

# WORKSHOP MANUAL

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## DAIHATSU

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# F300

[HD-ENGINE]

### FOREWORD

This workshop manual describes the maintenance and servicing procedures for Type HD engines which are mounted on the Daihatsu F300.

In this workshop manual, the entire portion is divided into 11 sections and four supplements. Each section has an index along with a table of contents at the beginning. For easier reference, the upper part of each page bears the section title concerned.

All information used in this workshop manual was in effect at the time when the manual was approved for printing. However, the specifications and procedures may be revised due to the continuing improvements in the design without advance notice and without incurring any obligation to us.

**Published in February, 1989**

**DAIHATSU MOTOR CO., LTD.**

WN88E-00001

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**NOTE:**

Type HD engine comes in two kinds: One is a carburetor-equipped engine. The other is an EFI-equipped engine.

For simplified expression, the carburetor-equipped engine is coded merely as Type HD-C engine, whereas the EFI-equipped engine is coded merely as Type HD-E engine in this Workshop Manual.

# **DAIHATSU**

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# **F300**

**GI**

[HD-ENGINE]

## **GENERAL INFORMATION**

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WN88E-GI001

## HOW TO USE THIS MANUAL

In this workshop manual, the entire portion is divided into 11 sections and four supplements. Each section has a table of contents in the beginning. For easier reference, a thumb index is provided. Also, the upper part of each page bears the section title concerned so that you may use this manual readily and fully.

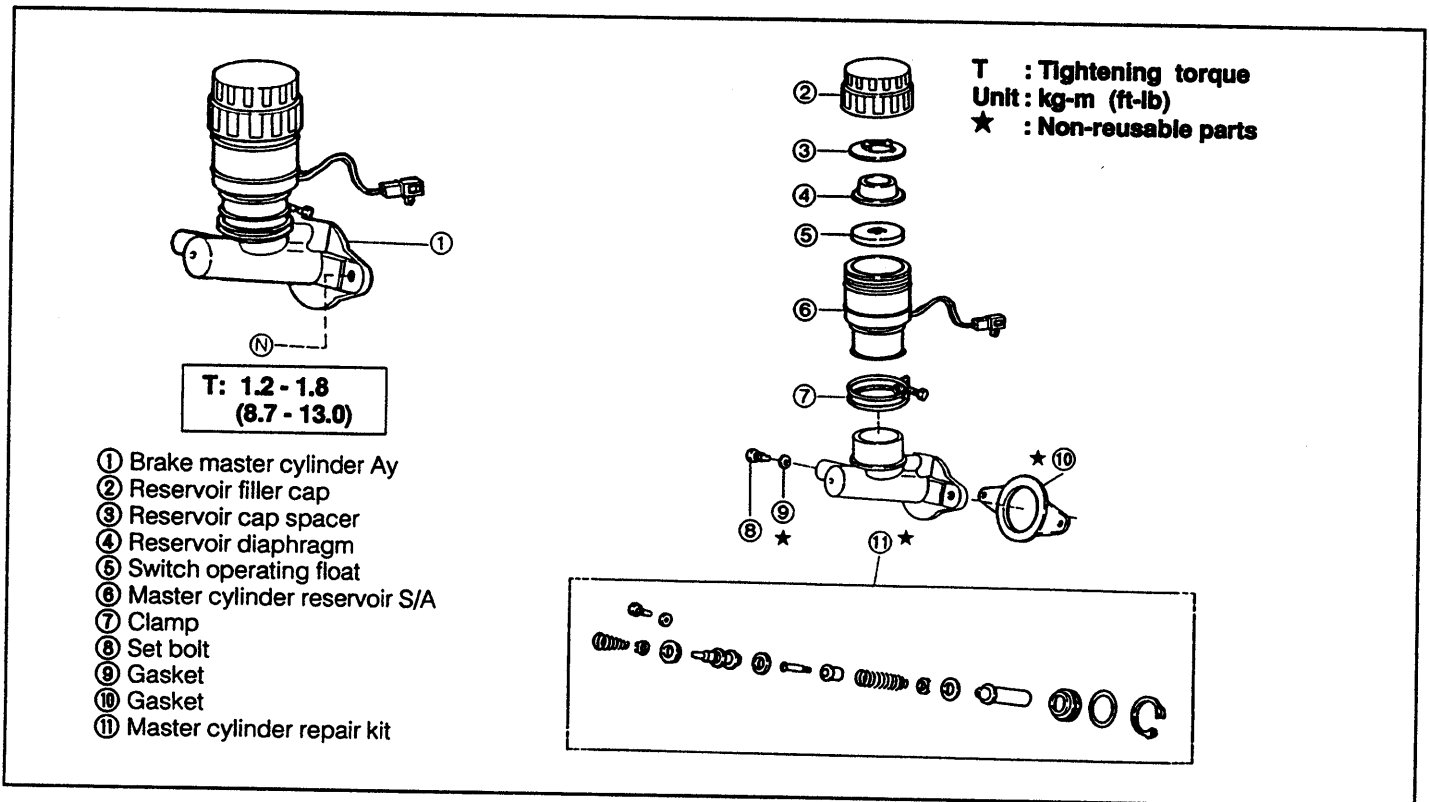
WN88E-GI002

## CONTENTS OF EXPLANATION

### 1. Schematic Diagram of Components

- (1) The schematic diagram of components that appears at the beginning of each section describes the nomenclature and installed conditions of each component. Also, the tightening torque is posted in the figure.
- (2) Those parts whose reuse is not permitted bear a "★" mark for an identification purpose. Be certain to replace these parts with new ones during the assembly.

#### (Example)



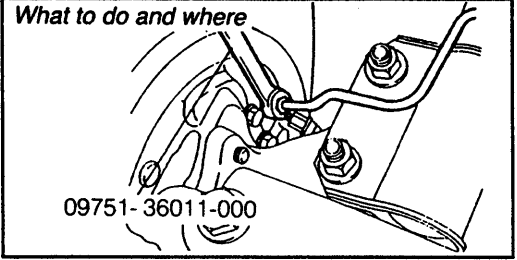
WN88E-GI003

### 2. Servicing Procedure

- (1) In principle, the servicing procedure is described in the following sequence given below: Removal → Inspection → Installation, and Disassembly → Inspection → Assembly.
- (2) The explanation covers detailed servicing methods, specifications and notes.
- (3) The main point of each item explains the servicing section and servicing procedure, using illustrations.

WN88E-GI004

**(Example)**

What to do	How to it	What to do and where
<p>3. Brake tube installation</p> <p>(1) Install the brake tube to the wheel cylinder temporarily by hands.</p> <p>(2) Tighten the brake tube to the wheel cylinder, using the following SST.</p> <p><b>SST: 09751-36011-000</b></p>		

WN88E-G1005

(4) The inspection section in this manual describes only checking operation. Therefore, if you find any malfunction, replace the defective parts with new ones.

**3. SST**

For those operations which require the use of any SST, the SST numbers concerned are given in bold letters.

Also, a table of all SSTs is collectively posted in the Appendix Data A.

**4. Service Specifications**

Service specifications are indicated in bold letters or enclosed by heavy lines. Be certain to confirm the specifications concerned.

Service specifications are collectively posted in the Appendix Data B.

**5. Tightening Torque**

For those operations which require the control of tightening torque, the relevant tightening torque is given in bold letters. Be certain to confirm the tightening torque concerned. Tightening torque specifications are collectively posted in the Appendix Data C.

**6. Definitions of Terms**

Specified Value ... A value which represents the allowable range during the inspection and adjustment.

Limit ..... A maximum or a minimum limit which the value should not exceed or fall below.

**WARNING, CAUTION & NOTE:**

All these symbols are indicated in bold letters.

**WARNING:**

This symbol means that there is a possibility of personal injury of the operator himself or the nearby workers if the operator fails to follow the operating procedure prescribed in this manual.

**CAUTION:**

This symbol means that there is a possibility of damage to the component being repaired if the operator fails to follow the operating procedure prescribed in this manual.

**NOTE:**

To accomplish the operation in an efficient manner, additional instructions concerning the operation are given in this section.

WN88E-G1006

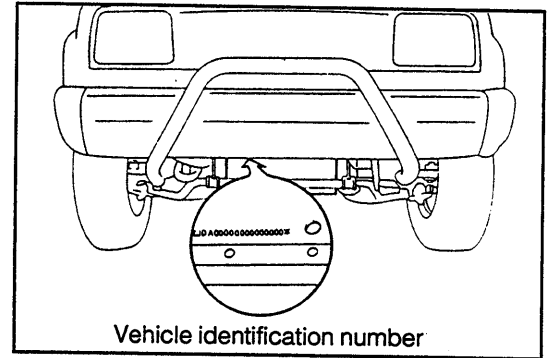
# GENERAL INFORMATION

## IDENTIFICATION INFORMATION

### VEHICLE IDENTIFICATION NUMBER

#### 1. Position of Vehicle Identification Number

The vehicle identification number is stamped on the crossmember at the vehicle front section.



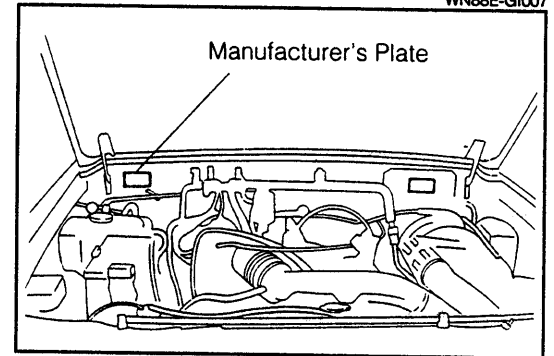
#### 2. The First Stamped Vehicle Identification Number

\* JDA00F30000000021 \*

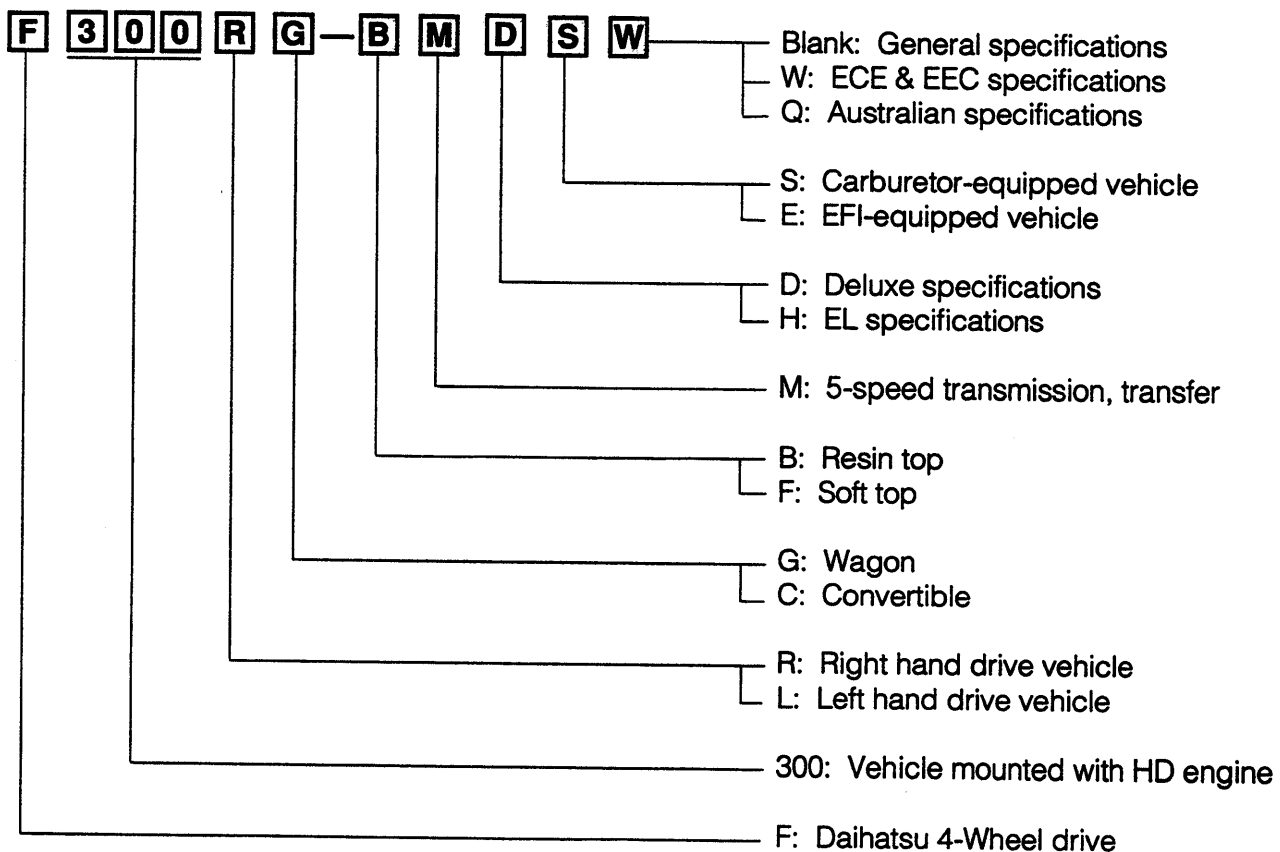
### MANUFACTURER'S PLATE

#### 1. Position of Manufacturer's Plate

The manufacturer's plate is affixed on the cowl panel inside the engine compartment.



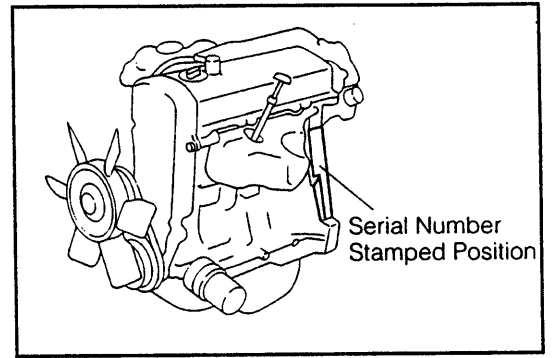
#### 2. Explanation of Vehicle Model Code



WN88E-GI009

## ENGINE NUMBER AND TYPE STAMPED POSITION

The engine number is stamped on the rear left side wall of the cylinder block and the engine type is indicated by embossed letters at near the engine number stamped position.



WN88E-GI010

### GENERAL SERVICE INSTRUCTIONS

1. Use fender covers, seat covers or floor sheets so that the vehicle may not get dirty or be scratched.
2. Jacking up
  - (1) When only the front section or rear section of the vehicle is jacked up, be sure to place chocks at the wheels so as to insure safe operations.
  - (2) When the vehicle has been jacked up, be sure to support the vehicle at the specified section using safety stands. (See page GI-9)
3. Handling instructions related to battery
  - (1) Before you start performing the electrical works, make certain to disconnect the battery cable from the negative (-) terminal of the battery.
  - (2) When it becomes necessary to disconnect the battery cables for the purpose of carrying out checks or repairs, always start at the negative (-) battery terminal which is grounded to the body.
  - (3) To avoid damaging the battery plates, after the terminal nut has been loosened, pull out the battery cable straight upward, rather than turning or prying the terminal.
  - (4) Clean the battery terminal posts or cable terminals, using a cloth. Never use a file or other adhesive agents.
  - (5) When connecting the cable terminal to the battery, first the cable terminal should be fitted onto the battery post with the attaching nut in a loose state. Then, tighten the nut. Never tap the terminal onto the battery post, using a hammer.
  - (6) As for the cover at the positive (+) terminal side, be sure to install it at the correct position.
4. Repairing of fuel system

Type HD-E engine employs a high fuel pressure. Therefore, the following notes should be observed.

  - (1) When the union bolt is removed take a measure to prevent the fuel from splashing with a cloth or the like. Slacken the union bolt gradually.
  - (2) Tighten each connecting section to the specified torque.
  - (3) Attach the specified clip to each connecting section.
5. For increased work efficiency and improved accuracy, be sure to utilize the SSTs (Special Service Tools) effectively.
6. Removal and disassembly
  - (1) When disassembling complicated components, put stamped marks or mating marks on those sections where such marks do not affect their functions so that the assembling operation may be performed easily.
  - (2) Each time a part removed, check the part for the assembled condition, deformation, breakage, roughness and scratches.
  - (3) Arrange the disassembled parts in the disassembling order. In addition, separate and arrange those parts to be replaced and those parts to be reused.
  - (4) Thoroughly clean and wash those parts to be reused.
  - (5) Inspection and measurement of part  
Perform thorough inspection and measurement on those parts to be reused, as required.
7. Installation and assembly
  - (1) Assemble those satisfactory parts, following the proper procedure and specified standards. (adjusting values and tightening torque, etc.)
  - (2) Ensure that seal packings and grease are applied to those sections where such application is needed.
  - (3) Be sure to use new packings, gaskets, cotter pins and so forth.
  - (4) Ensure that the specified bolts and nuts only be used. Moreover, where specified, make sure to employ a torque wrench to tighten bolts and nuts to the specified torque.  
Make sure to use only genuine parts for every replacement.



## 8. Adjustment and operation check

Adjust the reassembled or replaced components to the servicing specifications, using gauges and testers, as required.

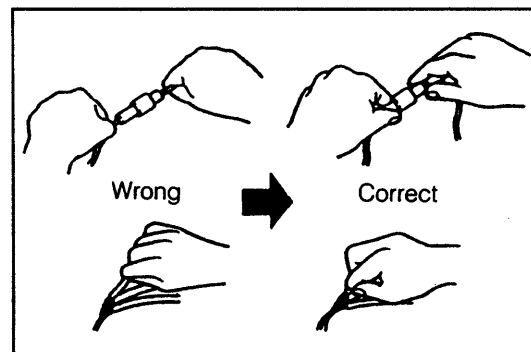
## 9. Handling of hoses, etc.

- (1) Connect fuel hoses and water hoses, etc. securely so that they exhibit no leakage.
- (2) When disconnecting fuel hoses, make sure that no fuel is splashed around the hose. (Special care must be exercised as to the engine mount rubber, etc., for there is a possibility that the rubber is deteriorated by the petrol-based liquid.)

WN88E-GI012

## 10. Observe the following precautions to avoid damage to the parts.

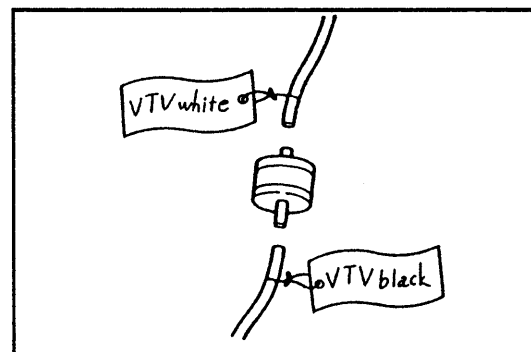
- (1) When pulling out vacuum hoses, be sure to hold the hose end, not the middle part of the hose.
- (2) When disconnecting connectors, be sure to hold the connector itself, not the wire portion.
- (3) Be very careful not to drop electrical components, such as sensors or relays, to the floor. If they are dropped, they must be replaced. Never reuse them.
- (4) When steam cleaning the engine, take precautionary measures so that no water is applied to the air filter, carburetor, distributor, ignition coil and so forth.
- (5) Never use an impact wrench to remove or install thermo switches or thermo sensors.
- (6) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
- (7) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.



WN88E-GI013

## 11. Tag hoses before disconnecting them:

- (1) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
- (2) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.



WN88E-GI014

## 12. The dimensions and specified values that appear in this manual are those values at 20°C (68°F), unless otherwise specified.

## 13. As for the values other those indicated in "si" unit, such as ft, inch, lb, cu-in and gallon, they are the converted values. Therefore, there are cases where the converted values have been rounded up or down according to their use at the time of conversion.

WN88E-GI015

### HANDLING INSTRUCTIONS ON CATALYTIC CONVERTER-EQUIPPED VEHICLES

**WARNING:**

When a great amount of unburnt gas is admitted into the catalytic converter, overheating is prone to occur, resulting in a fire hazard.

To avoid such trouble in advance, be certain to observe the following precautions. Also, be sure to explain such precautions to your customers.

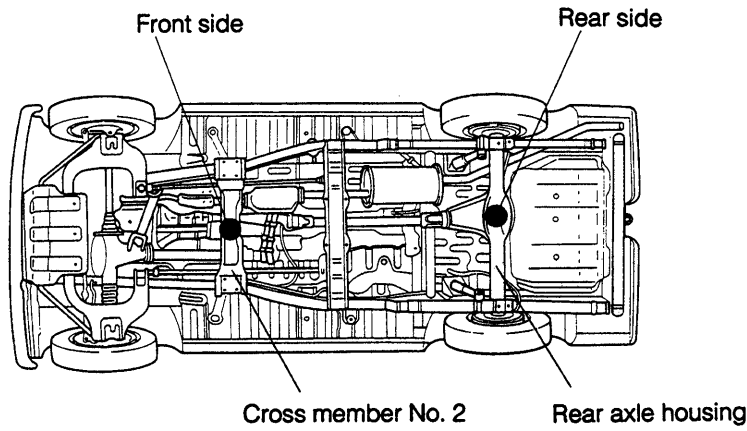
1. Use only unleaded gasoline to your vehicle.
2. Avoid idling the engine for a prolonged length of time.  
Do not run the engine continuously at the idle speed for more than 20 minutes.
3. Never perform spark jump tests.
  - (1) The spark jump test must be limited to cases where such test is absolutely necessary. Also, be sure to finish the test in the shortest possible time.
  - (2) Never race the engine during the test.
4. Do not run the engine when the fuel tank becomes nearly empty.  
Failure to observe this caution will cause misfiring. Also, it will apply excessive load to the converter, even leading to catalyst damage.
5. Do not dispose the waste catalyst along with parts contaminated with gasoline or oil.

WN88E-GI016

# JACKING POINTS & SUPPORTING POINTS OF SAFETY STANDS

• **Jacking point**

- Front side ..... Cross member No.2
- Rear side ..... Rear axle housing



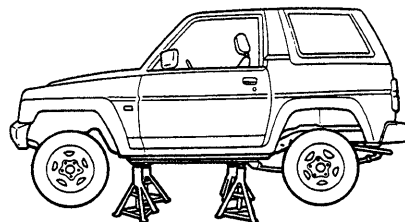
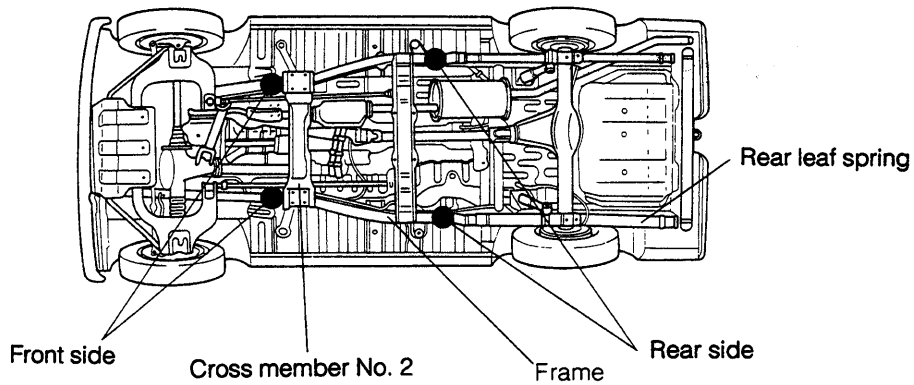
WN88E-GI017

## SUPPORTING POINTS OF TWO-POST LIFT

Align the supporting pads of a two-post lift with the supporting points of safety stands, as indicated in the figure below.

• **Supporting points**

- Front side ..... Frame (In front of the crossmember No.2)
- Rear side ..... Frame (In front of the rear leaf speing)



WN88E-GI018

# GENERAL INFORMATION

## ABBREVIATION CODES

The abbreviation codes that appear in this workshop manual stand for the following, respectively.

A/C	Air Conditioner
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
BVSV	Bimetal Vacuum Switching Valve
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
EX	Exhaust (Manifold Valve)
FL	Fusible Link
IN	Intake (Manifold, Valve)
LH	Left Hand
LHD	Left Hand Drive
LLC	Long Life Coolant
MP	Multipurpose
N.m.	Newton meter
PCV	Positive Crankcase Ventilation
PVSV	Pressure Vacuum Switching Valve
RH	Right Hand
SST	Special Service Tool
STD	Standard
TDC	Top Dead Center
TVSV	Thermostatic Vacuum Switching Valve
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
W/	With
W/O	without
4WD	Four-wheel Drive Vehicle
HIC	Hot Idle Compensator
ITC	Intake air Temperature Compensating valve
TP	Throttle positioner
TWC	Three-way catalyst
SD	Spark delay
C/B	Choke Breaker
EVAP	Fuel evaporative emission control

WN88E-GI019

The abbreviation codes that appear in the figure stand for the following, respectively.

Ⓑ	Bolt	Ⓢ	Screw
Ⓝ	Nut	Ⓦ	Washer

WN88E-GI020

# **DAIHATSU**

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# **F300**

[HD-ENGINE]

**MA**

## **MAINTENANCE**

<b>MAINTENANCE SCHEDULE .....</b>	<b>MA-2</b>
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<b>COLD ENGINE OPERATIONS .....</b>	<b>MA-3</b>
<b>HOT ENGINE OPERATIONS .....</b>	<b>MA-8</b>

WN88E-MA001

# MAINTENANCE

## MAINTENANCE SCHEDULE

O ... Check ● ... Change or replacement

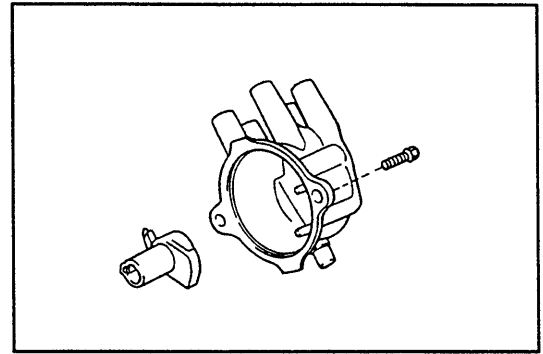
Section	Inspection	× 1,000 km	1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
		× 1,000 miles	0.6	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	
		(Months) Years	—	(3)	(6)	(9)	1	(3)	(6)	(9)	2	(3)	(6)	(9)	3	(3)	(6)	(9)	4	(3)	(6)	(9)	5	
Engine electrical system	• Distributor cap, rotor	• Damage					○				○				○				○				○	
	• Spark plug	• Cleaning					○				○				○				○				○	
	• Ignition timing	• Timing					○				○				○				○				○	
	• Battery	• Electrolyte level		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	• Wire harness	• Tightness clamps • Damage		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Engine	• Air cleaner element* <sup>1</sup>	• Cleaning			○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	
	• Valve clearance	• Clearance									○								○					
	• Engine oil* <sup>2</sup> (API SE or SF)	• Leakage • Level • Change (Every 10,000 km or 0.5 year)	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	
	• Oil filter* <sup>2</sup>	• Change			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	• Fuel filter	• Change	• HD-C engine									●								●				
			• HD-E engine																					●
	• Fuel lines & Connections	• Damage • Crack • Tightness • Leakage		○			○				○				○				○				○	
	• Carburetor (HD-C engine)	• Idle speed • Acceleration					○				○				○				○				○	
	• Choke system (HD-C engine)	• Operation					○				○				○				○				○	
	• Coolant	• Quantity • Leakage • Change (Long life coolant)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	• V-belt	• Tension • Crack • Damage		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	• Blow-by gas ventilation hose	• Connection • Damage										○							○					
	• Throttle positioner	• Operation					○				○				○				○					
• Spark control system	• Operation					○				○				○				○						
• Charcoal canister	• Operation					○				○				○				○						

\*<sup>1</sup> In case of driving on dusty roads, clean every 2,500 km (1,500 miles) and replace every 20,000 km (12,000 miles).  
 \*<sup>2</sup> In case of severe driving condition, replace every 5,000 km (3,000 miles).

# MAINTENANCE OPERATIONS

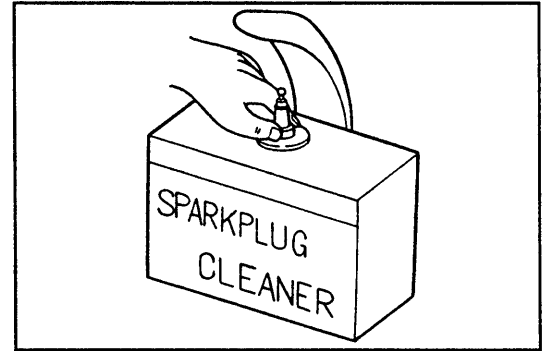
## COLD ENGINE OPERATIONS

1. Inspection of distributor cap and rotor.  
Visually inspect the distributor for cracks, wear or damage.



WN88E-MA003

2. Inspection and cleaning of spark plugs
  - (1) If there are traces of oil, remove it with gasoline before the spark plug is cleaned by the spark plug cleaner.



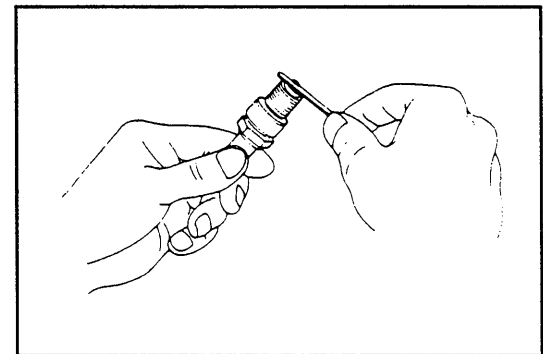
WN88E-MA004

- (2) Measure the electrode gap, using a plug gap gauge.

### Recommended a plug gap.

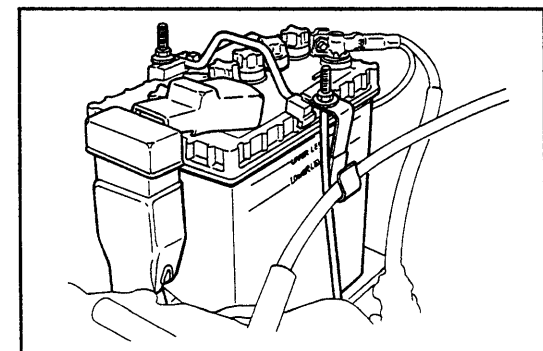
Spark plug	Air gap mm (inch)
Champion: RC9YC4	1.0 - 1.1 (0.039 - 0.043)
ND: K20PR-U11	
NGK: BKR 6E-11	

**Tightening Torque of Spark Plug: 1.5 - 2.2 kg-m  
(10.8 - 15.9 ft-lb)**



WN88E-MA005

3. Check of battery electrolyte level
  - (1) Visually check the electrolyte level between the upper line and the lower line.
  - (2) If the electrolyte level is below the lower level, replenish distilled water up to the upper level.



WN88E-MA006

# MAINTENANCE

4. Check of wiring harness clamp  
Visually check that the wiring harness is suitable clamp, damaged.

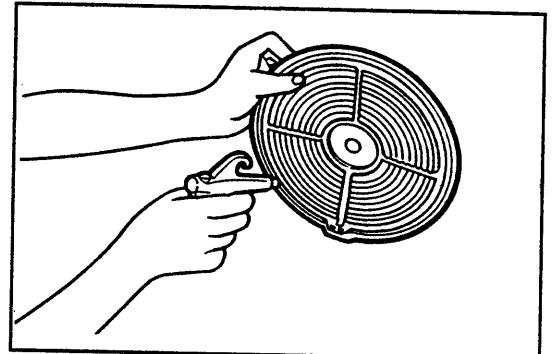
WN88E-MA007

5. Cleaning of air cleaner filter element
  - (1) Remove the air cleaner filter element from the air cleaner case.
  - (2) Clean the element with compressed air. First blow from the back side thoroughly. Then, blow off the front side of the element.

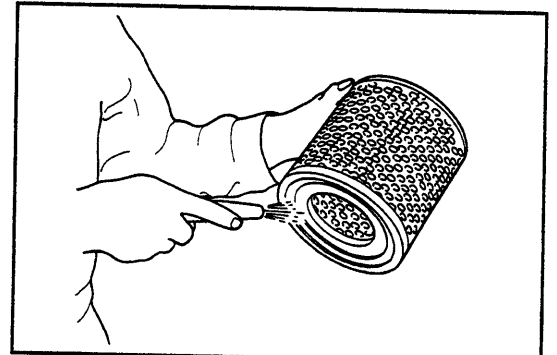
**CAUTION:**

The air pressure to be used for this cleaning operation should not exceed 4.0 kg/cm<sup>2</sup> (56.9 psi)

- (3) Install the air cleaner filter element in the air cleaner.

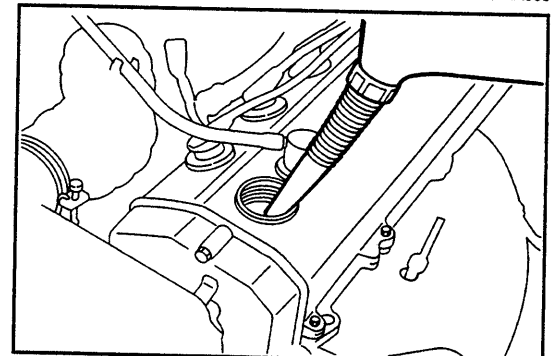


WN88E-MA008



WN88E-MA009

6. Engine oil change  
(See page LU-4)  
Recommended oil grade: API grade SE, SF  
Oil capacity  
When only engine oil is changed: 3.3 liter  
When engine oil is changed and oil filter is replaced: 3.5 liter

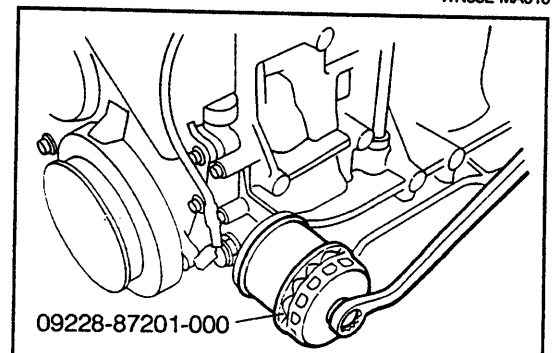


WN88E-MA010

7. Engine oil filter replacement
  - (1) Remove the oil filter, using the following SST.  
SST: 09228-87201-000

**NOTE:**  
Since the oil flows out during the replacement, receive the oil with an adequate container.

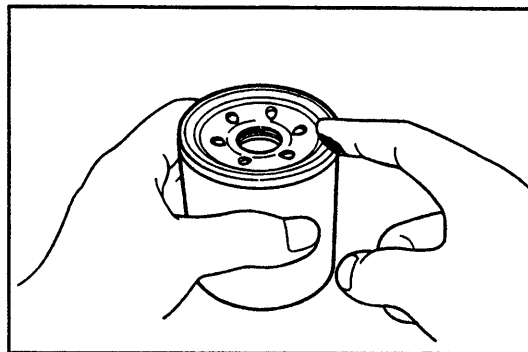
  - (2) Inspect and clean the oil filter installation surface.



WN88E-MA011

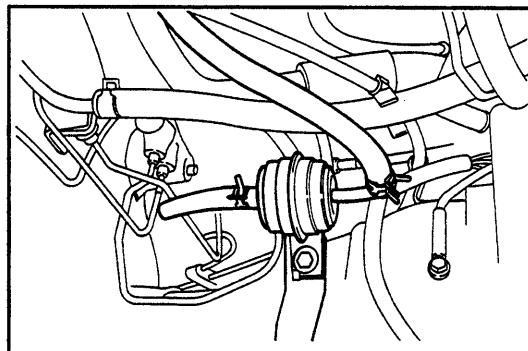


- (3) Apply clean engine oil to the gasket of a new oil filter.
- (4) Installation of oil filter  
Screw in the oil filter lightly by hand until the oil seal surface contacts the oil cooler.  
Then, tighten the oil filter one more turn, using the SST.  
SST: 09228-87201-000



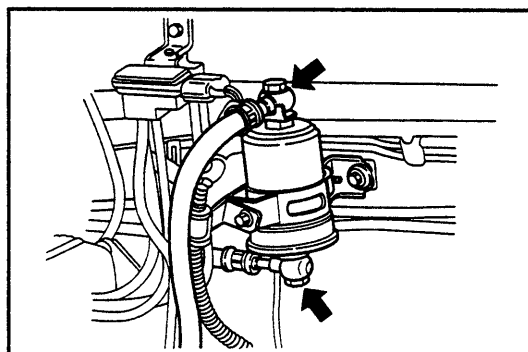
WN88E-MA012

8. Fuel filter replacement  
Carburetor installed engine:  
Disconnect the hose clamp. Then, replace the fuel filter.



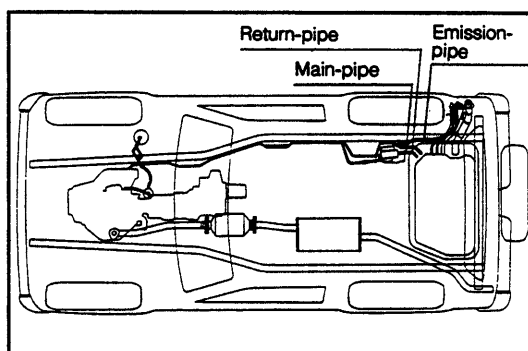
WN88E-MA013

- EFI installed engine:  
Loosen the union bolt slowly and pull it out.
- WARNING:**  
The fuel in the fuel pipe is pressurized to a pressure of  $2.55 \text{ kg/cm}^2$  (36.27 psi).  
Therefore, the union bolt should be removed slowly. Otherwise, the fuel may be splashed.



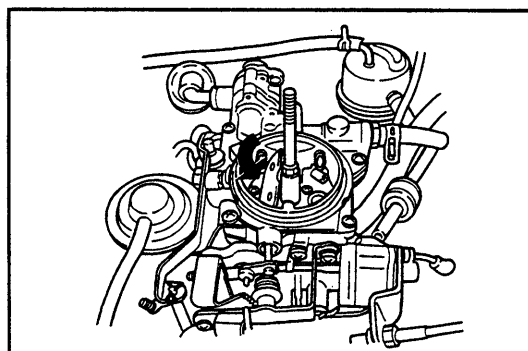
WN88E-MA014

9. Inspection of fuel lines and connections  
Visually inspect the fuel lines for cracks, leakage, loose connections, or deformation.



WN88E-MA015

10. Inspection of auto choke system (Only for HD-C)  
Check that choke valve is completely closed when cold engine.  
Then, start the engine, check that choke valve is gradually opened in accordance with the warning-up condition of the engine.



WN88E-MA016

# MAINTENANCE

## 11. Check of engine coolant

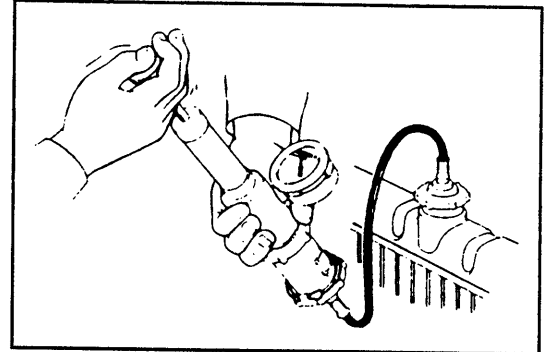
### (1) Check of cooling system for leakage

Apply a pressure of 1.2 kg/cm<sup>2</sup> (17 psi) to the cooling system by means of a radiator tester.

Ensure that the pressure does not drop.

#### WARNING:

Never remove the radiator tester when the coolant temperature is still high.

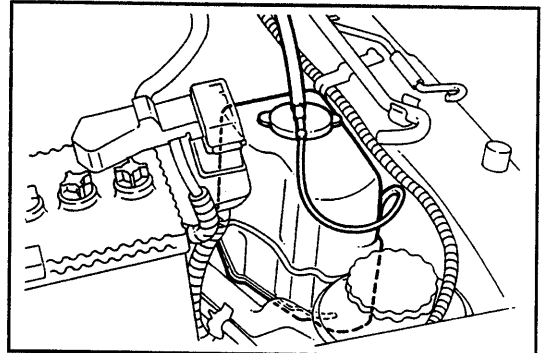


WN88E-MA017

### (2) Check of coolant level

Check to see if the coolant level is between the LOW and FULL lines of the reserve tank.

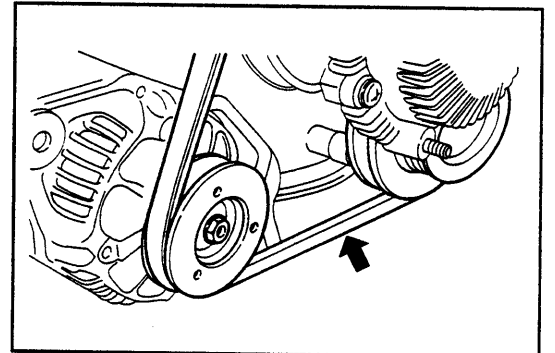
If the coolant level is near the low level or below the low level, add the coolant up to the full level.



WN88E-MA018

## 12. Inspection of drive belt

(1) Visually check the V belt for separation of the adhesive rubber above and below the core, core separation from the belt side, severed core, separation of the rib from the adhesive rubber, cracks or separation of the ribs, torn or worn ribs or cracks in the inner ridges of the ribs.



WN88E-MA019

(2) Measure the amount of the drive belt deflection when the midpoint of the drive belt between the alternator and the water pump pulley is pushed with a force of 10 kg (2.20 lb)

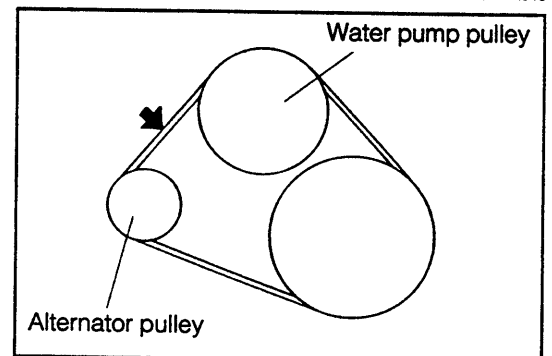
#### Specified Belt Deflection

New belt: 5.0 - 7.0 mm (0.20 - 0.28 inch)

Used belt: 6.0 - 8.0 mm (0.24 - 0.31 inch)

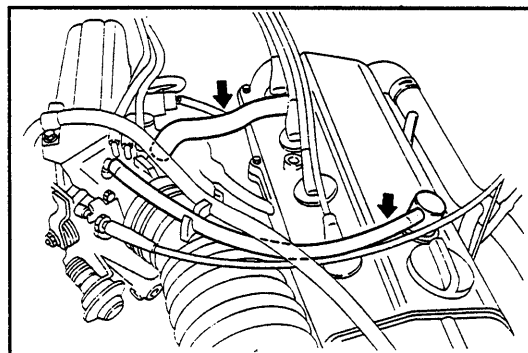
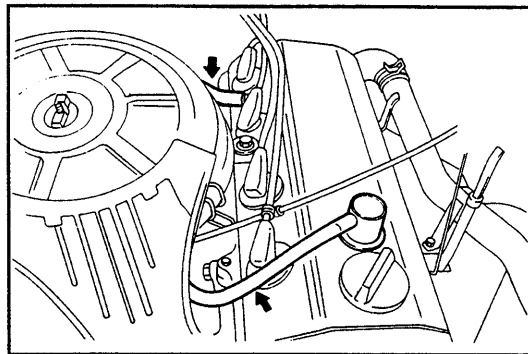
#### NOTE:

- "New belt" refers to a belt which has been used on a running engine for less than five minutes.
- After installing a new belt, run the engine for about five minutes and then recheck the tension.



WN88E-MA020

13. Inspection of blow-by gas recirculating system  
Check the hose, connections for cracks, leak or damage.

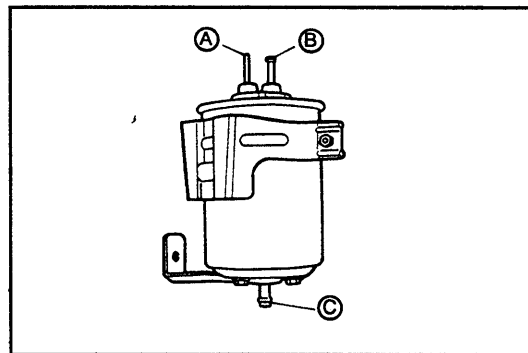


WN88E-MA021

14. Inspection of charcoal canister  
(1) Disconnect the rubber hoses and remove the charcoal canister.

HD-E:

- (2) Blow air of  $3 \text{ kg/cm}^2$  (43 psi) into the pipe (B) while holding the pipe (A) closed.  
Ensure that air flows smooth from the pipe (C).



WN88E-MA022

HD-C (Only for GCC Specifications)

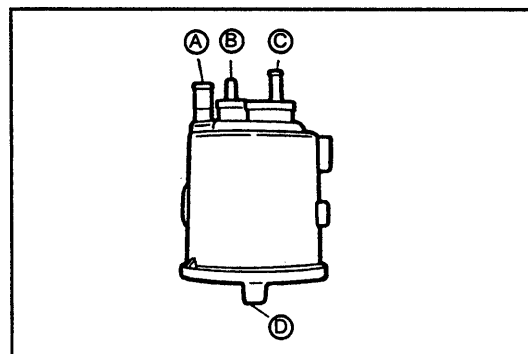
Plug the pipe (A) and (B) with your fingers and blow compressed air of  $3 \text{ kg/cm}^2$  (43 psi) through the pipe (C) (fuel tank side).

- Check that the air comes out of the bottom pipe (D).
- Check that no activated charcoal comes out.

**NOTE:**

Do not attempt to wash the charcoal canister.

- (3) Install the charcoal canister and reconnect the rubber hose.



WN88E-MA023

## 15. Removal of timing belt (See page EM-21.)

WN88E-MA024

## HOT ENGINE OPERATIONS

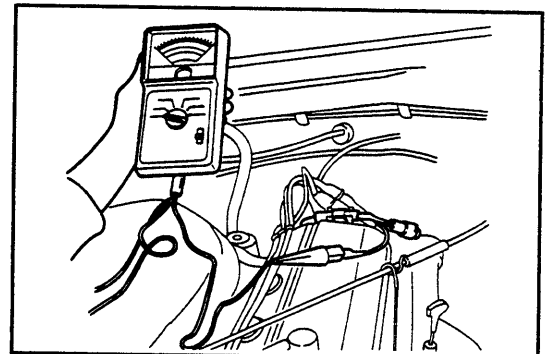
1. Adjustment of ignition timing
  - (1) Connect the tachometer to the ignition coil.
  - (2) With the engine idling as specified, use a timing light to check the timing.  
**Ignition timing:  $3^{\circ} \pm 2^{\circ}$  BTDC/850 rpm**
  - (3) If necessary, loosen the distributor bolts and turn the distributor to align the marks. Re-check the timing after tightening the distributor.

### NOTE:

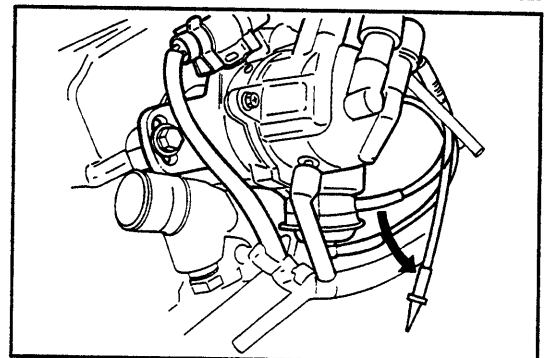
- Disconnect the vacuum hose of sub-diagram from the vacuum advancer of distributor and close the vacuum hose during test.
- The ignition coil has no terminal for external connection. Hence, insert an adequate jumper cord from the backside of the connector attached to the ignition coil. Then, connect the other end of the jumper cord to the measuring terminal of the tachometer.
- For the purpose of connecting tachometer, the SST for connecting to the distributor wire is available.  
SST: 09991-87703-000

### CAUTION:

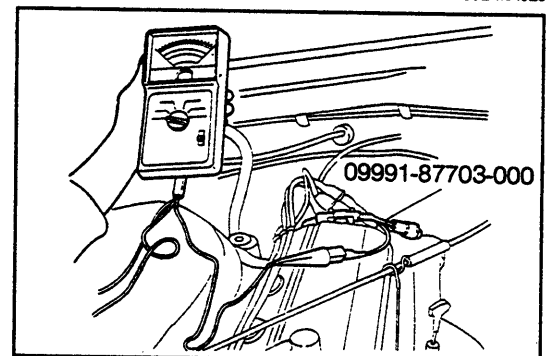
- Never allow the tachometer terminal to touch ground as it could result in damage to the ignitor and/or ignition coil.
- As some tachometers are not compatible with this ignition system, it is imperative to confirm the compatibility of your meter before it is used.



WN88E-MA025



WN88E-MA026



WN88E-MA027

## 2. Adjustment of valve clearances (See page EM-9)

### NOTE:

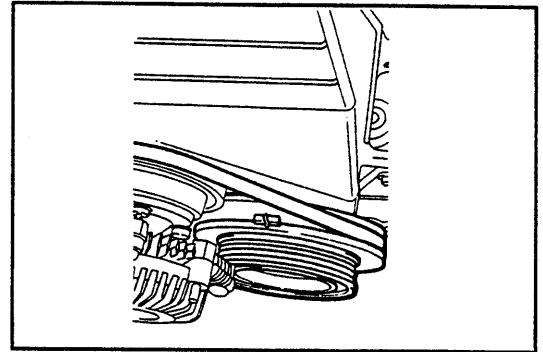
The valve clearance adjustment is performed normally when the engine is in a hot condition.

“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).

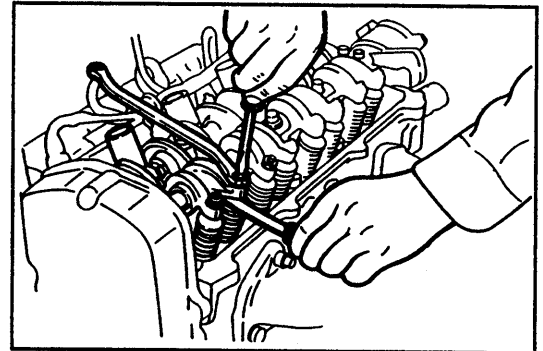
### Valve clearances (Hot condition)

Intake: 0.20 - 0.30 mm (0.0078 - 0.0118 inch)

Exhaust: 0.28 - 0.38 mm (0.0110 - 0.0150 inch)



WN88E-MA029



WN88E-MA030

## 3. Idle speed adjustment

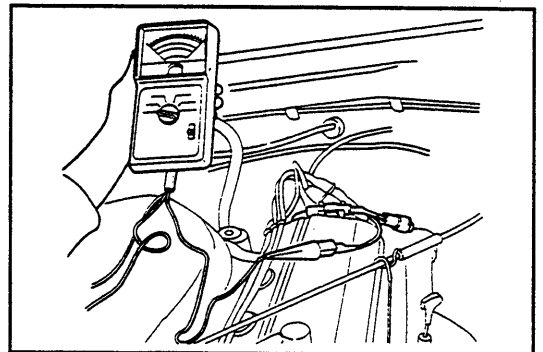
### (1) Preparation to be made prior to idle adjustment

- Warm up the engine thoroughly.
- All accessory switches are turned OFF.  
On those vehicle equipped with a day-lamp system, set the lamp control switch to the first stage with head lamps turned OFF.
- The air cleaner element is installed.
- All vacuum hoses are connected.

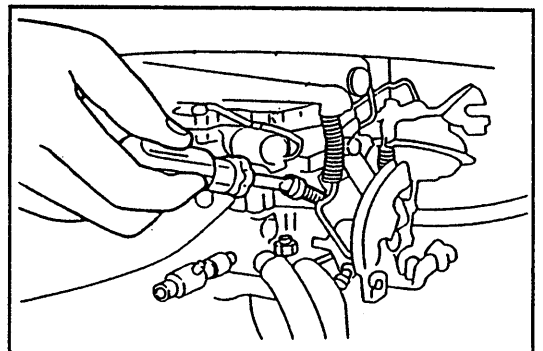
### (2) Connect the tachometer to the distributor. (See page MA-8)

### (3) Adjustment

- Carburetor equipped vehicle  
Adjust the throttle adjusting screw so that the engine idle speed may become the specified value.  
**Engine Idle Speed: 850 ± 50 rpm**

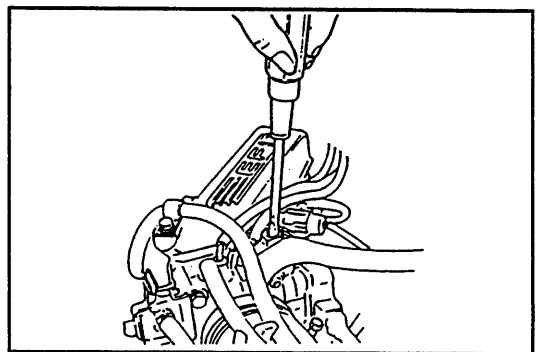


WN88E-MA031



WN88E-MA032

- EFI equipped vehicle  
Remove the idle adjusting screw cap from the throttle body. Then, set the idle speed by turning the idle speed adjusting screw.  
**Engine Idle Speed: 850 ± 50 rpm**



WN88E-MA033

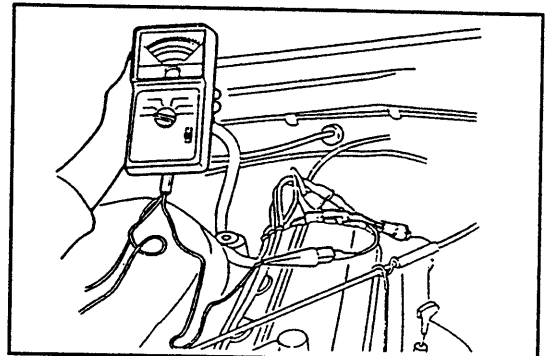
# MAINTENANCE

## 4. Inspection of throttle positioner system

- Carburetor equipped vehicle
  - (1) Warm up the engine.
  - (2) Raise the engine speed to approximately 2500 rpm and hold the engine speed at 2500 rpm for five seconds. Measure that the dashpot shaft is fully stretched.
  - (3) Close the throttle valve quickly.
  - (4) Make sure the time required for the engine speed to drop from 1500 rpm to 1200 rpm.  
Specified Time: 0.5 - 5.0 second

### NOTE:

Dashpot touch engine speed:  $1500 \pm 50$  rpm



WN88E-MA034

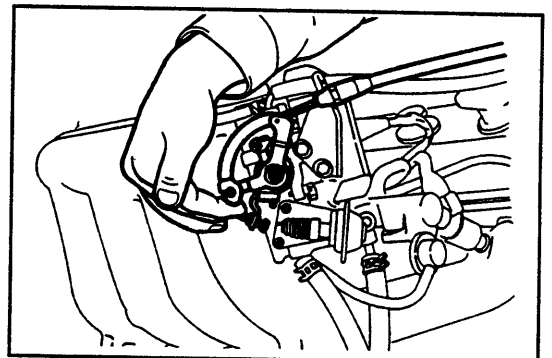
- EFI equipped vehicle
  - (1) Warm up the engine.
  - (2) Raise the engine speed to approximately 3500 rpm and hold the engine speed at 3500 rpm for five seconds. Ensure that the dashpot lever should be fully extended.
  - (3) Close the throttle valve quickly.

WN88E-MA035

- (4) Measure the time required for the engine speed to drop from 1800 rpm to idle speed ( $850 \pm 50$  rpm).  
Specified Time: 1.0 - 5.0 seconds

### NOTE:

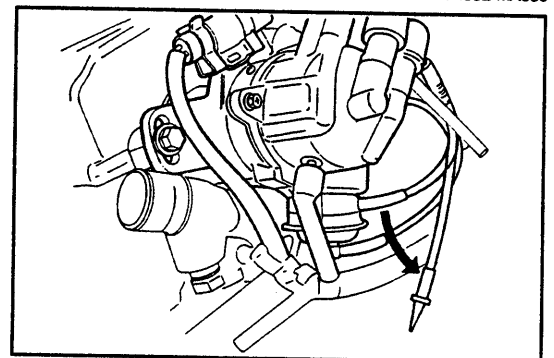
Dashpot touch engine speed:  $1800 \pm 100$  rpm



WN88E-MA036

## 5. Inspection of spark control system

- (1) Disconnect the vacuum hose of main and sub diagram from the vacuum advancer of distributor, and close the vacuum hose. Using a timing light, check the ignition advance timing, while engine speed is being raised.



WN88E-MA037

- (2) Dis-connect the plug from vacuum hose. Connect the MitgVac to the vacuum advancer of distributor, check the ignition advance timing, while vacuum is applied.

WN88E-MA038

# **DAIHATSU**

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# **F300**

[HD-ENGINE]

**EM**

## **ENGINE MECHANICALS**

<b>TROUBLE SHOOTING .....</b>	<b>EM- 2</b>
<b>ENGINE TUNE-UP .....</b>	<b>EM- 7</b>
<b>TIMING BELT .....</b>	<b>EM-21</b>
<b>CYLINDER HEAD .....</b>	<b>EM-32</b>
<b>CYLINDER BLOCK .....</b>	<b>EM-73</b>

WN88E-EM001

## TROUBLE SHOOTING (HD-C ENGINE)

Problem	Possible causes	Remedies	Page
Engine overheats.	Cooling system faulty Incorrect ignition timing Fuel system faulty Lubrication system faulty	Trouble shoot cooling system. Trouble shoot ignition system. Trouble shoot fuel system. Trouble shoot lubrication system.	CO-2 IG-2 FU-2 LU-2
Engine will not crank or cranks slowly.	Starting system faulty Charging system faulty	Trouble shoot starting system. Trouble shoot charging system.	ST-2 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>• Distributor</li> <li>• Ignition timing</li> </ul> Spark plugs faulty Resistive cords disconnected or faulty Vacuum leaks <ul style="list-style-type: none"> <li>• PCV line</li> <li>• ITC line</li> <li>• Intake manifold</li> <li>• Carburetor hoses</li> <li>• Brake booster line</li> </ul> Low compression No fuel supply to carburetor <ul style="list-style-type: none"> <li>• Fuel line</li> <li>• Fuel filter</li> <li>• Fuel pump</li> </ul> Carburetor problems <ul style="list-style-type: none"> <li>• Carburetor out of adjustment</li> <li>• Choke operation</li> <li>• Flooding (outer vent valve, BVSV)</li> <li>• Needle valve sticking or clogged</li> <li>• Vacuum hose disconnected</li> <li>• Fuel cut solenoid valve not open</li> </ul>	Inspect ignition coil. Inspect distributor. Reset timing. Inspect plugs. Inspect cords.  Check PCV line. Check ITC line. Check intake manifold. Check carburetor hoses. Check brake booster.  Check compression. Check fuel line and fuel pump.  Repair, as necessary.	IG-8 IG-9 MA-8 IG-6 IG-5  EC-4 EC-4 EM-18 FU-28 FU-32 FU-28 FU-16
Rough idle/Engine stalls or misses.	Spark plug faulty Resistive cords faulty Ignition problems <ul style="list-style-type: none"> <li>• Ignition coil</li> <li>• Distributor</li> </ul> Incorrect ignition timing Incorrect valve clearance Low compression Incorrect idle speed Vacuum leaks <ul style="list-style-type: none"> <li>• PCV line</li> <li>• ITC line</li> <li>• Intake manifold</li> <li>• Carburetor hoses</li> <li>• Brake booster line</li> </ul>	Inspect spark plugs. Inspect resistive cords.  Inspect ignition coil. Inspect distributor. Reset timing. Adjust valve clearances. Check compression. Adjust idle speed.  Check PCV system. Check ITC system. Check intake manifold. Check carburetor hoses. Check brake booster.	IG-6 IG-5 IG-8 IG-8 IG-9 MA-8 EM-10 EM-18 EM-13 EC-4 EC-3

WN88E-EM002



Problem	Possible causes	Remedies	Page
Rough idle/Engine stalls or misses.	Engine overheating Carburetor problems <ul style="list-style-type: none"> <li>• Slow jet clogged</li> <li>• Idle mixture incorrect</li> <li>• Fuel cut solenoid valve not open</li> <li>• Choke system faulty</li> </ul>	Repair, as necessary.	EM-2 FU-2
Engine hesitates/poor acceleration	Spark plug faulty Resistive cords faulty Ignition problems <ul style="list-style-type: none"> <li>• Distributor</li> <li>• Ignition coil</li> </ul> Incorrect ignition timing Incorrect valve clearances Low compression Engine overheats Air cleaner clogged Fuel system clogged Carburetor problems <ul style="list-style-type: none"> <li>• Float level too low</li> <li>• Accelerator pump faulty</li> <li>• Power valve faulty</li> <li>• Choke system faulty</li> <li>• Emission control system malfunctioning</li> <li>• ITC system always ON (hot engine)</li> </ul> Intake manifold thermo-control valve (cold engine) Hot water circulating system (cold engine) Clutch slipping Brakes dragging	Inspect spark plugs. Inspect resistive cords. Inspect distributor. Inspect coil. Reset timing. Adjust valve clearances. Check compression. Check cooling system. Check air cleaner. Check fuel system. Repair, as necessary. Check ITC system. Check thermo-control valve. Check hot water circulating system. Trouble shoot clutch. Trouble shoot brakes.	IG-6 IG-7 IG-2 IG-10 IG-8 IG-22 EM-10 EM-18 CO-2 EM-7 FU-2 FU-2  IG-23 CO-2 FU-2  EC-18  EM-7 FU-4 IG-23 EM-10
Engine dieseling (Runs after ignition switch is turned off)	Incorrect ignition timing Engine overheating Carburetor problems <ul style="list-style-type: none"> <li>• Fuel cut solenoid faulty</li> <li>• Idle speed out of adjustment</li> <li>• Linkage sticking</li> </ul>	Reset ignition timing. Check cooling system. Repair, as necessary.	IG-23 CO-2 FU-2
Muffler explosion (after fire) during deceleration only.	TP system faulty	Check TP system.	EC-18
Muffler explosion (after fire) all the time.	Air cleaner clogged Choke system faulty Incorrect ignition timing Incorrect valve clearance	Check air cleaner. Check choke system. Reset ignition timing. Adjust valve clearances.	EM-7 FU-4 IG-23 EM-10

WN88E-EM003

# ENGINE MECHANICAL

Problem	Possible causes	Remedies	Page
Engine backfires.	<p>Insufficient fuel flow</p> <p>Incorrect ignition timing</p> <p>Incorrect valve clearances</p> <p>Carbon deposits in combustion chambers</p> <p>Vacuum leaks</p> <ul style="list-style-type: none"> <li>• Carburetor hoses</li> <li>• PCV hoses</li> <li>• Intake manifold</li> <li>• Brake booster line</li> </ul>	<p>Trouble shoot fuel system.</p> <p>Reset ignition timing.</p> <p>Adjust valve clearances.</p> <p>Inspect cylinder head.</p> <p>Repair, as necessary.</p> <p>Check carburetor hoses.</p> <p>Check PCV system.</p> <p>Check intake manifold.</p>	<p>FU-2</p> <p>IG-23</p> <p>EM-10</p> <p>EC-3</p> <p>EC-4</p>
Excessive oil consumption.	<p>Oil leaks</p> <p>PCV line clogged</p> <p>Piston rings worn or damaged</p> <p>Valve stems worn</p> <p>Valve stem oil seals worn or damaged</p>	<p>Repair, as necessary.</p> <p>Check PCV hose.</p> <p>Check piston rings. (Check compression)</p> <p>Check valves and guides.</p> <p>Replace oil seals.</p>	<p>EC-4</p> <p>EM-18</p>
Poor fuel economy	<p>Spark plugs faulty</p> <p>Incorrect ignition timing</p> <p>Low compression</p> <p>Air cleaner clogged</p> <p>Fuel leak</p> <p>Carburetor problems</p> <ul style="list-style-type: none"> <li>• Choke system faulty</li> <li>• Idle speed too high</li> <li>• Power valve always on</li> </ul> <p>Tires improperly inflated</p> <p>Clutch slipping</p> <p>Brakes dragging</p>	<p>Inspect spark plugs.</p> <p>Reset ignition timing.</p> <p>Check compression.</p> <p>Check air cleaner.</p> <p>Repair, as necessary.</p> <p>Repair, as necessary.</p> <p>Inflate tires to proper pressure.</p> <p>Trouble shoot clutch.</p> <p>Trouble shoot brakes.</p>	<p>IG-6</p> <p>IG-22</p> <p>EM-18</p> <p>EM-7</p> <p>FU-2</p>
Unpleasant odor	<p>Incorrect idle speed</p> <p>Incorrect ignition timing</p> <p>Vacuum leaks</p> <ul style="list-style-type: none"> <li>• PCV line</li> <li>• Intake manifold</li> <li>• Carburetor hoses</li> <li>• Brake booster line</li> </ul> <p>Charcoal canister faulty</p> <p>Fuel filler cap faulty</p> <p>Outer vent valve faulty</p> <p>BVSV faulty</p>	<p>Adjust idle speed.</p> <p>Reset timing</p> <p>Repair, as necessary.</p> <p>Check PCV system.</p> <p>Check intake manifold.</p> <p>Check carburetor hoses.</p> <p>Check brake booster.</p> <p>Check charcoal canister.</p> <p>Check fuel filler cap.</p> <p>Check outer vent valve.</p>	<p>EM-13</p> <p>IG-23</p> <p>EC-4</p> <p>EC-3</p> <p>MA-7</p> <p>EC-10</p> <p>EC-12</p> <p>EC-12</p>

WN88E-EM004

## TROUBLE SHOOTING (HD-E ENGINE)

Problem	Possible causes	Remedies	Page
Engine overheats.	Cooling system faulty. Incorrect ignition timing.	Trouble shoot cooling system. Reset timing.	CO-2 IG-23
Engine will not crank or cranks slowly.	Starting system faulty. Charging system faulty	Trouble shoot starting system. Trouble shoot charging system.	ST-2 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> </ul> Spark plugs faulty Resistive cords disconnected or faulty. Low compression. 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> EFI system malfunctioning	Inspect ignition coil. Inspect igniter. Inspect distributor. Inspect plugs. Inspect cords. Check compression. Repair, as necessary. Trouble shoot EFI system.	IG-2 IG-8 IG-10 IG-6 IG-5 EM-18 EF-74 EF-2
Rough idle/Engine stalls or misses.	Spark plugs faulty. Resistive cords faulty. Ignition problem. <ul style="list-style-type: none"> <li>• Ignition coil</li> <li>• Igniter</li> <li>• Distributor</li> </ul> Incorrect ignition timing Incorrect valve clearance Low compression Incorrect idle speed Vacuum leaks. <ul style="list-style-type: none"> <li>• Throttle body</li> </ul> EFI system malfunctioning	Inspect plugs. Inspect cords. Inspect ignition coil. Inspect igniter Inspect distributor. Reset timing. Adjust valve clearance Check compression. Adjust idle speed. Check throttle body. Repair, as necessary.	IG-6 IG-5 IG-8 IG-10 IG-23 EM-10 EM-18 EM-13 EF-97 EF-4
Idle speed is too high.	Fuel line clogged Air suction <ul style="list-style-type: none"> <li>• Intake manifold</li> <li>• Vacuum hose disconnected</li> </ul> <ul style="list-style-type: none"> <li>• Throttle body</li> </ul> EFI system malfunctioning Incorrect idle speed.	Check fuel line. Check intake manifold. Check vacuum hose for proper piping. Check throttle body. Trouble shoot EFI system. Adjust idle speed.	EF-8 EC-15 EF-97 EF-4 EM-13

WN88E-EM005

# ENGINE MECHANICAL

Problem	Possible causes	Remedies	Page
Engine hesitates/Poor acceleration	Spark plugs faulty Resistive cords faulty. Incorrect ignition timing. Incorrect valve clearances. Low compression. Fuel system clogged. Air cleaner clogged. Engine overheats. Air leakage • Throttle body Emission control system malfunctioning (cold engine) EFI system malfunctioning	Inspect plugs. Inspect cords. Reset timing. Adjust valve clearances. Check compression. Check fuel system. Check air cleaner. Check cooling system. Check throttle body. Repair as necessary. Repair, as necessary.	IG-6 IG-5 IG-23 EM-10 EM-18 EF-74 EM-7 CO-2 EF-97 EC-13 EF-4
Engine dieseling (Runs after ignition switch is turned off.)	EFI system malfunctioning Incorrect ignition timing.	Repair, as necessary. Reset timing.	EF-4 IG-23
Muffler explosion (after fire) during deceleration only	Incorrect ignition timing. Incorrect valve clearance. Air cleaner clogged. EFI system malfunctioning	Reset timing. Adjust valve clearance. Check air cleaner. Repair, as necessary.	IG-23 EM-10 EM-7 EF-4
Engine backfires.	Incorrect ignition timing. Incorrect valve clearances. EFI system malfunctioning	Reset timing. Adjust valve clearance. Repair, as necessary.	IG-23 EM-10 EF-4
Excessive oil consumption.	Oil leak. PCV line clogged. Piston rings worn or damaged. Valve stems worn. Valve stem oil seals worn or damaged.	Repair, as necessary. Check PCV hose. Check rings. Check valves and guides. Replace oil seal.	EC-14 EM-18
Poor fuel economy	Spark plugs faulty. Incorrect ignition timing. Low compression. Air cleaner clogged. Fuel leak. Tires improperly inflated Clutch slipping Brakes dragging EFI system malfunctioning	Inspect spark plugs. Reset timing. Check compression. Check air cleaner. Repair, as necessary. Inflate tires to specified pressure. Trouble shoot clutch. Trouble shoot brakes. Repair, as necessary.	IG-6 IG-23 EM-18 EM-7 EF-4
Unpleasant odor	Incorrect idle speed Incorrect ignition timing Vacuum leaks • PCV line • Intake manifold • Throttle body EFI system malfunctioning	Adjust idle speed. Reset ignition timing. Check PCV system. Check intake manifold. Check throttle body. Repair, as necessary.	EM-13 IG-23 EC-14 EF-97 EF-4

WN88E-EM006

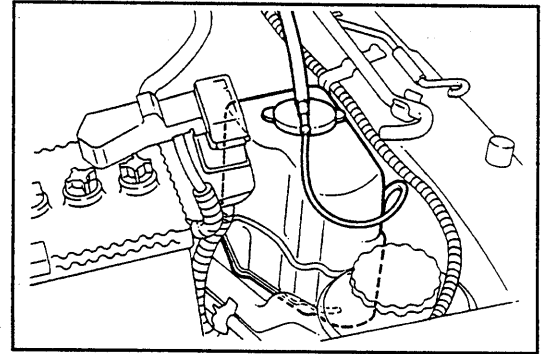
## ENGINE TUNE-UP

### 1. Inspection of engine coolant level

(See page CO-2.)

Cooling water capacity: 5.5 liters  
(6.3 liters for tropical spec.)

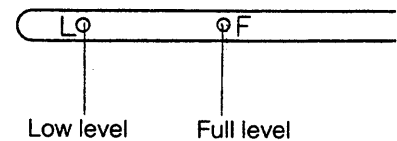
[Excluding 1.0 liter for reservoir tank]



WN88E-EM008

### 2. Inspection of engine oil level

(See page LU-2.)

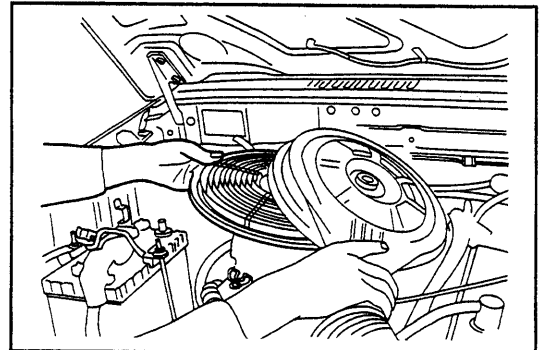


WN88E-EM009

### 3. Inspection of air filter element

[HD-C engine]

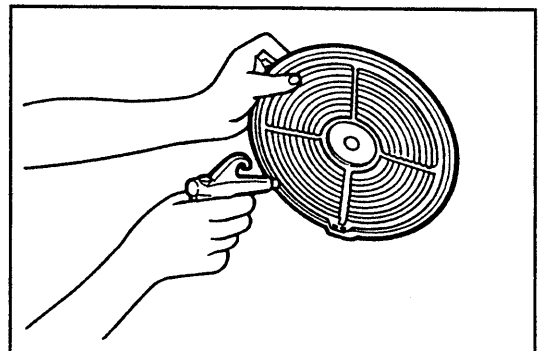
1. Remove the air filter element from the air cleaner case.
2. Visually check that the air filter element is not excessively dirty, damaged or oiled.  
Replace the air filter element, if necessary.



WN88E-EM010

3. Clean the element with compressed air.  
First, blow compressed air from the back side of the element thoroughly. Then, blow off the upper side of the element.  
**CAUTION:**  
The air pressure to be used for this cleaning operation should not exceed  $4.0 \text{ kg/cm}^2$  (56.9 psi).

Replace the air filter element, if necessary.

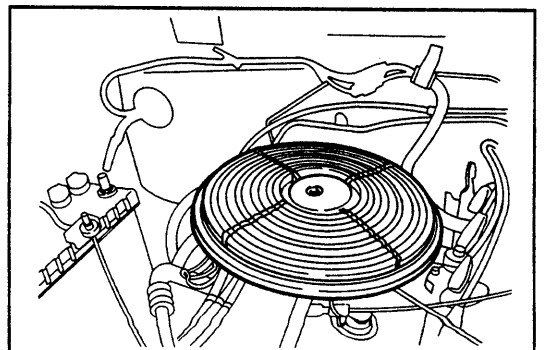


WN88E-EM012

4. Install the air cleaner filter element in the air cleaner case.

**NOTE:**

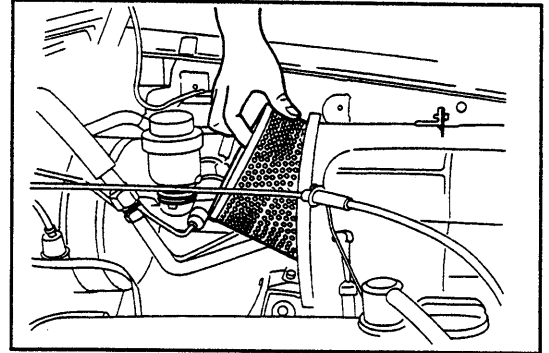
The air filter element has the correct installation direction to be observed. Turn the air filter element so that the element may be fitted securely in the air cleaner case.



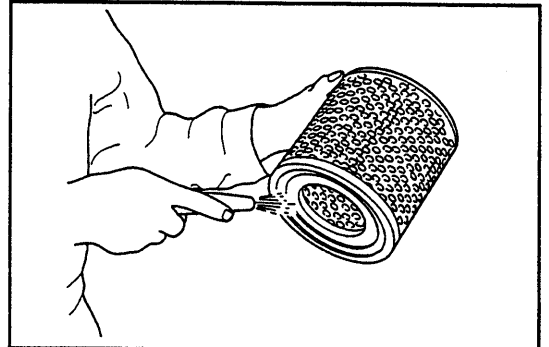
WN88E-EM013

## [HD-E engine]

1. Removal of the air filter element from the air cleaner case
  - 1) Unlock the air cleaner caps at the three points.
  - 2) Remove the air filter element installing nut, then remove the air filter element.
2. Visually check that the air filter element is not excessively dirty, damage or oil.  
Replace the air filter element, if necessary.

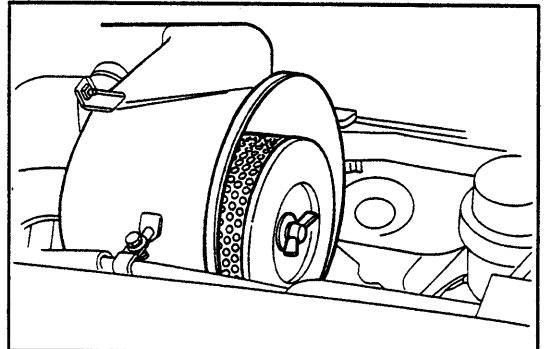


3. Clean the element with compressed air.  
First, blow compressed air from the back side of the element thoroughly. Then, blow off the upper side of the element.  
**CAUTION:**  
The air pressure to be used for this cleaning operation should not exceed 4.0 kg/cm<sup>2</sup> (56.9 psi).

