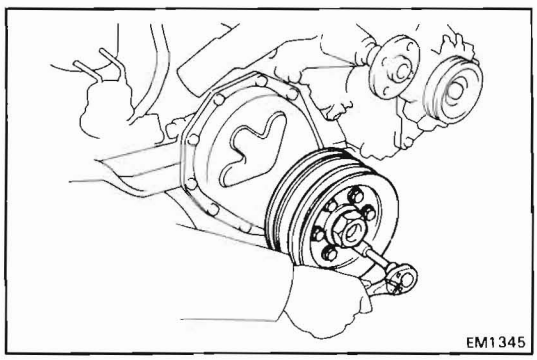
   Using a piece of wire, remove the twelve valve lifters in order, beginning from the No. 1 valve lifter.



EM1344

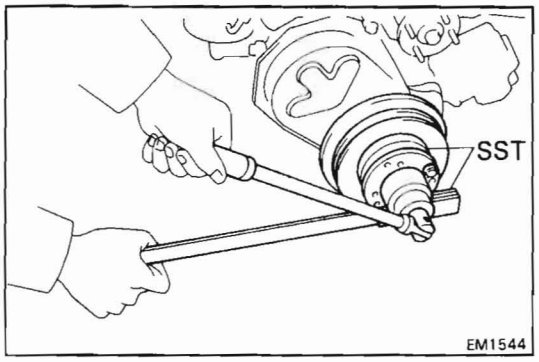
NOTE: Arrange the valve lifters in correct order.

6. **REMOVE DRIVE BELTS**


EM1345

7. **(w/ PS)**
   REMOVE POWER STEERING (PS) PULLEY FROM CRANKSHAFT PULLEY

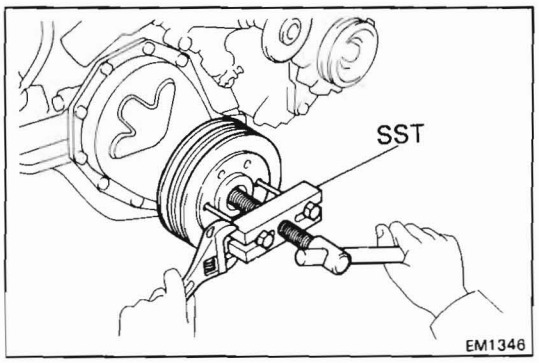
   Remove the six bolts and PS pulley.



8. REMOVE CRANKSHAFT PULLEY

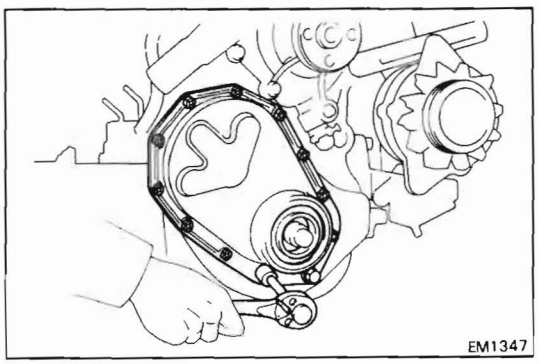
(a) Using SST and a 46 mm socket wrench, remove the pulley mount bolt.

SST 09213-58010 and 09330-00020



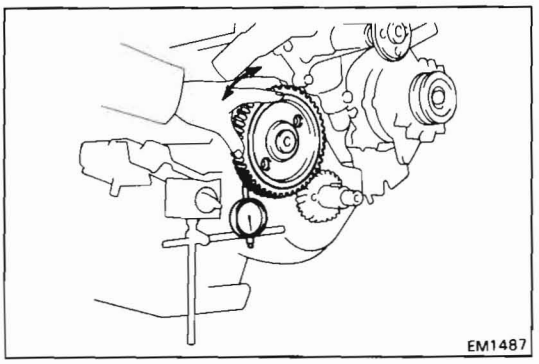
(b) Using SST, remove the pulley.

SST 09213-60017



9. REMOVE TIMING GEAR COVER

Remove the twelve bolts, gear cover and gasket.



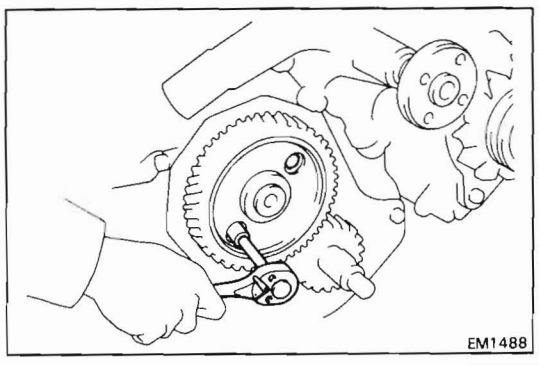
10. CHECK TIMING GEAR BACKLASH

Using a dial indicator, measure the backlash at several places while turning the camshaft clockwise and counter-clockwise.

Standard backlash: 0.100 – 0.183 mm (0.0039 – 0.0072 in.)

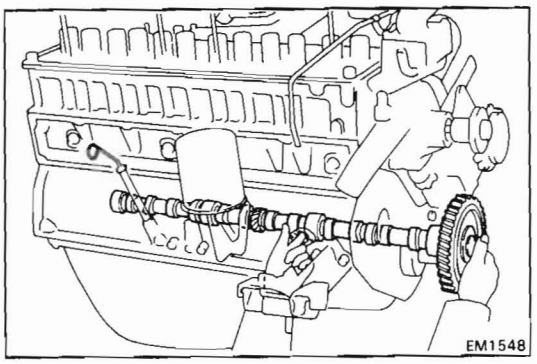
Maximum backlash: 0.25 mm (0.0098 in.)

If the backlash exceeds maximum, replace the camshaft and crankshaft timing gears.



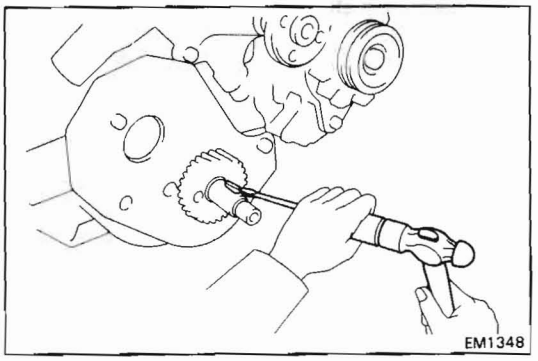
11. REMOVE CAMSHAFT TIMING GEAR AND CAMSHAFT ASSEMBLY

(a) Remove the two bolts mounting the thrust plate to the cylinder block.



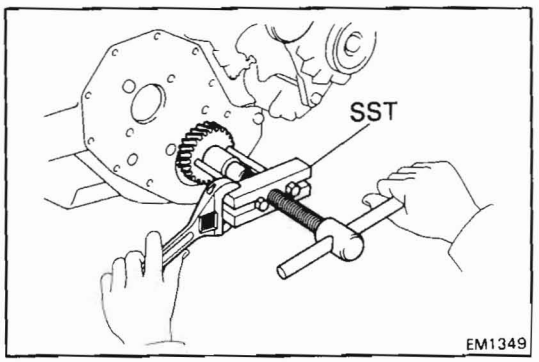
(b) Carefully pull out the camshaft and timing gear assembly.

CAUTION: Be careful not to damage the camshaft bearings.



12. REMOVE CRANKSHAFT TIMING GEAR

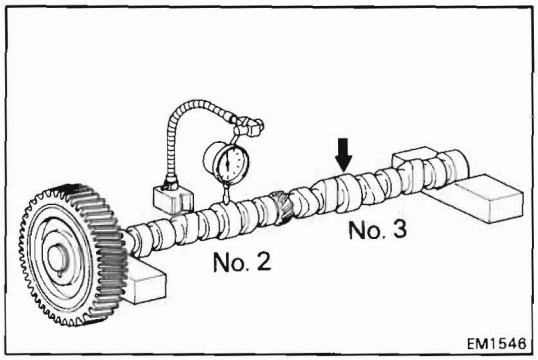
(a) Using a screwdriver and hammer, tap out the crankshaft pulley set key.

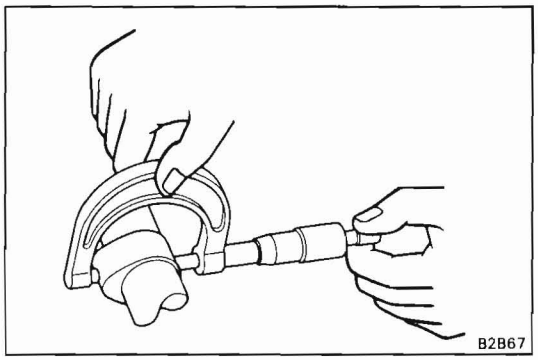


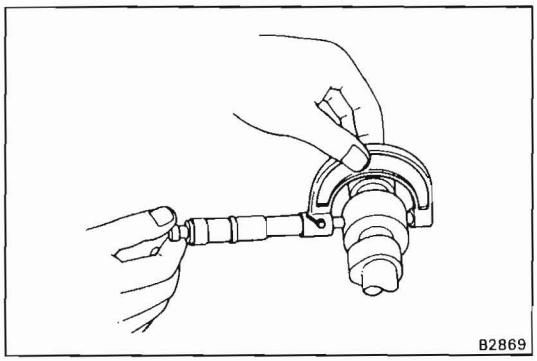
(b) Using SST, remove the timing gear.

SST 09213-60017

13. IF NECESSARY, REMOVE OIL NOZZLE







INSPECTION OF TIMING GEARS AND CAMSHAFT

INSPECT CAMSHAFT

(a) Place the camshaft on V-blocks and, using a dial indicator, measure the circle runout at the No. 2 and No. 3 journals.

Maximum circle runout: 0.30 mm (0.0118 in.)

If the circle runout exceeds maximum, replace the camshaft.

(b) Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake	**38.36 – 38.46 mm (1.5102 – 1.5142 in.)**
Exhaust	**38.25 – 38.35 mm (1.5059 – 1.5098 in.)**

Minimum cam lobe height:

Intake	**38.0 mm (1.496 in.)**
Exhaust	**37.9 mm (1.492 in.)**

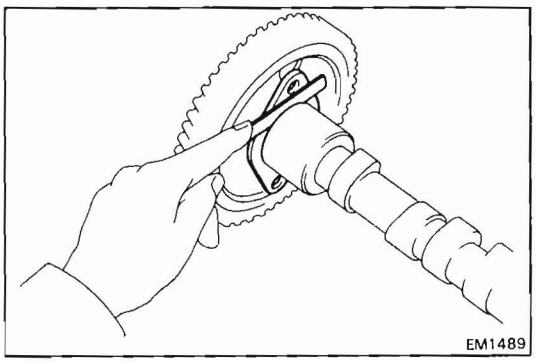
If the lobe height is less than minimum, replace the camshaft.

(c) Using a micrometer, measure the journal diameter.

Journal diameter (from front side):

STD	**No. 1**	**47.955 – 47.975 mm (1.8880 – 1.8888 in.)**
	No. 2	**46.455 – 46.475 mm (1.8289 – 1.8297 in.)**
	No. 3	**44.955 – 44.975 mm (1.7699 – 1.7707 in.)**
	No. 4	**43.455 – 43.475 mm (1.7108 – 1.7116 in.)**
U/S 0.25	**No. 1**	**47.715 – 47.725 mm (1.8785 – 1.8789 in.)**
	No. 2	**46.215 – 46.225 mm (1.8195 – 1.8199 in.)**
	No. 3	**44.715 – 44.725 mm (1.7604 – 1.7608 in.)**
	No. 4	**43.215 – 43.225 mm (1.7014 – 1.7018 in.)**
U/S 0.50	**No. 1**	**47.465 – 47.475 mm (1.8687 – 1.8691 in.)**
	No. 2	**45.965 – 45.975 mm (1.8096 – 1.8888 in.)**
	No. 3	**44.465 – 44.475 mm (1.7506 – 1.7510 in.)**
	No. 4	**42.965 – 42.975 mm (1.6915 – 1.6919 in.)**

If the journal diameter is not within specification, check the oil clearance. (See page EM-58)

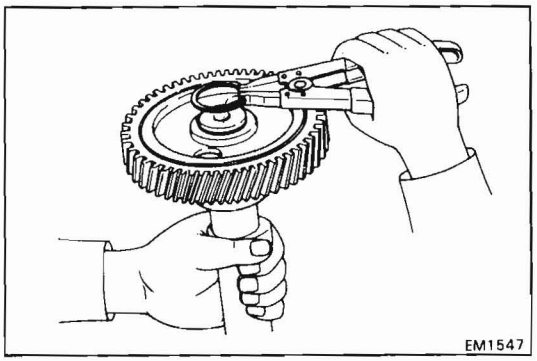


(d) Using a feeler gauge, measure the thrust clearance between the thrust plate and camshaft.

Standard thrust clearance: 0.200 — 0.290 mm (0.0079 — 0.0114 in.)

Maximum thrust clearance: 0.33 mm (0.0130 in.)

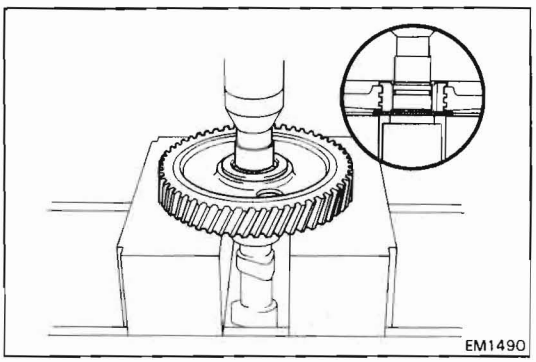
If the clearance exceeds maximum, replace the thrust plate. If necessary, replace the camshaft.



REPLACEMENT OF CAMSHAFT (OR CAMSHAFT TIMING GEAR)

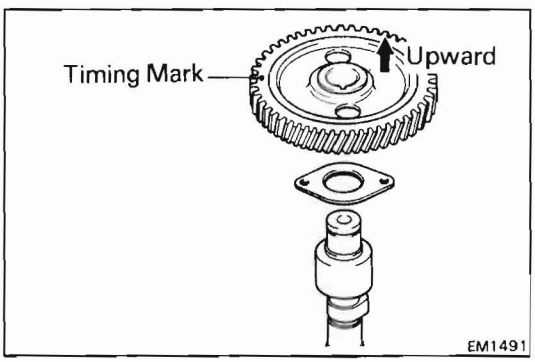
1. REMOVE SNAP RING

Using snap ring pliers, remove the snap ring.



2. REMOVE CAMSHAFT

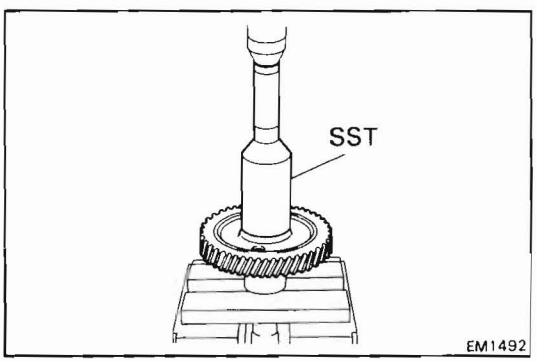
Using a socket wrench and press, press out the camshaft.



3. INSTALL NEW CAMSHAFT

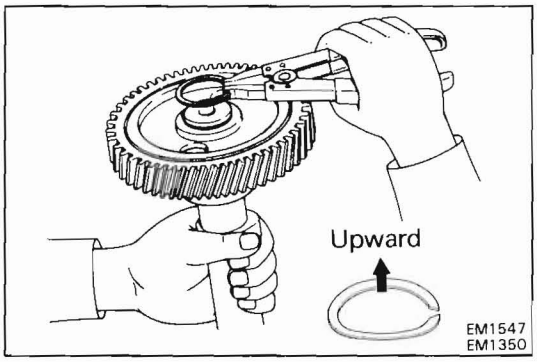
(a) Install the timing gear set key to the camshaft.

(b) Assemble the camshaft, thrust plate and timing gear as shown.



(c) Using SST and a press, align the timing gear set key with the key groove of the timing gear, and press in the camshaft.

SST 09214-60010

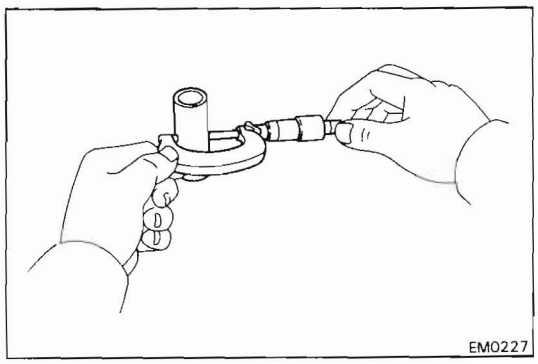


4. INSTALL SNAP RING

Using snap ring pliers, install the snap ring as shown.

5. CHECK CAMSHAFT THRUST CLEARANCE (See page EM-36)

Thrust clearance: 0.200 — 0.290 mm (0.0079 — 0.0114 in.)



INSPECTION OF VALVE LIFTERS

INSPECT VALVE LIFTERS

Using a micrometer, measure the valve lifter diameter.

Lifter diameter:

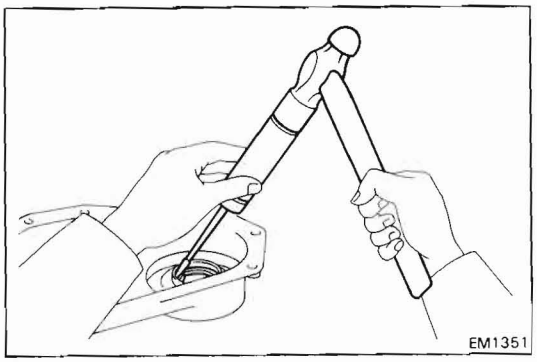
STD	**21.387 — 21.404 mm (0.8420 — 0.8427 in.)**
O/S 0.05	**21.437 — 21.454 mm (0.8440 — 0.8446 in.)**

If the diameter is not within specification, check the oil clearance. (See page EM-60)

REPLACEMENT OF CRANKSHAFT FRONT OIL SEAL

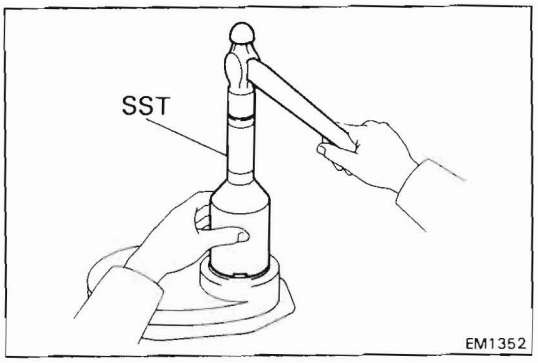
REPLACE CRANKSHAFT FRONT OIL SEAL

NOTE: There are two methods (A and B) to replace the oil seal as follows.



A. If timing gear cover is removed from cylinder block:

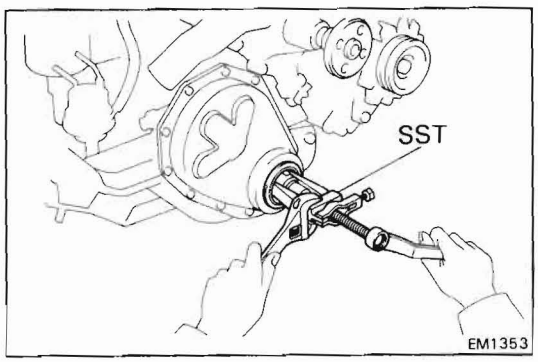
(a) Using a screwdriver and hammer, tap out the oil seal.



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the timing gear cover edge.

SST 09214-76011

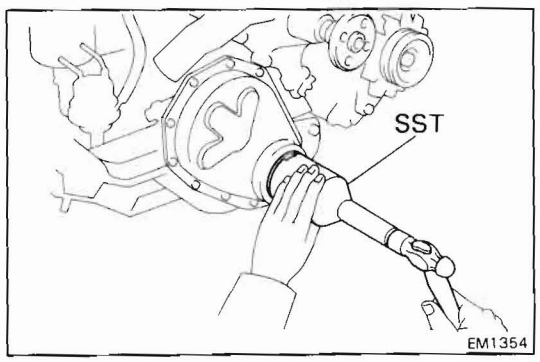
(c) Apply MP grease to the oil seal lip.



B. If timing gear cover is installed to cylinder block:

(a) Using SST, remove the oil seal.

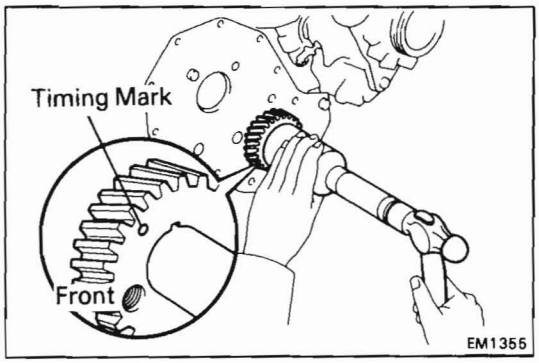
SST 09308-10010

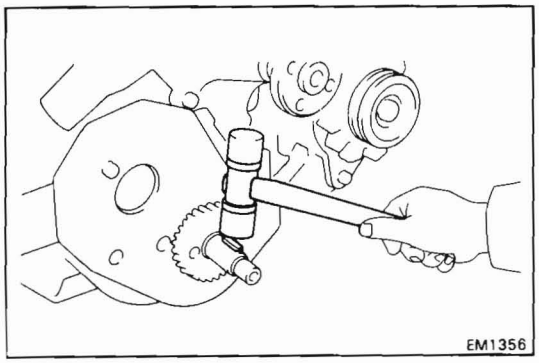


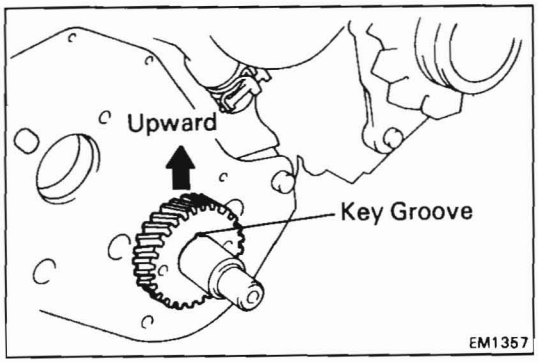
(b) Apply MP grease to a new oil seal lip.

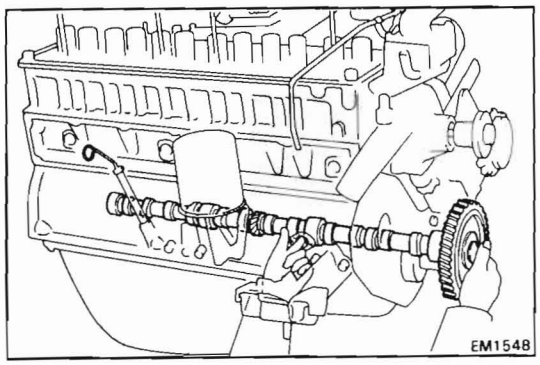
(c) Using SST and a hammer, tap in the oil seal until its surface is flush with the timing gear cover edge.

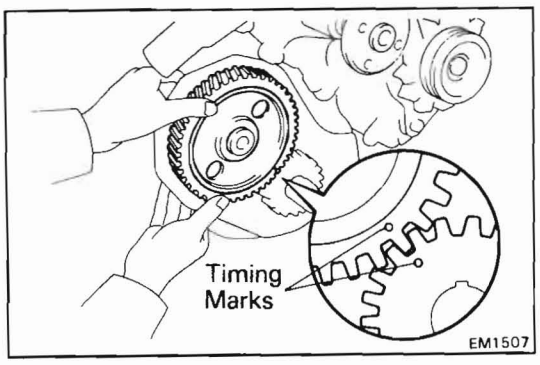
SST 09214-76011











INSTALLATION OF TIMING GEARS AND CAMSHAFT

(See page EM-31)

1. INSTALL CRANKSHAFT TIMING GEAR

(a) Put the timing gear on the crankshaft with the timing mark facing frontward.

(b) Align the timing gear set key with the key groove of the timing gear.

(c) Using SST and a hammer, tap in the timing gear.

SST 09214-60010

(d) Using a plastic-faced hammer, tap in the crankshaft pulley set key.

2. INSTALL CAMSHAFT TIMING GEAR AND CAMSHAFT ASSEMBLY

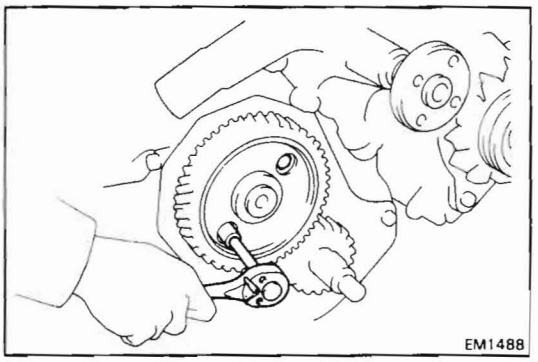
(a) Set the crankshaft timing gear with the key groove facing upward by turning the crankshaft clockwise.

(b) Insert the camshaft into the cylinder block:

CAUTION: Be careful not to damage the camshaft bearings.

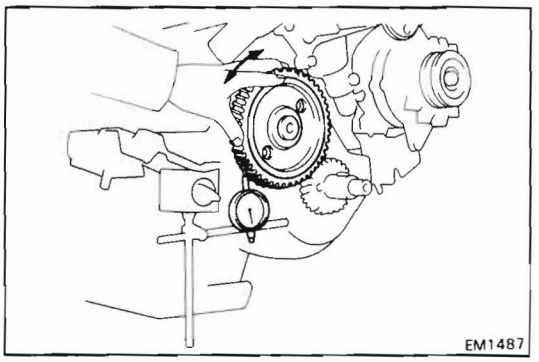
(c) Align the timing marks of the crankshaft and camshaft timing gears and mesh the gears.

NOTE: At this time, No. 6 cylinder should be at TDC/compression.



(d) Install the two bolts mounting the thrust washer to the cylinder block. Torque the bolts.

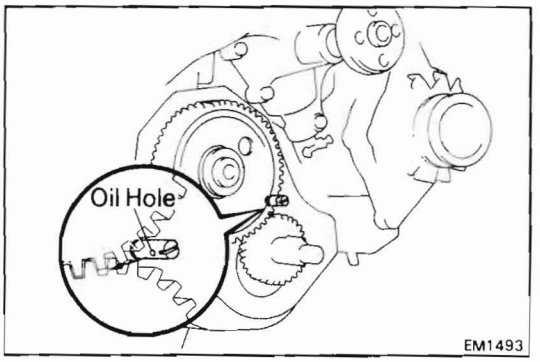
Torque: 120 kg-cm (9 ft-lb, 12 N·m)



3. CHECK TIMING GEAR BACKLASH

Using a dial indicator, measure the backlash at several places while turning the camshaft clockwise and counter-clockwise.

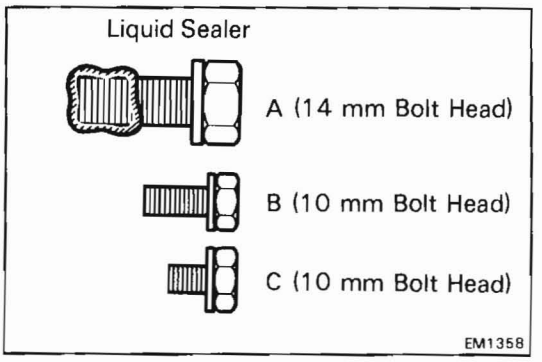
Standard backlash: 0.100 – 0.183 mm (0.0039 –0.0072 in.)
Maximum backlash: 0.20 mm (0.0078 in.)



4. INSTALL OIL NOZZLE

(a) Install and set the oil nozzle in position.

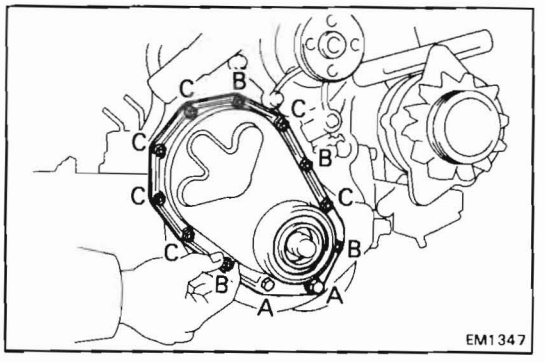
(b) Using a chisel and hammer, stake the threads of the oil nozzle.



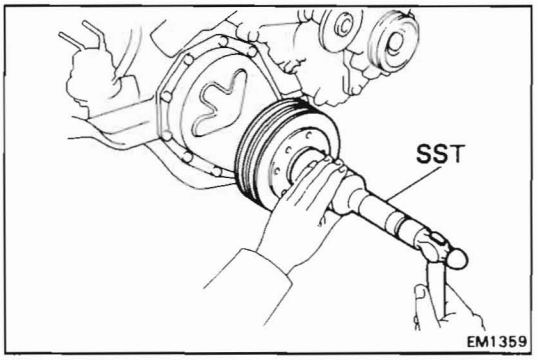
5. INSTALL TIMING GEAR COVER AND CRANKSHAFT PULLEY

NOTE: There are three side timing gear cover bolts indicated A, B and C.

(a) Apply liquid sealer to the threads of the two A bolts.



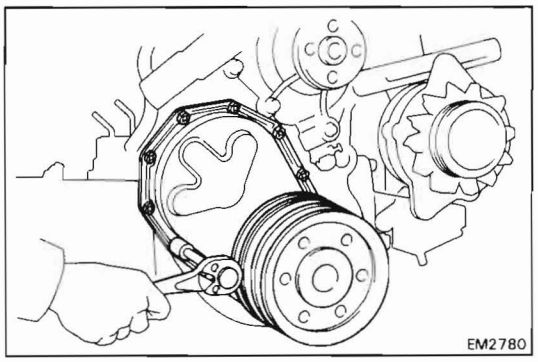
(b) Install a new gasket and the gear cover with the twelve bolts. Finger tighten all bolts.



(c) Align the pulley set key with the key groove of the pulley.

(d) Using SST and a hammer, tap in the pulley.

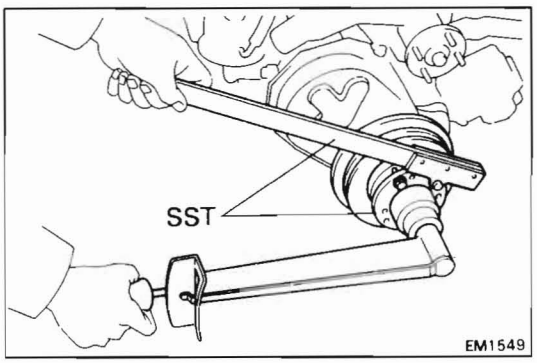
SST 09214-60010



(e) After installing the pulley, torque the cover bolts.

Torque:

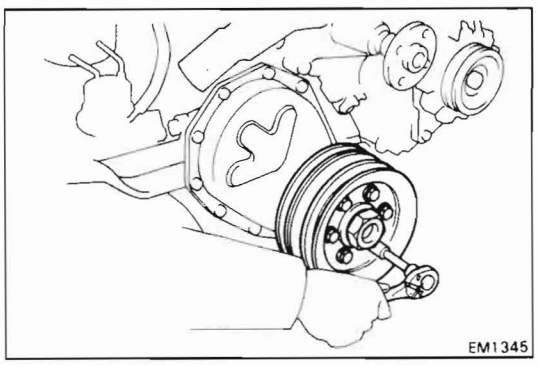
Bolts A	**250 kg-cm (18 ft-lb, 25 N·m)**
Bolts B and C	**50 kg-cm (43 in.-lb, 4.9 N·m)**



(f) Using SST and a 46-mm socket wrench, install and torque the pulley mount bolt.

SST 09213-58010

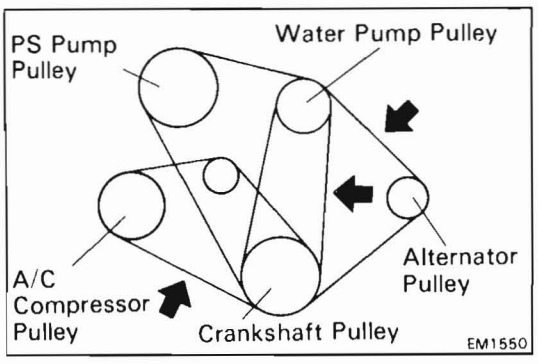
Torque: 3,500 kg-cm (253 ft-lb, 343 N·m)



6. (w/ PS)
INSTALL POWER STEERING (PS) PULLEY TO CRANKSHAFT PULLEY

Install the PS pulley with the six bolts. Torque the bolts.

Torque: 185 kg-cm (13 ft-lb, 18 N·m)



7. INSTALL AND ADJUST DRIVE BELTS

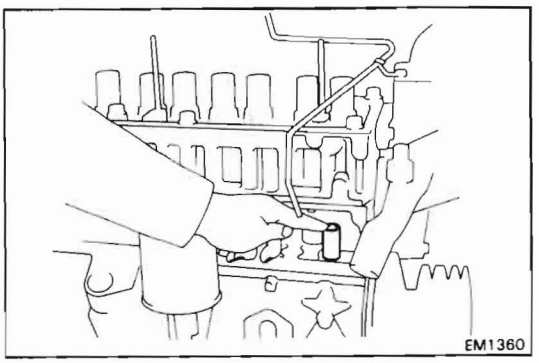
Drive belt defection at 10kg (22.0 lb, 98 N):

Alternator to water pump –
New belt 7.0 – 9.0 mm (0.278 – 0.354 in.)
Used belt 9.0 – 12.0 mm (0.354 – 0.472 in.)

PS pump to crankshaft –
New belt 7.0 – 9.5 mm (0.278 – 0.374 in.)
Used belt 8.0 – 10.0 mm (0.315 – 0.393 in.)

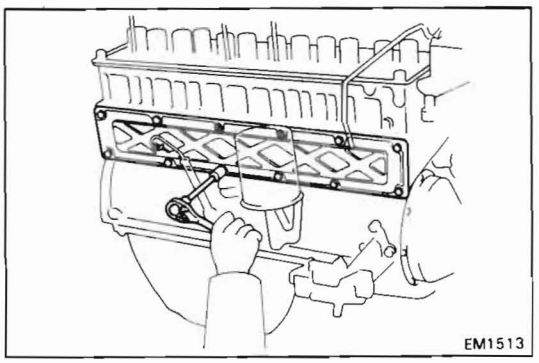
A/C compressor to crankshaft –
New belt 12.0 – 15.0 mm (0.472 – 0.590 in.)
Used belt 15.0 – 21.0 mm (0.590 – 0.827 in.)

NOTE:
- "New belt" refers to a new belt which has been used less than 5 minutes.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the belt, run the engine for about 5 minutes and then recheck the deflection.



8. INSTALL VALVE LIFTER

Carefully insert the twelve lifters into the lifter bore.



9. INSTALL VALVE LIFTER COVER

Install a new gasket and the lifter cover with the ten bolts and two nuts.

Torque: 40 kg-cm (35 in.-lb, 3.9 N·m)

10. INSTALL VALVE ROCKER SHAFT ASSEMBLY (See steps 2, 3, 6 and 7 on pages EM-28 to 30)

11. INSTALL FUEL PUMP (See page FU-25)

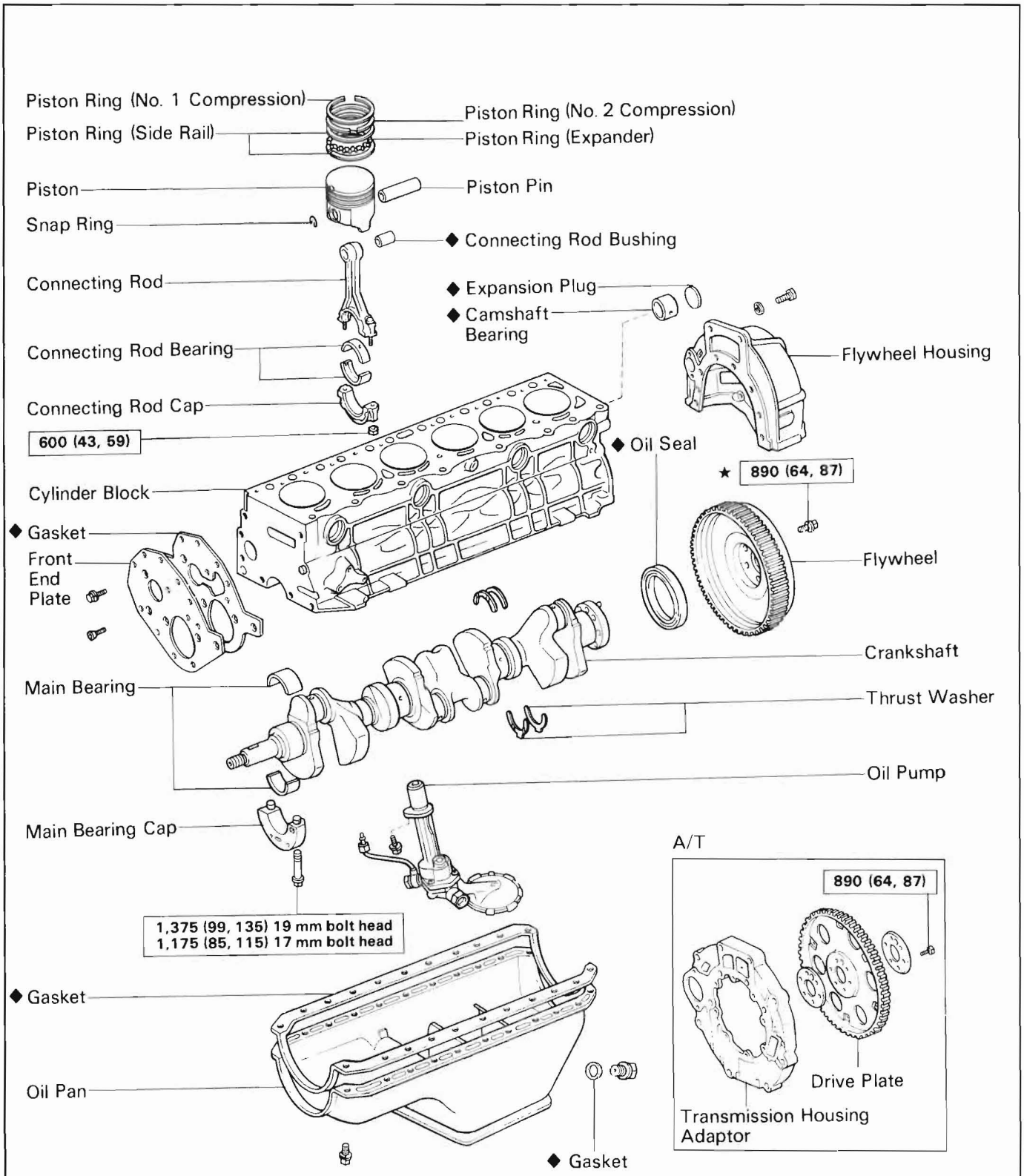
12. INSTALL DISTRIBUTOR (See page IG-16 or 26)

13. START ENGINE AND CHECK FOR LEAKS

14. CHECK ENGINE OIL (See page LU-3)

CYLINDER BLOCK

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ : Non-reusable part

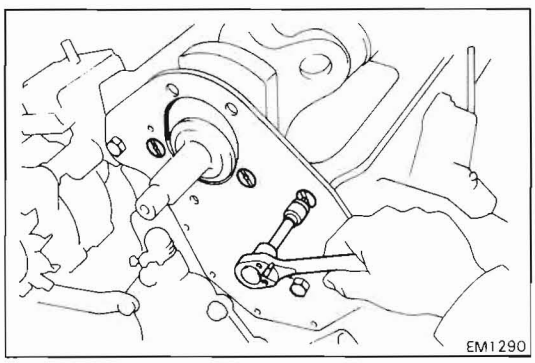
★ : Precoated part

EM1518

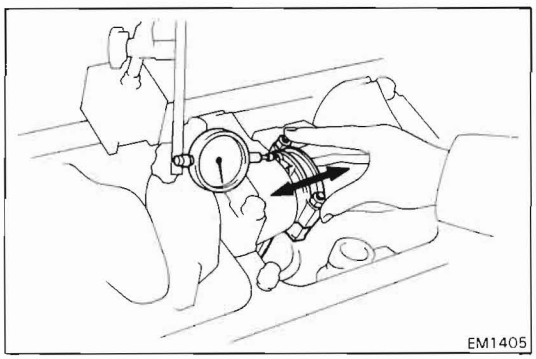
DISASSEMBLY OF CYLINDER BLOCK

(See page EM-43)

1. (M/T)
   REMOVE CLUTCH COVER AND DISC
2. (M/T)
   REMOVE FLYWHEEL
3. (A/T)
   REMOVE DRIVE PLATE
4. (M/T)
   REMOVE FLYWHEEL HOUSING
5. (A/T)
   REMOVE TRANSMISSION HOUSING ADAPTOR
6. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
7. REMOVE CYLINDER HEAD
   (See steps 5, 6, 9 to 11 on pages EM-15 to 17)
8. REMOVE TIMING GEARS AND CAMSHAFT
   (See steps 1, 2, 4, to 13 on pages EM-32 to 34)
9. REMOVE OIL PAN AND OIL PUMP (See page LU-6)



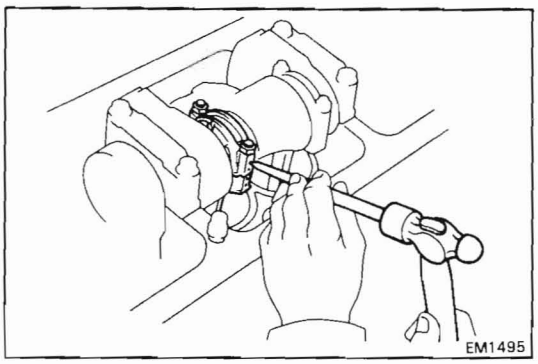
10. REMOVE FRONT END PLATE
    (a) Using a trox socket wrench, remove the three screws.
    (b) Remove the two bolts, front end plate and gasket.



11. CHECK CONNECTING ROD THRUST CLEARANCE
    Using a dial indicator, measure the thrust clearance while moving the rod back and forth.

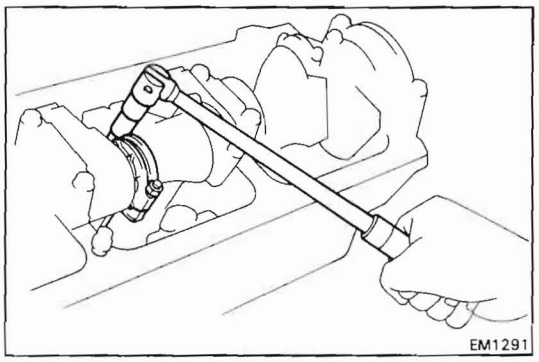
    Standard thrust clearance: 0.160 – 0.300 mm (0.0063 – 0.0118 in.)
    Maximum thrust clearance: 0.40 mm (0.0156 in.)

    If the clearance exceeds maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

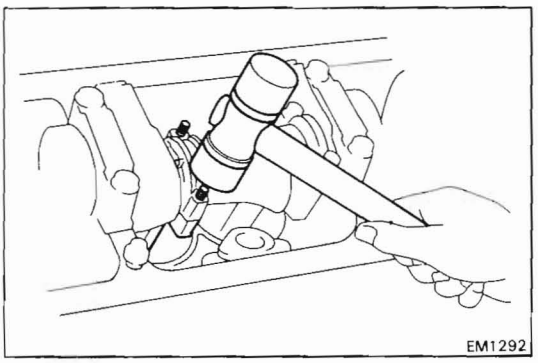


12. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Using a punch or numbering stamp, place match marks on the connecting rod and cap to ensure correct reassembly.

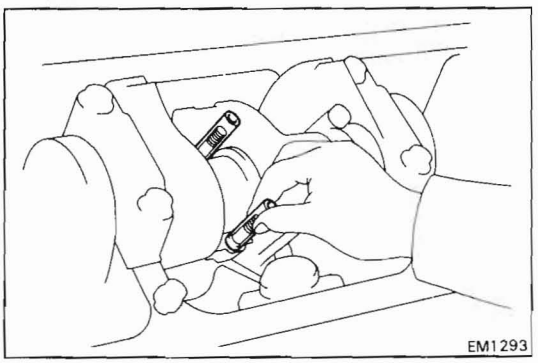


(b) Remove the connecting rod cap nuts.

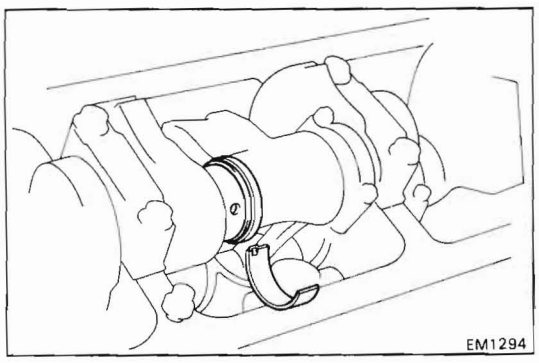


(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

NOTE: Keep the lower bearing inserted with the connecting rod cap.



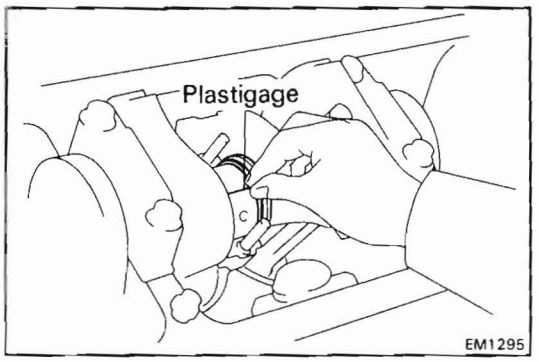
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



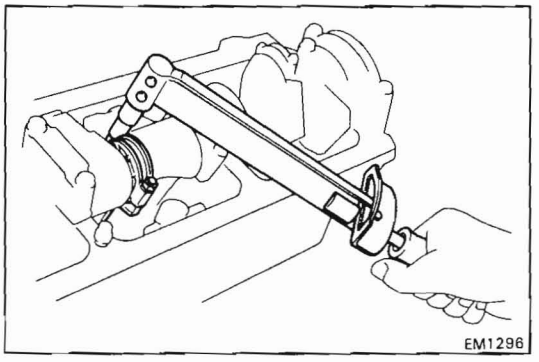
(e) Clean the crank pin and bearing.

(f) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing are damaged, replace the bearings. If necessary, replace the crankshaft.



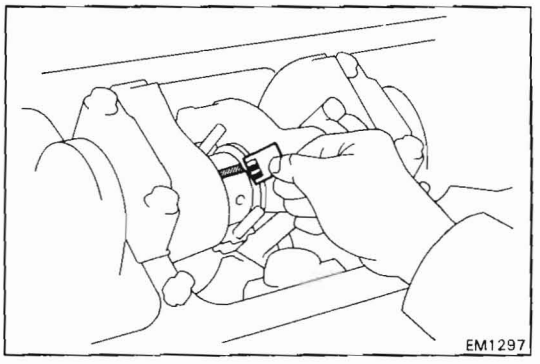
(g) Lay a strip of Plastigage across the crank pin.



(h) Install the connecting rod cap. (See page EM-65)

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

NOTE: Do not turn the crankshaft.



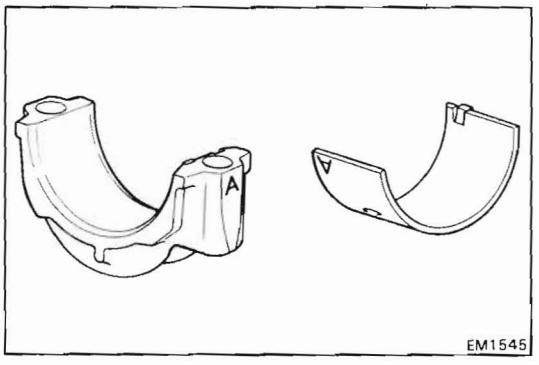
(i) Remove the connecting rod cap.

(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	**0.020 — 0.050 mm (0.0008 — 0.0020 in.)**
U/S 0.25 and 0.50	**0.019 — 0.063 mm (0.0007 — 0.0025 in.)**
Maximum oil clearance:	**0.10 mm (0.0039 in.)**

If the clearance exceeds maximum, replace the bearing. If necessary, replace the crankshaft.



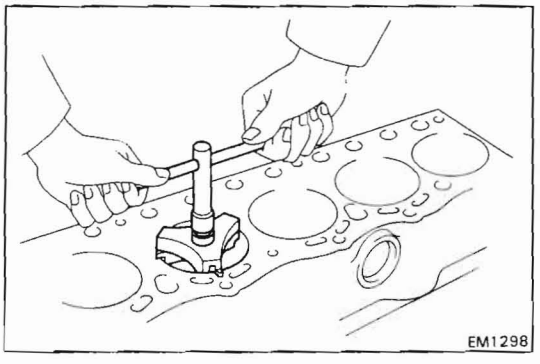
NOTE: If using a standard bearing, replace with one having the same number marked on the connecting rod cap. There are three sizes of standard bearings marked A, B and C.

(Reference)

Standard bearing thickness (at center wall):

Mark "A"	**1.484 — 1.488 mm (0.0584 — 0.0586 in.)**
Mark "B"	**1.488 — 1.492 mm (0.0586 — 0.0587 in.)**
Mark "C"	**1.492 — 1.496 mm (0.0587 — 0.0589 in.)**

(k) Completely remove the Plastigage.

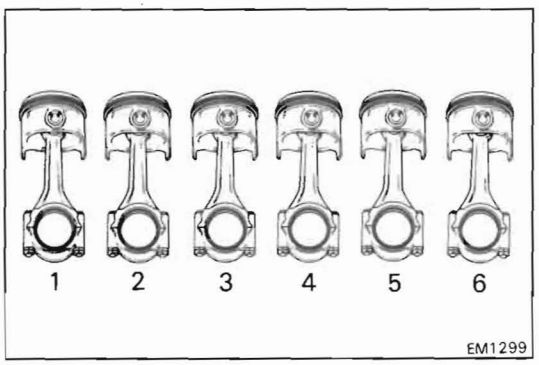


13. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

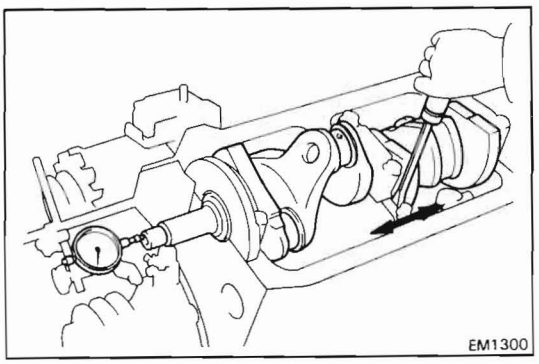
(a) Remove all the carbon from the piston ring ridge.

(b) Cover the connecting rod bolts. (See page EM-45)

(c) Push the piston, connecting rod assembly and upper bearing out through the top of the cylinder.



NOTE:
- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assembly in correct order.



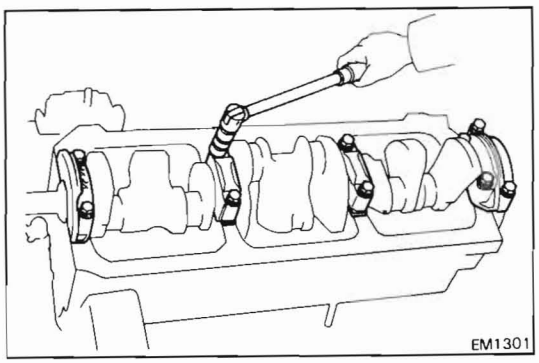
14. CHECK CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance: 0.015 — 0.204 mm (0.0006 — 0.0080 in.)
Maximum thrust clearance: 0.30 mm (0.0118 in.)

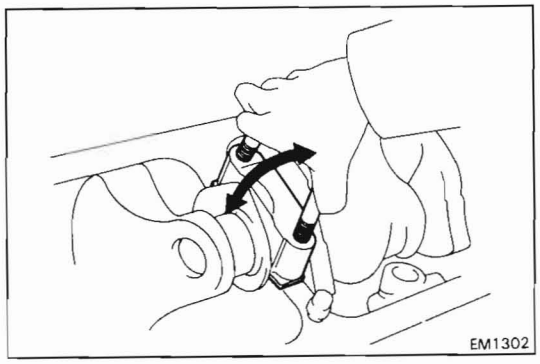
If the clearance exceeds maximum, replace the thrust washers as a set.

Thrust washer size: STD, O/S 0.125, 0.250



15. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

(a) Remove the main bearing cap bolts.



(b) Using the removed main bearing cap bolts, pry the cap back and forth, and remove the main bearing caps, lower bearings and lower thrust washers (No. 3 main bearing cap only).

NOTE:
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

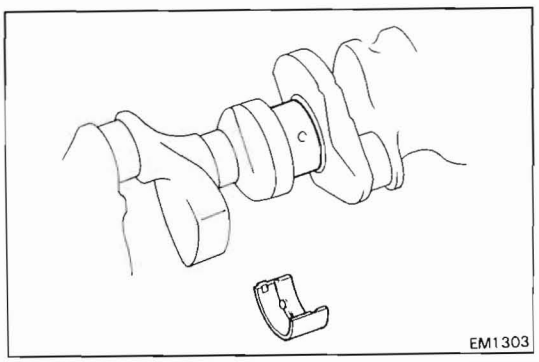
(c) Lift out the crankshaft.

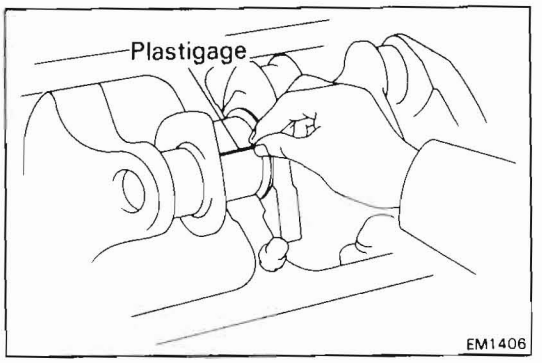
NOTE: Keep the upper bearings and upper thrust washers together with the cylinder block.

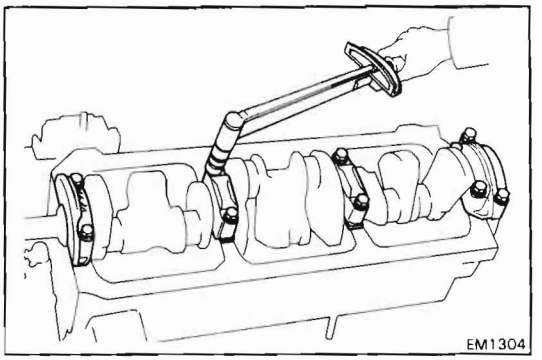
(d) Clean each main journal and bearing.

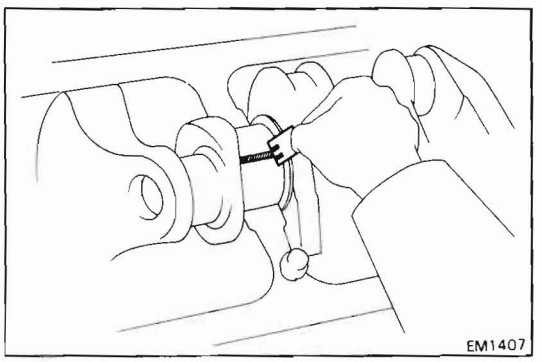
(e) Check each main journal and bearing for pitting and scratches.

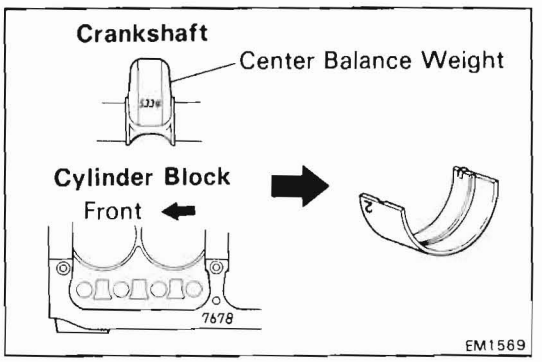
If the journal or bearing are damaged, replace the bearing. If necessary, replace the crankshaft.











(f) Place the crankshaft on the cylinder block.

(g) Lay a strip of Plastigage across each of the main journals.

(h) Install the main bearing caps. (See page EM-64)

Torque:
19 mm bolt head
1,375 kg-cm (99 ft-lb, 135 N·m)
17 mm bolt head
1,175 kg-cm (85 ft-lb, 115 N·m)

NOTE: Do not turn the crankshaft.

(i) Remove the main bearing caps.

(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	**0.016 – 0.056 mm (0.0006 – 0.0022 in.)**
U/S 0.25 and 0.50	**0.021 – 0.067 mm (0.0008 – 0.0026 in.)**
Maximum oil clearance:	**0.10 mm (0.0039 in.)**

NOTE: If replacing the cylinder block subassembly the bearing standard clearance will be:
0.004 – 0.060 mm (0.0002 – 0.0024 in.)

If the clearance exceeds maximum, replace the main bearing. If necessary, replace the crankshaft.

NOTE: If replacing a standard size bearing with a standard oil clearance, replace with one having the same number. If the number of the bearing cannot be determined, select a bearing from the table below according to the numbers imprinted on the cylinder block and crankshaft. There are five sizes of standard bearings, marked 1, 2, 3, 4 and 5.

	Number marked								
Crankshaft	3			4			5		
Cylinder block	6	7	8	6	7	8	6	7	8
Bearing	3	4	5	2	3	4	1	2	3

Example: Crankshaft No. 5, Cylinder Block No. 7 = Bearing No. 2

(Reference)
Crankshaft journal diameter:

Mark "3"	**No. 1**	**66.972 – 66.980 mm (2.6367 – 2.6370 in.)**
	No. 2	**68.472 – 68.480 mm (2.6957 – 2.6961 in.)**
	No. 3	**69.972 – 69.980 mm (2.7548 – 2.7551 in.)**
	No. 4	**71.472 – 71.480 mm (2.8139 – 2.8142 in.)**

Crankshaft journal diameter (Cont'd):

Mark "4"	No. 1	66.980 – 66.988 mm (2.6370 – 2.6373 in.)
	No. 2	68.480 – 68.488 mm (2.6961 – 2.6964 in.)
	No. 3	69.980 – 69.988 mm (2.7551 – 2.7554 in.)
	No. 4	71.480 – 71.488 mm (2.8142 – 2.8145 in.)
Mark "5"	No. 1	66.988 – 66.996 mm (2.6373 – 2.6376 in.)
	No. 2	68.488 – 68.496 mm (2.6964 – 2.6967 in.)
	No. 3	69.988 – 69.996 mm (2.7554 – 2.7557 in.)
	No. 4	71.488 – 71.496 mm (2.8145 – 2.8148 in.)

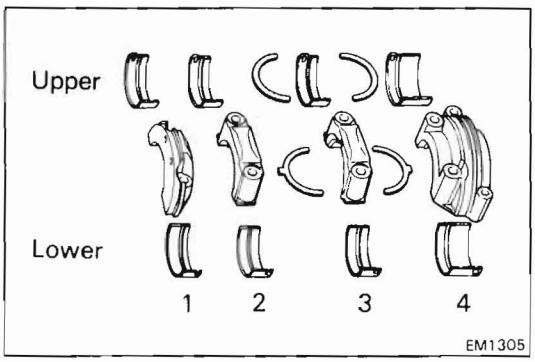
Cylinder block housing inside diameter:

Mark "6"	No. 1	72.010 – 72.018 mm (2.8350 – 2.8353 in.)
	No. 2	73.510 – 73.518 mm (2.8941 – 2.8944 in.)
	No. 3	75.010 – 75.018 mm (2.9531 – 2.9535 in.)
	No. 4	76.510 – 76.518 mm (3.0122 – 3.0125 in.)
Mark "7"	No. 1	72.018 – 72.026 mm (2.8353 – 2.8357 in.)
	No. 2	73.518 – 73.526 mm (2.8944 – 2.8947 in.)
	No. 3	75.018 – 75.026 mm (2.9535 – 2.9538 in.)
	No. 4	76.518 – 76.526 mm (3.0125 – 3.0128 in.)
Mark "8"	No. 1	72.026 – 72.034 mm (2.8357 – 2.8360 in.)
	No. 2	73.526 – 73.534 mm (2.8947 – 2.8950 in.)
	No. 3	75.026 – 75.034 mm (2.9538 – 2.9541 in.)
	No. 4	76.526 – 76.534 mm (3.0128 – 3.0131 in.)

Standard bearing thickness (at center wall):

Mark "1"	2.493 – 2.497 mm (0.0981 – 0.0983 in.)
Mark "2"	2.497 – 2.501 mm (0.0983 – 0.0985 in.)
Mark "3"	2.501 – 2.505 mm (0.0985 – 0.0986 in.)
Mark "4"	2.505 – 2.509 mm (0.0986 – 0.0988 in.)
Mark "5"	2.509 – 2.513 mm (0.0988 – 0.0989 in.)

(k) Completely remove the Plastigage.



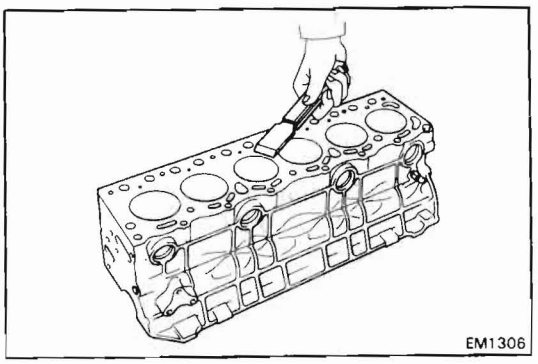
16. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

(b) Remove the upper bearings and upper thrust washers from the cylinder block.

