

# **DAIHATSU**

# **Rocky**

**EM**

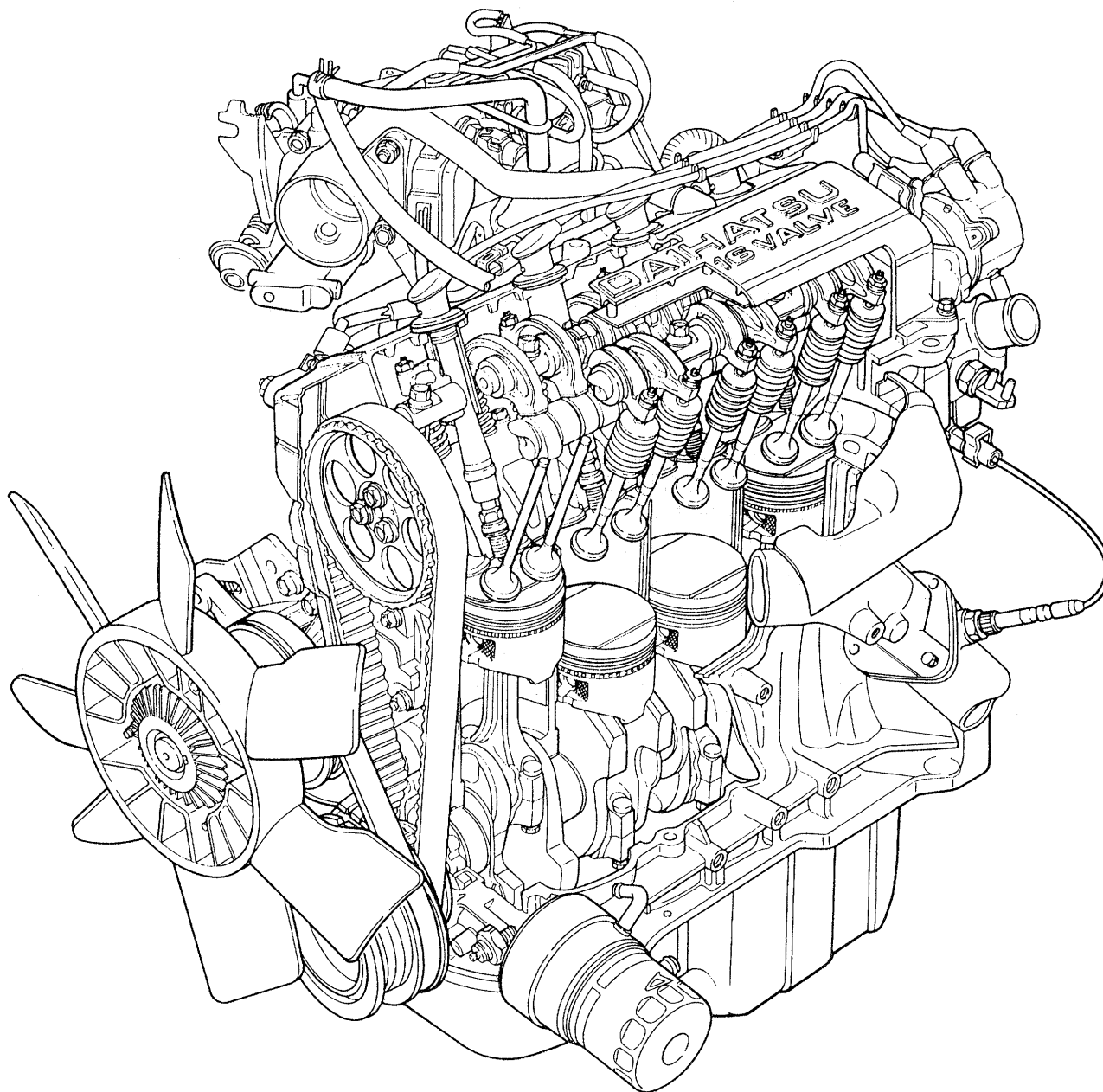
## **ENGINE MECHANICALS**

INTRODUCTION .....	EM- 2
TROUBLE SHOOTING .....	EM- 6
ENGINE TUNE-UP .....	EM- 9
CHECK METHOD OF IDLE HC/CO CONCENTRATIONS .....	EM-16
COMPRESSION CHECK .....	EM-18
TIMING BELT .....	EM-21
CYLINDER HEAD .....	EM-36
CYLINDER BLOCK .....	EM-82

WRU90-EM001

### INTRODUCTION

Type HD engine is a water-cooled, 4-cycle, 4-cylinder-in-line, SOHC 16-valve EFI gasoline engine. The cylinders are arranged in a sequence of 1-2-3-4 from the timing belt side.



## **FEATURES**

Type HD engine is mounted in the engine compartment longitudinally relative to the vehicle forward direction. The firing order is 1-3-4-2.

### **CYLINDER HEAD COVER**

The cylinder head cover is made of aluminum alloy. A ventilation baffle plate and an oil separator are integrated inside the cylinder head cover so that the oil contained in the blow-by gas may be separated. Moreover, to prevent the leakage of oil and blow-by gas, a grommet is press-fitted at the contact section with each spark plug tube.

### **CYLINDER HEAD**

In this aluminum alloy cylinder head, its combustion chamber adopts a pent roof type. The spark plug is located at the central position in the combustion chamber.

For improved flame propagation characteristics, the squash area is provided at the combustion chamber in order that a turbulence may be generated in the mixture during the compressed stroke.

### **CYLINDER HEAD GASKET**

The cylinder head gasket employs a carbon gasket which features remarkable durability.

### **CYLINDER BLOCK**

The cylinder block is made of aluminum alloy. The cylinder liner made of cast iron is cast at the cylinder block.

For assured rigidity, the crankshaft journal bearing caps are made of cast iron. Moreover, the bores have been machined integral with the cylinder block so as to improve the roundness accuracy.

### **OIL PAN**

In this oil pan made of pressed a steel sheets, ribbed sections are provided in order to increase its strength. Moreover, the oil pan is provided with a baffle plate so as to prevent excessive movements of the oil while the vehicle is cornering, moving off or stopping quickly. Also, the baffle plate prevents the generation of resonating noises.

### **PISTON**

The piston is made of aluminum alloy.

A triangle front mark is stamped on the piston's top.

The piston pin hole is offset 0.5 mm (0.02 inch) in relation to the center of the piston in order to reduce thrust pressure toward the piston cylinder wall.

In addition, slit type oil holes are provided in the oil ring groove in order that the lubricating performance may be further improved.

### **PISTON PIN**

The piston pin is made of chrome molybdenum steel which features adequate strength and light weight. This piston pin adopts a semi-floating type.

### **CONNECTING ROD**

The connecting rod employs a vanadium steel as the material in order to assure sufficient strength and reduce its weight for decreased stress of inertia. Also, a front mark is provided on each of the connecting rod and connecting rod cap.

Moreover, the adoption of serration type connecting rod bolts has improved the roundness of the connecting rod at its big end.

### **PISTON RINGS**

The piston ring No. 1 is made of steel iron, whereas the piston ring No. 2 is made of cast iron.

The oil ring made of stainless steel employs a three-piece type.

# ENGINE MECHANICALS

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## CAMSHAFT

The camshaft made of cast iron employs a hollow type so as to achieve the reduction in weight. This single camshaft actuates a total of 16 valves; two intake valves and two exhaust valves of each cylinder.

## VALVE SPRING

For improved anti-surfing characteristics, the valve spring adopts an unequal pitch type.

The valve springs are assembled in such a direction that the side having a painted mark (the side with a greater pitch) may come at the valve rocker arm side.

## VALVE ROCKER ARM & VALVE ROCKER SHAFT

The valve rocker shaft made of carbon steel has undergone nitriding treatment.

The valve rocker shaft is bolt-attached to the cylinder head together with the camshaft caps of the cylinder head.

Furthermore, the valve rocker shaft at the intake side is provided with recessed portions so as to accommodate the spark plug tubes.

When installing the valve rocker shaft, care must be exercised as to its correct installing direction. The chamfer dimension at the timing belt side is greater than that at the distributor side.

The valve rocker arm employs aluminum alloy. Moreover, high chrome cast iron is provided at its contact surface with the camshaft so that the durability may be enhanced.

The valve rocker arm comes in four different shapes.

## CAMSHAFT TIMING BELT PULLEY & CRANKSHAFT TIMING BELT PULLEY

Both the camshaft timing belt pulley and crankshaft timing belt pulley are made of sintered alloy.

The camshaft timing belt pulley is driven by the crankshaft timing belt pulley through an RU type cogged belt. The tension of this timing belt is maintained by means of a belt tensioner.

## CRANKSHAFT

The crankshaft employs spheroidal graphite cast iron as the material.

The crankshaft is supported via crankshaft bearings by the five main journals provided in the cylinder block.

For reduced weight, the crankshaft is a hollow type.

Furthermore, four balance weights prevents the occurrence of vibrations.

## CRANKSHAFT PULLEY

To reduce torsional vibrations, the crankshaft pulley adopts a damper.

The crankshaft pulley is attached to the crankshaft timing belt pulley by means of four bolts.

## FLYWHEEL

A flywheel made of cast iron is employed.

The flywheel adopts a thin contour which features excellent heat radiating properties. To provide an adequate inertia weight, the outer diameter of the flywheel has been made larger.

An oil catch is provided so that the engine oil may flow to the cylinder block. This design prevents the oil from reaching the clutch disc surface in the event that oil leaks out from the crankshaft side through the flywheel attaching bolts.

The ring gear is shrinkage-fitted onto the outer periphery of the flywheel.

## FLYWHEEL/ATTACHING BOLT

The bolt employs a 12 point type. To prevent these bolts from becoming loose, special care has been exercised to achieve the torque stability when tightening them.

In addition, the attaching holes at the crankshaft are of pass-through type. Therefore, the bolts are sealed by applying sealer to them.

WNU89-EM004



### **TIMING BELT COVER**

The timing belt cover is divided into two parts; the upper cover and lower cover. The ignition timing indicator is mounted on the lower cover.

### **INTAKE MANIFOLD**

Intake manifold is made of aluminum alloy. Design has been made so that the length from the throttle body attaching section to the intake manifold installation section on the cylinder head may become equal in all cylinders. Consequently, the air charging rate for each cylinder has been made uniformed.

In addition, the intake tube portion from the surge tank to the intake manifold adopts a diffuser type so as to improve the air charging efficiency.

WNU89-EM005

## TROUBLE SHOOTING

Problem	Possible causes	Remedies	Page
Engine overheats.	Cooling system faulty.	Troubleshoot cooling system.	CO- 3
	Incorrect ignition timing.	Reset timing.	IG- 22
	Excessive engine load <ul style="list-style-type: none"> <li>• Clutch faulty</li> <li>• Brake drag</li> </ul>	Troubleshoot clutch. Troubleshoot brake.	CL- 5
Engine will not crank or cranks slowly.	Starting system faulty.	Troubleshoot starting system.	ST- 2
	Charging system faulty	Troubleshoot charging system.	CH- 2
Engine will not start/Hard to start (Only cases where cranking by starter motor is normal).	Ignition problem <ul style="list-style-type: none"> <li>• Ignition coil</li> <li>• Igniter</li> <li>• Distributor</li> <li>• Ignition wiring</li> </ul>	Inspect ignition coil. Inspect igniter. Inspect distributor. Inspect ignition wiring.	IG- 8 IG- 4 IG- 10 IG- 3
	Spark plugs faulty	Inspect plugs.	IG- 6
	Spark plug wire disconnected or faulty.	Inspect wires.	IG- 5
	Low compression.	Check compression.	EM- 18
	Vacuum leaks <ul style="list-style-type: none"> <li>• EGR valve</li> <li>• Throttle body</li> <li>• PCV line</li> <li>• Intake manifold</li> </ul>	Check EGR system. Check throttle body. Check PCV line. Check intake manifold.	EC- 10 EF-119 EC- 4
	No fuel supply to injector <ul style="list-style-type: none"> <li>• No fuel in tank</li> <li>• Fuel pump not working</li> <li>• Fuel filter clogged</li> <li>• Fuel line clogged or leaking</li> </ul>	Repair, as necessary.	EF-115
	EFI system malfunctioning	Troubleshoot EFI system.	EF- 13
	Spark plugs faulty.	Inspect plugs.	IG- 6
	Spark plug wires faulty.	Inspect wires.	IG- 5
	Ignition problem. <ul style="list-style-type: none"> <li>• Ignition coil</li> <li>• Igniter</li> <li>• Distributor</li> <li>• Ignition wiring</li> </ul>	Inspect ignition coil. Inspect igniter. Inspect distributor. Inspect ignition wiring.	IG- 8 IG- 4 IG- 10
Rough idle/Engine stalls or misses.	Incorrect ignition timing	Reset timing.	IG- 22
	Incorrect valve clearance	Adjust valve clearance	EM- 11
	Low compression	Check compression.	EM- 18
	Incorrect idle speed	Adjust idle speed.	MA- 14
	Vacuum leaks. <ul style="list-style-type: none"> <li>• EGR valve</li> <li>• Throttle body</li> <li>• PCV line</li> <li>• Intake manifold</li> </ul>	Check EGR system. Check throttle body. Check PCV line. Check Intake manifold.	EC- 10 EF-119 EC- 4
	EFI system malfunctioning	Repair, as necessary.	EF- 11
	Spark plugs faulty.	Inspect plugs.	IG- 6
	Spark plug wires faulty.	Inspect wires.	IG- 5
	Ignition problem. <ul style="list-style-type: none"> <li>• Ignition coil</li> <li>• Igniter</li> <li>• Distributor</li> <li>• Ignition wiring</li> </ul>	Inspect ignition coil. Inspect igniter. Inspect distributor. Inspect ignition wiring.	IG- 8 IG- 4 IG- 10
	Incorrect ignition timing	Reset timing.	IG- 22

Problem	Possible causes	Remedies	Page
Idle speed is too high.	Fuel line clogged	Check fuel line.	EF-102
	Air suction <ul style="list-style-type: none"> <li>• Intake manifold</li> <li>• Vacuum hose disconnected</li> <li>• Throttle body</li> </ul>	Check intake manifold. Check vacuum hose for proper piping. Check throttle body.	EF-119
	EFI system malfunctioning	Troubleshoot EFI system.	EF- 11
	Incorrect idle speed.	Adjust idle speed.	MA- 14
Engine hesitates/Poor acceleration	Spark plugs faulty	Inspect plugs.	IG- 6
	Spark plug wires faulty.	Inspect wires.	IG- 5
	Incorrect ignition timing.	Reset timing.	IG- 22
	Ignition wiring failure	Inspect wiring.	IG- 3
	Incorrect valve clearances.	Adjust valve clearances.	EM- 11
	Low compression.	Check compression.	EM- 18
	Fuel system clogged.	Check fuel system.	EF- 93
	Air cleaner clogged.	Check air cleaner.	MA- 9
	Engine overheats.	Check cooling system.	CO- 3
	Vacuum leakage <ul style="list-style-type: none"> <li>• EGR valve</li> <li>• Throttle body</li> <li>• PCV line</li> <li>• Intake manifold</li> </ul>	Check EGR system. Check throttle body. Check PCV line. Check intake manifold.	EC- 10 EF-119 EC- 4
	Emission control system malfunctioning (cold engine)	Repair as necessary.	
	EGR system always on	Repair EGR system.	EC- 10
	EFI system malfunctioning	Repair, as necessary.	EF- 11
Engine dieseling (Runs after ignition switch is turned off.)	EFI system malfunctioning	Repair, as necessary.	EF- 11
	Incorrect ignition timing.	Reset timing.	IG- 22
Muffler explosion (after fire) during deceleration only	Incorrect ignition timing.	Reset timing.	IG- 22
	Incorrect valve clearance.	Adjust valve clearance.	EM- 11
	Air cleaner clogged.	Check air cleaner.	MA- 9
	EFI system malfunctioning	Repair, as necessary.	EF- 11
Engine backfires.	Incorrect ignition timing.	Reset timing.	IG- 22
	Incorrect valve clearances.	Adjust valve clearances.	EM- 11
	EFI system malfunctioning	Repair, as necessary.	EF- 11
	Vacuum leakage <ul style="list-style-type: none"> <li>• EGR valve</li> <li>• Throttle body</li> <li>• PCV line</li> <li>• Intake manifold</li> </ul>	Check EGR system. Check throttle body. Check PCV line. Check Intake manifold.	EC- 10 EF-119 EC- 4

WRU90-EM003

# ENGINE MECHANICALS

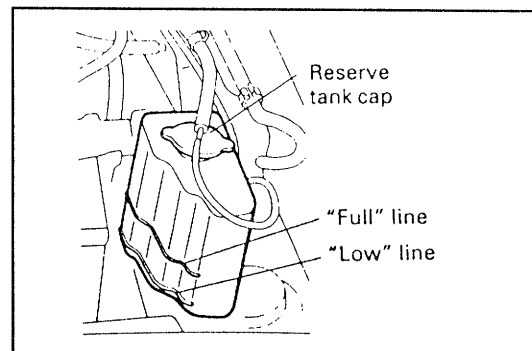
Problem	Possible causes	Remedies	Page
Excessive oil consumption	Oil leak.	Repair, as necessary.	
	PCV line clogged.	Check PCV hose.	EC- 4
	Piston rings worn or damaged.	Check rings.	EM- 99
	Valve stems worn.	Check valves and guides.	EM- 48
	Valve stem oil seals worn or damaged.	Replace oil seal.	EM-45, 60
Poor fuel mileage	Spark plugs faulty.	Inspect plugs.	IG- 6
	Incorrect ignition timing.	Reset timing.	IG- 22
	Ignition wiring failure	Check ignition wiring.	IG- 3
	Low compression.	Check compression.	EM- 18
	Air cleaner clogged.	Check air cleaner.	MA- 9
	Fuel leak.	Repair as necessary.	EF- 93
	EGR system always on	Check EGR system.	EC- 10
	Tires improperly inflated	Inflate tires to specified pressure.	
	Clutch slips.	Troubleshoot clutch.	CL- 5
	Brakes drag.	Troubleshoot brakes.	
	EFI system malfunctioning	Repair, as necessary.	EF- 11
	Idle speed too high	Reset idle speed.	MA- 14
	Distributor advance failure	Check distributor.	IG- 10
Engine detonation (knocking)	Incorrect ignition timing	Reset timing.	IG- 22
	Spark plugs faulty	Inspect plugs.	IG- 6
	Distributor advance failure	Check distributor.	IG- 10
	EFI system malfunctioning	Repair, as necessary.	EF- 11
Unpleasant odor	Incorrect idle speed.	Adjust idle speed.	MA- 14
	Incorrect ignition timing	Reset timing.	IG- 22
	Vacuum leaks	Check PCV system.	EC- 4
	• PCV line	Check EGR system.	EC- 10
	• EGR line	Check intake manifold.	
	• Intake manifold		
	EFI system malfunctioning	Repair, as necessary.	EF- 13

WRU90-EM004

## ENGINE TUNE-UP

### 1. Inspection of engine coolant level

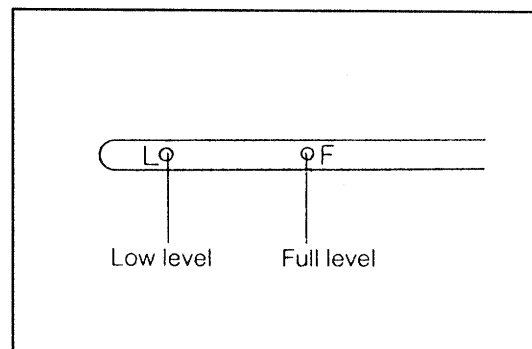
(See page CO-3.)



WRU90-EM005

### 2. Inspection of engine oil level

(See page LU-2.)

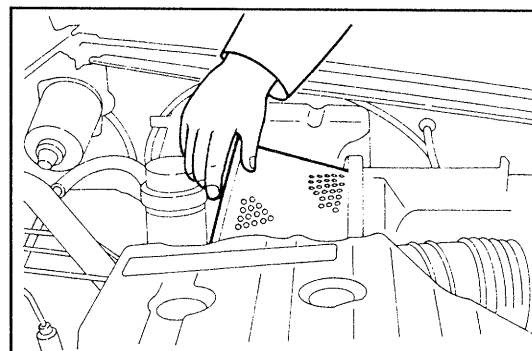


WRU90-EM006

### 3. Inspection of air cleaner filter element

(See page MA-9.)

Clean or replace the air cleaner filter element.

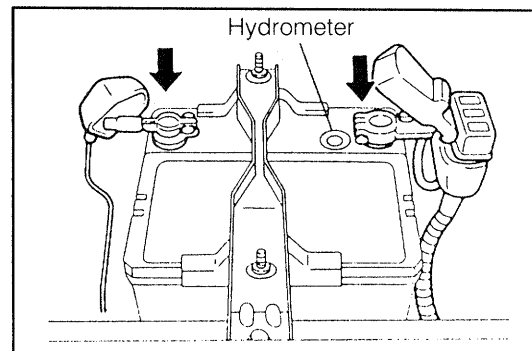


WRU90-EM007

### 4. Inspection of battery

Maintenance free battery

(See page CH-4.)



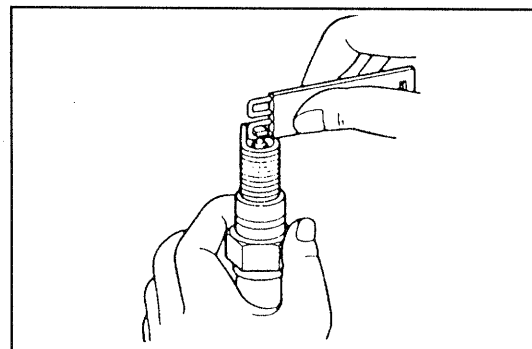
WRU90-EM008

### 5. Inspection of spark plugs

(See page IG-6.)

Recommended spark plugs:

CHAMPION	NIPPONDENSO	NGK
RC9YC4	K20PR-U11	BKR6E-11



WRU90-EM009

## 6. Inspection and adjustment of valve clearances

The measurement and adjustment of valve clearances are carried out when each of the pistons of the No. 1 and No. 4 cylinders is set to the top dead center at the end of the compression stroke.

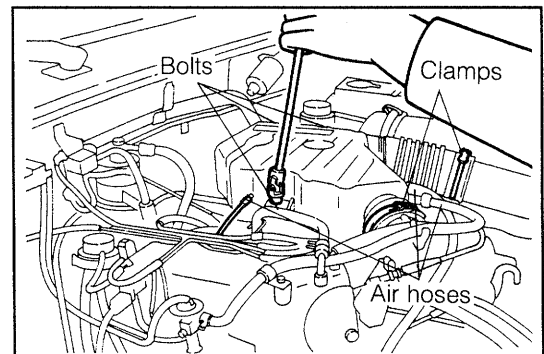
### NOTE:

- The valve clearance adjustment is performed normally when the engine is in a hot condition.
- "Hot engine condition" denotes a condition in which the cooling water temperature is 75 - 85°C (167 - 185°F) and the engine oil temperature is above 65°C (149°F).
- However, when the engine has been overhauled, it is necessary to adjust the valve clearances while the engine is cold and to readjust the valve clearances in a hot condition after warming up the engine.

WRU90-EM010

### (1) Removal of air chamber

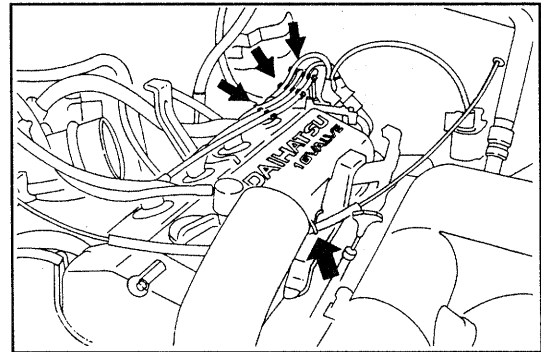
- ① Disconnect the air hoses from the air chamber.
- ② Detach the air chamber by removing the three attaching bolts.
- ③ Unlock the two clamps with your hand. Then remove the air chamber.



WRU90-EM011

### (2) Removal of cylinder head cover

- ① Disconnect the accelerator cable from the clamp.
- ② Detach the spark plug wires from the clamps.

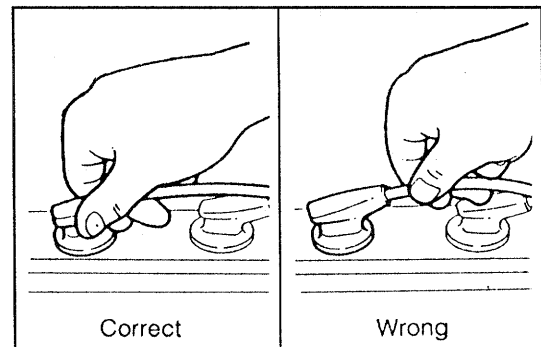


WRU90-EM012

- ③ Detach the spark plug wires at the cylinder head side.

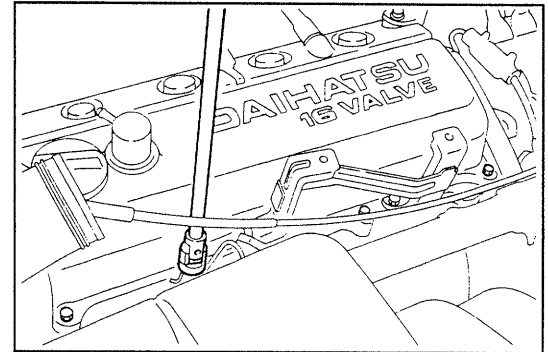
### NOTE:

- Be sure to hold the rubber boot during the spark plug wire disconnection. Never remove the spark plug wire, holding the cord portion.



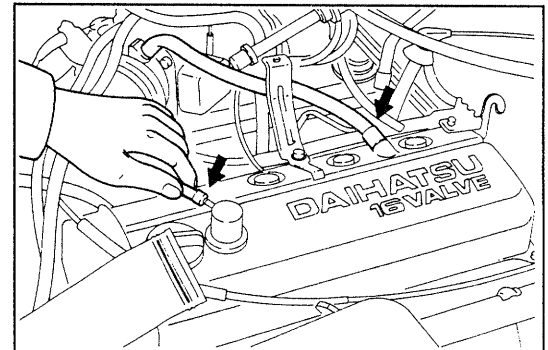
WRU90-EM013

- ④ Detach the air chamber bracket and accelerator cable clamp by removing two screws.  
(If the radio equipped vehicle, remove the bond cable from the air chamber bracket.)



WRU90-EM014

- ⑤ Disconnect the PCV hoses from the cylinder head cover.

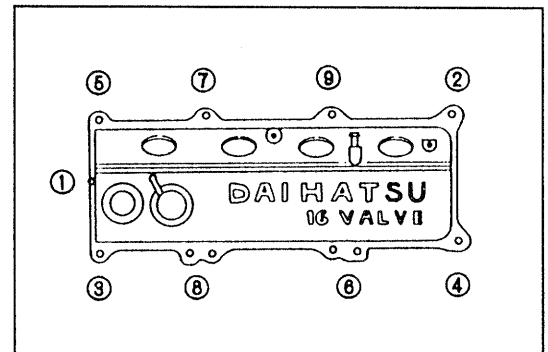


WRU90-EM015

- ⑥ Loosen the nine bolts (10 mm) over two or three stages in the sequence shown in the right figure. After removing the bolts, proceed to remove the cylinder head cover.

## NOTE:

- Be sure to loosen the bolts progressively and uniformly over two or three stages.
- The timing belt cover attaching bolt ① should be pulled out fully.
- Be very careful not to damage the grommets of the spark plug tubes.



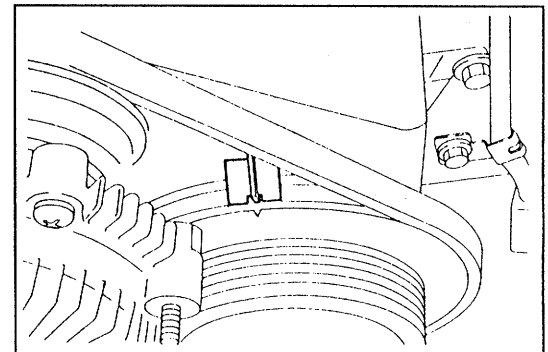
WRU90-EM016

## (3) Inspection and adjustment of valve clearances

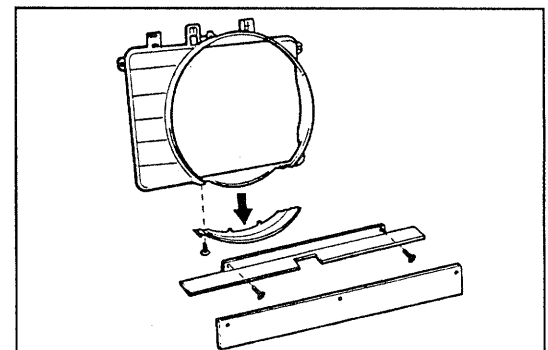
- ① Turn the crankshaft until the recessed mark on the crankshaft pulley is aligned with the indicator mark on the timing belt cover.

## NOTE:

- If the vehicles equipped with the power steering and the air-conditioner or only the power steering is equipped, turn the power steering pump pulley while pushing the drive belt.
- If the vehicles equipped with only the air conditioner, remove the engine under cover, rubber plate, engine under cover No. 3 and the lower fan shroud. Then turn the crankshaft pulley from the vehicle lower side.



WRU90-EM017



WRU90-EM018

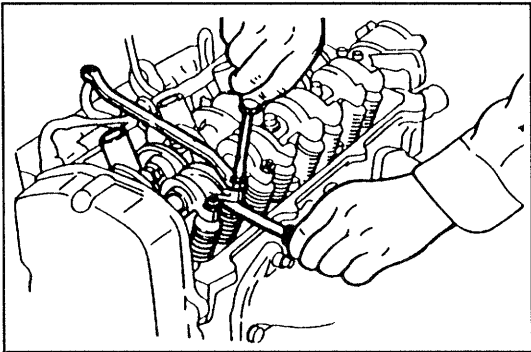
- ② Check to see if the valve rocker arms of the No. 1 cylinder are free or are being pushed up. According to the following table, check and/or adjust the valve clearances, using a thickness gauge.

Valve clearances (Hot condition)

Intake: 0.20 - 0.30 mm (0.008 - 0.012 inch )  
Exhaust: 0.28 - 0.38 mm (0.011 - 0.015 inch)

(Reference: Cold)

Intake: 0.18 mm (0.007 inch)  
Exhaust: 0.25 mm (0.010 inch)



WRU90-EM019

NOTE:

- Before the adjusting bolts are tightened, apply engine oil to the lock nuts and rocker arm adjusting bolts.

The “O” marks denote those valves that can be adjusted under that setting.

Cylinder No.		1	2	3	4
Rocker arm condition					
When valve rocker arms of No. 1 cylinder are free: (Piston of No. 1 cylinder is at top dead center under compression stroke)	IN	O	O		
	EX	O		O	
When valve rocker arms of No. 4 cylinder are free: (Piston of No. 4 cylinder is at top dead center under compression stroke)	EX			O	O
	IN		O		O

WRU90-EM020

- ③ Turn the crankshaft 360 degrees. Proceed to check and/or adjust the remaining valve clearances.

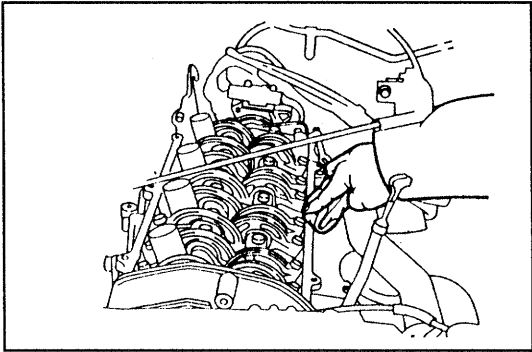
WRU90-EM021

(4) Installation of cylinder head cover

- ① Wipe off the oil or dirt from the gasket surface of the cylinder head cover.

CAUTION:

- Be sure not to drop the dirt or gasket tips into the timing belt cover.



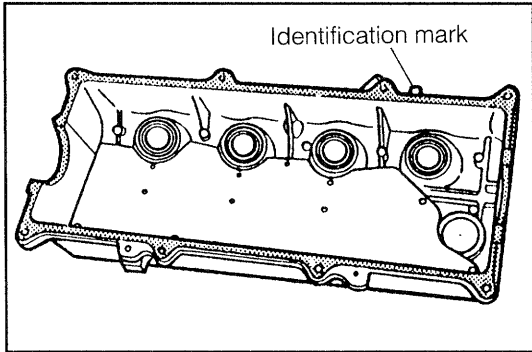
WRU90-EM022

- ② Check the cylinder head cover gasket for evidence of damage.

Replace the gasket, as required.

NOTE:

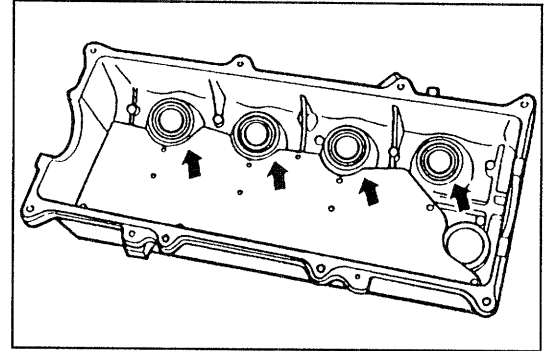
- Install the cylinder head cover gasket in such a direction that the identification mark may come at the intake side.



WRU90-EM023

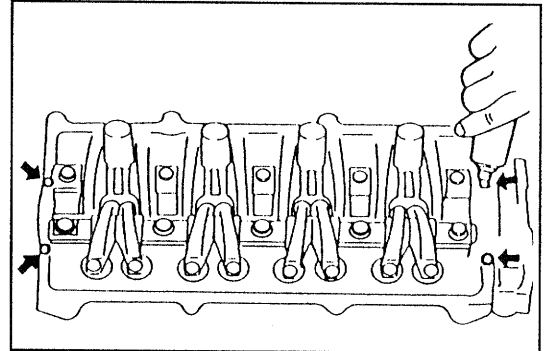


- ③ Check the rubber grommets of the spark plug tubes for evidence of damage.  
Replace the rubber grommets, as required.  
(See page EM-73.)



WRU90-EM024

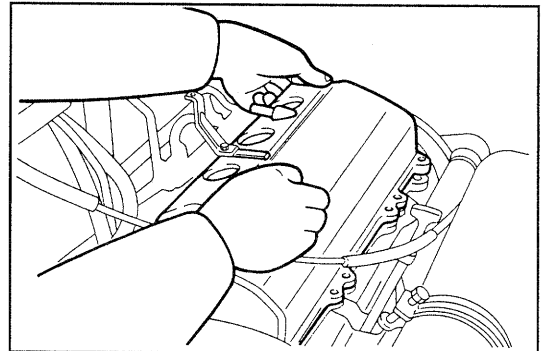
- ④ Install the cylinder head cover gasket on the cylinder head. Apply the Three Bond 1104 to the four points on the cylinder head, as indicated in the figure.



WRU90-EM025

- ⑤ Install the cylinder head cover on the cylinder head.  
**NOTE:**

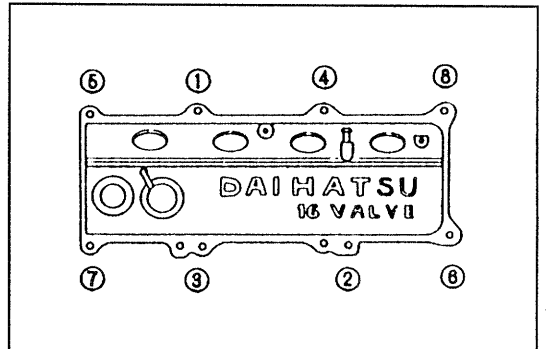
- Be very careful not to damage the rubber grommets for spark plugs during the cover installation.
- Make sure that the rubber grommet is fitted properly to the spark plug tube.



WRU90-EM026

- ⑥ Tighten the cylinder head cover bolts over two or three stages in the sequence shown in the right figure, until they are tightened to the specified torque.

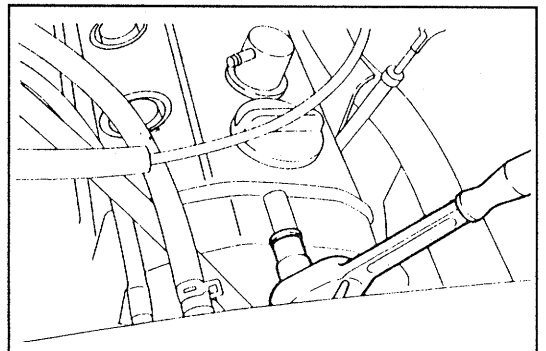
**Tightening Torque:** 0.3 - 0.5 kg-m  
(2.2 - 3.6 ft-lb, 3.0 - 4.9 N·m)



WRU90-EM027

- ⑦ Tighten the timing belt cover attaching bolt.

**Tightening Torque:** 0.2 - 0.4 kg-m  
(1.4 - 2.9 ft-lb, 2.0 - 3.9 N·m)



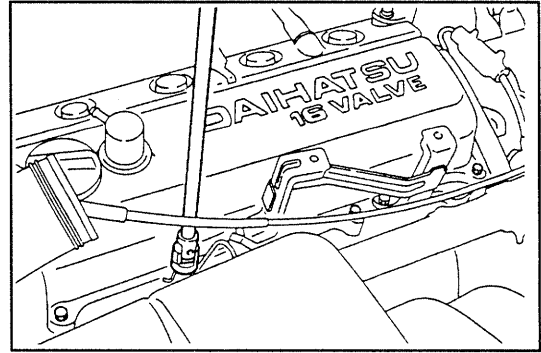
WRU90-EM028

- ⑧ Tighten the air chamber bracket tightening bolts and clamp bolt. Then clamp the accelerator cable.

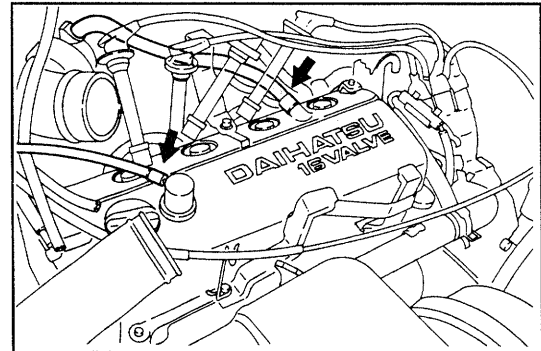
**Tightening Torque:** 0.3 - 0.5 kg-m  
(2.2 - 3.6 ft-lb, 3.0 - 4.9 N·m)

- ⑨ Connect the bond cable to the air chamber bracket, and tighten the attaching bolt.  
(Only for the radio equipped vehicle)

- ⑩ Connect the PCV hoses to the cylinder head cover.



WRU90-EM029

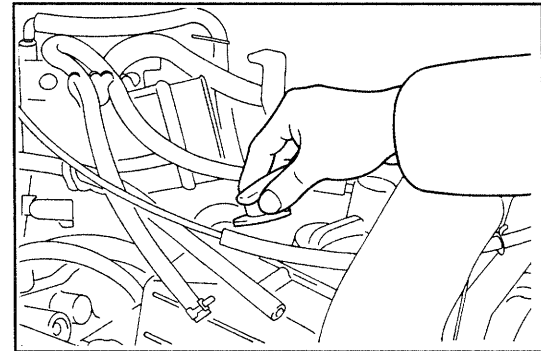


WRU90-EM030

- ⑪ Install the spark plug wires to the spark plugs.

**NOTE:**

- Be sure that the spark plug wire is connected securely to each spark plug.
- Care should be exercised not to damage the spark plug wire rubber grommet with the spark plug tube.

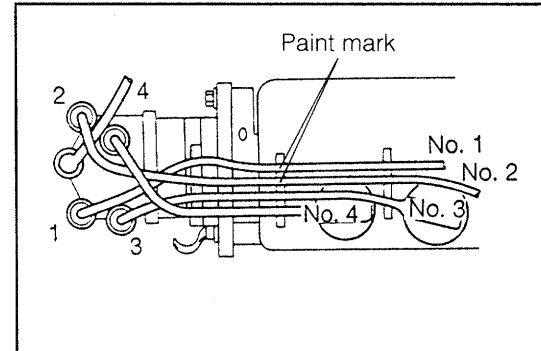


WRU90-EM031

- ⑫ Install the spark plug wires to clamps.

**NOTE:**

- Align the pink paint marks provided on the No. 1 and No. 2 spark plug wires with clamping position indicated in the right figure.



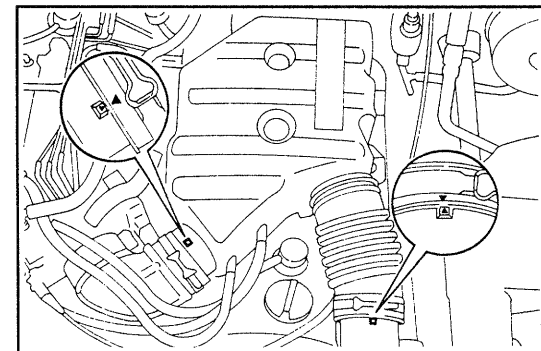
WRU90-EM160

(5) Installation of intake air chamber

- ① Connect the air hoses to the intake air chamber.

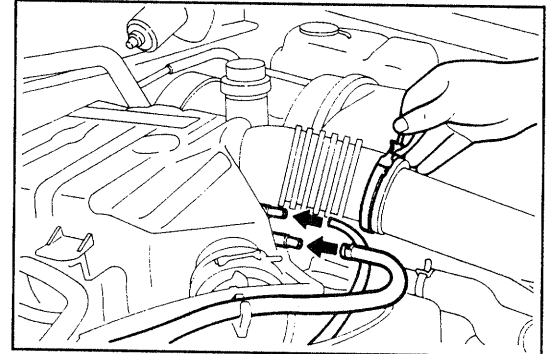
**NOTE:**

- At this time, make sure that the mating mark at the hose side is aligned with the mating mark at the intake air chamber side.



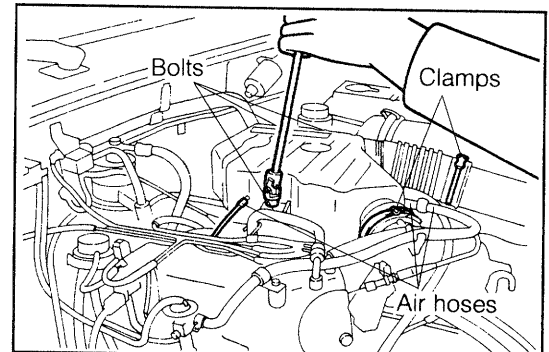
WRU90-EM033

- ② Install the clamps of the intake air chamber hoses.
- ③ Connect the air hoses of the air conditioner and power steering.



WRU90-EM034

- ④ Install the intake air chamber to the bracket with three bolts.
- (6) Start the engine. Ensure that the engine exhibits no trouble, such as oil leakage.



WRU90-EM035

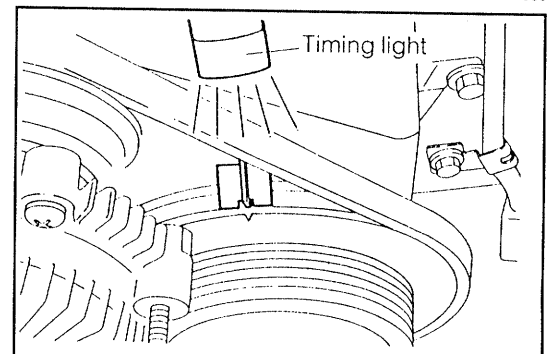
## 7. Inspection of ignition timing

(See page IG-22.)

Check to see if the ignition timing mark of the crankshaft pulley is aligned with the indicator of the timing belt cover.

### NOTE:

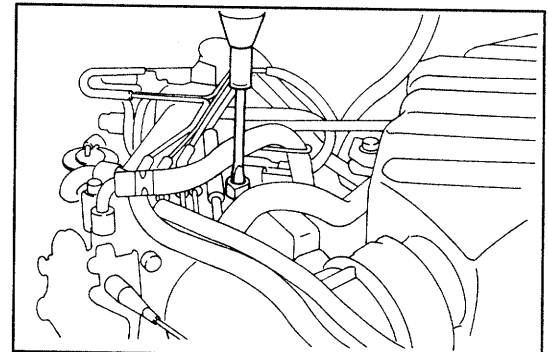
- This does not include the sub-ignition timing advance of the distributor.



WRU90-EM036

## 8. Adjustment of idle speed

(See page MA-14.)



WRU90-EM037

## CHECK METHOD OF IDLE HC/CO CONCENTRATIONS

### NOTE:

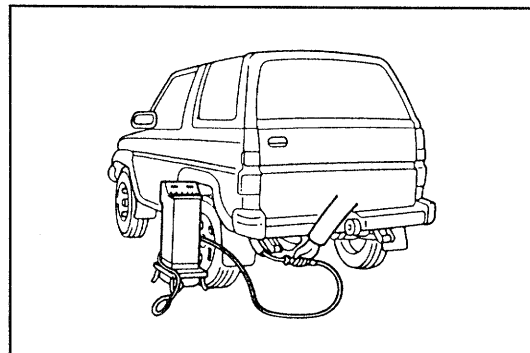
- This check is used only to determine whether or not the idle HC/CO emissions comply with the regulations.

### 1. Initial Conditions

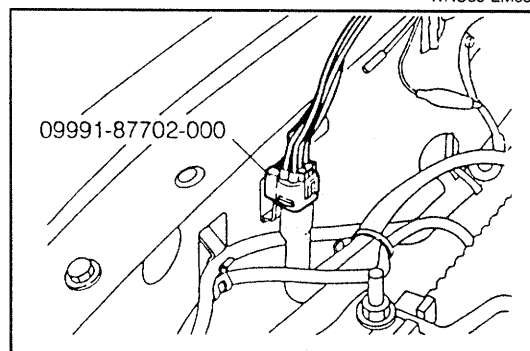
- (1) Air cleaner filter element installed.
- (2) All accessories switched OFF.
- (3) All vacuum lines connected.  
(e.g. EGR system)
- (4) All pipes and hose of air intake system connected.
- (5) Ignition timing set correctly.
- (6) Transmission in "Neutral" Position.
- (7) Warm up the engine thoroughly.
- (8) Ensure that the exhaust system exhibits no gas leakage.
- (9) Ensure that the intake system exhibits no air leakage.
- (10) Tachometer and HC/CO meter at hand and calibrated.

### 2. System inspection of oxygen sensor

- (1) Remove the cap of the check connector. Connect the following SST to the check connector.  
**SST: 09991-87702-000**



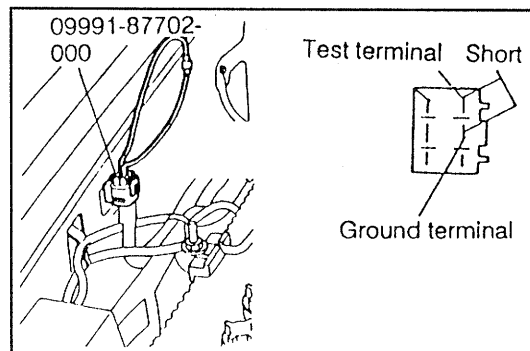
WNU89-EM037



WNU89-EM038

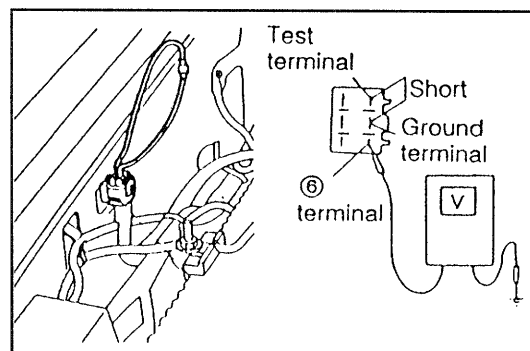
WNU89-EF190

- (2) Start and warm up the engine completely.
- (3) Connect the test terminal (brown) of the SST to the ground terminal (black).



WNU89-EF191

- (4) Connect a voltmeter to the output terminal (green) of the SST.



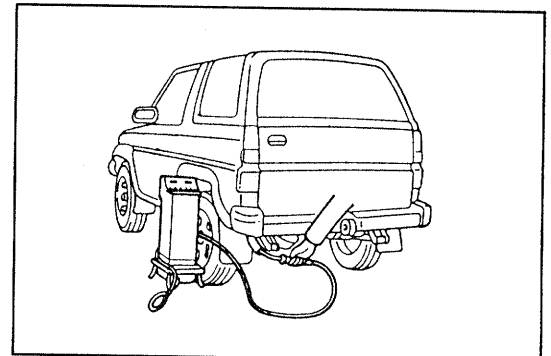
WNU89-EF092

- (5) Hold the engine speed at 3000 rpm.
- (6) After a lapse of 2 minutes, ensure that the reading of the voltmeter connected in the step (4) changes eight times or more for 10 seconds.  
If the change in voltage fails to occur eight times or more, check the diagnosis code. Replace the oxygen sensor if no malfunction code is memorized.

WNU89-EF093

### 3. Measurement

- (1) Insert the HC/CO meter testing probe into the tail pipe at least 400 mm (15.7 inch).



WNU89-EM039

- (2) Measurement of HC/CO concentrations at idle.  
Wait at least one minute before the measurement so as to allow concentrations to stabilize.  
Complete the measurement within three minutes.  
If the HC/CO concentrations dose not conform to the regulations, see the following table for possible causes.

WNU89-EF040

### Trouble shooting

HC	CO	Problems	Possible causes
High	Normal	Rough idle	<ol style="list-style-type: none"> <li>1. Faulty ignition <ul style="list-style-type: none"> <li>• Incorrect timing</li> <li>• Fouled, shorted or improperly gapped spark plugs</li> <li>• Open or crossed high tension cords</li> <li>• Cracked distributor cap</li> </ul> </li> </ol>
			<ol style="list-style-type: none"> <li>2. Incorrect valve clearance</li> <li>3. Leaky EGR valve</li> <li>4. Leaky exhaust valves</li> <li>5. Leaky cylinder</li> </ol>
High	Low	Rough idle (Fluctuating HC reading)	<ol style="list-style-type: none"> <li>1. Lean mixture causing misfire</li> </ol>
High	High	Rough idle (Black smoke from exhaust)	<ol style="list-style-type: none"> <li>1. Restricted air filter</li> <li>2. Faulty EFI system <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Clogged fuel return line</li> <li>• Defective water temp. sensor</li> <li>• Defective air temp. sensor</li> <li>• Faulty throttle position sensor</li> <li>• Faulty pressure sensor</li> <li>• Faulty injector</li> <li>• Faulty ECU</li> </ul> </li> <li>3. Insufficient warmed up three way catalyst</li> </ol>

WNU89-EM041

## COMPRESSION CHECK

### NOTE:

- After completion of the engine tune-up, if the engine exhibits lack of power, excessive oil consumption or poor fuel economy, measure the cylinder compression pressure.

- Warm up the engine thoroughly. Then turn OFF the ignition key.
- Remove the intake air chamber. (See page EM-10.)
- Removal of spark plugs
  - Remove the spark plug wires from the clamp.
  - Disconnect the spark plug wire at spark plug side.

### NOTE

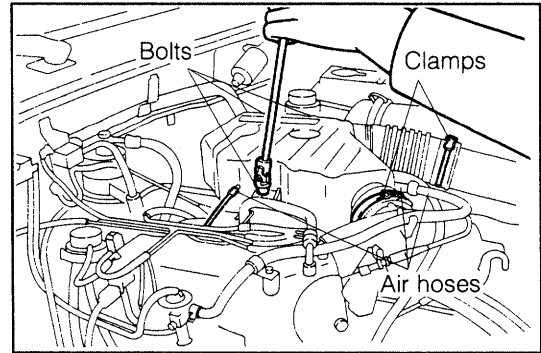
- Be sure to hold the rubber boot during the spark plug wire disconnection. Never remove the spark plug wire, holding the cord portion.

- Remove the all spark plugs, using the following SST {Plug wrench (16 mm)}.  
SST: 09268-87703-000

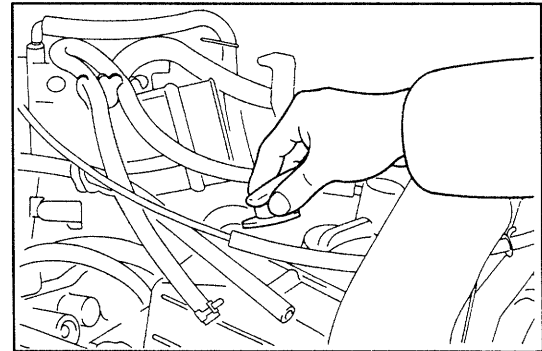
### WARNING:

Be very careful not to burn yourself.

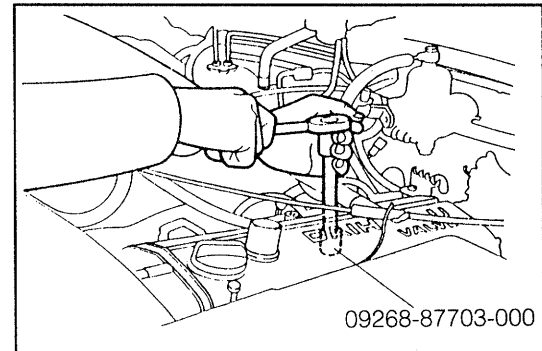
- Disconnect the distributor connector.
- Pull out the injector relay and fuel pump relay from the relay block.



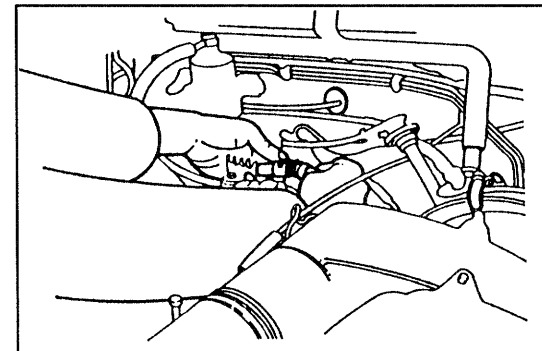
WRU90-EM038



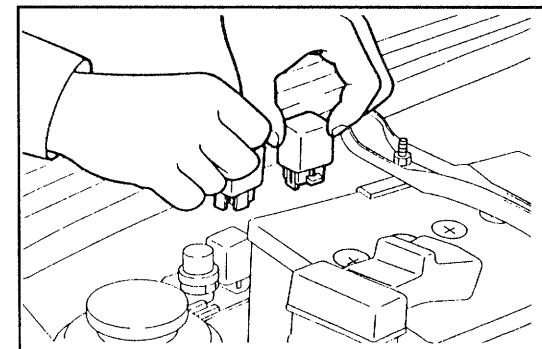
WRU90-EM039



WNU89-EM044



WNU89-EM045



WNU89-EM046

6. Measurement of cylinder compression pressure
  - (1) Insert a compression gauge into the spark plug hole.
  - (2) Depress the accelerator pedal fully.
  - (3) While cranking the engine, measure the compression pressure.

**NOTE:**

- Always use a fully charged battery so that at least a revolution speed of 300 rpm is attained.

- (4) Repeat the steps (1) through (3) for each cylinder.

**NOTE:**

- Perform the measurement in the shortest possible time.
- Crank the engine for the same duration for each cylinder.

Compression pressure:

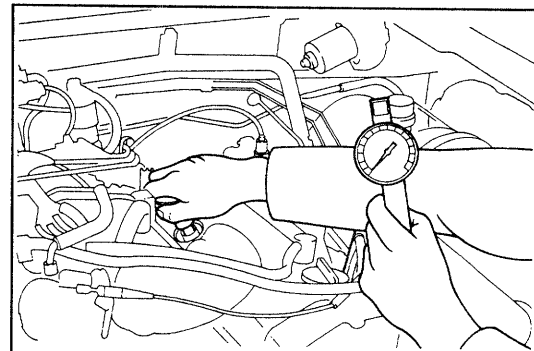
14 kg/cm<sup>2</sup>/at 300 rpm (199.1 psi/at 300 rpm)

Minimum pressure:

10.5 kg/cm<sup>2</sup>/at 300 rpm (149.4 psi/at 300 rpm)

Difference between cylinders:

1.5 kg/cm<sup>2</sup>/at 300 rpm (21.3 psi/at 300 rpm)

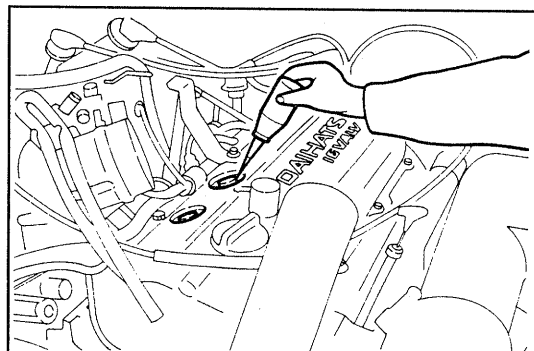


WRU90-EM040

- (5) If the compression of one or more cylinders is low, pour a small amount of engine oil into that cylinder through the spark plug hole and repeat the steps (1) through (4) for the cylinder with low compression.

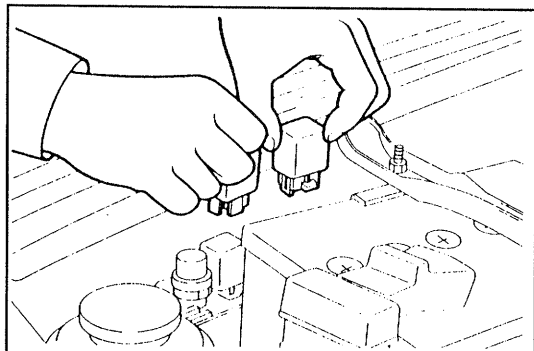
- If adding oil helps the compression to improve, chances are that the piston rings and/or cylinder bores are worn or damaged.
- If the pressure remains low after the operation described in the step (5) has been performed, the valve may be sticking or seated improperly, or there may be leakage past the gasket.

7. Install the injector relay and fuel pump relay to the relay block.



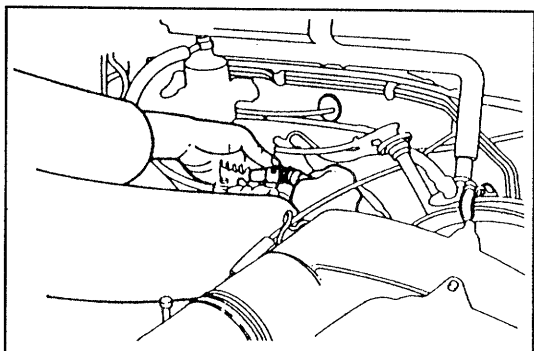
WNU89-EM047

WRU90-EM041



WNU89-EM049

8. Connect the distributor connector. Install it to the clamp.

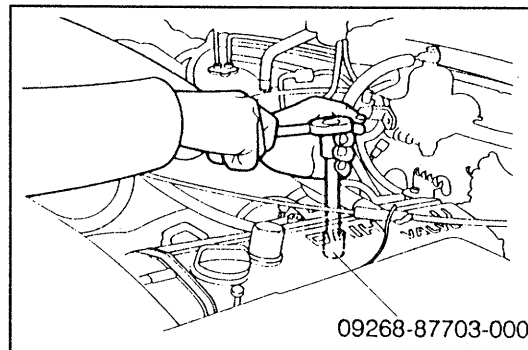


WNU89-EM050

(9) Install the spark plugs using the following SST.

SST: 09268-87703-000

Tightening Torque: 1.5 - 2.2 kg-m  
(10.9 - 15.9 ft-lb, 14.7 - 21.6 N·m)

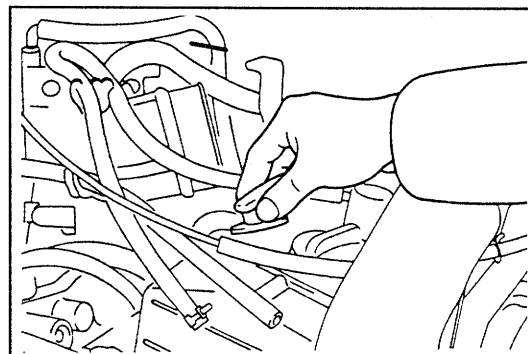


WNU89-EM051

(10) Connect the spark plug wire.

**NOTE:**

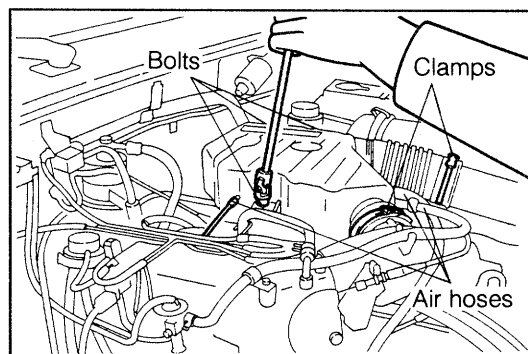
- Be sure that the spark plug wire is connected securely to each spark plug.
- Care should be exercised not to damage the spark plug wire with the spark plug tube.



WRU90-EM042

(11) Attach the spark plug wire to the clamp.

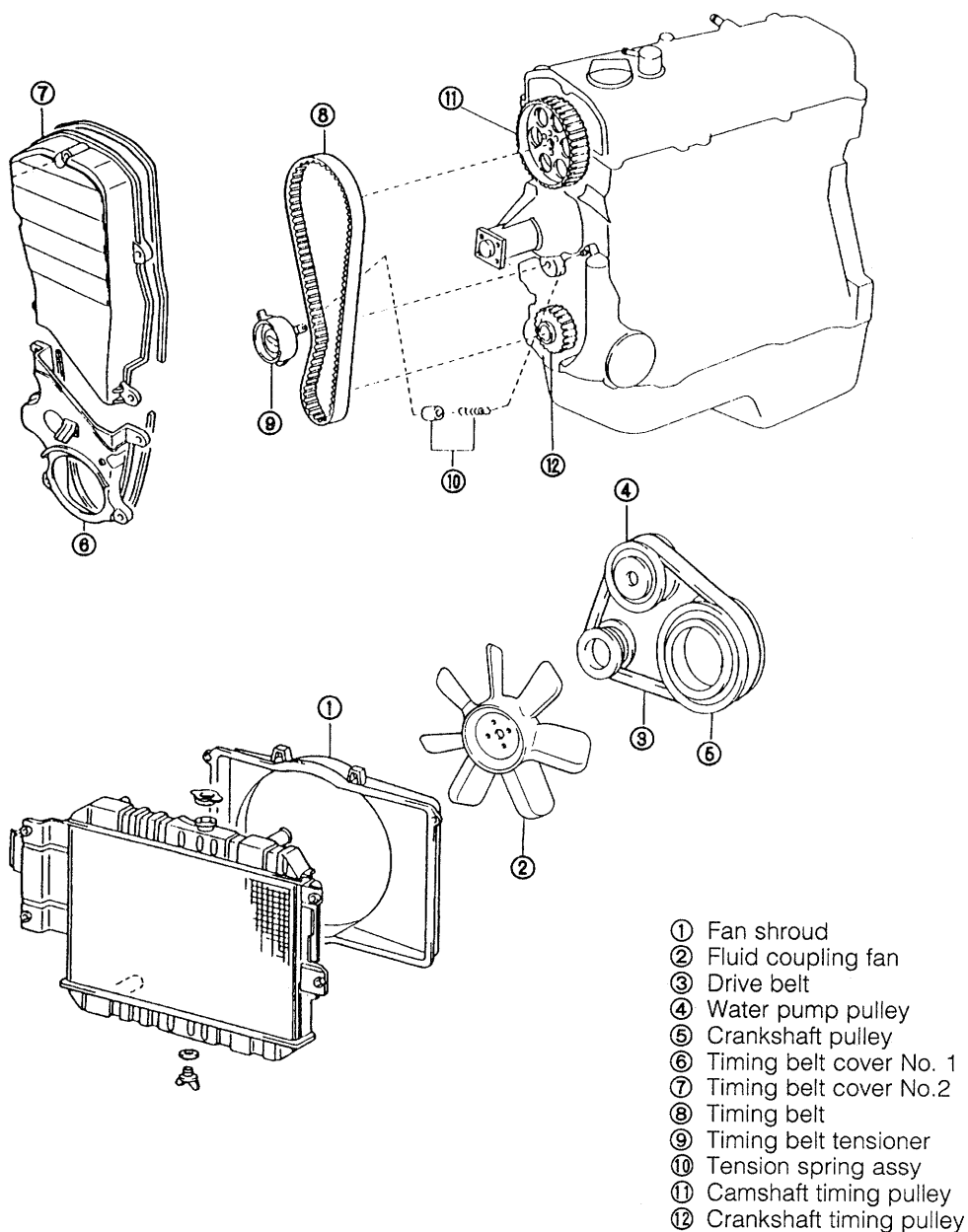
(12) Install the intake air chamber.  
(See page EM-14.)



WRU90-EM043



## TIMING BELT COMPONENTS



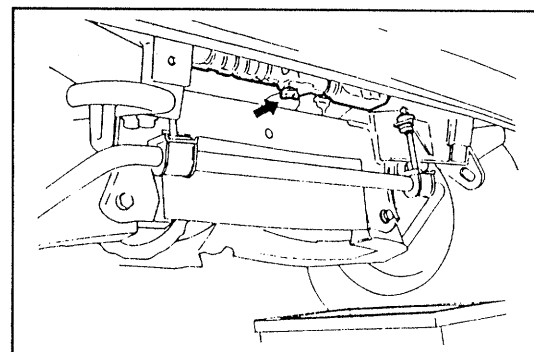
WRU90-EM044

## REMOVAL OF TIMING BELT

1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Remove the engine under cover. Drain the engine coolant about 1 liter from drain plug of the radiator.

### WARNING:

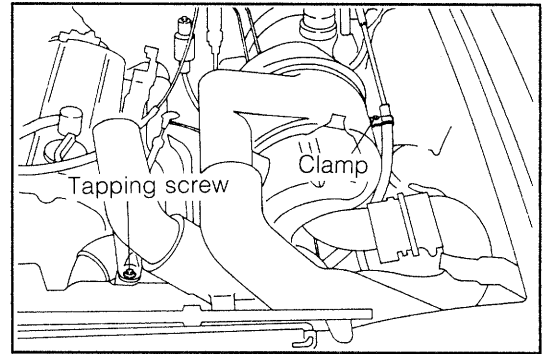
The engine coolant may be very hot. Care must be exercised to avoid getting scalded.



WRU90-EM045

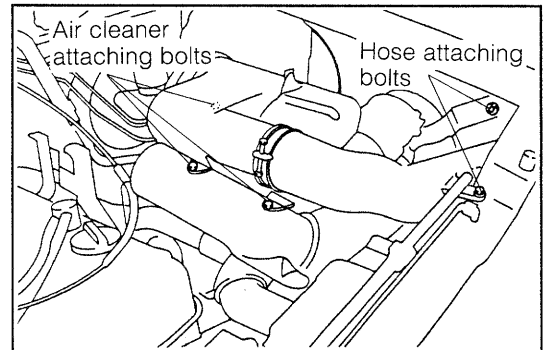
## ENGINE MECHANICALS

3. Removal of air cleaner and air cleaner hose subassembly
- (1) Remove the tapping screw from the radiator fan shroud upper side.
  - (2) Remove the clutch cable clamp provided at the air cleaner.



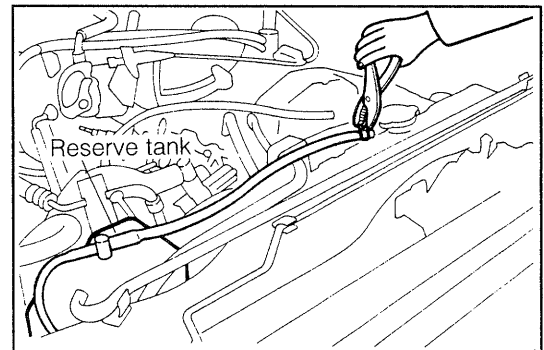
WRU90-EM047

- (3) Remove the air cleaner hose attaching bolts provided at the left fender panel and radiator center support. Remove the three air cleaner attaching bolts. Then remove the air cleaner and air cleaner hose subassembly.



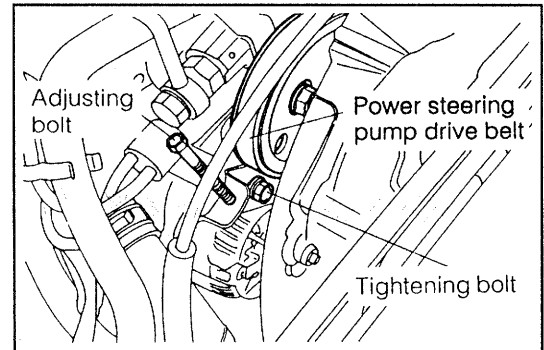
WRU90-EM048

4. Removal of the radiator reserve tank
- (1) Disconnect the radiator reserve tank hose from the radiator.
  - (2) Pull up the radiator reserve tank together with hose.



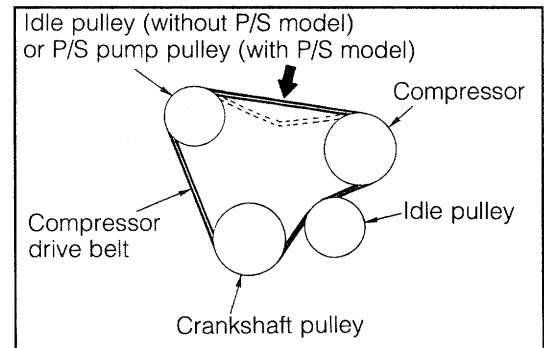
WRU90-EM049

5. Removal of the power steering pump drive belt. (power steering equipped vehicle only)
- (1) Loosen the adjusting bolt and two tightening bolts. Then push down the pump.
  - (2) Remove the drive belt.



WRU90-EM050

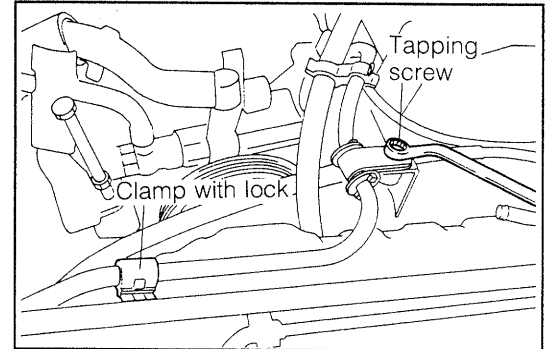
6. Remove the air conditioner drive belt by loosening the adjusting bolt. (air conditioner equipped vehicle)



WRU90-EM051

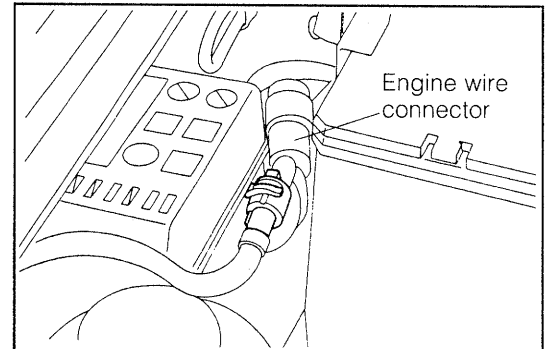
## 7. Disconnection of engine wire

- (1) Remove the tapping screw and detach the clamp with lock.



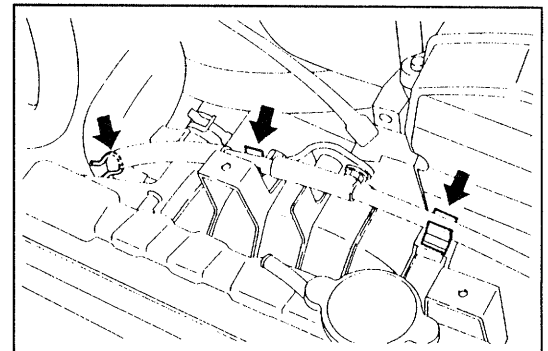
WRU90-EM052

- (2) Disconnect the engine wire connector at the relay box side.



WRU90-EM053

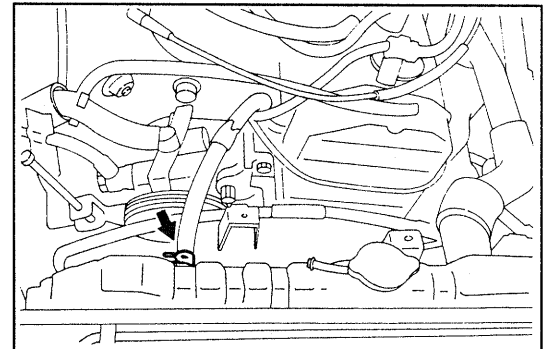
## 8. Remove the three clamps for clutch cable provide on the fan shroud.