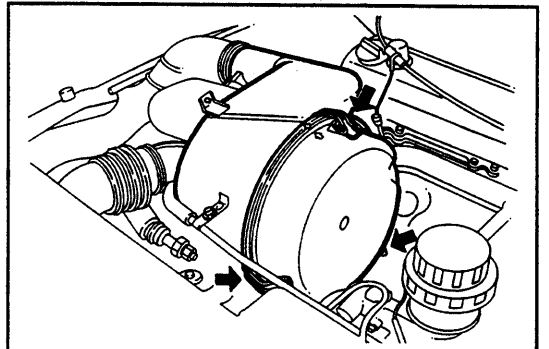


Replace the air filter element, if necessary.

4. Install the air cleaner filter element in the air cleaner case using the installing nut.

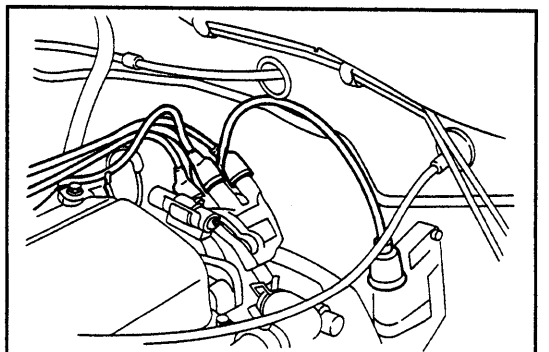


5. Lock the air cleaner caps at the three points.



## 4. Inspection of spark plug cords and distributor cap

Visually inspect the resistive cords for loose connection, deterioration, cracks or other damage. Also, visually inspect the distributor cap for cracks. Securely connect or replace the parts, as required.



## 5. Battery inspection

(See page CH-4.)

## 6. Inspection of spark plugs

(See page IG-8.)

### Recommended spark plugs

Make	Type
Nippon Denso	K20PR-U11
NGK	BKR6E-11
CHAMPION	RC9YC4

## 7. 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.

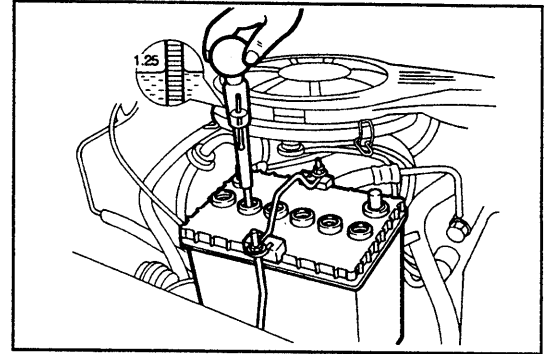
### 1. Removal of cylinder head cover

(1) Detach the resistive cords from the clamps.

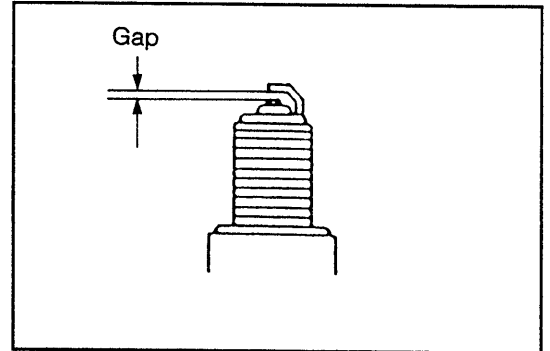
### NOTE:

Be sure to hold the rubber boot during the resistive cord disconnection. Never remove the resistive cord, holding the cord portion.

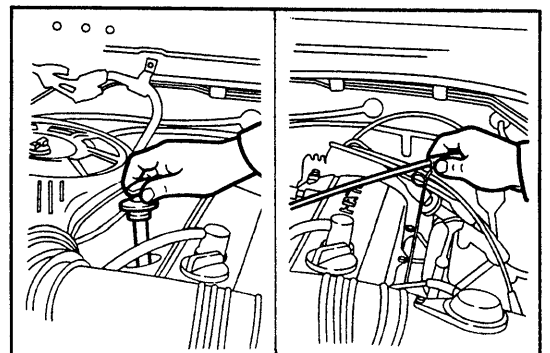
(2) Detach the acceleration cable from the cable clamp.  
(L.H.D unit only)



WN88E-EM018

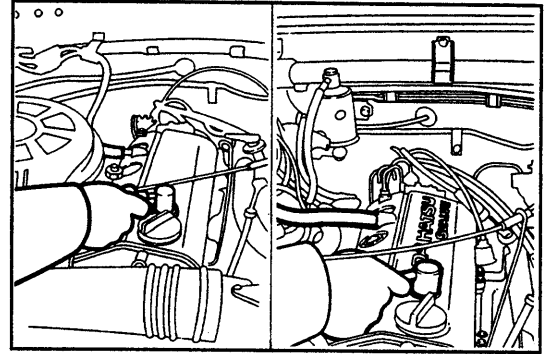


WN88E-EM020



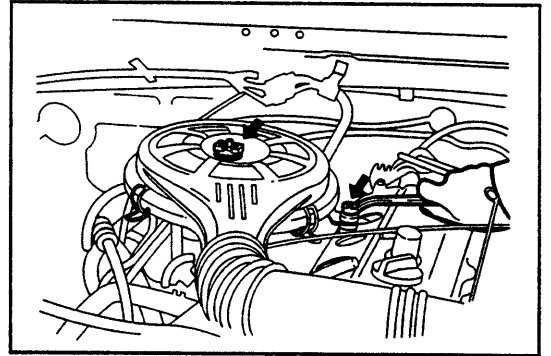
WN88E-EM022

- (3) Disconnect the blow-by gas hoses from the cylinder head cover.



WN88E-EM023

- (4) Remove the installing bolt and nut from the air cleaner case. (HD-C engine only)

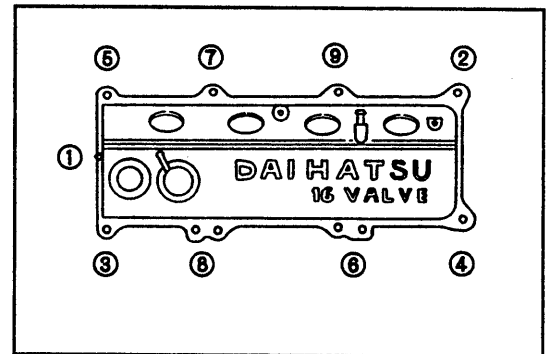


WN88E-EM024

- (5) 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 very careful not damage the grommets of the spark plug tubes.



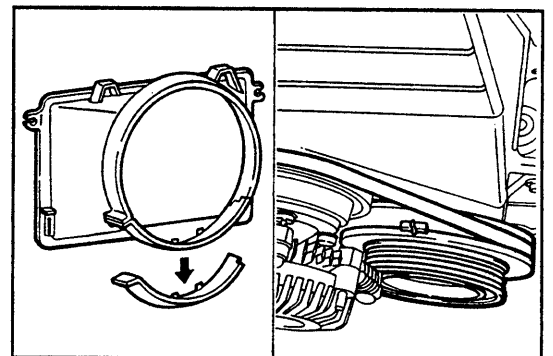
WN88E-EM025

**2. 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.

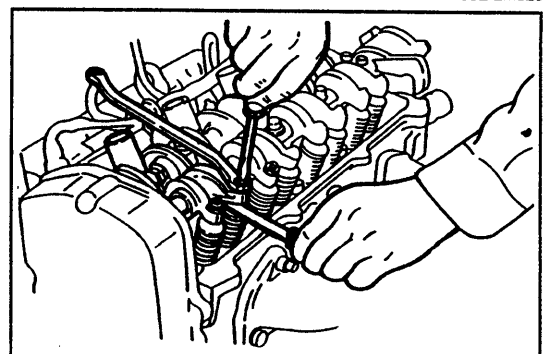
**NOTE:**

1. On the power steering-equipped vehicle, turn it's pulley while pushing the drive belt.
2. On the air conditioner-equipped vehicle, turn the crankshaft pulley from the underside of the vehicle with the fan lower shroud in a removed state



WN88E-EM026

- (2) Check to see if the valve rocker arms of the No.1 cylinder are free or are being pushed up. According to the table below, check and/or adjust the valve clearances, using a thickness gauge. The "O" mark denotes those valves that can be adjusted under that setting.



WN88E-EM027



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

**Valve clearances (Hot)**

Intake:  $0.25 \pm 0.05$  mm ( $0.0098 \pm 0.0020$  inch)

Exhaust:  $0.33 \pm 0.05$  mm ( $0.0130 \pm 0.0020$  inch)

**(Reference)**

**Valve clearances (Cold)**

Intake: 0.18 mm (0.0071 inch)

Exhaust: 0.25 mm (0.0098 inch)

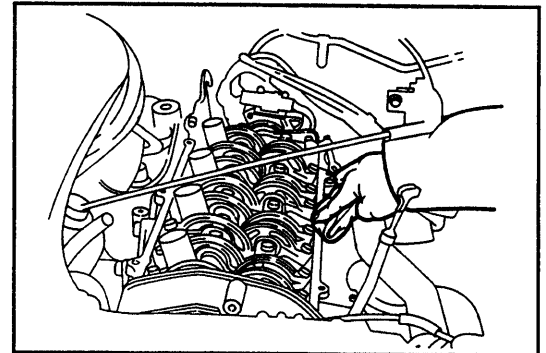
WN88E-EM028

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

WN88E-EM029

**3. Installation of cylinder head cover**

(1) Wipe off the oil from the gasket surface of the cylinder head cover.



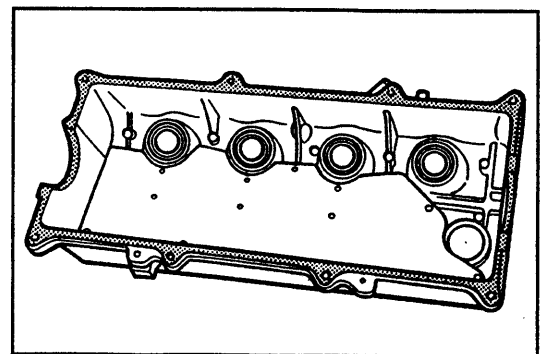
WN88E-EM030

(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.

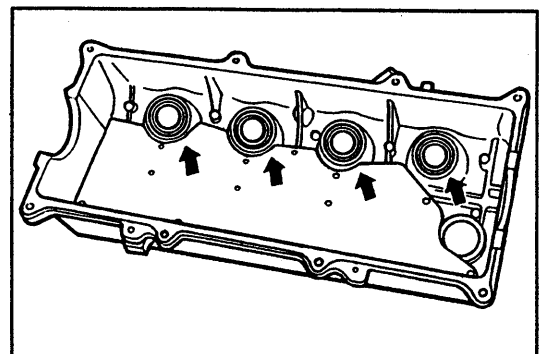


WN88E-EM031

(3) Check the rubber grommets of the spark plug tubes for evidence of damage.

Replace the rubber grommets, as required.

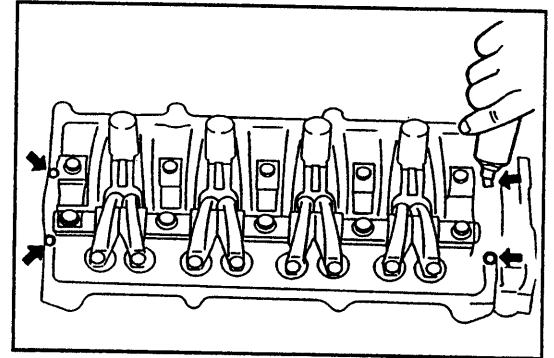
(See page EM-68.)



WN88E-EM032

# ENGINE MECHANICAL

- (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.

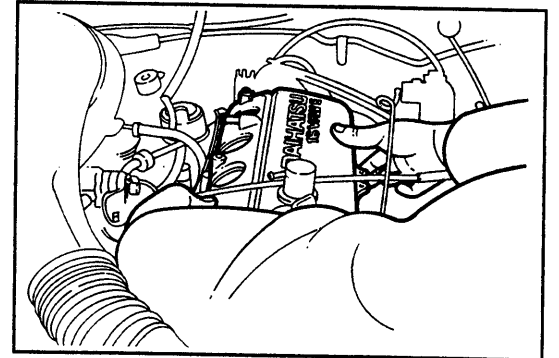


WN88E-EM033

- (5) Install the cylinder head cover on the cylinder head.

**NOTE:**

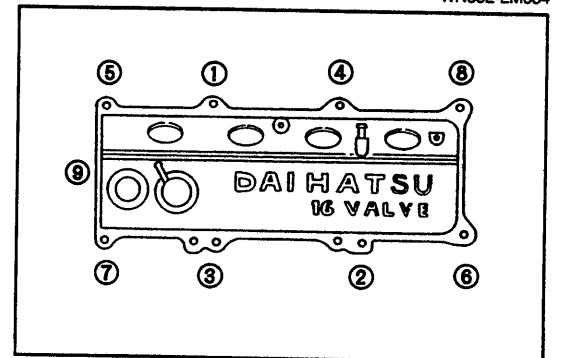
- Be very careful not to damage the rubber grommets for spark plugs during the cover installation.
- Make sure that the rubber grommet is fitted over the spark plug tube.



WN88E-EM034

- (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.

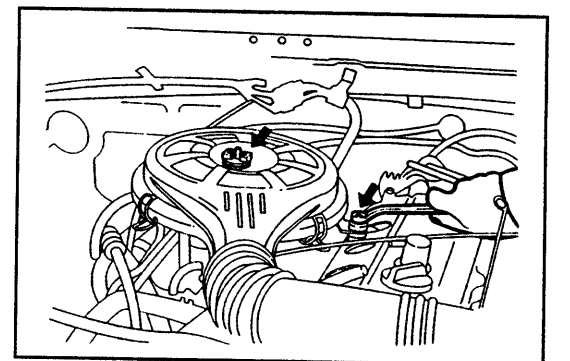
**Tightening Torque:** 0.3 - 0.5 kg-m (2.2 - 3.6 ft-lb)



WN88E-EM035

- (7) Tighten the timing belt cover attaching bolts.

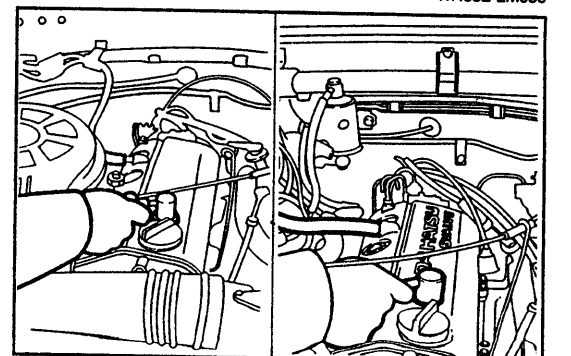
**Tightening Torque:** 0.2 - 0.4 kg-m (1.4 - 2.9 ft-lb)



WN88E-EM036

- (9) Connect the blow-by gas hoses to the cylinder head.

- (10) Attach the acceleration cable into the cable clamp.



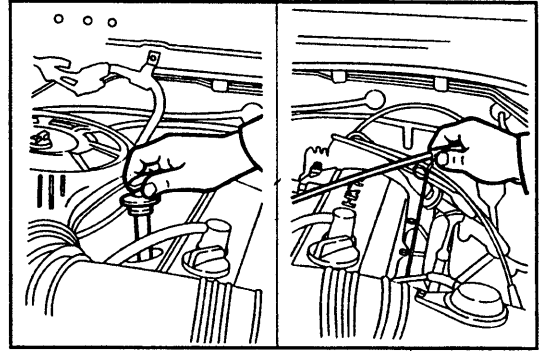
WN88E-EM037

(11) Install the resistive cords to the cylinder head.

**NOTE:**

- Be sure that the resistive cord is connected securely to each spark plug.
- Care should be exercised not to damage the resistive cord with the spark plug tube.
- Be sure that the resistive cord is connected securely to accelerator cable clamp.

(Only for L.H.D. carburetor-equipped vehicles)



WN88E-EM038

(12) Start the engine. Ensure that the engine exhibits no trouble, such as oil leakage.

**NOTE:**

If the engine exhibits any troubles, repair them depending on the situation.

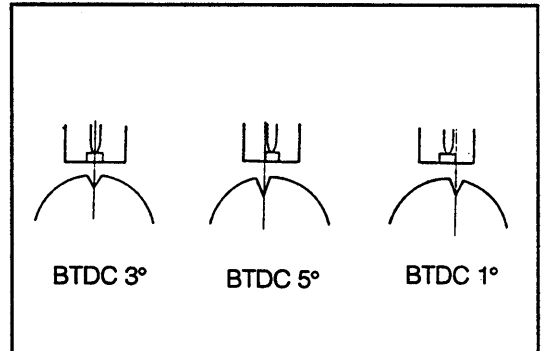
WN88E-EM039

**8. Inspection of Ignition timing**

Ignition timing	$3^{\circ} \pm 2^{\circ} / 1000 \text{ rpm}$ or less
-----------------	--

**NOTE:**

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



WN88E-EM040

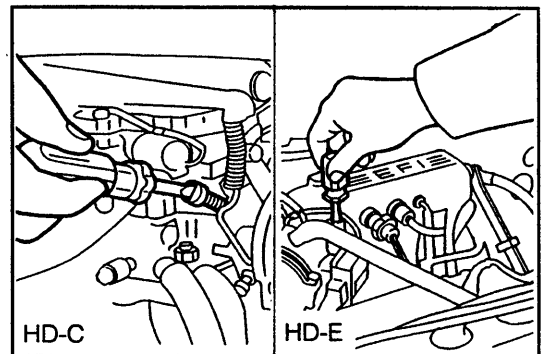
**9. Idle speed adjustment**

(See page MA-9)

**Engine Idle Speed**

HD-C engine:  $850 \pm 50 \text{ rpm}$

HD-E engine:  $850 \pm 50 \text{ rpm}$



WN88E-EM041

## 10. Fast idle speed check

### [HD-C engine]

#### Preparation to be made prior to fast idle check

- All accessory switches are turned OFF.  
On those vehicles equipped with a day-lamp system, set the lamp control switch to the first stage.
- The air cleaner element is installed.
- All vacuum hoses are connected.
- Ensure that the intake system exhibits no air leakage.
- Ensure that the exhaust system exhibits no air leakage.

#### NOTE:

- HD-C engine is mounted with automatic choke carburetor. Therefore, perform the engine fast idle check while the engine is cold.

- (1) Connect the tachometer to the engine with SST.

SST: 09991-87703-000

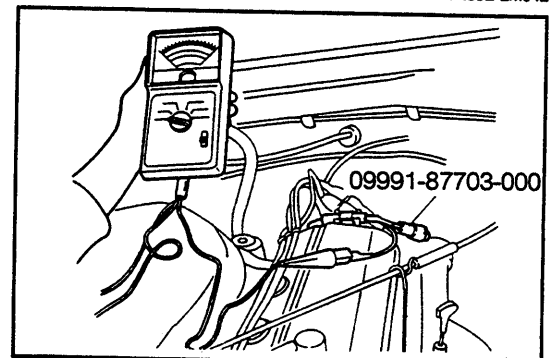
(See page MA-8)

- (2) Check to see if the fast idle speed sets within the specified value.

#### REFERENCE:

Engine Fast Idle Speed:

1,300 - 2,000 rpm at 22 - 28°C



WN88E-EM042

WN88E-EM043

## 11. Throttle positioner check

(See page MA-10)

### [HD-C engine]

Dashpot touch revolution speed: 1500 ± 50 rpm

Specified time: 0.5 - 5 seconds.

### [HD-E engine]

Dashpot touch revolution speed: 1800 ± 100 rpm

Specified time: 1 - 5 seconds

WN88E-EM044

## 12. Check and adjustment of CO/HC concentrations

### [HD-C engine]

- Warm up the engine thoroughly.
- All accessory switches are turned OFF.  
On those vehicles equipped with a day-lamp system, set the lamp control switch to the first stage.
- The air cleaner element is installed.
- All vacuum hoses are connected.
- Ensure that the intake system exhibits no air leakage.
- Ensure that the exhaust system exhibits no air leakage.

### CO adjustment

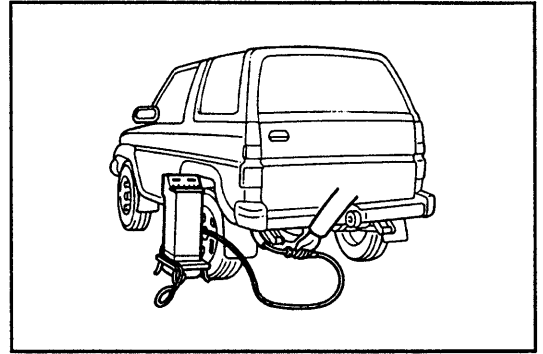
1. Adjust the idle speed.  
(See page EM-9)
2. Race the engine until its speed reaches 2000 rpm.

WN88E-EM045

3. Measure the CO concentration at the idle speed. Check to see if the CO concentration conforms to the specification.

**Specified CO Concentration:  $1.5 \pm 0.5\%$**

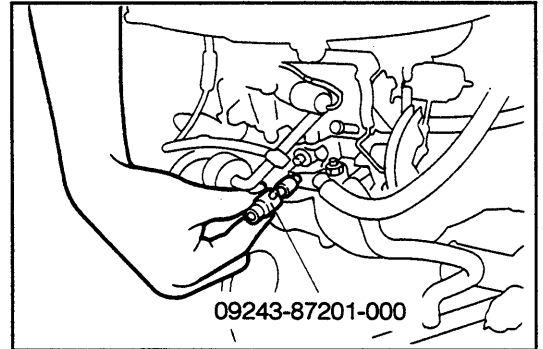
If the measured concentration fails to conform to the specification, perform the adjustments described in the step 4. onward.



WN88E-EM046

4. Using the following SST, gradually turn the mixture adjusting screw so that the CO concentration may conform to the specification.

**SST: 09243-87201-000**



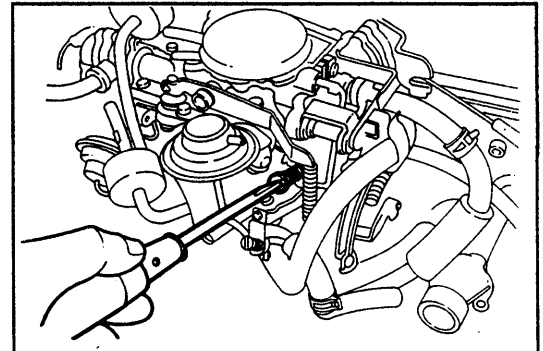
09243-87201-000

WN88E-EM047

5. Turn the throttle adjusting screw so that the idle speed may become the specified speed.

6. Measure the CO concentration. Check to see if the CO concentration conforms to the specification.

If the repeated adjustments will not get the conformity to the specification, carry out the trouble shooting in accordance with the table below.



WN88E-EM048

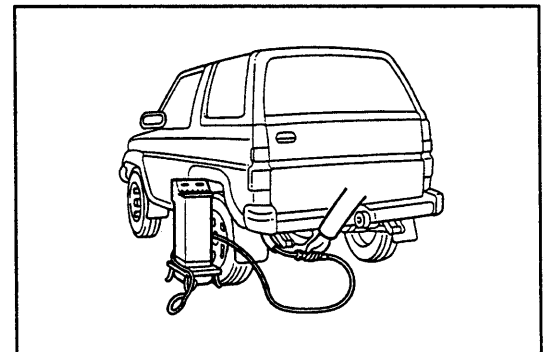
**HC adjustment**

1. Adjust the idle speed.  
(See page MA-9.)
2. Measure the HC concentration at the idle speed. Check to see if the HC concentration conforms to the specification.

**Specified CO Concentration:**

**Not to Exceed 1000 PPM**

If the measured concentration fails to conform to the specification, carry out the trouble shooting in accordance with the following tables.



WN88E-EM049

# ENGINE MECHANICAL

## POSSIBLE CAUSES FOR IMPROPER CO/HC CONCENTRATIONS

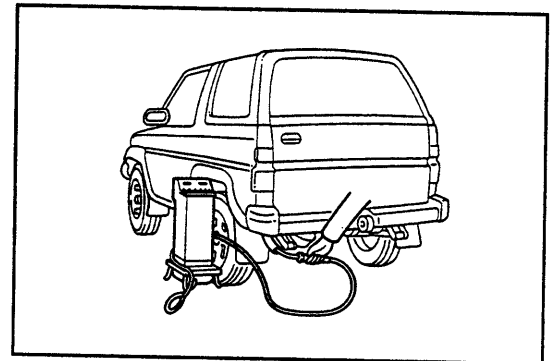
Possible cause	Item	CO concentration	HC concentration	Remarks
Ignition timing			○	
Valve clearances			○	
Improper valve seating			○	Compression pressure
Ignition system problems Spark plugs Resistive cord Distributor Ignition coil		○	○	
Air leakage in intake system		○	○	
ITC valve malfunctioning		○	○	
Great mechanical loss of engine inner parts		○	○	

WN88E-EM050

### [HD-E engine]

#### NOTE:

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



WN88E-EM051

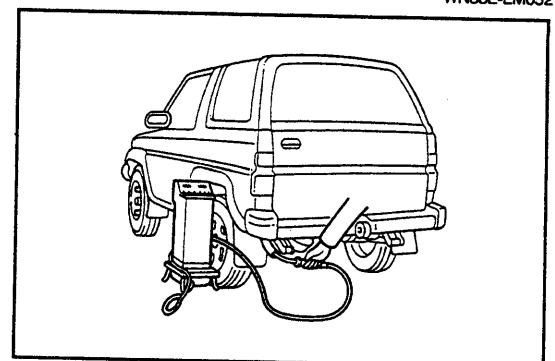
### Initial conditions

1. Air filter element installed.
2. All accessories turned OFF.
3. All vacuum lines connected.
4. All pipes and hose of air intake system connected.
5. Ignition timing set correctly.
6. Warm up engine thoroughly.
7. Ensure that the exhaust system exhibits no gas leakage.
8. Ensure that the intake system exhibits no air leakage.
9. Tachometer and HC/CO meter at hand and calibrated.
10. Ensure that the engine idle speed is the specified speed.

### Measurement

1. Insert the HC/CO testing probe into the tail pipe at least 400 mm (15.7 inch).
2. Measurement of HC/CO concentrations at idle speed  
Wait at least one minute before the measurement so as to allow the concentrations to stabilize.  
Complete the measurement within three minutes.  
If the HC/CO concentrations do not conform to the regulations, see the following table for possible causes.

WN88E-EM052



WN88E-EM053

**Trouble Shooting**

HC	CO	Problems	Possible causes
High	Normal	Rough idle	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> 2. Incorrect valve clearance 3. Leaky exhaust valves 4. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 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 ECU</li> <li>• Faulty Oxygen sensor</li> </ul>

WN88E-EM054

**13. 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.

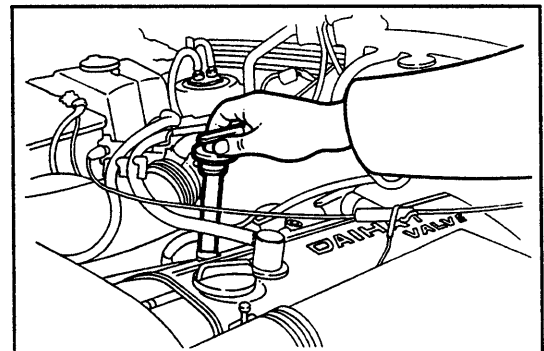
1. Warm up the engine thoroughly.
2. Turn OFF the ignition key switch.

3. Removal of spark plugs
  - (1) Remove the resistive cords from the clamp.
  - (2) Disconnect the resistive cord at spark plug side.

**NOTE**

Be sure to hold the rubber boot during the resistive cord disconnection. Never remove the resistive cord, holding the cord portion.

WN88E-EM055



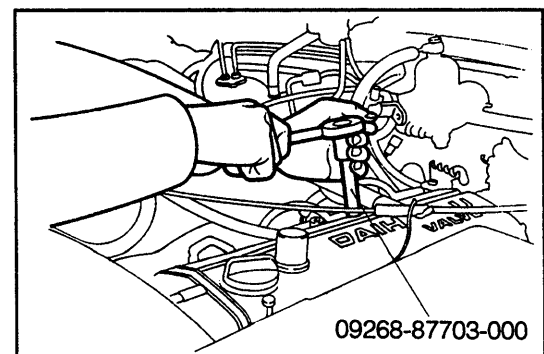
WN88E-EM056

- (3) Remove the spark plugs, using the following SST Plug wrench (16 mm).

**WARNING:**

Be very careful not to burn yourself.

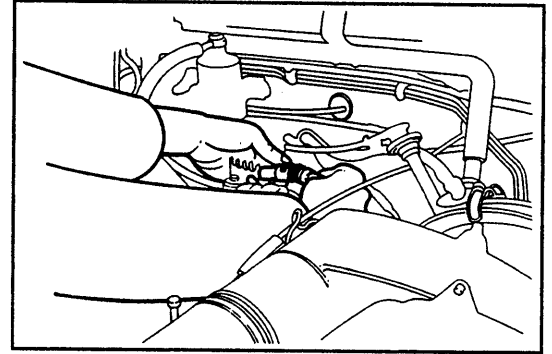
SST: 09268-87703-000



09268-87703-000

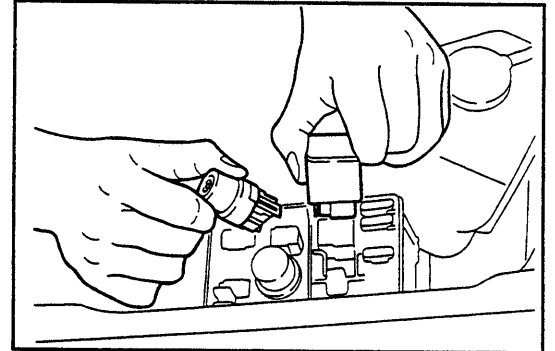
WN88E-EM057

(4) Disconnect the distributor connector.



WN88E-EM058

(5) Pull out the injector relay and fuel pump relay from the relay block.  
(HD-E engine only)



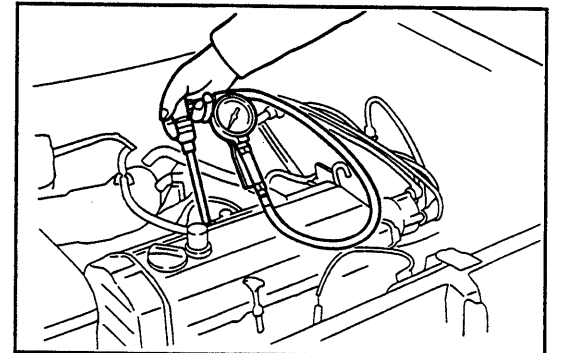
WN88E-EM059

(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.



WN88-EM060

**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:

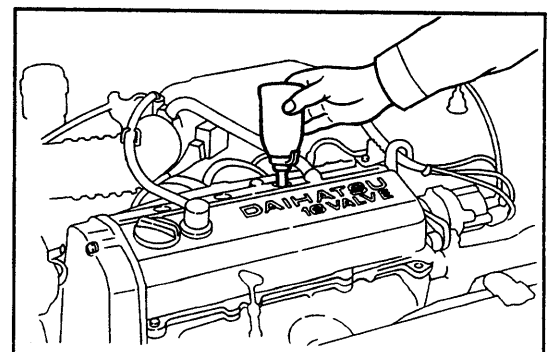
10.5 kg/cm<sup>2</sup>/at 300 rpm (149.4 psi/at 300 rpm)

Difference between cylinders:

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

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.

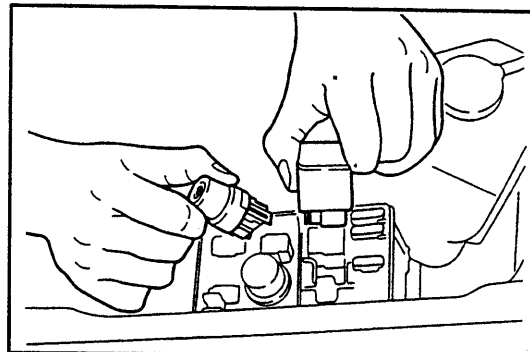


WN88E-EM061

WN88E-EM062

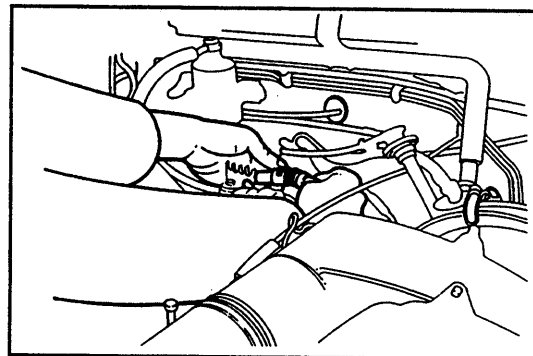


- (7) Install the injector relay and fuel pump relay to the relay block.  
(HD-E engine only)



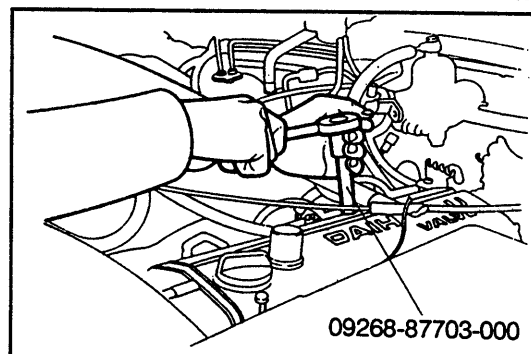
WN88E-EM063

- (8) Connect the distributor connector



WN88E-EM064

- (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)



09268-87703-000

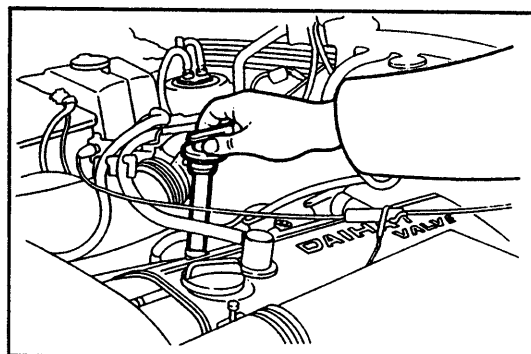
WN88E-EM065

- (10) Connect the resistive cord.

**NOTE:**

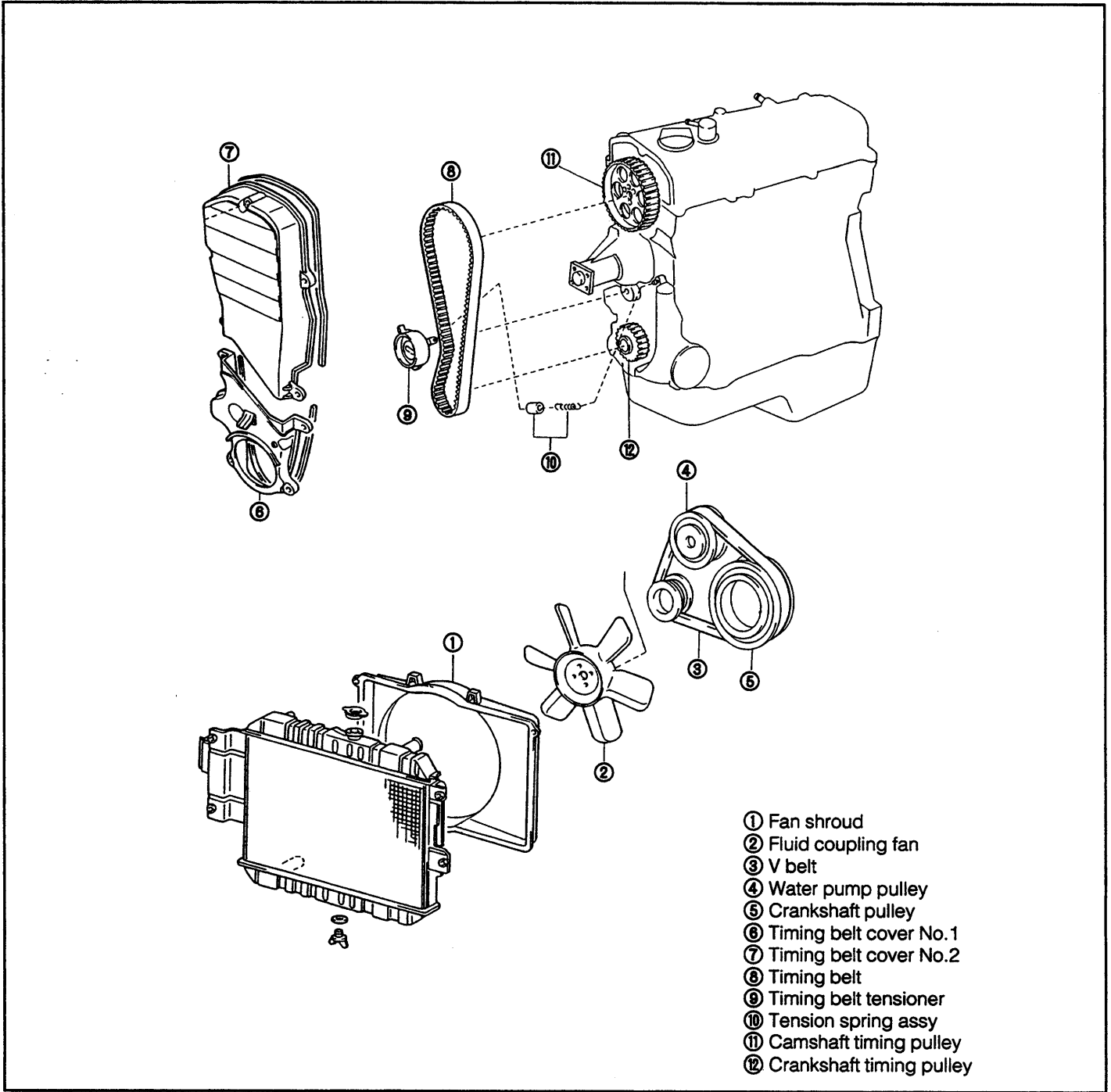
- Be sure that the resistive cord is connected securely to each spark plug.
- Care should be exercised not to damage the resistive cord with the spark plug tube.

- (11) Attach the resistive cord to the clamp.



WN88E-EM066

**TIMING BELT COMPONENTS**



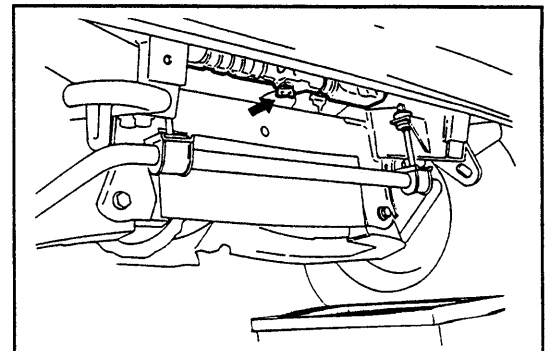
WN88E-EM067

**REMOVAL OF TIMING BELT**

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

**WARNING:**

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

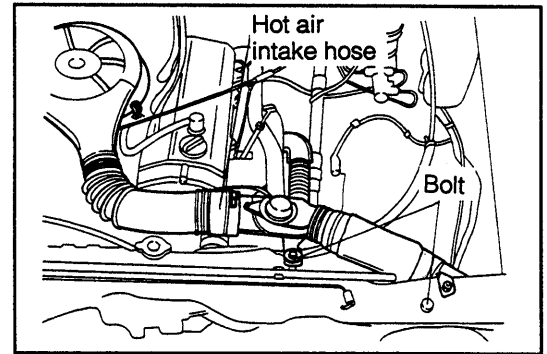


WN88E-EM068

### 3. Removal of air cleaner hose

Carburetor-equipped vehicle

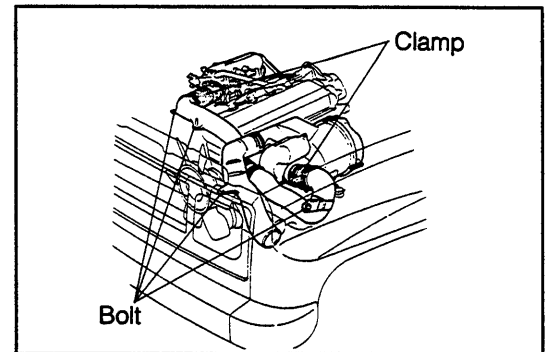
- (1) Remove the air cleaner hose from the air cleaner case by removing the two bolt and one clamp.
- (2) Disconnect the vacuum motor hose and hot air intake hose (except for GCC specification).
- (3) Remove the reserve tank.



WN88E-EM069

EFI-equipped vehicle

- (1) Remove the air cleaner pipe sub-assy and cool air intake duct by removing three clamps and four bolts.
- (2) Remove the two vacuum hose for idle-up and for power steering.
- (3) Remove the reserve tank.



WN88E-EM070

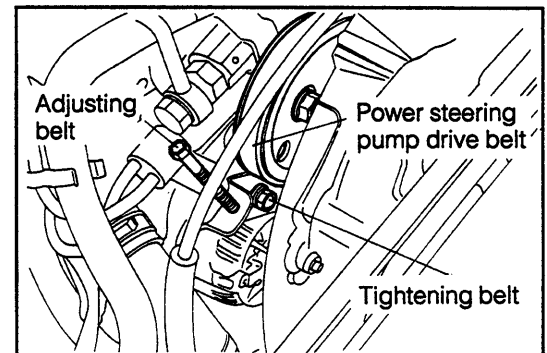
### 4. Removal of drive belt of power steering pump.

(Only power steering-equipped vehicle)

- (1) Loosen the adjusting bolt and the two tightening bolt. Then, pull down the pump.
- (2) Remove the drive belt.

### 5. Removal of the air conditioner drive belt.

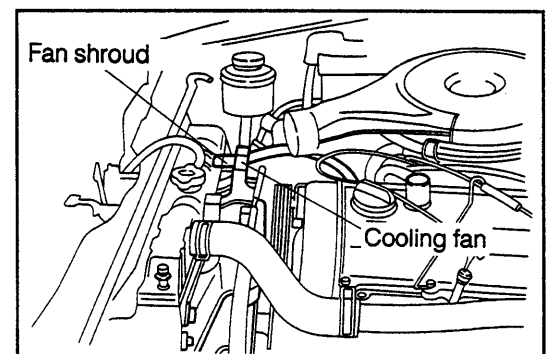
(Only air conditioner-equipped vehicle)



WN88E-EM071

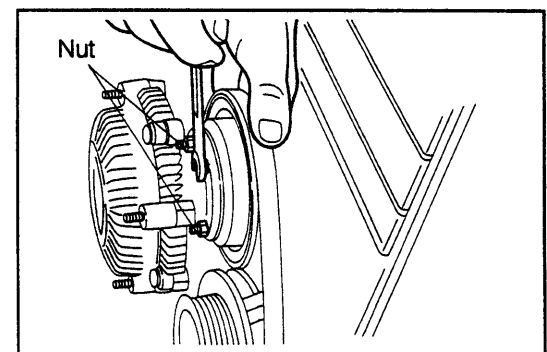
### 6. Removal of fluid coupling and fan shroud

- (1) Remove the two clamps for clutch cable on the fan shroud.
- (2) Disconnect the water hose from the radiator upper tank.



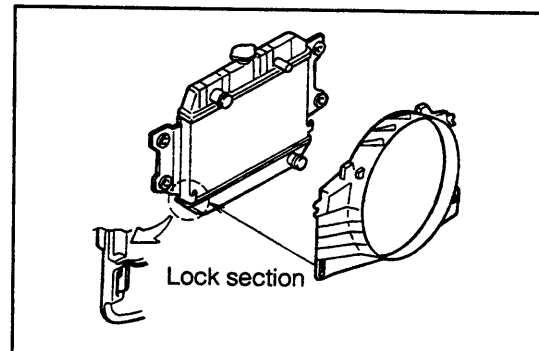
WN88E-EM072

- (3) Remove the fluid coupling with fan from water pump pulley by removing four nuts.



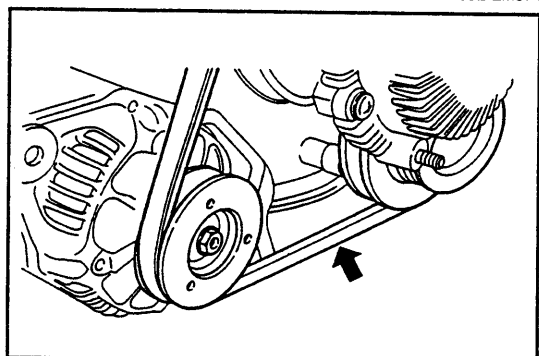
WN88E-EM073

- (4) Remove the two attaching bolts of the fan shroud. Then, Remove the lock section of fan shroud from radiator by pulling up the fan shroud.
- (5) Remove the fan shroud together with fluid coupling with fan.



WN88E-EM074

7. Loosen the alternator pulley adjusting bolt. Then, remove the V belt and water pump pulley.



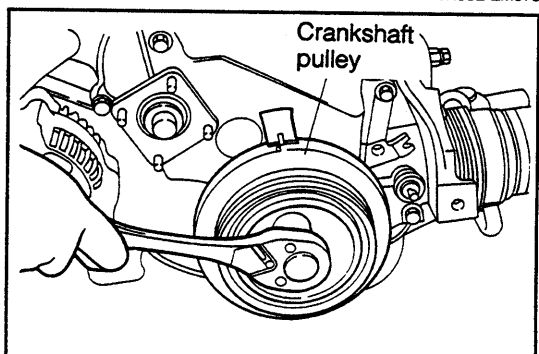
WN88E-EM075

## 8. Removal of crankshaft pulley

- (1) Rotate the crankshaft pulley until the top dead center of the piston of cylinder No. 1.

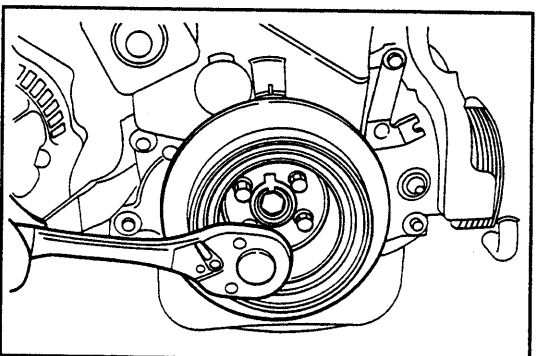
### NOTE:

Make sure that the ignition timing mark on the crankshaft pulley comes at a point of the indicator on the timing belt cover. Then, make sure that exhaust valve rocker is fully. If the valve rocker is not fully, turn the crankshaft one more turn.



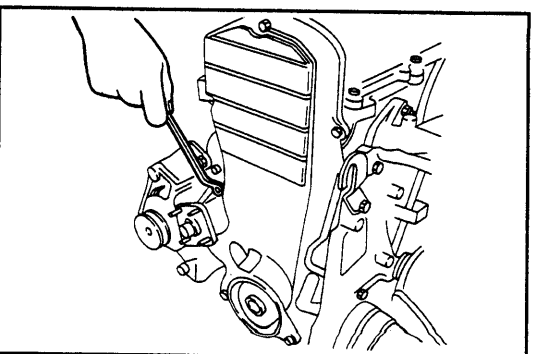
WN88E-EM076

- (2) Prevent the crankshaft from being rotated by placing the gear shift lever in the 5th gear position, and pull the parking break lever. Then, remove crankshaft pulley by loosening of four bolts.



WN88E-EM077

- (3) Remove the timing belt cover No. 1 and No. 2 by loosening of eight bolts.



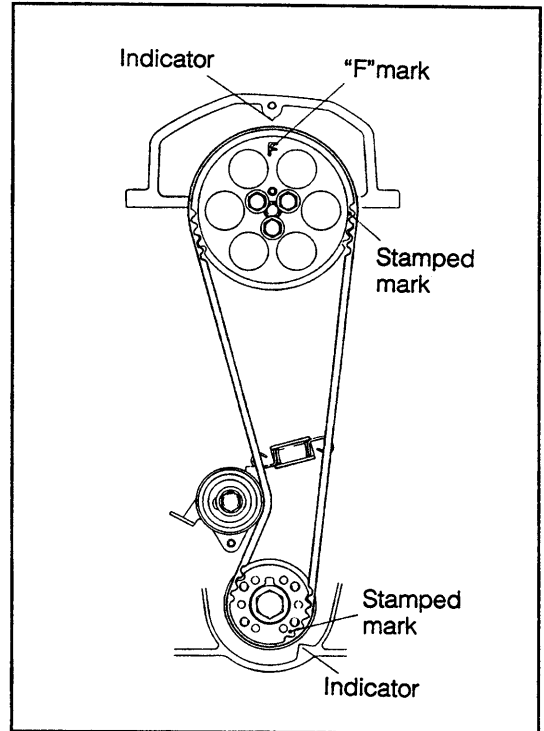
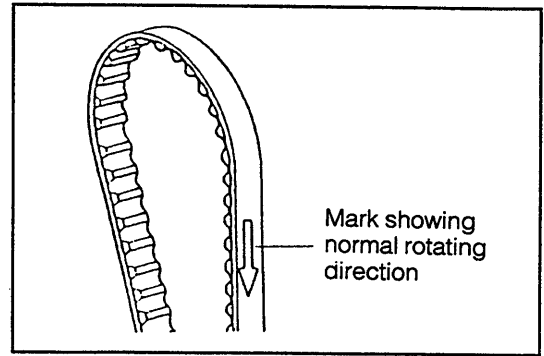
WN88E-EM078

## 9. Removal of timing belt

### NOTE:

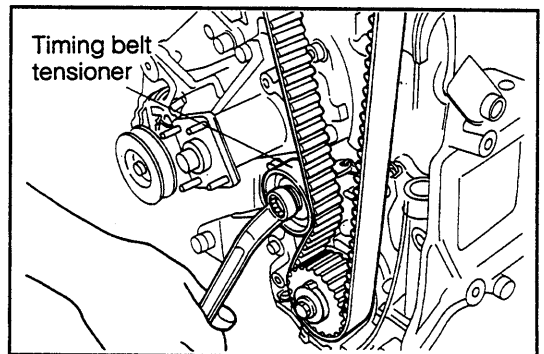
Prior to removal of the timing belt, put an arrow mark indicating the normal rotating direction on the belt, using a chalk or the like, when the belt is used again.

- (1) Rotate the crankshaft until the "F" mark of the crankshaft timing belt pulley is aligned with the indicator of the cylinder head cover, if the "F" mark comes not up to the indicator.



WN88E-EM079

- (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.



WN88E-EM080

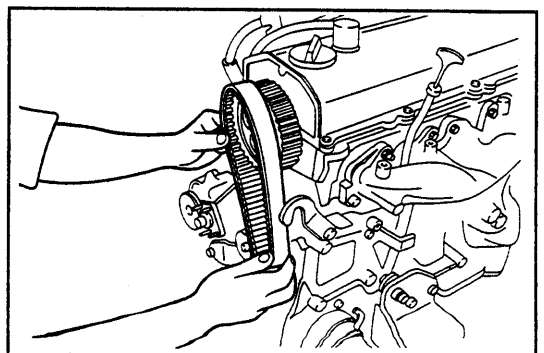
- (3) Remove the timing belt.

### CAUTION:

- Be careful not to damage the belt by using a screw driver or like during the removal or installation.
- Do not bend the belt at a sharp angle or turn the belt inside out, for it is very vulnerable to bending.
- Do not allow the belt to come into contact with oil, water or dust.

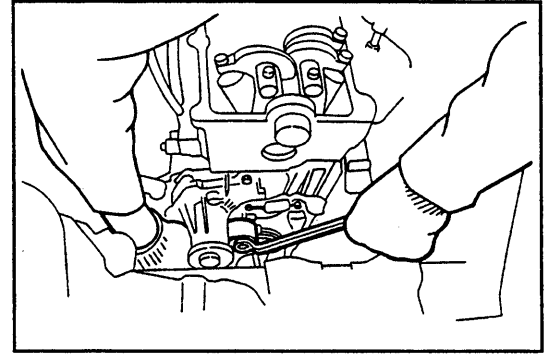
### NOTE:

It is possible to remove the timing belt until above steps.



WN88E-EM081

10. Remove setting bolt.  
Remove timing belt tensioner sub-assy.



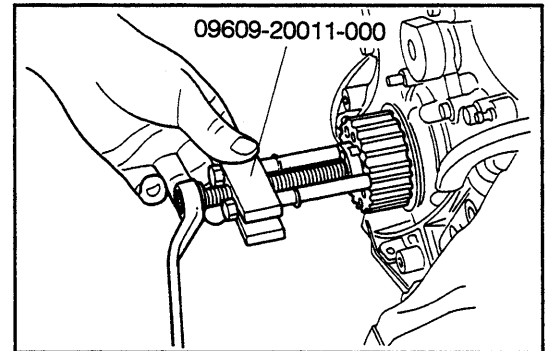
WN88E-EM082

11. Remove the crankshaft timing belt pulley and pulley flange by removing pulley bolt.

**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



WN88E-EM083

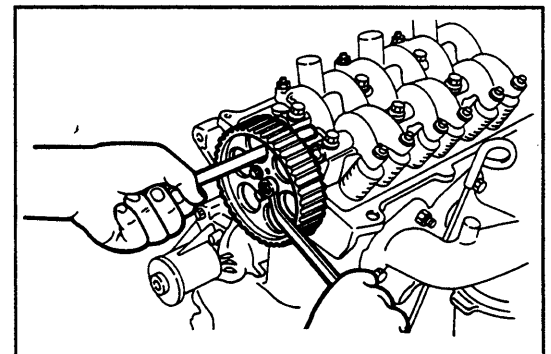
12. Removal of camshaft timing belt pulley

- (1) Remove the cylinder head cover.
- (2) Loosen the attaching bolt of the camshaft timing belt pulley.

**NOTE:**

While preventing the camshaft timing belt pulley from turning using a suitable iron bar.

- (3) Remove the camshaft timing belt pulley.



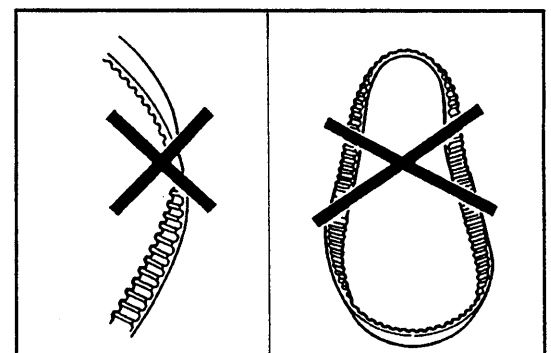
WN88E-EM084

## 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.

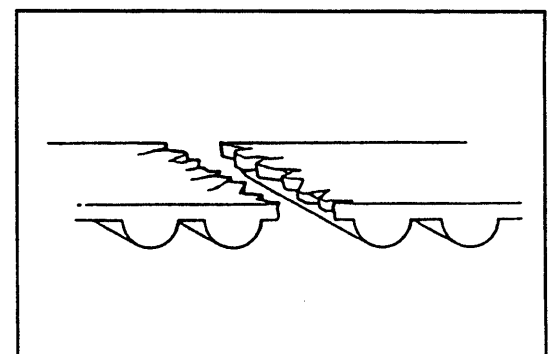


WN88E-EM085

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

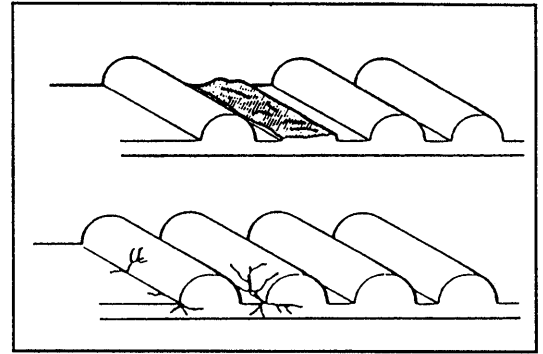
- (1) Premature separation

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



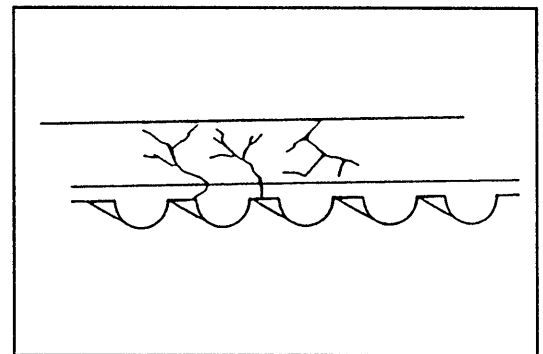
WN88E-EM086

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



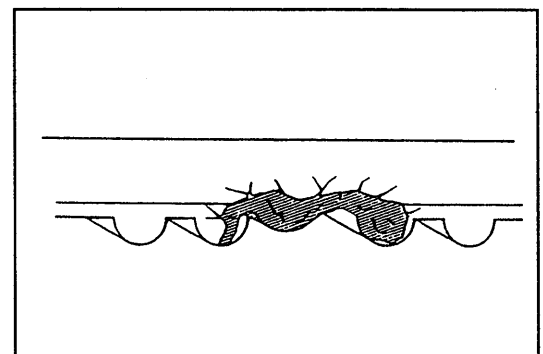
WN88E-EM087

- (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.



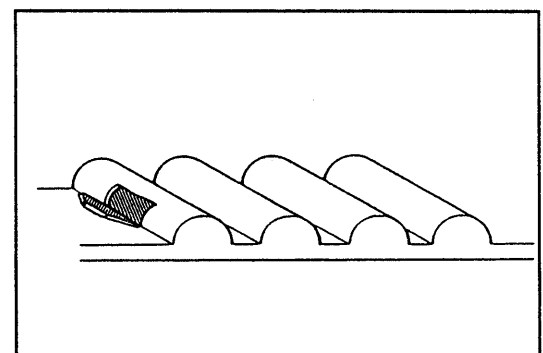
WN88E-EM088

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



WN88E-EM089

- (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.



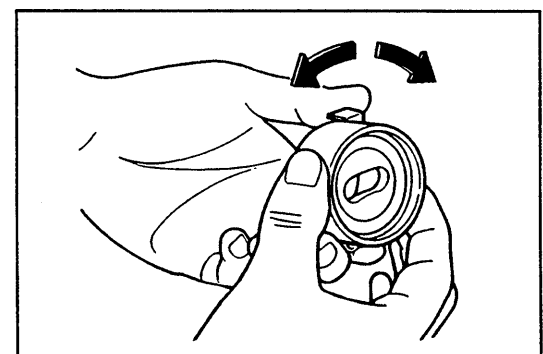
WN88E-EM090

## 2. Idler pulley inspection

- (1) Check the idler pulley for smooth turning.
- (2) Check the belt contact surface for damage.  
If necessary, replace the idler pulley.

### CAUTION:

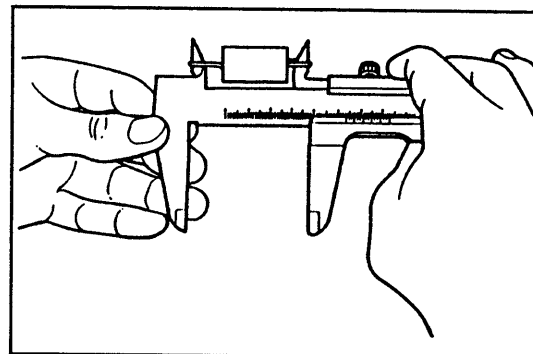
Never wash the idler pulley.



WN88E-EM091

# ENGINE MECHANICALS

3. Inspection of tension spring
- (1) Check the free length of the spring.  
Free length: 46.5 mm (2.22 inch)
  - (2) Check the tension of the spring at the specified installation length.  
Tension as installed: 3 kg at 50.9 mm (6.6 lb at 2 inch)

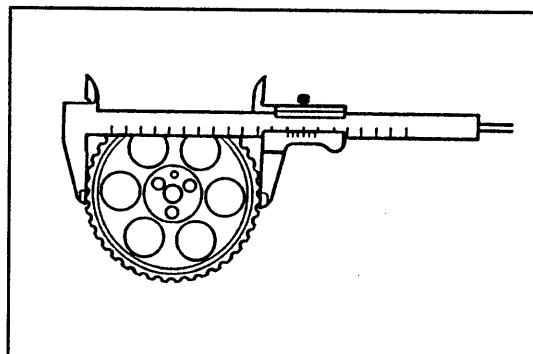


WN88E-EM092

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

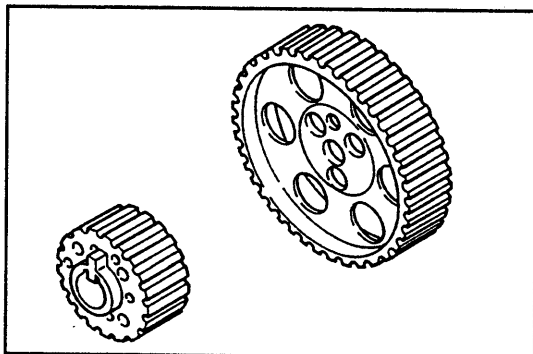
**Reference:**

Camshaft timing belt pulley: 119.8 mm (4.717 inch)
Crankshaft timing belt pulley: 59.3 mm (2.335 inch)



WN88E-EM093

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



WN88E-EM094

## INSTALLATION OF TIMING BELT

(See page EM-21)

1. Installation of camshaft timing belt pulley
  - (1) Install the camshaft timing belt pulley on the camshaft in such a way that the knock pin of camshaft is fitted into the pin hole of the camshaft timing belt pulley.
  - (2) Install the three attaching bolts of the camshaft timing belt pulley, while preventing the pulley from turning by inserting an iron bar into the hole of the pulley.  
Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

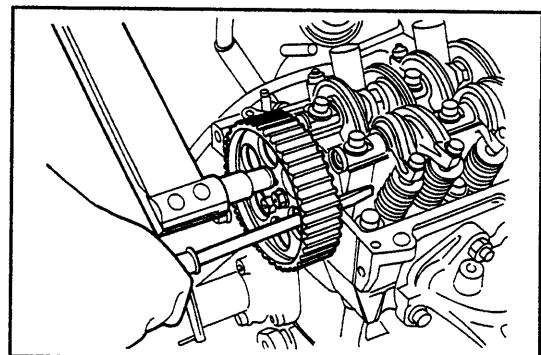
**NOTE:**

Be careful not to damage the cylinder head cover gasket surface.

- (3) Install the cylinder head cover to the cylinder head.

**NOTE:**

- Wipe off any oil from the cylinder head cover gasket surface of the cylinder head.
- Check the cylinder head cover gasket for damage.
- Check the grommets of the cylinder head spark plug tubes for damage or deformation.



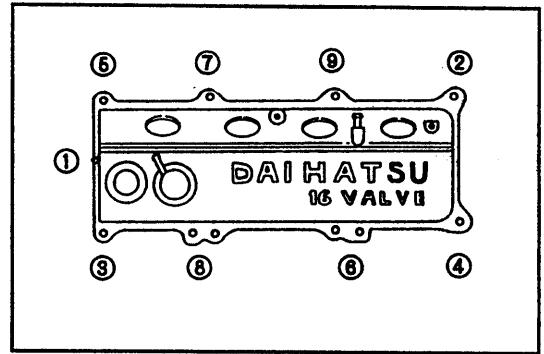
WN88E-EM095



- Apply the Three Bond 1104 to those points where the camshaft bearing caps No. 1 and No. 5 make contact with the cylinder head.

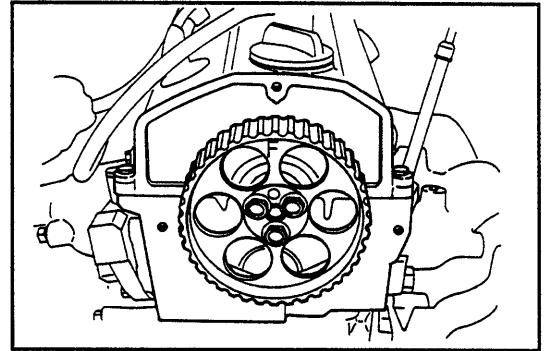
Tighten the attaching bolts of the cylinder head cover evenly over two or three stages to the specified torque, following the requence as a normal procedure.

**Tightening Torque: 0.3 - 0.5 kg-m (2.2 - 3.6 ft-lb)**



WN88E-EM095A

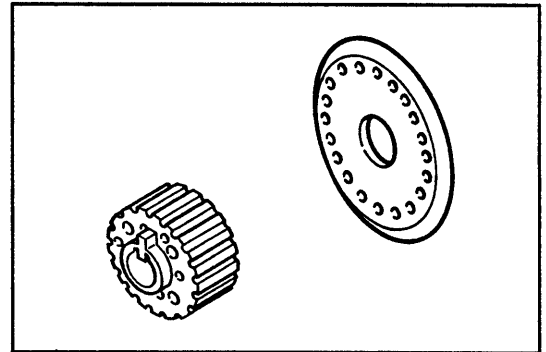
- (4) Align the "F" mark of the camshaft timing belt pulley with the indicator on the cylinder head cover.



WN88E-EM096

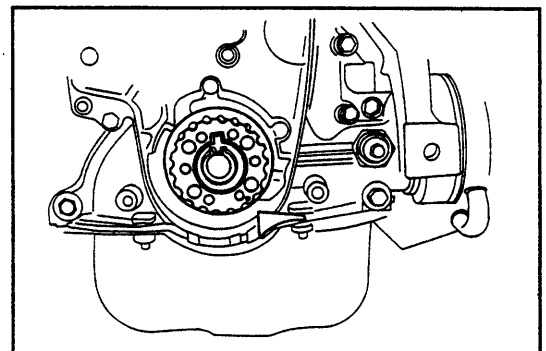
## 2. Installation of crankshaft timing belt pulley

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



WN88E-EM097

- (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.

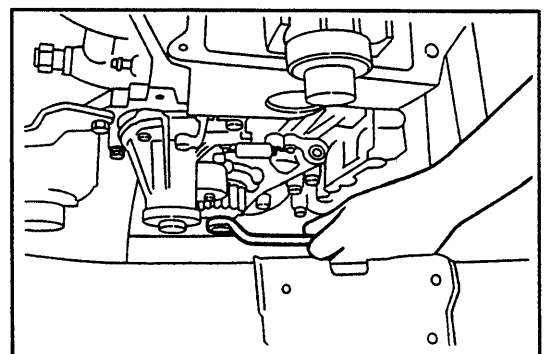


WN88E-EM098

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

### NOTE:

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



WN88E-EM098A

## 3. 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.
- When the timing belt is reused, install the timing belt in such a way that the direction of the arrow put during the removal of the arrow put during the removed may match with the engine rotation direction.

- (1) Make sure that the piston of cylinder No. 1 should come at top dead center.
- (2) 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.
- (3) Attach the timing belt tensioner.  
Hang the tension 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.

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

### NOTE:

- Be careful in the direction to hang of the tension spring as shown in the figure.
- Do not allow the tensioner to come into contact with oil, water or others.

- (4) Rotate the crankshaft 2 turns in the normal direction (to the clockwise 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.

### NOTE:

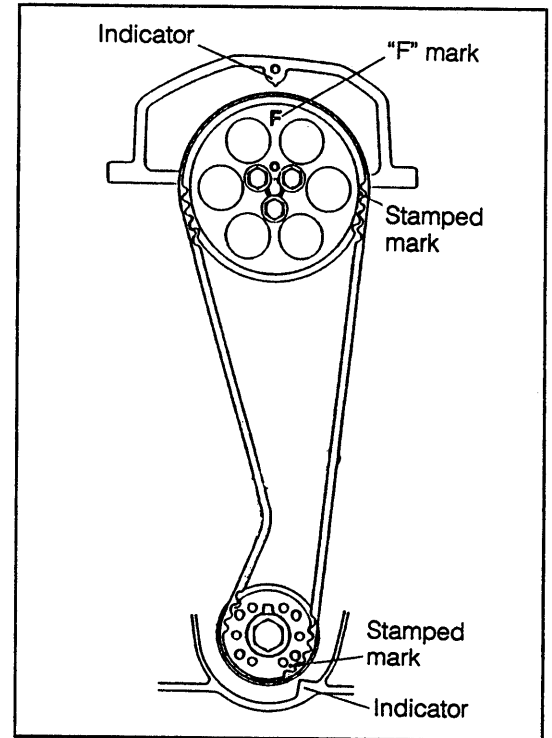
At this time, never turn the crankshaft reversely. If the crankshaft should be reversed or the timing belt should be tilted, turn the crankshaft two more turns, and repeat step (4).

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

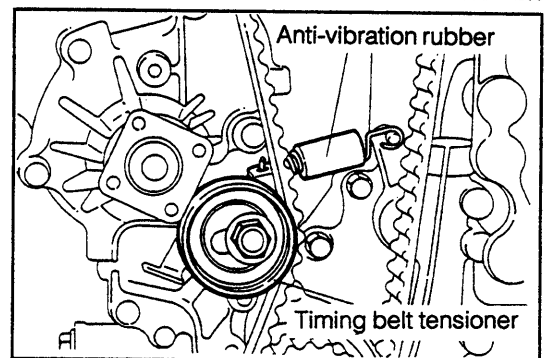
Then, turn the crankshaft further in the normal direction until the "F" mark of the camshaft timing belt pulley is aligned with the indicator of the cylinder head cover.

### NOTE:

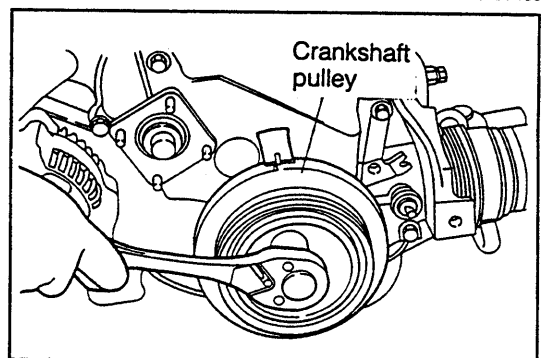
If the crankshaft should be reversed or turned beyond that point, temporarily tighten the tensioner attaching bolt and repeat from the step (4) onward.



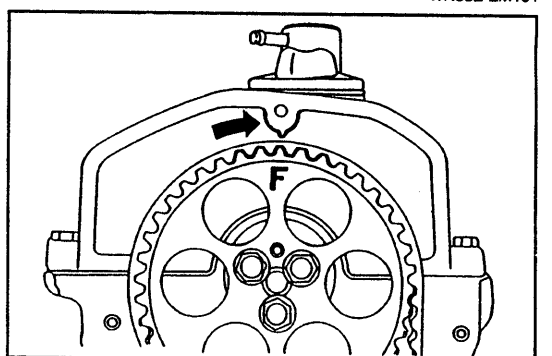
WN88E-EM099



WN88E-EM100

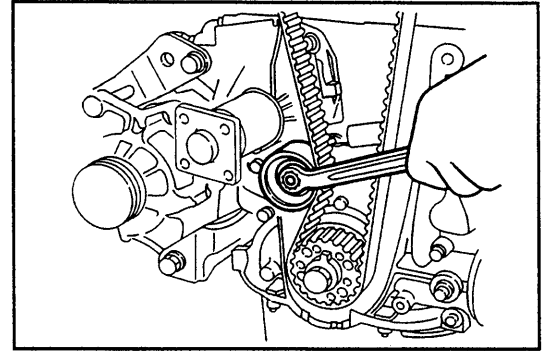


WN88E-EM101



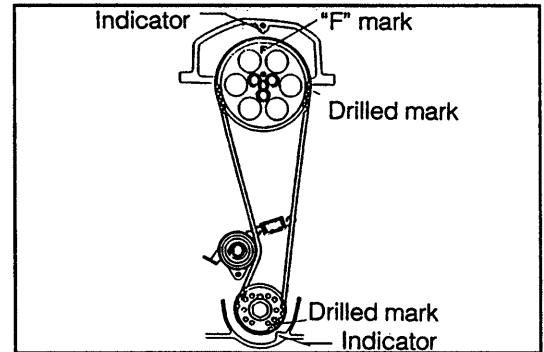
WN88E-EM102

- (6) 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)**



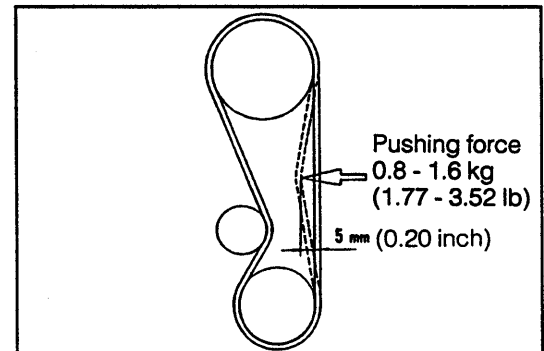
WN88E-EM103

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



WN88E-EM104

- (8) Check the timing belt tension. When the midpoint of the belt at the tension side is pushed with hand, ensure that the bend should be applied following specified values.  
**Specified Pushed Force: 0.8 - 1.6 kg (1.77 - 3.52 lb)**  
**When belt is deflected 5mm (0.20 inch)**



WN88E-EM105

#### 4. Installation of timing belt cover

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

**NOTE:**

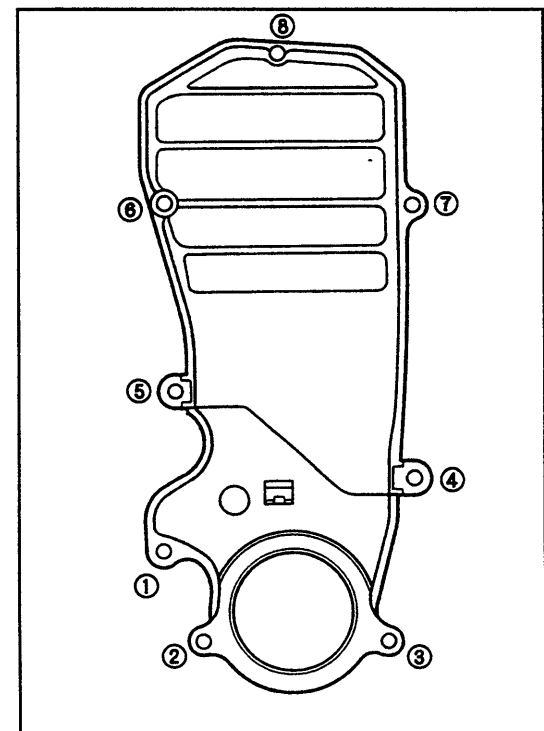
Attaching bolts ④ and ⑤ in the figure are tightened both upper and lower side cover.

- (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)**  
 (For both upper and lower cover)

**NOTE:**

Attaching bolts ④ and ⑤ should be installed first of all.