NOTE: Arrange the main bearing caps, bearings and thrust washers in the correct order.

INSPECTION OF CYLINDER BLOCK

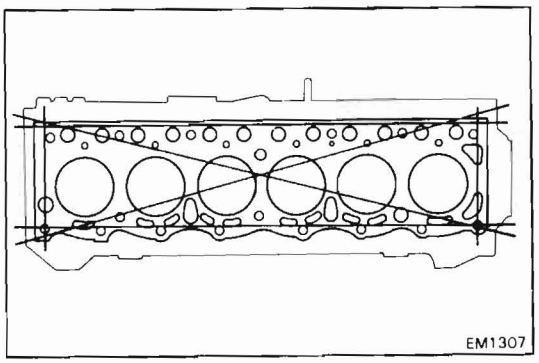


1. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all the gasket material from the top of the cylinder block surface.

2. CLEAN CYLINDER BLOCK

Using a soft brush and solvent, clean the block.

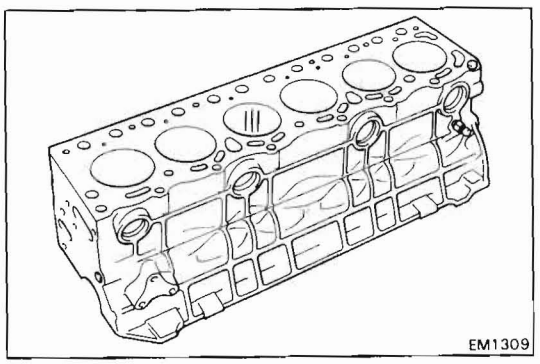


3. INSPECT TOP OF CYLINDER BLOCK FOR FLATNESS

Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head gasket for warpage.

Maximum warpage: 0.15 mm (0.0059 in.)

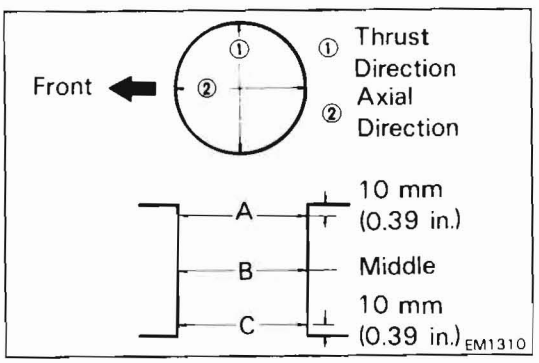
If warpage exceeds maximum, replace the cylinder block.



4. INSPECT CYLINDERS FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all six cylinders.



5. INSPECT CYLINDER BORE DIAMETER

Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

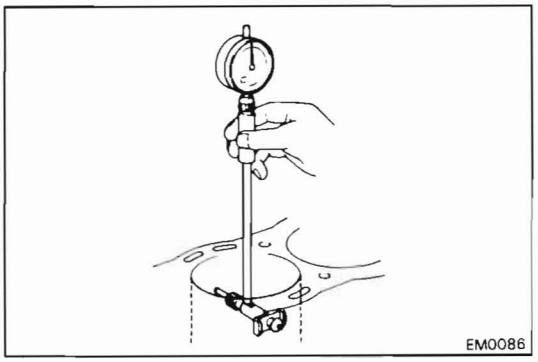
Standard diameter:

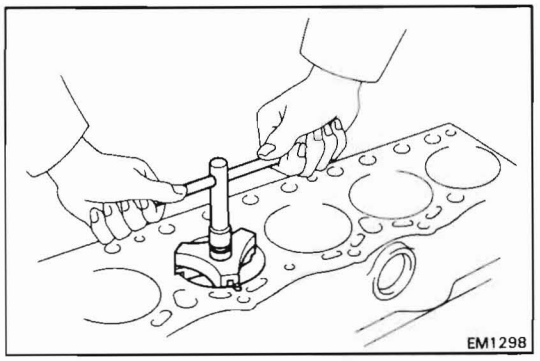
STD	**94.000 — 94.030 mm (3.7008 — 3.7020 in.)**

Maximum diameter:

STD	**94.23 mm (3.7098 in.)**
O/S 0.50	**94.73 mm (3.7295 in.)**
O/S 1.00	**95.23 mm (3.7492 in.)**
O/S 1.50	**95.73 mm (3.7689 in.)**

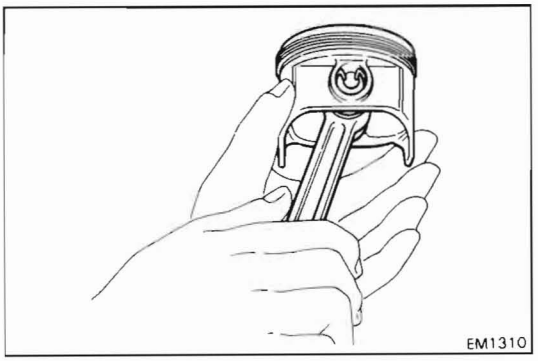
If the diameter exceeds maximum, rebore all six cylinders. If necessary, replace the cylinder block.





6. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), use a ridge reamer to machine the piston ring ridge at the top of the cylinder.



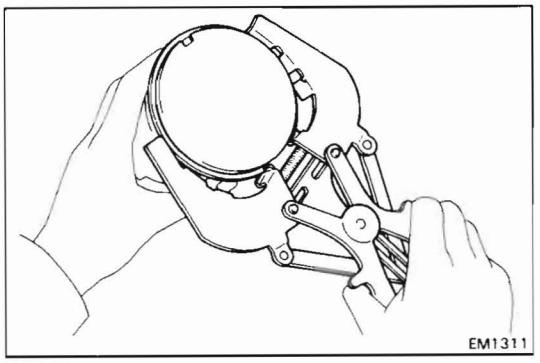
DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

(See page EM-43)

1. CHECK FIT BETWEEN PISTON AND PIN

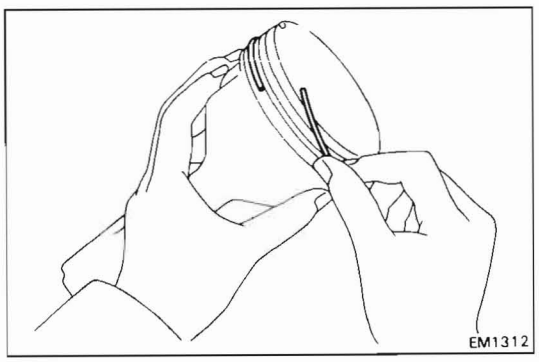
Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.



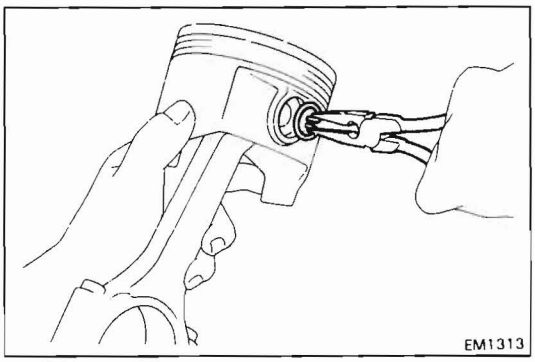
2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the compression rings.



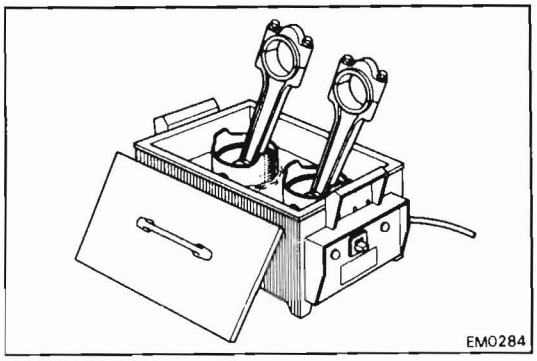
(b) Remove the two side rails and oil ring expander by hand.

NOTE: Arrange the rings in correct order.

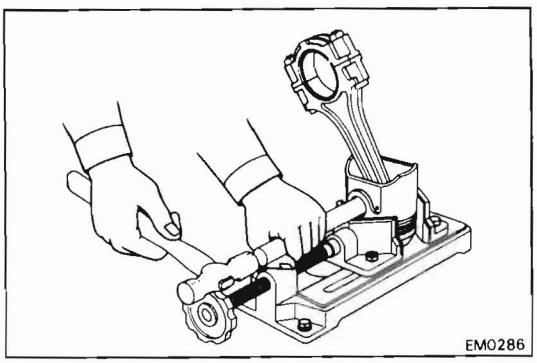


3. DISCONNECT CONNECTING ROD FROM PISTON

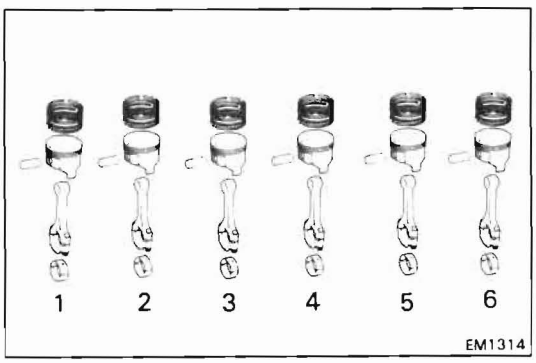
(a) Using needle-nose pliers, remove the snap rings.



(b) Gradually heat the piston to approx. 80°C (176°F).

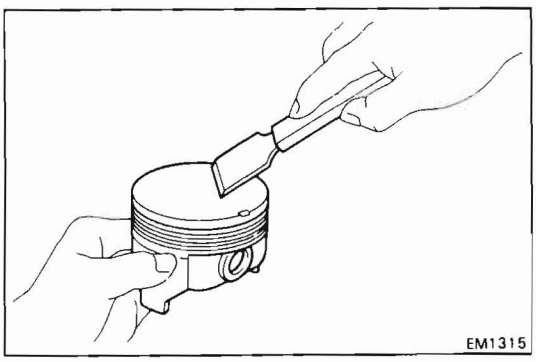


(c) Using a plastic-faced hammer and driver, lightly tap out the piston pin and remove the connecting rod.



NOTE:

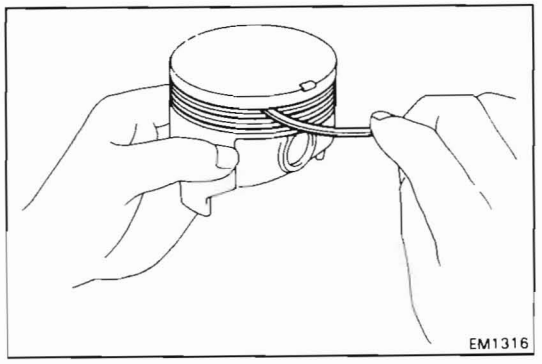
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order only.



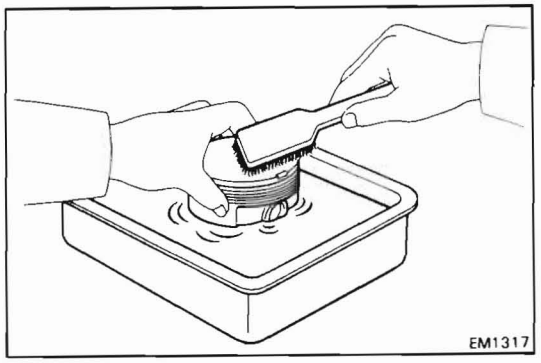
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

(a) Using a gasket scraper, remove the carbon from the piston top.

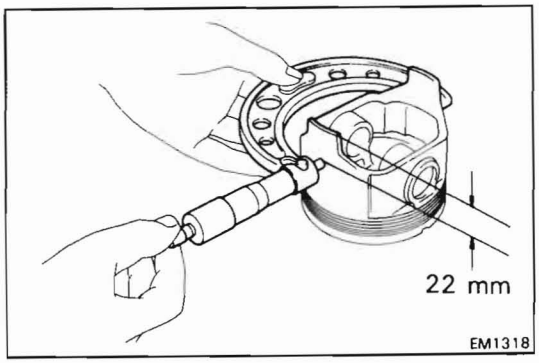


(b) Using a groove cleaning tool or broken ring, clean the ring grooves.



(c) Using solvent and a brush, thoroughly clean the piston.

CAUTION: Do not use a wire brush.



2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

(a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 22 mm (0.87 in.) below the skirt bottom edge.

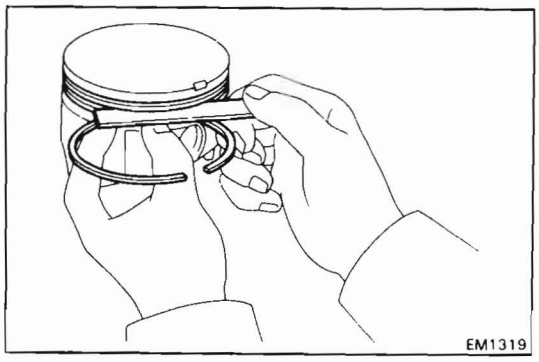
Standard diameter:

STD	**93.960 — 93.990 mm (3.6992 — 3.7004 in.)**
O/S 0.50	**94.460 — 94.490 mm (3.7189 — 3.7201 in.)**
O/S 1.00	**94.960 — 94.990 mm (3.7386 — 3.7398 in.)**
O/S 1.50	**95.460 — 95.490 mm (3.7583 — 3.7594 in.)**

(b) Measure the cylinder bore diameter in the thrust directions (See page EM-50) and subtract the piston diameter measurement from the cylinder bore diameter.

Oil clearance: 0.030 — 0.050 mm (0.0012 — 0.0020 in.)

If the clearance is not within specification, replace all six pistons. If necessary, rebore all six cylinders or replace the cylinder block.



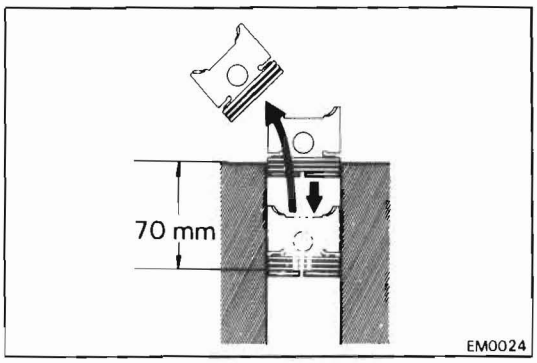
3. INSPECT CLEARANCE BETWEEN WALL OF PISTON RING GROOVE AND NEW PISTON RING

Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Ring groove clearance:

No. 1 0.030 — 0.070 mm (0.0012 — 0.0028 in.)
No. 2 0.050 — 0.090 mm (0.0020 — 0.0035 in.)

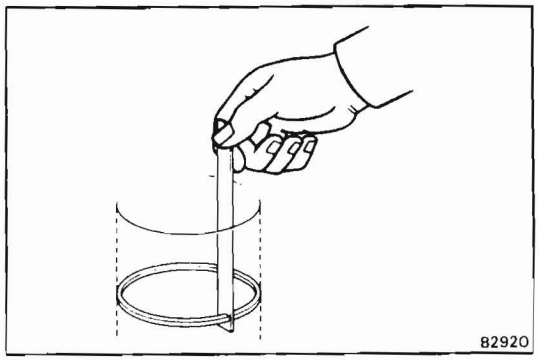
If the clearance is not within specification, replace the piston.



4. INSPECT PISTON RING END GAP

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel.
(70 mm or 2.76 in. from top surface of cylinder block)



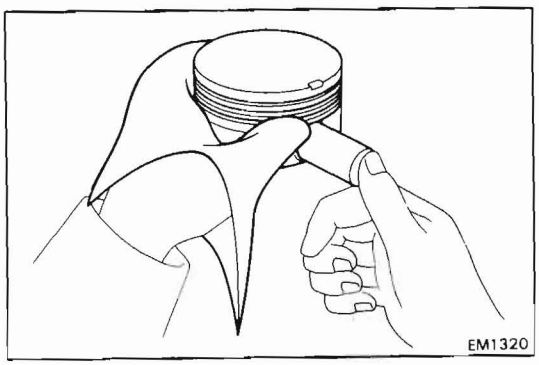
(c) Using a feeler gauge, measure the end gap.

Standard end gap:
No. 1 and No. 2
0.200 — 0.520 mm (0.0079 — 0.0205 in.)
Oil (side rail)
0.200 — 0.820 mm (0.0079 — 0.0323 in.)
Maximum end gap:

No. 1 and No. 2	**1.12 mm (0.0441 in.)**
Oil (side rail)	**1.42 mm (0.0559 in.)**

If the gap exceeds maximum, replace the piston ring.

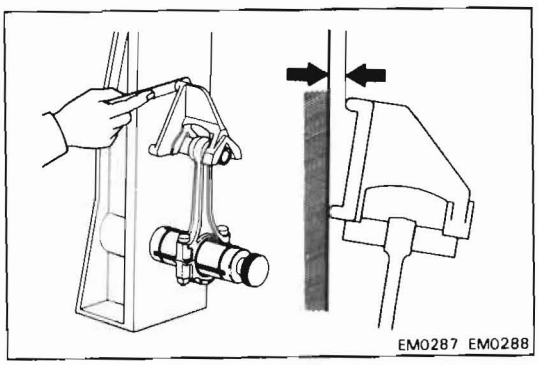
If the gap exceeds maximum, even with a new piston ring, rebore the cylinder and use an O/S piston ring.



5. CHECK PISTON PIN FIT

At 80°C (176 °F) you should be able to push the pin into the piston with your thumb.

If the pin can be installed at a lower temperature, replace the piston and pin as a set.



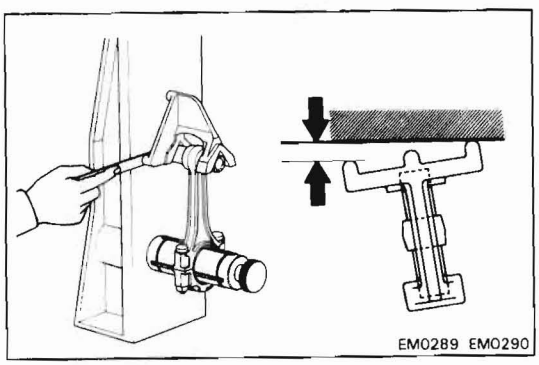
6. INSPECT CONNECTING RODS

(a) Using a rod aligner, check the connecting rod alignment.

- Check for bend.

Maximum bend:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

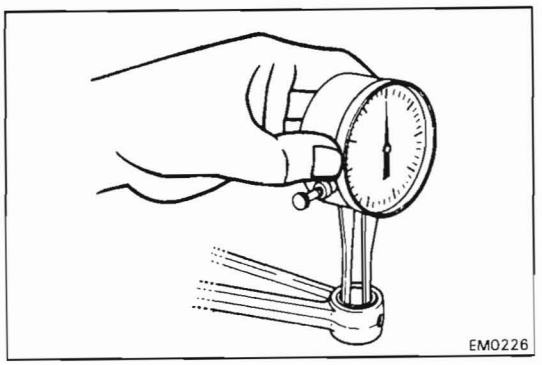
If bend exceeds maximum, replace the connecting rod assembly.



- Check for twist.

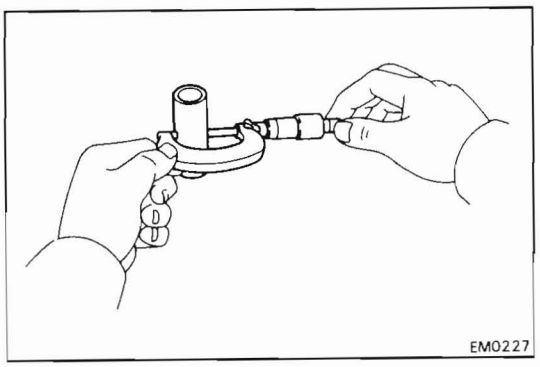
Maximum twist:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If twist exceeds maximum, replace the connecting rod assembly.



(b) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:
22.012 – 22.027 mm (0.8666 – 0.8672 in.)



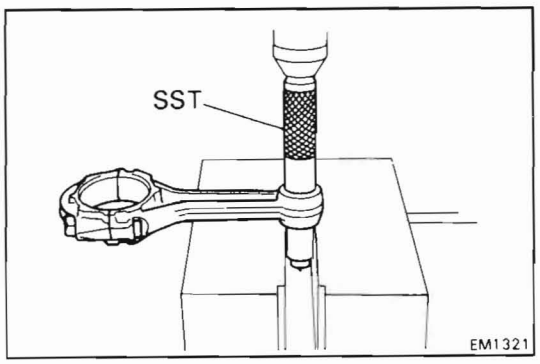
(c) Using a micrometer, measure the diameter of the piston pin.

Piston pin diameter:
22.004 – 22.019 mm (0.8663 – 0.8669 in.)

(d) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance: **0.005 – 0.011 mm (0.0002 – 0.0004 in.)**
Maximum oil clearance: **0.03 mm (0.0012 in.)**

If the clearance exceeds maximum, replace the connecting rod bushing. If necessary, replace the piston and piston pin assembly.

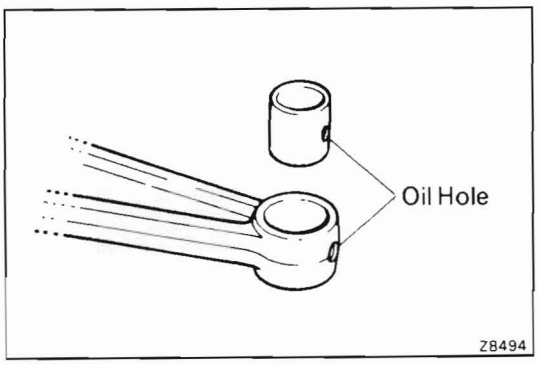


REPLACEMENT OF CONNECTING ROD BUSHINGS

1. REMOVE CONNECTING ROD BUSHING

Using SST and a press, press out the bushing.

SST 09222-30010

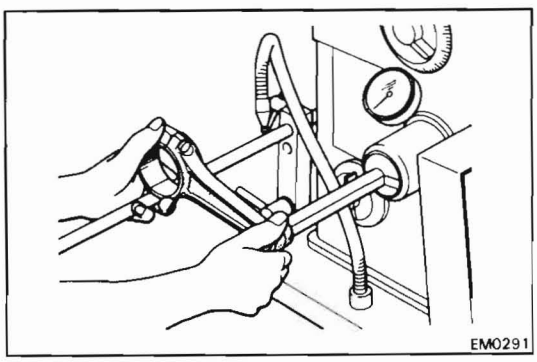


2. INSTALL NEW CONNECTING ROD BUSHING

(a) Align the oil holes of the bushing and connecting rod.

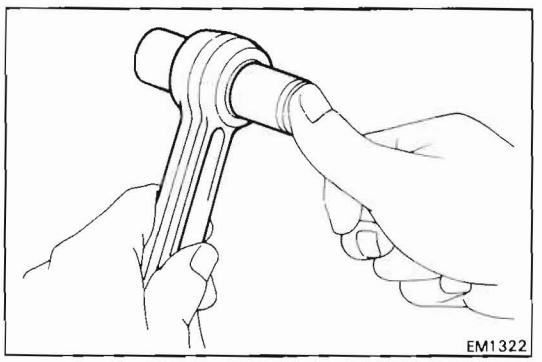
(b) Using SST and a press, press in the bushing.

SST 09222-30010



3. HONE ROD BUSHING AND CHECK PISTON PIN FIT IN CONNECTING ROD

(a) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (on page EM-54) between the bushing and piston pin.



(b) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil and push it into the rod with your thumb.

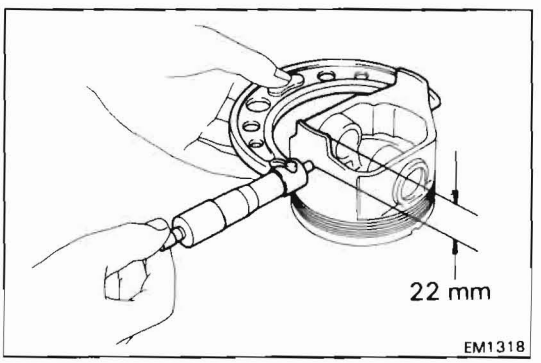
BORING OF CYLINDERS

NOTE:
- Bore all six cylinders for the oversized piston's outside diameter.
- Replace the piston rings with ones to match the oversized pistons.

1. SELECT OVERSIZED PISTON

Oversized piston diameter:

O/S 0.50	**94.460 — 94.490 mm (3.7189 — 3.7201 in.)**
O/S 1.00	**94.960 — 94.990 mm (3.7386 — 3.7398 in.)**
O/S 1.50	**95.960 — 95.490 mm (3.7583 — 3.7594 in.)**



2. CALCULATE AMOUNT TO BORE CYLINDER

(a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 22 mm (0.87 in.) below the skirt bottom edge.

(b) Calculate the amount each cylinder is to be rebored as follows:

Size to be rebored = P + C — H

P = Piston diameter

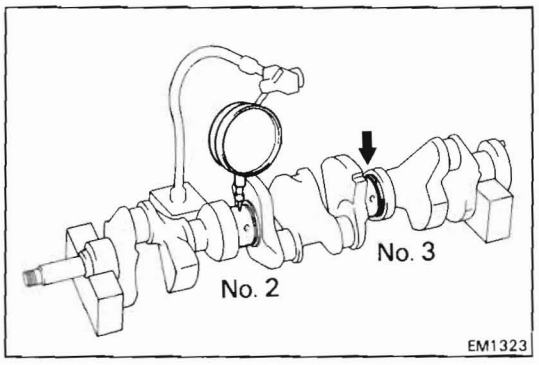
C = Piston clearance
0.030 — 0.050 mm (0.0012 — 0.0020 in.)

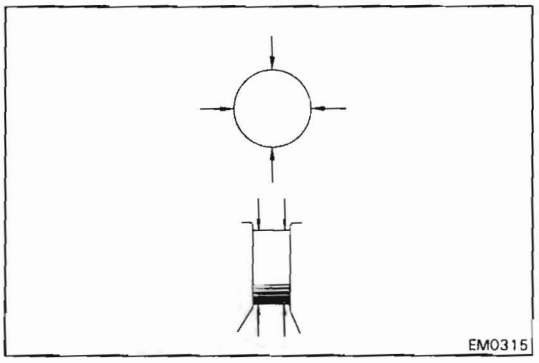
H = Allowance for honing
Less than 0.02 mm (0.0008 in.)

3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Maximum honing: 0.02 mm (0.0008 in.)

CAUTION: Excess honing will destroy the finished roundness.





INSPECTION AND REPAIR OF CRANKSHAFT

1. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V-blocks.

(b) Using a dial indicator, measure the circle runout at the No. 2 and No. 3 journals.

Maximum circle runout: 0.12 mm (0.0048 in.)

If the circle runout exceeds maximum, replace the crankshaft.

2. INSPECT MAIN JOURNALS AND CRANK PINS

(a) Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter (from front side):

STD	**No. 1**	**66.972 – 66.996 mm (2.6367 – 2.6376 in.)**
	No. 2	**68.472 – 68.496 mm (2.6957 – 2.6967 in.)**
	No. 3	**69.972 – 69.996 mm (2.7548 – 2.7557 in.)**
	No. 4	**71.472 – 71.496 mm (2.8139 – 2.8148 in.)**
U/S 0.25	**No. 1**	**66.745 – 66.755 mm (2.6278 – 2.6281 in.)**
	No. 2	**68.245 – 68.255 mm (2.6868 – 2.6872 in.)**
	No. 3	**69.745 – 69.755 mm (2.7459 – 2.7463 in.)**
	No. 4	**71.245 – 71.255 mm (2.8049 – 2.8053 in.)**
U/S 0.50	**No. 1**	**66.495 – 66.505 mm (2.6179 – 2.6183 in.)**
	No. 2	**67.995 – 68.005 mm (2.6770 – 2.6774 in.)**
	No. 3	**69.495 – 69.505 mm (2.7360 – 2.7364 in.)**
	No. 4	**70.995 – 71.005 mm (2.7951 – 2.7955 in.)**

Crank pin diameter:

STD size	**52.988 – 53.000 mm (2.0861 – 2.0866 in.)**
U/S 0.25	**52.701 – 52.711 mm (2.0748 – 2.0752 in.)**
U/S 0.50	**52.451 – 52.461 mm (2.0650 – 2.0654 in.)**

If the diameter is not within specification, check the oil clearance. If necessary, grind or replace the crankshaft.

(b) Check each main journal and crank pin for taper and out-of-round as shown.

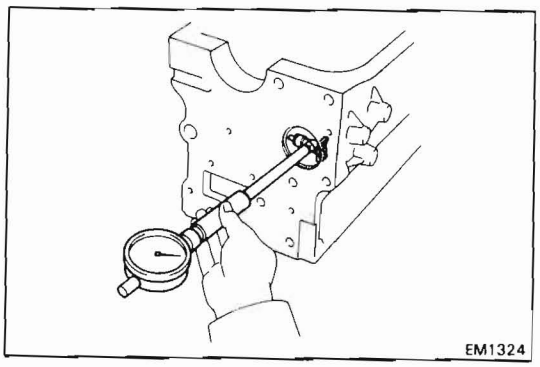
Maximum taper and out-of-round:
0.02 mm (0.0008 in.)

If taper and out-of-round exceeds the maximum, replace the crankshaft.

3. GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the undersized finished diameter. (See page EM-57)

Install new main journal and/or undersized crank pin bearings.



INSPECTION AND REPAIR OF CAMSHAFT BEARINGS

1. INSPECT CAMSHAFT OIL CLEARANCE

(a) Using a cylinder gauge, measure the inside diameter of the camshaft bearing.

Bearing inside diameter (from front side):

STD	**No. 1**	**48.000 – 48.030 mm (1.8898 – 1.8909 in.)**
	No. 2	**46.500 – 46.530 mm (1.8307 – 1.8319 in.)**
	No. 3	**45.000 – 45.030 mm (1.7717 – 1.7728 in.)**
	No. 4	**43.500 – 43.530 mm (1.7126 – 1.7138 in.)**
U/S 0.25	**No. 1**	**47.750 – 47.825 mm (1.8799 – 1.8829 in.)**
	No. 2	**46.250 – 46.325 mm (1.8209 – 1.8238 in.)**
	No. 3	**44.750 – 44.820 mm (1.7618 – 1.7646 in.)**
	No. 4	**43.250 – 43.320 mm (1.7028 – 1.7055 in.)**
U/S 0.50	**No. 1**	**47.500 – 47.575 mm (1.8701 – 1.8730 in.)**
	No. 2	**46.000 – 46.075 mm (1.8110 – 1.8140 in.)**
	No. 3	**44.500 – 44.570 mm (1.7520 – 1.7547 in.)**
	No. 4	**43.000 – 43.070 mm (1.6929 – 1.6957 in.)**

(b) Subtract the journal diameter measurement (See page EM-35) from the bearing inside diameter measurement.

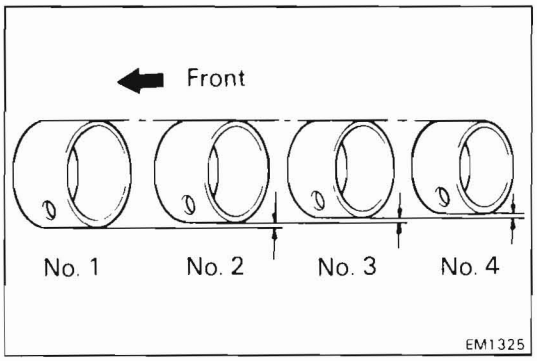
Standard clearance:

STD	**0.025 – 0.075 mm (0.0010 – 0.0030 in.)**
U/S 0.25 and 0.50	
No. 1 and No. 2	**0.025 – 0.110 mm (0.0010 – 0.0043 in.)**
No. 3 and No. 4	**0.025 – 0.105 mm (0.0010 – 0.0041 in.)**

Maximum clearance

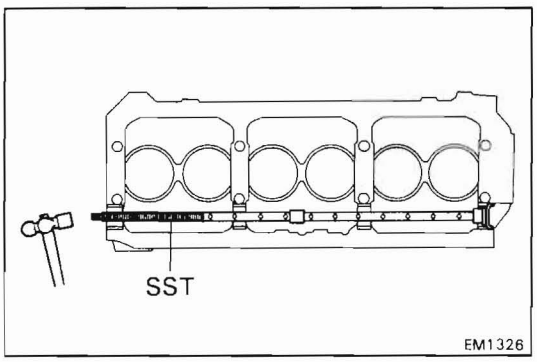
STD	**0.10 mm (0.0039 in.)**
U/S 0.25 and 0.50	**0.15 mm (0.0059 in.)**

If the clearance exceeds maximum, replace the camshaft bearings. If necessary, grind or replace the camshaft.



2. IF NECESSARY, REPLACE CAMSHAFT BEARINGS

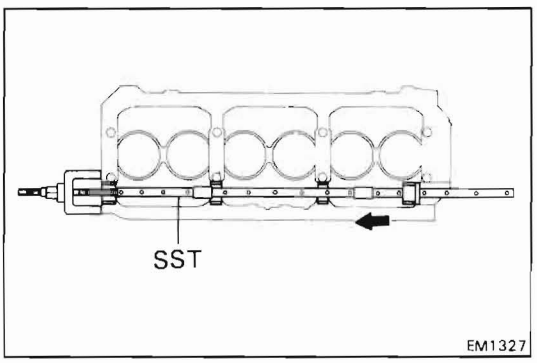
NOTE: The outside diameter varies with each bearing.



A. Remove expansion plug

Using SST and a hammer, tap out the expansion plug.

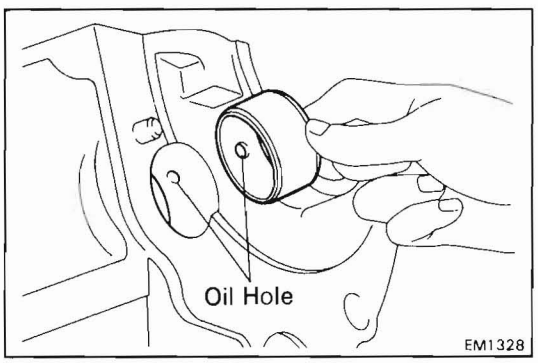
SST 09215-00012 and 09215-00100



B. Remove camshaft bearings

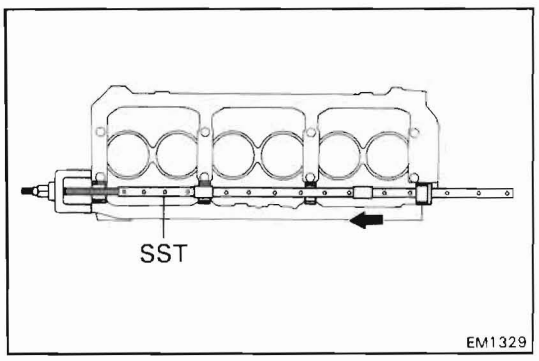
Using SST, remove the bearings.

SST 09215-00012 and 09215-00100



C. Install new camshaft bearings

(a) Align the oil holes of the bearing and cylinder block.

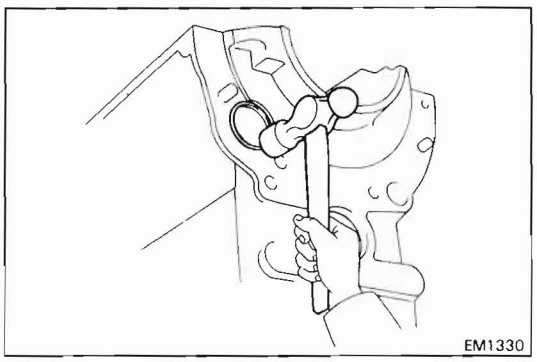


(b) Using SST, install the bearings.

SST 09215-00012 and 09215-00010

D. Ream camshaft bearings

Ream the bearings to the finished diameter. (See page EM-58)



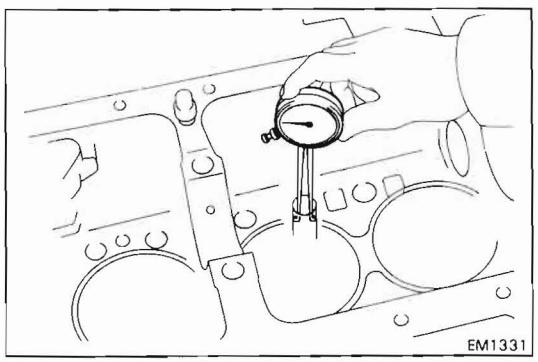
E. Install expansion plug

(a) Apply liquid sealer to the expansion plug surface of the cylinder block.

(b) Using a hammer, tap in a new expansion plug until its surface is flush with the cylinder block edge.

3. IF NECESSARY, GRIND AND HONE CAMSHAFT JORNALS

Grind and hone the journals to the undersized finished diameter. (See page EM-35)



INSPECTION OF VALVE LIFTER BORES

INSPECT VALVE LIFTER OIL CLEARANCE

(a) Using a caliper gauge, measure the valve lifter bore diameter.

Bore diameter: 21.417 – 21.443 mm (0.8432 – 0.8442 in.)

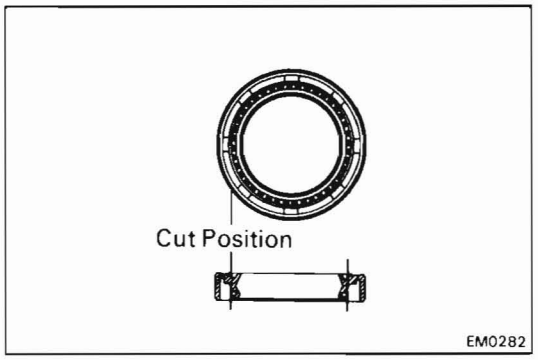
(b) Subtract the valve lifter diameter measurement (See page EM-37) from the valve lifter bore diameter measurement.

Standard oil clearance: 0.013 – 0.056 mm (0.0005 – 0.0022 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

If the clearance exceeds maximum, replace the valve lifters.

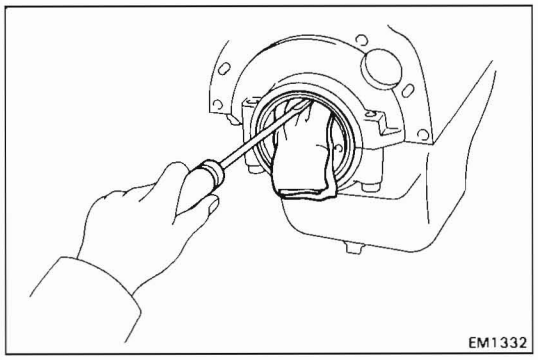
Valve lifter size: STD, O/S 0.05



REPLACEMENT OF CRANKSHAFT REAR OIL SEAL

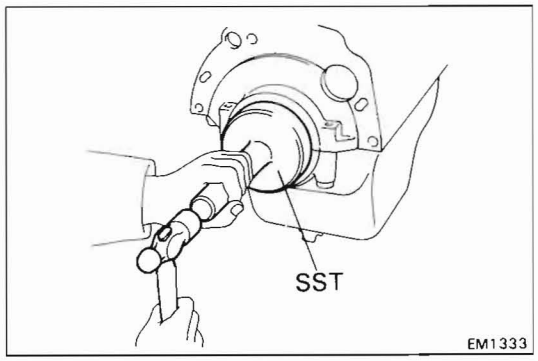
REPLACE CRANKSHAFT REAR OIL SEAL

(a) Using a knife, cut off the oil seal lip.



(b) Using a screwdriver, pry out the oil seal.

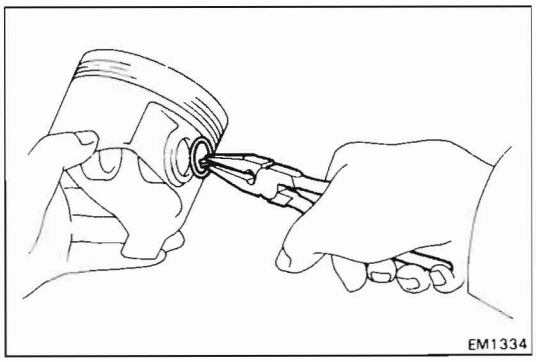
CAUTION: Be careful not to damage the crankshaft. Tape the screwdriver tip.



(c) Apply MP grease to a new oil seal lip.

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the cylinder block and main bearing cap edges.

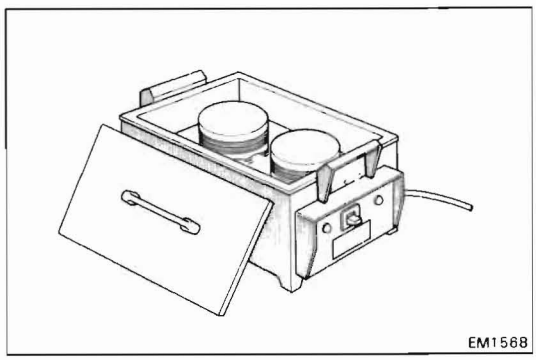
SST 09223-60010



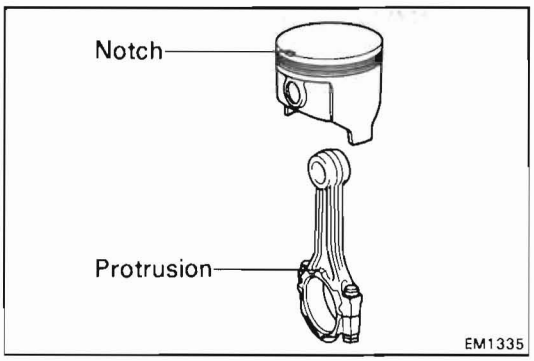
ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Install a new snap ring on one side of the piston pin hole.

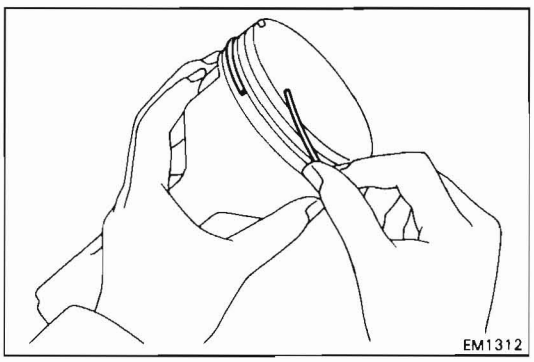


(b) Gradually heat the piston to approx. 80°C (176°F).



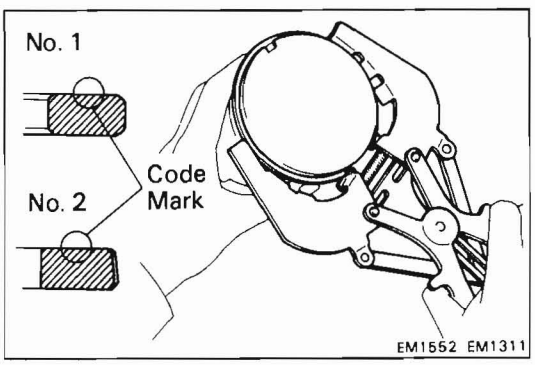
(c) Align the notch of the piston with the protrusion of the connecting rod and push in the piston pin with your thrumb.

(d) Install a new snap ring on the other side of the piston pin hole.

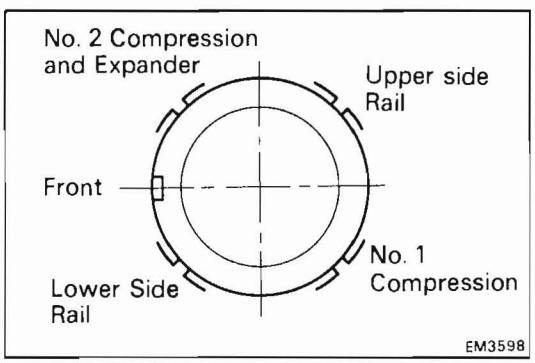


2. INSTALL PISTON RINGS

(a) Install the oil ring expander and two side rails by hand.

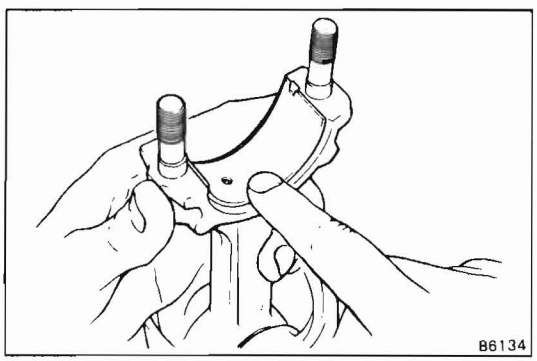


(b) Using a piston ring expander, install the two compression rings with the code mark facing upward.



(c) Position the piston rings so that the ring end gaps are as shown.

CAUTION: Do not align the end gaps.



3. INSTALL BEARINGS

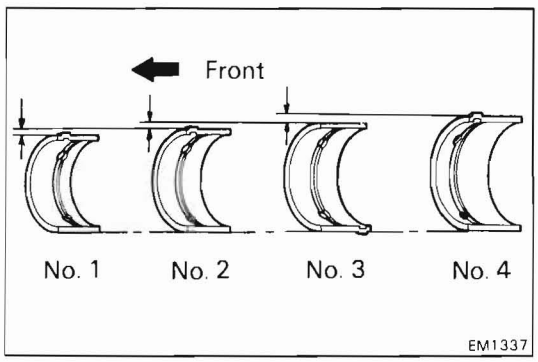
Install the bearings in the connecting rod and rod cap.

CAUTION: Install the bearing with the oil hole in the connecting rod.

ASSEMBLY OF CYLINDER BLOCK

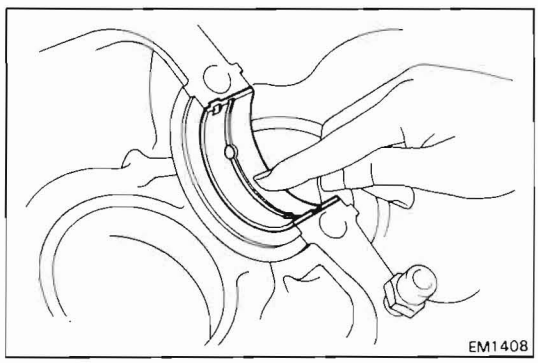
(See page EM-43)

NOTE:
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotaing surfaces.
- Replace all gaskets and oil seals with new part.



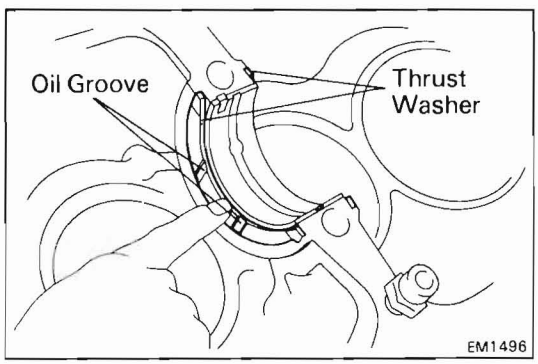
1. INSTALL MAIN BEARINGS

NOTE: The outside diameter varies with each bearing.



Install the bearing in the cylinder block and bearing caps.

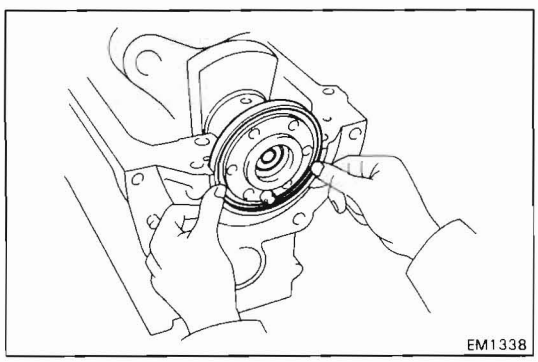
CAUTION: Install the bearing with the oil hole in the block.



2. INSTALL UPPER THRUST WASHERS

Install the thrust washers under the No. 3 main bearing cap position of the block with the oil grooves facing outward.

3. PLACE CRANKSHAFT ON CYLINDER BLOCK

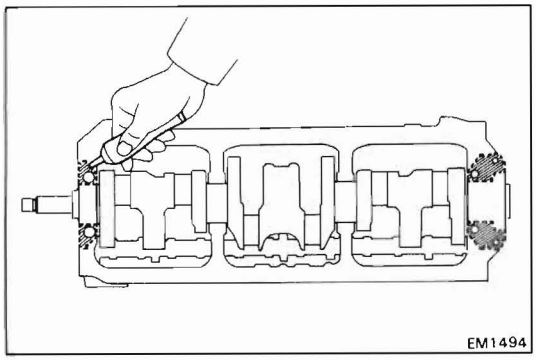


4. INSTALL NEW CRANKSHAFT REAR OIL SEAL

(a) Apply MP grease to the oil seal lip.

(b) Push in the oil seal until its surface is flush with the cylinder block edges.

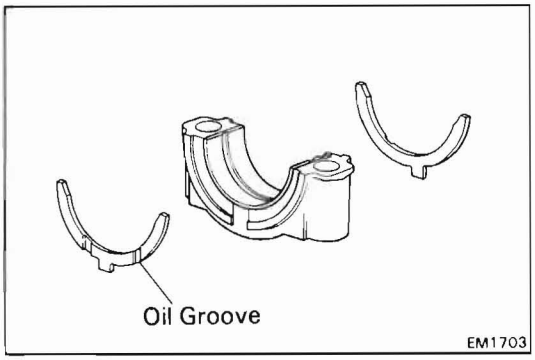
CAUTION: Be careful not to install the oil seal slantwise.



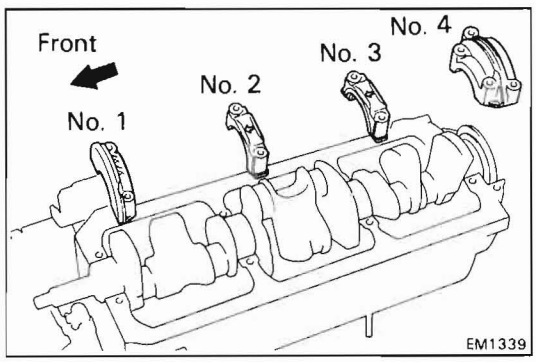
5. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

(a) Apply liquid sealer to the main bearing surface of the cylinder block.

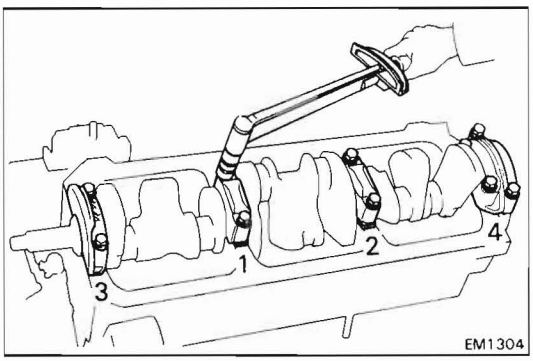
NOTE: Be carefull not to apply liquid sealer to the main bearing.



(b) Install the lower thrust washers on the No. 3 main bearing cap with the oil grooves facing outward.



(c) Install the main bearing caps in their proper locations.



(d) Apply a light coat of engine oil to the threads and under the bolt heads of the main bearing caps.

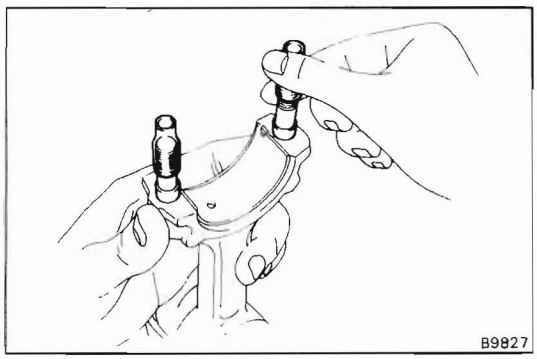
(e) Install and uniformly tighten the ten bolts of the main bearing caps in several passes, in the sequence shown.

Torque:

19 mm bolt head
1,375 kg-cm (99 ft-lb, 135 N·m)
17 mm bolt head
1,175 kg-cm (85 ft-lb, 115 N·m)

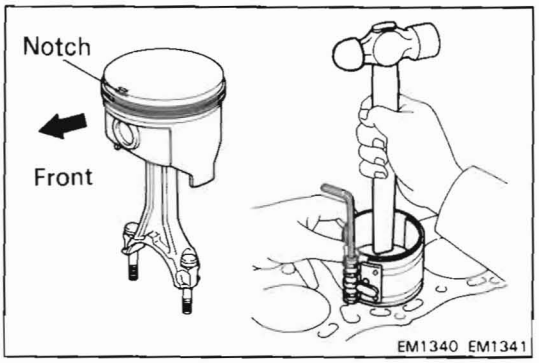
(f) Check that the crankshaft turns smoothly.

(g) Check the crankshaft thrust clearance.
(See page EM-47)

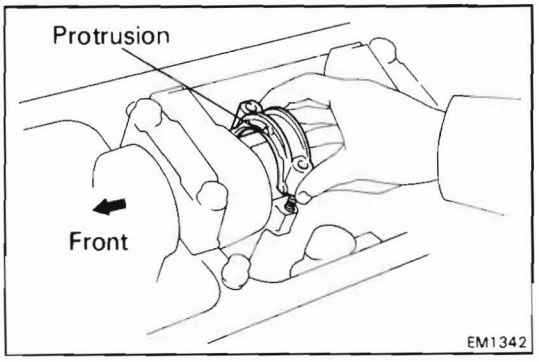


6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

(a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft and cylinder bore from damage.



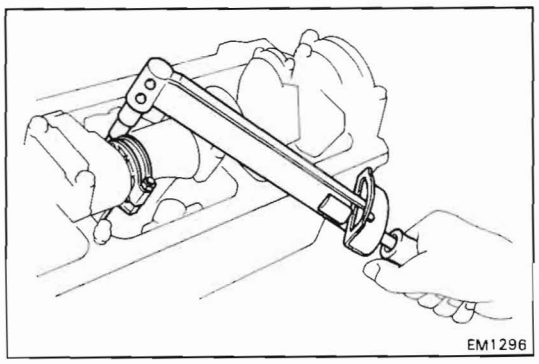
(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assembly into the cylinder with the notch of the piston facing forward.



7. INSTALL CONNECTING ROD CAPS

(a) Match the numbered cap with the numbered connecting rod.

(b) Install the connecting rod cap with the protrusion facing forward.



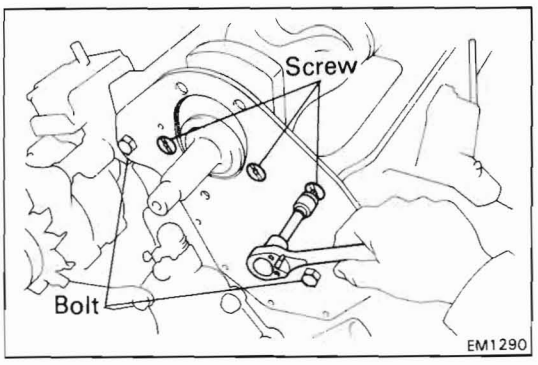
(c) Apply a light coat of engine oil to the threads and under the nuts of the connecting rod cap.

(d) Install and alternately tighten the nuts of the connecting rod cap in several passes.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

(e) Check that the crankshaft turns smoothly.

(f) Check the connecting rod thrust clearance.
(See page EM-44)



8. INSTALL FRONT END PLATE

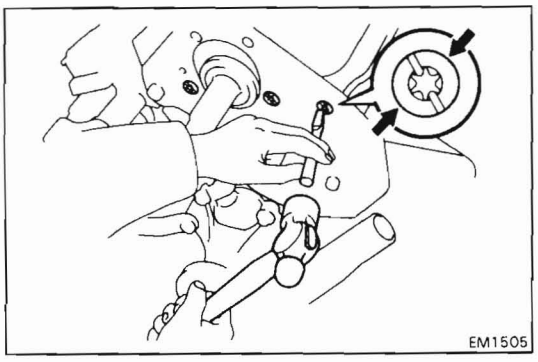
(a) Install the end plate with the two bolts.

(b) Using a trox socket wrench, torque the screws.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

(c) Torque the bolts.

Torque: 310 kg-cm (22 ft-lb, 30 N·m)



(d) Using a chisel and hammer, stake the screws.

9. **INSTALL TIMING GEARS AND CAMSHAFT**
(See steps 1 to 10, 12 and 13 on pages EM-39 to 42)

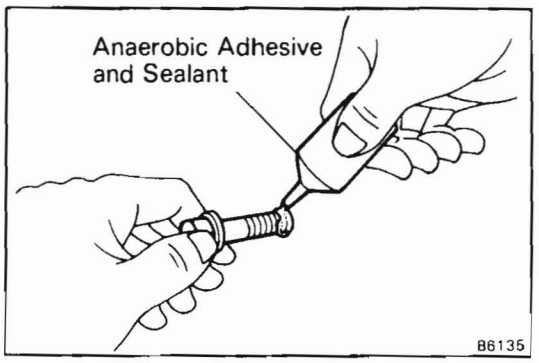
10. **INSTALL CYLINDER HEAD ASSEMBLY**
(See steps 1 to 3, 6 and 7 on pages EM-28 to 30)

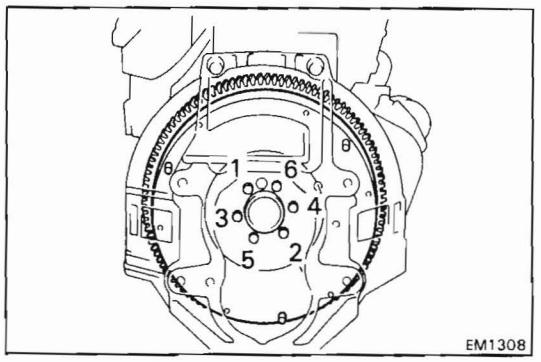
11. **INSTALL OIL PUMP AND OIL PAN**
(See pages LU-10 and 11)

12. **REMOVE ENGINE STAND**

13. **(M/T)**
INSTALL FLYWHEEL HOUSING

14. **(A/T)**
INSTALL TRANSMISSION HOUSING ADAPTOR





15. **(A/T)**
INSTALL FLYWHEEL

(a) Clean the set bolt threads and crankshaft bolt holes of any residual sealer, oil or foreign particles. Remove any oil with kerosene or gasoline.

(b) Apply anaerobic adhesive and sealant [THREE BOND 1324 (Part No. 08833-00070) or equivalent] to two or three threads of the bolt end.

- This adhesive will not harden while exposed to air.
- It will act as a sealer or binding agent only when applied to threads, etc., and the air is cut off.

(c) Install the flywheel on the crankshaft.

(d) Install and uniformly tighten the bolts in several passes, in the sequence shown.

Torque: 890 kg-cm (64 ft-lb, 87 N·m)

16. **(A/T)**
INSTALL DRIVE PLATE
(See procedure step 15)

Torque: 890 kg-cm (64 ft-lb, 87 N·m)

17. **(M/T)**
INSTALL CLUTCH DISC AND COVER

FUEL SYSTEM

PRECAUTIONS

1. **Before working on the fuel system, disconnect the cable from the negative battery terminal.**
2. **When working on the fuel system, keep away from possible fire hazards and do not smoke.**
3. **Keep gasoline off rubber or leather parts.**
4. **Work on only one component group at a time to help avoid confusion between similar looking parts.**
5. **Keep work area clean to avoid contamination of the carburetor and components.**
6. **Be careful not to mix up or lose clips and springs.**

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine will not start/ hard to start (cranks ok)	Carburetor problems ● Choke operation ● Needle valve sticking or clogged ● Vacuum hose disconnected or damaged ● Fuel cut solenoid valve not open	 Check choke system Check float and needle valve Check fuel cut solenoid valve	 FU-12 FU-12
Rough idle or stalls	Carburetor problems ● Idle speed incorrect ● Slow jet clogged ● Idle mixture incorrect ● Fuel cut solenoid valve not open ● Fast idle speed setting incorrect (cold engine) ● Choke valve open (cold engine)	 Adjust idle speed Adjust idle mixture Check fuel cut solenoid valve Adjust fast idle speed Check choke system	 EM-7 EM-7 FU-12 EM-11
Engine hesitates/ poor acceleration	Carburetor problems ● Float level too low ● Accelerator pump faulty ● Power valve faulty ● Choke valve closed (hot engine) ● Choke valve stuck open (cold engine) Fuel line clogged	 Adjust float level Check power piston and valve Check choke system Check choke system Check fuel line	 FU-17 FU-12
Engine dieseling (runs after ignition switch is turned off)	Carburetor problems ● Linkage sticking ● Idle speed or fast idle speed out of adjustment ● Fuel cut solenoid faulty	 Adjust idle speed or fast idle speed Check fuel cut solenoid valve	 EM-7, 11 FU-12
Poor gasoline mileage	Carburetor problems ● Choke faulty ● Idle speed too high ● Deceleration fuel cut system faulty ● Power valve always open Fuel leak	 Check choke system Adjust idle speed Check deceleration system Repair as necessary	 EM-7
Insufficient fuel supply to carburetor	Fuel filter clogged Fuel pump faulty Fuel line clogged Fuel line bent or kinked	Replace fuel filter Replace fuel pump Check fuel line Replace fuel line	FU-24

ON-VEHICLE INSPECTION

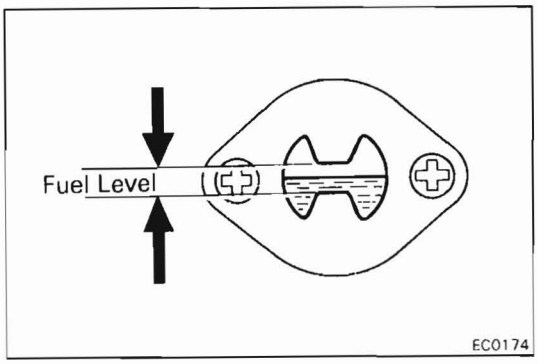
1. REMOVE AIR CLEANER OR AIR INTAKE CONNECTOR FROM CARBURETOR

2. INSPECT CARBURETOR AND LINKAGE

(a) Check that the various set screws, plugs and union bolts are tight and correctly installed.