WRU90-EM054

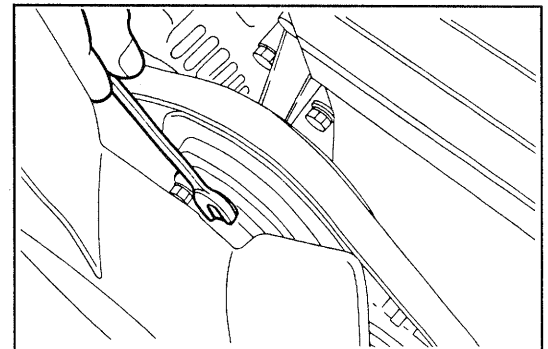
## 9. Removal of fluid coupling with fan and fan shroud

- (1) Disconnect the water hose from the radiator upper tank.



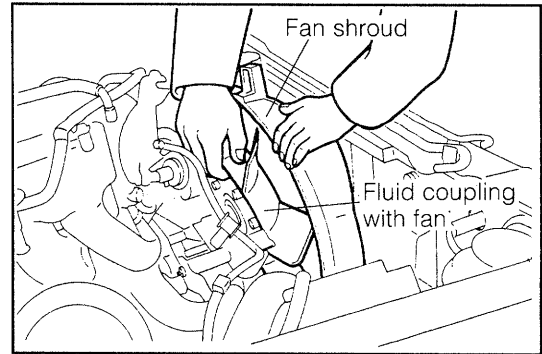
WRU90-EM055

- (2) Remove the four water pump pulley attaching nuts. Then detach the fluid coupling with fan from the water pump pulley temporarily.
- (3) Remove the drive belt by loosening the alternator pulley adjusting bolt.
- (4) Remove the water pump pulley.



WRU90-EM056

- (5) Remove the two fan shroud attaching bolts from the radiator.
- (6) Unlock the lock section of the fan shroud lower part from the radiator by pulling up the fan shroud.
- (7) Remove the fan shroud together with fluid coupling with fan from the engine compartment.

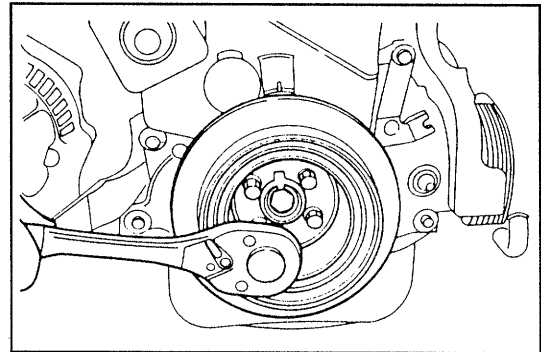


WRU90-EM057

10. Remove the crankshaft pulley by removing the four attaching bolts.

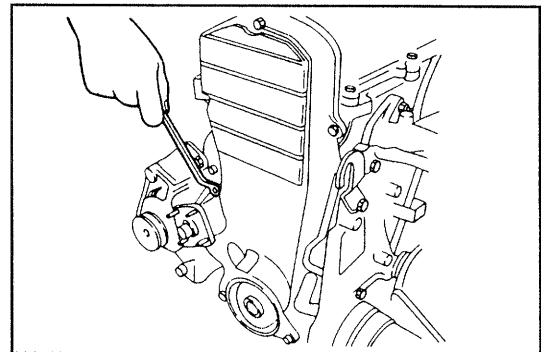
**NOTE:**

- Place the gear shift lever in the 5th gear position so as to prevent the rotation of the crankshaft.



WRU90-EM058

11. Remove the timing belt cover No. 1 and No. 2 by removing the eight bolts.



WRU90-EM059

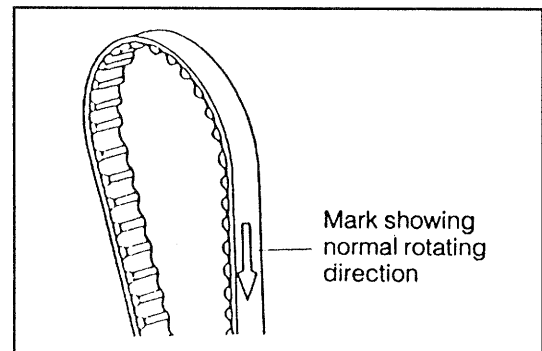
12. Removal of timing belt

**NOTE:**

- Prior to removal of the timing belt, put an arrow mark indicating the normal rotating direction on the belt, using a chalk or the like.

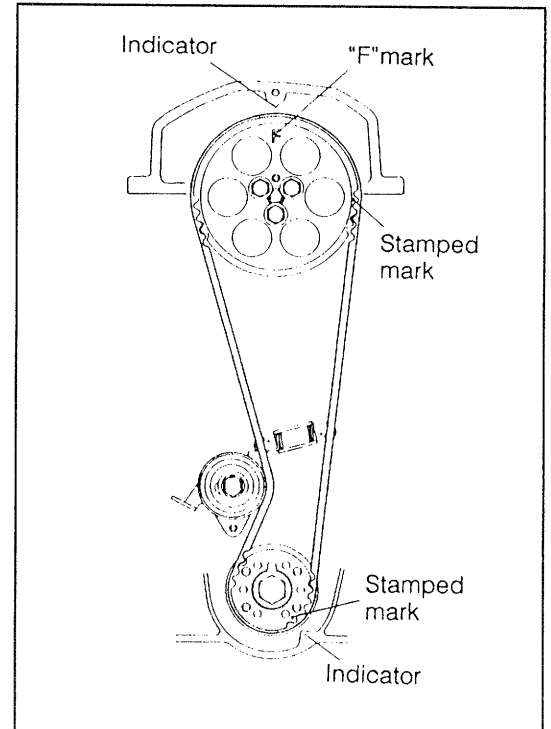
**CAUTION:**

- Do not try to pry the timing belt with a screwdriver or the like during the removal or installation.
- Do not allow the belt to come into contact with oil, water or dust.
- Do not bend the belt at a sharp angle or turn the belt inside out, for it is very vulnerable to bending.
- Do not utilize the tension of the timing belt pulley when loosening the set bolt of the camshaft timing belt pulley.



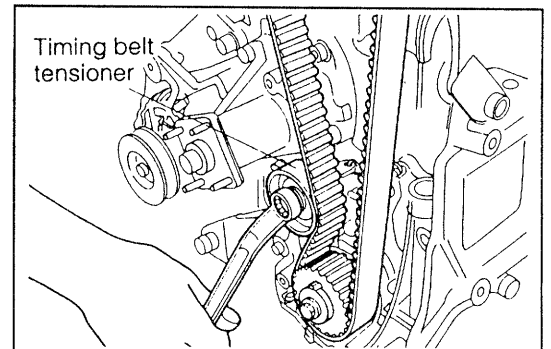
WRU90-EM060

- (1) Rotate the crankshaft until the "F" mark of the camshaft timing belt pulley is aligned with the indicator of the cylinder head cover.



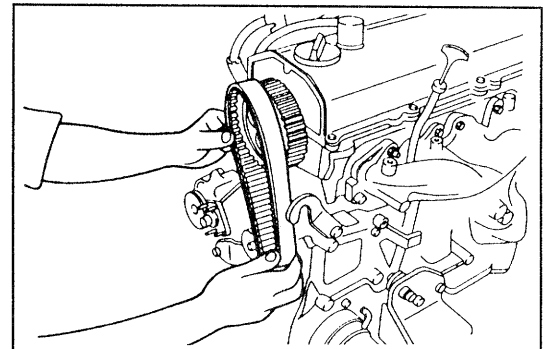
WNU89-EM066

- (2) Loosen the attaching bolt of the timing belt tensioner. Move the tensioner to the left as far as it will go and tighten the bolt temporarily.



WNU89-EM067

- (3) Remove the timing belt.



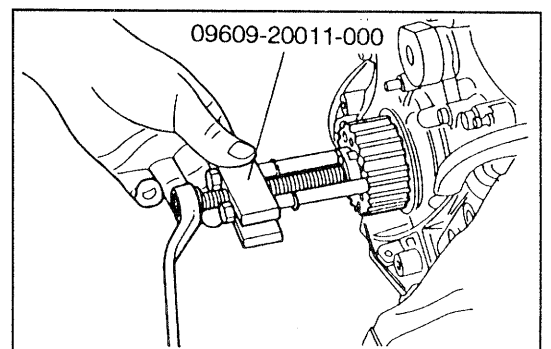
WNU89-EM068

13. Remove the crankshaft timing belt pulley and pulley flange by removing pulley bolt. (If required.)

**NOTE:**

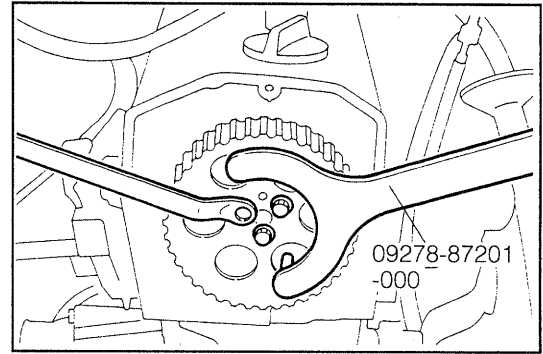
- Prevent the crankshaft from being rotated by placing the gear shift lever in the 5th gear position.
- If any difficulty is encountered in removing the crankshaft timing belt pulley, lightly screw in the set bolt of the crankshaft timing belt pulley. Then, remove the pulley, using the following SST.

SST: 09609-20011-000



WRU90-EM061

14. Removal of camshaft timing belt pulley (If required.)
  - (1) Loosen the attaching bolt of the camshaft timing belt pulley by using the following SST.  
SST: 09278-87201-000
  - (2) Remove the camshaft timing belt pulley.
15. Remove the timing belt tensioner and tension spring.



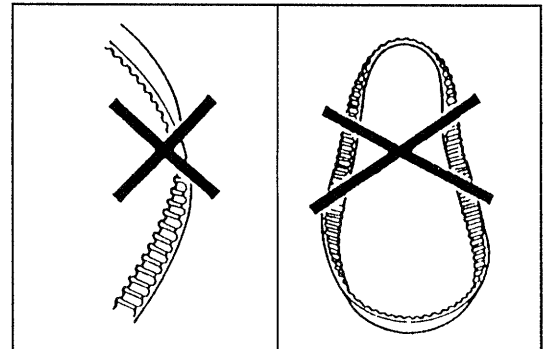
WRU90-EM062

## INSPECTION OF COMPONENTS

1. Timing belt inspection

### CAUTION:

- Do not bend, twist or turn the belt inside out.
- Do not allow the belt to come into contact with oil, water or steam.
- Keep the belt clean.

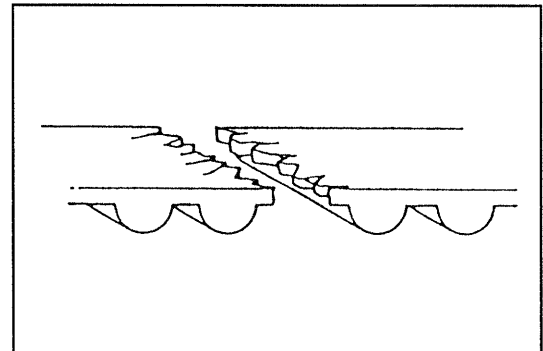


WNU89-EM071

If there are defects, as shown in the figures, check the following points and replace the timing belt, if necessary.

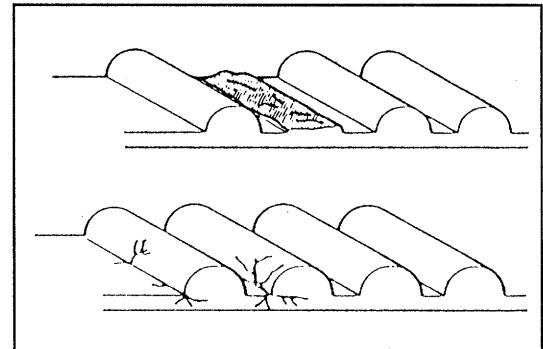
- (1) Premature separation

- Check for proper installation.
- Check the timing gear cover gaskets for damage and check for correct installation.



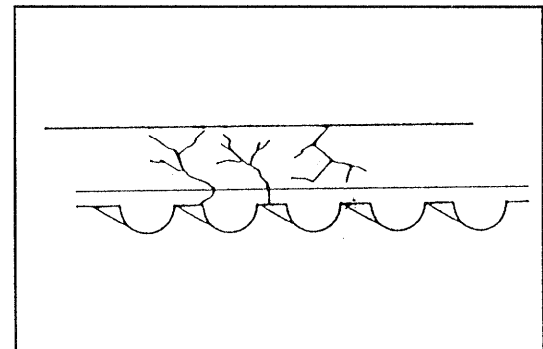
WNU89-EM072

- (2) If the belt teeth are cracked or damaged, check to see if the camshaft is seized.



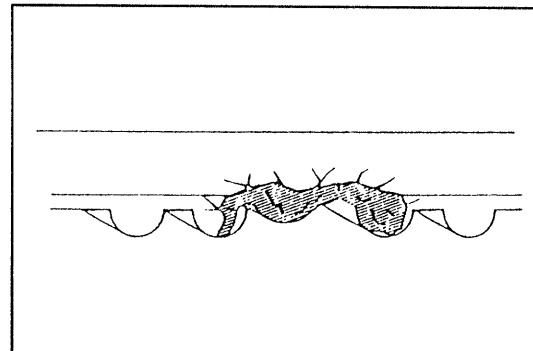
WNU89-EM073

- (3) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on one side of the idler pulley lock.



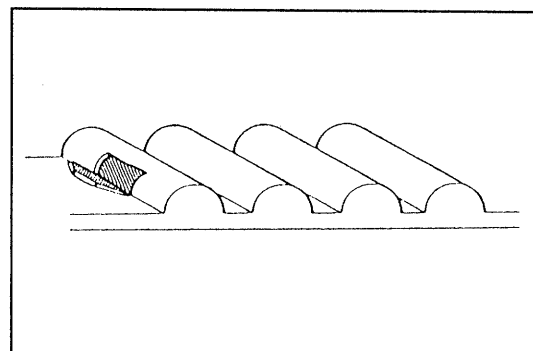
WNU89-EM074

- (4) If there is wear or damage on only one side of the belt, check the pulley flange.



WNU89-EM075

- (5) If there is noticeable wear on the belt teeth, check the timing cover gasket for damage and check for correct gasket installation. Check for foreign material on the pulley teeth.

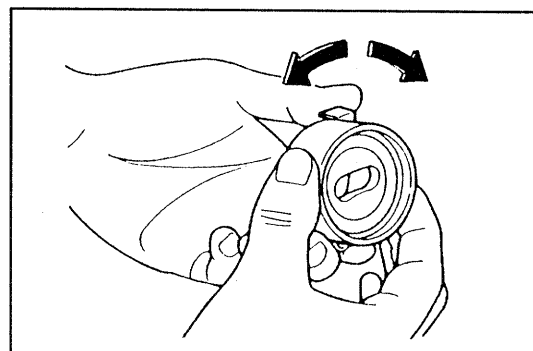


WNU89-EM076

2. Timing belt tensioner inspection
- Check the timing belt tensioner for smooth turning.
  - Check the belt contact surface for damage.
- If necessary, replace the timing belt tensioner.

**CAUTION:**

- Never wash the timing belt tensioner.



WNU89-EM077

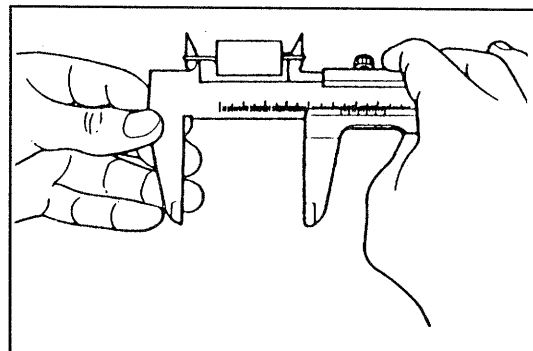
3. Inspection of tension spring

- (1) Check the free length of the spring  
Free length: 46.5 mm (1.83 inch)

- (2) Check the tension of the spring at the specified installation length.

Tension as installed: 3.0 kg at 50.9 mm  
(6.6 lb at 2.0 inch)

If the tension does not conform to the specification, replace the spring.



WRU90-EM400

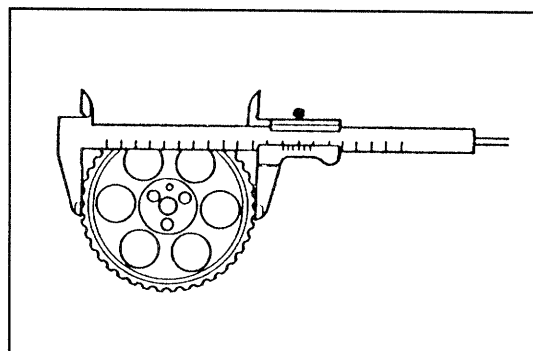
4. Inspection of timing belt pulley

- (1) Measure the maximum diameter of the timing belt pulley, using vernier calipers.

**Reference:**

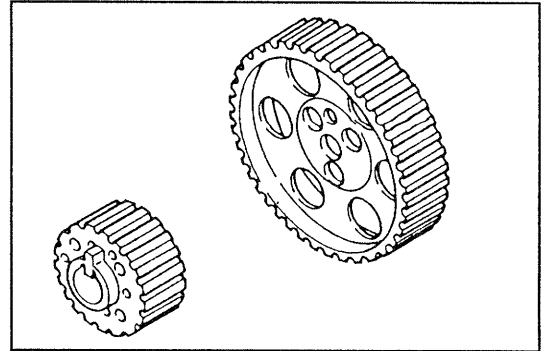
Camshaft timing belt pulley: 119.90 mm (4.720 inch)
-----------------------------------------------------

Crankshaft timing belt pulley: 59.37 mm (2.335 inch)
------------------------------------------------------



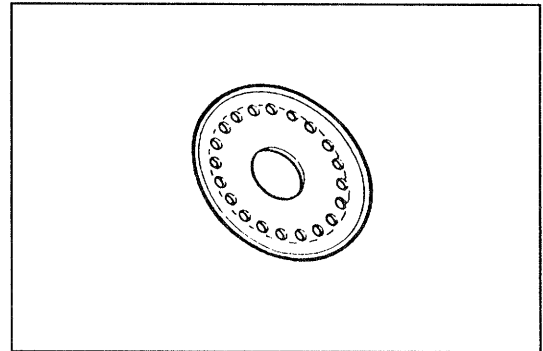
WRU90-EM063

(2) Visually inspect the timing belt pulley for damage.



WNU89-EM080

5. Inspection of crankshaft timing belt pulley flange  
Check the crankshaft timing belt pulley flange for bend, damage and wear.  
If necessary, replace the crankshaft timing belt pulley flange.



WNU89-EM081

## INSTALLATION OF TIMING BELT

(See page EM-21.)

### NOTE:

- Check the water pump for water leakage and the oil seal for oil leakage.

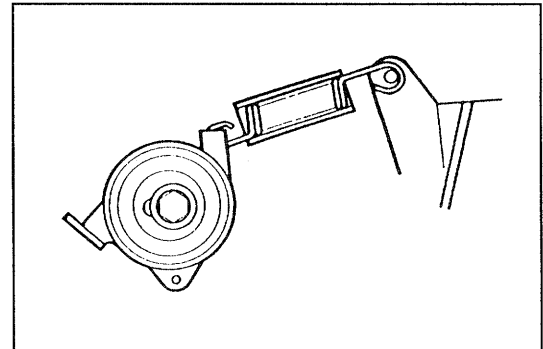
Repair any water leakage or oil leakage, if necessary.

WRU90-EM064

1. Attach the tension spring to the timing belt tensioner. Hang the tension spring hook on the pin. Assemble the timing belt tensioner in place and install the bolt.

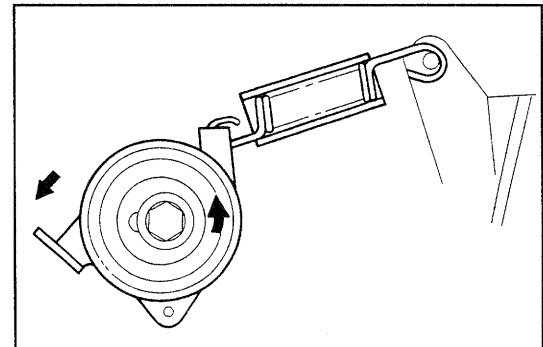
### CAUTION:

- Hang the spring hook securely on the pin groove.
- Ensure that the pin at the oil pump is fitted into the pin hole of the timing belt tensioner.



WNU89-EM083

2. While pulling the timing belt tensioner fully toward the water pump side, temporarily tighten the attaching bolt of the timing belt tensioner.

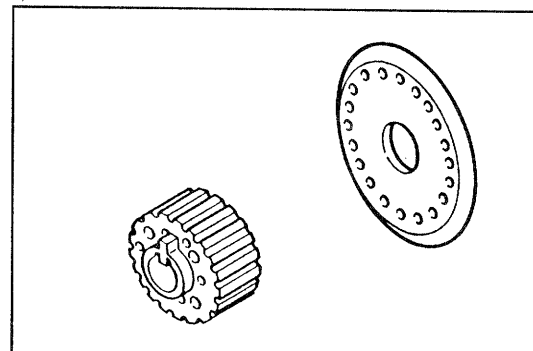


WRU90-EM065



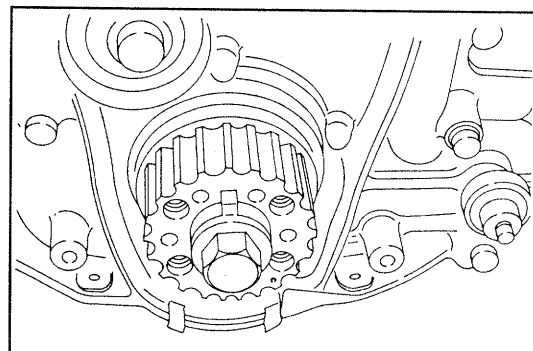
## 3. Installation of crankshaft timing belt pulley

- (1) Install the crankshaft timing belt pulley flange with its recessed side facing toward the oil pump side.



WNU89-EM085

- (2) Install the crankshaft timing belt pulley on the crankshaft by aligning it with the key groove. Install the setting bolt of the crankshaft timing belt pulley. Align the drilled mark of the crankshaft timing belt pulley with the indicator.

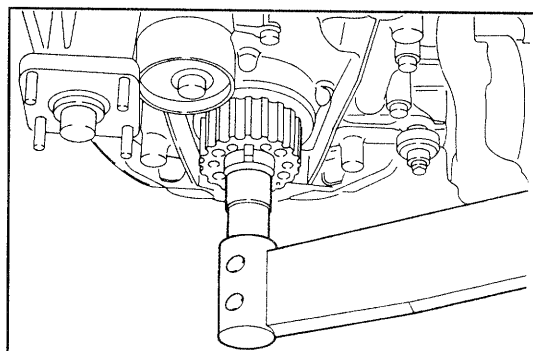


WRU90-EM066

- (3) Tighten the crankshaft timing belt pulley bolt.  
Tightening Torque: 9.0 - 10.0 kg-m  
(65.1 - 72.0 ft-lb, 88.3 - 98.0 N-m)

### NOTE:

- Prevent the crankshaft from being rotated by placing the gear shift lever in the 5 gear.



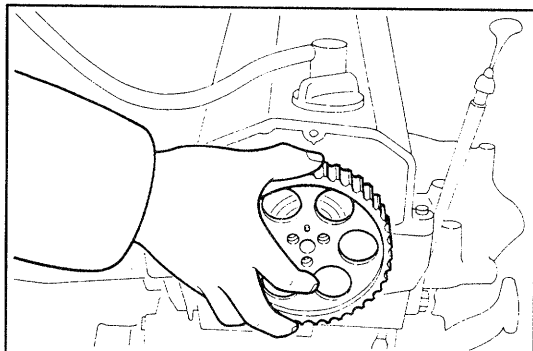
WRU90-EM067

## 4. Installation of camshaft timing belt pulley

- (1) Install the camshaft timing belt pulley on the camshaft in such a way that the "F" mark can be seen and the locating pin hole is aligned.

### NOTE:

- Remove any oil or water from the camshaft timing belt pulley. Keep the pulley clean.

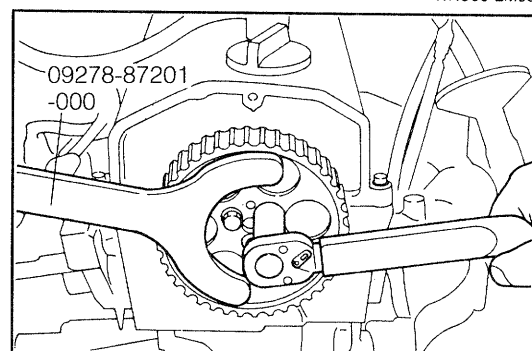


WRU90-EM068

- (2) Install the three attaching bolts of the camshaft timing belt pulley, while preventing the pulley from turning by using the following SST.

SST: 09278-87201-000

Tightening Torque: 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.8 - 21.5 N-m)



WRU90-EM069

### CAUTION:

- Never allow the camshaft to turn.

### 5. Installation of timing belt

#### CAUTION:

- Do not try to pry the timing belt with a screwdriver or the like.
- Do not allow the belt to come into contact with oil, water or dust.
- Do not bend the belt at a sharp angle or turn the belt inside out.
- Perform the engine turning operation at the crankshaft side.
- Do not utilize the tension of the timing belt when tightening the set bolt of the timing belt pulley.
- When the timing belt is reused, install the timing belt in such a way that the direction of the arrow put during the removal may match with the engine rotation direction.
- The adjustment of belt tension should be made when the cylinder block and its ambient temperatures are in between 5 - 50°C (41 - 122°F).

WRU90-EM070

- (1) Align the "F" mark of the camshaft timing belt pulley with the indicator on the cylinder head cover.

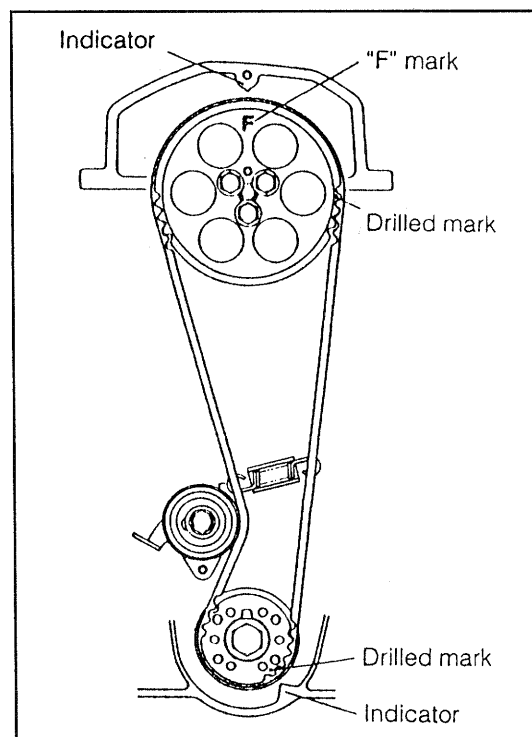
#### CAUTION:

- It should be noted that the piston may interfere with the valves if the camshaft is turned independently.

- (2) Align the drilled mark of the crankshaft timing belt pulley with the indicator with the indicator.

#### CAUTION:

- It should be noted that the piston may interfere with the valves if the crankshaft is turned independently.

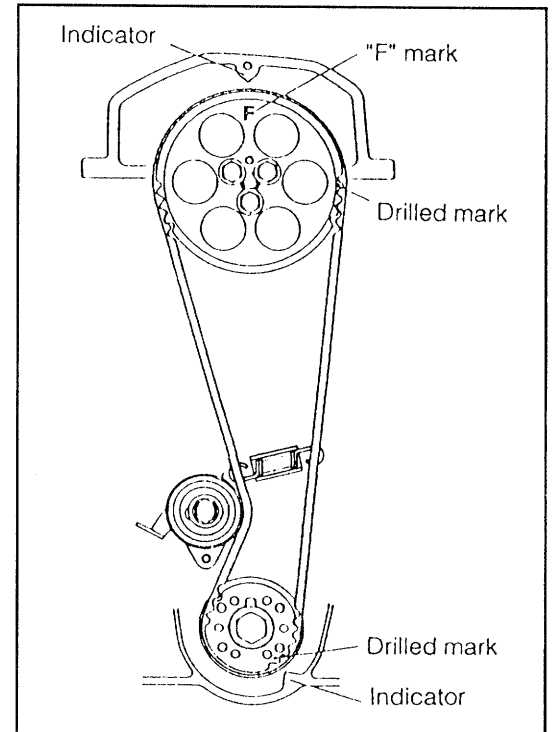


WNU89-EM099

- (3) Assemble the timing belt in such a way that the two mating marks on the timing belt may be aligned with the corresponding drilled marks on the crankshaft timing belt pulley and camshaft timing belt pulley.

**NOTE:**

- When the timing belt is reused, install the timing belt in such a way that there exist 35 teeth of the belt between the drilled marks of the crankshaft timing belt pulley and camshaft timing belt pulley.
- When the timing belt is reused, install the timing belt in such a way that the arrowhead which was put on during disassembly points in the direction of engine rotation.

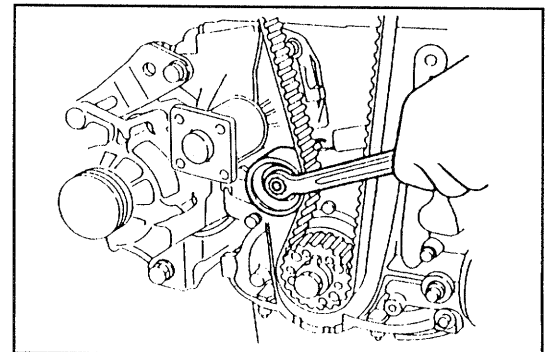


WRU90-EM401

- (4) Loosen the attaching bolt of the timing belt tensioner. Apply tension to the timing belt. Temporarily tighten the attaching bolt.

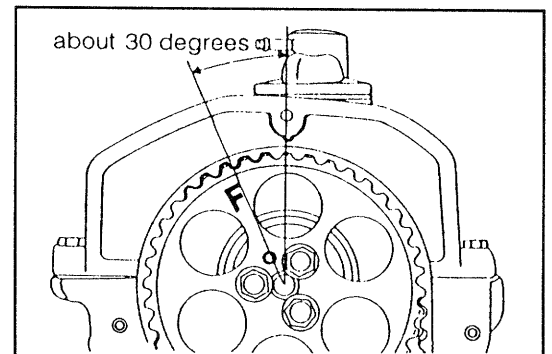
**NOTE:**

- Ensure that the belt exhibits no slack at the tension side of the belt (the side opposite to the tensioner).



WRU90-EM071

- (5) Rotate the crankshaft 1.9 turns in the normal direction (to the right as viewed from the engine cylinder No. 1) so that the "F" mark of the camshaft timing belt pulley comes at a point three teeth in the camshaft timing belt pulley before the indicator of the cylinder head cover.

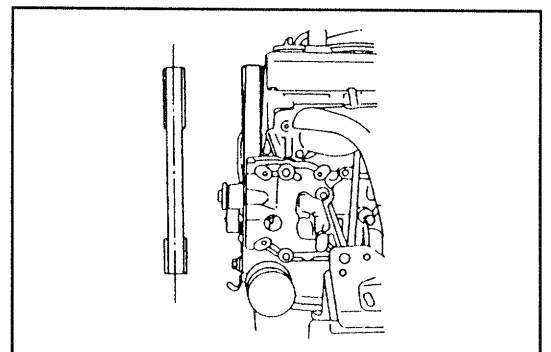


WNU89-EM102

**CAUTION:**

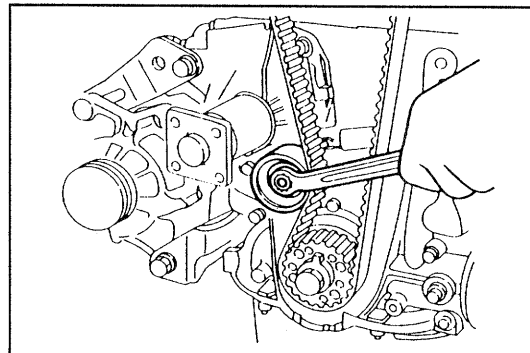
- At this time, never turn the crankshaft reversely.
- Make sure that the belt is not tilted between the crankshaft timing belt pulley and the camshaft timing belt pulley.

If the crankshaft should be reversed or the timing belt should be tilted, turn the crankshaft two more turns.



WNU89-EM103

- (6) Make the tensioner free by loosening the attaching bolt of the timing belt tensioner.

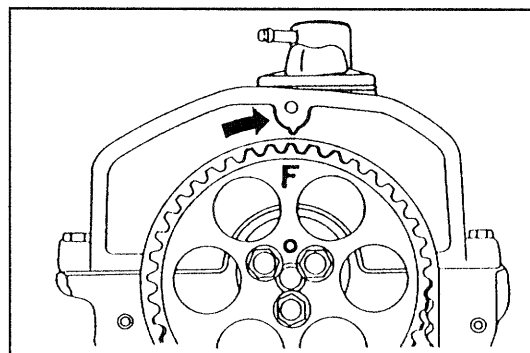


WNU89-EM104

- (7) Turn the crankshaft further in the normal direction until the "F" mark of the camshaft timing belt pulley is aligned with the indicator of the cylinder head cover.

**CAUTION:**

- Never turn the crankshaft reversely.
- Never turn the crankshaft beyond the point where the "F" mark of the camshaft timing belt pulley is aligned with the indicator.

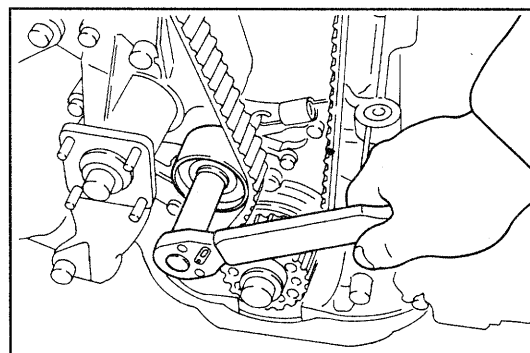


WNU89-EM105

If the crankshaft should be reversed or turned beyond that point, temporarily tighten the tensioner attaching bolt and repeat the operations from the step (5) onward.

- (8) Tighten the attaching bolt of the timing belt tensioner to the specified torque.

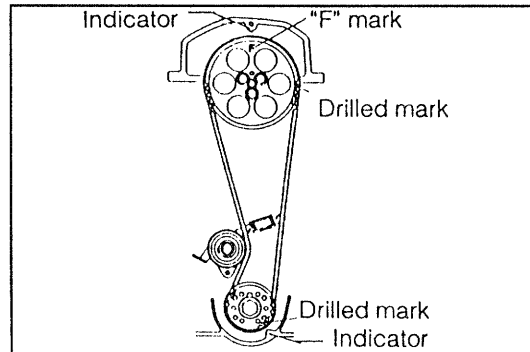
**Tightening Torque:** 3.0 - 4.5 kg-m  
(21.7 - 32.5 ft-lb, 29.4 - 44.1 N-m)



WRU90-EM072

- (9) Ensure that the drilled marks of the crankshaft timing belt pulley and camshaft timing belt pulley are aligned with the corresponding indicators.

If the drilled mark is not aligned with the indicator, repeat the operations from the step (1) onward.



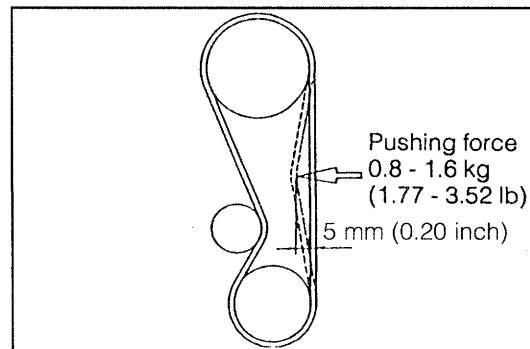
WNU89-EM107

**6. Check of timing belt tension**

When the midpoint of the belt at the tension side is pushed 5.0 mm (0.20 inch), ensure that the pushing force is 0.8 - 1.6 kg (1.77 - 3.52 lb).

**Specified Pushing Force:** 0.8 - 1.6 kg (1.77 - 3.52 lb)  
When belt is deflected 5.0 mm (0.20 inch)

If the belt does not conform to the specification, repeat the operations from the step 5 (4) onward.



WRU90-EM073

## 7. Installation of timing belt cover

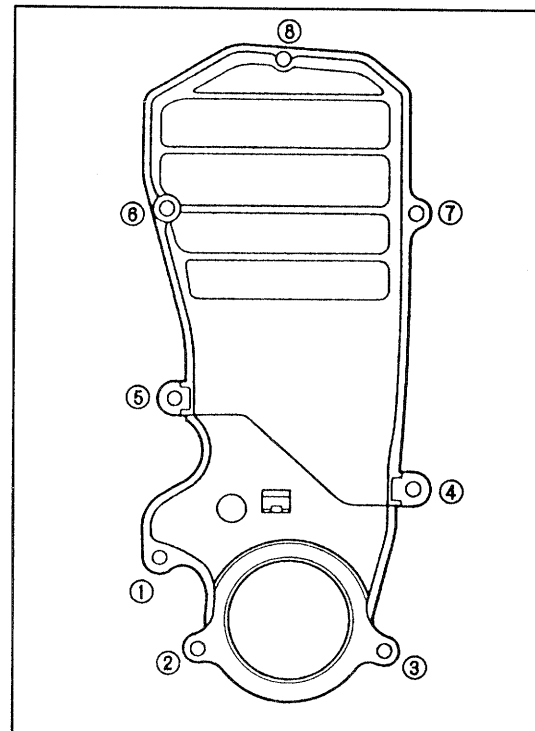
- (1) Install the timing belt cover No. 1 (lower side) with three bolts.

### NOTE:

- First, attaching bolts ① and ④ should be installed.
- Attaching bolts ④ and ⑤ in the figure are tightened both upper and lower side cover.

- (2) Install the timing belt cover No. 2 (upper side) with five bolts.

**Tightening Torque:** 0.2 - 0.4 kg-m  
(1.4 - 2.9 ft-lb, 2.0 - 3.9 N·m)  
(For both upper and lower cover)

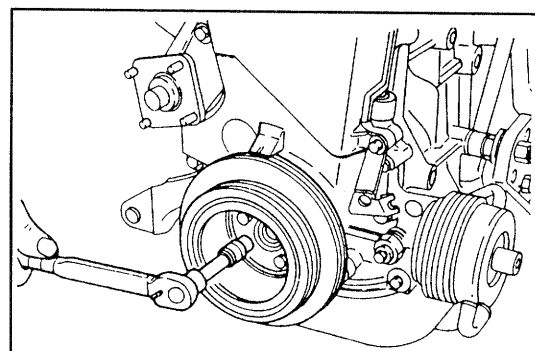


WRU90-EM074

## 8. Installation of crankshaft pulley

- (1) Prevent the crankshaft from turning by placing the gear shift lever in the 5th gear position, and pull the parking break lever.
- (2) Install the crankshaft pulley on the crankshaft timing belt pulley with four bolts.

**Tightening Torque:** 2.0 - 3.0 kg-m  
(14.5 - 21.6 ft-lb, 19.6 - 29.4 N·m)



WRU90-EM075

## 9. Installation of fluid coupling with fan and fan shroud

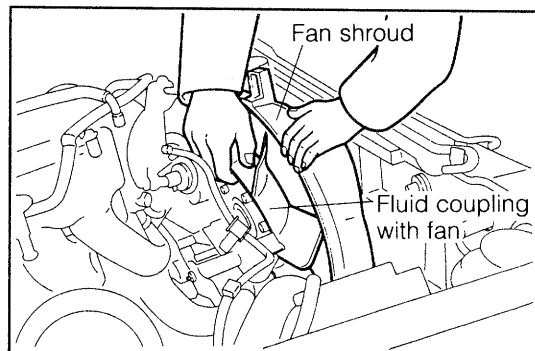
- (1) Temporarily install the water pump pulley.
- (2) Insert the radiator fan shroud together with the fluid coupling with fan between radiator and the engine.

### NOTE:

- Be sure that water pump pulley is seated properly to the water pump.

- (3) Install the fluid coupling with fan to the water pump by means of four bolts through water pump pulley.

**Tightening Torque:** 1.0 - 1.8 kg-m  
(7.2 - 13.0 ft-lb, 9.8 - 17.7 N·m)



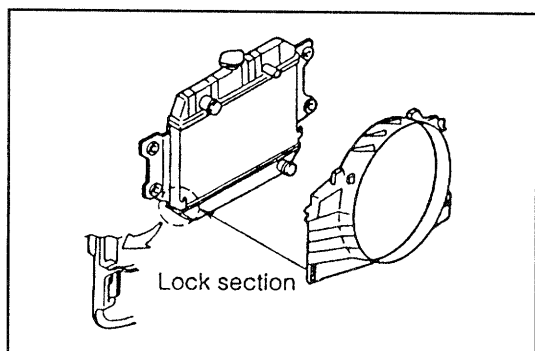
WRU90-EM076

### REFERENCE:

Tightening torque of fluid coupling and fan is as follows.

0.44 - 0.66 kg-m (3.2 - 4.8 ft-lb, 4.3 - 6.5 N·m)

- (4) Insert the lock section of fan shroud to the radiator. Then, tighten the two attaching bolts of the radiator upper side.
- (5) Connect the water hose to the radiator upper tank. Securely clamp the water hose clamp.



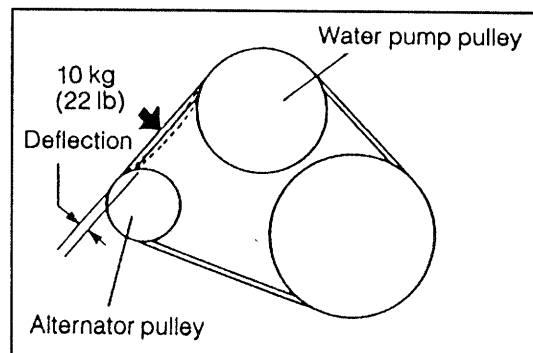
WRU90-EM077

## 10. Installation of V ribbed belt

- (1) Install the V ribbed belt.
- (2) Perform the adjustment in such a way that the deflection at the midpoint between the water pump pulley and the alternator may become the specified value when a force of 10 kg (22 lb) is applied to the midpoint.

### Specified Belt Deflection:

- New Belt:** 4.0 - 5.0 mm (0.157 - 0.197 inch)  
With a force of 10 kg (22 lb) applied to point indicated in figure
- Used Belt:** 5.0 - 6.0 mm (0.197 - 0.236 inch)  
With a force of 10 kg (22 lb) applied to point indicated in figure



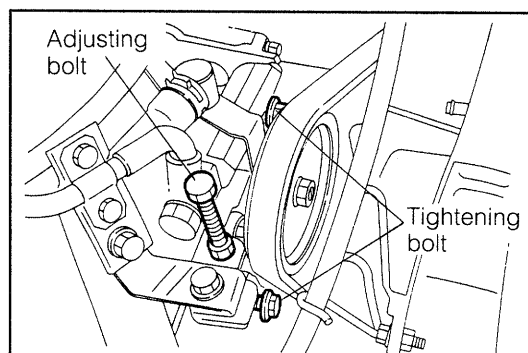
WRU90-EM078

### NOTE

- The term "used belt" denotes a belt which has been used for more than five minutes after it was put into use.

## 11. Installation of power steering drive belt (power steering equipped vehicle only)

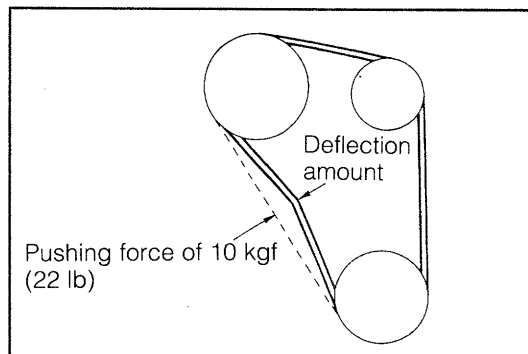
- (1) Install the power steering drive belt.



WRU90-EM079

- (2) Set the drive belt tension to the specified value by tightening the adjusting bolt.

**Specified Deflection:** 9 - 11 mm (0.35 - 0.43 inch)  
[When a force of 10 kg (22 lb) is applied]

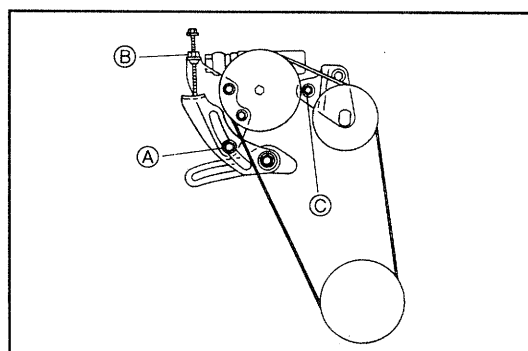


WRU90-EM080

- (3) Tighten the bolts and nut to the specified value.

### Tightening Torque:

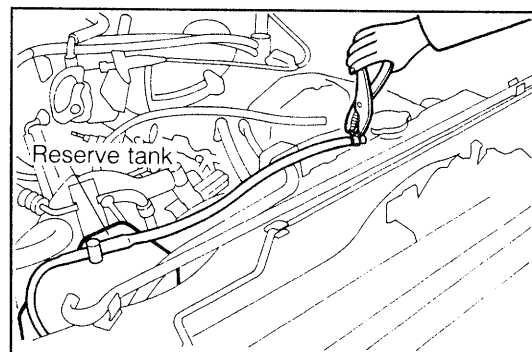
- Ⓐ ..... 3.5 - 4.5 kg-m  
(25.3 - 32.5 ft-lb, 34.3 - 44.1 N·m)
- Ⓑ ..... 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)
- Ⓒ ..... 5.0 - 7.0 kg-m  
(36.2 - 50.6 ft-lb, 49.0 - 68.6 N·m)



WRU90-EM081

## 12. Installation of reserve tank

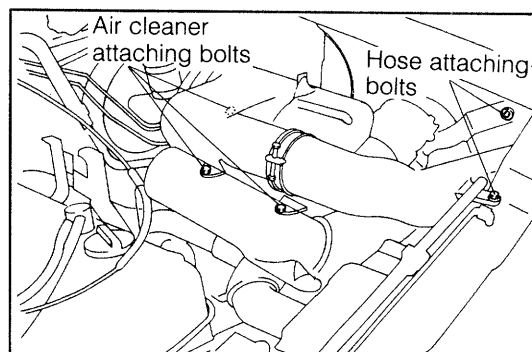
- (1) Install the reserve tank to the radiator assy bracket.
- (2) Insert the reserve tank hose to the radiator with clip.



WRU90-EM082

## 13. Installation of air cleaner and air cleaner hose

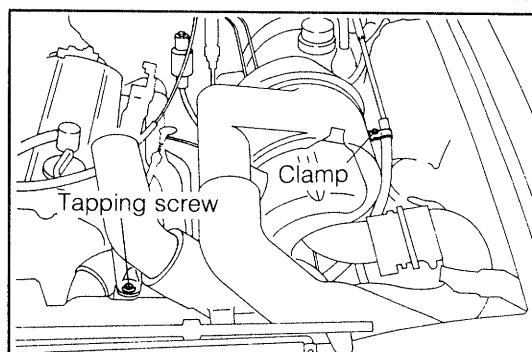
- (1) Put the air cleaner and air cleaner hose into position.
- (2) Tighten the three air cleaner attaching bolts.
- (3) Tighten the air cleaner hose attaching bolts provided at the left fender panel and the radiator center support.



WRU90-EM083

## 14. Install the clutch cable clamp provided at the air cleaner.

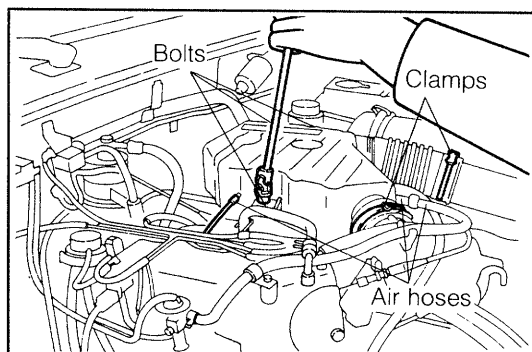
## 15. Install the tapping screw onto the radiator fan shroud upper side.



WRU90-EM084

## 16. Install the intake air chamber.

(See page EM-14)



WRU90-EM085

## 17. Pour the engine coolant about 1 liter into the radiator.

### NOTE:

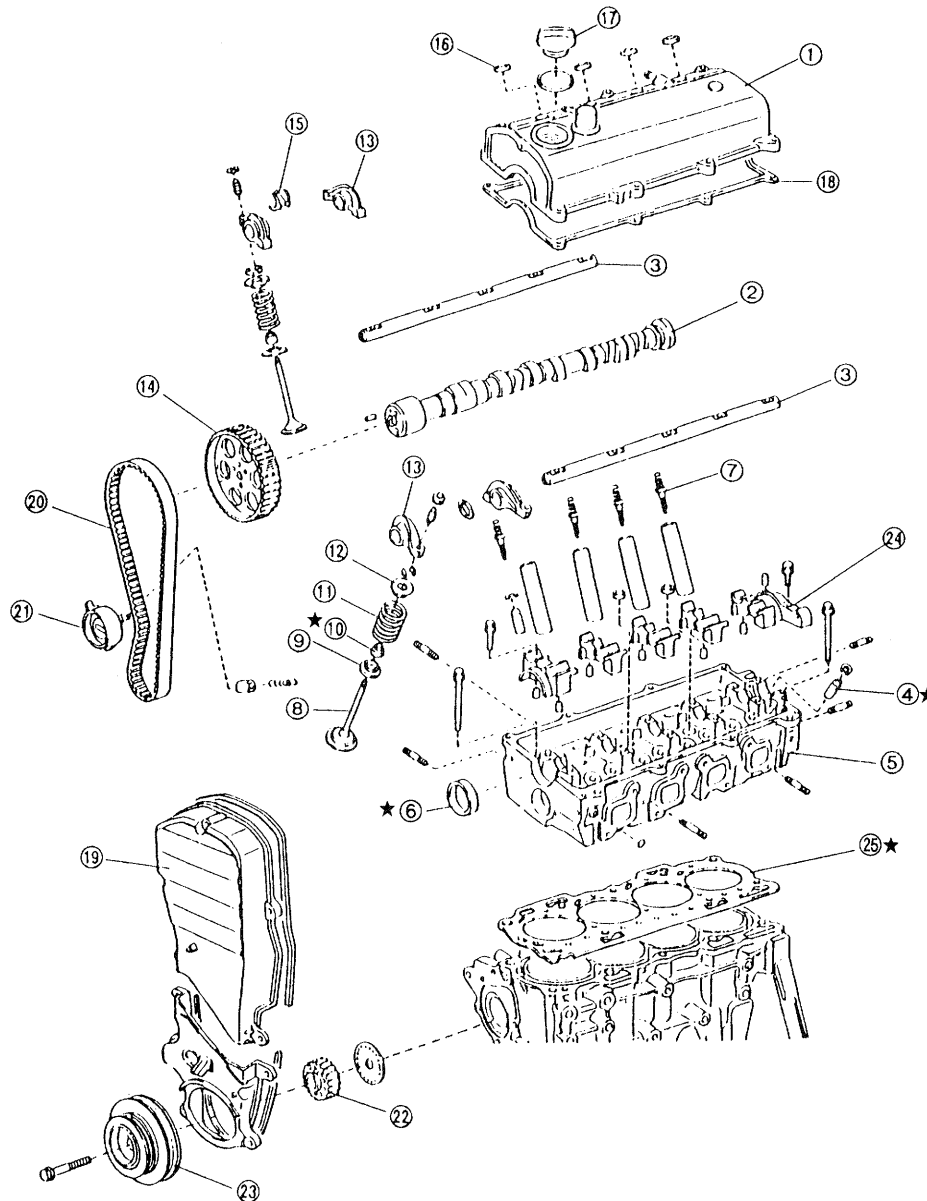
- Use the engine coolant which is drained from radiator in the step 2 of removal of timing belt.

## 18. Connect the battery ground cable to the negative (-) terminal of the battery.

WRU90-EM086

## CYLINDER HEAD COMPONENTS

★: Non-reusable parts



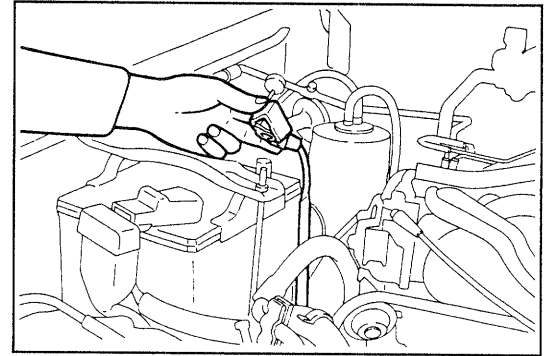
- ① Cylinder head cover
- ② Camshaft
- ③ Valve rocker shaft
- ④ Valve guide
- ⑤ Cylinder head
- ⑥ Oil seal
- ⑦ Spark plug
- ⑧ Valve
- ⑨ Spring seat
- ⑩ Valve stem oil seal
- ⑪ Valve spring
- ⑫ Valve spring retainer
- ⑬ Valve rocker arm

- ⑭ Camshaft timing belt pulley
- ⑮ Spacer
- ⑯ Grommet
- ⑰ Oil filler cap
- ⑱ Gasket
- ⑲ Timing belt upper cover
- ⑳ Timing belt
- ㉑ Timing belt tensioner
- ㉒ Crankshaft timing belt pulley
- ㉓ Crankshaft pulley
- ㉔ Camshaft cap
- ㉕ Cylinder head gasket



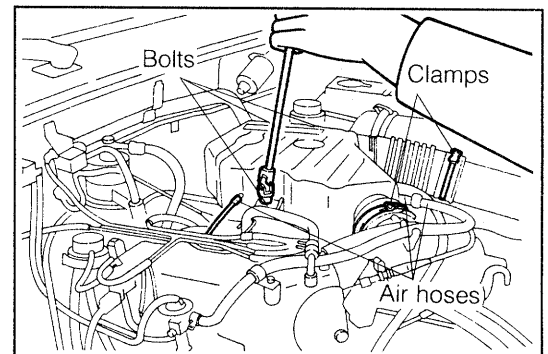
## REMOVAL OF CYLINDER HEAD WITH MANIFOLDS

1. Removal of battery
  - (1) Disconnect the battery ground cable from the negative (–) terminal of the battery. Then disconnect the positive cable from the positive (+) terminal.
  - (2) Remove the battery from the engine compartment by removing the battery holding clamp.
2. Drain the coolant. (See page CO–3.)
3. Drain the engine oil. (See page LU–4.)
4. Removal of engine hood
  - (1) Disconnect the window shield washer hose.
  - (2) Remove the engine hood by removing four bolts.



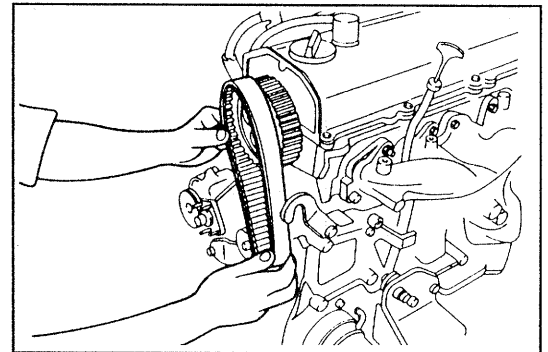
WRU90-EM088

5. Remove the intake air chamber. (See page EM–10.)



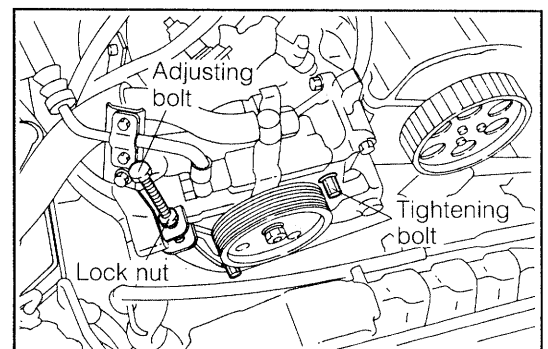
WRU90-EM090

6. Remove the timing belt. (See page EM–21 to EM–25.)



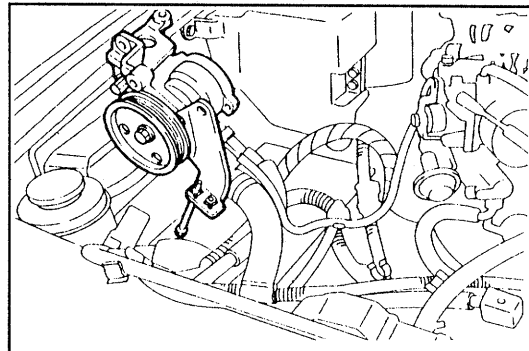
WRU90-EM091

7. Removal of the power steering pump (power steering equipped vehicle)
  - (1) Loosen the lock nut, adjusting bolt and two tightening bolts. Then push down the pump.



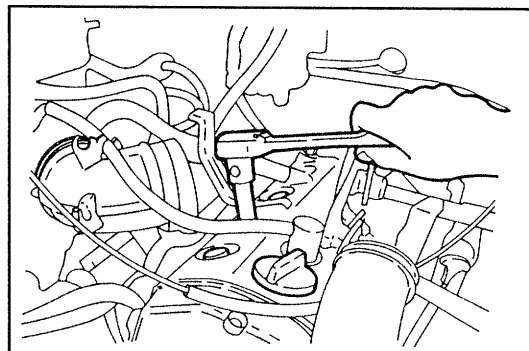
WRU90-EM092

- (2) Remove the power steering pump assembly from the engine by removing three bolts. Then temporarily put the pump assembly onto the battery mounting location.



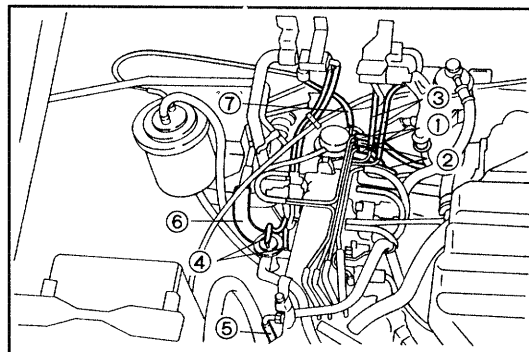
WRU90-EM093

8. Removal of spark plug
  - (1) Remove the spark plug wires.
  - (2) Remove the spark plugs, using the plug wrench (16 mm) or the following SST.  
SST: 09268-87703-000



WRU90-EM094

9. Removal of following vacuum hoses at surge tank side
  - (1) Distributor diaphragm ①
  - (2) BVSV ②
  - (3) Pressure VSV ③
  - (4) Air conditioner idle up VSV ④
  - (5) Power steering ACV ⑤
  - (6) Brake booster ⑥
  - (7) Charcoal canister ⑦

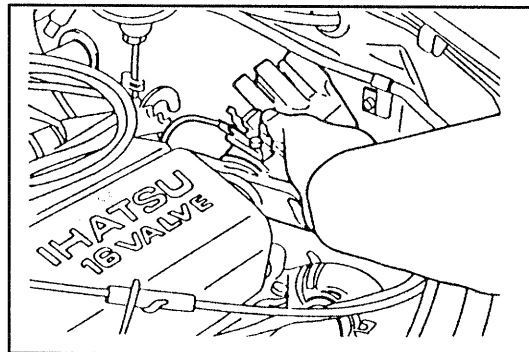


WRU90-EM095

10. Removal of distributor
  - (1) Disconnect the distributor wire connector.
  - (2) Remove the distributor from the cylinder head by removing the two attaching bolts.

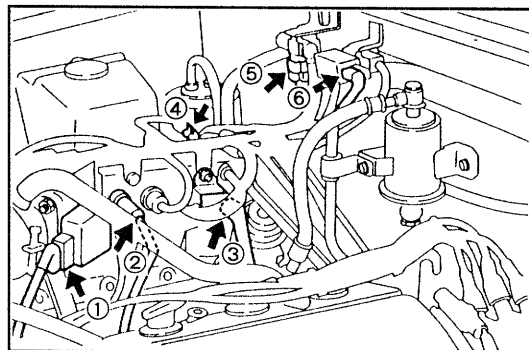
**NOTE:**

- Since the remaining engine oil will flow out, be certain to place a cloth etc..



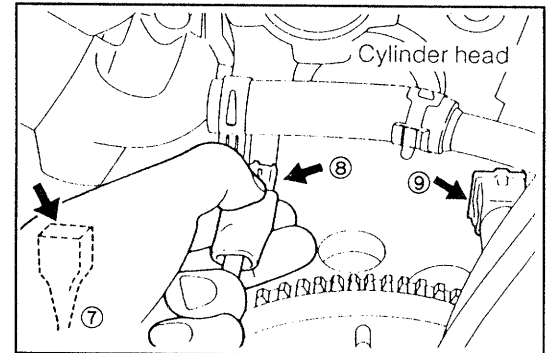
WRU90-EM096

11. Removal of engine wire harness
  - (1) Disconnect the following connectors.
    - ① Throttle position sensor ①
    - ② Intake air temperature sensor ②
    - ③ Idle speed control VSV ③
    - ④ EGR VSV and harness clamp ④
    - ⑤ Air-conditioner idle up VSV ⑤
    - ⑥ Pressure sensor, pressure VSV and clamp ⑥



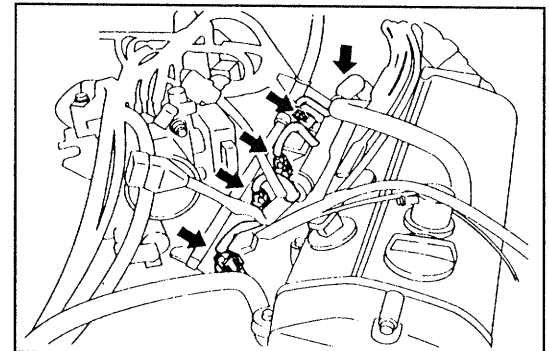
WRU90-EM097

- ⑦ Air conditioner water temperature switch ⑦
- ⑧ Water temperature sender gauge ⑧
- ⑨ Water temperature sensor ⑨
- ⑩ Oxygen sensor



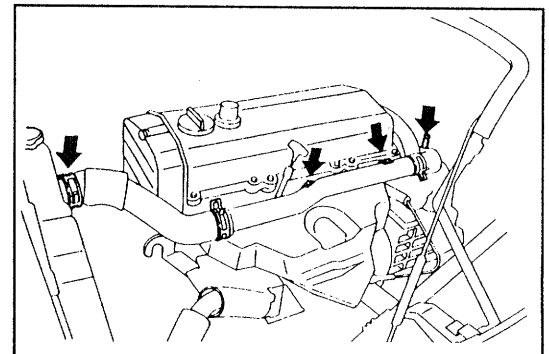
WRU90-EM098

- (2) Disconnect the four injector connectors.
- (3) Remove the engine wire clamps and engine ground cables.



WRU90-EM099

- 12. Remove the radiator hose No. 1 from the radiator upper tank by loosening the two clamps and two attaching bolts.



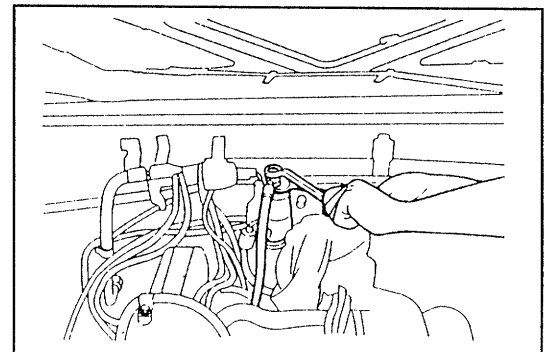
WRU90-EM100

- 13. Disconnect the hose No. 1 from the fuel filter.

**CAUTION:**

- Release the inner pressure of the fuel tank by removing the fuel filler cap in advance.
- The fuel pressure inside the fuel line is set to a pressure 2.55 kg/cm<sup>2</sup> (36.3 psi) higher than the atmospheric pressure.

Hence, gradually loosen the connection while preventing the fuel from splashing with a cloth or the like.

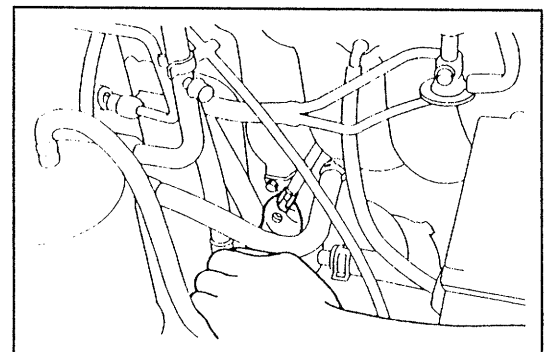


WRU90-EM101

- 14. Disconnect the fuel return hose from the fuel pipe No. 2.

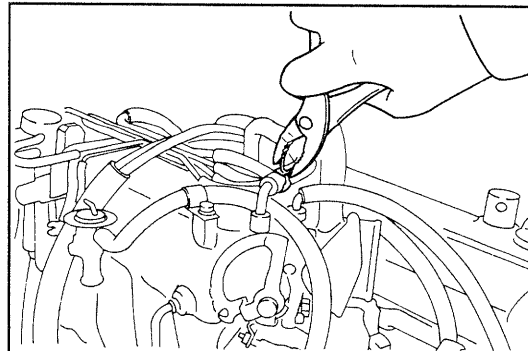
**CAUTION:**

- When disconnecting the fuel hose, take precautionary measures to prevent any dirt from entering into the fuel line.
- Place a suitable container or rags under the disconnecting portion because the fuel flows out.



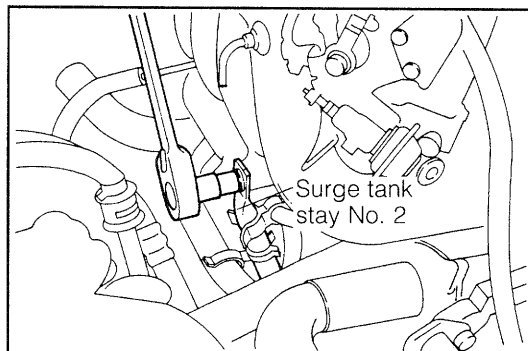
WRU90-EM102

15. Disconnect the water hose from the throttle body upper side.



WRU90-EM103

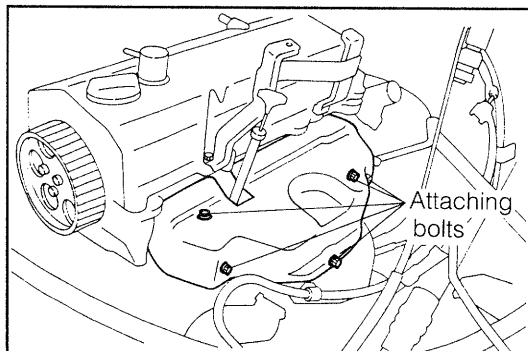
16. Remove the surge tank stay No. 2 from the surge tank.



WRU90-EM104

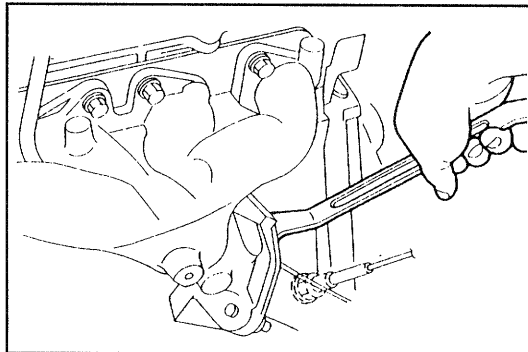
17. Remove the exhaust manifold cover by removing the five bolts.

18. Remove the oil level gauge support by removing the clamping bolt.



WRU90-EM105

19. Disconnect the exhaust pipe from the exhaust manifold by removing the three attaching nuts.



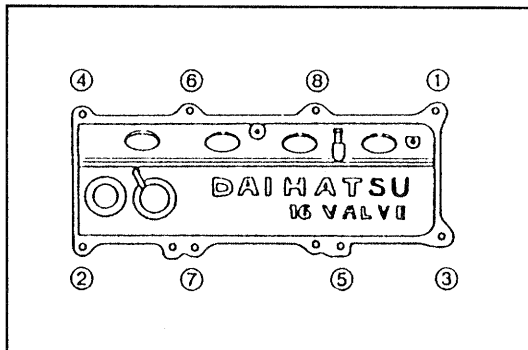
WRU90-EM106

20. Removal of cylinder head cover

- (1) Remove the air chamber bracket and the accelerator cable clamp from the cylinder head cover.

- (2) Loosen the cylinder head cover attaching bolts evenly over two or three stages in the sequence indicated in the figure.

Remove the cylinder head cover attaching bolts.



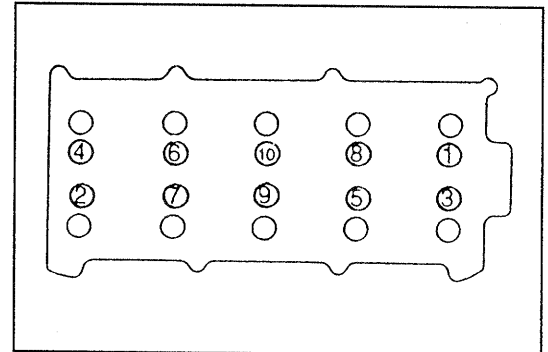
WRU90-EM107

## 21. Removal of cylinder head

- (1) Loosen the cylinder head bolts, using a hexagon wrench.

**CAUTION:**

- Loosen the cylinder head bolts evenly over two or three stages in the sequence indicated in the figure.

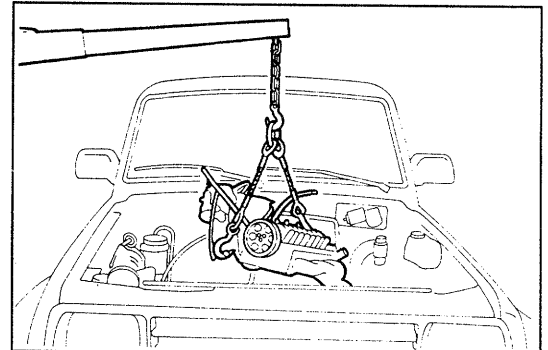


WRU90-EM108

- (2) Remove the cylinder head with intake and exhaust manifold by using the chain block.

**CAUTION:**

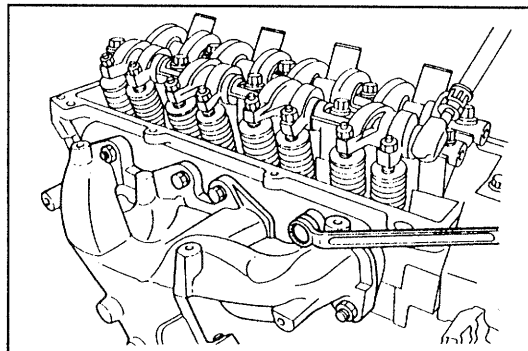
- Be careful not to allow the cylinder head to hit to the vehicle body and/or other parts.
- Place the removed cylinder head on suitable two wooden blocks in order that the cylinder head surface and valve may not be damaged.



WRU90-EM109

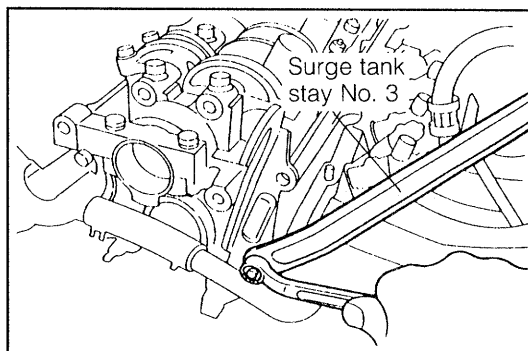
## SEPARATION OF INTAKE AND EXHAUST MANIFOLDS

1. Remove the exhaust manifold by removing the six bolts and two nuts.
2. Remove the exhaust manifold gasket.



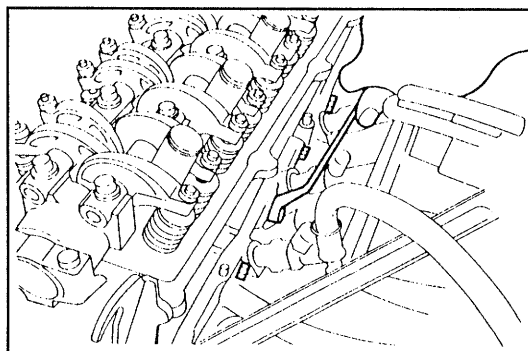
WRU90-EM110

3. Removal of intake manifold assembly
  - (1) Remove the surge tank stay No. 3.



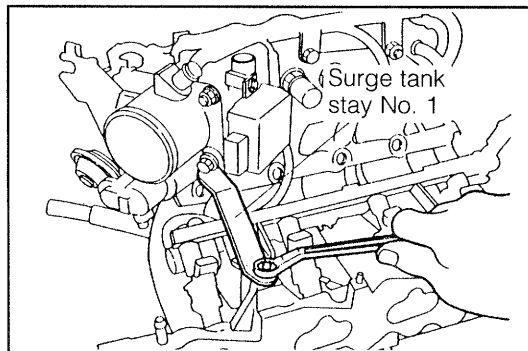
WRU90-EM111

- (2) Remove the intake manifold assembly by removing the eight bolts and four nuts.
  - (3) Remove the intake manifold gasket.