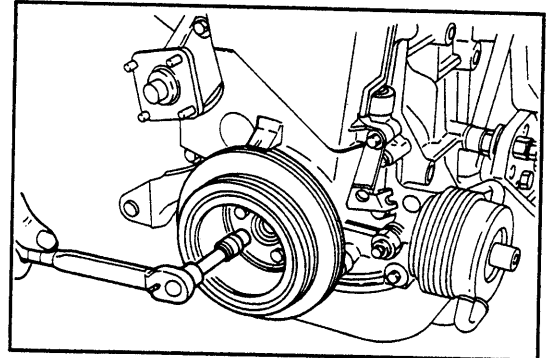


WN88E-EM106

# ENGINE MECHANICALS

## 5. 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)



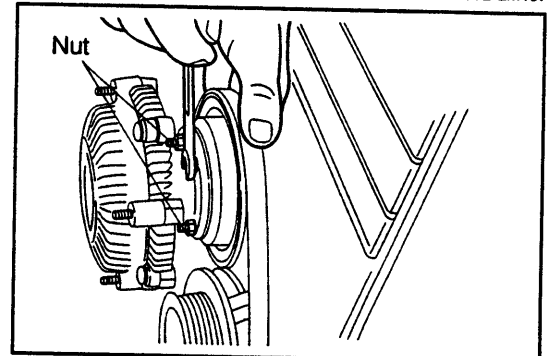
WN88E-EM107

## 6. Installation of fluid coupling 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.

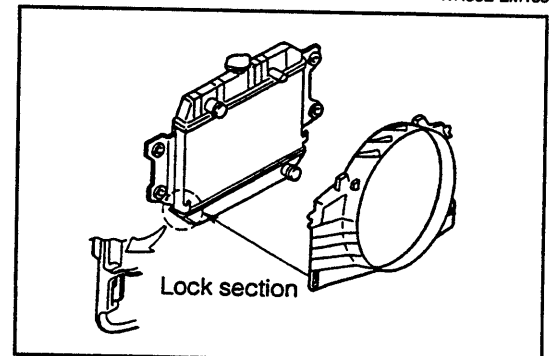


WN88E-EM109

- (3) Install the fluid coupling 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)

### REFERENCE:

Tightening torque of fluid coupling and fan is as follows.  
0.44 - 0.66 kg-m (3.2 - 4.8 ft-lb)



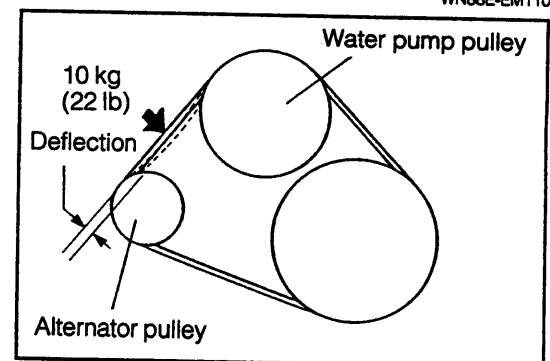
WN88E-EM110

## 7. Installation of V belt

- (1) Install the V 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:** 5.0 - 7.0 mm (0.20 - 0.28 inch)  
With a force of 10 kg (22 lb) applied to point indicated in figure
- Used Belt:** 6.0 - 8.0 mm (0.24 - 0.31 inch)  
With a force of 10 kg (22 lb) applied to point indicated in figure



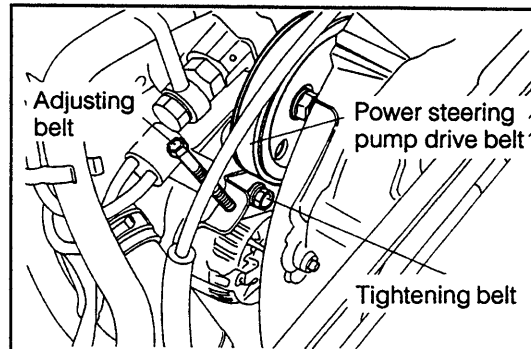
WN88E-EM111

### NOTE

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

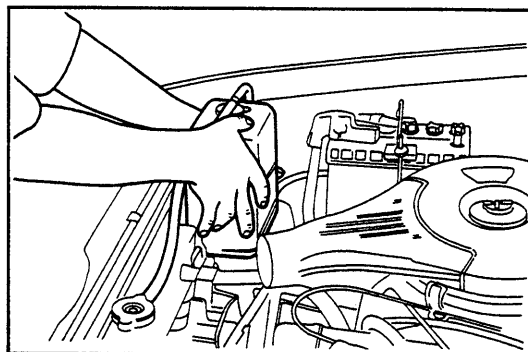
8. Install the drive belt(s) of power steering pump with the specified belt deflection.

**Deflection Amount:** 9 - 11 mm (0.354 - 0.433 inch)  
When a force of 10 kg (22 lb) is applied.



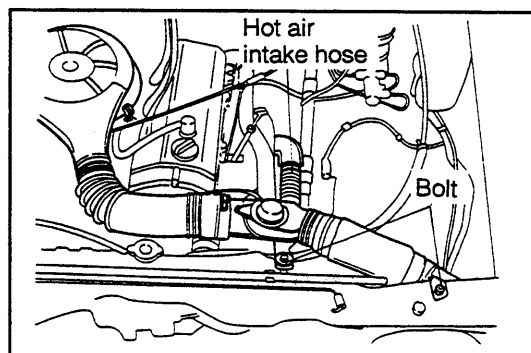
WN88E-EM112

9. Installation of reserve tank  
(1) Install the reserve tank to the radiator assy bracket.  
(2) Insert the over flow hose to the radiator with clip.



WN88E-EM113

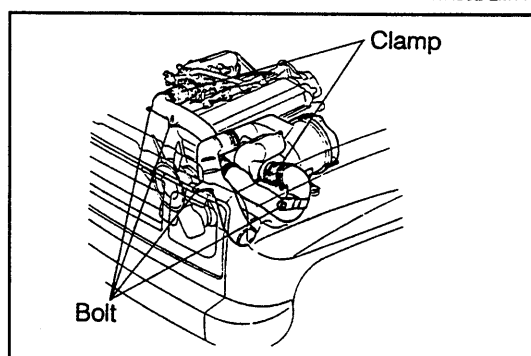
10. Installation of air cleaner hose  
Carburetor-equipped vehicle  
(1) Connect the vacuum motor hose to the air cleaner hose.  
(Except G.C.C. specification)  
(2) Connect the hot air intake hose to the pipe.  
(3) Connect the air cleaner hose to the air cleaner case and the pipe with two bolts and one clamp.



WN88E-EM114

### EFI-equipped vehicle

- (1) Connect the two vacuum hose for idle-up and for power steering.  
(2) Connect the air cleaner pipe sub-assy and cool air intake duct with three clamps and four bolts.



WN88E-EM115

11. Pour the engine coolant about 1 liter into the radiator.

### NOTE:

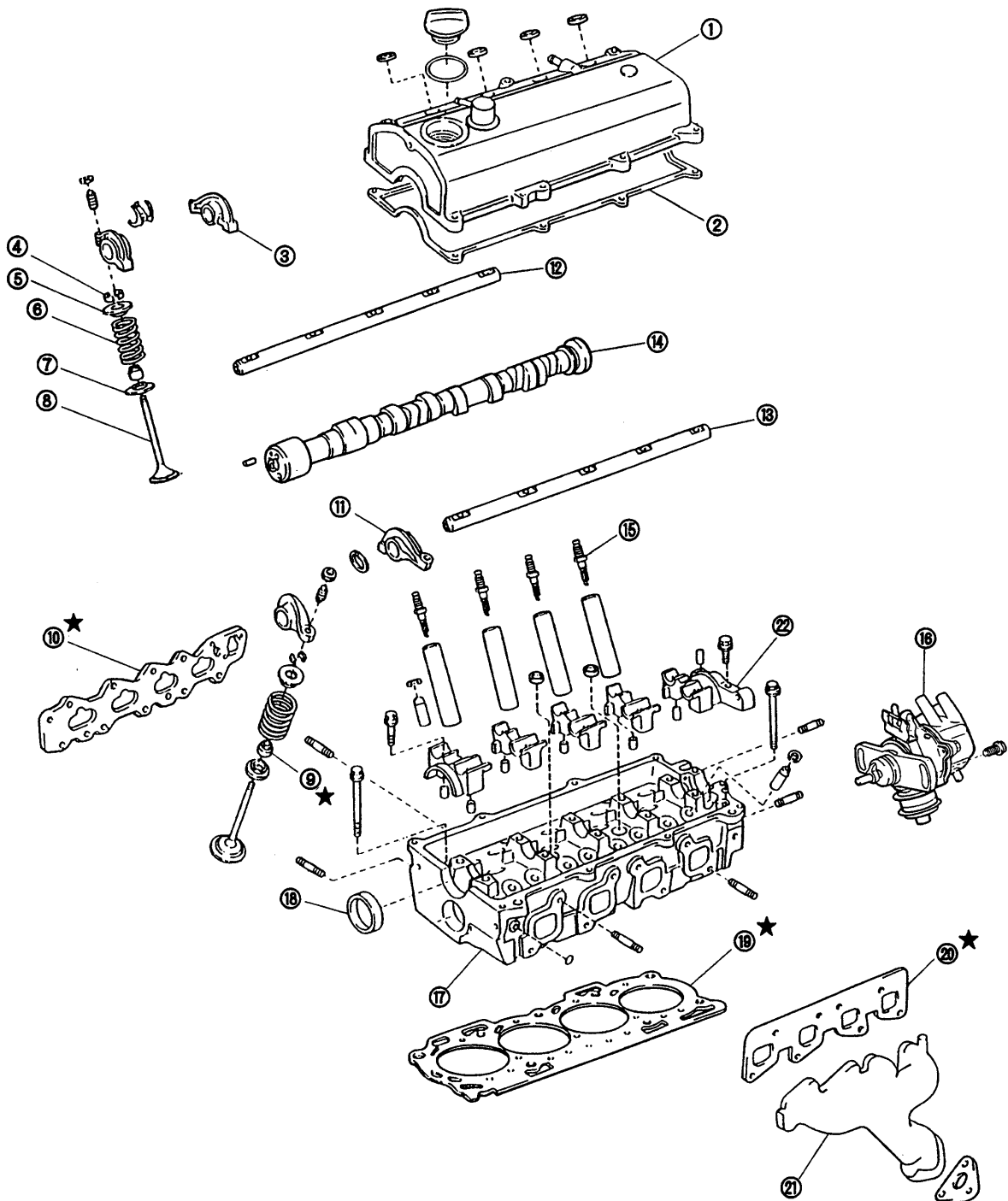
Use the engine coolant which is drained from radiator in the step 2 of removal of timing belt.

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

WN88E-EM116

**CYLINDER HEAD  
COMPONENTS**

★ : Non-reusable parts



- ① Cylinder head cover
- ② Cylinder head cover gasket
- ③ Valve rocker arm IN
- ④ Valve spring retainer lock
- ⑤ Valve spring retainer
- ⑥ compression spring
- ⑦ Valve spring seat

- ⑧ Intake valve
- ⑨ Valve stem oil seal
- ⑩ Intake manifold gasket
- ⑪ Valve rocker arm EX
- ⑫ Valve rocker shaft IN
- ⑬ Valve rocker shaft EX
- ⑭ Camshaft

- ⑮ Spark plug
- ⑯ Distributor
- ⑰ Cylinder head assy
- ⑱ Oil seal
- ⑲ Cylinder head gasket
- ⑳ Exhaust manifold gasket
- ㉑ Exhaust manifold

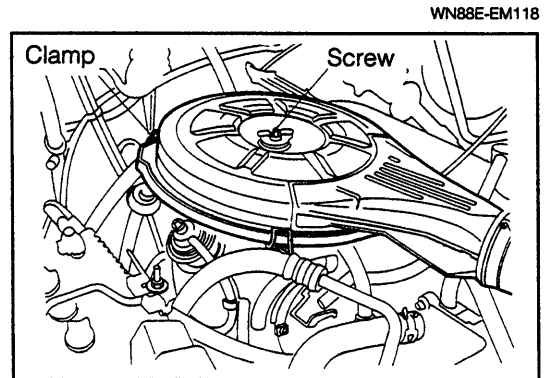
## REMOVAL OF CYLINDER HEAD

### Carburetor-equipped vehicle

1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Drain the coolant (See page CO-3).
3. Drain the engine oil (See page LU-4).
4. Remove the timing belt (See page EM-21).

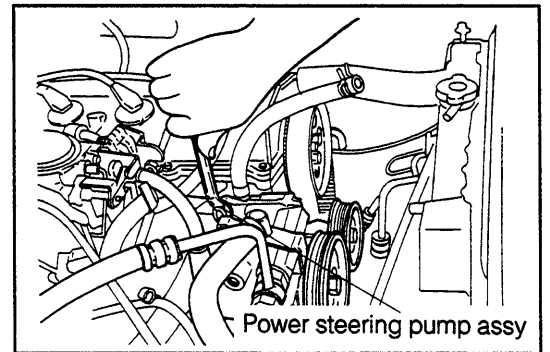
### 5. Removal of air cleaner Assy

- (1) Disconnect the following hoses at air cleaner side.
  - ITC vacuum hose to carburetor
  - Vacuum hose to TVSV
  - PCV hoses
  - Vacuum hose for vacuum motor
- (2) Remove the air cleaner by removing the attaching bolts and wing nut.



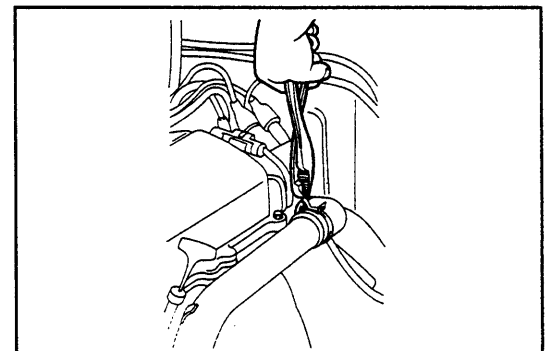
### 6. Removal of power steering pump Assy

- (Only power steering equipped vehicle)
- (1) Remove the battery after disconnect the battery (+) cable from the battery terminal.
  - (2) Remove the power steering pump Assy by removing the three attaching bolts and put on the battery carrier temporarily.
  - (3) Disconnect the vacuum hose for idle up.

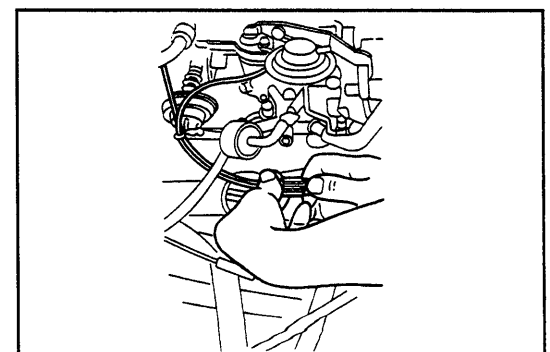


### 7. Removal of water hose and coupler

- (1) Disconnect the water out let hose at the engine rear side.
- (2) Disconnect the heater hose at the rear right side of engine.
- (3) Disconnect the small water hose at the water inlet side.



- (4) Disconnect the coupler of solenoid valve wiring harness.



WN88E-EM122

# ENGINE MECHANICALS

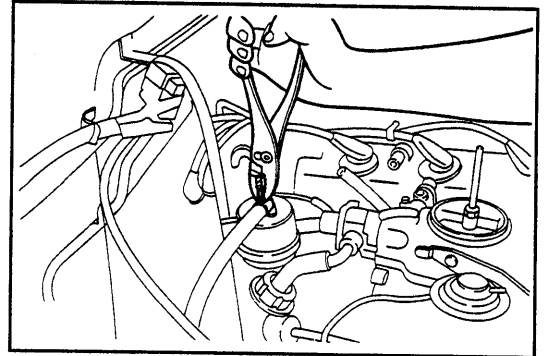
## 8. Removal of fuel line

(1) Disconnect the fuel hoses to fuel filter from the fuel pump.

### NOTE:

When disconnecting the fuel hose, take precautionary measures to prevent any dirt from entering into the fuel line.

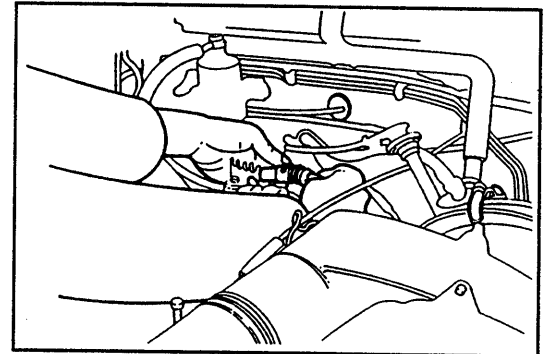
(2) Disconnect the evaporative emission hoses at the charcoal canister.



WN88E-EM123

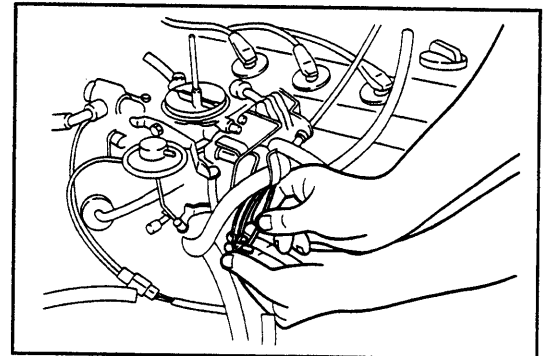
9. Disconnect the brake booster vacuum hose from the intake manifold.

10. Disconnect the coupler of wiring harness of the distributor.



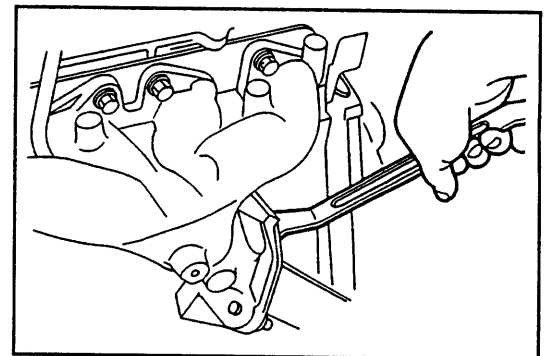
WN88E-EM124

11. Disconnect the accelerator cable from the carburetor.



WN88E-EM125

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



WN88E-EM126

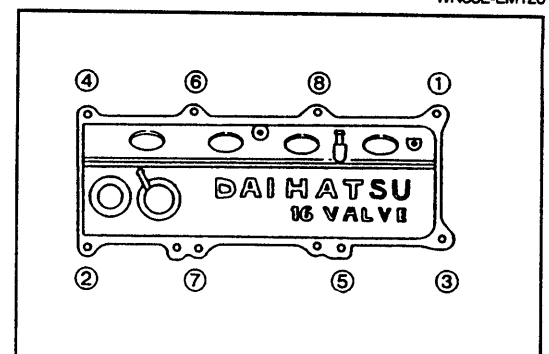
## 13. Removal of cylinder head cover

(1) Remove the resistive cords from cylinder.

(2) Remove the spark plugs, using the SST.

SST: 09268-877703-000

(3) 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.



WN88E-EM127



## 14. Removal of cylinder head

- (1) Disconnect the bypass hose from the intake manifold.
- (2) Disconnect the water hose from the thermo valve.
- (3) Remove the engine electrical wiring harness clamp from the intake manifold.
- (4) Disconnect the water outlet hose at the cylinder head side.
- (5) Disconnect the heater inlet hose at the cylinder head side.

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

### NOTE:

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

- (7) Remove the cylinder head with intake and exhaust manifold.

### NOTE:

- If it is difficult to remove the head, pry up the cylinder head by using a iron bar.
- Place the removed cylinder head on suitable two wooden blocks in order that the cylinder head surface and valve may not be damaged.

- (8) Remove the cylinder head gasket.

15. Remove the exhaust manifold by removing the six attaching bolts and two nuts.

16. Remove the exhaust manifold gasket.

## 17. Removal of intake manifold

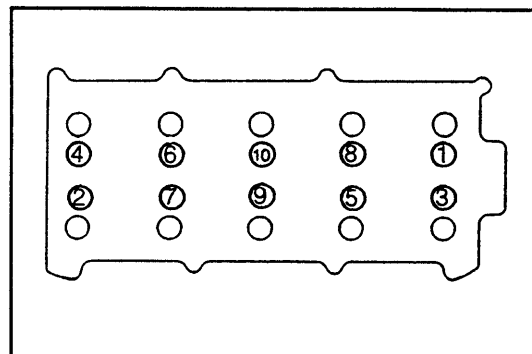
- (1) Disconnect the fuel hose at the carburetor side.
- (2) Disconnect the choke breaker hoses.
- (3) Disconnect the vacuum hose of main and sub diaphragm of distributor.
- (4) Disconnect the water by-pass hose.
- (5) Remove the intake manifold with carburetor by removing the eight attaching bolts and the four nuts.  
(Seven bolts and four nuts for carburetor equipped vehicles)

## 18. Removal of fuel pump

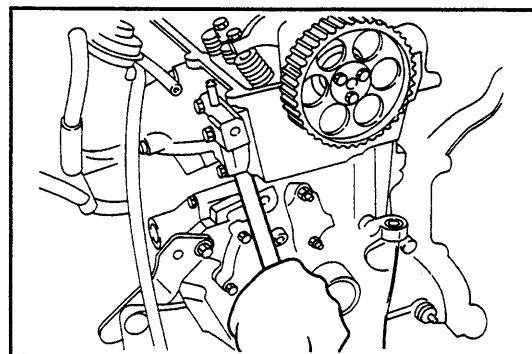
### NOTE:

When disconnecting the fuel pump, take precautionary measures to flow out the engine oil.

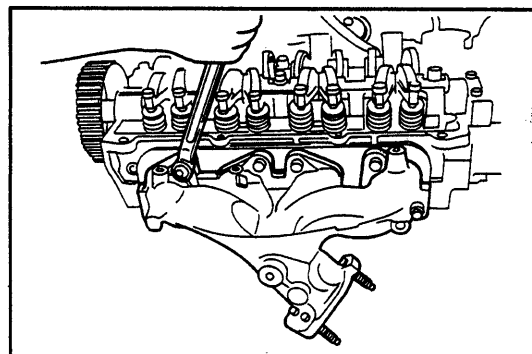
- (1) Remove the fuel pump assy by removing the two attaching bolts.
- (2) Remove the push rod and insulator.
- (3) Remove the intake manifold gasket.



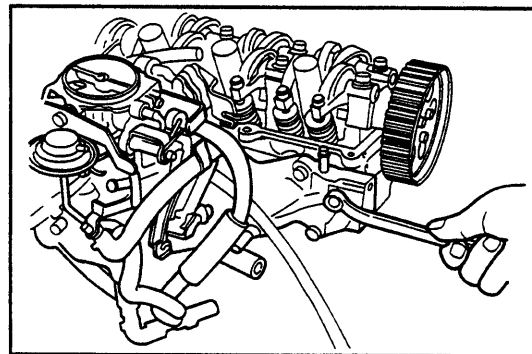
WN88E-EM135



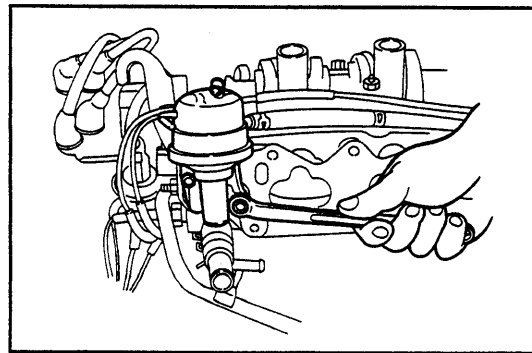
WN88E-EM136



WN88E-EM137

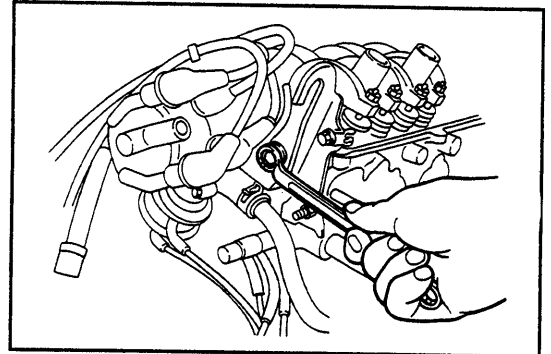


WN88E-EM139



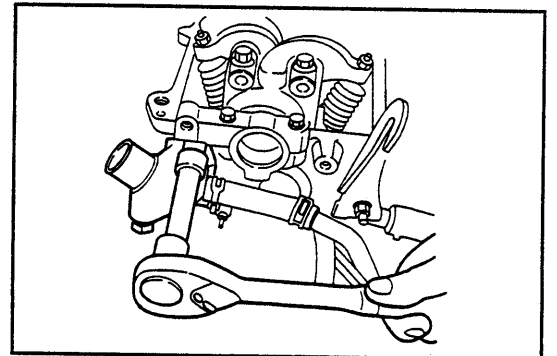
WN88E-EM140

19. Remove the distributor assy by removing the two attaching bolts.



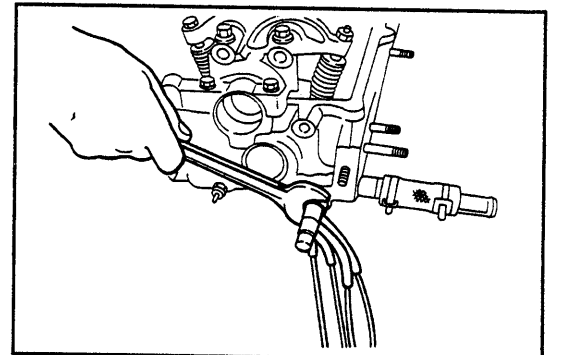
WN88E-EM141

20. Remove the water outlet housing by removing the attaching bolt and nut.  
21. Remove the engine hanger by removing the attaching bolt and nut.



WN88E-EM142

22. Remove the TVSV and water temperature sensor gauge.



WN88E-EM143

## EFI equipped vehicle

1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Drain the coolant (See page CO-3).
3. Drain the engine oil (See page LU-4).
4. Remove the timing belt (See page EM-21).
5. Removal of engine wire
  - (1) Disconnect the following connectors.
    - Throttle position sensor
    - Intake air temperature sensor
    - Pressure sensor
    - Injector
    - Cooling water temperature sensor
    - Distributor
    - Oxygen sensor
    - Water temperature sensor
  - (2) Remove the engine wire clamp, clamp bolt and ground cable.

**NOTE:**  
Disconnect the pressure sensor wire together with the vacuum hose.
  - (3) Remove the engine wire.

6. Disconnect the brake booster hose at the engine side.
7. Disconnect the rubber hose for the idle-up VSV at the throttle body side.
8. Remove the accelerator cable.
9. Disconnect the fuel hose No. 1 from the fuel filter.

**WARNING:**

- The fuel pressure inside the fuel line is set to a pressure 2.55 kg/cm<sup>2</sup> higher than the atmospheric pressure. Hence, gradually loosen the connection while preventing the fuel from splashing with a cloth or the like.

10. Disconnect the fuel return hose from the pressure regulator.

**NOTE:**

When disconnecting the fuel hose, take precautionary measures to prevent any dirt from entering into the fuel line.

11. Disconnect the coupler of wiring harness of the distributor.

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

**13. Removal of cylinder head cover**

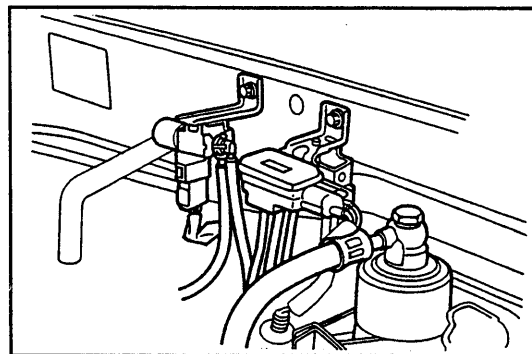
(1) Remove the resistive cords from cylinder.

(2) Remove the spark plugs, using the SST.

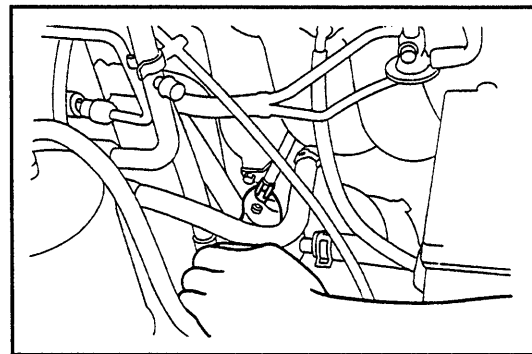
SST: 09268-87703-000

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

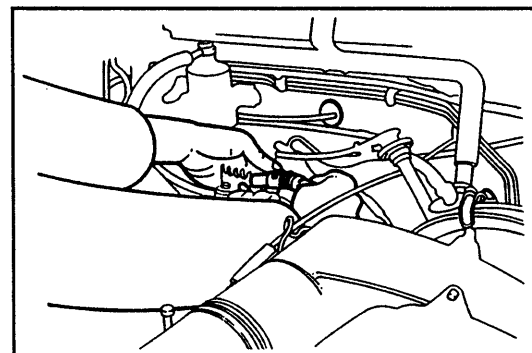
Remove the cylinder head cover attaching bolts.



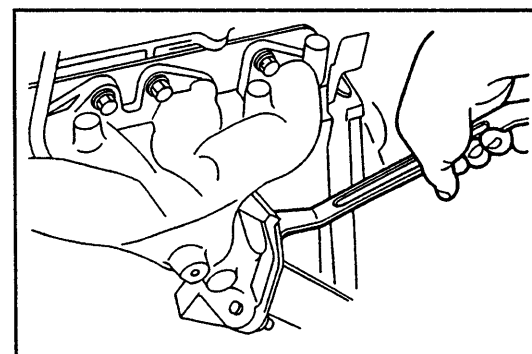
WN88E-EM130



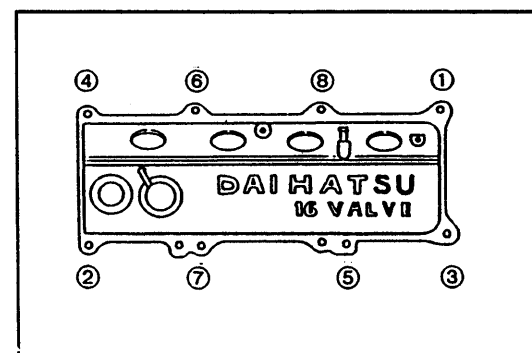
WN88E-EM131



WN88E-EM132



WN88E-EM133

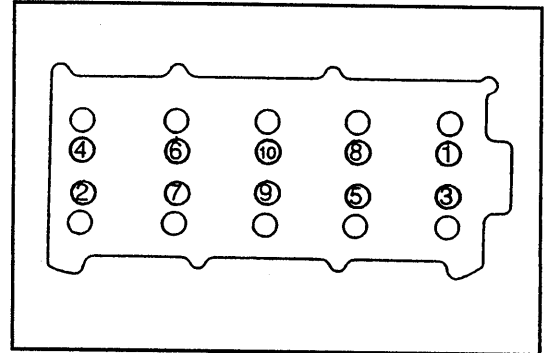


WN88E-EM134

# ENGINE MECHANICALS

## 14. Removal of cylinder head

- (1) Disconnect the bypass hose from the intake manifold.
- (2) Disconnect the water hose from the thermo valve.
- (3) Remove the engine electrical wiring harness clamp from the intake manifold.
- (4) Disconnect the water outlet hose at the cylinder head side.
- (5) Disconnect the heater inlet hose at the cylinder head side.

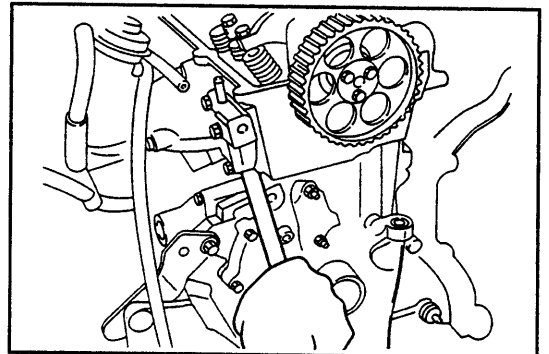


WN88E-EM135

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

### NOTE:

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

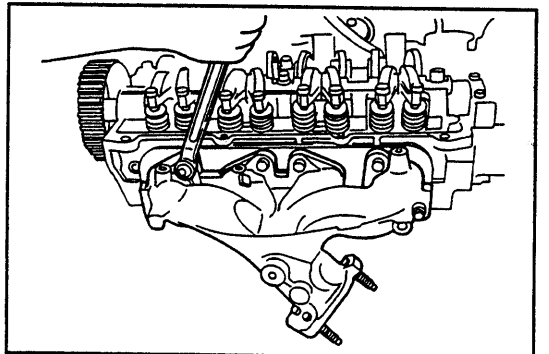


WN88E-EM136

- (7) Remove the cylinder head with intake and exhaust manifold.

### NOTE:

- If it is difficult to remove the head, pry up the cylinder head by using a iron bar.
- Place the removed cylinder head on suitable two wooden blocks in order that the cylinder head surface and valve may not be damaged.



WN88E-EM137

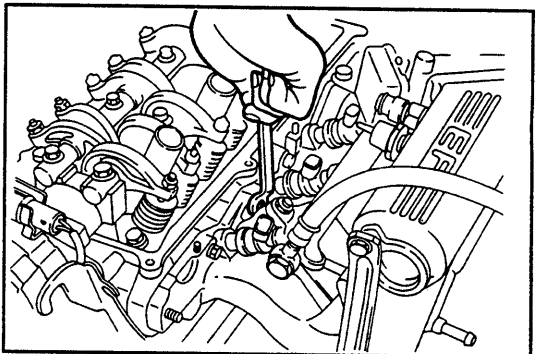
- (8) Remove the cylinder head gasket.

15. Remove the exhaust manifold by removing the six attaching bolts and two nuts.

16. Remove the exhaust manifold gasket.

## 17. Removal of intake manifold

- (1) Remove the surge tank stay No. 3 and engine hanger.
- (2) Remove the attaching bolts and nuts of the intake manifold.
- (3) Remove the intake manifold.



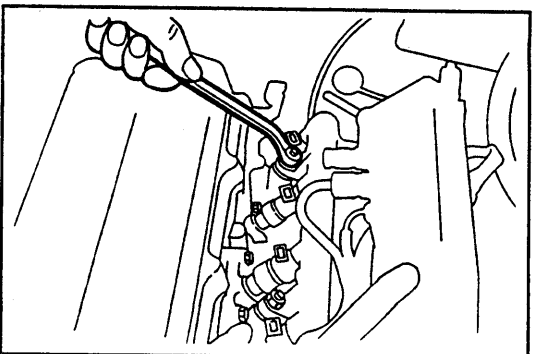
WN88E-EM140A

18. Remove the attaching nut of the delivery pipe.

19. Remove the delivery pipe.

### NOTE:

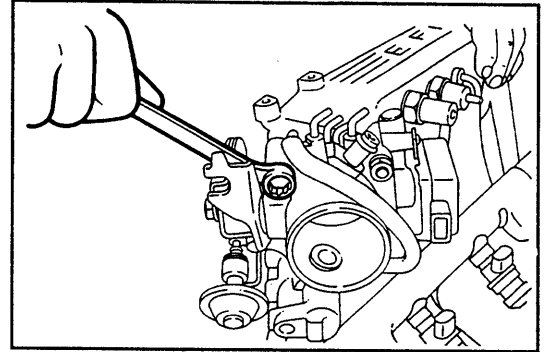
- Leave the injector at the manifold side
- Be very careful not to drop the injectors.
- Place an adequate cloth or the like under the injector, because the fuel flows out.



WN88E-EM140B

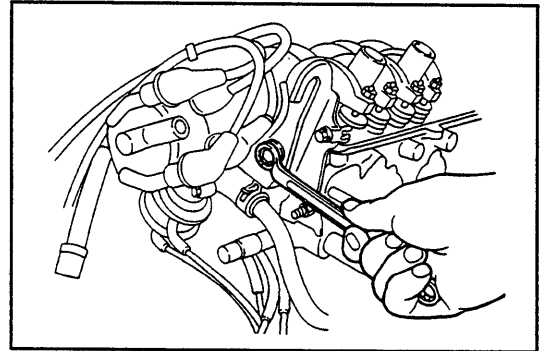
## 20. Removal of the throttle body

- (1) Disconnect the hose for circulating cooling water from the body.
- (2) Disconnect the two blow-by gas hoses from the throttle body.
- (3) Remove the attaching bolts and nuts of the throttle body from the surge tank.



WN88E-EM140C

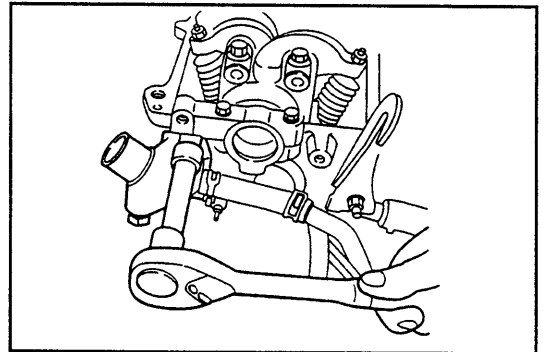
## 21. Remove the distributor assy by removing the two attaching bolts.



WN88E-EM141A

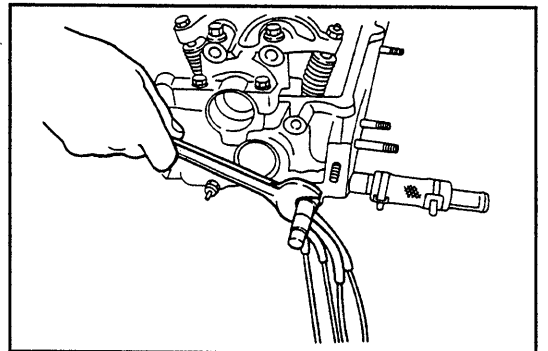
## 22. Remove the water outlet housing by removing the attaching bolt and nut.

## 23. Remove the engine hanger by removing the attaching bolt and nut.



WN88E-EM142A

## 24. Remove the TVSV and water temperature sensor gauge.

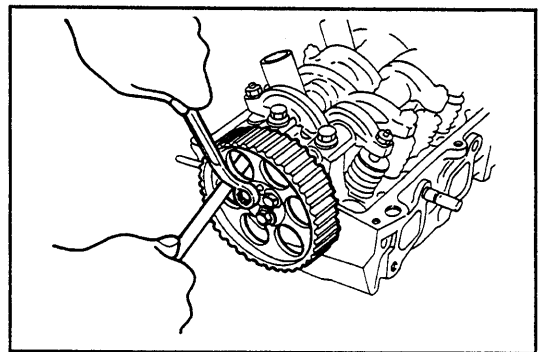


WN88E-EM143A

## DISASSEMBLY OF CYLINDER HEAD

### 1. Removal of camshaft timing belt pulley

- (1) Remove the attaching bolts of the camshaft timing belt pulley, while preventing the camshaft timing belt pulley from turning with an adequate iron rod.
- (2) Remove the camshaft timing belt pulley.



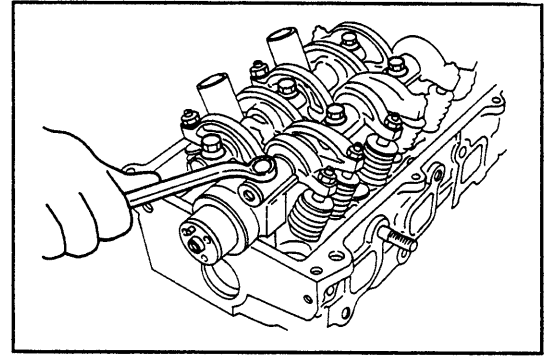
WN88E-EM144

## ENGINE MECHANICALS

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

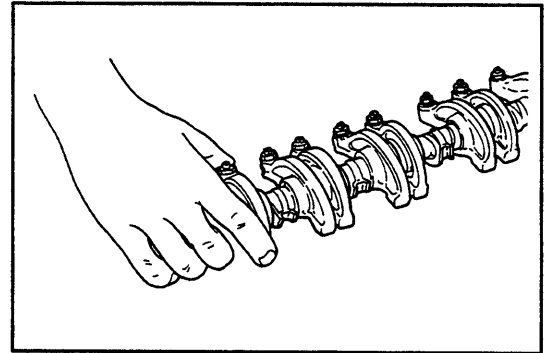
**NOTE:**

Remove the attaching bolts by loosening them over two or three stages, following the sequence shown in the figure.



- Remove the valve rocker shaft together with the rocker arms from the cylinder head.

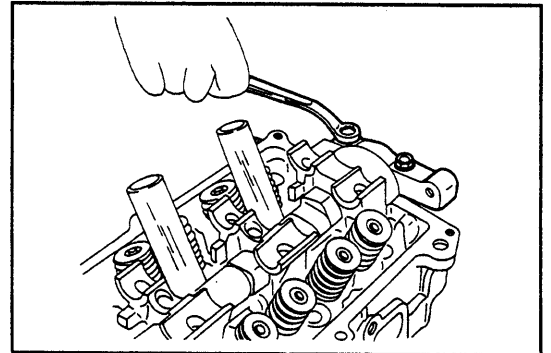
Remove the valve rocker arm, spacer and wave washer from valve rocker shaft.



- Removal of camshaft

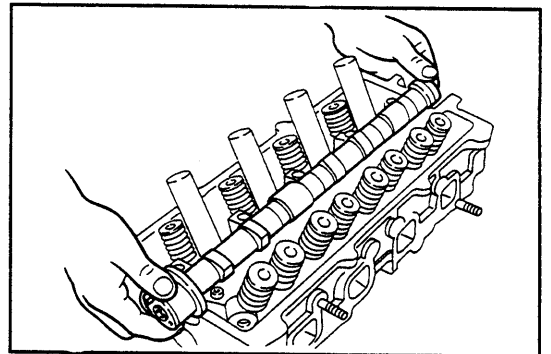
(1) Remove the camshaft bearing cap No. 5 by removing the two attaching bolts.

(2) Remove the camshaft bearing cap No. 1 to No. 4.



(3) Remove the camshaft.

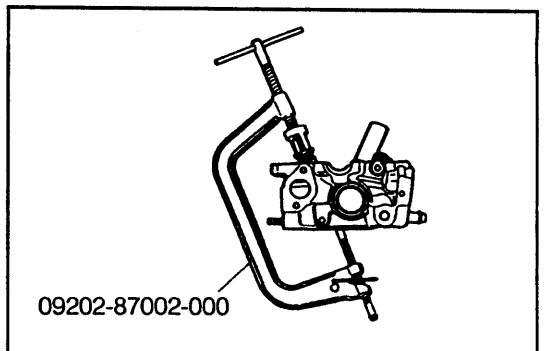
(4) Remove the oil seal from the camshaft.



- Removal of intake & exhaust valve

(1) Remove the valve spring retainer locks, using the following SST.

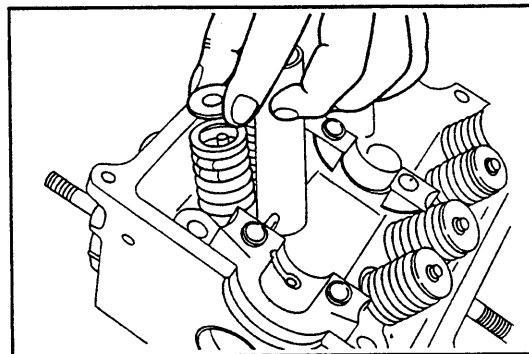
SST: 09202-87002-000



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

**NOTE:**

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

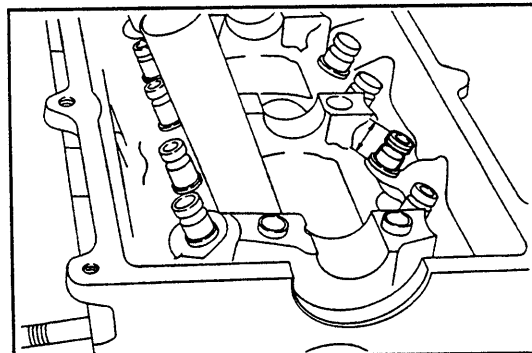


WN88E-EM150

6. 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 (176°F - 182°F) after heating it gradually.



WN88E-EM152

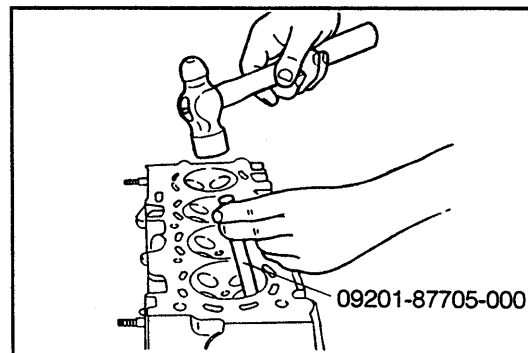
(1) Removal of valve guide bush

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

SST: 09201-87705-000

**CAUTION:**

Be careful not to tap the cylinder head.



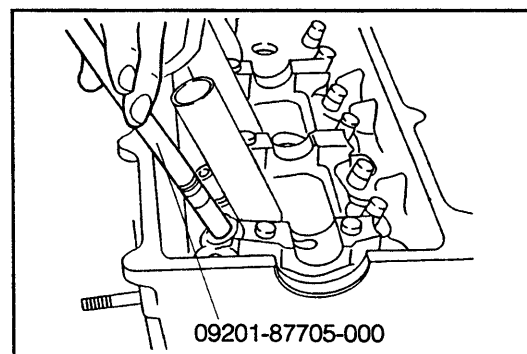
WN88E-EM153

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

SST: 09201-87705-000

**CAUTION:**

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



WN88E-EM154

## 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.

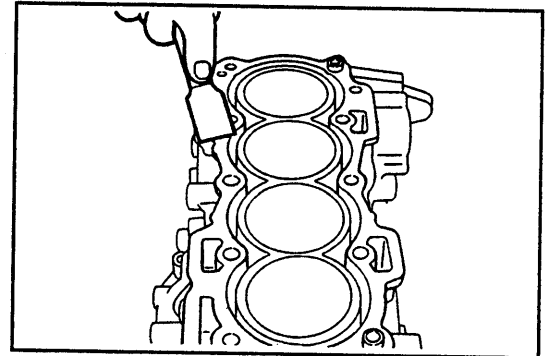
**WARNING:**

Protect your eyes during the cleaning operation using compressed air.

**CAUTION:**

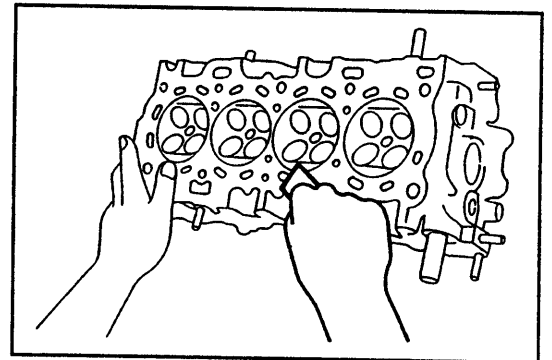
Do not scratch the gasket surfaces of the piston and cylinder block.

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



WN88E-EM156

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

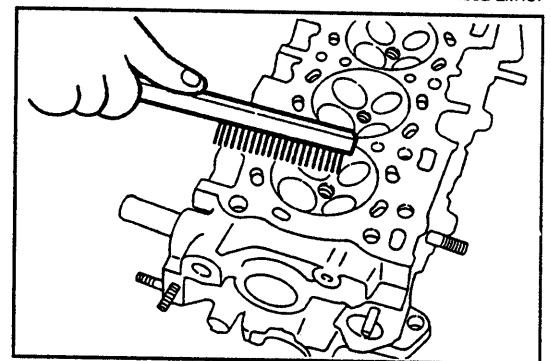


WN88E-EM157

3. Cleaning of combustion chamber  
Using a wire brush, remove all carbon deposits from the combustion chambers.

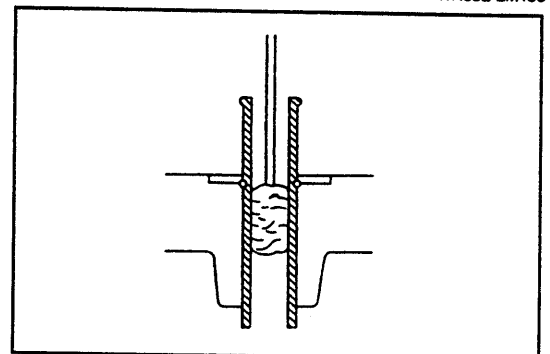
**CAUTION:**

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



WN88E-EM158

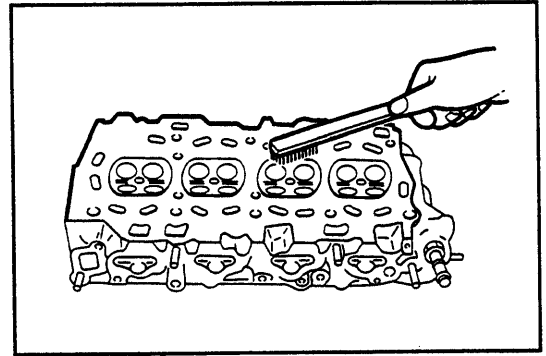
4. Cleaning of valve guide bushings  
Using a valve guide brush and solvent, clean all the valve guide bushings.



WN88E-EM159



5. **Cleaning of cylinder head**  
Using a soft brush and solvent, thoroughly clean the cylinder head.

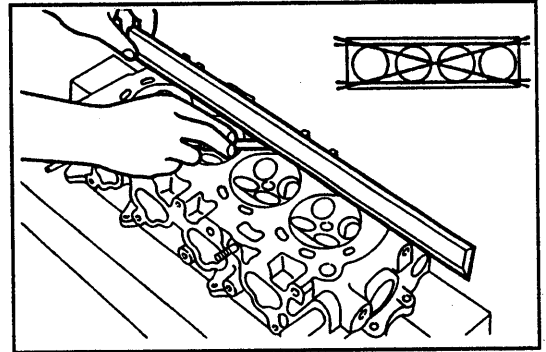


WN88E-EM160

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.

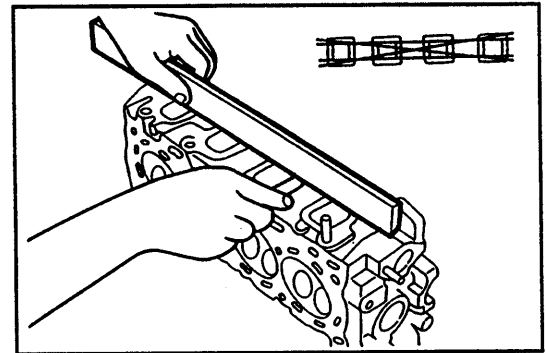
**Maximum surface warpage:**

- 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)



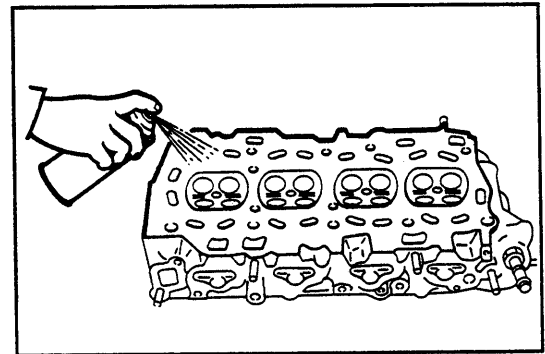
WN88E-EM161

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



WN88E-EM162

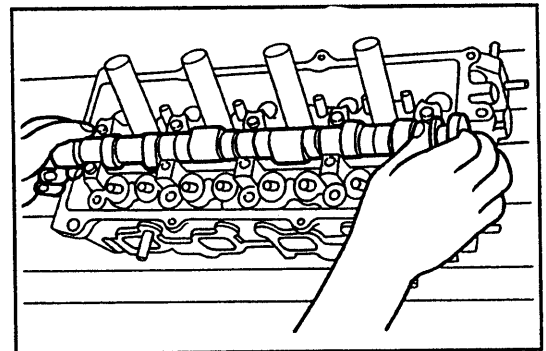
7. **Inspection of cylinder head for cracks**  
Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and top of the head for cracks.  
If a crack is found, replace the cylinder head.



WN88E-EM163

8. **Inspection of camshaft oil clearance**  
**NOTE:**  
Prior to this oil clearance check, the camshaft should be checked for bend in advance. (See page EM-50).

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



WN88E-EM164

- (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 - 26.7 ft-lb)
M8 bolt	1.3 - 1.7 kg-m/Dry (9.5 - 12.2 ft-lb)

**NOTE:**

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

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

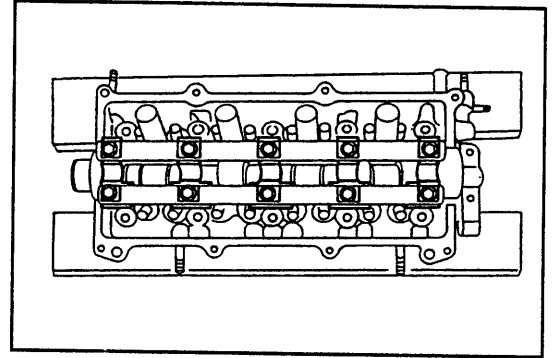
**Clearance:**

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

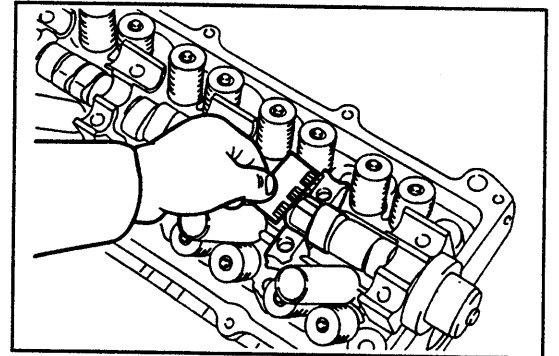
If the oil clearance exceeds the allowable limit, replace the cylinder head and camshaft as a set.

**NOTE:**

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



WN88E-EM165



WN88E-EM166

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)
M8 bolt	1.3 - 1.7 kg-m/Dry (9.4 - 12.3 ft-lb)

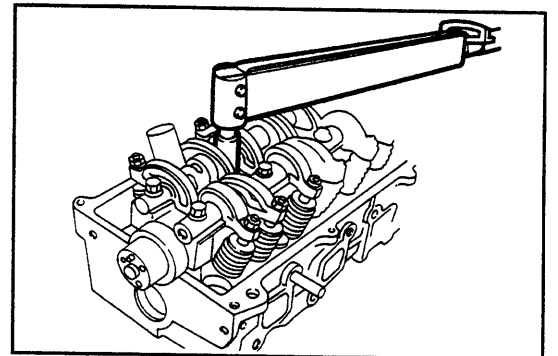
**NOTE:**

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

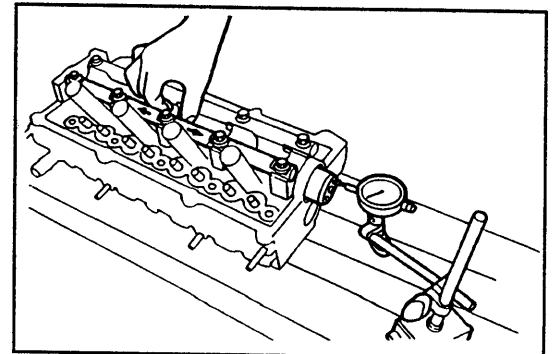
- (3) With a dial gauge attached to the camshaft, measure the thrust clearance.

**Thrust Clearance:**

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



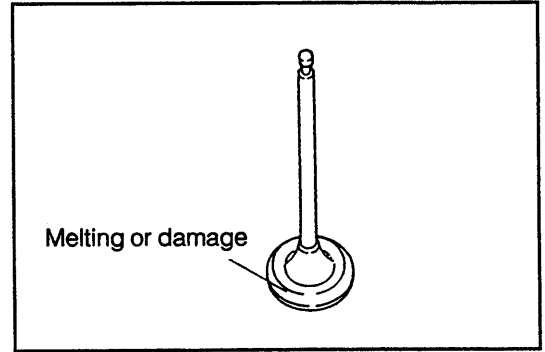
WN88E-EM168



WN88E-EM169

## 10. Cleaning of valve and inspection

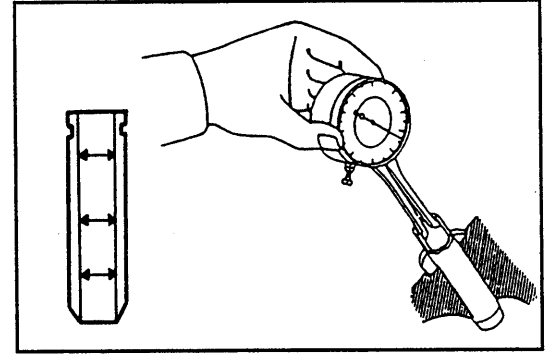
- (1) Clean the valve with a gasket scraper and a wire brush.
- (2) Visually inspect the valve stem for seizure or damage.
- (3) Visually inspect the valve head for melting or damage.



WN88E-EM170

## 11. 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 measure values.



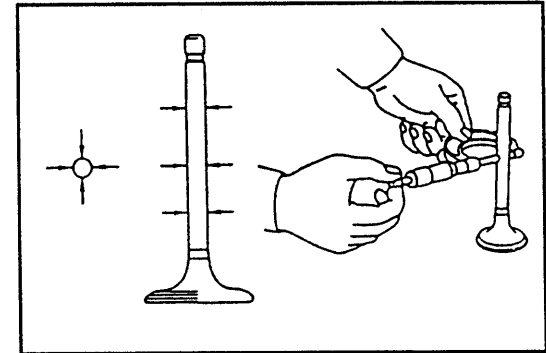
WN88E-EM171

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

### Specified value

**INTAKE:** 6,560 - 6,580 mm (0.2583 - 0.259 inch)

**EXHAUST:** 6,555 - 6,575 mm  
(0.2581 - 0.2588 inch)



WN88E-EM172

- (3) Calculation of oil clearance

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

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

### Specified Oil Clearance

**Intake valve side:** 0.020 - 0.06 mm  
(0.0008 - 0.0023 inch)

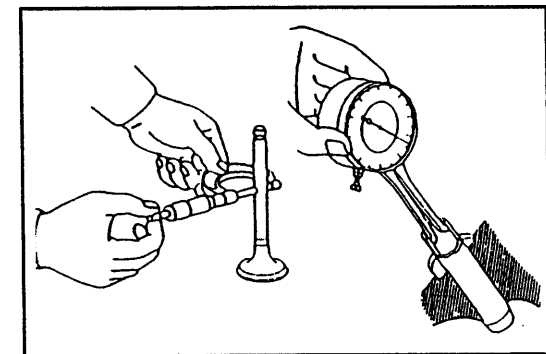
**Exhaust valve side:** 0.025 - 0.065 mm  
(0.0010 - 0.0025 inch)

### 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.



WN88E-EM173

## 12. Replacement of valve guide bush

- (1) Removal of valve guide bush.  
(See page EM-43)
- (2) Installation of valve guide bush.  
(See page EM-43)
- (3) Using an adjustable reamer, ream the valve guide bush to remove any burr or the like.

### NOTE:

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

## (4) Inspection of oil clearance

Ensure that the oil clearance meets the specifications.

Oil clearance specified value

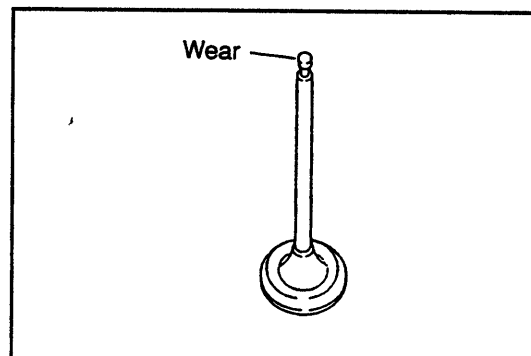
INTAKE: 0.020 - 0.060 mm  
(0.0008 - 0.0023 inch)

EXHAUST: 0.025 - 0.065 mm  
(0.0010 - 0.0025 inch)

WN88E-EM174

## 13. Inspection and grinding of valves

- (1) Visually inspect the valve stem for seizure or damage.
- (2) Grind the valves only enough to obtain a smooth contact surface with the valve seat.  
Valve Face Angle: 45.5°



WN88E-EM175

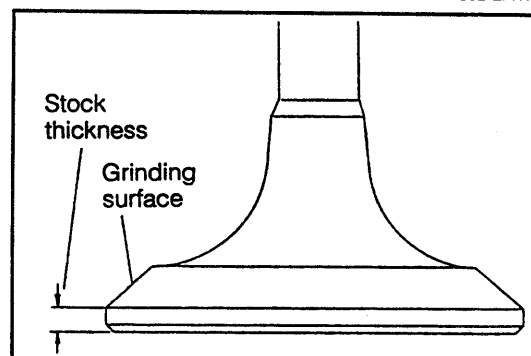
## (3) Inspect the valve head for its stock thickness.

Minimum Stock Thickness

Intake Valve: 0.8 mm (0.0315 inch)

Exhaust Valve: 1.0 mm (0.0394 inch)

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



WN88E-EM176

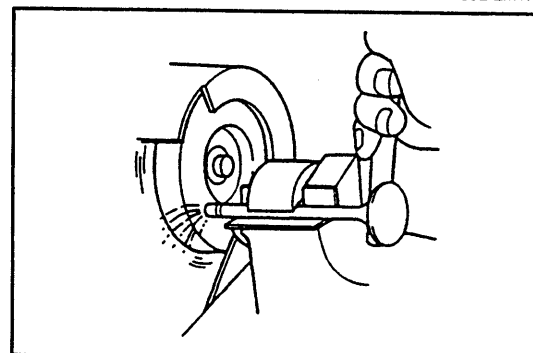
## (4) Inspect the overall length of the valve.

Standard overall length

Intake: 112.8 mm (4.441 inch)

Exhaust: 114.5 mm (4.508 inch)

If the valve stem end exhibits abnormal wear, correct the stem end with a valve refacer.



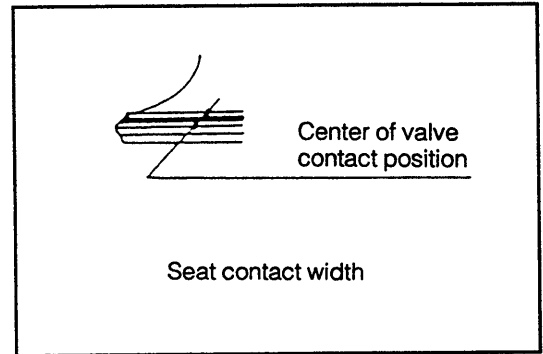
WN88E-EM177

## 14. 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.

WN88E-EM178

- (5) Inspect the valve face and seat for the following items.
  - Ensure that the valve seat contact surface of the valve is continuous over the whole circumference. If not, replace the valve.
  - Ensure that the valve contact surface of the valve seat is continuous over the whole circumference.
  - If not, reface the valve seat.



WN88E-EM179

- 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.

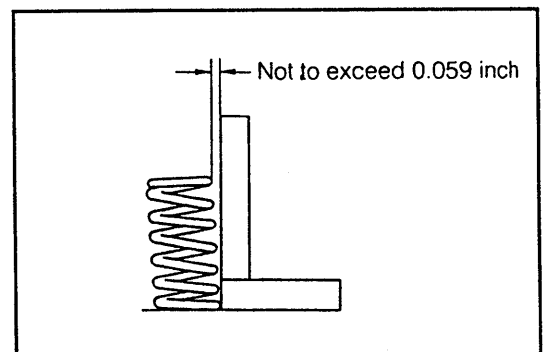
WN88E-EM180

## 15. Inspection of valve springs

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

**Maximum squareness: 1.6 mm (0.063 inch)**

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



WN88E-EM181

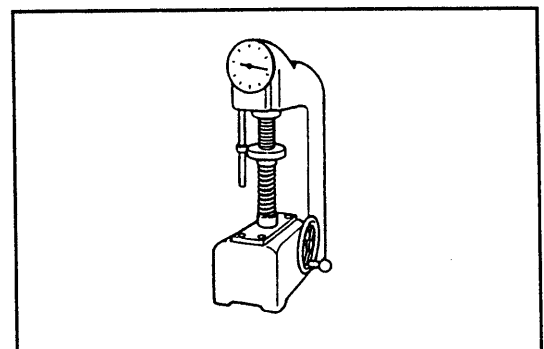
- (2) Measure the valve spring for free length and spring tension, using a spring tester.

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

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

**Minimum tension/installation height:**  
26.4 kg/38 mm (58.2 lb/1.496 inch)

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

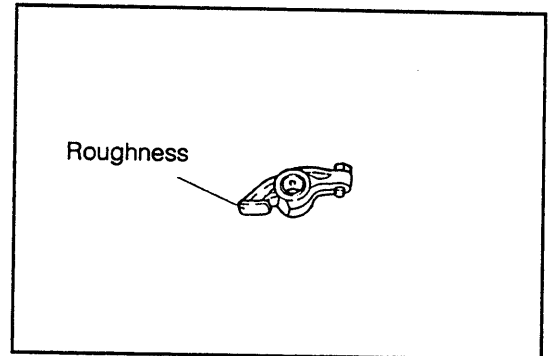


WN88E-EM182

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

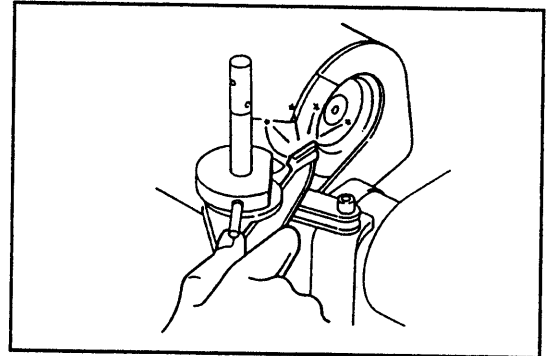
- (1) Visually inspect the valve rocker arm for cracks, seizure or wear.

Replace the valve rocker arm, if necessary.



WN88E-EM183

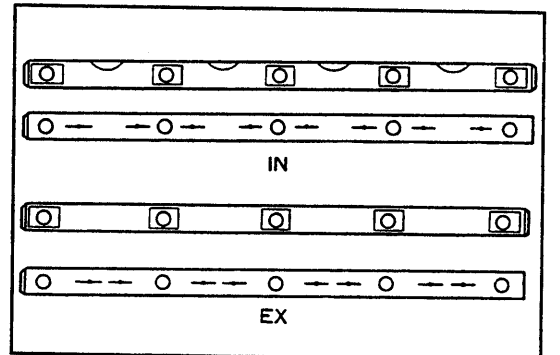
- (2) If the valve rocker arm-to-cam contact surface is worn excessively, grind or replace the rocker arm.



WN88E-EM184

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

Replace the valve rocker shaft, if necessary.



WN88E-EM185

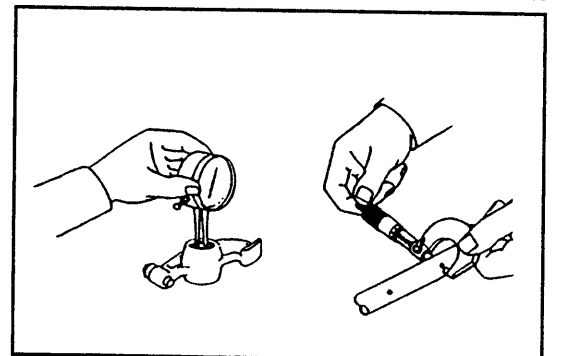
- (4) Measure the valve rocker shaft-to-valve rocker arm.

- 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:**

0.012 - 0.053 mm (0.0005 - 0.0020 inch)

**Allowable Limit:** 0.08 mm (0.0031 inch)



WN88E-EM186

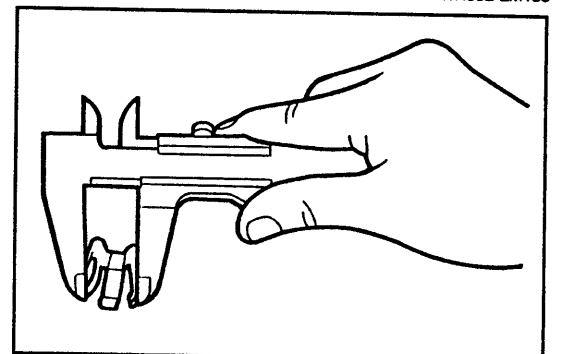
## 17. Inspection of spacer and wave washer

- (1) Visually inspect the wave washer for flattened condition or damage.

- (2) 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.



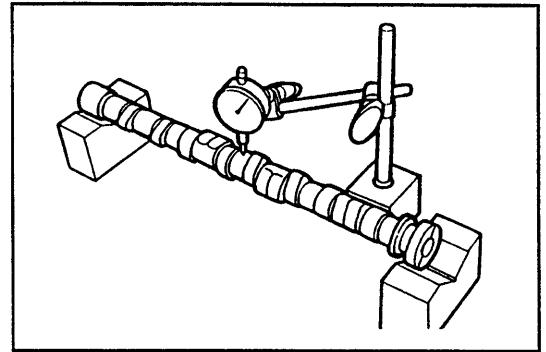
WN88E-EM187

## 18. Inspection of camshaft

- (1) 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.

- (2) Turn the camshaft one turn. Take the difference between the maximum and minimum readings on the dial gauge during the turning.

**Maximum runout:** 0.03 mm (0.0012 inch)



WN88E-EM188

- (3) Checking of cam lobe height

Measure the cam lobe height, using a micrometer.

**Specified cam lobe height**

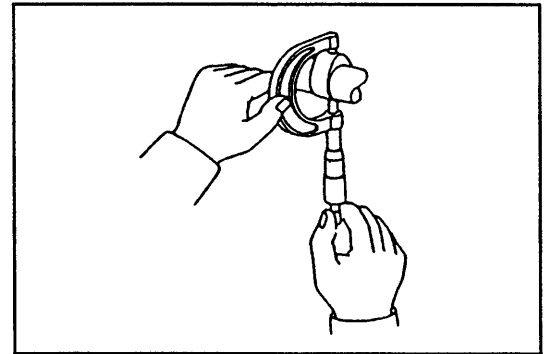
**Intake:** 33.08 - 33.28 mm (1.302 - 1.310 inch)

**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)

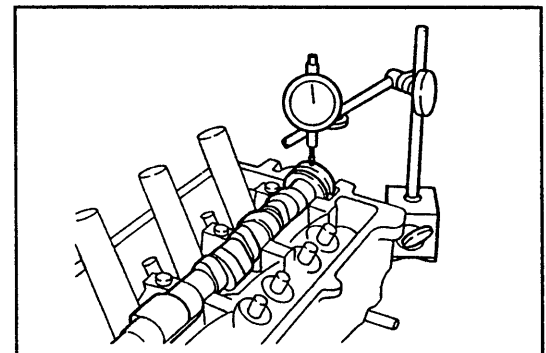


WN88E-EM189

- (4) Inspection of cam for fuel pump  
(Carburetor equipped vehicle only)  
**Diameter:** 42.65 mm (1.679 inch)

- Apply engine oil to the cylinder head camshaft journals and install the camshaft.
- With a dial gauge set exactly from the top direction, turn the camshaft so as to measure the cam stroke.

**Minimum cam stroke:** 4.8 mm (0.189 inch)

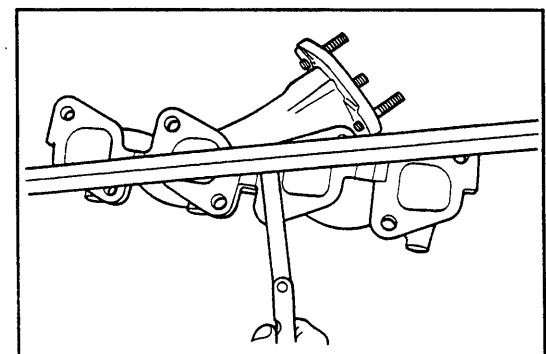


WN88E-EM190

## 19. Inspection of intake manifold and exhaust manifold

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

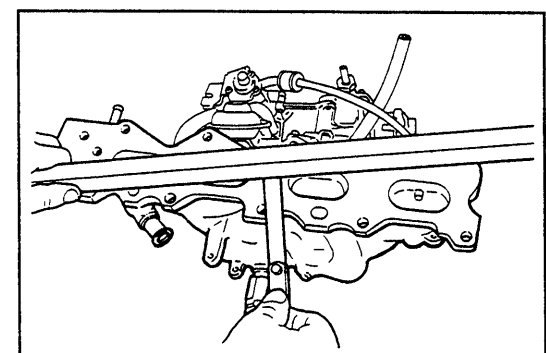
**Maximum warpage:** 0.1 mm (0.0039 inch)



WN88E-EM191

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

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



WN88E-EM192

## ASSEMBLY OF CYLINDER HEAD

### 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.

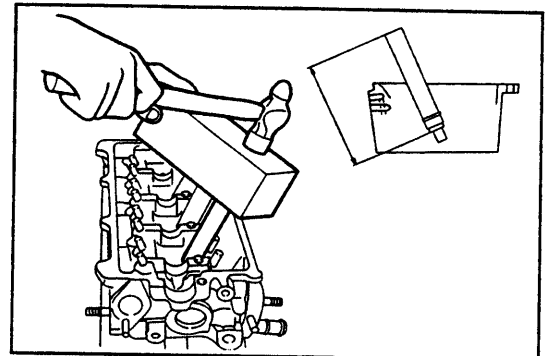
WN88E-EM193

### 1. Assembly of cylinder head

When new cylinder head is installed, spark plug tubes and a heater outlet tube have been furnished separately.

Assembly 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.

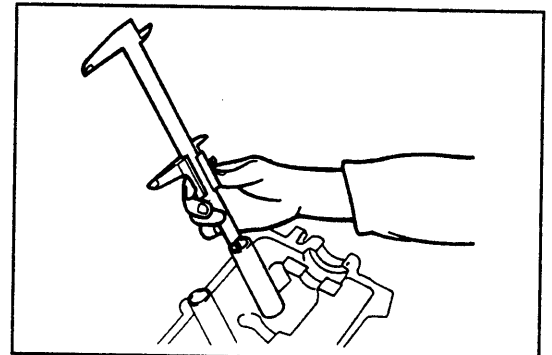


WN88E-EM194

- (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 (5.57 inch)  $\pm$  1 mm.

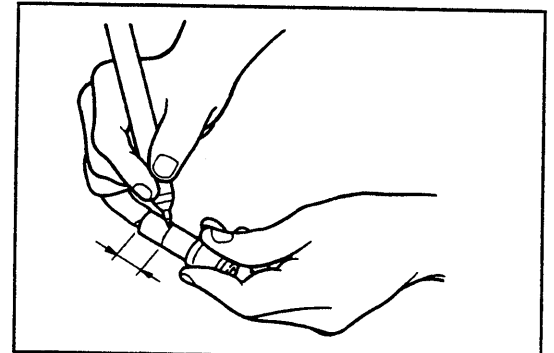
### NOTE:

- Be careful not to drive the spark plug tube too deeply.
- Be 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.



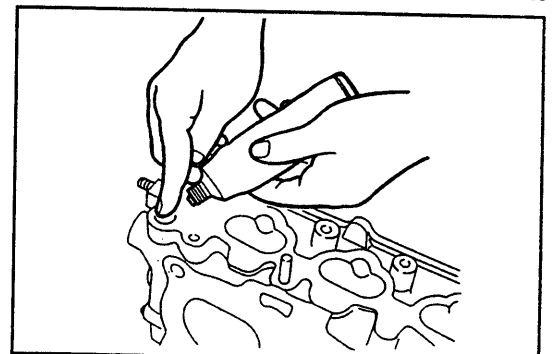
WN88E-EM195

- (4) Put a mark at a point 45.0 mm (1.772 inch) from the forward end of the heater outlet tube.



WN88E-EM196

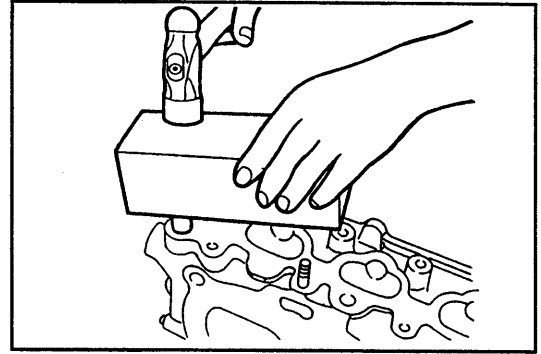
- (5) Apply a thin film of the Tree Bond 1377B to the attaching section for the heater outlet tube on the cylinder head.