(b) Check the linkage for excessive wear and missing snap rings.

(c) Check that the throttle valves open fully when the accelerator pedal is fully depressed.



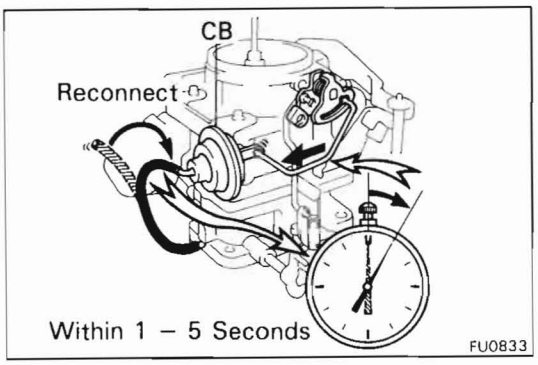
3. INSPECT FLOAT LEVEL

Check that the float level is about even with the correct level in the sight glass.

If not, check the carburetor needle valve and float level and adjust or repair as necessary.

COLD ENGINE

4. (w/ CB)
INSPECT CHOKE BREAKER (CB) SYSTEM



(a) Start the engine.

(b) Disconnect the vacuum hose from the CB and check that the choke linkage moves.

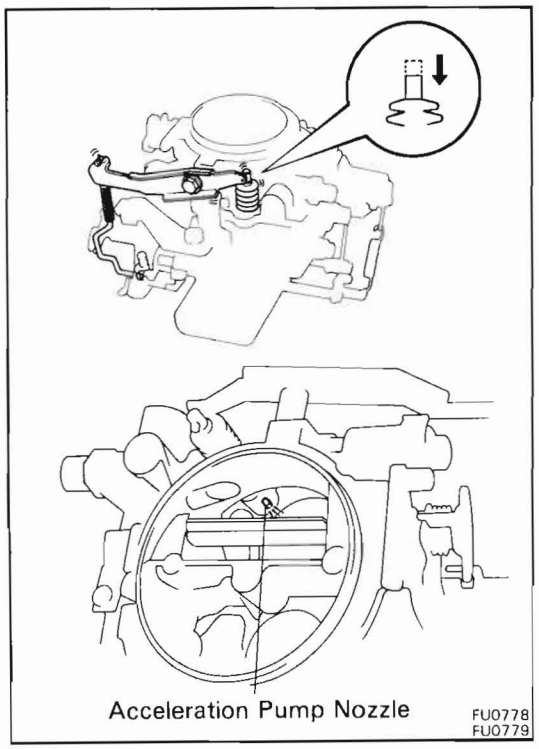
(c) Reconnect the vacuum hose to the CB and check that the choke linkage moves within the specified time after reconnecting the hose.

Time: 1 – 5 seconds

HOT ENGINE

5. INSPECT ACCELERATION PUMP

Open the throttle valve, and check that gasoline spurts out from the acceleration nozzle.



6. INSTALL AIR CLEANER ASSEMBLY OR AIR INTAKE CONNECTOR TO CARBURETOR

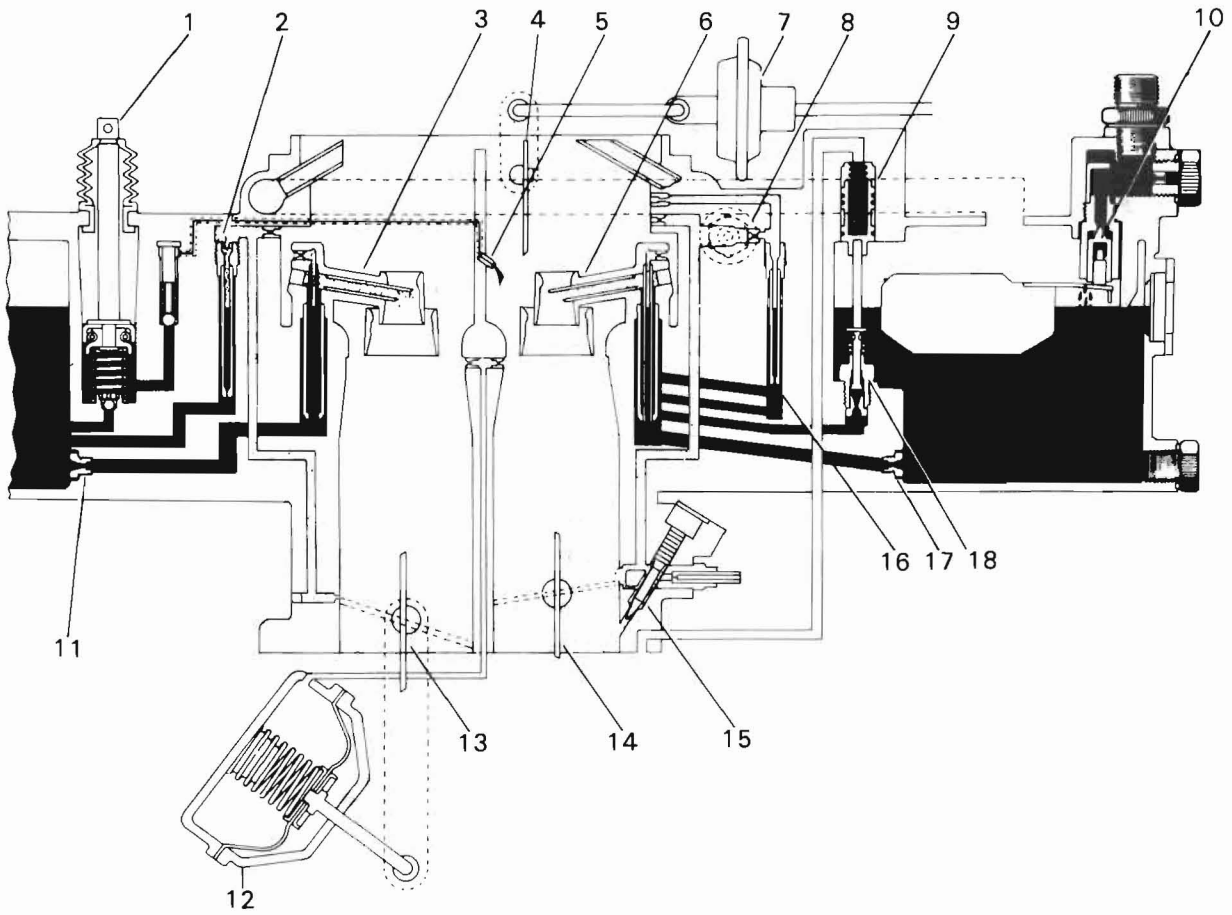
7. INSPECT AND ADJUST IDLE SPEED AND MIXTURE (See page EM-7)

8. INSPECT AND ADJUST FAST IDLE SPEED (See page EM-11)

9. INSPECT AND ADJUST THROTTLE POSITIONER SETTING SPEED (See page EM-12)

CARBURETOR

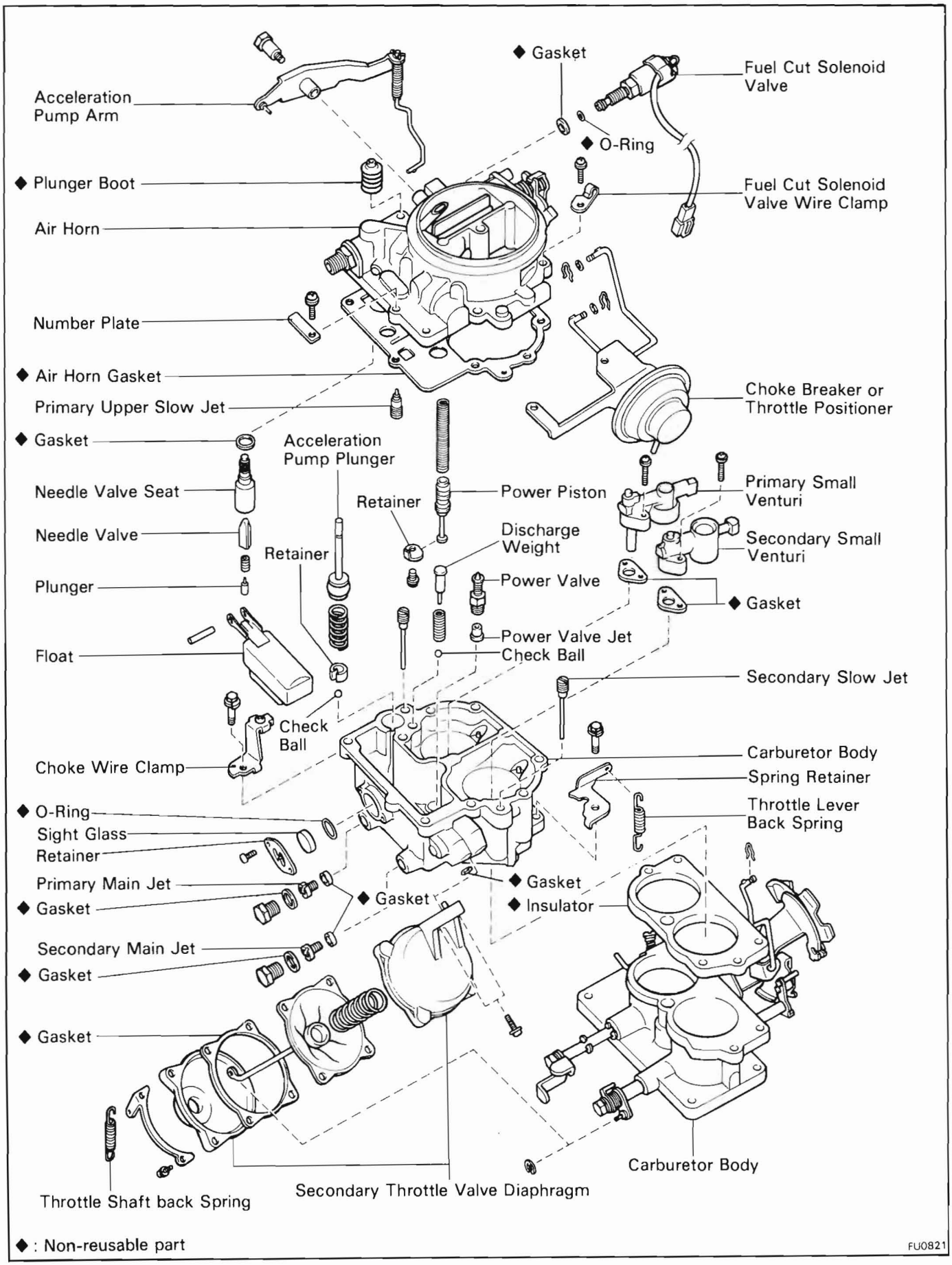
CARBURETOR CIRCUIT



1. Acceleration Pump Plunger
2. Secondary Slow Jet
3. Secondary Main Nozzle
4. Choke Valve
5. Acceleration Nozzle
6. Primary Main Nozzle
7. Choke Breaker
8. Fuel Cut Solenoid Valve
9. Power Piston
10. Needle Valve
11. Secondary Main Jet
12. Secondary Throttle Valve Diaphragm
13. Secondary Throttle Valve
14. Primary Throttle Valve
15. Idle Mixture Adjusting Screw
16. Primary Slow Jet
17. Primary Main Jet
18. Power Valve

FU0820

COMPONENTS



◆ : Non-reusable part

FU0821

REMOVAL OF CARBURETOR

1. REMOVE AIR CLEANER ASSEMBLY OR AIR INTAKE CONNECTOR

2. DISCONNECT CONNECTOR OF FUEL CUT SOLENOID VALVE

3. DISCONNECT CABLES

(a) Accelerator throttle cable

(b) Choke cable

(c) Automatic transmission throttle cable

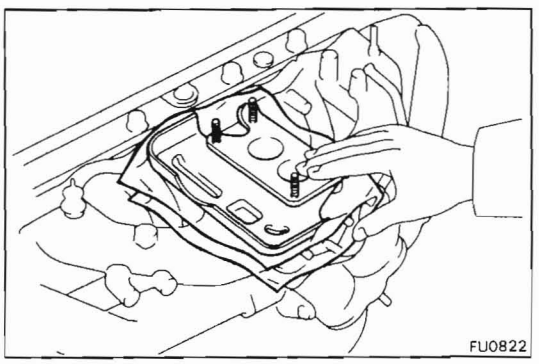
4. DISCONNECT FUEL INLET PIPE

5. DISCONNECT HOSES

(a) Emission control hoses

NOTE: Before disconnecting the emission control hoses, use tag to identify how they should be reconnected.

(b) (w/ Outer Vent Control Valve)
Outer vent control hose



6. REMOVE CARBURETOR

(a) Remove the four mount nuts.

(b) Lift out the carburetor.

(c) Cover the inlet hole of the intake manifold with a cloth.

DISASSEMBLY OF CARBURETOR

(See page FU-5)

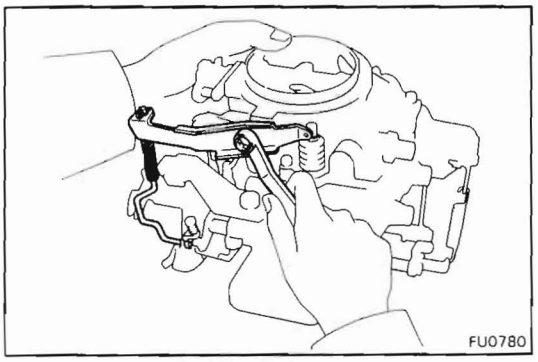
The following instructions are organized so that you work on only one component group at a time. This will help avoid confusion from similar looking parts from different sub-assemblies being on your workbench at the same time.

(a) To facilitate reassembly, arrange parts in order.

(b) Be careful not to mix up or lose clips and springs.

(c) Use SST (carburetor driver set).

SST 09860-11011



Disassembly of Air Horn

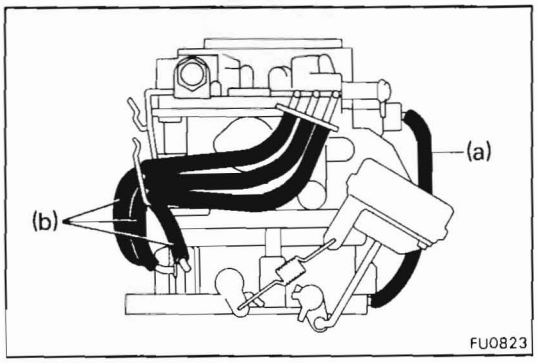
(See page FU-5)

1. REMOVE ACCELERATION PUMP ARM

(a) Remove the pivot bolt.

(b) Disconnect the pump arm from the pump plunger.

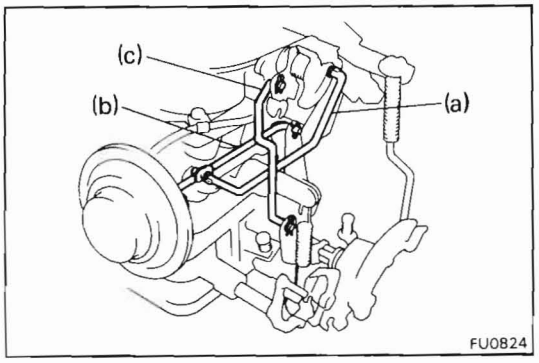
(c) Disconnect the pump connecting link from the throttle lever and remove the pump arm and pump connecting link.



2. DISCONNECT VACUUM HOSES FROM FLANGE PORTS

(a) (w/ CB only)
Choke breaker (CB) vacuum hose

(b) (S. Arabia and Australia)
Other three vacuum hoses

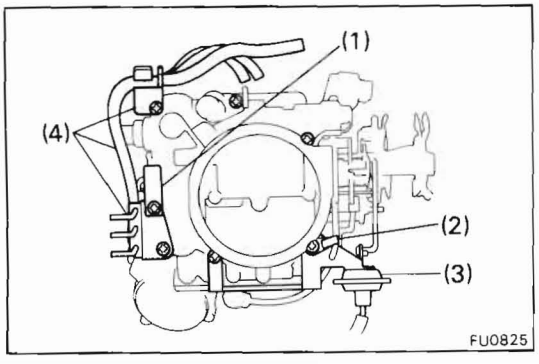


3. DISCONNECT LINKS FROM LEVERS

(a) (w/ CB)
Choke breaker (CB) link

(b) (w/ TP)
Throttle positioner (TP) link

(c) Fast idle Link



4. REMOVE AIR HORN ASSEMBLY

(a) Remove the seven screws and following parts:

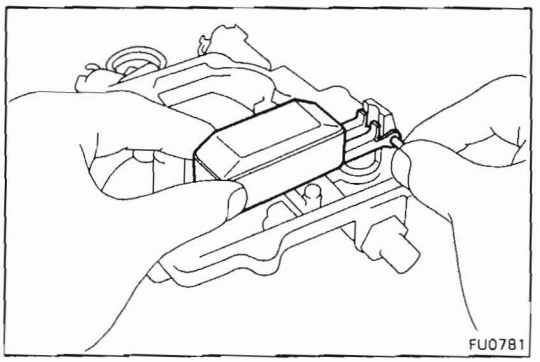
(1) (General countries M/T)
Number plate

(2) Wire clamp of fuel cut solenoid valve

(3) (w/ CB or TP)
Choke breaker (CB) with hose or Throttle positioner (TP)

(4) (S. Arabia and Australia)
Vacuum pipe supports with three hoses

(b) Lift off the air horn assembly together with the air horn gasket.



5. REMOVE FLOAT

Remove the pivot pin and float.

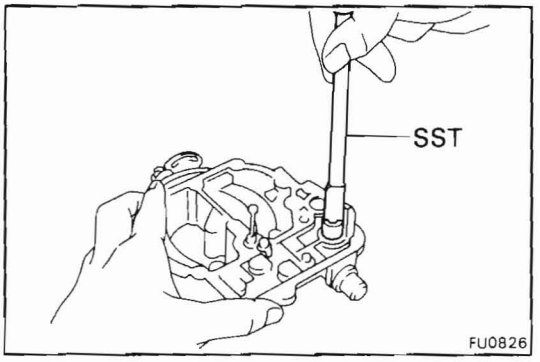
6. REMOVE NEEDLE VALVE

Remove the plunger, spring and needle valve.

7. REMOVE ACCELERATION PUMP PLUNGER

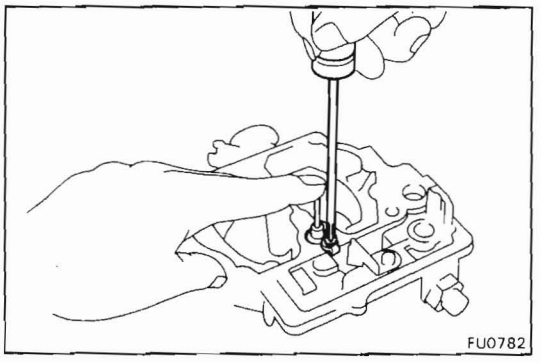
Remove the pump plunger and boot.

8. REMOVE AIR HORN GASKET



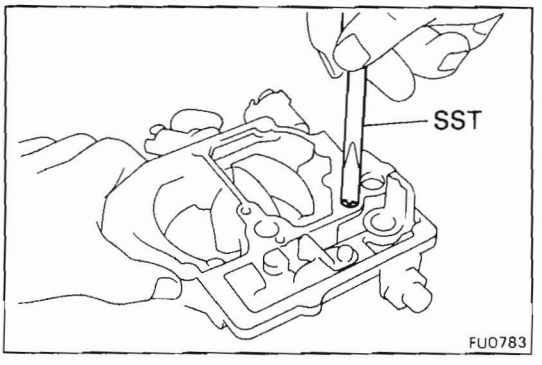
9. REMOVE NEEDLE VALVE SEAT

Remove the needle valve seat and gasket.

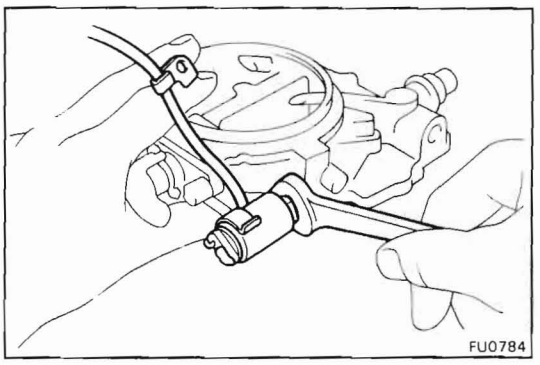


10. REMOVE POWER PISTON

Remove the screw, retainer, power piston and spring.

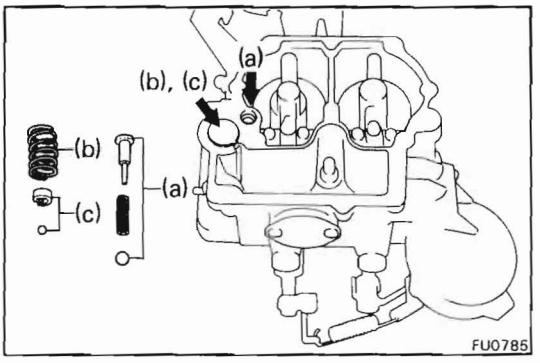


11. REMOVE PRIMARY UPPER SLOW JET



12. REMOVE FUEL CUT SOLENOID VALVE

Remove the solenoid valve and gasket.



Disassembly of Carburetor Body

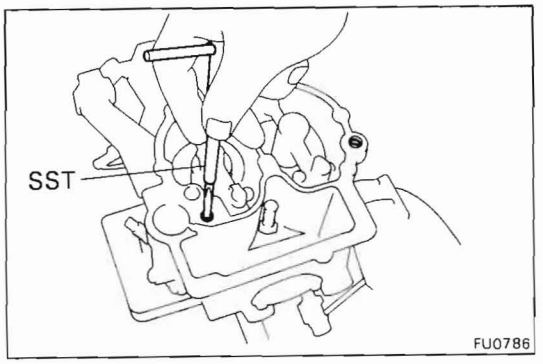
(See page FU-5)

1. REMOVE CHECK BALLS FOR ACCELERATION

(a) Remove the pump discharge weight, spring and large ball.

(b) Remove the plunger spring.

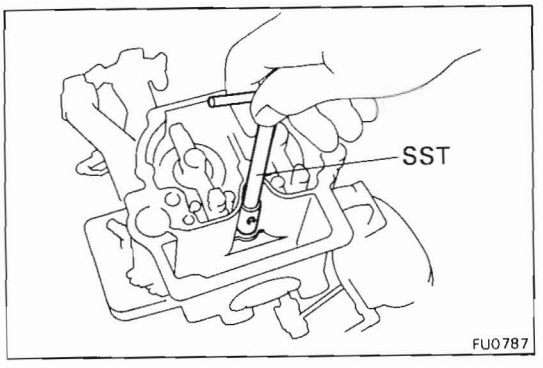
(c) Using tweezers, remove the plunger retainer and small ball.



2. REMOVE SLOW JETS

(a) Remove the primary slow jet.

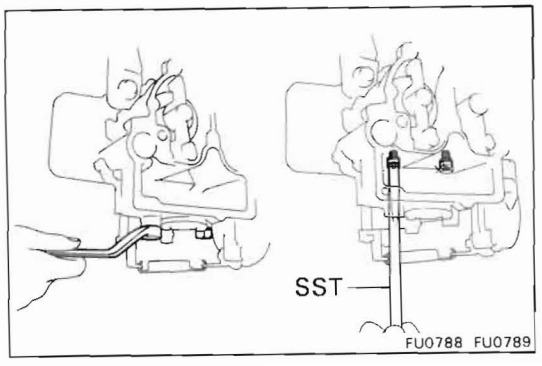
(b) Remove the secondary slow jet.



3. REMOVE POWER VALVE

(a) Remove the power valve and jet assembly.

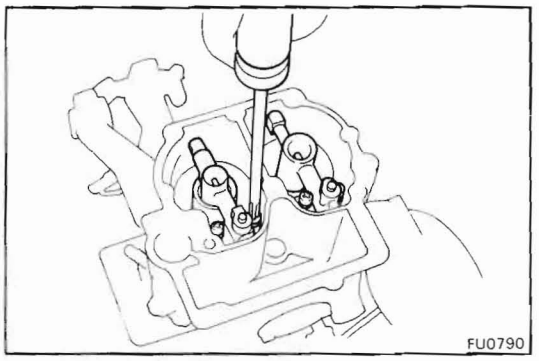
(b) Disassemble the power valve and jet.



4. REMOVE MAIN JETS

(a) Remove the primary main passage plug and gasket, and remove the primary main jet and gasket.

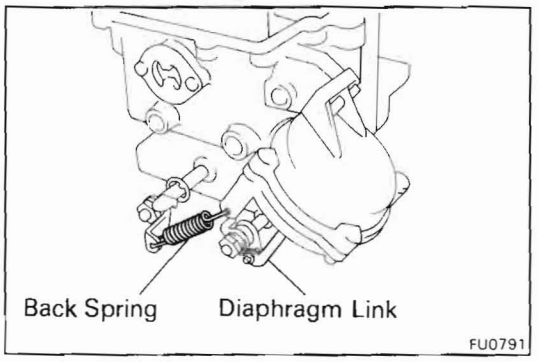
(b) Remove the secondary main passage plug and gasket, and remove the secondary main jet and gasket.



5. REMOVE SMALL VENTURIES

(a) Remove the two screws, primary small venturi and gasket.

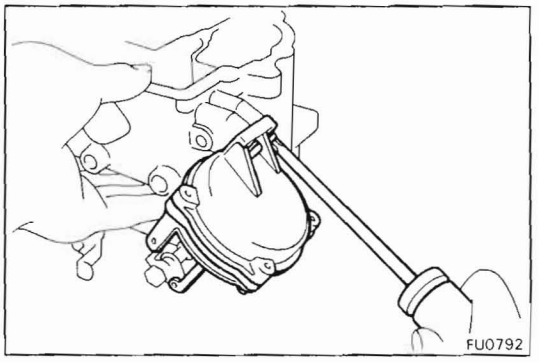
(b) Remove the two screws, secondary small venturi and gasket.



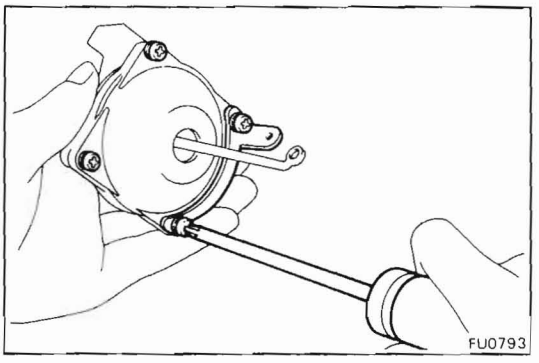
6. REMOVE SECONDARY THROTTLE VALVE DIAPHRAGM

(a) Remove the throttle shaft back spring.

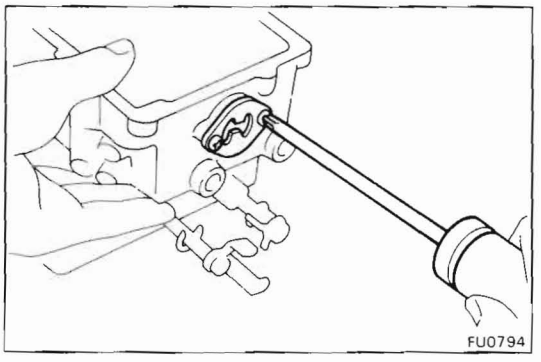
(b) Remove the E-ring and disconnect the diaphragm link.



(c) Remove the two screws, throttle valve diaphragm assembly and gasket.

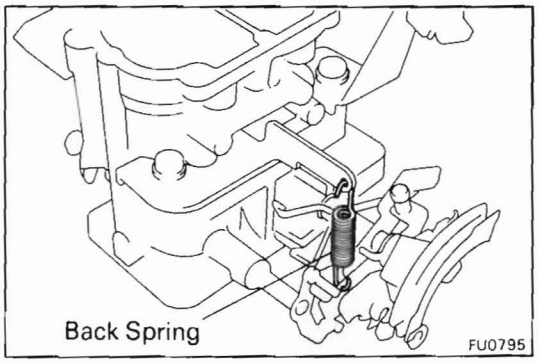


(d) If necessary, remove the four screws and spring retainer and disassemble the throttle valve diaphragm.



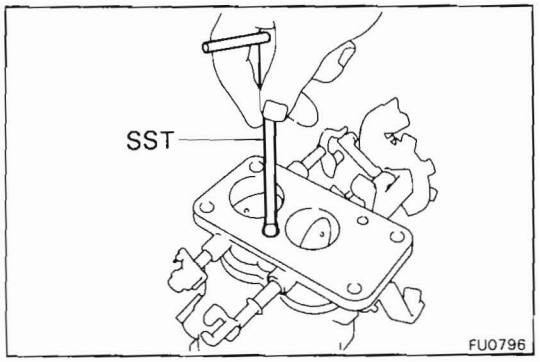
7. IF NECESSARY, REMOVE SIGHT GLASS

Remove the two screws, retainer, sight glass and O-ring.

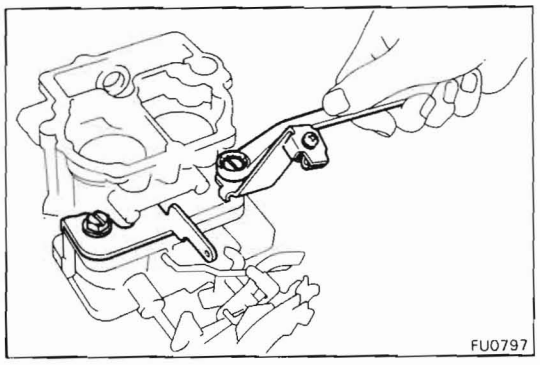


8. SEPARATE CARBURETOR BODY AND FLANGE

(a) Remove the throttle lever back spring.



(b) Remove the passage screw and spring washer.

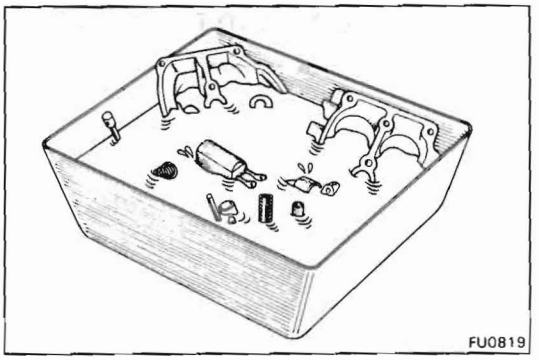


(c) Remove the bolt, spring washer and choke wire clamp.

(d) Remove the bolt, spring washer and spring retainer.

(e) Separate the body and flange.

(f) Remove the insulator.


FU0819

GENERAL CLEANING PROCEDURE

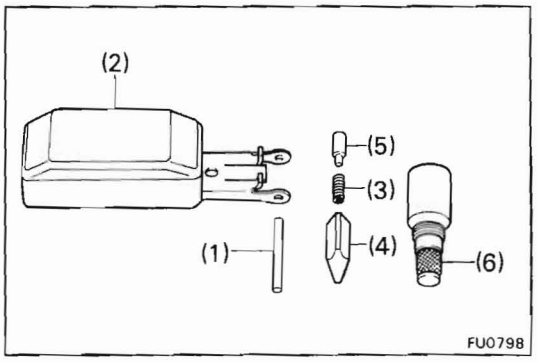
CLEAN DISASSEMBLED PARTS BEFORE INSPECTION

(a) Wash and clean the cast parts with a soft brush and carburetor cleaner.

(b) Clean off the carbon around the throttle valve.

(c) Wash the other parts thoroughly in carburetor cleaner.

(d) Blow all dirt and other foreign matter from the jets, fuel passages and restrictions in the body.



FU0798

INSPECTION OF CARBURETOR

1. INSPECT FLOAT AND NEEDLE VALVE

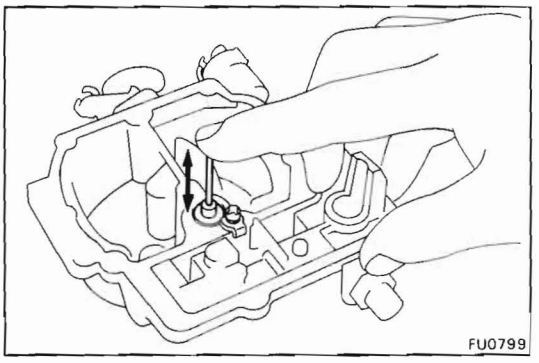
(a) Check pivot pin (1) for scratches and excessive wear.

(b) Check the float (2) for broken lips and wear in the pivot pin holes.

(c) Check the spring (3) for breaks and deformation.

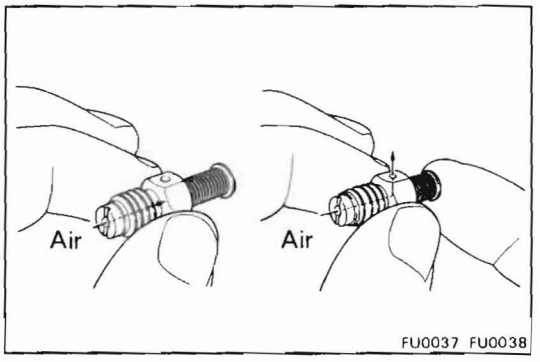
(d) Check the needle valve (4) and plunger (5) for wear or damage.

(e) Check the strainer (6) for rust and breaks.


FU0799

2. INSPECT POWER PISTON

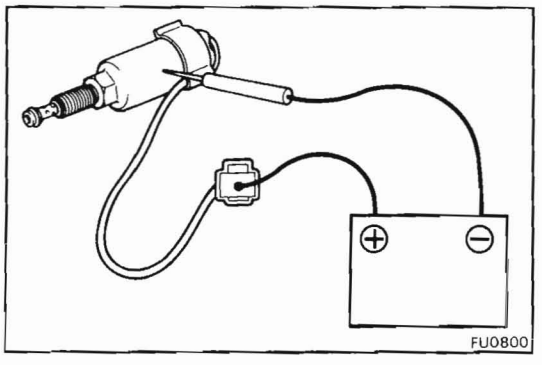
Check that the power piston moves smoothly.



FU0037 FU0038

3. INSPECT POWER VALVE

Check for faulty opening and closing action.



FU0800

4. INSPECT FUEL CUT SOLENOID VALVE

(a) Connect the valve body and terminal to the battery terminals.

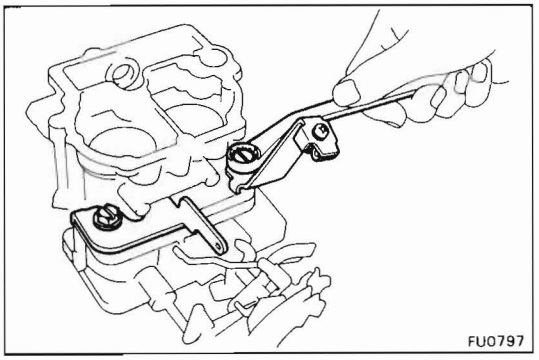
(b) You should feel a click from the solenoid valve when the battery power is connected and disconnected.

If the solenoid valve does not operate properly, replace it.

ASSEMBLY OF CARBURETOR

(See page FU-5)

NOTE: Use new gaskets and O-rings throughout.



Assembly of Carburetor Body

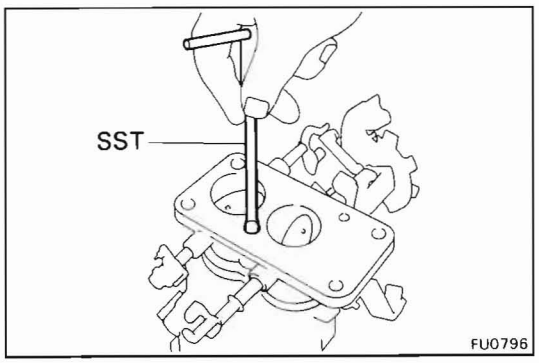
(See page FU-5)

1. ASSEMBLE CARBURETOR BODY AND FLANGE

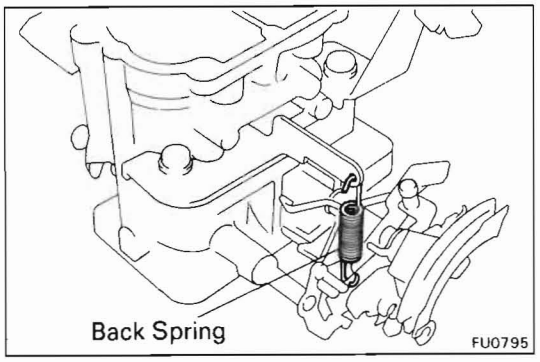
(a) Assemble the flange and body together with a new insulator.

(b) Install the spring retainer with the bolt.

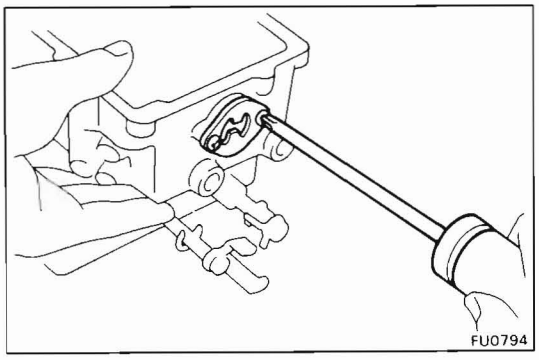
(c) Install the choke wire clamp with the bolt.



(d) Install the passage screw together with the spring washer.

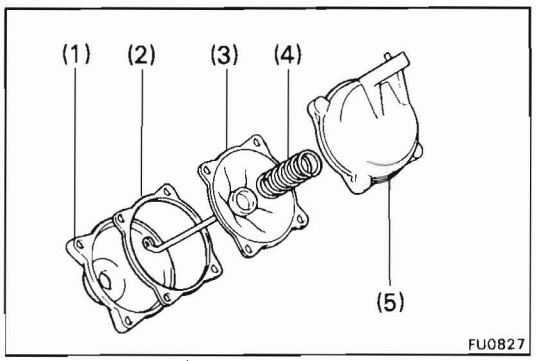


(e) Install the throttle lever back spring.



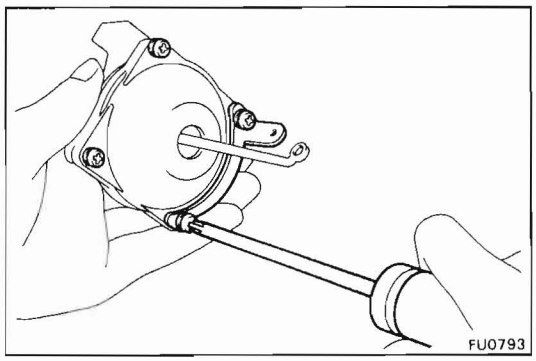
2. INSTALL SIGHT GLASS

Install a new O-ring, the sight glass and retainer with the two screws.

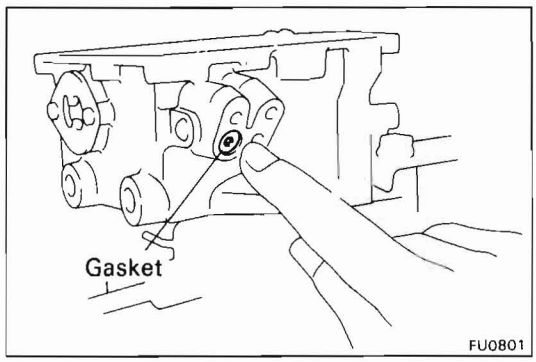


3. INSTALL SECONDARY THROTTLE VALVE DIAPHRAGM

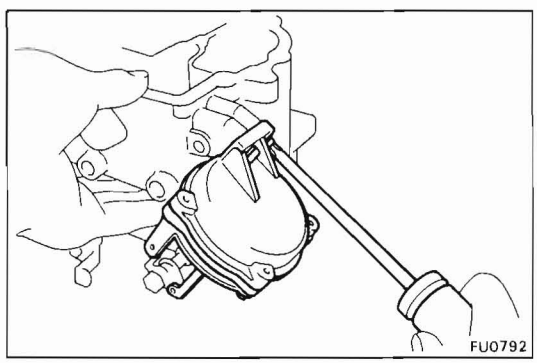
(a) Assemble the housing (1), a new gasket (2), the diaphragm (3), spring (4) and cover (5).



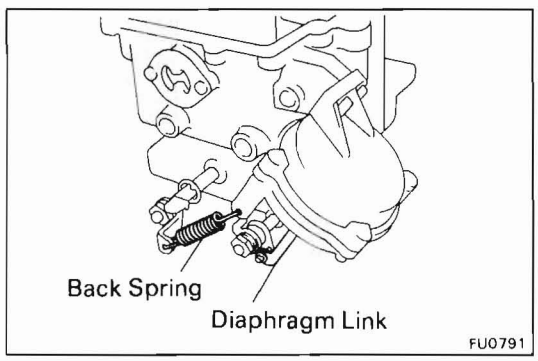
(b) Install the spring retainer and four screws.



(c) Place a new gasket in position on the carburetor body.

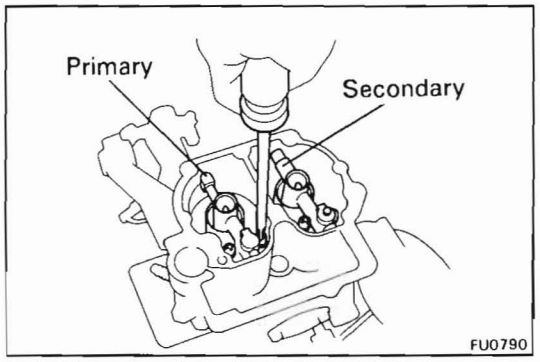


(d) Install the throttle valve diaphragm with the two screws.



(e) Connect the diaphragm link with the E-ring.

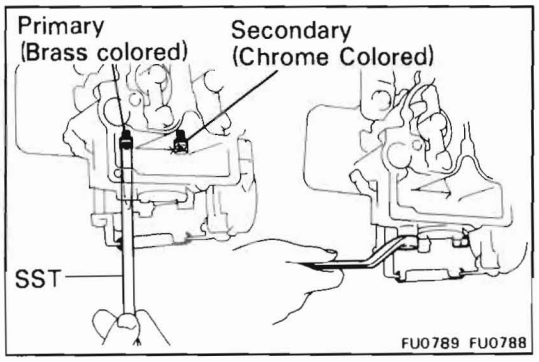
(f) Install the throttle shaft back spring.



4. INSTALL SMALL VENTURIES

(a) Install a new gasket and the primary venturi with the two screws.

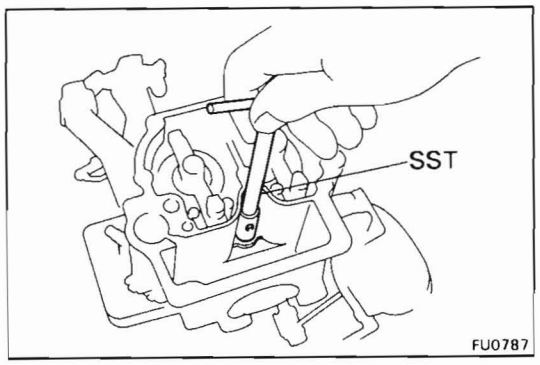
(b) Install a new gasket and the secondary venturi with the two screws.



5. INSTALL MAIN JETS

(a) Install a new gasket and the primary main jet (Brass colored). Install a new gasket and the passage plug.

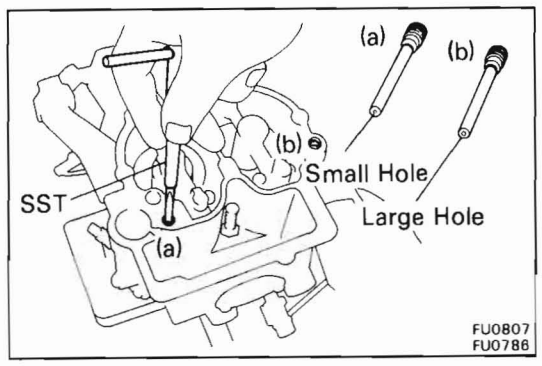
(b) Install a new gasket and the secondary main jet (Chrome colored). Install a new gasket and the passage plug.



6. INSTALL POWER VALVE

(a) Assemble the power valve and jet.

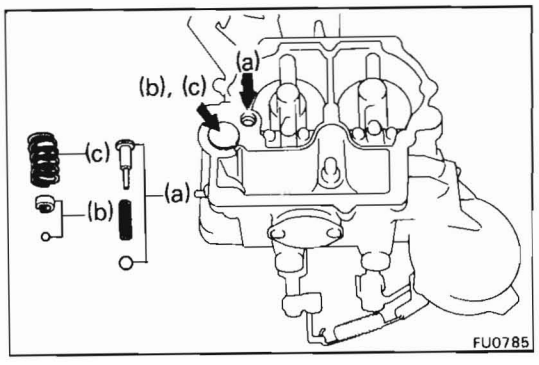
(b) Install the power valve assembly.



7. INSTALL SLOW JETS

(a) Install the primary slow jet.

(b) Install the secondary slow jet.

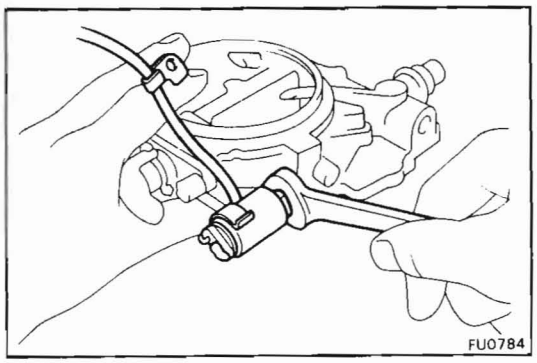


8. INSTALL CHECK BALLS FOR ACCELERATION

(a) Install the pump discharge large ball, spring and weight.

(b) Using tweezers, install the plunger small ball and retainer.

(c) Install the plunger spring.



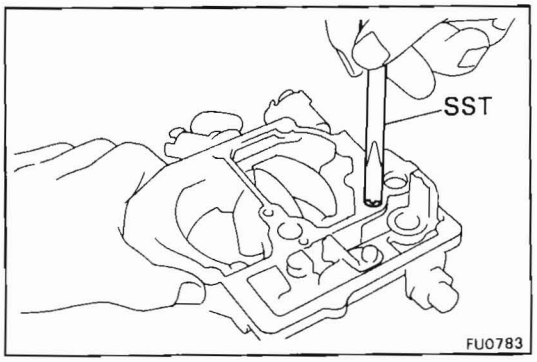
Assembly of Air Horn

(See page FU-5)

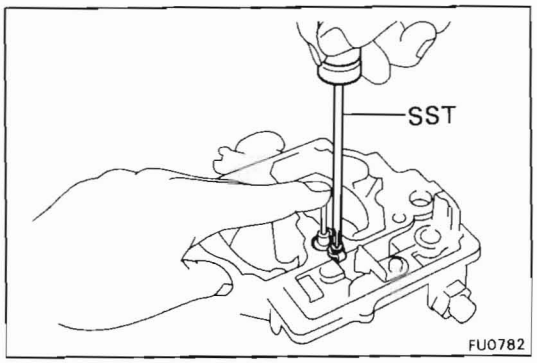
1. INSTALL FUEL CUT SOLENOID VALVE

(a) Install a new O-ring to the solenoid valve.

(b) Install the solenoid valve together with a new gasket.

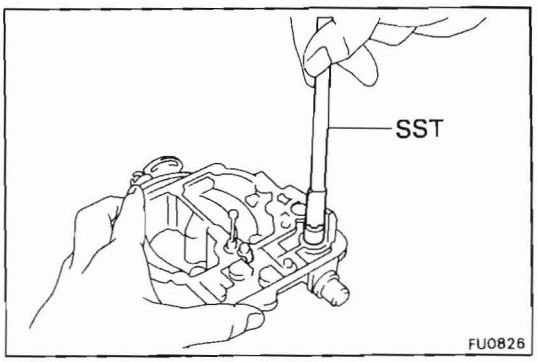


2. INSTALL PRIMARY UPPER SLOW JET



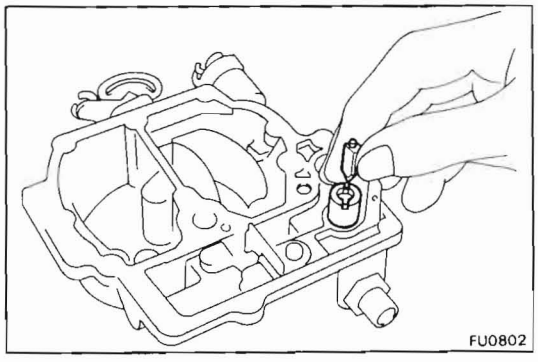
3. INSTALL POWER PISTON

Install the spring and power piston with the retainer and screw.



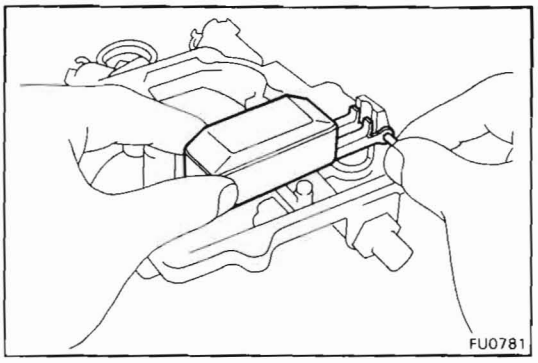
4. INSTALL NEEDLE VALVE SEAT

Install the valve seat together with a new gasket.



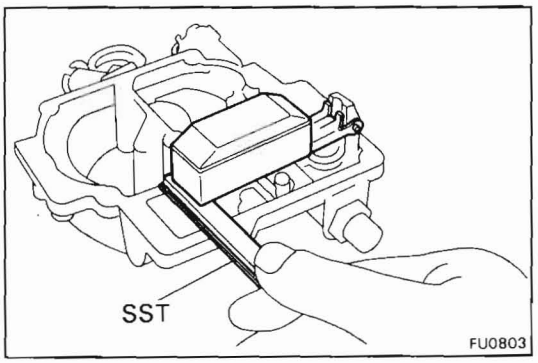
5. INSTALL NEEDLE VALVE

Insert the needle valve, spring and plunger into the needle valve seat.



6. ADJUST FLOAT LEVEL

(a) Install the float with the pivot pin.

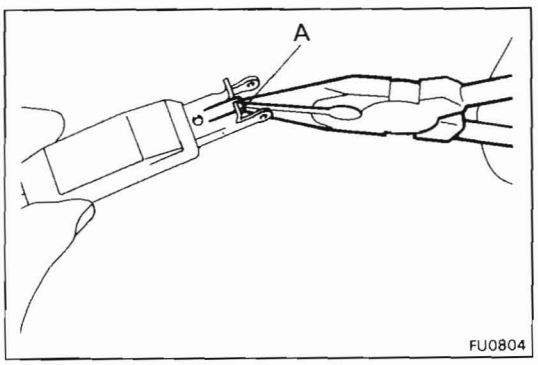


(b) Allow the float to hang down by its own weight. Using SST, measure the clearance between the float tip and air horn.

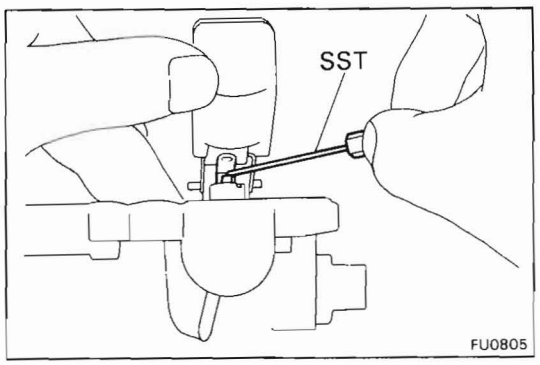
SST 09240-00014

Float level (raised position): 6.0 mm (0.236 in.)

NOTE: This measurement should be made without a gasket on the air horn.



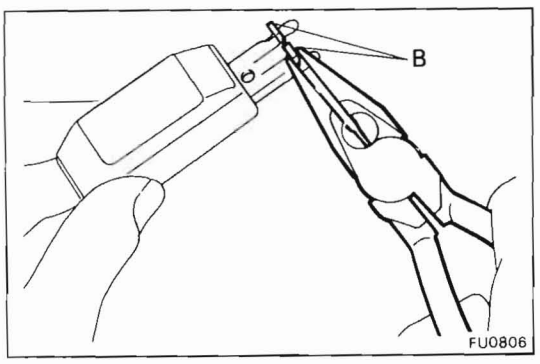
(c) Adjust by bending the portion of the float lip marked A.



(d) Lift up the float.
Using SST, measure the clearance between the needle valve plunger and float lip.

SST 09240-00020

Float level (lowered position): 1.1 mm (0.043 in.)



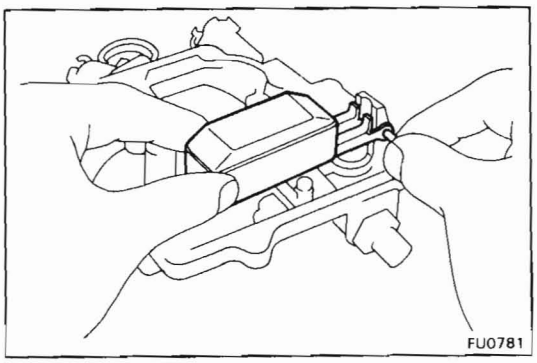
(e) Adjust by bending the position of the float lip marked B.

7. INSTALL NEW AIR HORN GASKET

Place the air horn gasket in the air horn.

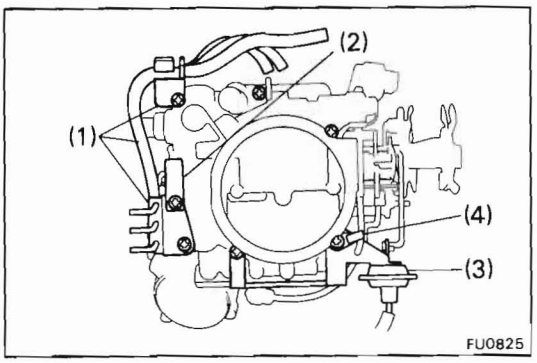
8. INSTALL ACCELERATION PUMP PLUNGER

Install a new boot and the pump plunger.



9. INSTALL FLOAT

Install the float with the pivot pin.



10. INSTALL AIR HORN ASSEMBLY

(a) Place the air horn in the carburetor body.

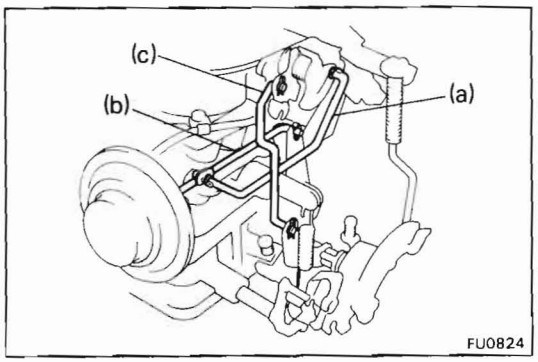
(b) Install the following parts with the seven screws:

(1) (S. Arabia and Australia)
Vacuum pipe supports with three hoses

(2) (General Countries M/T)
Number plate

(3) (w/ CB or TP)
Choke breaker (CB) with hose or throttle positioner (TP)

(4) Wire clamp of fuel cut solenoid valve

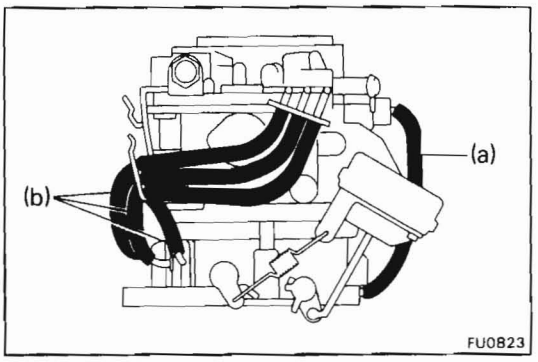


11. CONNECT LINKS

(a) (w/ CB)
Choke breaker (CB) link

(b) (w/ TP)
Throttle positioner (TP) link

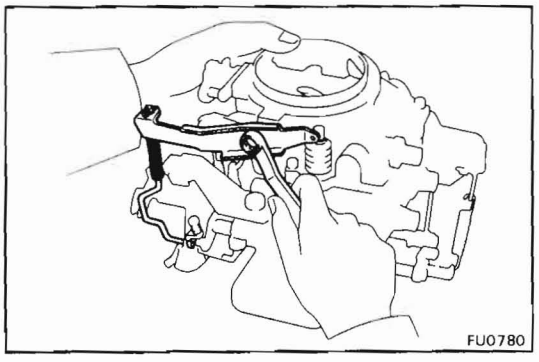
(c) Fast idle link



12. CONNECT VACUUM HOSES:

(a) (w/ CB only)
Choke breaker (CB) vacuum hose

(b) (S. Arabia and Australia)
Other three vacuum hoses



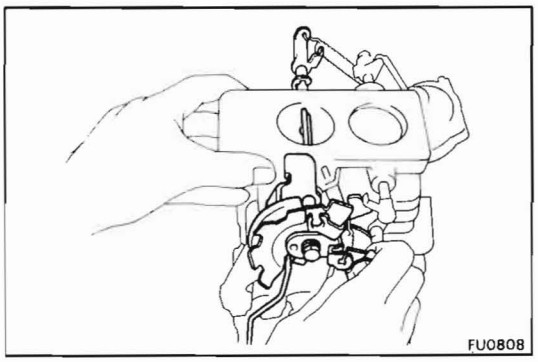
13. INSTALL ACCELERATION PUMP ARM

(a) Connect the pump connecting link to the throttle lever.

(b) Connect the pump arm to the pump plunger.

(c) Install the pump arm with the pivot bolt.

14. CHECK FOR SMOOTH OPERATION OF EACH PART



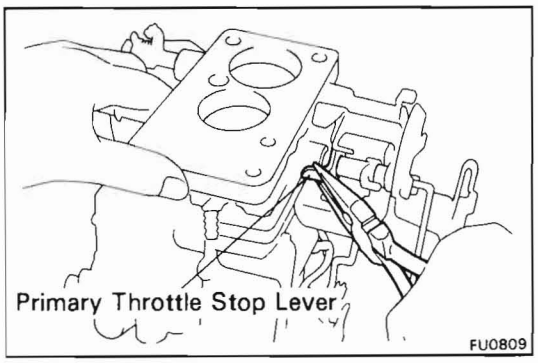
ADJUSTMENT OF CARBURETOR

NOTE: Use SST 09240-00014 to make adjustment.

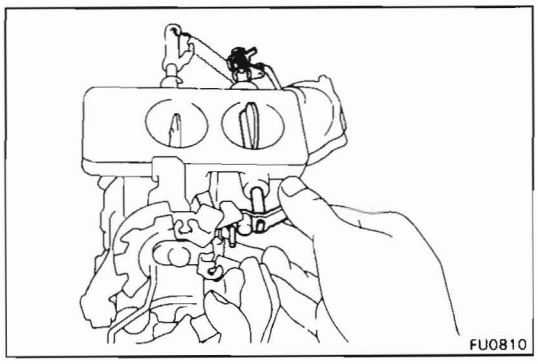
1. CHECK AND ADJUST THROTTLE VALVE OPENING

(a) Check the full opening angle of the primary throttle valve.

Standard angle: 90° from horizontal

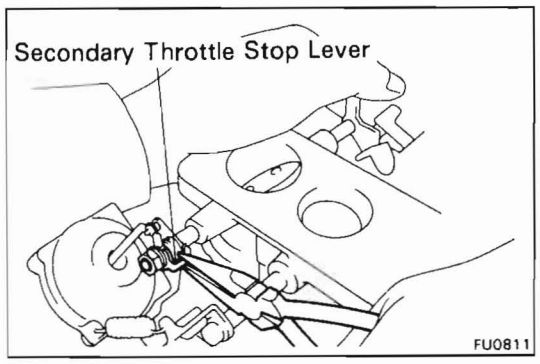


(b) Adjust by bending the primary throttle stop lever.

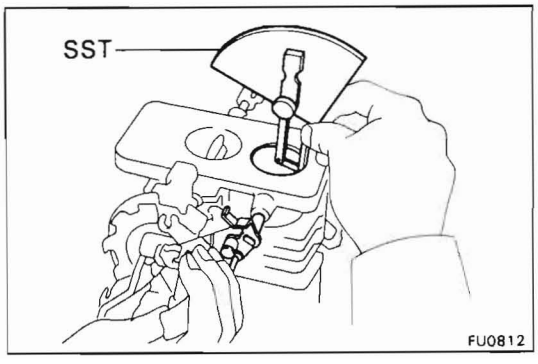


(c) Check the full opening angle of the secondary throttle valve.