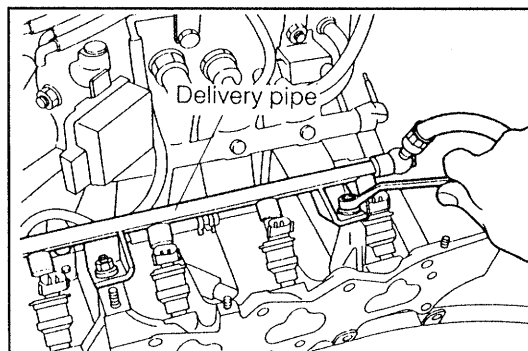
WNU89-EM149

4. Remove the surge tank stay No. 1 by removing the bolt and nut.



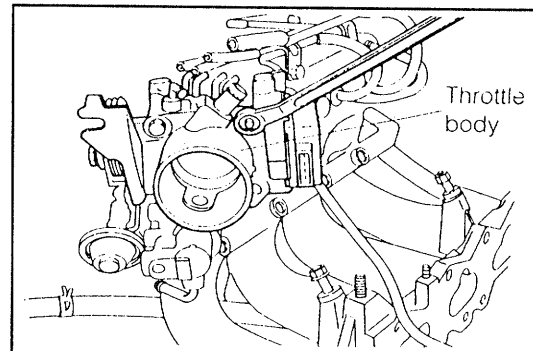
WRU90-EM112

5. Remove the fuel delivery pipe by removing the two attaching bolts.



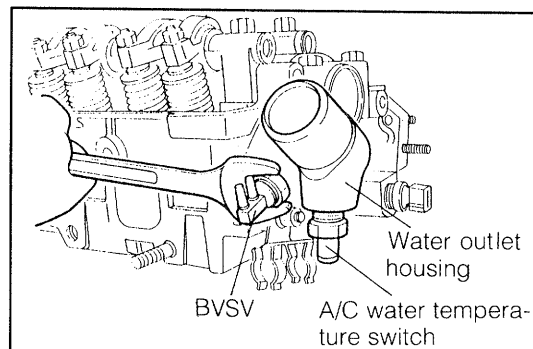
WRU90-EM113

6. Remove the throttle body by removing the two bolts and nut.



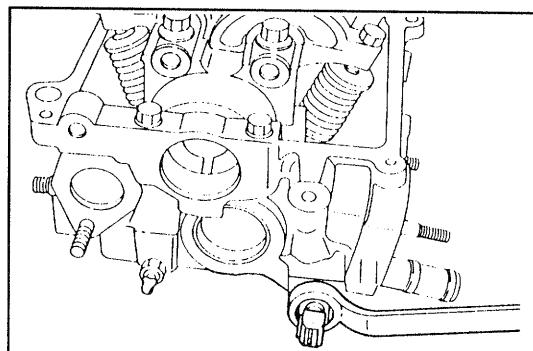
WRU90-EM114

7. Removal of water outlet housing from the cylinder head
  - (1) Remove the BVSV.
  - (2) Remove the A/C water temperature switch.
  - (3) Remove the water outlet housing by removing the attaching bolt and nut.



WRU90-EM115

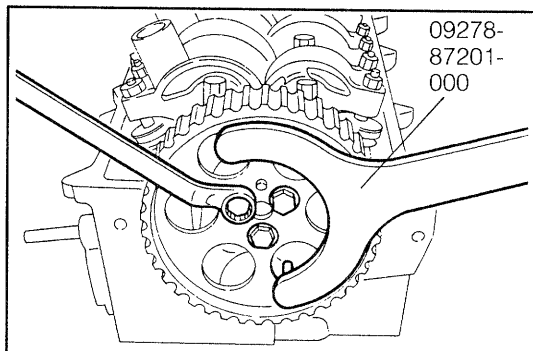
8. Remove the water temperature sensor and water temperature sender gauge.



WRU90-EM116

## DISASSEMBLY OF CYLINDER HEAD

1. Removal of camshaft timing belt pulley
  - (1) Remove the attaching bolts of the camshaft timing belt pulley, using the following SST.  
SST: 09278-87201-000
  - (2) Remove the camshaft timing belt pulley.

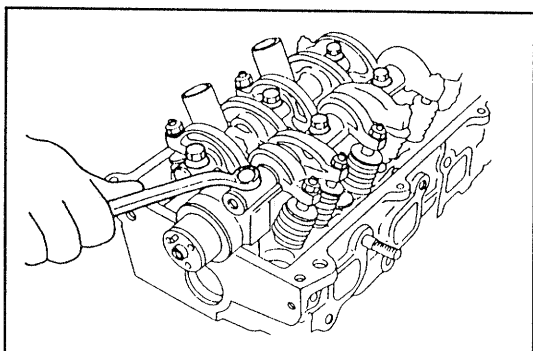


WRU90-EM117

2. Remove the valve rocker shaft sub assembly No. 1 (intake side) and No. 2 (exhaust side) by removing the ten attaching bolts.

### NOTE:

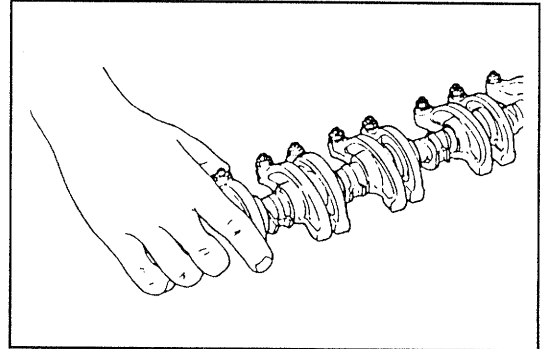
- Remove the attaching bolts by loosening them evenly over two or three stages.



WNU89-EM156

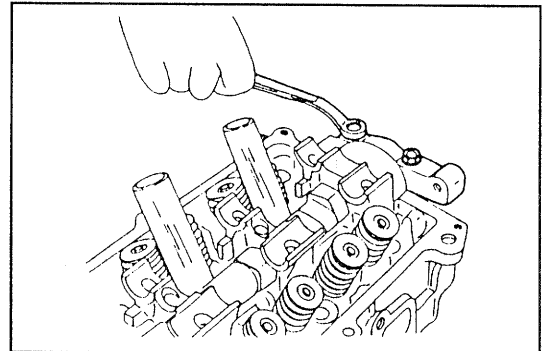
## ENGINE MECHANICALS

3. Remove the valve rocker shaft together with the rocker arms from the cylinder head.
4. Remove the valve rocker arm, spacer and wave washer from valve rocker shaft.



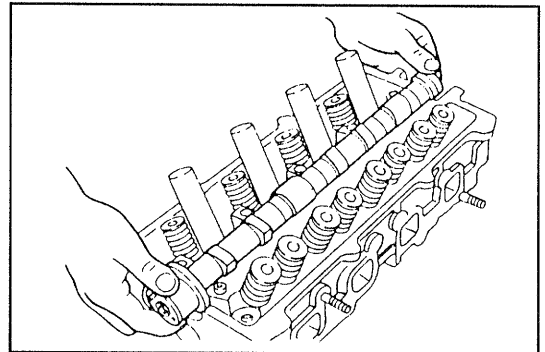
WNU89-EM157

5. Removal of camshaft
  - (1) Remove the camshaft bearing cap No. 5 by removing the two attaching bolts.
  - (2) Remove the camshaft bearing cap No. 1 to No. 4.



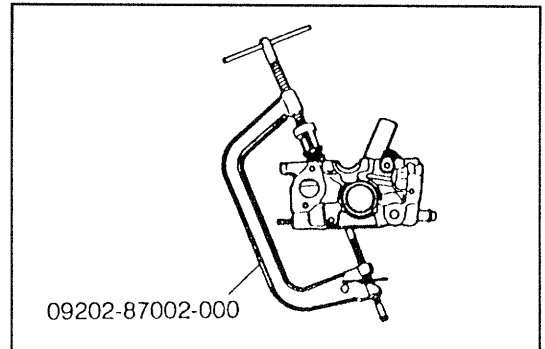
WNU89-EM158

- (3) Remove the camshaft.
  - (4) Remove the oil seal from the camshaft.



WNU89-EM159

6. Removal of intake and exhaust valve
  - (1) Remove the valve spring retainer locks, using the following SST.  
SST: 09202-87002-000

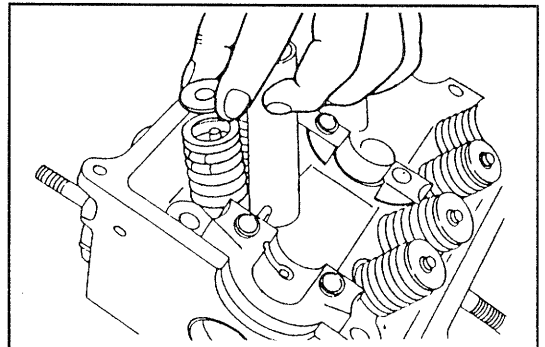


WNU89-EM160

- (2) Remove the valve spring retainers, compression springs, valves, valve stem oil seals and valve spring seats.

### NOTE:

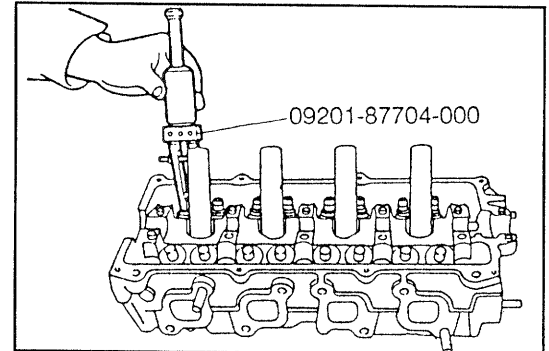
- Arrange the removal parts in order so that their installing positions may be known easily.



WNU89-EM161



- If any difficulty is encountered in removing the valve stem oil seal, pull the oil stem, using the following SST.  
SST: 09201-87704-000

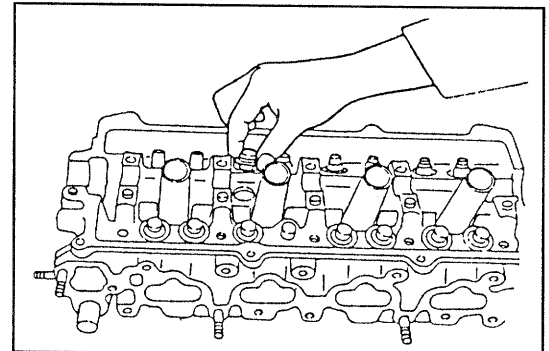


WNU89-EM162

7. Remove the valve spring seats.

**NOTE:**

- Arrange the removed parts in order so that their installing positions may be known easily.



WRU90-EM118

8. Wash the disassembled parts except for electrical parts, plastic parts and grease sealed bearings. Dry them by blowing compressed air.

WRU90-EM119

## INSPECTION, CLEANING AND REPAIRS OF CYLINDER HEAD COMPONENTS

1. Cleaning of top of each piston and cylinder block
  - (1) Turn the crankshaft until each piston is brought to the top dead center.  
Using a gasket scraper, remove all carbon deposits from the piston tops.
  - (2) Using a gasket scraper, remove any remaining gasket material from the top of the cylinder block.  
Blow carbon deposits and oil from the bolt holes.

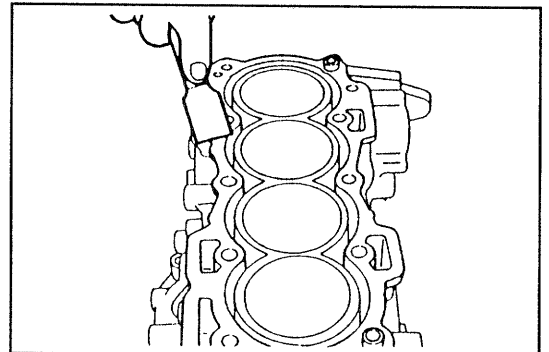
**WARNING:**

Protect your eyes during the cleaning operation when using compressed air.

**CAUTION:**

- Do not scratch the gasket surfaces of the piston and cylinder block.

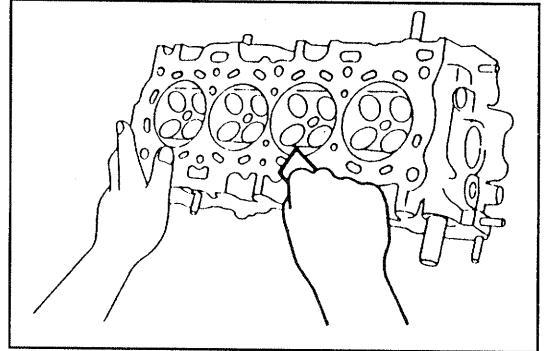
- (3) Set the piston No. 1 to the top dead center.



WRU90-EM402

### 2. Removal of gasket material

Using a gasket scraper, remove any remaining gasket material from the cylinder head and manifold surfaces.



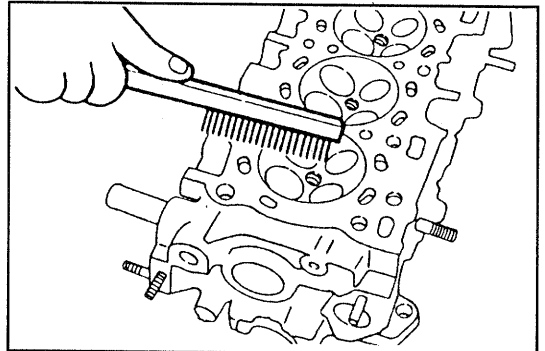
WNU89-EM167

### 3. Cleaning of combustion chamber

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

#### CAUTION:

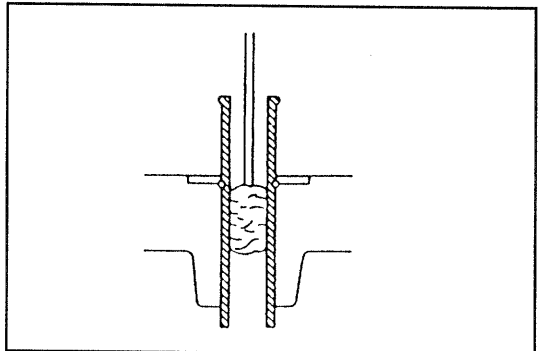
- Be careful not to scratch the cylinder head gasket contact surfaces.



WNU89-EM168

### 4. Cleaning of valve guide bushings

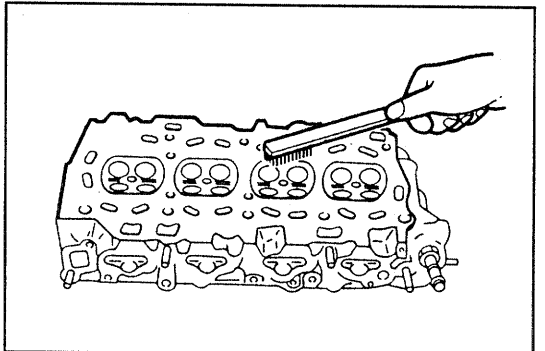
Using a valve guide brush and solvent, clean all the valve guide bushings.



WNU89-EM169

### 5. Cleaning of cylinder head

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



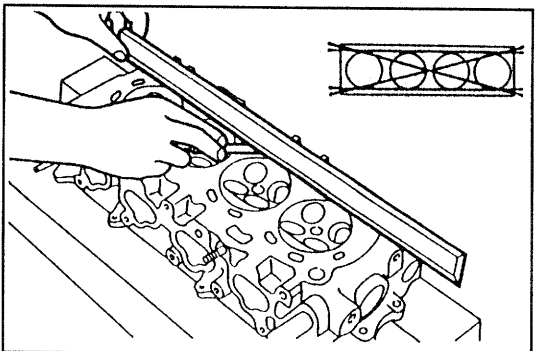
WNU89-EM170

### 6. Inspection of cylinder head for flatness

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

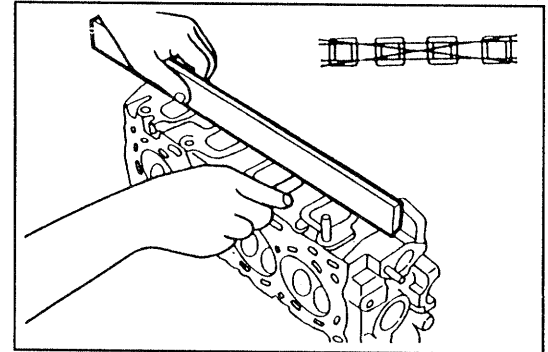
#### Maximum surface warpage:

- Cylinder block side: 0.10 mm (0.0039 inch)
- Intake manifold side: 0.10 mm (0.0039 inch)
- Exhaust manifold side: 0.10 mm (0.0039 inch)



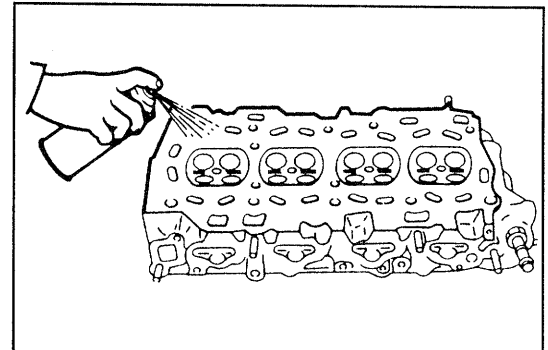
WNU89-EM171

If surface warpage of the cylinder block side exceeds the maximum limit replace the cylinder head.



WNU89-EM172

7. Inspection of cylinder head for cracks  
Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and top of the head for cracks.  
If a crack is found, replace the cylinder head.



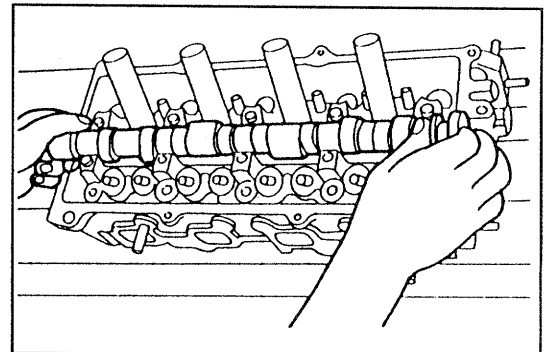
WNU89-EM173

8. Inspection of camshaft oil clearance

**NOTE:**

- Prior to this oil clearance check, the camshaft should be checked for runout in advance. (See page EM-57).

- (1) Clean the bearing and camshaft journals with cloth.
- (2) Install the camshaft to the cylinder head.
- (3) Place plastigage on each bearing.



WRU90-EM120

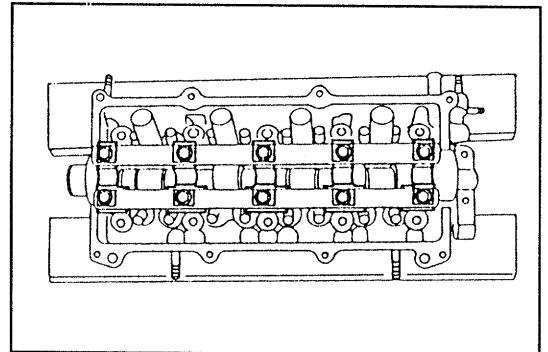
- (4) Install the bearing caps and valve rocker shaft. Tighten them to the specified torque.

**Tightening Torque:**

M10 bolt	2.9 - 3.7 kg-m/Dry (21.0 - 26.8 ft-lb)
M8 bolt	1.3 - 1.7 kg-m/Dry (9.4 - 12.3 ft-lb)

**NOTE:**

- Ensure that the bolt holes and bolts are dry when tightening the bolts.

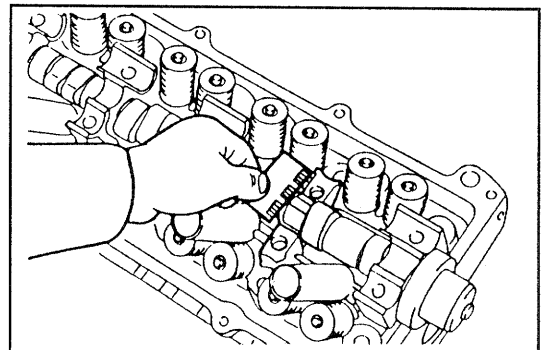


WRU90-EM121

- (5) Remove the bearing caps and measure the oil clearance.

**Clearance:**

Specified Value:	0.035 - 0.076 mm (0.0014 - 0.0029 inch)
Allowable Limit:	0.17 mm (0.0067 inch)



WNU89-EM176

If the oil clearance exceeds the allowable limit, replace the cylinder head and camshaft as a set.

**NOTE:**

- After completion of the check, remove the plastigages. Wash the camshaft and bearing caps in cleaning solvent.

WNU89-EM177

9. Inspection of camshaft thrust clearance

- (1) Apply engine oil to the camshaft journals.
- (2) Install the camshaft to the cylinder head. Install the bearing caps and rocker shafts and tighten them to the specified torque.

**Tightening Torque:**

M10 bolt	2.9 - 3.7 kg-m/Dry (21.0 - 26.8 ft-lb, 28.4 - 36.3 N·m)
M8 bolt	1.3 - 1.7 kg-m/Dry (9.4 - 12.3 ft-lb, 12.7 - 16.7 N·m)

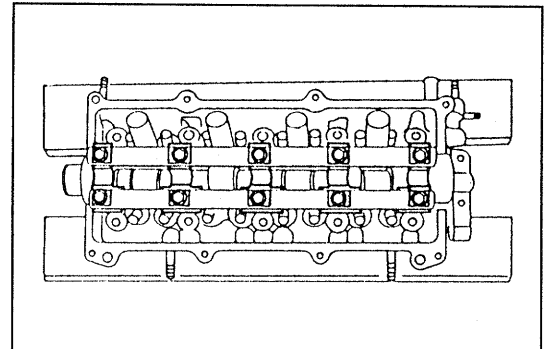
**NOTE:**

- Ensure that the bolt holes and bolts are dry when tightening the bolts.

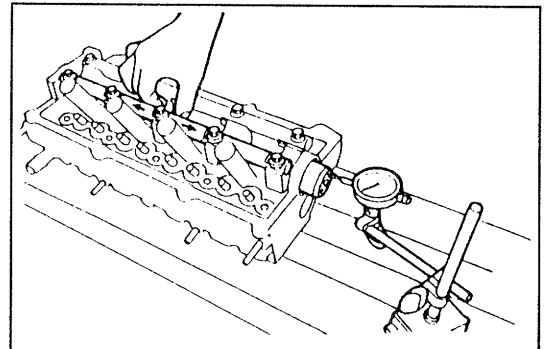
- (3) With a dial gauge attached to the camshaft, measure the thrust clearance.

**Thrust Clearance:**

Specified Value:	0.1 - 0.25 mm (0.0039 - 0.0098 inch)
Allowable Limit:	0.45 mm (0.018 inch)



WRU92-EM422



WNU89-EM179

10. Inspection and grinding of valves

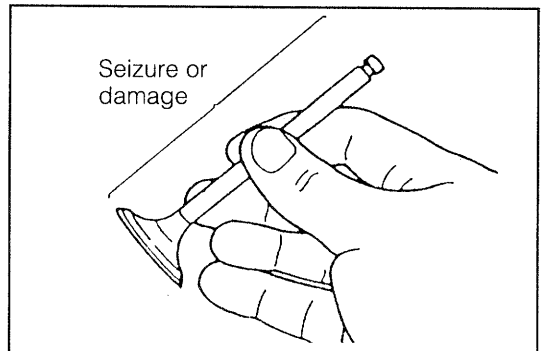
- (1) Visually inspect the valve stem for seizure or damage.

**NOTE:**

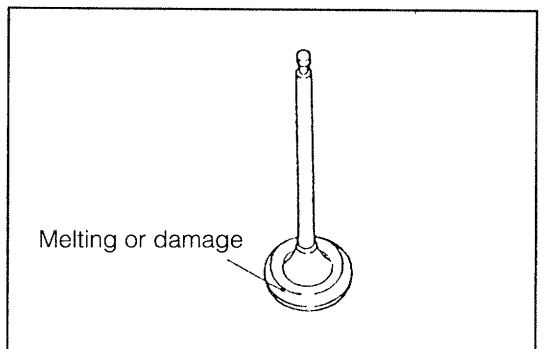
- If seizure or damage is found, replace the valve and valve guide bush as a set. However, this replacement should be performed only after the checks for the cylinder head have been finished.
- The valve guide bush hole must be used for refacing the valve seat. Hence, if the valve guide bush hole exhibits any roughness due to seizure, etc., clean the valve guide bush with an adjustable reamer.

- (2) Visually inspect the valve head for melting or damage. If the valve head exhibits any melting or damage, replace the valve.

If the roughness on the contact surface can be corrected, grind the valve seat contact surface with a valve refacer.



WRU90-EM403



WNU89-EM181

- (3) Grind the valves only enough to obtain a smooth contact surface with the valve seat.

Valve Face Angle:  $45.5^\circ$

**NOTE:**

- Make sure the valves are ground to the correct valve face angle.

- (4) Visually inspect the valve stem end for abnormal wear.

If the valve stem end exhibits abnormal wear, correct the stem end with a valve refacer. However, this correction should be made within a limit of 0.8 mm (0.0315 inch) from that of standard length.

**[Reference]**

Valve Length (STD):

Intake Valve: 112.8 mm (4.441 inch)

Exhaust Valve: 114.5 mm (4.508 inch)

- (5) Inspect the valve head for its stock thickness.

**Minimum Stock Thickness**

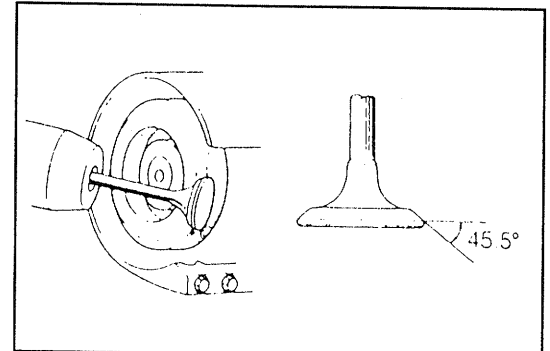
Intake Valve: 0.8 mm (0.032 inch)

Exhaust Valve: 1.0 mm (0.039 inch)

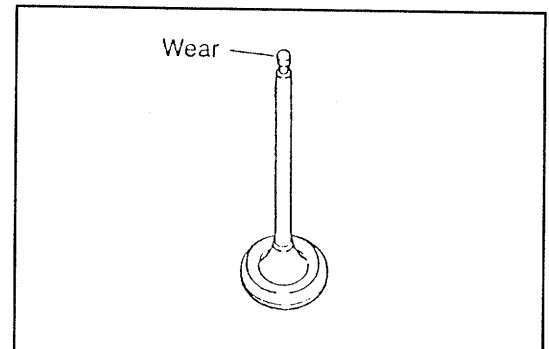
If the stock thickness of the valve head is less than the minimum stock thickness, replace it with a new one.

**11. Inspection and cleaning of valve seats**

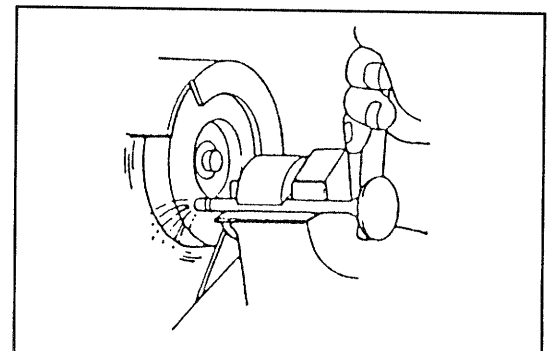
- (1) Using a 45-degree valve seat cutter, reface the valve seats. Remove only enough metal stock to clean the seats.
- (2) Apply a thin film of red lead (or white lead) to the valve seat.
- (3) Let the valve drop by its own weight onto the valve seat two or three times.
- (4) Take out the valve.



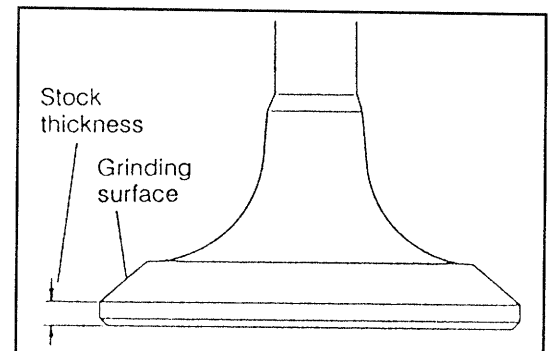
WNU89-EM182



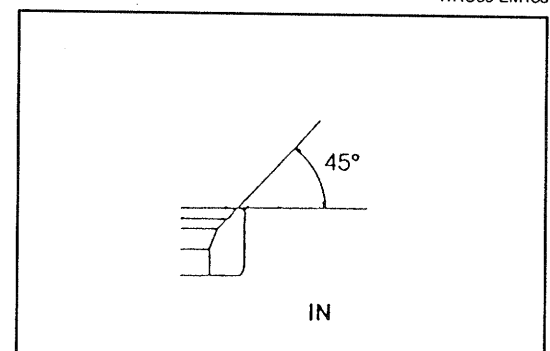
WNU89-EM183



WNU89-EM184



WNU89-EM185



WNU89-EM186

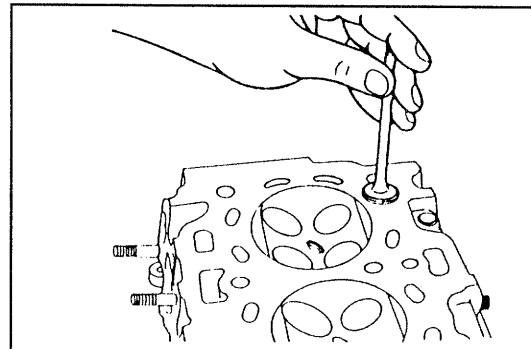
(5) Inspect the valve face and seat for the following items.

- ① Ensure that the valve seat contact surface of the valve is continuous over the whole circumference. If not, replace the valve.
- ② Ensure that the valve contact surface of the valve seat is continuous over the whole circumference. If not, reface the valve seat.

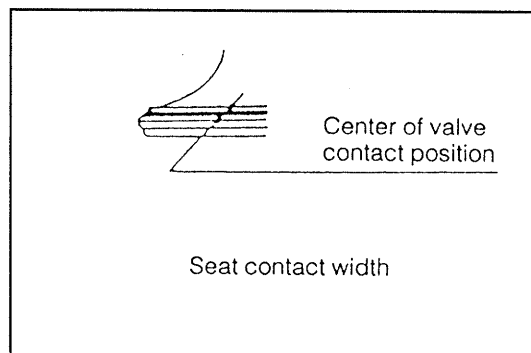
- ③ Measure the width of the contact surface of valve seat.

Contact surface of valve seat: 1.2 - 1.6 mm  
(0.048 - 0.062 inch)

If not, reface the valve seat.



WNU89-EM187

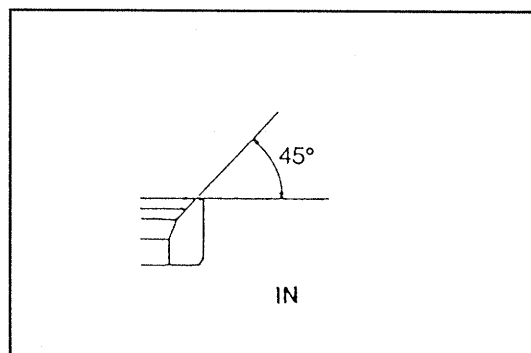


WNU89-EM188

## 12. Refacing of valve seat

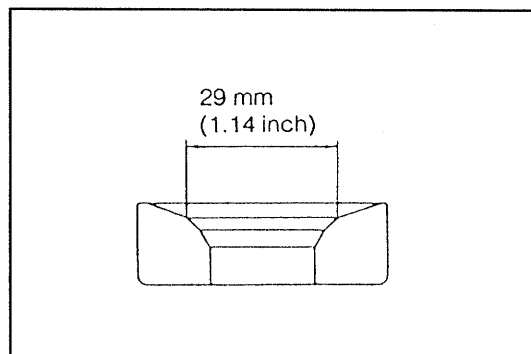
(1) Refacing procedure for intake valve seats

- ① Using a 45-degree cutter, recondition the roughness on the valve-to-valve seat contact surface, only enough to obtain a smooth surface.



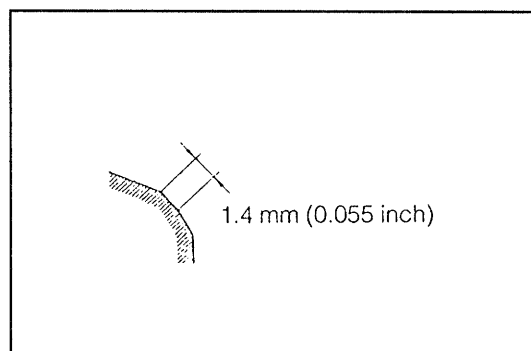
WNU89-EM189

- ② Using a 30-degree cutter, cut the valve seat in such way that the circumference of the surface refaced by the 45-degree cutter may become  $29 \pm 0.1$  mm ( $1.142 \pm 0.004$  inch)



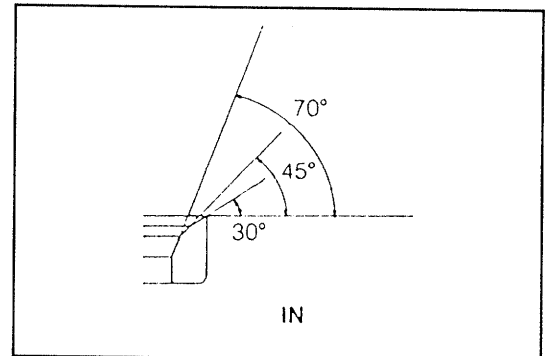
WNU89-EM190

- ③ Using a 70-degree cutter, cut the seat in such way that the width, of the surface refaced by the 45-degree cutter may became 1.4 mm (0.055 inch).



WNU89-EM191

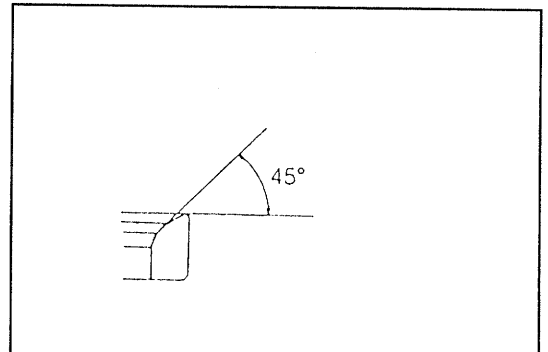
- ④ Using the 45-degree cutter, remove burrs produced during the refacing by the 30-degree and 70-degree cutters.



WNU89-EM192

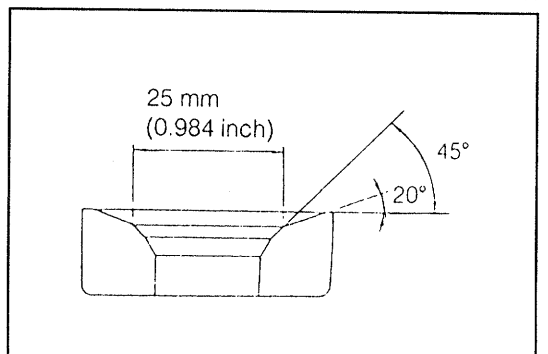
(2) Refacing procedure for exhaust valve seats

- ① Using a 45-degree cutter, recondition the roughness on the valve-to-valve seat contact surface, only enough to obtain a smooth surface.



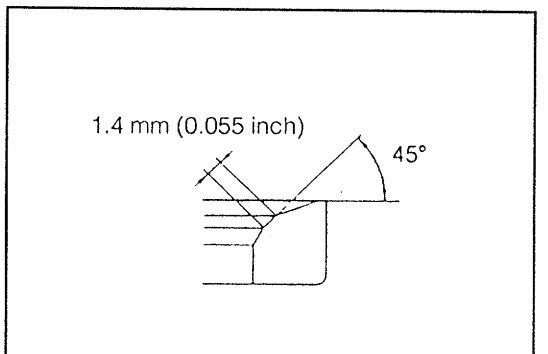
WNU89-EM193

- ② Using a 20-degree cutter, cut the valve seat in such a way that the circumference of the surface refaced by the 45-degree cutter may become 25 mm (0.984 inch).



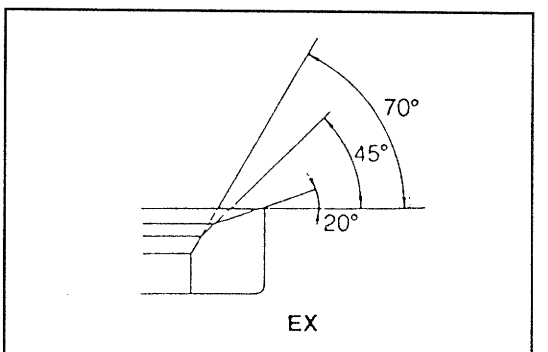
WNU89-EM194

- ③ Using a 70-degree cutter, cut the valve seat in such a way that the width of the surface refaced by the 45-degree cutter may become 1.4 mm (0.055 inch).



WNU89-EM195

- ④ Using the 45-degree cutter, remove burrs produced during the refacing by the 20-degree and 70-degree cutters.



WNU89-EM196

### 13. Hand lapping of valves

- (1) Perform hand lapping of the valves and valve seats, using an abrasive compound.
- (2) Clean the valves and valve seats after the hand lapping of the valves.

WNU89-EM197

### 14. Inspection of valve recession

After the valve seat has been refaced, install the new valve. Measure the distance between the cylinder attaching surface of the cylinder head (attaching surface of the cylinder head gasket) and the upper most section of the valve. Ensure that the distance does not exceed the following maximum limit.

#### Maximum limit

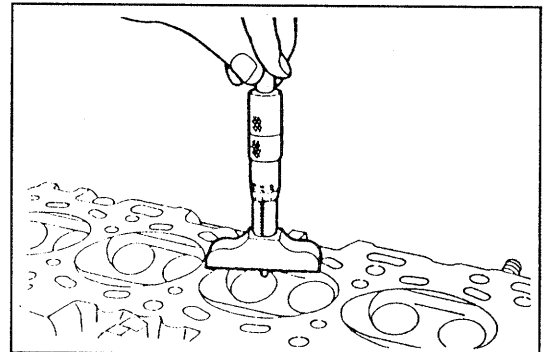
Intake valve 2.775 mm (0.1092 inch)

Exhaust valve 6.026 mm (0.2372 inch)

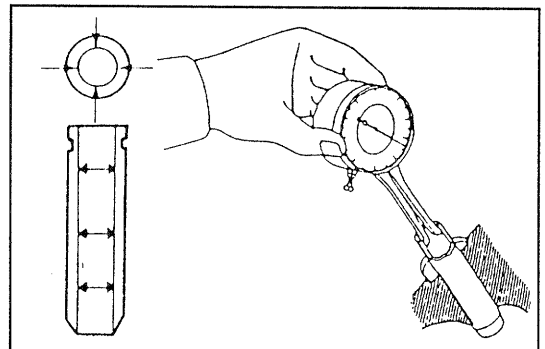
If the recession exceeds the maximum limit, replace the cylinder head.

### 15. Inspection of valve stem-to-guide bushing oil clearance

- (1) Using a caliper gauge, measure the inner diameter of the valve guide at six points. Record the measured values.

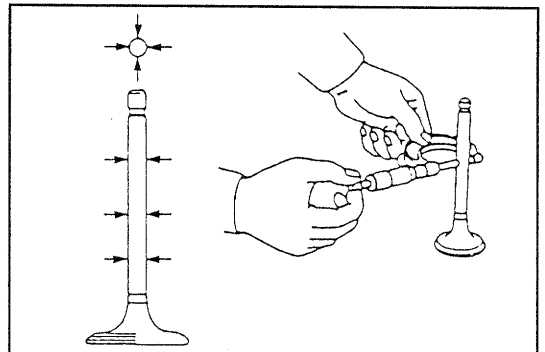


WNU89-EM198



WNU89-EM199

- (2) Using a micrometer, measure the diameter of the valve stem at six points. Record the measured values.



WRU90-EM123



(3) Calculation of oil clearance

Calculate the oil clearance of each valve according to the following formula.

$$\text{Oil clearance} = \frac{\text{Inner diameter of valve stem guide} - \text{Outer diameter of valve stem}}{\text{Specified Oil Clearance}}$$

Specified Oil Clearance

Intake valve side: 0.020 - 0.060 mm  
(0.0008 - 0.0024 inch)

Exhaust valve side: 0.025 - 0.065 mm  
(0.0010 - 0.0026 inch)

Allowable Limit

Intake valve side: 0.080 mm (0.0031 inch)

Exhaust valve side: 0.090 mm (0.0035 inch)

If the calculated oil clearance exceeds the allowable limit, replace the valve guide bush and valve as a set.

WRU90-EM124

16. Replacement of valve guide bush

NOTE:

- Removal and installation of the valve guide bush should be carried out while the cylinder head temperature is 80°C - 100°C (170°F - 212°F) after heating it gradually.

(1) Intake valve guide bush

NOTE:

- If the intake valve guide bush has been already installed with a locating ring, replace the cylinder head.

- Drive out the valve guide bush from the combustion chamber side, using the following SST.

SST: 09201-87705-000

NOTE:

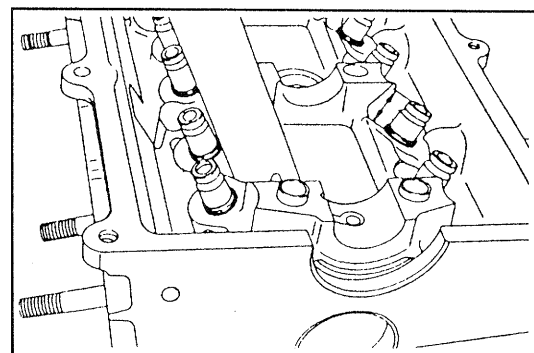
- Be careful not to tap the cylinder head.

- Drive a new valve guide bush into position, until the snap ring contacts the cylinder head, using the following SST.

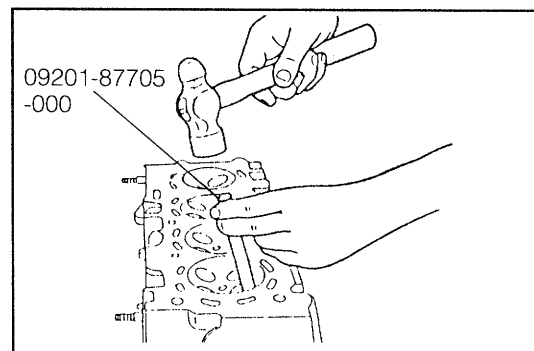
SST: 09201-87705-000

CAUTION:

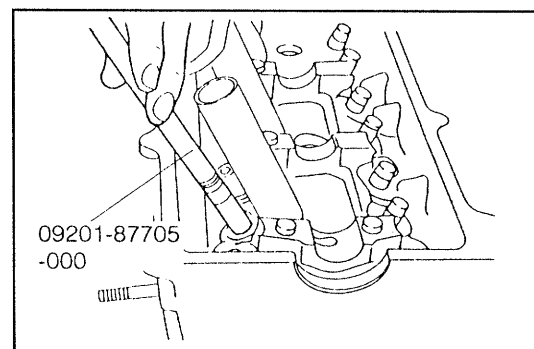
- Be very careful not to give an excessive impact during the installation. Failure to observe this caution will result in a cracked valve guide bush.
- Care should be exercised not to detach the snap ring due to driving the valve guide bush excessively.



WRU90-EM125



WRU90-EM126

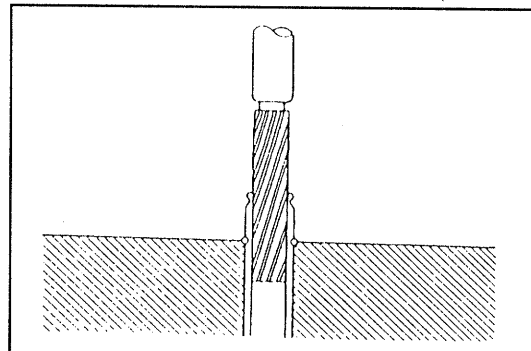


WRU90-EM404

- ③ Using an adjustable reamer, ream the valve guide bush to remove any burr or the like.

**NOTE:**

- This reaming should be done only enough to remove the burr or the like.



WRU90-EM405

- ④ Inspection of oil clearance  
Ensure that the oil clearance meets the specifications.

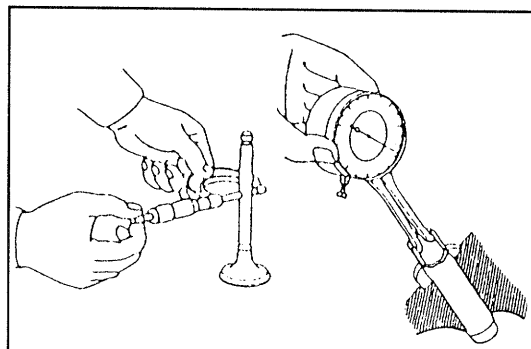
**Oil Clearance:**

**Specified Value:**

Intake 0.020 - 0.060 mm  
(0.0008 - 0.0024 inch)

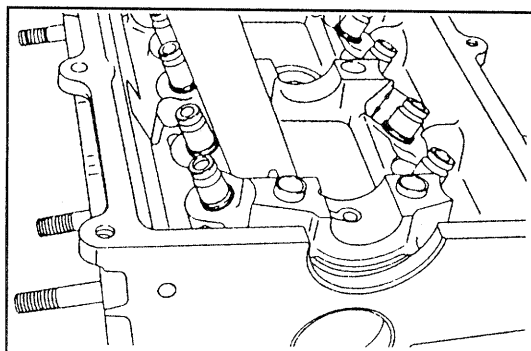
**Allowable Limit:**

Intake 0.08 mm (0.0031 inch)



WNU89-EM202

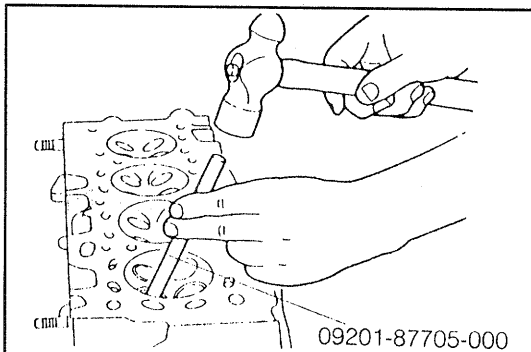
(2) Exhaust valve guide bush



WRU90-EM127

- ① Drive out the valve guide bush from the combustion chamber side, using the following SST.

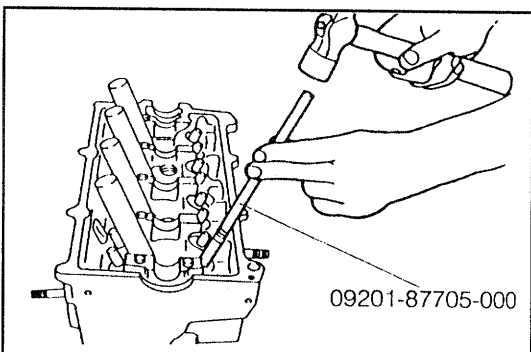
SST: 09201-87705-000



WNU89-EM204

- ② Drive a new valve guide bush into position, until the snap ring contacts the cylinder head, using the following SST.

SST: 09201-87705-000



WRU90-EM406

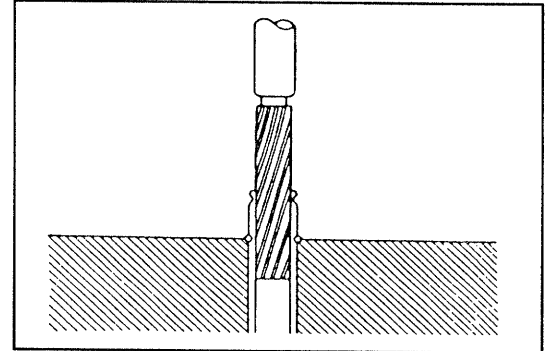
**CAUTION:**

- Be very careful not to give an excessive impact during the installation. Failure to observe this caution will result in a cracked valve guide bush.
- Care should be exercised not to detach the snap ring due to driving the valve guide bush excessively.

- ③ Using an adjustable reamer, ream the valve guide bush to remove any burr or the like.

**NOTE:**

- This reaming should be done only enough to remove the burr or the like.



WRU90-EM407

- ④ Inspection of oil clearance  
Ensure that the oil clearance meets the specifications.

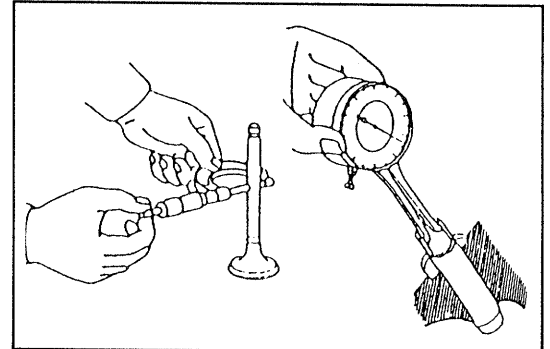
**Oil Clearance:**

**Specified Value:**

Exhaust 0.025 - 0.065 mm  
(0.0010 - 0.0025 inch)

**Allowable Limit:**

Exhaust 0.09 mm (0.0035 inch)



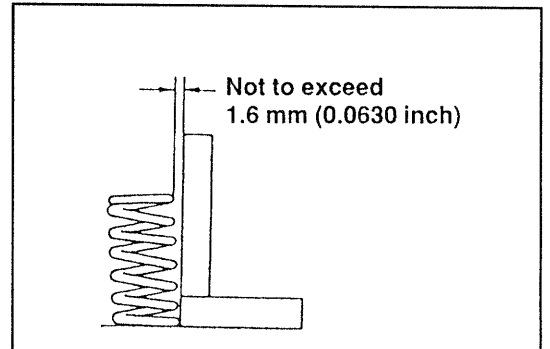
WNU89-EM206

## 17. Inspection of valve springs

- (1) Check the valve spring for squareness, using a steel square.

**Maximum squareness:** 1.6 mm (0.0630 inch)

If the squareness exceeds the maximum limit, replace the valve spring.



WNU89-EM207

- (2) Measure the valve spring for free length and spring tension, using a spring tester.

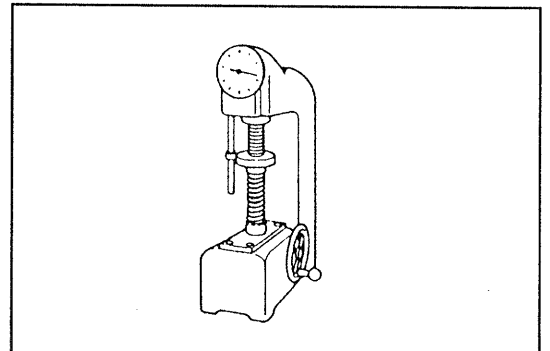
**Minimum free length:** 44.3 mm (1.74 inch)

**Minimum tension/installation height:**  
26.4 kg/38.0 mm (58.2 lb/1.5 inch)

If the minimum free length and/or minimum tension is less than the minimum limit, replace the valve spring.

**Reference**

**Standard free length:** 45.2 - 46.0 mm  
(1.78 - 1.81 inch)

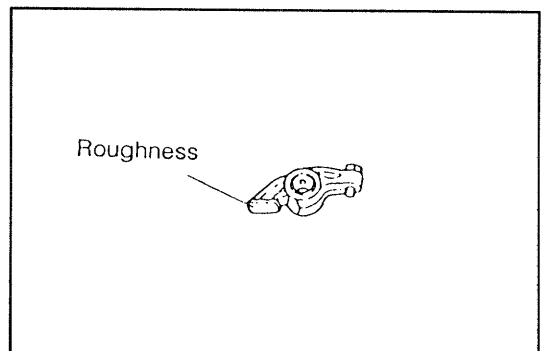


WNU89-EM208

## 18. Inspection of valve rocker arms and valve rocker shaft

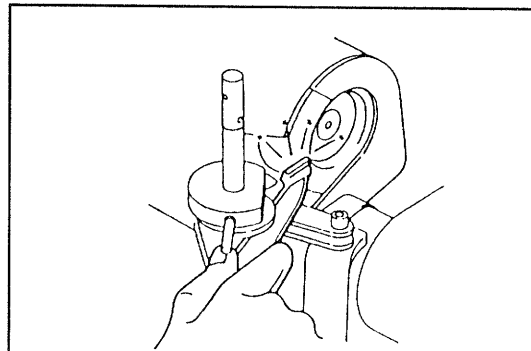
- (1) Visually inspect the valve rocker arm for cracks, seizure or wear.

Replace the valve rocker arm, if necessary.



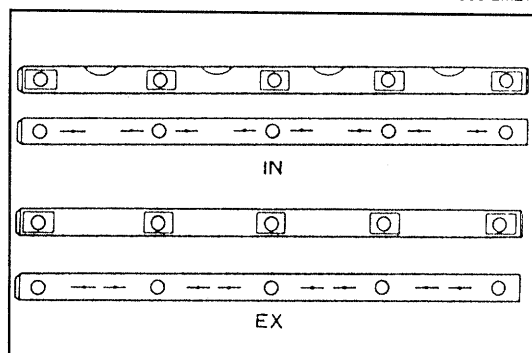
WNU89-EM209

- (2) If the valve rocker arm-to-cam contact surface is worn excessively, grind or replace the rocker arm.



WNU89-EM210

- (3) Visually inspect the valve rocker shaft for cracks, seizure or wear.  
Replace the valve rocker shaft, if necessary.



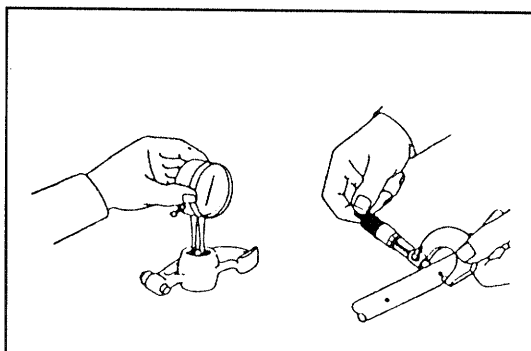
WNU89-EM211

- (4) Valve rocker shaft-to-valve rocker arm
- Using a dial gauge, measure the inner diameter of the valve rocker arm in two directions, 90 degrees apart from each other.
  - Using a micrometer, measure the outer diameter of the valve rocker arm attaching position of the camshaft in two directions, 90 degrees apart from each other.
  - Calculate the oil clearance by subtracting the rocker shaft diameter from the rocker arm diameter.

#### Oil Clearance

Specified Value: 0.012 - 0.053 mm  
(0.0005 - 0.0020 inch)

Allowable Limit: 0.08 mm (0.0031 inch)



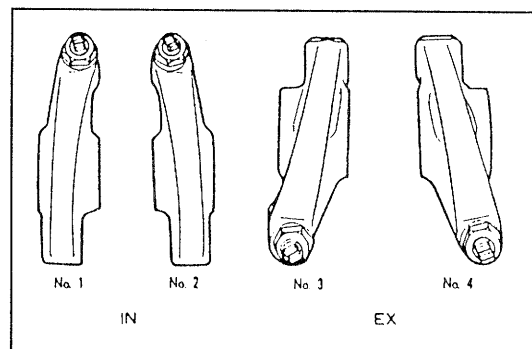
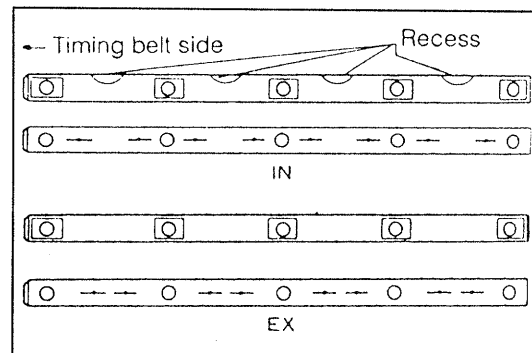
WNU89-EM212

#### NOTE:

- The measurement of the rocker shaft outer diameter must be performed at the assembling position of each rocker shaft.

## Reference

- Identification of valve rocker shafts  
On the intake valve rocker shaft, recesses for the spark plug tube are provided.  
Also, the oil grooves are provided very closely to the bolt holes.  
On the exhaust valve rocker shaft, the oil grooves are located near the midpoint of the bolt holes.
- Installing direction of valve rocker shaft  
The valve rocker shaft should be installed in such a way that the side having a wider chamfer comes at the timing belt side.
- Identification of valve rocker arm  
The valve rocker arm comes in four kinds; two kinds each for the intake side and exhaust side, as shown in the right figure.
- Specified dimensions of valve rocker shaft and valve rocker arm  
Outer diameter of valve rocker shaft:  
19.468 - 19.488 mm (0.7665 - 0.7672 inch)  
Bore diameter of valve rocker arm:  
19.500 - 19.521 mm (0.7678 - 0.7685 inch)



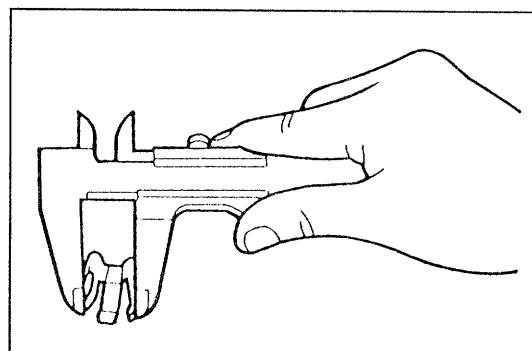
WRU90-EM128

## 19. Inspection of valve rocker arm, spacer and wave washer

- (1) Measure the free width of the spacer, using vernier calipers.

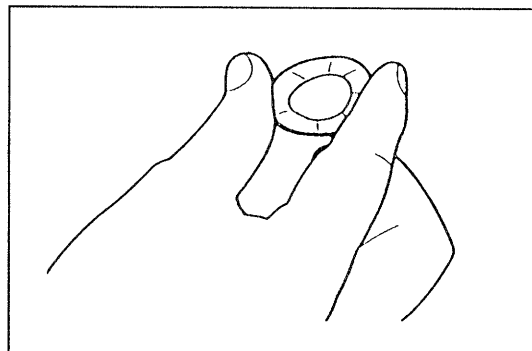
Minimum Free Width: 22.0 mm (0.866 inch)

Replace the spacer whose free length is less than the minimum free width.



WNU89-EM214

- (2) Visually inspect the wave washer for flattened condition or damage.  
Replace the wave washer, if necessary.



WNU89-EM215

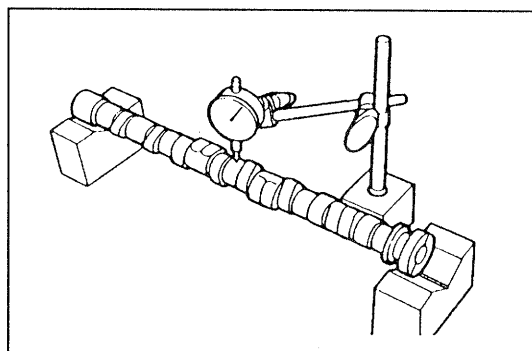
## 20. Inspection of camshaft

- (1) Checking camshaft for runout

Support the camshaft at its both ends with V-shaped blocks. Set a dial gauge to the mid-point of the center journal section of the camshaft. Turn the camshaft one turn, making sure that the camshaft will not move back and forth. Take a reading on the dial gauge during the turning. Calculate the maximum runout, i.e. the difference between the maximum and minimum readings.

Maximum runout: 0.03 mm (0.0012 inch)

If the runout exceeds the maximum limit, replace the camshaft.



WRU90-EM408

(2) Checking of cam lobe height

Measure the cam lobe height, using a micrometer.

**Specified Cam Lobe Height:**

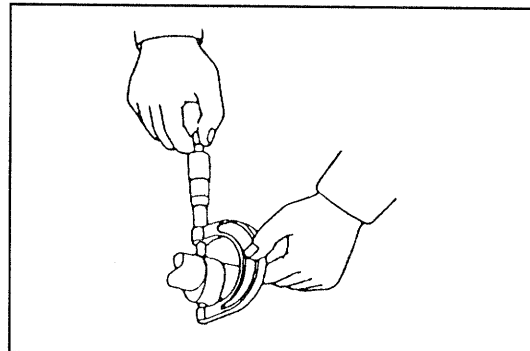
Intake: 33.08 - 33.28 mm (1.302 - 1.310 inch)

Exhaust: 33.00 - 33.20 mm (1.299 - 1.307 inch)

**Minimum Limit:**

Intake: 32.9 mm (1.295 inch)

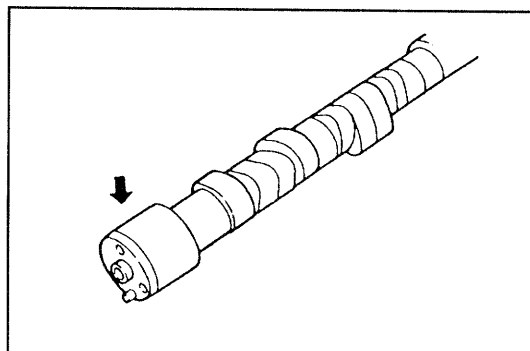
Exhaust: 32.85 mm (1.293 inch)



WNU89-EM217

(3) Inspection of oil seal contact surface

Inspect the oil seal contact surface for abnormal wear.  
Replace the camshaft if the contact surface exhibits any abnormal wear.



WNU89-EM218

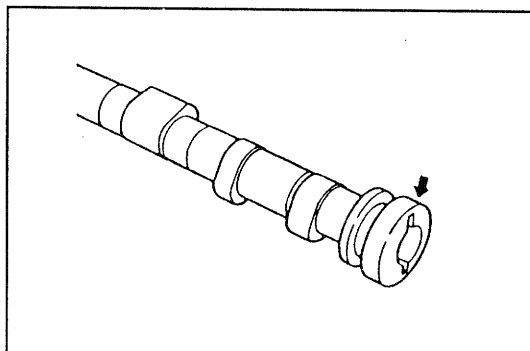
(4) Inspection of groove for driving distributor

Visually inspect to see if any damage is present at the groove for driving the distributor.

Replace the camshaft if the groove exhibits any damage.

**NOTE:**

- If any damage is present, check the distributor side, too.  
(See page IG-15.)

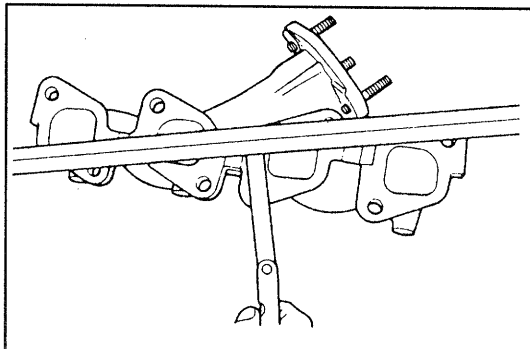


WRU90-EM129

21. Inspection of exhaust manifold and intake manifold

- (1) Check the cylinder head attaching surface of the exhaust manifold for warpage, using a straight edge and a thickness gauge.

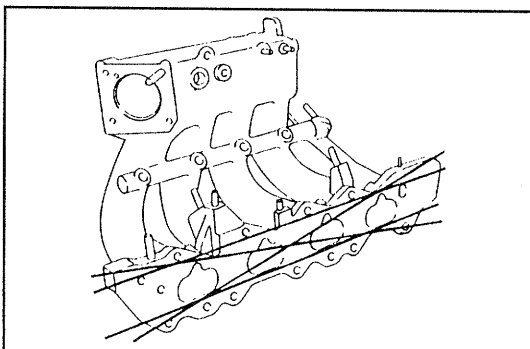
**Maximum warpage:** 0.1 mm (0.0039 inch)



WRU90-EM409

- (2) Check the contact surface of the intake manifold with the cylinder head.

**Maximum warpage:** 0.1 mm (0.0039 inch)



WNU89-EM221

22. Check the valve spring seats, valve spring retainers and valve retainer locks for damage and cracks.  
If any damage is present, replace such faulty parts.

## ASSEMBLY OF CYLINDER HEAD

(See page EM-36.)

### NOTE:

- (1) Thoroughly clean all parts to be assembled.
- (2) Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- (3) Replace all gaskets and oil seals with new ones.

1. Assembly of cylinder head (When new cylinder head is installed:)

When new cylinder head is installed, spark plug tubes and a heater outlet tube have been furnished separately. Assemble these parts, following the procedure given below.

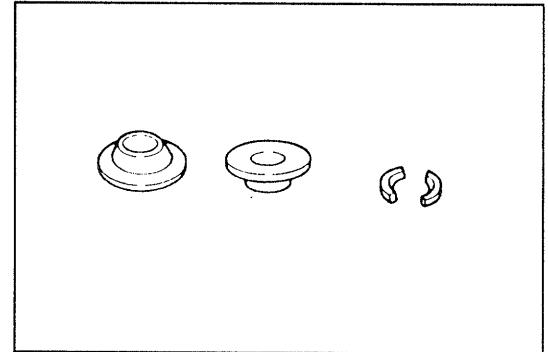
- (1) Wash the cylinder head in cleaning solvent and dry it with compressed air.
- (2) Apply a thin film of the Three Bond 1377B to the cylinder head attaching surfaces for the spark plug tubes.

- (3) With a wooden piece or the like placed on the upper end of the spark plug tube, drive the spark plug tube to the cylinder head in such an extent that the distance between the spark plug tightening surface and the upper end of the spark plug tube becomes 139 mm (5.47 inch).

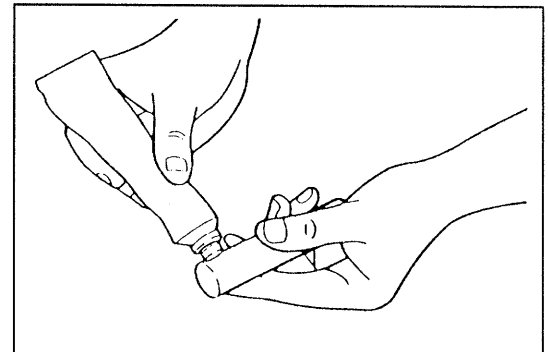
### NOTE:

- Be very careful not to drive the spark plug tube too deeply.
- Be very careful not to damage the upper end of the spark plug tube.
- When driving the spark plug tube into position, make sure that the tube will not tilt in relation to the cylinder head tube hole.

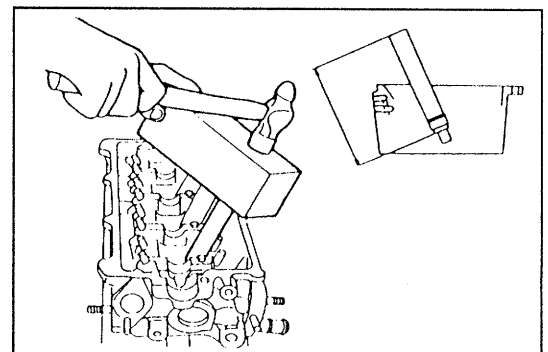
- (4) Put mark at a point  $45.0 \pm 1.0$  mm ( $1.77 \pm 0.04$  inch) from the forward end of the heater outlet tube.



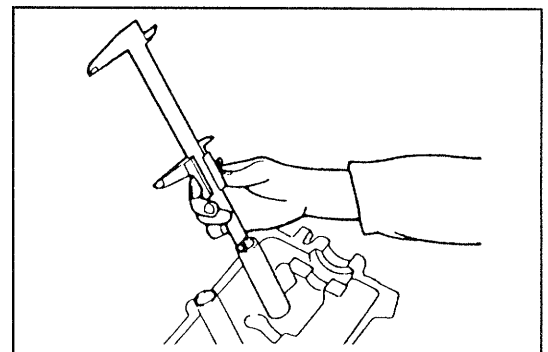
WNU89-EM222



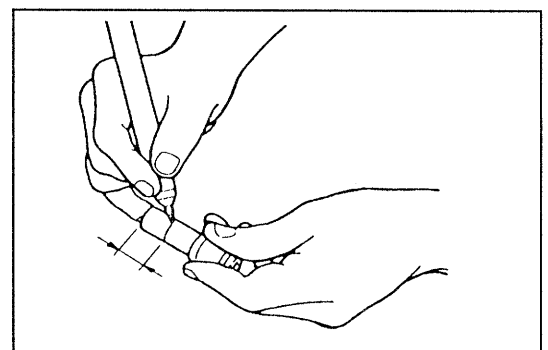
WRU90-EM130



WNU89-224

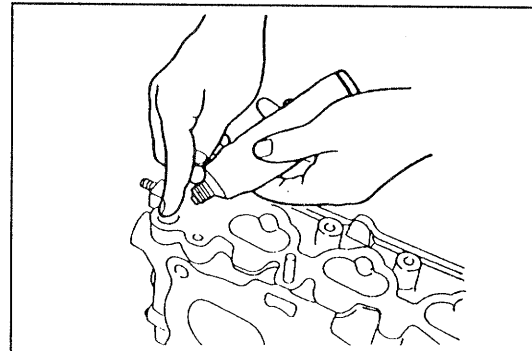


WNU89-EM225



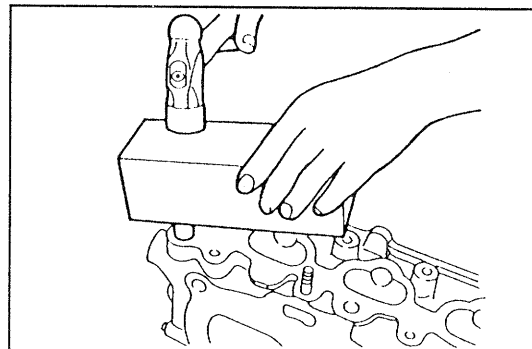
WNU89-EM226

- (5) Apply a thin film of the Three Bond 1377B to the attaching section for the heater outlet tube on the cylinder head.



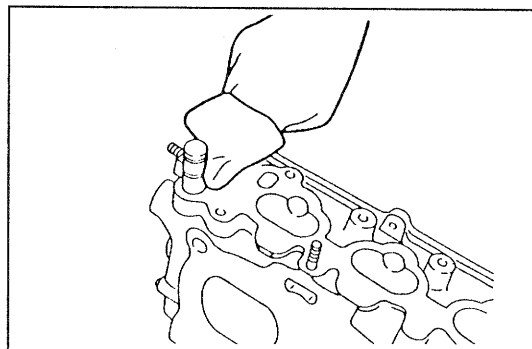
WNU89-EM227

- (6) With a wooden piece interposed, drive the heater outlet tube to the point marked in Step (4).



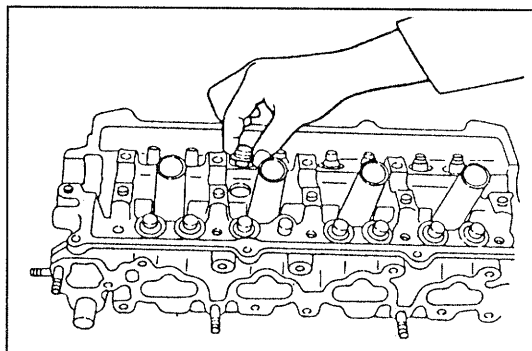
WNU89-EM228

- (7) After completion of the operation, remove any oozed bond, wooden chips and so forth.



WNU89-EM229

2. Install the valve spring seats to the cylinder head.



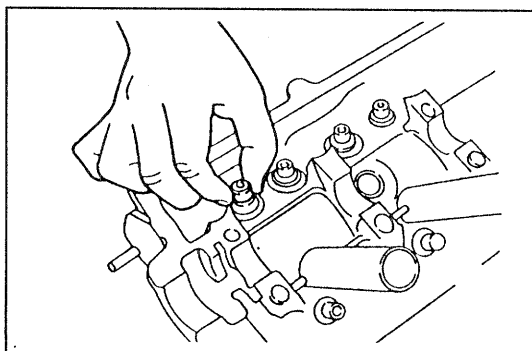
WNU89-EM230

3. Installation of valve stem oil seal

- (1) Apply engine oil to the bore of the valve stem oil seal.  
(2) Drive the valve stem oil seal into the valve stem guide bush by hand.

**NOTE:**

- When driving the oil seal, make sure that the oil seal is not tilted.
- Do not reuse any oil seal which was tilted or driven diagonally.
- Hold the frame of the oil seal. Do not touch the rubber lip section of the oil seal.