WN88E-EM197

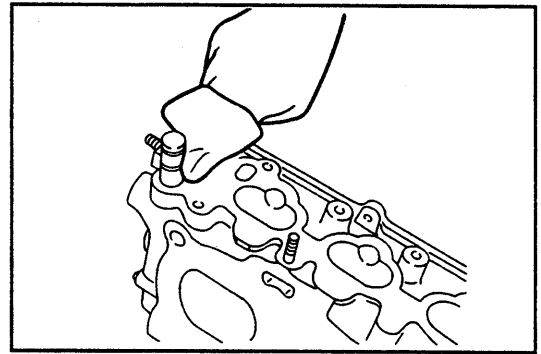


- (6) With a wooden piece interposed, drive the heater outlet tube to the point marked in step (4).



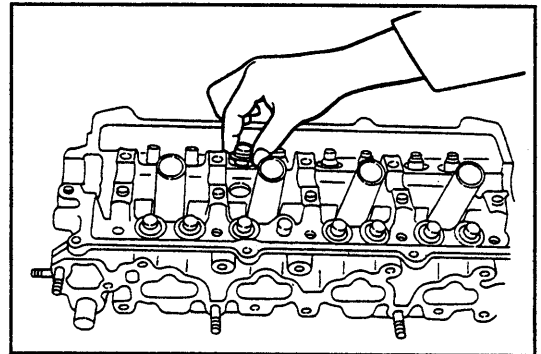
WN88E-EM198

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



WN88E-EM199

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



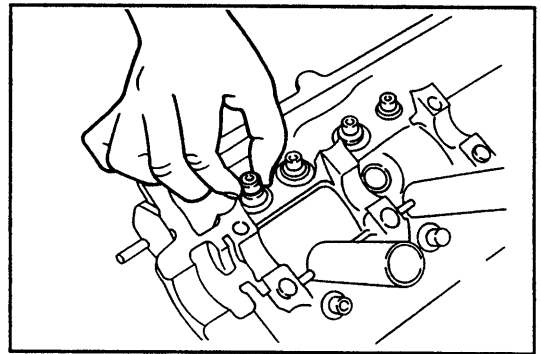
WN88E-EM200

3. Installation of valve stem oil seal

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

**NOTE:**

- Hold the frame of the oil seal.

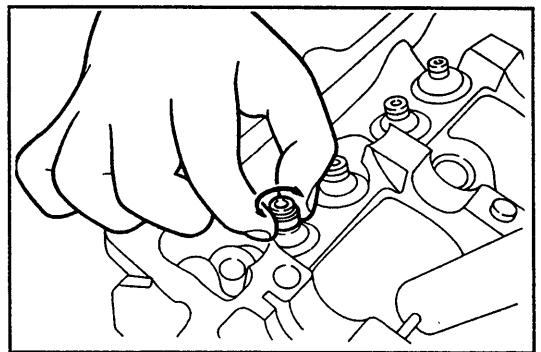


WN88E-EM201

- (3) Turn the oil seal slightly by hand to make sure if it has not been tilted.

**NOTE:**

- Never rotate the oil seal more than one turn, because excessive turning may cause scratches on the oil seal.
- Do not re-use any oil seal which was tilted or driven diagonally.



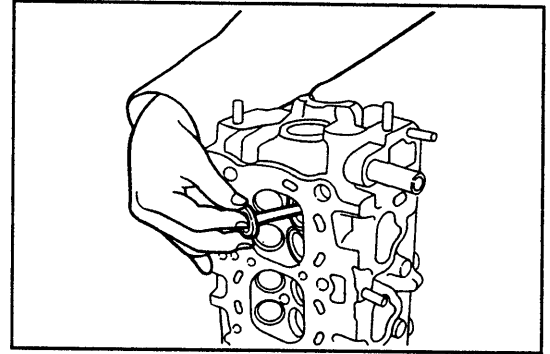
WN88E-EM202

# ENGINE MECHANICALS

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

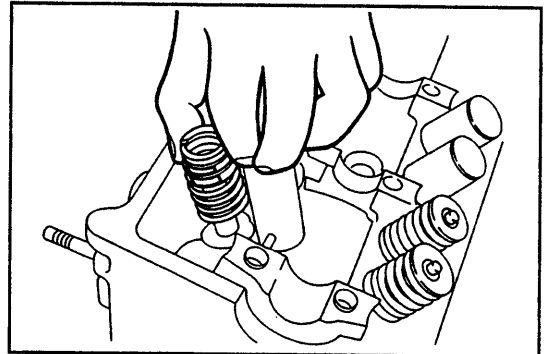
**NOTE:**

- 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.



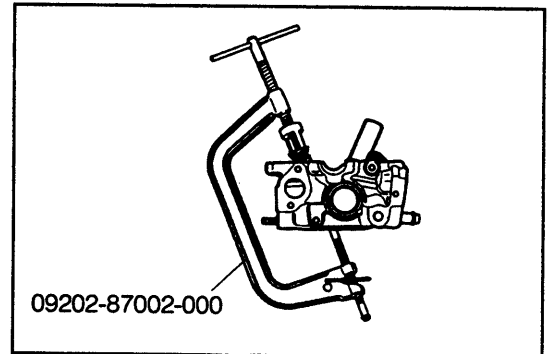
5. Assembly of valve springs, valve spring retainers and valve spring retainer locks

- (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.



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

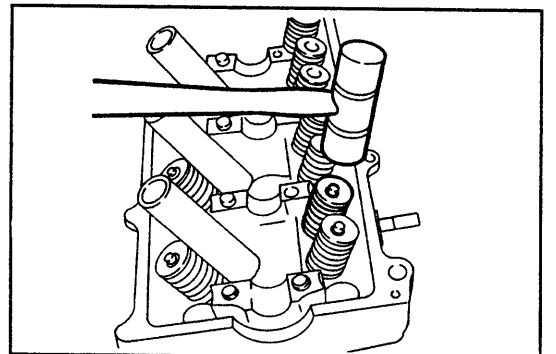
SST: 09202-87002-000



- (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:**

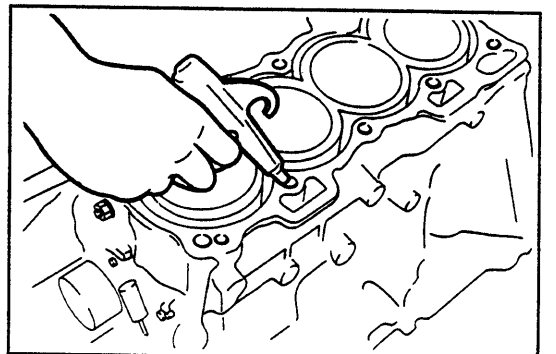
- During this operation, care must be exercised to ensure that the valve spring retainer or retainer locks may not be jumped out.
- Protect your eyes with safety goggles during this operation.



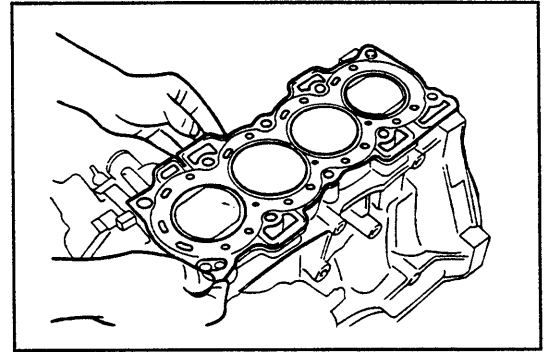
6. Clean the cylinder block head bolt holes.

**WARNING**

Protect your eyes with goggles when using compressed air.

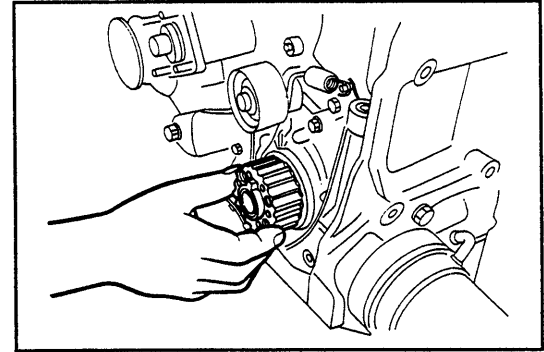


7. Clean the cylinder block upper gasket surface. Install the cylinder head gasket, while aligning it with the pin ring for locating use.



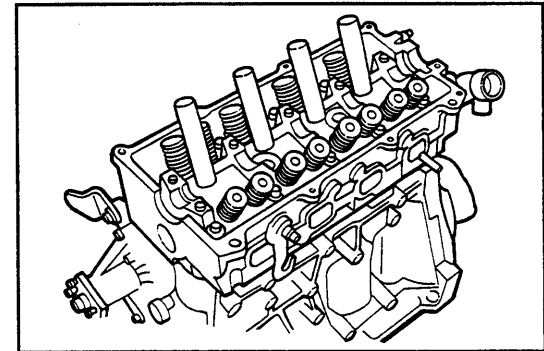
WN88E-EM208

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



WN88E-EM209

9. Install the cylinder head on the cylinder block.



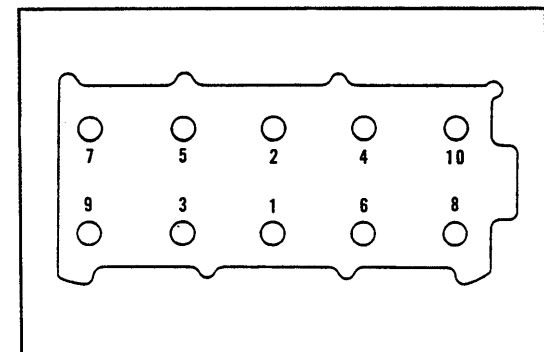
WN88E-EM210

10. 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)**

**NOTE:**

**Make sure that all the bolts are torqued uniformly to a constant level, not only they are torqued within the specified range.**



WN88E-EM211

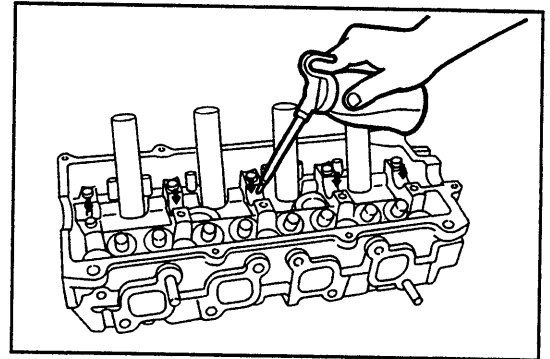
11. Installation of camshaft and rocker shafts  
 (1) Wash and dry the holes for the camshaft cap attaching bolts.

**WARNING:**

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

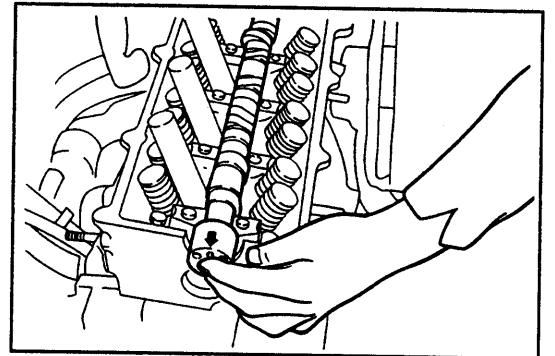
WN88E-EM212

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



WN88E-EM213

- (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.

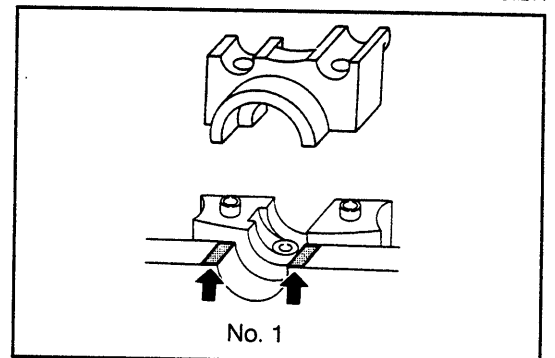


WN88E-EM214

- (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.



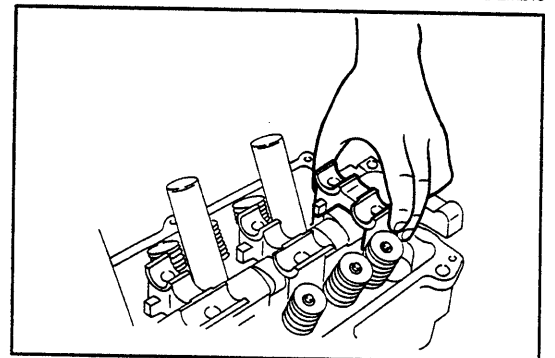
No. 1

WN88E-EM215

- (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.

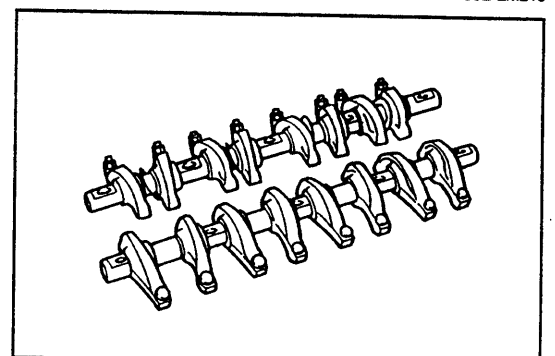


WN88E-EM216

- (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 it.



WN88E-EM218

(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.

(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:**

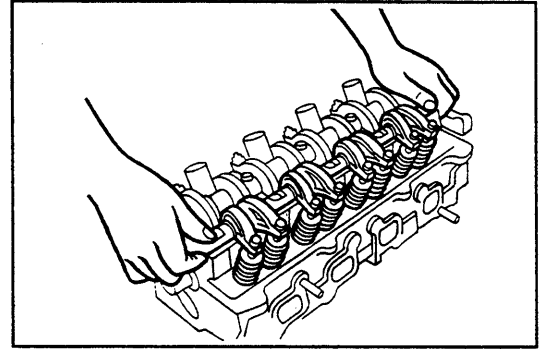
M10 bolt 2.9 - 3.7 kg-m (21.0 - 26.8 ft-lb)

M8 bolt 1.3 - 1.7 kg-m (9.4 - 12.3 ft-lb)

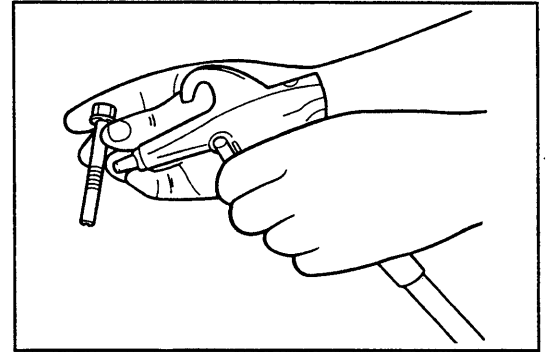
**CAUTION:**

- Never exceed the specified tightening torque.
- The bolts and bolt holes should be dry when tightening the bolts.
- When using compressed air, protect your eyes with safety goggles.

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



WN88E-EM218



WN88E-EM219

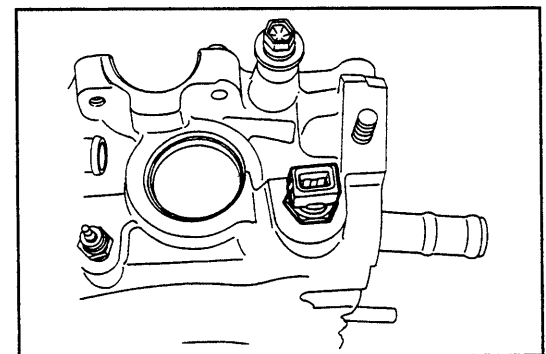
WN88E-EM220

13. Clean the threaded portion of the water temperature sensor. Wind seal tape around the threaded portion and install the sensor to the cylinder head. (HD-E engine only)

**Tightening Torque:** 2.5 - 3.5 kg-m (18.1 - 25.3 ft-lb)

**NOTE:**

When using a new water temperature sensor, seal tape is unnecessary since seal material is coated on the water temperature sensor.

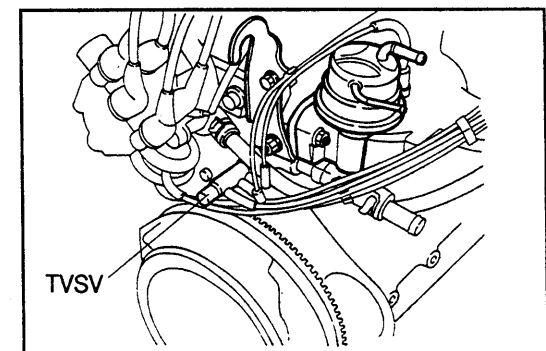


WN88E-EM221

14. Clean the threaded portion of the TVSV. Wind seal tape around the threaded portion and install the TVSV to the cylinder head.

**NOTE:**

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



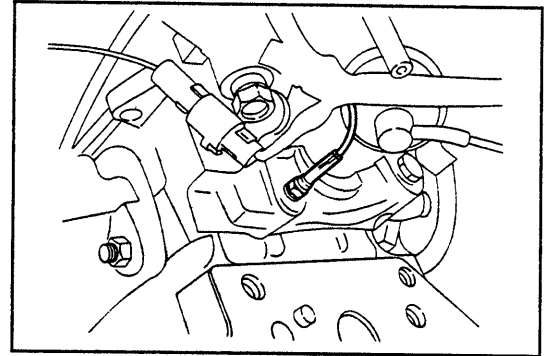
WN88E-EM222

## ENGINE MECHANICALS

15. 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)

**NOTE:**

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

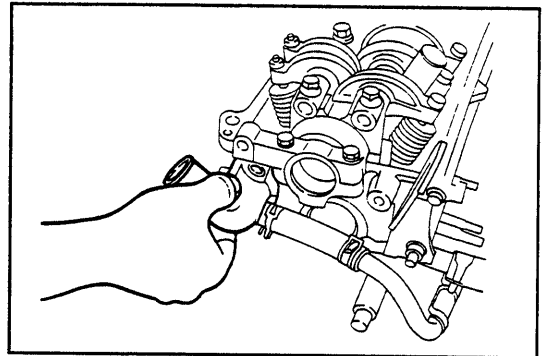


WN88E-EM223

16. Install the water outlet to the cylinder head with a new gasket interposed.

**NOTE:**

Tighten the oxygen sensor connector clamp too, at the stud bolt side. (HD-E engine only)



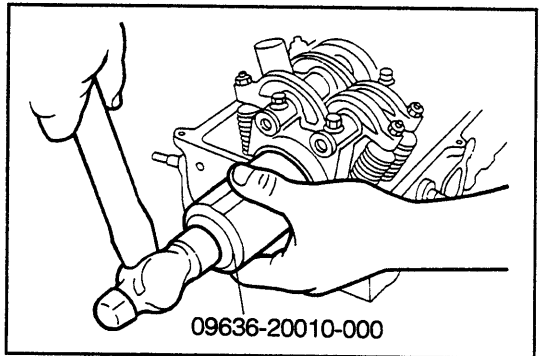
WN88E-EM224

17. Connect the by-pass hoses and by-pass pipe to the water outlet.

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

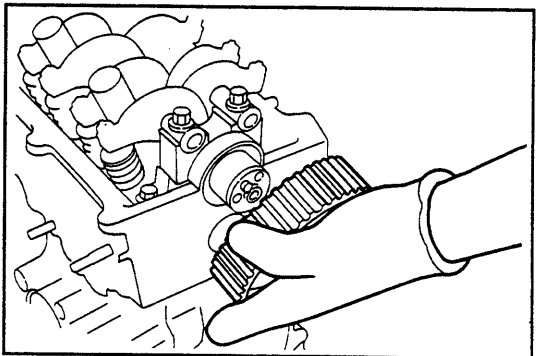
Drive the oil seal into position, using the following SST.

SST: 09636-20010-000



WN88E-EM225

19. 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.



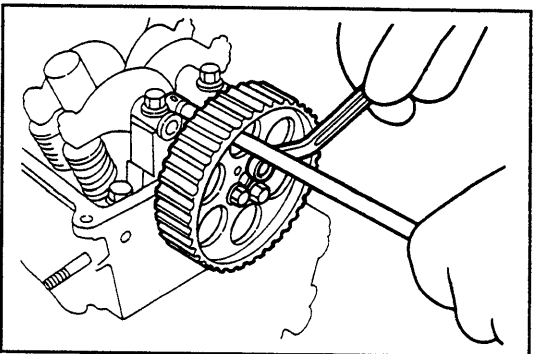
WN88E-EM226

20. Attach the attaching bolts of the camshaft timing belt pulley. Tighten the attaching bolt while preventing the camshaft timing belt pulley from turning by means of a suitable iron rod.

Tightening Torque: 1.5 - 2.2 kg-m (10.9 - 15.9 ft-lb)

**NOTE:**

- Do not turn the camshaft independently.
- Be careful not to damage the cylinder head cover gasket surface.
- The bolts and bolts holes should be dry during the tightening.

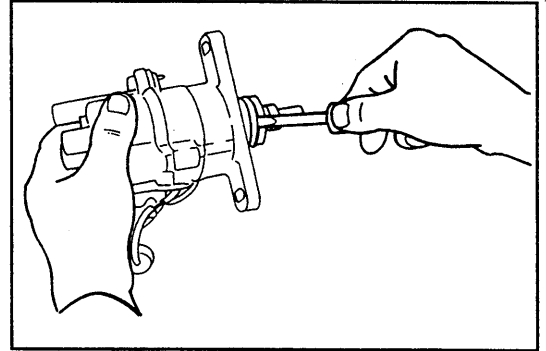


WN88E-EM227

21. Replace the "O" ring of the distributor body with a new one.

**NOTE:**

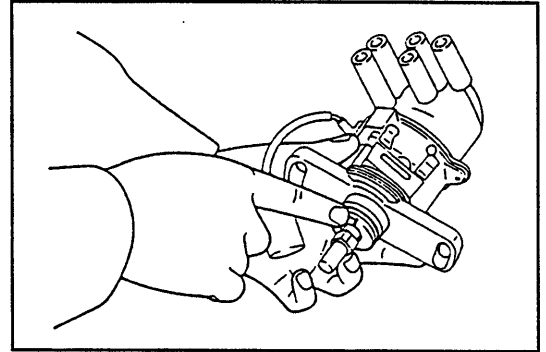
Care must be exercised to avoid scratching the new "O" ring.



WN88E-EM228

22. 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.

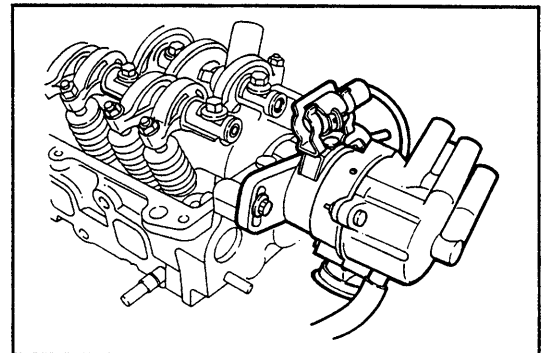
During this installation, the aligned cutout sections must come at the top side of the engine.



WN88E-EM229

23. 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 (10.9 - 15.9 ft-lb)



WN88E-EM230

24. Connect the distributor connector, the water temperature sender gauge and the water temperature sensor connector.

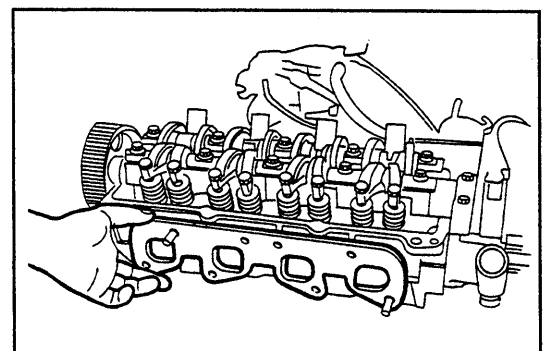
WN88E-EM231

25. Fill 30 cc (1.83 cubic inch) of engine oil to the oil well of each cylinder of the cylinder head.

26. 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.

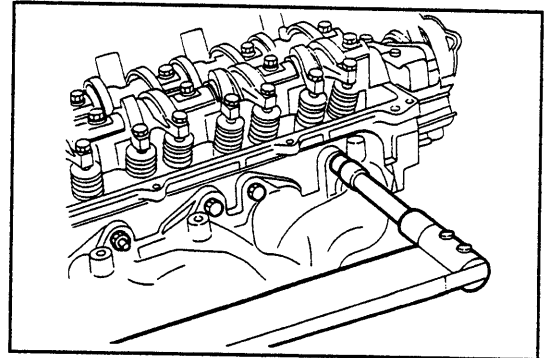


WN88E-EM232

## ENGINE MECHANICALS

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

**Tightening Torque: 3.0 - 4.5 kg-m (21.7 - 32.5 ft-lb)**

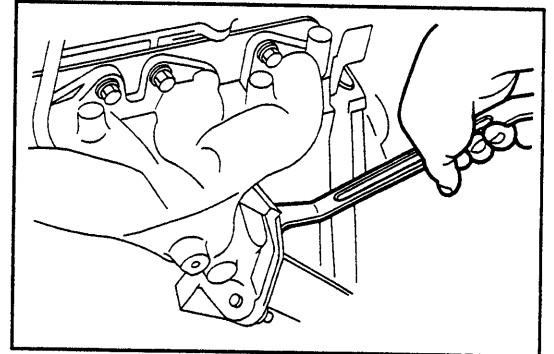


WN88E-EM233

28. Connect the exhaust pipe to the exhaust manifold with a new gasket interposed.

Then, Tighten the attaching nuts.

**Tightening Torque: 3.5 - 5.0 kg-m (25.3 - 36.2 ft-lb)**



WN88E-EM234

29. Replace the "O" ring of the oil level gauge guide with a new "O" ring. Insert the oil level gauge guide into the cylinder block.

WN88E-EM235

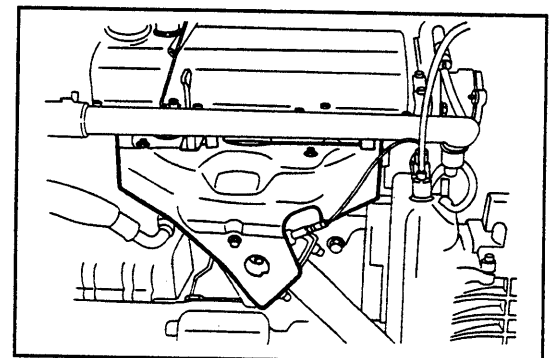
30. Install the exhaust manifold cover and tighten the attaching bolts.

31. Connect the water outlet pipe to the water outlet with water outlet hoses. Install the hose band.

32. Install the Oxygen sensor to the exhaust manifold (HD-E engine only).

**Tightening Torque: 3.0 - 4.0 kg-m (21.7 - 28.9 ft-lb)**

33. Install the oil level gauge.



WN88E-EM236

34. Installation of water inlet

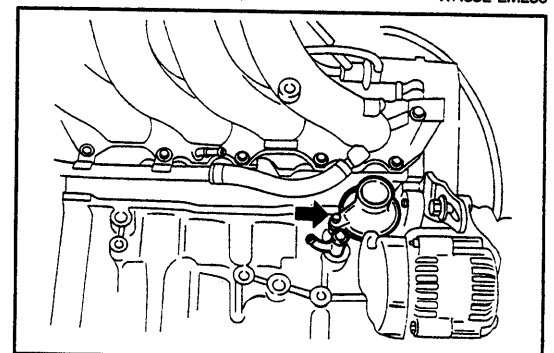
- (1) Install the thermostat to the cylinder block in such a way the jiggle pin of the thermostat comes exactly at the top of the engine.

**NOTE:**

**Be careful not to damage the gasket section.**

- (2) Install the water inlet to the cylinder block.

**Tightening Torque: 0.6 - 0.9 kg-m (4.3 - 6.5 ft-lb)**



WN88E-EM237



35. Connect the water hose as follows.
- (1) Front heater outlet at dush panel
  - (2) Front heater inlet at dush panel

WN88E-EM238

## INSTALLATION OF INTAKE MANIFOLD SIDE PARTS

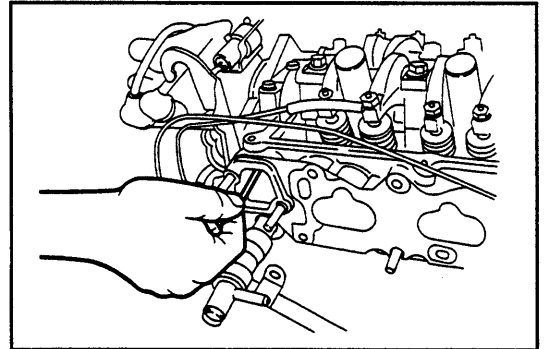
### [HD-C Engine]

1. Installation of fuel pump
  - (1) Attach a new intake manifold gasket.
  - (2) Apply engine oil to the fuel pump rod. Insert it into the cylinder head.
  
- (3) Install the fuel pump to the cylinder head with a new fuel pump insulator interposed.
 

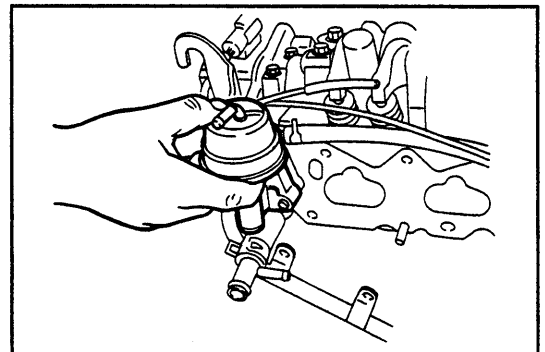
**Tightening Torque:** 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

#### NOTE:

Be careful to install the insulator in the correct assembly direction. Failure to observe this caution will fail to assemble the insulator because it will interfere with other parts.



WN88E-EM239



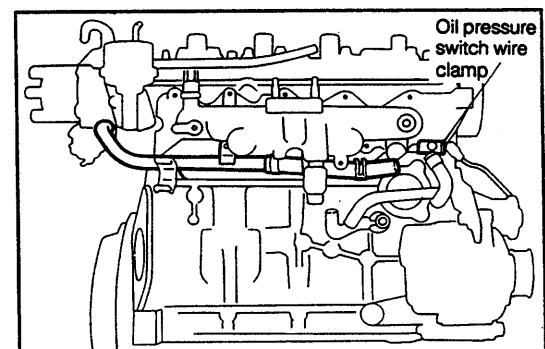
WN88E-EM240

2. Connect the fuel hose to the fuel pump. Attach the hose bands.
 

**NOTE:**  
The knobbed section of the hose clip for the fuel hose between the fuel pump and the carburetor should be faced downward.
  
3. Installation of make manifold
  - (1) Attach the intake manifold to the cylinder head.

WN88E-EM241

- (2) Install the water by-pass pipe to the stud bolt of the cylinder head, as shown in the figure. Connect the by-pass hose to the intake manifold. Attach the hose bands.
- (3) Install the oil pressure switch wire clamp to the stud bolt, as shown in the figure.

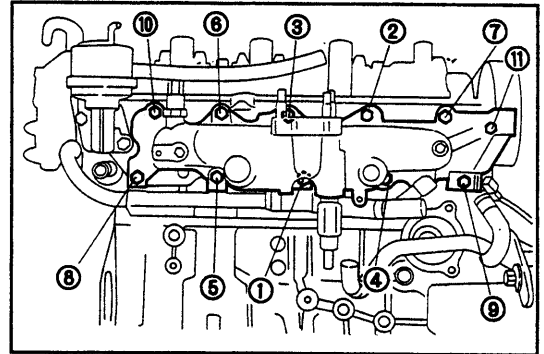


WN88E-EM242

## ENGINE MECHANICALS

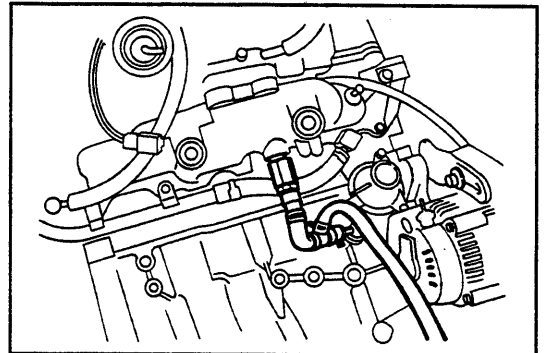
- (4) Tighten the intake manifold attaching bolts and nuts evenly to the specified torque over two or three stages in the sequence as indicated in the figure.

Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)



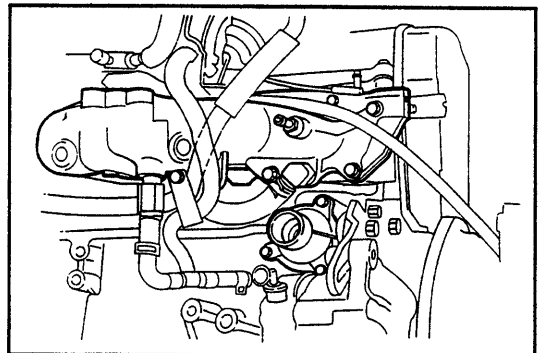
WN88E-EM243

4. Connect the water hose to the thermo valve. Attach the hose bands.



WN88E-EM244

5. Connect the brake booster hose to the intake manifold in such a way that the arrow mark of the booster hose faces the intake manifold side.  
6. Install the water hose clamp to the intake manifold.



WN88E-EM245

7. Install the carburetor heat insulator to the intake manifold.

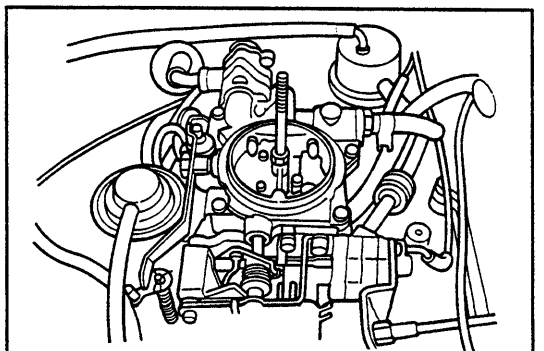
**NOTE:**

Be careful not to damage the gasket. Replace the heat insulator with a new part if the gasket exhibits damage.

WN88E-EM246

8. Install the carburetor to the intake manifold.  
Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

9. Connect the connectors of the solenoid valve and outer vent valve.

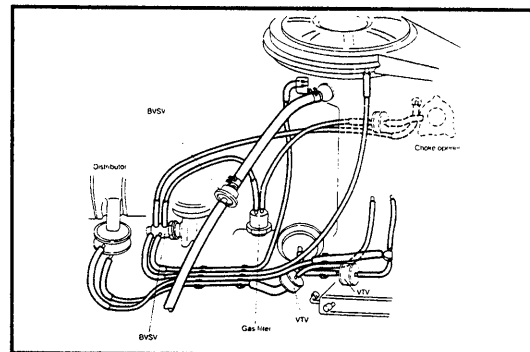


WN88E-EM247

## 10. Connection of vacuum hoses

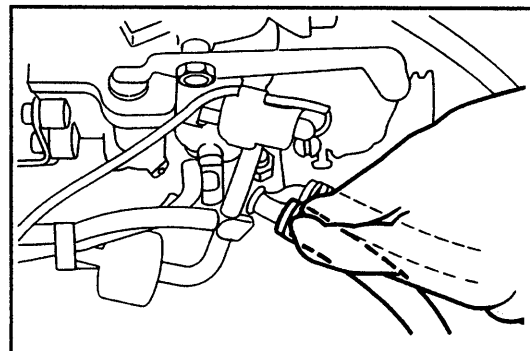
Connect the vacuum hose, as shown in the figure.

- Outer vent hose to outer vent
- Choke breaker to TVSV
- Carburetor to BSVV
- Throttle positioner to carburetor
- Vacuum hose to gas filter
- Vacuum hose to distributor



WN88E-EM248

## 11. Connector the hot water circulating hose to the carburetor. Attach the hose bands.

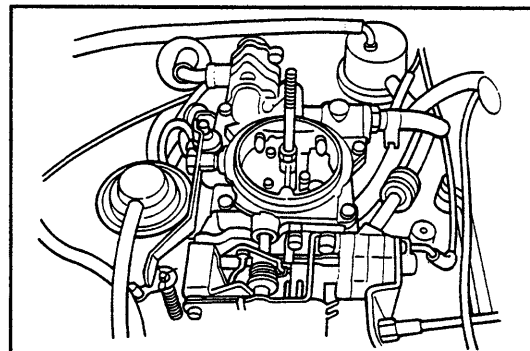


WN88E-EM249

## 12. Connect the fuel hose to the carburetor.

Attach the hose bands.

## 13. Temporarily install the cylinder head cover to the cylinder head.



WN88E-EM250

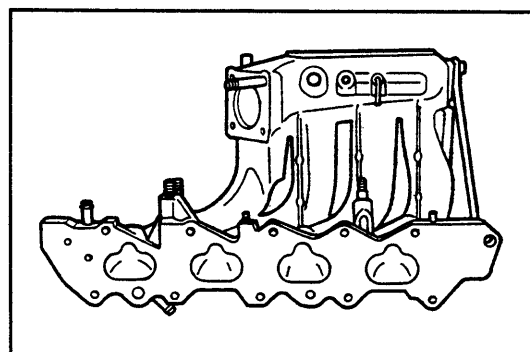
## INSTALLATION OF INTAKE MANIFOLD SIDE PARTS

### [HD-E Engine]

1. Clean the intake manifold.

#### WARNING:

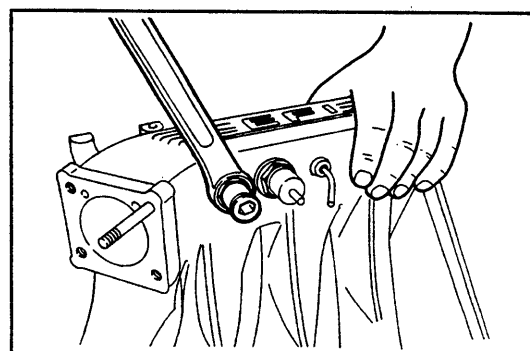
When using compressed air, protect your eyes with safety goggles.



WN88E-EM251

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

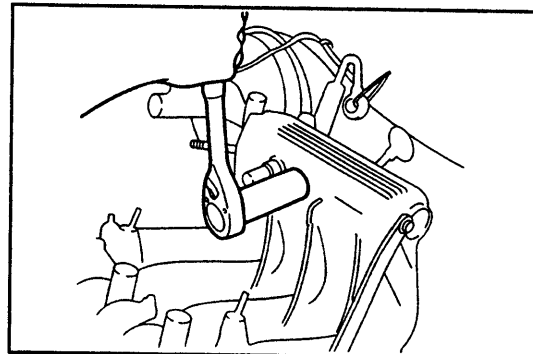
Tightening Torque: 3.0 - 4.0 kg-m (21.7 - 28.9 ft-lb)



WN88E-EM252

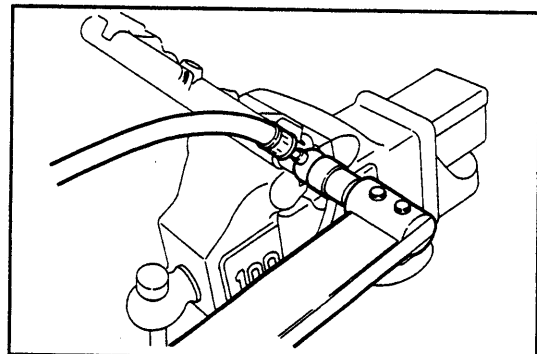
## ENGINE MECHANICALS

3. 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 - 14.5 ft-lb)



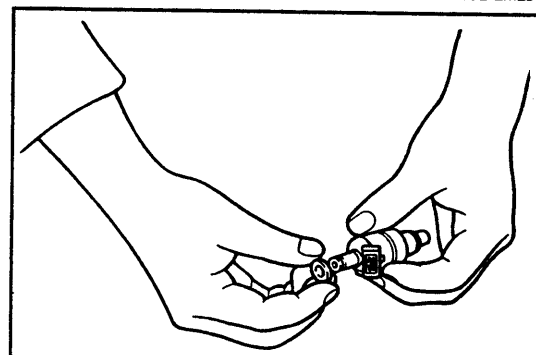
WN88E-EM253

4. Install the fuel hose to the delivery pipe with a new washer interposed.  
Tightening Torque: 3.5 - 4.5 kg-m (25.4 - 32.6 ft-lb)



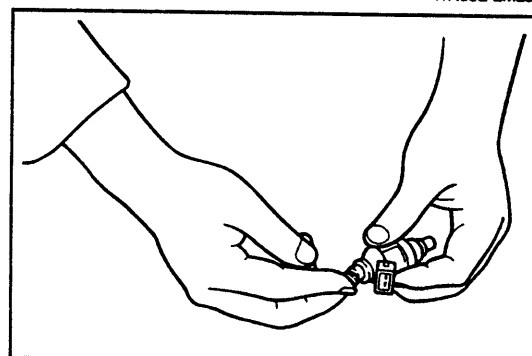
WN88E-EM254

6. 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.



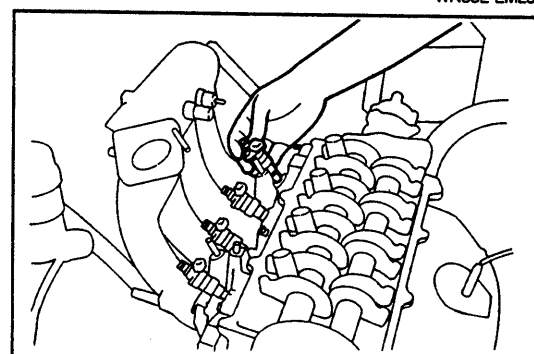
WN88E-EM255

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



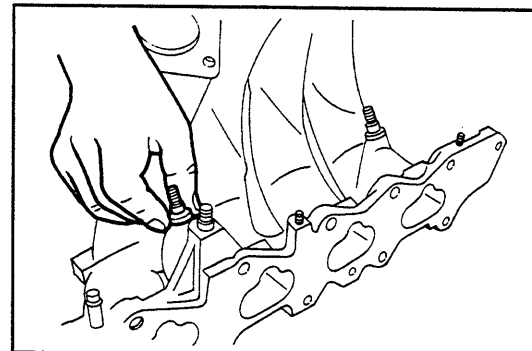
WN88E-EM256

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



WN88E-EM257

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

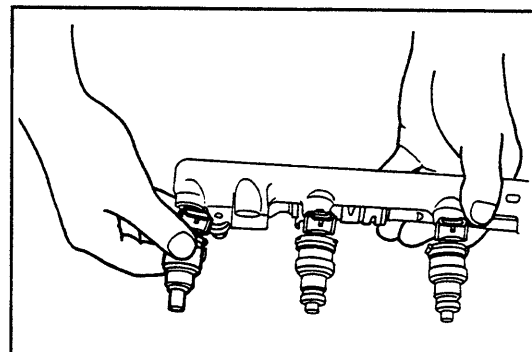


WN88E-EM258

10. Apply gasoline or silicon oil to the "O" ring of the injector.  
Then, install the injector to the delivery pipe.
11. Install the injector vibration insulator to the intake manifold section.

**NOTE:**

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

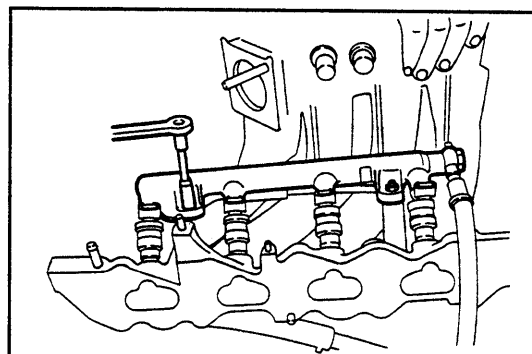


WN88E-EM259

12. Install the delivery pipe to the intake manifold.

**CAUTION:**

- Be 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.



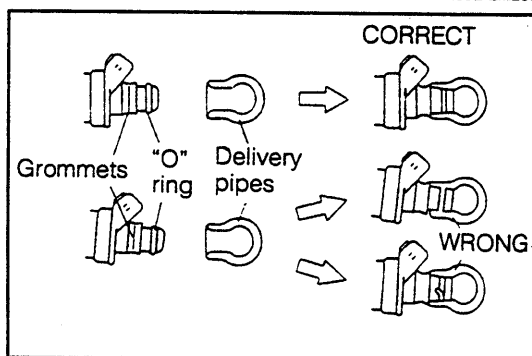
WN88E-EM260

13. Tighten the attaching bolt and nuts of the delivery pipe.  
Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

**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.



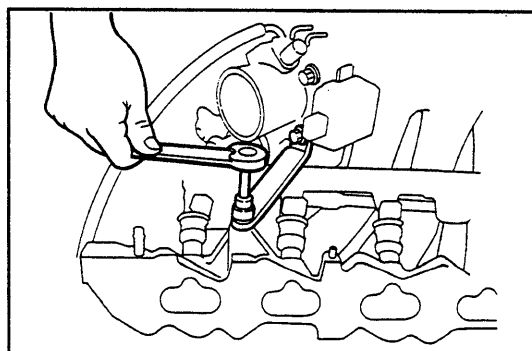
WN88E-EM261

14. Install the throttle body to the surge tank with a new gasket interposed. Install the surge tank stay No. 1 to the throttle body intake manifold, using bolts and nuts.

**Tightening Torque:**

Bolt 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

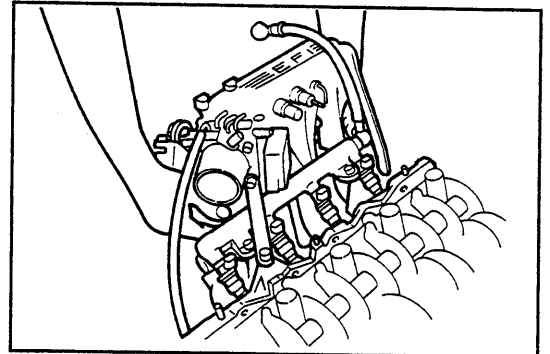
Nut 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)



WN88E-EM262

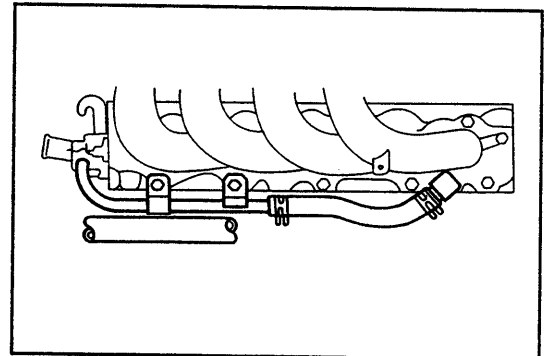
## ENGINE MECHANICALS

15. Install the intake manifold assembly to the cylinder head with a new intake manifold gasket interposed.
16. Connect the heater inlet hose to the cylinder head and attach the hose band.



WN88E-EM263

17. Install the water by-pass pipe to the stud bolt for intake manifold installation use, as shown in the figure.



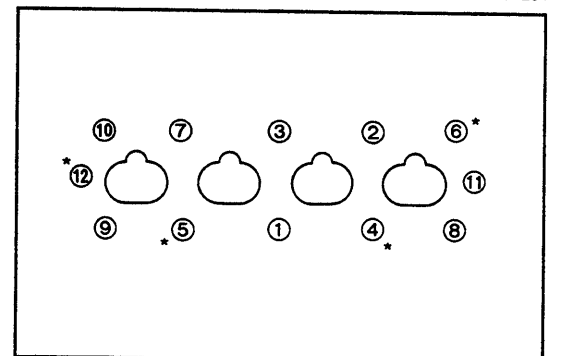
WN88E-EM264

18. Tighten the attaching bolts and nuts of the intake manifold evenly over two or three stages, following the sequence in the figure.

**Tightening Torque:** 1.5 - 2.2 kg-m (10.9 - 15.9 ft-lb)

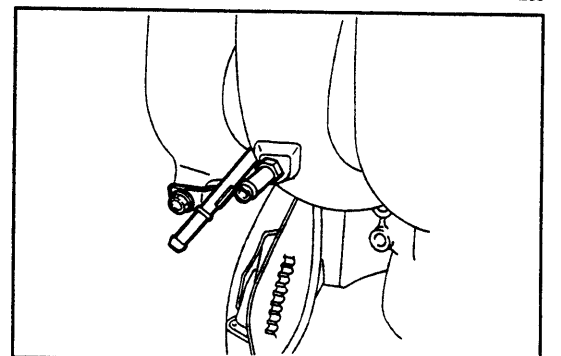
**NOTE:**

Do not install the nut bearing an asterisk "\*" mark. Attach the wire harness clamp on the point with the asterisk "\*" mark.



WN88E-EM265

19. Tighten the fuel return pipe from the fuel pressure regulator valve to the intake manifold with the attaching bolt.

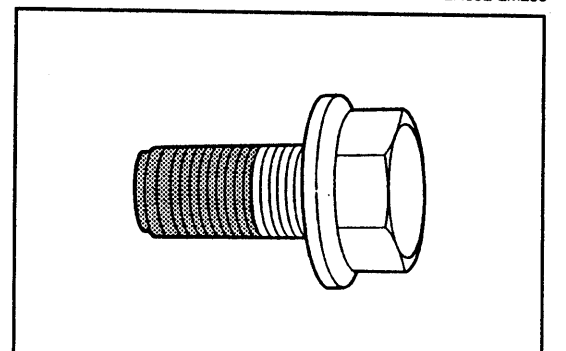


EN88E-EM266

20. Clean the surge tank side attaching bolt of the surge tank stay No. 3. Apply a thin film of the Three Bond 1104 to the threaded portion.

**NOTE:**

Be careful not to let the bond to stick to the bolt washer.



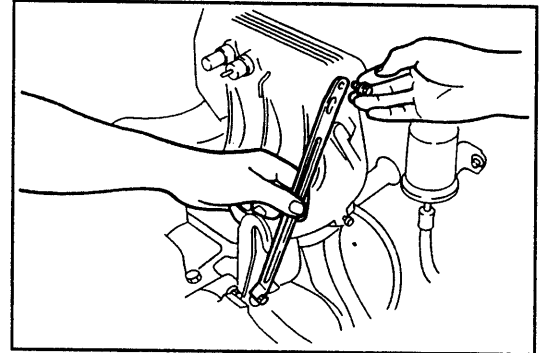
WN88E-EM266A

21. Install the engine hanger No. 2 and surge tank stay No. 3 to the stud bolt at the cylinder head transmission side. Install the surge tank stay No. 3 to the surge tank side. Tighten the attaching nuts and bolts.

**Tightening Torque:**

**Bolt** 1.9 - 3.1 kg-m (13.7 - 22.4 ft-lb)

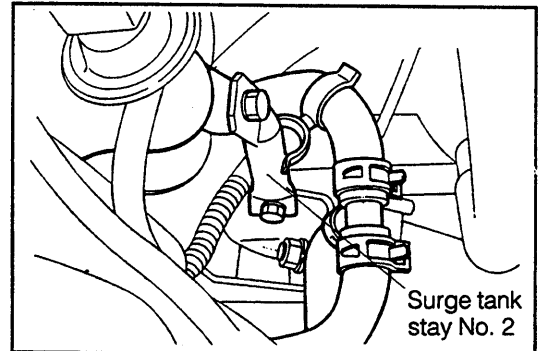
**Nut** 1.9 - 3.1 kg-m (13.7 - 22.4 ft-lb)



WN88E-EM267

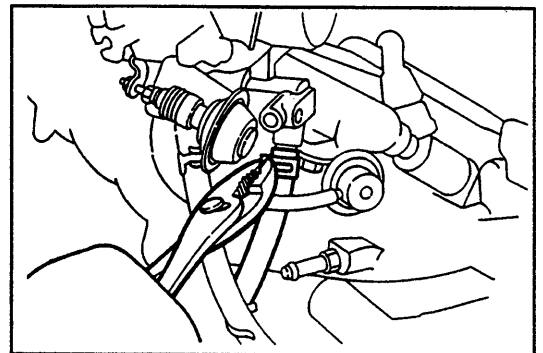
22. Fit the surge tank stay No. 2 to the surge tank. Tighten the attaching bolt and nut.

**Tightening Torque:** 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)



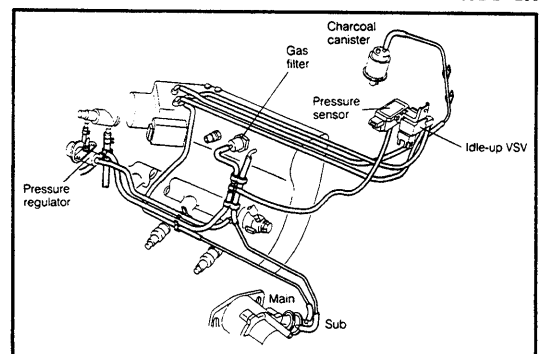
WN88E-EM268

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



WN88E-EM269

24. Connect the vacuum hose as shown in the figure. Connect the hose clamp between the delivery pipe and the pressure regulator.



WN88E-EM270

25. Connect the brake booster hose to the intake manifold.

**NOTE:**

Connect the brake booster hose in such a way that the arrow mark of the booster hose faces the intake manifold side.

26. Connection of engine wire

(1) Install the engine wire clamp, clamp bolt and ground cable.

(2) Connect the following connectors.

- Oxygen sensor connectors

## ENGINE MECHANICALS

- Water temperature sender gauge connector
- Distributor connector
- Cooling water temperature sensor connector
- Injector connectors
- Pressure sensor connector
- Intake air temperature sensor connector
- Throttle position sensor connector

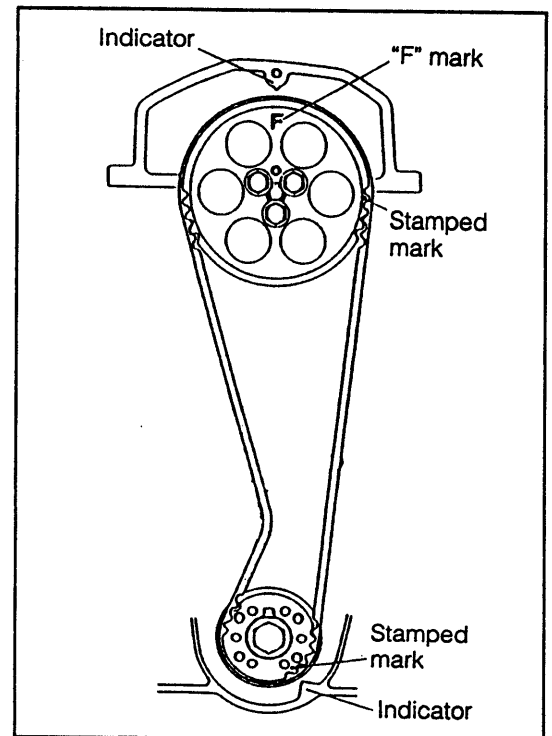
27. Temporarily install the cylinder head cover to the cylinder head.

WN88E-EM271

### INSTALLATION OF TIMING BELT

(See page EM-27)

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



WN88E-EM272

### ADJUSTMENT AND INSTALLATION OF OTHER PART

1. Adjustment of Valve Clearances

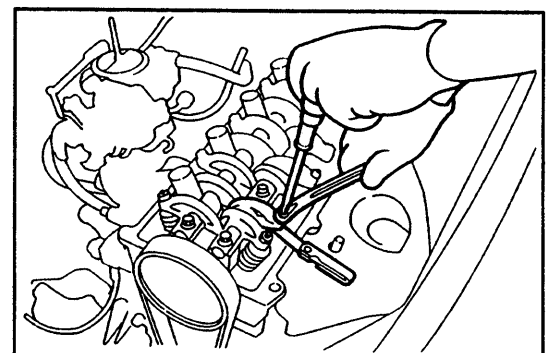
#### NOTE:

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.

WN88E-EM273

- (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.



WN88E-EM274



Rocker arm condition		Cylinder No.	1	2	3	4
(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		○	○	×	×
	EX		○	×	○	×

**Valve Clearance (Cold):**

Intake 0.18 mm (0.0071 inch)

Exhaust 0.25 mm (0.0098 inch)

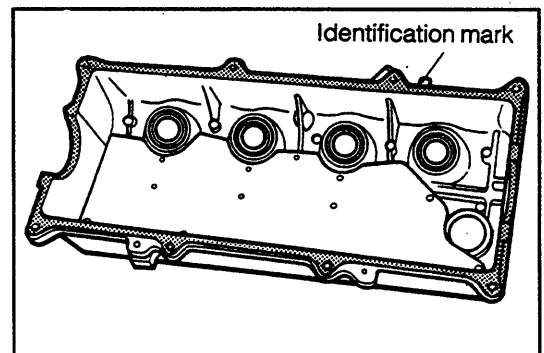
**NOTE:**

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

WN88E-EM275

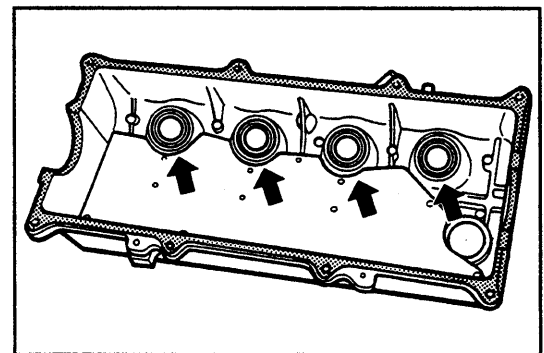
**2. Installation of cylinder head cover**

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



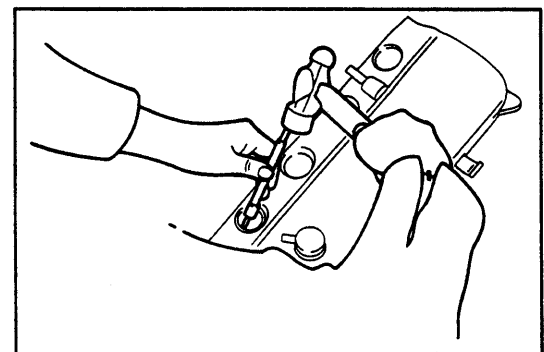
WN88E-EM276

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



WN88E-EM277

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



WN88E-EM278

# ENGINE MECHANICALS

- When installing the grommet, drive it into position, using the following SST.  
SST: 09388-87702-000

## NOTE:

- Make sure that the grommet 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.

- (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:

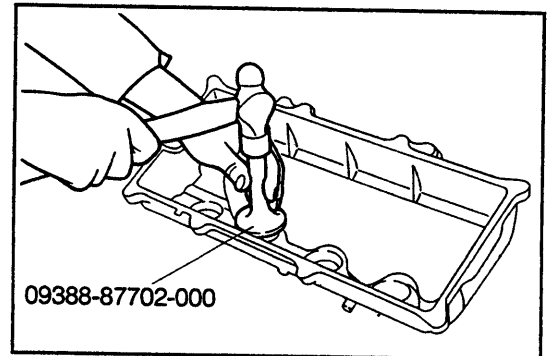
- Be careful not to scratch the rubber grommet for the spark plug tube during the installation.
- Care must be exercised to ensure that the rubber grommet will not ride over the spark plug tube.

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

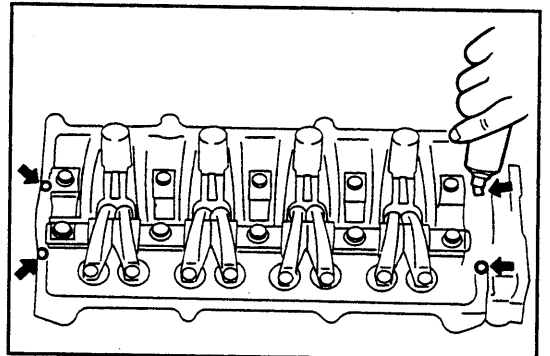
Tightening Torque: 0.3 - 0.5 kg-m (21.7 - 36.1 ft-lb)

- (7) Install the oxygen sensor harness to the clamp. (HD-E engine only)

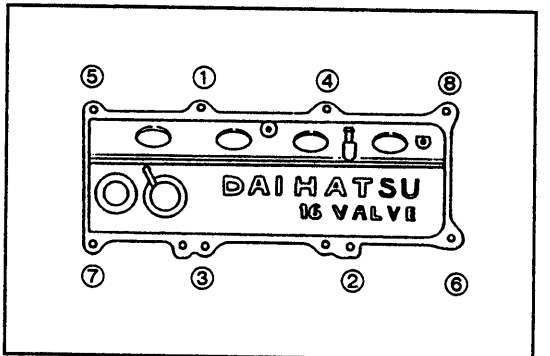
- (8) Connect the blow-by gas hoses to the cylinder head and throttle body. (HD-E engine only)



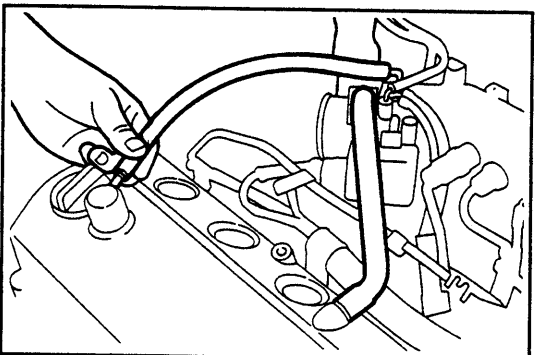
WN88E-EM279



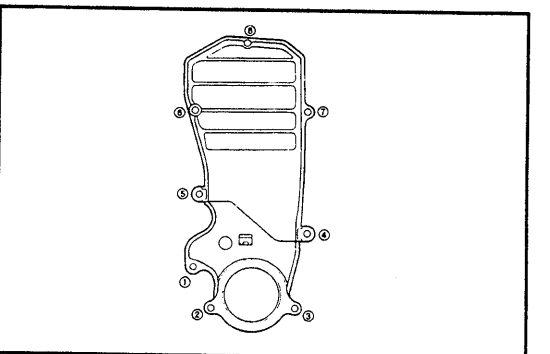
WN88E-EM280



WN88E-EM281



WN88E-EM282



WN88E-EM283

3. Install the timing belt cover.

Tightening Torque: 0.2 - 0.4 kg-m (1.4 - 2.9 ft-lb)

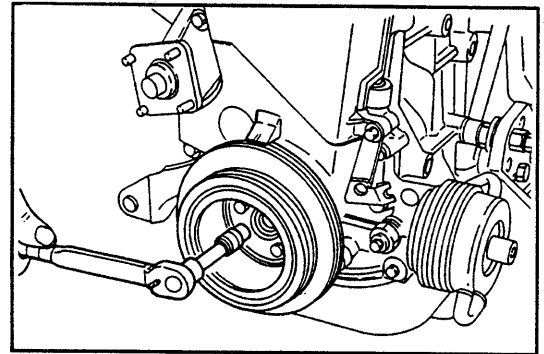
## NOTE:

Attaching bolts ④ and ⑤ should be installed first of all.

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)

**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.

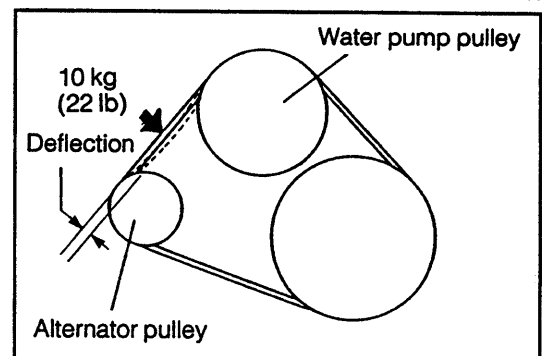


WN88E-EM284

5. Installation of fluid coupling 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.
  - (3) Install the fluid coupling to the water pump by means of four bolts through water pump pulley.  
Tightening Torque: 1.0 - 1.8 kg-m (7.2 - 13 ft-lb)

- (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 tanks.

6. Install the V 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: 6.0 - 8.0 mm (0.24 - 0.31 inch)  
With a force of 10 kg (22 lb) applied to point indicated in figure



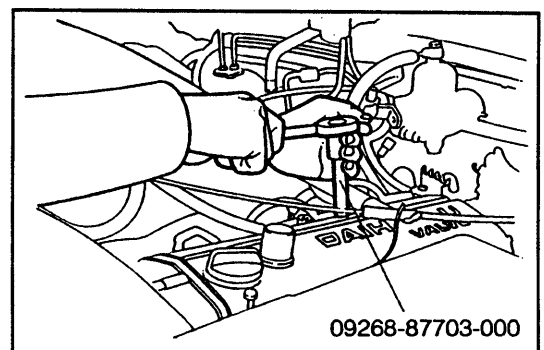
WN88E-EM286

WN88E-EM287

7. Install the power steering pump and the air conditioning pump. (if equipped)
8. Install the drive belt of power steering pump and Install the drive belt of air conditioning pump. (if equipped)

WN88E-EM288

9. Install the reserve tank to the radiator assembly bracket. Insert the over flow hose to the radiator.
10. Install the spark plug by using SST.  
SST: 09268-87703-000

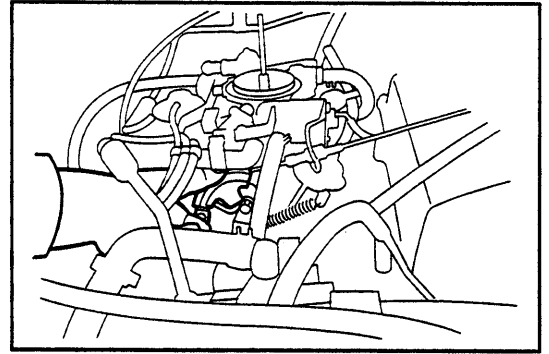


09268-87703-000

WN88E-EM289

## ENGINE MECHANICALS

11. Connect the accelerator cable to the carburetor. Adjust the accelerator cable so that the free play in its axial direction may be 3 - 8 mm (0.12 - 0.13 inch).

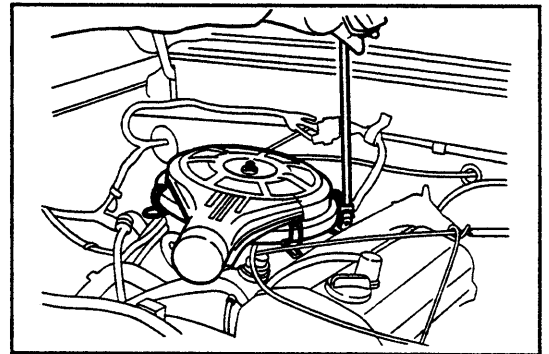


WN88E-EM290

12. Install the air cleaner case onto the carburetor.  
(HD-C engine only)

**NOTE:**

In this time, if the gasket is damaged, replace the gasket.



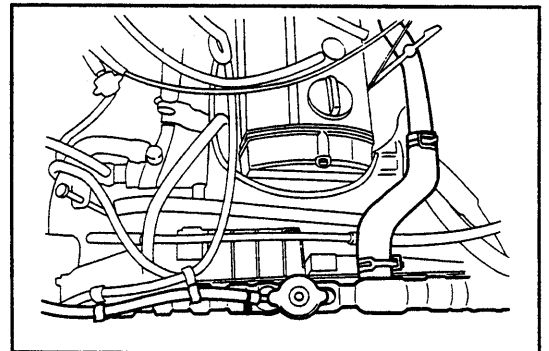
WN88E-EM291

13. Connect the vacuum hoses as follows.  
(HD-C engine)

- Between the air cleaner and the TVSV
- Between the carburetor and the ITC valve
- Between the outer vent valve and the BVSV

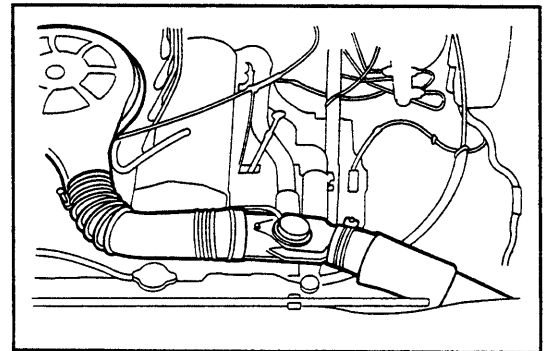
WN88E-EM292

14. Connect the water outlet hose to the radiator upper tank.



WN88E-EM293

15. Install the cool air intake.  
(HD-C engine)
16. Install the hot air intake hose.  
(HD-C engine)
17. Install the PCV hoses. (HD-C engine)



WN88E-EM294

18. Connect the resistive cord (HD-C engine)

**NOTE:**

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

19. Connect the resistive cord to the cord clamp. (HD-C engine)

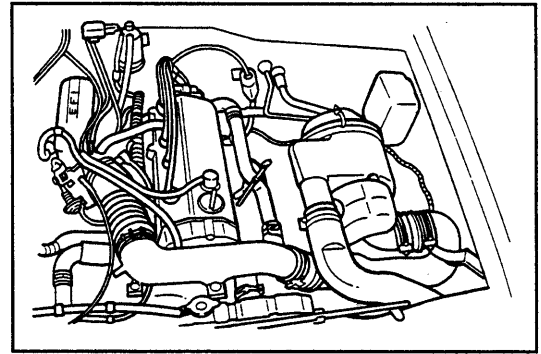
WN88E-EM295

## INSTALLATION OF AIR CLEANER (HD-E engine)

1. Installation of air cleaner assembly
  - (1) Install the air cleaner to the vehicle.
  - (2) Connect the air cleaner hose to the throttle body.
  - (3) Install the cool air intake.
  - (4) Tighten the hose band for cool air intake use.
2. Install the spark plugs, using SST.
 

SST: 09268-87703-000

Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)



WN88E-EM296

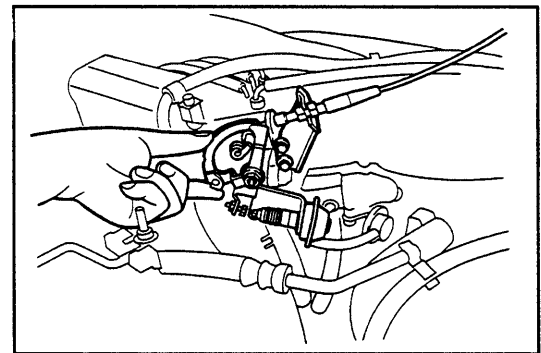
3. Connect the resistive cords to the ignition coil, distributor and spark plugs. Attach the wire clamps.

**NOTE:**

- Be sure that the resistive cord is connected securely to each spark plug.
- Be careful not to damage the resistive cord with the spark plug tube.

WN88E-EM297

4. Connect the accelerator cable. Adjust the play in the axial direction of the accelerator cable to 3 - 8 mm (0.12 - 0.31 inch).



WN88E-EM298

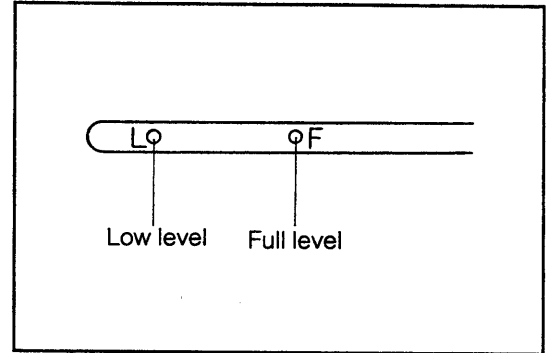
## FILLING OF ENGINE OIL AND COOLING WATER

1. Fill the engine oil to the F level. (See page LU-4)
2. Reconnect the battery ground cable to the negative (-) terminal of the battery.
3. Fill the cooling water. (See page CO-3)

WN88E-EM299

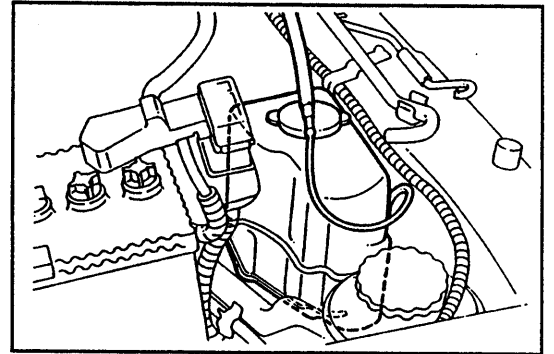
# ENGINE MECHANICALS

4. Start the engine. Check the engine for oil fuel and water leakages.  
If any leakage exists, repair the faulty parts.
5. Stop the engine. Recheck the oil level two or three minutes later.  
If the oil level is too low, add the engine oil to the F level.



WN88E-EM300

6. Allow the temperature of the engine to drop to the room temperature.  
Check the cooling water level at the reserve tank.  
If the cooling water level is insufficient, replenish the cooling water.  
(See page CO-2).



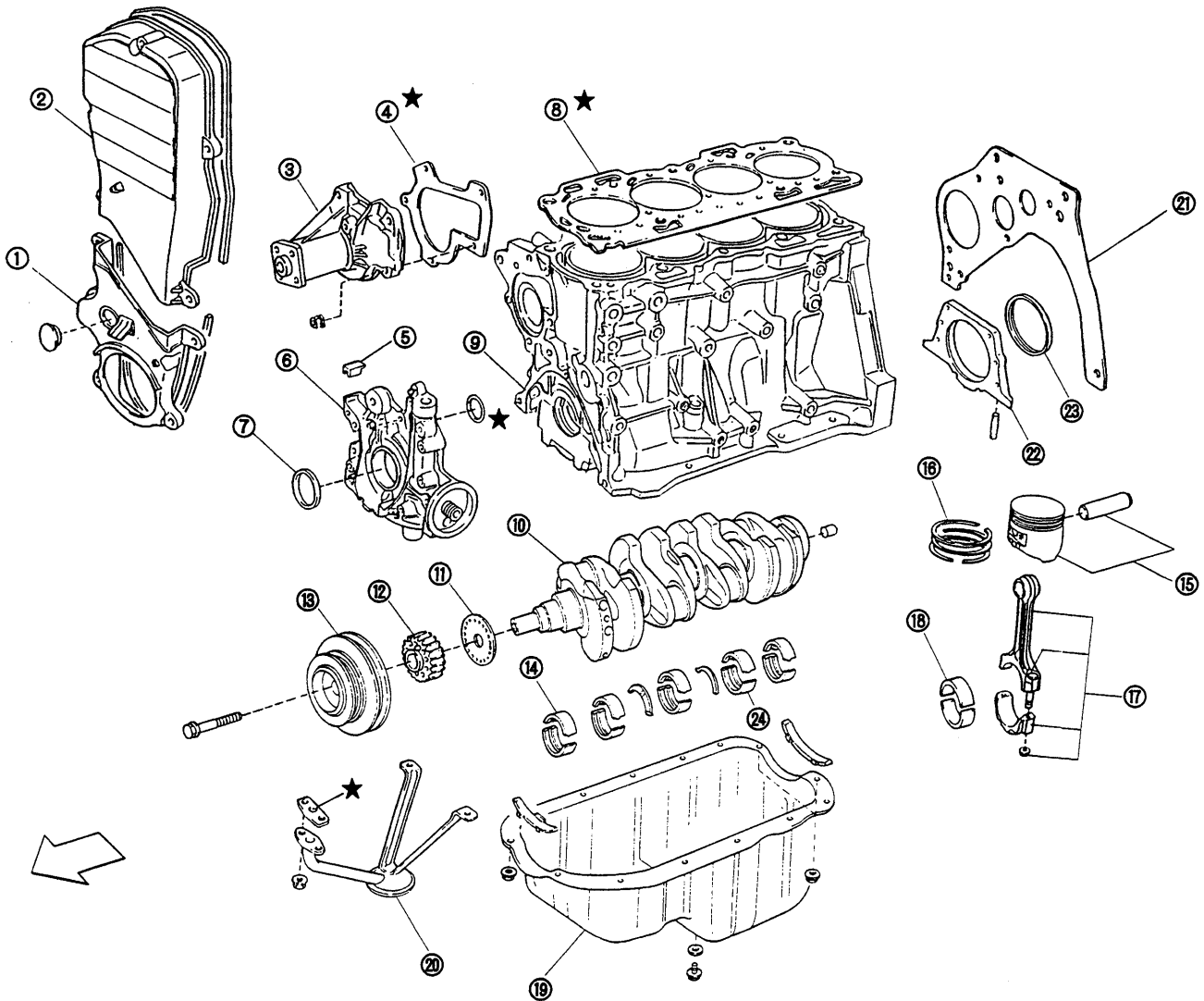
WN88E-EM301

7. Perform the engine turn-up.  
(See page EM-7).

WN88E-EM302

# CYLINDER BLOCK COMPONENTS

★: Non-reused 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.