Standard angle: 90° from horizontal



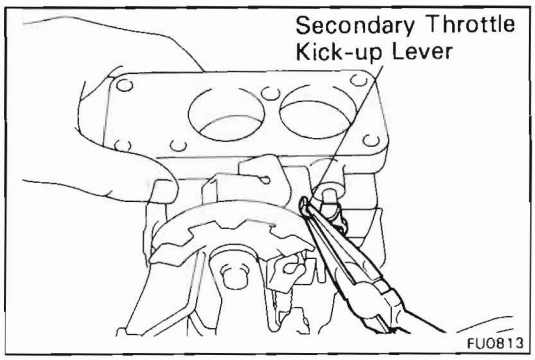
(d) Adjust by bending the secondary throttle stop lever.



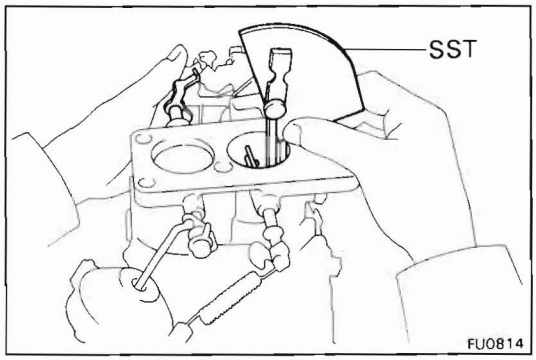
2. CHECK AND ADJUST KICK-UP SETTING

(a) With the primay throttle valve fully opened, check the opening angle of the secondary throttle valve.

Standard angle: 25° from horizonal



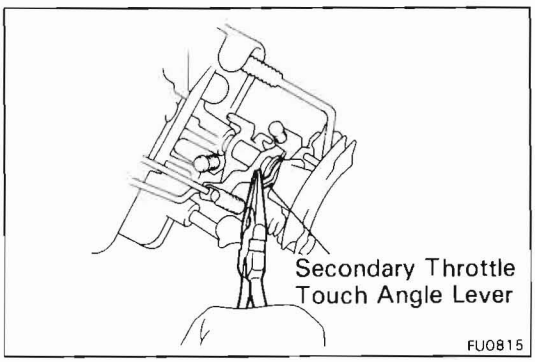
(b) Adjust by bending the secondary throttle kick-up lever.



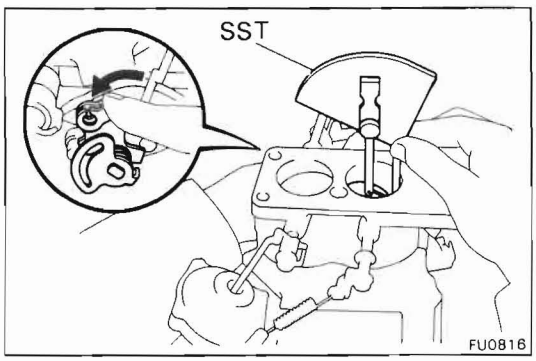
3. CHECK AND ADJUST SECONDARY TOUCH ANGLE

(a) Check the primary throttle valve opening angle at the same time the primary kick lever just touches the secondary kick lever.

Standard angle: 67° from horizontal



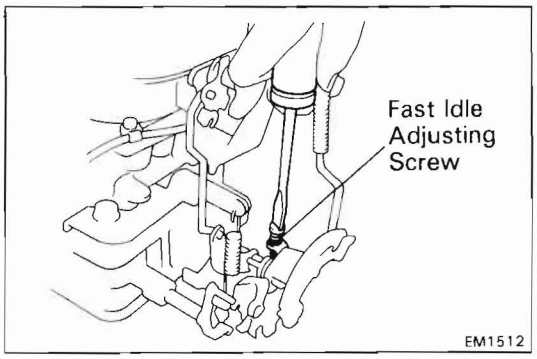
(b) Adjust by bending the secondary throttle touch angle lever.



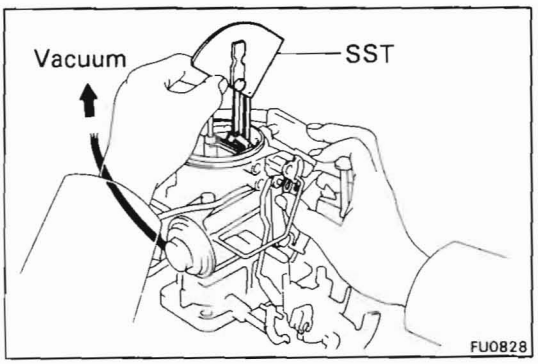
4. CHECK AND ADJUST FAST IDLE SETTING

(a) With the choke valve fully closed, check the primary throttle valve angle.

Standard angle: 23° from horizontal



(b) Adjust by turning the fast idle adjusting screw.

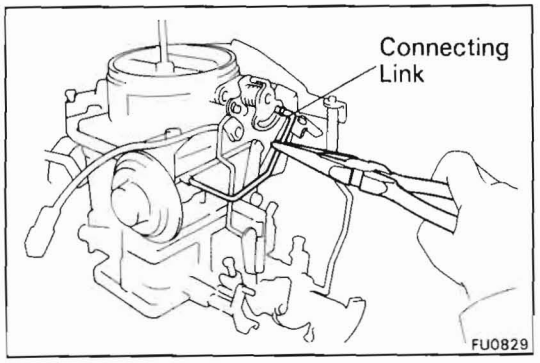


5. CHECK AND ADJUST CHOKE BREAKER (CB)

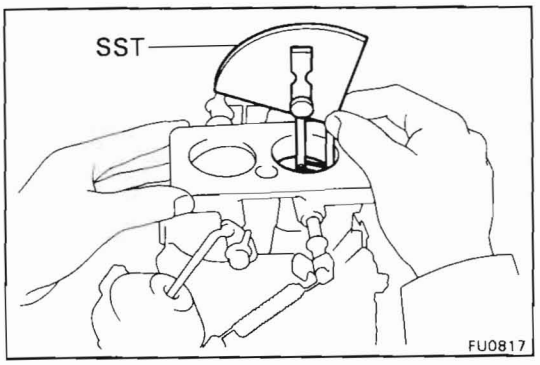
(a) With the choke valve fully closed, apply vacuum to the CB.

(b) Check the choke valve angle.

Standard angle: 38° from horizontal



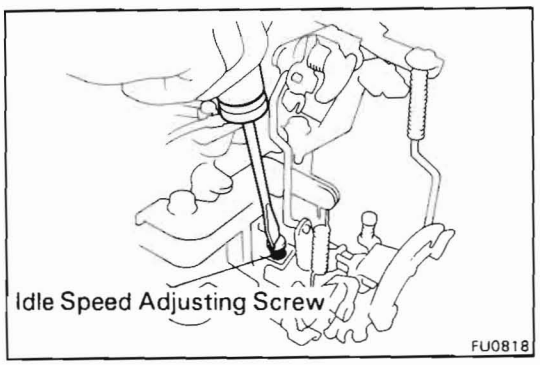
(c) Adjust by bending the connecting link.



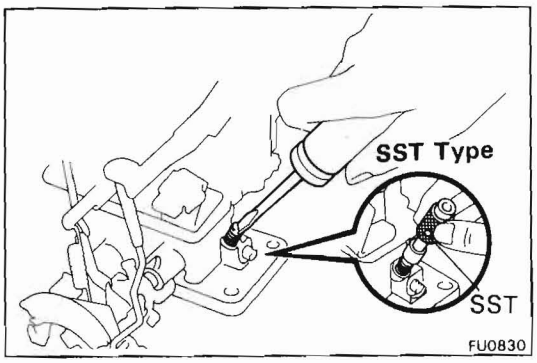
6. PRESET IDLE SPEED ADJUSTING SCREW

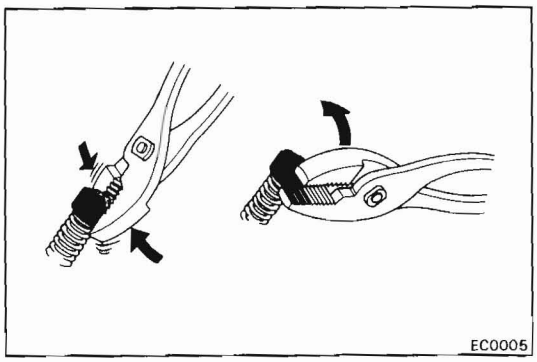
(a) Check the primary throttle valve angle.

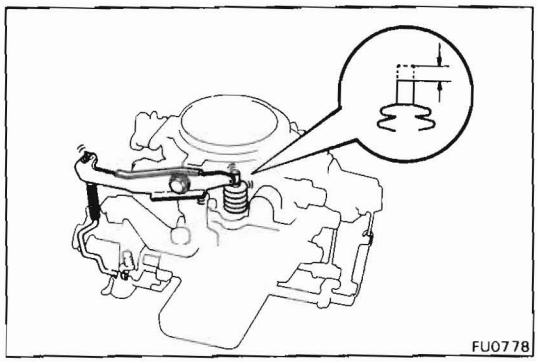
Standard angle: 14° from horizontal



(b) Adjust by turning the idle speed adjusting screws.







7. PRESET IDLE MIXTURE ADJUSTING SCREW

If the idle mixture adjusting screw has been removed, fully screw it in and then unscrew it the following amount.

Standard:

S. Arabia M/T
Return 3 3/4 turns from fully closed
S. Arabia A/T
Return 4 1/2 turns from fully closed
Other Return 2 turns from fully closed

SST 09243-00020 (S. Arabia)

CAUTION: Use care not to screw it in too tightly and damage the screw tip.

NOTE: If there is an idle limiter cap on the idle mixture adjusting screw, remove it.

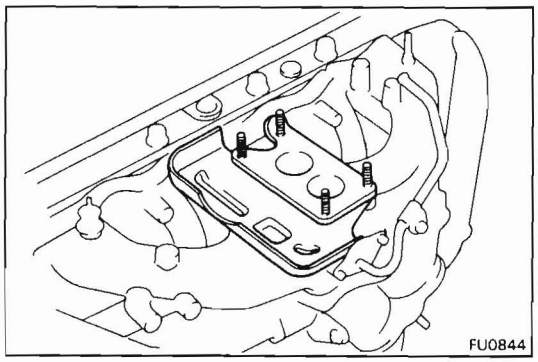
8. CHECK AND ADJUST ACCELERATION PUMP STROKE

(a) Rotate the throttle shaft and check the length of the stroke.

Standard stroke: 9.5 mm (0.374 in.)

(b) Adjust the pump stroke by bending the connecting link.

9. CHECK FOR SMOOTH OPERATION OF EACH PART



INSTALLATION OF CARBURETOR

1. **INSTALL CARBURETOR**
   (a) Place the insulator on the intake manifold.
   (b) Install the carburetor with the four nuts.

2. **CONNECT HOSES**
   (a) Emission control hoses
   (b) (w/ Outer Vent Control Valve)
   Outer vent control hose

3. **CONNECT FUEL INLET PIPE**
   Torque: 150 kg-cm (11 ft-lb, 15 N·m)

4. **CONNECT CABLES**
   (a) Accelerator throttle cable
   (b) Choke cable
   (c) Throttle cable for automatic transmission

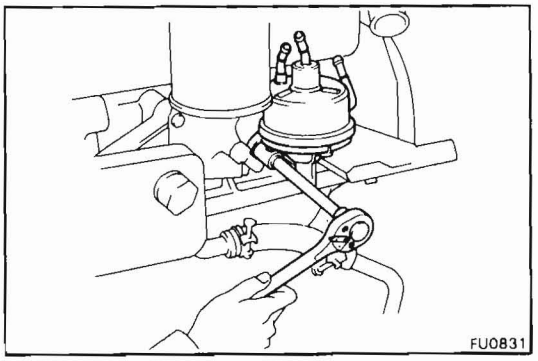
5. **CONNECT CONNECTOR OF FUEL CUT SOLENOID VALVE**

6. **INSTALL AIR CLEANER ASSEMBLY OR AIR INTAKE CONNECTOR**

7. **CHECK AND ADJUST IDLE SPEED AND IDLE MIXTURE (See page EM-7)**

8. **CHECK AND ADJUST FAST IDLE SPEED (See page EM-11)**

9. **CHECK AND ADJUST THROTTLE POSITIONER SETTING SPEED (See page EM-12)**



FUEL PUMP

REMOVAL OF FUEL PUMP

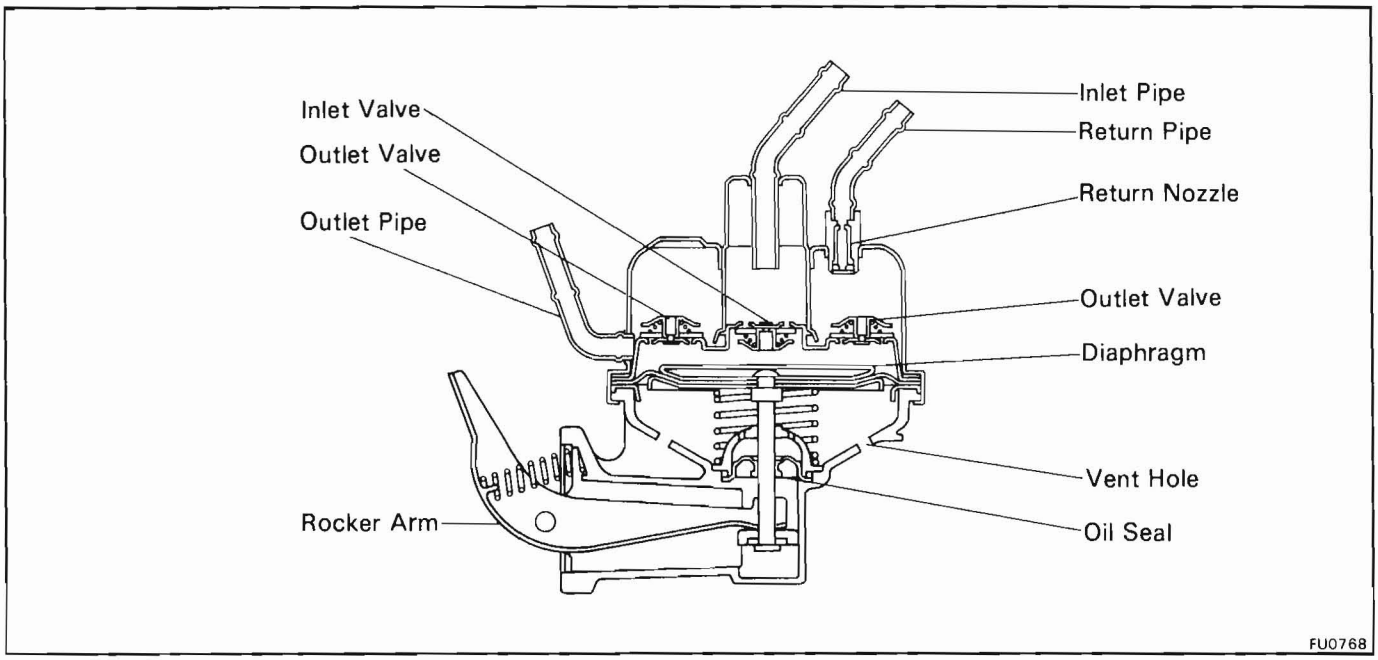
1. DISCONNECT FUEL HOSES FROM FUEL PUMP

2. REMOVE FUEL PUMP

Remove the two bolts, fuel pump, insulator and gasket.

INSPECTION OF FUEL PUMP (Airtight Test)

CUTAWAY VIEW

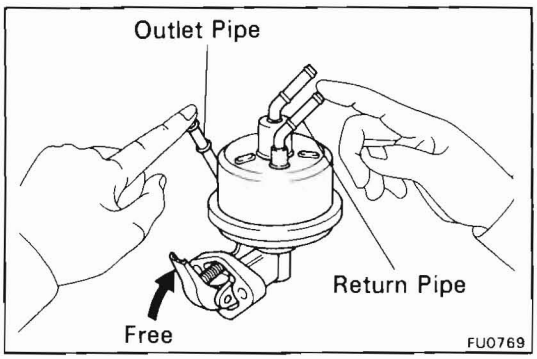


PRECHECKS

Before performing the following checks on the fuel pump:

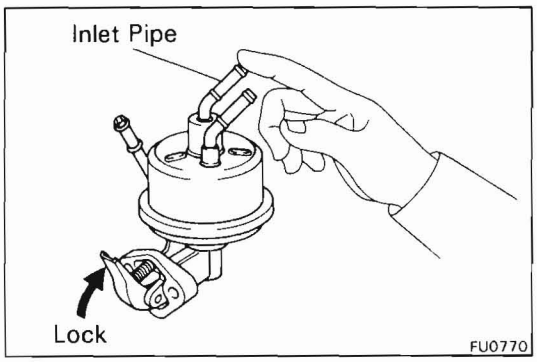
(a) Run some fuel through the pump to insure that the check valves seal tightly (a dry check valve may not seal properly).

(b) Without blocking off any pipes, operate the rocker arm and check the amount of force necessary for operation and the amount of arm play. This same amount of force should be used in the checks.



1. CHECK INLET VALVE

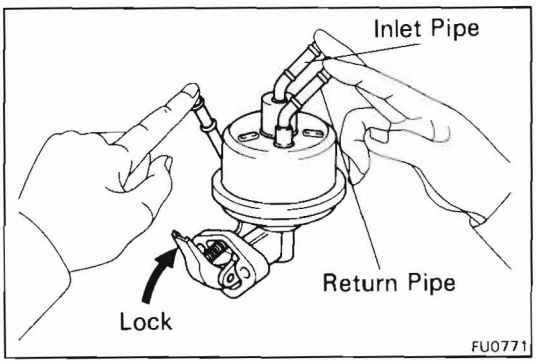
Block off the outlet and return pipes with your finger and check that there is an increase in rocker arm play and that the rocker arm moves freely (no reaction force).



2. CHECK OUTLET VALVE

Block off the inlet pipe with your finger and check that the rocker arm locks (does not operate with same amount of force used in the precheck above).

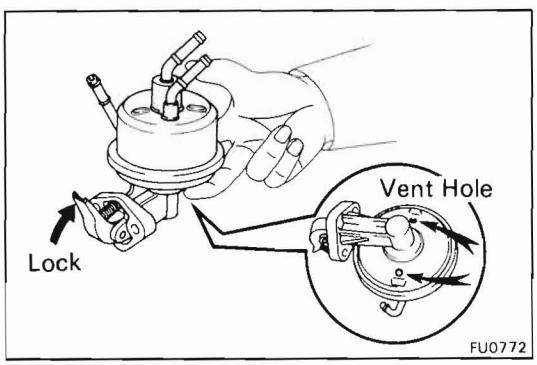
NOTE: Never use more force than that used in the precheck. This applies to checks 3 and 4 also.



3. CHECK DIAPHRAGM

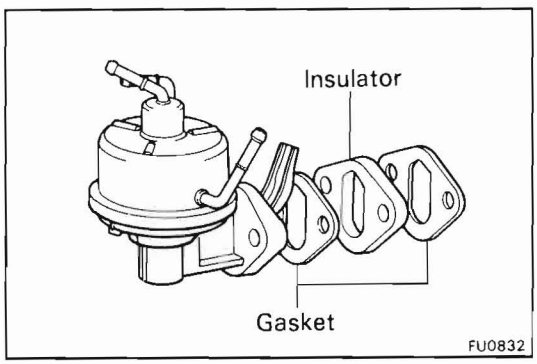
Block off the inlet, outlet and return pipes and check that the rocker arm locks.

NOTE: If all three of these checks are not as specified, the caulking (sealing) of the body and upper casing is defective.



4. CHECK OIL SEAL

Block off the vent hole with your finger and check that the rocker arm locks.



INSTALLATION OF FUEL PUMP

1. INSTALL FUEL PUMP

Install new gaskets, insulator and fuel pump with the two bolts.

Torque: 185 kg-cm (13 ft-lb, 18 N·m)

2. CONNECT FUEL HOSES TO FUEL PUMP

3. START ENGINE AND CHECK FOR LEAKS

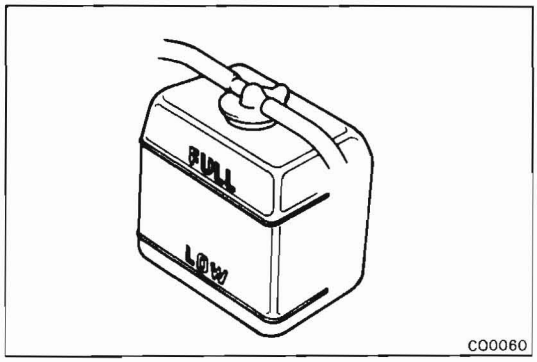
– MEMO –

COOLING SYSTEM

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine overheats	Fan belt loose or missing	Adjust or replace belt	CH-4
	Dirt, leaves or insects on radiator or condenser	Clean radiator or condenser	
	Hoses, water pump, thermostat housing, radiator, heater, core plugs or head gasket leakage	Repair as necessary	
	Thermostat faulty	Check thermostat	CO-11
	Ignition timing retarded	Set timing	EM-6
	Fluid coupling faulty	Replace fluid coupling	
	Radiator hose plugged or rotted	Replace hose	
	Water pump faulty	Replace water pump	CO-4
	Radiator plugged or cap faulty	Check radiator	CO-12
	Cylinder head or block cracked or plugged	Repair as necessary	

NOTE: The thermostat on the 3F engine is equipped with a by-pass valve. Therefore, if the engine tends to overheat, removal of the thermostat would have an adverse effect, causing a lowering in cooling efficiency.

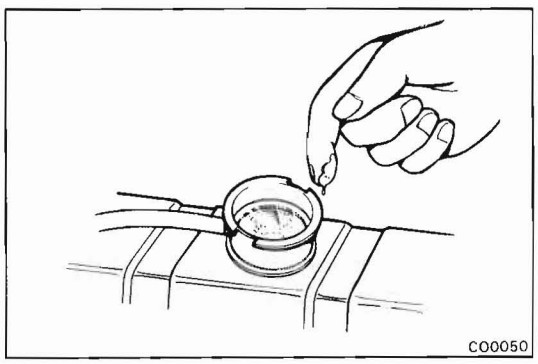


CHECK AND REPLACEMENT OF ENGINE COOLANT

1. CHECK ENGINE COOLANT LEVEL AT RESERVE TANK

The coolant level should be between the "LOW" and "FULL" lines.

If low, check for leaks and add coolant up to the "FULL" line.



2. CHECK ENGINE COOLANT QUALITY

There should not be excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.

3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.

(b) Drain the coolant from radiator and engine drain cocks. (Engine drain cock is at left rear of engine block.)

(c) Close the drain cocks.

Torque (Engine drain cock):
450 kg-cm (33 ft-lb, 44 N·m)

(d) Fill the system with coolant.

Use a good brand of ethylene-glycol base coolant, mixed according to the manufacturer's directions.

Capacity:

FJ70, 73, 75 series —

w/o Heater
15.0 liters (15.9 US qts, 13.2 Imp. qts)

w/ Front heater
17.0 liters (18.0 US qts, 15.0 Imp. qts)

w/ Front and rear heaters
19.0 liters (20.1 US qts, 16.7 Imp. qts)

FJ62 series —

w/o Heater
15.5 liters (16.4 US qts, 13.6 Imp. qts)

w/ Front heater
17.5 liters (18.5 US qts, 15.4 Imp. qts)

w/ Front and rear heaters
19.5 liters (20.6 US qts, 17.2 Imp. qts)

(e) Install the radiator cap.

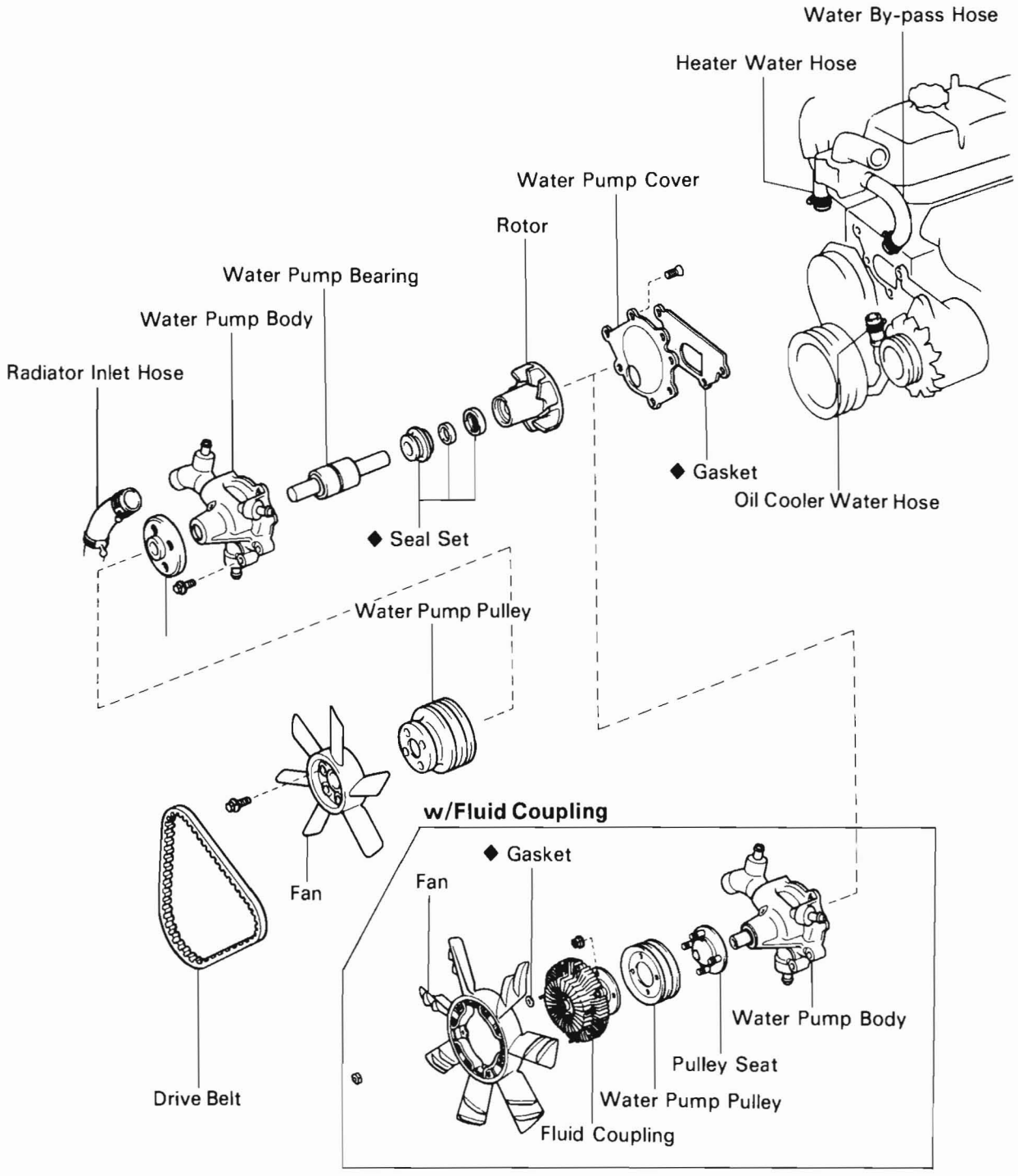
(f) Start the engine and check for leaks.

(g) Recheck the coolant level and refill as necessary.

WATER PUMP

COMPONENTS

NOTE: Replacement of the water pump bearing, seal set and rotor can only be done if the water pump body is cast iron.



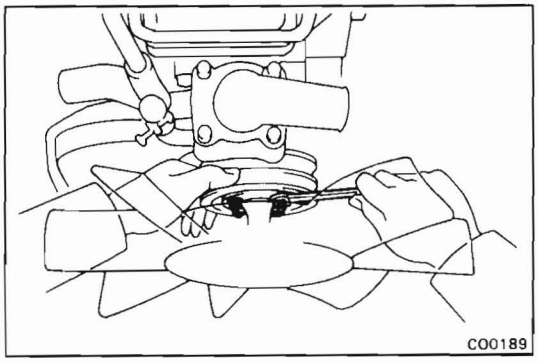
◆ : Non-reusable part

CO0181

REMOVAL OF WATER PUMP

(See page CO-4)

1. DRAIN ENGINE COOLANT (See page CO-3)
2. REMOVE DRIVE BELTS



3. REMOVE FAN AND WATER PUMP PULLEY

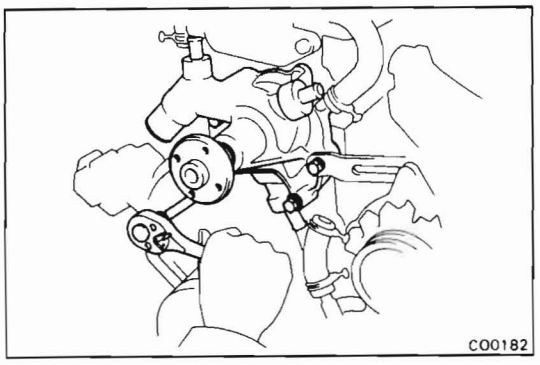
(w/ Fluid Coupling)

Remove the four nuts holding the fluid coupling to the pulley seat, and remove the fan and fluid coupling assembly and the pump pulley.

(w/o Fluid Coupling)

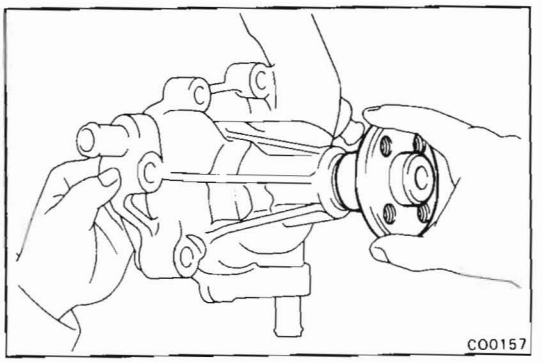
Remove the four bolts holding the fan to the pulley seat, and remove the fan and pump pulley.

4. DISCONNECT HOSES FROM WATER PUMP
   (a) Radiator inlet hose
   (b) Water by-pass hose
   (c) Heater water hose
   (d) Oil cooler water hose



5. REMOVE WATER PUMP

Remove the four bolts, water pump and gasket.

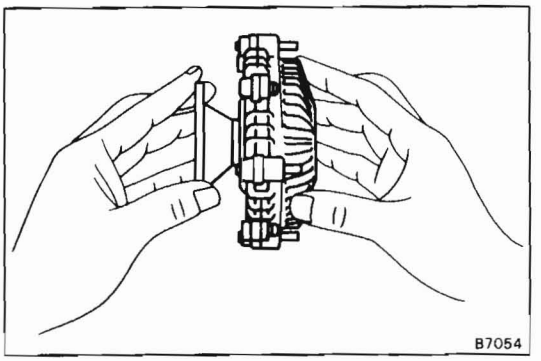


INSPECTION OF WATER PUMP COMPONENTS

1. INSPECT WATER PUMP

Turn the pulley seat and check that the water pump bearing is not rough or noisy.

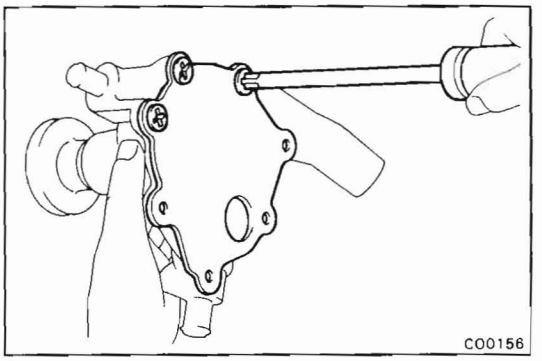
If necessary, replace the water pump bearing.



2. INSPECT FLUID COUPLING

Check the fluid coupling for damage and silicon oil leakage.

If necessary, replace the fluid coupling.



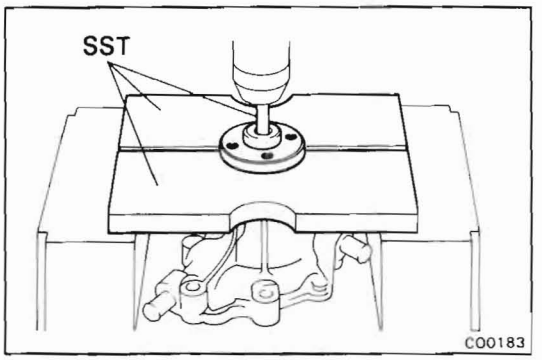
DISASSEMBLY OF WATER PUMP

(See page CO-4)

Aluminum Body

1. REMOVE WATER PUMP PLATE

Remove the three screws, plate and gasket.

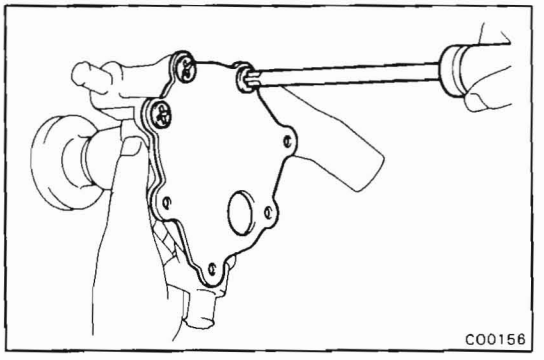


2. REMOVE PULLEY SEAT

Using SST and a press, press the shaft of the bearing and remove the pulley seat.

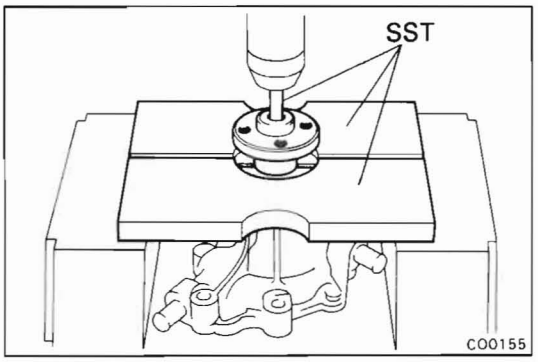
SST 09236-00101

Cast Iron Body



1. REMOVE WATER PUMP PLATE

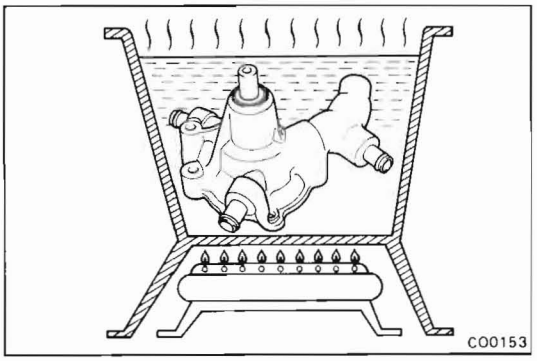
Remove the three screws, plate and gasket.



2. REMOVE PULLEY SEAT

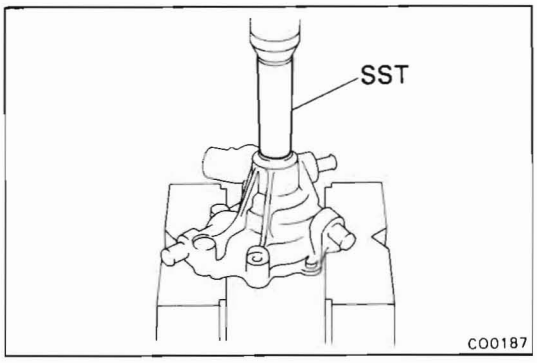
Using SST and a press, press the shaft of the bearing and remove the pulley seat.

SST 09236-00101



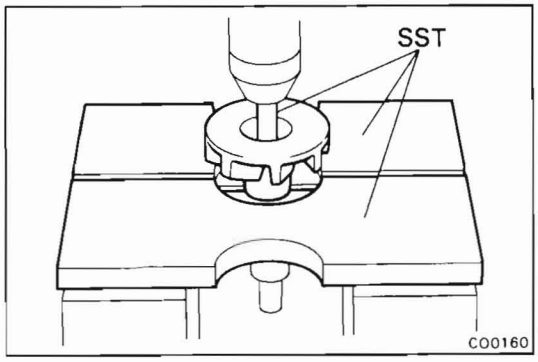
3. REMOVE WATER PUMP BEARING

(a) Gradually heat the water pump body to approx. 85°C (185°F).



(b) Using SST and a press, press the outer race of the bearing and remove the bearing together with the rotor.

SST 09236-00101

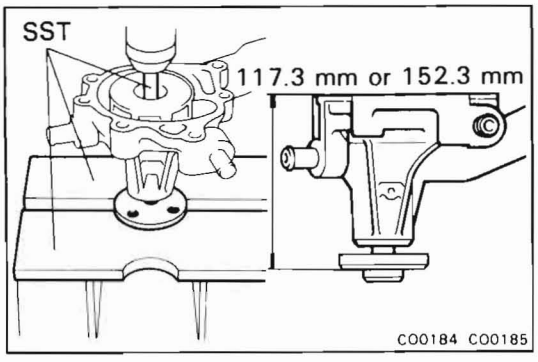


4. REMOVE ROTOR

Using SST and a press, press the shaft of the bearing and remove the rotor.

SST 09236-00101

5. REMOVE SEAL, SEAT AND PACKING



ASSEMBLY OF WATER PUMP

(See page CO-4)

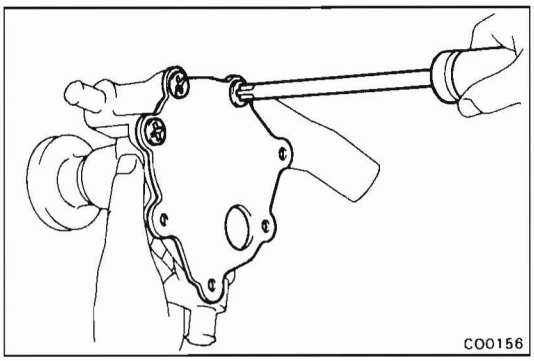
Aluminum Body

1. INSTALL WATER PUMP SEAT

Using SST and a press, press the shaft of the bearing and install the pulley seat to a distance specified below from the water pump body edge.

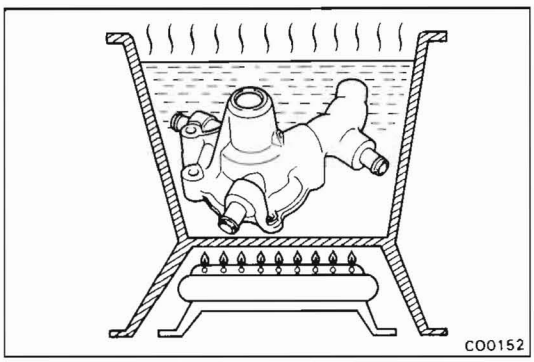
SST 09236-00101

Distance:	**w/ Fluid Coupling**	**117.3 mm (4.618 in.)**
	w/o Fluid Coupling	**152.3 mm (5.996 in.)**



2. INSTALL WATER PUMP PLATE

Install a new gasket and the water pump plate with the three screws.

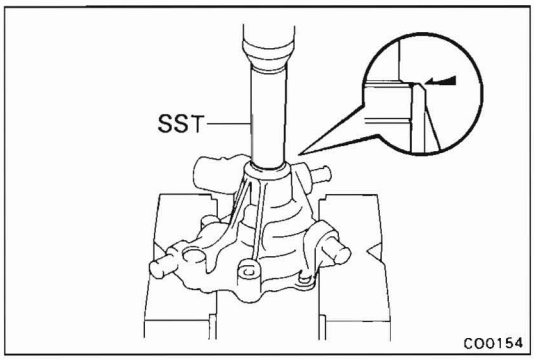


Cast Iron Body

NOTE: Always assemble the water pump with a new seal set.

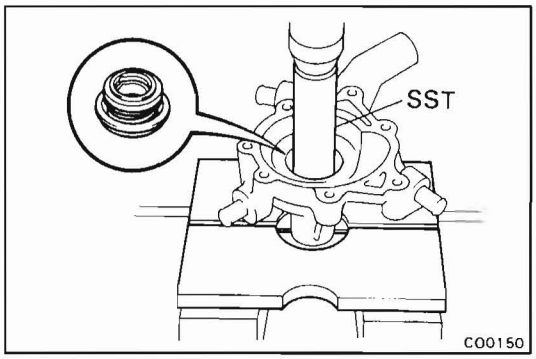
1. INSTALL WATER PUMP BEARING

(a) Gradually heat the water pump body to approx. 85°C (185°F).



(b) Using SST and a press, press the outer race of the bearing until its surface is flush with the water pump body edge.

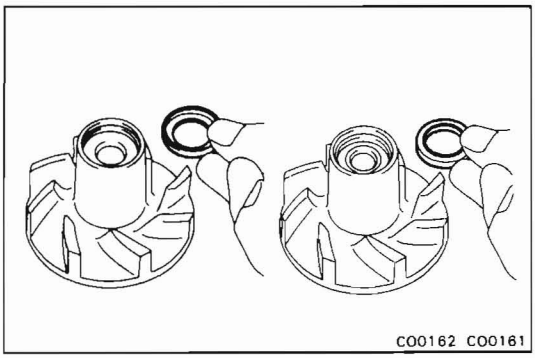
SST 09236-00100



2. INSTALL SEAL

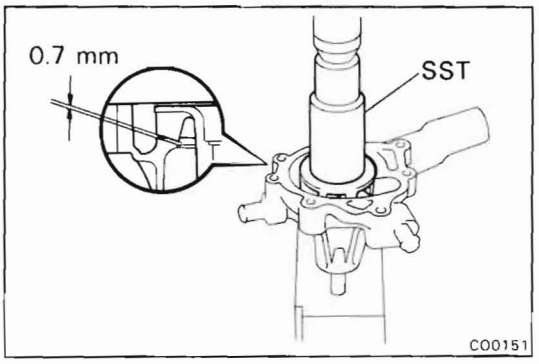
Using SST and a press, press in a new seal.

SST 09236-00101



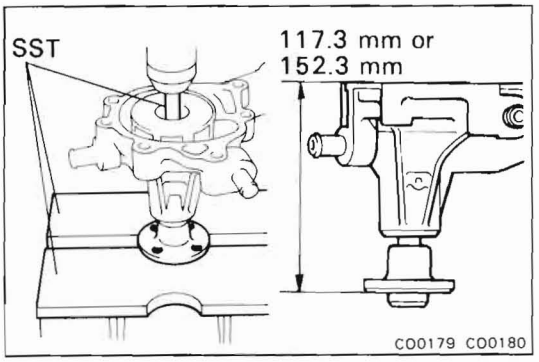
3. INSTALL ROTOR

(a) Place a new packing and seat into the rotor.



(b) Using SST and press, press in the rotor to a clearance of 0.7 mm (0.028 in.) from the water pump body.

SST 09236-00101

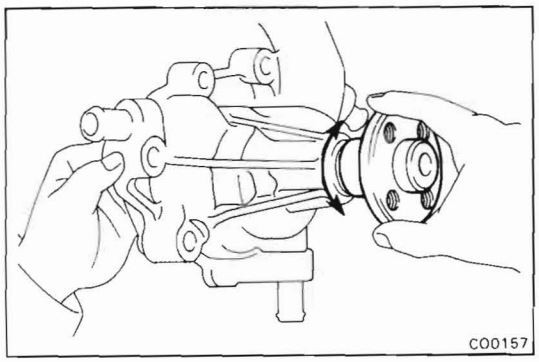


4. INSTALL PULLEY SEAT

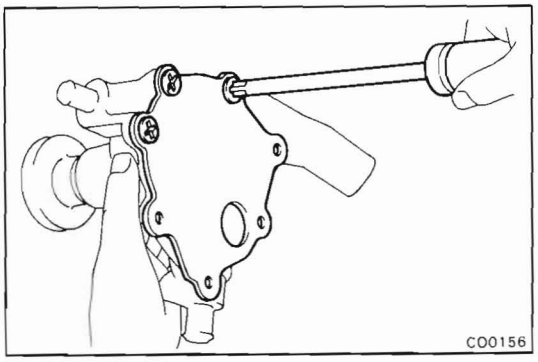
Using SST and a press, press the shaft of the bearing and install the pulley seat to a distance specified below from the water pump body edge.

SST 09236-00101

Distance:	**w/ Fluid Coupling**	**117.3 mm (4.618 in.)**
	w/o Fluid Coupling	**152.3 mm (5.996 in.)**

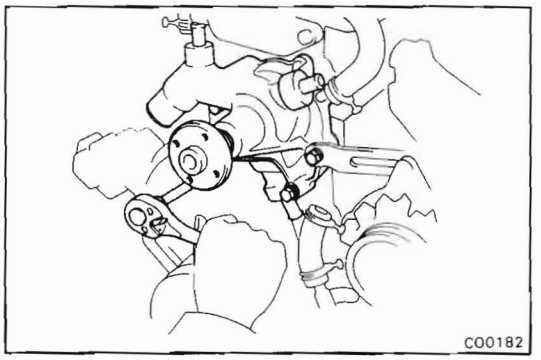


5. CHECK THAT WATER PUMP BEARING ROTATES SMOOTHLY



6. INSTALL WATER PUMP PLATE

Install a new gasket and the water pump plate with the three screws.



INSTALLATION OF WATER PUMP

(See page CO-4)

1. **INSTALL WATER PUMP**

   Install a new gasket and the water pump with the four bolts. Install the alternator bracket. Torque the bolts.

   Torque: 380 kg-cm (27 ft-lb, 37 N·m)

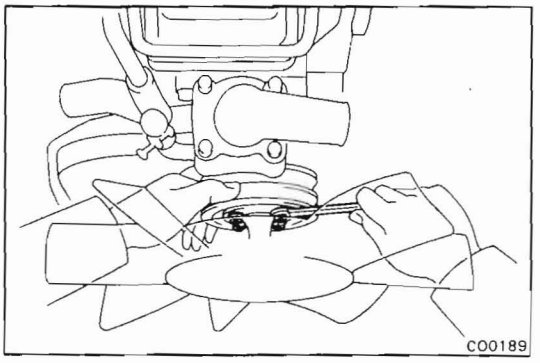
2. **CONNECT HOSES TO WATER PUMP**

   (a) Radiator inlet hose

   (b) Water by-pass hose

   (c) Heater water hose

   (d) Oil cooler water hose



3. **INSTALL WATER PUMP PULLEY AND FAN**

   (w/ Fluid Coupling)

   Install the pump pulley and the fluid coupling and fan assembly with the four nuts.

   (w/o Fluid Coupling)

   Install the pump pulley and fan with the four bolts.

4. **INSTALL AND ADJUST DRIVE BELTS**
   (See page EM-41)

5. **FILL WITH ENGINE COOLANT** **(See page CO-3)**

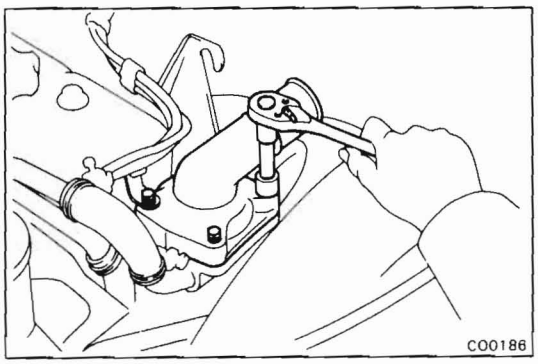
6. **START ENGINE AND CHECK FOR LEAKS**

THERMOSTAT

REMOVAL OF THERMOSTAT

1. **DRAIN ENGINE COOLANT (See page CO-4)**

2. **DISCONNECT RADIATOR INLET AND WATER BY-PASS HOSES FROM WATER OUTLET**



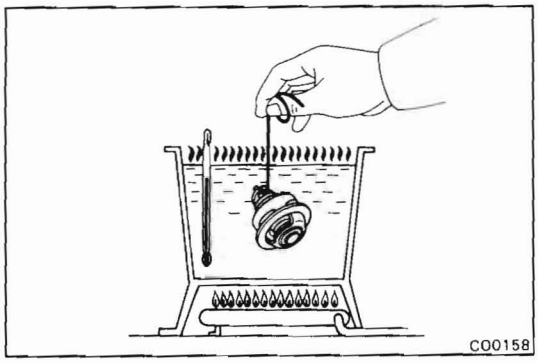
3. **REMOVE WATER OUTLET**

   Remove the four bolts, water outlet and gasket.

4. **REMOVE THERMOSTAT**

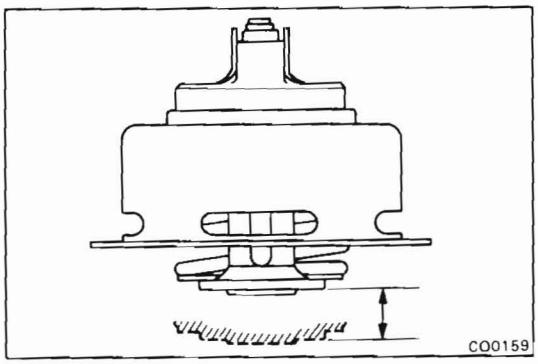
INSPECTION OF THERMOSTAT

INSPECT THERMOSTAT



NOTE: The thermostat is numbered with the valve opening temperature.

(a) Immerse the thermostat in water and gradually heat the water.



(b) Check the valve opening temperature.

Valve opening temperature: 86 — 90°C (187 —194°F)

If the valve opening temperature is within specification, replace the thermostat.

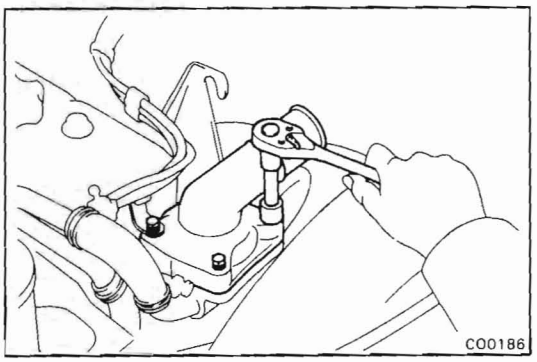
(c) Check the valve lift.

Valve Lift:
10 mm (0.39 in.) or more at 100°C (212°F)

If the valve lift is less than specification, replace the thermostat.

(d) Check that the valve spring is tight when the thermostat is fully closed .

If necessary, replace the thermostat.



INSTALLATION OF THERMOSTAT

1. **PLACE THERMOSTAT IN WATER OUTLET HOUSING**

2. **INSTALL WATER OUTLET**

   Install a new gasket and the water outlet with the four bolts. Install the fuel pipe clamp. Torque the bolts.

   Torque: 185 kg-cm (13 ft-lb, 18 N·m)

3. **CONNECT RADIATOR INLET AND WATER BY-PASS HOSES**

4. **FILL WITH ENGINE COOLANT (See page CO-4)**

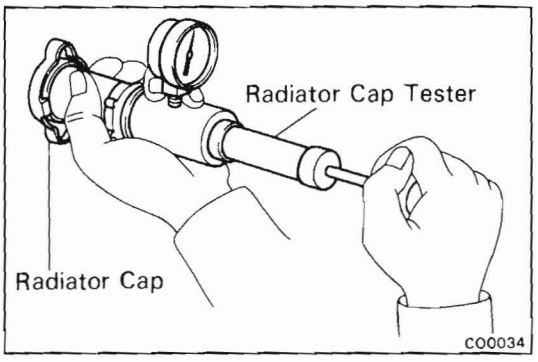
RADIATOR

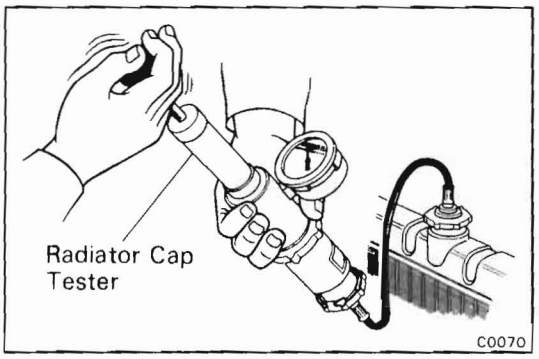
CLEANING OF RADIATOR

CLEAN RADIATOR

Using water or a steam cleaner, remove any mud and dirt from the radiator core.

CAUTION: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 30 – 35 kg/cm² (427 – 498 psi, 2,942 – 3,432 kPa), keep a distance of at least 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle.





INSPECTION OF RADIATOR

1. **INSPECT RADIATOR CAP**

   Using a radiator cap tester, pump the tester and measure the relief valve opening pressure.

   Standard opening pressure:
   0.75 – 1.05 kg/cm²
   (10.7 – 14.9 psi, 74 – 103 kPa)
   Minimum opening pressure:
   0.6 kg/cm² (8.5 psi, 59 kPa)

   If the opening pressure is less than minimum, replace the radiator cap.

2. **INSPECT COOLING SYSTEM FOR LEAKS**

   (a) Fill the radiator with coolant and attach a pressure tester.

   (b) Warm up the engine.

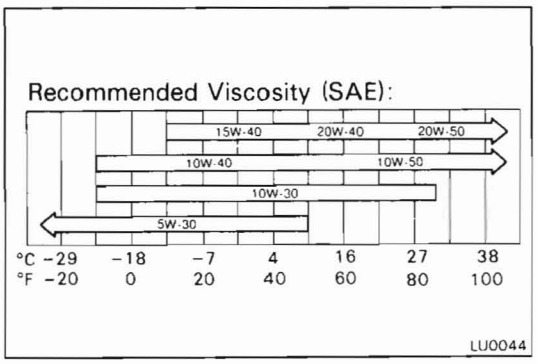
   (c) Pump it to 1.2 kg/cm² (17 psi, 118 kPa), check that pressure does not drop.

   If the pressure drops, check for leaks from the hoses, radiator or water pump. If no external leaks are found, check the heater core, block and head.

LUBRICATION SYSTEM

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Oil leakage	Cylinder head, cylinder block or oil pump body damaged or cracked	Repair as necessary	
	Oil seal faulty	Replace oil seal	EM-38, 61
	Gasket faulty	Replace gasket	
Low oil pressure	Oil leakage	Repair as necessary	
	Relief valve faulty	Repair relief valve	LU-5
	Oil pump faulty	Repair oil pump	LU-5
	Engine oil poor quality	Replace engine oil	LU-4
	Crankshaft bearing faulty	Replace bearing	EM-43
	Connecting rod bearing faulty	Replace bearing	EM-43
	Oil filter clogged	Replace oil filter	LU-4
High oil pressure	Relief valve faulty	Repair relief valve	LU-5



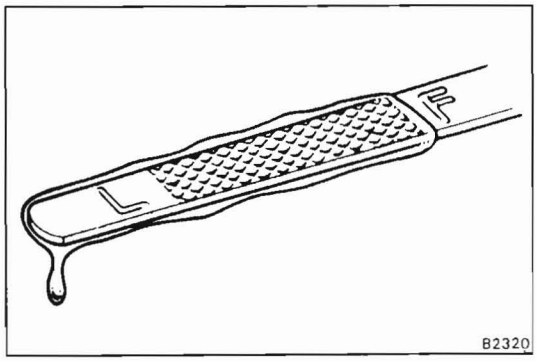
OIL PRESSURE CHECK

1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is poor, replace the oil.

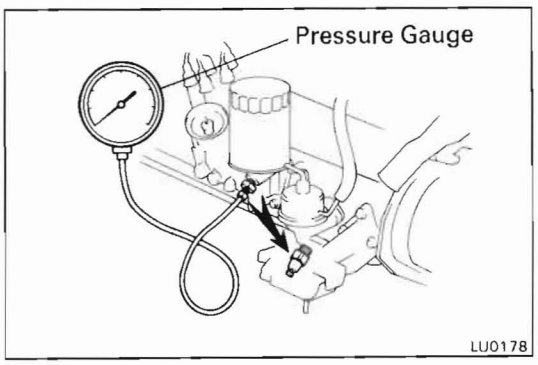
Use API grade SC, SD, SE, SF or better and recommended viscosity oil.



2. CHECK ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the level gauge.

If low, check for leakage and add oil up to the "F" mark.



3. REMOVE OIL PRESSURE SWITCH OR SENDER GAUGE

4. INSTALL OIL PRESSURE GAUGE

5. START ENGINE

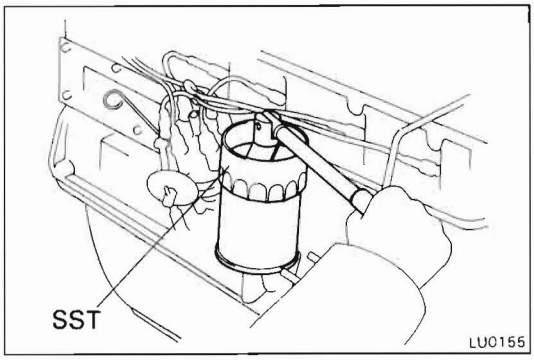
Start engine and warm it up to normal operating temperature.

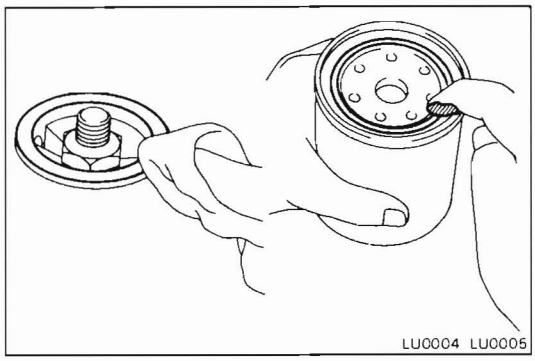
6. CHECK OIL PRESSURE

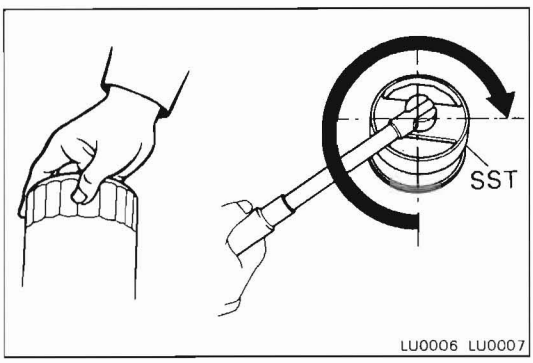
Oil pressure:

At idle	**0.3 kg/cm² (4.3 psi, 29 kPa) or more**
At 4,000 rpm	**2.5 – 5.0 kg/cm² (36 – 71 psi, 245 – 490 kPa)**

NOTE: Check for oil leakage after reinstalling the oil pressure switch or sender gauge.







REPLACEMENT OF ENGINE OIL AND OIL FILTER

1. DRAIN ENGINE OIL

(a) Remove the oil filler cap.

(b) Remove the oil drain plug and drain the engine oil into a container.

2. REPLACE OIL FILTER

(a) Using SST, remove the oil filter.

SST 09228-44010

(b) Check and clean the oil filter installation surface.

(c) Apply clean engine oil to the gasket of a new oil filter.

(d) Lightly screw in the oil filter by hand to until you feel resistance.

(e) Using SST, tighten the oil filter an extra 3/4 turn.

SST 09228-44010

3. FILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket. Torque the drain plug.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

(b) Fill the engine with new engine oil, API grade SC, SD, SE, SF, or better and recommended viscosity oil.

Capacity:

Drain and refill–

w/o Oil filter change

7.0 liters (7.4 US qts, 6.2 Imp.qts)

w/ Oil filter change

7.8 liters (8.2 US qts, 6.9 Imp.qts)

Dry fill– 8.0 liters (8.5 US qts, 7.0 Imp.qts)

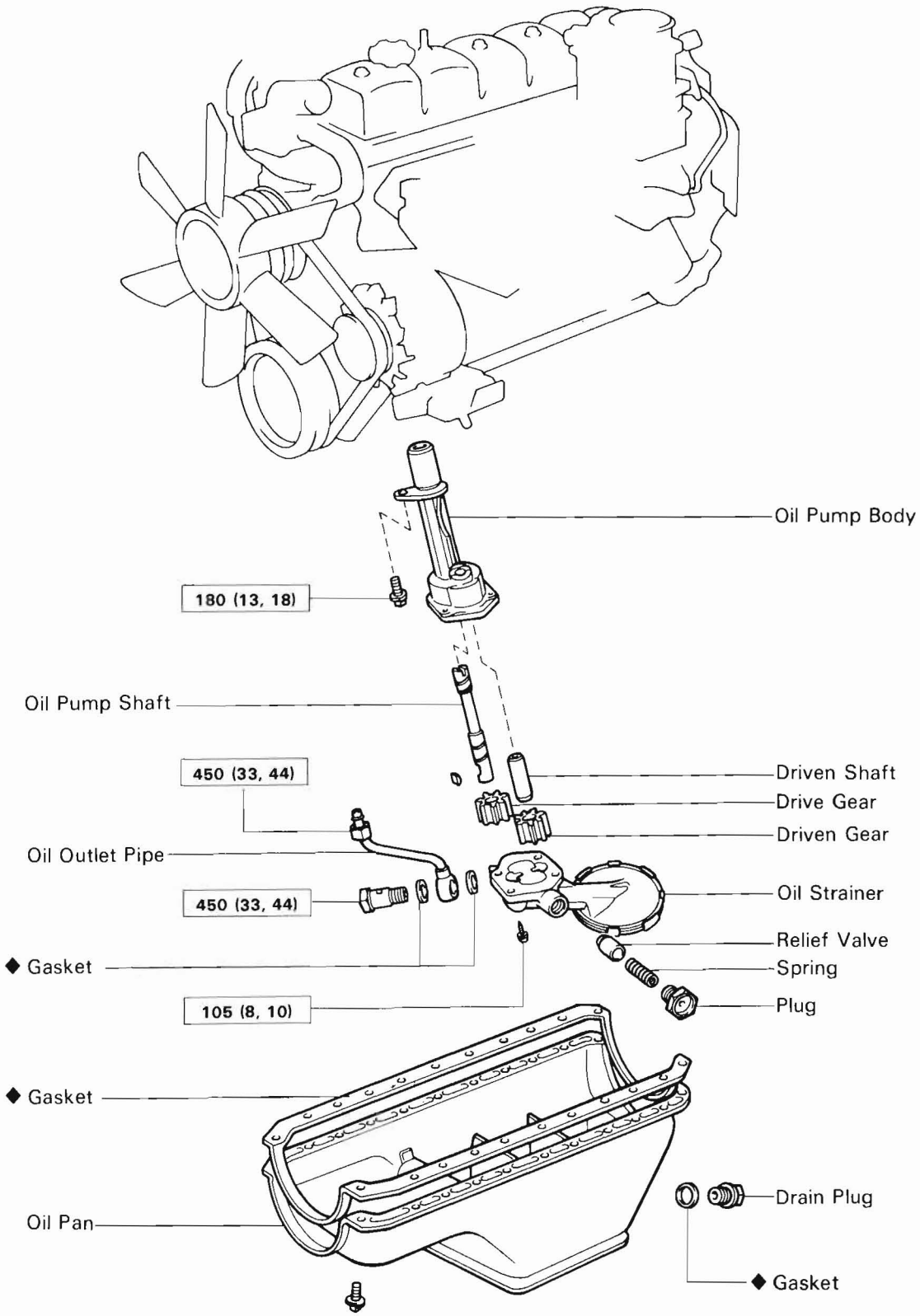
(c) Install the oil filler cap with the gasket.