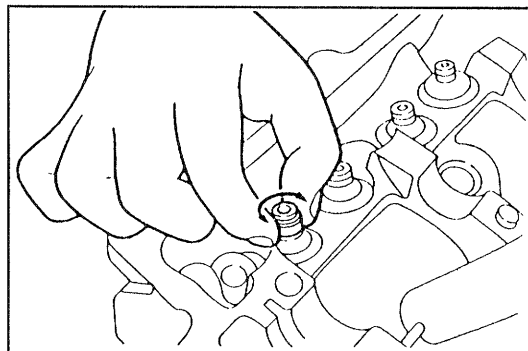
WNU89-EM231



- (3) Turn the oil seal slightly by hand to see if it can be turned.

**NOTE:**

- Never rotate the oil seal more than one turn, because excessive turning may cause scratches on the oil seal.
- If the oil seal can not be turned by hand, it means that the oil seal has been tilted, driven diagonally or press-fitted improperly.
- Do not reuse any oil seal which was tilted or driven diagonally.

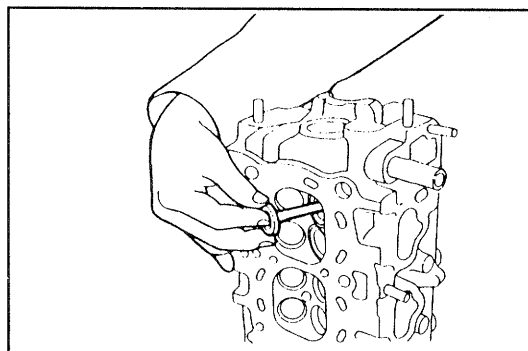


WNU89-EM232

4. Apply oil to the valve stem. Install the valve to the cylinder head.

**NOTE:**

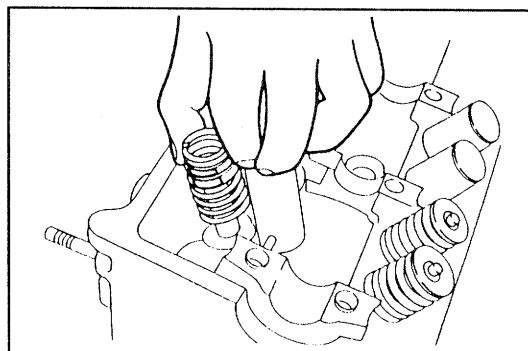
- Care must be exercised as to the installing position. Do not pull out the valve once it has been inserted.
- If the inserted valve should be pulled out, replace the valve stem oil seal.



WNU89-EM233

5. Assembly of valve springs, valve spring retainers and valve spring retainer locks

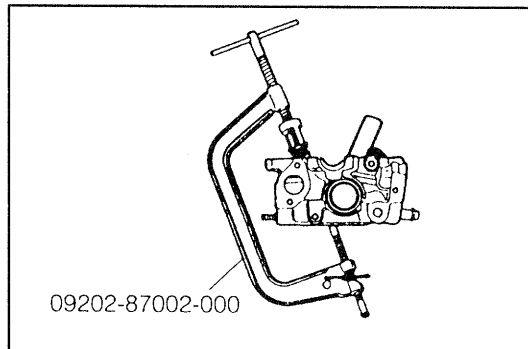
- (1) Assemble the valve spring in such a way that the painted side (the side having a larger pitch) comes at the valve spring retainer.



WNU89-EM234

- (2) Install the valve spring retainer to the valve spring. Install the valve spring retainer locks while compressing the valve spring retainer, using the following SST.

SST: 09202-87002-000

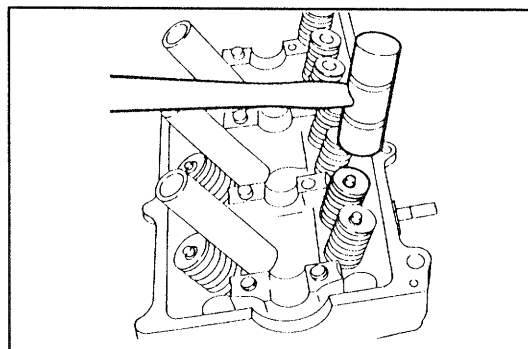


WNU89-EM235

- (3) After installing the valve spring retainer lock, lightly tap the valve spring retainer with a hammer or the like so as to ensure that the valve spring retainer locks are installed securely.

**WARNING**

- During this operation, care must be exercised to ensure that the valve spring retainer or retainer locks may not be jumped out.
- Protect your eyes with safety goggles during this operation.



WNU89-EM236

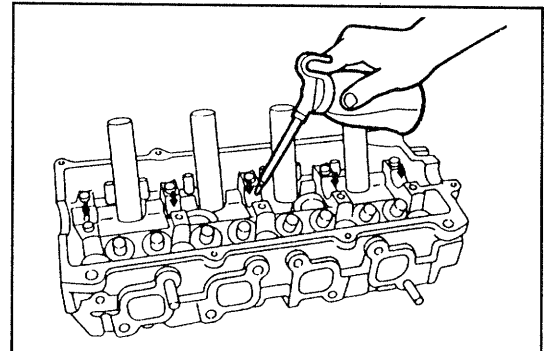
6. Installation of camshaft and rocker shafts
- (1) Wash and dry the holes for the camshaft cap attaching bolts.

**WARNING:**

When using compressed air, protect your eyes with safety goggles.

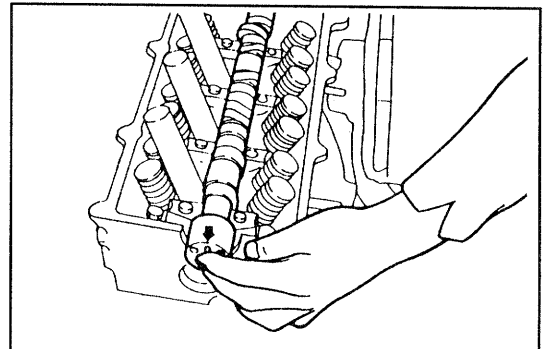
WNU89-EM237

- (2) Liberally apply engine oil to the journal sections and thrust bearing sections.



WNU89-EM238

- (3) Assemble the camshaft on the cylinder head in such a way that the locating pin for the camshaft timing belt pulley comes exactly at the top position.  
Apply engine oil to the camshaft journal section.

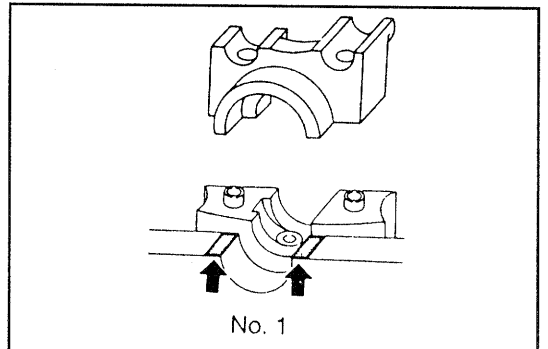


WNU89-EM239

- (4) Apply the Three Bond 1104 to the camshaft cap No. 1 attaching section of the cylinder head at those points shown in the right figure.

**NOTE:**

- Be careful not to allow any oil to flow into the bearing cap attaching holes.

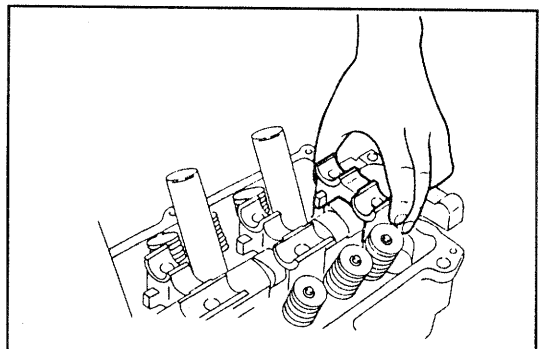


WNU89-EM240

- (5) Install the camshaft bearing caps in the sequence of embossed figures on the caps.

**NOTE:**

- Before the camshaft bearing caps are installed, wipe off any bond oozed from the camshaft cap No. 1.

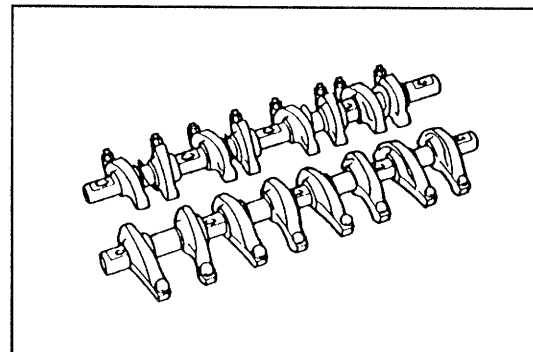


WNU89-EM241

- (6) Assemble the valve rocker arms and wave washers onto the valve rocker shaft, while applying engine oil liberally as shown in the right figure.

**NOTE:**

- The intake valve rocker shaft can be identified by the recessed sections.

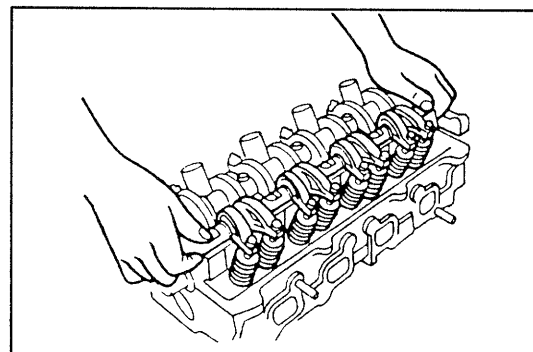


WNU89-EM242

- (7) Install the valve rocker shaft on the camshaft caps.

**NOTE:**

- For easier installation, it is advisable to insert the rocker arm first to the camshaft cap side.

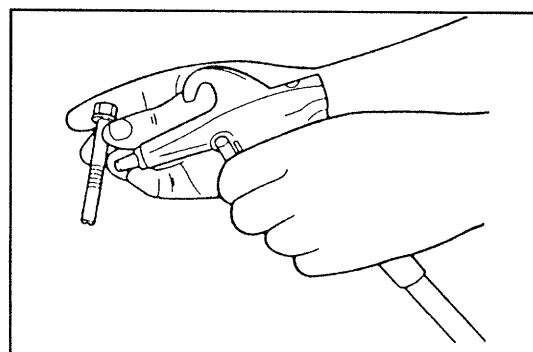


WNU89-EM243

- (8) Clean the attaching bolts and dry them with compressed air. Install them to the cylinder head through the rocker shafts and camshaft caps. Tighten the bolts evenly over two or three stages to the specified torque.

**Tightening Torque:**

M10 bolt	2.9 - 3.7 kg-m/Dry (21.0 - 26.8 ft-lb, 28.4 - 36.3 N·m)
M8 bolt	1.3 - 1.7 kg-m/Dry (9.4 - 12.3 ft-lb, 12.8 - 16.7 N·m)



WRU90-EM131

**WARNING:**

- When using compressed air, protect your eyes with safety goggles.

**CAUTION:**

- Never exceed the specified tightening torque.
- The bolts and bolt holes should be dry when tightening the bolts.

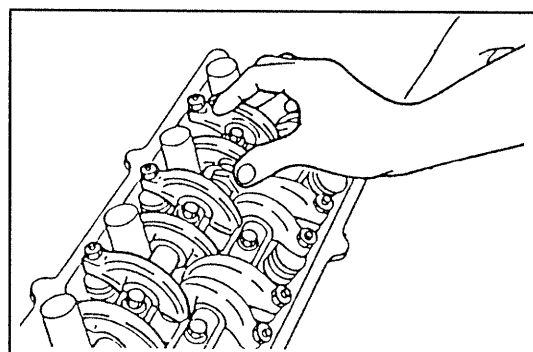
7. Install the spacers into between the intake valve rocker arms on the rocker shaft.

8. Clean the threaded portion of the water temperature sensor. Wind seal tape around the threaded portion and install the sensor to the cylinder head.

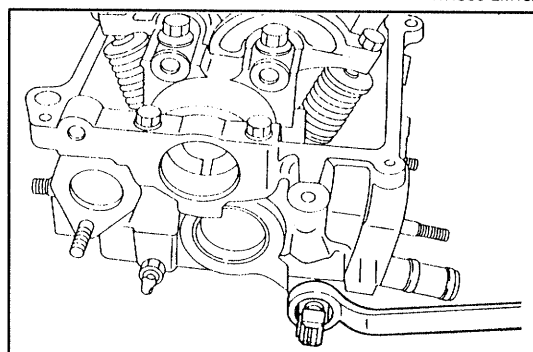
**Tightening Torque:** 2.5 - 3.5 kg-m  
(18.1 - 25.3 ft-lb, 24.5 - 34.3 N·m)

**NOTE:**

- When using a new water temperature sensor, seal tape is unnecessary since seal material is coated on the water temperature sensor.
- Ensure that the water temperature sensor is installed horizontally.



WRU90-EM132



WRU90-EM133

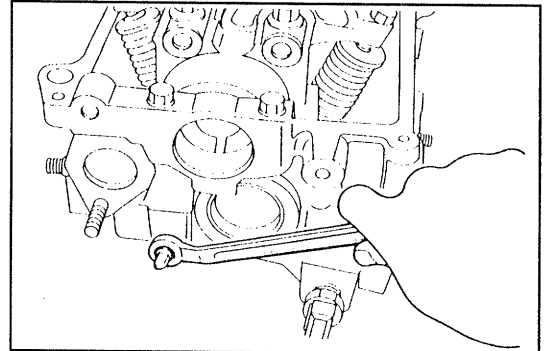
9. Clean the threaded portion of the water temperature sender gauge. Wind seal-tape around the threaded portion. Tighten the gauge to the cylinder head, using the long box wrench.

Tightening Torque: 1.2 - 2.0 kg-m  
(8.7 - 14.5 ft-lb, 11.8 - 19.6 N·m)

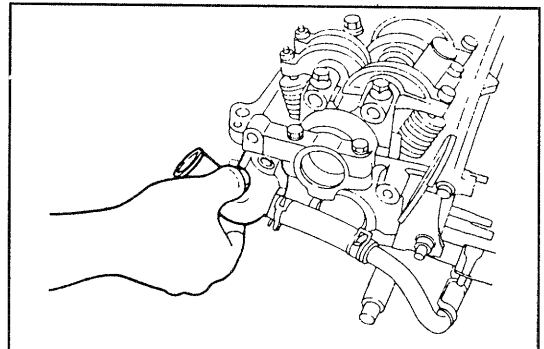
**NOTE:**

- When using a new sender gauge, seal-tape is unnecessary since seal material is coated on the sender gauge.

10. Install the water outlet to the cylinder head with a new gasket interposed.
11. Connect the by-pass hoses and by-pass pipe to the water outlet.



WNU89-EM247



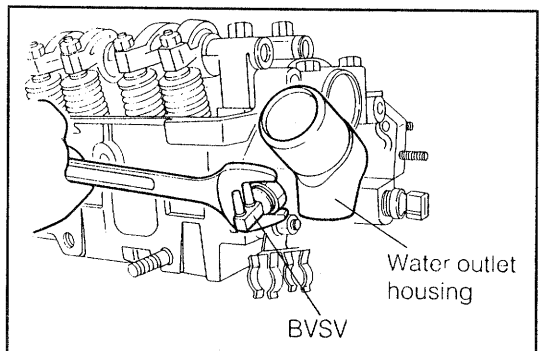
WNU89-EM248

12. Clean the threaded portion of the BVSV. Wind seal tape around the threaded portion and install the BVSV to the cylinder head.

Tightening Torque: 2.5 - 3.5 kg-m  
(18.1 - 25.3 ft-lb, 24.5 - 34.3 N·m)

**NOTE:**

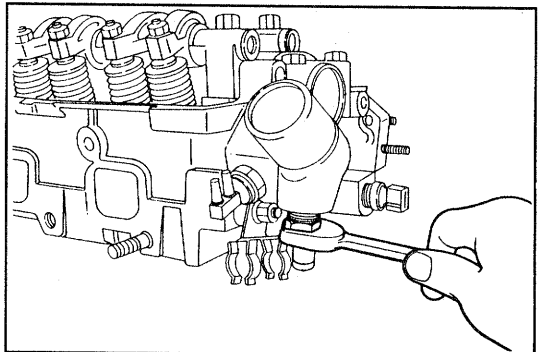
- When using a new BVSV, seal-tape is unnecessary since seal material is coated on the BVSV.



WNU89-EM249

Clean the threaded portion of the A/C water temperature switch. Wind seal tape around the threaded portion and install the A/C water temperature switch to the water outlet (Air conditioner-equipped model only)

Tightening Torque: 2.5 - 3.5 kg-m  
(18.1 - 25.3 ft-lb, 24.5 - 34.3 N·m)



WRU90-EM134

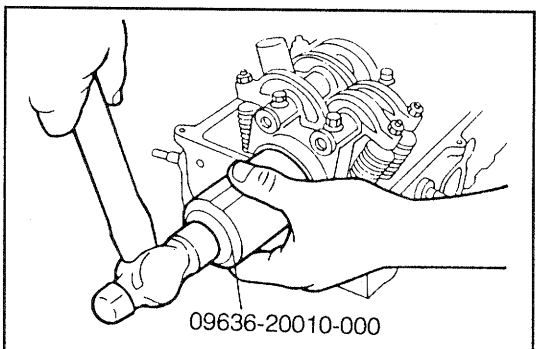
13. Apply engine oil to the bore of the type T oil seal for the camshaft.

Drive the oil seal into position, using the following SST.

SST: 09636-20010-000

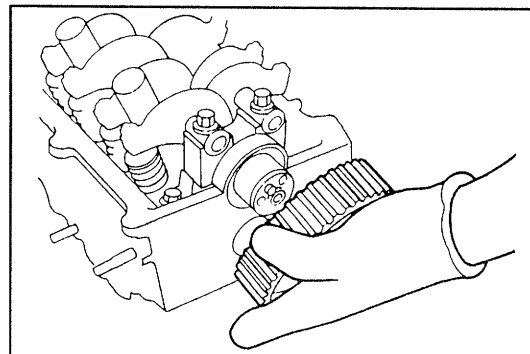
**NOTE:**

- Be very careful not to slant the T oil seal during the installation.



WRU90-EM135

14. Install the camshaft timing belt pulley in such a way that it is aligned with the locating pin of the camshaft and the "F" mark can be seen from the timing belt side.



WNU89-EM252

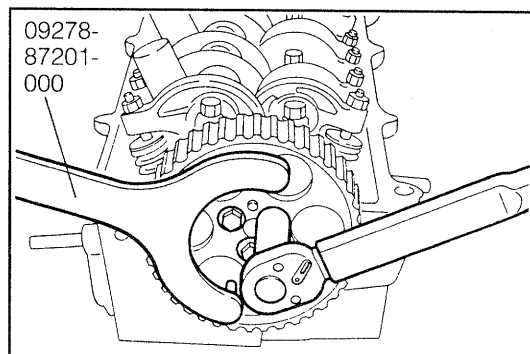
15. Attach the attaching bolts of the camshaft timing belt pulley. Tighten the attaching bolt while preventing the camshaft timing belt pulley from turning, using the following SST.

SST: 09278-87201-000

Tightening Torque: 1.5 - 2.2 kg-m  
(10.9 - 15.9 ft-lb, 14.7 - 21.5 N·m)

**NOTE:**

- Do not turn the camshaft independently.
- The bolts and bolt holes should be dry during the tightening.



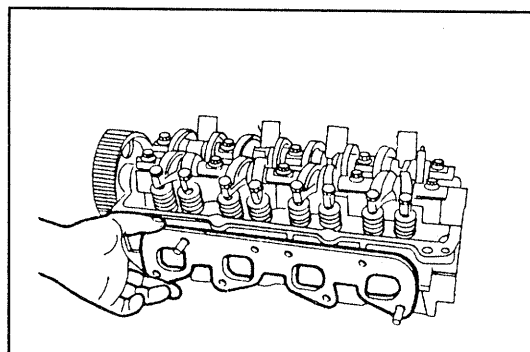
WRU90-EM136

## INSTALLATION OF EXHAUST MANIFOLD SIDE PARTS

1. Install the exhaust manifold gasket on the cylinder head.

**NOTE:**

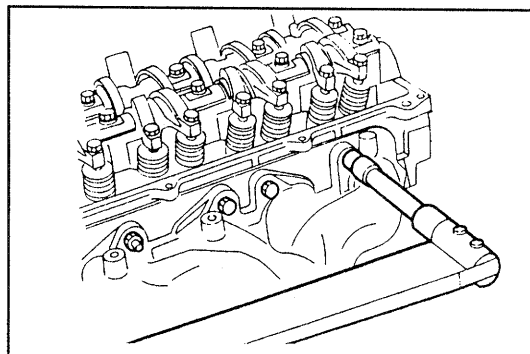
- The exhaust manifold gasket should be installed in such a direction that the side where the grommet turned-out section is bulged may come at the exhaust manifold.



WNU89-EM254

2. Install the exhaust manifold to the cylinder head. Tighten the attaching bolts and nuts evenly over two or three stages.

Tightening Torque: 3.0 - 4.5 kg-m  
(21.7 - 32.5 ft-lb, 29.4 - 44.1 N·m)



WRU90-EM137

## INSTALLATION OF THE INTAKE MANIFOLD SIDE PARTS

1. Clean the intake manifold.

**WARNING:**

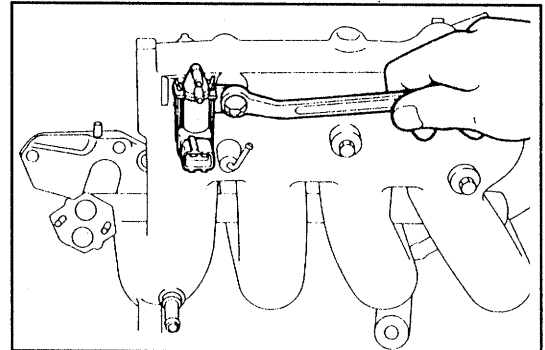
When using compressed air, protect your eyes with safety goggles.

WNU89-EM256

2. Install the EGR VSV to the surge tank.

**NOTE:**

- Apply thin film of the Three Bond 1104 to the threaded portion of the bolt.

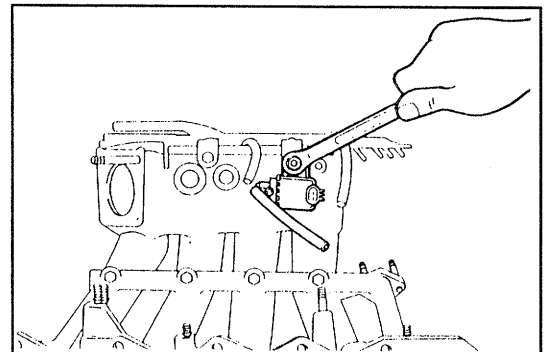


WNU89-EM257

3. Install the vacuum hose sub assembly onto the surge tank.

**NOTE:**

- Apply the thin film of the Three Bond 1104 to the threaded portion of the bolt.



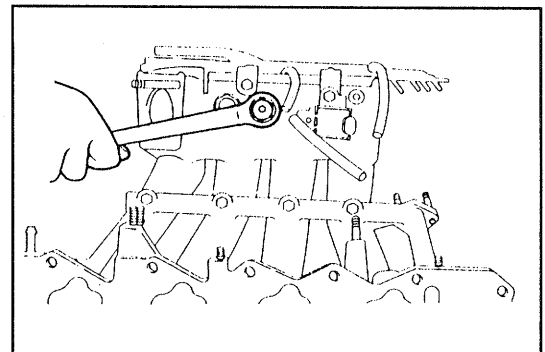
WNU89-EM258

5. Clean the threaded portion of the gas filter.  
Wind seal tape around the threaded portion and install it to the surge tank.

Tightening Torque: 1.2 - 2.0 kg-m  
(8.7 - 14.4 ft-lb, 11.8 - 19.6 N-m)

**NOTE:**

- This operation is required only when the gas filter has been removed.
- Use a hexagonal long box wrench for tightening.



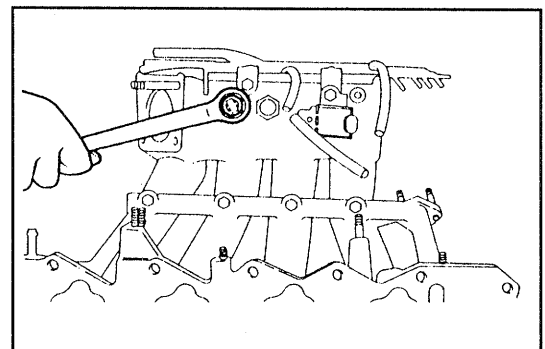
WRU90-EM410

6. Install the intake air temperature sensor to the surge tank with a new washer interposed.

Tightening Torque: 3.0 - 4.0 kg-m  
(21.7 - 28.9 ft-lb, 29.4 - 39.2 N-m)

**NOTE:**

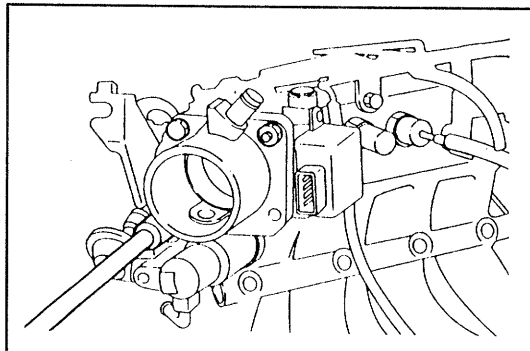
- This operation is required only when the intake air temperature sensor has been removed.



WNU89-EM260

7. Install the throttle body to the surge tank with a new gasket interposed.

**Tightening Torque:** 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N-m)

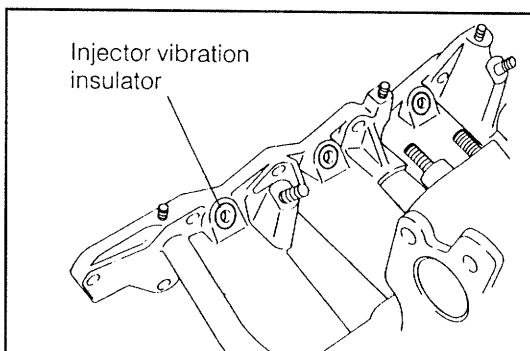


WRU90-EM138

8. Install the injector vibration insulator to the intake manifold section.

**CAUTION:**

- Prior to installation, check the insulator for damage and cracks. Replace any faulty insulator with a new part.

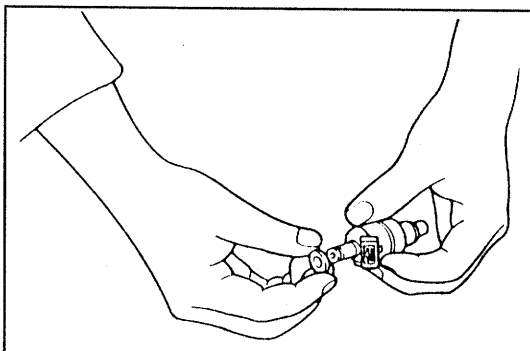


WNU89-EM262

9. Remove the "O" ring of the injector. Remove the grommet and check it for damage or cracks.

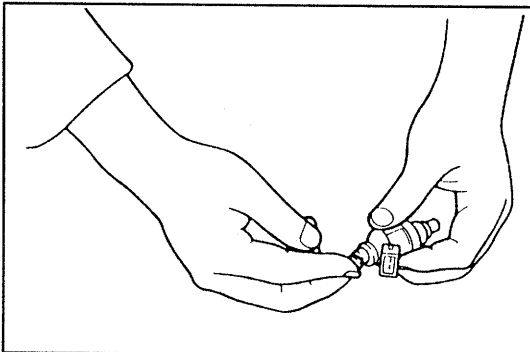
**NOTE:**

- If the grommet exhibits any fault, replace it with a new one.



WNU89-EM263

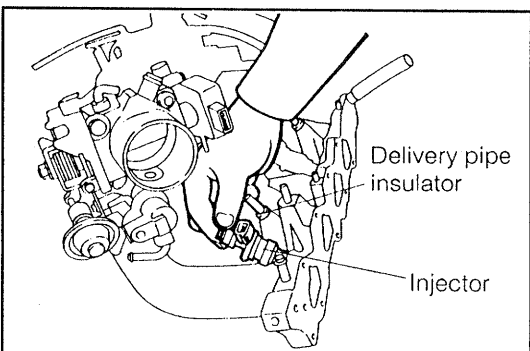
10. Install the grommet and new "O" ring to the injectors.



WNU89-EM264

11. Insert the injector to the vibration insulator hole of the intake manifold.

12. Install the delivery pipe insulator to the stud bolt of the intake manifold.

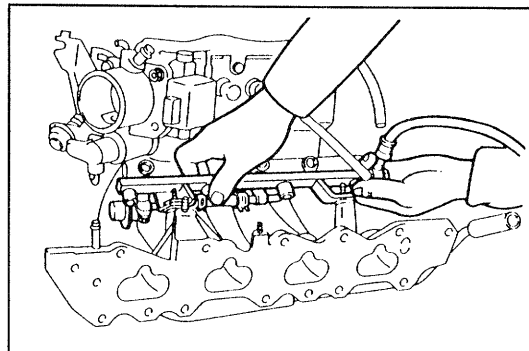


WRU90-EM411

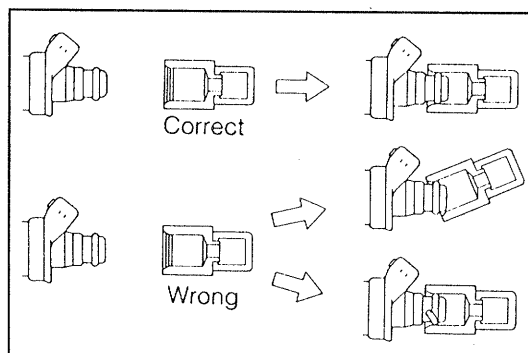
13. Apply silicon oil to the "O" ring of the injector.  
Then, install the delivery pipe.

**CAUTION:**

- Be very careful not to damage the "O" ring of the injector during the delivery pipe installation.
- Do not install the delivery pipe diagonally to the injector.



WRU90-EM139

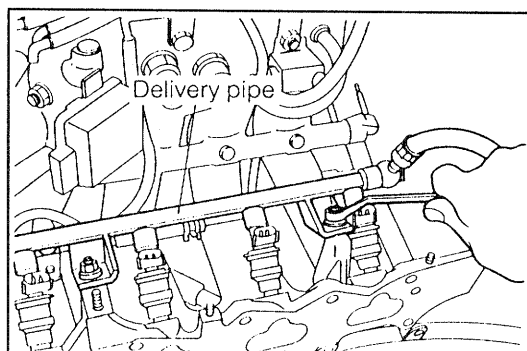


WNU89-EM267

14. Tighten the attaching nuts of the delivery pipe.  
Tightening Torque: 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)

**NOTE:**

- After tightening the delivery pipe, make sure that the injector can be turned by hand. If the injector can not be turned, it indicates probably a damaged injection "O" ring. Hence, replace the injector "O" ring with a new part.



WNU89-EM268

15. Install the surge tank stay No. 1 to the throttle body and intake manifold, using bolt and nut.

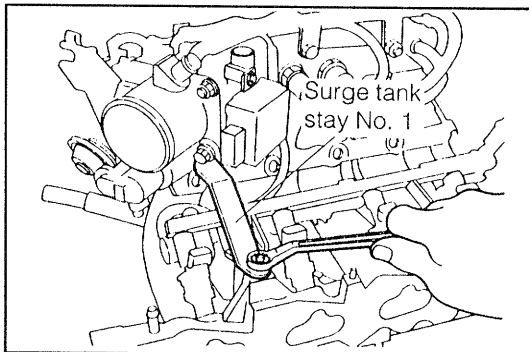
**Tightening Torque:**

Bolt : 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.5 N·m)

Nut: 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.5 N·m)

16. Install the intake manifold to the cylinder head. Tighten the attaching bolts and nuts evenly over two or three stage.

Tightening Torque: 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.5 N·m)



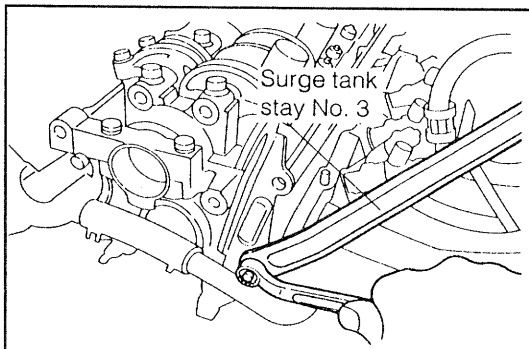
WRU90-EM412

17. Install the engine hanger No. 2 and surge tank stay No. 3 to the stud bolt at the cylinder head. Install the surge tank stay No. 3 to the surge tank side.

**Tightening Torque:**

Bolt: 1.9 - 3.1 kg-m  
(13.8 - 22.4 ft-lb, 18.6 - 30.3 N·m)

Nut: 1.9 - 3.1 kg-m  
(13.8 - 22.4 ft-lb, 18.6 - 30.3 N·m)



WRU90-EM413

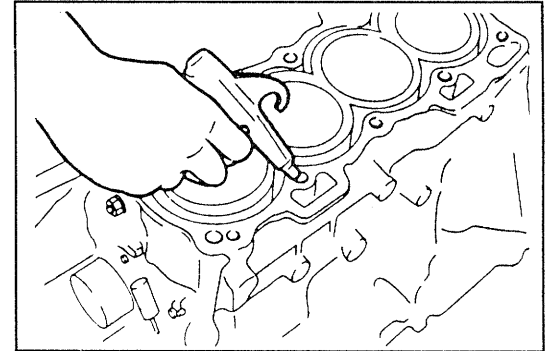


## INSTALLATION OF CYLINDER HEAD WITH MANIFOLDS

1. Clean the cylinder block head bolt holes.

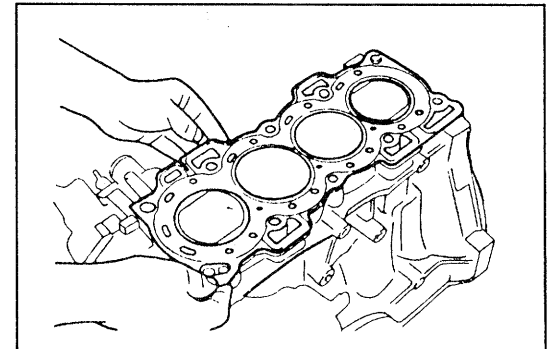
**WARNING:**

Protect your eyes with goggles when using compressed air.



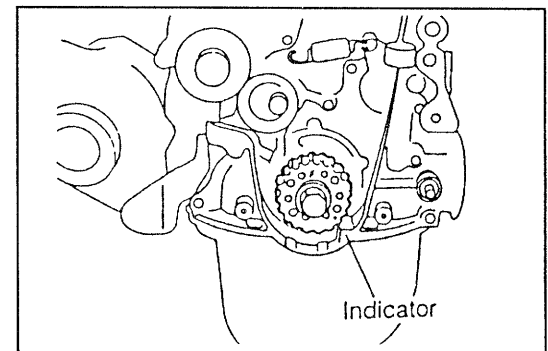
WNU89-EM271

2. Clean the cylinder block upper gasket surface. Install the cylinder head gasket, while aligning it with the pin ring for locating use.



WNU89-EM272

3. Turn the crankshaft so that the crankshaft key groove may come at the top position.

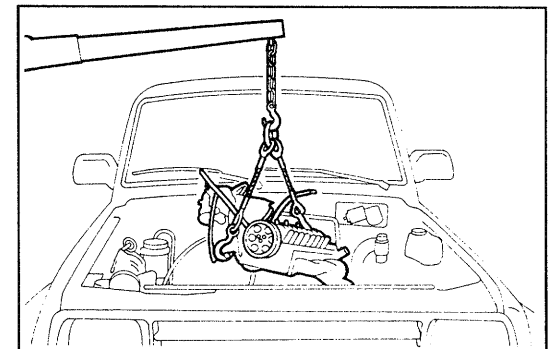


WNU89-EM273

4. Install the cylinder head onto the cylinder block, using chain block.

**CAUTION:**

- Be careful not to allow the cylinder head to hit to the vehicle body and/or other parts.



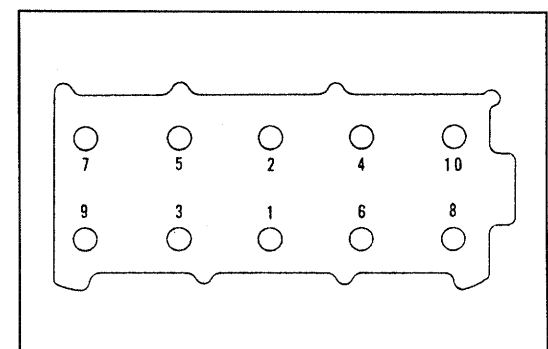
WRU90-EM140

5. Coat each cylinder head bolt with a thin film of engine oil. Using these bolts, install the cylinder head to the cylinder block. Tighten the bolts evenly over two or three stages, following the sequence shown in the right figure.

Tightening Torque: 6.0 - 6.8 kg-m  
(43.4 - 49.2 ft-lb, 58.8 - 66.7 N·m)

**NOTE:**

- Make sure that all the bolts are torqued uniformly to a constant level, not just torqued within the specified range.

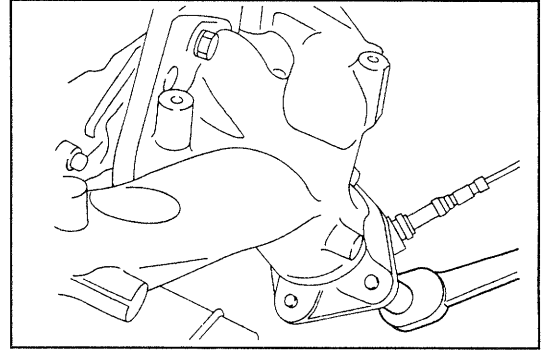


WRU90-EM414

## ENGINE MECHANICALS

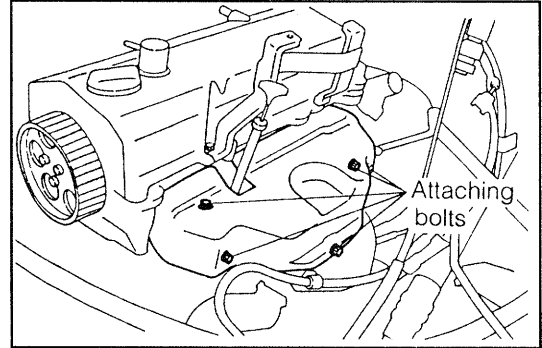
6. Connect the exhaust pipe to the exhaust manifold with a new gasket interposed.  
Then, tighten the attaching nuts.

Tightening Torque: 4.5 - 5.5 kg-m  
(32.5 - 39.8 ft-lb, 44.1 - 53.9 N·m)



WRU92-EM425

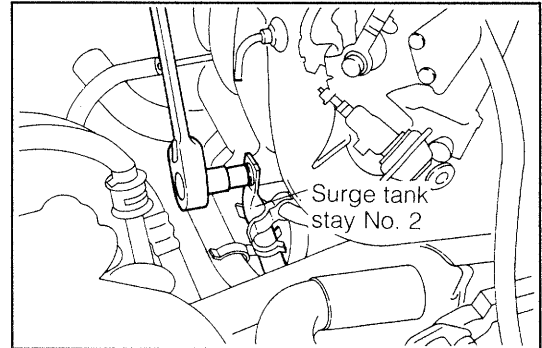
7. Install the oil level gauge support.  
Tighten the clamping bolt.  
8. Install the exhaust manifold cover.  
Tighten the five attaching bolts.



WRU90-EM142

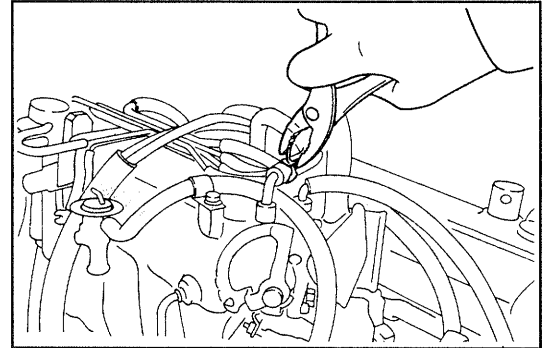
9. Fit the surge tank stay No. 2 to the surge tank. Tighten the attaching bolt and nut.

Tightening Torque: 3.0 - 4.5 kg-m  
(21.7 - 32.5 ft-lb, 29.4 - 44.1 N·m)



WRU90-EM143

10. Connect the cooling water hoses to the air valve on the throttle body.

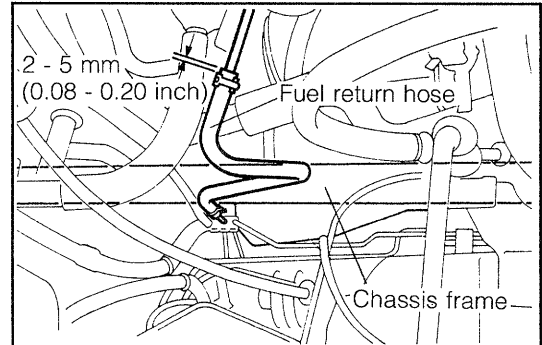


WRU90-EM144

11. Connection of fuel return hose to fuel pipe No. 2.  
(1) Insert the fuel return hose onto the fuel pipe No. 2 until second spool of fuel pipe.  
(2) Securely clamp the fuel hose at 2 - 5 mm (0.08 - 0.20 inch) from fuel return hose end.

### NOTE:

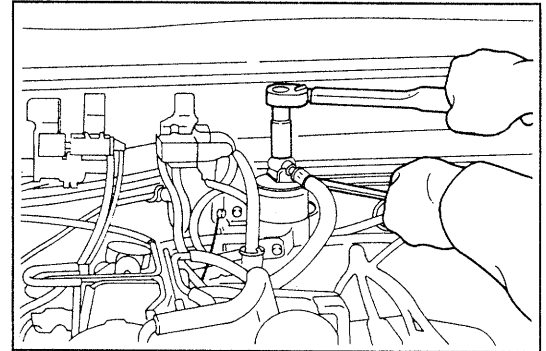
- Install the fuel return hose in parallel with chassis frame.



WRU90-EM145

12. Install the fuel hose No. 1 to the fuel filter with a new gasket interposed.

Tightening Torque: 3.5 - 4.5 kg-m  
(25.4 - 32.5 ft-lb, 34.3 - 44.1 N·m)

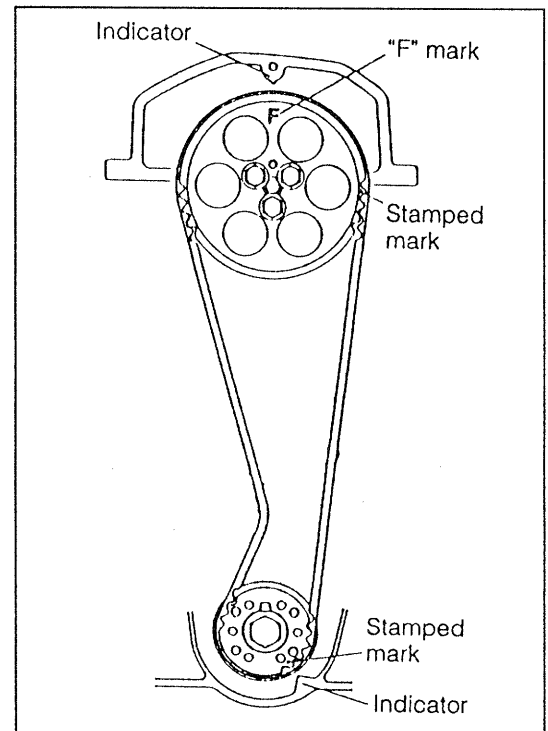


WRU90-EM146

## INSTALLATION OF TIMING BELT

(See page EM-30)

1. Install the cylinder head cover temporarily.
2. Install the timing belt tensioner and tensioner spring. Temporarily tighten them, while they are being pushed toward the alternator side.
3. Align the mating marks of the crankshaft timing belt pulley and camshaft timing belt pulley with the corresponding mating marks.
4. Install the timing belt.
5. Loosen the tensioner attaching bolt so that tension may be given to the belt.  
Then, temporarily tighten the attaching bolt again.
6. Turn the crankshaft 2 turns in the normal direction.
7. Loosen the tensioner attaching bolt.
8. Turn the crankshaft until the "F" mark of the camshaft is aligned with the indicator on the cylinder head cover.
9. Tighten the tensioner attaching bolt to the specified torque.
10. Remove the cylinder head cover.



WRU90-EM147

ADJUSTMENT AND INSTALLATION OF OTHER PART

1. Adjustment of Valve Clearances

NOTE:

- When tightening the adjusting nuts, apply engine oil to the lock nuts, adjusting bolts and rocker arms.

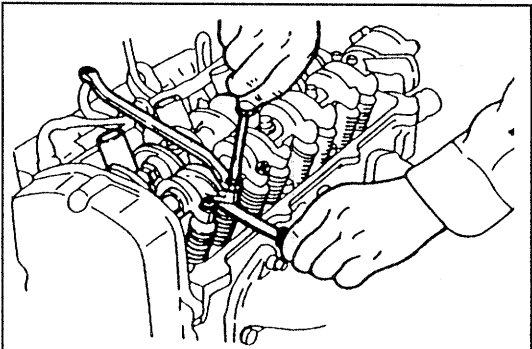
(1) Align the drilled mark of the crankshaft timing belt pulley with the indicator mark of the oil pump.

(2) Check to see if the valve rocker arms of the No. 1 cylinder are in a free state or they are pushed up by the cam.

Adjust the valve clearances in accordance with the table below.

The mark represents a valve which can be adjusted at that time.

WRU90-EM148



WNU89-EM284

Cylinder No.		1	2	3	4
Rocker arm condition					
(1)When valve rocker arms of No. 1 cylinder is free; "O" marks are available to adjust. (2)Turn the crankshaft 360 degrees. (3)When valve rocker arms of No. 4 cylinder is free; "x" marks are available to adjust.	IN	O	O	x	x
	EX	O	x	O	x

Valve Clearances (Cold):

- Intake 0.18 mm (0.0071 inch)
- Exhaust 0.25 mm (0.0098 inch)

NOTE:

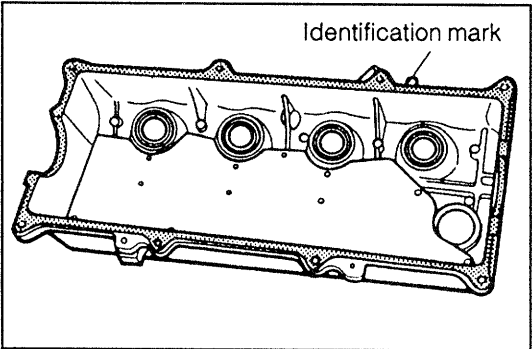
- The valve clearance should be readjusted after the engine has been warmed up thoroughly.

WRU90-EM179

2. Installation of cylinder head cover

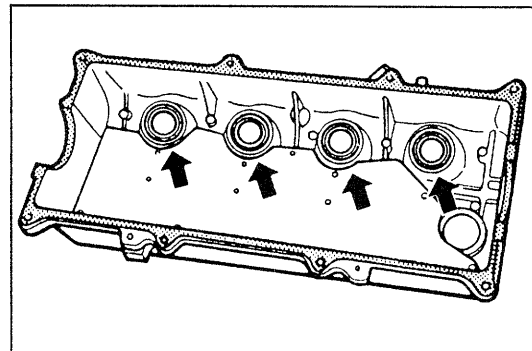
- Clean the cylinder head cover gasket surface of the cylinder head.
- Check the cylinder head cover gasket for damage. Replace the cylinder head cover gasket, as required. Assemble the cylinder head cover gasket with the identification mark facing toward the intake side.

Identification mark



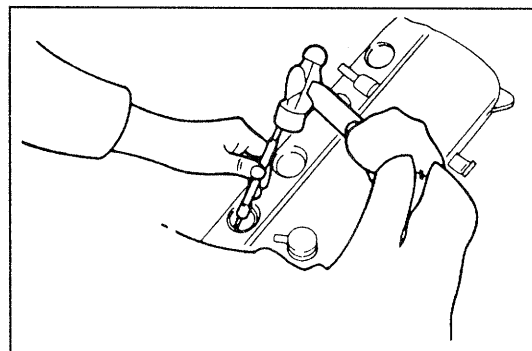
WRU90-EM149

- (3) Check the rubber grommets of the spark plug tubes for damage.  
Replace the rubber grommets, as required.



WNU89-EM287

- Replacement of rubber grommets  
For removal operation, use a slotted pin puller.



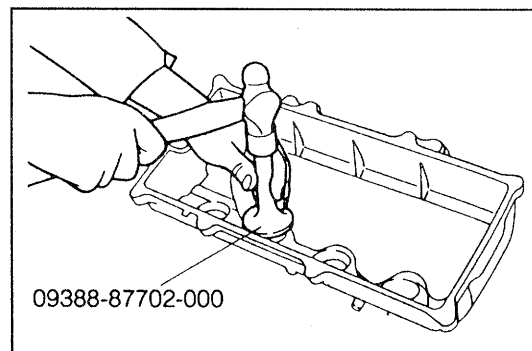
WNU89-EM288

- When installing the grommet, drive it into position, using the following SST.

SST: 09388-87702-000

## NOTE:

- Make sure that the grommets is not tilted when it is driven into position.
- Be sure to use a suitable wooden piece so as to prevent the cylinder head cover from damage.
- Be careful not to damage the lip section of the grommet.

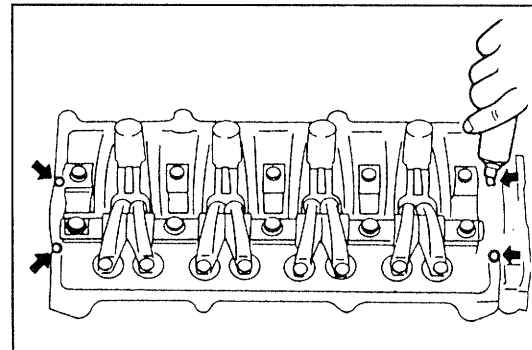


WNU89-EM289

- (4) Apply the Three Bond 1104 to the cylinder head at points indicated in the figure.  
(5) Install the cylinder head cover to the cylinder head.

## NOTE:

- Be careful not to scratch the rubber grommet for the spark plug tube during the installation.
- Care must be exercised to ensure that the rubber grommet will not ride over the spark plug tube.

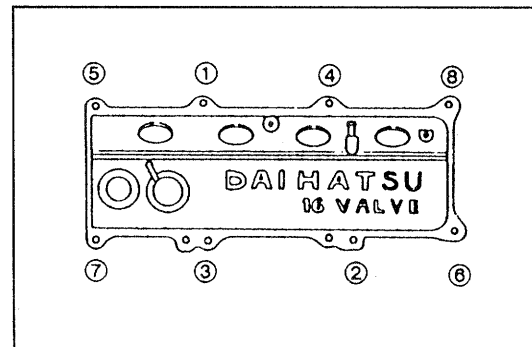


WNU89-EM290

- (6) Tighten the cylinder head cover bolts evenly over two or three stages to the specified torque, following the sequence shown at the figure.

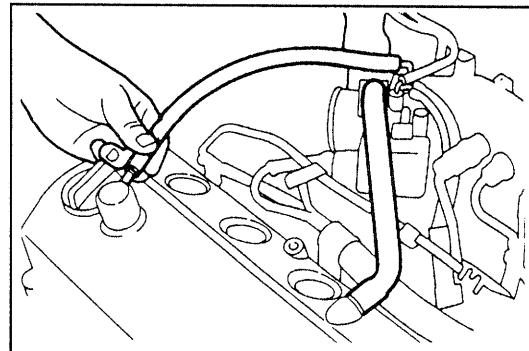
Tightening Torque: 0.3 - 0.5 kg-m  
(2.2 - 3.6 ft-lb, 2.9 - 4.9 N-m)

- (7) Install the oxygen sensor harness to the clamp.



WRU90-EM415

- (8) Connect the blow-by gas hoses to the cylinder head and throttle body.



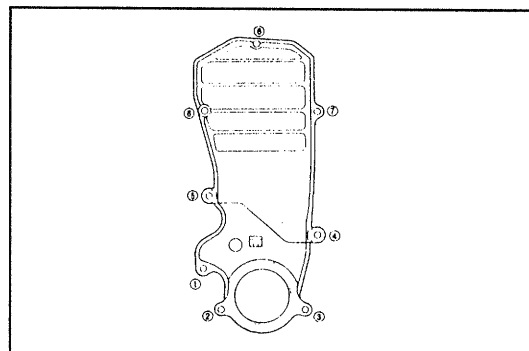
WNU89-EM-292

3. Install the timing belt cover.

Tightening Torque: 0.2 - 0.4 kg-m  
(1.4 - 2.9 ft-lb, 2.0 - 3.9 N-m)

**NOTE:**

- Attaching bolts ① and ④ should be installed first of all.



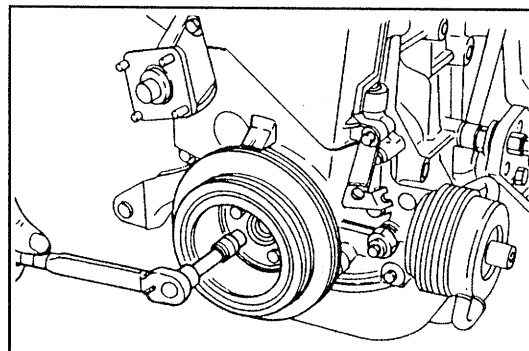
WRU90-EM150

4. Install the crankshaft pulley on the crankshaft timing belt pulley with four bolts.

Tightening Torque: 2.0 - 3.0 kg-m  
(14.5 - 21.7 ft-lb, 19.6 - 29.4 N-m)

**NOTE:**

- Prevent the engine from turning by placing the shift lever in the 5th speed gear position.
- Special care must be exercised to get the specified tightening torque, for the crankshaft may turn slightly, while tightening.



WNU89-EM294

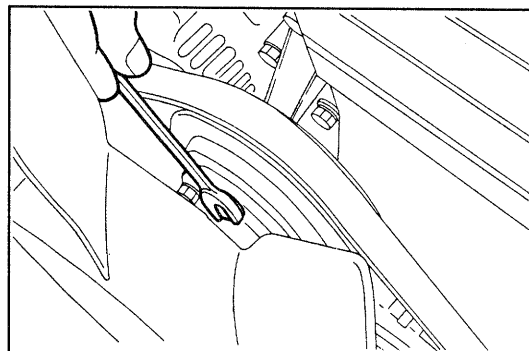
5. Installation of fluid coupling with fan and fan shroud
- (1) Install the water pump pulley to the water pump with temporarily attaching.
- (2) Insert the radiator fan shroud together with the fluid coupling with fan between radiator and the engine.

**NOTE:**

- Be sure that the water pump pulley is not ride to the spigot section of the water pump pulley seat.

- (3) Install the fluid coupling with fan to the water pump by means of four bolts through water pump pulley.

Tightening Torque: 1.0 - 1.8 kg-m  
(7.2 - 13.0 ft-lb, 9.8 - 17.7 N-m)



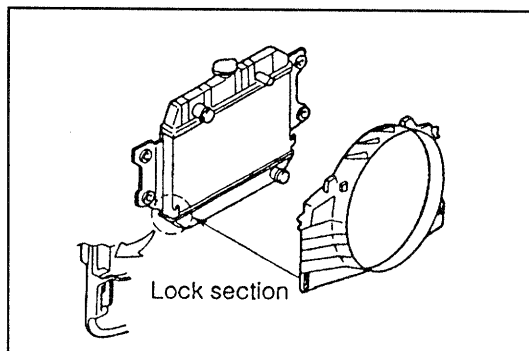
WRU90-EM151

**REFERENCE:**

Tightening torque of fluid coupling and fan is as follows.

0.44 - 0.66 kg-m (3.2 - 4.8 ft-lb, 4.3 - 6.5 N-m)

- (4) Insert the lock section of fan shroud to the radiator. Then, tighten the two attaching bolts of the radiator upper side.
- (5) Connect the water hose to the radiator upper tank. Securely clamp the water hose clamp.

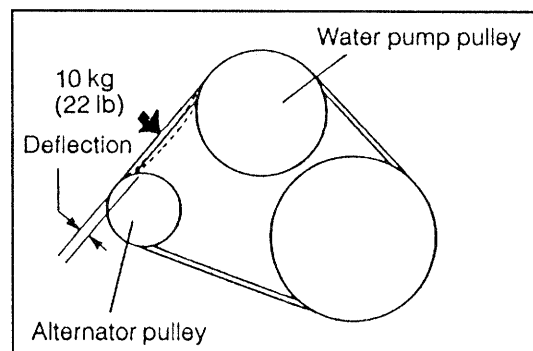


WRU90-EM152

6. Install the V ribbed belt and perform the adjustment in such a way that the deflection at the midpoint between the water pump pulley and the alternator may become the specified value when a force of 10 kg (22 lb) is applied to the midpoint.

Used Belt: 5.0 - 6.0 mm (0.197 - 0.236 inch)

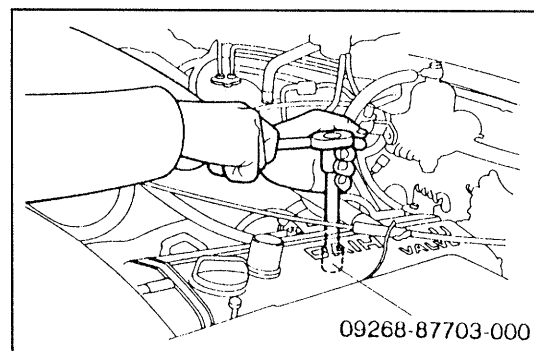
With a force of 10 kg (22 lb) applied to point indicated in figure



WNJ89-EM296

7. Install the reserve tank to the radiator assembly bracket. Insert the over flow hose to the radiator.
8. Install the spark plug, using the following SST.

SST: 09268-87703-000

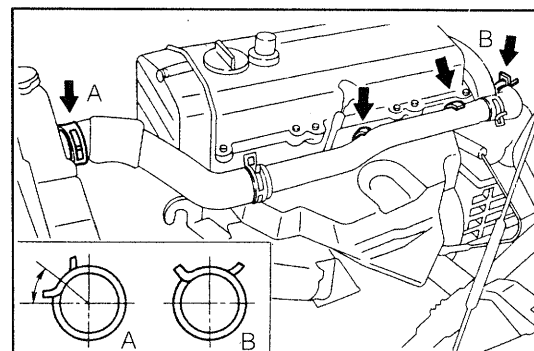


WRU90-EM153

9. Install the radiator hose No. 1 to the radiator upper tank. Tighten the two clamps and two attaching bolts.

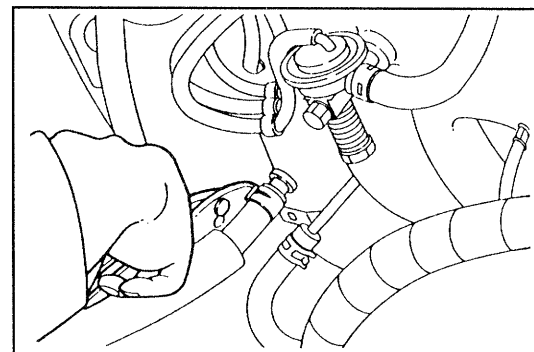
**NOTE:**

- Ensure that the clamps are installed as illustrated in right figure.



WRU90-EM154

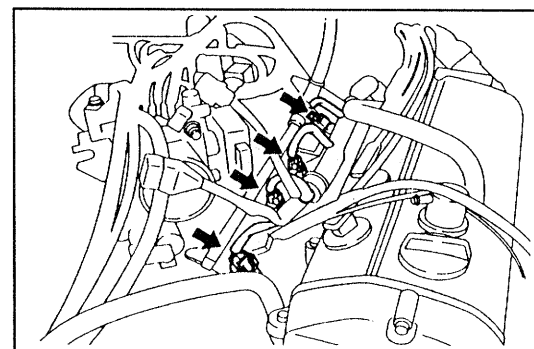
10. Connect the vacuum hose for the brake booster to the intake manifold.



WRU90-EM155

11. Installation of engine wire harness

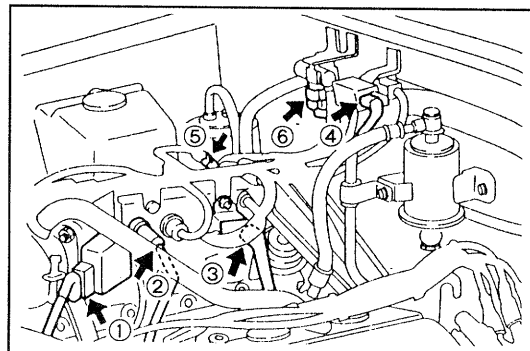
- (1) Install the engine wire clamps and engine ground cables.
- (2) Connect the injector connectors.



WRU90-EM156

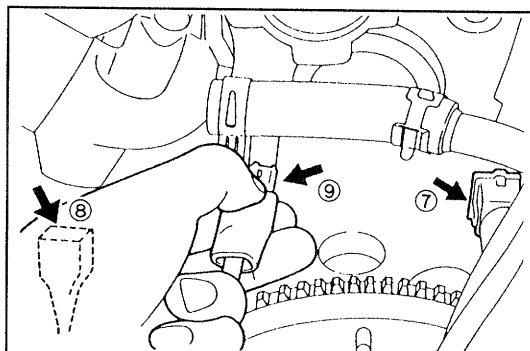
(3) Connect the following connectors.

- ① Throttle position sensor
- ② Intake air temperature sensor
- ③ Idle speed control VSV
- ④ Pressure sensor, pressure VSV and clamp
- ⑤ EGR VSV
- ⑥ A/C idle up VSV



WRU90-EM157

- ⑦ Water temperature sensor
- ⑧ A/C water temperature switch
- ⑨ Water temperature sender gauge
- ⑩ Oxygen sensor



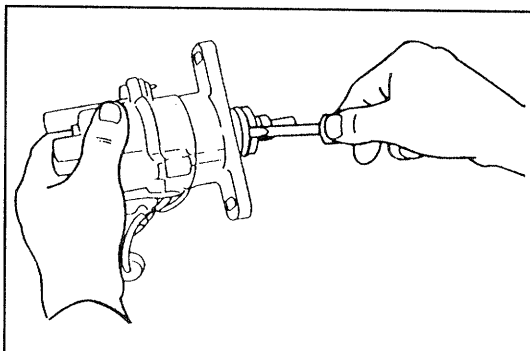
WRU90-EM158

## 12. Installation of the distributor

- (1) Replace the "O" ring of the distributor body with a new one.

### NOTE:

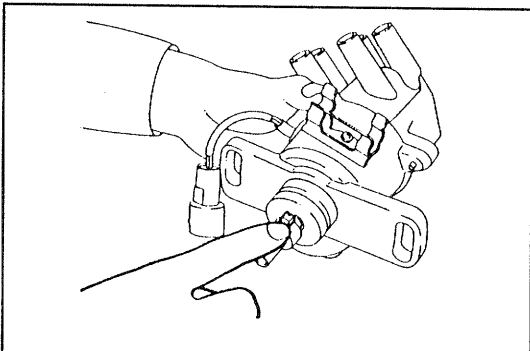
- Care must be exercised to avoid scratching the new "O" ring.



WRU90-EM159

- (2) Align the cutout section of the distributor proper with the cutout groove of the coupling. Assemble the distributor on the cylinder head, lining up the protrusion of the distributor with the camshaft groove.

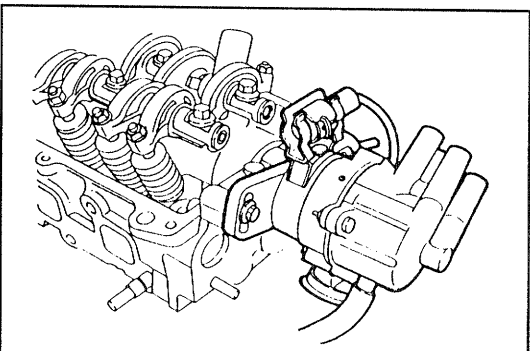
During this installation, the aligned cutout sections must come at the top side of the engine.



WNU89-EM304

- (3) With the center of each elongated hole on the flange section of the distributor proper aligned with the corresponding threaded hole of the cylinder head, tighten the distributor attaching bolts.

**Tightening Torque:** 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)



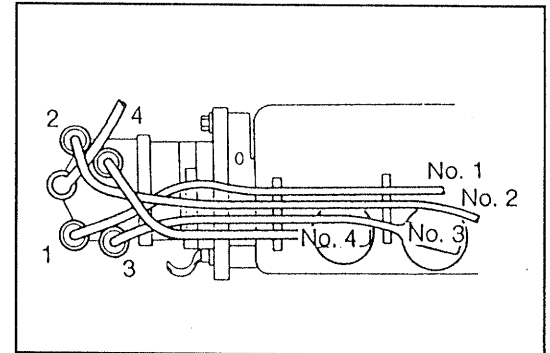
WNU89-EM305



(4) Connect the distributor connector.

**NOTE:**

- Be sure to install the spark plug wire into the distributor cap as indicated in the right figure.

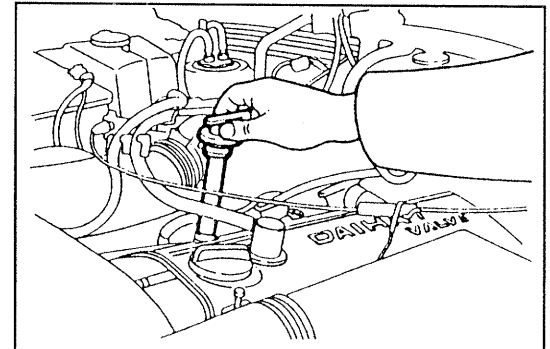


WRU90-EM160

13. Connect the spark plug wire.

**CAUTION:**

- Hold the rubber boot section of the spark plug wire. Securely connect it to the spark plugs, the distributor cap and the ignition coil.
- Be careful not to damage the spark plug wire with the spark plug tube.

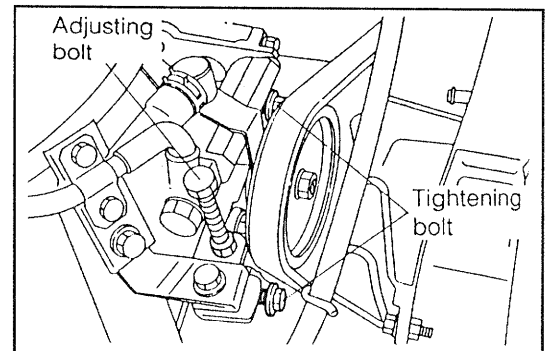


WRU90-EM161

14. Connect the spark plug wire to the cord clamp.

15. Installation of the power steering pump and drive belt (P/S equipped vehicle only)

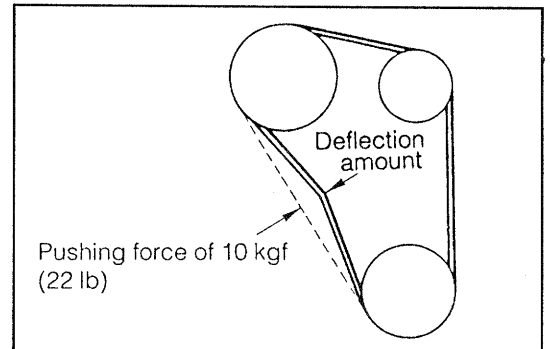
- (1) Install the power steering pump assembly into the position.
- (2) Install the power steering drive belt.



WRU90-EM162

(3) Set the drive belt tension to the specified value by tightening the adjusting bolt.

**Specified Deflection:** 9 - 11 mm (0.35 - 0.43 inch)  
[When a force of 10 kg (22 lb) is applied:]

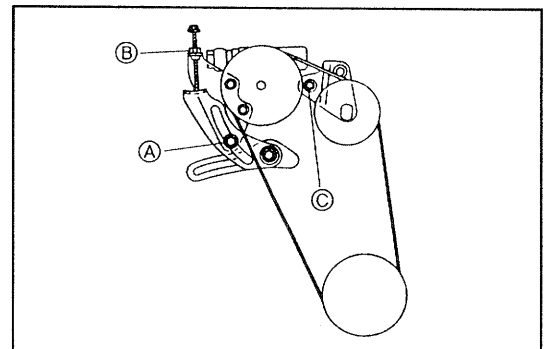


WRU90-EM163

(4) Tighten the bolts to the specified value.

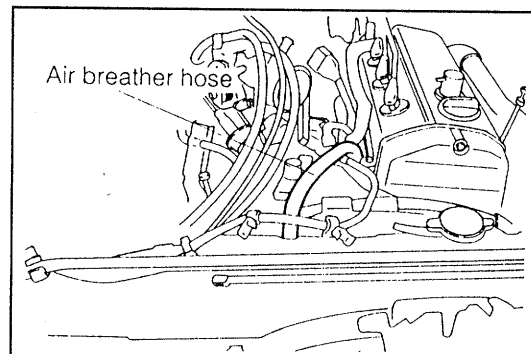
**Tightening Torque:**

- Ⓐ ..... 3.5 - 4.5 kg-m  
(25.3 - 32.5 ft-lb, 34.3 - 44.1 N·m)
- Ⓑ ..... 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)
- Ⓒ ..... 5.0 - 7.0 kg-m  
(36.2 - 50.6 ft-lb, 49.0 - 68.6 N·m)



WRU90-EM164

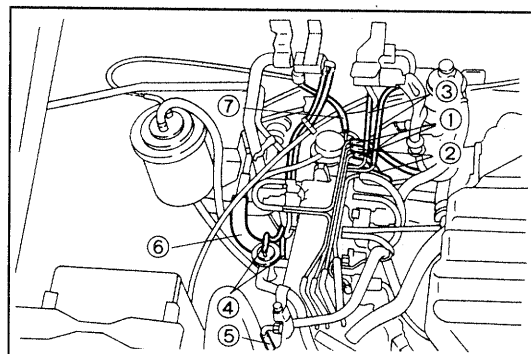
16. Connect the air breather hose to the radiator upper tank.



WRU90-EM165

17. Installation of vacuum hoses at the surge tank

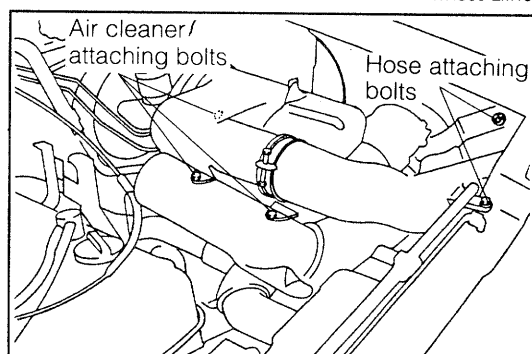
- (1) Distributor diaphragm ①
- (2) BVSV ②
- (3) Pressure VSV ③
- (4) Air-con idle up VSV ④
- (5) Power steering ACV ⑤
- (6) Brake booster ⑥
- (7) Charcoal canister ⑦



WRU90-EM166

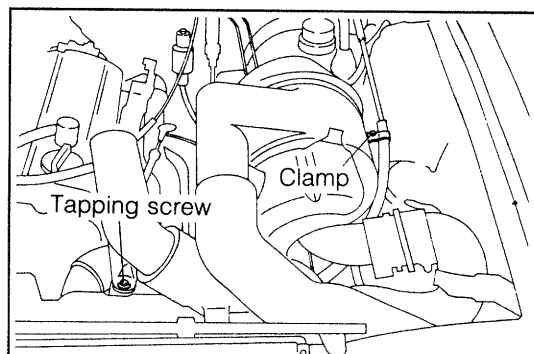
18. Installation of the air cleaner sub assembly

- (1) Install the air cleaner sub assembly into position.  
Tighten the three attaching bolts.
- (2) Tighten the attaching bolts to the left fender panel and radiator center support.



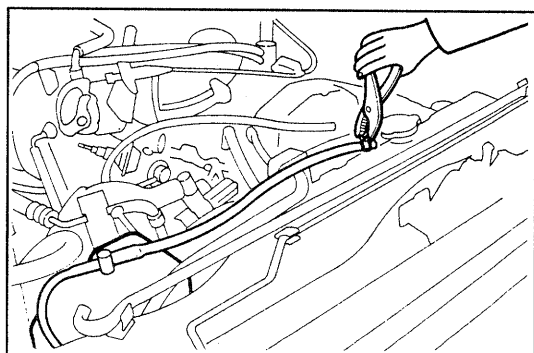
WRU90-EM167

- (3) Tighten the tapping screw at the fan shroud.
- (4) Install the clutch cable clamp to the air cleaner.