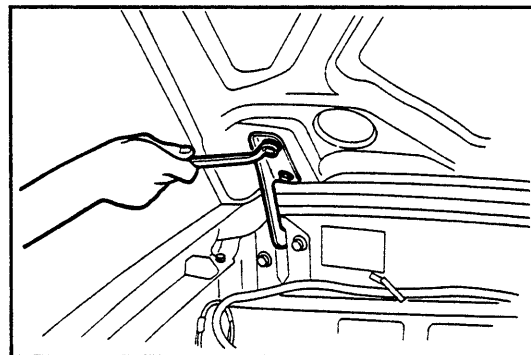
WN88E-EM304

## ENGINE REMOVAL

1. Remove the engine hood, as follows:
  - (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.

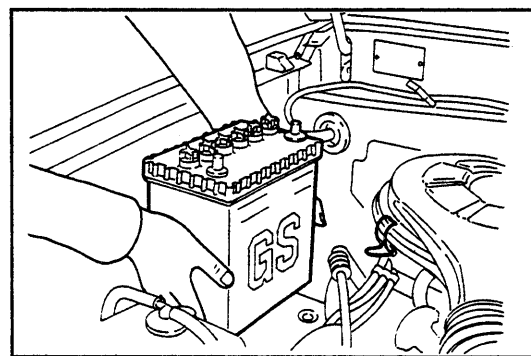
2. Disconnect the battery ground cable from the negative (-) terminal of the battery,  
Disconnect the wires from the positive (+) terminal of the battery.

WN88E-EM305



WN88E-EM306

3. Remove the battery hold-down clamp and battery clamp bolts.
4. Remove the battery from the engine room.  
**CAUTION:**  
Handle the battery carefully. Never allow any flame to be brought to the battery.



WN88E-EM307

5. Drain the coolant.  
(See page CO-3)
6. Drain the engine oil.  
(See page LU-4)
7. Drain the transmission oil.  
(See the Chassis Workshop Manual)

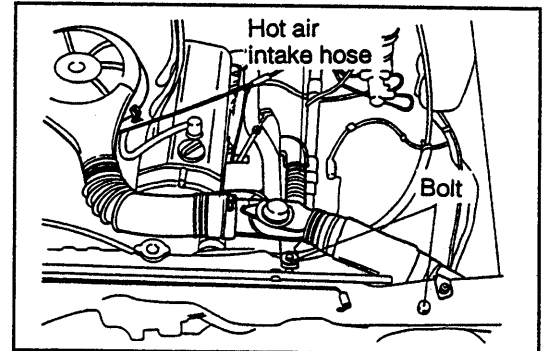
WN88E-EM308



## 8. Removal of air cleaner hose assembly

<Carburetor-equipped vehicle>

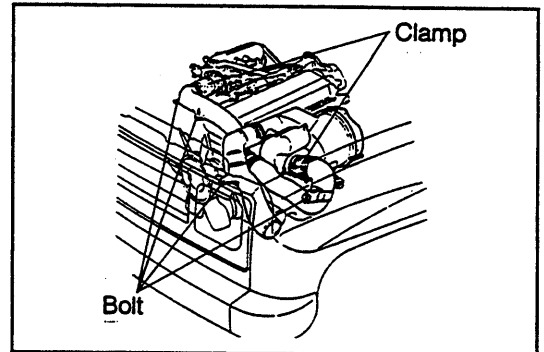
- (1) Remove the air cleaner hose from the air cleaner case by removing the two bolts and the clamp.
- (2) Disconnect the vacuum motor hose and hot air intake hose.  
(Except for GCC and tropical specifications)



WN88E-EM309

<EFI-equipped vehicle>

- (1) Remove the air cleaner pipe subassembly and cool air intake duct by removing three clamps and four bolts.
- (2) Remove the two vacuum hose for idle-up and for power steering.

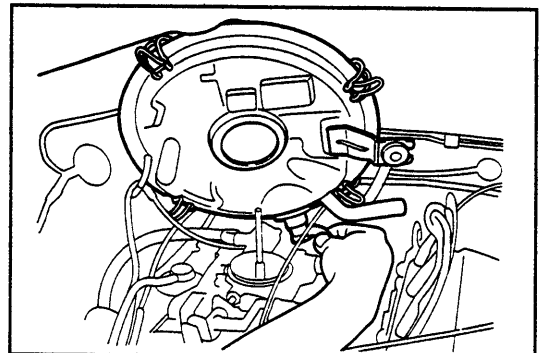


WN88E-EM310

## 10. Removal of air cleaner assembly

<Carburetor-equipped vehicle>

- (1) Disconnect the following hoses at air cleaner side.
  - ITC vacuum hoses
  - PCV hoses
  - Vacuum hose to BVSV
- (2) Remove the air cleaner assembly by removing the attaching bolts of air cleaner bracket and wing nut.



WN88E-EM311

<EFI-equipped vehicle>

Remove the air cleaner assembly by removing the three attaching bolts.

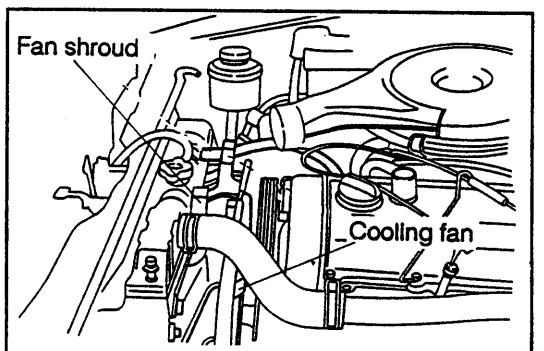
## 11. Removal of radiator

- (1) Remove the reserve tank.
- (2) Remove the radiator hose No. 1 and No. 3 at radiator side.

### CAUTION:

When the radiator hose is loosened, be sure to protect the alternator because the coolant flows out.

- (3) Disconnect the small water hose from the radiator upper tank.
- (4) Remove the two clamps for clutch cable on the fan shroud.
- (5) Remove the two attaching bolts of the fan shroud. Then, disconnect the lock section of the fan shroud from radiator.



WN88E-EM312

WN88E-EM313

- (6) Remove the radiator grill.  
(See the Chassis Workshop Manual)
- (7) Remove the radiator by removing the four attaching bolts.
- (8) Remove the fan shroud.

WN88E-EM314

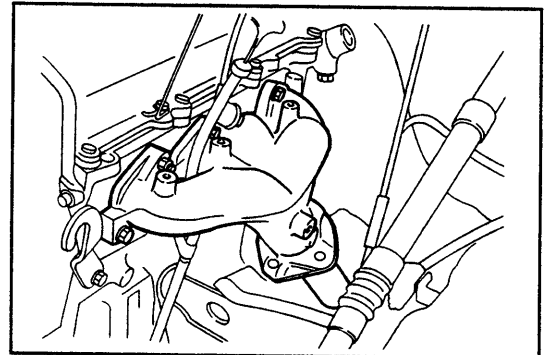
## 12. Removal of starter assembly

- (1) Disconnect the wire of the positive (+) terminal and S terminal at the starter side.
- (2) Remove the starter assembly by removing the two attaching bolts.

WN88E-EM315

## 13. 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.



WN88E-EM316

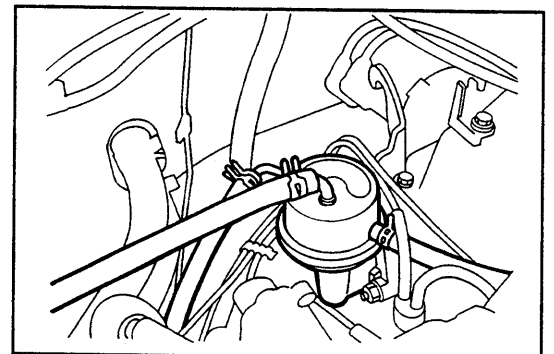
## 14. Disconnecting of fuel line

<Carburetor-equipped vehicle>

Disconnect the fuel inlet hose and return hose from fuel pump.

**NOTE:**

Make sure to plug the disconnected hose so that no fuel may flow out.



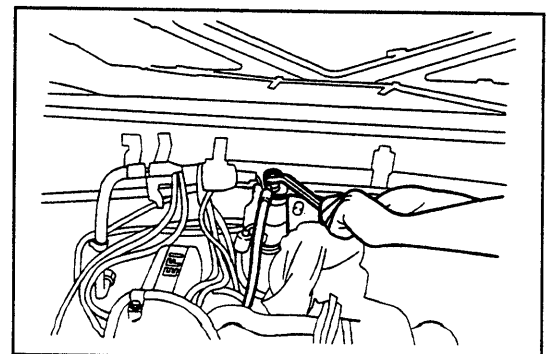
WN88E-EM317

<EFI-equipped vehicle>

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

**CAUTION:**

The pressure in the fuel line is kept 2.55 kg/cm<sup>2</sup> 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.

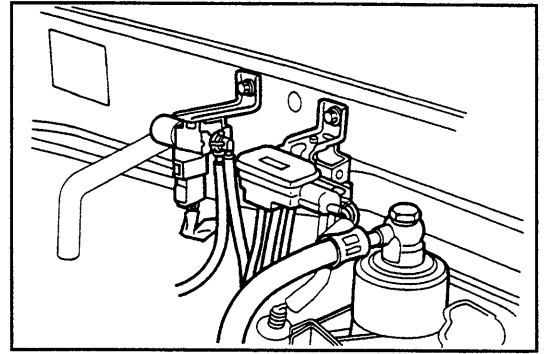


WN88E-EM318

15. Removal of idle-up VSV & pressure sensor

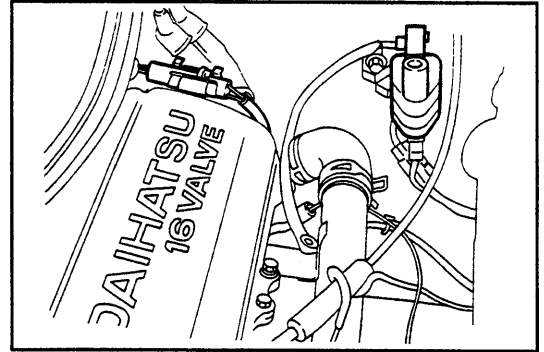
(EFI-equipped vehicle only)

- (1) Remove the pressure sensor, by removing the attaching bolt.
- (2) Disconnect the idle-up VSV by removing the attaching bolt.



WN88E-EM319

16. Disconnect the resistive cord from the ignition coil.
17. Disconnect the coupler of wiring harness of the distributor.

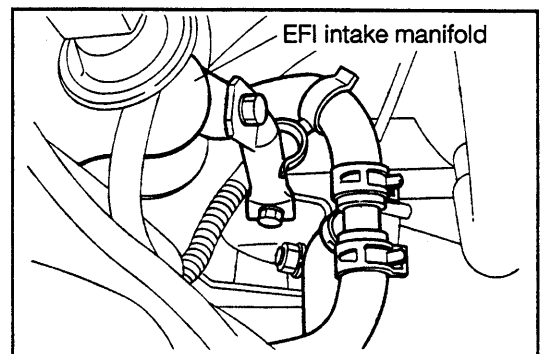


WN88E-EM320

18. Disconnect the accelerator cable.  
(See page EM-35).

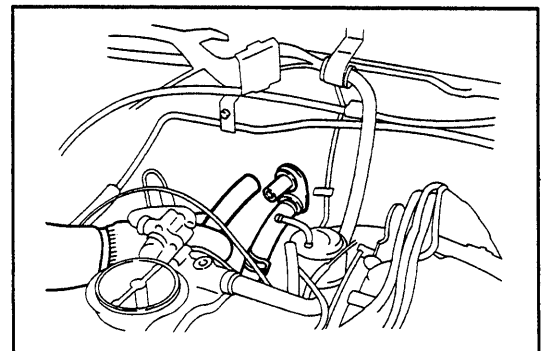
WN88E-EM321

19. Remove the positive wire clamp from the body.  
Remove the battery ground cable from the body.
20. Remove the surge tank stay No. 2 from the engine mount bracket. (EFI-equipped vehicle only)



WN88E-EM322

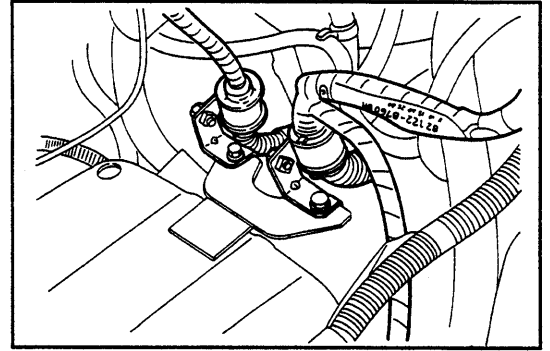
21. Disconnect the heater hose of inlet and outlet from the body.



WN88E-EM323

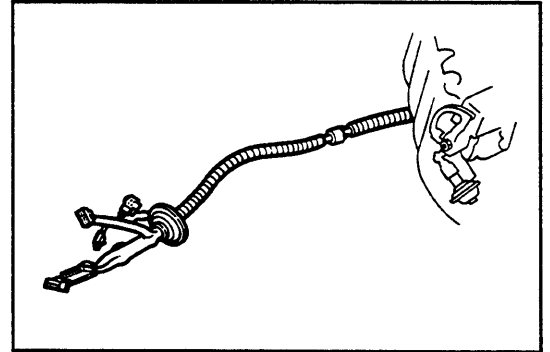
## ENGINE MECHANICALS

22. Disconnect the following wires and cords.
- (1) The cowl wire and alternator wire.
  - (2) The engine wire and fuse block connector (EFI only).
  - (3) The engine wire clamp at the cylinder block right-hand.

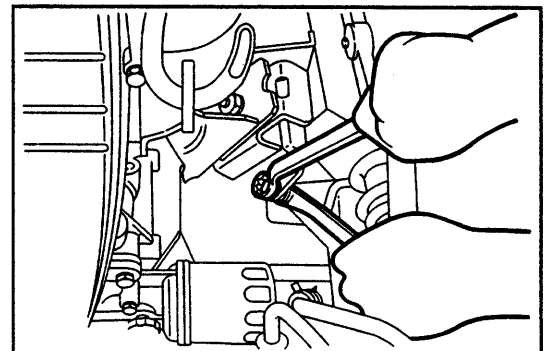


WN88E-EM324

23. Removal of engine wire for 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.
24. Suspend the engine, using a chain block.
25. Separate the engine from the transmission by removing the attaching bolts. While support the transmission using the transmission jack.
- (See the Chassis Workshop Manual)
26. Remove the attaching bolts of the engine mounting at right and left-hand.

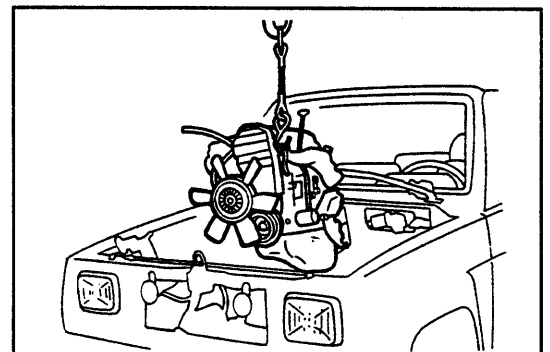


WN88E-EM325



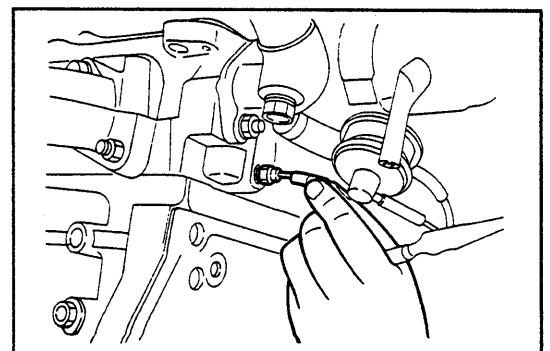
WN88E-EM326

27. 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.



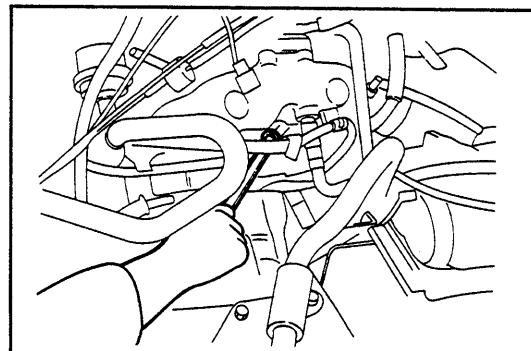
WN88E-EM327

28. Removal of engine harness from engine
- (1) Disconnect the water temperature sender gauge connector.
  - (2) Disconnect the alternator connector and the terminal.



WN88E-EM328

- (3) Remove the engine wire clamp.
- (4) Remove the engine wire.



WN88E-EM329

- 29. Remove the timing belt.
- 30. Install the engine assembly onto the following SST.  
SST: 09219-87202-000
- 31. Remove the cylinder head assembly together with intake and exhaust manifold.  
(See page EM-36).

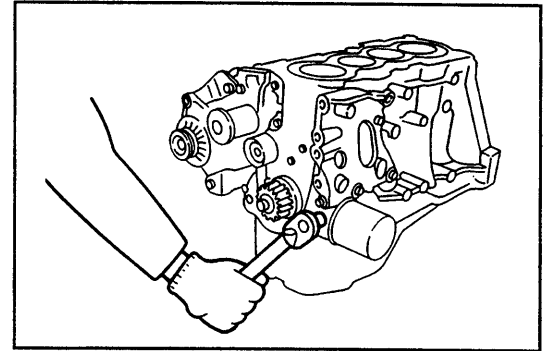
WN88E-EM330

## DISASSEMBLY OF CYLINDER BLOCK

1. Remove the oil pressure switch.

**NOTE:**

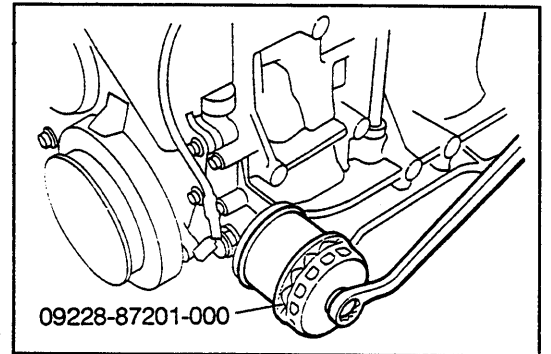
Use a hexagon box wrench for the removal operation.



WN88-EM331

2. Remove the oil filter, using following SST.

SST: 09228-87201-000

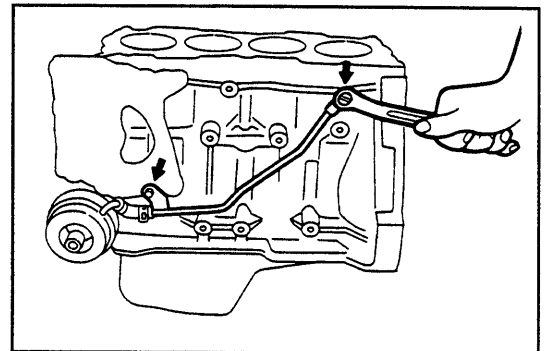


WN88-EM332

3. Removal of oil cooler. (Only for GCC and tropical specifications)

(1) Remove the oil cooler pipe from the cylinder block.

(2) Release the hose band and remove the oil cooler pipe.

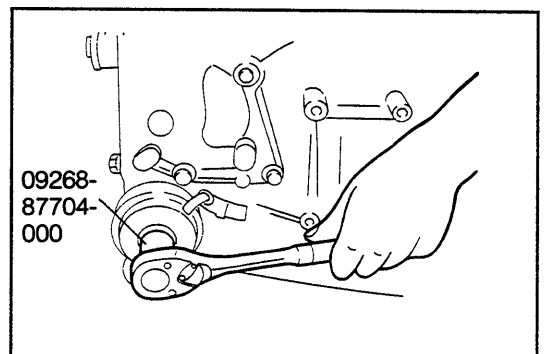


WN88-EM333

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

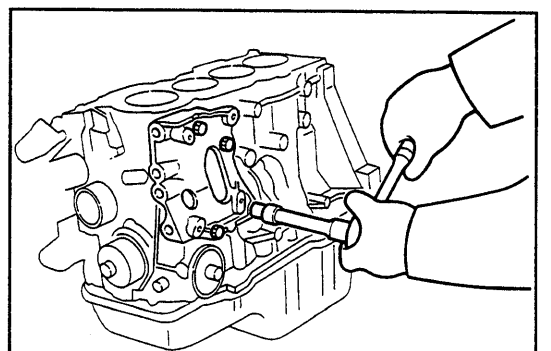
SST: 09268-87704-000

(4) Remove the water hose from oil cooler.



WN88-EM334

4. Remove the compressor bracket.



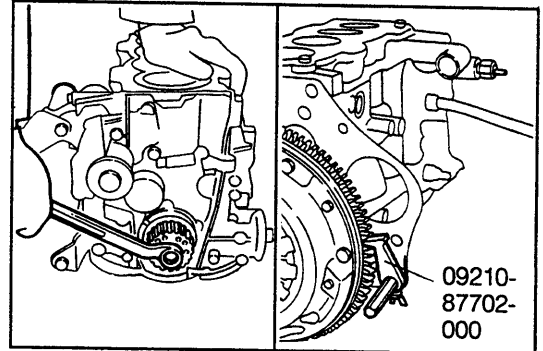
WN88-EM335

5. Remove the crankshaft pulley bolt.

**NOTE:**

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

SST: 09210-87702-000



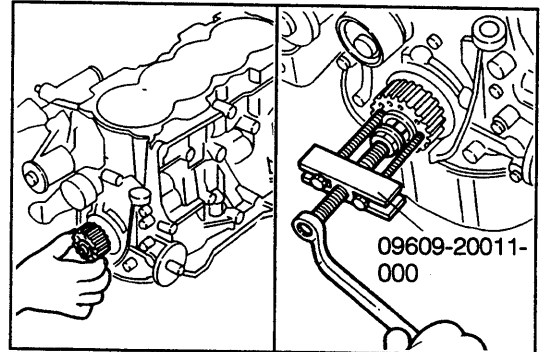
WN88-EM336

6. Remove the crankshaft pulley.

**NOTE:**

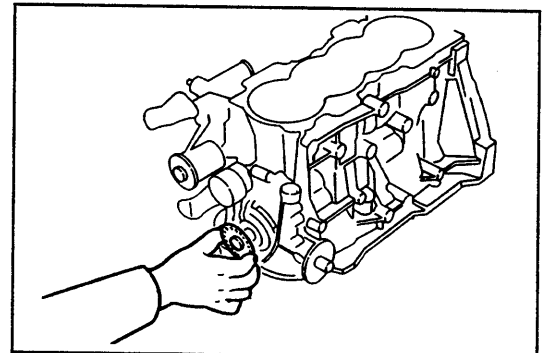
If the crankshaft pulley can not be removed by hand, install the following SST with the crankshaft pulley bolt interposed.

SST: 09609-20011-000



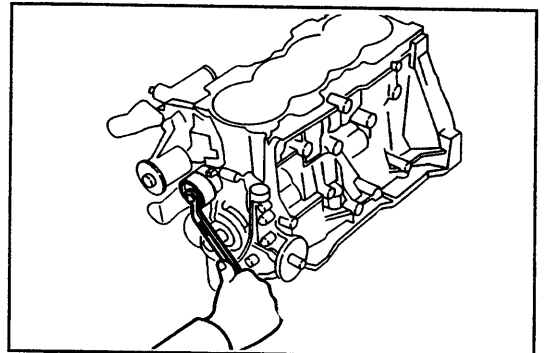
WN88-EM337

7. Remove the crankshaft pulley flange.



WN88-EM338

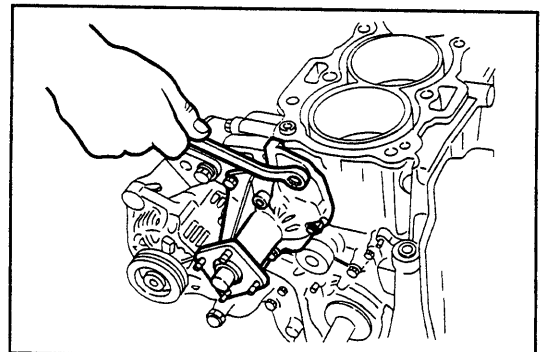
8. Remove the tensioner and tension spring.



WN88-EM339

9. Remove the water pump.

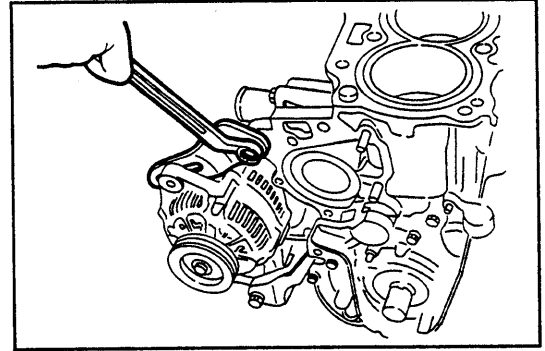
10. Remove the water pump gasket.



WN88-EM340

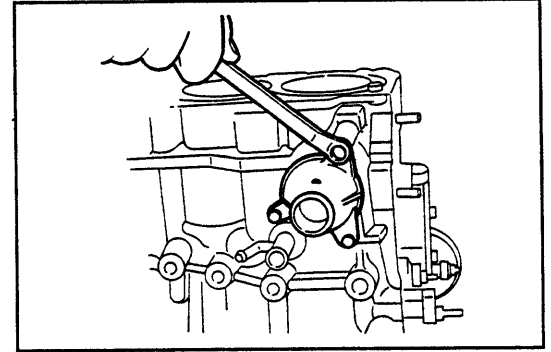
# ENGINE MECHANICALS

11. Remove the alternator assy with bracket.



WN88-EM341

12. Remove the water inlet and thermostat.



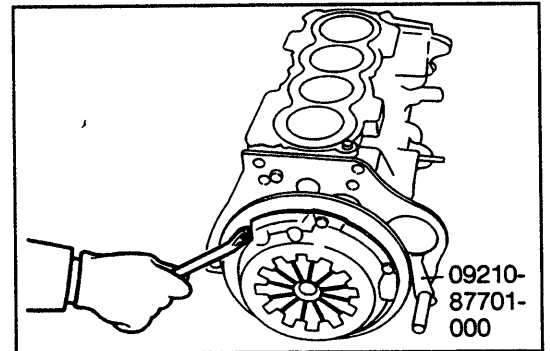
WN88-EM342

13. Remove the pressure plate and clutch disc.

**NOTE:**

Prevent the pressure plate from turning, using the following SST.

SST: 09210-87701-000

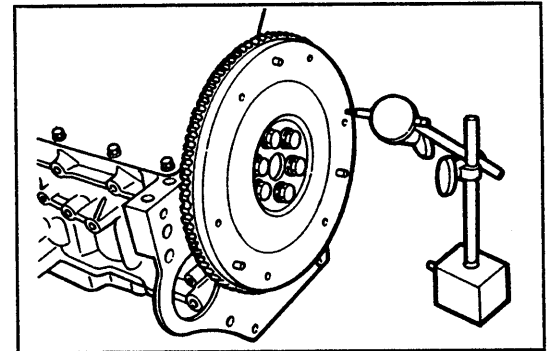


WN88-EM343

14. Check the flywheel for runout. (See page EM-119.)

**NOTE:**

If the runout does not conform to the specification, confirm the tightening torque of the flywheel. Only case where the tightening torque conforms to the specified value, replace the flywheel.



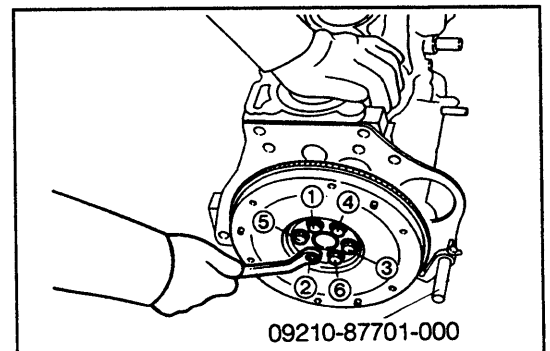
WN88-EM344

15. 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.

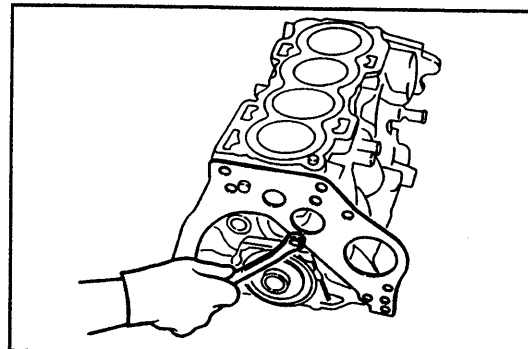
SST: 09210-87701-000



WN88-EM345



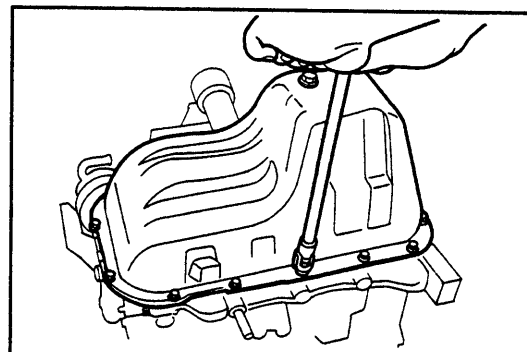
16. Remove the rear end plate.



WN88-EM346

17. Oil pan removal

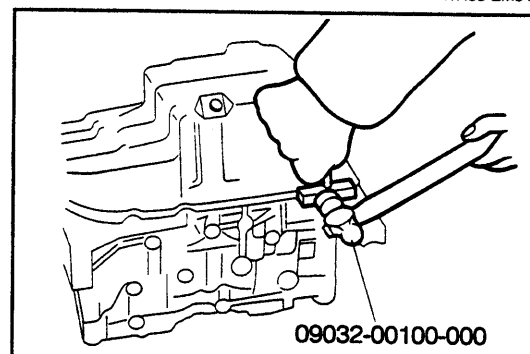
(1) Loosen the attaching bolts and nuts of the oil pan over two or three stages. Pull out the bolts and nuts.



WN88-EM347

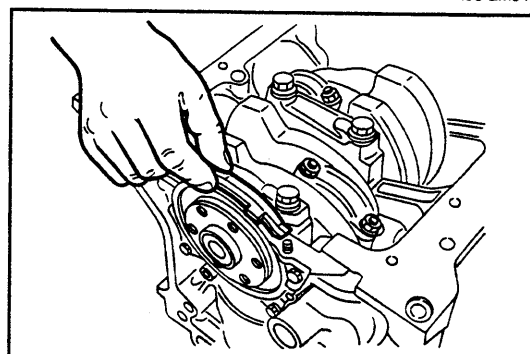
(2) Separate the oil pan from the cylinder block by driving the following SST into between the cylinder block and the oil pan.

SST: 09032-00100-000



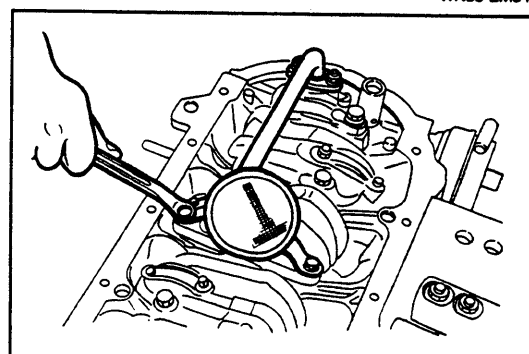
WN88-EM348

18. Remove the oil pan gasket.



WN88-EM349

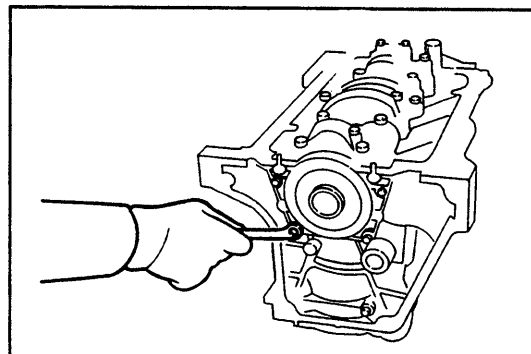
19. Remove the oil pump strainer.



WN88-EM350

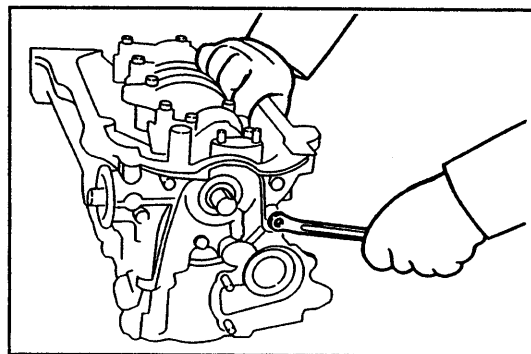
# ENGINE MECHANICALS

20. Remove the rear oil seal retainer.



WN88-EM351

21. Remove the oil pump.



WN88-EM352

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

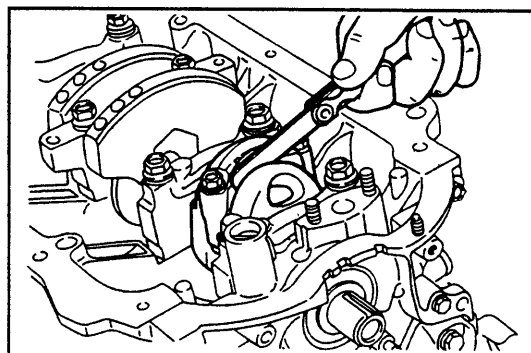
Thrust clearance:

Standard 0.15 - 0.4 mm (0.0060 - 0.015 inch)

Maximum 0.45 mm (0.017 inch)

**NOTE:**

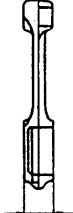
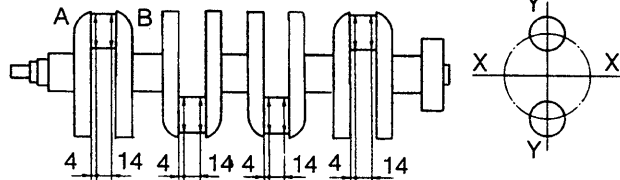
The thrust clearance should be measured while the connecting rod is being pushed against either side of the crankshaft in the axial direction. Measure the thrust clearance at the opposite side.



WN88-EM353

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.

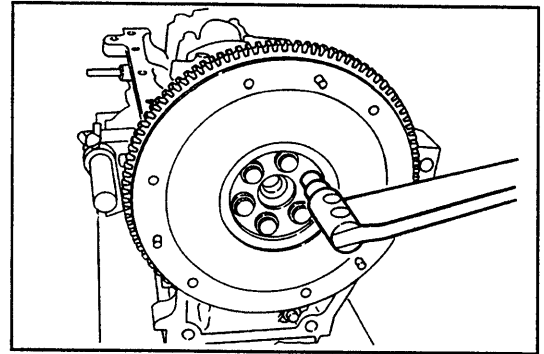
**Reference**

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>Crankshaft</p>  <p>Unit: mm</p>

WN88-EM435

## 23. Measurement of crankpin journal oil clearance

(1) Install the flywheel temporarily.

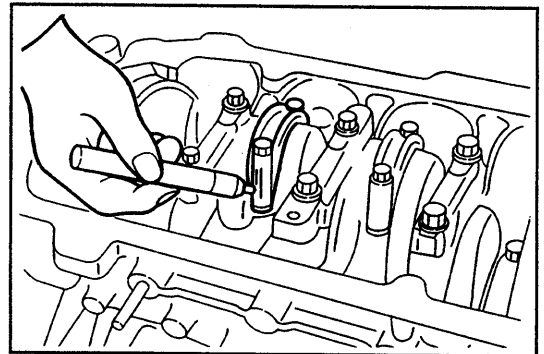


WN88-EM354

(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.

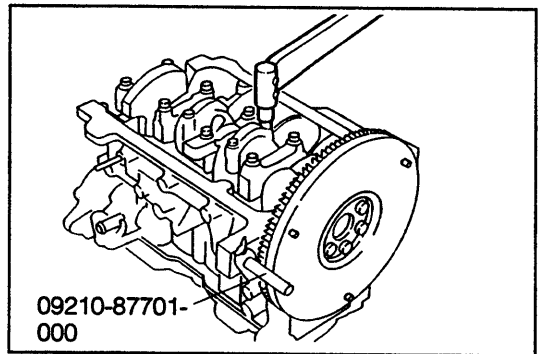


WR88-EM752

(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.



09210-87701-000

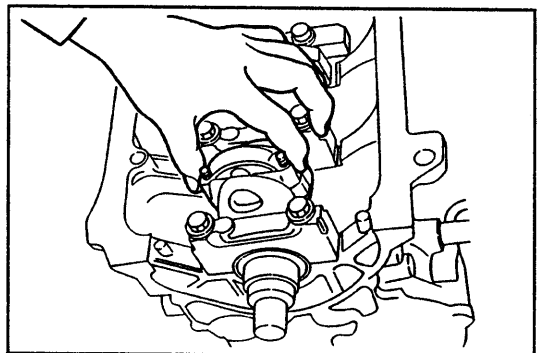
WR88-EM753

(6) Remove the bearing cap.

**NOTE:**

Replace the crankshaft if the crankpin journals exhibit damages, such as seizure.

(See page EM-88.)

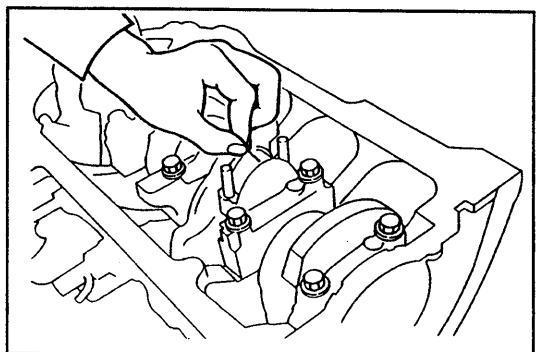


WR88-EM754

(7) Place a plastigage on the crankpin journal.

**NOTE:**

Wipe off any oil from the crankpin journal.



WR88-EM755

- (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.

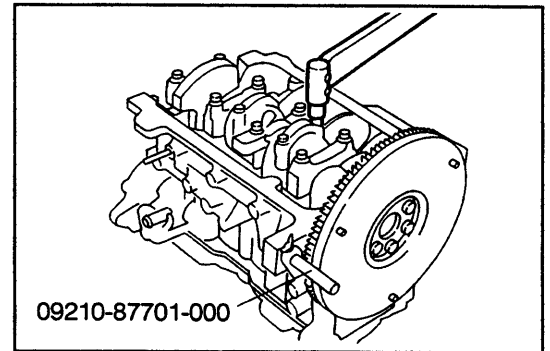
**Tightening Torque:** 3.5 - 4.5 kg-m (25.4 - 32.5 ft-lb)

**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



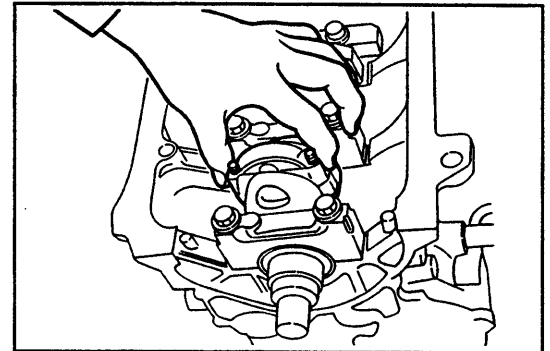
WR88-EM756

- (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



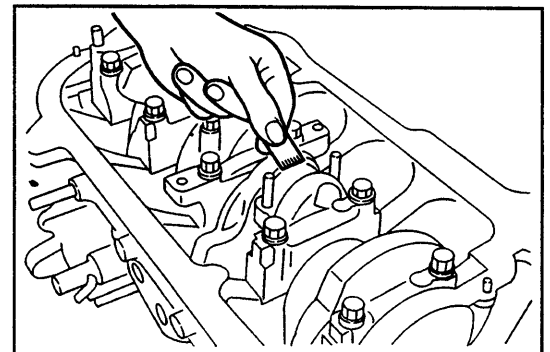
WR88-EM757

- (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.



WR88-EM758

**24. Selection of connecting rod bearings**

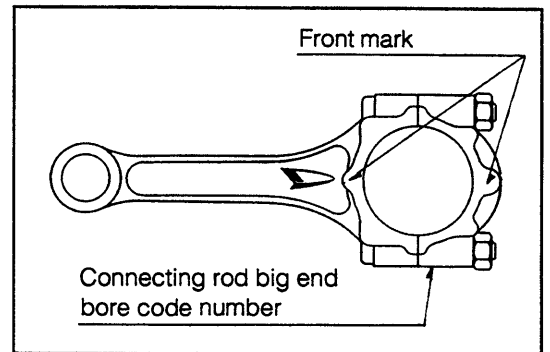
**NOTE:**

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.

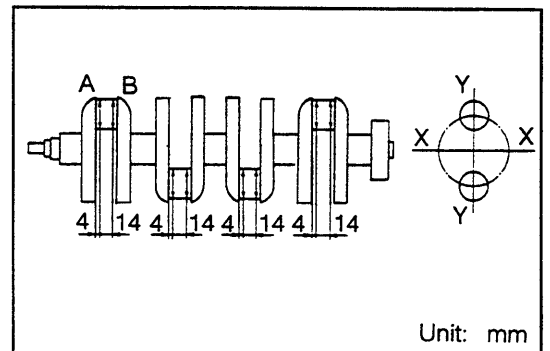


WN88-EM355

- (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.



Unit: mm

WN88-EM436

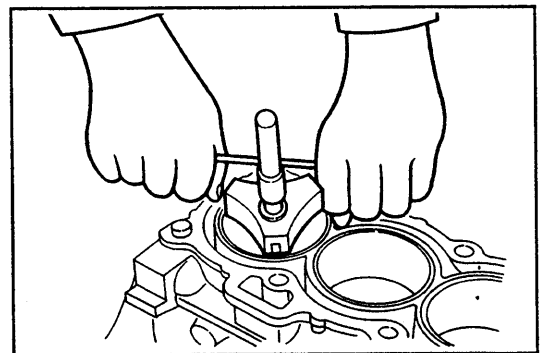
(3) Select the connecting rod bearing or replace the crankshaft, based on the results of (1) and (2).

Connecting rod big end bore code number	Crankpin journal diameter	Bearing classification number (color)	Remarks
4	44.993 - 45.000 (1.7714 - 1.7716)	1 (Yellow)	—
	44.985 - 44.992 (1.7710 - 1.7713)	2 (Green)	—
	44.976 - 44.984 (1.7708 - 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 (1.7710 - 1.7713)	3 (Brown)	—
	44.976 - 44.984 (1.7708 - 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

WR88-EM761

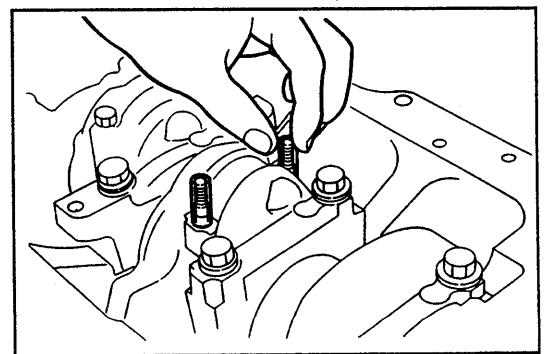
## 25. Piston Removal

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



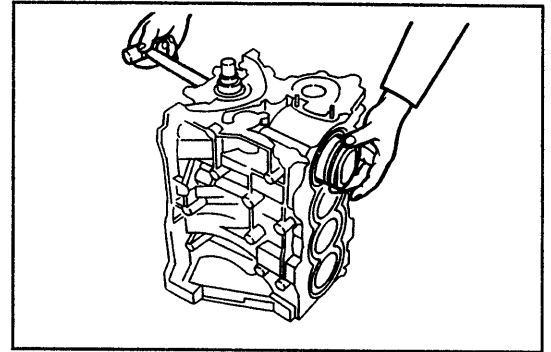
WN88-EM356

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



WR88-EM763

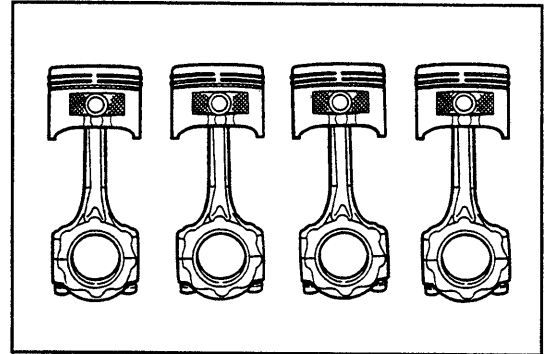
- (3) Push out the piston and connecting rod assembly and the upper bearing through the top of the cylinder block.



WR88-EM764

**NOTE:**

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



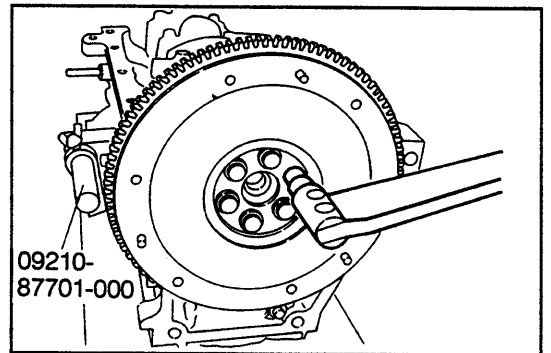
WN88-EM357

26. Remove the flywheel.

**NOTE:**

Prevent the ring gear from turning with the SST.

SST: 09210-87701-000



WN88-EM358

27. Check of crankshaft thrust clearance

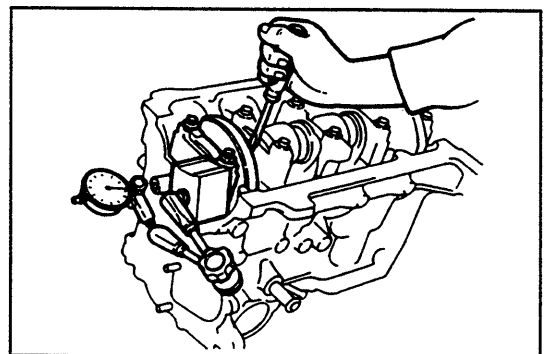
**NOTE:**

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)

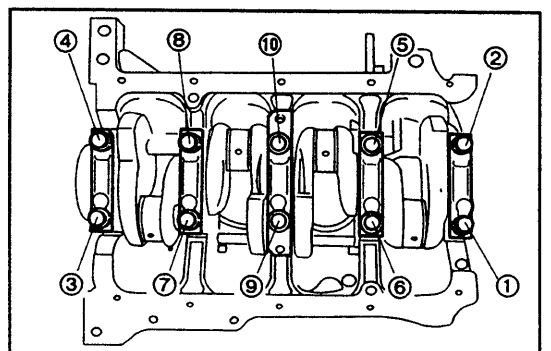


WN88-EM359

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.

28. Check of crankshaft main journal oil clearance

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

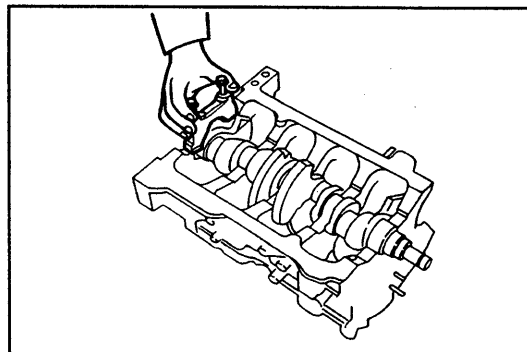


WN88-EM360

- (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.

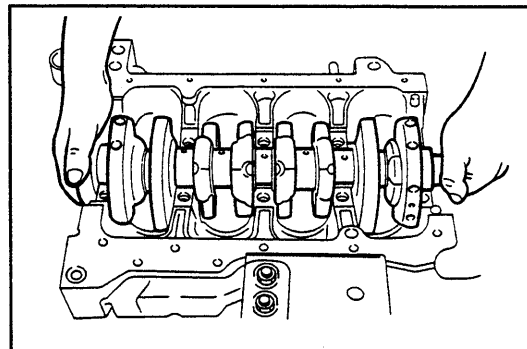


WR88-EM769

- (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.



WN88-EM361

- (4) Clean the main journals and bearings, using cleaning solvent. Blow them with compressed air.

**CAUTION:**

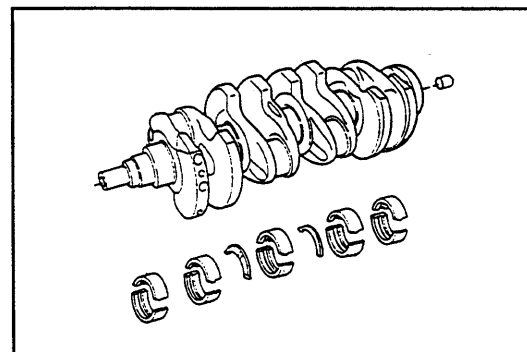
Protect your eyes with safety goggles during the cleaning operation.

WR88-EM771

- (5) Check the main journals and bearings for pitting or scratches.

If the main journals are damaged, replace the crankshaft. (See page EM-93.)

If the main journal bearings are damaged, replace the main journal bearings.

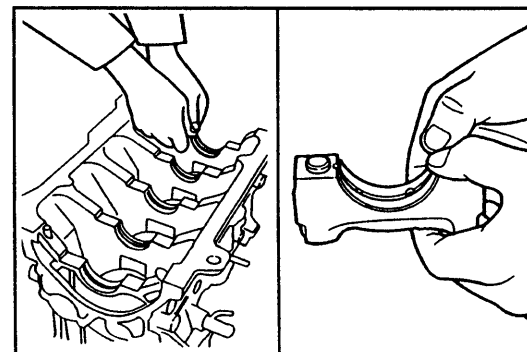


WN88-EM362

- (6) Install the main bearings to the cylinder block and crankshaft main bearing cap.

**NOTE:**

Do not touch the metal surface of the bearing.

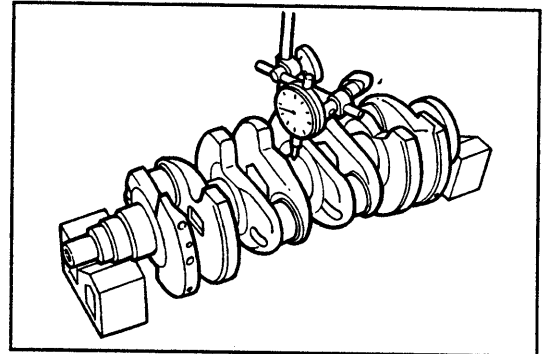


WR88-EM773

# ENGINE MECHANICALS

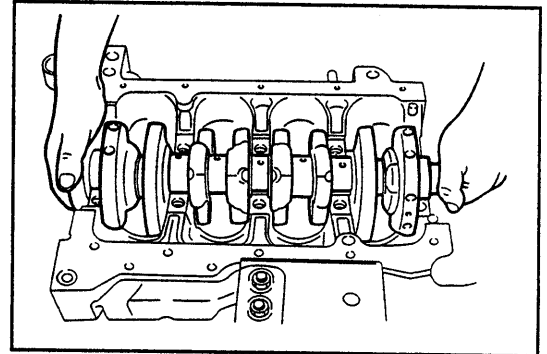
- (7) Support the both ends of the crankshaft with a V-block. Measure the crankshaft runout with a dial gauge. Allowable limit of runout: 0.06 mm (0.00236 inch)

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



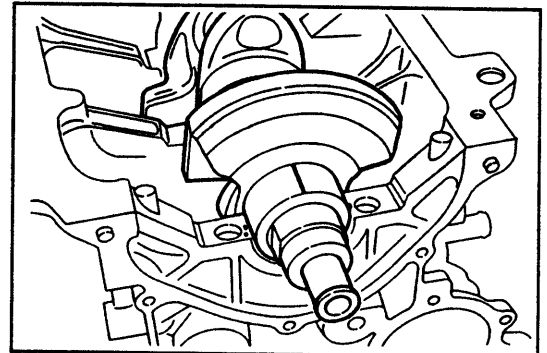
WN88-EM363

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



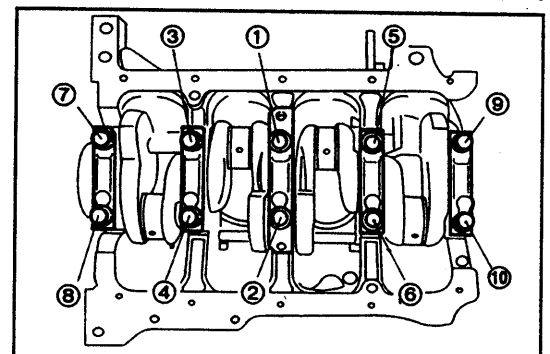
WR88-EM364

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



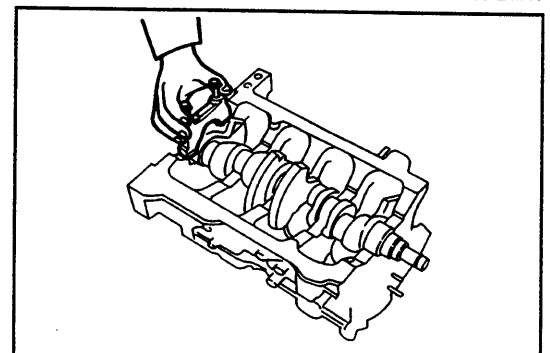
WR88-EM776

- (10) 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)



WR88-EM777

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



WR88-EM778

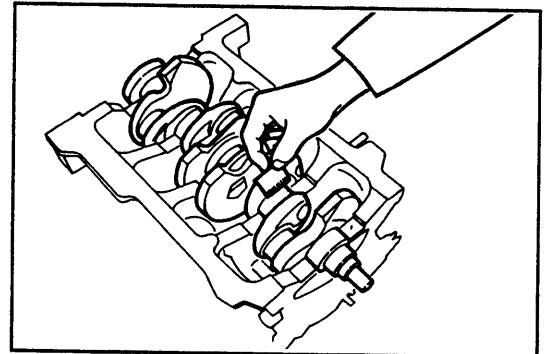


- (12) Measure the plastigage width at its widest point.  
**Oil Clearance: 0.024 - 0.042 mm**  
 (0.0010 - 0.0016 inch)

If the oil clearance fail 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-93.)

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



WN88-EM365

## 29. Selection of crankshaft bearings

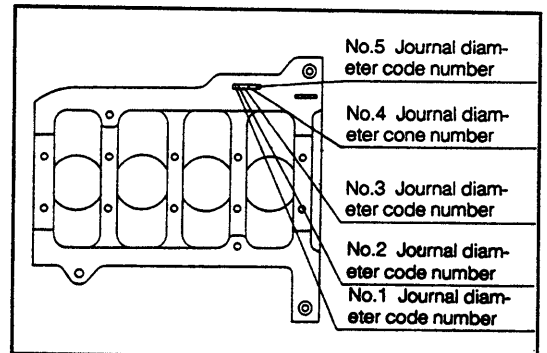
### NOTE:

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.

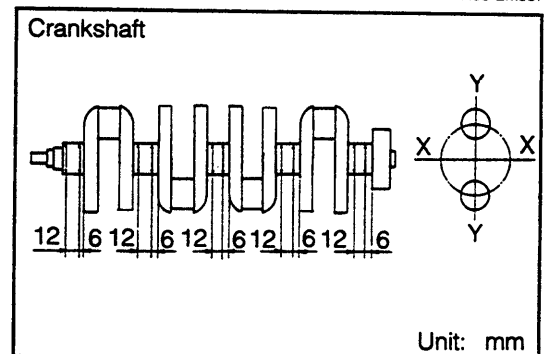
### NOTE:

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



WN88-EM367

- (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.



WN88-EM368

# ENGINE MECHANICALS

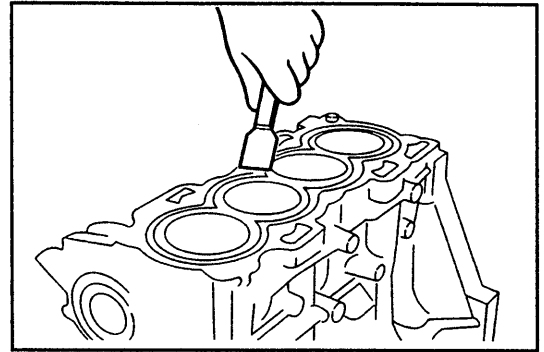
(3) Select the crankshaft bearings or replace the crankshaft, based on the results of (1) and (2).

Main journal diameter code mm (inch)	Crankmain journal diameter	Bearing classification number (color)	Remarks
5	49.995 - 50.000 (1.9684 - 1.9685)	1 (Yellow)	—
	49.989 - 49.994 (1.9681 - 1.9682)	2 (Green)	—
	49.983 - 49.988 (1.9679 - 1.9680)	3 (Brown)	—
	49.976 - 49.982 (1.9676 - 1.9677)	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 - 1.9682)	3 (Brown)	—
	49.983 - 49.988 (1.9679 - 1.9680)	4 (Black)	—
	49.976 - 49.982 (1.9676 - 1.9677)	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 - 1.9682)	4 (Black)	—
	49.983 - 49.988 (1.9679 - 1.9680)	5 (Blue)	—
	49.976 - 49.982 (1.9676 - 1.9677)	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 - 1.9682)	5 (Blue)	—
	49.983 - 49.988 (1.9679 - 1.9680)	6 (White)	—
	49.976 - 49.982 (1.9676 - 1.9677)	7 (Pink)	—
	49.975 or less (1.9675)	—	Crankshaft replacement

WR88-EM783

**INSPECTION OF CYLINDER BLOCK**

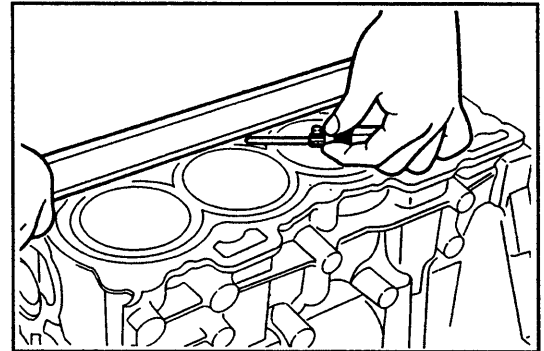
1. Removal of gasket material  
Remove all gasket materials from the cylinder block.
2. Cleaning of cylinder block  
Clean the cylinder block, using a soft brush and cleaning solvent.



WR88-EM784

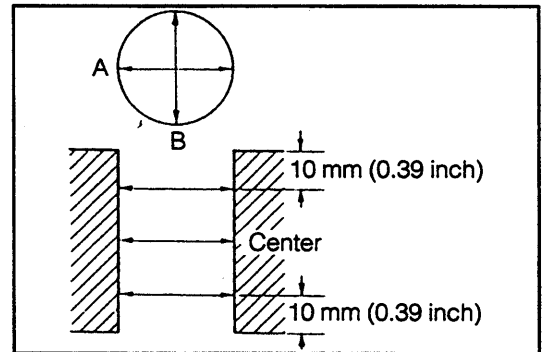
3. Inspection of top surface of cylinder block  
Using a precision straightedge and a thickness gauge, check the surface contacting the cylinder head gasket for warpage in the six directions as shown in the figure.  
**Maximum Warpage: 0.10 mm (0.0039 inch)**

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



WN88-EM369

4. 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).



WR88-EM786

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.

WR88-EM787

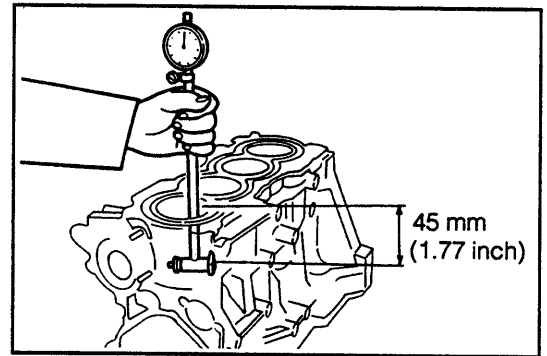
**Reference**

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)

WR88-EM788

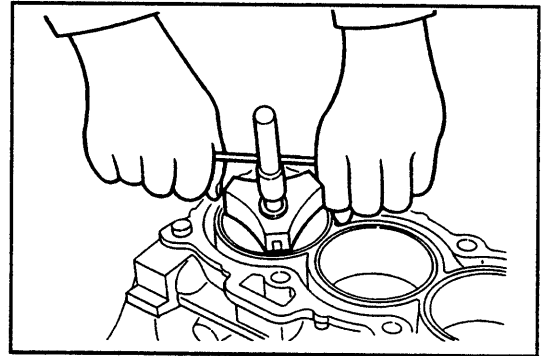
- (2) Measure the bore diameter of each cylinder at a position shown in the right figure. The measured value is regarded as the cylinder bore diameter.



WR88-EM789

## 5. Removal of cylinder ridges

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



WR88-EM780

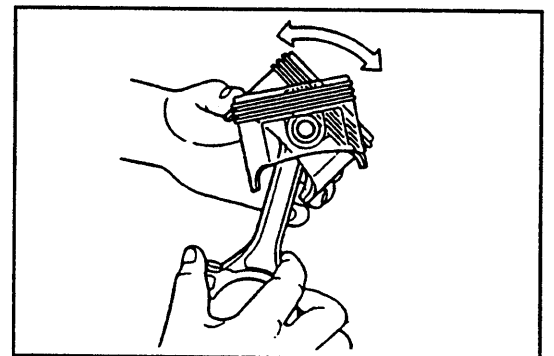
## INSPECTION OF PISTONS AND CONNECTING RODS

### 1. Inspection of fit between piston and piston pin

Try to move the piston back and forth on the piston pin. If any movement is felt replace the piston and piston pin as a set. (See page EM-98.)

#### 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.



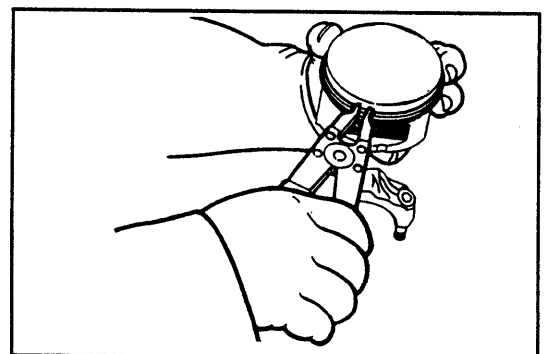
WN88-EM370

### 2. 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.



WN88-EM371

## INSPECTION OF PISTONS

### 1. Cleaning of pistons

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

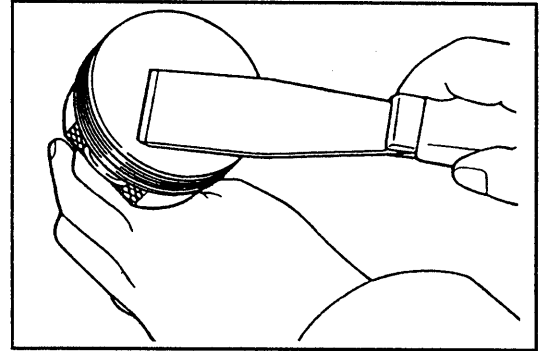
**NOTE:**

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.



WR88-EM793

### 2. Inspection of pistons

Visually inspect the piston for cracks, damage or seizure. Replace the piston, if necessary.

WR88-EM794

### 3. Measurement of piston diameter

- (1) Measure the piston outer diameter horizontally at a point 13 mm (0.51 inch) from the lower end of the piston at right angles to the piston pin.

- (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:**

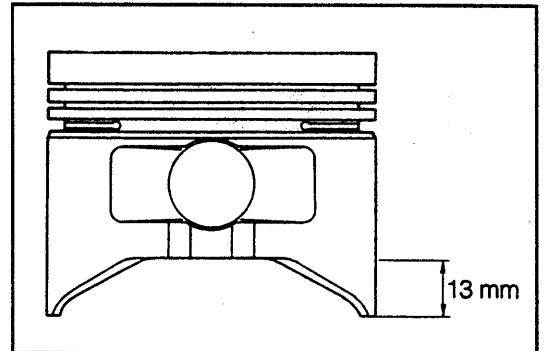
**Specified Value** 0.045 - 0.065 mm  
(0.0018 - 0.0025 inch)

**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-100.)

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

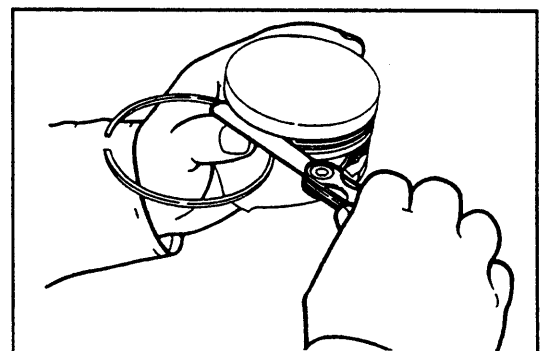


WN88-EM372

### 4. 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.



WN88-EM374

# ENGINE MECHANICALS

## 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.

WR88-EM798

## 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)

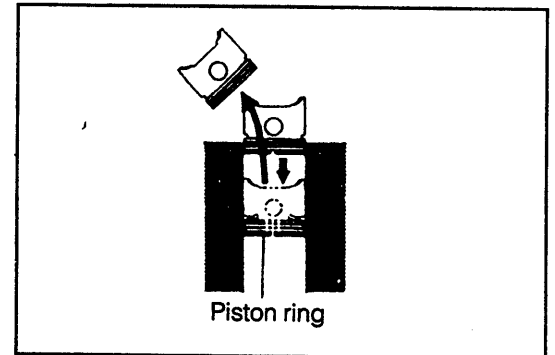
### NOTE:

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

WR88-EM799

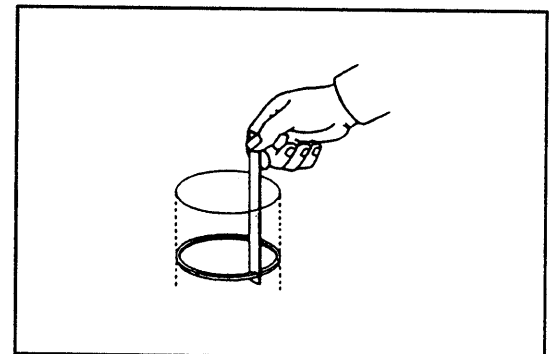
## 5. Inspection of piston ring end gap

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



WR88-EM800

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



WR88-EM801

## Piston ring end gap

	Specified value mm (inch)	Allowable limit mm (inch)
Compression ring No. 1	0.27 - 0.42 (0.011 - 0.016)	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 - 0.027)	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.

WR88-EM802

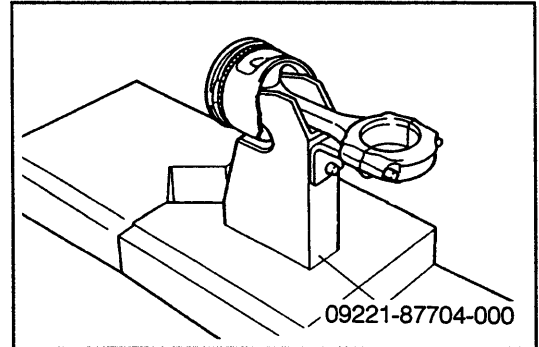
## ASSEMBLY/DISASSEMBLY OF PISTON & CONNECTING ROD

### 1. Disassembly of piston and connecting rod

WN88-EM375

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

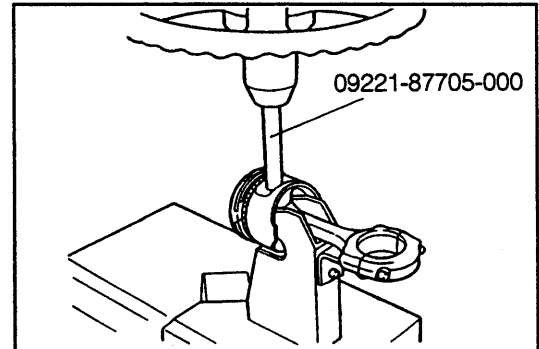
SST: 09221-87704-000



WN88-EM376

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

SST: 09221-87705-000



WN88-EM377

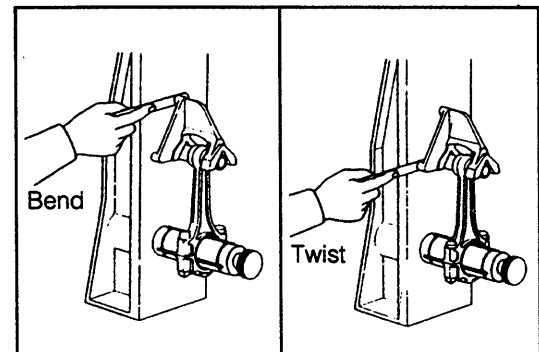
### 2. Inspection of connecting rods

- (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)

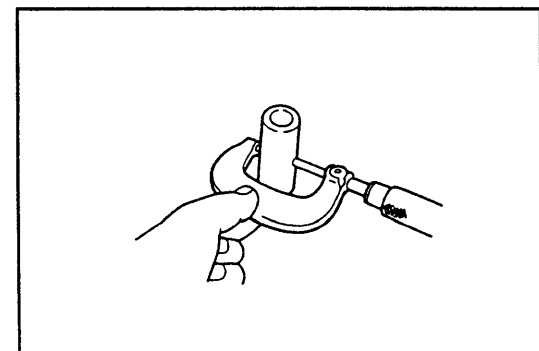
If the bend and/or twist is greater than the maximum limit, replace the connecting rod assembly.  
(See page EM-106.)

### 3. Inspection of piston pin-to-connecting rod interference fit

- (1) Measure the outer diameter of the piston pin contacting with the connecting rod, using a micrometer.



WN88-EM378



WR88-EM807

- (2) Measure the inner diameter of the connecting rod, using a bore dial gauge.
- (3) Determine the interference fit by subtracting the inner diameter of the connecting rod from the outer diameter of the piston pin.

**Interference Fit:**

0.012 - 0.044 mm (0.0005 - 0.0017 inch)

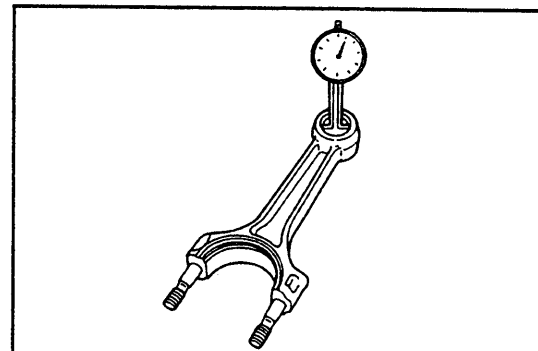
If the interference fit does not conform to the specification, replace the connecting rod.

(See page EM-106.)

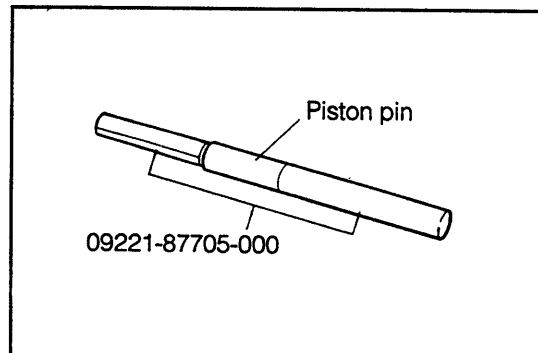
### 3. Assembly of piston and connecting rod

- (1) Install the piston pin to the following SST in a way shown in the right figure.

**SST: 09221-87705-000**



WN88-EM379



WN88-EM380

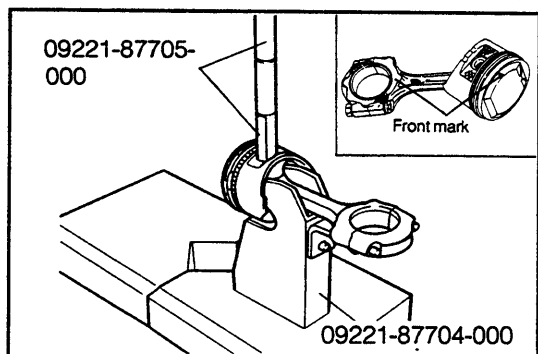
- (2) Install the piston and connecting rod in the SST in a way shown in the right figure. Insert the SST installed with the piston pin into the piston pin hole.

**SST: 09221-87704-000**

**09221-87705-000**

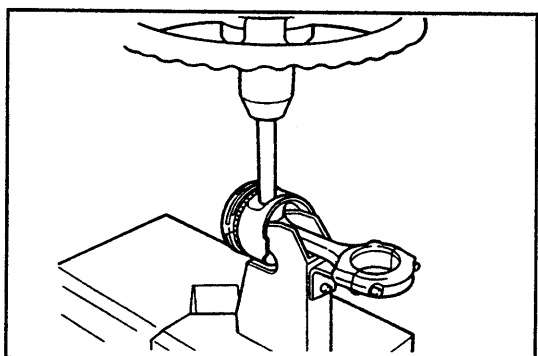
#### NOTE:

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.



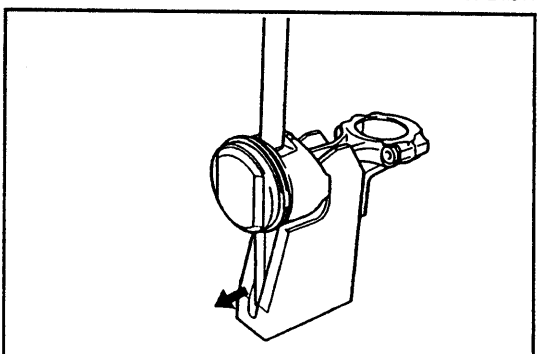
WN88-EM381

- (3) Press the piston pin into the piston and connecting rod, using a hydraulic press.



WN88-EM811

- (4) Remove the piston and connecting rod assembly from the SST. Remove the SST from the piston pin.



WN88-EM382



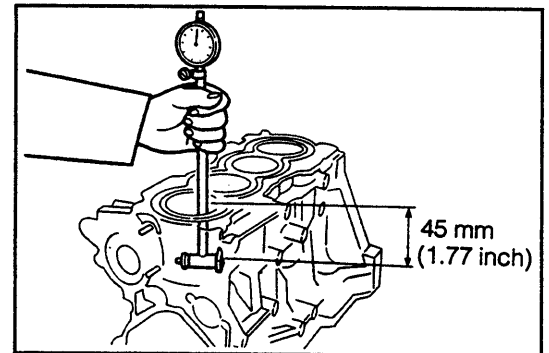
## CYLINDER BORING

**NOTE:**

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

WR88-EM813

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 (3.00 inch), replace the cylinder block.



WR88-EM814

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 13 mm (0.51 inch) from the piston lower end.
- Perform the measurement horizontally, not in a tilted state.