4. START ENGINE AND CHECK FOR LEAKS

5. RECHECK ENGINE OIL LEVEL (See page LU-3)

OIL PUMP

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ : Non-reusable part

LU0173

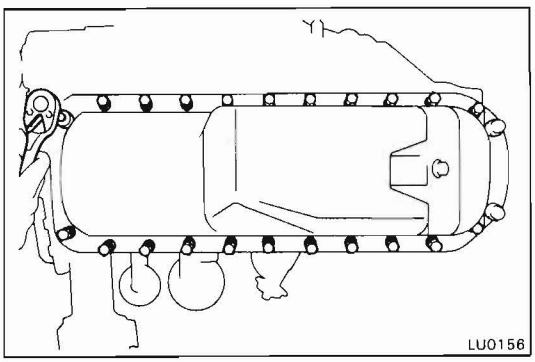
REMOVAL OF OIL PUMP

NOTE: When repairing the oil pump, the oil pan and strainer should be removed and cleaned.

1. **RAISE VEHICLE**

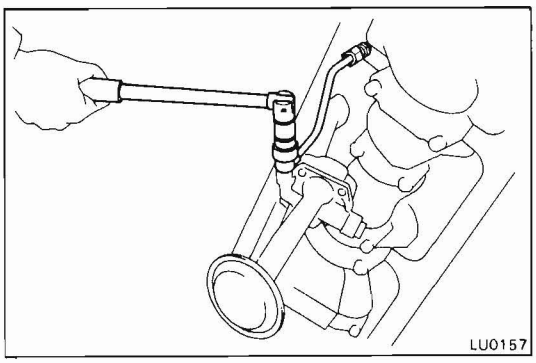
   CAUTION: Be sure the vehicle is securely supported.

2. **DRAIN ENGINE OIL (See step 1 on page LU-4)**



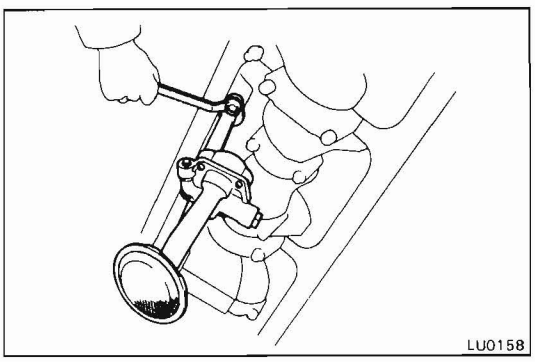
3. **REMOVE OIL PAN**

   Remove the twenty-two bolts, oil pan and gasket.



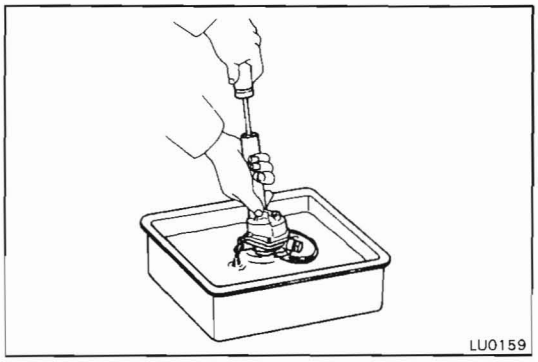
4. **REMOVE OIL OUTLET PIPE**

   Remove the union nut, bolt, two gaskets and outlet pipe.



5. **REMOVE OIL PUMP**

   Remove the bolt and oil pump.

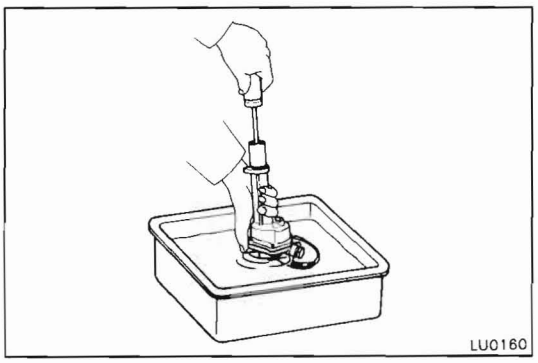


DISASSEMBLY OF OIL PUMP

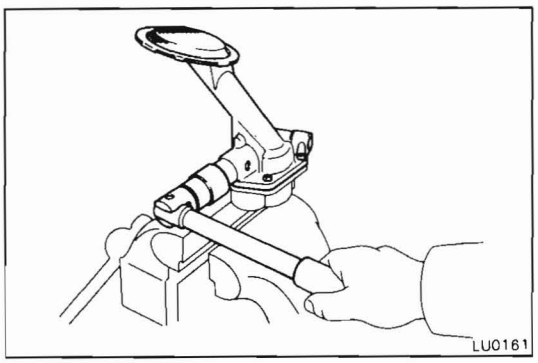
(See page LU-5)

1. CHECK OIL PUMP OPERATION

(a) Using a screwdriver, immerse the oil strainer in oil and turn the oil pump shaft clockwise. Oil should come out of the oil outlet hole.



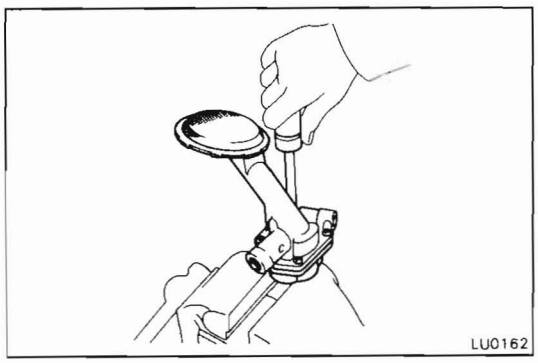
(b) Close the oil outlet hole with your thumb and turn the oil pump shaft as before. The oil pump shaft should be difficult to turn.



2. MOUNT OIL PUMP IN VISE

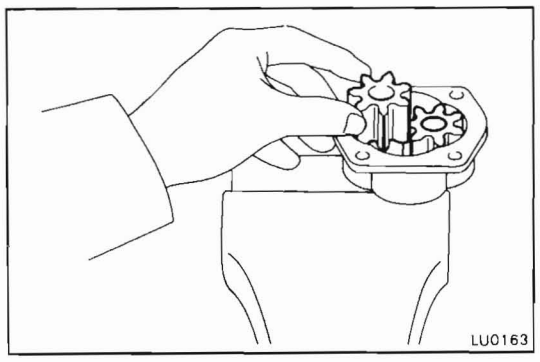
3. REMOVE RELIEF VALVE

Remove the plug, spring and valve.



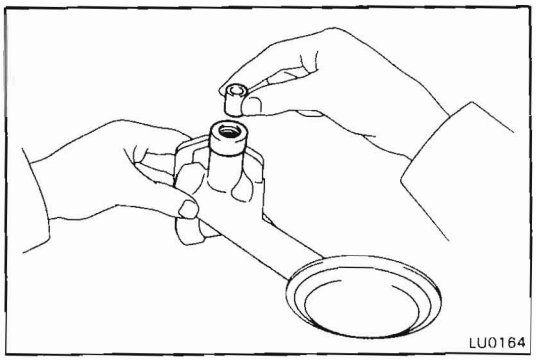
4. REMOVE OIL PUMP STRAINER

Remove the four screws and strainer.



5. REMOVE DRIVEN GEAR

6. REMOVE DRIVE GEAR AND OIL PUMP SHAFT ASSEMBLY

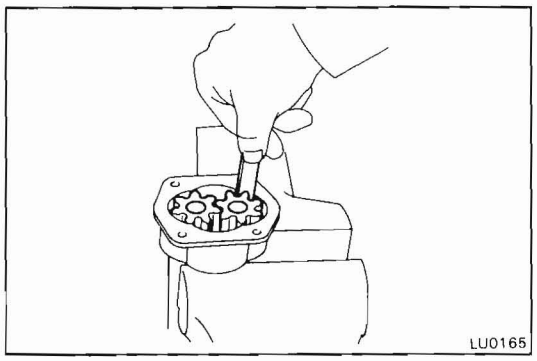


INSPECTION OF OIL PUMP

1. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If operation is not as specified, replace the relief valve. If necessary, replace the oil strainer.

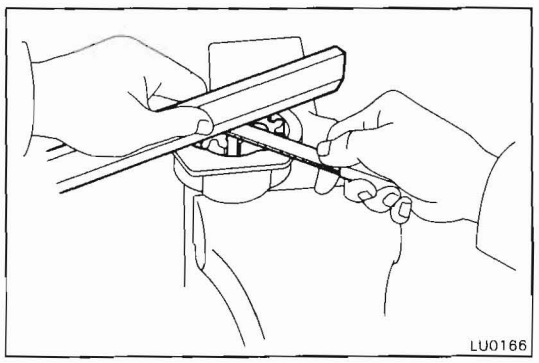


2. INSPECT GEAR BODY CLEARANCE

Using a feeler gauge, measure the clearance between the gear and body.

Standard body clearance: **0.095 – 0.175 mm (0.0037 – 0.0069 in.)**
Maximum body clearance: **0.20 mm (0.0079 in.)**

If the clearance exceeds maximum, replace the shaft. If necessary, replace the gears or oil pump assembly.

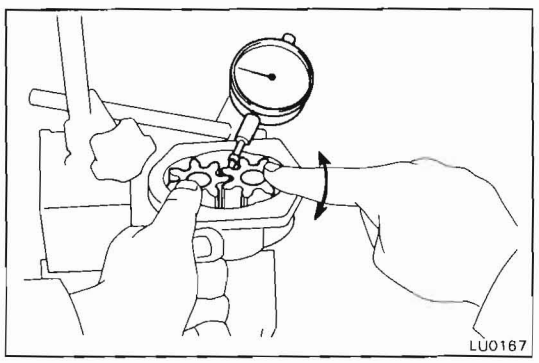


3. INSPECT GEAR SIDE CLEARANCE

Using a feeler gauge and precision straight edge, measure the clearance between the gear and precision straight edge.

Standard side clearance: **0.030 – 0.090 mm (0.0012 – 0.0035 in.)**
Maximum side clearance: **0.15 mm (0.0059 in.)**

If the clearance exceeds maximum, replace the gears. If necessary, replace the oil pump assembly.

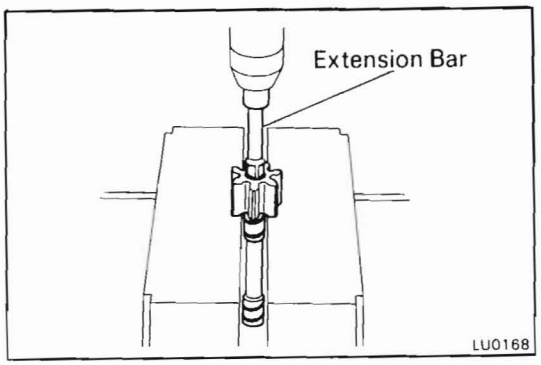


4. INSPECT GEAR BACKLASH

Using a dial indicator, measure the backlash while turning the driven gear clockwise and counterclockwise in several places.

Standard backlash: **0.500 – 0.600 mm (0.0197 – 0.0236 in.)**
Maximum backlash: **0.95 mm (0.0374 in.)**

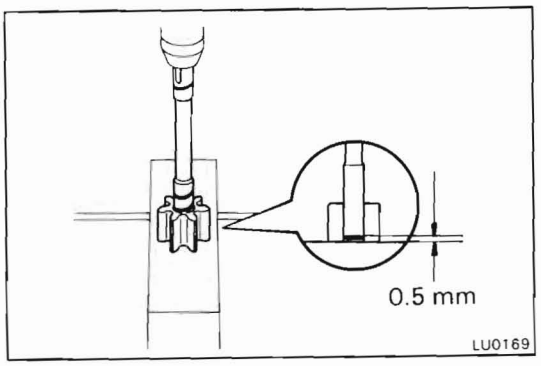
If the backlash exceeds maximum, replace the gears. If necessary, replace the shaft.



REPLACEMENT OF OIL PUMP COMPONENTS

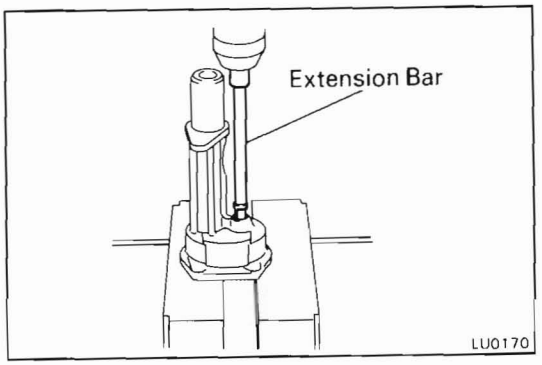
1. REPLACE DRIVE GEAR (OR OIL PUMP SHAFT)

(a) Using an extension bar and press, press out the oil pump shaft from the drive gear.



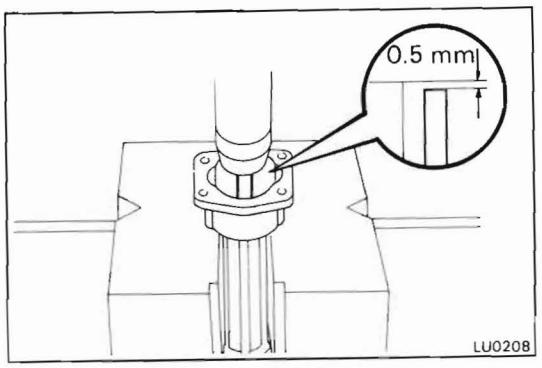
(b) Align the drive gear set key with the key groove of a new drive gear.

(c) Using a press, press in the oil pump shaft until it is 0.5 mm (0.020 in.) from the drive gear edge.

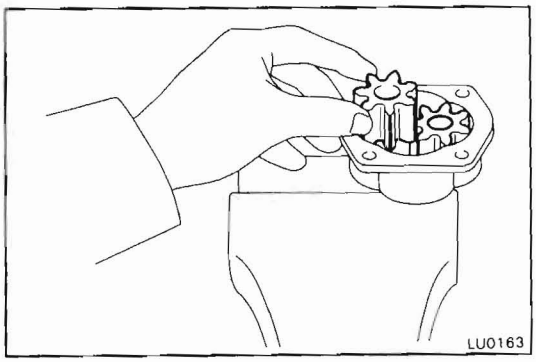


2. REPLACE DRIVEN SHAFT

(a) Using an extension bar and press, press out the driven shaft from the oil pump body.



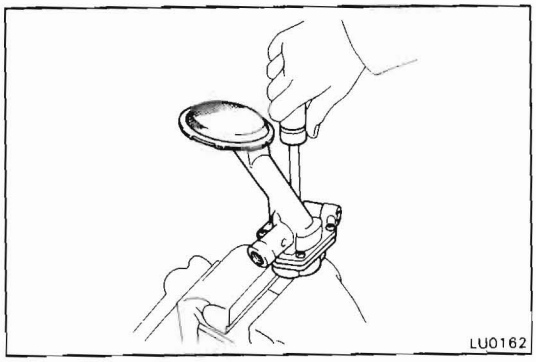
(b) Using a press, press in a new driven shaft until it is 0.5 mm (0.020 in.) from the oil pump body edge.



ASSEMBLY OF OIL PUMP

(See page LU-5)

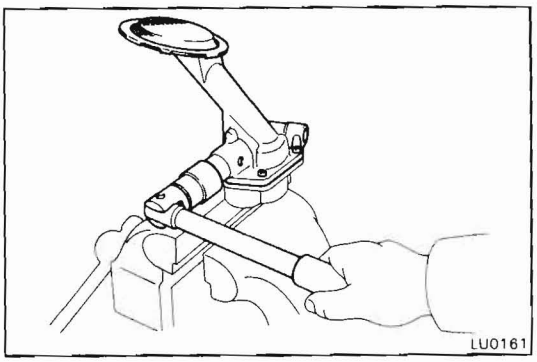
1. **MOUNT OIL PUMP BODY IN VISE**
2. **INSTALL DRIVE GEAR AND OIL PUMP SHAFT ASSEMBLY**
3. **INSTALL DRIVEN GEAR**



4. **INSTALL OIL STRAINER**

   Install the strainer with the four screws. Torque the screws.

   Torque: 100 kg-cm (7 ft-lb, 10 N·m)

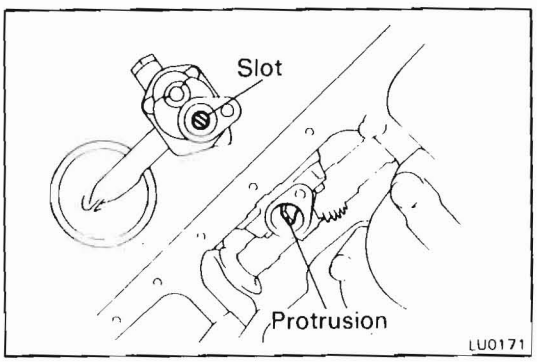


5. **INSTALL RELIEF VALVE**

   Install the valve and spring with the plug. Torque the plug.

   Torque: 375 kg-cm (27 ft-lb, 37 N·m)

6. **CHECK OIL PUMP OPERATION**
   (See page LU-7)

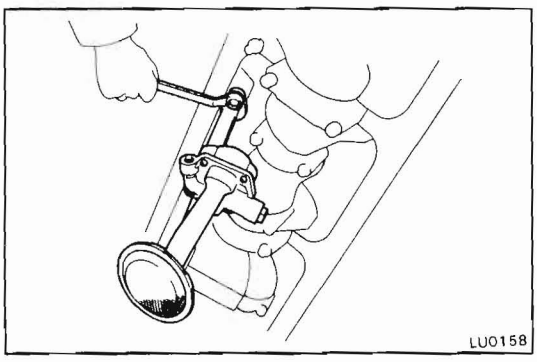


INSTALLATION OF OIL PUMP

(See page LU-5)

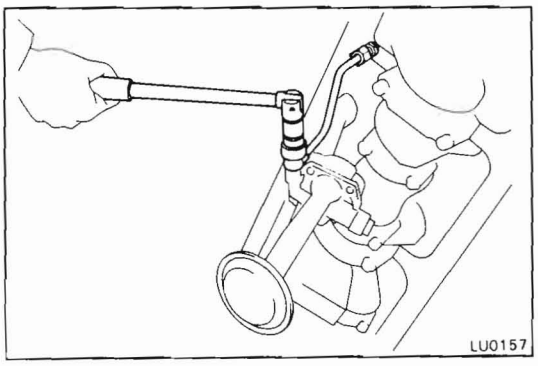
1. **INSTALL OIL PUMP**

   (a) Align the oil pump shaft slot of the oil pump with the governor shaft protrusion of the distributor.



   (b) Install the oil pump with the bolt. Torque the bolt.

   Torque: 180 kg-cm (13 ft-lb, 18 N·m)



2. INSTALL OIL OUTLET PIPE

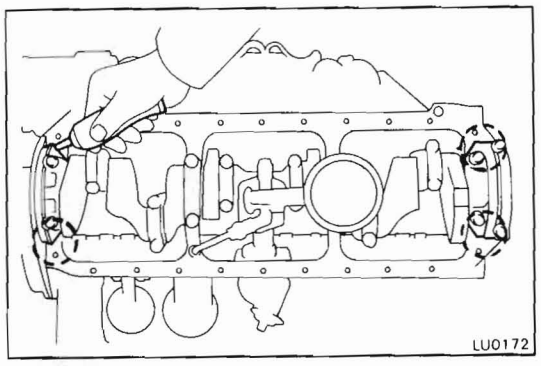
(a) Place the outlet pipe in position.

(b) Install and torque the union bolt with the two gaskets.

Torque: 450 kg-cm (33 ft-lb, 44 N·m)

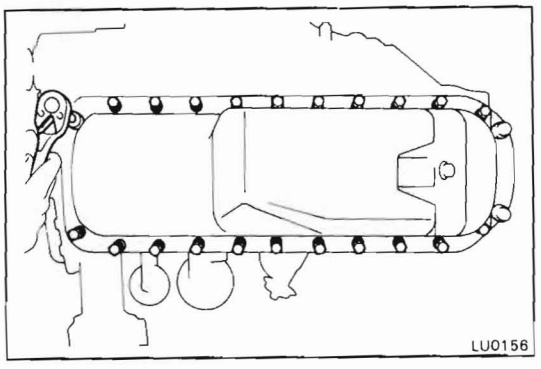
(c) Install and torque the union nut.

Torque: 450 kg-cm (33 ft-lb, 44 N·m)



3. INSTALL OIL PAN

(a) Apply liquid sealer to the cylinder block, the No. 1 and No. 4 main bearing caps as shown.



(b) Install a new gasket and the oil pan with the twenty-two bolts. Torque the bolts.

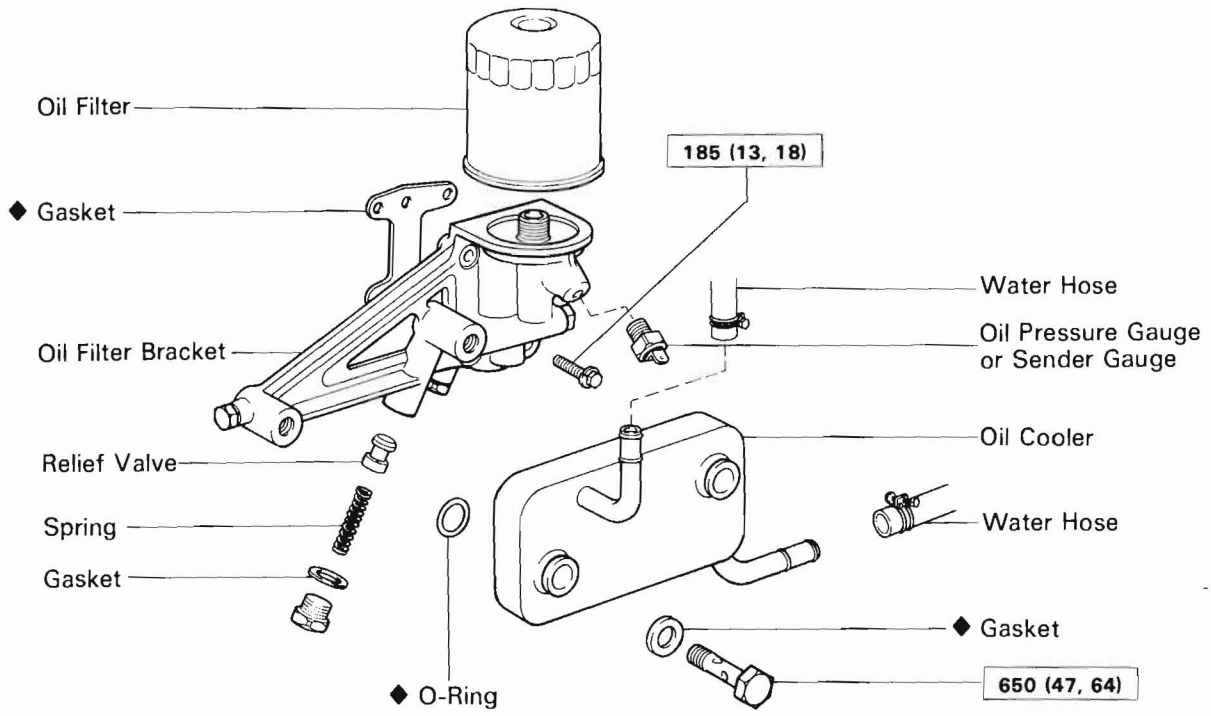
Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)

4. FILL WITH ENGINE OIL (See page LU-4)

5. START ENGINE AND CHECK FOR LEAKS

OIL COOLER AND RELIEF VALVE

COMPONENTS

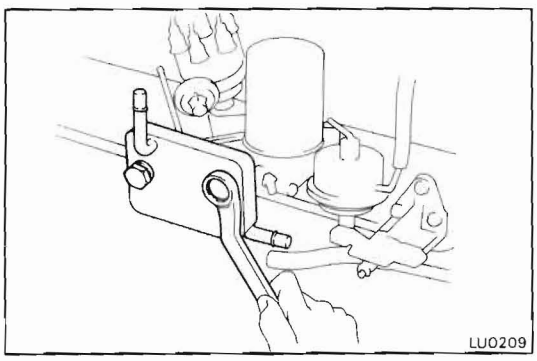


kg-cm (ft-lb, N·m) : Specified torque
◆ : Non-reusable part

LU0210

REMOVAL OF OIL COOLER AND RELIEF VALVE

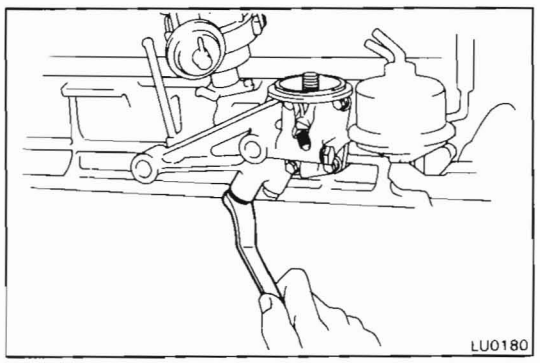
1. **DRAIN ENGINE COOLANT (See page CO-3)**
2. **REMOVE OIL FILTER (See page LU-4)**
3. **REMOVE OIL PRESSURE GAUGE OR SENDER GAUGE**
4. **DISCONNECT OIL COOLER HOSES**



LU0209

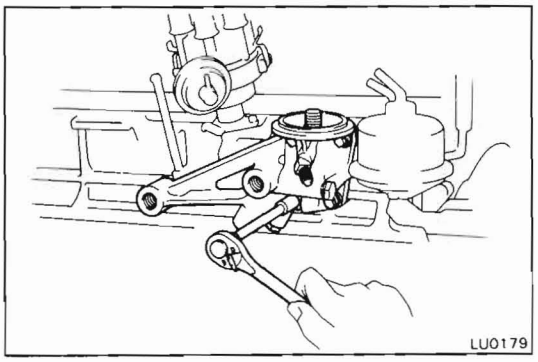
5. **REMOVE OIL COOLER**

   Remove the two union bolts, gaskets, oil cooler and O-rings.



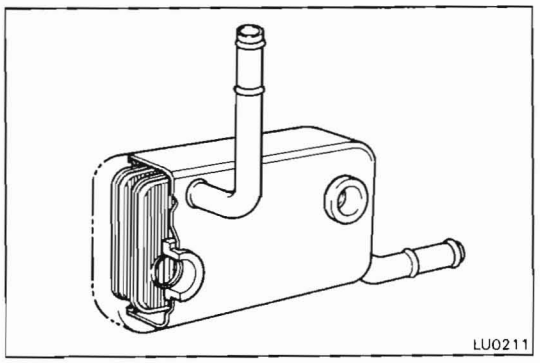
6. REMOVE RELIEF VALVE

Remove the plug, gasket, spring and relief valve.



7. REMOVE OIL FILTER BRACKET

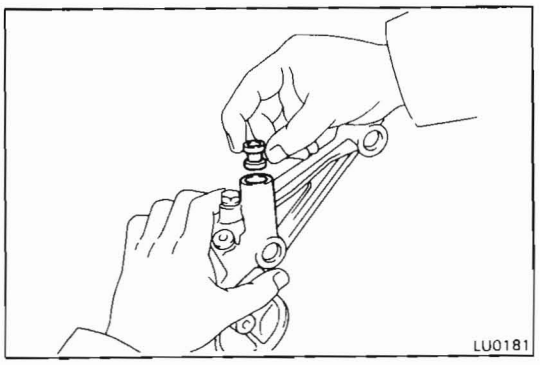
Remove the four bolts, oil filter bracket and gasket.



INSPECTION OF OIL COOLER AND RELIEF VALVE

1. INSPECT OIL COOLER

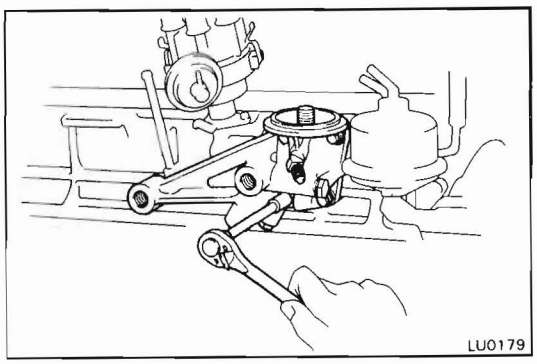
Check the oil cooler for damage or clogging.



2. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If operation is not as specified, replace the relief valve. If necessary, replace the oil filter bracket.



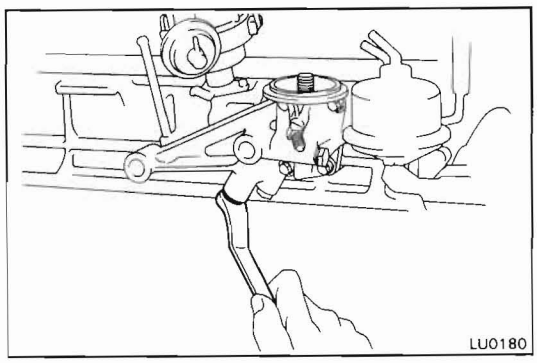
INSTALLATION OF OIL COOLER AND RELIEF VALVE

(See page LU-12)

1. INSTALL OIL FILTER BRACKET

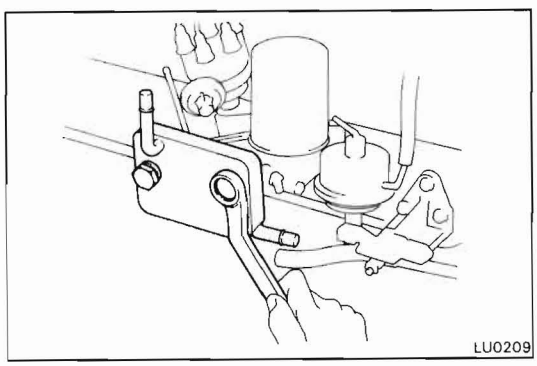
Install a new gasket and oil filter bracket with the four bolts. Torque the bolts.

Torque: 185 kg-cm (13 ft-lb, 18 N·m)



2. INSTALL RELIEF VALVE

Install the relief valve, spring, a new gasket and the plug.



3. INSTALL OIL COOLER

(a) Place two new O-rings in position on the oil cooler.

(b) Install the oil cooler, two new gaskets and the union bolts. Torque the union bolts.

Torque: 650 kg-cm (47 ft-lb, 64 N·m)

4. CONNECT OIL COOLER HOSES

5. INSTALL OIL PRESSURE GAUGE OR SENDER GAUGE

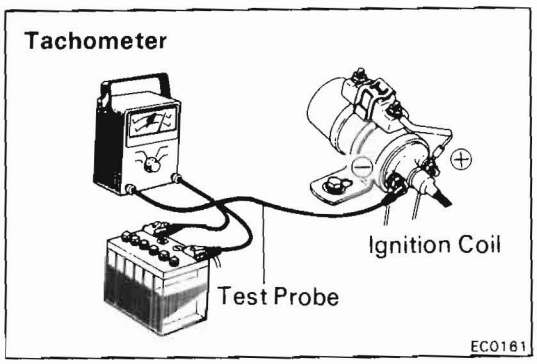
6. INSTALL OIL FILTER (See page LU-4)

7. FILL WITH ENGINE COOLANT

8. START ENGINE AND CHECK FOR LEAKS

9. CHECK ENGINE OIL LEVEL (See page LU-3)

IGNITION SYSTEM



PRECAUTIONS

1. **Do not keep the ignition switch on for more than 10 minutes if the engine does not start.**
2. **When a tachometer is used, connect the test probe of the tachometer to the ignition coil negative (−) terminal.**
3. **It is recommended that you consult with the manufacturer before using a tachometer as some are not compatible with this system.**
4. **NEVER allow the ignition coil terminals to touch ground as it could result in damage to the ignition coil.**
5. **Do not disconnect the battery while the engine is running.**

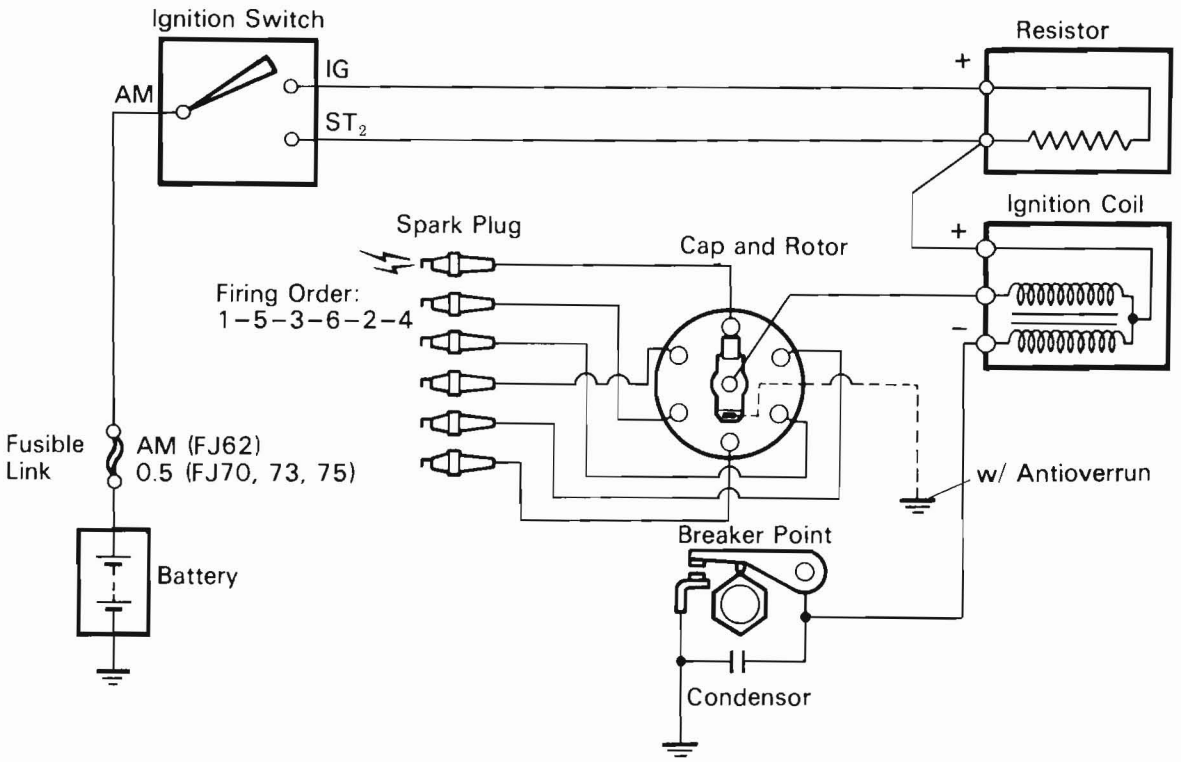
   Make sure that the igniter is properly grounded to the body.

TROUBLESHOOTING

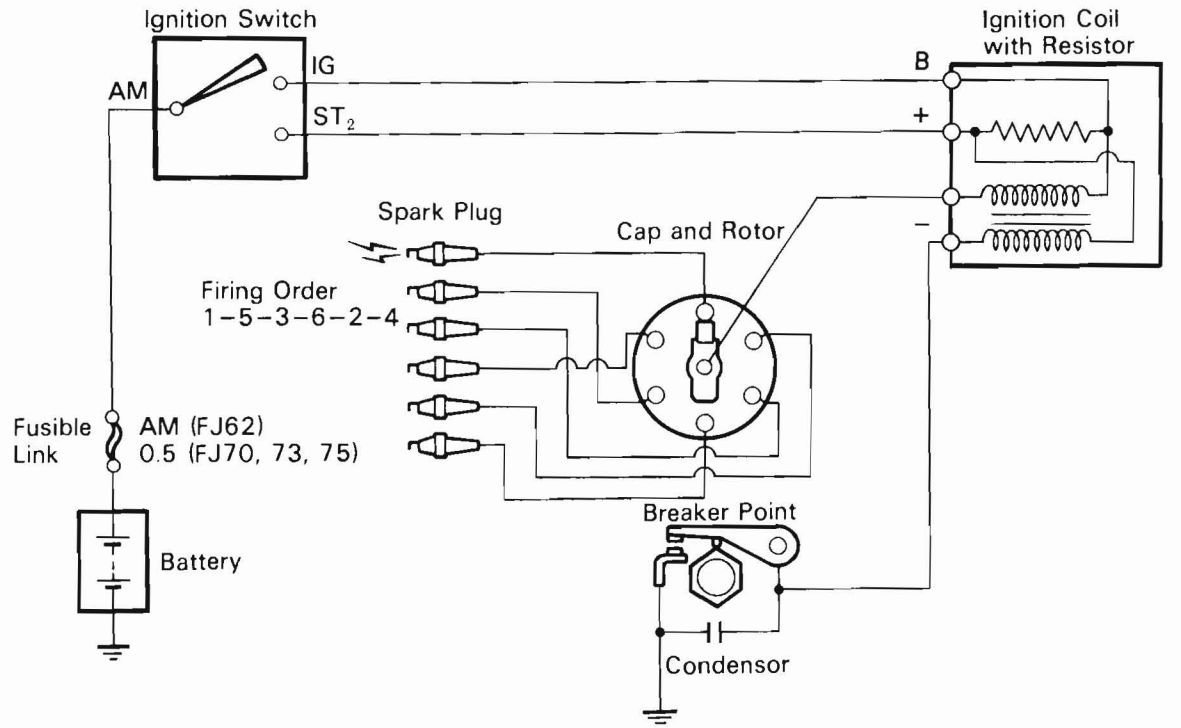
Problem	Possible cause	Remedy	Page
Engine will not start/ hard to start (cranks ok)	Incorrect ignition timing	Reset timing	EM-6
	Ignition coil faulty	Inspect coil	IG-5
	Distributor faulty	Inspect distributor	IG-8, 18
	High-tension cord faulty	Inspect high-tension cords	IG-4
	Spark plug faulty	Inspect plugs	IG-4
	Ignition wiring disconnected or broken	Inspect wiring	
Rough idle or stalls	Spark plug faulty	Inspect plugs	IG-4
	Ignition wiring faulty	Inspect wiring	
	Incorrect ignition timing	Reset timing	EM-6
	Ignition coil faulty	Inspect coil	IG-5
	Distributor faulty	Inspect distributor	IG-8, 18
	High-tension cord faulty	Inspect high-tension cords	IG-4
Engine hesitates/ poor acceleration	Spark plug faulty	Inspect plugs	IG-4
	Ignition wiring faulty	Inspect wiring	
	Incorrect ignition timing	Reset timing	EM-6
Engine dieseling (runs after ignition switch is turned off)	Incorrect ignition timing	Reset timing	EM-6
Muffler explosion (after fire) all the time	Incorrect ignition timing	Reset timing	EM-6
Engine backfires	Incorrect ignition timing	Reset timing	EM-6
Poor gasoline mileage	Spark plug faulty	Inspect plugs	IG-4
	Incorrect ignition timing	Reset timing	EM-6
Engine overheats	Incorrect ignition timing	Reset timing	EM-6

IGNITION SYSTEM CIRCUIT

w/ External Resistor



w/ Internal Resistor



IG0267
IG0266

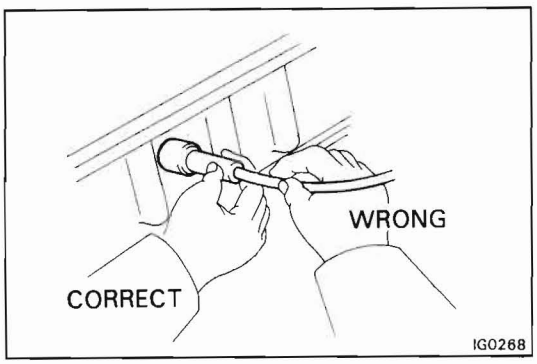
ON-VEHICLE INSPECTION

SPARK TEST

NOTE: Perform this test to check that there is voltage from the distributor to each spark plug.

CRANK ENGINE AND CHECK THAT LIGHT FLASHES

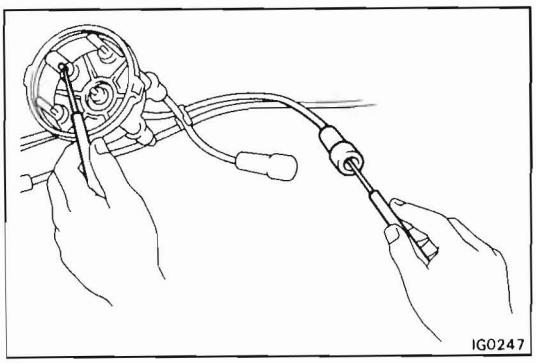
Connect a timing light to the spark plug. If the timing light does not flash, check the wiring connections, ignition coil and distributor.



INSPECTION OF HIGH-TENSION CORDS

1. **CAREFULLY REMOVE HIGH-TENSION CORDS BY RUBBER BOOT FROM SPARK PLUGS**

   CAUTION: Pulling on or bending the cords may damage the conductor inside.

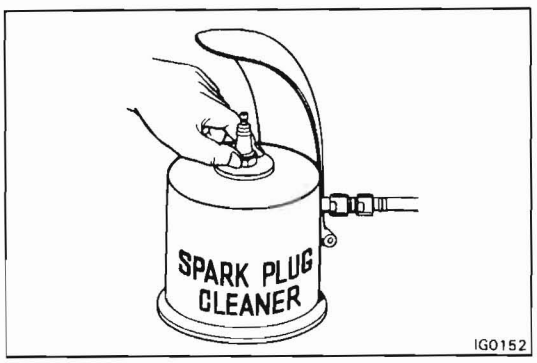


2. **INSPECT HIGH-TENSION CORD RESISTANCE**

   Using an ohmmeter, measure the resistance without disconnecting the cap.

   Maximum resistance: 25 kΩ per cord

   If resistance exceeds maximum, check the terminals.
   If necessary, replace the high-tension cord and/or distributor cap.

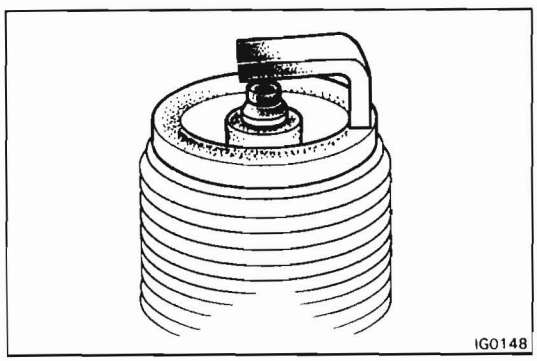


INSPECTION OF SPARK PLUGS

1. **REMOVE SPARK PLUGS**

2. **CLEAN SPARK PLUGS**

   Using a spark plug cleaner or wire brush, clean the spark plug.

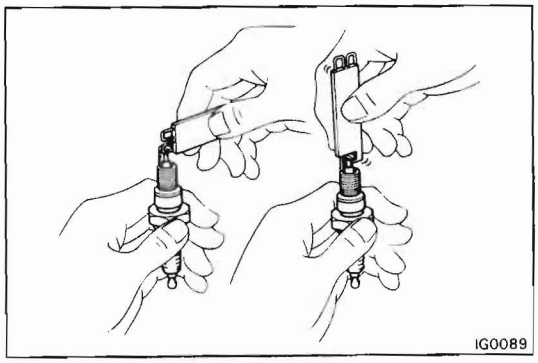


3. **VISUALLY INSPECT SPARK PLUGS**

   Check the spark plug for electrode wear, thread damage and insulator damage.
   If abnormal, replace the plugs.

   Recommended spark plugs:

ND	**W14EX-U**
NGK	**BP4EY**



4. **ADJUST ELECTRODE CAP**

Carefully bend the outer electrode to obtain the correct electrode gap.

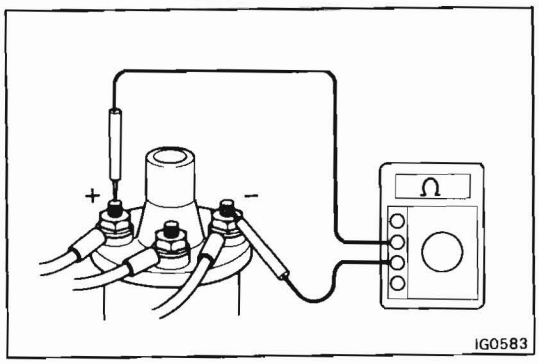
Correct electrode gap: 0.8 mm (0.031 in.)

5. **INSTALL SPARK PLUGS**

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

INSPECTION OF IGNITION COIL

w/ Internal Resistor

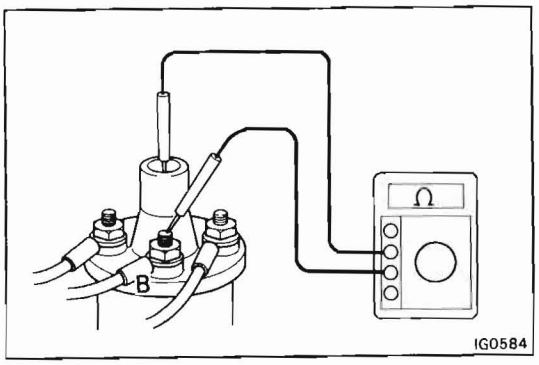


1. **DISCONNECT HIGH-TENSION CORD**

2. **INSPECT PRIMARY COIL RESISTANCE**

Using an ohmmeter, measure the resistance between the + and − terminals.

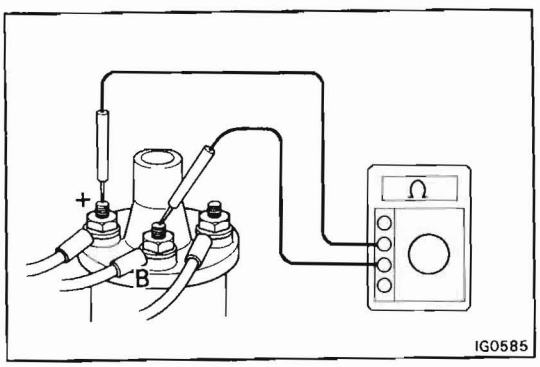
Primary coil resistance (cold): 1.5 − 1.9 Ω



3. **INSPECT SECONDARY COIL RESISTANCE**

Using an ohmmeter, measure the resistance between the B terminal and the high-tension terminal.

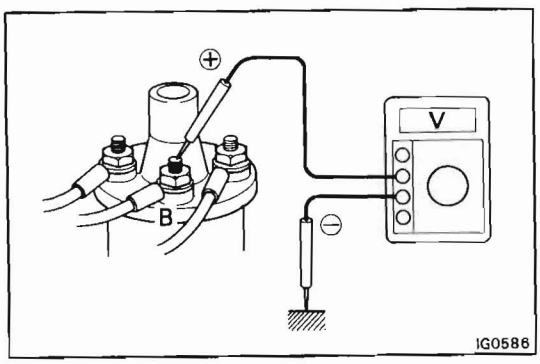
Secondary coil resistance (cold): 13.7 − 18.5 kΩ



4. **INSPECT RESISTOR RESISTANCE**

Using an ohmmeter, measure the resistance between the B and + terminals.

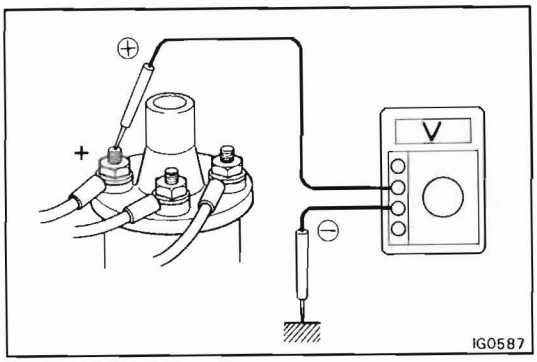
Resistor resistance (cold): 0.9 − 1.2 Ω



5. **INSPECT POWER SOURCE LINE**

(a) With the ignition switch at ON and using a voltmeter, connect the positive (+) probe to the B terminal and the negative (−) probe to body ground.

Voltage: Approx. 12V



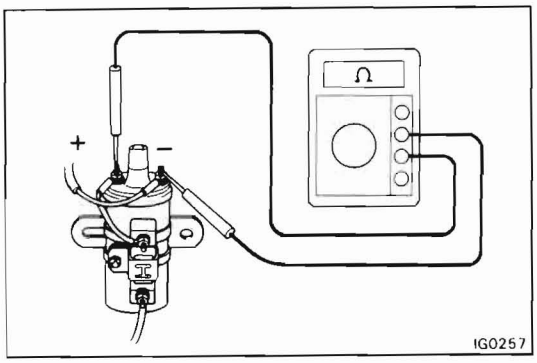
(b) With the ignition switch at "START" and using a voltmeter, connect the positive (+) probe to the + terminal and the negative (−) probe to body ground.

Voltage: Approx. 12V

If abnormal, check the ignition switch and wire harness.

w/ External Resistor

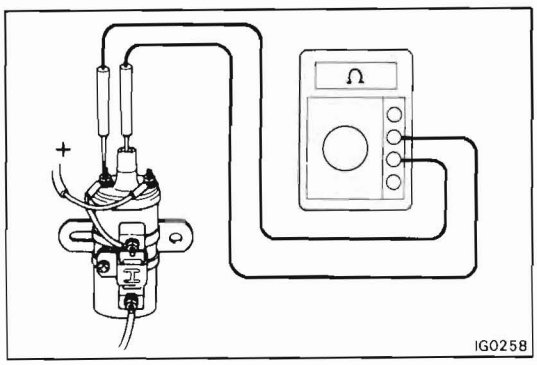
1. DISCONNECT HIGH-TENSION CORD



2. INSPECT PRIMARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the + and − terminals.

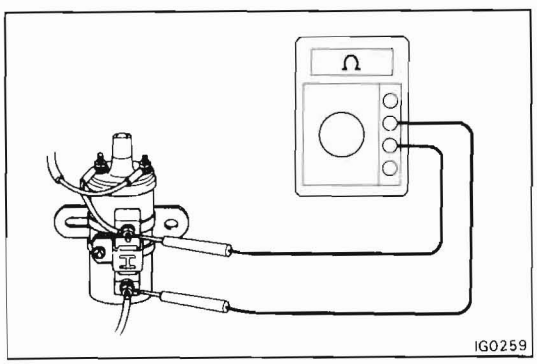
Primary coil resistance (cold): 1.3 − 1.6 Ω



3. INSPECT SECONDARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the + terminal and high-tension terminal.

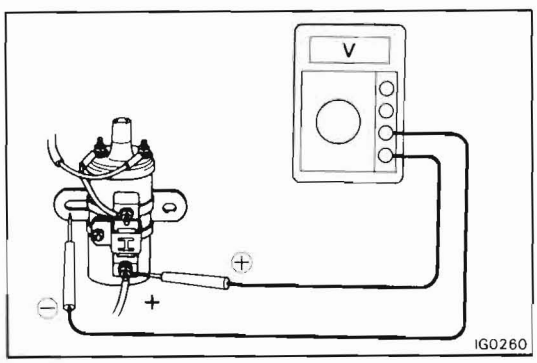
Secondary coil resistance (cold): 10.7 − 14.5 kΩ



4. INSPECT RESISTOR RESISTANCE

Using an ohmmeter, measure the resistance between resistor terminals.

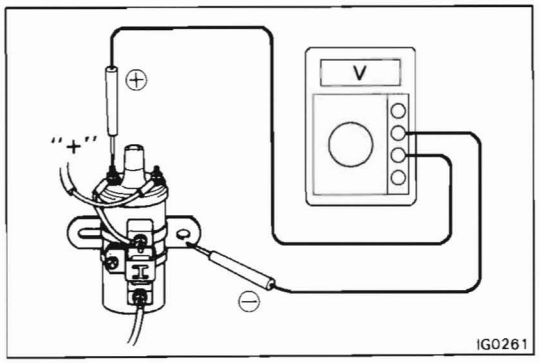
Resistor resistance (cold): 1.3 − 1.5 Ω



5. INSPECT POWER SOURCE LINE

(a) With the ignition switch at "ON" and using a voltmeter, connect the positive (+) probe to the + terminal of the resistor and the negative (−) probe to body ground.

Voltage: Approx. 12V



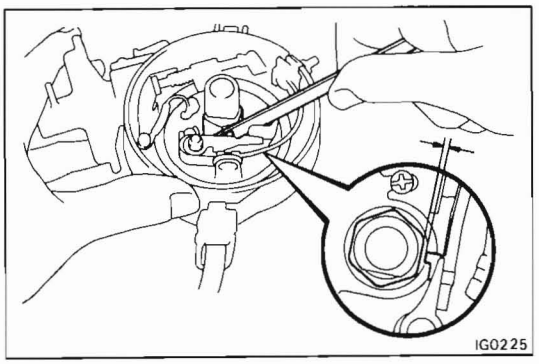
(b) With the ignition switch at START and using a voltmeter, connect the positive (+) probe to the + terminal of the ignition coil and the negative (–) probe to body ground.

Voltage: Approx. 12V

If abnormal, check the ignition switch and wire harness.

INSPECTION OF DISTRIBUTOR

1. INSPECT BREAKER POINT

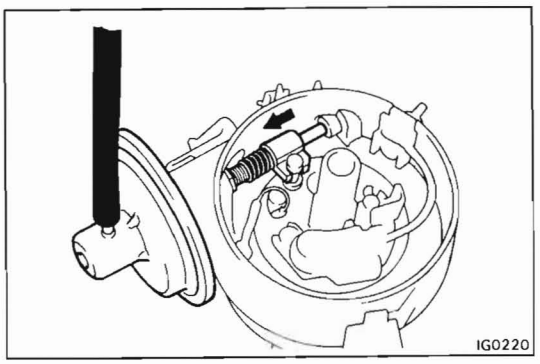


Using a feeler gauge, measure the gap between the cam and rubbing block.

Rubbing block gap: 0.3 mm (0.012 in.)

If the gap is not within specification, adjust the gap.
(See page IG-15 or 25)

2. INSPECT VACUUM ADVANCE

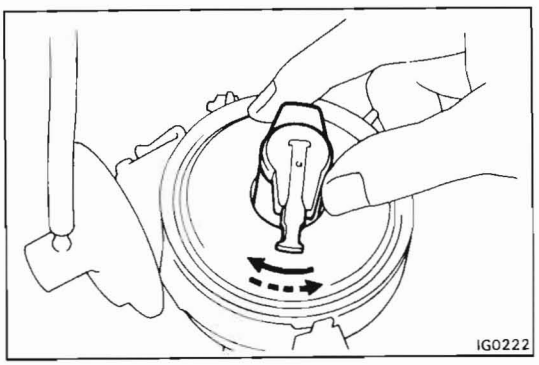


(a) Disconnect the vacuum hose and connect a vacuum pump to the vacuum advancer.

(b) Apply vacuum and check that the vacuum advancer moves.

If the vacuum advancer does not work, repair or replace as necessary.

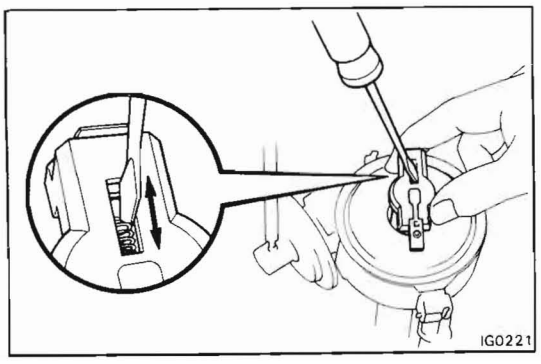
3. INSPECT GOVERNOR ADVANCE



(a) Turn the rotor clockwise, release it and check that the rotor returns quickly counterclockwise.

(b) Check that the rotor is not excessively loose.

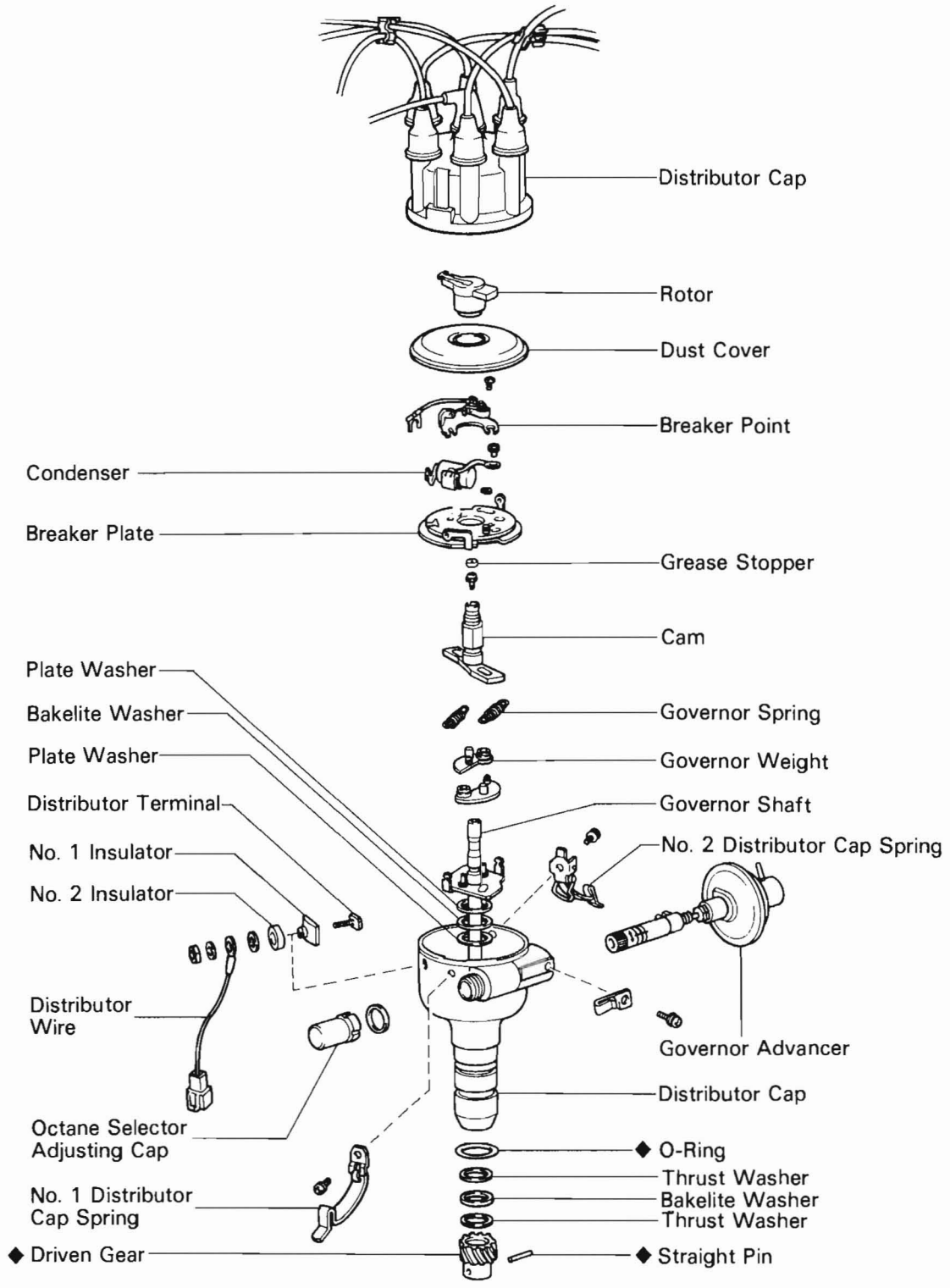
4. (w/ ANTIOVERRUN) INSPECT ROTOR



Check that the rotor weight moves smoothly.

If abnormal, replace the rotor.