WRU90-EM168

19. Install the radiator reserve tank into position.  
Clamp the water hose securely.



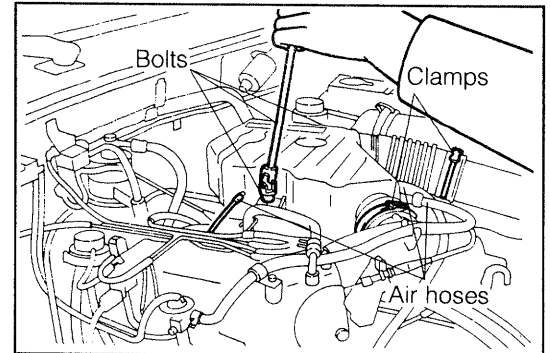
WRU90-EM169

## 20. Installation of air chamber

- (1) Install the air chamber by attaching the three screws and two clamps.

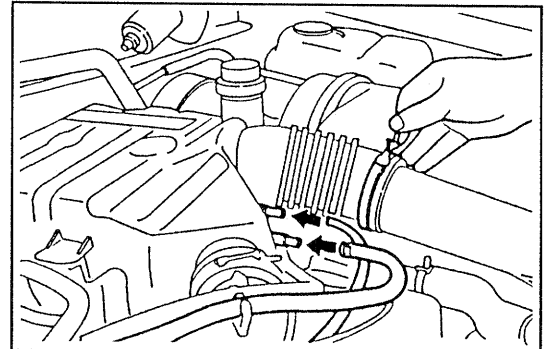
### NOTE:

- Align the matching marks provided on the air chamber and air hose.



WRU90-EM170

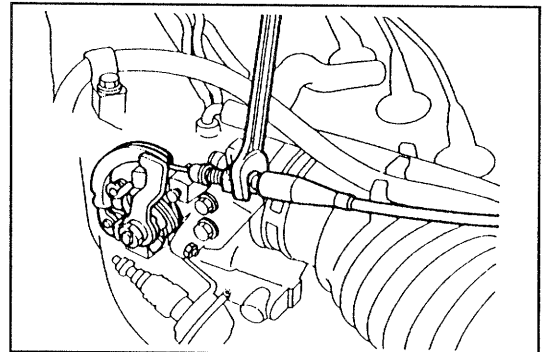
- (2) Install the air hoses for air conditioner and power steering idle up.



WRU90-EM171

## 21. Connect the accelerator cable to the throttle body.

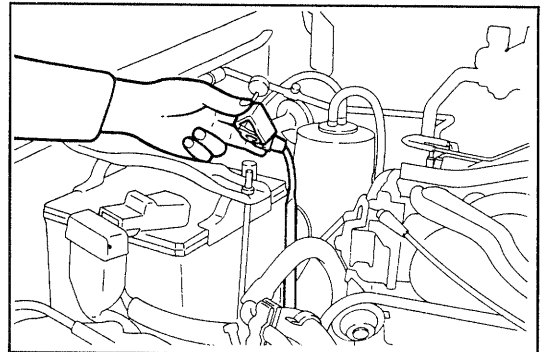
22. Adjust the accelerator cable so that the accelerator pedal free play may become 1 - 5 mm (0.04 - 0.20 inch).



WNU89-EM319

## 23. Installation of the battery

- (1) Install the battery into position.
- (2) Install the battery holding clamp.
- (3) Connect the positive cable to the positive (+) terminal. Then connect the battery ground cable to the negative (-) terminal of the battery.



WRU90-EM172

## FILLING OF ENGINE OIL AND COOLING WATER

### 1. Filling engine oil

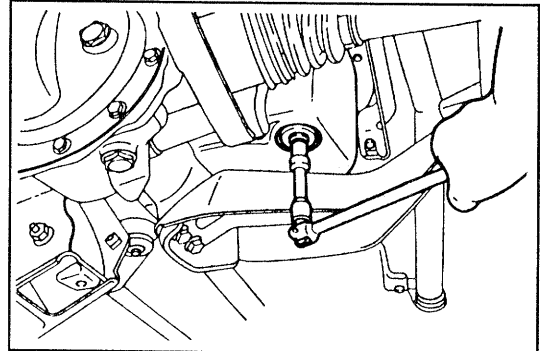
- (1) Clean the oil drain plug. Install it with a new gasket interposed.

#### NOTE:

- Remove any remaining gasket material from the oil pan, using a gasket scraper.

Tightening Torque:

2.0 - 3.0 kg-m (14.5 - 21.7 ft-lb, 19.6 - 29.4 N-m)



WRU90-EM173

- (2) Fill the engine with engine oil.

The oil should be API grade SG or SF multigrade viscosity, fuel-efficient oil.

#### Oil capacity

When only engine oil is changed:

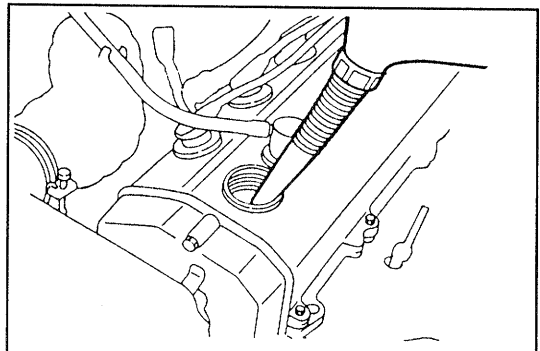
3.3 liter (3.5 US qt.)

When engine oil is changed and oil filter is replaced:

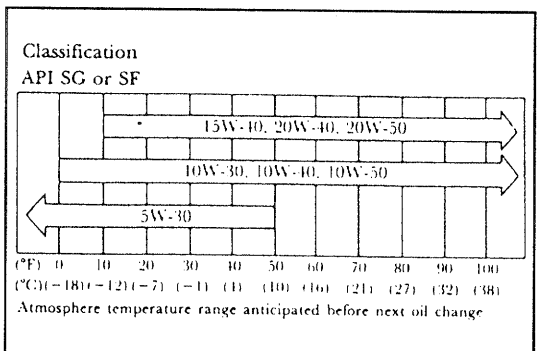
3.5 liter (3.7 US qt.)

After engine has been overhauled or when engine oil has been drained completely from engine:

3.8 liter (4.0 US qt.)



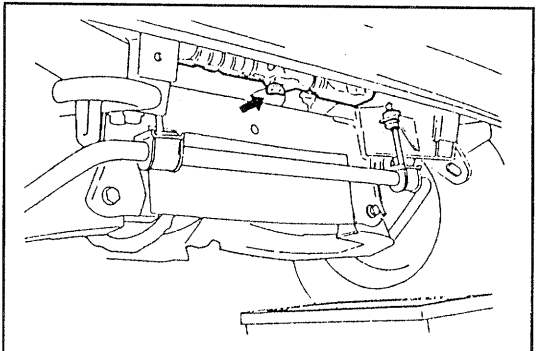
WNU89-LU017



WNU89-LU018

### 2. Filling cooling water

- (1) Install the cooling water drain plug with new gasket.



WRU90-EM174

- (2) Fill the radiator and reserve tank with antifreeze solution in accordance with the instructions of the manufacturer of the antifreeze solution.

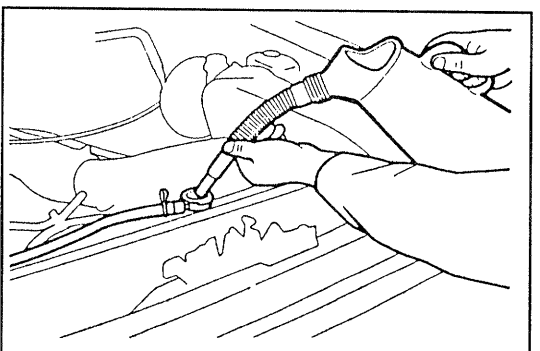
#### CAUTION:

- Use a Good brand of ethylene-glycol base antifreeze solution.

Coolant capacity (Vehicle with front heater):

5.5 liter (5.8 US qt)

[excluding 1.0 liter (1.1 US qt) for reserve tank]



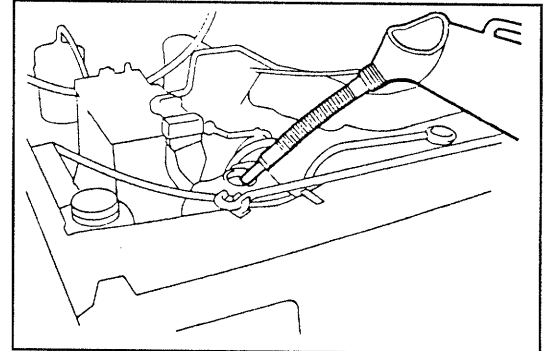
WRU90-EM175

- (3) Fill the system with water.
- (4) Start the engine. Check the coolant level. Add water, as required.
- (5) Tighten the radiator cap.
- (6) Warm the engine. Afterwards, allow the coolant to cool down to the atmospheric temperature. Recheck the coolant level at the reserve tank. Add coolant to the full level, as required.

If no coolant remains at all in the reserve tank, recheck the coolant level in the radiator. Replenish the radiator with water, as required. Replenish the reserve tank with coolant up to the full level.

**NOTE:**

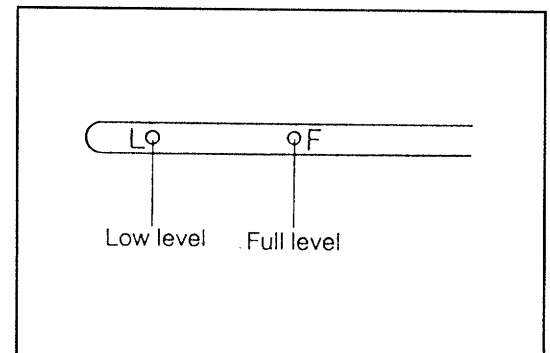
- Here, the coolant refers to the mixture of water and antifreeze that has been mixed in accordance with the instructions of the antifreeze manufacturer.



WRU90-EM176

- (7) A lapse of two or three minutes after the engine stop, check the oil level.

If the oil level is less than the full level, replenish the oil to the full level.



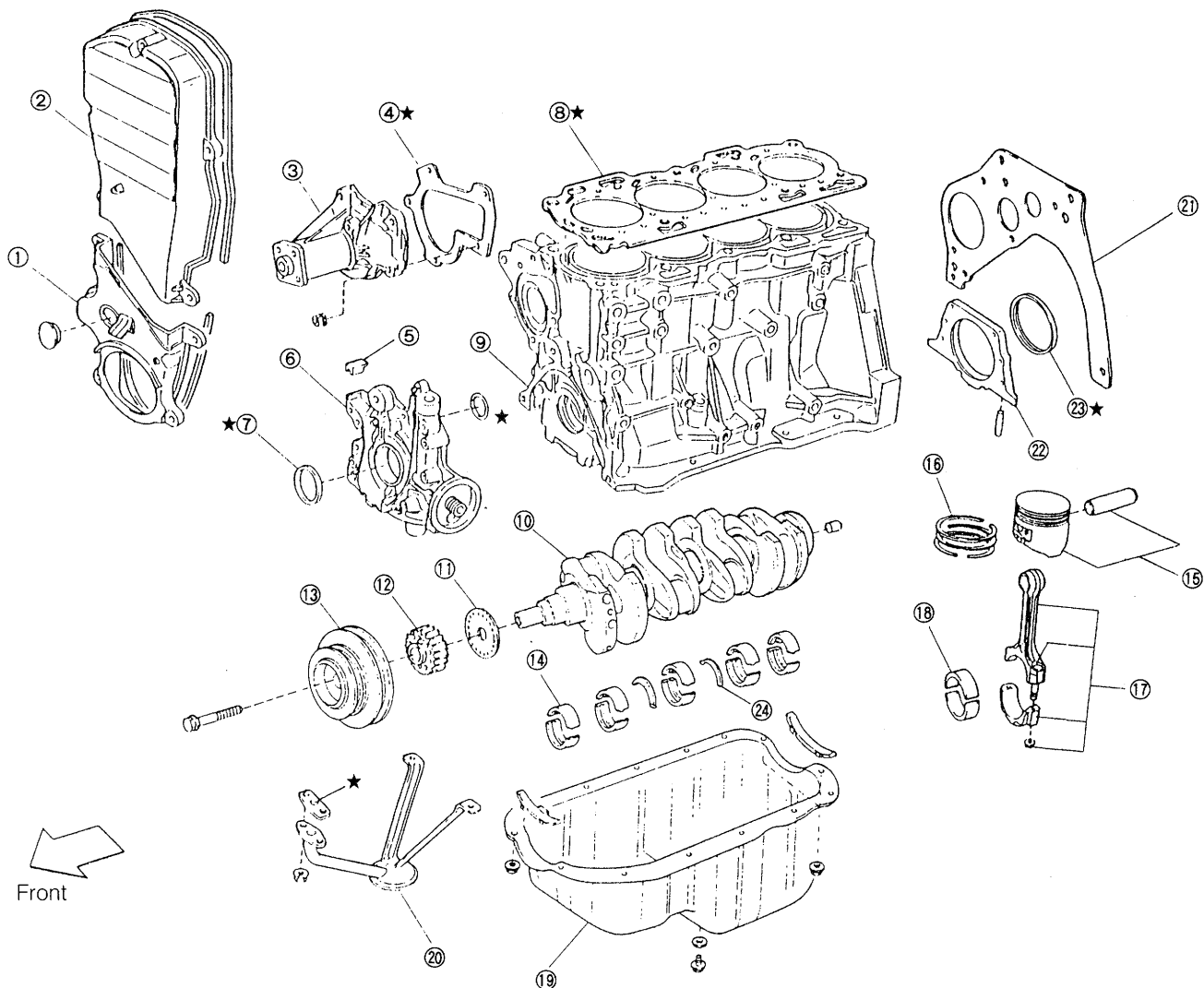
WRU90-EM177

3. Perform the engine tune-up.  
(See page EM-9).

WRU90-EM178

## CYLINDER BLOCK COMPONENTS

★: Non-reusable parts



- |                                        |                             |
|----------------------------------------|-----------------------------|
| ① Timing belt cover No. 1              | ⑬ Crankshaft pulley         |
| ② Timing belt cover No. 2              | ⑭ Crankshaft bearing        |
| ③ Water pump Ay                        | ⑮ Piston with pin           |
| ④ Water pump gasket                    | ⑯ Piston ring               |
| ⑤ Dust seal                            | ⑰ Connecting rod            |
| ⑥ Oil pump Ay                          | ⑱ Connecting rod bearing    |
| ⑦ Oil seal                             | ⑲ Oil pan                   |
| ⑧ Cylinder head gasket                 | ⑳ Oil pump strainer         |
| ⑨ Cylinder block                       | ㉑ Rear end plate            |
| ⑩ Crankshaft                           | ㉒ Oil seal retainer         |
| ⑪ Crankshaft timing belt pulley flange | ㉓ Oil seal                  |
| ⑫ Crankshaft timing belt pulley        | ㉔ Crankshaft thrust bearing |

## INSTRUCTIONS PRIOR TO OPERATION

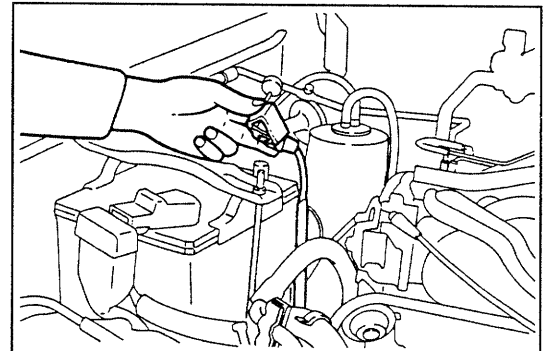
Install fender covers to the fenders so that no scratch may be made to the fenders.

WNU89-EM325

## ENGINE REMOVAL

### 1. Removal of battery

- (1) Disconnect the battery ground cable from the negative (–) terminal of the battery. Then disconnect the wires from the positive (+) terminal of the battery.



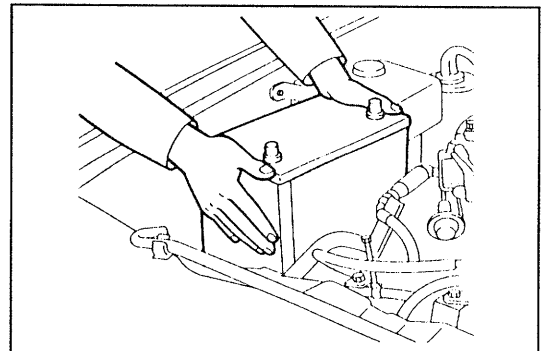
WRU90-EM180

- (2) Remove the battery hold-down clamp and battery clamp bolts.

- (3) Remove the battery from the engine room.

**WARNING:**

Handle the battery carefully. Never allow any flame to be brought to the battery.

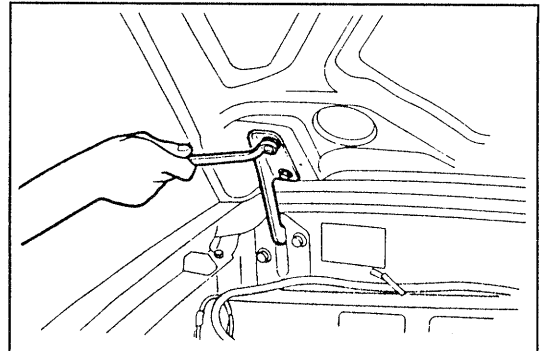


WRU90-EM181

### 2. Removal of engine hood

- (1) Disconnect the windshield washer hose from the three-way joint. Remove the hose from the clamp of the engine hood.

- (2) Remove the hood, being careful not to scratch the body and hood.



WNU89-EM327A

### 3. Drain the coolant.

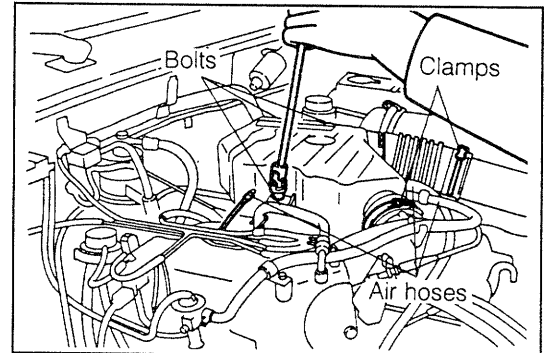
(See page CO-3.)

### 4. Drain the engine oil.

(See page LU-4.)

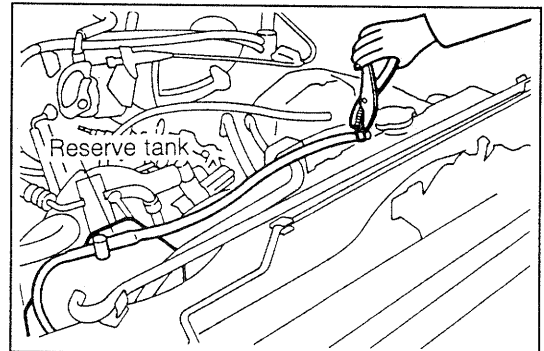
WRU90-EM182

5. Remove the intake air chamber.  
(See page EM-10.)



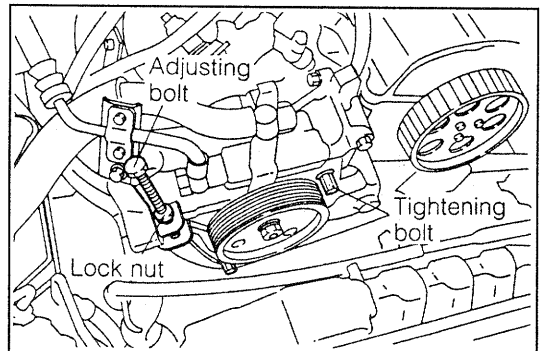
WRU90-EM183

6. Removal of radiator reserve tank  
(1) Disconnect the radiator reserve tank hose from the radiator.  
(2) Pull up the radiator reserve tank together with hose.



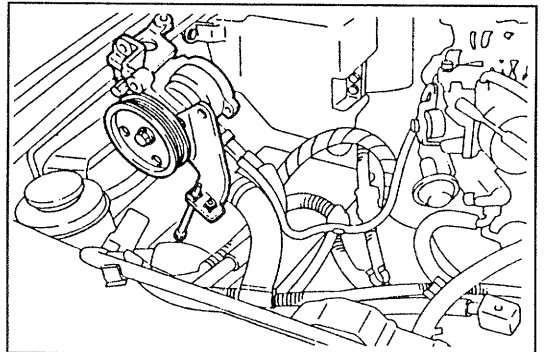
WRU90-EM184

7. Removal of power steering pump and drive belt (Power steering equipped vehicle only)  
(1) Loosen the lock nut, adjusting bolt and two tightening bolts. Then push down the power steering pump.



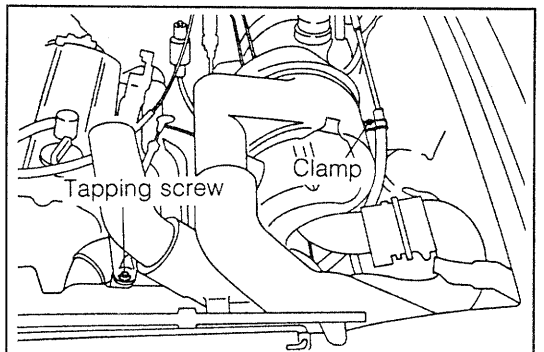
WRU90-EM185

- (2) Remove the power steering pump assembly from the engine by removing three screws. Then temporarily put the pump assembly onto the battery mounting location.



WRU90-EM186

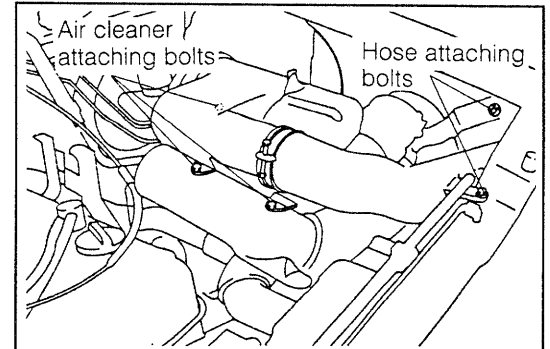
8. Removal of air cleaner and air cleaner hose assembly  
(1) Remove the tapping screw from the radiator fan shroud upper side.  
(2) Remove the clutch cable clamp provided at the air cleaner.



WRU90-EM187



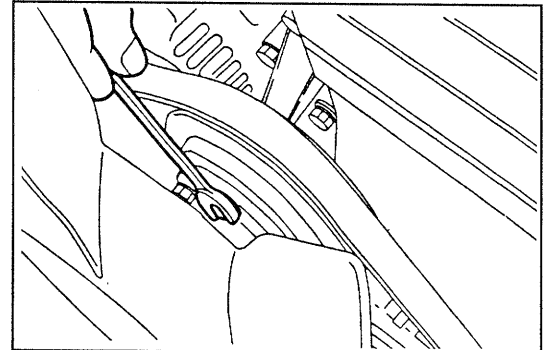
- (3) Remove the air cleaner hose attaching bolts provided at the left fender panel and radiator center support.



WRU90-EM188

## 9. Removal of radiator

- (1) Disconnect the air breather hose from the radiator upper tank.

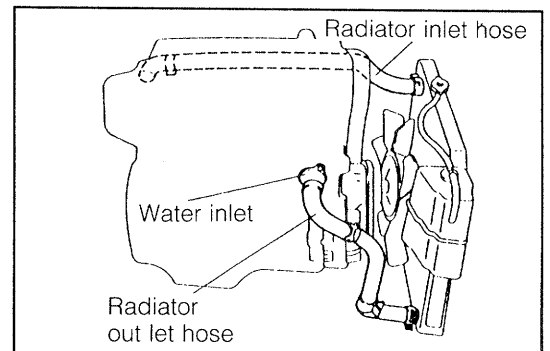


WRU90-EM189

- (2) Remove the radiator inlet hose by disconnecting the radiator and water outlet side clamps.
- (3) Disconnect the radiator outlet hose at the center connection.

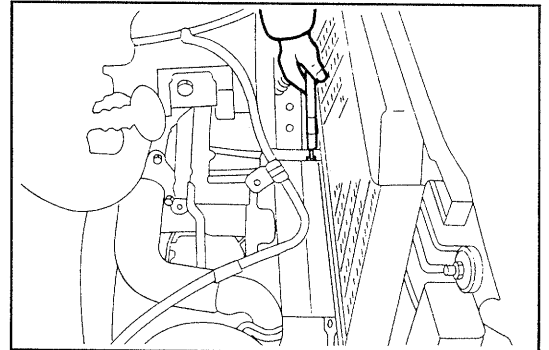
### CAUTION:

- When disconnect the radiator outlet hose, be sure to protect the alternator in order to prevent the alternator from entering of coolant.



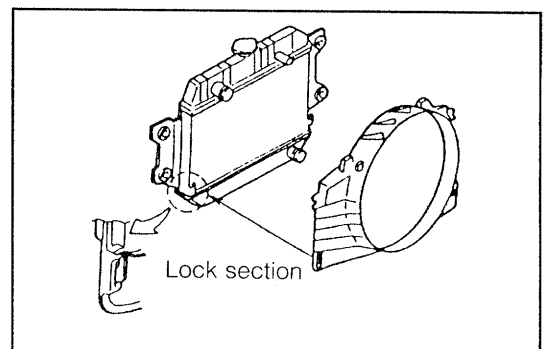
WRU90-EM190

- (4) Disconnect the oil cooler hose from the radiator.



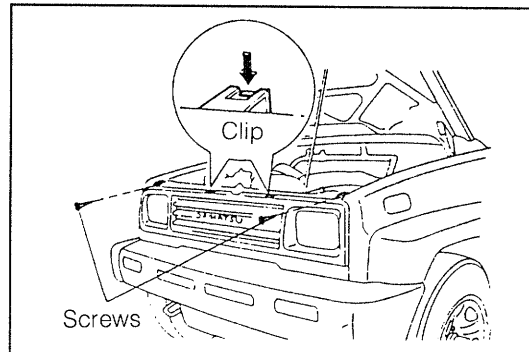
WRU90-EM191

- (5) Remove the two attaching bolts of the fan shroud. Then, disconnect the lock section of the fan shroud from radiator.
- (6) Disconnect the fluid coupling with fan by removing the four attaching bolts. Then remove the fluid coupling with fan together with fan shroud.



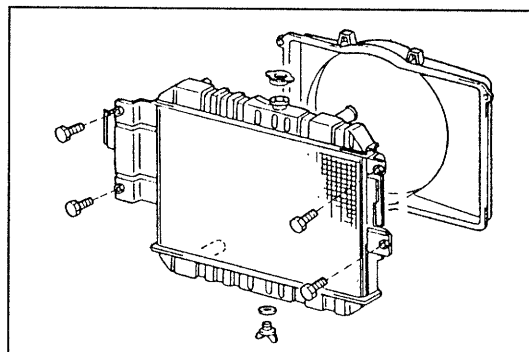
WRU90-EM192

(7) Remove the radiator grille.



WRU90-EM193

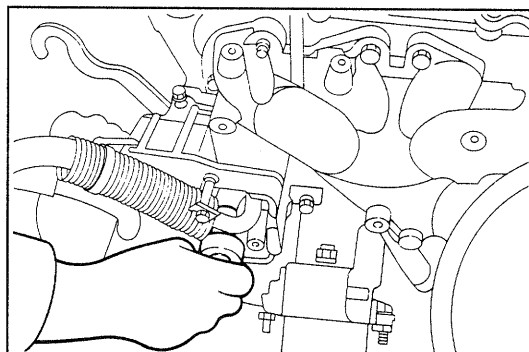
(8) Remove the radiator by removing the four attaching bolts.



WRU90-EM194

## 10. Removal of air conditioner compressor

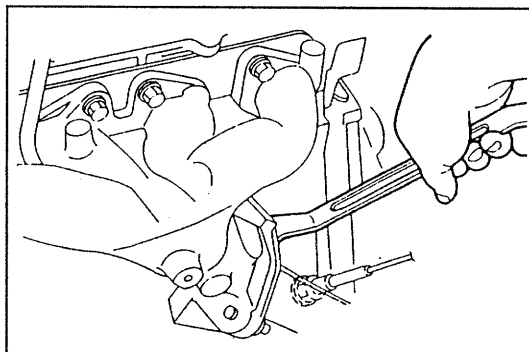
- (1) Remove the compressor cover by removing the attaching bolts.
- (2) Remove the compressor assembly by removing the attaching bolts. Then temporarily put the compressor assembly onto the engine compartment left side.



WRU90-EM195

## 11. Disconnecting of exhaust pipe

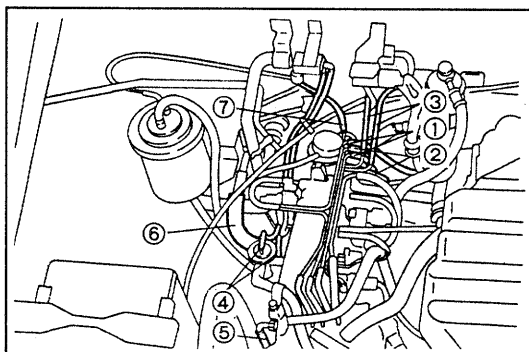
- (1) Remove the exhaust manifold cover.
- (2) Disconnect the exhaust pipe from the exhaust manifold by removing the three attaching nuts.
- (3) Disconnect the exhaust pipe from the bracket provided at the transmission.



WRU90-EM196

## 12. Removal of following vacuum hoses at surge tank side

- (1) Distributor diaphragm ①
- (2) BVSV ②
- (3) Pressure VSV ③
- (4) Air conditioner idle up VSV ④
- (5) Power steering ACV ⑤
- (6) Brake booster ⑥
- (7) Charcoal canister ⑦



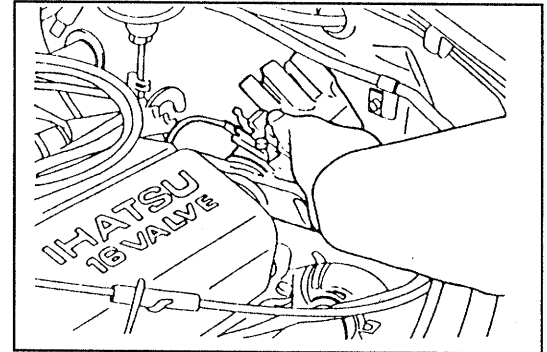
WRU90-EM197

## 13. Removal of distributor

- (1) Disconnect the distributor wire connector.
- (2) Remove the distributor from the cylinder head by removing the two attaching bolts.

### NOTE:

- Since the remaining engine oil will flow out, be certain to place a cloth etc..

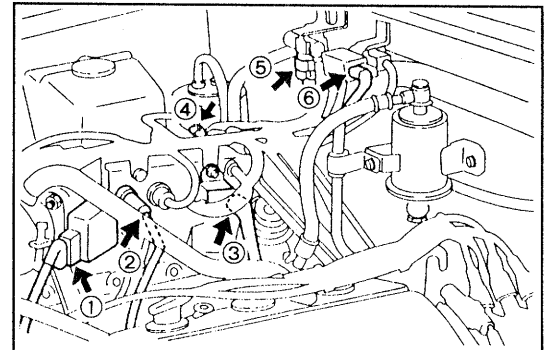


WRU90-EM198

## 14. Removal of engine wire harness

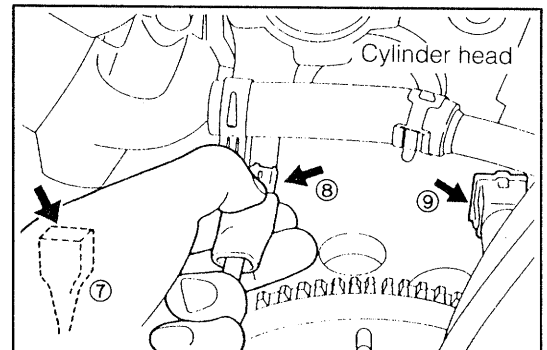
- (1) Disconnect the following connectors.

- ① Throttle position sensor ①
- ② Intake air temperature sensor ②
- ③ Idle speed control VSV ③
- ④ EGR VSV and harness clamp ④
- ⑤ Air-conditioner idle up VSV ⑤
- ⑥ Pressure sensor, Pressure VSV and clamp ⑥



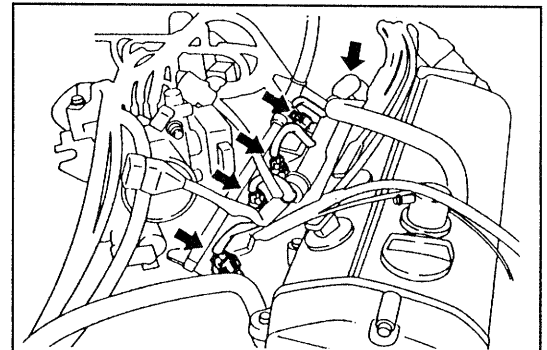
WRU90-EM199

- ⑦ Air conditioner water temperature switch ⑦
- ⑧ Water temperature sender gauge ⑧
- ⑨ Water temperature sensor ⑨
- ⑩ O<sub>2</sub> sensor



WRU90-EM200

- (2) Disconnect the four injector connectors.
- (3) Remove the engine wire clamps and engine ground cables.

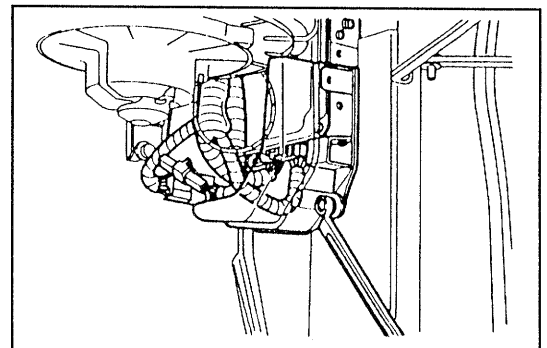


WRU90-EM201

- (4) Removal of engine wire from ECU

- ① Remove the ECU cover at the cowl side panel of passenger seat side.
- ② Disconnect the engine wire connector from the engine control computer assembly (ECU).
- ③ Pull out the engine wire toward the engine compartment.

- (5) Remove the engine wire from the engine compartment.



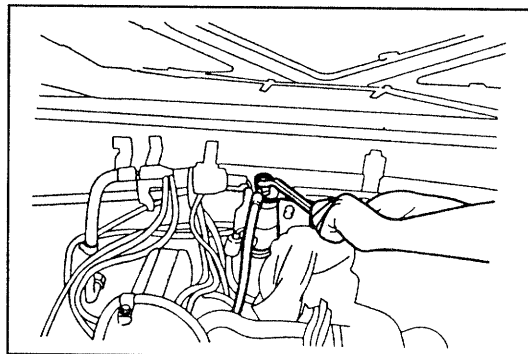
WRU90-EM202

## ENGINE MECHANICALS

15. Disconnect the fuel hose at the upper part of fuel filter.

**CAUTION:**

- Release the inner pressure of the fuel tank by removing the fuel filler cap in advance.
- The pressure in the fuel line is kept  $2.55 \text{ kg/cm}^2$  (36.3 psi) higher than the atmospheric pressure. Hence, when the fuel line is loosened, be sure to prevent the fuel from splashing using an adequate cloth or the like. Furthermore, place a suitable container under the fuel filter because the fuel flows out.

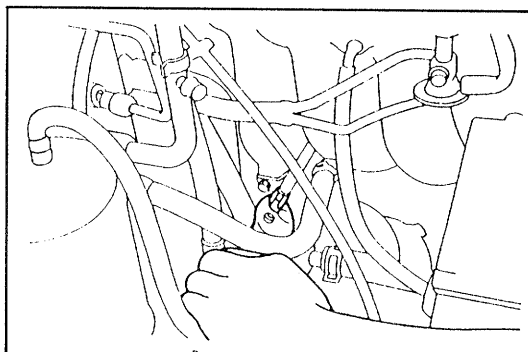


WRU90-EM203

16. Disconnect the fuel return hose from the fuel pipe No.2.

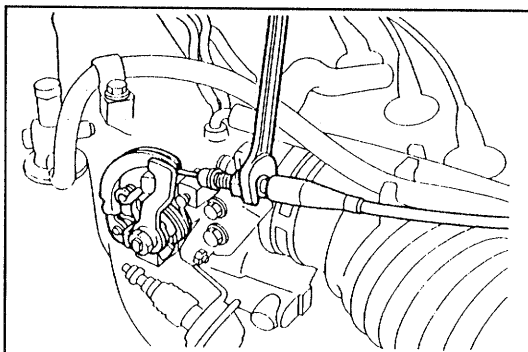
**CAUTION:**

- When disconnecting the fuel hose, take precautionary measures to prevent any dirt from entering into the fuel line.
- Place a suitable container or rags under the disconnecting portion because the fuel flows out.



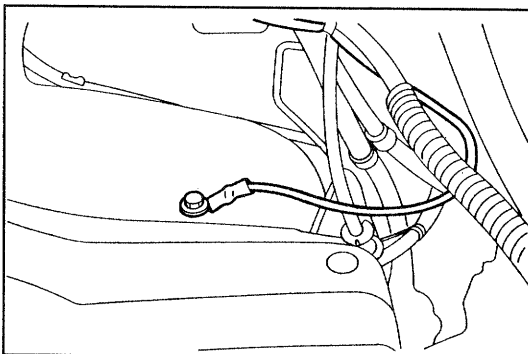
WRU90-EM204

17. Disconnect the accelerator cable.



WRU90-EM205

18. Remove the battery ground cable from the body.

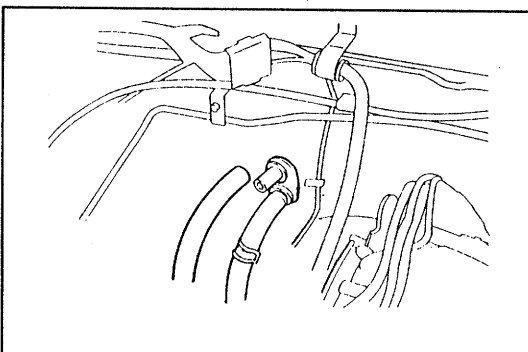


WRU90-EM206

19. Disconnect the inlet and outlet hoses from the heater pipes.

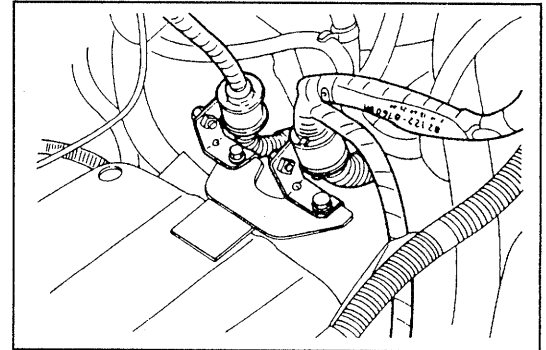
**CAUTION:**

- Care must be exercised not to damage the heater pipe end.



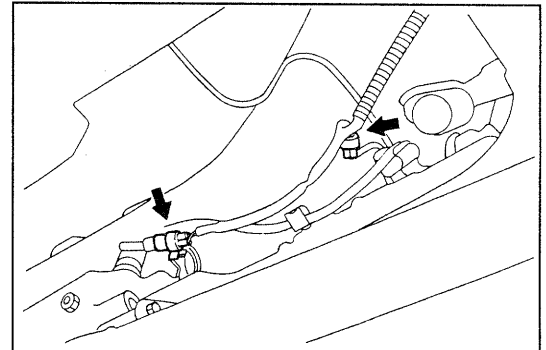
WRU90-EM207

20. Disconnect the following wires and cords.
- (1) Cowl wire and alternator wire
  - (2) Engine wire and relay block connectors
  - (3) Engine wire clamps at the cylinder block



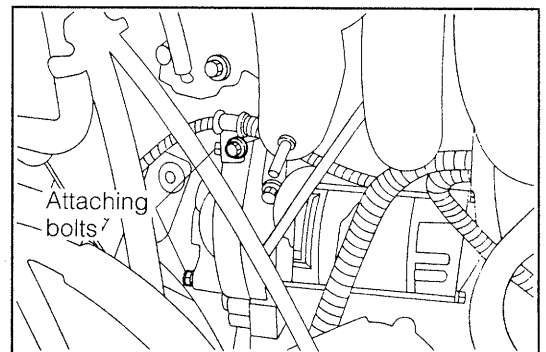
WRU90-EM208

21. Disconnect the connectors from the transmission and transfer by jacking up the vehicle. Disconnect the air breather hose from the transmission.



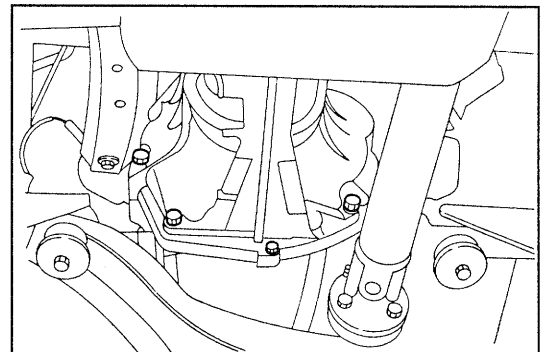
WRU90-EM209

22. Removal of starter
- (1) Disconnect the connector with lock and remove the harness clamping bolt.
  - (2) Remove the starter by removing the two attaching bolts.



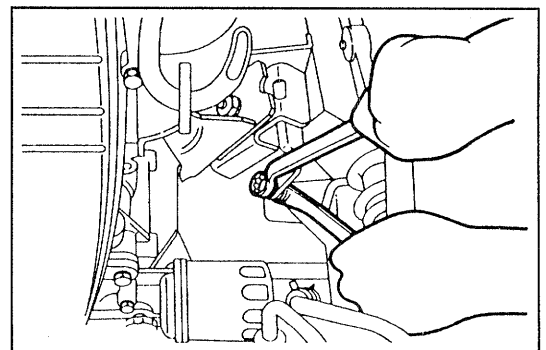
WRU90-EM210

23. Remove the engine-transmission attaching bolts.



WRU90-EM211

24. Remove the attaching bolts of the engine mountings while suspending the engine, using the chain block.



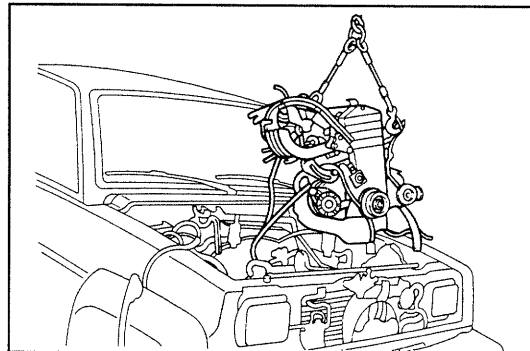
WRU90-EM212

## ENGINE MECHANICALS

25. Take out the engine from the body, using chain block.

**CAUTION:**

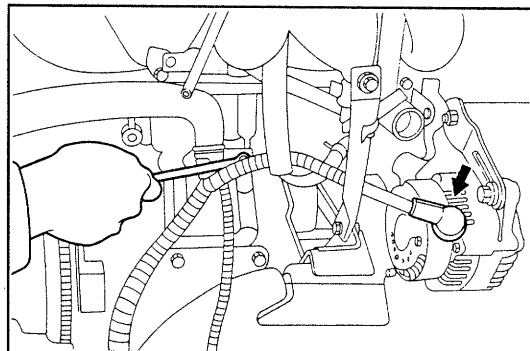
- Be careful not to allow the engine to hit to the vehicle body and/or other parts.
- Make sure that the any hose or wire has been disconnected from the body.



WRU90-EM213

26. Removal of engine harness from engine

- (1) Disconnect the alternator connector and the terminal.
- (2) Remove the engine wire clamp.
- (3) Remove the engine wire from the engine.



WRU90-EM214

27. Remove the engine mountings and surge tank stay No.2.

28. Remove the timing belt.

29. Remove the cylinder head assembly together with intake and exhaust manifold.  
(See page EM-37.)

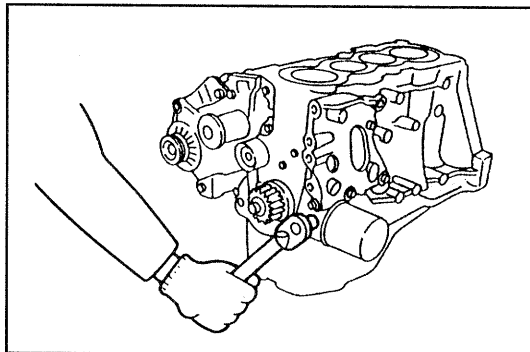
WRU90-EM215

## DISASSEMBLY OF CYLINDER BLOCK

1. Remove the oil pressure switch.

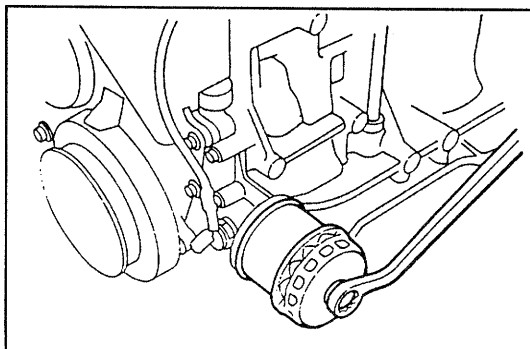
**NOTE:**

- Use a hexagon box wrench for the removal operation.



WNU89-EM348

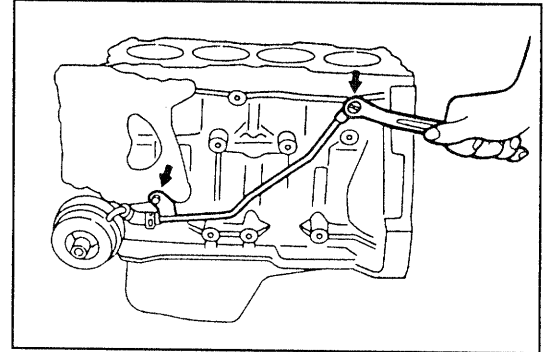
2. Remove the oil filter.



WRU90-EM216

## 3. Removal of oil cooler

- (1) Remove the oil cooler pipe from the cylinder block.
- (2) Release the hose band and remove the oil cooler pipe.

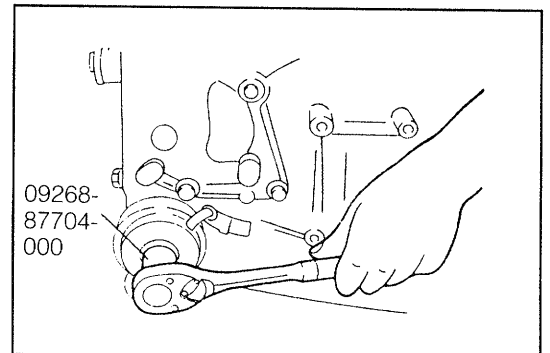


WNU89-EM350

- (3) Remove the oil cooler from cylinder block, using the following SST.

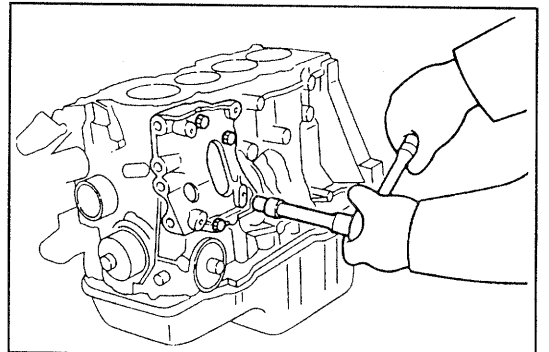
SST: 09268-87704-000

- (4) Remove the water hose from oil cooler.



WNU89-EM351

- ## 4. Remove the compressor bracket, by removing the four attaching bolts.



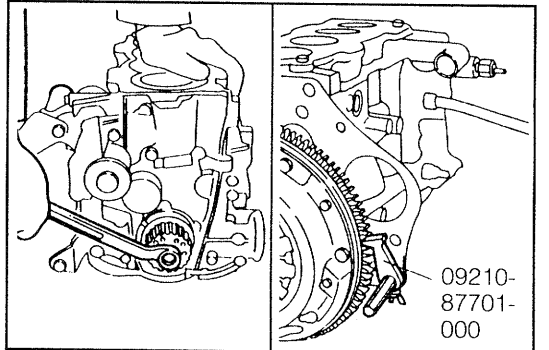
WRU90-EM217

- ## 5. Remove the crankshaft pulley bolt.

### NOTE:

- Prevent the ring gear from turning, using the following SST.

SST: 09210-87701-000



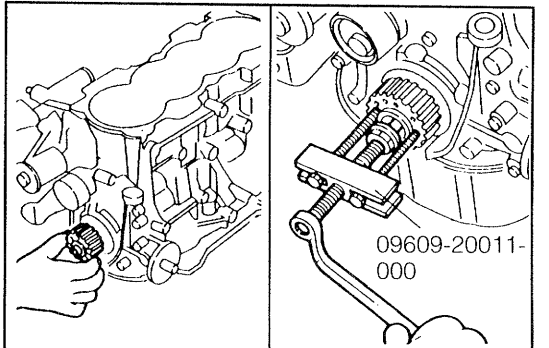
WNU89-EM353

- ## 6. Remove the crankshaft pulley.

### NOTE:

- If the crankshaft pulley can not be removed by hand, install the following SST with the crankshaft pulley bolt interposed.

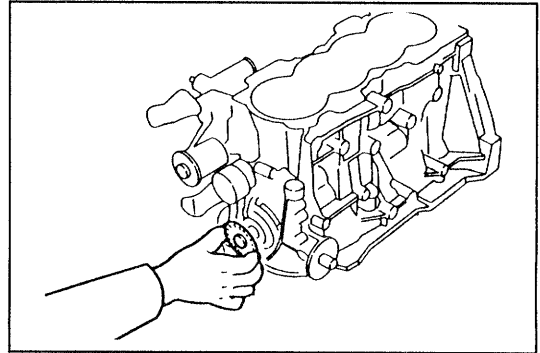
SST: 09609-20011-000



WNU89-EM354

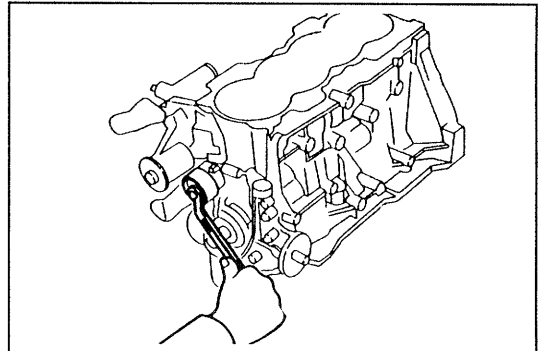
## ENGINE MECHANICALS

7. Remove the crankshaft pulley flange.



WNU89-EM355

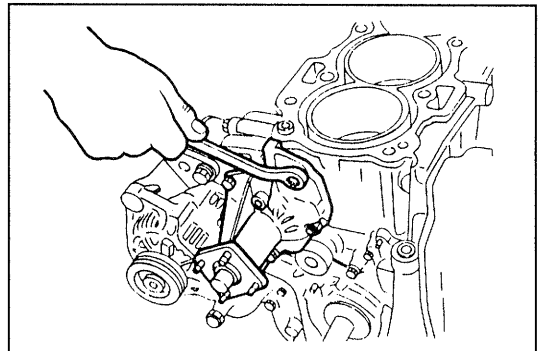
8. Remove the tensioner and tension spring.



WNU89-EM356

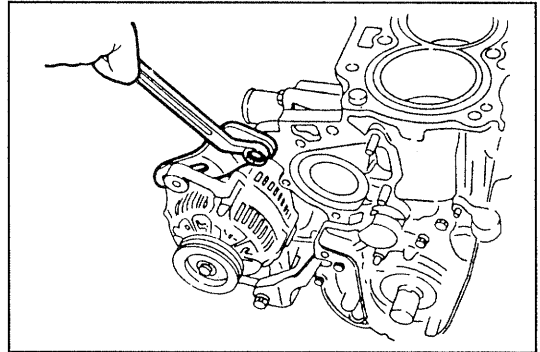
9. Remove the water pump, by removing the three attaching bolts and two nuts.

10. Remove the water pump gasket.



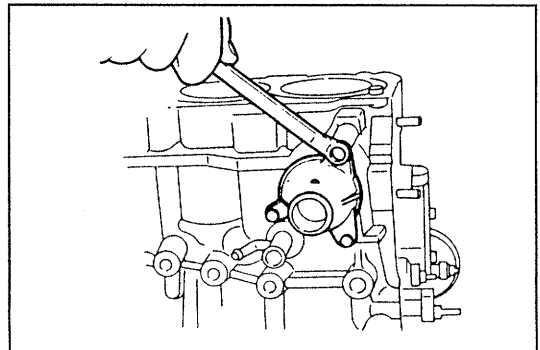
WRU90-EM218

11. Remove the alternator assy with bracket, by removing the two attaching bolts and an adjusting bolt.  
Then, remove the alternator bracket by removing a bolt and nut.



WRU90-EM219

12. Remove the water inlet and thermostat by removing the three attaching bolts.



WRU90-EM220

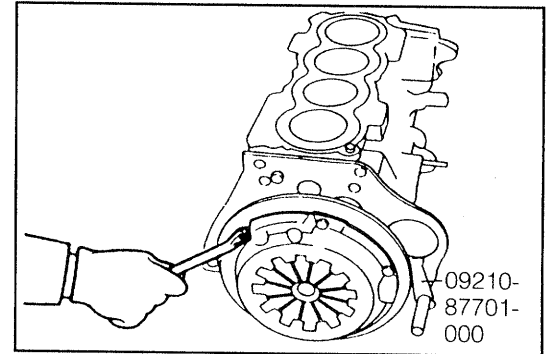


13. Remove the clutch cover and clutch disc, by removing the six attaching bolts.

**NOTE:**

- Prevent the clutch cover from turning, using the following SST.

SST: 09210-87701-000



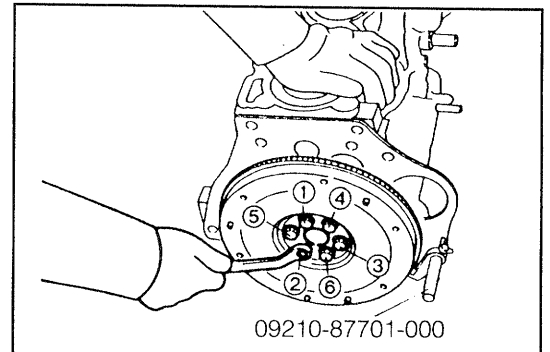
WRU90-EM221

14. Loosen the attaching bolts of the flywheel in the sequence as indicated in the right figure. Remove the flywheel.

**NOTE:**

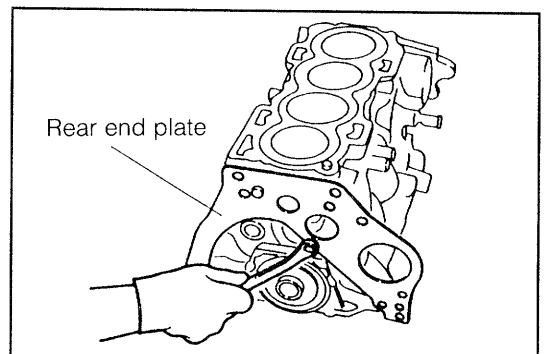
- Prevent the flywheel from turning, using the following SST.

SST: 09210-87701-000



WRU90-EM222

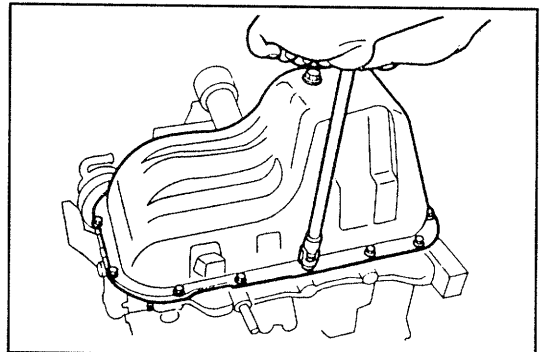
15. Remove the rear end plate, by removing the two attaching bolts.



WRU90-EM223

**16. Oil pan removal**

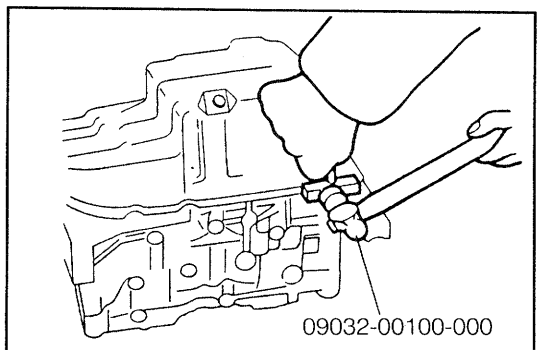
- (1) Loosen the ten attaching bolts and four nuts of the oil pan over two or three stages. Pull out the bolts and nuts.



WRU90-EM224

- (2) Separate the oil pan from the cylinder block by driving the following SST into between the cylinder block and the oil pan.

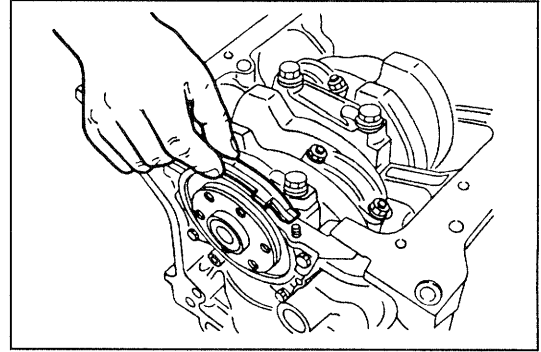
SST: 09032-00100-000



WNU89-EM365

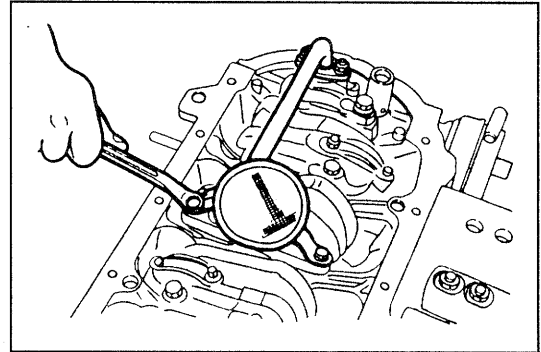
## ENGINE MECHANICALS

17. Remove the oil pan gasket front and rear.



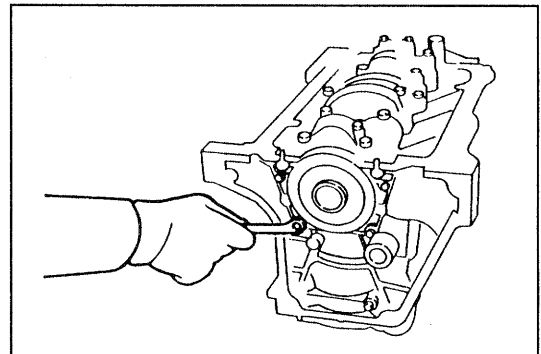
WRU90-EM225

18. Remove the oil pump strainer, by removing the two attaching bolts and two nuts.



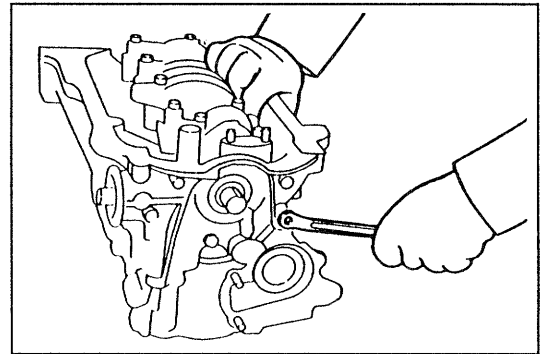
WRU90-EM226

19. Remove the rear oil seal retainer, by removing the four attaching bolts.



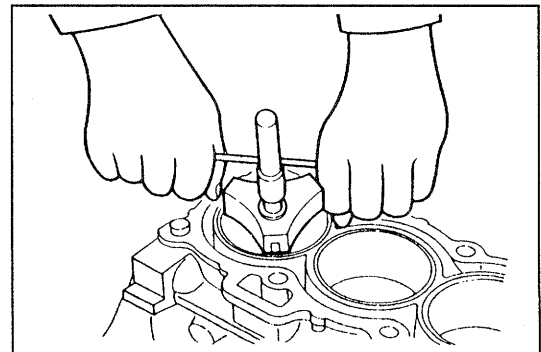
WRU90-EM227

20. Remove the oil pump, by removing the seven attaching bolts.



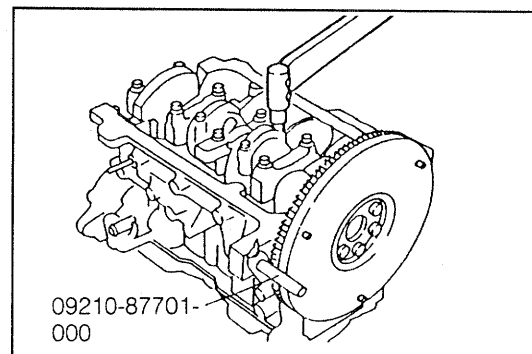
WRU90-EM228

21. Removal of piston  
(1) Remove all carbon deposits from the piston ring ridges.



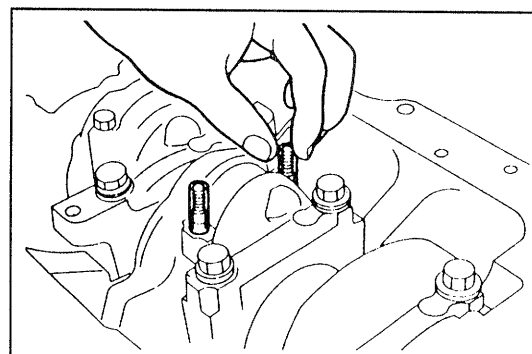
WRU90-EM229

- (2) Remove the connecting rod bearing cap by removing the two attaching nuts.



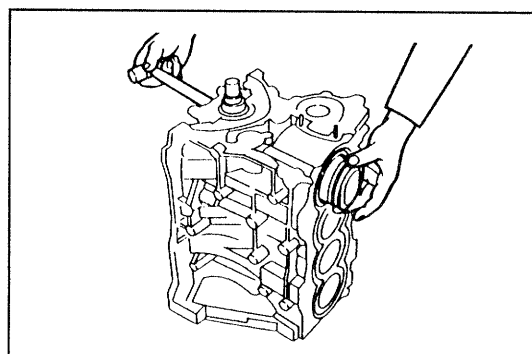
WRU90-EM230

- (3) Cover each connecting rod bolt with a short piece of hose to protect the crankpin journal from damage.



WRU90-EM231

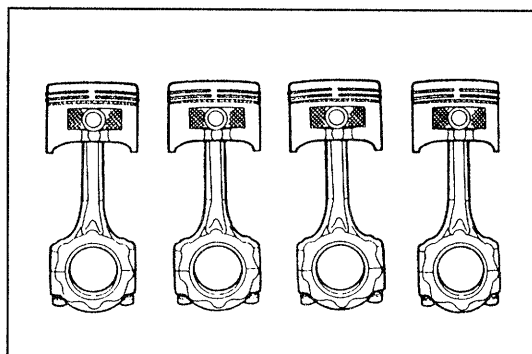
- (4) Push out the piston and connecting rod assembly and the upper bearing through the top of the cylinder block.



WRU90-EM232

## NOTE:

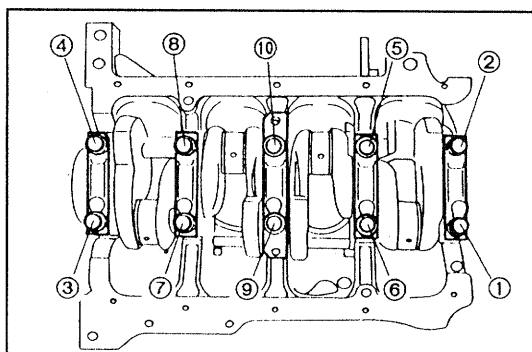
- Arrange the disassembled piston and connecting rods in order that their installation positions may be known readily.
- Care should be exercised so as not to damage the bearings.



WRU90-EM233

## 22. Removal of crankshaft

- (1) Gradually loosen the main bearing cap bolts over three stages in the numerical sequence shown in the figure. Remove the bearing cap bolts.

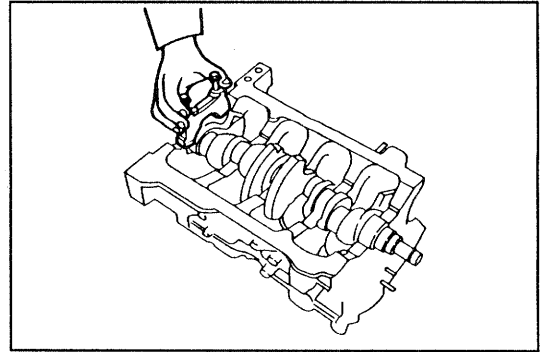


WRU90-EM234

- (2) With the main bearing cap bolts inserted into the bolt holes of the main bearing cap, wiggle the bearing cap back and forth. Remove the bearing cap together with the lower bearing.

**NOTE:**

- Keep the lower bearing fitted to the main bearing cap. Arrange the removed main bearing caps in order.

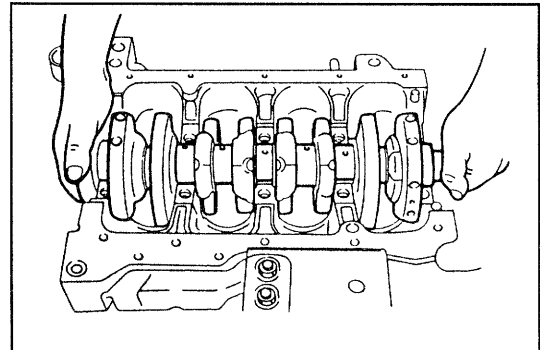


WNU89-EM390

- (3) Lift off the crankshaft.

**NOTE:**

- Be very careful not to allow the main bearings to be mixed with the bearings of the other cylinders.
- Remove the thrust washer.

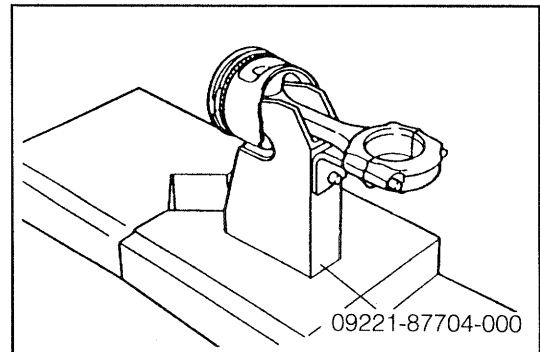


WNU89-EM391

### 23. Disassembly of piston and connecting rod

- (1) Install the connecting rod in the following SST as shown in the right figure.

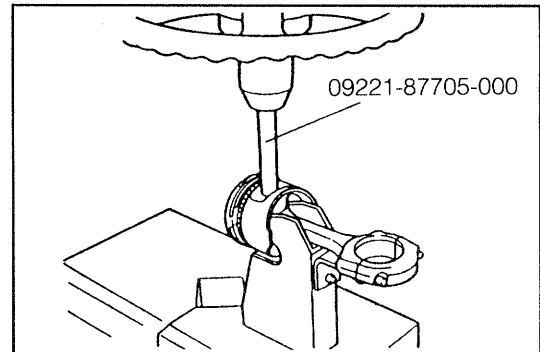
SST: 09221-87704-000



WRU90-EM235

- (2) Insert the longer SST into the piston pin hole. Press off the piston, using a hydraulic press.

SST: 09221-87705-000



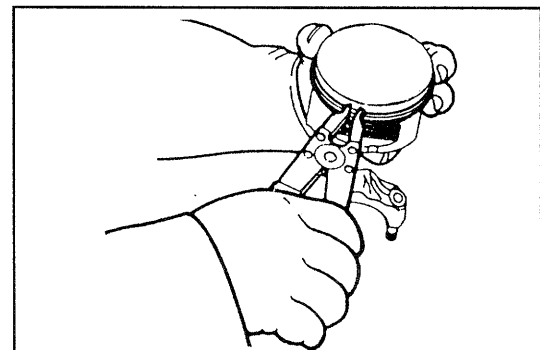
WNU89-EM423

### 24. Removal of piston rings

**NOTE:**

- Arrange the removed piston rings in order so that their installation positions may be known readily.
- Do not expand the piston ring unnecessarily beyond the required extent.

- (1) Remove the piston rings No. 1 and No. 2, using a piston ring expander.
- (2) Remove the oil ring side rails by hand.
- (3) Remove the oil ring expander by hand.



WRU90-EM236

## 25. Cleaning of pistons

- (1) Remove the carbon deposits from the piston top, using a gasket scraper or the like.

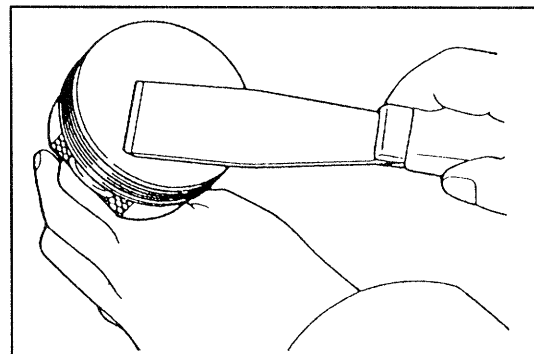
### NOTE:

- Be very careful not to scratch the piston.

- (2) Clean the piston grooves with a broken piston ring or a groove cleaning tool.

### NOTE:

- Be very careful not to scratch the piston.



WRU90-EM237

## 26. Clean the disassembled parts using cleaning solvent. Blow them with compressed air.

### WARNING:

Protect your eyes with safety goggles during the cleaning operation.

WRU90-EM238

## 27. Measure the bore diameter of each cylinder at a position shown in the right figure. The measured value is regarded as the cylinder bore diameter.

### Specified Bore Diameter:

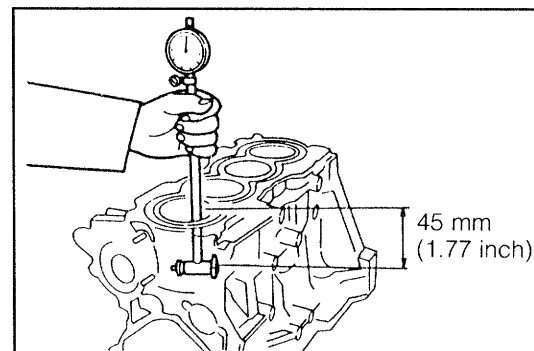
76.000 - 76.030 mm (2.9922 - 2.9933 inch)

### Piston-to-Cylinder Bore Clearance:

Specified value: 0.025 - 0.045 mm

(0.0010 - 0.0018 inch)

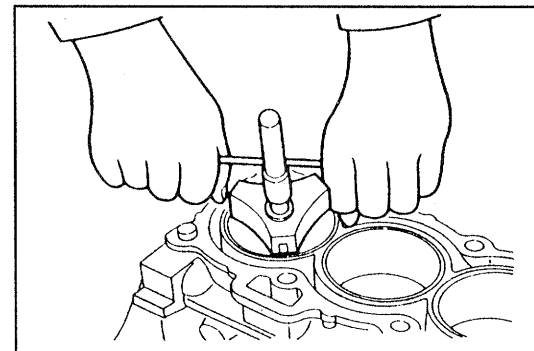
Allowable limit: 0.11 mm (0.0043 inch)



WRU90-EM239

## 28. Removal of cylinder ridges

If ridges are formed at the upper parts of the cylinder bores, use a ridge reamer to remove the ridges.



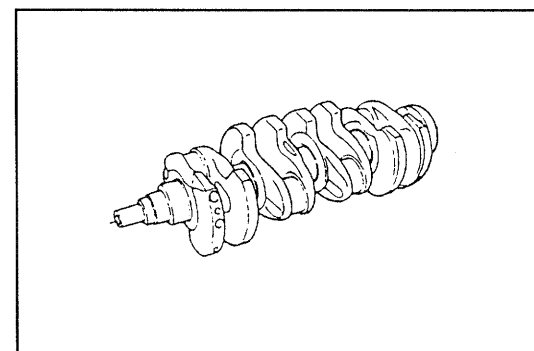
WRU90-EM416

## INSPECTION OF EACH PART

### Inspection of crankshaft

1. Check the main journals and bearings for pitting or scratches.

If the main journals are damaged, replace the crankshaft.

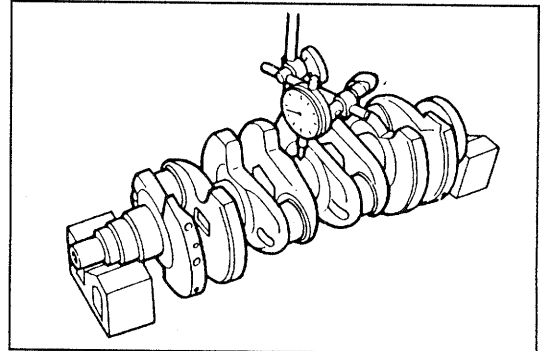


WRU90-EM240

- Support the both ends of the crankshaft with a V-block.  
Measure the crankshaft runout with a dial gauge.