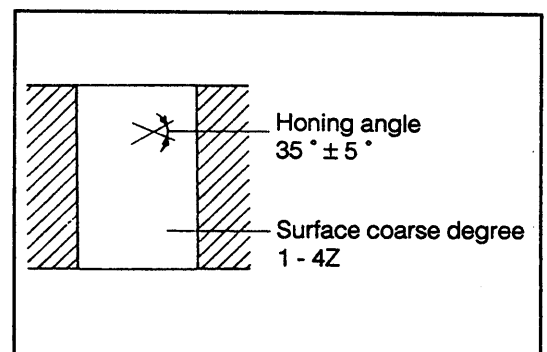
WR88-EM815

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

- A: Piston diameter
- B: Piston-to-cylinder bore clearance  
 0.045 - 0.065 mm  
 (0.0018 - 0.0025 inch)
- C: Honing allowance  
 0.02 mm (0.0008 inch)
- D: Finishing diameter  
 $D = A + B - C$

WR88-EM816

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



WR88-EM817

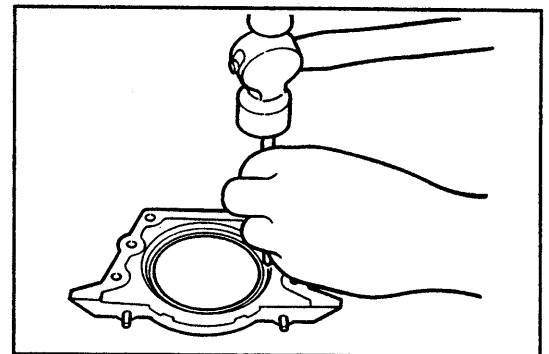
## REPLACEMENT OF REAR OIL SEAL

### (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.



WR88-EM818

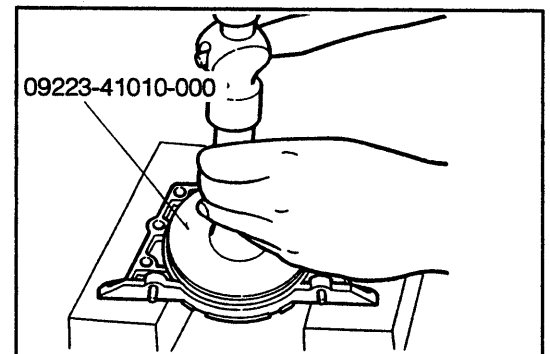
### (2) Installation of rear oil seal

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.



WR88-EM833

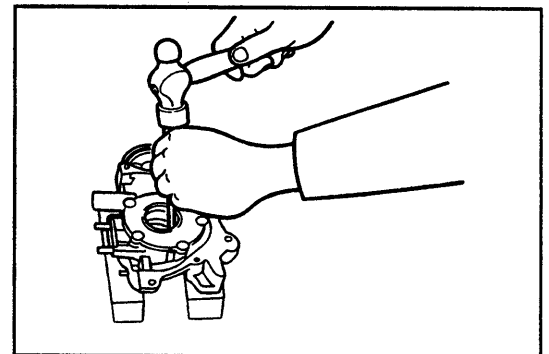
## REPLACEMENT OF FRONT OIL SEAL

### (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.

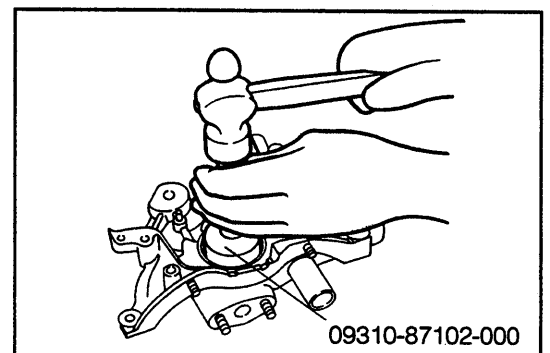


WR88-EM820

### (2) Installation of front oil seal

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

SST: 09310-87102-000



WR88-EM384

## REPLACEMENT OF CYLINDER BLOCK

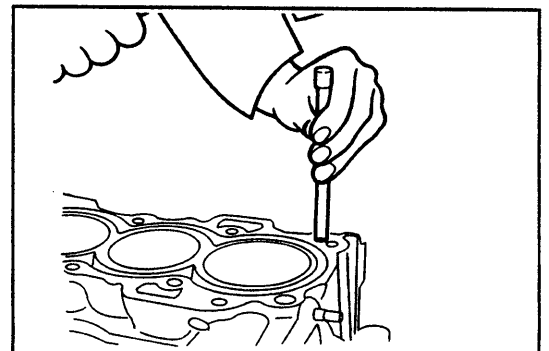
#### NOTE:

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:

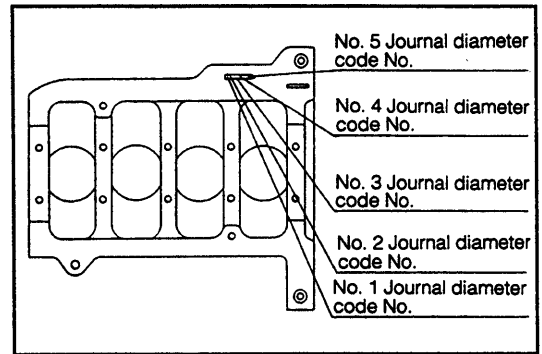
For driving this oil orifice, use an iron rod having an outer diameter of 10 mm (0.39 inch).



WR88-EM822

## 3. Selection of crankshaft bearings

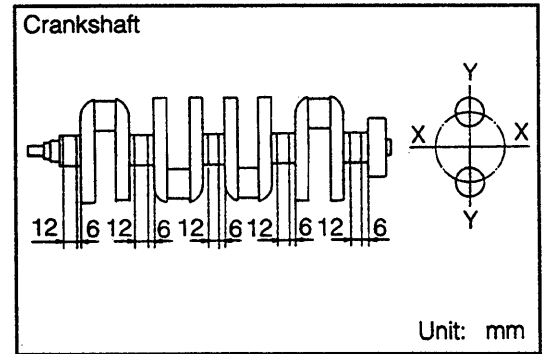
(1) Read the crankshaft journal diameter code number on the cylinder block.



WN88-EM385

(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.



Unit: mm

WN88-EM437

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

WR88-EM825

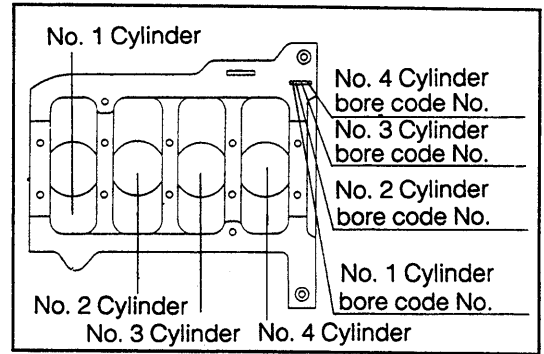
# ENGINE MECHANICALS

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 (1.9682 - 1.9681)	2 (Green)	—
	49.988 - 49.983 (1.9680 - 1.9679)	3 (Brown)	—
	49.982 - 49.976 (1.9677 - 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 (1.9682 - 1.9681)	3 (Brown)	—
	49.988 - 49.983 (1.9680 - 1.9679)	4 (Black)	—
	49.982 - 49.976 (1.9677 - 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 (1.9682 - 1.9681)	4 (Black)	—
	49.988 - 49.983 (1.9680 - 1.9679)	5 (Blue)	—
	49.982 - 49.976 (1.9677 - 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 (1.9682 - 1.9681)	5 (Blue)	—
	49.988 - 49.983 (1.9680 - 1.9679)	6 (White)	—
	49.982 - 49.976 (1.9677 - 1.9676)	7 (Pink)	—
	49.975 or less (1.9675)	—	Crankshaft replacement

WR88-EM826

## 4. Selection of pistons (reference)

(1) Read the cylinder block bore code number.

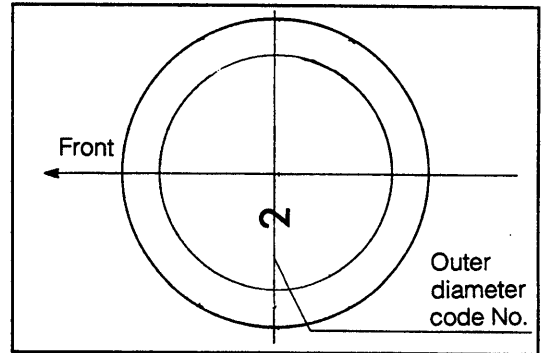


WR88-EM827

(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.



WN88-EM386

## REPLACEMENT OF CRANKSHAFT

(Replacement of the crankshaft only)

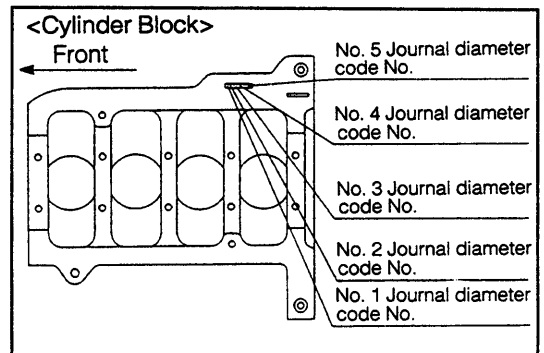
1. Wash the crankshaft using cleaning solvent. Dry it with compressed air.

**NOTE:**

- Make sure that the oil gallery exhibits no restriction due to rust-proof oil.
- As for the crankshaft for automatic transmission, drive the rear end bush into the rear end of the crankshaft with a brass rod so as to prevent damage to the bush.

## 2. Selection of crankshaft bearings

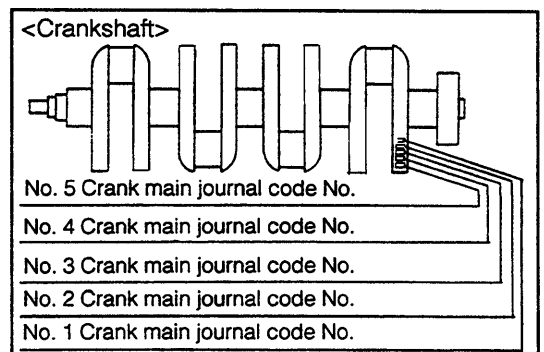
(1) Read the crankshaft journal diameter code number of the cylinder block.



WR88-EM829

WR88-EM830

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



WN88-EM387

# ENGINE MECHANICALS

(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

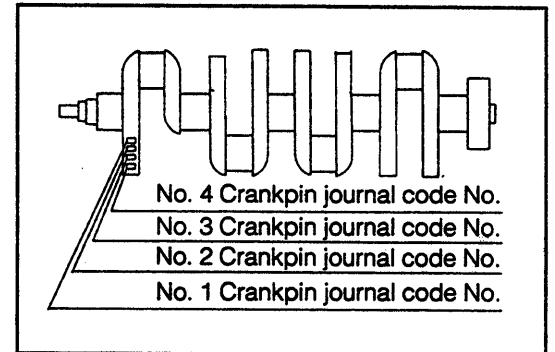
WR88-EM832

## Reference

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

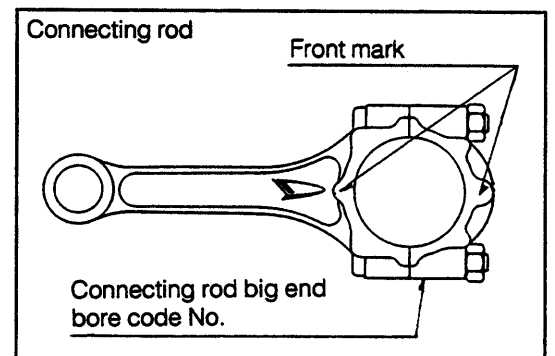
WR88-EM833

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



WR88-EM388

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



WR88-EM835

- (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 borecode No.	4	3	2	1
	5	4	3	2
	6	5	4	3

WR88-EM836

Reference

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

WR88-EM837

**REPLACEMENT OF CONNECTING RODS**

1. Wash the connecting rods using cleaning solvent.

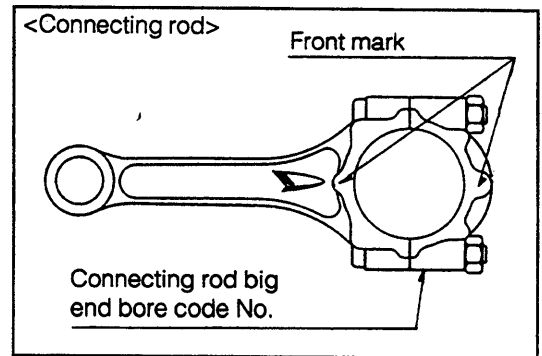
**WARNING:**

Be sure to protect your eyes, wearing goggles.

WR88-EM838

2. Selection of connecting rod bearings

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



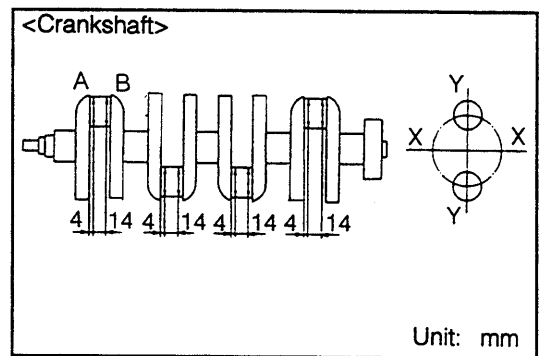
- (2) Measure the crankshaft pin diameter of the crankshaft in four directions for each crankshaft pin, 90 degrees spaced, at those points indicated in the right figure.

**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.

- (3) Select the connecting rod bearing in accordance with the table posted in next page.



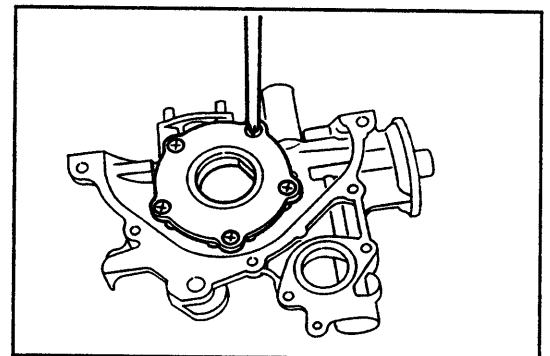
# ENGINE MECHANICALS

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 - 1.7708)	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 - 1.7708)	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 - 1.7708)	5 (Blue)	—
	44.975 or less (1.7706)	—	Crankshaft replacement

WR88-EM841

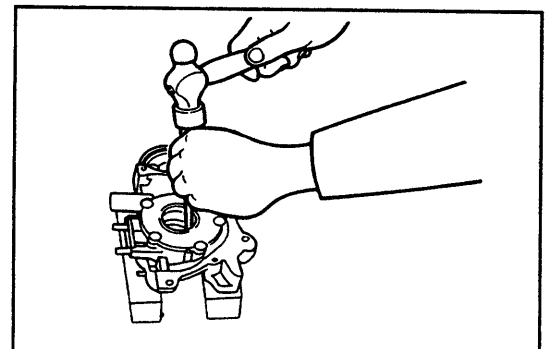
## DISASSEMBLY OF OIL PUMP

1. Detach the oil pump cover.



WR88-EM842

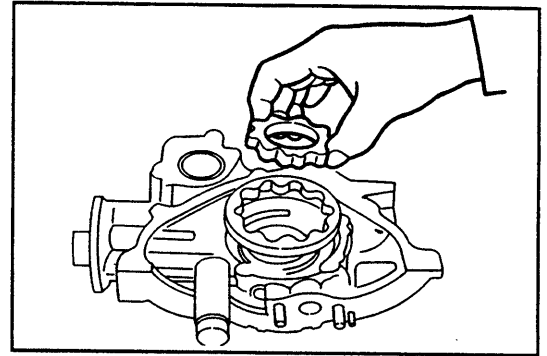
2. Remove the front oil seal.



WR88-EM843



3 Remove the oil pump rotor set.

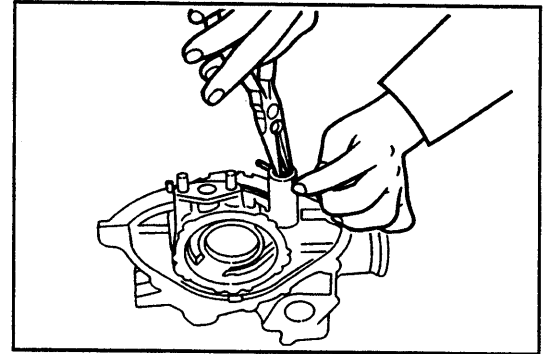


WR88-EM844

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.

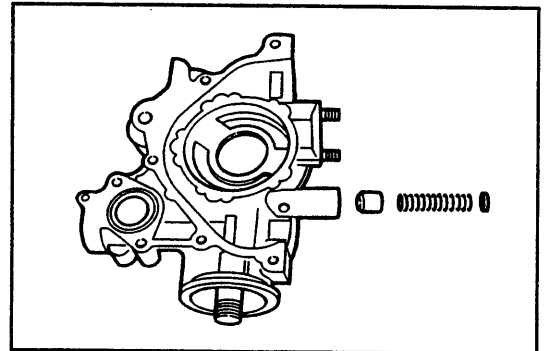


WR88-EM845

5. Remove the oil pump relief valve spring retainer, compression spring and oil pump relief valve.

**NOTE:**

Wash the disassembled parts in cleaning solvent.

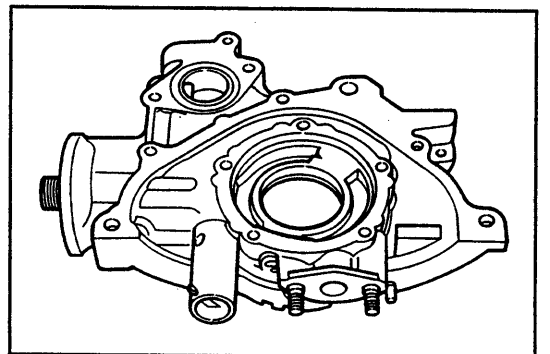


WR88-EM846

6. Inspection of each part

(1) Check the pump body for damage.

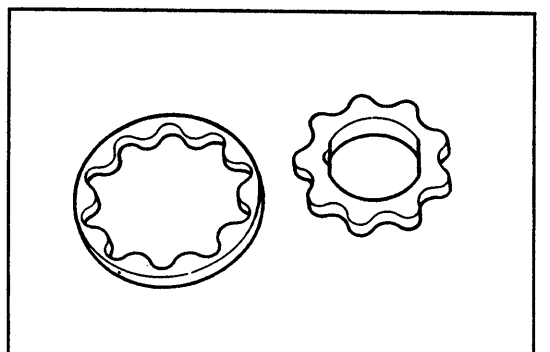
Replace the pump body if it exhibits damage.



WR88-EM847

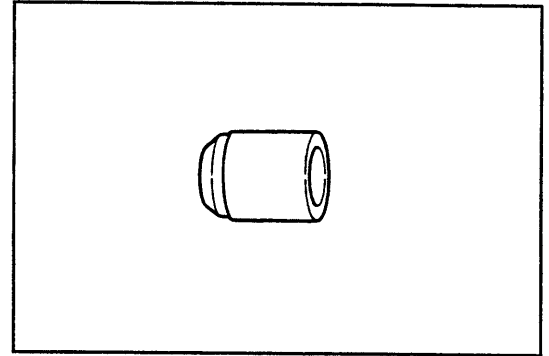
(2) Check the rotor set for damage.

Replace the rotor set if it exhibits damage.



WR88-EM848

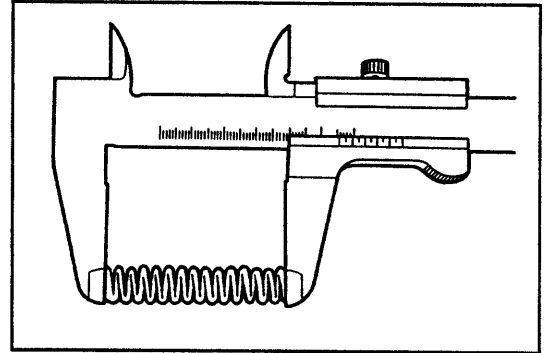
- (3) Check the oil pump relief valve for damage. Replace the relief valve if it exhibits damage. Also, check to see if any damage is present at the relief valve installation hole of the oil pump body.



WR88-EM849

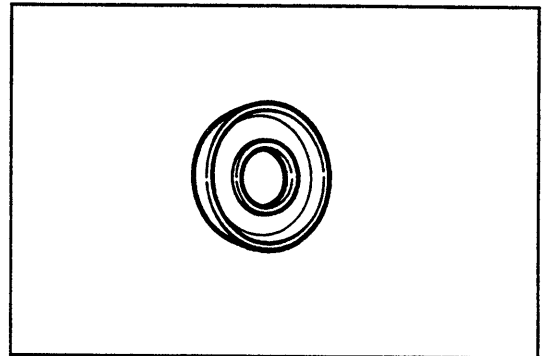
- (4) Check the compression spring for damage. Also, measure its free length.  
Specified Free Length: 57 mm (2.244 inch)

Replace the compression spring if it exhibits damage or the free length is less than the specified value.



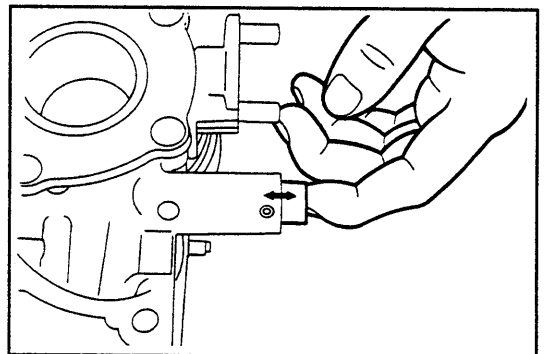
WR88-EM850

- (5) Check the oil pump relief valve spring retainer for damage. Replace the retainer if it exhibits damage.



WR88-EM851

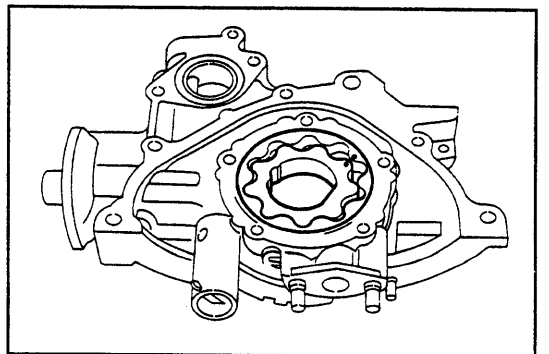
- (6) Apply engine oil to the oil pump relief valve. Insert the oil pump relief valve into the oil pump body. Check to see if the valve slides smoothly. Replace the oil pump body if the valve fails to slide smoothly.



WR88-EM852

7. Measurement of body clearance, tip clearance and side clearance

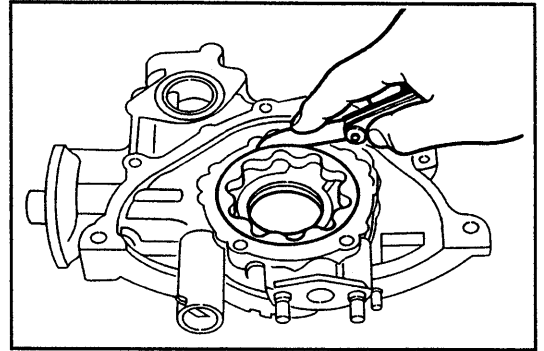
- (1) Apply a thin film of engine oil to the rotor mate surface of the oil pump body as well as to the rotor set. Assemble the rotor set in the oil pump body in such a way that the drilled mark may be seen from the outside.



WN88-EM390

- (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)

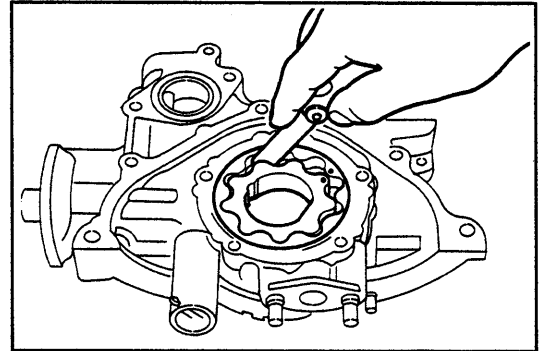
Replace the oil pump if the body clearance exceeds the specified value.



WR88-EM854

- (3) Measure the tip clearance of the rotor set, using a thickness gauge.  
**Tip Clearance:** 0.16 - 0.24 mm  
 (0.0063 - 0.094 inch)

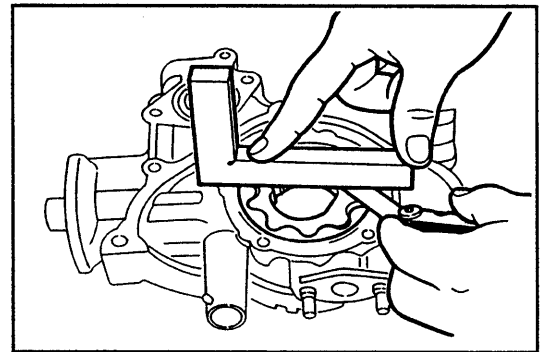
Replace the rotor set if the tip clearance exceeds the specified value.



WR88-EM855

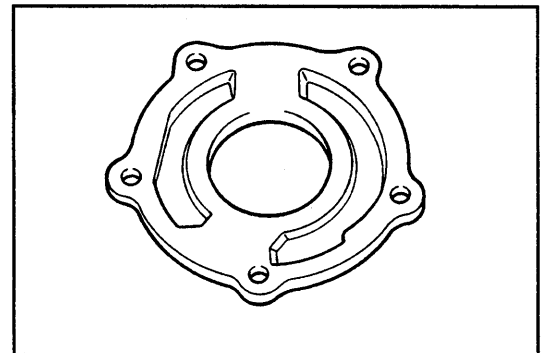
- (4) Measure the side clearance between the oil pump body and the rotor set, using a straightedge and a thickness gauge.  
**Side Clearance:** 0.035 - 0.085 mm  
 (0.0014 - 0.033 inch)

Replace the oil pump if the side clearance exceeds the specified value.



WR88-EM856

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.



WR88-EM857

## 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.

WR88-EM858

# ENGINE MECHANICALS

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.

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.

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.

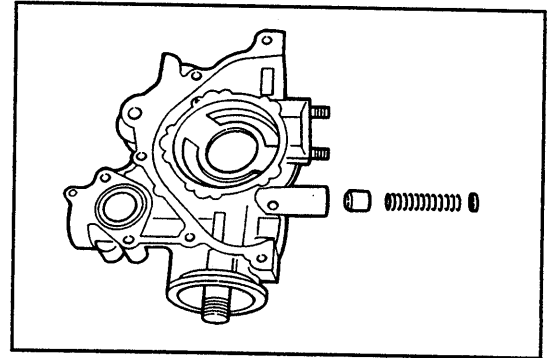
5. Install the oil pump cover. Tighten the cover to the specified torque.

**Tightening Torque:** 0.8 - 1.3 kg-m (5.8 - 9.4 ft-lb)

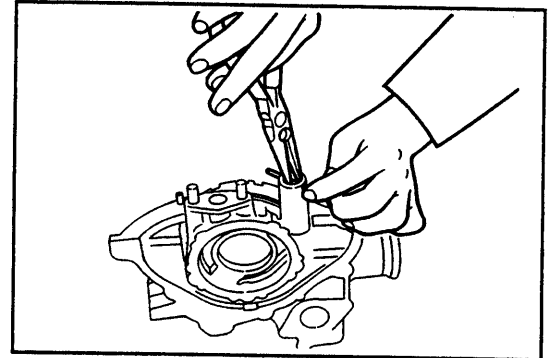
6. Drive a new oil seal into position, using the following SST.  
SST: 09310-87102-000

**NOTE:**

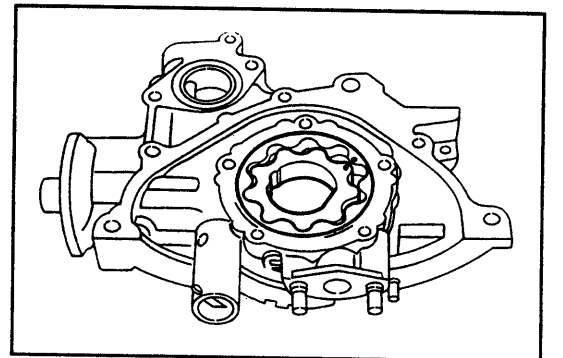
- Be very careful not damage the oil pump during the installation.
- Make sure that the oil seal is not driven into position in a tilted state.



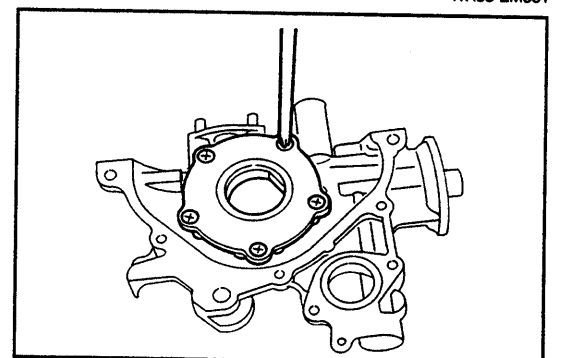
WR88-EM859



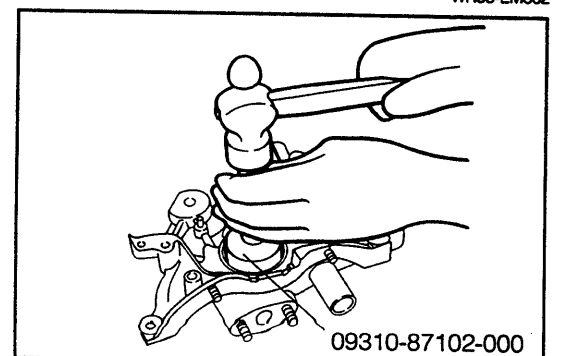
WR88-EM860



WR88-EM861



WR88-EM862



09310-87102-000

WN88-EM391

### INSPECTION OF FLYWHEEL

Inspect the flywheel for cracks or damage.  
Replace the flywheel if it exhibits defects.

### INSPECTION AND REPLACEMENT OF RING GEAR

Inspect the ring gear for damage.  
Replace the ring gear if it exhibits defects.

### 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.

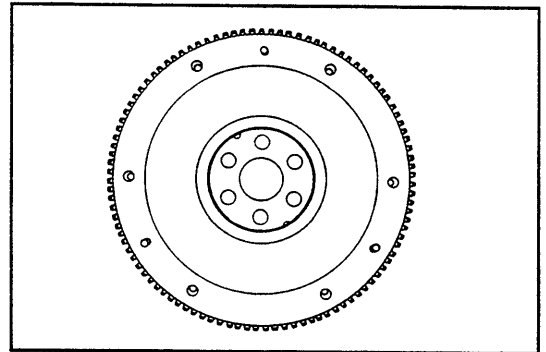
2. Place a new ring gear horizontally on the flywheel.

3. Using a gas burner, heat the ring gear evenly, until the ring gear due to its own weight fits onto the flywheel.

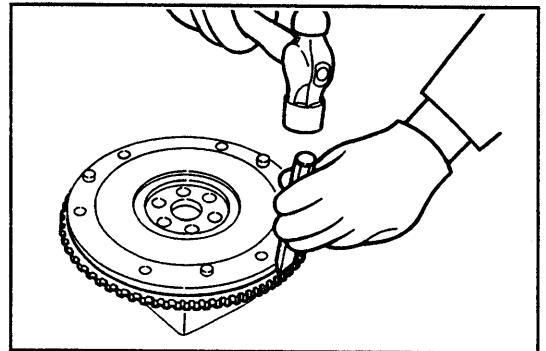
**NOTE:**

- Do not tap the ring gear using a hammer or the like.
- Never cool the ring gear quickly using water or the like.

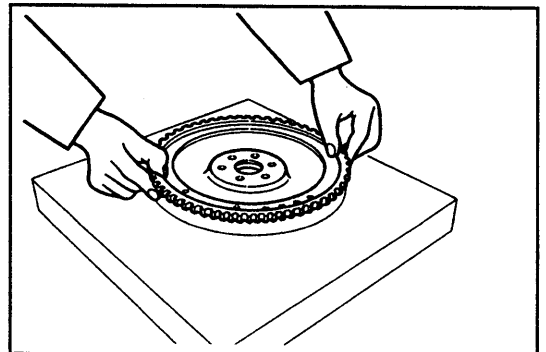
4. Allow the ring gear to cool naturally.



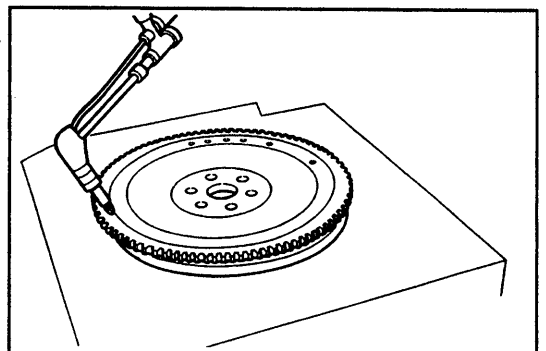
WR88-EM864



WR88-EM865



WR88-EM866



WR88-EM867

### ASSEMBLY OF CYLINDER BLOCK

(See page EM-74.)

**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.

WN88-EM392

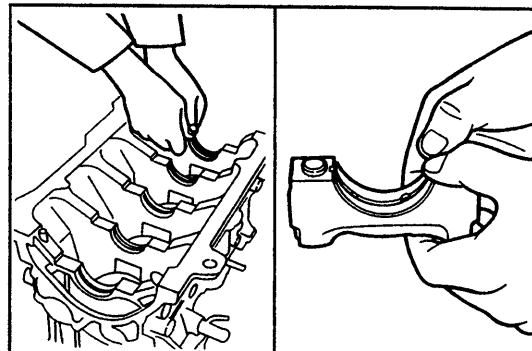
# ENGINE MECHANICALS

## 1. 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.

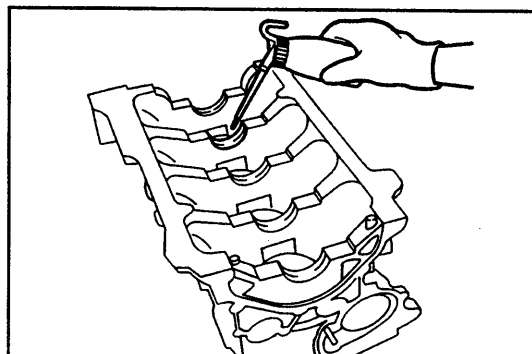


WR88-EM869

- (2) Lubricate the surface of each bearing with engine oil.

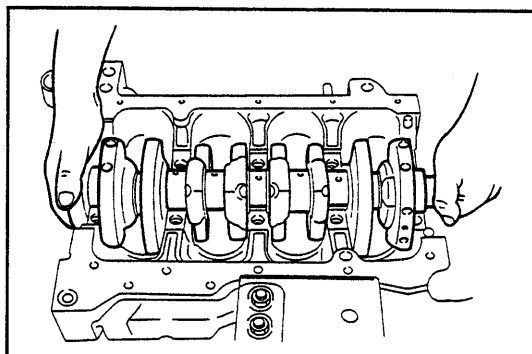
**NOTE:**

- Do not touch with the front and back surfaces of each bearing.
- Never apply engine oil to the crankshaft bearing caps.



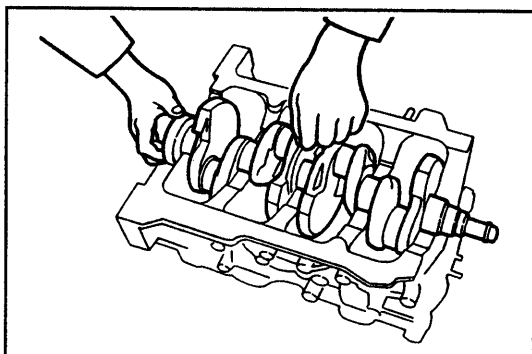
WR88-EM870

- (3) Install the crankshaft in the cylinder block.



WR88-EM398

- (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.

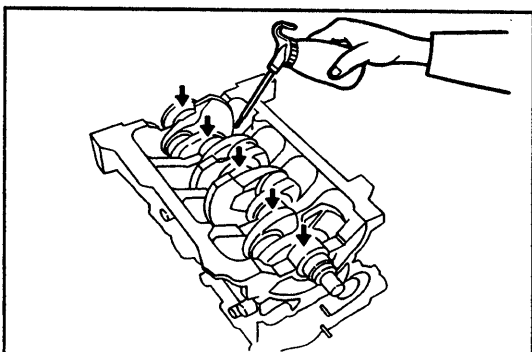


WR88-EM872

- (5) Apply engine oil to the crankshaft main journal sections.

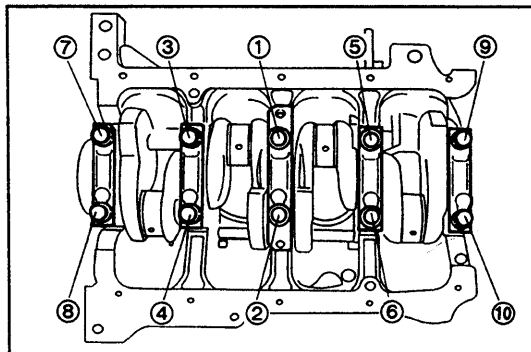
**NOTE:**

Care must be exercised to ensure that no oil flows into the bearing cap attaching bolt holes.



WR88-EM873

- (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**  
**(32.55 - 39.78 ft-lb)**

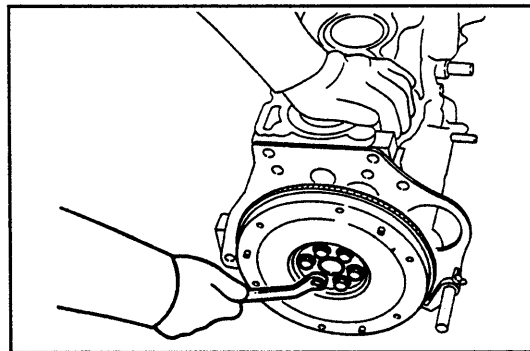


WR88-EM874

2. Assembly of piston and 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.

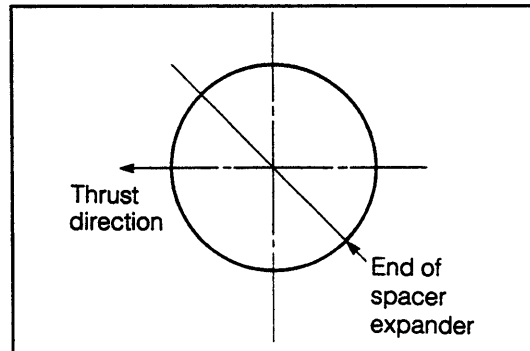


WR88-EM875

- (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.

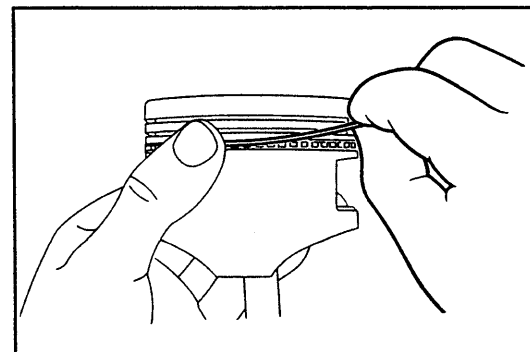
**NOTE:**

Do not expand the spacer expander to an extent more than necessary.



WR88-EM876

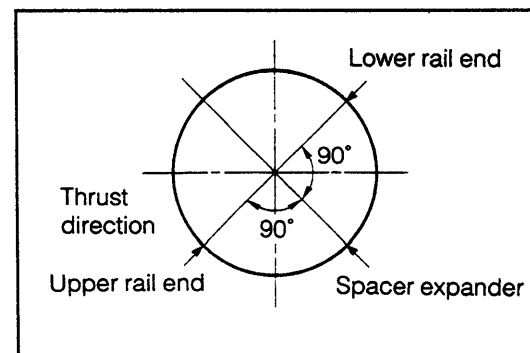
- (2) Fit the upper rail into position in such a manner that it is wound up while pushing the edge section of the oil ring spacer expander with your thumb.



WR88-EM877

**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.

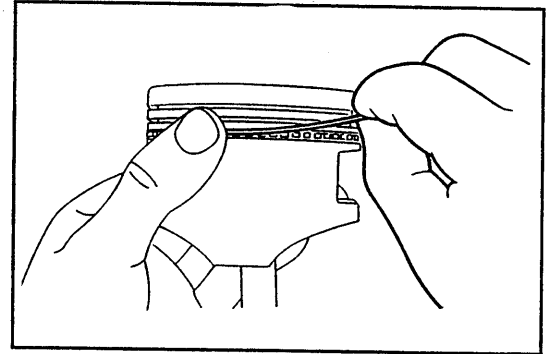


WR88-EM878

- (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.

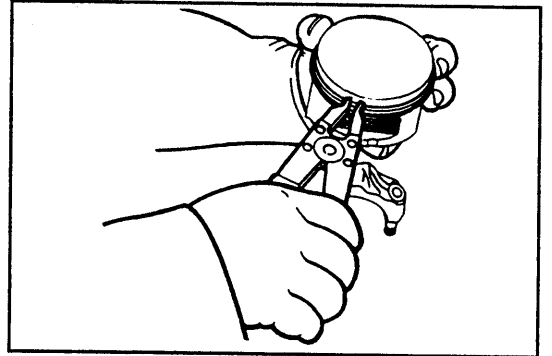


WR88-EM879

- (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.



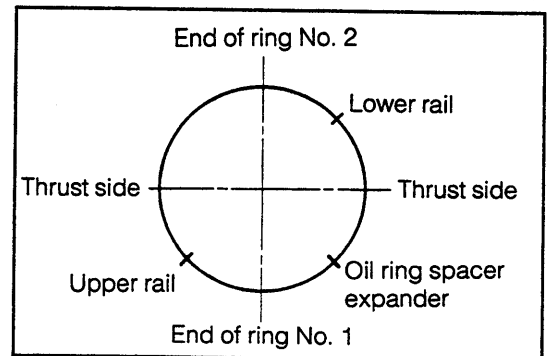
WR88-EM394

- (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.

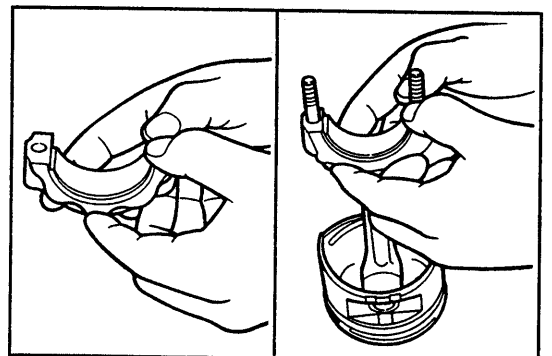
**NOTE:**

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.



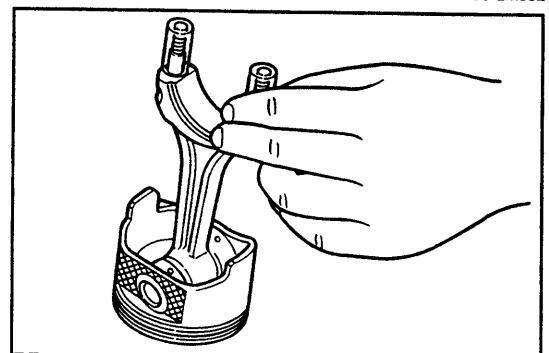
WR88-EM881

- (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.



WR88-EM882

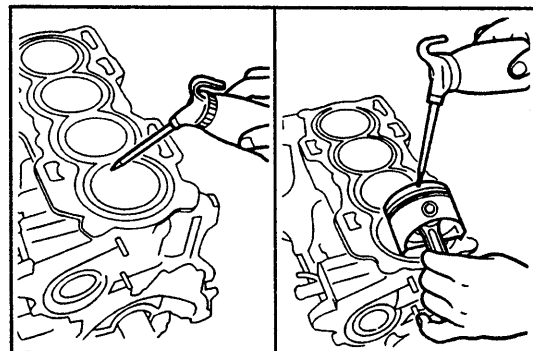
- (8) Cut an appropriate vinyl hose to a suitable length. Fit the vinyl hose to each connecting rod bolt sections.



WR88-EM883



- (9) Apply engine oil to the piston rings, piston pins, connecting rod bearings, cylinder walls and crankpin journals.



WR88-EM884

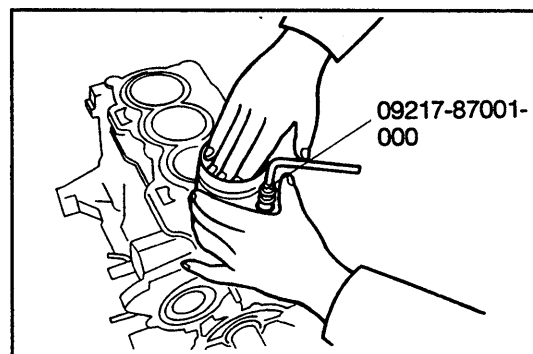
- (10) Compress the piston rings by means of the piston ring compressor SST, making sure that the piston ring ends will not move during the installation.

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.



WR88-EM885

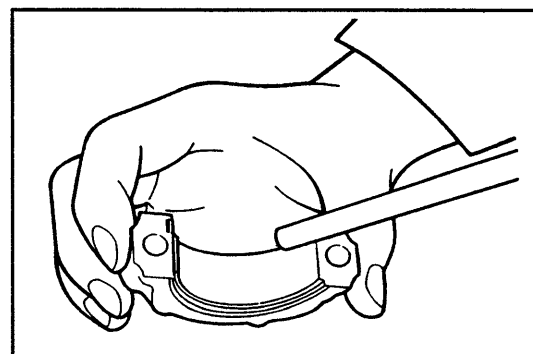
- (12) Push the piston by hand until the connecting rod reaches the crankpin journal.

- (13) Apply engine oil to the bearing surface of each connecting rod bearing.

**NOTE:**

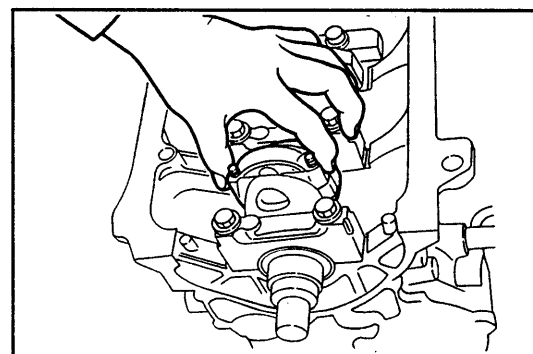
Do not touch with the bearing front surface.

- (14) Remove the vinyl hoses which were attached to the connecting rod bolt sections.



WN88-EM395

- (15) Install the connecting rod cap with the front mark facing toward the oil pump side.



WR88-EM887

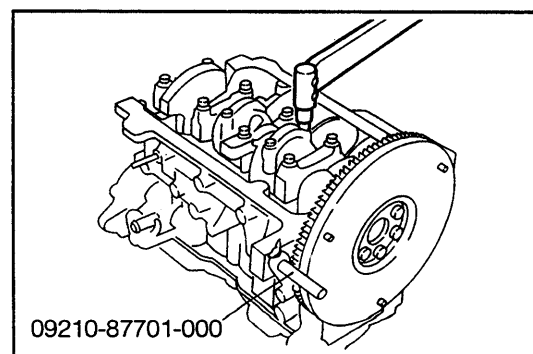
- (16) Prevent the crankshaft from turning, using the following SST.

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)

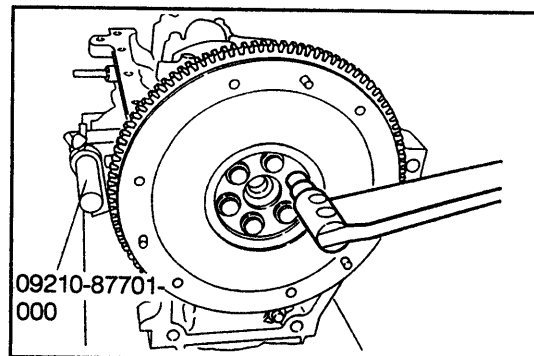
- (18) Perform the operations described in the steps (1) through (18) for each cylinder.



WN88-EM396

## ENGINE MECHANICALS

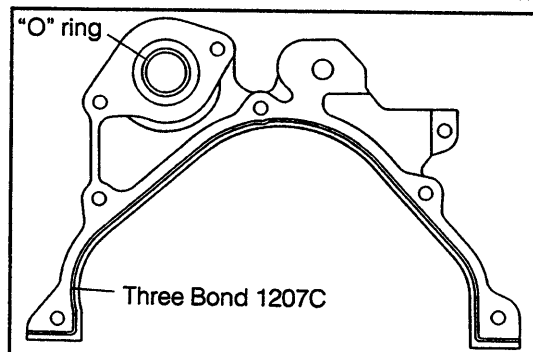
- (19) Remove the flywheel.
- (20) Remove the following SST.  
SST: 09210-87701-000



WN88-EM397

### 3. Installation of oil pump

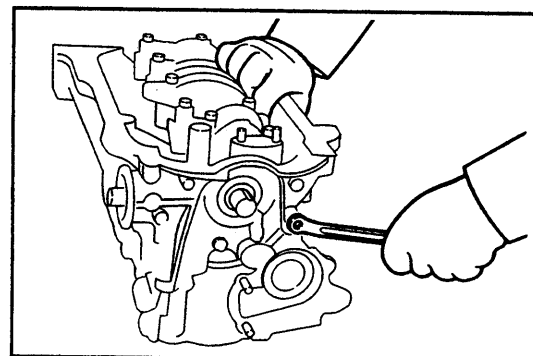
- (1) Apply the Three Bond 1207C to the oil pump installation surface of the cylinder block, as indicated in the right figure.
- (2) Replace the "O" ring of the oil pump with a new part.



WN88-EM398

- (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.

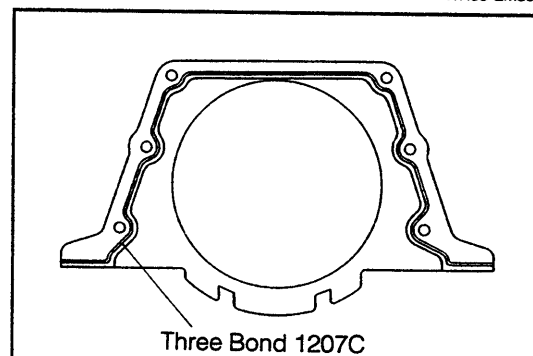
**Tightening Torque: 0.6 - 0.9 kg-m (4.4 - 6.5 ft-lb)**



WR88-EM892

### 4. Installation of oil seal retainer

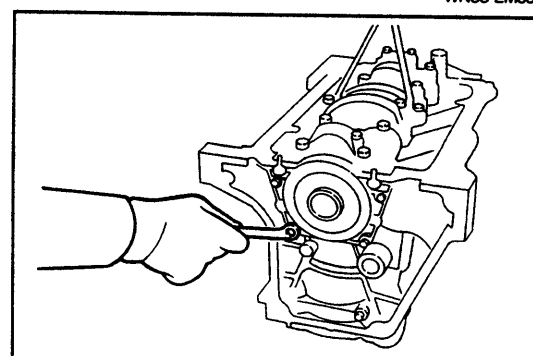
- (1) Apply the Three Bond 1207C to the oil seal retainer installation surface of the cylinder block, as indicated in the right figure.



WN88-EM399

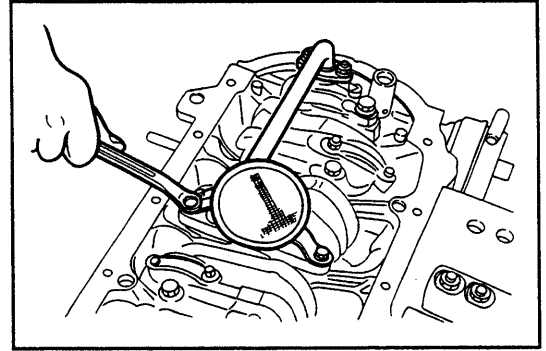
- (2) Apply engine oil to the inner surface of the oil seal. Install the oil seal retainer to the cylinder block. Perform tightening to the specified torque.

**Tightening Torque: 0.6 - 0.9 kg-m (4.4 - 6.5 ft-lb)**



WN88-EM400

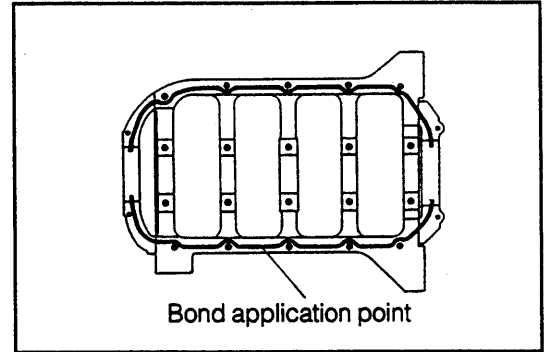
5. Install the oil strainer with a new gasket interposed.



WN88-EM401

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.



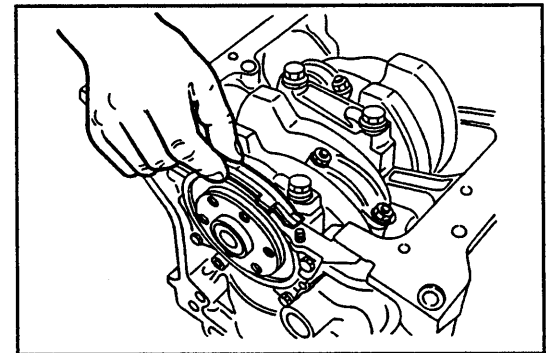
Bond application point

WR88-EM896

(2) Place the oil pan gasket.

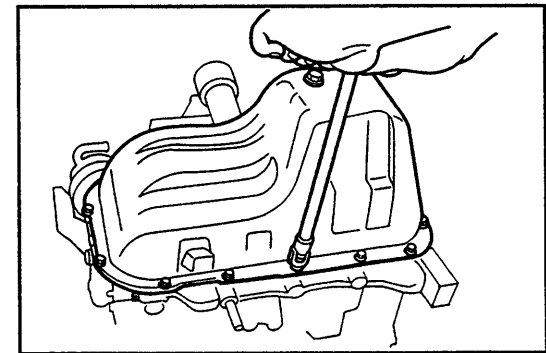
**NOTE:**

Ensure that the end section of the oil pan gasket is overlapped at least 10 mm (0.39 inch) with the Three Bond 1207C.



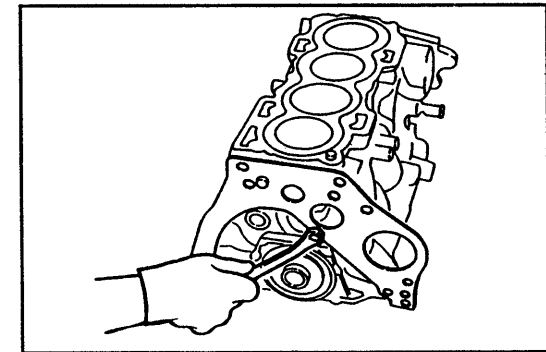
WN88-EM402

(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 - 8.6 ft-lb)



WN88-EM403

7. Install the rear end plate.



WR88-EM899

## 8. Installation of flywheel

- (1) Install the flywheel on the crankshaft.

WN88E-EM404

### (2) Application of flywheel bolt sealing material

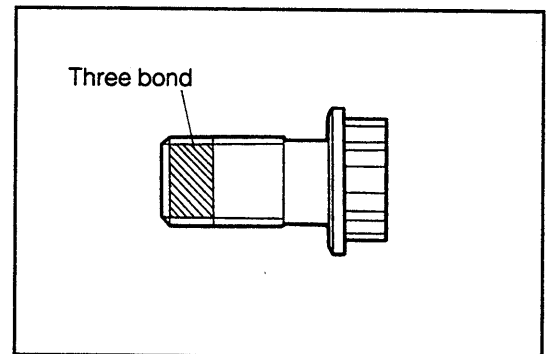
- ① Wash the flywheel bolts. Then, degrease and dry them.

**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.



WN88-EM439

- 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 oil 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.

- (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 (32.5 - 47.0 ft-lb)

**NOTE:**

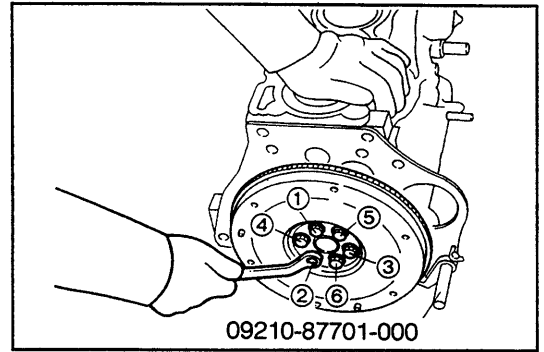
Prevent the crankshaft from turning at the ring gear section, using the following SST.

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).



WR88-EM902

- (4) Tighten the flywheel attaching bolts to the specified torque in the sequence indicated in the right figure.

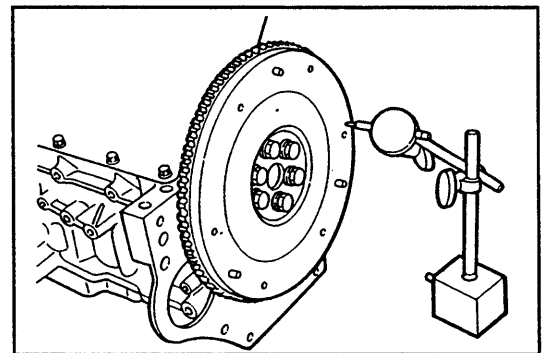
Tightening Torque: 8.0 - 10.0 kg-m (57.9 - 72.3 ft-lb)

- (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.



WR88-EM904

**9. Assembly of clutch disc and pressure plate**

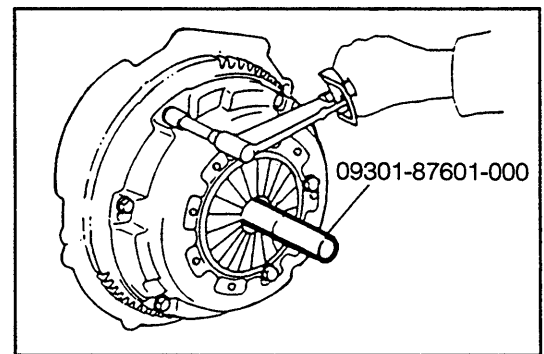
- (1) Insert the following SST into the crankshaft rear end.

SST: 09301-87601-000

- (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)

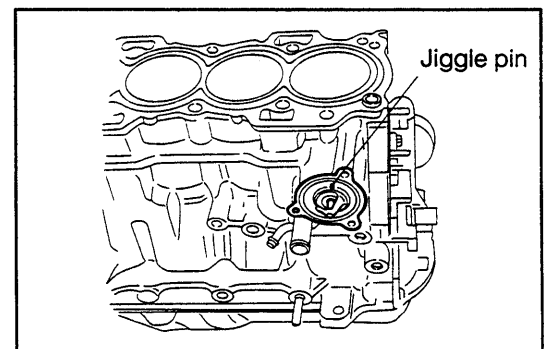


WN88-EM406

10. Install the thermostat in the cylinder block in such a way that the jiggle pin section may come at the upper side.

**CAUTION:**

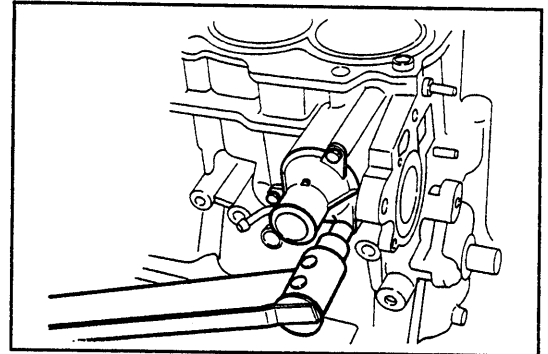
Make sure to install the jiggle pin of the thermostat in the correct direction. Failure to observe this precaution will be cause of overheating.



WN88-EM407

# ENGINE MECHANICALS

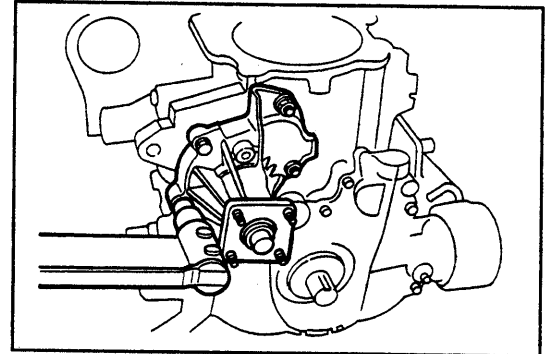
11. Install the water inlet.  
Tightening Torque: 0.6 - 0.9 kg-m (4.4 - 6.5 ft-lb)



WN88-EM408

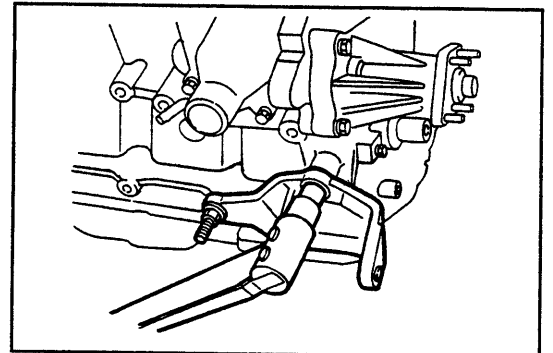
12. Installation of water pump  
(1) Install a new water pump gasket on the cylinder block.  
(2) Install and tighten the water pump to the specified torque.  
Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

**NOTE:**  
When the stud bolts have been replaced, apply the Three Bond 1377B to the threaded portion at the cylinder block side.



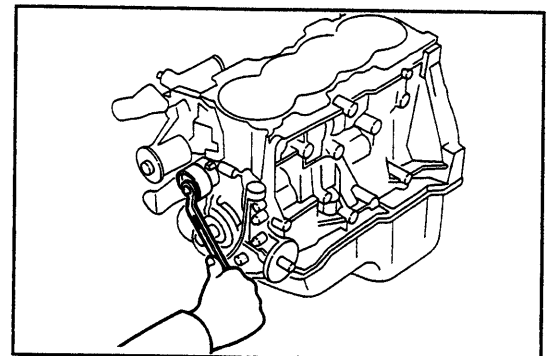
WN88-EM409

13. Install the alternator bracket.  
Tightening Torque: 3.5 - 5.0 kg-m (25.3 - 36.2 ft-lb)



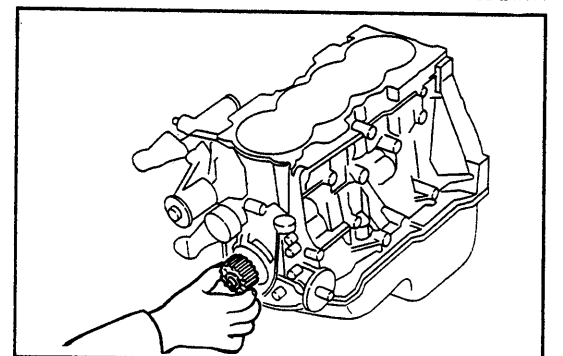
WN88-EM410

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.



WN88-EM411

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.



WN88-EM412

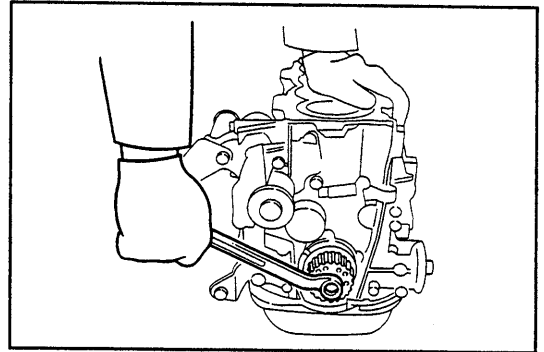
17. Install the crankshaft timing belt attaching bolt. Tighten the bolt to the specified torque.

**Tightening Torque:** 9.0 - 10.0 kg-m (65.1 - 72.3 ft-lb)

**NOTE:**

Prevent the crankshaft from turning, using the following SST.

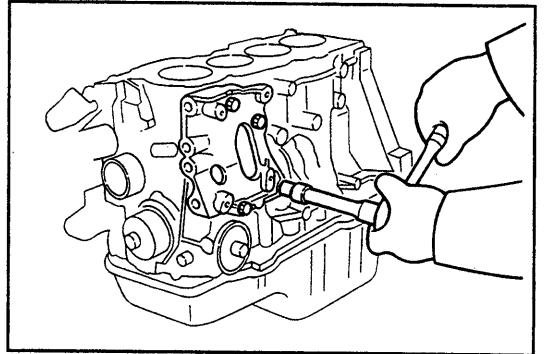
SST: 09210-87701-000



WN88-EM413

18. Install the compressor mounting bracket.

**Tightening Torque:** 3.0 - 4.5 kg-m (21.7 - 32.5 ft-lb)

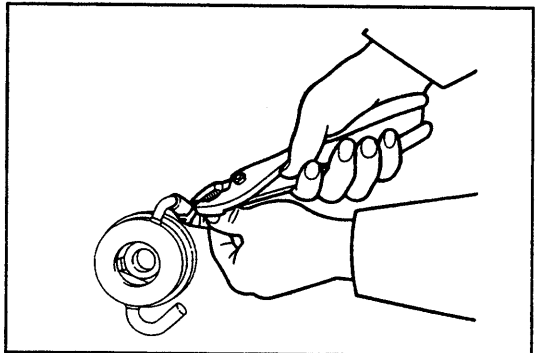


WN88-EM414

19. Install the oil cooler.

(Oil cooler-equipped vehicle only)

- (1) Install a new "O" ring.
- (2) Connect the oil cooler hose to the oil cooler.
- (3) Place the rib for locating the oil cooler to the cylinder block. Then install the oil cooler with the set bolts.

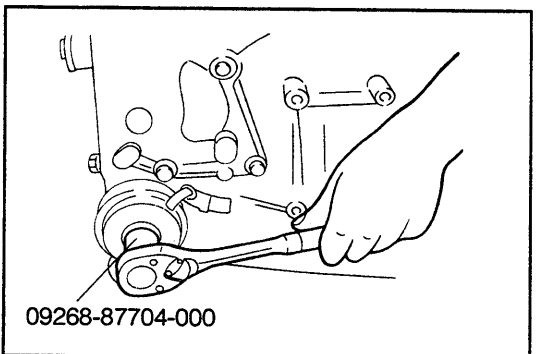


WR88-EM923

- (4) Tighten the set bolts to the specified torque using the following SST.

SST: 09268-87704-000

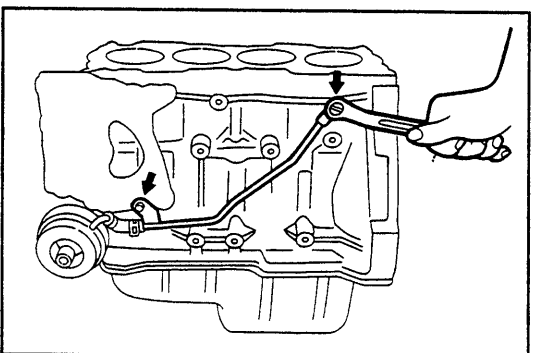
**Tightening Torque:** 2.5 - 3.5 kg-m (18.1 - 25.3 ft-lb)



09268-87704-000

WN88-EM415

- (5) Connect the oil cooler inlet pipe into the oil cooler hose and install the hose band.
- (6) Install the oil cooler pipe to the cylinder block with a new gasket interposed.

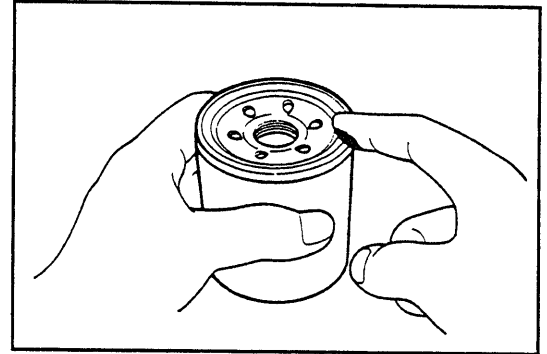


WN88-EM416

## ENGINE MECHANICALS

### 20. Installation of oil filter

- (1) Thinly apply engine oil to the oil seal of the oil filter.

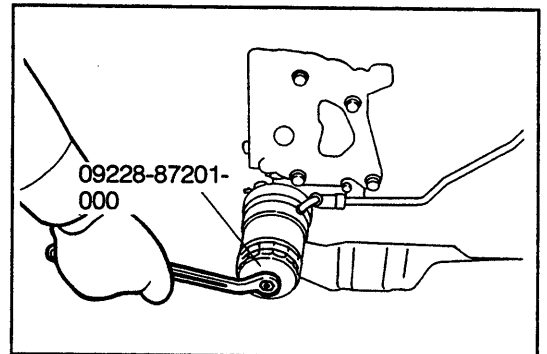


WR88-EM928

- (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 further one complete turn (360 degrees), using the following SST.

SST: 09228-87201-000



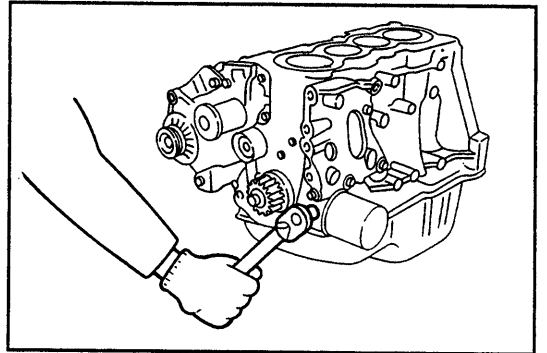
WN88-EM417

### 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)

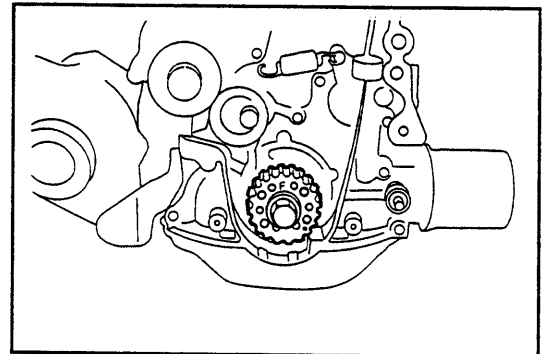


WN88-EM418

### 22. Install the alternator.

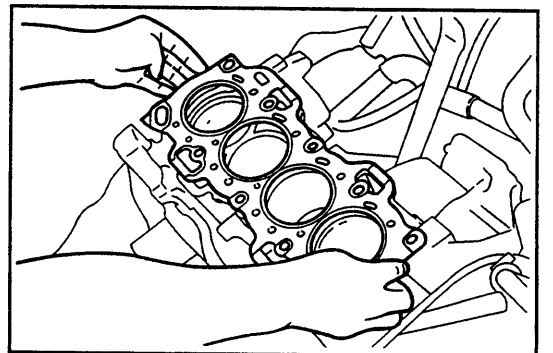
## ASSEMBLY OF CYLINDER HEAD

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



WN88-EM419

2. Install the cylinder head gasket on the cylinder block.



WN88-EM420

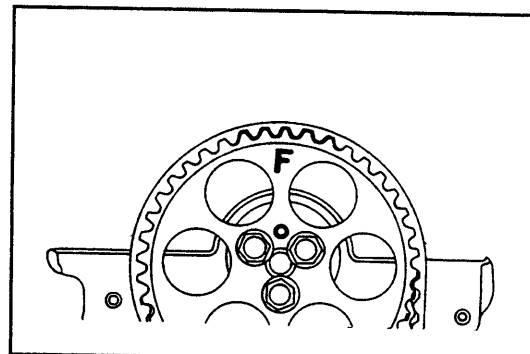


- Turn the crankshaft, until the "F" mark of the camshaft timing belt pulley comes exactly at the top position.

- 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.



WN88-EM421

- Apply engine oil to the threaded portion of each cylinder head bolt. Install the bolts to the cylinder head.

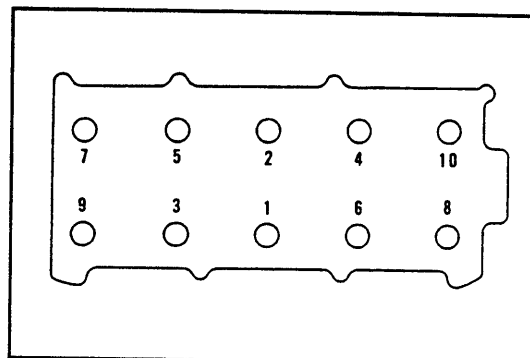
**NOTE:**

- 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.

WN88-EM422

- Tighten the cylinder head bolts evenly over two or three stages to the specified torque, following the sequence shown in the right figure.

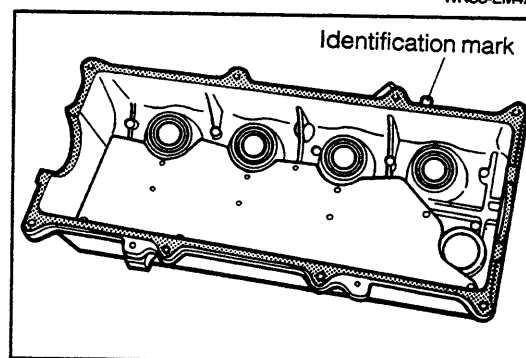
**Tightening Torque:** 6.0 - 6.8 kg-m (43.4 - 49.2 ft-lb)



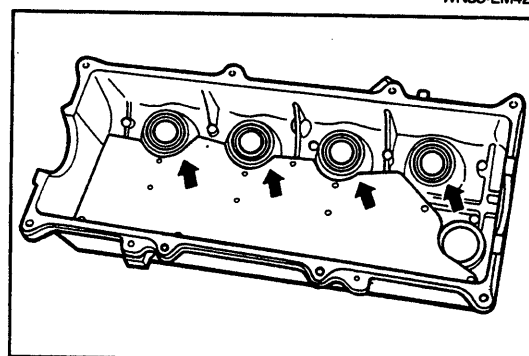
WN88-EM423

## INSTALLATION OF CYLINDER HEAD COVER

- Check the cylinder head cover gasket for damage. Replace the cylinder head cover gasket if it is damaged.
- 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.
- Check the spark plug tube grommets for damage. Replace any grommet which exhibits damage. (See page EM-68.)



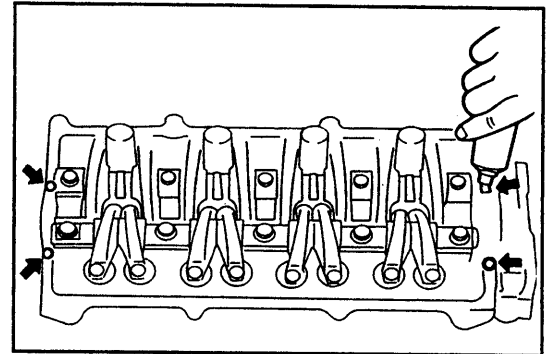
WN88-EM424



WN88-EM425

## ENGINE MECHANICALS

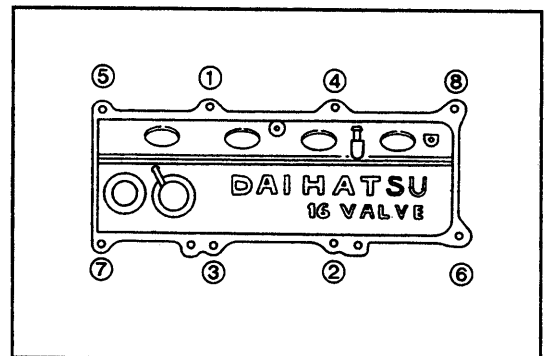
4. Wipe off any oil from the cylinder head cover gasket surface of the cylinder head.
5. Apply the Three Bond 1104 to the mate surface of the cylinder head with the camshaft bearing caps No. 1 and No. 5, but only to those sections which contact the cylinder head gasket.