DISTRIBUTOR
w/ Octane Selector
COMPONENTS



◆: Non-reusable part

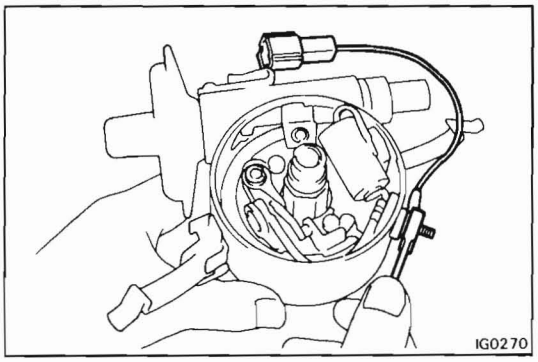
IG0269

DISASSEMBLY OF DISTRIBUTOR

(See page IG-8)

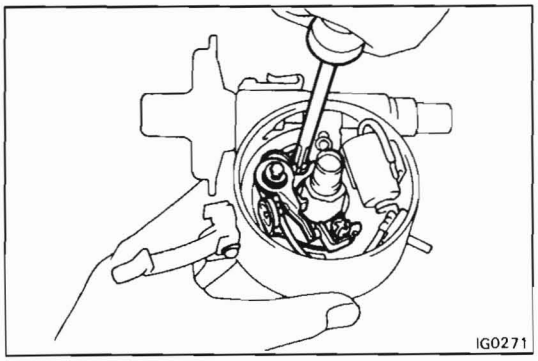
1. **REMOVE DISTRIBUTOR CAP WITHOUT DISCONNECTING HIGH-TENSION CORDS**

2. **REMOVE ROTOR AND DUST COVER**



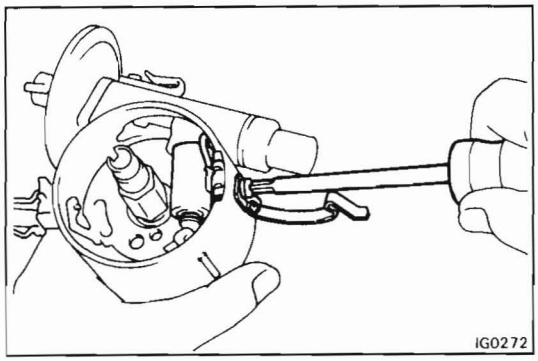
3. **REMOVE DISTRIBUTOR WIRE**

   Remove the nut, spring washer, distributor wire, plate washer and No. 2 insulator.



4. **REMOVE BREAKER POINT**

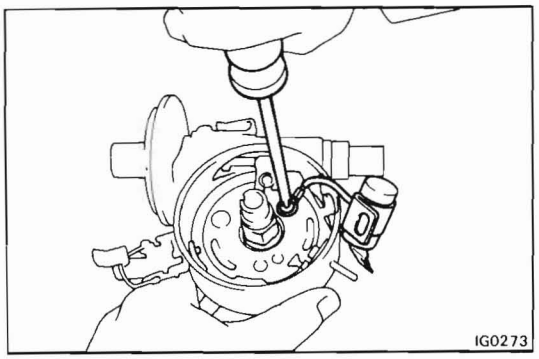
   Remove the two screws and breaker point.



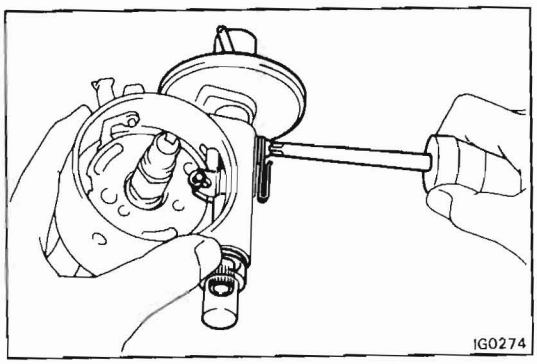
5. **REMOVE CONDENSOR**

   (a) Remove the screw and No. 1 distributor cap spring.

   (b) Remove the screw and condenser.



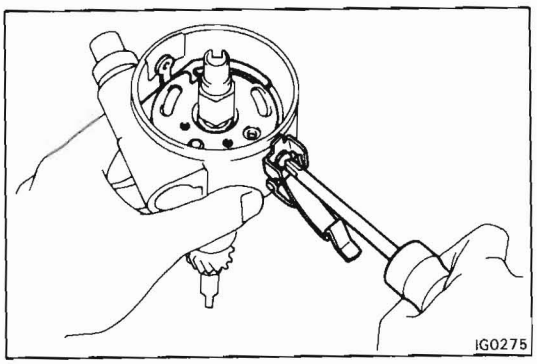
6. **REMOVE DISTRIBUTOR TERMINAL AND NO.1 INSULATOR**



7. REMOVE VACUUM ADVANCER

(a) Remove the screw and clamp.

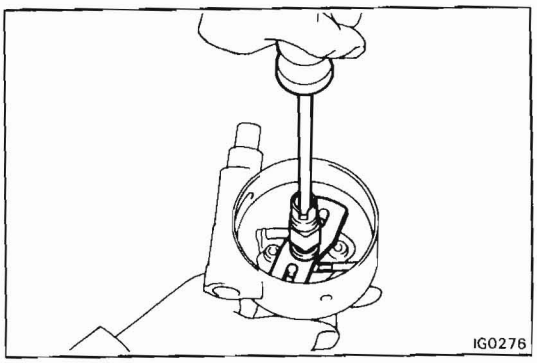
(b) Pull out the vacuum advancer.



8. REMOVE BREAKER PLATE

(a) Remove the screw and No. 2 distributor cap spring.

(b) Pull out the breaker plate.

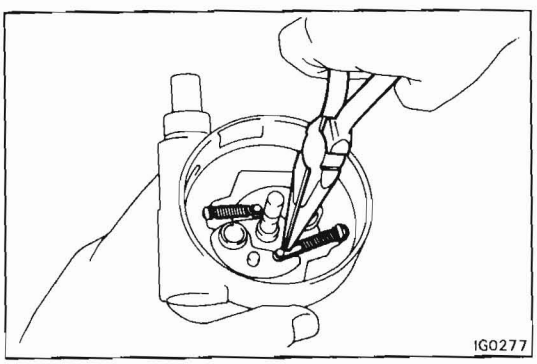


9. REMOVE CAM

(a) Remove the grease stopper.

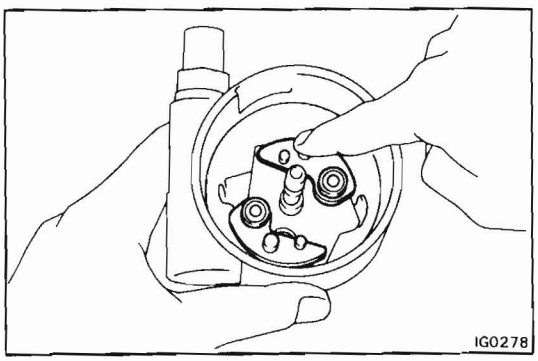
(b) Remove the screw at the end of the governor shaft.

(c) Pull out the cam.

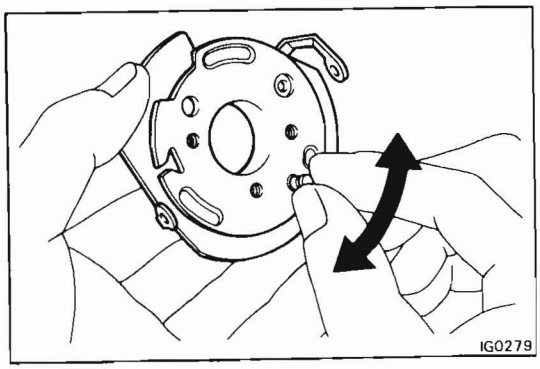


10. REMOVE GOVERNOR SPRINGS

Using needle-nose pliers, remove the two springs.



11. REMOVE GOVERNOR WEIGHTS

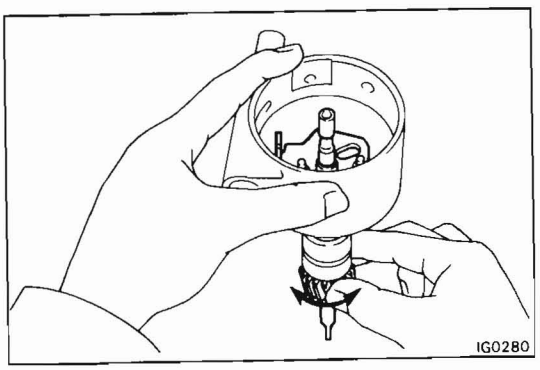


INSPECTION OF DISTRIBUTOR

1. INSPECT BREAKER PLATE

Turn the breaker plate and check that it has a slight drag.

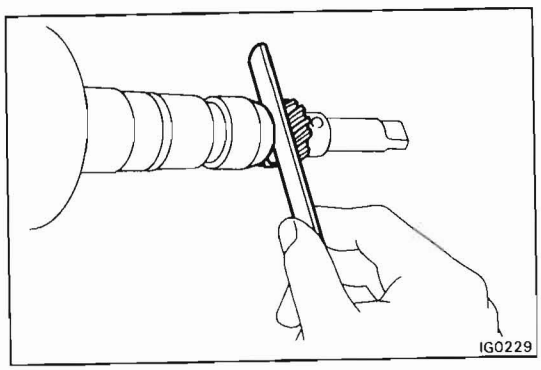
If it sticks or strongly resists, replace the breaker plate.



2. INSPECT GOVERNOR SHAFT

(a) Turn the governor shaft and check that it is not rough or worn.

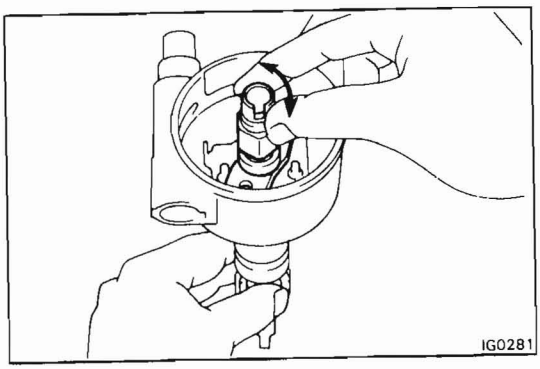
If it feels rough or worn, replace the governor shaft.



(b) Using a feeler gauge, measure the governor shaft thrust clearance.

Thrust Clearance: 0.15 — 0.50 mm (0.0059 — 0.0197 in.)

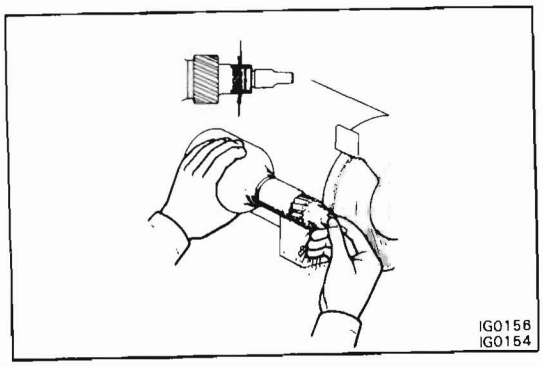
If the thrust clearance is not within specification, adjust by increasing or decreasing the number of the thrust washers.



3. INSPECT CAM

Install the cam to the governor shaft and check that they fit correctly.

If they don't fit, replace the cam and/or governor shaft.

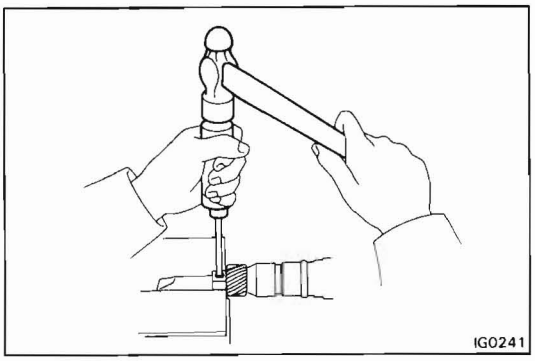


REPLACEMENT OF GOVERNOR SHAFT (OR DRIVEN GEAR)

1. REMOVE DRIVEN GEAR

(a) Using a grinder, grind the driven gear and straight pin.

CAUTION: Be careful not to damage the governor shaft.



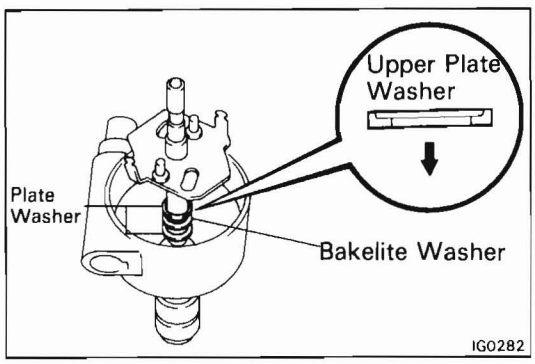
(b) Mount the driven gear in a vise.

(c) Using a pin punch and hammer, tap out the straight pin.

(d) Remove the drive gear, thrust washers and bakelite washer.

2. REMOVE GOVERNOR SHAFT

Remove the governor shaft, plate washers and bakelite washer.

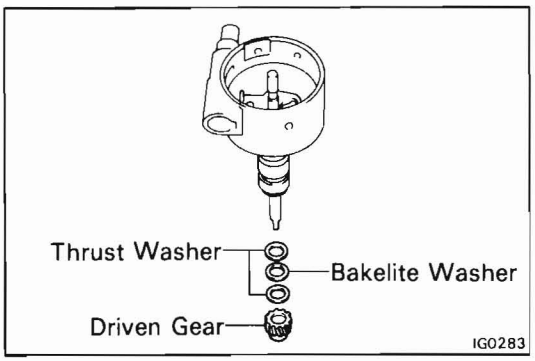


3. INSTALL NEW GOVERNOR SHAFT

(a) Lightly coat the gover shaft with high-temperature grease.

(b) Slide the upper plate washer, bakelite washer and lower plate washer onto the governor shaft.

(c) Push the governor shaft into the housing.



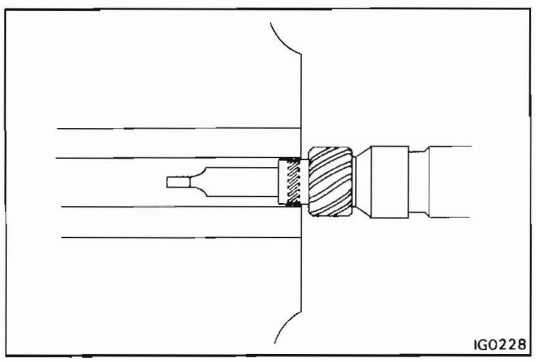
4. INSTALL NEW DRIVEN GEAR

(a) Slide the thrust washer, bakelite washer, thrust washer and driven gear onto the governor shaft.

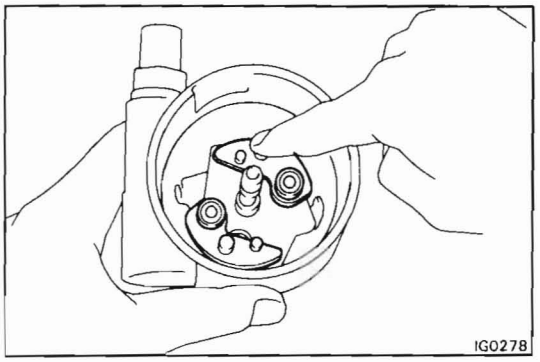
(b) Install a new straight pin.

(c) Check the governer shaft thrust clearance. (See page IG-11)

Thrust Clearance: 0.15 — 0.50 mm (0.0059 — 0.0197 in.)



(d) Secure the ends of the straight pin in a vise.



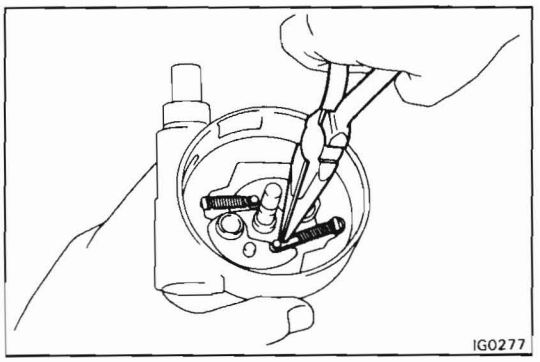
ASSEMBLY OF DISTRIBUTOR

(See page IG-8)

1. INSTALL GOVERNOR WEIGHTS

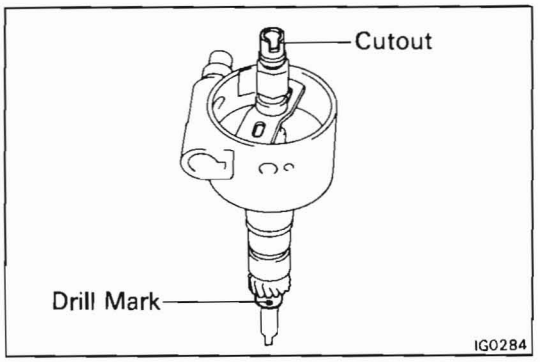
(a) Lightly coat the pivot pin of governor shaft with high-temperature grease.

(b) Install the two governor weights.



2. INSTALL GOVERNOR SPRINGS

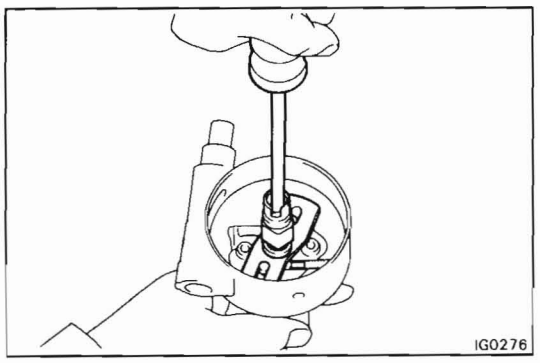
Using needle-nose pliers, install the two springs.



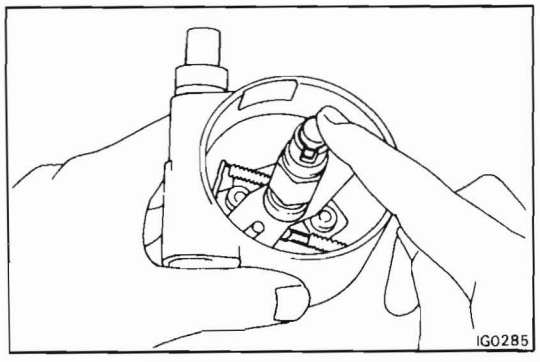
3. INSTALL CAM

(a) Lightly coat the governor shaft with high-temperature grease.

(b) Install the cam on the governor shaft as shown.

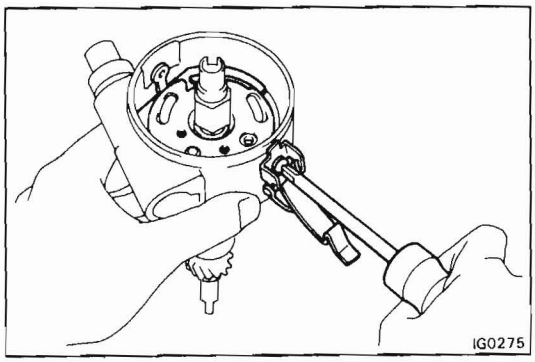


(c) Install the screws.



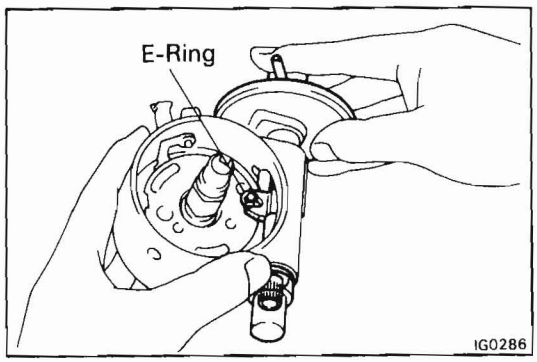
(d) Pack high-temperature grease into the shaft.

(e) Push on the grease stopper with your finger.



4. INSTALL BREAKER PLATE

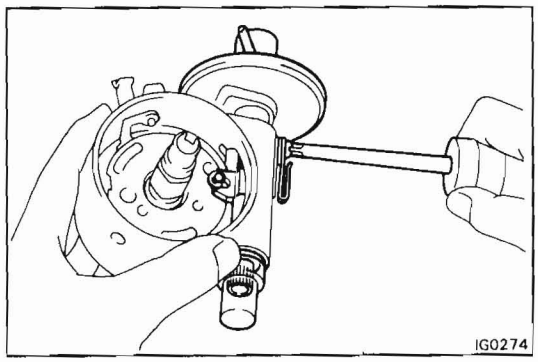
Install the breaker plate and No. 2 distributor cap spring with the screw.



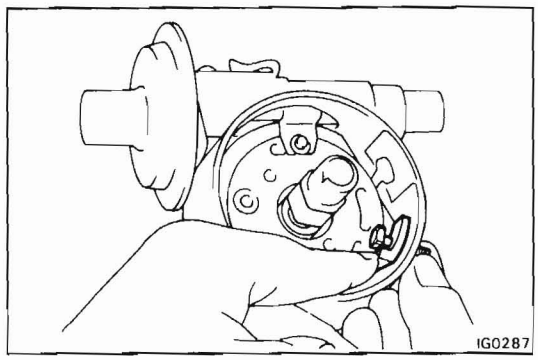
5. INSTALL VACUUM ADVANCER

(a) Install the E-ring to the pivot pin of the breaker plate.

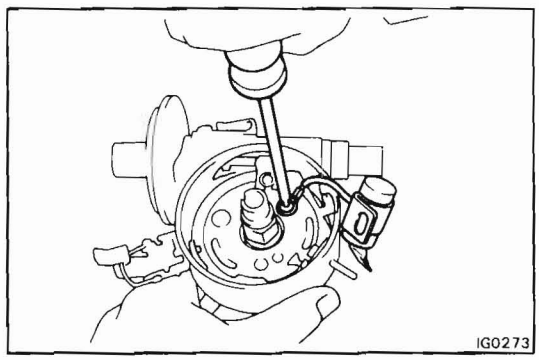
(b) Insert the vacuum advancer into the housing, connecting the pivot pin to pivot.



(c) Install the clamp with the screw.

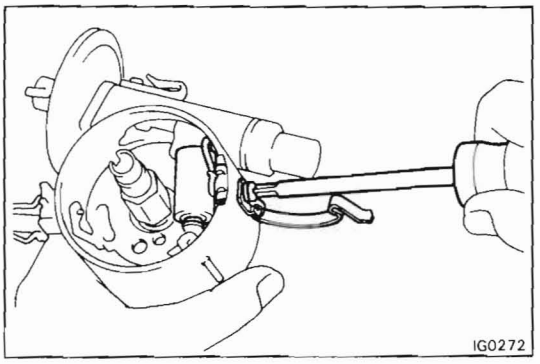


6. INSTALL NO. 1 INSULATOR AND DISTRIBUTOR TERMINAL

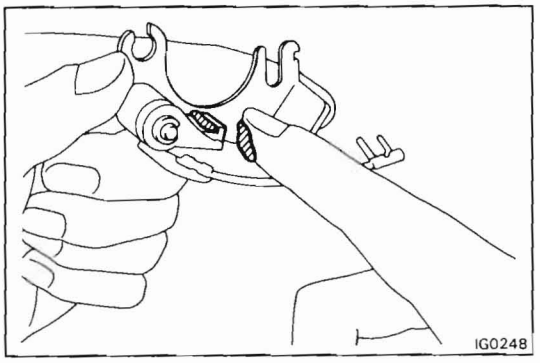


7. INSTALL CONDENSER

(a) Install the lead wire of the condenser.



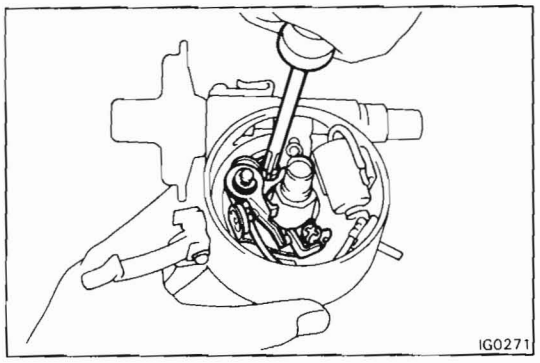
(b) Install the condenser and No. 1 distributor cap spring.



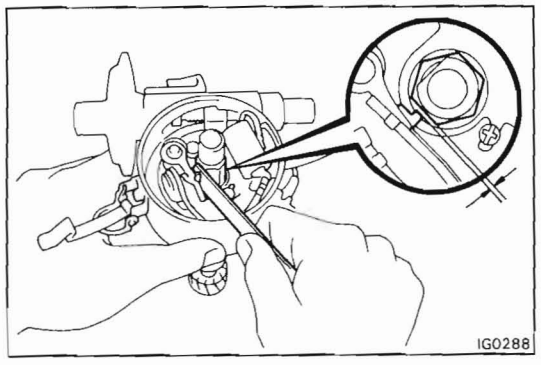
8. INSTALL AND ADJUST BREAKER POINT

(a) Clean the contact surfaces of the points with a piece of cloth saturated in solvent.

(b) Apply high-temperature grease to the rubbing block.

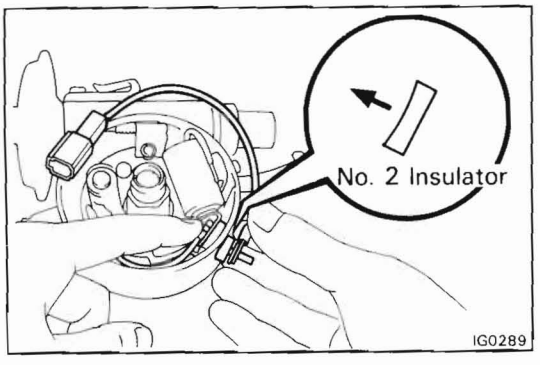


(c) Loosely install the breaker point with the two screws.



(d) Using a feeler gauge, adjust the gap between the cam and rubbing block.

Rubbing block gap: 0.3 mm (0.012 in.)

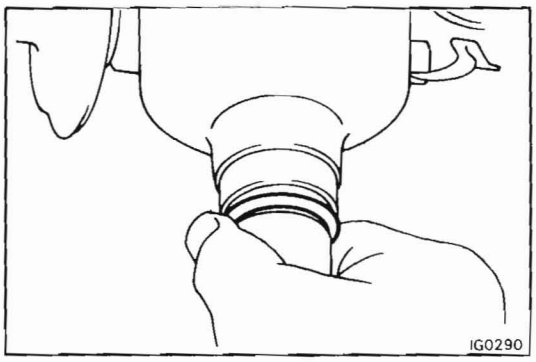


9. INSTALL DISTRIBUTOR WIRE

(a) Install the No. 2 insulator and plate washer.

(b) Connect the lead wires of the breaker point (A) and distributor (B).

(c) Install the spring washer and nut.



10. INSTALL NEW O-RING

(a) Lightly coat the O-ring with engine oil.

(b) Install the O-ring onto the housing.

INSTALLATION OF DISTRIBUTOR

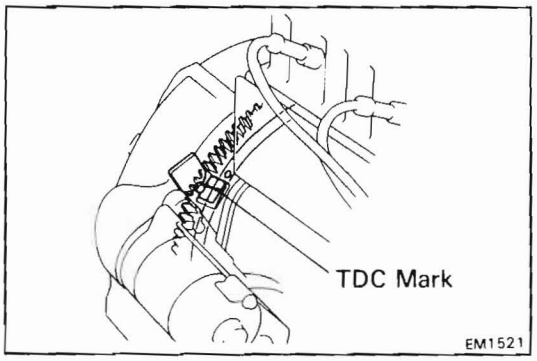
1. SET NO. 1 CYLINDER TO TDC/COMPRESSION

Set to TDC/compression in the following manner.

(a) Remove the No. 1 spark plug.

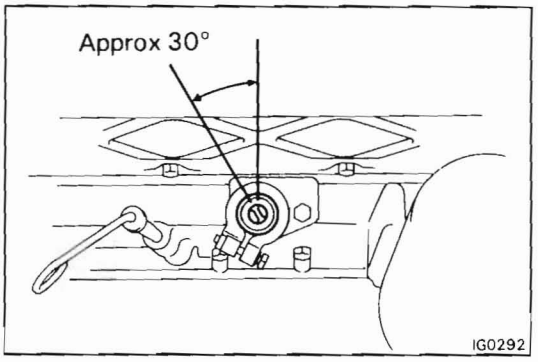
(b) Place your finger over the hole of the No. 1 spark plug and rotate the crankshaft clockwise to TDC. if pressure is felt on your finger, this is TDC/compression of the No. 1 cylinder. If not, repeat the process.

(c) Install the No. 1 spark plug.



2. SET OIL PUMP SHAFT SLOT

Position the oil pump shaft slot in the direction shown in the figure.

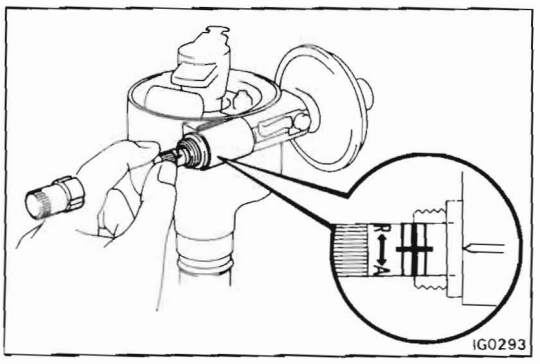


3. SET OCTANE SELECTOR

(a) Remove the adjusting cap.

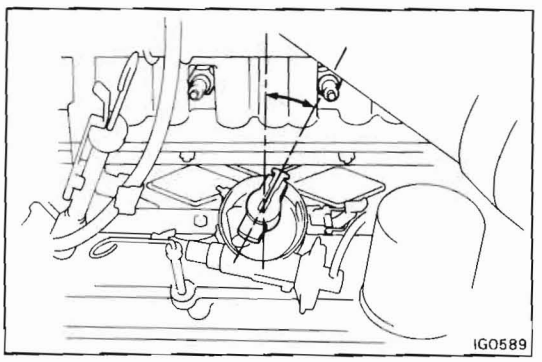
(b) Set the octane selector at the standard line.

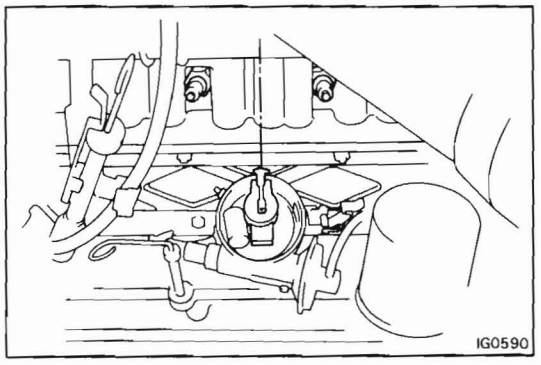
(c) Install the adjusting cap.



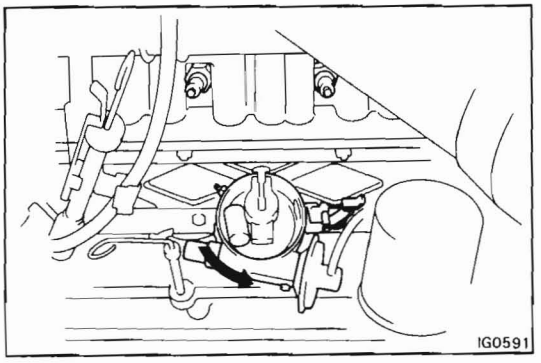
4. INSTALL DISTRIBUTOR

(a) Begin installation of the distributor with the rotor pointing as shown in the figure.





(b) When fully installed, the distributor should point as shown in the figure.



(c) Turn the ignition switch to ON, but do not crank the starter motor.

(d) Rotate the distributor body counterclockwise until a spark jumps between the points and tighten the clamp bolt in that position.

5. **INSTALL DUST COVER AND ROTOR**

6. **INSTALL DISTRIBUTOR CAP WITH HIGH-TENSION CORDS**

7. **CONNECT HIGH-TENSION CORDS**
   Firing order: 1–5–3–6–2–4

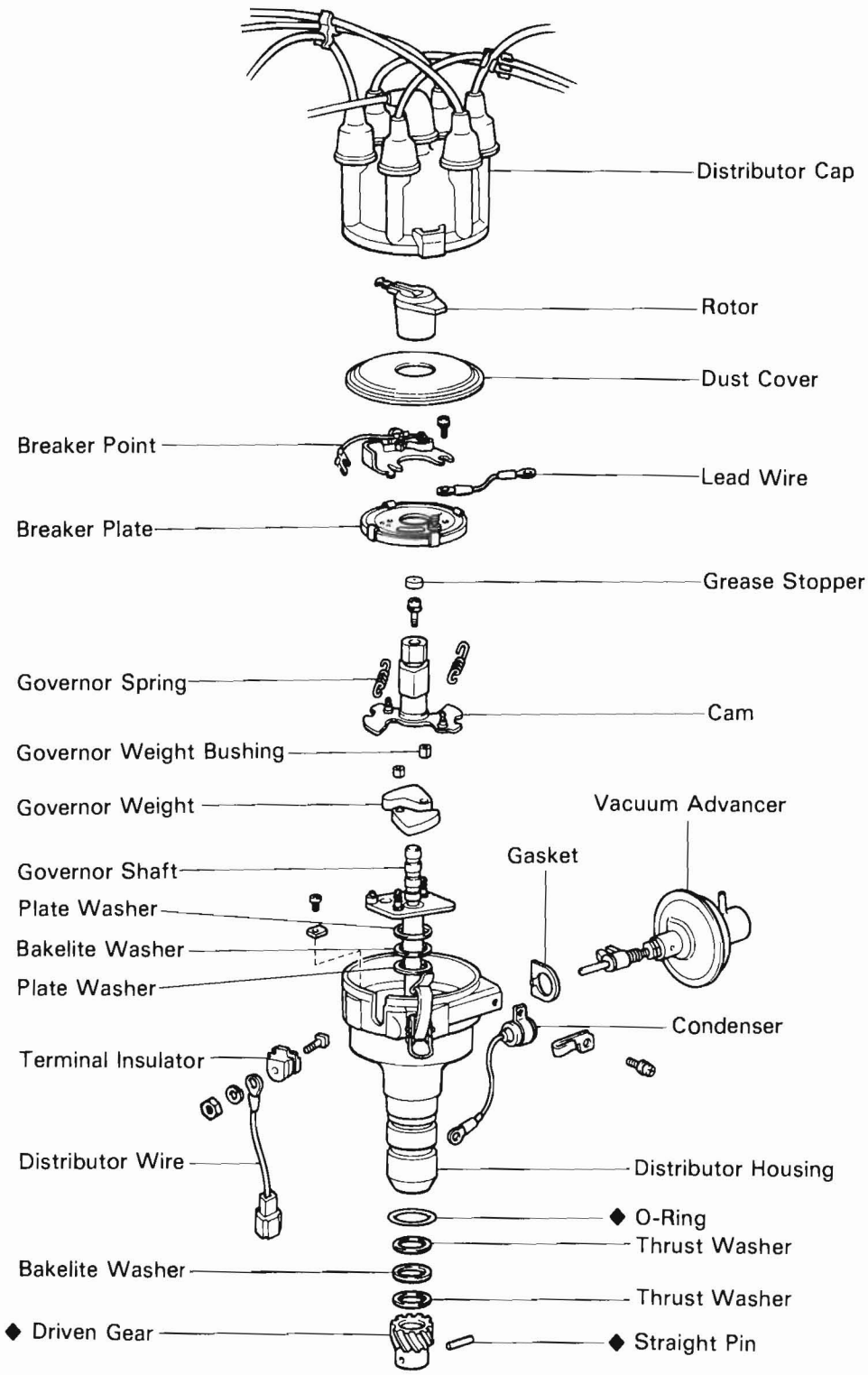
8. **CONNECT DISTRIBUTOR CONNECTOR**

9. **CONNECT VACUUM HOSE**

10. **ADJUST IGNITION TIMING (See page EM-6)**

w/o Octane Selector

COMPONENTS



◆ : Non-reusable part

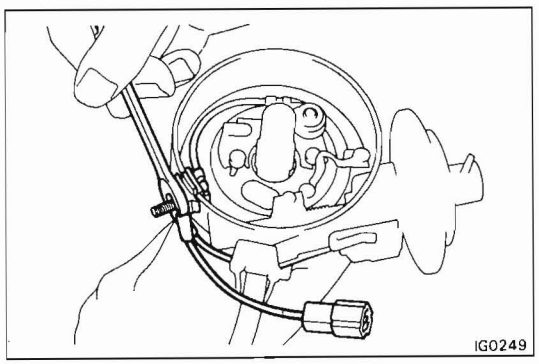
IG0297

DISASSEMBLY OF DISTRIBUTOR

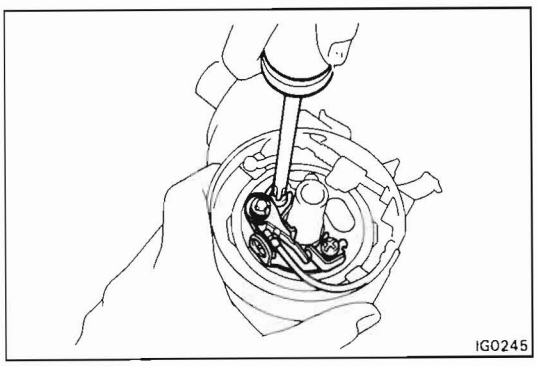
(See page IG-18)

1. REMOVE DISTRIBUTOR CAP WITHOUT DISCONNECTING HIGH-TENSION CORDS

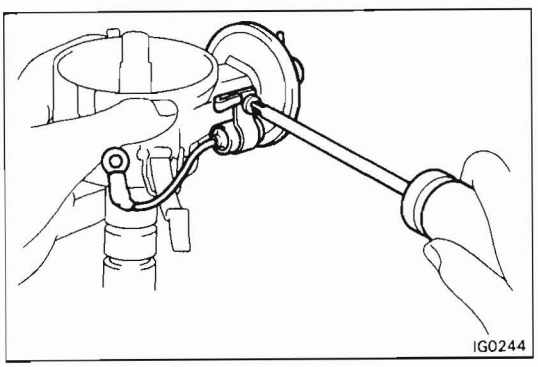
2. REMOVE ROTOR AND DUST COVER



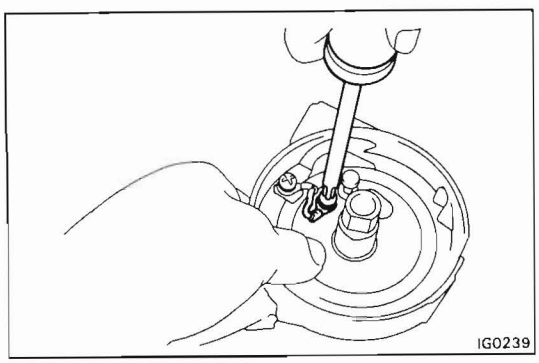
3. REMOVE DISTRIBUTOR TERMINAL
   (a) Remove the nut, spring washer and distributor wire.
   (b) Disconnect the lead wires of the condenser and breaker point.
   (c) Remove the terminal and insulator.



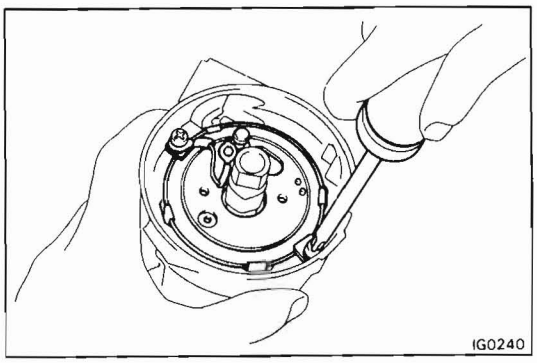
4. REMOVE BREAKER POINT
   Remove the two screws and breaker point.



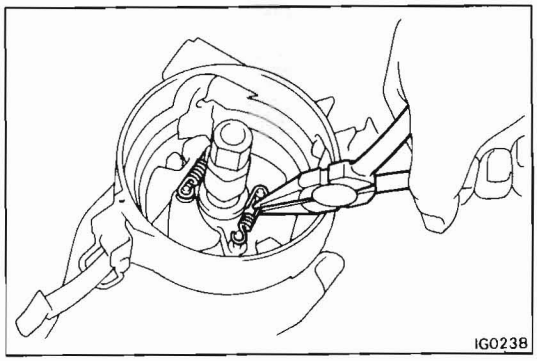
5. REMOVE VACUUM ADVANCER
   (a) Remove the screw, clamp and condenser.
   (b) Pull out the vacuum advancer.



6. REMOVE BREAKER PLATE
   (a) Remove the screw and disconnect the lead wire from the breaker plate.

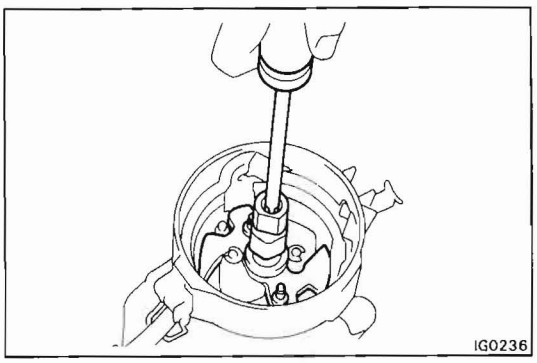


(b) Remove the two screws, plate washers and lead wire.
(c) Pull out the breaker plate.



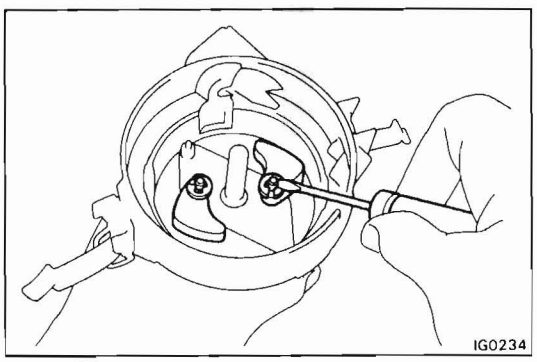
7. REMOVE GOVERNOR SPRINGS

Using needle-nose pliers, remove the two springs.



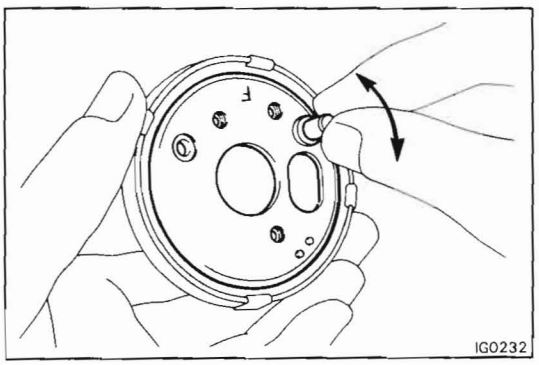
8. REMOVE CAM

(a) Remove the grease stopper.
(b) Remove the screw at the end of the governer shaft.
(c) Pull out the cam.



9. REMOVE GOVERNOR WEIGHTS

Using a small screwdriver, remove the E-ring and pull out the weight and bushing. Remove the two weights.

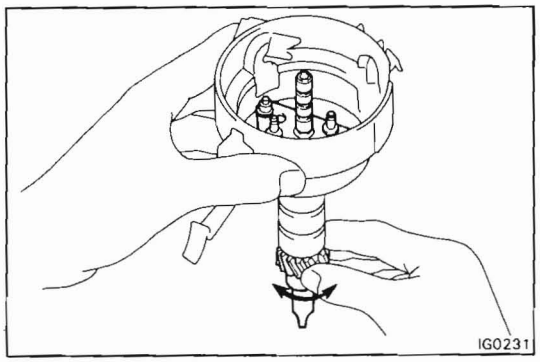


INSPECTION OF DISTRIBUTOR

1. INSPECT BREAKER PLATE

Turn the breaker plate and check that it has a slight drag.

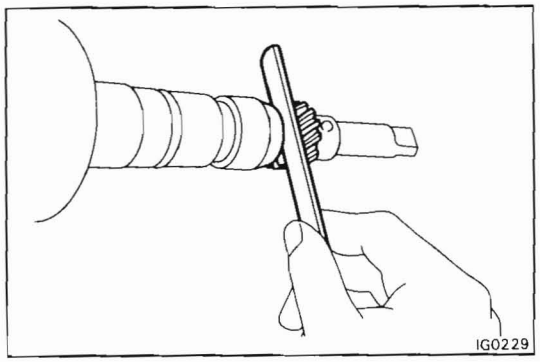
If it sticks or strongly resists, replace the breaker plate.



2. INSPECT GOVERNOR SHAFT

(a) Turn the governor shaft and check that it is not rough or worn.

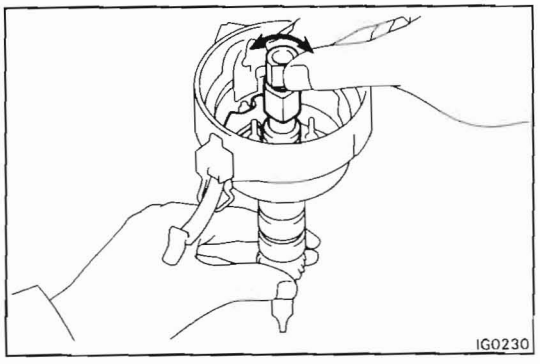
If it feels rough or worn, replace the governor shaft.



(b) Using, a feeler gauge, measure the governor shaft thrust clearance.

Thrust clearance: 0.15 — 0.50 mm (0.0059 — 0.0197 in.)

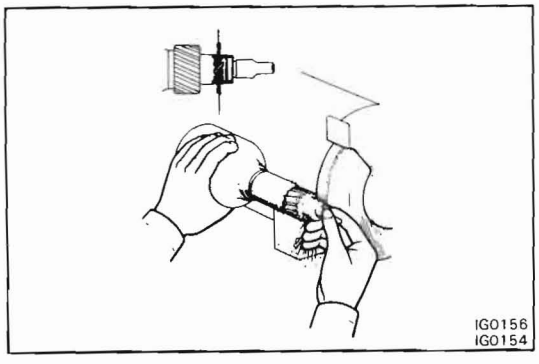
If the thrust clearance is not within specification, adjust by increasing or decreasing the number of the thrust washers.



3. INSPECT CAM

Install the cam to the governor shaft and check that they fit correctly.

If they don't fit, replace the cam and/or governor shaft.

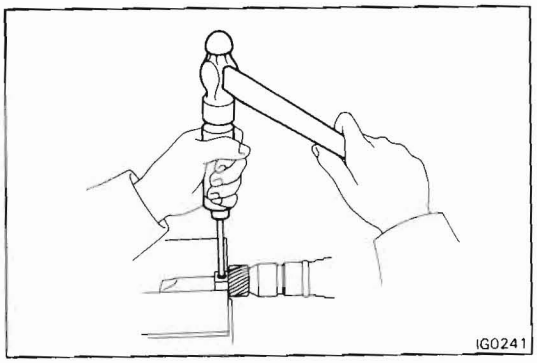


REPLACEMENT OF GOVERNOR SHAFT (OR DRIVEN GEAR)

1. REMOVE DRIVEN GEAR

(a) Using a grinder, grind the driven gear and straight pin.

CAUTION: Be careful not to damage the governor shaft.



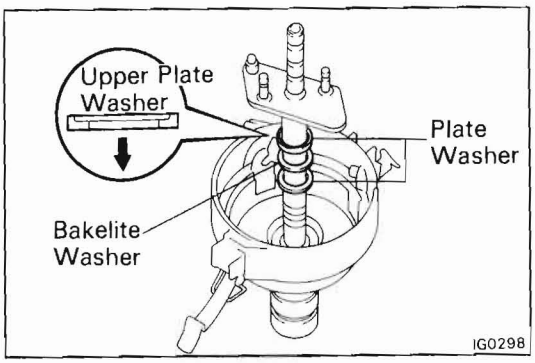
(b) Mount the driven gear in a vise.

(c) Using a pin punch and hammer, tap out the straight pin.

(d) Remove the drive gear, plate washers and bakelite washer.

2. REMOVE GOVERNOR SHAFT

Remove the governor shaft, thrust washers and bakelite washer.

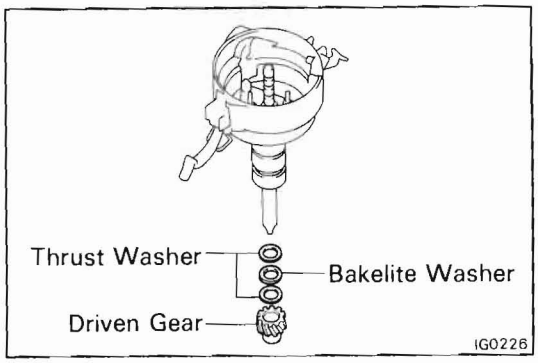


3. INSTALL NEW GOVERNOR SHAFT

(a) Lightly coat the gover shaft with high-temperature grease.

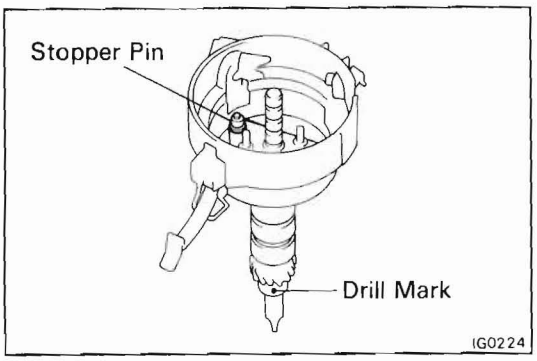
(b) Slide the upper plate washer, bakelite washer and lower plate washer onto the governor shaft.

(c) Push the governor shaft into the housing.



4. INSTALL NEW DRIVEN GEAR

(a) Slide the thrust washer, bakelite washer, thrust washer and driven gear onto the governor shaft.

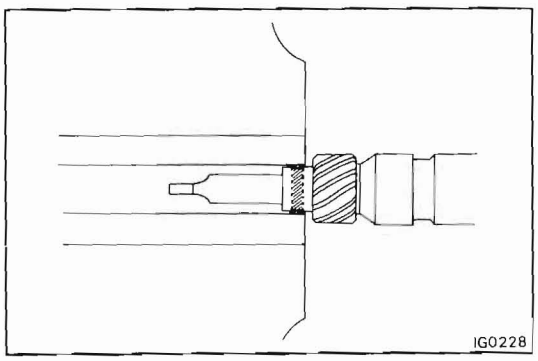


(b) Position the drill mark on the driven gear and stopper pin as shown.

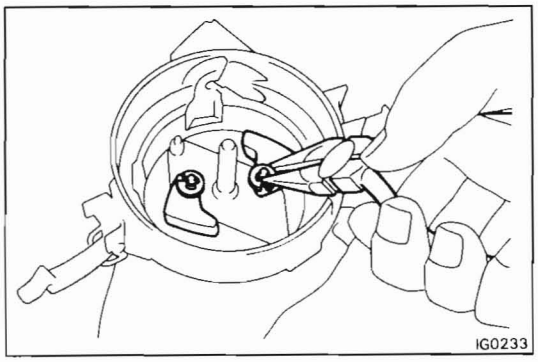
(c) Install a new pin.

(d) Check the governer shaft thrust clearance. (See page IG-21)

Thrust clearance: 0.15 — 0.50 mm (0.0059 — 0.0197 in.)



(e) Secure the ends of the straight pin in a vise.

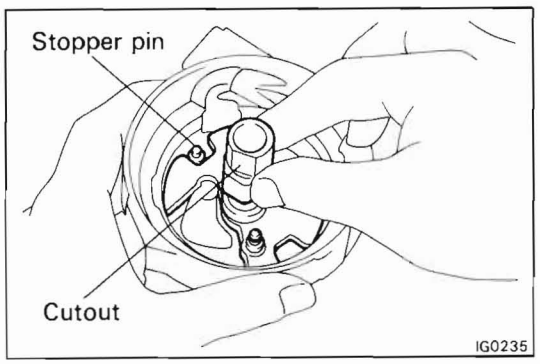


ASSEMBLY OF DISTRIBUTOR

(See page IG-18)

1. INSTALL GOVERNOR WEIGHTS

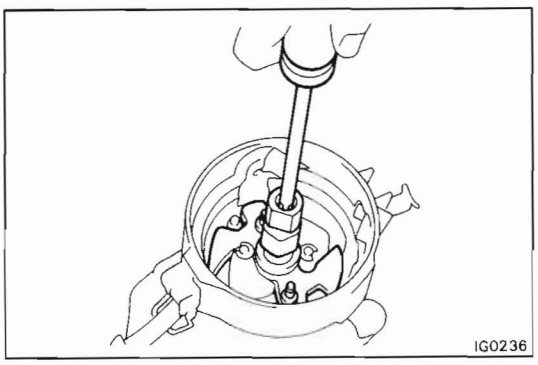
Using needle-nose pliers, install the bushing and weight with the E-ring. Install the two weights.



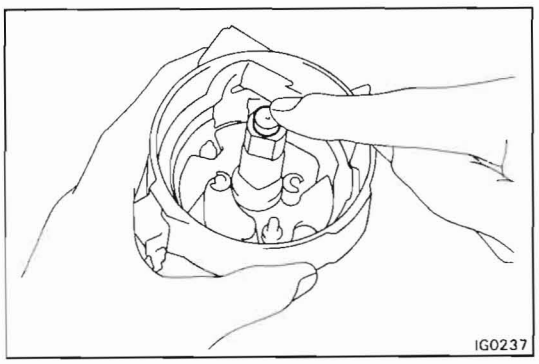
2. INSTALL CAM

(a) Lightly coat the governor shaft with high-temperature grease.

(b) Install the cam on the governor shaft as shown.

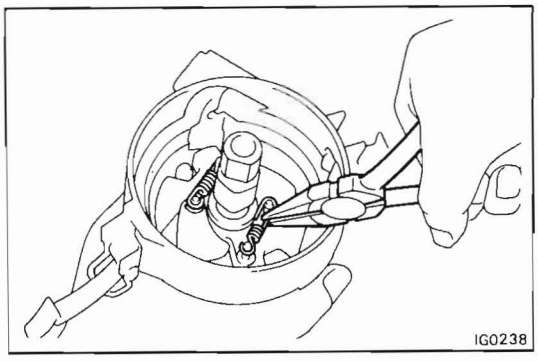


(c) Install the screw.



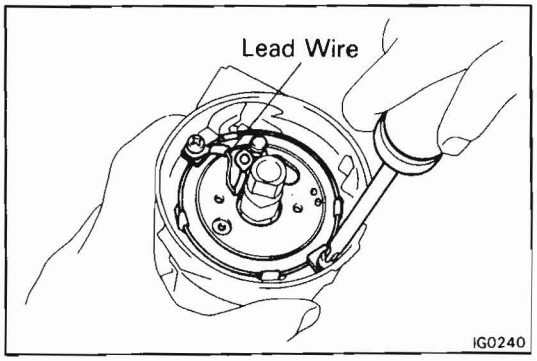
(d) Pack high-temperature grease into the cam.

(e) Push on the grease stopper with your finger.



3. INSTALL GOVERNOR SPRINGS

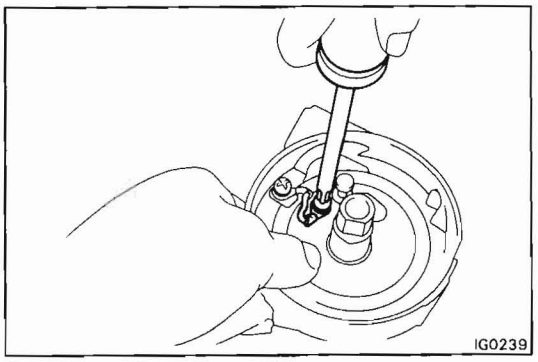
Using needle-nose pliers, install the two springs.



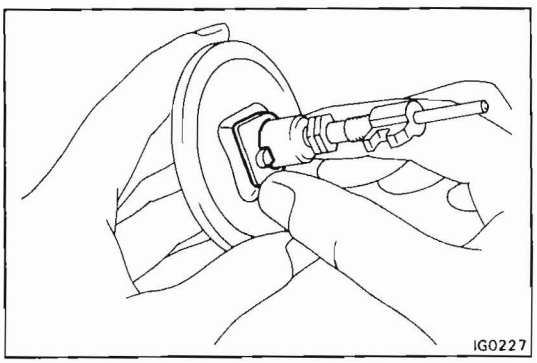
4. INSTALL BREAKER PLATE

(a) Align the four clips on the breaker plate with the cutout parts of the housing and insert the breaker plate.

(b) Install the two plate washers, lead wire and two screws as shown.

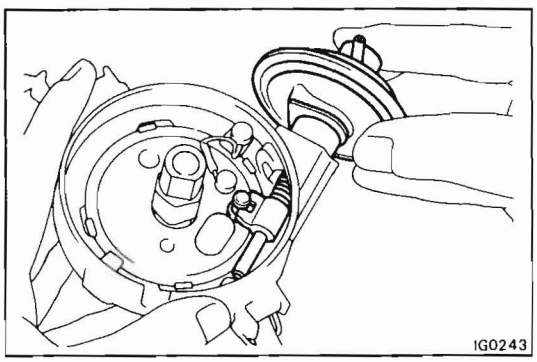


(c) Connect the lead wire with the screw.

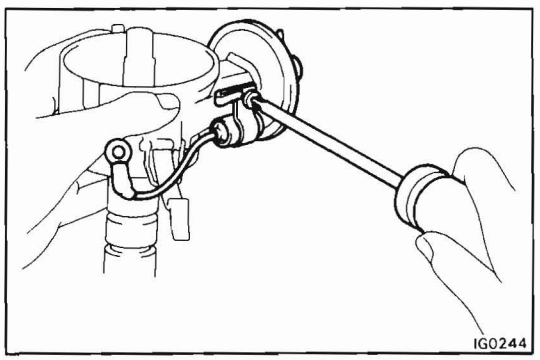


5. INSTALL VACUUM ADVANCER

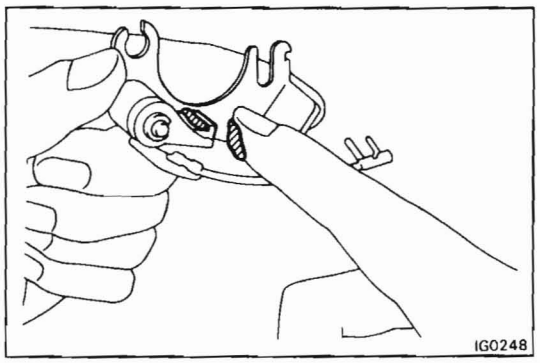
(a) Install a new gasket to the advancer.



(b) Insert the vacuum advancer into the housing connecting the pivot pin to the pivot.



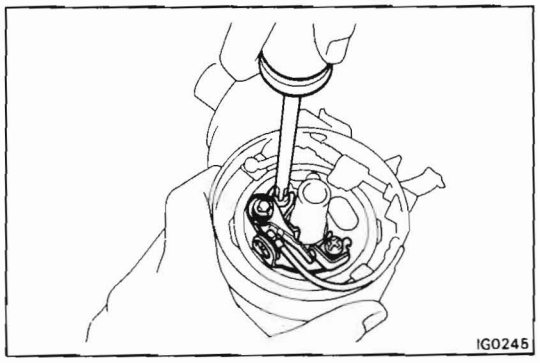
(c) Install the condenser and clamp with the screw.



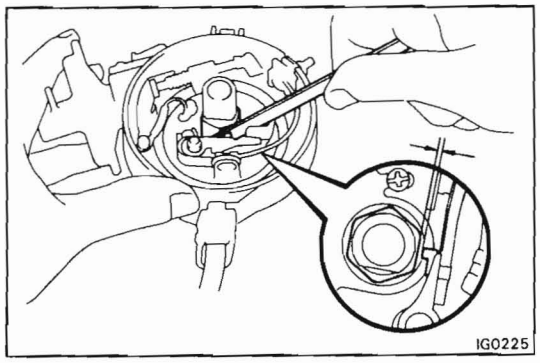
6. INSTALL AND ADJUST BREAKER POINT

(a) Clean the contact surfaces of the points with a piece of cloth saturated in solvent.

(b) Apply high-temperature grease to the rubbing block.

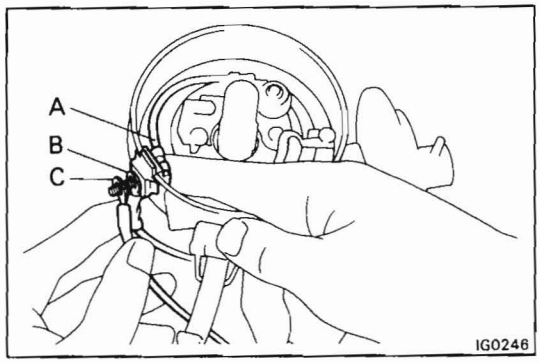


(c) Loosely install the breaker point with the two screws.



(d) Using a feeler gauge, adjust the gap between the cam and rubbing block.

Rubbing block gap: 0.3 mm (0.012 in.)

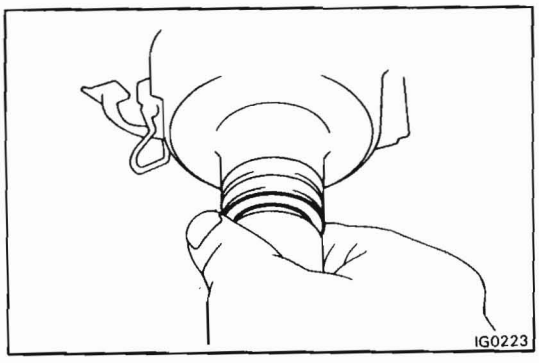


7. INSTALL DISTRIBUTOR TERMINAL

(a) Install the insulator and terminal to the housing.

(b) Connect the lead wires of the breaker point A, condenser B and distributor C to the terminal.

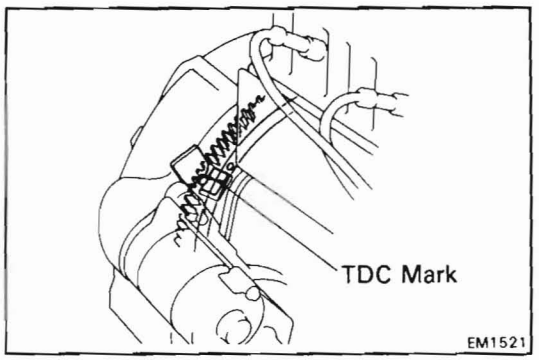
(c) Install the spring washer and nut.



8. INSTALL NEW O-RING

(a) Lightly coat the O-ring with engine oil.

(b) Install the O-ring onto the housing.