Allowable limit of runout: 0.06 mm (0.0024 inch)

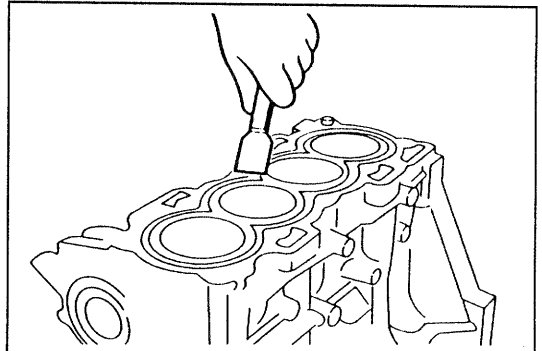
If the runout exceeds the allowable limit, replace the crankshaft.



WRU90-EM241

### Inspection of cylinder block

- Removal of gasket material  
Remove all gasket materials from the cylinder block.
- Cleaning of cylinder block  
Clean the cylinder block, using a soft brush and cleaning solvent.

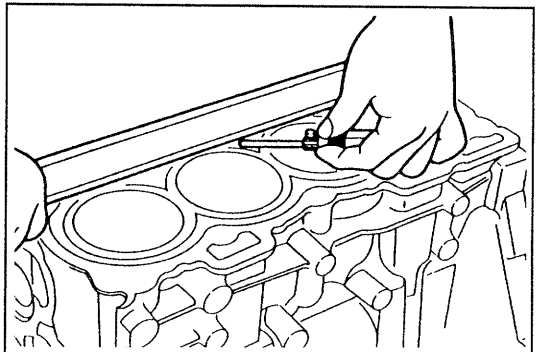


WRU90-EM242

- Inspection of top surface of cylinder block  
Using a precision straightedge and a thickness gauge, check the surface contacting the cylinder head gasket for warpage in the six directions as shown in the figure.

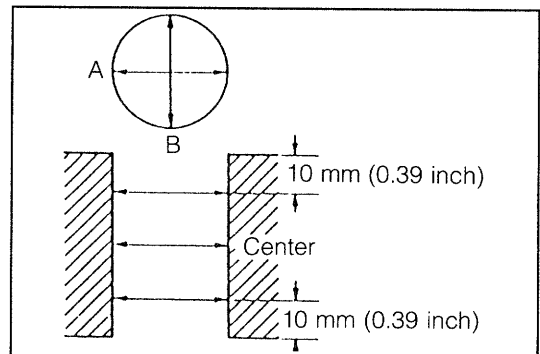
Maximum Warpage: 0.10 mm (0.0039 inch)

If the warpage exceeds the allowable limit, replace the cylinder block.



WNU89-EM405

- Measurement of cylinder bores  
(1) Measure the bore diameter of each cylinder at the four points shown in the right figure. Ensure that the difference between the maximum and minimum bore diameters of each cylinder is within 0.1 mm (0.0039 inch).



WNU89-EM406

If the difference between the maximum and minimum values exceeds 0.1 mm (0.0039 inch), perform boring and/or honing for the cylinder bore in accordance with the oversized piston.

The honing angle is  $35^\circ \pm 5^\circ$ . The surface coarse degree is 1 - 4Z.

WNU89-EM407

### Reference

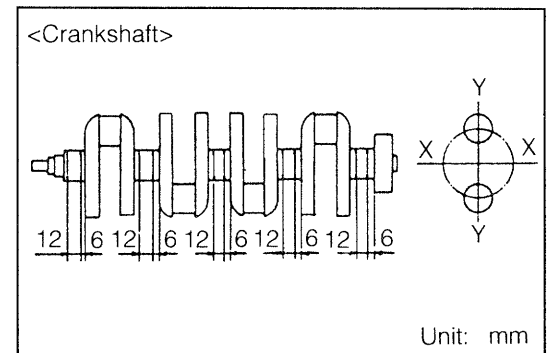
The table below shows the cylinder bore diameter when oversized pistons are used.

However, after the diameter of the replacement piston has been measured, perform the finishing in accordance with the piston diameter.

Standard	O/S 0.25
76.000 - 76.030 mm (2.9922 - 2.9933 inch)	76.250 - 76.280 mm (3.002 - 3.0031 inch)

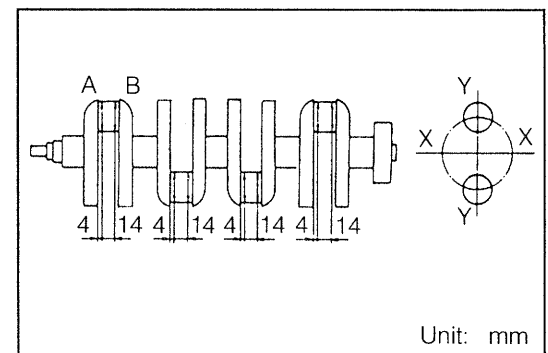
WN089-EM408

- Measure the diameter of the crankshaft main journals.  
The measurement should be performed at four points, 90 degrees spaced, for each crankshaft main journal at the points shown in the right figure. The maximum value is regarded as the crankshaft main journal diameter.  
However, if the variation in the measured diameters exceeds 0.026 mm (0.0010 inch), replace the crankshaft.



WRU90-EM243

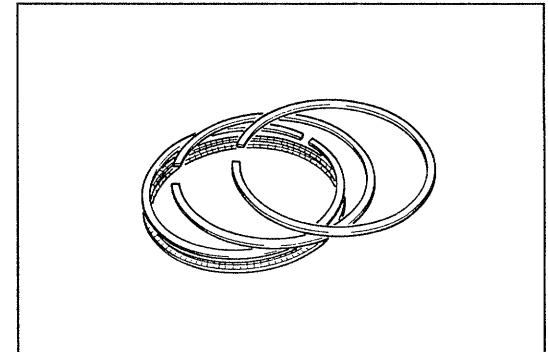
- Measure the diameter of the crankpin journal.  
The measurement should be performed at four points, 90 degrees spaced, for each crankpin journal at the points shown in the right figure. The maximum value is regarded as the crankpin journal diameter.  
However, if the variation in the measured diameters exceeds 0.044 mm (0.0017 inch), replace the crankshaft.



WRU90-EM244

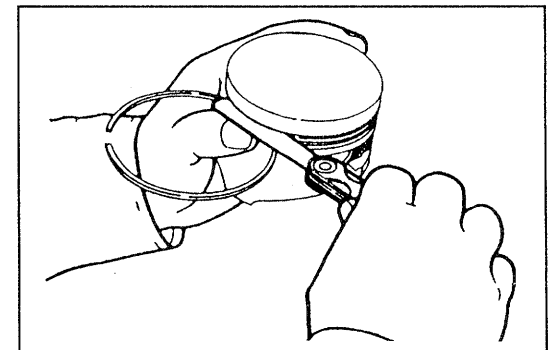
### Inspection of piston ring

- Visually inspect the piston ring for extreme wear, seizure or damage.  
Replace the piston ring, if necessary.



WRU90-EM245

- Inspection of piston ring groove side clearance  
Measure the side clearances of the piston rings No.1 and No.2 over the entire periphery of each groove, using a thickness gauge.  
The maximum measured value is regarded as the piston ring side clearance.



WRU90-EM246

## Piston ring side clearance

	Specified value mm (inch)	Allowable limit mm (inch)
Compression ring No. 1	0.03 - 0.07 (0.0012 - 0.0027)	0.12 (0.0047)
Compression ring No. 2	0.02 - 0.06 (0.0008 - 0.0023)	0.12 (0.0047)

If the piston side clearance exceeds the allowable limit, measure the piston ring thickness. Referring to the piston ring standard thicknesses given below, replace the piston ring and/or piston so that the piston ring side clearance may become less than the allowable limit.

WNU89-EM416

## Piston ring specified thickness

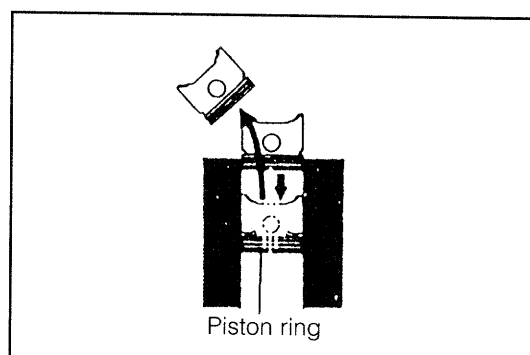
Compression ring No. 1 mm (inch)	1.17 - 1.19 (0.0461 - 0.0468)
Compression ring No. 2 mm (inch)	1.47 - 1.49 (0.0579 - 0.0586)

### NOTE:

- When replacing the piston rings, a set of piston rings for one cylinder should be replaced.

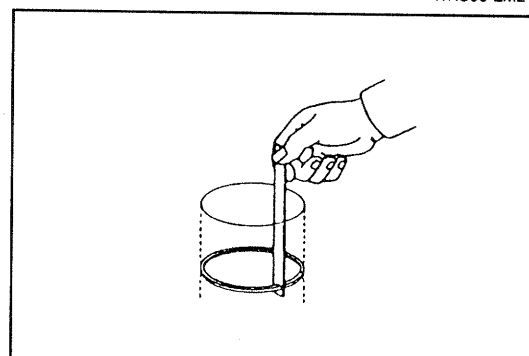
WNU89-EM417

- Inspection of piston ring end gap
  - Apply engine oil to the cylinder walls.
  - Insert the piston rings into the cylinder bore.
  - Using a piston, push down the piston ring to a point 110 mm (4.33 inch) measured from the cylinder block upper surface.



WRU90-EM247

- Measure the piston ring end gap, using a thickness gauge or a feeler gauge.



WNU89-EM419

## Piston ring end gap

	Specified value mm (inch)	Allowable limit mm (inch)
Compression ring No. 1	0.27 - 0.42 (0.0107 - 0.0165)	0.7 (0.028)
Compression ring No. 2	0.35 - 0.50 (0.0138 - 0.0196)	0.8 (0.031)
Oil ring	0.20 - 0.70 (0.0079 - 0.0275)	1.0 (0.039)

If the piston ring end gap exceeds the allowable limit, a set of piston rings for one cylinder should be replaced.

WNU89-EM420



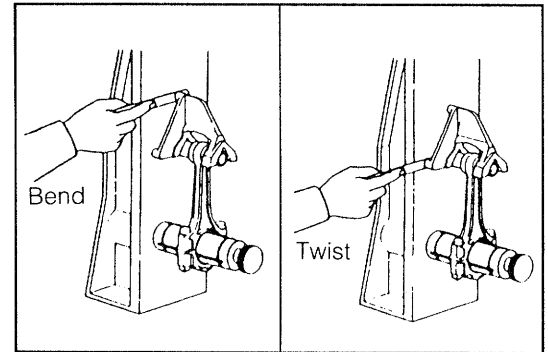
### Inspection of connecting rods

1. Visually inspect the connecting rods for damage or cracks.
2. Check the connecting rod for bend and twist, using a connecting rod aligner.

Maximum bend: 0.05 mm (0.0020 inch)

Maximum twist: 0.05 mm (0.0020 inch)

If the bend and/or twist is greater than the maximum limit, replace the connecting rod assembly.  
(See page EM-118.)



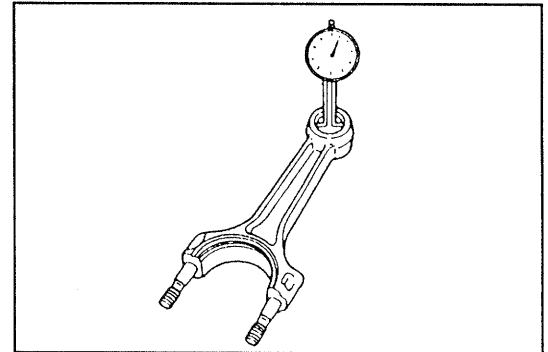
WRU90-EM248

3. Measure the inner diameter of connecting rod small end, using a bore dial gauge.

Specified Value: 18.953 - 18.979 mm  
(0.746 - 0.747 inch)

Interference Fit with Piston Pin:

0.012 - 0.044 mm (0.0005 - 0.0017 inch)



WRU90-EM249

4. Measure the width of connecting rod big end, using a micrometer.

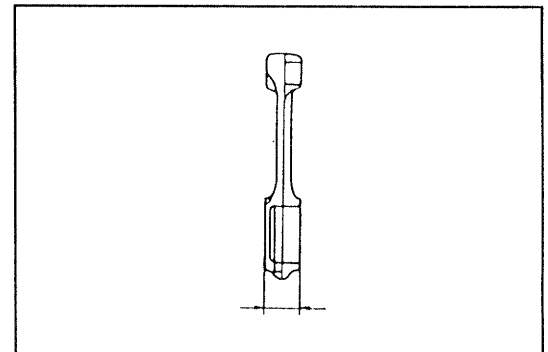
Specified Value:

21.80 - 21.85 mm (0.858 - 0.860 inch)

Allowable Limit:

21.70 mm (0.854 inch)

If the width of connecting rod big end exceeds specified value, replace the connecting rod.



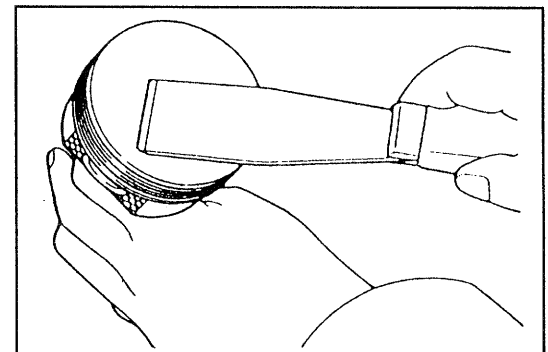
WRU90-EM250

### Inspection of pistons

1. Cleaning of pistons
  - (1) Remove the carbon deposits from the piston top, using a gasket scraper or the like.
  - (2) Clean the piston grooves with a broken piston ring or a groove cleaning tool.

**NOTE:**

- Be very careful not to scratch the piston.



WRU90-EM251

2. Inspection of pistons  
Visually inspect the piston for cracks, damage or seizure.  
Replace the piston, if necessary.

WRU90-EM252

## 3. Measurement of piston diameter

- (1) Measure the piston outer diameter horizontally at a point 15 mm (0.59 inch) from the lower end of the piston at right angles to the piston pin.

**Specified Value:** 75.965 - 75.995 mm  
(2.991 - 2.992 inch)

- (2) Calculation of piston-to-cylinder bore clearance

Subtract the measured piston outer diameter from the measured cylinder bore diameter. Ensure that this piston-to-cylinder bore clearance is less than 0.11 mm (0.0043 inch).

**Piston-to-Cylinder Bore Clearance:**

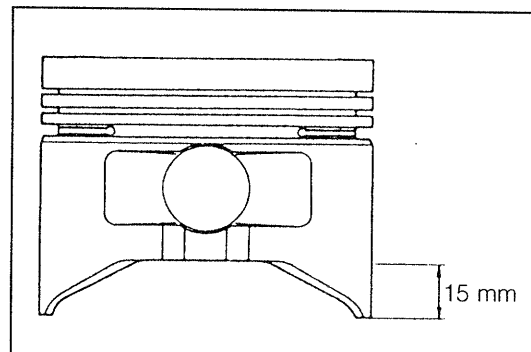
**Specified Value** 0.025 - 0.045 mm  
(0.0010 - 0.0018 inch)

**Allowable Limit** 0.11 mm  
(0.0043 inch)

If the piston-to-cylinder bore clearance exceeds the allowable limit, perform boring and honing the cylinder bores so that the cylinder bore diameter may match with the oversized piston.

(See page EM-112.)

However, when the cylinder bore diameter exceeds 76.28 mm (3.003 inch), replace the cylinder block.



WRU90-EM253

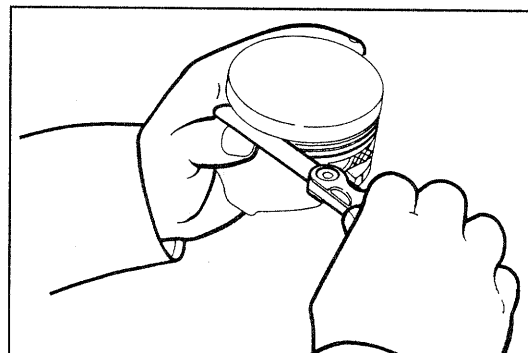
## 4. Measurement of piston ring grooves

Measure the piston ring grooves for No.1 and No.2 over the entire periphery, using a thickness gauge.

**Specified Value:**

**No.1:** 1.202 - 1.204 mm (0.0473 - 0.0474 inch)

**No.2:** 1.501 - 1.503 mm (0.0591 - 0.0592 inch)



WRU90-EM255

## 5. Measurement of bore for piston pin

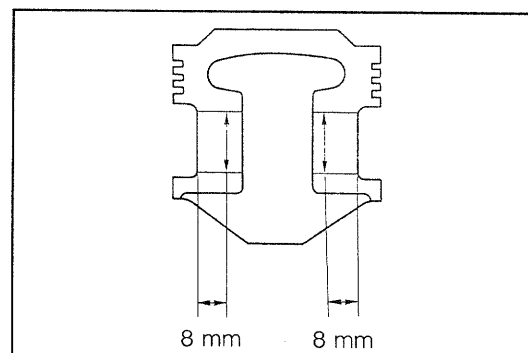
Measure the bore diameter of the piston pin installation positions as shown in the right figure. The minimum value is regarded as the bore diameter for piston pin installation hole.

**Specified Value:**

18.995 - 19.005 mm (0.7478 - 0.7482 inch)

**Piston-to-Piston pin Bore Clearance:**

0.005 - 0.011 mm (0.0002 - 0.0004 inch)



WRU90-EM256

## Inspection of piston pin

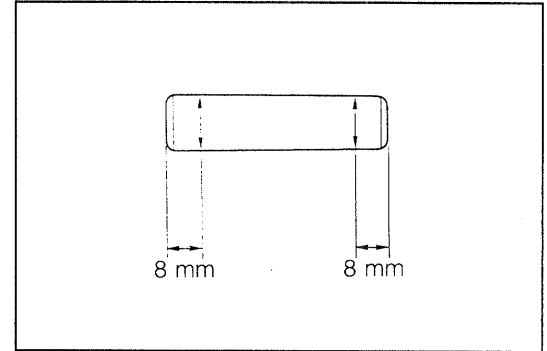
1. Visually inspect the piston pin for a damage or scratch.  
Replace the piston with piston pin, if necessary.
2. Measure the piston pin outer diameter at each point as shown in the right figure.  
The maximum value is regarded as the outer diameter of piston pin.

Specified Value:

18.991 - 18.997 mm (0.7477 - 0.7479 inch)

Piston-to-Piston pin Bore Clearance:

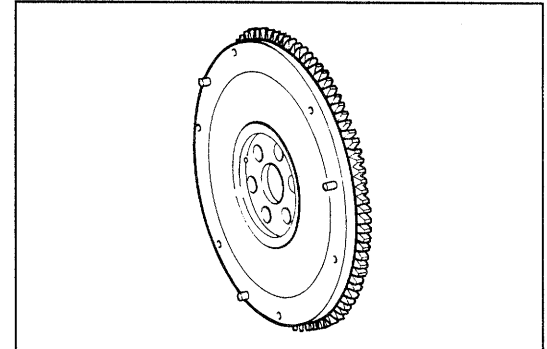
0.005 - 0.011 mm (0.0002 - 0.0004 inch)



WRU90-EM257

## Inspection of flywheel

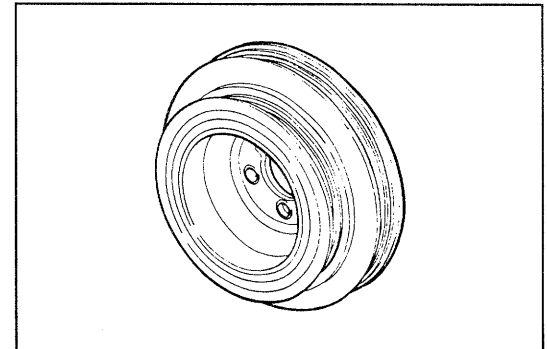
1. Visually inspect the flywheel for damage or cracks.  
Replace the flywheel, if necessary.
2. Inspect the ring gear and knock pin for installing condition and/or damage.  
Replace the ring gear and/or knock pin, if necessary.



WRU90-EM258

## Inspection of crankshaft pulley

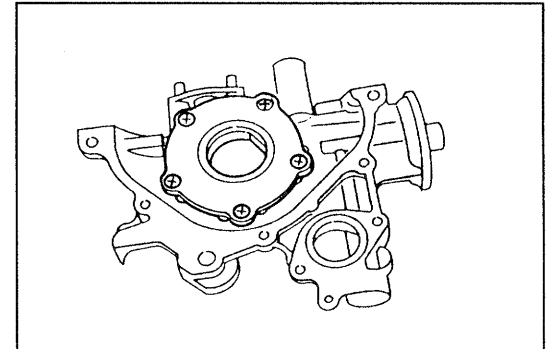
Visually inspect the crankshaft pulley for damage or cracks.  
Replace the crankshaft pulley, if necessary.



WRU90-EM259

## Inspection of oil pump assembly

1. Visually inspect the rotor surface and oil seal for damage and/or wear.  
Replace the rotor and/or oil seal, if necessary.

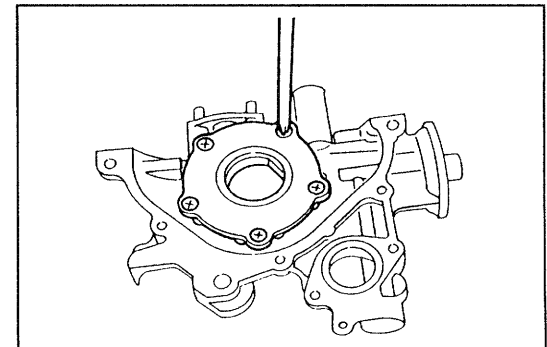


WRU90-EM260

2. Check the oil pump cover installing bolts tightening condition.

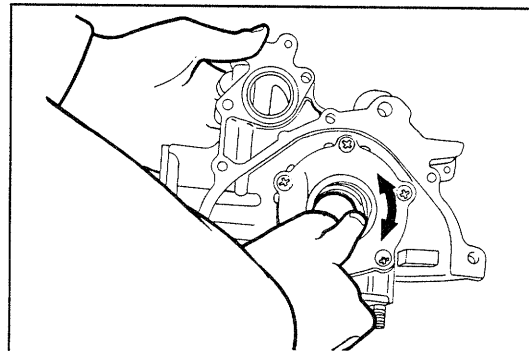
Retighten the bolt if it loosen, using the screw driver.

Tightening Torque: 0.8 - 1.3 kg-m  
(5.8 - 9.4 ft-lb, 7.8 - 12.7 N·m)



WRU90-EM261

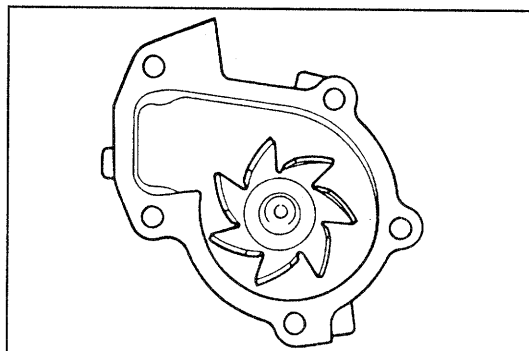
3. Rotate the rotor by applying a force with your finger. Check to see if the rotor rotates smoothly without any sticking. Disassembly and check the oil pump, if necessary. (See page EM-121.)



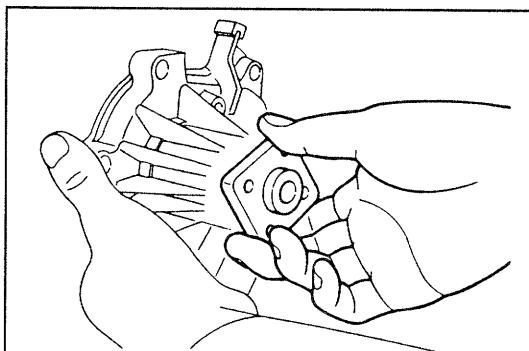
WRU90-EM262

### Inspection of water pump

1. Visually inspect the following points.
  - (1) Mechanical seal for water leaked mark
  - (2) Water pump rotary fan for damage, deformation and cracks
  - (3) Installation surface for damageReplace the water pump, if necessary.
2. Check the water pump bearing journal section and the water pump pulley installing section for rattle. Replace the water pump, if necessary.
3. Ensure that the water pump rotates smoothly by hand. Replace the water pump, if necessary.



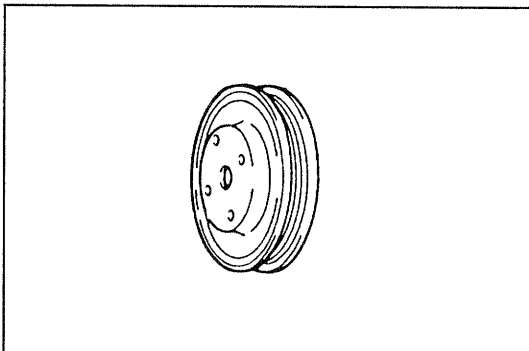
WRU90-EM263



WRU90-EM264

### Inspection of water pump

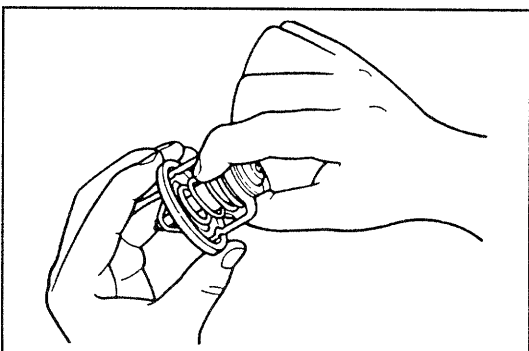
1. Visually inspect the following points.
  - (1) Water pump pulley installing surface for deformation and wear
  - (2) V-ribbed belt install section for deformation and wear



WRU90-EM265

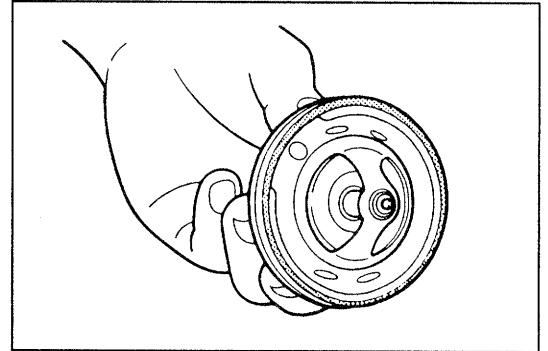
### Inspection of thermostat

1. Ensure that the thermostat valve is closed completely at room temperature 20°C (68°F) and the spring has no play. Replace the thermostat if the valve is open or the spring has a play.



WRU90-EM266

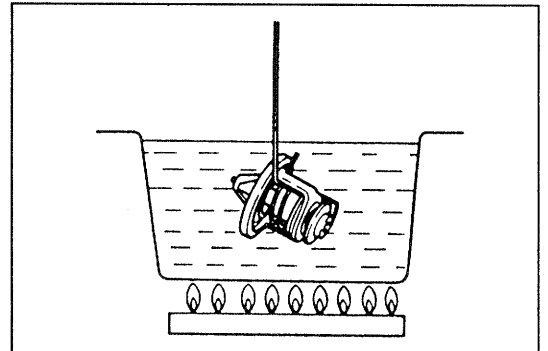
2. Check the rubber grommet of the thermostat for damage or crack.  
Replace the thermostat if the rubber grommet exhibits damage or crack.



WNU89-CO028

3. Immerse the thermostat in water, and check the valve opening temperature by heating the water gradually.

Specifications	Valve opening temperature °C (°F)	Valve lift
Standard specifications	76 - 80 (168.8 - 176)	8.5 mm or more at 91°C (0.34 inch or more at 195.8°F)
Cold area specifications	82 - 86 (179.6 - 186.8)	8.5 mm or more at 98°C (0.34 inch or more at 208.4°F)

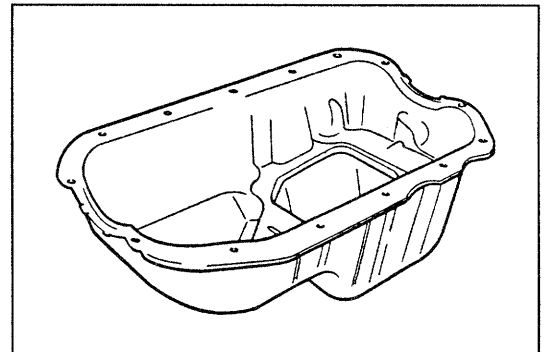


WNU89-CO029

Replace the thermostat if the valve operation fails to conform to the specifications.

### Inspection of oil pan

1. Visually inspection the oil pan for damage or cracks.  
Replace the oil pan, if necessary.



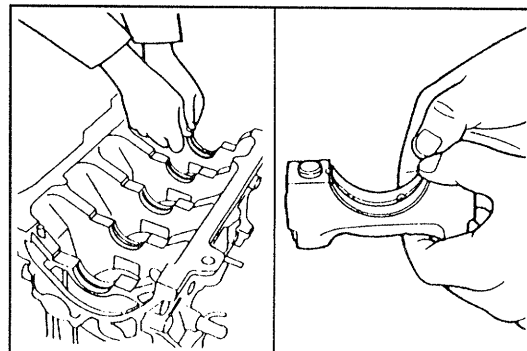
WRU90-EM267

## MEASUREMENT OF EACH OIL CLEARANCE

1. Measurement of main journal oil clearance
  - (1) Install the main bearings to the cylinder block and crankshaft main bearing cap.

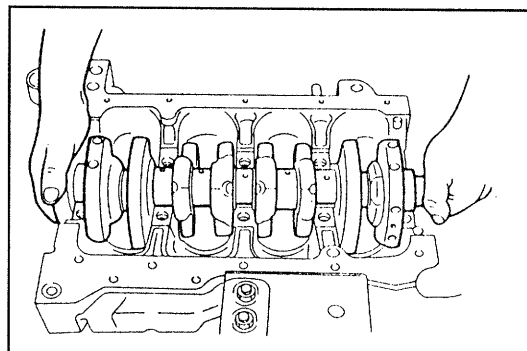
**NOTE:**

- Do not touch the metal surface of the bearing.



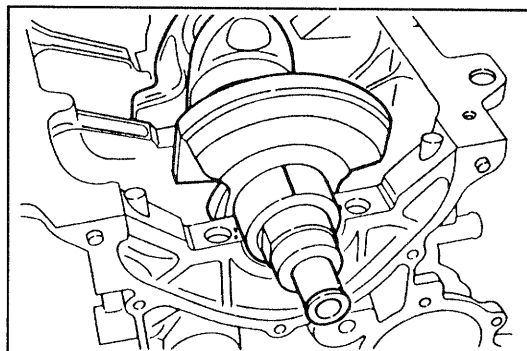
WRU90-EM268

- (2) Place the crankshaft in the cylinder block.



WRU90-EM269

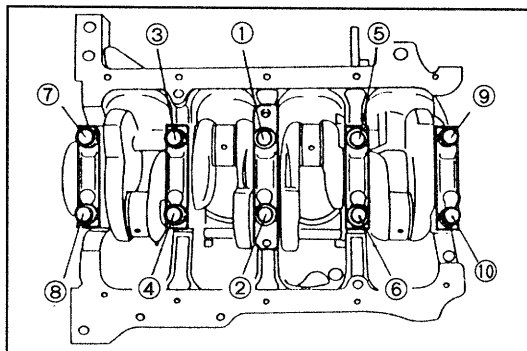
- (3) Lay a strip of plastigage across each crankshaft main journal.



WRU90-EM270

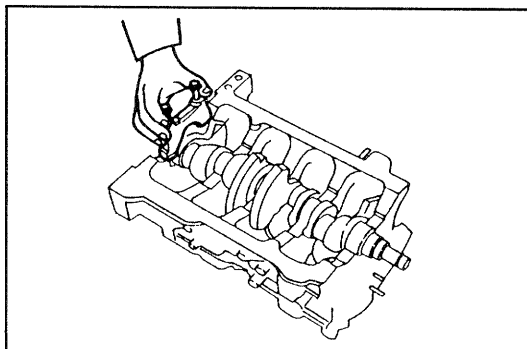
- (4) Install the crankshaft bearing caps. Tighten the crankshaft bearing cap bolts evenly in the sequence indicated in the right figure.

**Tightening Torque:** 4.5 - 5.5 kg-m  
(32.5 - 39.8 ft-lb, 44.1 - 53.9 N·m)



WRU90-EM271

- (5) Remove the main bearing caps with the lower bearings fitted on them.



WRU90-EM272

- (6) Measure the plastigage width at its widest point.

Oil Clearance: 0.024 - 0.042 mm  
(0.0010 - 0.0016 inch)

If the oil clearance fails to conform to the specified value, measure the crankshaft main journal diameter and select suitable connecting rod bearings or replace the crankshaft.

(See page EM-116.)

- (7) Remove the plastigage from the crankshaft main journals.

## 2. Selection of crankshaft bearings

### NOTE:

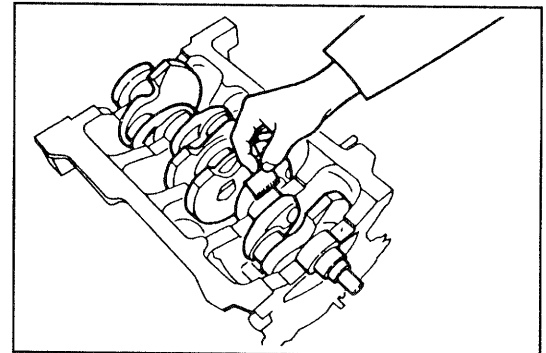
- The replacement of the crankshaft bearings should be performed after all inspections have been finished.

- (1) Read the cylinder block main journal diameter code number.

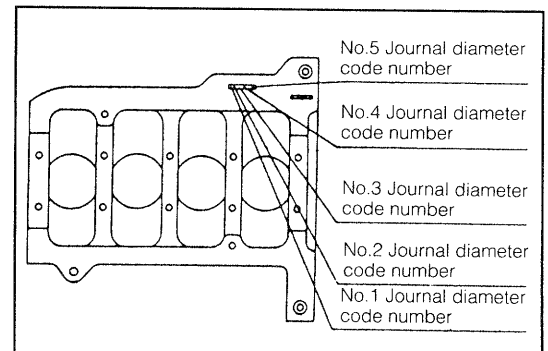
### NOTE:

- The main journal diameter code comes in four kinds of 5, 6, 7 and 8.

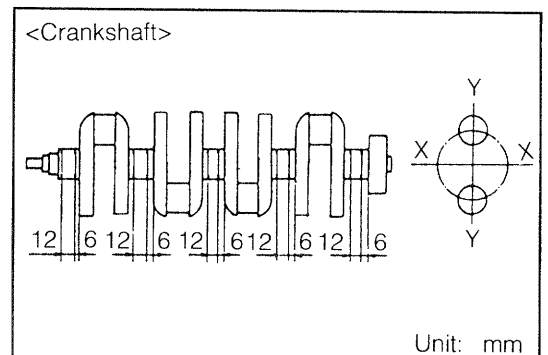
- (2) Measure the diameter of the crankshaft main journals. The measurement should be performed at four points, 90 degrees spaced, for each crankshaft main journal at the points shown in the right figure. The maximum value is regarded as the crankshaft main journal diameter. However, if the variation in the measured diameters exceeds 0.026 mm (0.0010 inch), replace the crankshaft.



WRU90-EM273



WRU90-EM274



Unit: mm

WRU90-EM275

(3) Select the crankshaft bearings or replace the crankshaft, based on the results of (1) and (2).

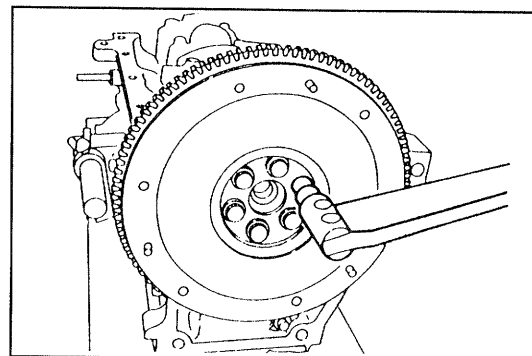
Main journal diameter code	Crankshaft main journal diameter mm (inch)	Bearing classification number (color)	Remarks
5	49.995 - 50.000 (1.9684 - 1.9685)	1 (Yellow)	—
	49.989 - 49.994 (1.9681 - 1.9683)	2 (Green)	—
	49.983 - 49.988 (1.9679 - 1.9680)	3 (Brown)	—
	49.976 - 49.982 (1.9676 - 1.9678)	4 (Black)	—
	49.975 or less (1.9675)	—	Crankshaft replacement
6	49.995 - 50.000 (1.9684 - 1.9685)	2 (Green)	—
	49.989 - 49.994 (1.9681 - 1.9683)	3 (Brown)	—
	49.983 - 49.988 (1.9679 - 1.9680)	4 (Black)	—
	49.976 - 49.982 (1.9676 - 1.9678)	5 (Blue)	—
	49.975 or less (1.9675)	—	Crankshaft replacement
7	49.995 - 50.000 (1.9684 - 1.9685)	3 (Brown)	—
	49.989 - 49.994 (1.9681 - 1.9683)	4 (Black)	—
	49.983 - 49.988 (1.9679 - 1.9680)	5 (Blue)	—
	49.976 - 49.982 (1.9676 - 1.9678)	6 (White)	—
	49.975 or less (1.9675)	—	Crankshaft replacement
8	49.995 - 50.000 (1.9684 - 1.9685)	4 (Black)	—
	49.989 - 49.994 (1.9681 - 1.9683)	5 (Blue)	—
	49.983 - 49.988 (1.9679 - 1.9680)	6 (White)	—
	49.976 - 49.982 (1.9676 - 1.9678)	7 (Pink)	—
	49.975 or less (1.9675)	—	Crankshaft replacement

WRU90-EM276



## 3. Measurement of crankpin journal oil clearance

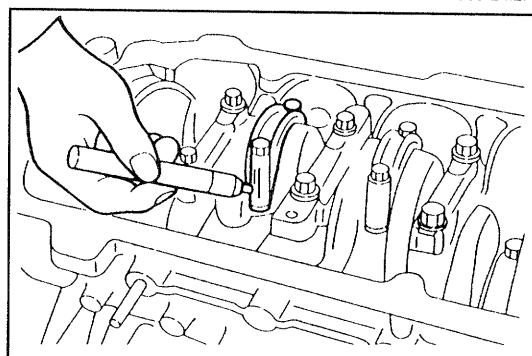
(1) Install the flywheel temporarily.



WRU90-EM277

(2) Wipe off any oil from the side of the mate surface between the connecting rod bearing cap and the connecting rod. Daub a mate mark with an oily paint on the side so that the parts can be assembled correctly in the original combination.  
(Also ensure that the cylinder number may be identified)

(3) Turn the crankshaft, until the connecting rod bearing cap to be removed comes at the oil pan side.

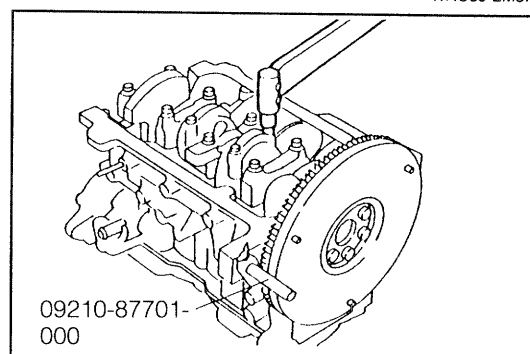


WNU89-EM373

(4) Lock the flywheel to prevent the crankshaft from turning, using the following SST.

**SST: 09210-87701-000**

(5) Loosen the connecting rod bearing cap nuts evenly over two or three stages. Then, remove the connecting rod bearing cap nuts.

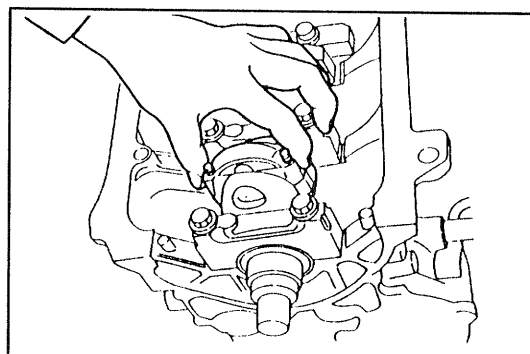


WNU89-EM374

(6) Remove the bearing cap.

### NOTE:

- Replace the crankshaft if the crankpin journals exhibit damages, such as seizure.  
(See page EM-116.)

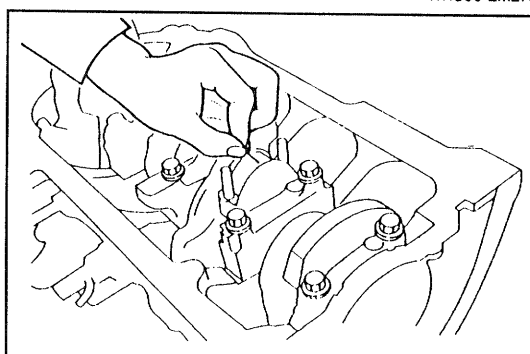


WRU90-EM278

(7) Place a plastigage on the crankpin journal.

### NOTE:

- Wipe off any oil from the crankpin journal.



WNU89-EM376

- (8) Install the connecting rod cap, making sure that the mate marks are lined up. Tighten the connecting rod bearing cap nuts evenly over two or three stages to the specified torque.

Tightening Torque: 3.5 - 4.5 kg-m  
(25.4 - 32.5 ft-lb, 34.3 - 44.1 N·m)

**NOTE:**

- When tightening of the bearing cap nuts, apply engine oil to the bearing cap nuts.  
Prevent the crankshaft from turning, using the SST.  
SST: 09210-87701-000

- (9) Loosen the connecting rod bearing cap nuts evenly over two or three stages. Then, remove the connecting rod bearing cap.

**NOTE:**

- Prevent the crankshaft from turning, using the SST.  
SST: 09210-87701-000

- (10) Measure the plastigage width at its widest point.

Oil Clearance: 0.020 - 0.044 mm  
(0.0008 - 0.0017 inch)

If the oil clearance fails to conform to the specified value, measure the crankpin journal diameter and select a suitable connecting rod bearing or replace the crankshaft.

- (11) Remove the plastigage from the crankpin journal.

- (12) Measure the oil clearances of the remaining crankpin journals.

4. Selection of connecting rod bearings

**NOTE:**

- The replacement of the connecting rod bearings should be performed after all inspections have been finished.

- (1) Read the connecting rod big end bore code number.

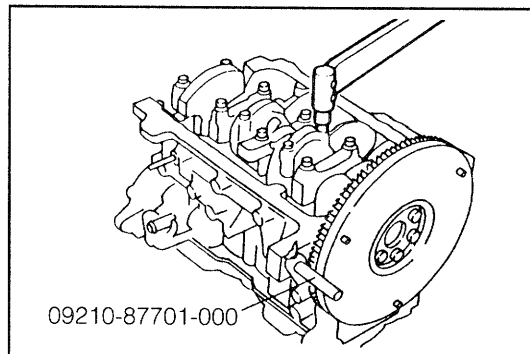
**NOTE:**

- The connecting rod big end bore code number comes in three kinds of 4, 5 and 6.

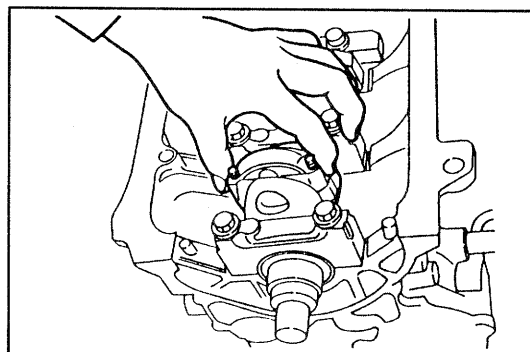
- (2) Measure the diameter of the crankpin journal.

The measurement should be performed at four points, 90 degrees spaced, for each crankpin journal at the points shown in the right figure. The maximum value is regarded as the crankpin journal diameter.

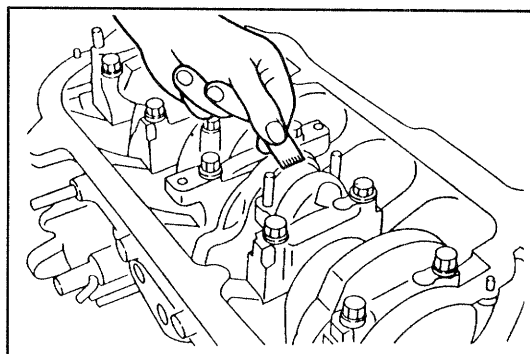
However, if the variation in the measured diameters exceeds 0.044 mm (0.0017 inch), replace the crankshaft.



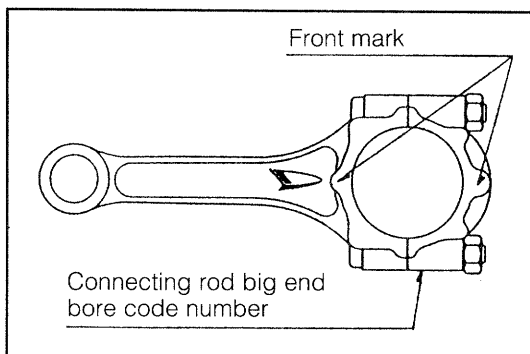
WNU89-EM377



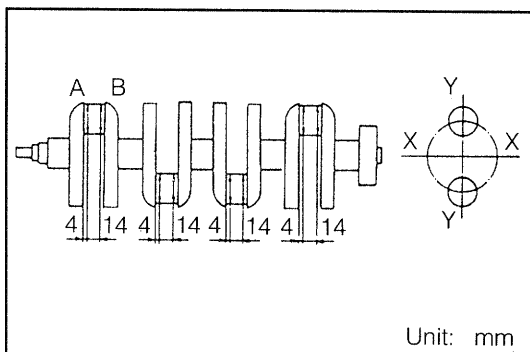
WNU89-EM378



WNU89-EM379



WRU90-EM278A



Unit: mm

WRU90-EM279

(3) Select the connecting rod bearing or replace the crankshaft, based on the results of (1) and (2).

Connecting rod big end bore code number	Crankpin journal diameter mm (inch)	Bearing classification number (color)	Remarks
4	44.993 - 45.000 (1.7714 - 1.7716)	1 (Yellow)	—
	44.985 - 44.992 (1.7711 - 1.7713)	2 (Green)	—
	44.976 - 44.984 (1.7707 - 1.7710)	3 (Brown)	—
	44.975 or less (1.7706)	—	Crankshaft replacement
5	44.993 - 45.000 (1.7714 - 1.7716)	2 (Green)	—
	44.985 - 44.992 (1.7711 - 1.7713)	3 (Brown)	—
	44.976 - 44.984 (1.7707 - 1.7710)	4 (Black)	—
	44.975 or less (1.7706)	—	Crankshaft replacement
6	44.993 - 45.000 (1.7714 - 1.7716)	3 (Brown)	—
	44.985 - 44.992 (1.7710 - 1.7713)	4 (Black)	—
	44.976 - 44.984 (1.7708 - 1.7710)	5 (Blue)	—
	44.975 or less (1.7706)	—	Crankshaft replacement

WNU89-EM382

### 5. Check of crankshaft thrust clearance

#### NOTE:

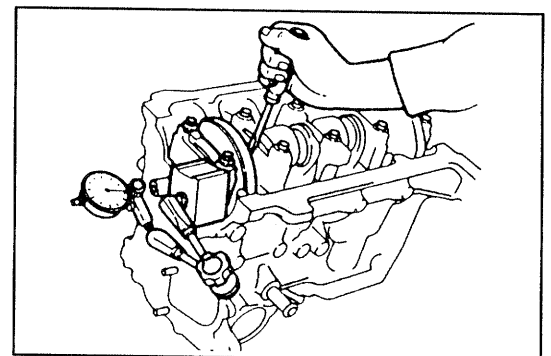
- Measure the thrust clearance, using a dial gauge.

Thrust Clearance:

Specified value: 0.02 - 0.22 mm  
(0.0008 - 0.0086 inch)

Allowable limit: 0.30 mm (0.012 inch)

If the thrust clearance exceeds the allowable limit, measure the width of the crankshaft thrust bearing contact surface. If the measured value is less than 39.92 mm (1.57 inch), replace the thrust washer. If the measured value exceeds 39.92 mm (1.57 inch), replace the crankshaft and thrust washer.



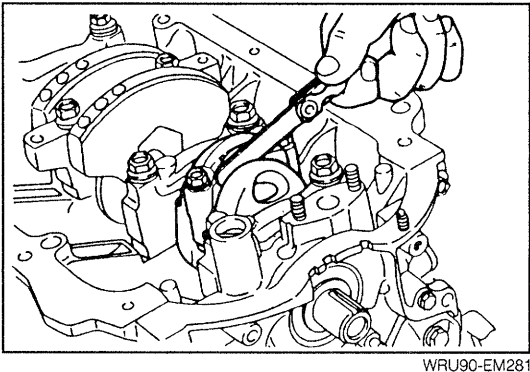
WRU90-EM280

6. Measurement of connecting rod thrust clearance  
Measure the thrust clearance between the connecting rod and the crankshaft, using a thickness gauge.

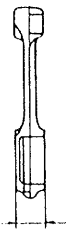
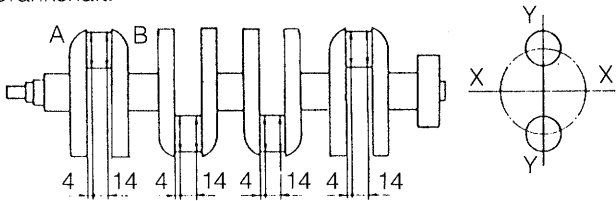
Thrust clearance:  
Standard 0.15 - 0.4 mm (0.0060 - 0.015 inch)  
Maximum 0.45 mm (0.018 inch)

- NOTE:
- The thrust clearance should be measured while the connecting rod is being pushed against either side of the crankshaft in the axial direction. Measure the thrust clearance at the opposite side.

If the clearance exceeds the specified value, replace the connecting rod or the crankshaft, or both of them, referring to the width of the big end of the connecting rod in the thrust direction and the side width of the crankpin journal.



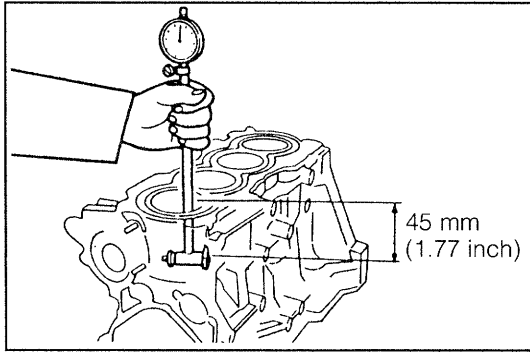
Reference

Width of big end of connecting rod in thrust direction	Side width of crankpin
21.80 - 21.85 mm (0.858 - 0.860 inch)	22.0 - 22.2 mm (0.867 - 0.874 inch)
	<p>&lt;Crankshaft&gt;</p>  <p>Unit: mm</p>

CYLINDER BORING

- NOTE:
- When the cylinder is bored, all cylinders should be bored at the same time.
  - As for piston rings, use oversized piston rings.

1. Measurement of cylinder bore diameter  
Measure the diameter at a point 45 mm (1.77 inch) from the cylinder upper surface in the direction shown in the right figure.  
If the measured value exceeds 76.28 mm (3.003 inch), replace the cylinder block.



2. Determining cylinder finishing diameter
  - (1) Measure the diameter of the oversized piston to be used, using a micrometer.

**NOTE:**

- The measurement should be conducted at the skirt section 15 mm (0.59 inch) from the piston lower end.
- Perform the measurement horizontally, not in a tilted state.

- (2) Calculate the finishing dimension, as follows.

A: Piston diameter

B: Piston-to-cylinder bore clearance

0.025 - 0.045 mm

(0.0010 - 0.0018 inch)

C: Honing allowance

0.02 mm (0.0008 inch)

D: Finishing diameter

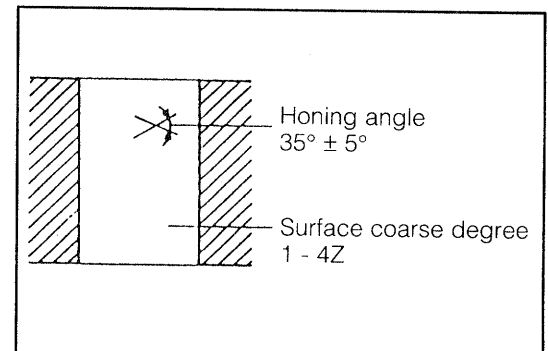
$$D = A + B - C$$

WRU90-EM282

3. Hone the cylinder after the boring.
  - (1) Bore the cylinder, leaving a honing allowance of 0.02 mm (0.0008 inch).
  - (2) Hone the cylinder.
 

**Honing angle:**  $35^\circ \pm 5^\circ$

**Surface coarse degree:** 1 - 4Z



WNU89-EM434

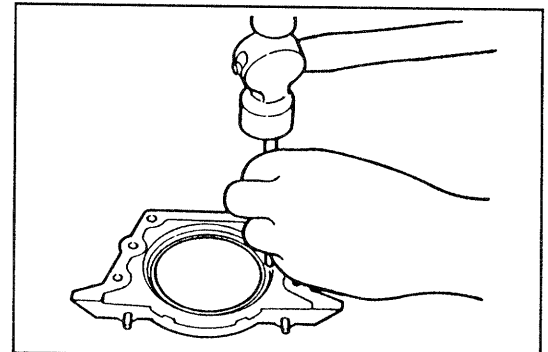
## REPLACEMENT OF REAR OIL SEAL

1. Removal of rear oil seal
 

Remove the rear oil seal from the rear oil seal retainer, using a pin punch.

**NOTE:**

- Be very careful not to damage the oil seal retainer.



WRU90-EM283

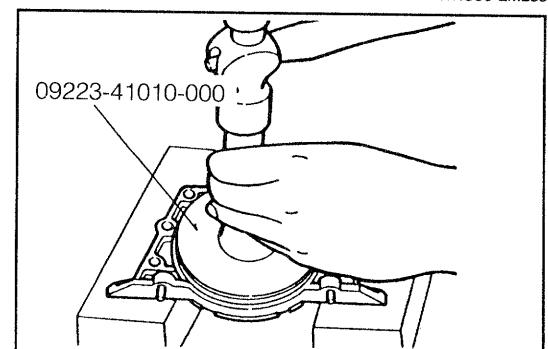
2. Installation of rear oil seal
 

Drive a new rear oil seal into position, using the following SST.

**SST:** 09223-41010-000

**NOTE:**

- Care must be exercised to ensure that the oil seal is not driven in a tilted state.



WRU90-EM284

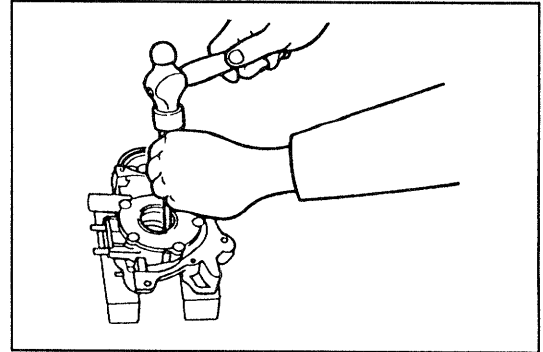
## REPLACEMENT OF FRONT OIL SEAL

### 1. Removal of front oil seal

Remove the front oil seal from the oil pump, using a pin punch.

#### NOTE:

- Be very careful not to damage the oil pump during the removal.

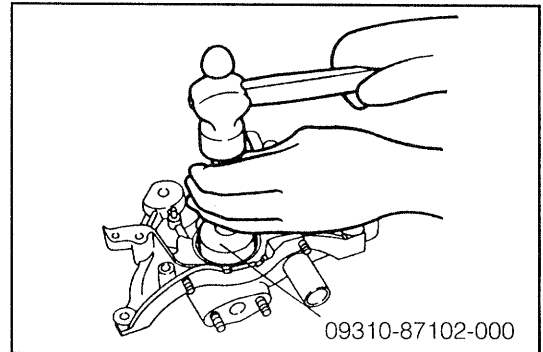


WRU90-EM285

### 2. Installation of front oil seal

Drive a new front oil seal into position, using the following SST.

SST: 09310-87102-000



09310-87102-000

WRU90-EM286

## REPLACEMENT OF CYLINDER BLOCK

#### NOTE:

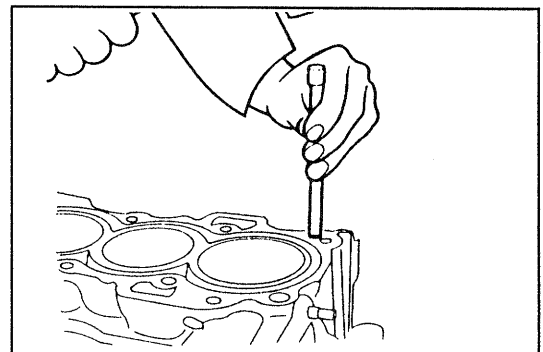
- The cylinder block is furnished along with the pistons as a set. Hence, make sure that each piston is installed in the mated cylinder bore.

### 1. Wash the cylinder block using cleaning solvent.

### 2. Drive the oil orifice until it is recessed $3.0 \pm 1.0$ mm ( $0.12 \pm 0.039$ inch) from the cylinder upper surface.

#### NOTE:

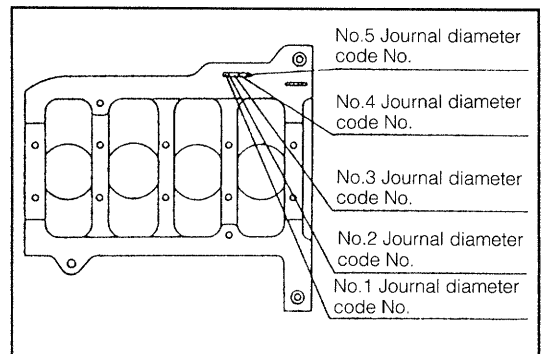
- For driving this oil orifice, use an iron rod having an outer diameter of 10 mm (0.39 inch).



WNU89-EM439

### 3. Selection of crankshaft bearings

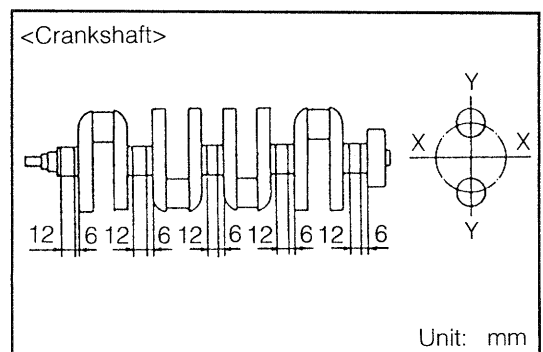
(1) Read the crankshaft journal diameter code number on the cylinder block.



WNU89-EM440

(2) Measure the main journal diameter of the crankshaft at those points indicated in the right figure.

- The measurement should be conducted in four directions for each main journal, 90 degrees spaced, at those points indicated in the right figure.



WNU89-EM440A

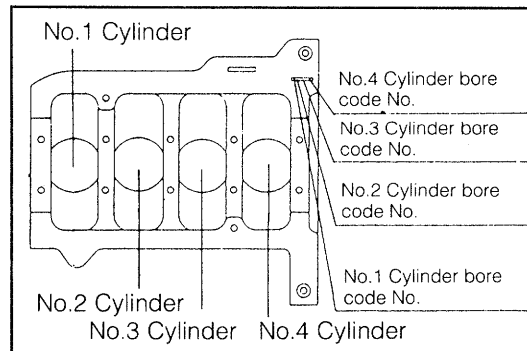
(3) Select the crankshaft bearings in accordance with the table below.

Crankshaft journal hole code	Crankshaft journal diameter mm (inch)	Crankshaft bearing classification No. (color)	Remarks
5	50.000 - 49.995 (1.9685 - 1.9684)	1 (Yellow)	—
	49.994 - 49.989 (1.9683 - 1.9681)	2 (Green)	—
	49.988 - 49.983 (1.9680 - 1.9679)	3 (Brown)	—
	49.982 - 49.976 (1.9678 - 1.9676)	4 (Black)	—
	49.975 or less (1.9675)	—	Crankshaft replacement
6	50.000 - 49.995 (1.9685 - 1.9684)	2 (Green)	—
	49.994 - 49.989 (1.9683 - 1.9681)	3 (Brown)	—
	49.988 - 49.983 (1.9680 - 1.9679)	4 (Black)	—
	49.982 - 49.976 (1.9678 - 1.9676)	5 (Blue)	—
	49.975 or less (1.9675)	—	Crankshaft replacement
7	50.000 - 49.995 (1.9685 - 1.9684)	3 (Brown)	—
	49.994 - 49.989 (1.9683 - 1.9681)	4 (Black)	—
	49.988 - 49.983 (1.9680 - 1.9679)	5 (Blue)	—
	49.982 - 49.976 (1.9678 - 1.9676)	6 (White)	—
	49.975 or less (1.9675)	—	Crankshaft replacement
8	50.000 - 49.995 (1.9685 - 1.9684)	4 (Black)	—
	49.994 - 49.989 (1.9683 - 1.9681)	5 (Blue)	—
	49.988 - 49.983 (1.9680 - 1.9679)	6 (White)	—
	49.982 - 49.976 (1.9678 - 1.9676)	7 (Pink)	—
	49.975 or less (1.9675)	—	Crankshaft replacement

WRU90-EM287

## 4. Selection of pistons (reference)

(1) Read the cylinder block bore code number.

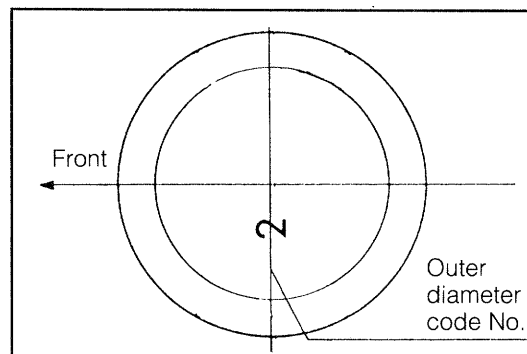


WNU89-EM443

(2) Select a piston having the same classification number as the cylinder block bore code number.

### NOTE:

- The piston code number is stamped on the top of each piston.



WNU89-EM444

## REPLACEMENT OF CRANKSHAFT

(Replacement of the crankshaft only)

1. Wash the crankshaft using cleaning solvent. Dry it with compressed air.

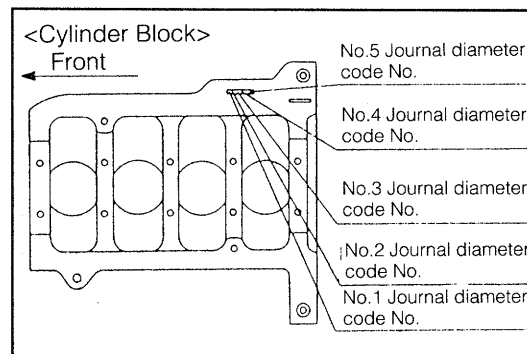
### NOTE:

- Make sure that the oil gallery exhibits no restriction due to rust-proof oil.

WNU89-EM445

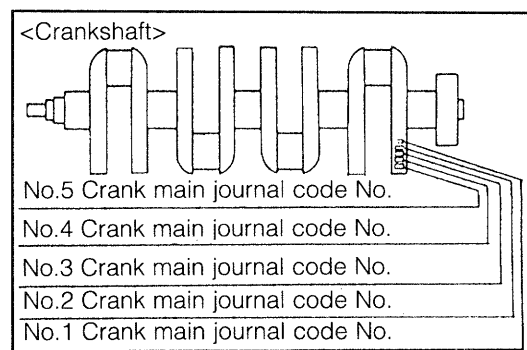
## 2. Selection of crankshaft bearings

(1) Read the crankshaft journal diameter code number of the cylinder block.



WNU89-EM446

(2) Read the crankshaft main journal diameter code number.



WNU89-EM447



- (3) Establish the crankshaft bearing classification number, using the table below.

Cylinder block		Crankshaft journal			
		1	2	3	4
Crankshaft journal diameter code No.	5	4	3	2	1
	6	5	4	3	2
	7	6	5	4	3
	8	7	6	5	4

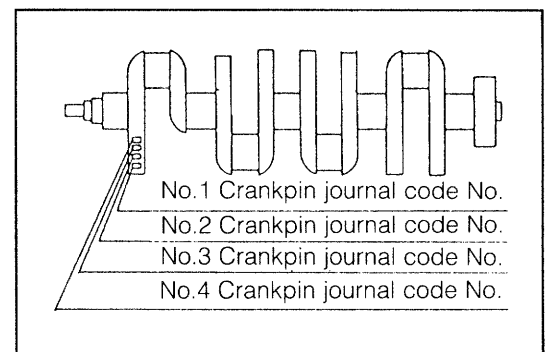
WNU89-EM448

### Reference

Bearing classification No.	1	2	3	4	5	6	7
Identification color	Yellow	Green	Brown	Black	Blue	White	Pink

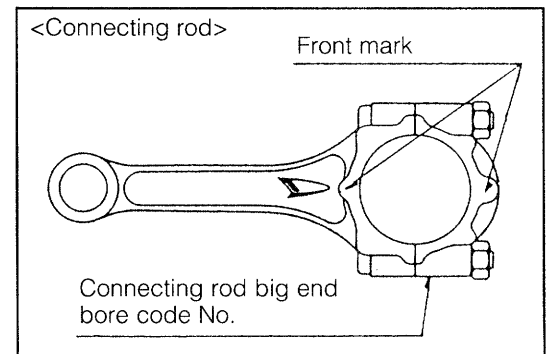
WNU89-EM449

3. Selection of connecting rod bearings  
 (1) Read the crankpin journal diameter code number.



WNU89-EM450

- (2) Read the connecting rod big end bore code number.



WNU89-EM451

- (3) Establish the classification number of the connecting rod bearing, using the table below.

Connecting rod		Crankpin journal diameter code No.		
		1	2	3
Connecting rod big end bore code No.	4	3	2	1
	5	4	3	2
	6	5	4	3

WRU90-EM418

## Reference

Bearing classification No.	1	2	3	4	5
Identification color	Yellow	Green	Brown	Black	Blue

WNU89-EM453

## REPLACEMENT OF CONNECTING RODS

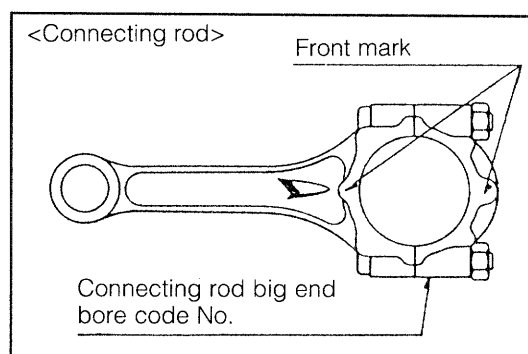
1. Wash the connecting rods using cleaning solvent.

### WARNING:

Be sure to protect your eyes, wearing goggles.

WNU89-EM454

2. Selection of connecting rod bearings
  - (1) Read the connecting rod big end bore code number.

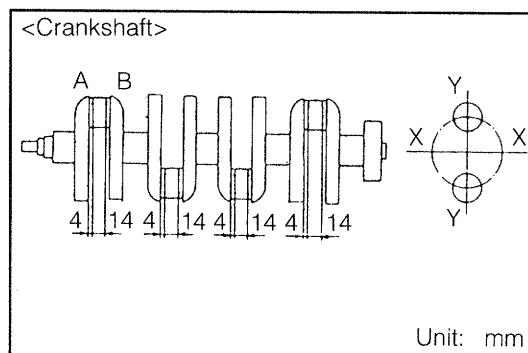


WNU89-EM455

- (2) Measure the crankshaft pin diameter of the crankshaft in four directions for each crankshaft pin, 90 degrees spaced, at those points indicated in the right figure.

### NOTE:

- The greatest value among the measured diameters is regarded as the crankpin journal diameter.
- However, if the difference among the measured values exceeds 0.044 mm (0.0017 inch), replace the crankshaft.



WNU89-EM456

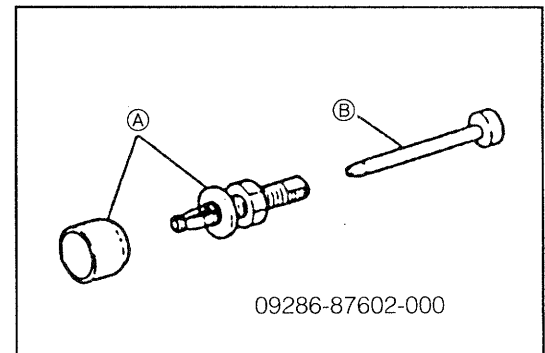
(3) Select the connecting rod bearing in accordance with the table posted in next page.

Connecting rod big end bore code No.	Crankpin journal diameter mm (inch)	Connecting rod bearing classification No. (color)	Remarks
4	45.000 - 44.993 (1.7716 - 1.7714)	1 (Yellow)	—
	44.992 - 44.985 (1.7713 - 1.7711)	2 (Green)	—
	44.984 - 44.976 (1.7710 - 1.7707)	3 (Brown)	—
	44.975 or less (1.7706)	—	Crankshaft replacement
5	45.000 - 44.993 (1.7716 - 1.7714)	2 (Green)	—
	44.992 - 44.985 (1.7713 - 1.7711)	3 (Brown)	—
	44.984 - 44.976 (1.7710 - 1.7707)	4 (Black)	—
	44.975 or less (1.7706)	—	Crankshaft replacement
6	45.000 - 44.993 (1.7716 - 1.7714)	3 (Brown)	—
	44.992 - 44.985 (1.7713 - 1.7711)	4 (Black)	—
	44.984 - 44.976 (1.7710 - 1.7707)	5 (Blue)	—
	44.975 or less (1.7706)	—	Crankshaft replacement

WNU89-EM457

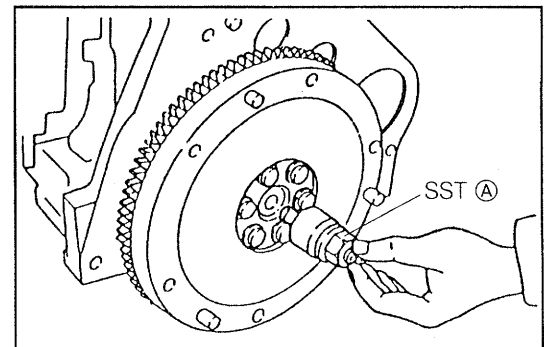
## REPLACEMENT CRANKSHAFT REAR END BEARING

- Removal of crankshaft rear end bearing.  
SST: 09286-87602-000



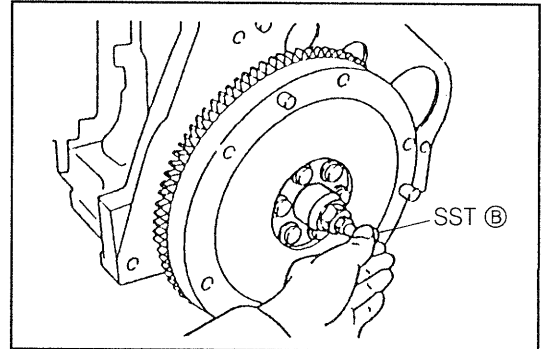
WRU90-EM288

- Insert the SST ① into the crankshaft rear end bearing.



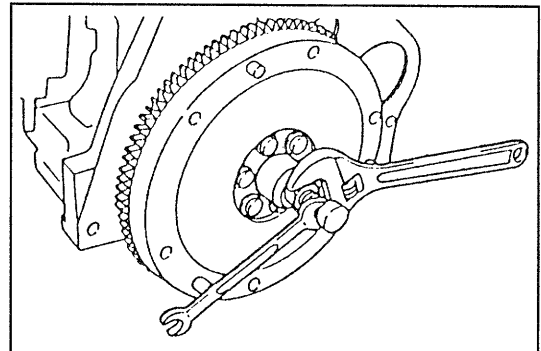
WRU90-EM289

(2) Insert the SST ⑥ into the SST ⑤.



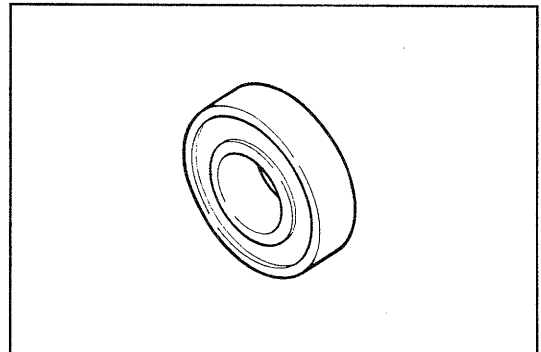
WRU90-EM290

(3) While holding the SST ⑤ by means of a wrench or the like, tighten the nut.  
Then, remove the rear end bearing.