WR88-EM944

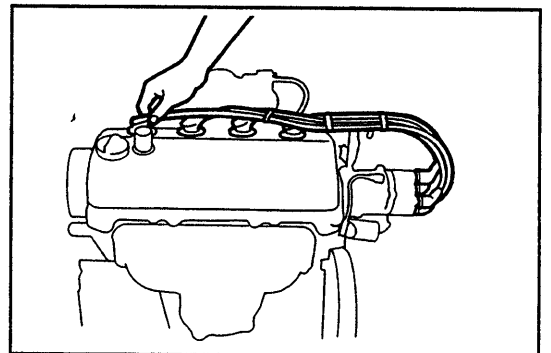
6. Install the cylinder head cover to the cylinder head. Tighten the cylinder head cover attaching bolts to the specified torque, following the sequence in the right figure.

Tightening Torque: 0.3 - 0.5 kg-m (2.2 - 3.6 ft-lb)



WR88-EM945

7. Connect the resistive cords to the distributor spark plug. Attach the resistive cords to the clamp.

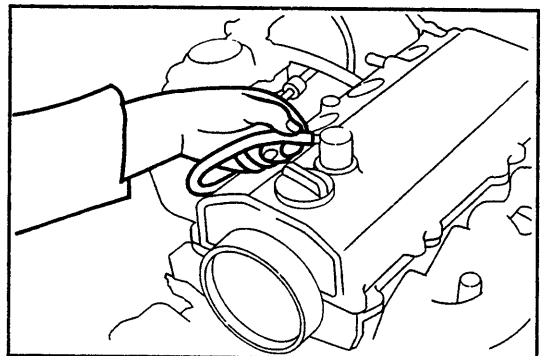


WR88-EM946

8. Connect the PCV hose to the cylinder head cover.

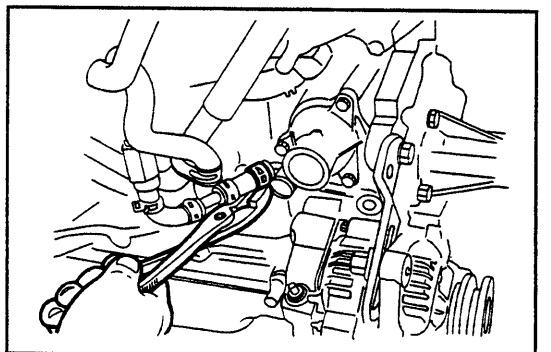
**NOTE:**

The side that the paint mark is daubed should be connected to the cylinder head cover side. (Only for carburetor-equipped vehicles)



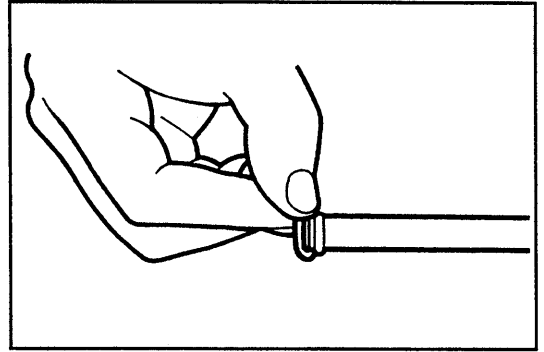
WN88-EM426

9. Connect the water hose to the cylinder block. (HD-C engine)  
Connect the water hose to the throttle body. (HD-E engine)



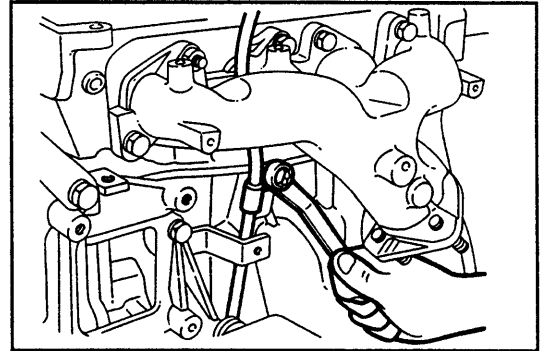
WN88-EM427

10. Replace the "O" ring of the oil level gauge guide with a new "O" ring.



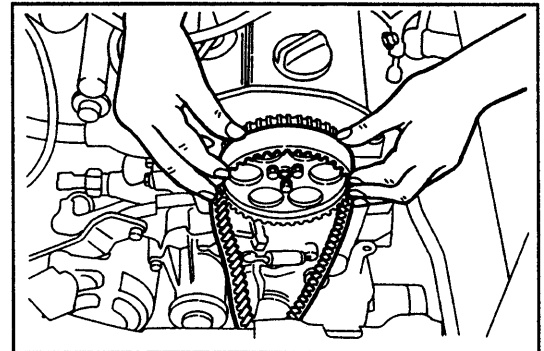
WN8-EM428

11. Insert the oil level gauge guide into the cylinder block.  
 12. Install the oil level gauge guide attaching bolts.  
**Tightening Torque: 1.9 - 3.1 kg-m (13.7 - 22.4 ft-lb)**



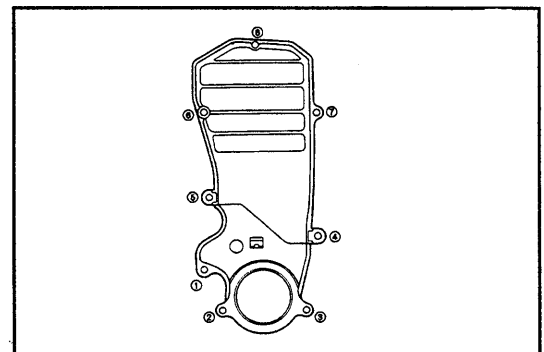
WN88-EM429

13. Install the oil level gauge.  
 14. Installation of timing belt  
 (1) Check the timing belt.  
 (See page EM-25.)  
 (2) Install the timing belt.  
 (See page EM-27.)



WN88-EM430

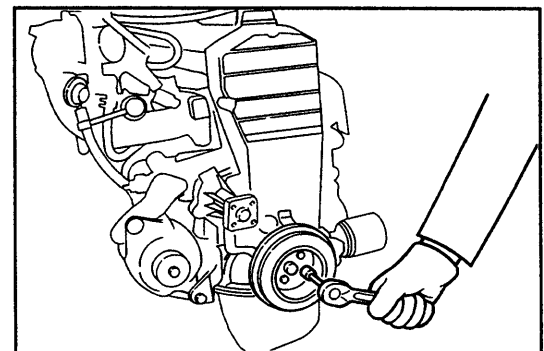
15. Install the timing belt cover.  
 (See page EM-30.)



WN88-EM431

16. Install the crankshaft timing belt pulley.  
**Tightening Torque: 2.0 - 3.0 kg-m (14.5 - 21.7 ft-lb)**

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



WN88-EM432

## ENGINE MECHANICALS

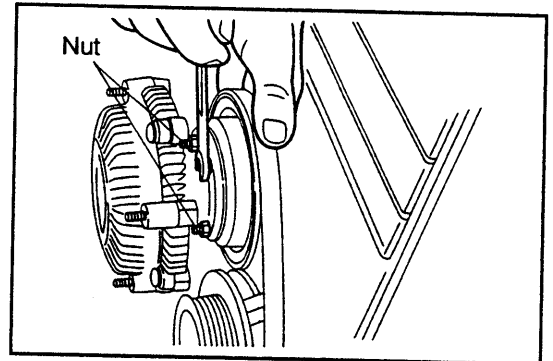
### 17. Installation of the fluid coupling fan

- (1) Install the water pump pulley onto the position.
- (2) Install the fluid coupling 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)

#### NOTE:

Be sure that the water pump pulley is not ride over the spigot section of the water pump pulley.



### 18. Installation of the V belt

- (1) Install the V 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.

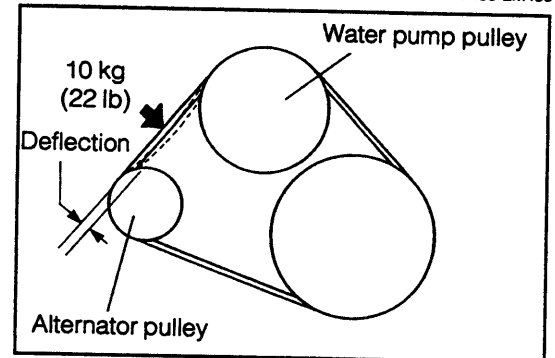
#### Specified Belt Deflection

**New Belt:** 5 - 7 mm (0.20 - 0.28 inch)

**Used Belt:** 6 - 8 mm (0.24 - 0.31 inch)

#### NOTE:

- "New belt" refers to a belt with has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine 5 minutes or more.

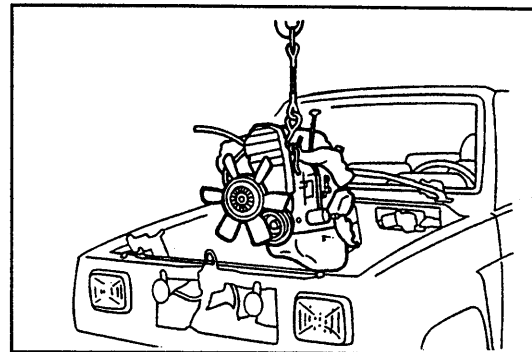


## ENGINE INSTALLATION

1. Place the engine in the engine compartment.

**CAUTION:**

Be careful not to allow the engine to hit the vehicle body and or other parts.



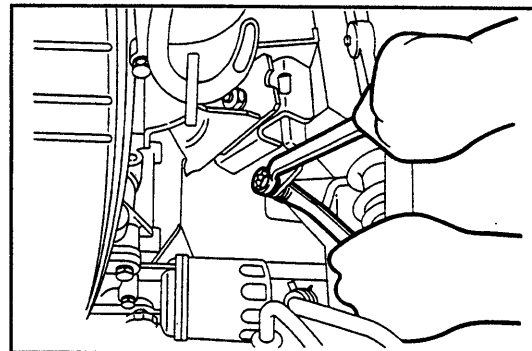
WN88-EM518

2. Connect the engine mounting to the engine mounting section of the chassis with two attaching bolts.

**NOTE:**

- When connecting the engine mounting section, using a chain block, adjust the engine position to such a point that the engine mounting can be installed.
- There are two engine mounting section which is both side of the right hand and the left hand.

Tightening Torque: 3.0 - 4.5 kg-m (21.7 - 32.5 ft-lb)

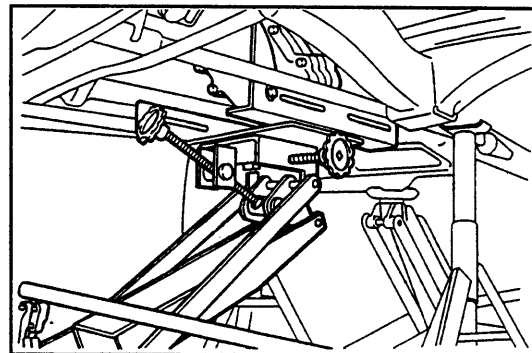


WN88-EM519

3. Insert the transmission input shaft into the clutch disc.

**NOTE:**

While supporting the transmission assembly with a transmission jack, install the transmission assembly to the engine.



WN88-EM520

4. Connect the cylinder block to the transmission case assembly with the six attaching bolts temporarily.

**NOTE:**

At that time, the starter motor and the attaching bolts does not connect.

WN88-EM521

5. Install the starter motor to the engine block with attaching bolts.

Tightening Torque: 5.0 - 7.0 kg-m (36.2 - 50.6 ft-lb)

WN88-EM522

## ENGINE MECHANICALS

6. Tighten the attaching bolts between engine side and transmission side.

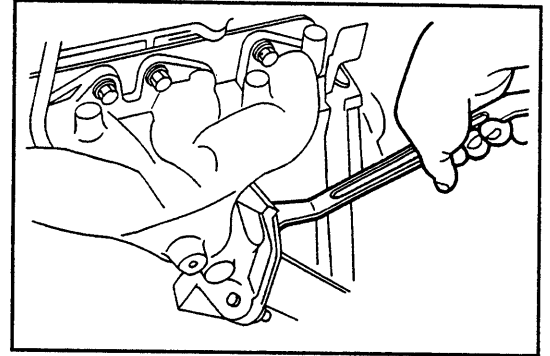
**Tightening Torque:** 5.0 - 7.0 kg-m (36.2 - 50.6 ft-lb)

7. Remove the transmission jack.
8. Remove the chain block from the engine.

WN88E-EM523

9. Connect the exhaust pipe to the exhaust manifold with a new gasket interposed.

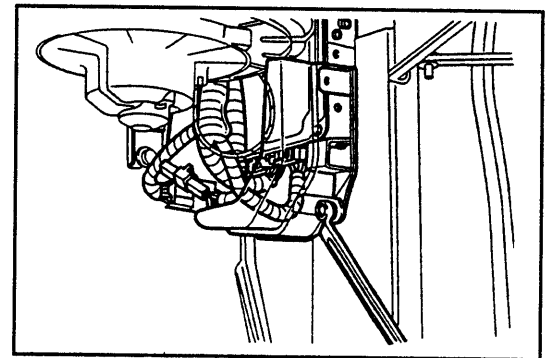
**Tightening Torque:** 3.5 - 5.0 kg-m (25.3 - 36.2 ft-lb)



WN88E-EM524

10. Installation of engine wire for ECU.

- (1) Install the engine wire connector for ECU to the cowl side panel of passenger seat side through the dash panel.
- (2) Connect the engine wire connector to the engine control computer assembly (ECU).



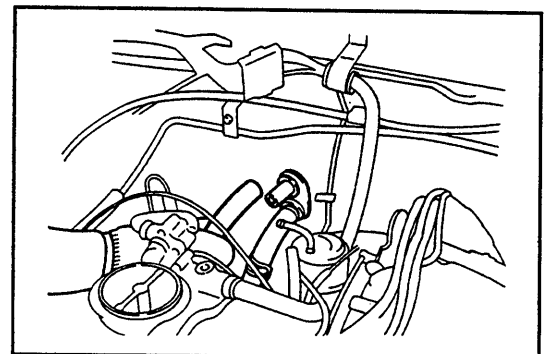
WN88E-EM525

11. Connect the following wiring harness. (See pages EM-133, EM-141)

- (1) The cowl wire and alternator wire.
- (2) The engine wire and fuse block connector
- (3) The engine wire clamp at the cylinder block
- (4) The oxygen sensor connector (HD-E engine only)

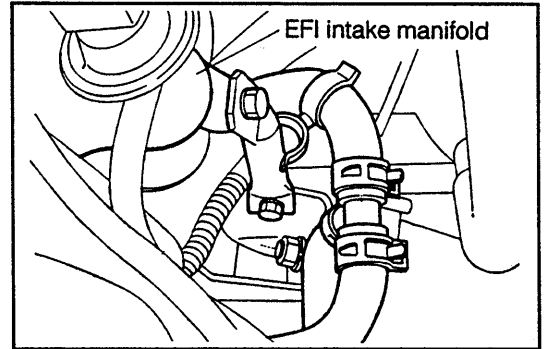
WN88E-EM526

12. Connect the heater hose of inlet and outlet at the dash panel.



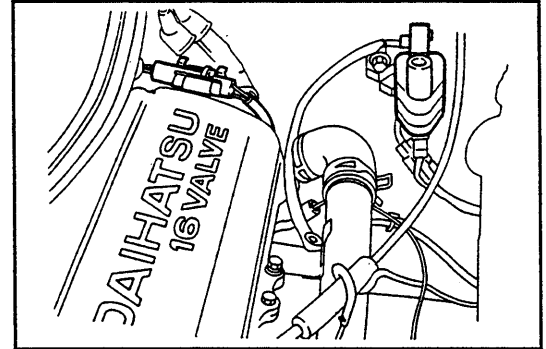
WN88E-EM527

13. Install the serge tank stay No. 2 between engine mounting bracket and intake manifold. (HD-E engine only)  
 Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)



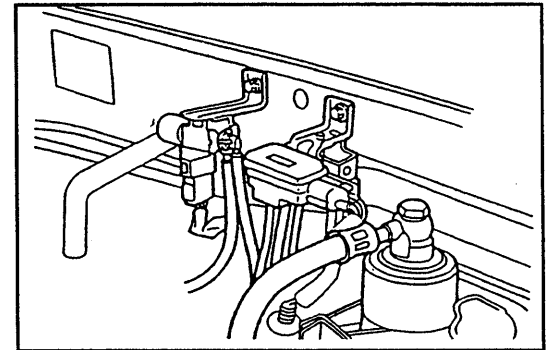
WN88E-EM528

14. Connect the accelerator cable to the position.  
 15. Clamp the accelerator cable to resistive cord No. 1 by using the clamp. (Only for L.H.D. carburetor-equipped vehicles)  
 16. connect the coupler of wiring harness of the distributor.  
 17. Connect the resistive cord from the ignition coil.



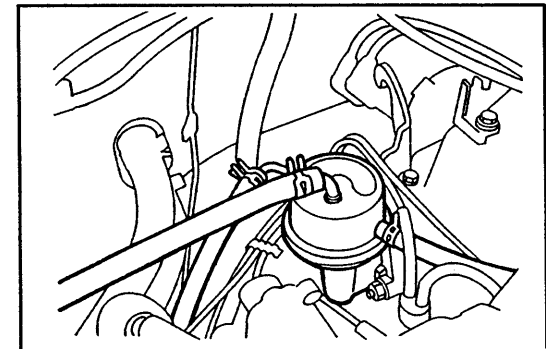
WN88E-EM529

18. Connect the pressure sensor to the dash panel. (HD-E engine only)  
 19. Connect the idle-up VSV to the dash panel (HD-E engine only)



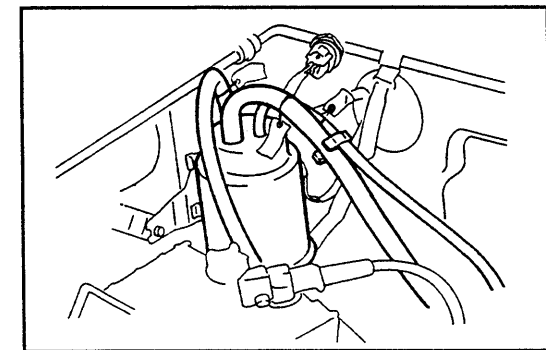
WN88E-EM530

20. Connect the fuel hose to the fuel filter.  
 21. Connect the fuel return hose.



WN88E-EM531

22. Connect the outer vent hose to the charcoal canister. (GCC specification only)  
 23. Connect the hose between the charcoal canister and throttle body. (HD-E engine only)



WN88E-EM532

## ENGINE MECHANICALS

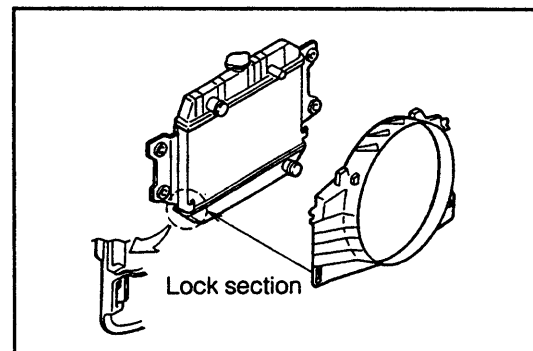
24. Place the radiator fan shroud to the cooling fan side.
25. Install the radiator in the engine room. Then, tighten the attaching bolts.

WN88E-EM533

26. Install the radiator fan shroud with two attaching bolts.

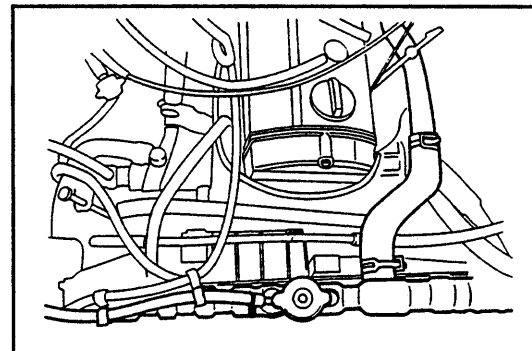
**NOTE:**

Before attaching the fan shroud to the radiator, insert the lock section of the fan shroud to the lower section of the radiator.



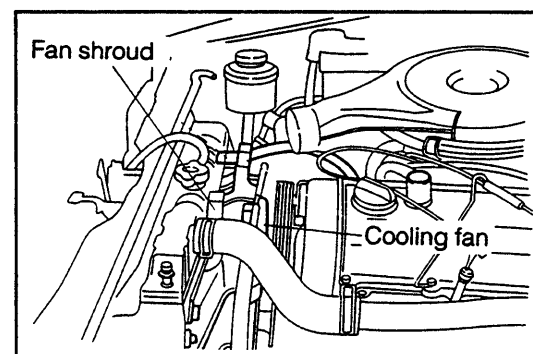
WN88E-EM534

27. Connect the radiator hose No. 1 and No. 3 to the radiator.
28. connect the air bleed hose from the intake manifold to the radiator upper tank.



WN88E-EM535

29. Clamp the clutch cable on the fan shroud with the two clamps.
30. Install the reserve tank to the radiator.



WN88E-EM536

31. Installation of air cleaner assembly

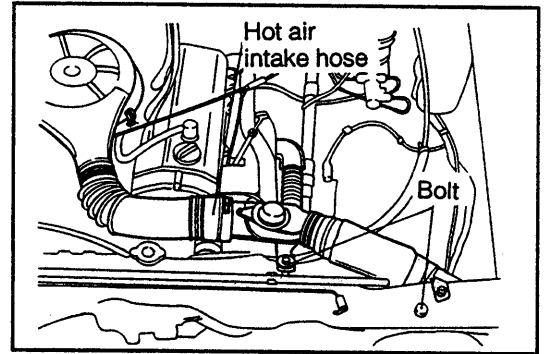
- (1) Install the air cleaner assembly on the carburetor by the attaching bolts of air cleaner brackets and wing nut.  
(HD-C engine)
- (2) Install the air cleaner assembly on the left hand side of the engine room by the three attaching bolts.  
(HD-E engine)

WN88E-EM537



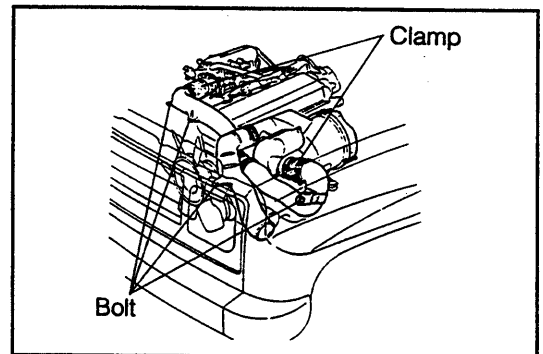
## 32. Installation of air cleaner hose assembly

- (1) Install the cool air intake to the air cleaner inlet by the two bolts and the clamp. (HD-C engine)
- (2) Connect the vacuum motor hose and the hot air intake. (except for GCC specification)



WN88E-EM538

- (3) Install the air cleaner pipe sub assembly and cool air intake duct by the three clamps and four bolts. (HD-E engine)
- (4) Connect the two vacuum hose for idle-up and for power steering. (HD-E engine)



WN88E-EM539

## 33. Fill the engine coolant.

(See page CO-3)

## 34. Fill the engine oil.

(See page LU-5)

## 35. Place the battery on the battery carrier.

Then, install the battery hold-down clamp.

### NOTE:

Care must be exercised so as not to damage the battery due to excessive tightening of it.

WN88E-EM540

36. Connect the wire of the positive terminal to the battery positive  $\oplus$  terminal.
37. Connect the battery ground cable to the negative  $\ominus$  terminal of the battery.
38. Start the engine. Ensure that the engine exhibits no leakage of cooling water or oil. Then, stop the engine.
39. Install the engine hood.
40. Connect the window screen washer hose.
41. Install the radiator grill.

WN88E-EM541

## OPERATION OF WIRE HARNESS

### 1. General Instructions

- (1) Never pull the connectors or step on them during the wire harness transport or assembly.  
(Prevention of pulling-out of terminals, connector cracks, deformation and so forth)
- (2) Care must be exercised to ensure that no scratch is made to the wire harness by burrs or edges during the wire harness transport or assembly.  
(Prevention of scratches to the outer trim, electrical insulators and so forth)

#### (3) Clamping method

- In the case of resin clamps, ensure that the clamp section is fitted in the body hole.

#### NOTE:

Ensure that the clamp will not be detached when it is pulled lightly in the arrow-headed direction.

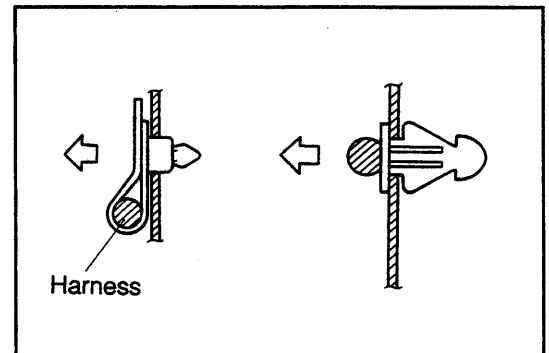
(Prevention of interference due to the detachment of the clamp)

- In the case of metal sheet welded clamps, be sure to assemble the harness in such a way that the harness will not come in contact with the welded surface.  
(Prevention of wire harness damage due to welding burrs)

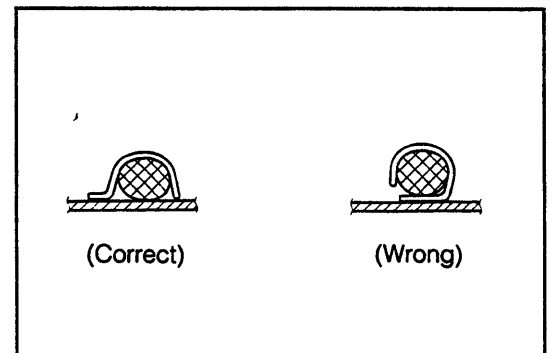
- In case that the locating guide of the clamp position or the clamp mark is clamped, make sure that the clamp is located within the guide. As for the clamp at the clamp mark section, ensure that the clamping is made at a point within  $\pm 10$  mm.

(Prevention of slackness or interference)

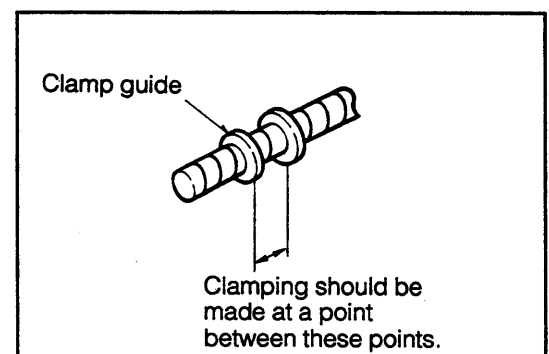
WN88-EM500



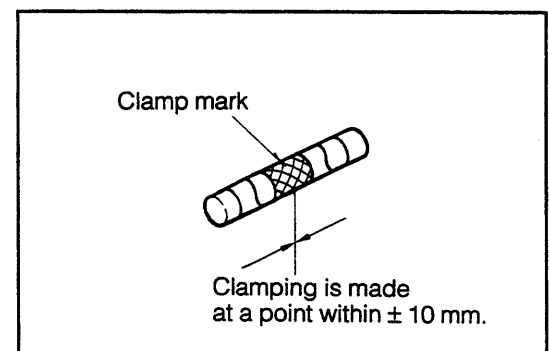
WN88-EM501



WN88-EM502



WN88-EM503



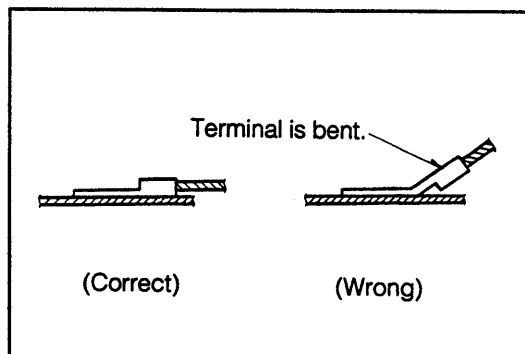
WN88-EM504

(4) Terminals and connectors

- Perform the connection of connectors positively.
  - Connector with lock ..... Ensure that the locking is made.
  - Connector without lock ..... Connect the connector positively until it stops.

WN88E-EM505

- Retention by screws
  - When the tightening torque is specified, be sure to observe the specification strictly. (The tightening torque is posted in the table separately.)
  - Ensure that the staked section may not come on the assembling surface.
  - After completion of the tightening operation, lightly pull out the terminal. Ensure that there is no slackness.
- When performing other operations, care must be exercised to ensure that no connected connector is detached by pulling out the wire harness forcibly.



WN88-EM506

WN88E-EM507

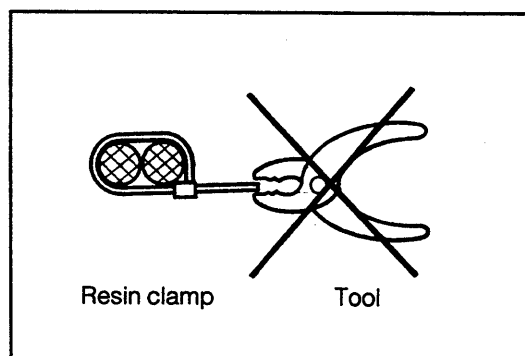
**2. Work Procedure for Tightening-up Type Resin Clamps**

(Work procedure)

When the tightening-up type resin clamps are employed, do not use any pliers, cutting pliers or the like.

(Reason)

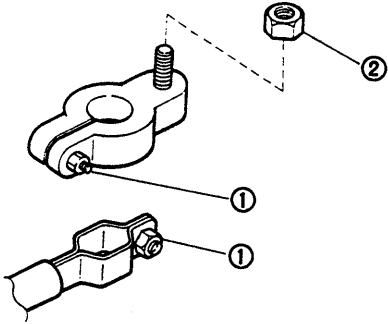
Prevention of clamps being cut or scratched



WN88-EM509

# ENGINE MECHANICALS

## 3. Tightening Torque Table

No.	Parts	Fastener	Tightening torque (kgf-cm)	Remarks
1	Alternator (+B)	M6 nut	50 - 80	
2	Battery terminal 	(1) M6 nut (2) M8 nut	50 - 80 80 - 120	
3	Starter (+B)	M8 nut	100 - 160	
4	Battery cable ⊖	M12 bolt	350 - 550	
5	Ground	M6 bolt	70 - 100	

WN88-EM510

4. Engine Wire Harness for HD-C engine

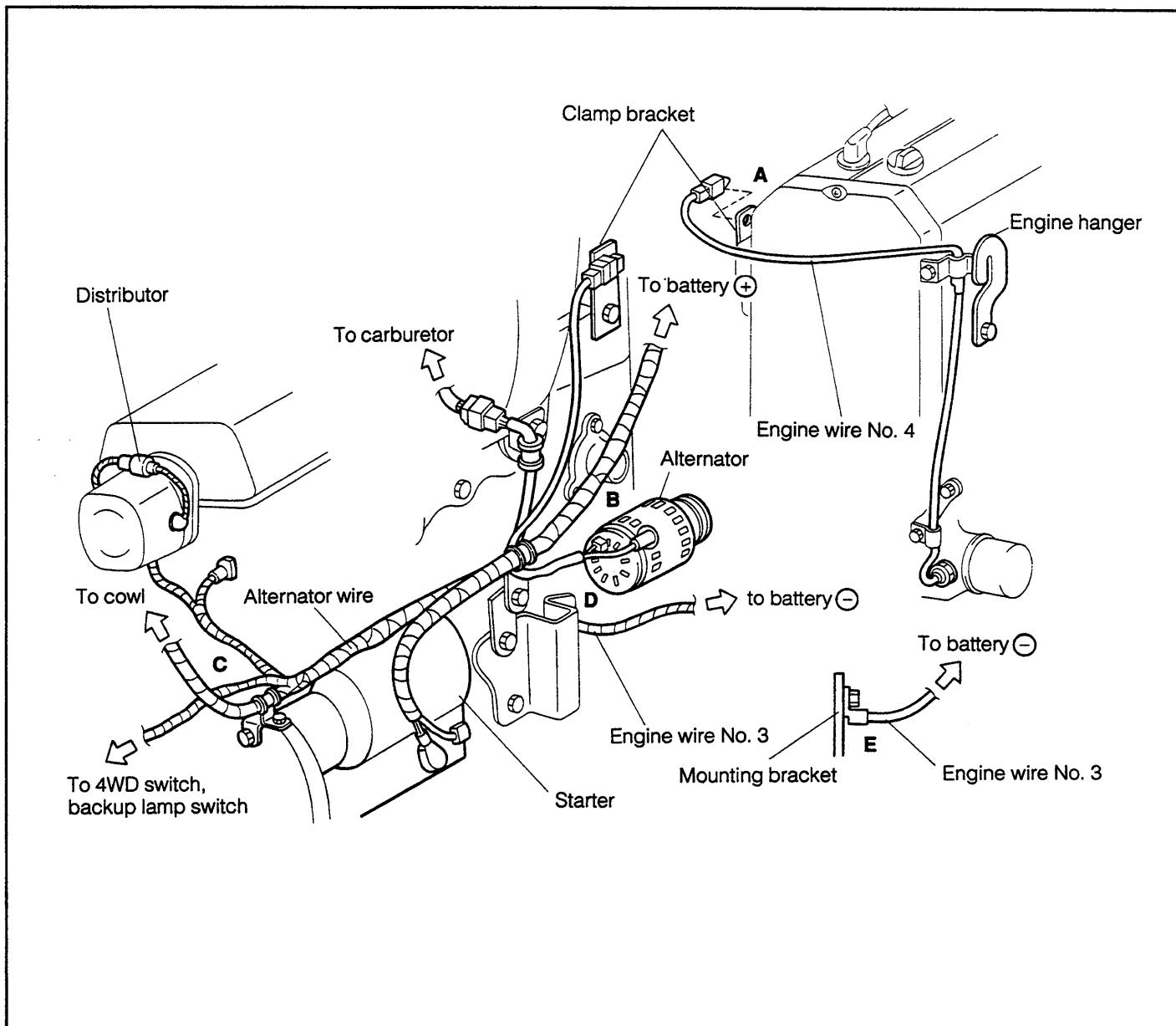


Fig. 1

No.	Work procedure	Parts	Control item
1	Secure the connector at the engine wire No. 4 to the bracket clamp.	A	Ensure that the connector is inserted positively.
2	Route the alternator wire under the heater hose.	B	Ensure that the wire for alternator is routed below the heater hose.
3	Route the wire for 4WD switch and backup lamp switch underneath the wire for cowl.	C	Ensure that the wire for 4WD switch and backup lamp switch is routed underneath the wire for cowl.
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 toward exactly back of the alternator.
5	Install the engine wire No. 3 in such a way that its staked section may come at the lower side in relation with the attaching bolt.	E	Ensure that the staked section comes at the lower side.

WN88E-EM511

## 5. Engine Wire Harness for HD-E engine

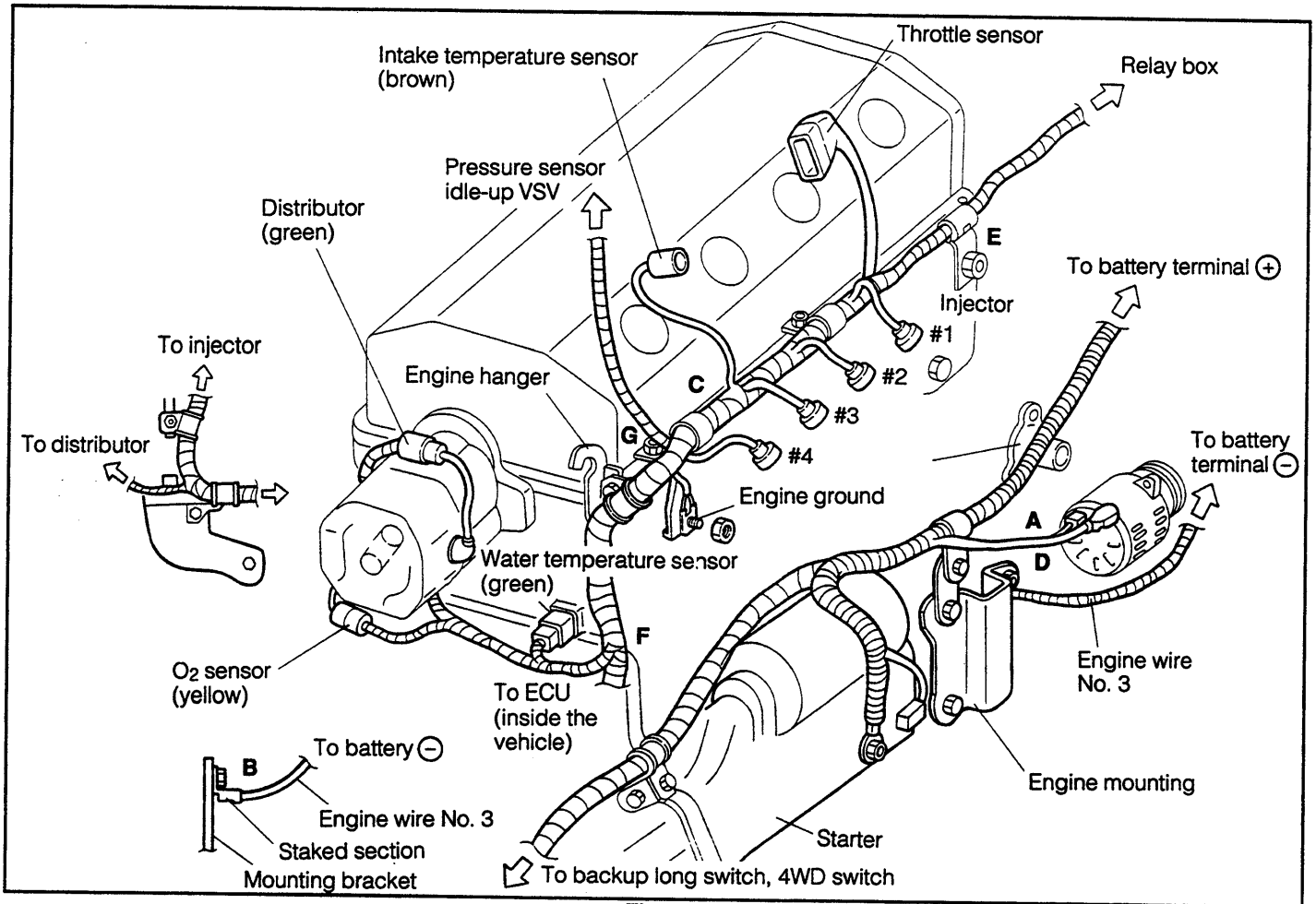


Fig. 2

No.	Work procedure	Parts	control item
1	Route the alternator wire under the heater hose and above the engine wire No. 3 (A).	A	Ensure that the alternator wire is routed under the heater hose and above the engine wire No. 3 (A).
2	Install the engine wire No. 3 in such a way that its staked section (A) may come at the lower side in relation with the attaching bolt.	B	Ensure that its staked section (A) 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. (Fig. 2)	F	Ensure that the ECU harness points horizontally and toward the outside.
7	Route the junction of the pressure sensor	G	Ensure that the junction of the pressure sensor with the idle-up VSV is not routed below the main harness.

6. Starter Harness

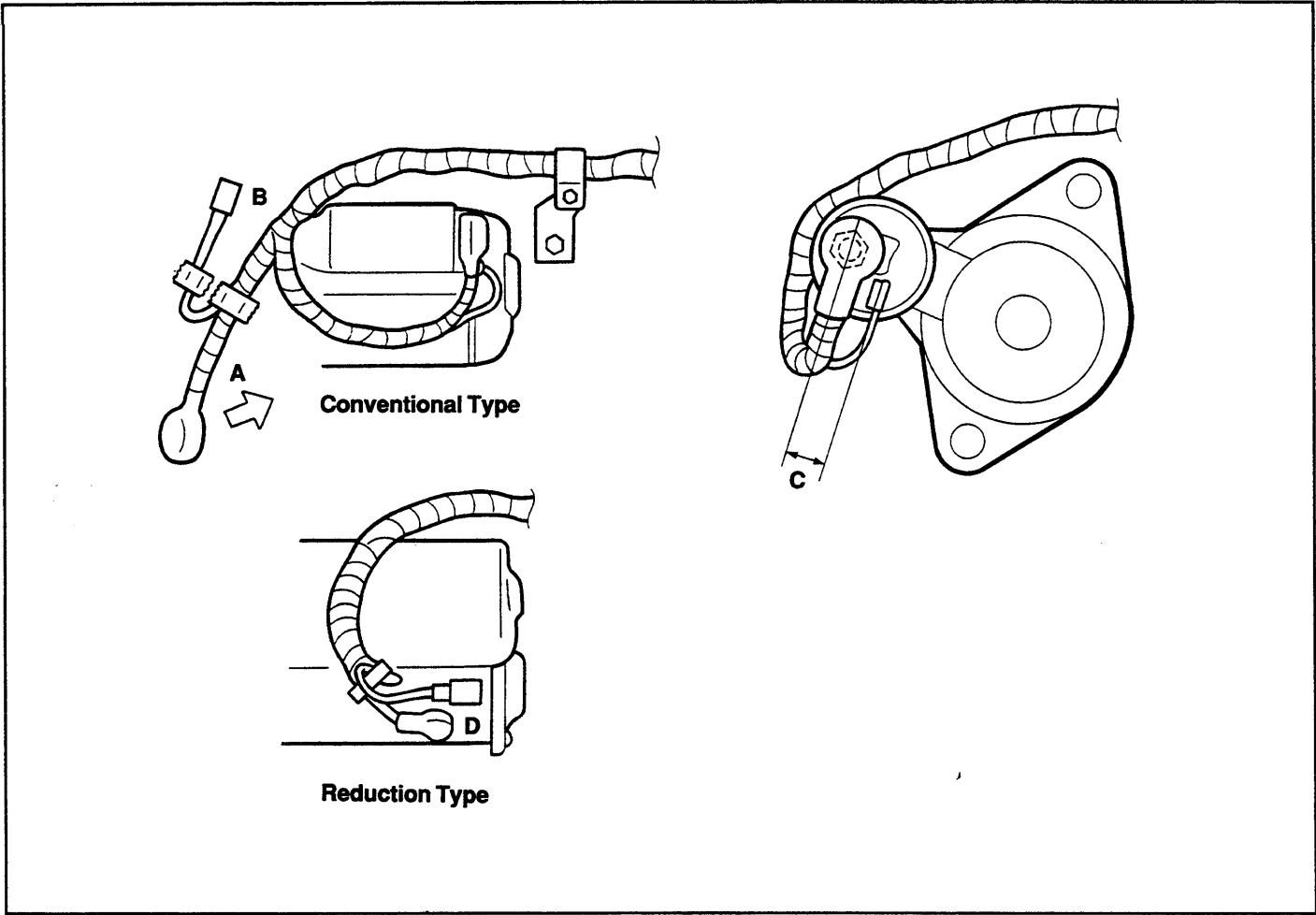


Fig. 4

No.	Work procedure	Parts	Control item
1	In the case of conventional type, connect the starter after removing the option tape retainer.	A	Ensure that the connection is made after the option tape retainer has been removed completely.
2	Route the harness along with starter.	B	Ensure that the harness is routed along with the starter and it is not floated.
3	Install the terminal B of starter in parallel with the terminal ST.	C	Ensure that the terminal B is tightened in parallel with the terminal ST.
4	After the terminal B has been tightened, cover the terminal with the cap.	D	Ensure that the terminal is covered fully with the cap.

WN88E-EM514

## 7. Harness Around Radiator Support

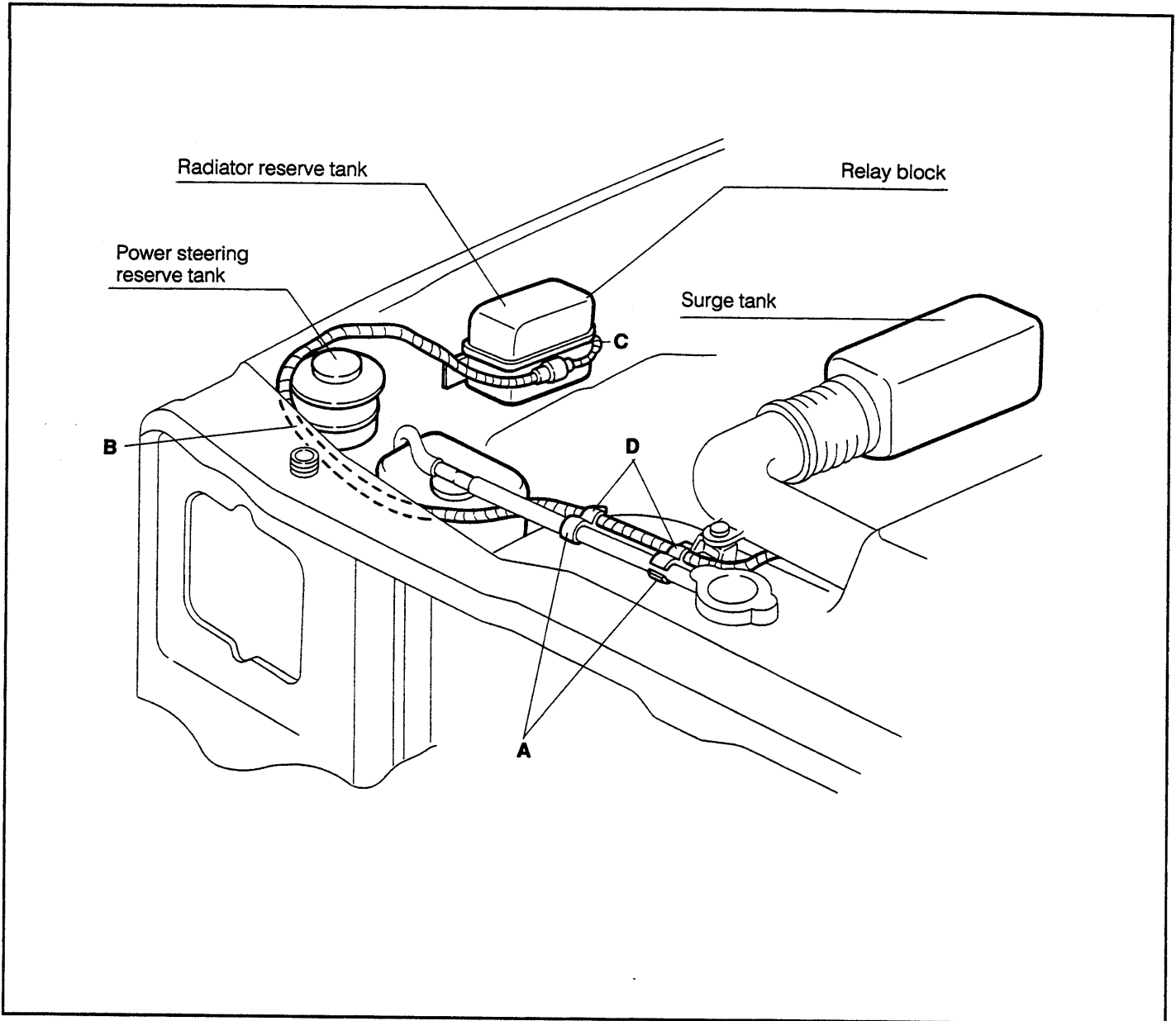


Fig. 5

No.	Work procedure	Parts	Control item
1	Clamp the harness leading to the relay block and the reserve tank-to-radiator hose.	A	Ensure that each of the harness and hoses is clamped positively.
2	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).	B	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 (A).
3	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.	C	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.
4	Insert and secure the built-in clamp of the harness into the bracket of the radiator.	D	Ensure that the clamp is inserted and secured positively in place.

WN88E-EM515



8. Harness Around Battery

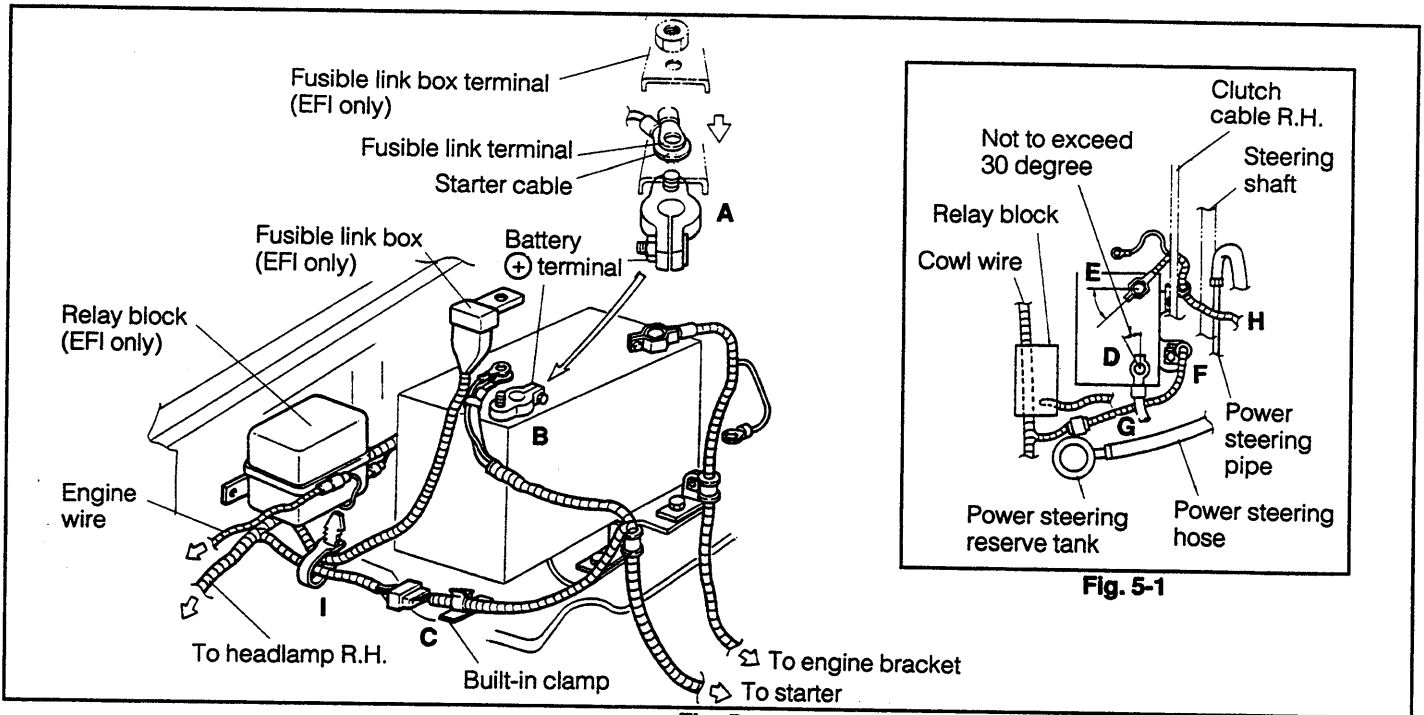


Fig. 5

Fig. 5-1

No.	Work procedure	Parts	Control item
1	Perform assembly so that the bent member [ ] of the fusible link box terminal may not ride on the starter cable and fusible link terminal. (Fig. 6)	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. (Fig. 6)	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. (Fig. 6-1)	D	Ensure that the terminal assumes an angle of not more than 30 degrees.
5	Route the battery terminal ⊖ cable below the clutch cable on R.H.D. vehicle. Also, install the terminal at an angle of 45 degrees inward as viewed toward the rear of the vehicle. (Fig. 6-1)	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. (Fig. 6-1)	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. (Fig. 2)	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. (Fig. 2)	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.

## 9. Oil Pressure Switch Harness

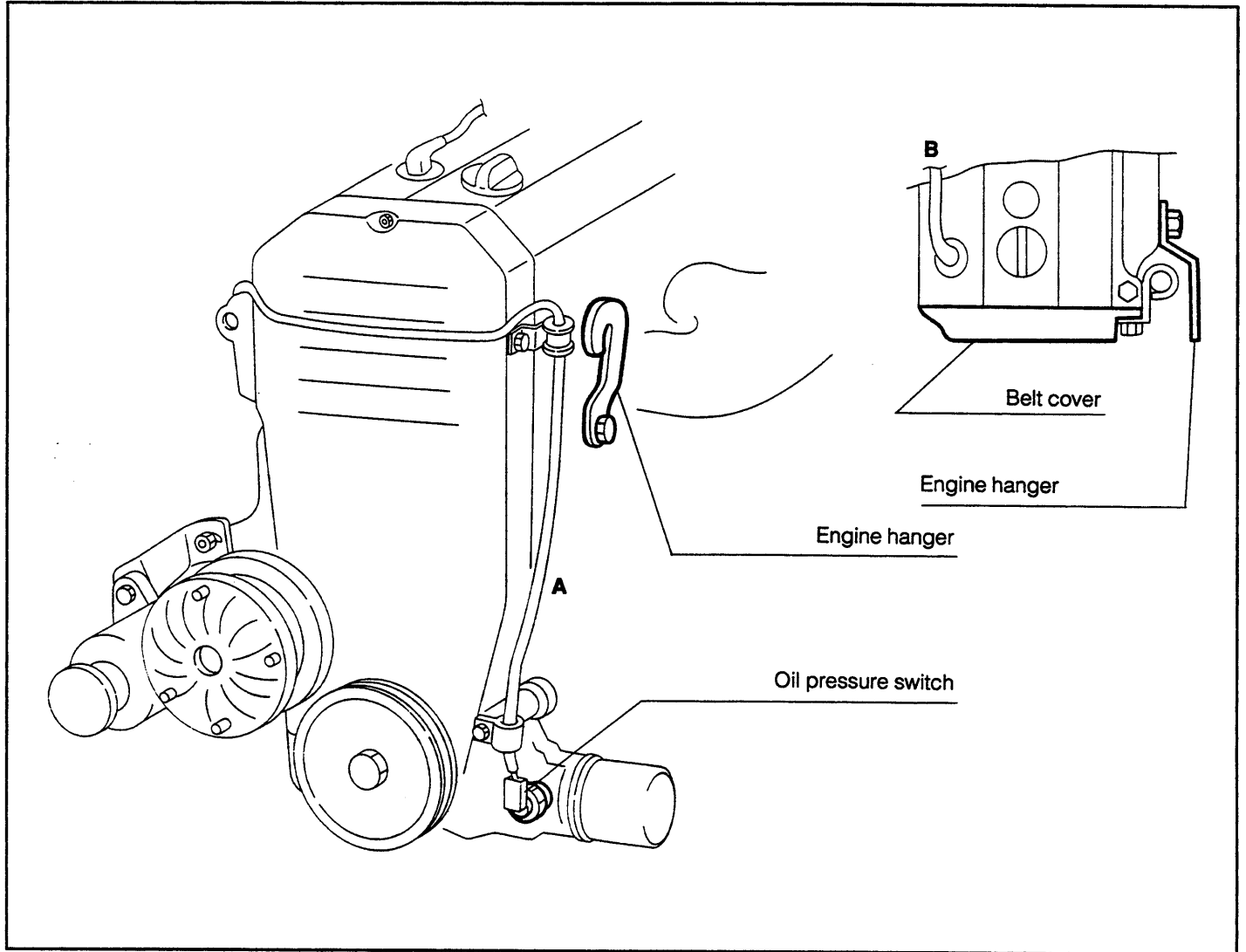


Fig. 6

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.

WN88E-EM517

# **DAIHATSU**

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# **F300**

[HD-ENGINE]

## **EMISSION CONTROL SYSTEMS**

**EC**

[HD-C Engine]	
PURPOSE OF SYSTEM .....	EC- 2
COMPONENT LAYOUT & SCHEMATIC	
DIAGRAM .....	EC- 3
POSITIVE CRANKCASE VENTILATION	
(PCV) .....	EC- 4
FUEL EVAPORATIVE EMISSION	
CONTROL SYSTEM .....	EC-10
[HD-E Engine]	
PURPOSE OF SYSTEMS .....	EC-13
POSITIVE CRANKCASE VENTILATION	
SYSTEM (PCV) .....	EC-14
COMPONENT LAYOUT & SCHEMATIC	
DIAGRAM .....	EC-15
FUEL EVAPORATIVE EMISSION CONTROL	
(EVAP) SYSTEM .....	EC-16
THROTTLE POSITIONER (TP)	
SYSTEM .....	EC-18
THREE-WAY CATALYST (TWC)	
SYSTEM .....	EC-19

WN88-EC001

# EMISSION CONTROL SYSTEMS

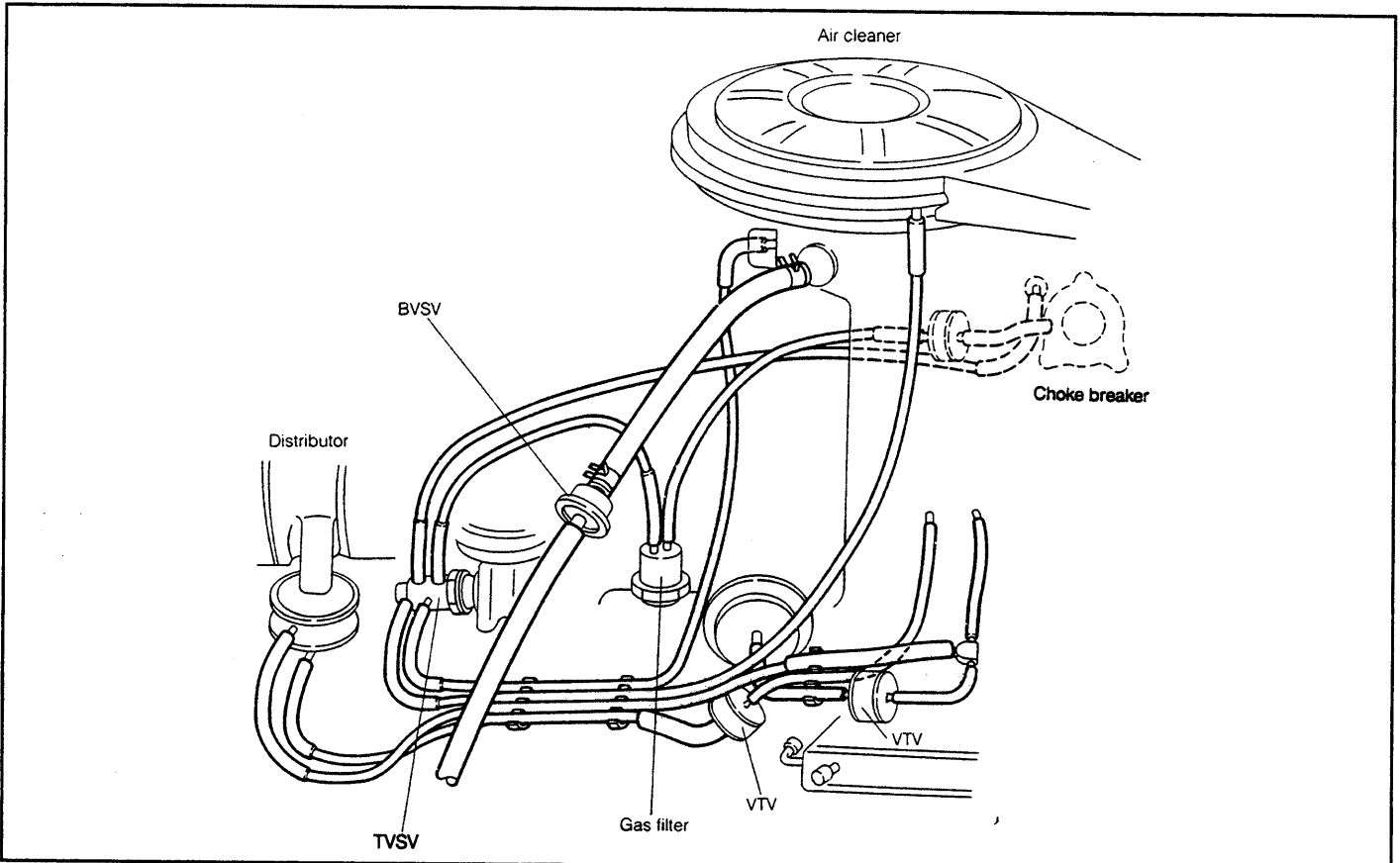
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## [HD-C Engine] PURPOSE OF SYSTEM

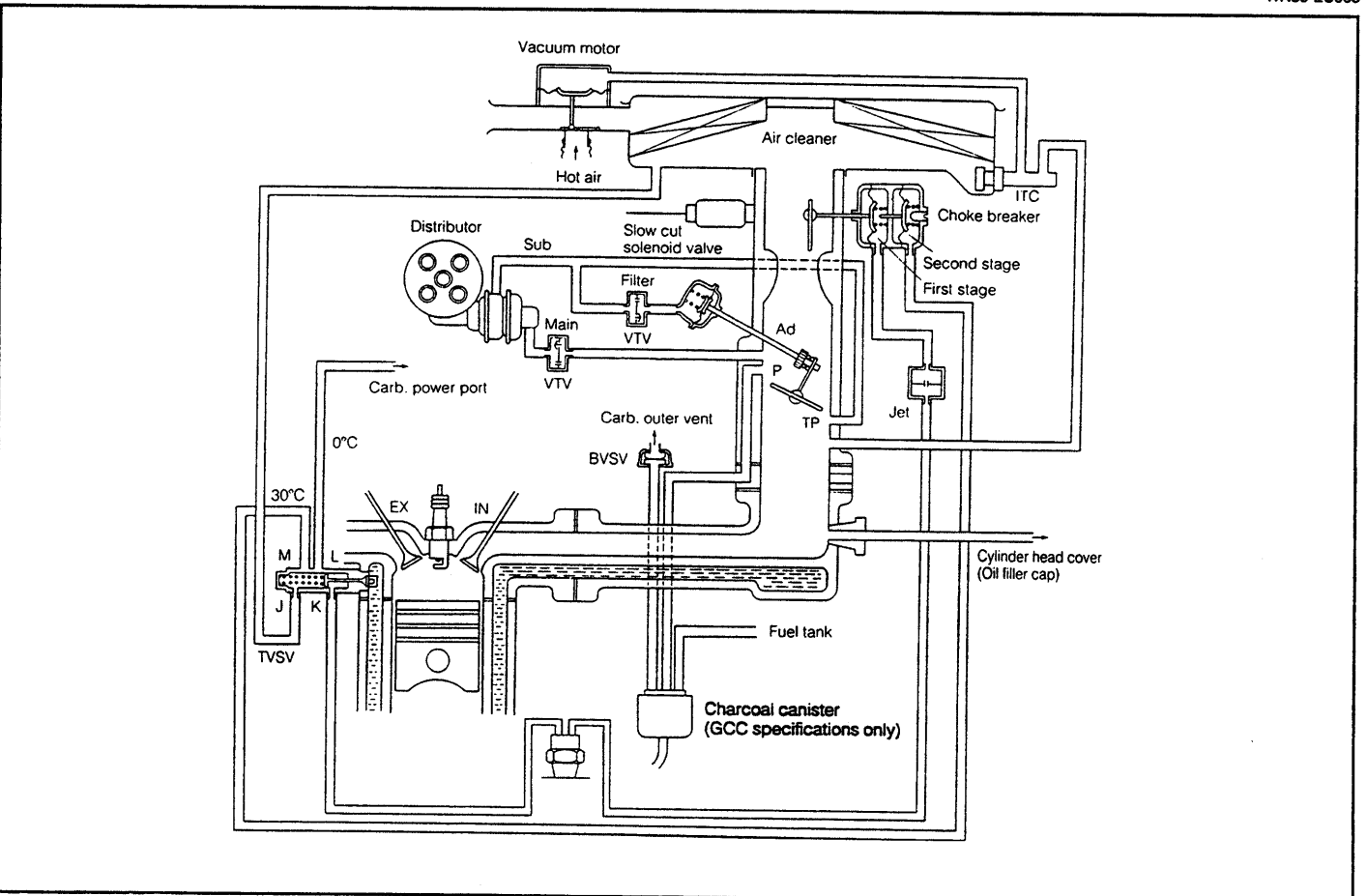
System	Abbreviation	PURPOSE
Positive crank case ventilation	PCV	Prevents blow-by gases from being released to atmosphere (HC)
Spark delay system	SD	Reduces HC and NOx.
Choke breaker system	C/B	Reduces HC and CO.
Throttle positioner system	TP	Reduces HC and CO.
Fuel evaporative emission control system	—	Reduces HC.

WN88-EC002

COMPONENT LAYOUT & SCHEMATIC DIAGRAM



WN88-EC003



WN88-EC004

## POSITIVE CRANKCASE VENTILATION (PCV)

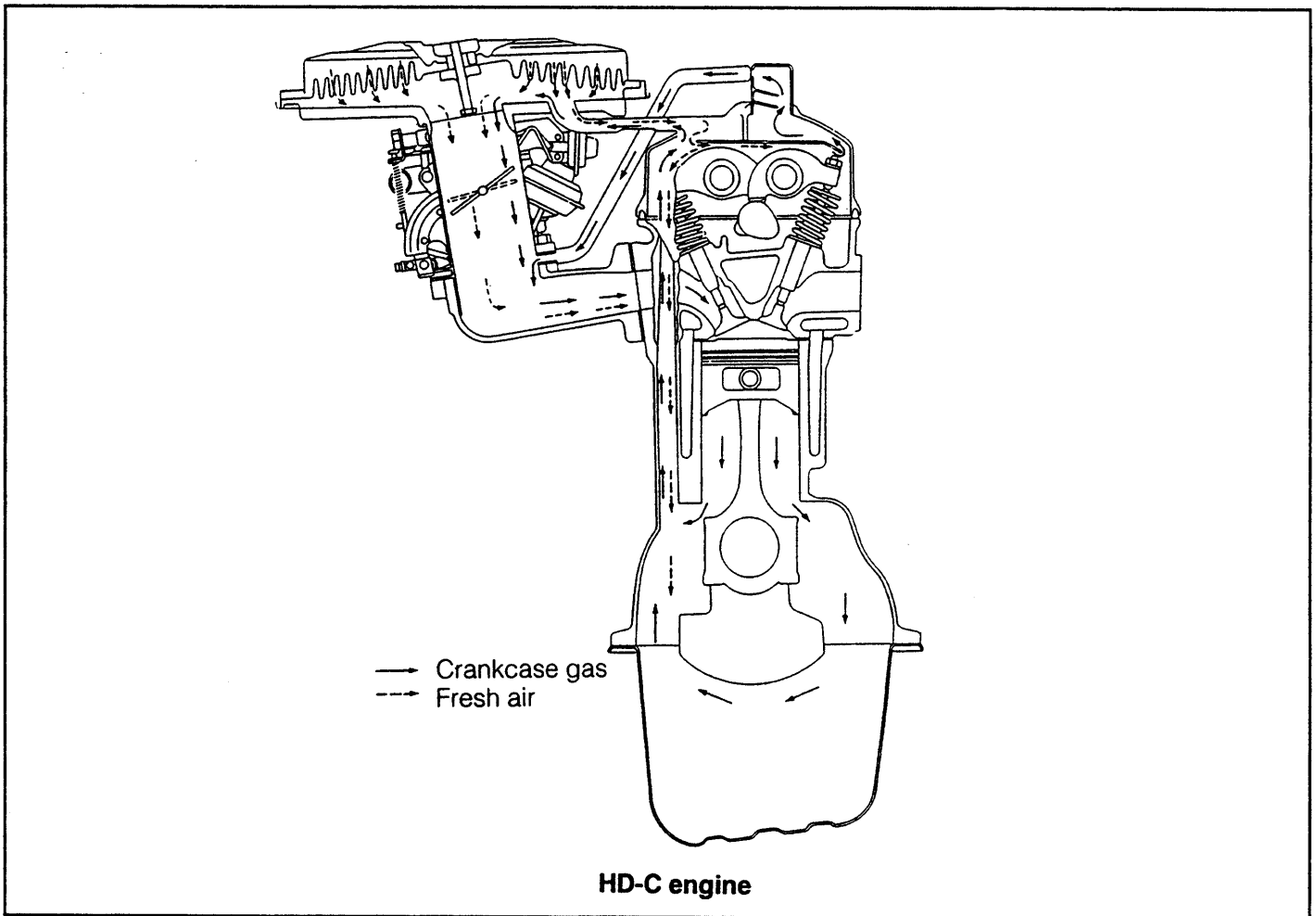
To combat with air-pollution problems, the engine is equipped with a sealed type positive crankcase ventilation system in order to prevent blow-by gases generated inside the crankcase from being released into the atmosphere.

The blow-by gases generated inside the crankcase flow into the cylinder head side through the gas passages of the cylinder block.

When the throttle valve opening degree is small, first the oil in the blow-by gas is separated by the oil separator provided at the cylinder head cover. Then, the blow-by gases flow from the carburetor heat insulator section to the intake manifold. Thus, the gases are sucked into the cylinder and burned there again.

At this time, fresh air flows from the upstream of the throttle valve into the cylinder head cover. The air flow rate is restricted by a jet located at the cylinder head cover, thus stabilizing the engine idling.

When the throttle valve opening degree is great and/or a large amount of blow-by gases are generated, the blow-by gases flow through both the upstream and the downstream of the throttle valve and are sucked into the combustion chamber.



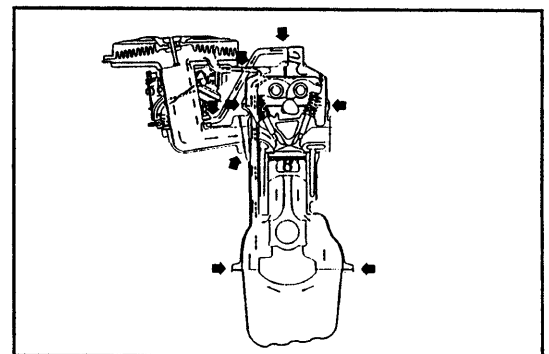
WN88-EC005

## INSPECTION OF PCV HOSE & CONNECTION

### Visual inspection of hoses and connection

Check the hoses for improper connections, cracks, leak or damage.

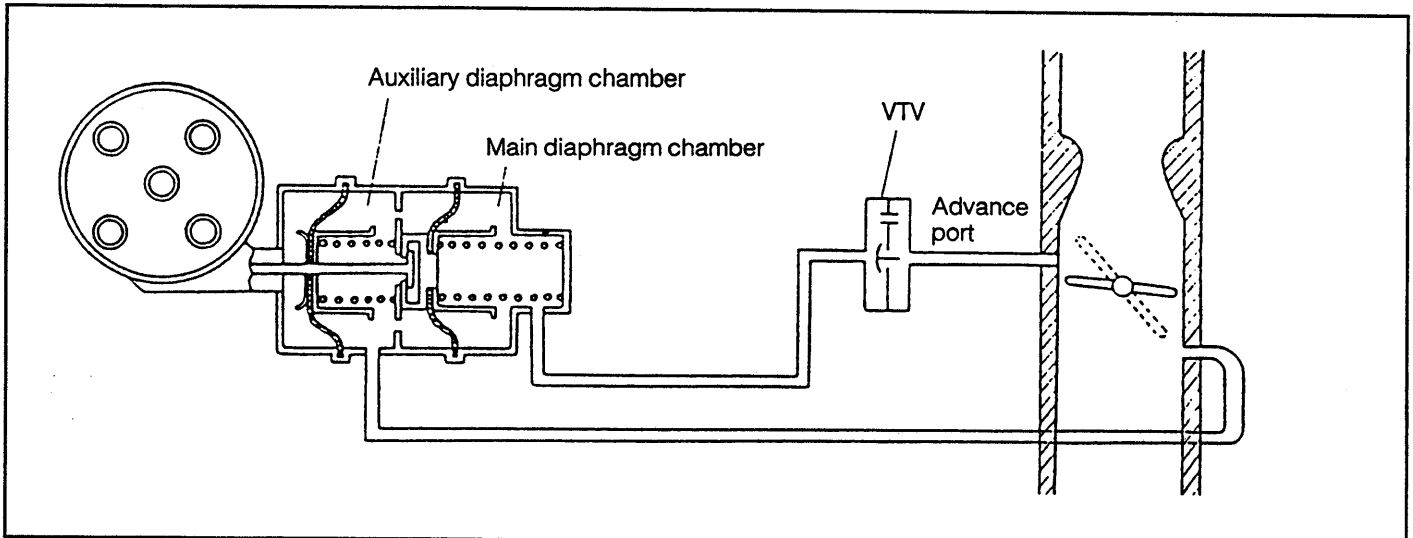
Replace or repair any part which exhibits defects.



WN88-EC006

## SPARK DELAY SYSTEM

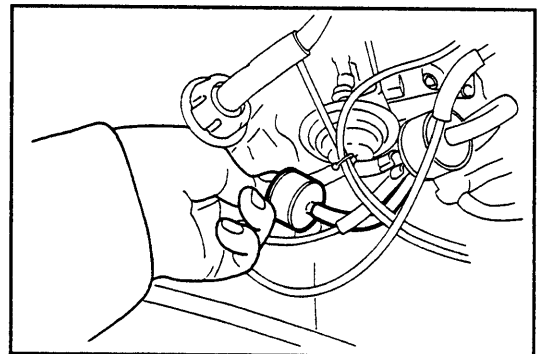
During an acceleration period, this system reduces the HC and NO<sub>x</sub> emissions generated during the transient period by retarding the ignition advance timing temporarily. This is accomplished by means of the VTV which retards the application of a negative pressure being applied to the main diaphragm of the distributor vacuum advancer through the carburetor advance port.



WN88-EC007

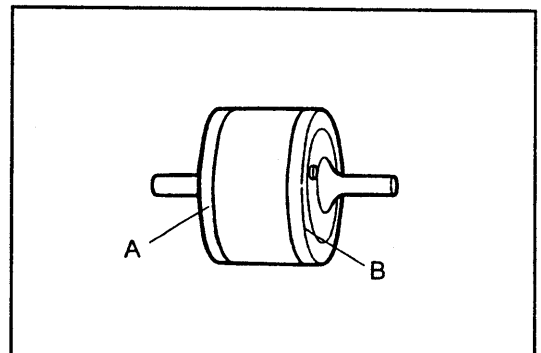
### Check of Ignition Timing

1. Warm up the engine thoroughly.  
Stop the engine. Remove the VTV.



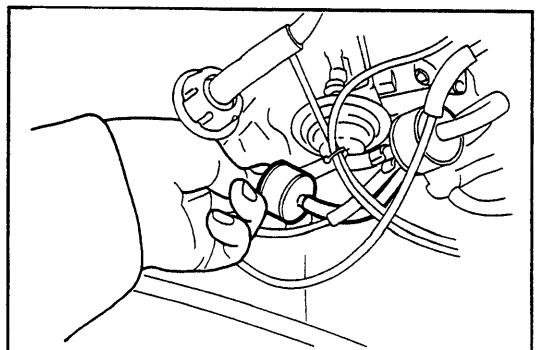
WN88-EC008

2. Inspection of VTV
  - (1) Blow your breath into the VTV carburetor side (side B).  
Ensure that the air passes through without restriction.  
If significant restriction exists, replace the VTV.
  - (2) Blow your breath into the VTV distributor side (side A).  
Ensure that there is restriction.  
If no restriction exists, replace the VTV.