INSTALLATION OF DISTRIBUTOR

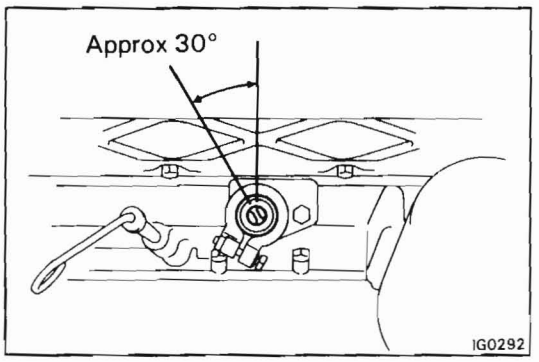
1. SET NO. 1 CYLINDER TO TDC/COMPRESSION

Set to TDC/compression in the following manner.

(a) Remove the No. 1 spark plug.

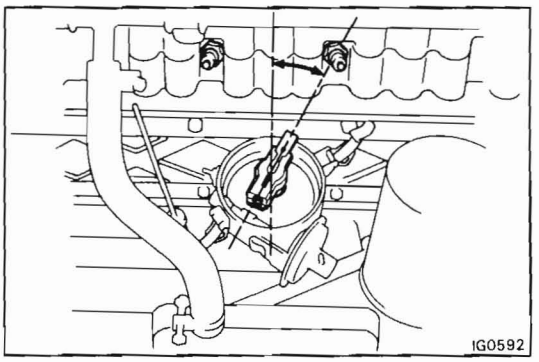
(b) Place your finger over the hole of the No. 1 spark plug and rotate the crankshaft clockwise to TDC. If pressure is felt on your finger, this is TDC/compression of the No. 1 cylinder. If not, repeat the process.

(c) Install the No. 1 spark plug.



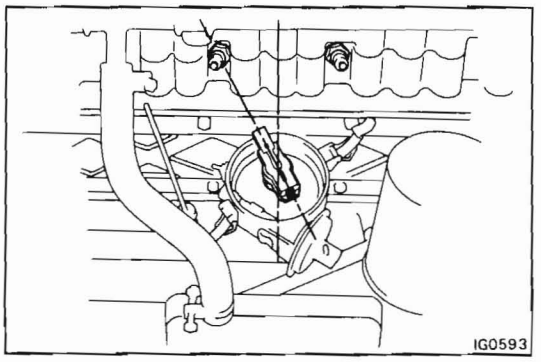
2. SET OIL PUMP SHAFT SLOT

Position the oil pump shaft slot in the direction shown in the figure.

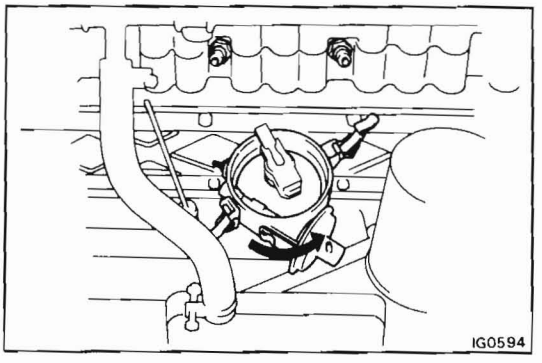


3. INSTALL DISTRIBUTOR

(a) Begin installation of the distributor with the rotor pointing as shown in the figure.



(b) When fully installed, the distributor should point as shown in the figure.



(c) Turn the ignition switch to ON, but do not crank the starter motor.

(d) Rotate the distributor body counterclockwise until a spark jumps between the points and tighten the clamp bolt in that position.

4. INSTALL DUST COVER AND ROTOR
5. INSTALL DISTRIBUTOR CAP WITH HIGH-TENSION CORDS
6. CONNECT HIGH-TENSION CORDS
   Firing order: 1—5—3—6—2—4
7. CONNECT DISTRIBUTOR CONNECTOR
8. CONNECT VACUUM HOSE
9. ADJUST IGNITION TIMING (See page EM-6)

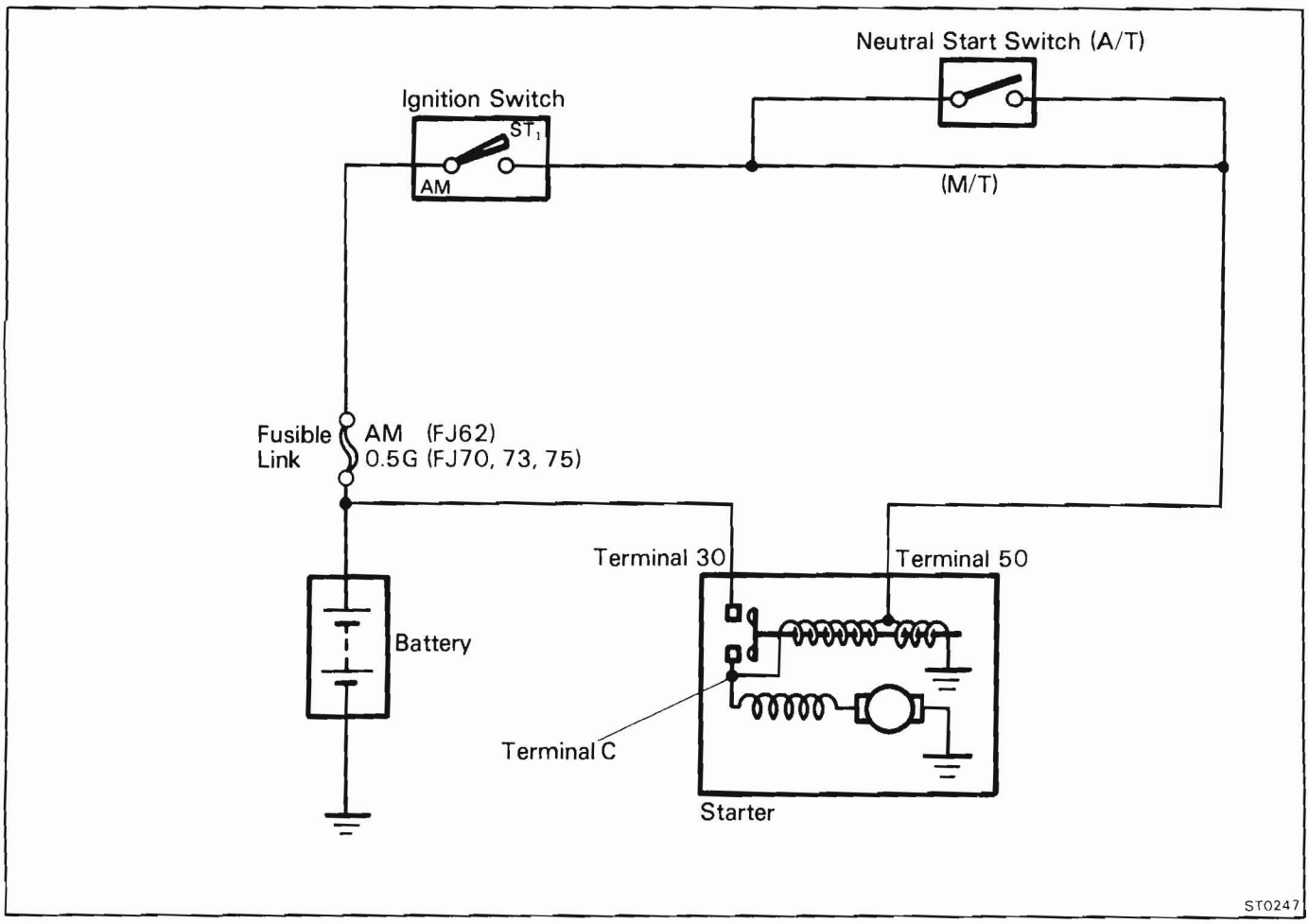
– MEMO –

STARTING SYSTEM

TROUBLESHOOTING

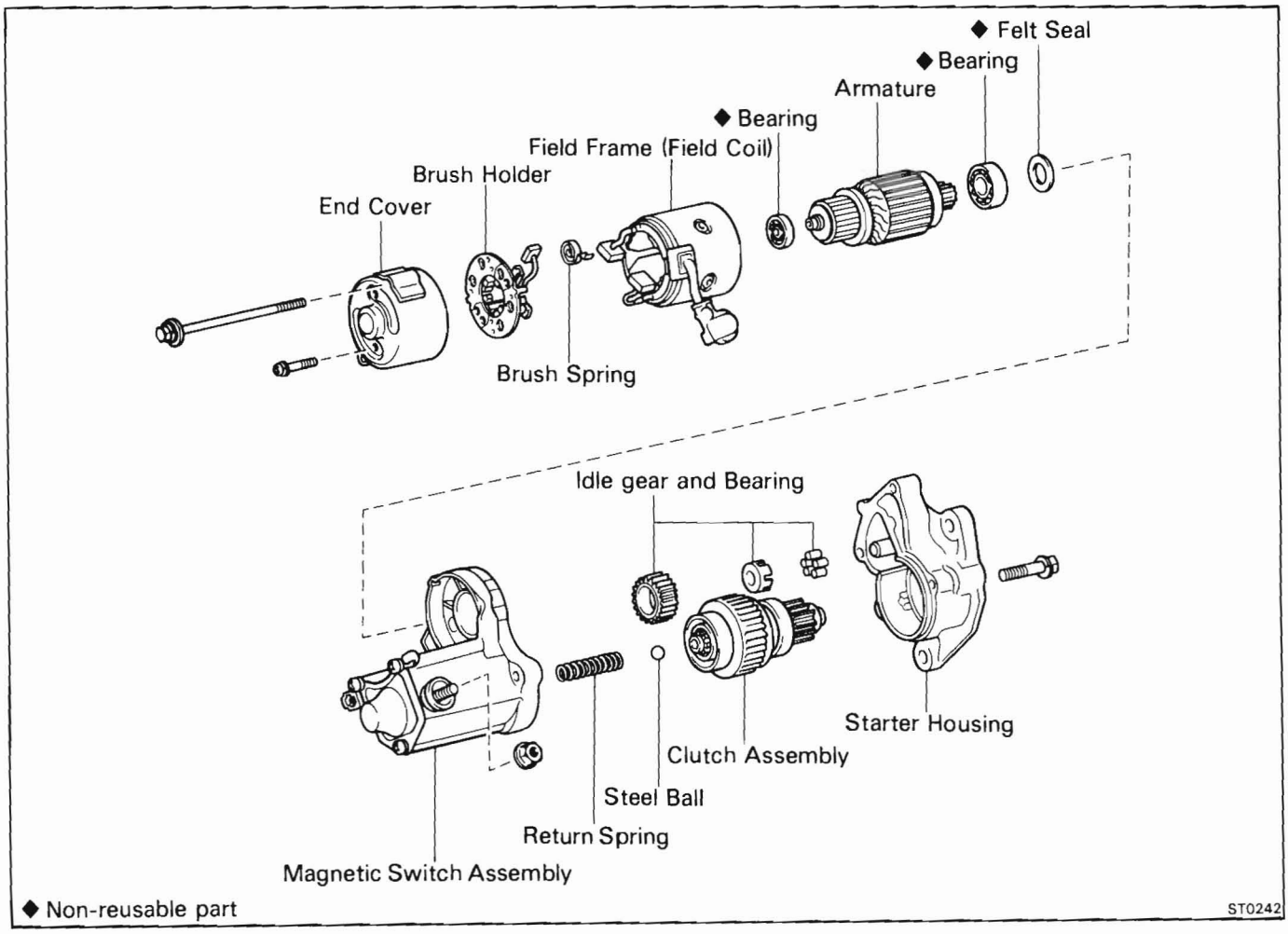
Problem	Possible cause	Remedy	Page
Engine will not crank	Battery charge low	Check battery specific gravity Charge or replace battery	CH-4
	Battery cables loose, corroded or worn	Repair or replace cable	
	Neutral start switch faulty (A/T only)	Replace switch	
	Fusible link blown	Replace fusible link	
	Starter faulty	Repair starter	ST-3
	Ignition switch faulty	Replace ignition switch	
Engine cranks slowly	Battery charge low	Check battery specific gravity Charge or replace battery	CH-4
	Battery cables loose, corroded or worn	Repair or replace cables	
	Starter faulty	Repair starter	ST-3
Starter keeps running	Starter faulty	Repair starter	ST-3
	Ignition switch faulty	Replace ignition switch	
	Short in wiring	Repair wiring	
Starter spins but engine will not crank	Pinion gear teeth broken or faulty starter Flywheel teeth broken	Repair starter Replace flywheel	ST-3

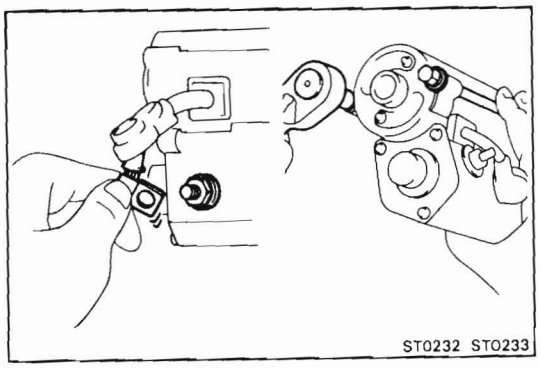
STARTING SYSTEM CIRCUIT



STARTER

COMPONENTS





DISASSEMBLY OF STARTER

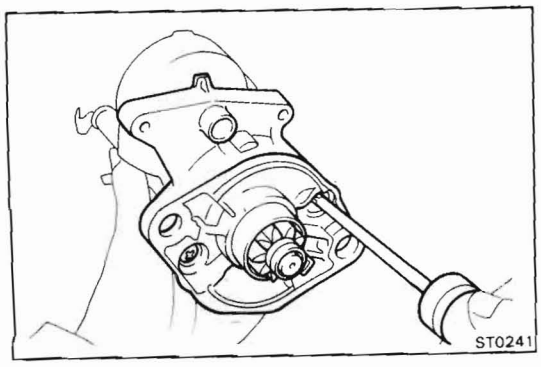
1. REMOVE FIELD FRAME AND ARMATURE ASSEMBLY

(a) Remove the nut and disconnect the lead wire from the magnetic switch terminal.

(b) Remove the two through bolts.

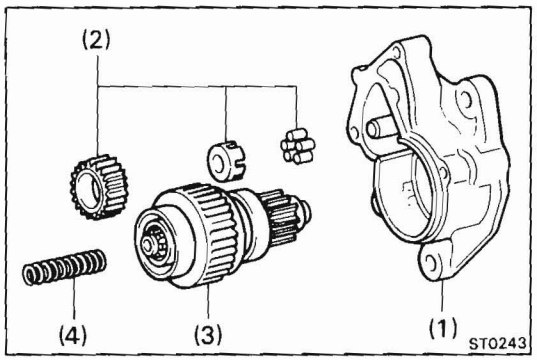
(c) Pull out the field frame together with the armature.

(d) Remove the felt seal.

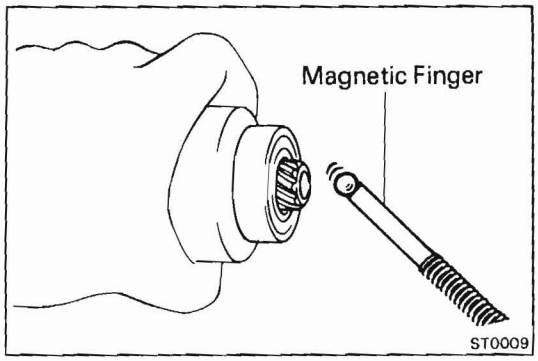


2. REMOVE CLUTCH ASSEMBLY AND IDLE GEAR

(a) Remove the two screws.

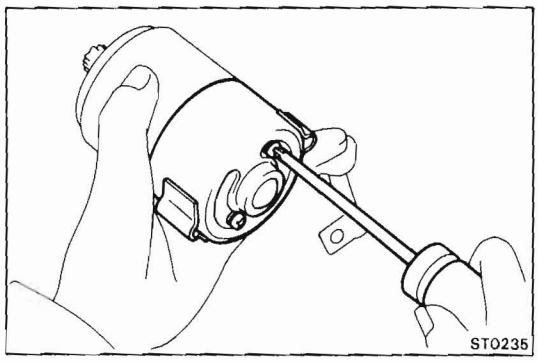


(b) Remove the following parts from the magnetic switch assembly:
(1) Starter housing
(2) Idler gear and bearing
(3) Clutch assembly
(4) Return spring



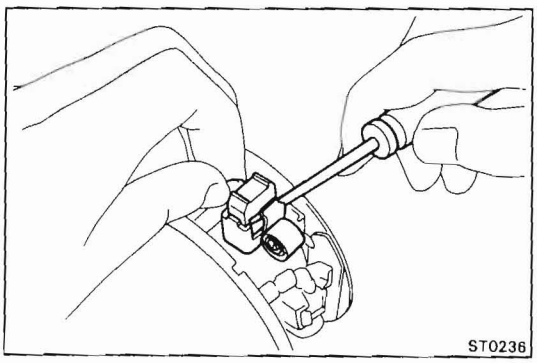
3. REMOVE STEEL BALL

Using a magnetic finger, remove the steel ball from the clutch shaft hole.



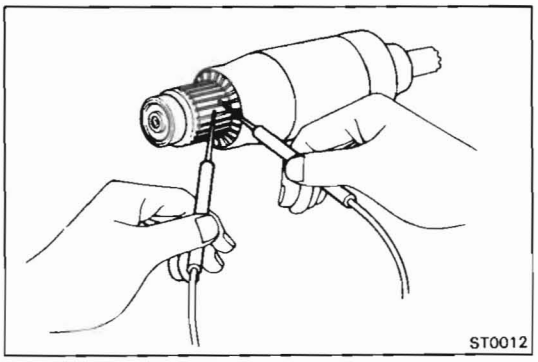
4. REMOVE BRUSH HOLDER

(a) Remove the two screws and end cover from the field frame.



(b) Using a screwdriver, hold the spring back and disconnect the brush from the brush holder. Disconnect the four brushes and remove the brush holder.

5. REMOVE ARMATURE FROM FIELD FRAME



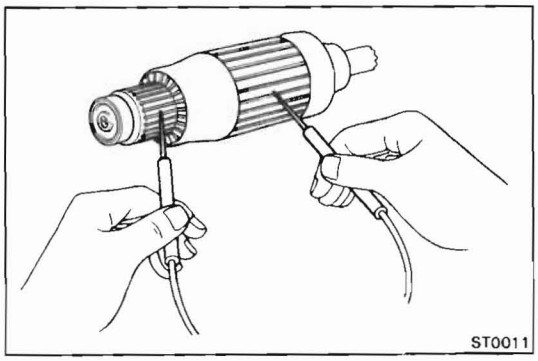
INSPECTION OF STARTER

Armature Coil

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator.

If there is no continuity, replace the armature.



2. INSPECT COMMUTATOR FOR GROUND

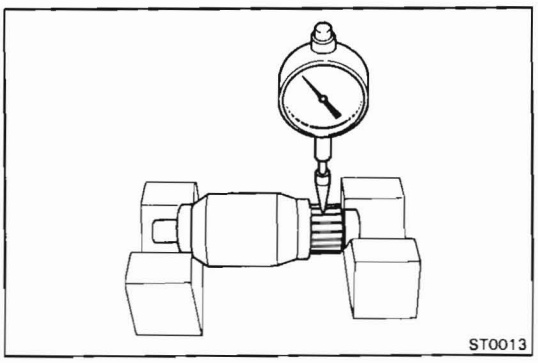
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

If the surface is dirty or burnt, correct it with sandpaper (No. 400) or a lathe.



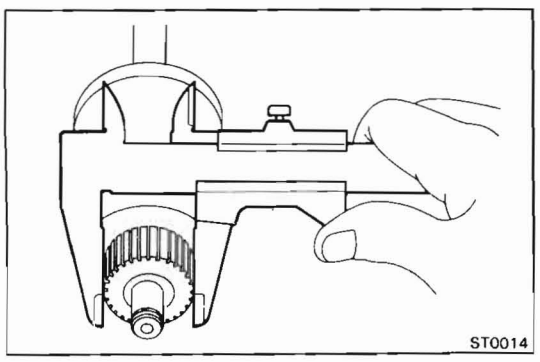
2. INSPECT COMMUTATOR CIRCLE RUNOUT

(a) Place the commutator on V-blocks.

(b) Using a dial indicator, measure the circle runout.

Maximum circle runout: 0.05 mm (0.0020 in.)

If the circle runout exceeds maximum, correct it with a lathe.

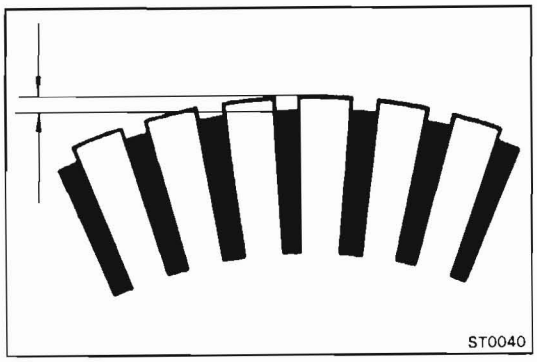


3. INSPECT COMMUTATOR DIAMETER

Using calipers, measure the commutator diameter.

Standard diameter: 30 mm (1.18 in.)
Minimum diameter: 29 mm (1.14 in.)

If the diameter is less than minimum, replace the armature.



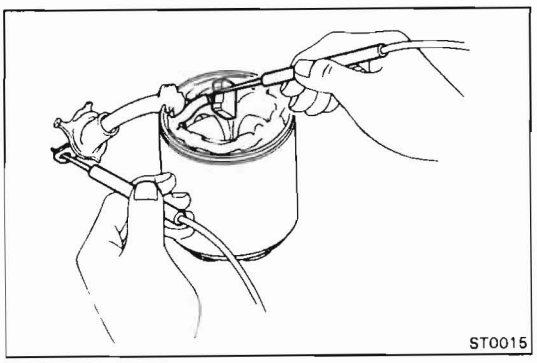
4. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign particles. Smooth out the edge.

Standard undercut depth: 0.6 mm (0.024 in.)
Minimum undercut depth: 0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

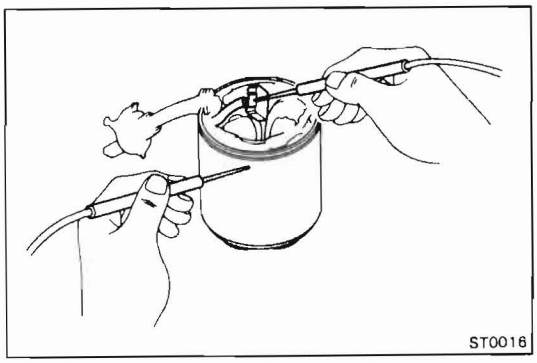
Field Coil (Field Frame)



1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

If there is no continuity, replace the field coil.

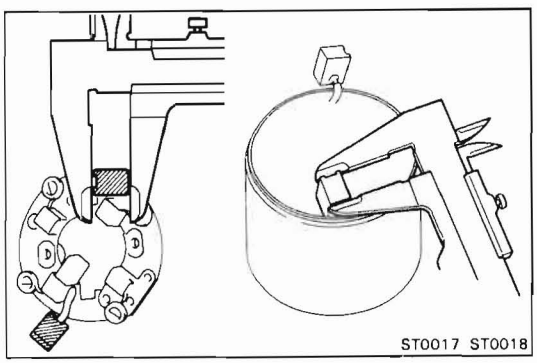


2. INSPECT FIELD COIL FOR GROUND

Using an ohmmeter, check that there is no continuity between the field coil brush lead and field frame.

If there is continuity, repair or replace the field coil.

Brushes



INSPECT BRUSH LENGTH

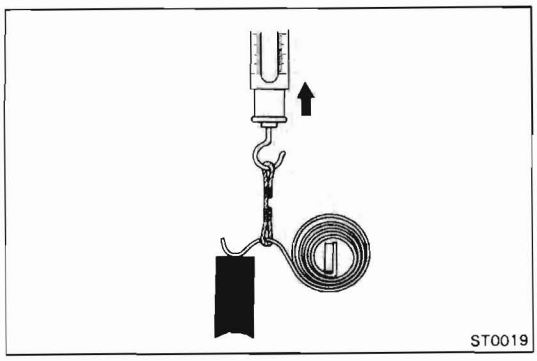
Using calipers, measure the brush length.

Standard length: 13.5 mm (0.531 in.)

Minimum length: 8.5 mm (0.335 in.)

If the length is less than minimum, replace the brush holder and field frame.

Brush Springs

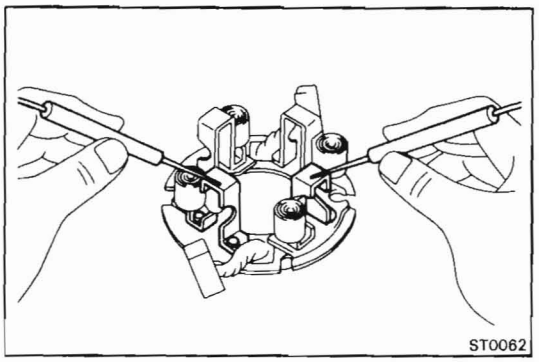


INSPECT BRUSH SPRING LOAD

Take the pull scale reading at the very instant the brush spring separates from the brush.

Standard installed load:
1.79 — 2.41 kg (3.9 — 5.3 lb, 18 — 24 N)
Minimum installed load:
1.20 kg (2.6 lb, 12 N)

If the installed load is less than minimum, replace the brush springs.



Brush Holder

INSPECT BRUSH HOLDER INSULATION

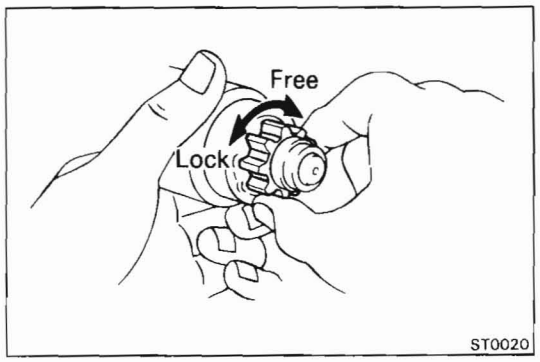
Using an ohmmeter, check that there is no continuity between the positive (+) and negative (−) brush holders.

If there is continuity, repair or replace the brush holder.

Clutch and Gears

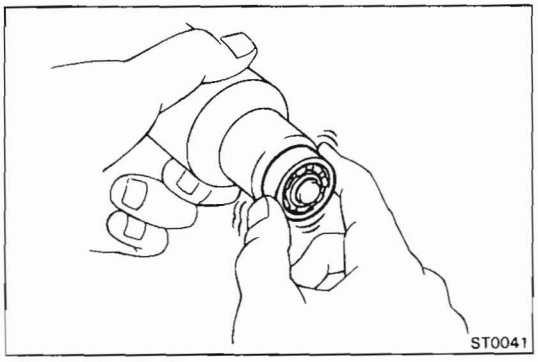
1. INSPECT GEAR TEETH

Check the gear teeth on the idler gear and clutch assembly for wear or damage. Replace if damaged.
If damaged, also check the flywheel ring gear for wear or damage.



2. INSPECT CLUTCH

Rotate the pinion clockwise and check that it turns freely. Try to rotate the pinion counterclockwise and check that it locks.

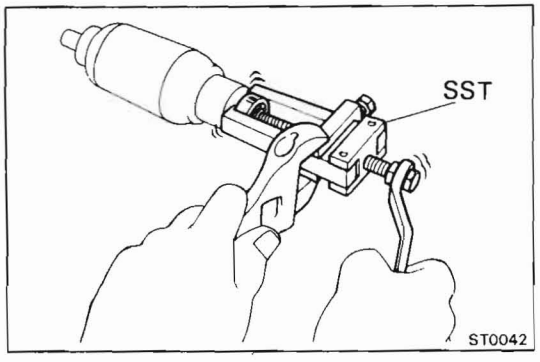


Bearings

1. INSPECT BEARINGS

Turn each bearing by hand while applying inward force.

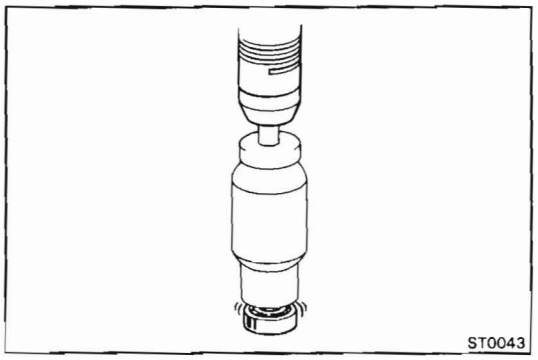
If resistance is felt or if the bearing sticks, replace the bearing.



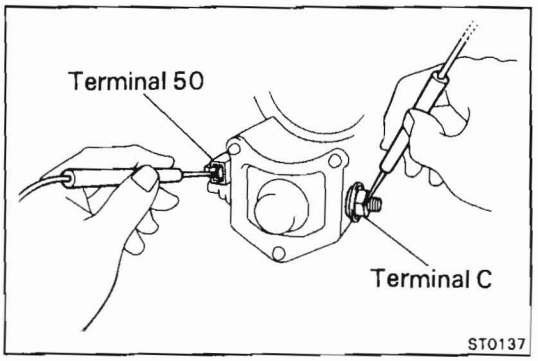
2. IF NECESSARY, REPLACE BEARINGS

(a) Using SST, remove the bearing.

SST 09286-46011



(b) Using a press, press in a new bearing.

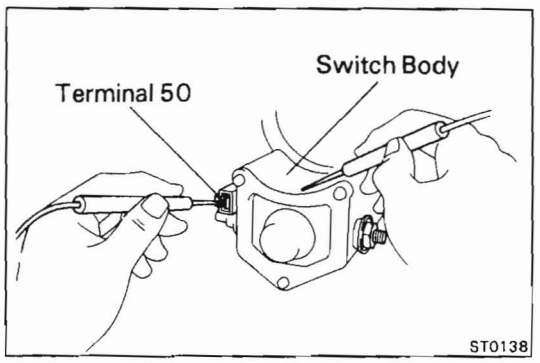


Magnetic Switch

1. PERFORM PULL-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminals 50 and C.

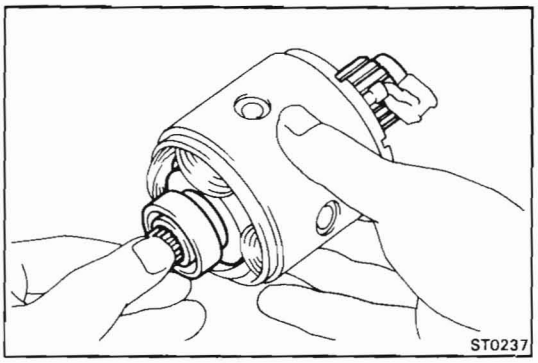
If there is no continuity, replace the magnetic switch assembly.



2. PERFORM HOLD-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch assembly.



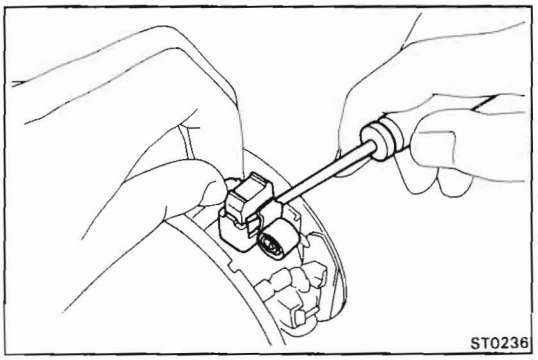
ASSEMBLY OF STARTER

(See page ST-3)

NOTE: Use high-temperature grease to lubricate the bearings and gears when assembling the starter.

1. PLACE ARMATURE INTO FIELD FRAME

Apply grease to the armature bearings and insert the armature into the field frame.

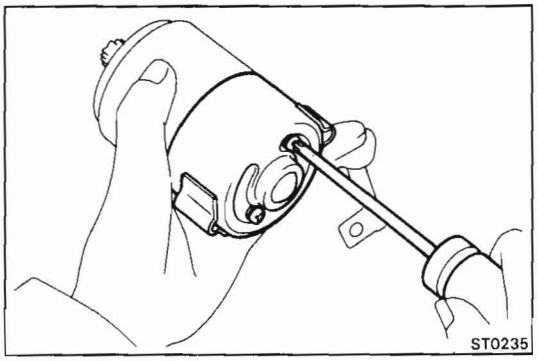


2. INSTALL BRUSH HOLDER

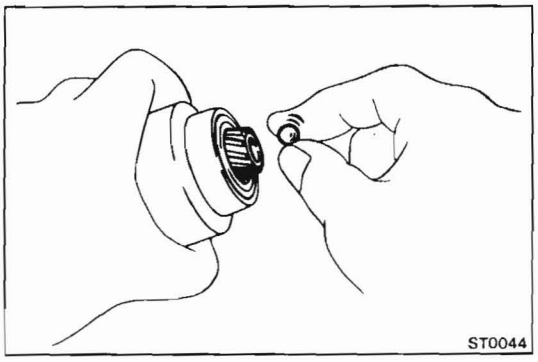
(a) Place the brush holder on the armature.

(b) Using a screwdriver, hold the brush spring back and connect the brush into the brush holder. Connect the four brushes.

NOTE: Check that the positive lead wires are not grounded.



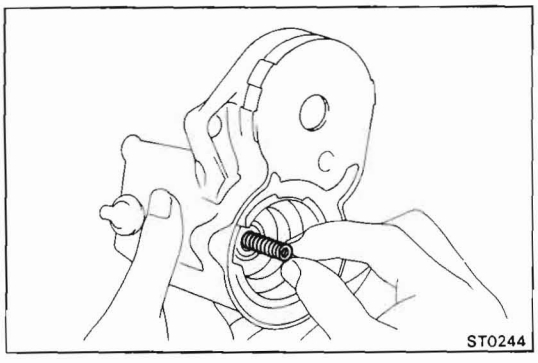
(c) Install the end cover with the two screws.



3. INSTALL STEEL BALL

(a) Apply grease to the steel ball.

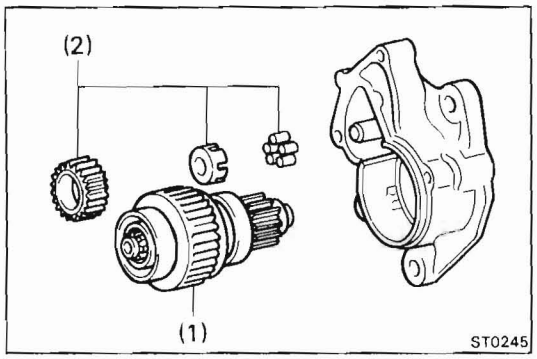
(b) Insert the steel ball into the clutch shaft hole.



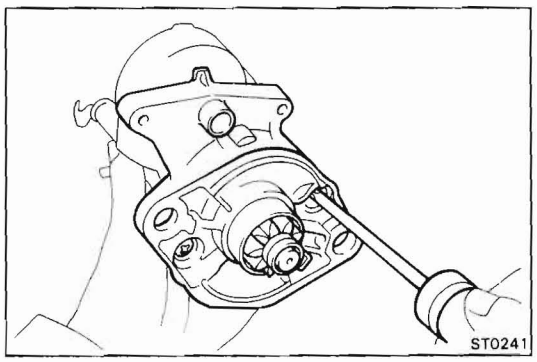
4. INSTALL CLUTCH ASSEMBLY AND IDLE GEAR

(a) Apply grease to the return spring, the clutch assembly, idle gear and bearing.

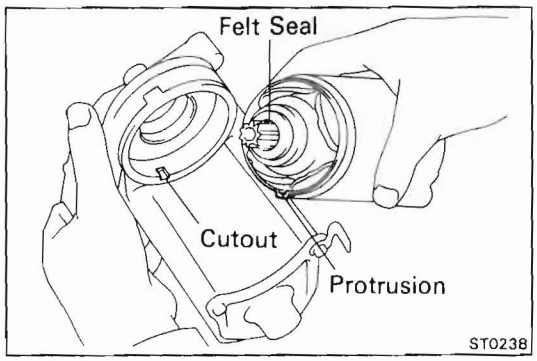
(b) Insert the return spring into the magnetic switch hole.



(c) Place the following parts in position on the starter housing:
(1) Clutch assembly
(2) Idler gear and bearing



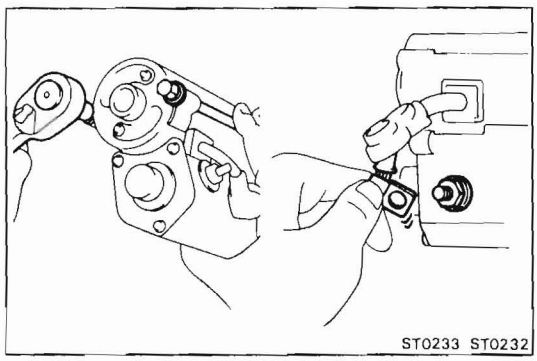
(d) Assemble the starter housing and magnetic switch with the two screws.



5. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

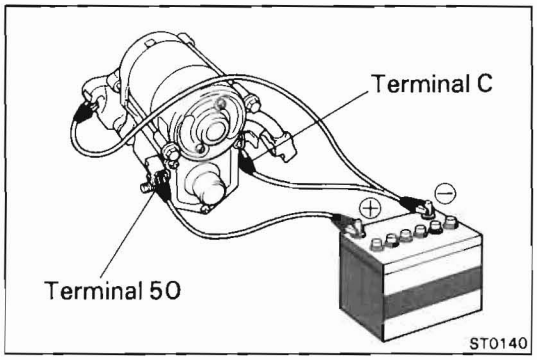
(a) Place a new felt seal in position on the armature shaft.

(b) Align the protrusion of the field frame with the cutout of the magnetic switch.



(c) Install the field frame and armature assembly with the two through bolts.

(d) Connect the lead wire to the magnetic switch terminal, and install the nut.



PERFORMANCE TEST OF STARTER

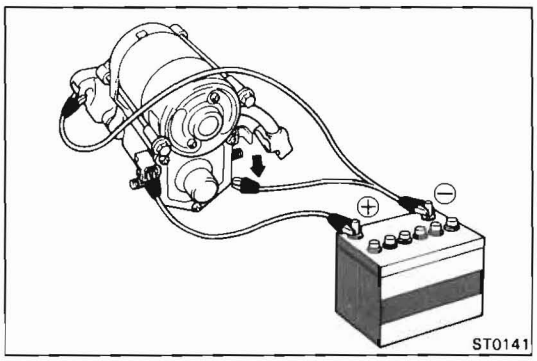
CAUTION: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

1. PERFORM PULL-IN TEST

(a) Disconnect the field coil lead from terminal C.

(b) Connect the battery to the magnetic switch as shown. Check that the pinion gear moves outward.

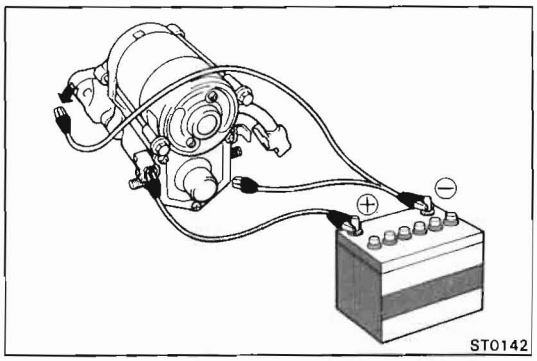
If the pinion gear does not move, replace the magnetic switch assembly.



2. PERFORM HOLD-IN TEST

While connected as above with the pinion gear out, disconnect the negative (−) lead from terminal C. Check that the pinion gear remains out.

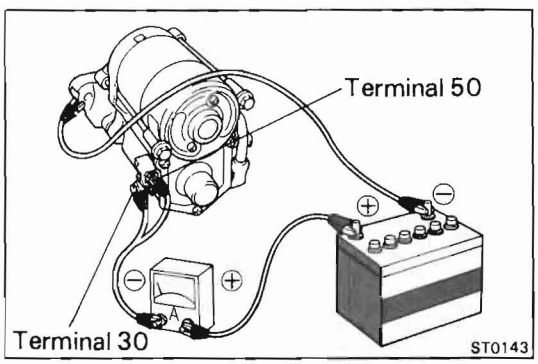
If the pinion gear returns inward, replace the magnetic switch assembly.



3. INSPECT PLUNGER RETURN

Disconnect the negative (−) lead from the switch body. Check that the pinion gear returns inward.

If the pinion gear does not return, replace the magnetic switch assembly.



4. PERFORM NO-LOAD PERFORMANCE TEST

(a) Connect the battery and ammeter to the starter as shown.

(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter reads the specified current.

Specified current: 90 A or less at 11.5V

CHARGING SYSTEM

PRECAUTIONS

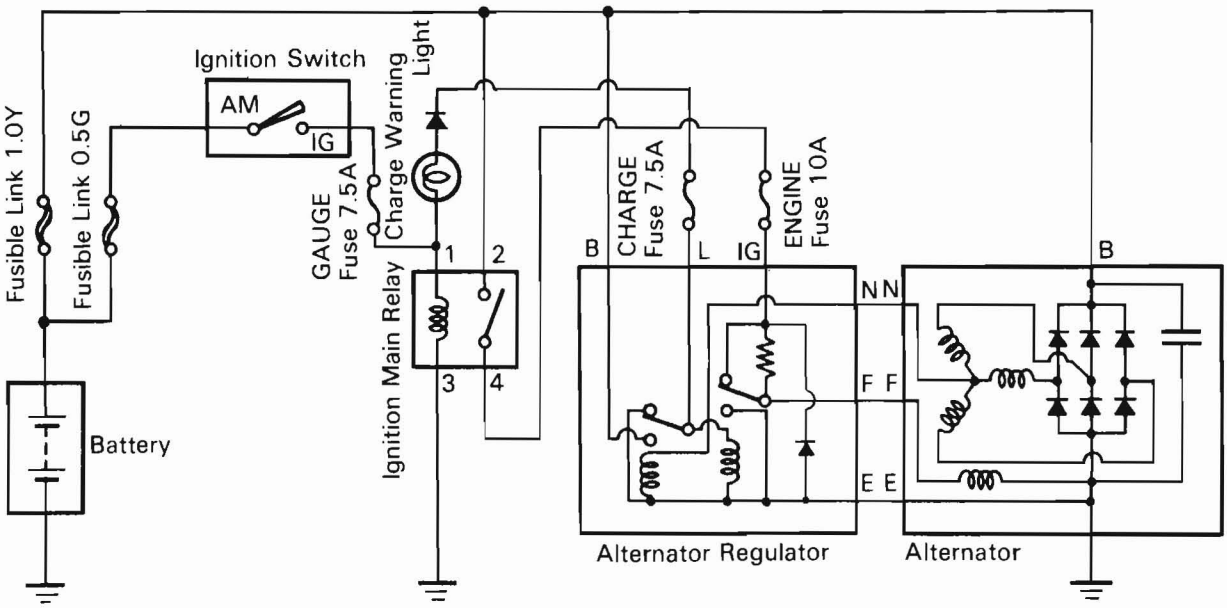
1. **Check that the battery cables are connected to the correct terminals.**
2. **Disconnect the battery cables when the battery is given a quick charge.**
3. **Do not perform tests with a high voltage insulation resistance tester.**
4. **Never disconnect the battery while the engine is running.**

TROUBLESHOOTING

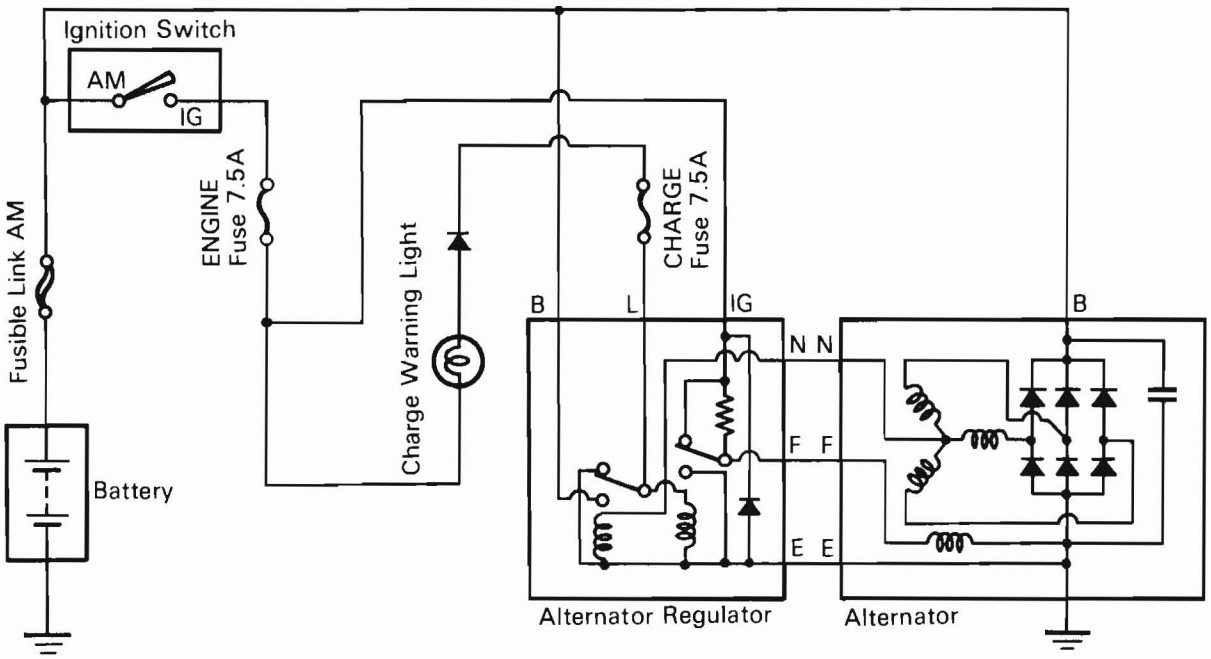
Problem	Possible cause	Remedy	Page
Charge light does not light with ignition "ON" and engine off	Fuse blown	Check IGN, CHARGE and ENGINE fuses	
	Light burned out	Replace light	
	Wiring connection loose	Tighten loose connections	
	Alternator regulator faulty	Check regulator	CH-15
Charge light does not go out with engine running (battery requires frequent recharging)	Drive belt loose or worn	Adjust or replace drive belt	CH-4
	Battery cables loose, corroded or worn	Repair or replace cables	
	Fuse blown	Check ENGINE fuse	
	Ignition main relay faulty	Check relay	CH-17
	Fusible link blown	Replace fusible link	
	Alternator regulator or alternator faulty	Check charging system faulty	CH-4
	Wiring faulty	Repair wiring	

CHARGING SYSTEM CIRCUIT

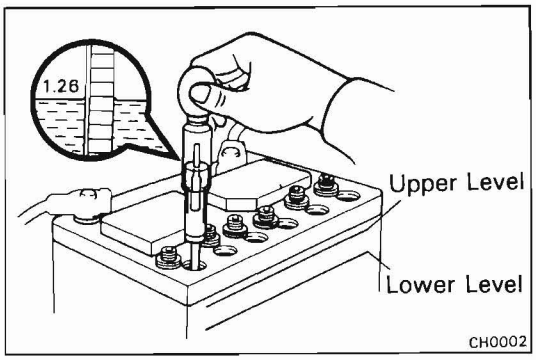
FJ62 Series



FJ70, 73, 75 Series



CH0280
CH0281



ON-VEHICLE INSPECTION

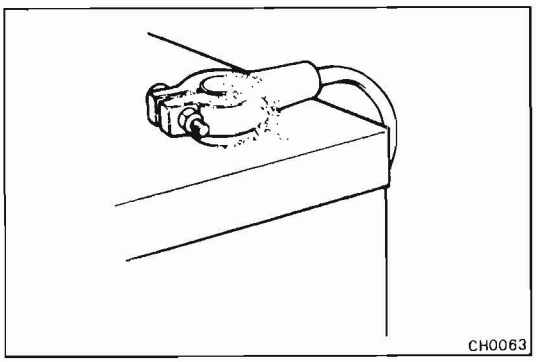
1. CHECK BATTERY SPECIFIC GRAVITY

(a) Check the specific gravity of each cell.

Standard specific gravity:
1.25 — 1.27 when fully charged at 20°C (68°F)

(b) Check the electrolyte quantity of each cell.

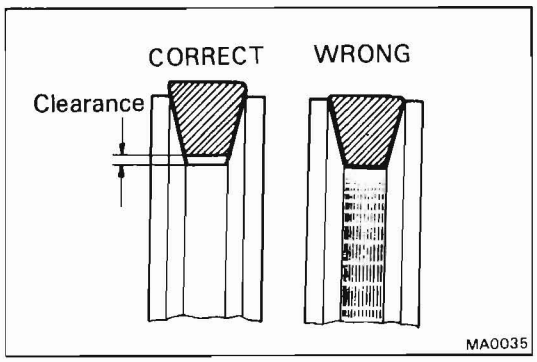
If insufficient, refill with distilled (or purified) water.



2. CHECK BATTERY TERMINALS, FUSIBLE LINKS AND FUSES

(a) Check that the battery terminals are not loose or corroded.

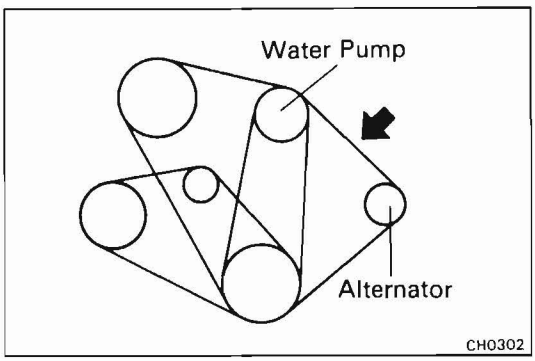
(b) Check the fusible link and fuses for continuity.



3. INSPECT DRIVE BELT

(a) Visually check the drive belt for cracks, oiliness or wear. Check that the belt does not touch the bottom of the pulley groove.

If necessary, replace the drive belt.

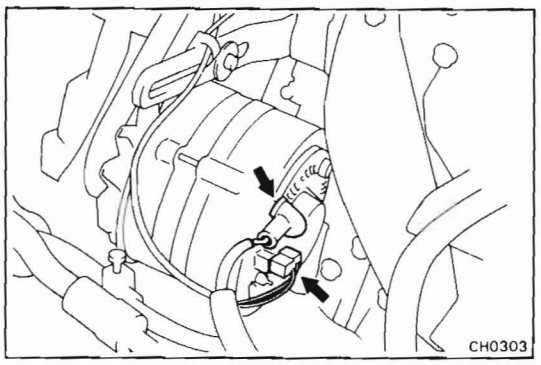


(b) Check the drive belt deflection by pressing on the belt at the points indicated in the figure with 10 kg (22.0 lb, 98 N) of pressure.

Drive belt deflection:
New belt 7.0 — 9.0 mm (0.278 — 0.354 in.)
Used belt 9.0 — 12.0 mm (0.354 — 0.472 in.)

If the belt deflection is not within specification, adjust it.

NOTE:
- "New belt" refers to a new belt which has never been used.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.



4. VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

(a) Check that the wiring is in good condition.

(b) Check that there are no abnormal noises from the alternator while the engine is running.

5. INSPECT CHARGE WARNING LIGHT CIRCUIT

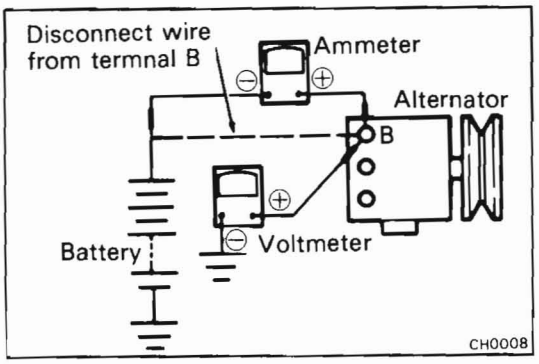
(a) Warm up the engine and then turn it off.

(b) Turn off all accessories.

(c) Turn the starter swtich to "ON." Check that the charge warning light is lit.

(d) Start the engine. Check that the light goes out.

If the light does not operate as specified, troubleshoot the warning light circuit.

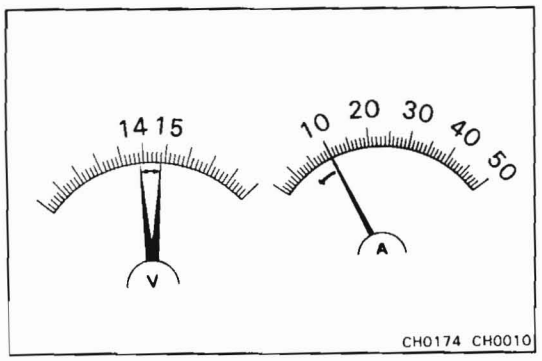


6. CHECK CHARGING CIRCUIT WITHOUT LOAD

NOTE: If a battary/alternator tester is available, connect the tester to the charging circuit as per the manufacturer's instructions.

(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:

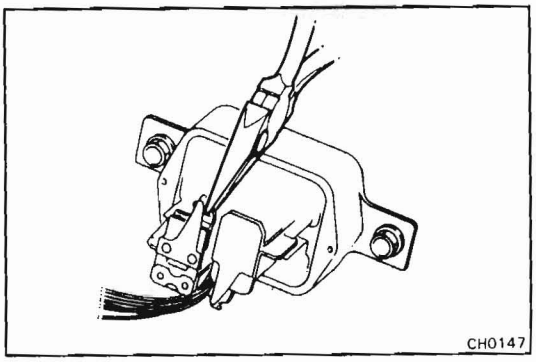
- Disconnect the wire from terminal B of the alternator and connect it to the negative (−) probe of the ammeter.
- Connect the test probe from the positive (+) terminal of the ammeter to terminal B of the alternator.
- Connect the positive (+) probe of the voltmeter to terminal B of the alternator.
- Ground the negative (−) probe of the voltmeter.



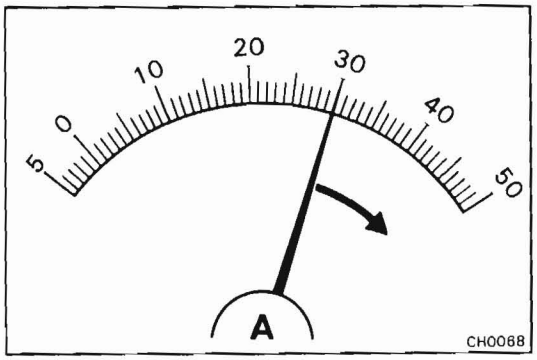
(b) Check the charging circuit as follows:

With the engine running from idle to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage: Less than 10A
Standard voltage: 13.8 − 14.8V at 25°C (77°F)



If the reading is not within standard voltage, adjust the regulator or replace it.

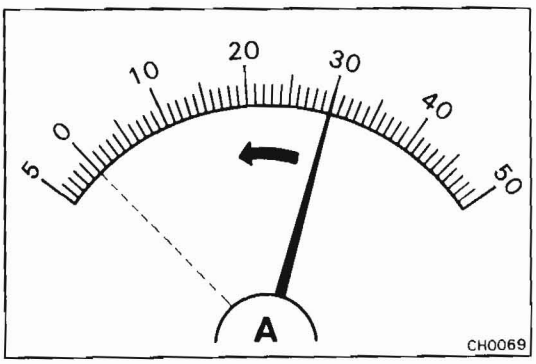


7. CHECK CHARGING CIRCUIT WITH LOAD

(a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater fan control switch on "HI."

(b) Check the reading on the ammeter.

Standard amperage: More than 30A

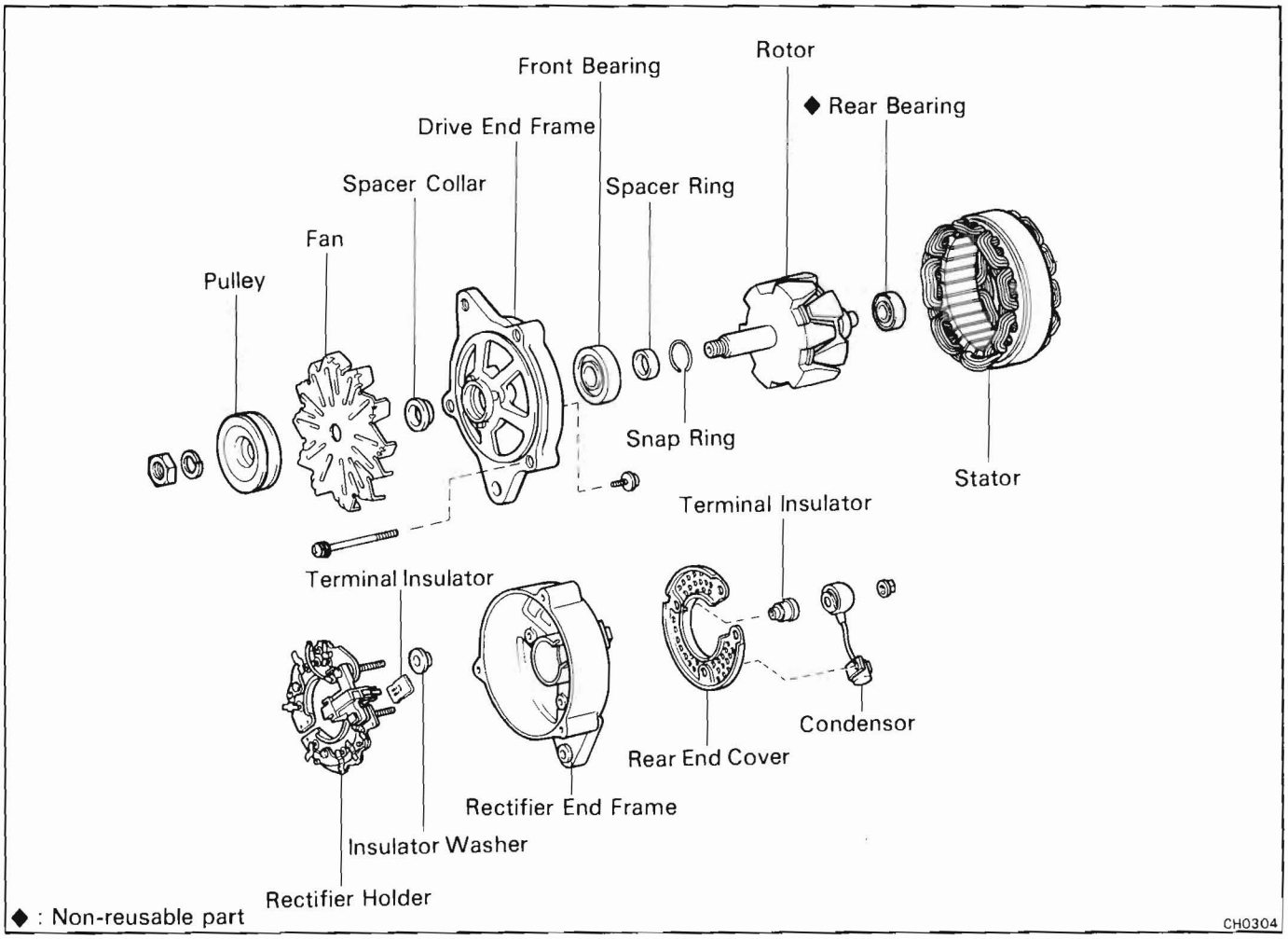


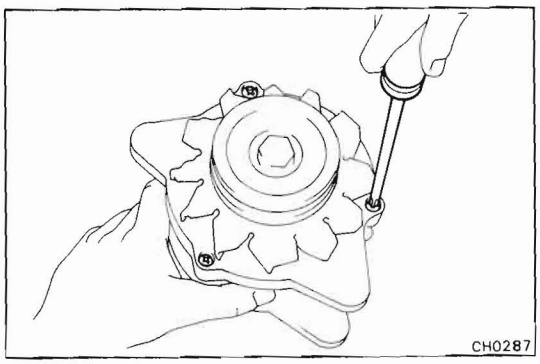
If the ammeter reading is less than 30A, repair the alternator. (See page CH-7)

NOTE: If the battery is fully charged, the indication will sometimes be less than 30A.

ALTERNATOR

COMPONENTS

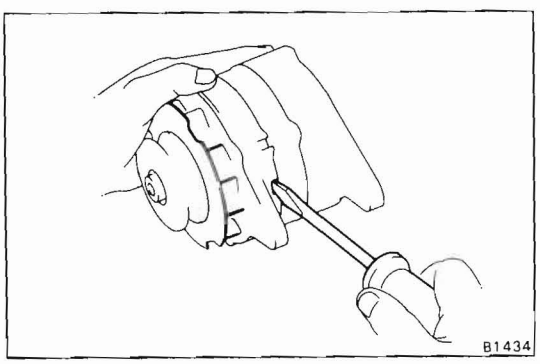




DISASSEMBLY OF ALTERNATOR

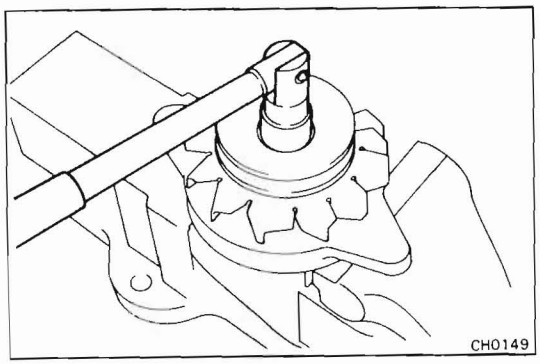
1. REMOVE DRIVE END FRAME AND ROTOR ASSEMBLY FROM STATOR

(a) Remove the three through screws.



(b) Using a screwdriver, pry the end frame and remove it together with the rotor.