WRU90-EM291

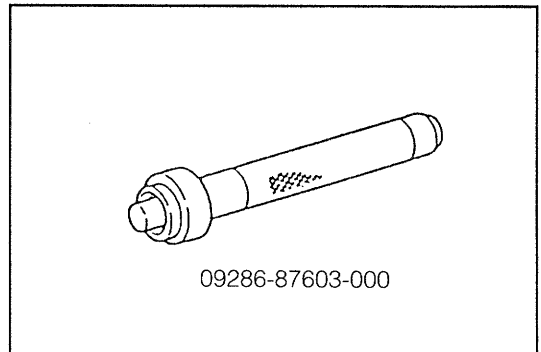
2. Inspect the crankshaft rear end bearing, damage or wear.



WRU90-EM292

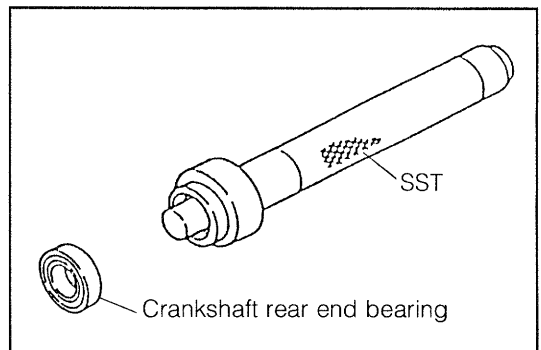
3. Install the crankshaft rear end bearing, using the following SST.

SST: 09286-87603-000



WRU90-EM293

(1) Install the crankshaft rear end bearing to the SST.

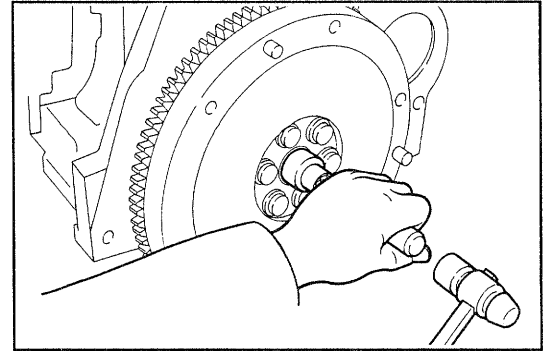


WRU90-EM294

- (2) Press the crankshaft rear end bearing into the crankshaft rear end.

**NOTE:**

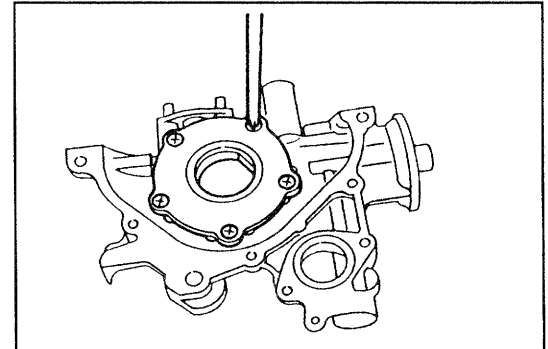
- Be sure to press the bearing, until the end surface of the SST contacts with the crankshaft rear end section.
- When pressing the bearing, be very careful not to allow the bearing to tilt



WRU90-EM295

## DISASSEMBLY OF OIL PUMP

1. Detach the oil pump cover, by removing the five attaching bolts.

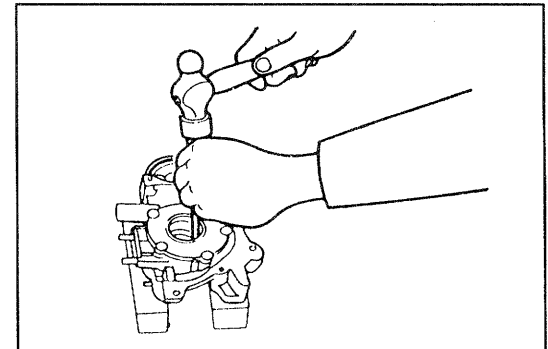


WRU90-EM296

2. Remove the front oil seal from the oil pump, using a pin punch.

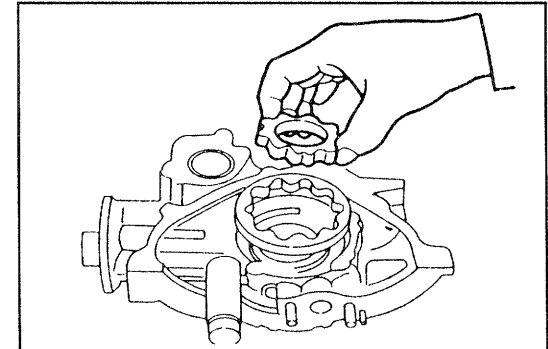
**NOTE:**

- Be very careful not to damage the oil pump during the removal.



WRU90-EM297

3. Remove the oil pump rotor set.

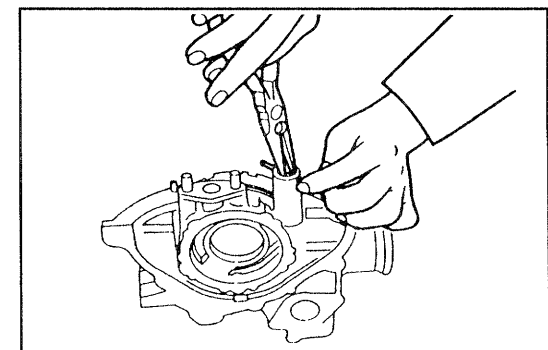


WNU89-EM460

4. Pull out the cotter pin, while pushing the spring retainer with nose pliers or the like.

**NOTE:**

- Put an appropriate cloth, etc. on the retainer spring so that it may not jump out.

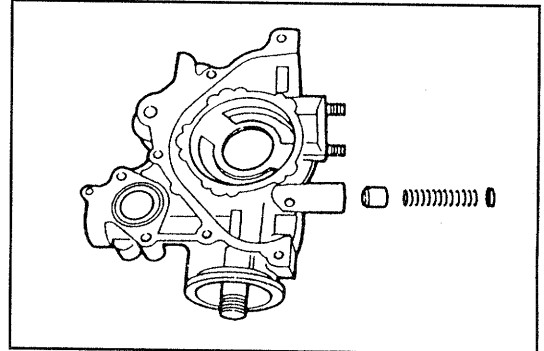


WNU89-EM461

5. Remove the oil pump relief valve spring retainer, compression spring and oil pump relief valve.

**NOTE:**

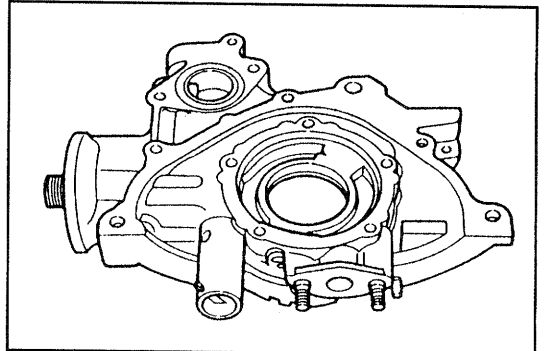
- Wash the disassembled parts in cleaning solvent.



WNU89-EM462

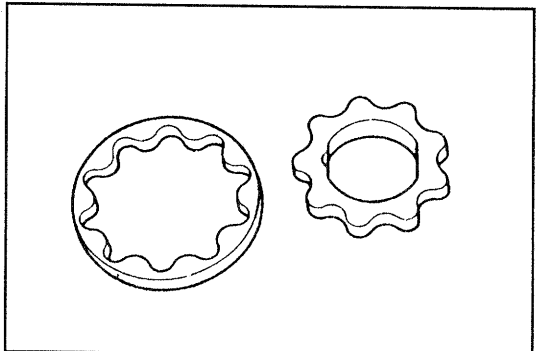
6. Inspection of each part

- (1) Check the pump body for damage.  
Replace the pump body if it exhibits damage.



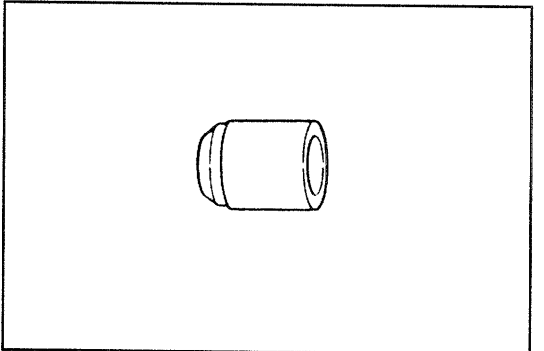
WNU89-EM463

- (2) Check the rotor set for damage.  
Replace the rotor set if it exhibits damage.



WNU89-EM464

- (3) Check the oil pump relief valve for damage.  
Replace the relief valve if it exhibits damage. Also, check to see if any damage is present at the relief valve installation hole of the oil pump body.

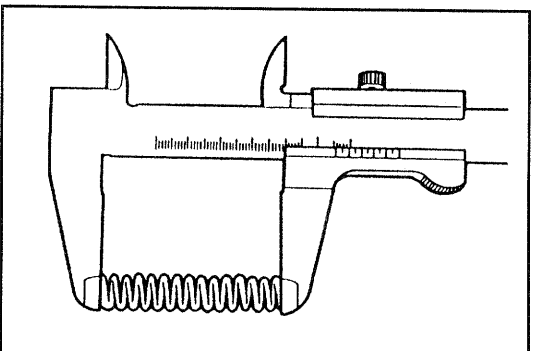


WNU89-EM465

- (4) Check the compression spring for damage. Also, measure its free length.

**Specified Free Length: 57 mm (2.244 inch)**

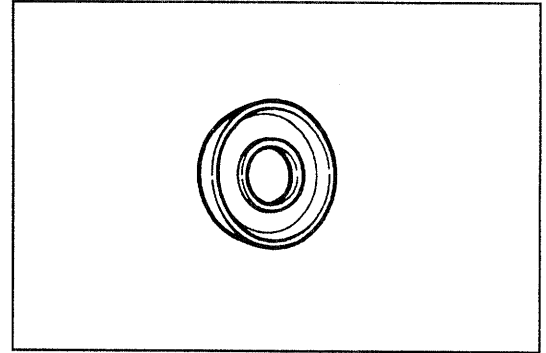
Replace the compression spring if it exhibits damage or the free length is less than the specified valve.



WNU89-EM466

- (5) Check the oil pump relief valve spring retainer for damage.

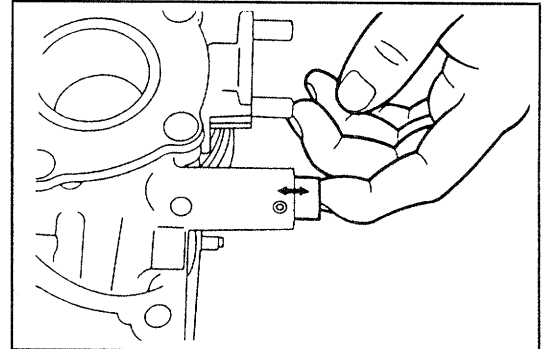
Replace the retainer if it exhibits damage.



WNU89-EM467

- (6) Apply engine oil to the oil pump relief valve. Insert the oil pump relief valve into the oil pump body. Check to see if the valve slides smoothly.

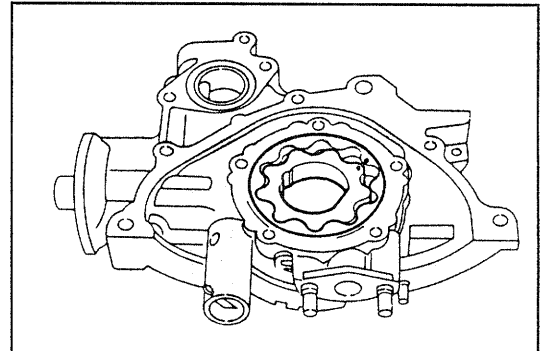
Replace the oil pump body if the valve fails to slide smoothly.



WNU89-EM468

7. Measurement of body clearance, tip clearance and side clearance

- (1) Apply a thin film of engine oil to the rotor mate surface of the oil pump body as well as to the rotor set. Assemble the rotor set in the oil pump body in such a way that the drilled mark may be seen from the outside.

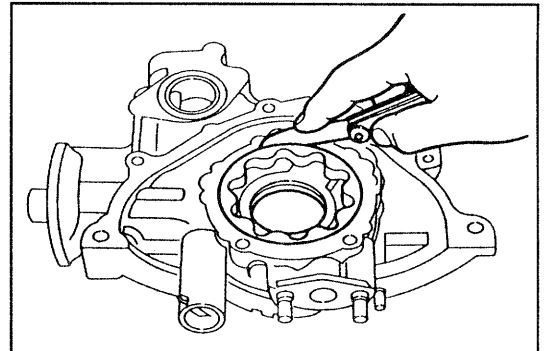


WNU89-EM469

- (2) Measure the body clearance between the oil pump body and the outer rotor, using a thickness gauge.

**Body Clearance:** 0.20 - 0.28 mm  
(0.0079 - 0.011 inch)

Replace the oil pump if the body clearance exceeds the specified value.

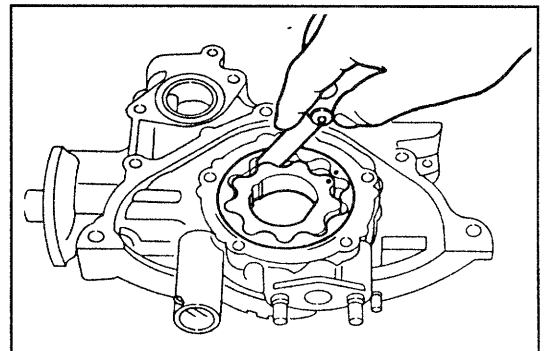


WNU89-EM470

- (3) Measure the tip clearance of the rotor set, using a thickness gauge.

**Tip Clearance:** 0.16 - 0.24 mm  
(0.0063 - 0.0094 inch)

Replace the rotor set if the tip clearance exceeds the specified value.



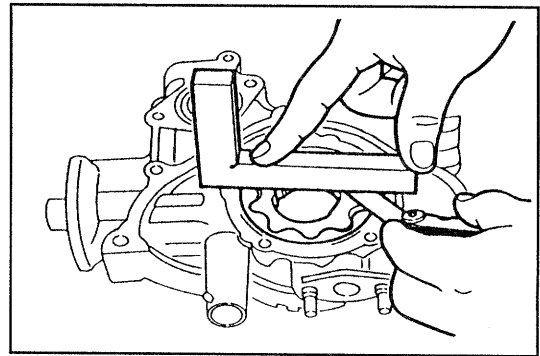
WRU90-EM419

- (4) Measure the side clearance between the oil pump body and the rotor set, using a straightedge and a thickness gauge.

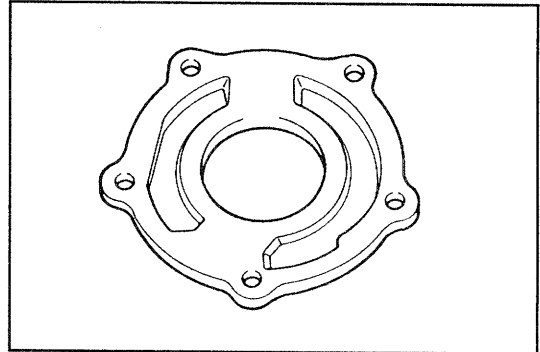
Side Clearance: 0.035 - 0.085 mm  
(0.0014 - 0.0033 inch)

Replace the oil pump if the side clearance exceeds the specified value.

8. Check to see if any wear is present at the rotor set mate surface of the pump cover.  
Replace the oil pump cover if it exhibits wear.



WRU90-EM420



WNU89-EM473

## ASSEMBLY OF OIL PUMP

### NOTE:

Wash those parts to be assembled in cleaning solvent. Dry them using compressed air.

### WARNING:

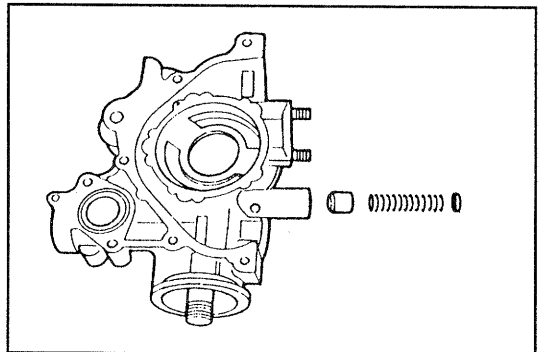
When you use compressed air, be sure to protect your eyes, wearing goggles.

WNU89-EM474

1. Apply engine oil to the relief valve. Then, insert the relief valve into the oil pump body.
2. Insert the compression spring and retainer into the oil pump body.

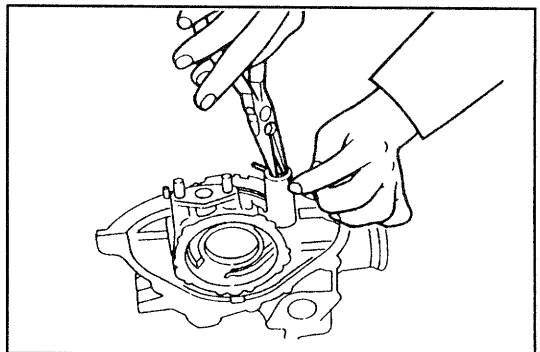
### NOTE:

- Install the retainer in such a direction that its projected side may come at the compression spring side.



WNU89-EM475

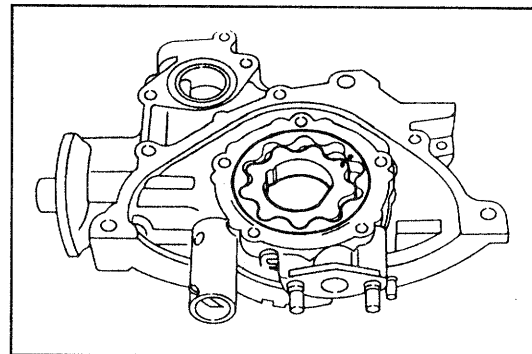
3. Insert a new cotter pin into the retainer while the retainer is being compressed with pliers, etc. Split the end of the cotter pin to form an anchor-like shape.



WNU89-EM476



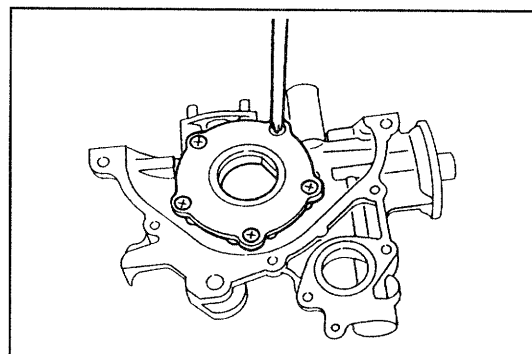
4. Apply engine oil to the rotor set. Assemble the rotor set in the pump body in such a direction that the drilled mark of the rotor may be seen from the outside.



WNU89-EM477

5. Install the oil pump cover. Tighten the cover to the specified torque.

Tightening Torque: 0.8 - 1.3 kg-m  
(5.8 - 9.4 ft-lb, 7.8 - 12.7 N·m)

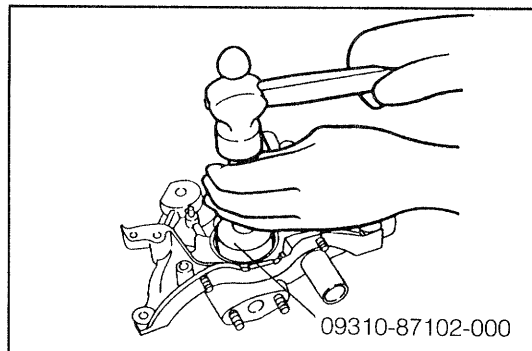


WNU89-EM478

6. Drive a new oil seal into position, using the following SST.  
SST: 09310-87102-000

**NOTE:**

- Be very careful not damage the oil pump during the installation.
- Make sure that the oil seal is not driven into position in a tilted state.

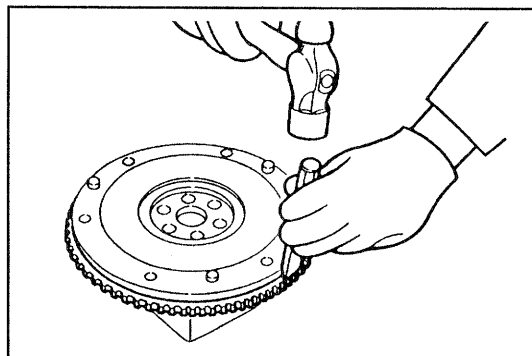


09310-87102-000

WNU89-EM479

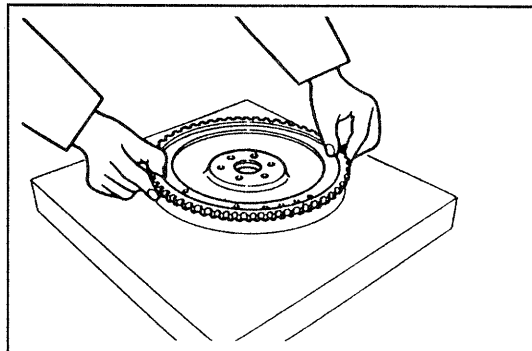
## REMOVAL/INSTALLATION OF RING GEAR

1. Place the ring gear on an adequate wooden block. Drive out the ring gear, using a chisel in combination with a hammer.



WNU89-EM481

2. Place a new ring gear horizontally on the flywheel.



WNU89-EM482

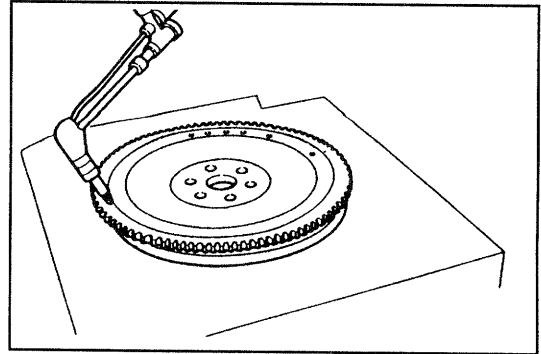
## ENGINE MECHANICALS

- Using a gas burner, heat the ring gear evenly, until the ring gear due to its own weight fits onto the flywheel.

### NOTE:

- Do not tap the ring gear using a hammer or the like.
- Never cool the ring gear quickly using water or the like.

- Allow the ring gear to cool naturally.



WRU90-EM421

## ASSEMBLY OF CYLINDER BLOCK

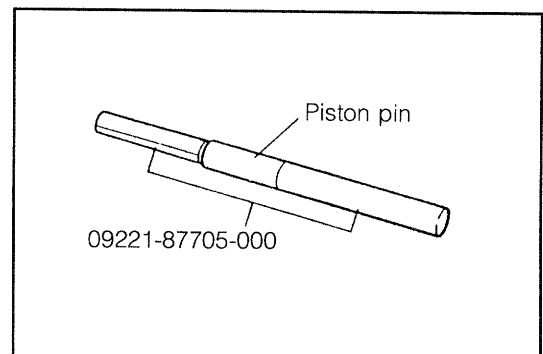
(See page EM-82.)

### NOTE:

- As for those parts to be reassembled, wash them in cleaning solvent (excluding those parts, such as grease-sealed type bearings, dust seals and electrical parts). Then, dry them using compressed air.
- Remove any remaining sealer, etc. from the threaded portions of the switches and sensors.

- Assembly of piston and connecting rod
  - Install the piston pin to the following SST in a way shown in the right figure.

SST: 09221-87705-000

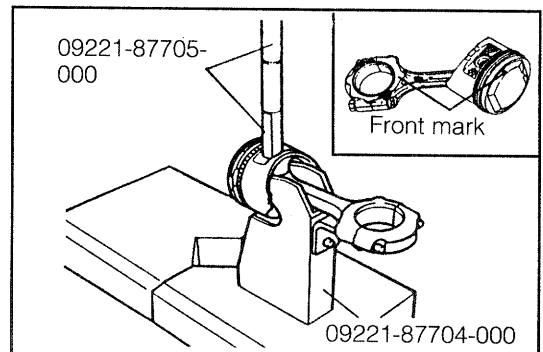


WRU90-EM298

- Install the piston and connecting rod in the SST in a way shown in the right figure. Insert the SST installed with the piston pin into the piston pin hole.

SST: 09221-87704-000

09221-87705-000

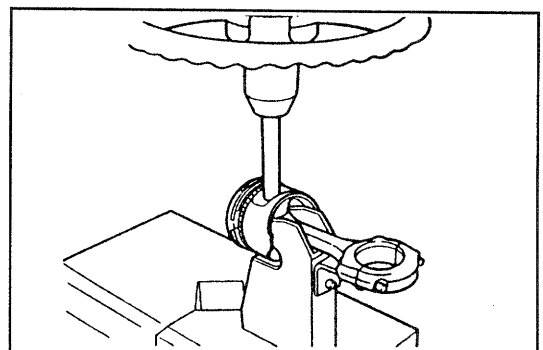


WRU90-EM299

### NOTE:

- The piston and connecting rod should be assembled in such a way that the piston front mark and connecting rod front mark come in the same direction.

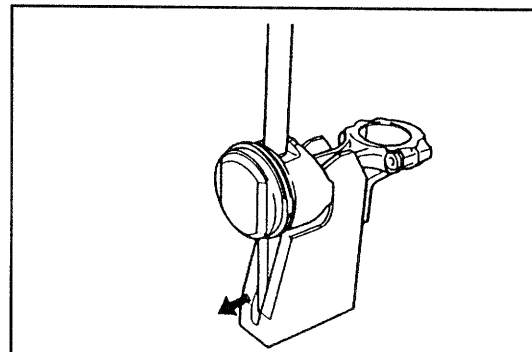
- Press the piston pin into the piston and connecting rod, using a hydraulic press.



WNU89-EM428

WNU89-EM429

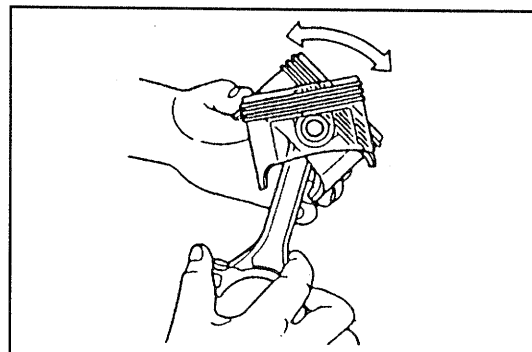
- (4) Remove the piston and connecting rod assembly from the SST. Remove the SST from the piston pin.



WNU89-EM430

**NOTE:**

- When the piston is moved back and forth on the piston pin, you may encounter hard movement. However, if the piston moves smoothly without any binding, this fitting of the piston is normal.



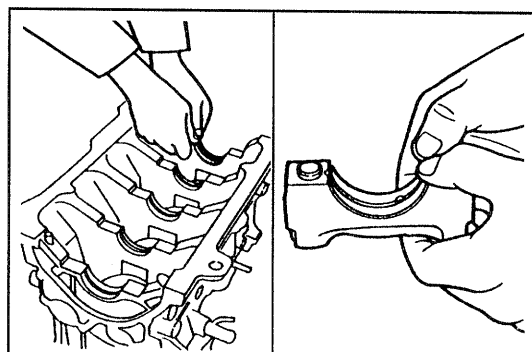
WRU90-EM300

## 2. Crankshaft installation

- (1) Install the bearings to the cylinder block and crankshaft bearing caps.

**NOTE:**

- Do not touch with the front and back surfaces of each bearing. Be sure to hold the bearing at its edge surfaces.

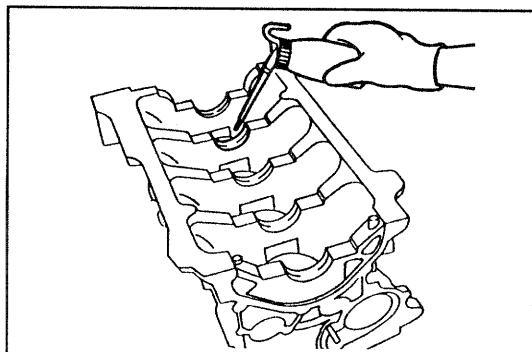


WRU90-EM301

- (2) Lubricate the surface of each bearing with engine oil.

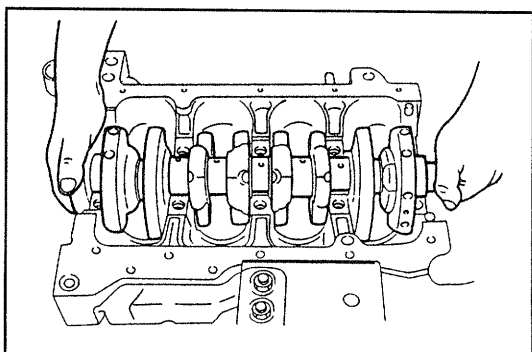
**NOTE:**

- Do not touch with the front and back surfaces of each bearing.
- Never apply engine oil to the crankshaft bearing caps.



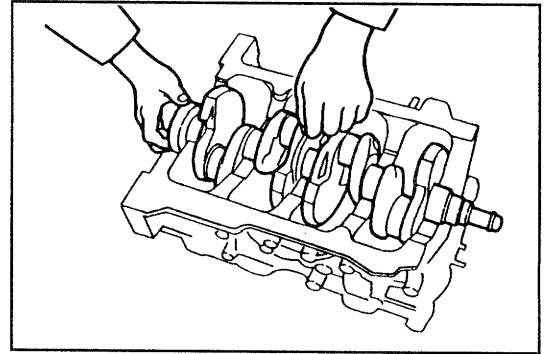
WNU89-EM486

- (3) Install the crankshaft in the cylinder block.



WNU89-EM487

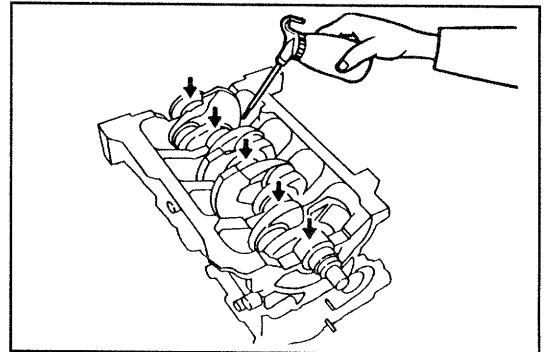
- (4) Apply engine oil to the thrust washers. With the side having the oil groove facing toward the crankshaft side, insert each thrust washer between the crankshaft main journal No. 3 and the cylinder block.



WNU89-EM488

- (5) Apply engine oil to the crankshaft main journal sections.  
**NOTE:**

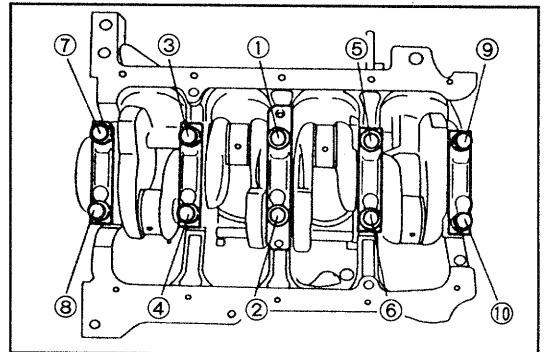
- Care must be exercised to ensure that no oil flows into the bearing cap attaching bolt holes.



WNU89-EM489

- (6) Install the crankshaft bearing caps with the arrow marks facing toward the oil pump side and also in the numerical sequence.  
(7) Thinly apply engine oil to the crankshaft bearing cap bolts. Tighten the bolts to the specified torque over two or three stages in the sequence shown in the right figure.

**Tightening Torque:** 4.5 - 5.5 kg-m  
(32.5 - 39.8 ft-lb, 44.1 - 53.9 N-m)

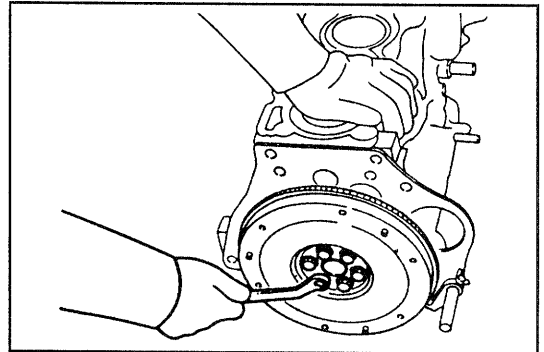


WNU89-EM490

3. Assembly of piston with connecting rod  
Install the flywheel on the crankshaft temporarily.

**NOTE:**

- Care must be exercised to ensure that no oil, etc. gets to the bolts or bolt holes.

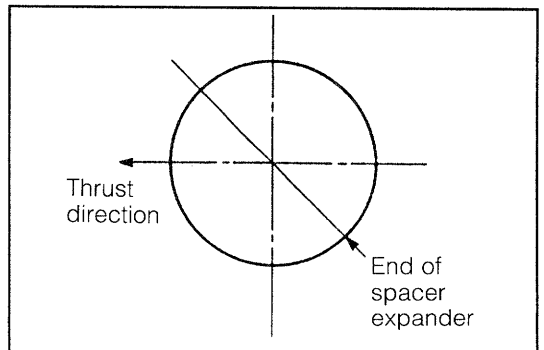


WRU90-EM302

- (1) Install the oil ring spacer expander in the oil ring groove. Ensure that the expander end may not line up with the thrust direction nor with the axial direction.

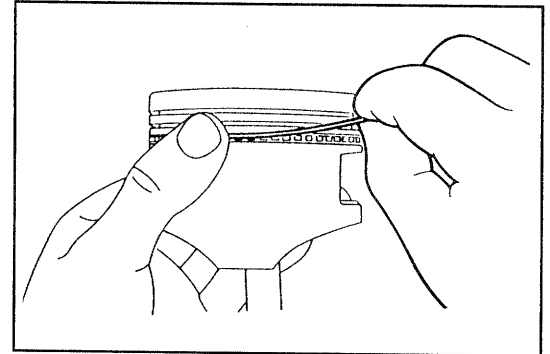
**NOTE:**

- Do not expand the spacer expander to an extent more than necessary.



WNU89-EM492

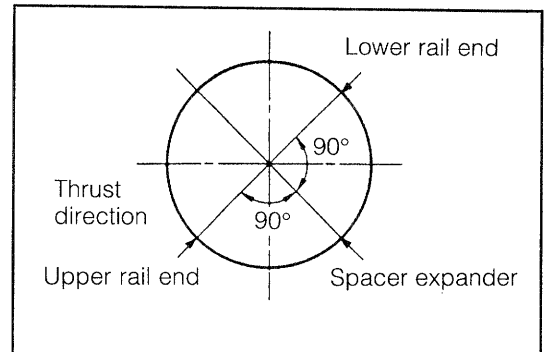
- (2) Fit the upper rail into position in such a manner that it is wound up while pushing the edge section of the oil ring spacer expander with your thumb.



WNU89-EM493

**NOTE:**

- Ensure that the rail end is deviated 90 degrees to the left from the end of the oil ring spacer expander.
- Do not expand the rail to an extent more than necessary.

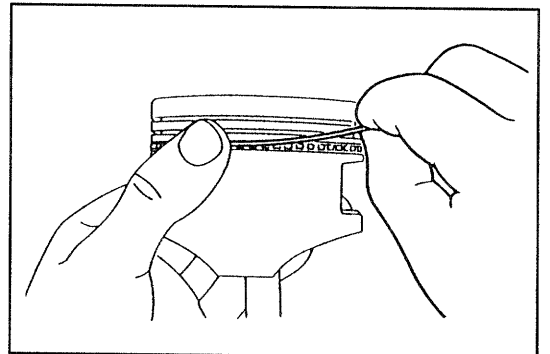


WNU89-EM494

- (3) Fit the lower rail into position in such a manner that it is wound up.

**NOTE:**

- Ensure that the rail end is deviated 90 degrees to the right from the end of the oil ring spacer expander.
- Do not expand the rail to an extent more than necessary.
- Make sure that the oil ring can be rotated smoothly.

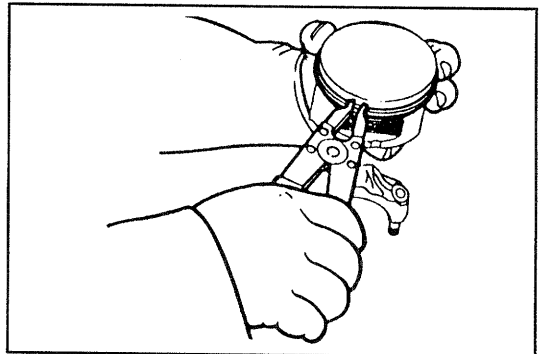


WNU89-EM495

- (4) Install the compression ring No. 2 with the stamped mark of T, 2T, N or 2N facing upward, using a piston ring expander.

**NOTE:**

- Do not expand the piston ring to an extent more than necessary.



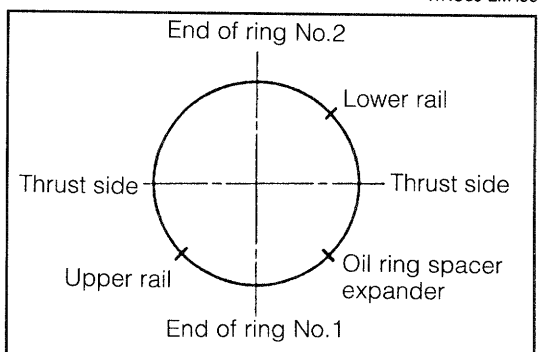
WNU89-EM496

- (5) Install the compression ring No. 1 with the stamped mark of T or N facing upward, using a piston ring expander.

- (6) Position the piston rings so that each ring end may come at the respective points as indicated in the right figure.

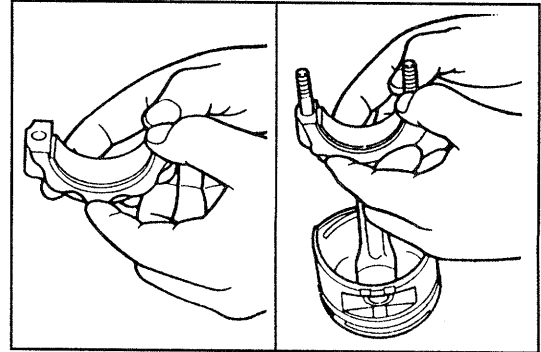
**NOTE:**

- It is not necessarily required to follow strictly the right figure. However, be sure that the ring end is not lined up with the thrust direction. Also, each ring should be deviated about 120 to 180 degrees from the adjacent ring.



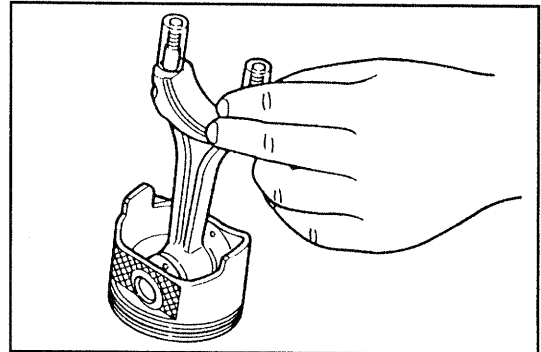
WNU89-EM497

- (7) Install the connecting rod bearings on the connecting rod and connecting rod cap, making sure that your fingers will not touch with the front and back surfaces of the bearings.



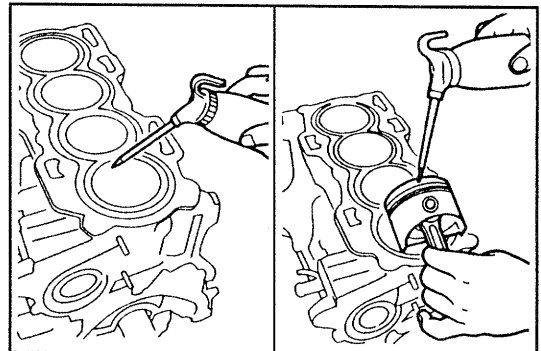
WNU89-EM498

- (8) Cut an appropriate vinyl hose to a suitable length. Fit the vinyl hose to each connecting rod bolt sections.



WNU89-EM499

- (9) Apply engine oil to the piston rings, piston pins, connecting rod bearings, cylinder walls and crankpin journals.



WNU89-EM500

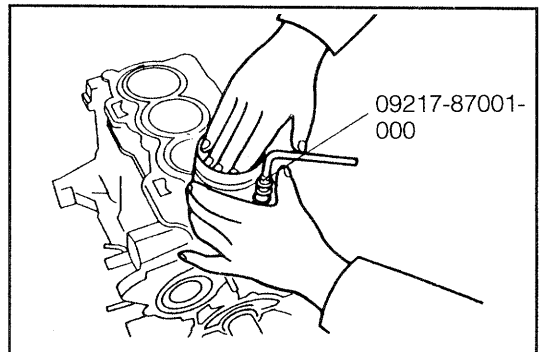
- (10) Compress the piston rings by means of the piston ring compressor SST, making sure that the piston ring ends will not move during the installation.

**SST: 09217-87001-000**

- (11) Push the piston by hand into the cylinder bore with the front mark facing toward the oil pump side.

**NOTE:**

- Be very careful to avoid damaging the connecting rod bearings during the installation.
- Care must be exercised to ensure that the crankpin journal is not scratched by the connecting rod.



WNU89-EM501

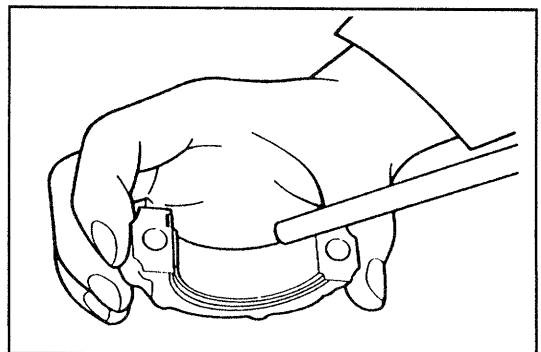
- (12) Push the piston by hand until the connecting rod reaches the crankpin journal.

- (13) Apply engine oil to the bearing surface of each connecting rod bearing.

**NOTE:**

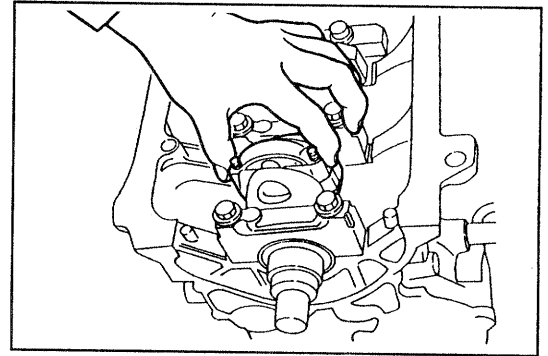
- Do not touch with the bearing front surface.

- (14) Remove the vinyl hoses which were attached to the connecting rod bolt sections.



WNU89-EM502

- (15) Install the connecting rod cap with the front mark facing toward the oil pump side.



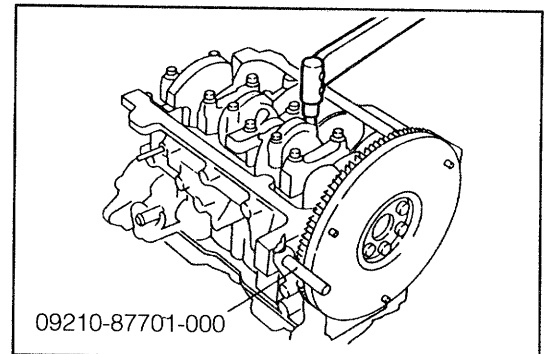
WNU89-EM503

- (16) Prevent the crankshaft from turning, using the following SST.

SST: 09210-87701-000

- (17) Thinly apply engine oil to the connecting rod cap attaching nuts. Tighten the nuts to the specified torque evenly over two or three stages.

Tightening Torque: 3.5 - 4.5 kg-m  
(25.4 - 32.5 ft-lb, 34.3 - 44.1 N·m)



09210-87701-000

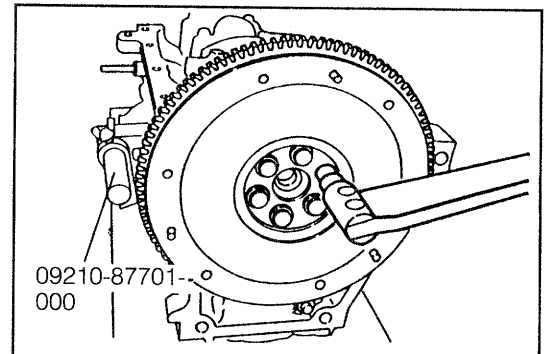
WNU89-EM504

- (18) Perform the operations described in the steps (1) through (18) for each cylinder.

- (19) Remove the flywheel.

- (20) Remove the following SST.

SST: 09210-87701-000



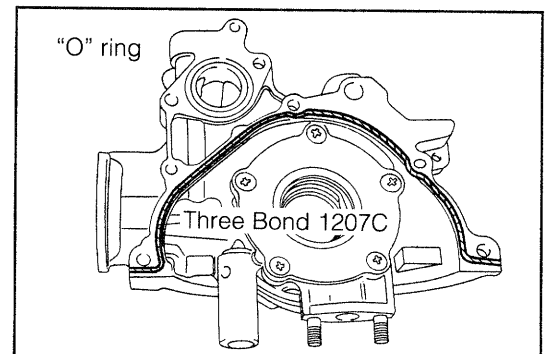
09210-87701-000

WNU89-EM505

### 3. Installation of oil pump

- (1) Apply the Three Bond 1207C to the oil pump installation surface of the cylinder block, as indicated in the right figure.

- (2) Replace the "O" ring of the oil pump with a new part.



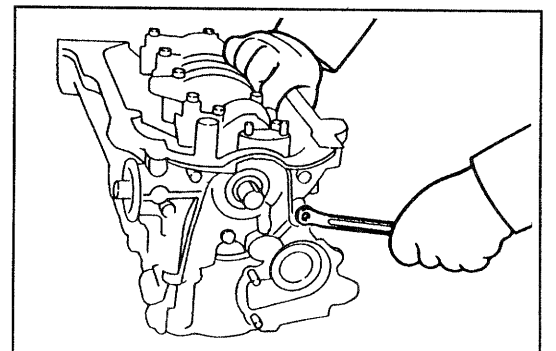
"O" ring

Three Bond 1207C

WRU90-EM303

- (3) Apply engine oil to the inner surface of the oil seal. Install the oil pump to the cylinder block. Perform tightening to the specified torque.

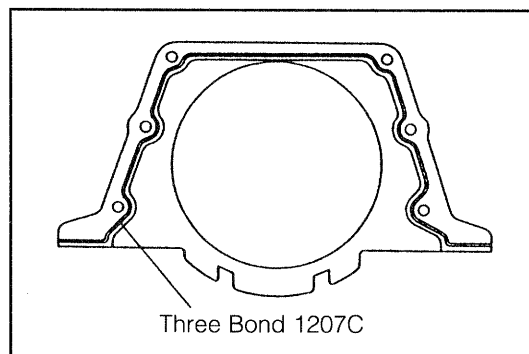
Tightening Torque: 0.6 - 0.9 kg-m  
(4.4 - 6.5 ft-lb, 5.9 - 8.8 N·m)



WNU89-EM507

## 4. Installation of oil seal retainer

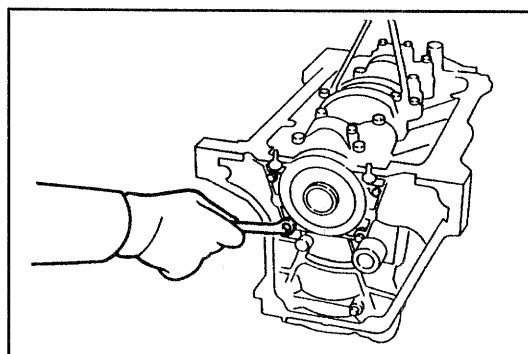
- (1) Apply the Three Bond 1207C to the oil seal retainer installation surface of the cylinder block, as indicated in the right figure.



WNU89-EM508

- (2) Apply engine oil to the inner surface of the oil seal. Install the oil seal retainer to the cylinder block. Perform tightening to the specified torque.

**Tightening Torque:** 0.6 - 0.9 kg-m  
(4.4 - 6.5 ft-lb, 5.9 - 8.8 N·m)

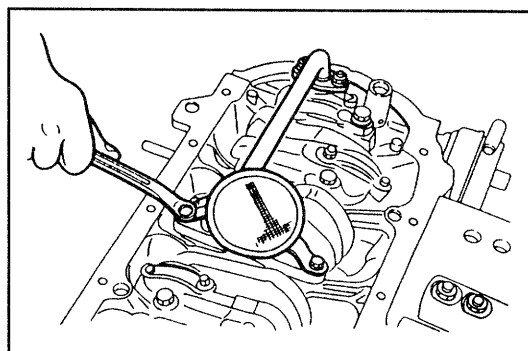


## 5. Install the oil strainer with a new gasket interposed.

**Tightening Torque:**

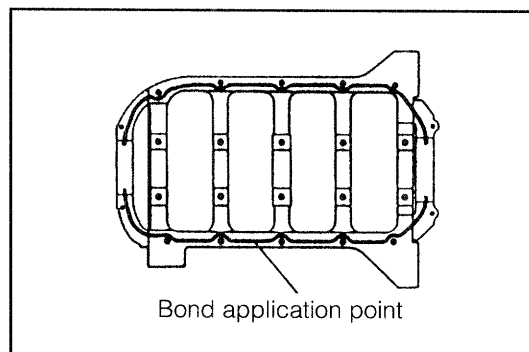
**Bolt:** 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)

**Nut:** 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)



## 6. Installation of oil pan

- (1) Apply the Three Bond 1207C to the oil pan installation surface of the cylinder block, as indicated in the right figure.

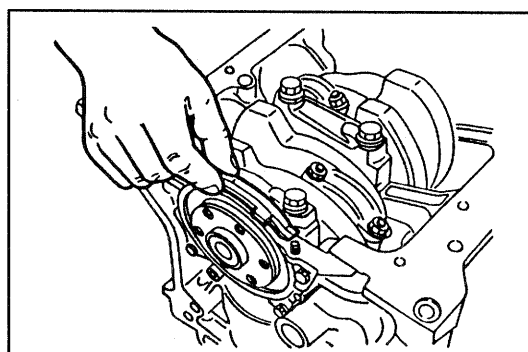


WNU89-EM511

- (2) Place the oil pan gasket.

### NOTE:

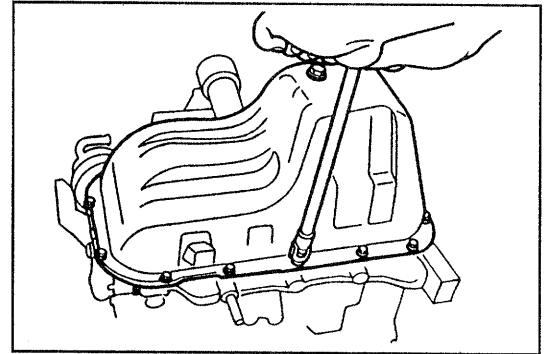
- Ensure that the end section of the oil pan gasket is overlapped at least 10 mm (0.39 inch) with the Three Bond 1207C.





- (3) Install the oil pan. Tighten the oil pan attaching nuts and bolts to the specified torque over two or three stages.

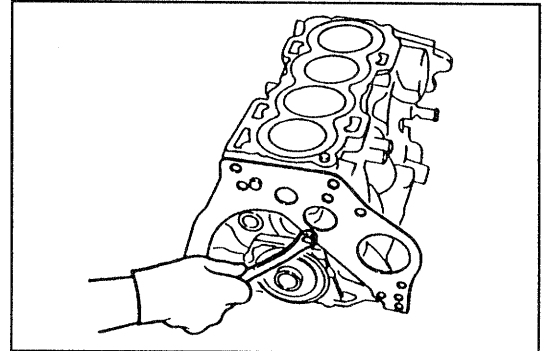
Tightening Torque: 0.7 - 1.2 kg-m  
(5.1 - 8.7 ft-lb, 6.9 - 11.8 N·m)



WNU89-EM513

7. Install the rear end plate.

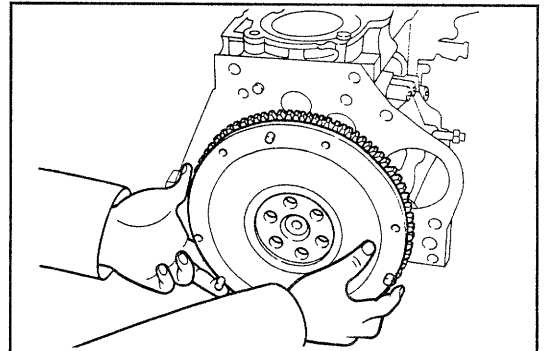
Tightening Torque: 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)



WRU90-EM305

8. Installation of flywheel

(1) Install the flywheel on the crankshaft.



WRU90-EM306

(2) Application of flywheel bolt sealing material

- ① Wash the flywheel bolts. Then, degrease and dry them.

**NOTE:**

- When degreasing the bolts, remove any oil completely, using a solvent such as a degreasing spraying agent or alcohol.

**CAUTION:**

- Make sure that no bond nor other foreign matter, such as dust, gets to the bolts.
- Even when new bolts are used, be sure to perform this operation.

- ② Check the flywheel bolts for damage. Replace any flywheel bolt which exhibits damage with a new one.

**CAUTION:**

- Even when a new bolt is used, be sure to perform the operation in the step ①.

- ③ Clean the flywheel bolt threaded holes at the rear end section of the crankshaft. Degrease and dry them.

**CAUTION:**

- Make sure that no bond nor other foreign matter, such as dust, gets to the bolt threaded holes.
- As for degreasing, wipe off any oil from the threaded portion with a cloth damped with alcohol.
- Never allow alcohol to get to resin or rubber parts, specifically, the rear oil seal.

- ④ Clean the bolt seating surface of the flywheel and degrease it.

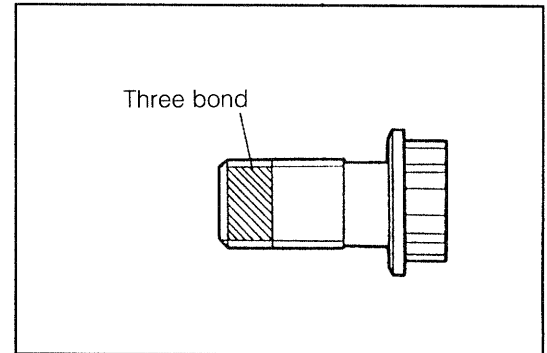
**NOTE:**

- As for degreasing, wipe the bolt seating surface with a cloth damped with alcohol.
- Never allow alcohol to get to resin or rubber parts.

- ⑤ Apply two to three drops of the Three Bond 1324 to the forward end of the threaded portion of each flywheel bolt.

**CAUTION:**

- If the Three Bond 1324 is applied excessively beyond the specified amount, the bond sealer will penetrate up to the bolt seating surface. This may cause loosening of the bolts.
- Never use bond sealers other than the designated one.
- Never allow the bond sealer to get to resin or rubber parts.



WNU89-EM516

- (3) Tighten the flywheel attaching bolts temporarily to the specified torque in the sequence indicated in the right figure.

Tightening Torque: 4.5 - 6.5 kg-m  
(Temporarily) : (32.5 - 47.0 ft-lb, 44.1 - 63.7 N-m)

**NOTE:**

- Prevent the crankshaft from turning at the ring gear section, using the following SST.
- SST: 09210-87701-000

**CAUTION:**

- When tightening the bolt, make sure that no bond is present on the bolt seating surface.
- If the bond oozes out, perform the operations again, starting the step (2).

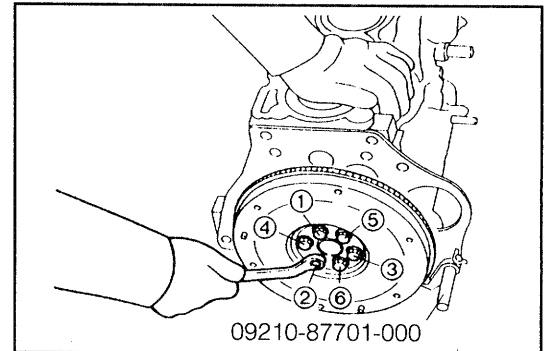
- (4) Tighten the flywheel attaching bolts to the specified torque in the sequence indicated in the right figure.

Tightening Torque: 8.0 - 10.0 kg-m  
(57.9 - 72.3 ft-lb, 78.5 - 98.0 N-m)

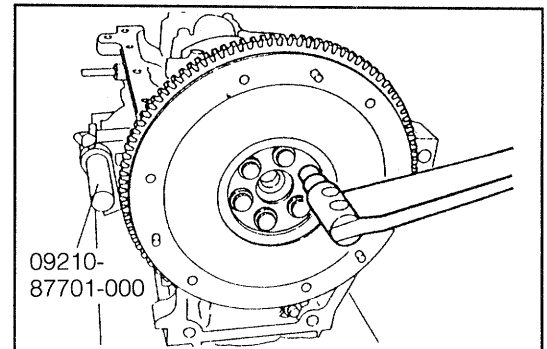
- (5) Measure the flywheel runout, using a dial gauge.
- Allowable Runout Limit: 0.1 mm (0.0039 inch)

**NOTE:**

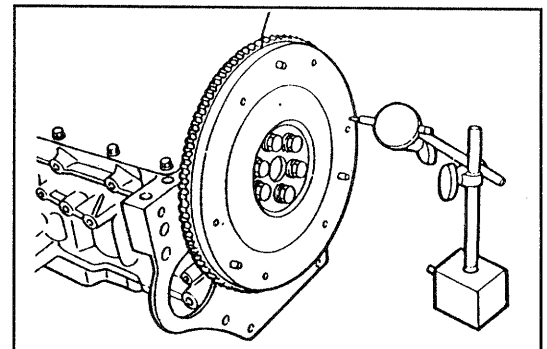
- Replace the flywheel if its runout exceeds the allowable limit.



WRU90-EM307



WRU90-EM308



WNU89-EM518

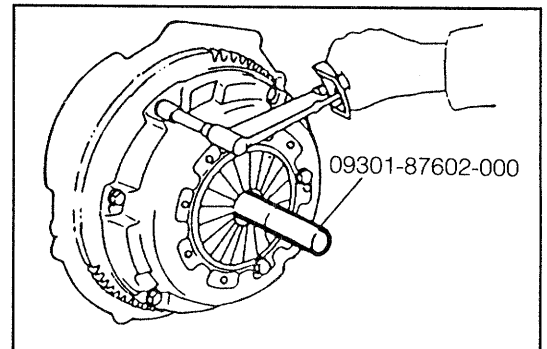
**9. Assembly of clutch disc and clutch cover**

- (1) Insert the following SST into the crankshaft rear end.
- SST: 09301-87602-000

- (2) Install the clutch disc.

- (3) Install the pressure plate, lining up the locating pin of the pressure plate. Tighten the attaching bolts to the specified torque.

Tightening Torque: 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N-m)

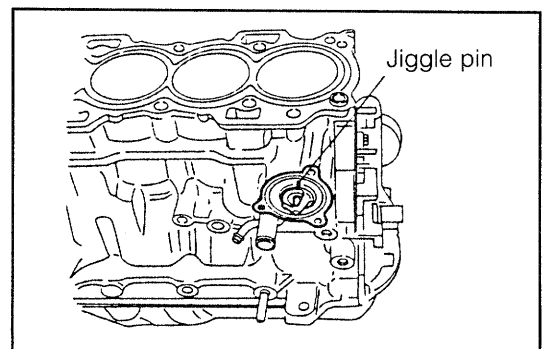


WRU90-EM309

10. Install the thermostat in the cylinder block in such a way that the jiggle pin section may come at the upper side.

**CAUTION:**

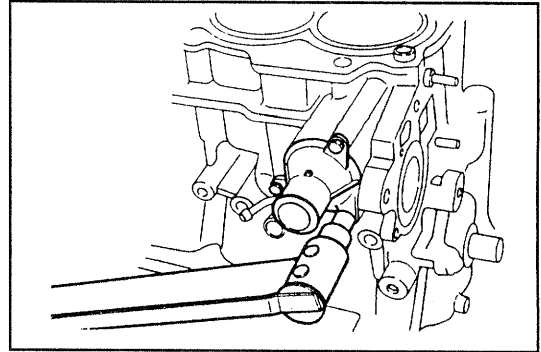
- Make sure to install the jiggle pin of the thermostat in the correct direction. Failure to observe this precaution will be cause of overheating.



WNU89-EM520

11. Install the water inlet.

Tightening Torque: 0.6 - 0.9 kg-m  
(4.4 - 6.5 ft-lb, 5.9 - 8.8 N-m)



WNU89-EM521

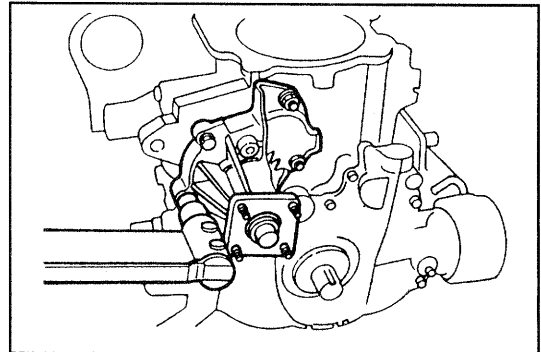
12. Installation of water pump

- (1) Install a new water pump gasket on the cylinder block.
- (2) Install and tighten the water pump to the specified torque.

Tightening Torque: 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N-m)

**NOTE:**

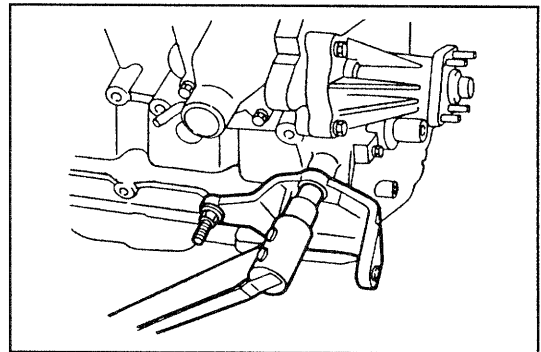
- When the stud bolts have been replaced, apply the Three Bond 1377B to the threaded portion at the cylinder block side.



WNU89-EM522

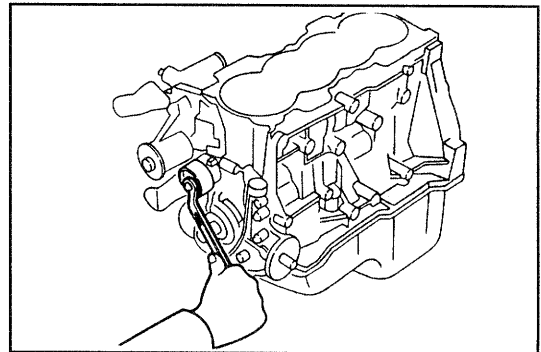
13. Install the alternator bracket.

Tightening Torque: 3.5 - 5.0 kg-m  
(25.3 - 36.2 ft-lb, 34.3 - 49.0 N-m)



WNU89-EM523

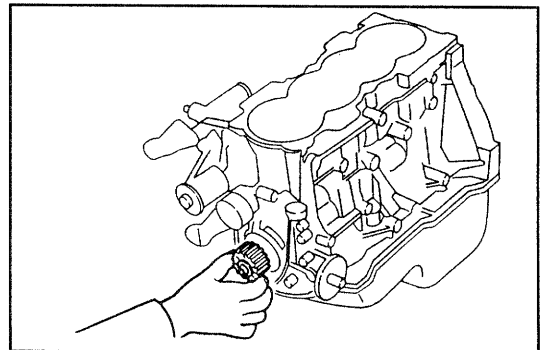
14. Assemble the tensioner tension spring as indicated in the right figure. Push the tensioner to the alternator side as far as it will go. Tighten the tensioner temporarily.



WNU89-EM524

15. Install the crankshaft pulley flange in such a way that its recessed side may come at the cylinder block side.

16. Install the crankshaft timing belt pulley.



WNU89-EM525

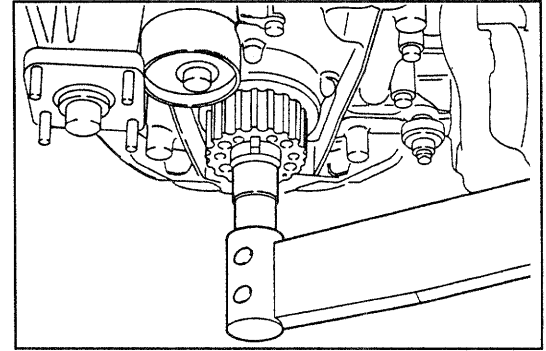
17. Install the crankshaft timing belt attaching bolt. Tighten the bolt to the specified torque.

Tightening Torque: 9.0 - 10.0 kg-m  
(65.1 - 72.3 ft-lb, 88.3 - 98.0 N·m)

**NOTE:**

- Prevent the crankshaft from turning, using the following SST.

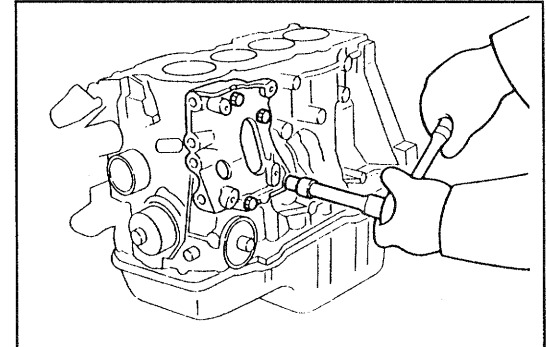
SST: 09210-87701-000



WRU90-EM310

18. Install the compressor mounting bracket.

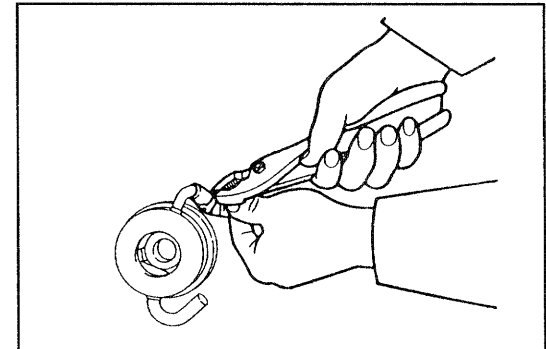
Tightening Torque: 3.0 - 4.5 kg-m  
(21.7 - 32.5 ft-lb, 29.4 - 44.1 N·m)



WNU89-EM527

19. Install the oil cooler.

- Install a new "O" ring.
- Connect the oil cooler hose to the oil cooler.
- Place the rib for locating the oil cooler to the cylinder block. Then install the oil cooler with the set bolts.

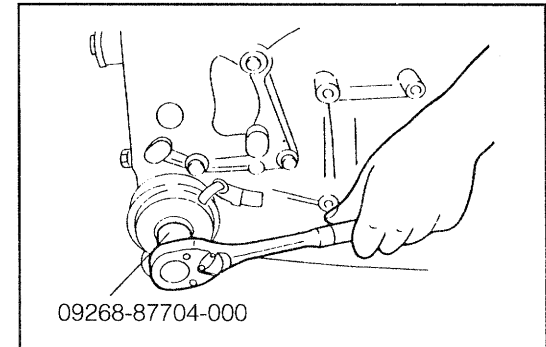


WNU89-EM528

- Tighten the set bolts to the specified torque using the following SST.

SST: 09268-87704-000

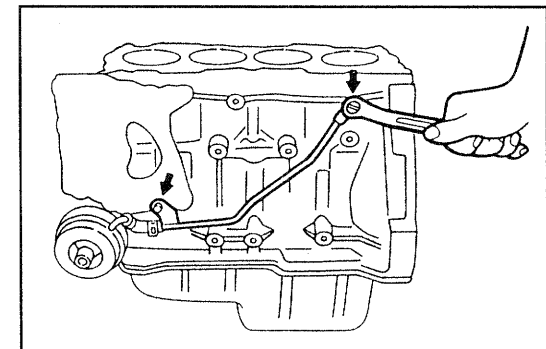
Tightening Torque: 2.5 - 3.5 kg-m  
(18.1 - 25.3 ft-lb, 24.5 - 34.3 N·m)



09268-87704-000

WNU89-EM529

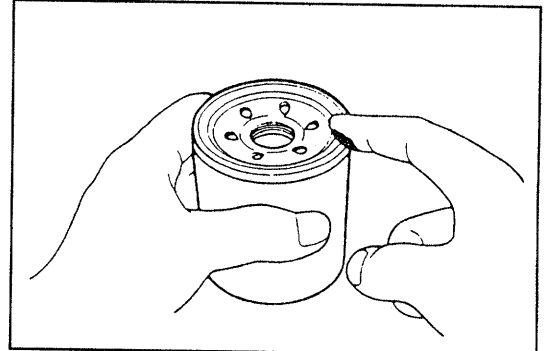
- Connect the oil cooler inlet pipe into the oil cooler hose and install the hose band.
- Install the oil cooler pipe to the cylinder block with a new gasket interposed.



WNU89-EM530

### 20. Installation of oil filter

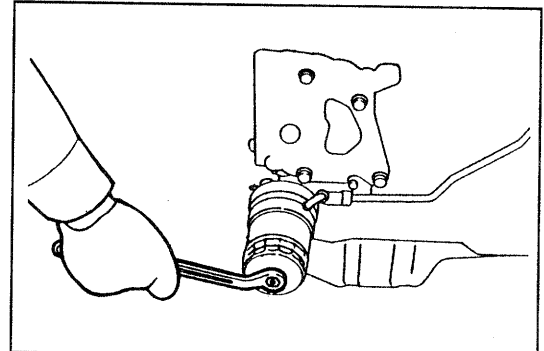
(1) Thinly apply engine oil to the oil seal of the oil filter.



WNU89-EM531

(2) Screw in the oil filter until the oil seal of the oil filter comes in contact with the oil pump or the contact surface of the oil cooler.

(3) Then, rotate the oil filter three fourths to one turn.



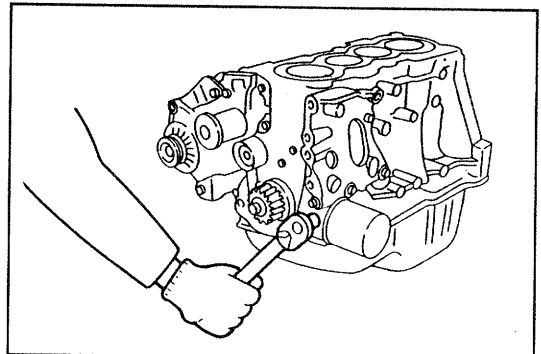
WRU90-EM311

### 21. Installation of oil pressure switch

(1) Clean the threaded portion of the oil pressure switch. Wind seal tape around the threaded portion.

(2) Tighten the oil pressure switch to the specified torque using a long box wrench having a hexagonal hole.

**Tightening Torque:** 1.2 - 2.0 kg-m  
(8.7 - 14.5 ft-lb, 11.8 - 19.6 N·m)



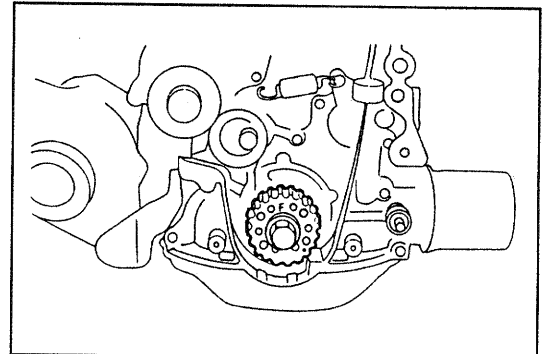
WNU89-EM533

### 22. Install the alternator.

## ASSEMBLY OF CYLINDER HEAD WITH MANIFOLDS

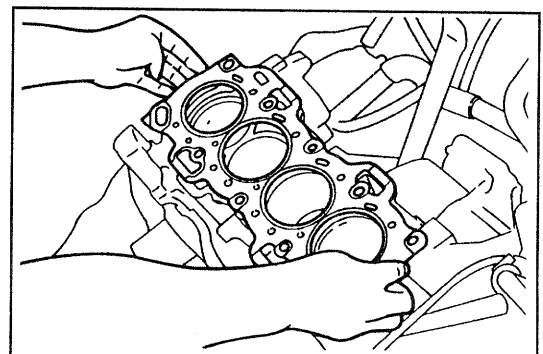
(See page EM-36)

1. Align the drilled mark of the crankshaft timing belt pulley with the indicator of the oil pump.



WRU90-EM312

2. Install the cylinder head gasket on the cylinder block.

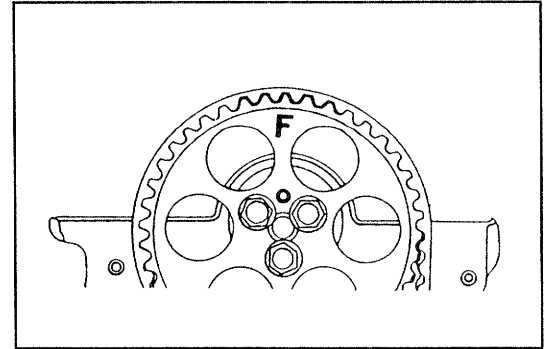


WNU89-EM535

3. Turn the camshaft, until the "F" mark of the camshaft timing belt pulley comes exactly at the top position.
4. Install the cylinder head assembly on the cylinder block.