CAUTION: Do not pry on the coil wires.

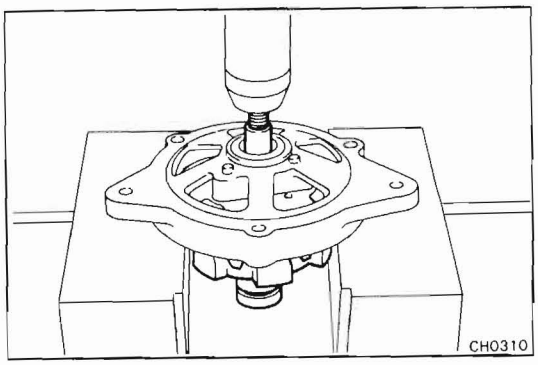


2. REMOVE PULLEY AND FAN

(a) Mount the rotor in a soft jaw vise.

(b) Remove the nut and spring washer.

(c) Remove the pulley, fan and spacer collar.

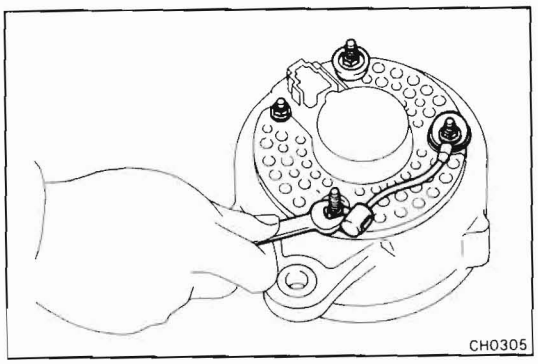


3. REMOVE ROTOR

(a) Using a press, press out the rotor

(b) (40A and 45A types)
Remove the spacer ring and snap ring.

(c) (50A and 55A types)
Remove the spacer ring.



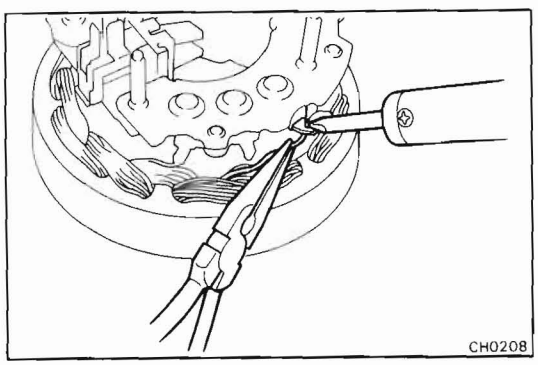
4. REMOVE RECTIFIER END FRAME

(a) Remove the four nuts, condenser (50A type only) and two terminal insulators.

(b) Remove the rear end cover and rectifier end frame.

(c) Remove the two insulator washers from the rectifier holder studs.

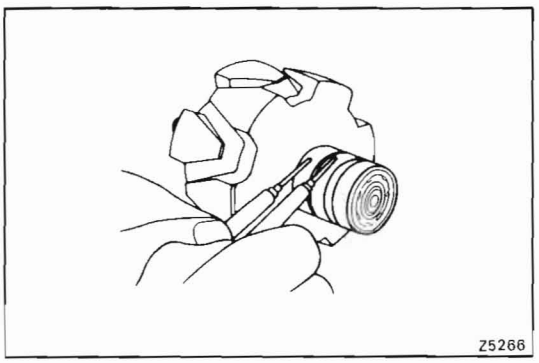
(d) Remove the insulator washer from the brush holder.



5. REMOVE RECTIFIER HOLDER

Hold the rectifier terminal with needle-nose pliers and unsolder the leads.

CAUTION: Protect the rectifiers from heat.



INSPECTION OF ALTERNATOR

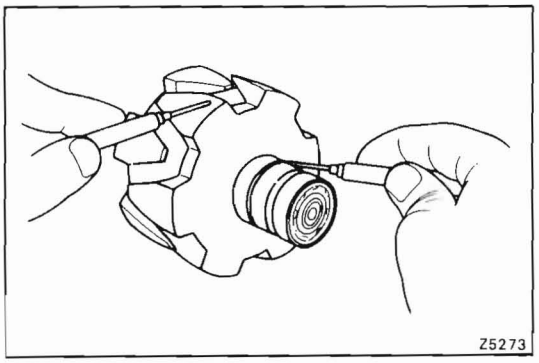
Rotor

1. INSPECT ROTOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the slip rings.

Standard resistance: 3.9 – 4.1 Ω

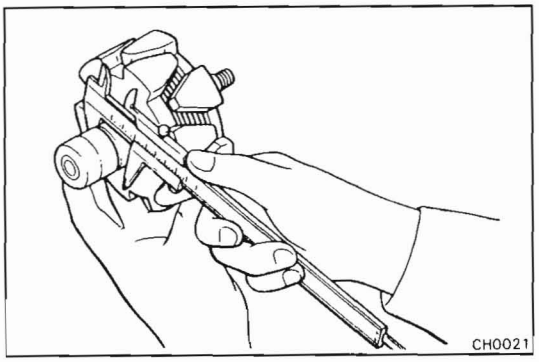
If there is no continuity, replace the rotor.



2. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and the rotor.

If there is continuity, replace the rotor.



3. INSPECT SLIP RINGS

(a) Check that the slip rings are not rough or scored.

If rough or scored, replace the rotor.

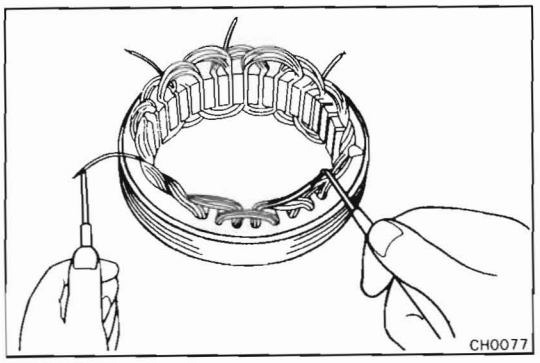
(b) Using calipers, measure the slip ring diameter.

Standard diameter: 32.3 – 32.5 mm (1.272 – 1.280 in.)

Minimum diameter: 32.1 mm (1.264 in.)

If the diameter is less than minimum, replace the rotor.

Stator

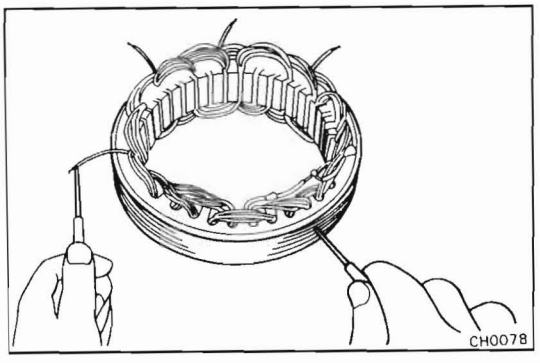


1. INSPECT STATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the coil leads.

NOTE: At this time, the meeting wires should be connected with soldered.

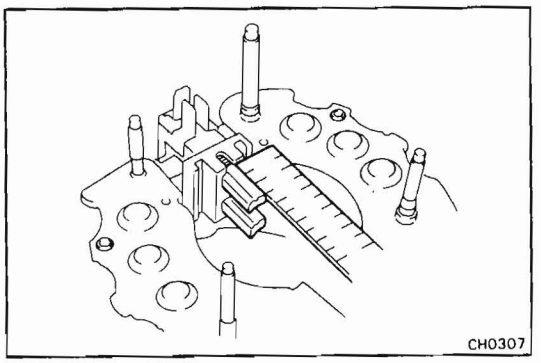
If there is no continuity, replace the stator.



2. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil leads and stator core.

If there is continuity, replace the stator.



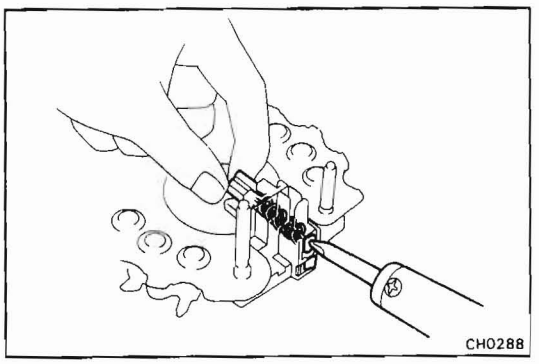
Brushes

1. INSPECT EXPOSED BRUSH LENGTH

Using a scale, measure the exposed brush length.

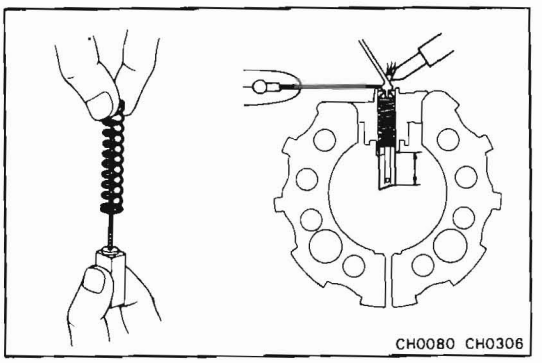
Standard exposed length: 12.5 mm (0.492 in.)
Minimum exposed length: 5.5 mm (0.217 in.)

If the length is less than minimum, replace the brushes



2. IF NECESSARY, REPLACE BRUSHES

(a) Unsolder and remove the brush and spring.



(b) Insert the brush wire through the spring.

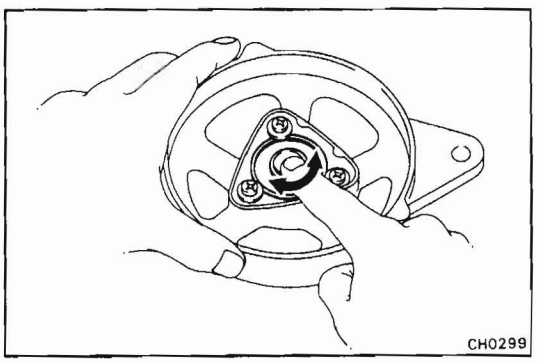
(c) Install the brush in the brush holder.

(d) Solder the wire to the brush holder at specifield exposed length.

Exposed length: 12.5 mm (0.492 in.)

(e) Check that the brush moves smoothly in the brush holder.

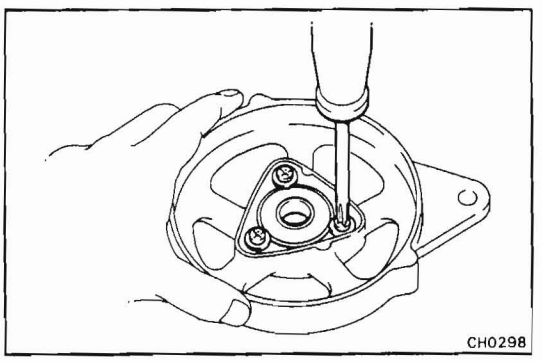
(f) Cut off any excess wire.



Bearings

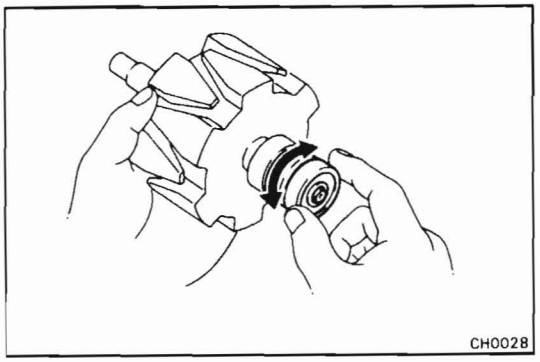
1. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.



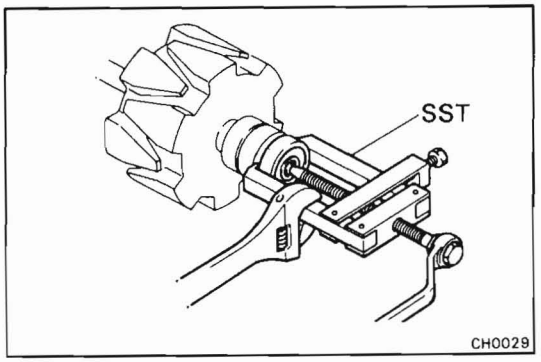
2. IF NECESSARY, REPLACE FRONT BEARING

Remove the three screw, and replace the bearing.



3. INSPECT REAR BEARING

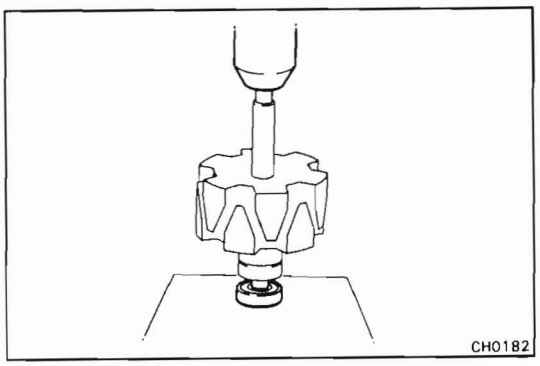
Check that the bearing is not rough or worn.



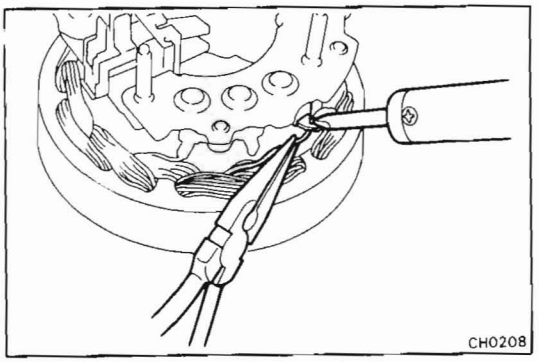
4. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing.

SST 09286-46011



(b) Using a press, press in a new bearing.



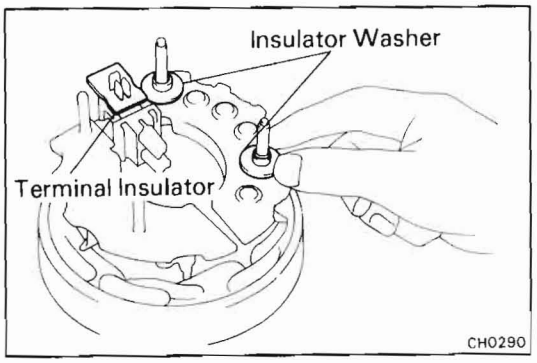
ASSEMBLY OF ALTERNATOR

(See page CH-7)

1. INSTALL RECTIFIER HOLDER TO STATOR

Hold the rectifier terminal with needle-nose pliers while soldering the leads.

CAUTION: Protect the rectifiers from heat.

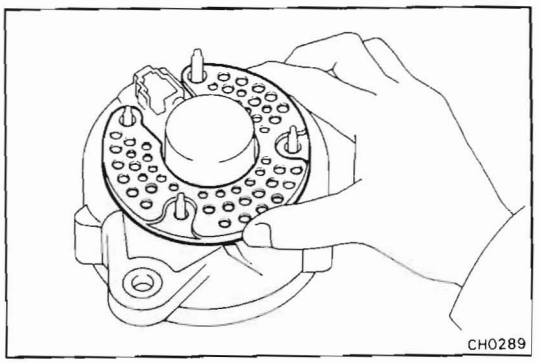


2. INSTALL RECTIFIER END FRAME TO RECTIFIER HOLDER

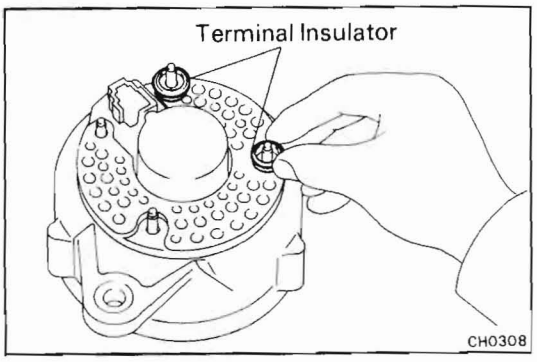
(a) Place the terminal insulator on the brush holder terminal.

(b) Place the two insulator washers on the positive studs of the rectifier holder.

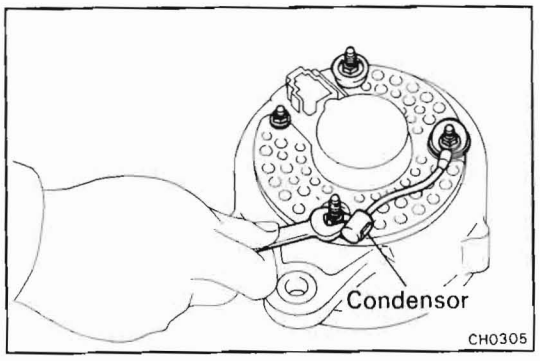
(c) Place the rectifier end frame on the rectifier holder.



(d) Place the rear end cover on the rectifier end frame.



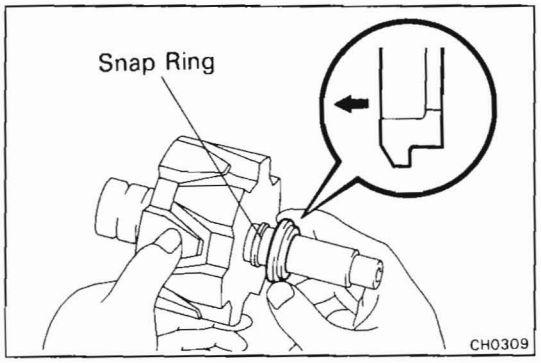
(e) Place the two terminal insulators on the positive studs of the rectifier holder.



(f) (55A type)
Place the condenser in position.

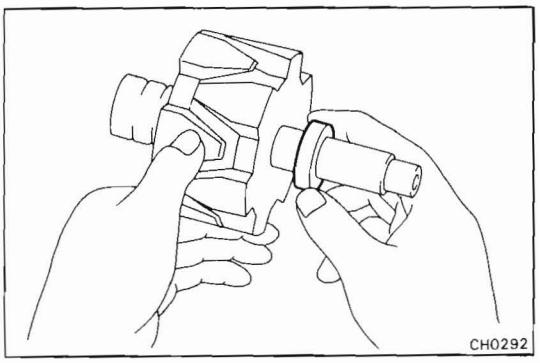
(g) Install the four nuts.

(h) Check that the wires are not touching the rectifier end frame.

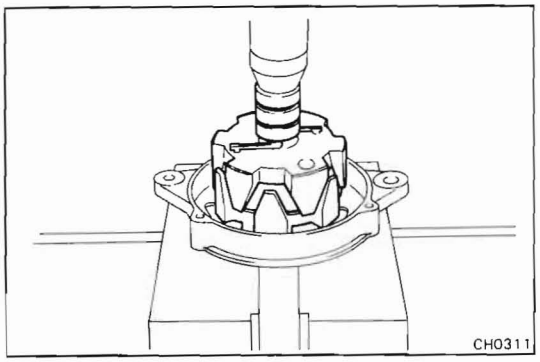


3. INSTALL ROTOR

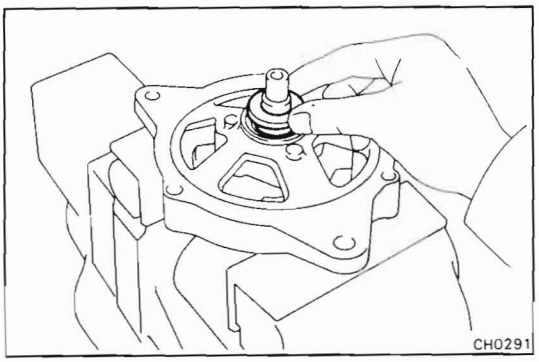
(a) (40A and 45A types)
Slide the snap ring and spacer ring onto the rotor shaft.



(b) (50A and 55A types)
Slide the spacer ring onto the rotor shaft.



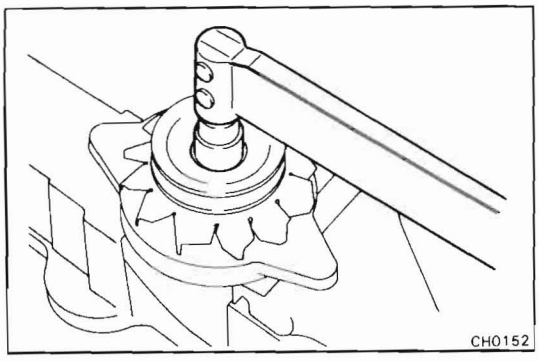
(c) Using a press, press in the rotor.



4. INSTALL FAN AND PULLEY

(a) Mount the rotor in soft jaw vise.

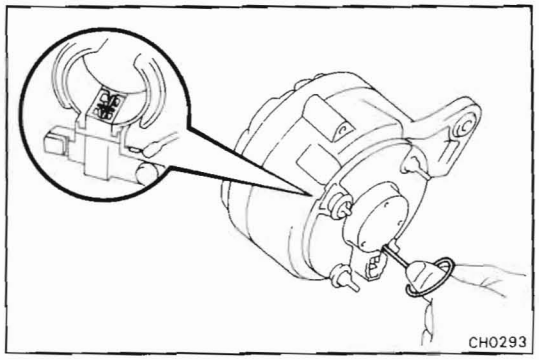
(b) Slide the spacer collar onto the rotor shaft.



(c) Slide the fan, pulley and spring washer onto the rotor shaft.

(d) Install and torque the nut.

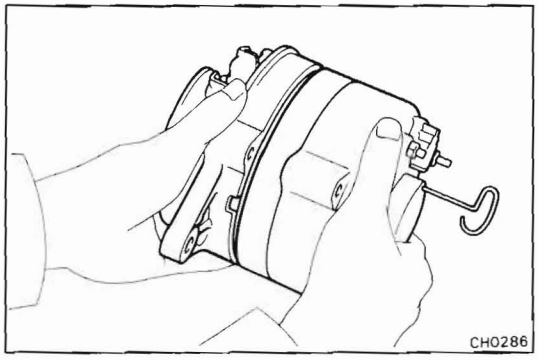
Torque: 625 kg-cm (45 ft-lb, 61 N·m)



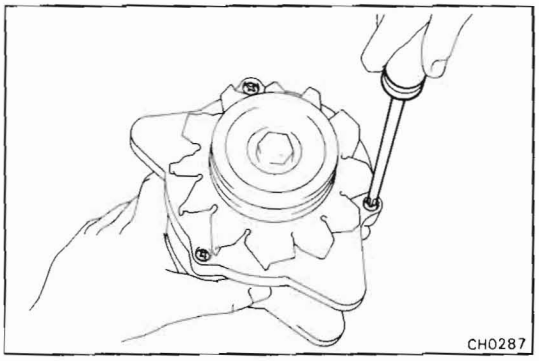
5. ASSEMBLE DRIVE END FRAME AND RECTIFIER END FRAME

(a) Bend the rectifier lead wires back to clear the rotor.

(b) Using a curved tool, push the brushes in as far as they will go and hold them in place by inserting a stiff wire through the access hole in the rectifier end frame.

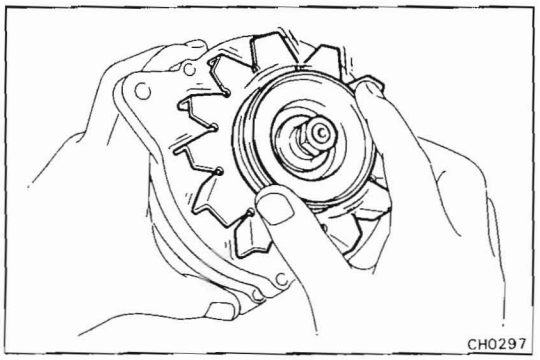


(c) Assemble the drive end frame and the rectifier end frame by inserting the rear bearing on the rotor shaft into the rectifier end frame.



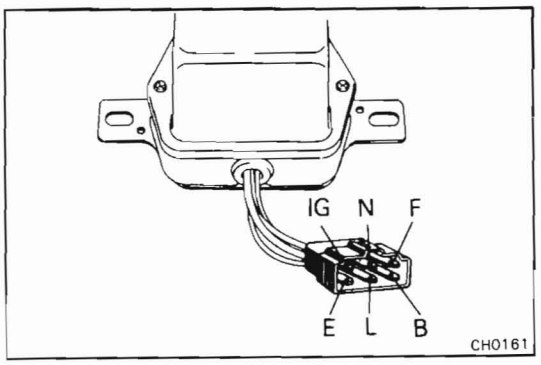
(d) Install the three through screws.

(e) Remove the stiff wire from the access hole.



(f) Check that the rotor rotates smoothly.

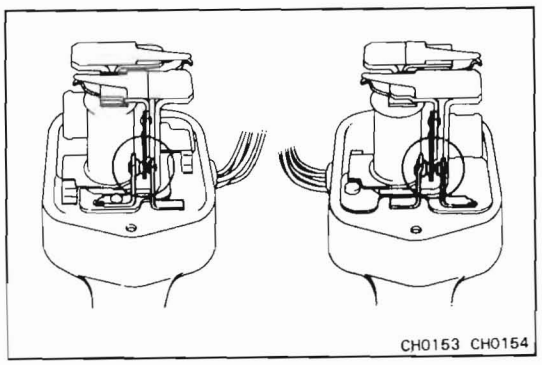
(g) Seal the access hole.



ALTERNATOR REGULATOR

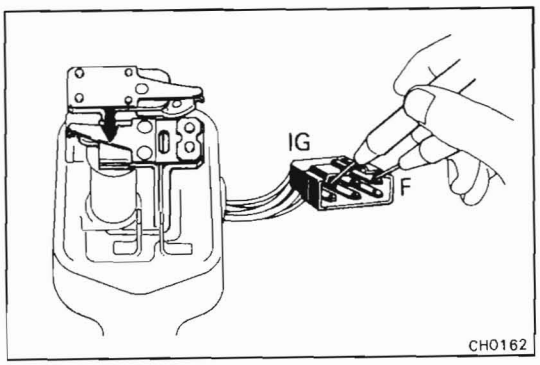
INSPECTION OF ALTERNATOR REGULATOR

LOCATION: On the left fender apron in the engine compartment.



1. INSPECT POINT SURFACES FOR SEIZURE AND DAMAGE

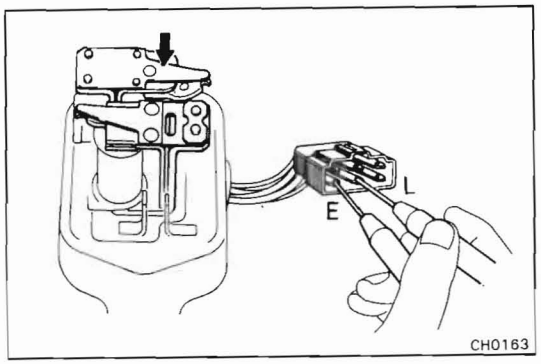
If defective, replace the regulator.



2. INSPECT RESISTANCE BETWEEN TERMINALS

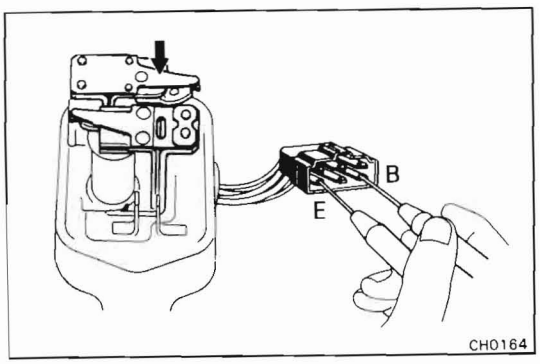
(a) Using an ohmmeter, measure the resistance between terminals IG and F.

Resistance (voltage regulator):
At rest 0 Ω
Pulled in Approx. 11 Ω



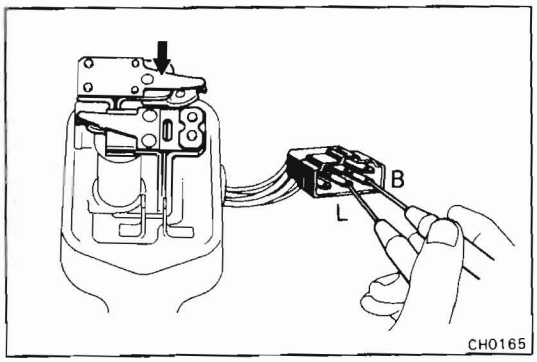
(b) Measure the resistance between terminals E and L.

Resistance (voltage relay):
At rest 0 Ω
Pulled in Approx. 100 Ω



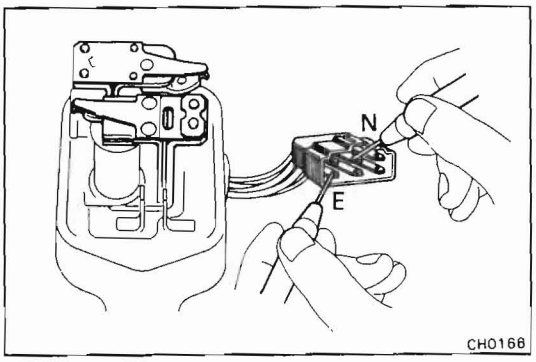
(c) Measure the resistance between terminals B and E.

Resistance (voltage relay):
At rest Infinity
Pulled in Approx. 100 Ω



(d) Measure the resistance between terminals B and L.

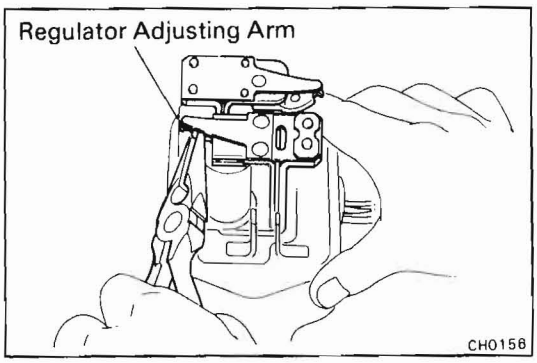
Resistance (voltage relay): At rest Infinity
Pulled in 0 Ω



(e) Measure the resistance between terminals N and E.

Resistance: Approx. 23 Ω

If any of the above checks are not positive, replace the alternator regulator.

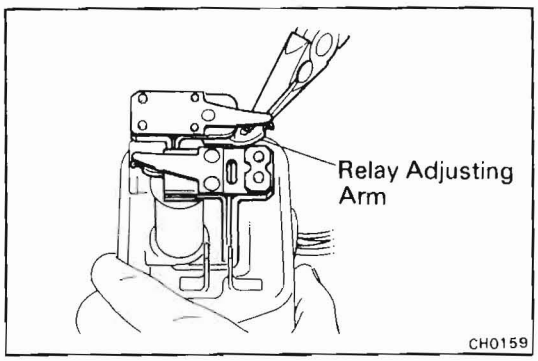


VOLTAGE ADJUSTMENT OF ALTERNATOR REGULATOR

1. ADJUST VOLTAGE REGULATOR

Bend the regulator adjusting arm to adjust.

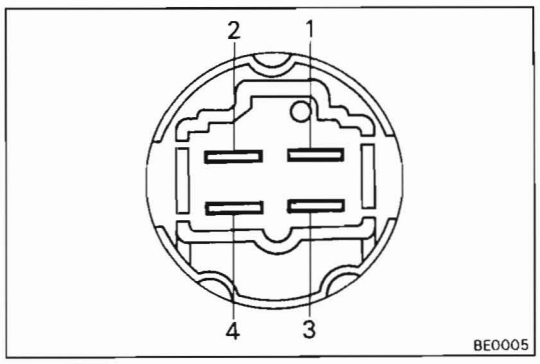
Regulating voltage: 13.8 – 14.8 V



2. ADJUST VOLTAGE RELAY

Bend the relay adjusting arm to adjust.

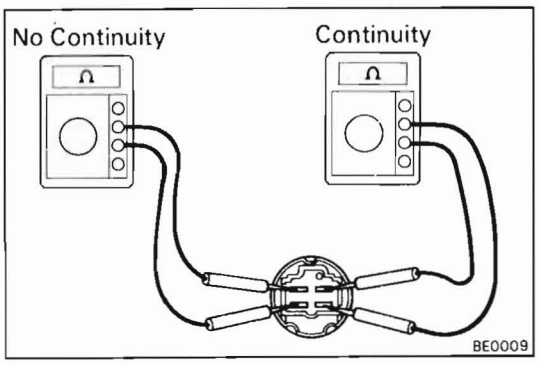
Relay actuating voltage: 4.0 – 5.8 V



IGNITION MAIN RELAY (FJ62 Series)

INSPECTION OF IGNITION MAIN RELAY

LOCATION: Under the instrument panel on the front drive side in the relay box.

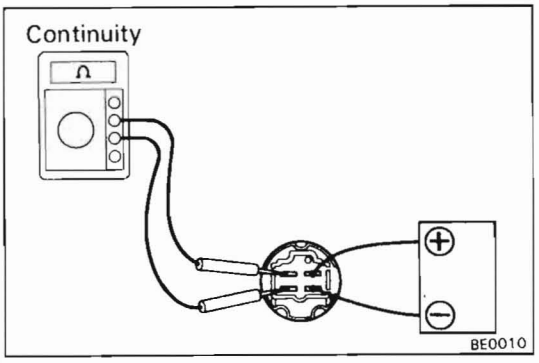


1. INSPECT RELAY CONTINUITY

(a) Check that there is continuity between terminals 1 and 3.

(b) Check that there is no continuity between terminals 2 and 4.

If continuity is not as specified, replace the relay.



2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals 1 and 3.

(b) Check that there is continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.

SERVICE SPECIFICATIONS

ENGINE MECHANICAL

Specifications

Engine coolant capacity					
FJ70, 73, 75 series	w/o Heater		15.0 liters	15.9 US qts	13.2 Imp. qts
	w/ Front heater		17.0 liters	18.0 US qts	15.0 Imp. qts
	w/ Front and rear heaters		19.0 liters	20.1 US qts	16.7 Imp. qts
FJ62 series	w/o Heater		15.5 liters	16.4 US qts	13.6 Imp. qts
	w/ Front heater		17.5 liters	18.5 US qts	15.4 Imp. qts
	w/ Front and rear heaters		19.5 liters	20.6 US qts	17.2 Imp. qts
Engine oil capacity					
Drain and refill	w/o Oil filter change		7.0 liters	7.4 US qts	6.2 Imp. qts
	w/ Oil filter change		7.8 liters	8.2 US qts	6.9 Imp. qts
Dry fill			8.0 liters	8.5 US qts	7.0 Imp. qts
Battery gravity when fully charged at 20°C (68°F)			1.25 – 1.27		
High-tension cord	Resistance	Limit	25 kΩ per cord		
Spark plug					
Type		ND	W14EX-U		
		NGK	BP4EY		
Correct electrode gap			0.8 mm	0.031 in.	
Drive belt deflection with 10 kg (22.0 lb, 98N)					
Alternator – Water pump		New belt	7.0 – 9.0 mm	0.278 – 0.354 in.	
		Used belt	9.0 – 12.0 mm	0.354 – 0.472 in.	
PS pump – Crankshaft		New belt	7.0 – 9.5 mm	0.278 – 0.374 in.	
		Used belt	8.0 – 10.0 mm	0.315 – 0.393 in.	
A/C compressor – Crankshaft		New belt	12.0 – 15.0 mm	0.472 – 0.590 in.	
		Used belt	15.0 – 21.0 mm	0.590 – 0.827 in.	
Valve clearance	at hot	IN	0.20 mm	0.008 in.	
		EX	0.35 mm	0.014 in.	
Distributor	Dwell angle		41 ± 4°		
Ignition timing			7° BTDC @ Max. 900 rpm		
Idle speed		M/T	650 rpm		
		A/T	750 rpm		
Maximum speed (w/ Anti-over run)			4,600 ± 200 rpm		
Idle mixture speed		M/T	690 rpm		
		A/T	790 rpm		
Fast idle speed			1,800 rpm		
TP setting speed			1,000 rpm		
Idle CO concentration			1.5 ± 1.0%		
Intake manifold vacuum	at idle speed		420 mmHg (16.54 in.Hg, 56.0 kPa) or more		
Compression pressure	at 200 rpm	STD	10.5 kg/cm² (149 psi, 1,030 kPa) or more		
		Limit	8.0 kg/cm² (114 psi, 785 kPa)		
Pressure difference between each cylinder			1.0 kg/cm² (14 psi, 98 kPa) or less		

Specifications (Cont'd)

Cylinder head	Cylinder block surface warpage Limit	0.15 mm	0.0059 in.
	Manifold surface warpage Limit	0.10 mm	0.0039 in.
	Valve seat Refacing angle IN	25°, 45°, 70°	
	EX	25°, 45°, 65°	
	Contacting angle	45°	
	Contacting width IN	1.1 – 1.7 mm	0.043 – 0.067 in.
	EX	1.4 – 2.0 mm	0.055 – 0.079 in.
Valve guide bushing	Inside diameter	8.010 – 8.030 mm	0.3154 – 0.3161 in.
	Outside diameter STD size	14.028 – 14.041 mm	0.5523 – 0.5528 in.
	O/S 0.05	14.078 – 14.091 mm	0.5543 – 0.5548 in.
Valve	Overall length STD IN	124.8 mm	4.913 in.
	EX w/ Retainer	125.0 mm	4.921 in.
	w/ Rotator	128.0 mm	5.039 in.
	Limit IN	124.3 mm	4.894 in.
	EX w/ Retainer	124.5 mm	4.902 in.
	w/ Rotator	127.5 mm	5.020 in.
	Face angle IN & EX	44.5°	
	Stem diameter IN	7.970 – 7.985 mm	0.3138 – 0.3144 in.
	EX	7.960 – 7.975 mm	0.3134 – 0.3140 in.
	Stem oil clearance STD IN	0.025 – 0.060 mm	0.0010 – 0.0024 in.
	EX	0.035 – 0.070 mm	0.0014 – 0.0028 in.
	Limit IN	0.10 mm	0.0039 in.
	EX	0.12 mm	0.0047 in.
	Margin thickness STD IN	1.5 – 2.1 mm	0.059 – 0.083 in.
	EX	1.7 – 2.3 mm	0.067 – 0.091 in.
	Limit IN	1.0 mm	0.039 in.
	EX	1.2 mm	0.047 in.
Valve spring	Squareness Limit	1.8 mm	0.071 in.
	Free length	51.5 mm	2.028 in.
	Installed tension at 43.0 mm (1.693 in.)		
	STD	32.5 kg 71.6 lb	319N
	Limit	27 kg 59.5 lb	265 N
Valve rocker arm and shaft	Rocker arm inside diameter		
	STD	18.494 – 18.515 mm	0.7281 – 0.7289 in.
	Shaft diameter STD	18.464 – 18.485 mm	0.7269 – 0.7278 in.
	Rocker arm to shaft diameter		
	STD	0.009 – 0.051 mm	0.0004 – 0.0020 in.
	Limit	0.08 mm	0.0031 in.
Push rod	Circle runout Limit	1.0 mm	0.039 in.
Manifold	Warpage Limit IN with EX (RH)	0.50 mm	0.0197 in.
	EX (LH)	0.30 mm	0.0118 in.

Specification (Cont'd)

Timing gear	Backlash	STD		0.100 – 0.183 mm	0.0039 – 0.0072 in.
		Limit		0.25 mm	0.0098 in.
Camshaft and Bearing	Circle runout	Limit		0.30 mm	0.0118 in.
	Cam lobe height	STD	IN	38.36 – 38.46 mm	1.5102 – 1.5142 in.
			EX	38.25 – 38.35 mm	1.5059 – 1.5098 in.
		Limit	IN	38.0 mm	1.496 in.
			EX	37.9 mm	1.492 in.
	Journal diameter	STD	No. 1	47.955 – 47.975 mm	1.8880 – 1.8888 in.
			No. 2	46.455 – 46.475 mm	1.8289 – 1.8297 in.
			No. 3	44.955 – 44.975 mm	1.7699 – 1.7707 in.
			No. 4	43.455 – 43.475 mm	1.7108 – 1.7116 in.
		U/S 0.25	No. 1	47.715 – 47.725 mm	1.8785 – 1.8789 in.
			No. 2	46.215 – 46.225 mm	1.8195 – 1.8199 in.
			No. 3	44.715 – 44.725 mm	1.7604 – 1.7608 in.
			No. 4	43.215 – 43.225 mm	1.7014 – 1.7018 in.
		U/S 0.50	No. 1	47.465 – 47.475 mm	1.8687 – 1.8691 in.
			No. 2	45.965 – 45.975 mm	1.8096 – 1.8888 in.
			No. 3	44.465 – 44.475 mm	1.7506 – 1.7510 in.
			No. 4	42.965 – 42.975 mm	1.6915 – 1.6919 in.
	Bearing inside diameter	STD	No. 1	48.000 – 48.030 mm	1.8898 – 1.8909 in.
			No. 2	46.500 – 46.530 mm	1.8307 – 1.8319 in.
			No. 3	45.000 – 45.030 mm	1.7717 – 1.7728 in.
			No. 4	43.500 – 43.530 mm	1.7126 – 1.7138 in.
		U/S 0.25	No. 1	47.750 – 47.825 mm	1.8799 – 1.8829 in.
			No. 2	46.250 – 46.325 mm	1.8209 – 1.8238 in.
			No. 3	44.750 – 44.820 mm	1.7618 – 1.7646 in.
			No. 4	43.250 – 43.320 mm	1.7028 – 1.7055 in.
		U/S 0.50	No. 1	47.500 – 47.575 mm	1.8701 – 1.8730 in.
			No. 2	46.000 – 46.075 mm	1.8110 – 1.8140 in.
			No. 3	44.500 – 44.570 mm	1.7520 – 1.7547 in.
			No. 4	43.000 – 43.070 mm	1.6929 – 1.6957 in.
	Journal oil clearance				
	STD	STD		0.025 – 0.075 mm	0.0010 – 0.0030 in.
		U/S 0.25 and 0.50			
		No. 1 and No. 2		0.025 – 0.110 mm	0.0010 – 0.0043 in.
		No. 3 and No. 4		0.025 – 0.105 mm	0.0010 – 0.0041 in.
	Limit	STD		0.10 mm	0.0039 in.
		U/S 0.25 and 0.50		0.15 mm	0.0059 in.
	Thrust clearance	STD		0.200 – 0.290 mm	0.0079 – 0.0114 in.
		Limit		0.33 mm	0.0130 in.
Valve lifter	Lifter diameter	STD		21.387 – 21.404 mm	0.8420 – 0.8427 in.
		O/S 0.05		21.437 – 21.454 mm	0.8440 – 0.8446 in.
	Cylinder block lifter bore diameter			21.417 – 21.443 mm	0.8432 – 0.8442 in.
	Lifter oil clearance	STD		0.013 – 0.056 mm	0.0005 – 0.0022 in.
		Limit		0.10 mm	0.0039 in.
Cylinder block	Warpage		Limit	0.15 mm	0.0059 in.
	Cylinder bore diameter	STD	STD	94.000 – 94.030 mm	3.7008 – 3.7020 in.
			Limit	94.23 mm	3.7098 in.
		O/S 0.50	Limit	94.73 mm	3.7295 in.
		O/S 1.00	Limit	95.23 mm	3.7492 in.
		O/S 1.50	Limit	95.73 mm	3.7689 in.

Specification (Cont'd)

Piston and piston ring	Piston diameter	STD		93.960 – 93.990 mm	3.6992 – 3.7004 in.
		O/S 0.50		94.460 – 94.490 mm	3.7189 – 3.7201 in.
		O/S 1.00		94.960 – 94.990 mm	3.7386 – 3.7398 in.
		O/S 1.50		95.460 – 95.490 mm	3.7583 – 3.7594 in.
	Piston oil clearance			0.030 – 0.050 mm	0.0012 – 0.0020 in.
	Piston ring groove clearance				
		No. 1		0.030 – 0.070 mm	0.0012 – 0.0028 in.
		No. 2		0.050 – 0.090 mm	0.0020 – 0.0035 in.
	Piston ring end gap	STD No. 1 & No. 2		0.200 – 0.520 mm	0.0079 – 0.0205 in.
		Oil		0.200 – 0.820 mm	0.0079 – 0.0323 in.
		Limit No. 1 & No. 2		1.12 mm	0.0441 in.
		Oil		1.42 mm	0.0559 in.
Connecting rod and piston pin	Thrust clearance	STD		0.160 – 0.300 mm	0.0063 – 0.0118 in.
		Limit		0.40 mm	0.0156 in.
	Connecting rod bearing center wall thickness				
	STD	Mark A		1.484 – 1.488 mm	0.0584 – 0.0586 in.
		Mark B		1.488 – 1.492 mm	0.0586 – 0.0587 in.
		Mark C		1.492 – 1.496 mm	0.0587 – 0.0589 in.
	Connecting rod oil clearance				
	STD	STD		0.020 – 0.050 mm	0.0008 – 0.0020 in.
		U/S 0.25 and 0.50		0.019 – 0.063 mm	0.0007 – 0.0025 in.
	Limit			0.10 mm	0.0039 in.
	Bend per 100 mm (3.94 in.)				
		Limit		0.05 mm	0.0020 in.
	Twist per 100 mm (3.94 in.)				
		Limit		0.05 mm	0.0020 in.
	Bushing inside diameter			22.012 – 22.027 mm	0.8666 – 0.8672 in.
	Piston pin diameter			22.004 – 22.019 mm	0.8663 – 0.8669 in.
	Piston pin to bushing oil clearance				
		STD		0.005 – 0.011 mm	0.0002 – 0.0004 in.
		Limit		0.03 mm	0.0012 in.
Crankshaft and bearing	Thrust clearance	STD		0.015 – 0.204 mm	0.0006 – 0.0080 in.
		Limit		0.30 mm	0.0118 in.
	Thrust washer thickness				
		STD		2.430 – 2.480 mm	0.0957 – 0.0976 in.
		O/S 0.125		2.493 – 2.543 mm	0.0981 – 0.1001 in.
		O/S 0.250		2.555 – 2.605 mm	0.1006 – 0.1026 in.
	Main journal oil clearance				
	STD	STD		0.016 – 0.056 mm	0.0006 – 0.0022 in.
		U/S 0.25 and 0.50		0.021 – 0.067 mm	0.0008 – 0.0026 in.
	Limit			0.10 mm	0.0039 in.
	Main journal diameter	STD	No. 1	66.972 – 66.996 mm	2.6367 – 2.6376 in.
			No. 2	68.472 – 68.496 mm	2.6957 – 2.6967 in.
			No. 3	69.972 – 69.996 mm	2.7548 – 2.7557 in.
			No. 4	71.472 – 71.496 mm	2.8139 – 2.8148 in.
		U/S 0.25	No. 1	66.745 – 66.755 mm	2.6278 – 2.6281 in.
			No. 2	68.245 – 68.255 mm	2.6868 – 2.6872 in.
			No. 3	69.745 – 69.755 mm	2.7459 – 2.7463 in.
			No. 4	71.245 – 71.255 mm	2.8049 – 2.8053 in.

Specification (Cont'd)

Crankshaft and bearing (Cont'd)	Main journal diameter (cont'd)				
		U/S 0.50	No. 1	66.495 – 66.505 mm	2.6179 – 2.6183 in.
			No. 2	67.995 – 68.005 mm	2.6770 – 2.6774 in.
			No. 3	69.495 – 69.505 mm	2.7360 – 2.7364 in.
			No. 4	70.995 – 71.005 mm	2.7951 – 2.7955 in.
	Main bearing center wall thickness				
		STD	Mark 1	2.493 – 2.497 mm	0.0981 – 0.0983 in.
			Mark 2	2.497 – 2,501 mm	0.0983 – 0.0985 in.
			Mark 3	2.501 – 2.505 mm	0.0985 – 0.0986 in.
			Mark 4	2.505 – 2.509 mm	0.0986 – 0.0988 in.
			Mark 5	2.509 – 2.513 mm	0.0988 – 0.0989 in.
	Crank pin diameter		STD	52.988 – 53.000 mm	2.0861 – 2.0866 in.
			U/S 0.25	52.701 – 52.711 mm	2.0748 – 2.0752 in.
			U/S 0.50	52.451 – 52.461 mm	2.0650 – 2.0654 in.
	Circle runout		Limit	0.12 mm	0.0048 in.
	Taper and out-of-round				
	Main journal and crank pin		Limit	0.02 mm	0.0008 in.

Torque Specifications

Part Tightened	kg-cm	ft-lb	N·m
Cylinder head x Cylinder block	1,250	90	123
Valve rocker support x Cylinder head			
12 mm bolt head	240	17	24
14 mm bolt head and nut	340	25	33
Manifold x Cylinder head			
14 mm bolt head	510	37	50
17 mm bolt head	700	51	69
Nut	570	41	56
Water outlet housing x Cylinder head	250	18	25
Water outlet x Water outlet housing	185	13	18
Cylinder head cover x Cylinder head	90	78 in.-lb	8.8
Camshaft thrust washer x Cylinder block	120	9	12
Timing gear cover x Front end plate or cylinder block			
10 mm bolt head	50	43 in.-lb	4.9
14 mm bolt head	250	18	25
Crankshaft pulley x Crankshaft	3,500	253	343
PS pulley x Crankshaft pulley	185	13	18
Valve lifter cover x Cylinder block	40	35 in.-lb	3.9
Main bearing cap x Cylinder block			
19 mm bolt head	1,375	99	135
17 mm bolt head	1,175	85	115
Connecting rod cap x Connecting rod	600	43	59
Front end plate x Cylinder block			
Screw	250	18	25
Bolt	310	22	30
Flywheel x Crankshaft	890	64	87
Drive plate x Crankshaft	890	64	87
Fuel pipe x Carburetor	150	11	15

Torque Specifications (Cont'd)

Part Tightened	kg-cm	ft-lb	N·m
Fuel pump x Cylinder block	185	13	18
Coolant drain plug (cylinder block side)	450	33	44
Water pump x Cylinder block	380	27	37
Engine oil drain plug	400	29	39
Oil strainer x Oil pump body	100	7	10
Oil pump relief valve x Oil strainer	375	27	37
Oil pump x Cylinder block	180	13	18
Oil outlet pipe x Oil pump	450	33	44
Oil outlet pipe x Cylinder block	450	33	44
Oil pan x Cylinder block	80	69 in.-lb	7.8
Oil filter bracket x Cylinder block	185	13	18
Oil cooler x Oil filter bracket	650	47	64
Spark plug x Cylinder head	180	13	18

FUEL SYSTEM

Carburetor	Part No.	General countries (M/T)	21100-61190	
		General countries (A/T)	21100-61220	
		General countries (w/ Outer vent)	21100-61270	
		S. Arabia (M/T)	21100-61200	
		S. Arabia (A/T)	21100-61230	
		Middle east	21100-61270	
		Australia	21100-61250	
	Float lever	Raised position	6.0 mm	0.236 in.
		Lowered position	1.1 mm	0.043 in.
	Throttle valve closed angle	Primary	9° from horizontal	
		Secondary	20° from horizontal	
	Throttle valve fully open angle	Primary	90° from horizontal	
		Secondary	90° from horizontal	
	Secondary valve kick-up angle		25° from horizontal	
	Secondary touch angle		67° from horizontal	
	Fast idle angle		23° from horizontal	
	Choke valve fully closed angle		20° from horizontal	
	Choke breaker angle		38° from horizontal	
	Idle speed angle		14° from horizontal	
	Idle mixture adjusting screw presetting			
		S. Arabia (M/T)	Screw out 3 3/4 turns	
		S. Arabia (A/T)	Screw out 3 1/2 turns	
		Others	Screw out 2 turns	
	Acceleration pump stroke		9.5 mm	0.374 in.

COOLING SYSTEM

Engine coolant capacity			See page A-2
Thermostat	Valve opening temperature		86 – 90°C 187 – 194°F
	Valve lift at 100°C (212°F)		10 mm (0.39 in.) or more
Radiator	Relief valve opening pressure	STD	0.75 – 1.05 kg/cm² (10.7 – 14.9 psi, 74 – 103 kPa)
		Limit	0.6 kg/cm² 8.5 psi 59 kPa

LUBRICATION SYSTEM

Engine oil capacity			See page A-2
Oil pressure		at idle	0.3 kg/cm² (4.3 psi, 29 kPa) or more
		at 4,000 rpm	2.5 – 5.0 kg/cm² (36 – 71 psi, 245 – 490 kPa)
Oil Pump	Body clearance	STD	0.095 – 0.175 mm 0.0037 – 0.0069 in.
		Limit	0.20 mm 0.0079 in.
	Gear side clearance	STD	0.030 – 0.090 mm 0.0012 – 0.0035 in.
		Limit	0.15 mm 0.0059 in.
	Gear backlash	STD	0.500 – 0.600 mm 0.0197 – 0.0236 in.
		Limit	0.95 mm 0.0374 in.

IGNITION SYSTEM

Ignition timing Firing order			7° BTDC @ Max. 900 rpm 1–5–3–6–2–4
High-tension cord	Resistance	Limit	25 kΩ per cord
Spark plug	Type	ND	W14EX-U
		NGK	BP4EY
	Correct electrode gap		0.8 mm 0.031 in.
Ignition coil	Primary coil resistance at cold		
	w/ Internal resistor		1.5 – 1.9 Ω
	w/ External resistor		1.3 – 1.6 Ω
	Secondary coil resistance at cold		
	w/ Internal resistor		13.7 – 18.5 kΩ
	w/ External resistor		10.7 – 14.5 kΩ
	Resistor resistance at cold		
	w/ Internal resistor		0.9 – 1.2 kΩ
	w/ External resistor		1.3 – 1.5 kΩ

IGNITION SYSTEM (Cont'd)

Distributor	Rubbing block gap		0.3 mm	0.012 in.	
	Governor shaft thrust clearance		0.15 – 0.50 mm	0.0059 – 0.0197 in.	
	Distributor advance angle (Part No.)	Governor		Vacuum	
		Dis. rpm	Advance angle	mmHg (in. Hg, kPa)	Advance angle
	w/ Octane selector (19100-61150)	500 1,000 1,900 3,000	Advance begins 6.5° 12.0° 11.7°	80 (3.15, 10.7) 130 (5.12, 17.3) 270 (10.6, 36.0) 360 (14.2, 48.0)	Advance begins 3.5° 9.6° 12.0°
	w/o Octane selector (Middle east A/T) (19100-61210)	500 904 1,800 3,000	Advance begins 3.0° 11.5° 11.1°	80 (3.15, 10.7) 122 (4.80, 16.3) 182 (7.17, 24.3) 252 (9.92, 33.6) 340 (13.4, 45.3)	Advance begins 3.4° 7.0° 10.2° 13.0°
	w/o Octane selector (ex. Middle east A/T) (19100-61160) (19100-61180)	500 692 1,000 1,800 3,000	Advance begins 2.3° 6.5° 11.5° 11.1°	80 (3.15, 10.7) 130 (5.12, 17.3) 270 (10.6, 36.0) 360 (14.2, 48.0)	Advance begins 3.5° 9.6° 12.0°

STARTING SYSTEM

Starter	Rated voltage and output power		12V 1.0 kW		
	No-load characteristic	Ampere	90A or less at 11.5V		
		rpm	3,000 rpm or more		
	Commutator Outer diameter	STD	30 mm	1.18 in.	
		Limit	29 mm	1.14 in.	
	Under cut depth	STD	0.6 mm	0.024 in.	
		Limit	0.2 mm	0.008 in.	
	Circle runout	Limit	0.05 mm	0.0020 in.	
	Brush Length	STD	13.5 mm	0.531 in.	
		Limit	8.5 mm	0.335 in.	
	Spring installed load	STD	1.79 – 2.41 kg	3.9 – 5.3 lb	18 – 24N
		Limit	1.20 kg	2.6 lb	12N

CHARGING SYSTEM

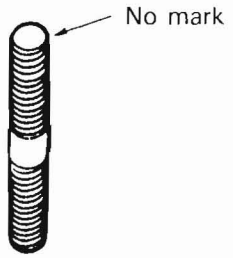
Drive belt deflection			See page A-2		
Battery specific gravity when fully charged at 20°C (68°F)			1.25 – 1.27		
Alternator	Rated output		12V 40A, 12V, 45A, 12V 50A, 12V 55A		
	Rotor coil resistance		3.9 – 4.1 Ω		
	Slip ring diameter	STD	32.3 – 32.5	1.272 – 1.280	
		Limit	32.1 mm	1.264 in.	
	Brush exposed length	STD	12.5 mm	0.492 in.	
		Limit	5.5 mm	0.217 in.	
Alternator regulator	Regulating voltage at 25°C (77°F)		13.8 – 14.8 V		

STANDARD BOLT TORQUE SPECIFICATIONS

STANDARD BOLT TORQUE SPECIFICATIONS

HOW TO DETERMINE BOLT STRENGTH

<table>
<tr><th></th><th>Mark</th><th>Class</th><th></th><th>Mark</th><th>Class</th></tr>
<tr><td rowspan="2">Hexagon head bolt</td><td> 

Bolt head No. 4– 5– 6– 7–</td><td>4T
5T
6T
7T</td><td rowspan="4">Stud bolt</td><td rowspan="2"> 
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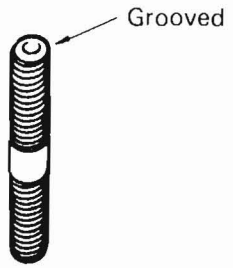
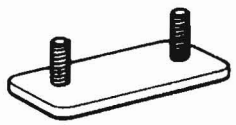
<tr><td> 
No mark</td><td>4T</td></tr>
<tr><td>Hexagon flange bolt
w/washer hexagon bolt</td><td> 
No mark</td><td>4T</td><td rowspan="2"> 
</td><td rowspan="2">6T</td></tr>
<tr><td>Hexagon head bolt</td><td> 
Two protruding lines</td><td>5T</td></tr>
<tr><td>Hexagon flange bolt
w/washer hexagon bolt</td><td> 
Two protruding lines</td><td>6T</td><td rowspan="2">Welded bolt</td><td rowspan="2">  </td><td rowspan="2">4T</td></tr>
<tr><td>Hexagon head bolt</td><td> 
Three protruding lines</td><td>7T</td></tr>
</table>

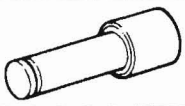
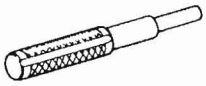
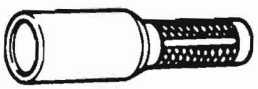
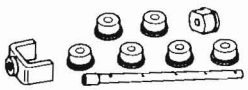
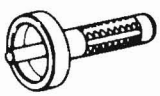
SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Torque specifications					
			Hexagon head bolt			Hexagon flange bolt		
			kg-cm	ft-lb	N·m	kg-cm	ft-lb	N·m
4T	6	1	55	48 in.-lb	5.4	60	52 in.-lb	5.9
	8	1.25	130	9	13	145	10	14
	10	1.25	260	19	25	290	21	28
	12	1.25	480	35	47	540	39	53
	14	1.5	760	55	75	850	61	83
	16	1.5	1,150	83	113		–	
5T	6	1	65	56 in.-lb	6.4		–	
	8	1.25	160	12	16		–	
	10	1.25	330	24	32		–	
	12	1.25	600	43	59		–	
	14	1.5	930	67	91		–	
	16	1.5	1,400	101	137		–	
6T	6	1	80	69 in.-lb	7.8	90	78 in.-lb	8.8
	8	1.25	195	14	19	215	16	21
	10	1.25	400	29	39	440	32	43
	12	1.25	730	53	72	810	59	79
	14	1.5		–		1,250	90	123
7T	6	1	110	8	11	120	9	12
	8	1.25	260	19	25	290	21	28
	10	1.25	530	38	52	590	43	58
	12	1.25	970	70	95	1,050	76	103
	14	1.5	1,500	108	147	1,700	123	167
	16	1.5	2,300	166	226		–	

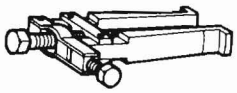
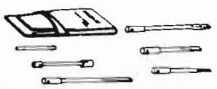
– MEMO –

SST AND SSM

SST (SPECIAL SERVICE TOOLS)

Illustration • Part No. • Part Name (Section)	EM	FU	CO	LU	ST	CH
 09201-31010 (Valve Stem Oil Seal Replacer)	●					
 09201-60011 (Valve Stem Guide Remover & Replacer)	●					
 09202-43013 (Valve Spring Compressor)	●					
 09213-58010 (Crankshaft Pulley Holding Tool)	●					
 09213-60017 (Crankshaft Pulley Puller)	●					
 09214-60010 (Crankshaft Pulley & Gear Replacer)	●					
 09214-76011 (Crankshaft Pulley Replacer)	●					
 09215-00012 (Camshaft Bearing Remover & Replacer Set)	●					
 09215-00100 (Camshaft Bearing Remover & Replacer)	●					
 09222-30010 (Connecting Rod Bushing Remover & Replacer)	●					
 09223-60010 (Crankshaft Rear Oil Seal Replacer)	●					
 09228-44010 (Oil Filter Wrench)				●		
 09236-00101 (Water Pump Overhaul Tool Set)			●			
 09240-00014 (Carburetor Adjusting Gauge Set)		●				

SST (SPECIAL SERVICE TOOLS)(Cont'd)

Section / Illustration • Part No. • Part Name	EM	FU	CO	LU	ST	CH
 09240-00020 (Wire Gauge Set)		●				
 09243-00020 (Idle Adjusting Screw Wrench)	●					
 09286-46011 (Injection Pump Spline Shaft Puller)					●	●
 09308-10010 (Oil Seal Puller)	●					
 09330-00021 (Companion Flange Holding Tool)	●					
 09860-11011 (Carburetor Drive Set)		●				

SSM (SPECIAL SERVICE MATERIALS)

Part Name	Part No.	Sec.	Use, etc.
THREE BOND 1324	08833-00070	EM	Flywheel or drive plate mount bolt

– MEMO –