**NOTE:**

- Be very careful not to damage the cylinder head gasket and cylinder head gasket surface.



WRU90-EM313

5. Apply engine oil to the threaded portion of each cylinder head bolt. Install the bolts to the cylinder head.

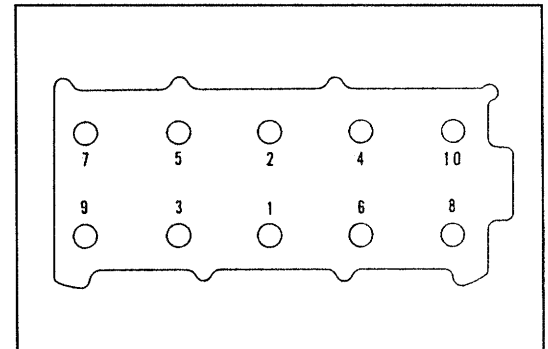
**NOTE:**

- As for the two bolts at the distributor side, use the bolt whose nominal length is 112 mm (4.41 inch), which is shorter than that of others.
- The cylinder head bolt attaching holes provided on the cylinder block should be dry condition.

WNU89-EM537

6. Tighten the cylinder head bolts evenly over two or three stages to the specified torque, following the sequence shown in the right figure.

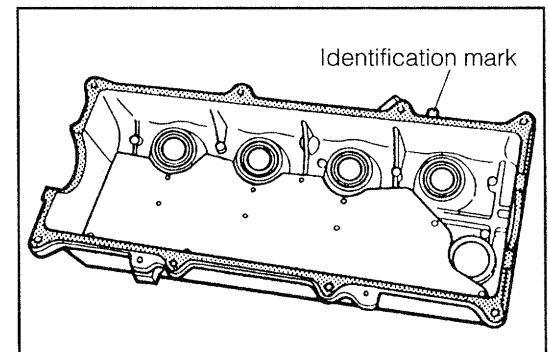
Tightening Torque: 6.0 - 6.8 kg-m  
(43.4 - 49.2 ft-lb, 58.8 - 66.7 N-m)



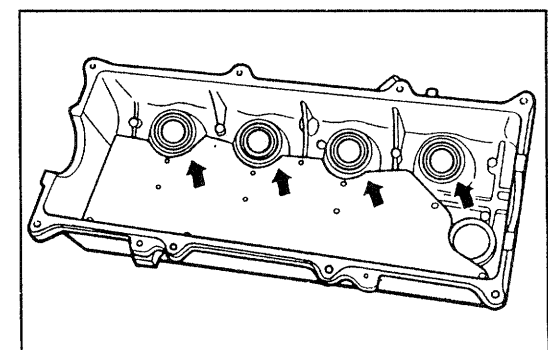
WNU89-EM538

## INSTALLATION OF CYLINDER HEAD COVER

1. Check the cylinder head cover gasket for damage. Replace the cylinder head cover gasket if it is damaged.
2. Removal of cylinder head cover gasket  
(Only case where such replacement is required:)  
Remove the cylinder head cover gasket from the cylinder head cover. Install a new cylinder head cover gasket in such a way that the identification mark comes at the intake side.
3. Check the spark plug tube grommets for damage. Replace any grommet which exhibits damage.  
(See page EM-73.)

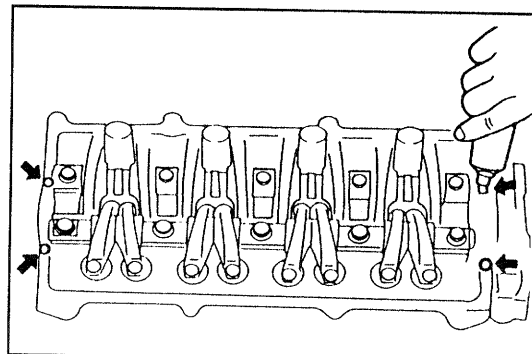


WNU89-EM539



WRU90-EM314

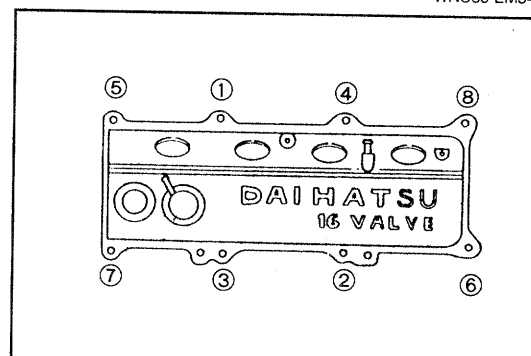
4. Wipe off any oil from the cylinder head cover gasket surface of the cylinder head.
5. Apply the Three Bond 1104 to the mate surface of the cylinder head with the camshaft bearing caps No. 1 and No. 5, but only to those sections which contact the cylinder head gasket.



WNU89-EM541

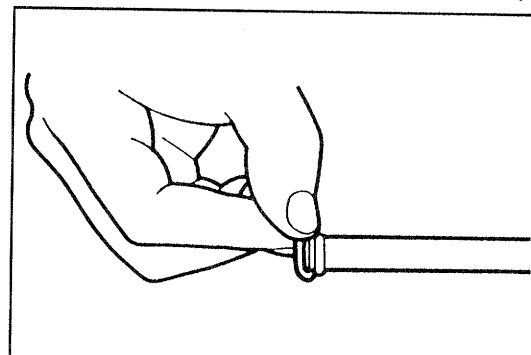
6. Install the cylinder head cover to the cylinder head. Tighten the cylinder head cover attaching bolts to the specified torque, following the sequence in the right figure.

**Tightening Torque:** 0.3 - 0.5 kg-m  
(2.2 - 3.6 ft-lb, 2.9 - 4.9 N-m)



WNU89-EM542

7. Replace the "O" ring of the oil level gauge guide with a new "O" ring.

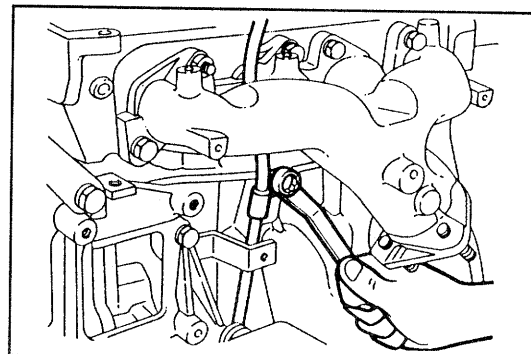


WRU90-EM316

8. Insert the oil level gauge guide into the cylinder block.

9. Install the oil level gauge guide attaching bolts.

**Tightening Torque:** 1.9 - 3.1 kg-m  
(13.7 - 22.4 ft-lb, 18.6 - 30.4 N-m)

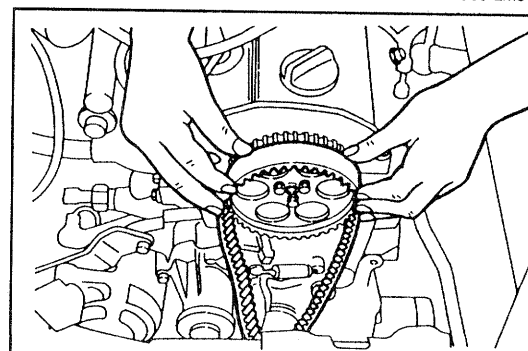


WRU90-EM316

10. Install the oil level gauge.

11. Installation of timing belt

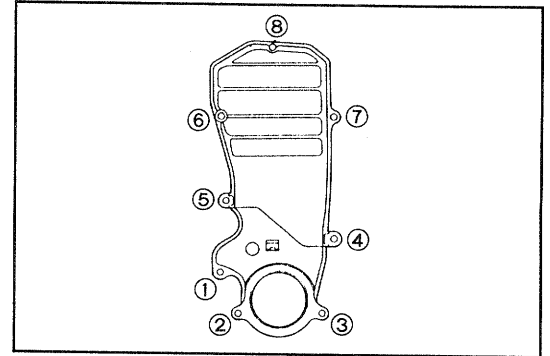
- (1) Check the timing belt.  
(See page EM-26.)
- (2) Install the timing belt.  
(See page EM-28.)



WRU90-EM317



12. Install the timing belt cover.  
(See page EM-33.)

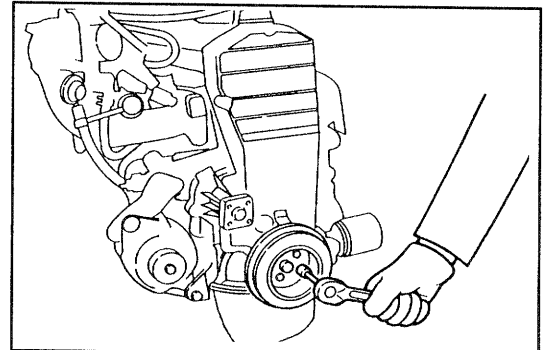


WRU90-EM318

13. Install the crankshaft pulley.  
Tightening Torque: 2.0 - 3.0 kg-m  
(14.5 - 21.7 ft-lb, 19.6 - 29.4 N·m)

**NOTE:**

- Prevent the crankshaft from turning, using the following SST.
- SST: 09210-87701-000



WRU90-EM319

## INSTALLATION OF ENGINE ASSEMBLY

### Operations before installation

- Install the cylinder head assembly onto the cylinder block.  
(See page EM-69.)
- Install the engine wire and the engine ground cable onto the cylinder block.
- Install the alternator onto the cylinder block and securely connect the alternator harness clamp.

**WARNING:**

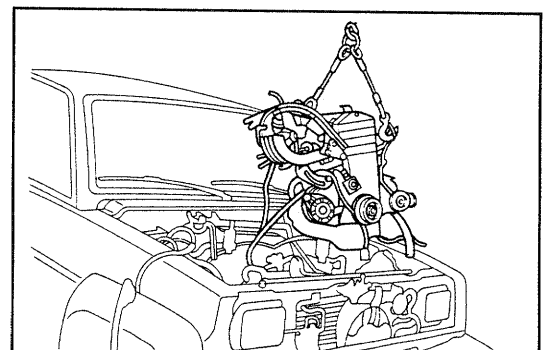
Be very careful not to pinch your fingers or hands while installing the engine assembly into the engine compartment.

**CAUTION:**

- Be careful not to allow the engine assembly to hit the vehicle body and/or other parts.

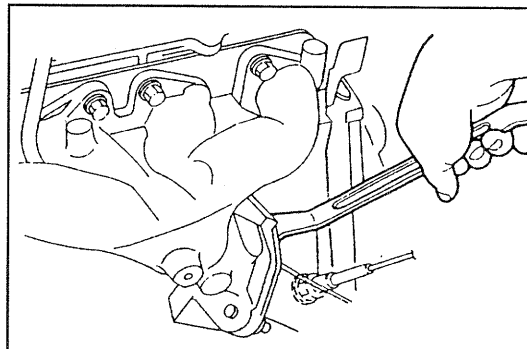
WRU90-EM320

1. Connection of engine and transmission
  - (1) Carefully lower the engine assembly into the engine compartment by using the chain block in order to align the input shaft and the crankshaft rear end bearing.
  - (2) Tighten the engine and transmission attaching bolts temporarily.



WRU90-EM321

- (3) Connect the exhaust pipe to the exhaust manifold with a new gasket interposed with the three attaching bolts temporarily.



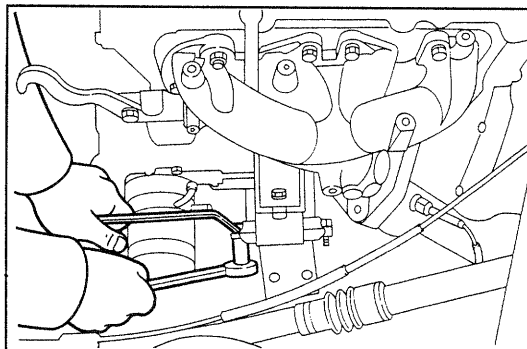
WRU90-EM322

- (4) Connect the engine mounting LH with the engine mounting bracket.

**Tightening Torque:**

**NUT:** 3.5 - 5.5 kg-m  
(25.3 - 39.8 ft-lb, 34.3 - 53.9 N·m)

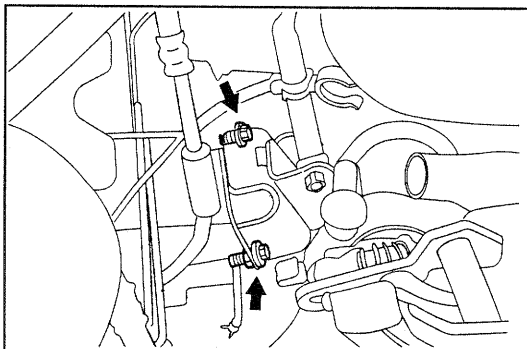
**BOLT:** 3.0 - 4.5 kg-m  
(21.7 - 32.5 ft-lb, 29.4 - 44.1 N·m)



WRU90-EM323

- (5) Connect the engine mounting RH with the engine mounting bracket.

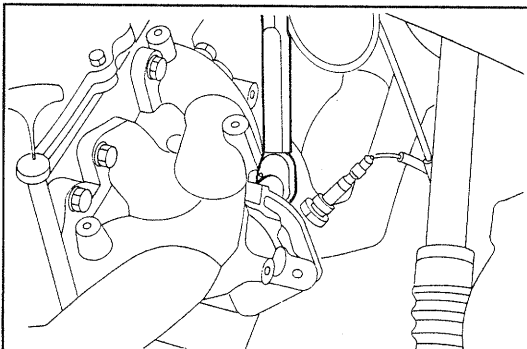
**Tightening Torque:** 3.0 - 4.5 kg-m  
(21.7 - 32.5 ft-lb, 29.4 - 44.1 N·m)



WRU90-EM324

- (6) Tighten the exhaust manifold with the exhaust pipe.

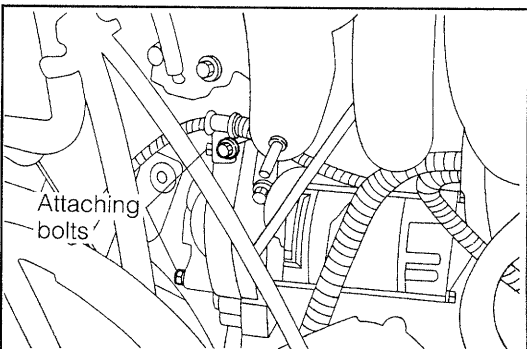
**Tightening Torque:** 4.5 - 5.5 kg-m  
(32.5 - 39.8 ft-lb, 44.1 - 53.9 N·m)



WRU92-EM426

- (7) Install the starter motor onto the cylinder block with two attaching bolts.

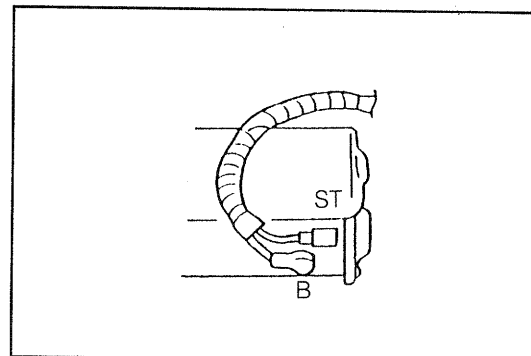
**Tightening Torque:** 5.0 - 7.0 kg-m  
(36.2 - 50.6 ft-lb, 49.0 - 68.6 N·m)



WRU90-EM326

(8) Installation of starter motor harness

- ① Insert the ST terminal harness into position until securely locked.
- ② Install the B terminal onto starter motor with attaching bolt.



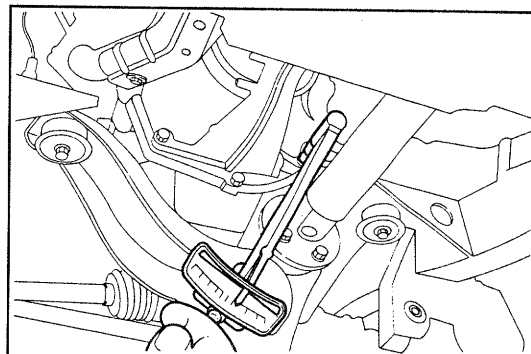
WRU90-EM327

(9) Securely tighten the attaching bolts between engine and transmission.

**Tightening Torque:** 5.0 - 7.0 kg-m  
(36.2 - 50.6 ft-lb, 49.0 - 68.6 N-m)

(10) Tighten the engine end plate with an attaching bolt.

**Tightening Torque:** 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N-m)

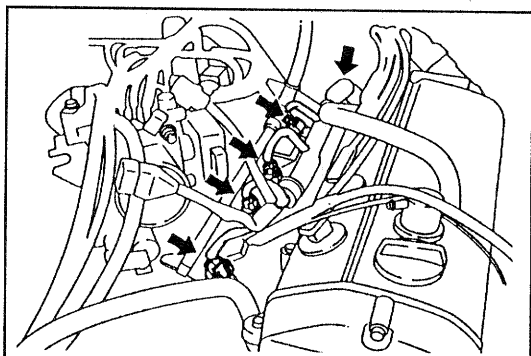


WRU90-EM328

2. Installation of engine wire for ECU

(See page EM-152.)

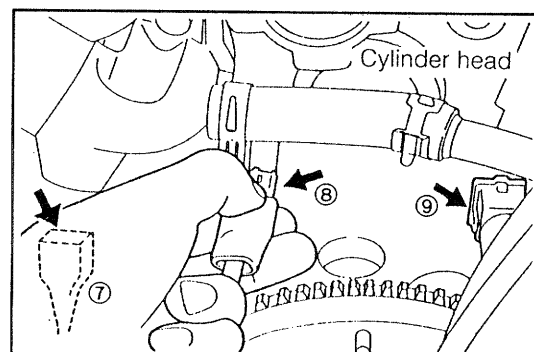
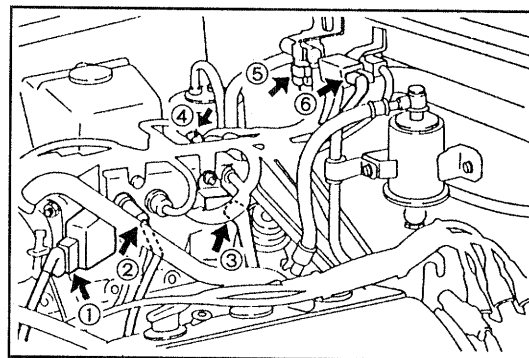
- (1) Pull the engine wire connector for ECU from the cowl side panel of passenger seat side through the dash panel hole.
- (2) Securely connect the engine wire connector to the ECU.
- (3) Install the ECU cover onto the ECU.



WRU90-EM329

(4) Connect the following engine wire connectors with each part securely.

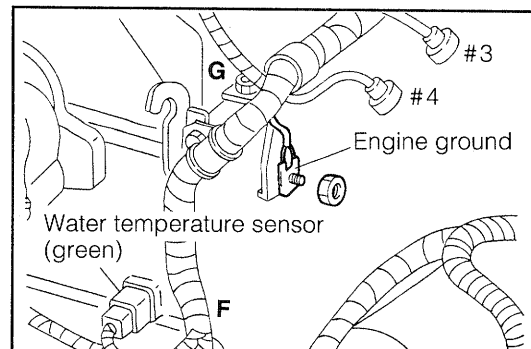
- Water temperature sender gauge
- Water temperature sensor
- Water temperature switch (for A/C)
- O<sub>2</sub> sensor
- Injector
- Oil pressure switch
- Throttle sensor
- Intake air temperature sensor
- ISC VSV
- EGR VSV
- Pressure sensor
- Pressure VSV



WRU90-EM330

- (5) Installation of engine ground cable
- ① Ensure that the engine ground cable is securely tightened onto the cylinder block.
- Tightening Torque:** 5.0 - 7.0 kg-m  
(36.2 - 50.6 ft-lb, 49.0 - 68.6 N·m)

- ② Install the engine ground cable between the surge tank stay No.3 and the fuel filter bracket.

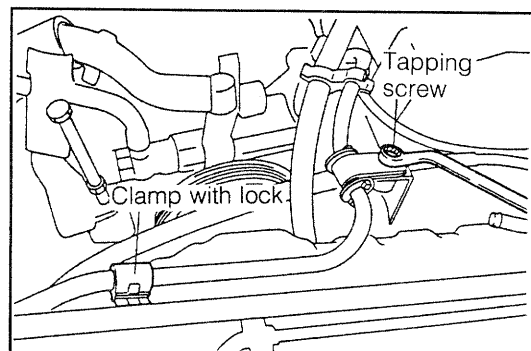


WRU90-EM331

- (6) Connect the engine wire to the relay block side.

**NOTE:**

- Securely tighten the wire with the two clamps.

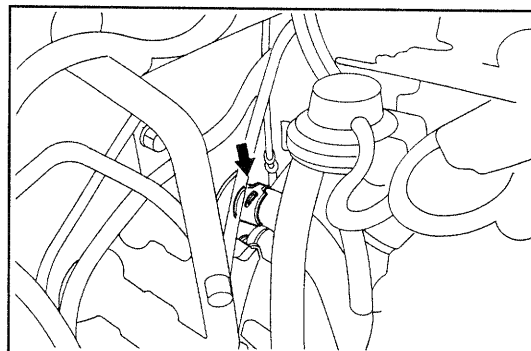


WRU90-EM332

3. Connect the heater inlet and outlet hoses with the heater hose union at the dash panel.

**NOTE:**

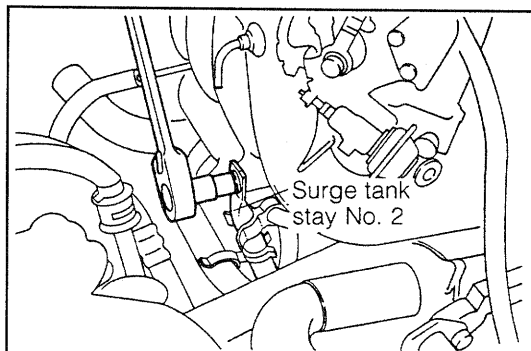
- Be sure not to damage the hose installation position.
- Be sure to clamp the hose with the clip.



WRU90-EM333

4. Install the surge tank stay No.2 between the engine mounting bracket and the intake manifold.

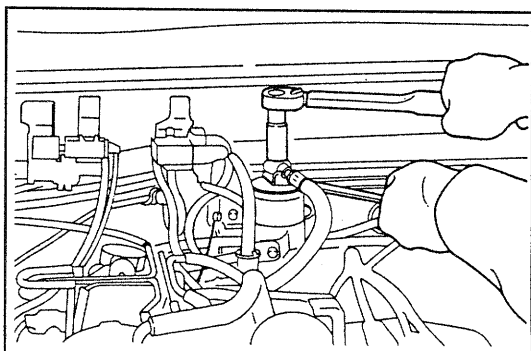
**Tightening Torque:** 3.0 - 4.5 kg-m  
(21.7 - 32.5 ft-lb, 29.4 - 44.1 N·m)



WRU90-EM334

5. Connect the fuel hose No.1 to the fuel filter.

**Tightening Torque:** 3.5 - 4.5 kg-m  
(25.3 - 32.5 ft-lb, 34.3 - 44.1 N·m)

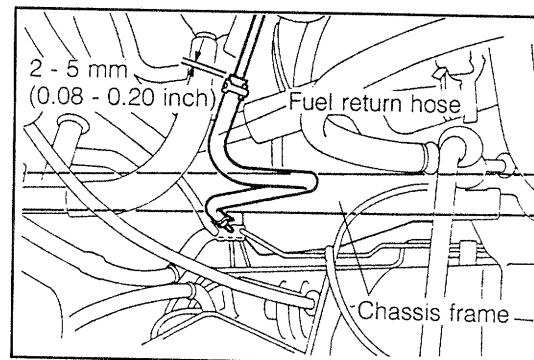


WRU90-EM335

6. Connection of fuel return hose to fuel pipe No.2
  - (1) Insert the fuel return hose onto the fuel pipe No.2 until second spool of fuel pipe.
  - (2) Securely clamp the fuel hose at 2 - 5 mm (0.08 - 0.20 inch) from the fuel return hose end.

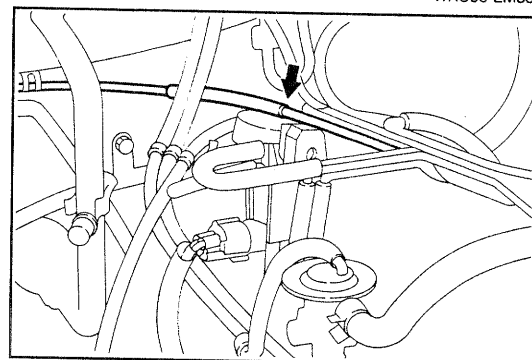
**NOTE:**

- Install the fuel return hose in parallel with chassis frame.



WRU90-EM336

7. Install the charcoal canister hose to the vacuum pipe provided on the surge tank.

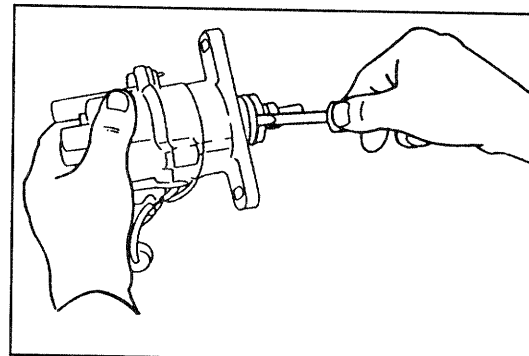


WRU90-EM337

8. Installation of the distributor
  - (1) Replace the "O" ring of the distributor body with a new one.

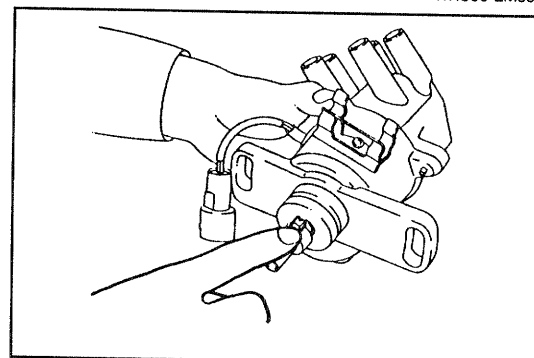
**NOTE:**

- Care must be exercised to avoid scratching the new "O" ring.



WRU90-EM338

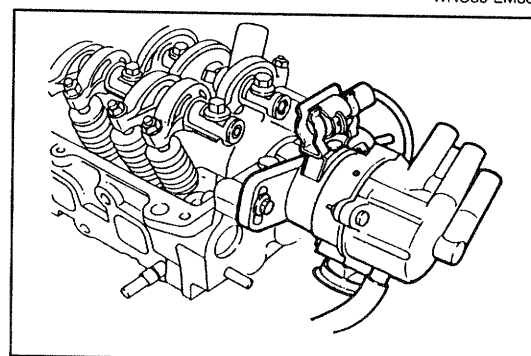
- (2) Align the cutout section of the distributor proper with the cutout groove of the coupling. Assemble the distributor on the cylinder head, lining up the protrusion of the distributor with the camshaft groove. During this installation, the aligned cutout sections must come at the top side of the engine.



WNU89-EM304

- (3) With the center of each elongated hole on the flange section of the distributor proper aligned with the corresponding threaded hole of the cylinder head, tighten the distributor attaching bolts.

**Tightening Torque:** 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)

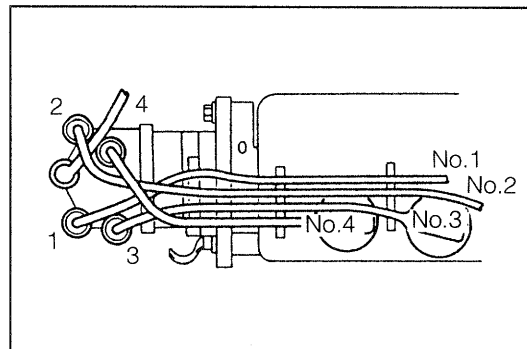


WNU89-EM305

(4) Connect the distributor connector.

**NOTE:**

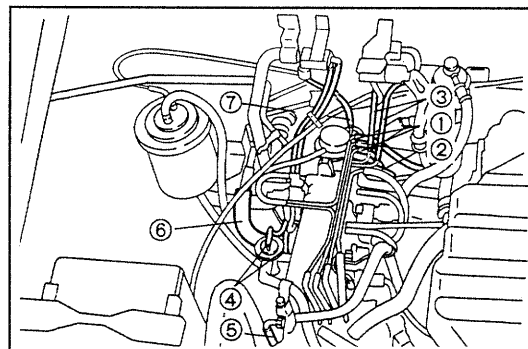
- Be sure to install the spark plug wire into the distributor cap as indicated in the right figure.



WRU90-EM339

9. Connect the following vacuum hoses to each part.

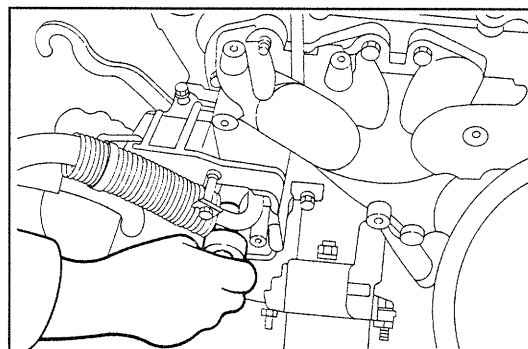
- (1) Distributor main and sub diaphragm ①
- (2) BVSV ②
- (3) Pressure VSV ③
- (4) Air conditioner idle-up VSV ④
- (5) Power steering ACV ⑤
- (6) Brake booster ⑥
- (7) Charcoal canister ⑦



WRU90-EM340

10. Install the air conditioner compressor onto the compressor bracket together with resistance cover with mounting bolts.

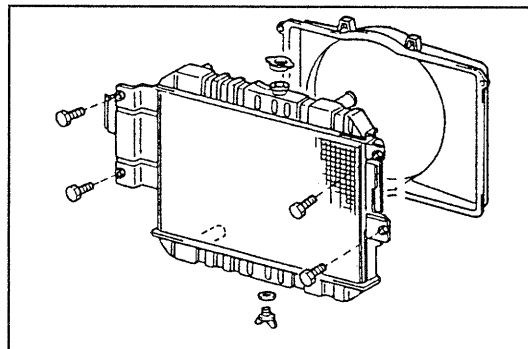
**Tightening Torque:** 2.5 kg-m (18 ft-lb, 24.5 N-m)



WRU92-EM424

11. Put the radiator onto position with four attaching bolts.

**Tightening Torque:** 1.0 - 1.6 kg-m  
(7.2 - 11.6 ft-lb, 9.8 - 15.7 N-m)

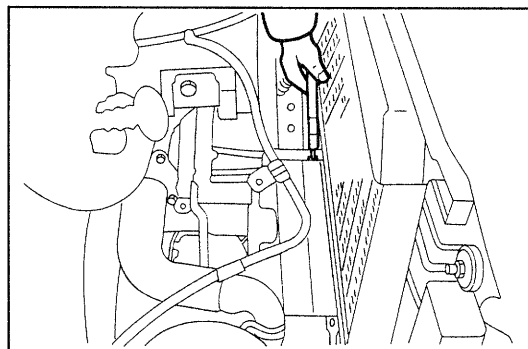


WRU90-EM342

12. Connect the radiator outlet hose and oil cooler hose to the radiator.

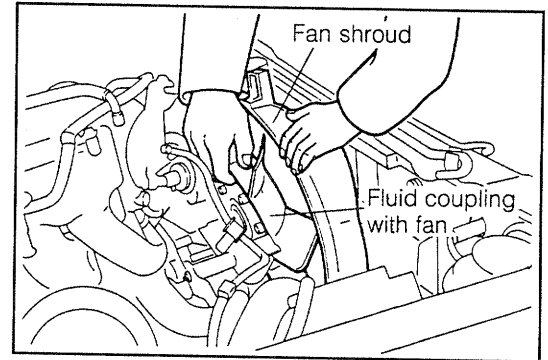
**NOTE:**

- Make sure that the clamps are securely installed.



WRU90-EM343

13. Put the radiator fan shroud into position together with fluid coupling with fan.



WRU90-EM344

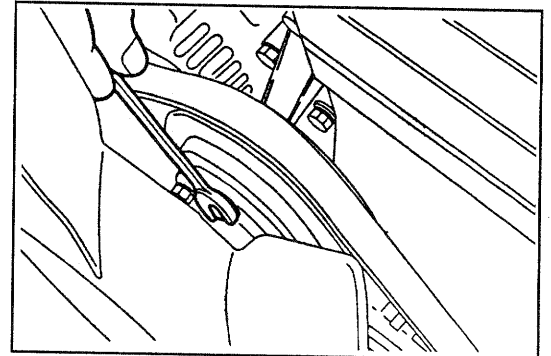
14. Installation of fluid coupling with fan and fan shroud
  - (1) Temporarily install the water pump pulley.

**NOTE:**

- Be sure that the water pump pulley is seated properly to the water pump.

- (2) Install the fluid coupling with fan to the water pump by means of four bolts through water pump pulley.

**Tightening Torque:** 1.0 - 1.8 kg-m  
(7.2 - 13.0 ft-lb, 9.8 - 17.7 N-m)

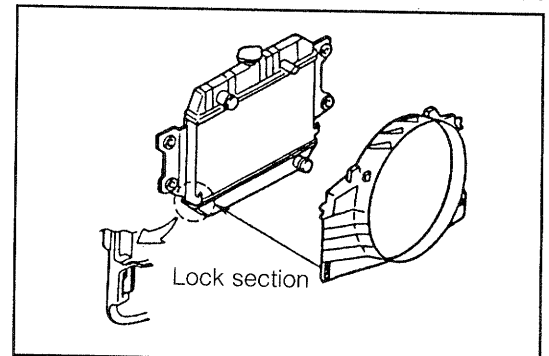


WRU90-EM345

**REFERENCE:**

Tightening torque of fluid coupling and fan is as follows.  
0.44 - 0.66 kg-m (3.2 - 4.8 ft-lb, 4.3 - 6.5 N-m)

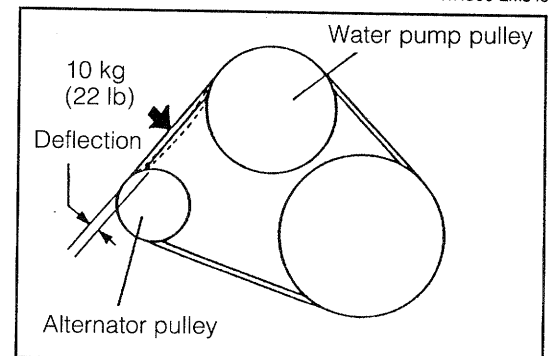
- (3) Insert the lock section of fan shroud to the radiator. Then, tighten the two attaching bolts of the radiator upper side.
- (4) Connect the water hose to the radiator upper tank. Securely clamp the water hose clamp.



WRU90-EM346

15. Install the V ribbed belt and perform the adjustment in such a way that the deflection at the midpoint between the water pump pulley and the alternator may become the specified value when a force of 10 kg (22 lb) is applied to the midpoint.

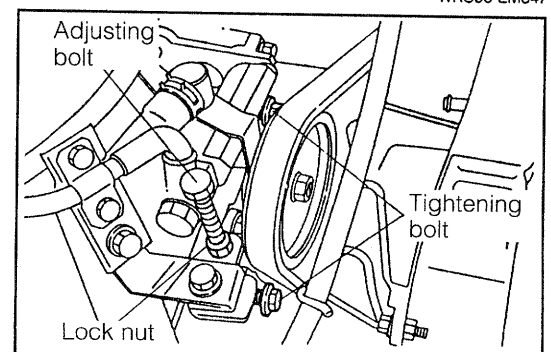
**Used Belt:** 5.0 - 6.0 mm (0.197 - 0.236 inch)  
With a force of 10 kg (22 lb) applied to point indicated in figure



WRU90-EM347

16. Installation of the power steering pump and drive belt (P/S equipped vehicle only)

- (1) Install the power steering pump assembly into the position.
- (2) Install the power steering drive belt.

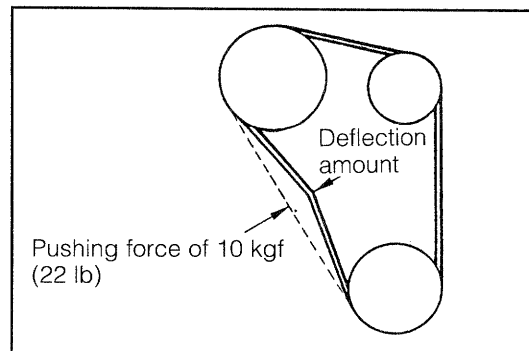


WRU90-EM348

- (3) Set the drive belt tension to the specified value by tightening the adjusting bolt.

**Specified Deflection:** 9 - 11 mm (0.35 - 0.43 inch)

[When a force of 10 kg (22 lb) is applied:]

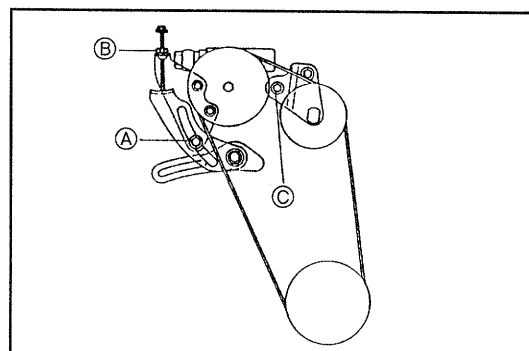


WRU90-EM349

- (4) Tighten the bolts to the specified value.

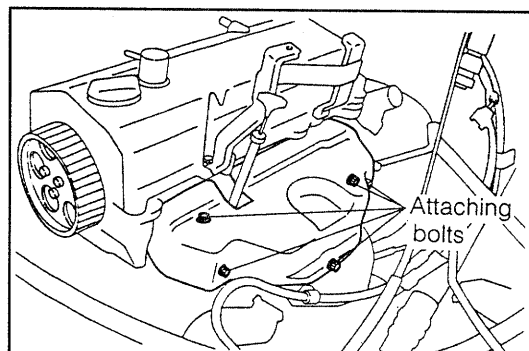
**Tightening Torque:**

- Ⓐ .... 3.5 - 4.5 kg-m  
(25.3 - 32.5 ft-lb, 34.3 - 44.1 N·m)
- Ⓑ .... 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb, 14.7 - 21.6 N·m)
- Ⓒ .... 5.0 - 7.0 kg-m  
(36.2 - 50.6 ft-lb, 49.0 - 68.6 N·m)



WRU90-EM350

17. Tighten the exhaust manifold cover temporarily.

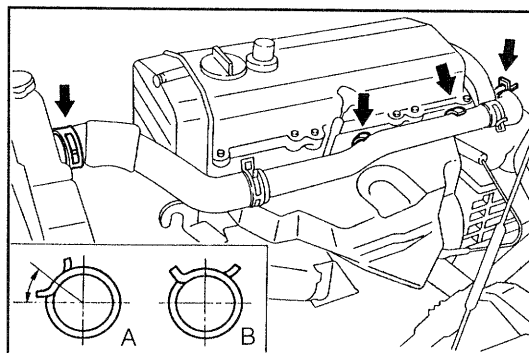


WRU90-EM351

18. Install the radiator hose No. 1 to the radiator upper tank. Tighten the two clamps and two attaching bolts.

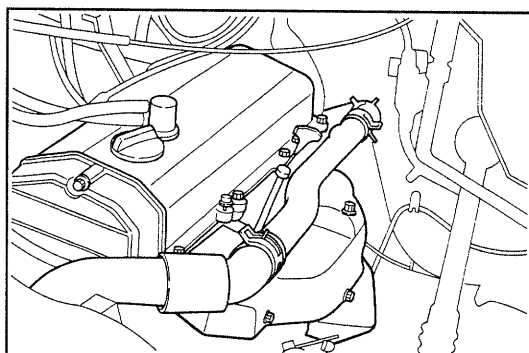
**NOTE:**

- Ensure that the clamps are installed as illustrated in right figure.



WRU90-EM352

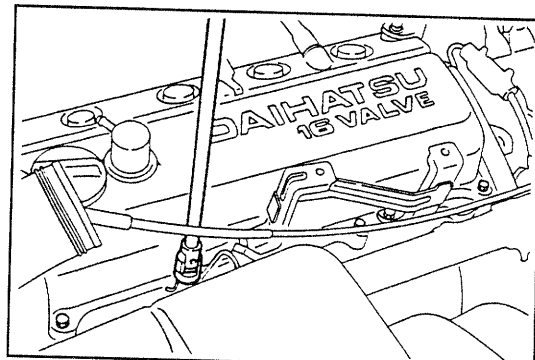
19. Tighten the exhaust manifold cover with five attaching bolts.



WRU90-EM353

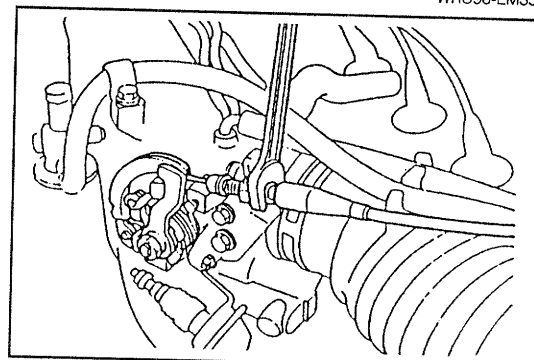


20. Install the air chamber bracket and the accelerator cable clamp onto the cylinder head cover with attaching bolts.



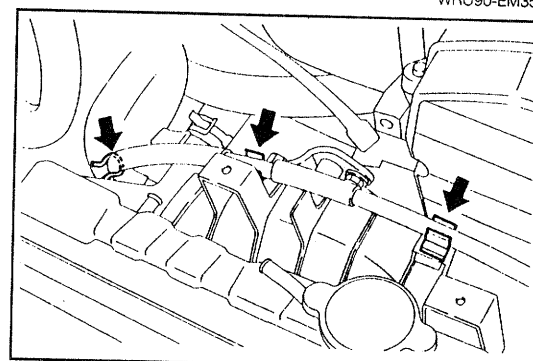
WRU90-EM354

21. Install the accelerator cable to the throttle body.
22. Adjust the accelerator cable so that the accelerator pedal free ply may become 1 - 5 mm (0.04 - 0.20 inch).



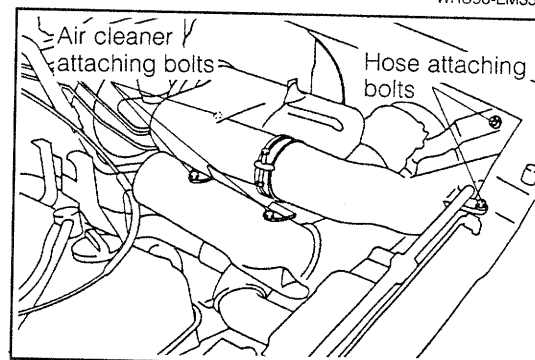
WRU90-EM355

23. Fix the clutch cable with three clamps.



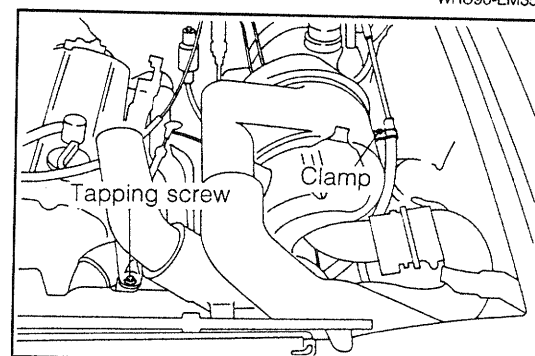
WRU90-EM356

24. Installation of the air cleaner sub assembly
  - (1) Install the air cleaner sub assembly into position. Then tighten the three attaching bolts.
  - (2) Tighten the attaching bolts to the left fender panel and radiator center support.



WRU90-EM357

- (3) Tighten the tapping screw at the fan shroud.
  - (4) Install the clutch cable clamp to the air cleaner.



WRU90-EM358

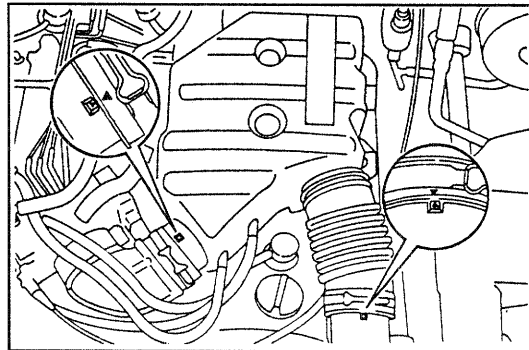
## ENGINE MECHANICALS

### 25. Installation of air chamber

- (1) Install the air chamber with three attaching screws and two clamps.

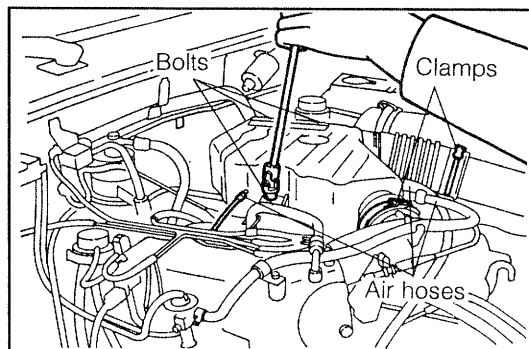
#### NOTE:

- Align the matching marks provided on the air chamber and air hose.



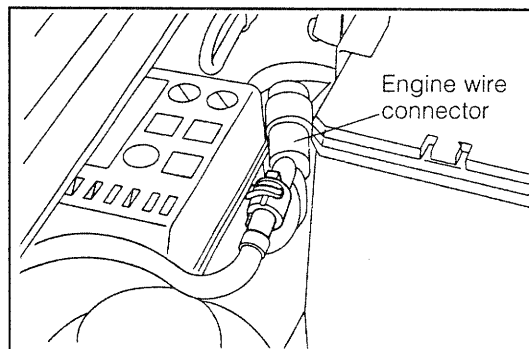
WRU90-EM359

- (2) Install the air hoses for air conditioner and power steering idle-up.



WRU90-EM360

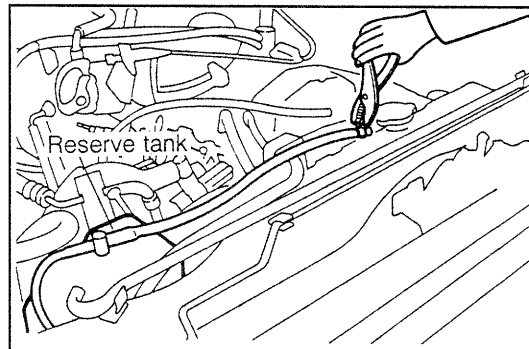
### 26. Connect the connectors located around the fuse and relay box.



WRU90-EM361

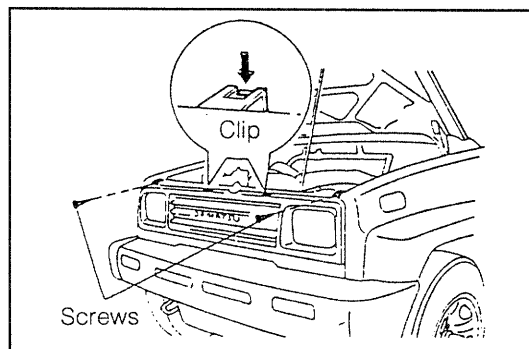
### 27. Installation of reserve tank

- (1) Securely insert the reserve tank into the bracket.
- (2) Clamp the reserve tank with clip securely.



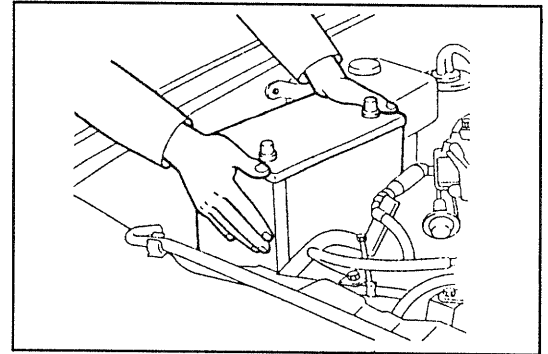
WRU90-EM362

### 28. Install the front grille.



WRU90-EM363

30. Installation of battery
  - (1) Install the battery tray onto position.
  - (2) Put the battery onto position and securely tighten the battery holding clamps.



WRU90-EM364

31. Fill the radiator and reserve tank with coolant.  
(See page CO-4.)
32. Fill the engine with oil.  
(See page LU-6.)
33. Install the engine hood into position with four bolts.

**NOTE:**

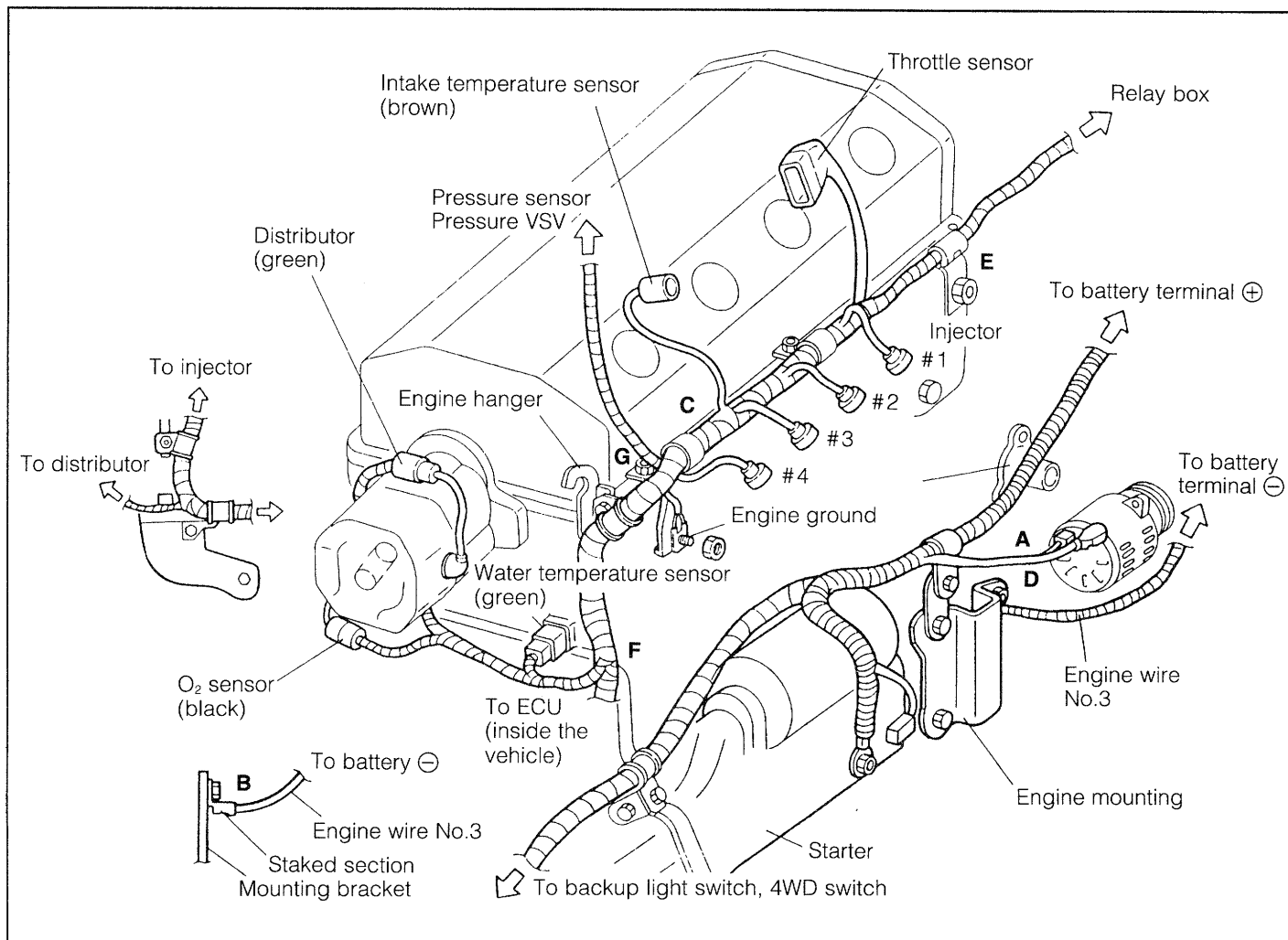
- Be careful not to damage the engine hood.

34. Connect the window washer hose.
35. Connect the wire of the positive terminal to the battery positive  $\oplus$  terminal.
36. Connect the battery ground cable to the negative  $\ominus$  terminal of the battery.
37. Start the engine. Ensure that the engine exhibits no leakage of cooling water or oil.
38. Perform the engine tune-up.  
(See page EM-9.)

WRU90-EM365

## Connection of Engine Wire harness

### 1. Engine Wire Harness (1)

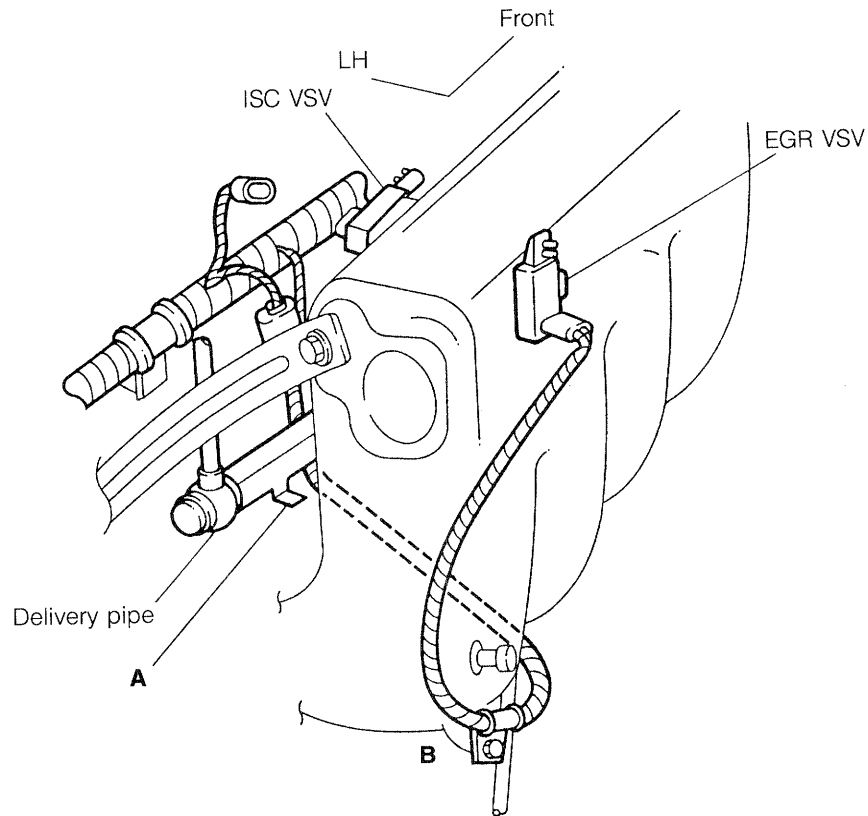


WRU90-EM366

No.	Work procedure	Parts	control item
1	Route the alternator wire under the heater hose and above the engine wire No. 3.	A	Ensure that the alternator wire is routed under the heater hose and above the engine wire No. 3.
2	Install the engine wire No. 3 in such a way that its staked section (B) may come at the lower side in relation with the attaching bolt.	B	Ensure that its staked section (B) comes at the lower side of the attaching bolt.
3	Install the harness at the section C in such a way that the white marking may come at the exact top position.	C	Ensure that the white marking comes at the exact top position. (Ensure that the junction of the injector with the intake air temperature sensor comes at the exactly top position.)
4	Tighten the alternator terminal B in such a direction that the harness points exactly toward the back of the alternator.	D	Ensure that the harness points exactly toward the back of the alternator.
5	As for the clamp provided at the forward edge of the intake manifold, install the clamp in such a way that it may embrace the harness. Also, bend the claw.	E	Ensure that the embraced section is retained positively by the claw.
6	Install the common clamp at the mating section with the transmission in such a direction that the ECU harness may point horizontally.	F	Ensure that the ECU harness points horizontally and toward the outside.
7	Route the junction of the pressure sensor with idle-up VSV harness in such a direction that the junction may point of the top position.	G	Ensure that the junction of the pressure sensor with the idle-up VSV is not routed below the main harness.

WNU89-EM574

## 1. Engine wire harness (2)

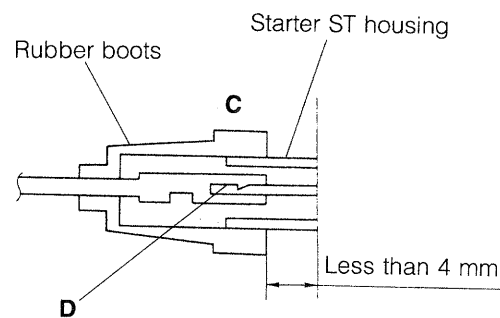
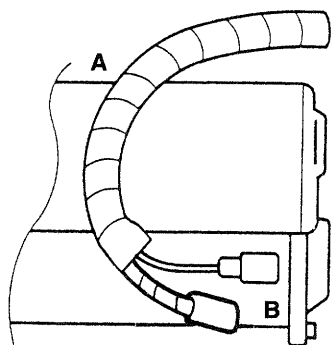


WNU89-EM575

No.	Work procedure	Parts	Control item
1	Route the wire for EGR VSV under the delivery pipe.	A	Ensure that the wire for EGR VSV is routed below the delivery pipe.
2	Install the wire for EGR VSV at level.	B	Ensure that the wire for EGR VSV is tightened at level.

WNU89-EM576

2. Starter Harness



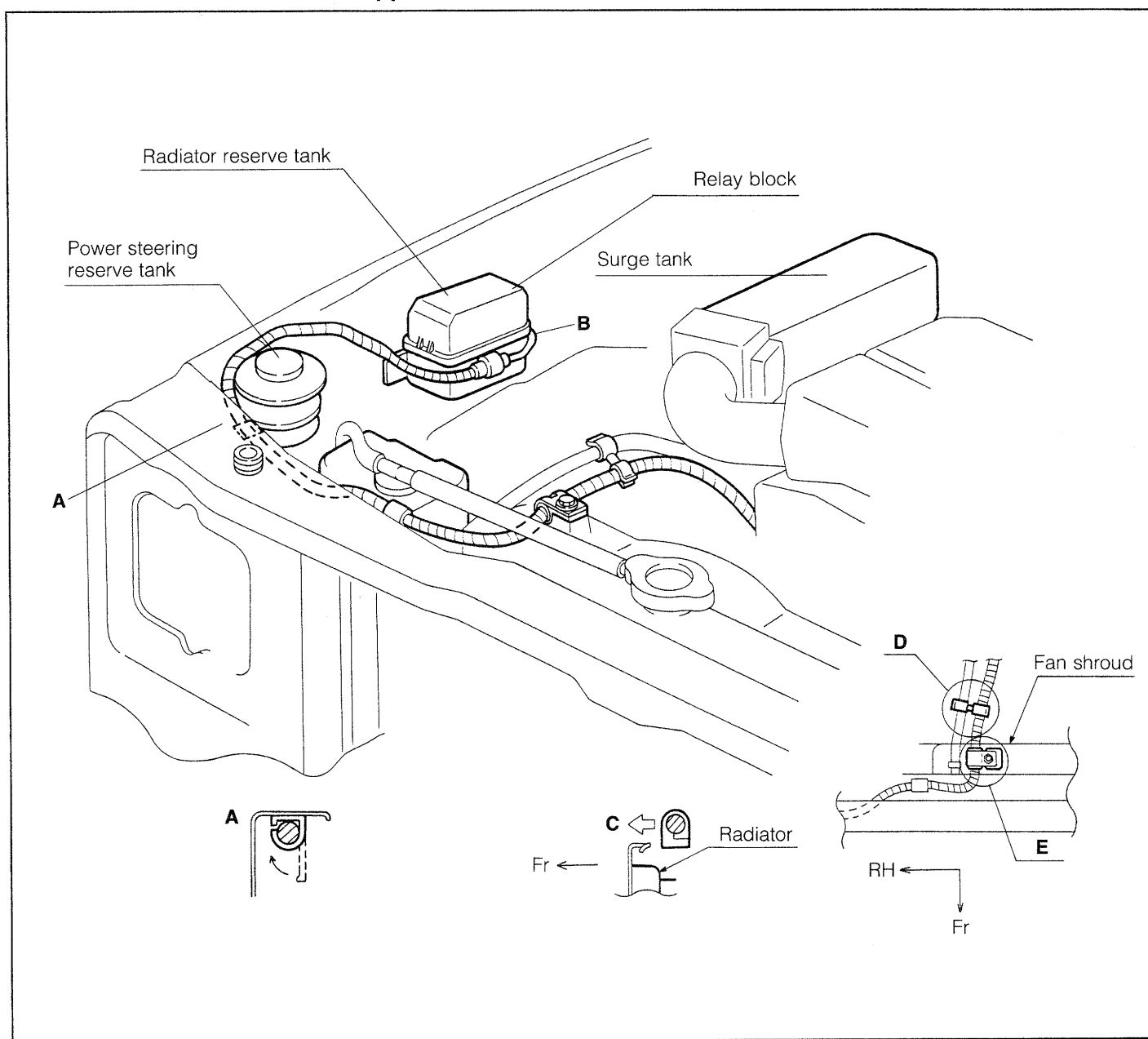
Detail of ST terminal

WRU90-EM367

No.	Work procedure	Parts	Control item
1	Route the harness along with starter.	A	Ensure that the harness is routed along with the starter and it is not floated.
2	After the terminal B has been tightened, cover the terminal with the cap.	B	Ensure that the terminal is covered fully with the cap.
3	Insert the rubber boots of ST terminal completely into the housing.	C	Ensure that the rubber boots is inserted to the position that remaining distance of the housing is less than 4mm. Ensure that the rubber boots is not distortion.
4	Insert the ST terminal until the terminal is locked	D	Ensure that the ST terminal is locked completely.

WNU89-EM578

### 3. Harness Around Radiator Support

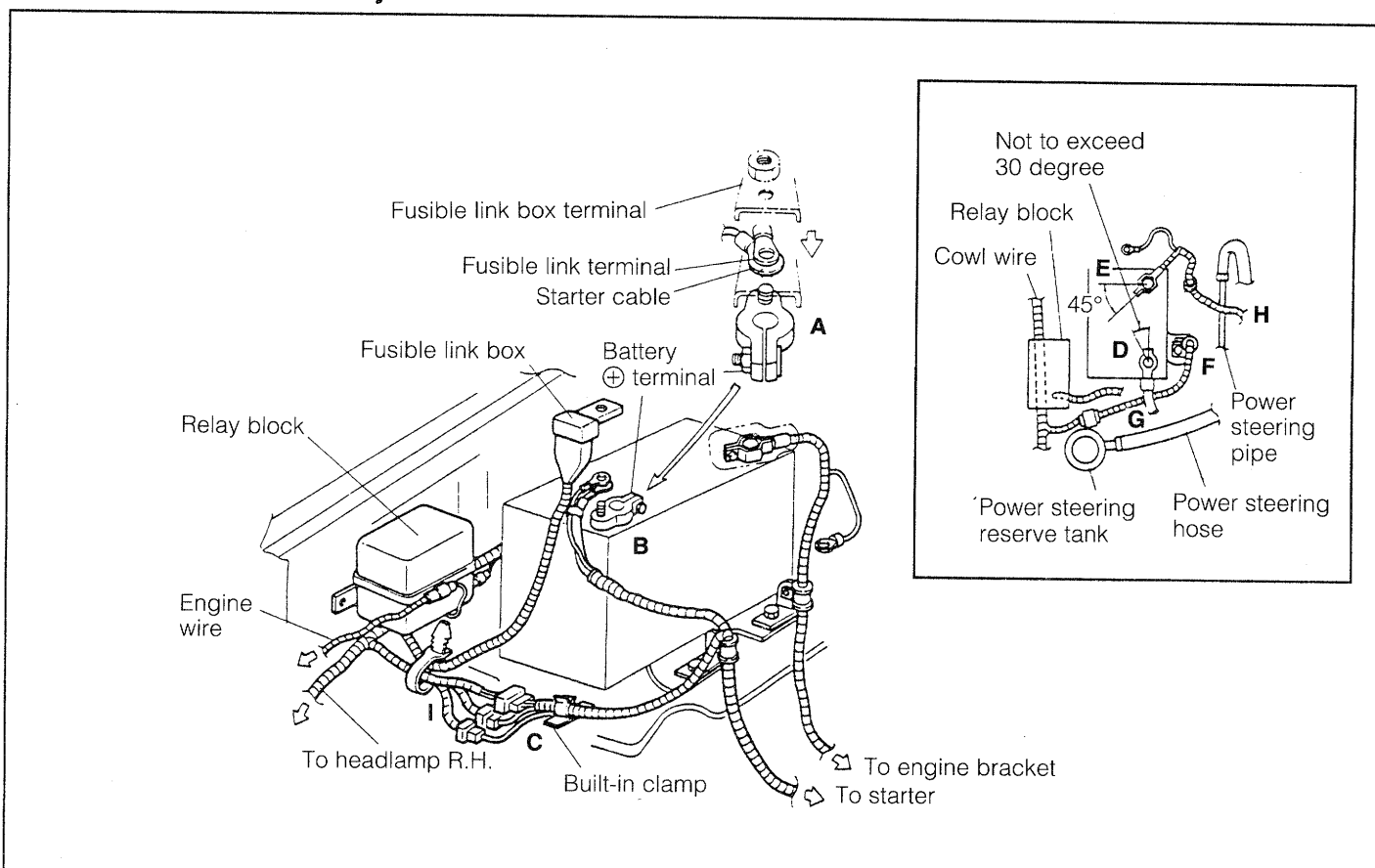


WRU90-EM368

No.	Work procedure	Parts	Control item
1	Route the harness leading to the relay block below the lower surface of the radiator support and through the side of the apron. Clamp the harness by means of the clamp located at the lower surface of the radiator support.	A	Ensure that the harness is routed below the lower surface of the radiator support and through the outside of the power steering reserve tank. Also, ensure that the edges of the clamps are overlapped.
2	Connect the connector (water-proof type, with one pole colored black) to the relay block positively. Secure the harness to the cowl section at the side of the relay block.	B	Ensure that the lock of the connector is fitted properly. Also, ensure that the connector is secured to the claw at the side of the relay block.
3	Insert and secure the built-in clamp of the harness into the bracket of the radiator.	C	Ensure that the clamp is inserted and secured positively in place.
4	Clamp the hose leading to the radiator and the harness to the relay block.	D	Ensure that each of harness and hoses is clamped positively.
5	Clamp the collar of harness leading to the relay block at the outside of the fan shroud boss position.	E	Ensure that the harness collar is clamped at the outside of the fan shroud boss section.

WRU90-EM369

## 4. Harness Around Battery



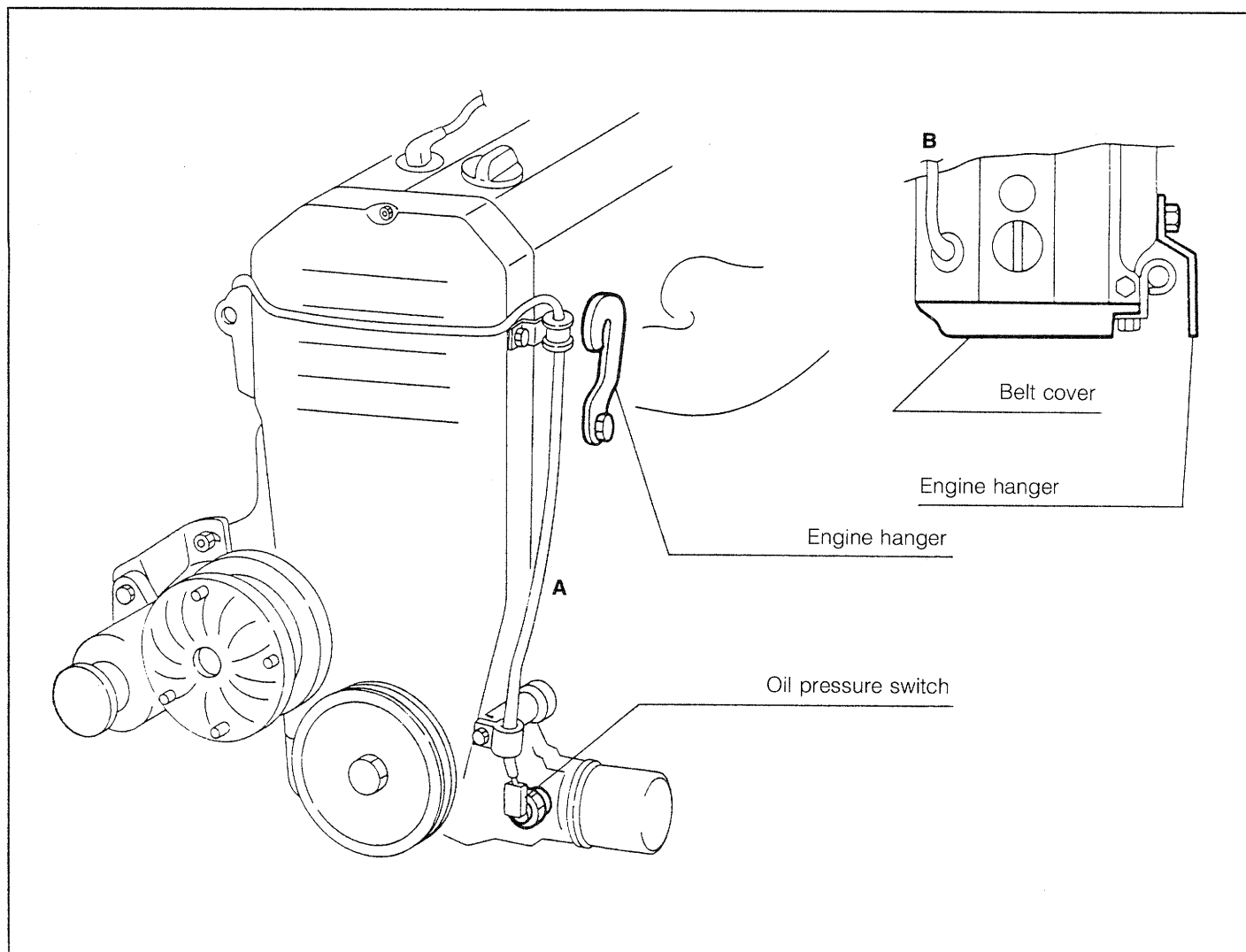
WNU89-EM581

No.	Work procedure	Parts	Control item
1	Perform assembly so that the bent member [E] of the fusible link box terminal may not ride on the starter cable and fusible link terminal.	A	Ensure that the terminal does not ride on other parts.
2	Install the following parts to the battery ⊕ terminal in this sequence: (1) starter cable (2) fusible link terminal and (3) fusible link box terminal.	B	Ensure that all parts are assembled as specified.
3	Clamp the battery cable ⊕ leading to the cowl at the side of the carrier.	C	Ensure that the cable is clamped securely to the bracket.
4	Install the battery terminal ⊕ in such a direction that the terminal assumes an angle not to exceed 30 degrees inward as viewed toward the front of the vehicle.	D	Ensure that the terminal assumes an angle of not more than 30 degrees.
5	Install the battery terminal ⊖ at an angle of 45 degrees inward as viewed toward the rear of the vehicle.	E	Ensure that the battery cable is routed above the clutch cable and the terminal assumes an angle of 45 degrees.
6	When the battery cable ⊕ is clamped at the clamp guide section, install the clamp in such a way that the cowl junction may come at the front side of the vehicle.	F	Install the cowl junction comes at the front side of the vehicle.
7	Route the cowl junction and harness leading to fusible link box through between the power steering hose and the battery.	G	Ensure that the cowl junction and harness leading to fusible link box is routed through between the power steering hose and the battery.
8	Route the battery cable ⊖ above the power steering pipe.	H	Ensure that the battery cable ⊖ is routed above the power steering pipe.
9	Secure the relay box-to-fusible link box wire and the cable leading to the battery by means of band clamps.	I	Ensure that the wires are clamped securely.

WNU89-EM582



## 5. Oil Pressure Switch Harness



WNU89-EM583

No.	Work procedure	Parts	Control item
1	Install the harness between the oil pressure switch and the clamp in such a way that it exhibits no slackness.	A	Ensure that the harness is not interfering with the belt.
2	Install the side clamp of the engine hanger at a point backward from the cover tightening surface. (As viewed from top)	B	Ensure that the clamp is directed as indicated in the view from top above.

WNU89-EM584