WR88-EC023

3. Install the VTV to the engine.



WN88-EC009

# EMISSION CONTROL SYSTEMS

## CHOKE BREAKER SYSTEM

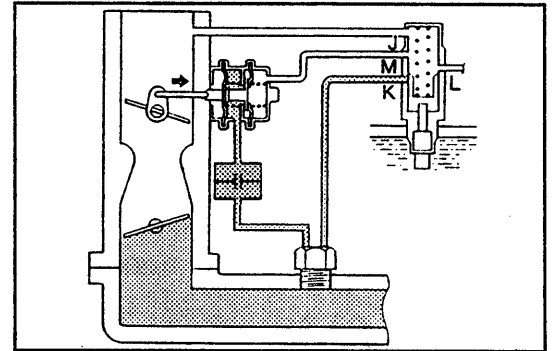
This system opens the choke valve during a period immediately after starting so as to reduce the HC and CO emissions.

### Operation

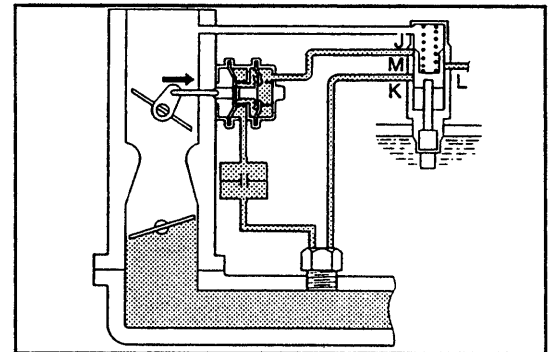
During a period immediately after starting, negative pressure is applied gradually to the first stage of the choke breaker diaphragm. Consequently, the choke valve is opened slightly. When the water temperature is low, the atmosphere is applied to the second stage of the choke breaker diaphragm via the TVSV. Thus, the second diaphragm remains inoperative.

When the temperature reaches a certain level as the cooling water temperature rises, the negative pressure of the intake manifold starts to be applied to the second stage of the choke breaker diaphragm via the TVSV.

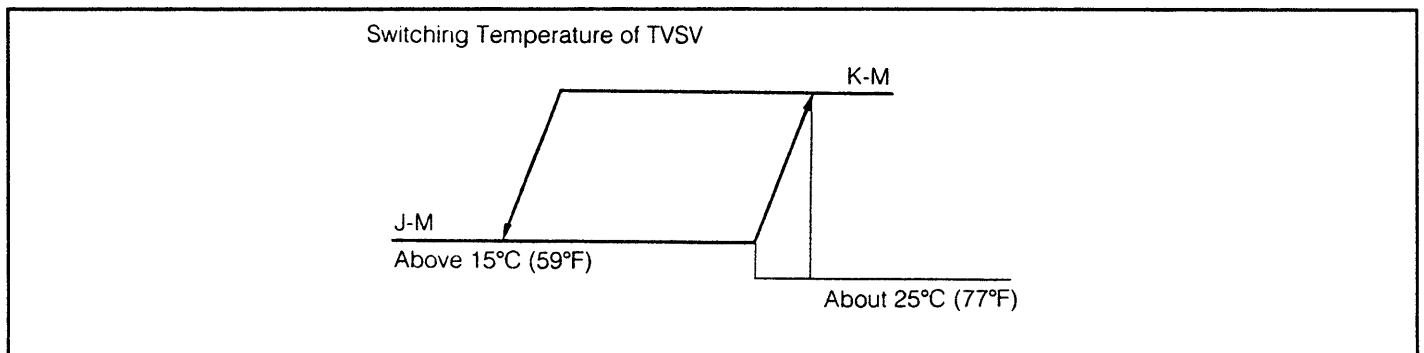
As a result, the choke valve opens further, thereby preventing the air-to-fuel ratio from becoming too rich.



WN88-EC010



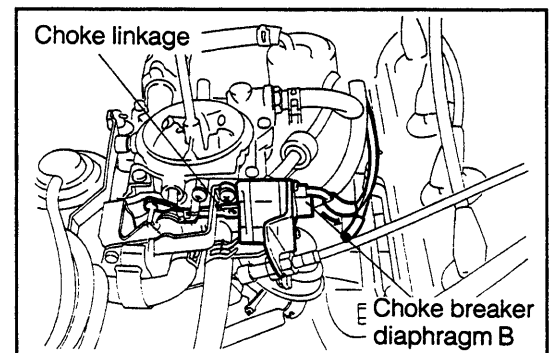
WN88-EC011



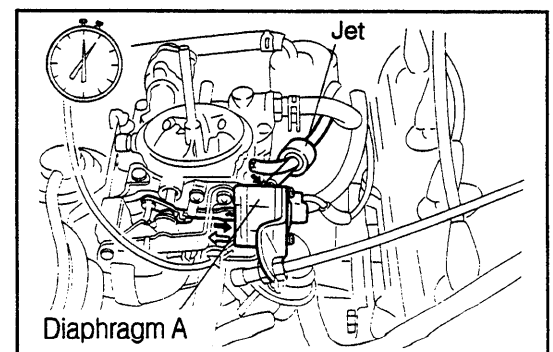
WN88-EC012

### Inspection of choke breaker system

1. Inspection of TVSV with cold engine
  - (1) Start the engine.
  - (2) With the coolant temperature below 15°C (59°F), disconnect the vacuum hose from choke breaker diaphragm B and check that the choke linkage does not move.
  - (3) Reconnect the vacuum hose to diaphragm B.
2. Inspection of jet and diaphragm A
  - (1) Disconnect the vacuum hose from the choke breaker diaphragm A and check linkage moves.
  - (2) Reconnect the vacuum hose to diaphragm A and check that the choke linkage moves within the specified time after reconnecting the hose.  
Specified Time: 1 - 5 seconds



WN88-EC013

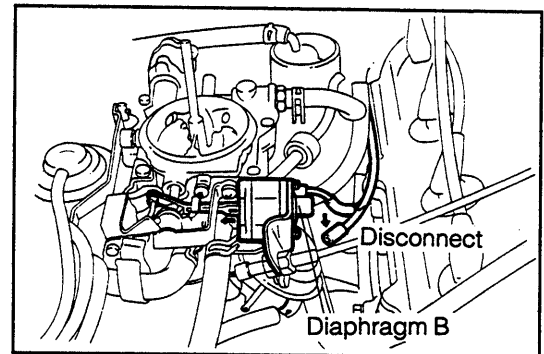


WN88-EC014



3. Inspection of TVSV and diaphragm B with warm engine
  - (1) After warming up the engine, disconnect the vacuum hose from diaphragm B and check that the choke linkage returns.
  - (2) Reconnect the vacuum hose to diaphragm B.

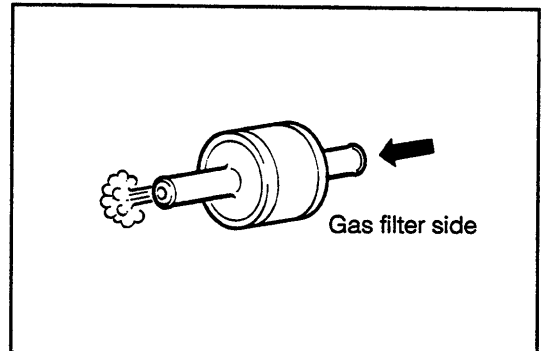
If no problem is found with this inspection, the system is okay; otherwise inspect each part.



WN88-EC015

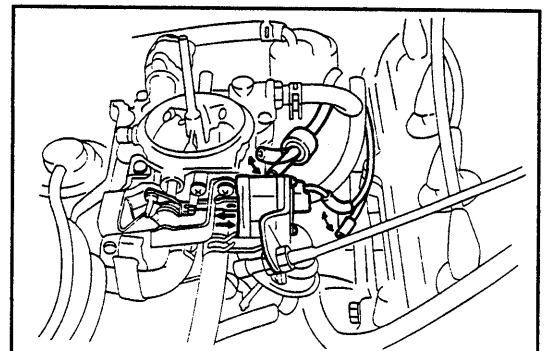
## Unit inspection of choke breaker

1. Inspection of jet
  - (1) Check the jet by blowing air from each side.
  - (2) Ensure that there is no restriction if the air blows from the gas filter side.



WN88-EC016

2. Inspection of choke breaker diaphragms
  - (1) Check that choke linkage moves in accordance with applied vacuum.

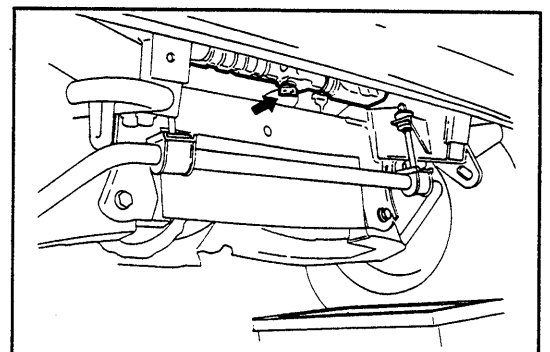


WN88-EC017

3. Inspection of TVSV
  - (1) Drain the cooling water from radiator into a suitable container.
  - (2) Disconnect the vacuum hose from the TVSV, and remove the TVSV.

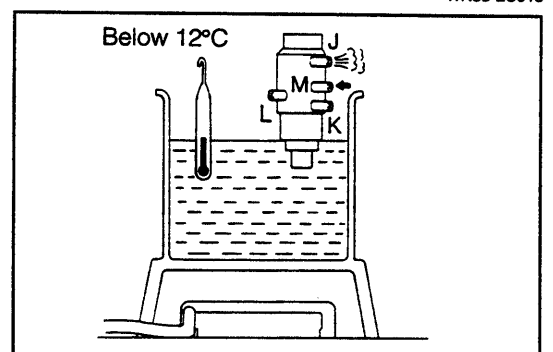
### NOTE:

Be very careful not to damage the TVSV by hitting it to the by-pass pipe.



WN88-EC018

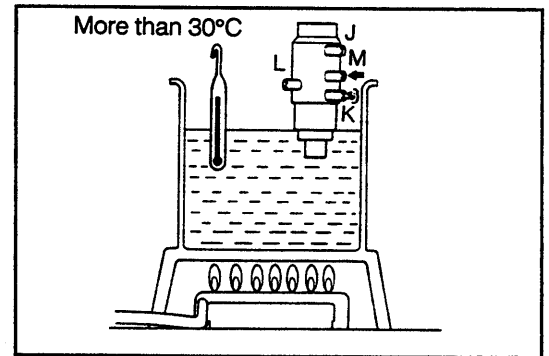
- (3) Cool the TVSV thermo sensing section to below 12°C (54°F), and check that air flows from pipe M to pipe J.



WN88-EC019

# EMISSION CONTROL SYSTEMS

- (4) Heat the TVSV more than 30°C (86°F), and check that air flows from pipe M to pipe K.

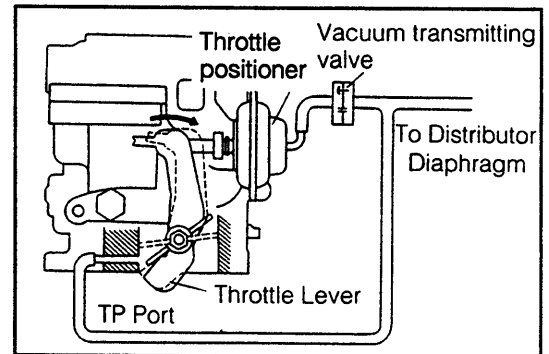


WN88-EC020

## THROTTLE POSITIONER (TP) SYSTEM

### Operation

For the purpose of reducing the CO and HC emissions, the throttle positioner prevents the throttle valve from being closed suddenly during the engine braking period, utilizing a negative pressure generated in the intake manifold.



WN88-EC021

### Inspection of throttle positioner system

1. Warm up the engine.
2. Disconnect the vacuum hose from the throttle positioner. Plug the hole, using the following SST.  
SST: 09258-00030-000

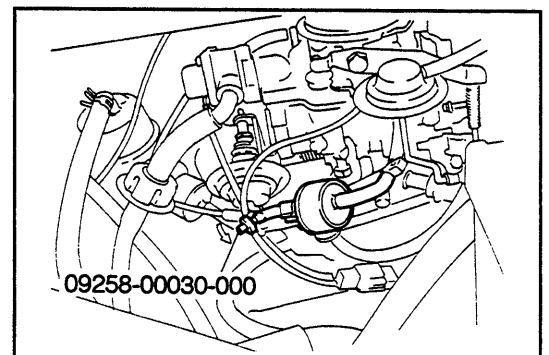
#### NOTE:

At this time, be sure that the throttle positioner shaft is stretched fully.

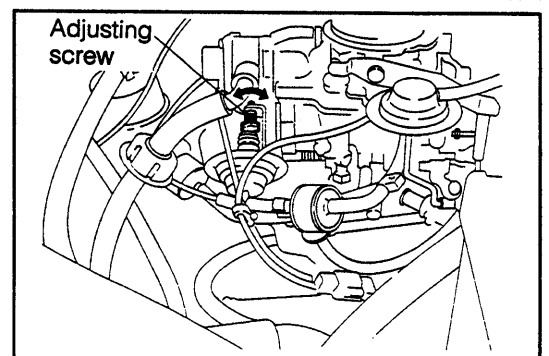
3. Check that touch revolution speed is set.  
Touch Revolution Speed: 1500 ± 50 rpm
4. If not at specified speed adjust with throttle positioner adjusting screw.
5. Hold the engine revolution speed at about 2500 rpm at least five seconds by opening the throttle valve. Then, release the throttle lever. Check that the time required for the engine revolution speed to drop from 1500 rpm to 1200 rpm conforms to the specified value.

Specified Time: 0.5 - 5 seconds

If the time will not conform to the specification, check the direction of the VTV. Then, proceed to check the VTV.



WN88-EC022

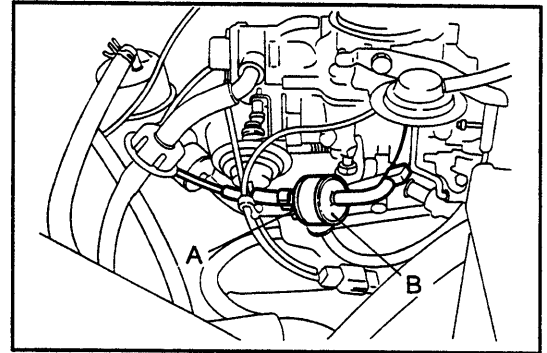


WN88-EC023

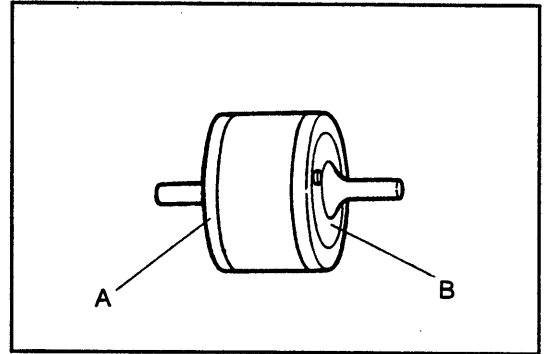
WN88-EC024

## Inspection of VTV

1. Remove the VTV. Blow your breath into the VTV from the carburetor side (side B). Ensure that the air passes through without restriction. If significant restriction exists, replace the VTV.
2. Blow your breath into the VTV from the throttle positioner side (side A). Ensure that there is restriction. If no restriction exists, replace the VTV.



WN88-EC025



WN88-EC026

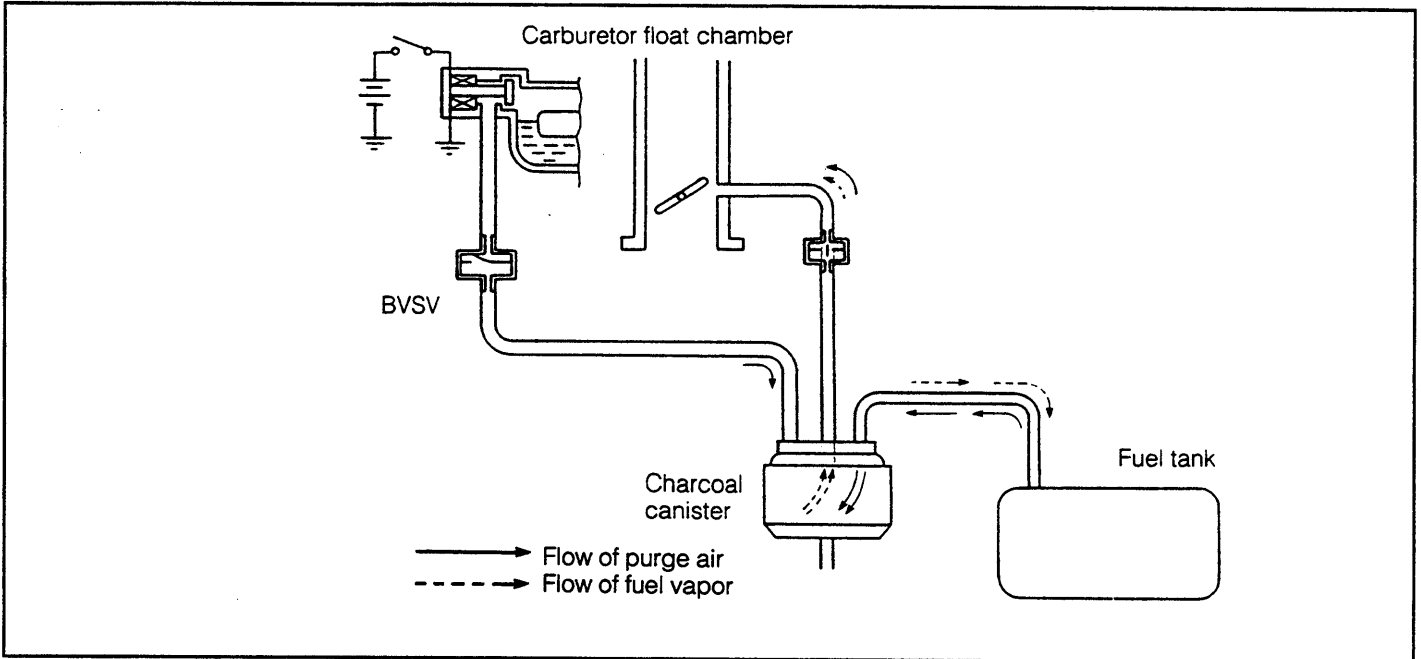
## FUEL EVAPORATIVE EMISSION CONTROL SYSTEM (GCC specifications only)

The fuel evaporative emission control system prevents the fuel evaporative emission generated inside the fuel tank or the float chamber of the carburetor from being discharged to the atmosphere.

As the temperature rises, the pressure of the fuel evaporative emission generated in the fuel tank increases while the engine is stopped. When this pressure rise exceeds a certain level, the check valve at the positive pressure side is raised and the evaporative emission is absorbed into the activated carbon in a charcoal canister.

When the engine starts running, the check valve at the negative pressure side opens so that any evaporative emission stored in the canister may be sent to the combustion chamber to be reburnt there.

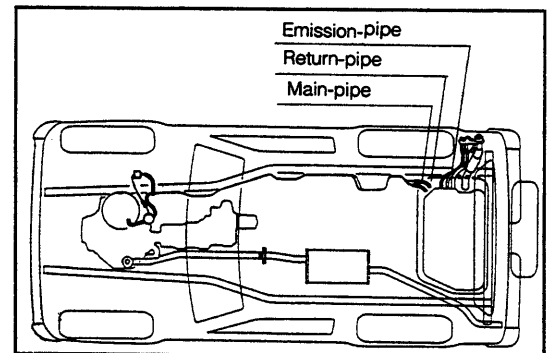
On the other hand, the fuel evaporative emission generated in the float chamber of the carburetor is sent into the charcoal canister when the BSVS exceeds the set temperature (65°C, 149°F).



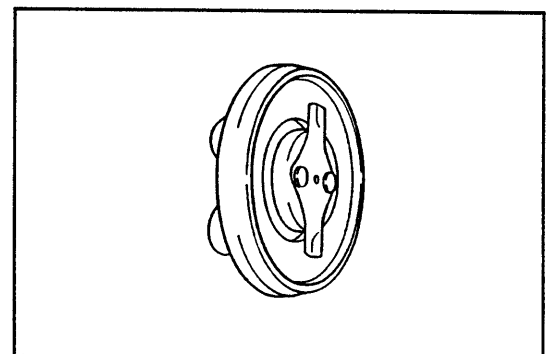
WN88-EC027

### Inspection of fuel vapor lines, fuel tank & filler cap

1. Visual inspection of fuel vapor line and connections  
Check the line and connections for loose connections, kinks or damage.
2. Visual inspection of fuel tank  
Check the fuel tank for deformation, cracks or fuel leakage.
3. Visual inspection of fuel filler cap  
Check the cap and gasket for damage or deformation.  
Replace the cap, if necessary.



WN88-EC028



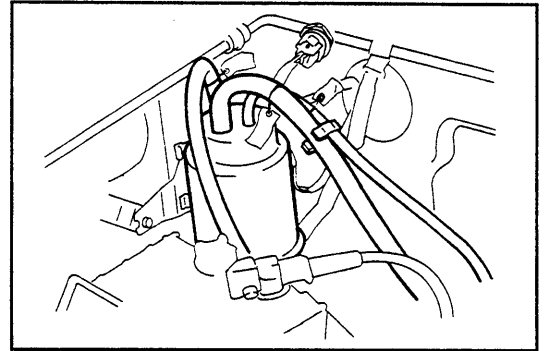
WR88-EC059

## Inspection of Charcoal Canister

1. Disconnect the rubber hoses and remove the charcoal canister.

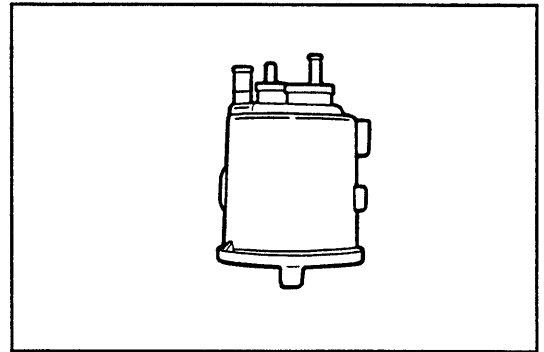
**NOTE:**

Put a tag on each of the rubber hoses so that they may be reconnected correctly to the original positions.



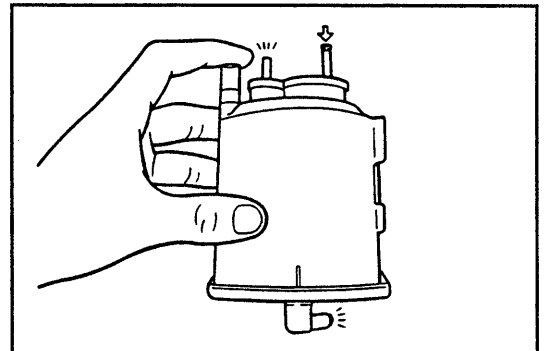
WN88-EC029

2. Visual inspection of charcoal canister case  
Visually inspect the charcoal canister case for cracks or damage.



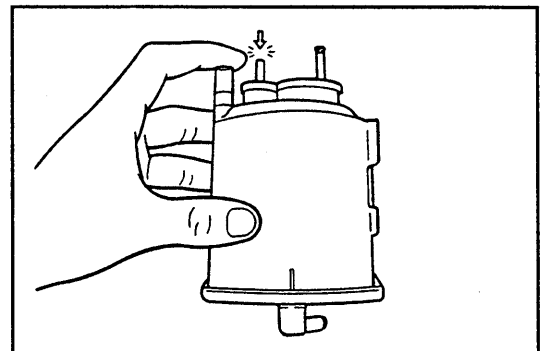
WR88-EC061

3. Check of canister for restriction  
(1) With the pipe at the BVSV side plugged with your finger, apply compressed air from the pipe at the fuel tank side. Ensure that air leaks from the other pipe.



WR88-EC062

- (2) Apply compressed air from the purge side. Ensure that no air continuity exists. If the check results are unsatisfactory, replace the charcoal canister.



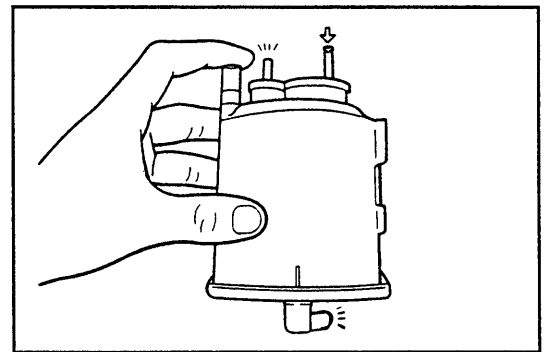
WR88-EC063

4. Cleaning of filter in canister  
Clean the filter by blowing compressed air of 3 kg/cm<sup>2</sup> (43 psi) into the tank pipe while holding the other upper canister pipe closed.

**NOTE:**

- Do not attempt to wash the canister.
- No activated carbon should come out during the test.

5. Install the charcoal canister and reconnect the rubber hose.

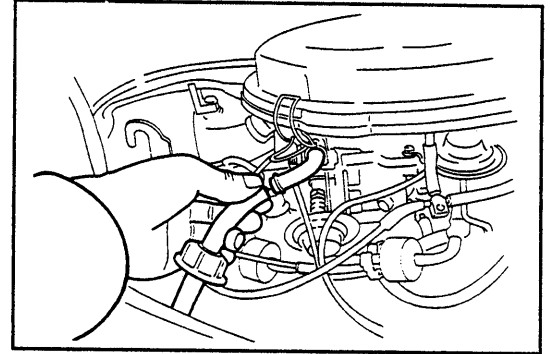


WR88-EC064

# EMISSION CONTROL SYSTEMS

## Inspection of Outer Vent Valve

1. Disconnect the rubber hose at the BVSV side.

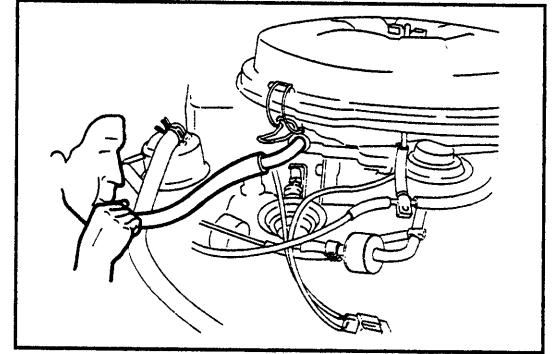


WN88-EC030

2. With the ignition key switch turned ON, blow air into the outer vent valve. Ensure that no air continuity exists. If air continuity exists, check to see if any abnormality is present in the electric circuit of the outer vent valve. Then, replace the outer vent valve, as required.

**CAUTION:**

**Never inhale the air during the continuity inspection.**



WN88-EC031

3. With the ignition key switch turned OFF, blow air into the outer vent valve. Ensure that air continuity exists. If no air continuity exists, check to see if any abnormality is present in the electric circuit of the outer vent valve. Then, replace the outer vent valve, as required.

**CAUTION:**

**Never inhale the air during the continuity inspection.**

4. Connect the rubber hose to the BVSV. Attach the hose bands.

## Inspection of BVSV

1. Remove the BVSV.  
2. Check the air continuity of the BVSV under the following ambient air temperature conditions.

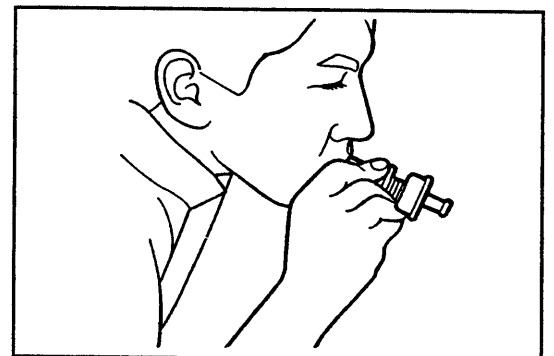
Below 50 °C (122 °F) ....

No air continuity exists.

Above 65 °C (149 °F) ....

Air continuity exists.

3. Install the BVSV on the carburetor.



WN88-EC032

WN88-EC033

**[HD-E Engine]  
PURPOSE OF SYSTEMS**

System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduction of blow-by gas (HC emission)
Fuel evaporative emission control	EVAP	Reduction of evaporative HC emission
Throttle positioner	TP	Reduction of HC and CO emissions
Three-way catalyst	TWC	Reduction of HC, CO and NOx emissions
Electronic fuel injection*	EFI	Regulation of all engine conditions for reduction of exhaust emissions

\*For inspection and repairs of the EFI system, refer to the EFI section.

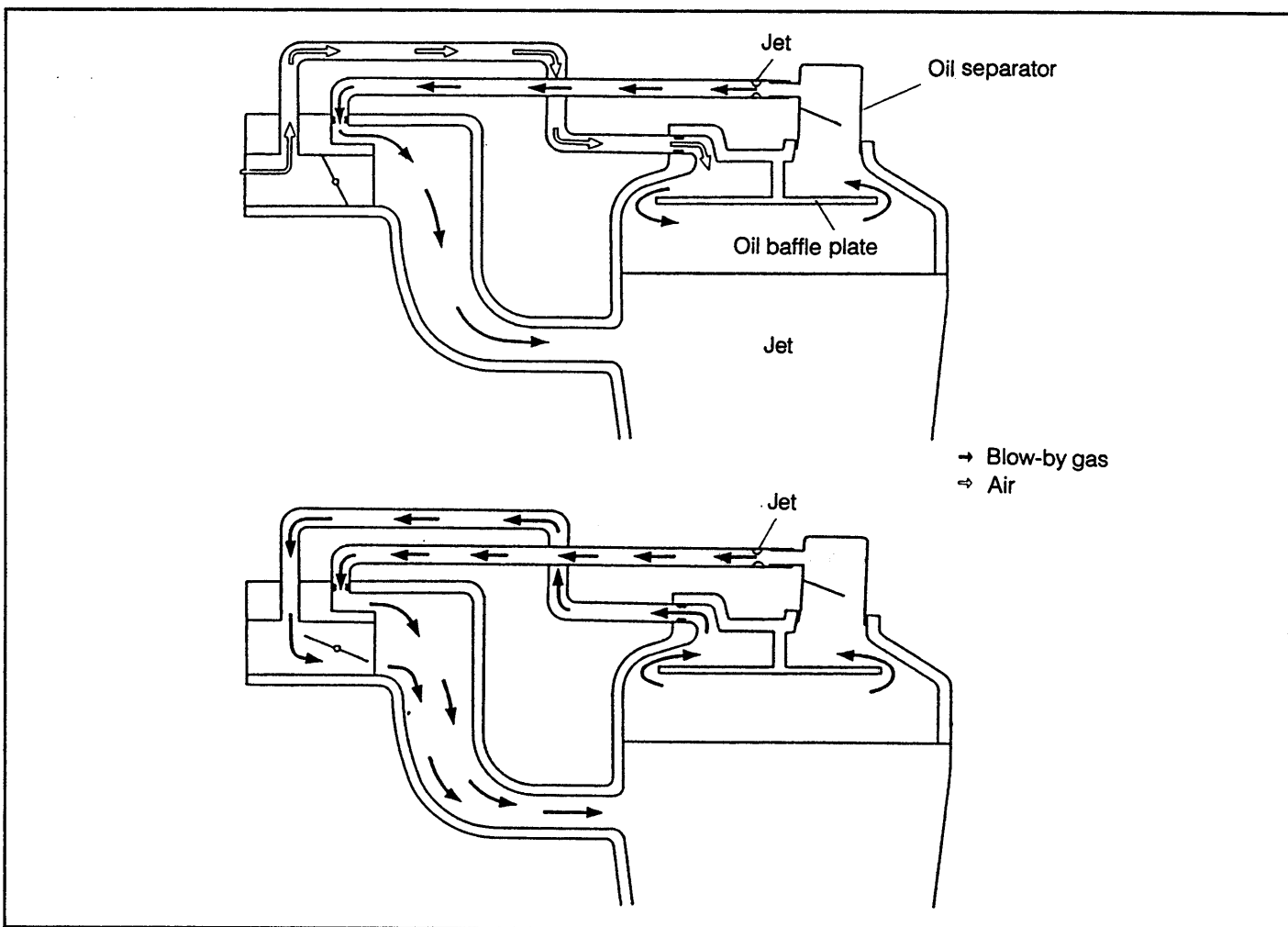
WN88-EC034

## POSITIVE CRANKCASE VENTILATION SYSTEM (PCV)

To combat with air-pollution problems, the engine is equipped with a sealed type positive crankcase ventilation system in order to prevent blow-by gases generated inside the crankcase from being released into the atmosphere.

The blow-by gases generated inside the crankcase flow into the cylinder side through the gas path of the cylinder block. When the opening degree of the throttle valve is small, oil in the blow-by gases is separated by the oil separator provided at the cylinder head cover. Then, the blow-by gases are sucked into the cylinders from the throttle body to be burnt there again.

Fresh air enters the cylinder head cover from the upstream path of the throttle valve. At this time, the air flow rate is regulated by a jet provided at the cylinder head cover, thus stabilizing the engine idling. When the opening degree of the throttle valve is large and/or when a large amount of blow-by gases are generated, the blow-by gases are sucked into the combustion chambers both through the upstream path and the downstream path of the throttle valve.

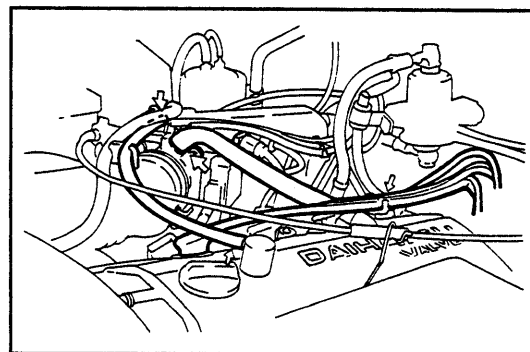


WR88-EC074

## INSPECTION OF PCV HOSE & CONNECTION

Visual inspection of hoses and connections check the hoses and connections for cracks, leakage or damage.

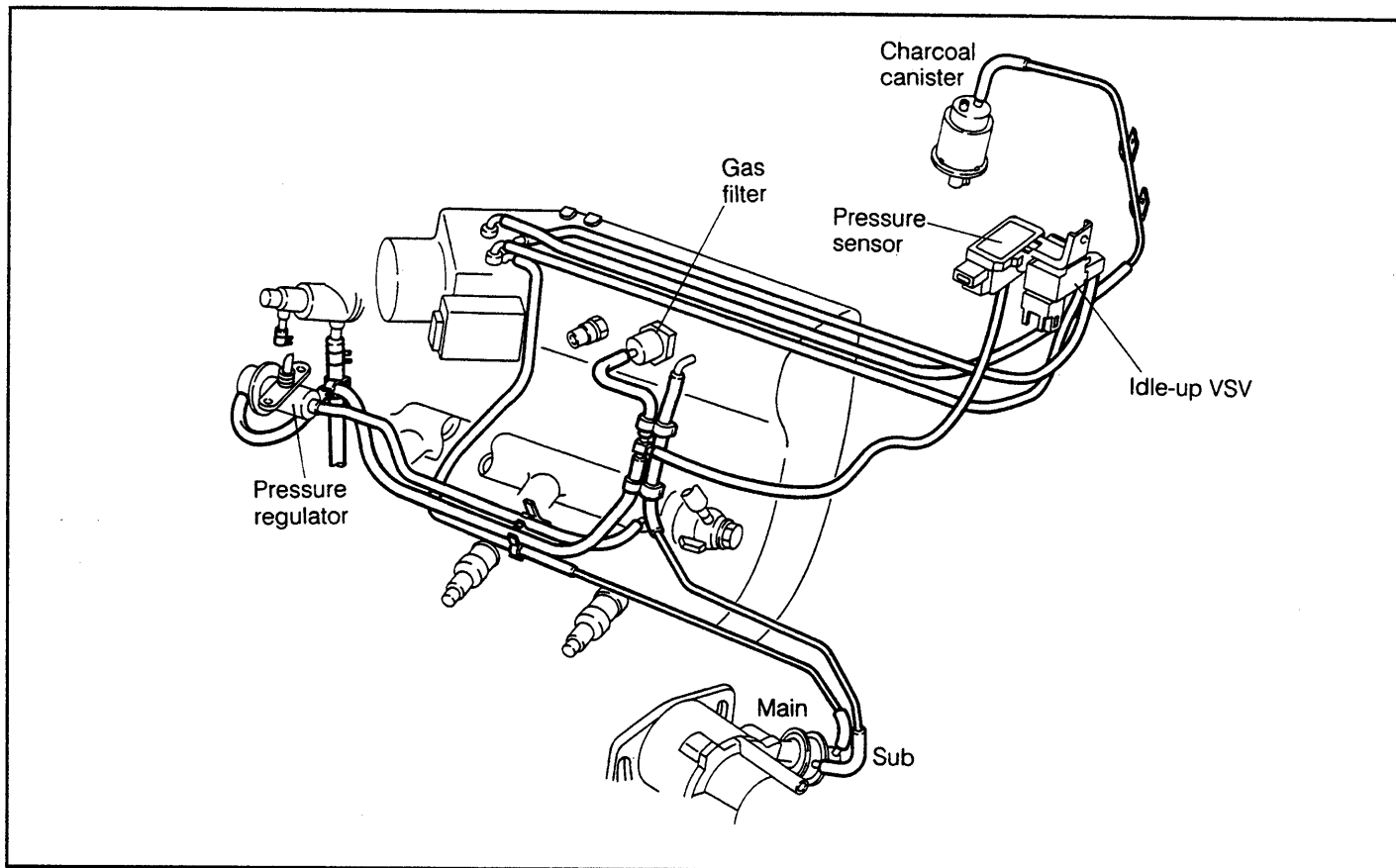
If any parts exhibit fault, replace or repair them, as required.



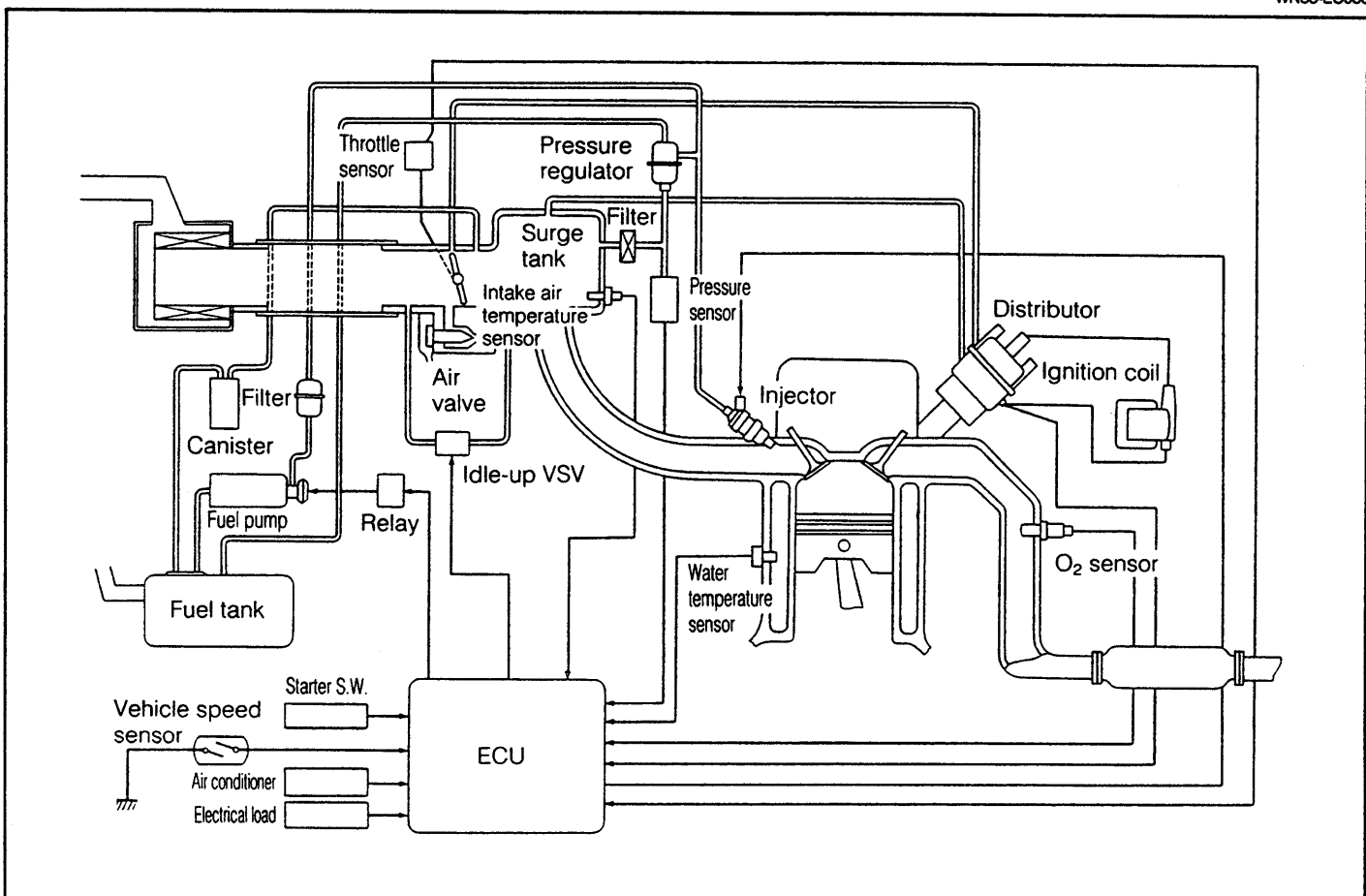
WN88-EC035



COMPONENT LAYOUT & SCHEMATIC DIAGRAM



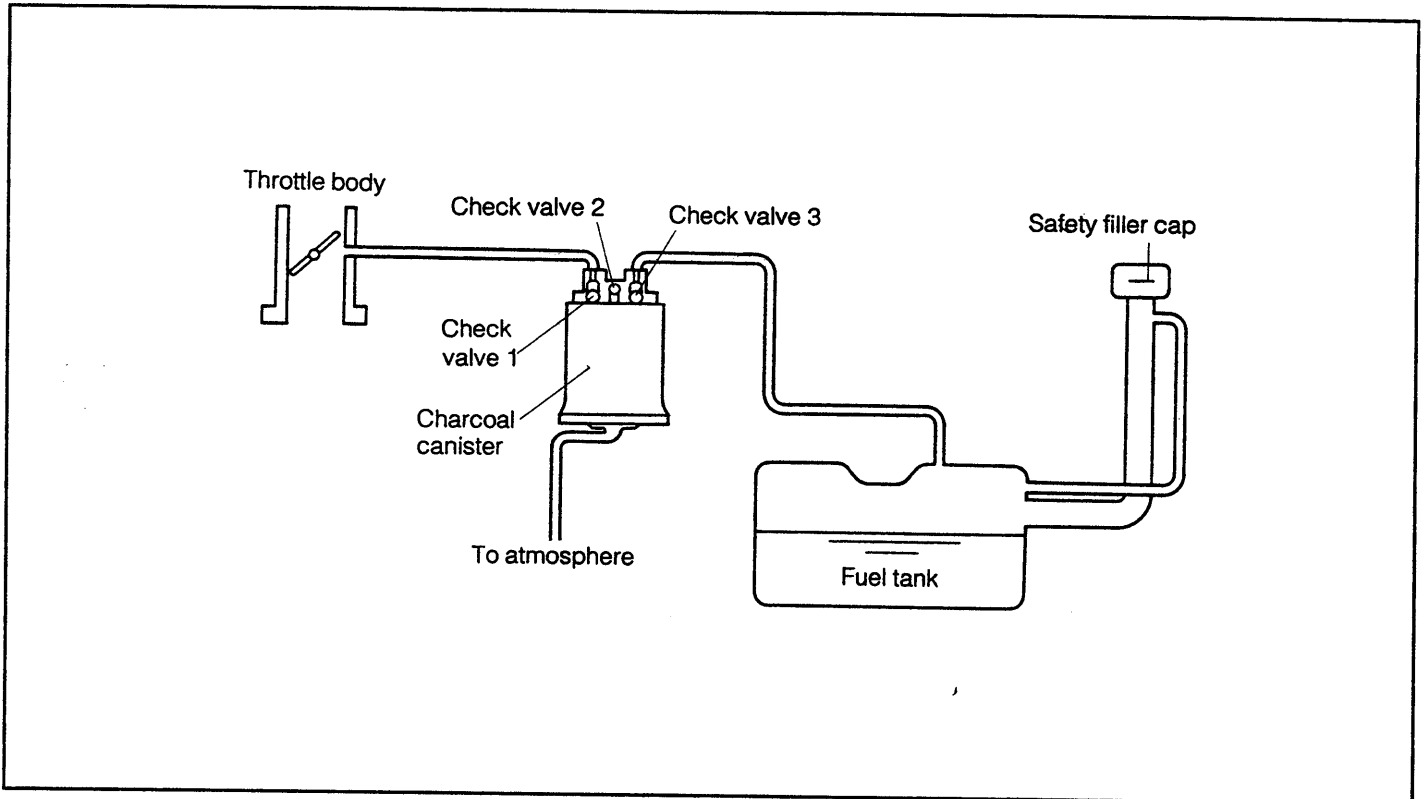
WN88-EC036



WN88-EC037

## FUEL EVAPORATIVE EMISSION CONTROL (EVAP) SYSTEM

The fuel evaporative emission control system employs the charcoal canister type. The charcoal canister type leads the fuel vapor into the charcoal canister which uses activated carbon to absorb HC emission. The separated HC emission is drawn into the throttle body to be burnt together with mixture in the combustion chamber.



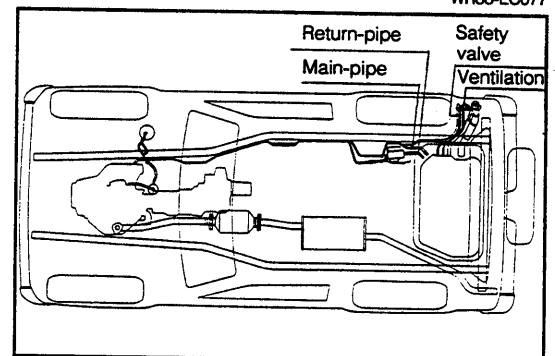
WN88-EC038

Pressure condition in tank	Engine condition	Canister check valve			Check valve in safety filler cap	Evaporated Fuel (HC)
		1	2	3		
High pressure in tank	When engine is rotating:	open	open	closed	closed	HC emission is sucked into engine through charcoal canister
High vacuum in tank	When engine is rotating:	open	closed	open	open	HC engine absorbed by charcoal canister is sucked into engine
High pressure in tank	When engine is stopped:	closed	open	closed	closed	HC emission is absorbed by charcoal canister
High vacuum in tank	When engine is stopped:	closed	closed	open	open	HC emission remains absorbed by charcoal canister. However, a part of HC emission is returned to fuel tank when negative pressure in fuel tank becomes great

WR88-EC077

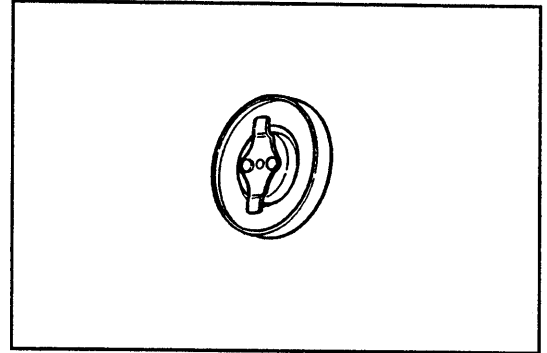
### Inspection of fuel vapor lines, fuel tank & filler cap

1. Visual inspection of fuel vapor lines and connections  
Check the lines and connections for loose connections, kinks or damage.
2. Visual inspection of fuel tank  
Check the fuel tank for deformation, cracks or fuel leakage.



WN88-EC039

3. Visual inspection of fuel filler cap  
Check the cap and gasket for damage or deformation.  
Replace the cap, if necessary.



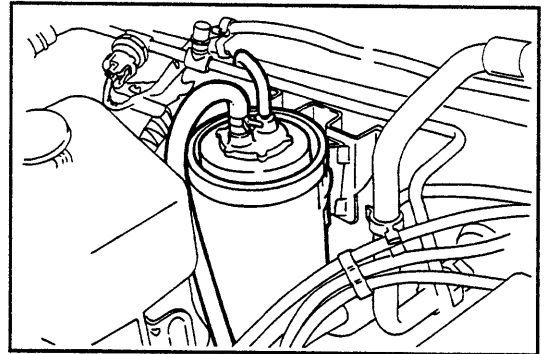
WR88-EC079

## Inspection of charcoal canister

1. Disconnect the rubber hose and remove the charcoal canister.

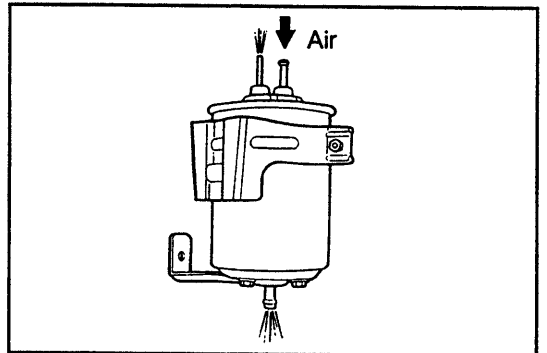
### NOTE:

Prior to disconnection of the rubber hose, put a tag on the hose so that the original installation position may be known easily.



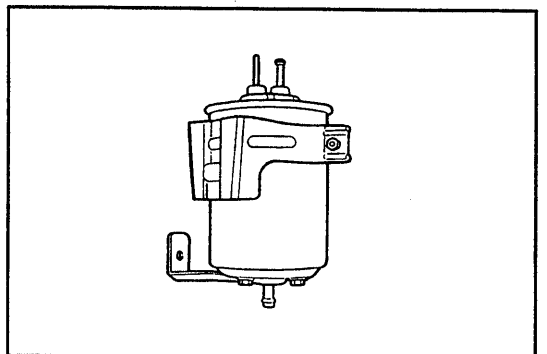
WN88-EC040

2. Visual inspection of charcoal canister  
Visually inspect the charcoal canister case for cracks or damage.



WN88-EC041

3. Check of filter for restriction
  - (1) Blow low pressure compressed air into the tank pipe.  
Ensure that air flows without resistance from the other pipe.
  - (2) Blow air into the purge pipe. Ensure that no air flows from the other pipe.  
Replace the charcoal canister, if it exhibits any defect.



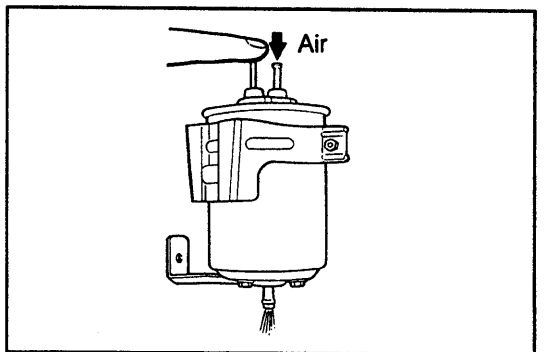
WN88-EC042

4. Cleaning of filter in canister  
Clean the filter by blowing compressed air of 3 kg/cm<sup>2</sup> (43 psi) into the tank pipe while holding the other upper canister pipe closed.

### NOTE:

- Do not attempt to wash the canister.
- No activated carbon should come out during the test.

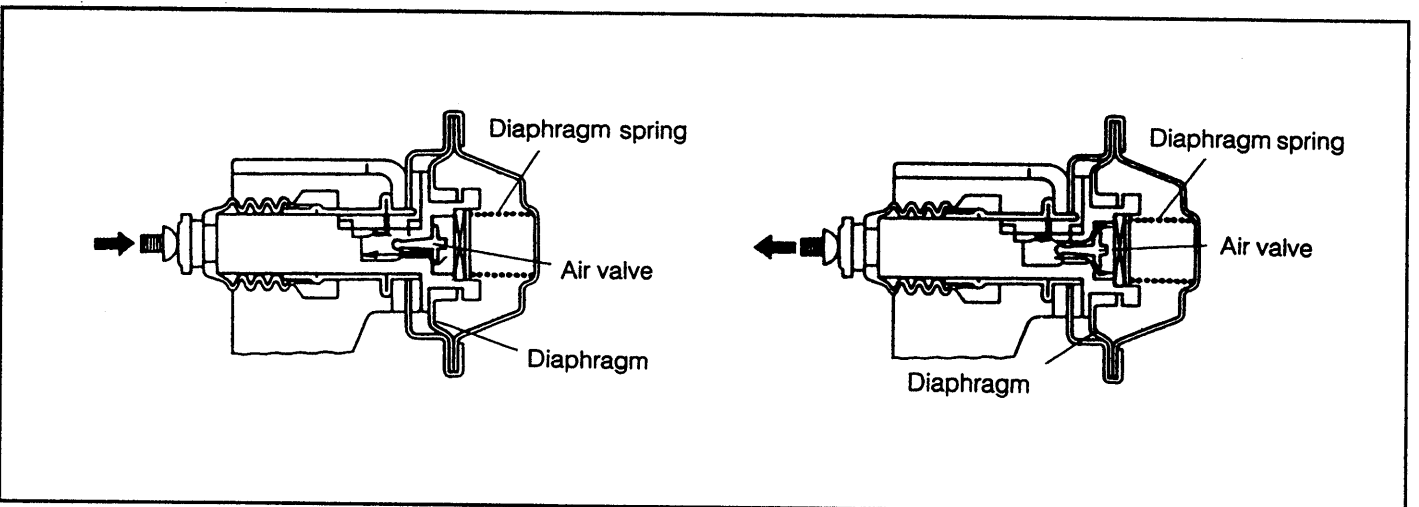
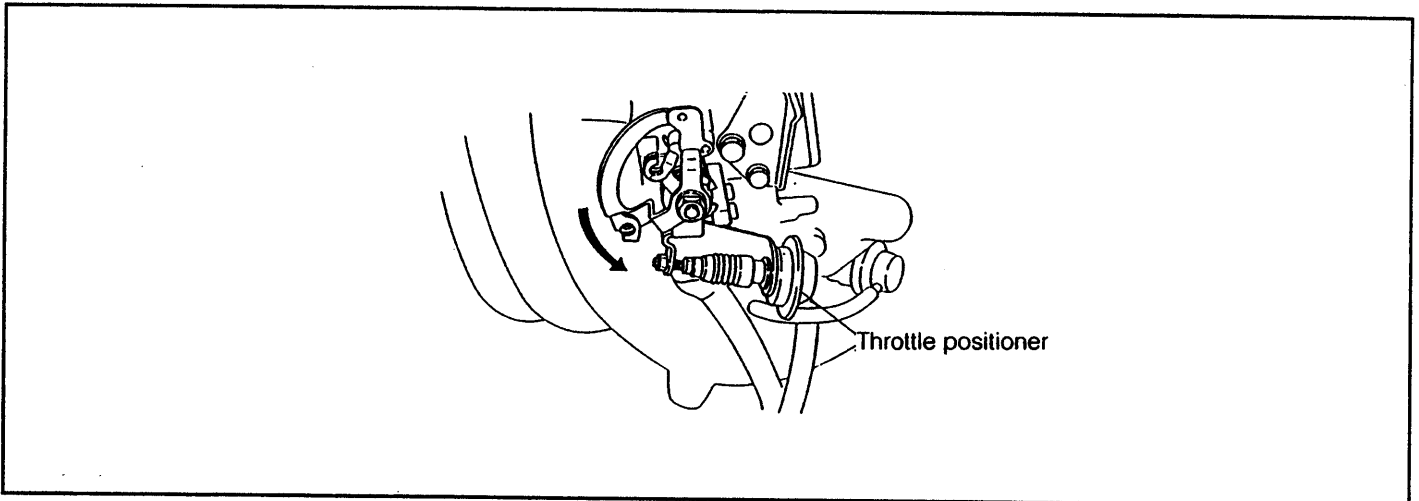
5. Install the charcoal canister and reconnect the rubber hose.



WN88-EC043

## THROTTLE POSITIONER (TP) SYSTEM

This system prevents the throttle valve from suddenly closing, thus reducing the CO and HC emissions.



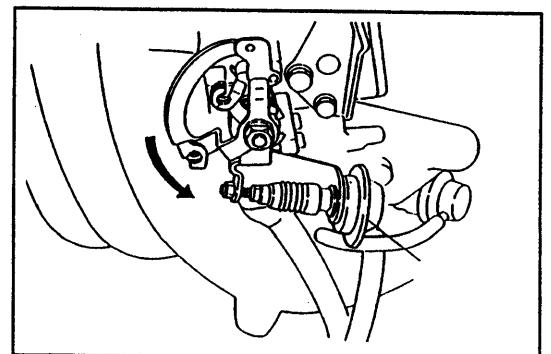
WR88-EC084

Conditions	TP diaphragm	Throttle valve
Idling	Pushed in by return force of throttle valve	Idle speed position
Normal driving	Pushed out by diaphragm spring	Opened position
Deceleration	Pushed in by return force of throttle valve*	Slightly opens and then slowly closes to the idle position.

\*At this point, the function of the air valve provided inside the TP diaphragm prevents the throttle valve from being closed suddenly.

WR88-EC085

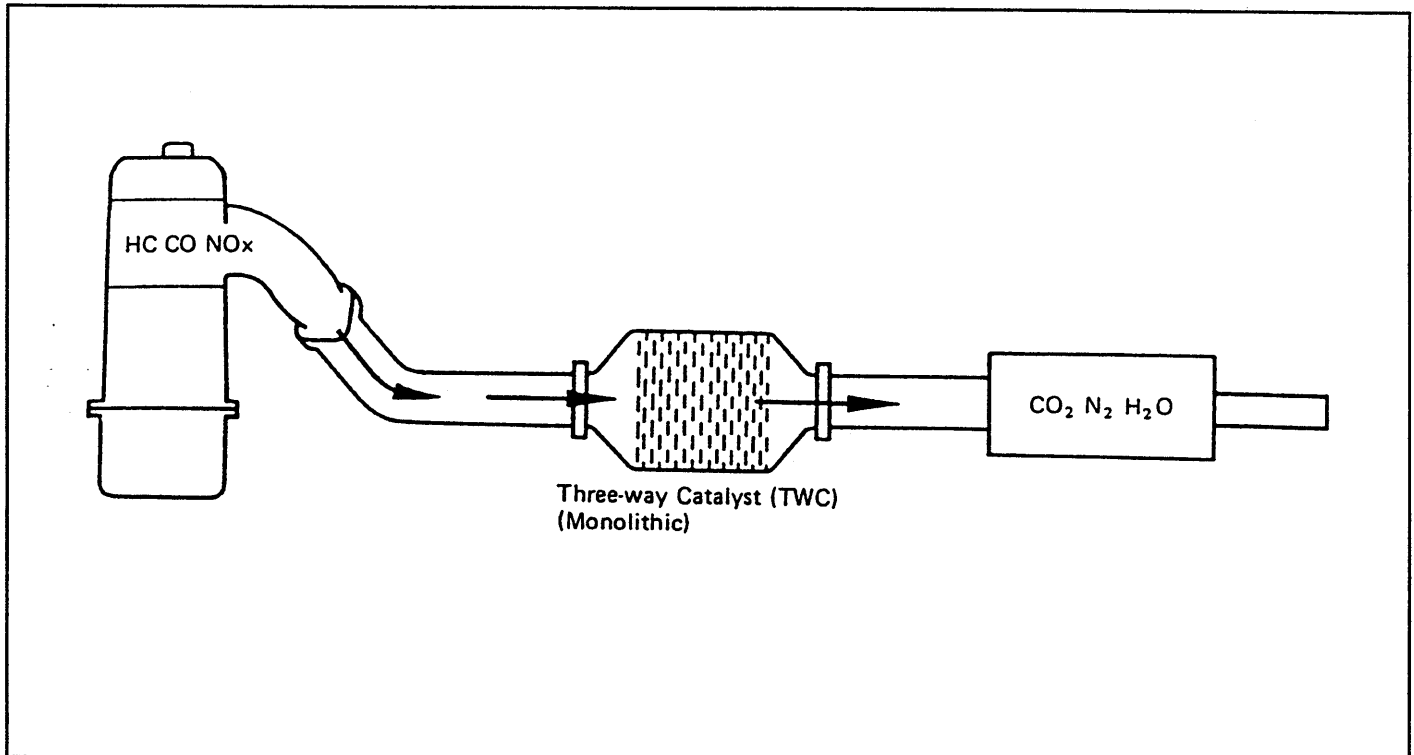
### Inspection of throttle positioner (TP) system (See page MA-10)



WN88-EC044

## THREE-WAY CATALYST (TWC) SYSTEM

If this three-way catalyst, the oxidation of carbon monoxide (CO) and the reduction of nitrogen oxides (NOx) contained in exhaust gas can take place simultaneously. Thus, the three-way catalyst purifies the exhaust gas by converting its harmful components gas into harmless carbon dioxide (CO<sub>2</sub>), water vapor (H<sub>2</sub>O) and nitrogen (N<sub>2</sub>).



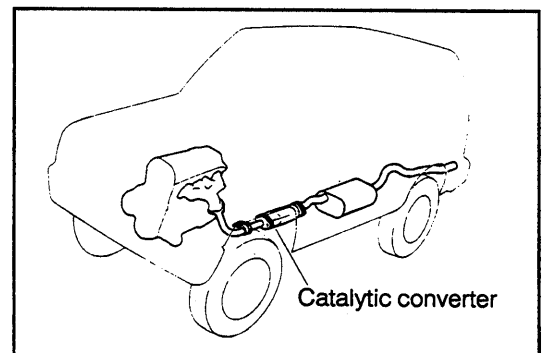
WN88-EC045

Exhaust gas component	TWC	Exhaust gas
HC, CO and NOx	⇒ Oxidation and reduction	⇒ CO <sub>2</sub> , H <sub>2</sub> O and N <sub>2</sub>

WR88-EC088

### Inspection of exhaust pipe assembly

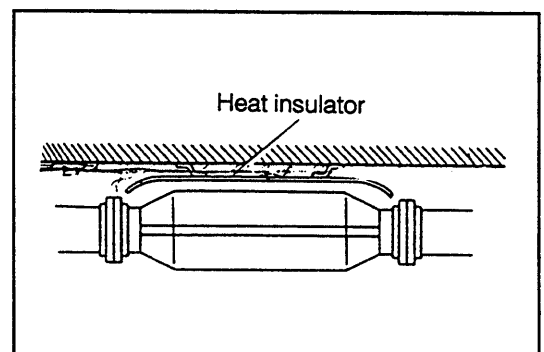
1. Check the connections for looseness or damage.
2. Check the clamps for weakness, bend or damage.



WN88-EC046

### Inspection of heat insulator

1. Check heat insulator for damage.
2. Check for adequate clearance between catalytic converter and heat insulator.



WN88-EC047

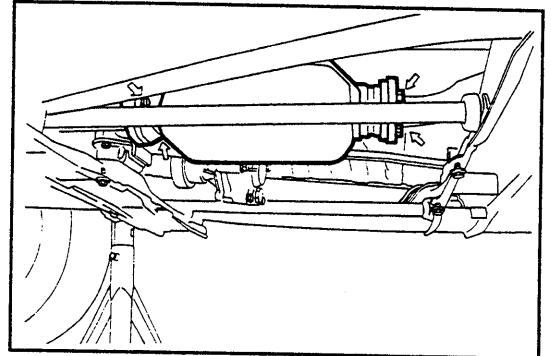
# EMISSION CONTROL SYSTEMS

## Replacement of catalytic converter

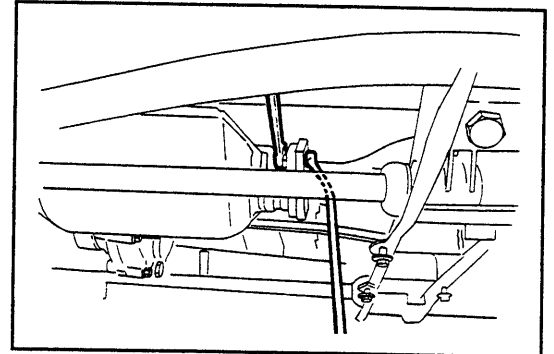
### CAUTION:

Do not perform any operation while the exhaust pipe is still hot.

1. Jack up the vehicle and support it with safety stands.  
(See page GI-9)
2. Remove the bolts at the front and rear of the converter.
3. Remove the converter and gaskets.
4. Place new gaskets on the converter front and rear pipes, and connect the converter to the exhaust pipes.
5. Tighten the bolts.  
**Tightening Torque: 3.7 - 5.2 kg-m (26.7 - 37.6 ft-lb)**



WN88-EC048



WN88-EC049

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# DAIHATSU

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# F300

[HD-ENGINE]

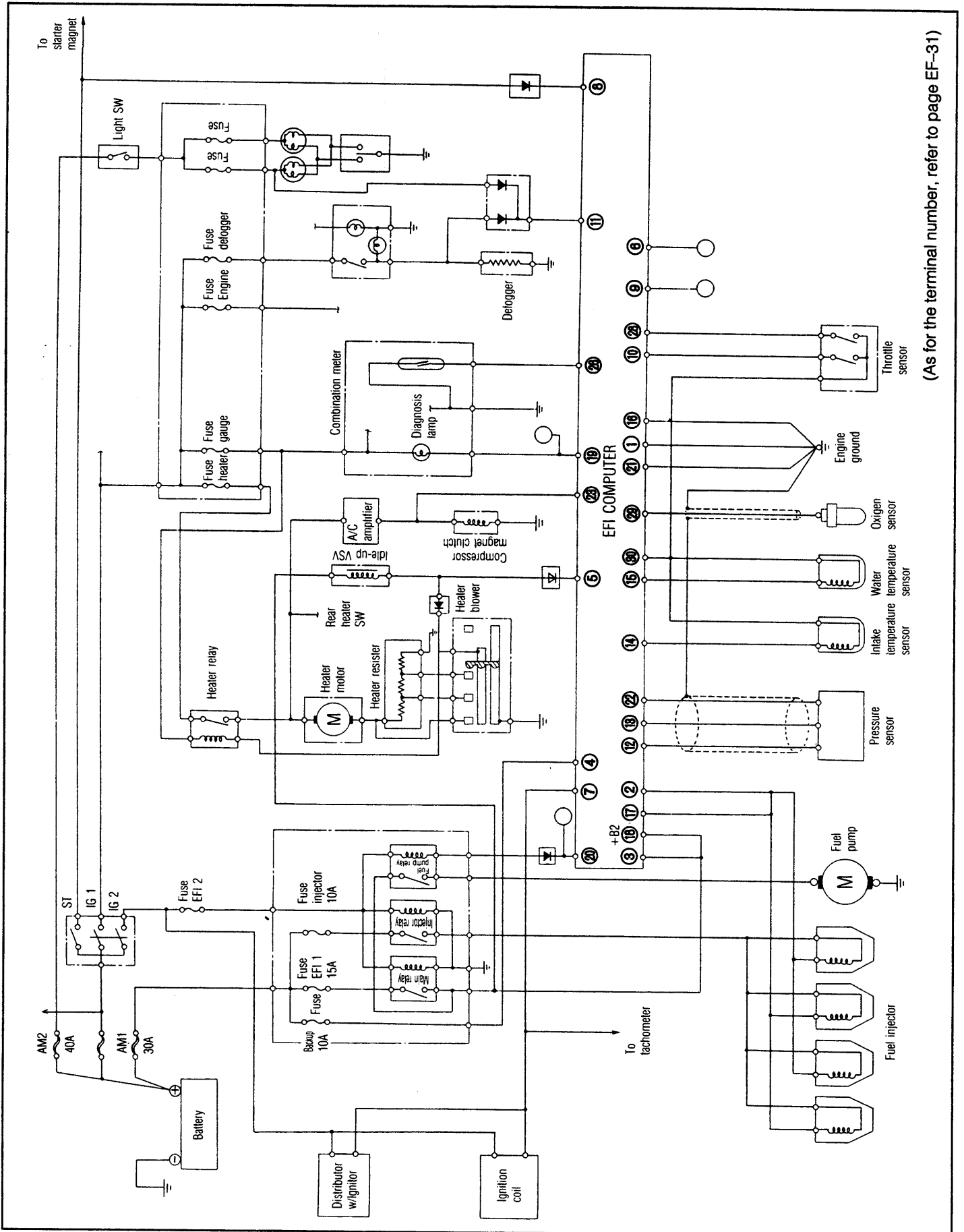
## EFI SYSTEM



SYSTEM CIRCUIT .....	EF-	2
SCHEMATIC DIAGROM .....	EF-	3
PRECAUTION .....	EF-	4
TROUBLE SHOOTING .....	EF-	9
DIAGNOSIS SYSTEM .....	EF-	25
ELECTRONIC CONTROL SYSTEM .....	EF-	47

WN88E-EF001

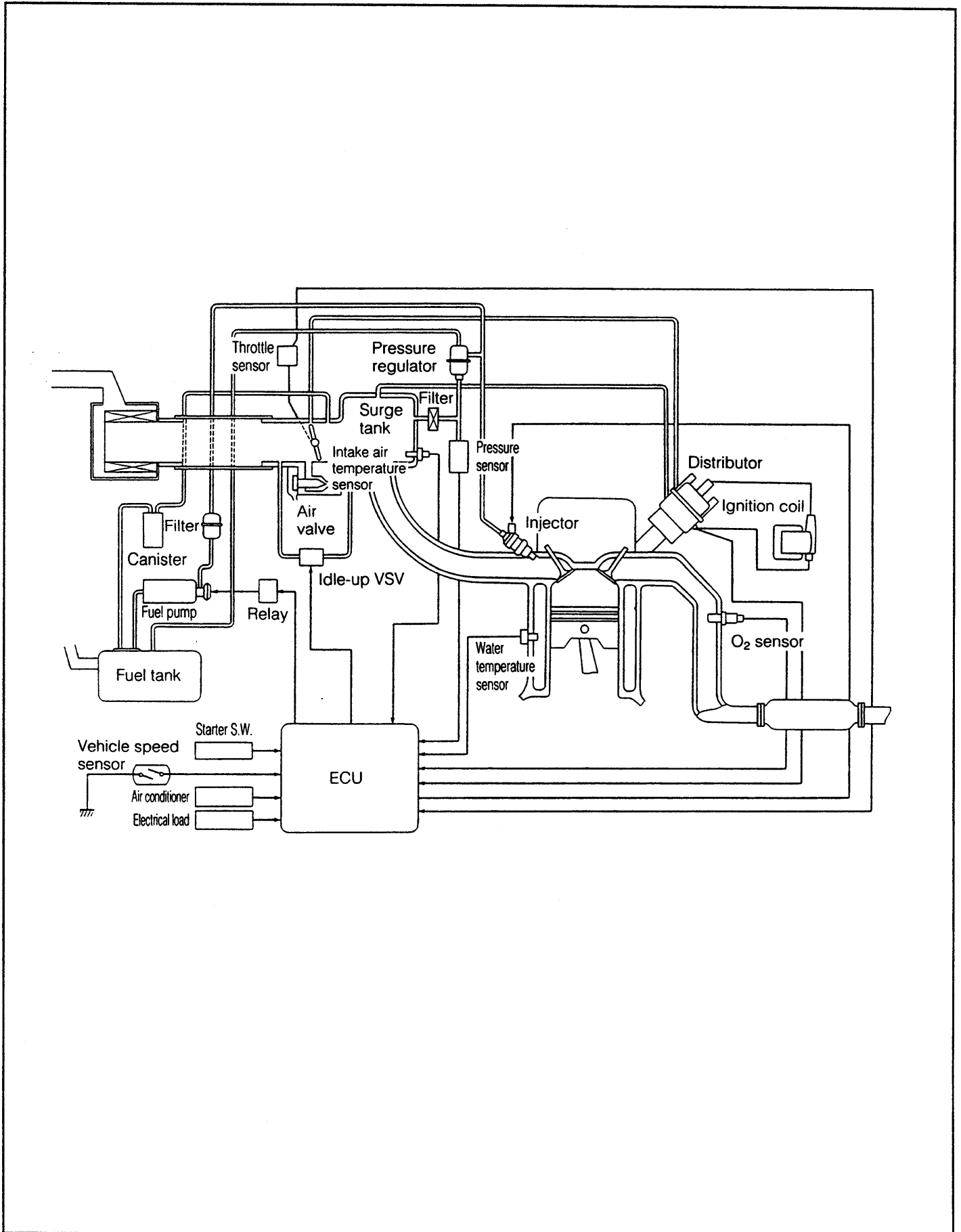
SYSTEM CIRCUIT



(As for the terminal number, refer to page EF-31)



**SCHEMATIC DIAGRAM**



## PRECAUTIONS

1. The engine control system has self diagnosis function. The ECU memorizes malfunction codes for malfunctions which are occurring at present and/or occurred in the past. Memorized malfunction codes are erased when the battery is disconnected. Be sure to read the diagnosis code before starting any operations relating to the encountered malfunctions.
2. Before disconnecting the fuel line system, be sure to disconnect the cable (wire) from the negative terminal of the battery.
3. The fuel line is pressurized to a pressure 2.5 atm. (2.55 kg/cm<sup>2</sup>) higher than the pressure inside the surge tank. Therefore, when disconnecting the fuel line, be sure to prevent the fuel from splashing with a cloth or the like.
4. Do not allow gasoline to get to any parts made of rubber, leather, and/or resin.
5. When cleaning the engine compartment, be very careful to protect the electrical system from water.

WN88E-EF004

## INSPECTION PRECAUTIONS

### Maintenance Precautions

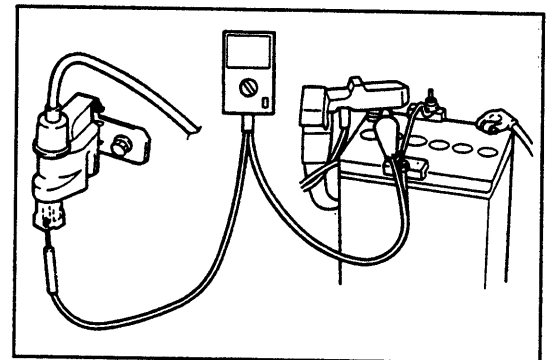
1. Ensure that the engine is correctly tuned up.
2. Precautions during gauge connection
  - (1) Connect the measuring terminal of the tachometer to the negative (-) terminal of the ignition coil.

### NOTE:

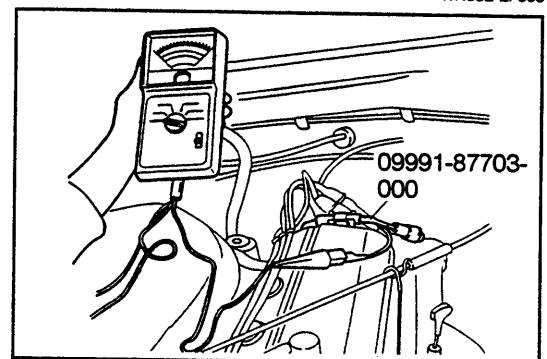
- The ignition coil has no terminal for external connection. Hence, insert an adequate jumper cord from the backside of the connector attached to the ignition coil. Then, connect the other end of the jumper cord to the measuring terminal of the tachometer.
- For the purpose of connecting tachometer, the SST for connecting to the distributor wire is available.  
SST: 09991-87703-000

### CAUTION:

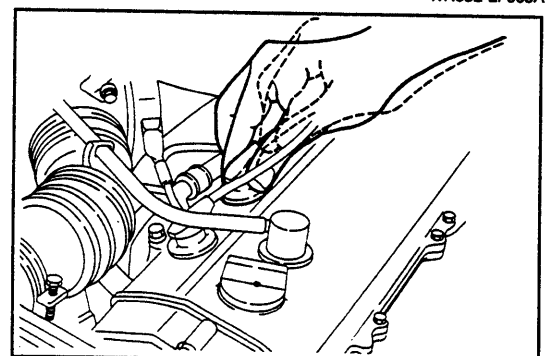
- Never allow the tachometer terminal to touch ground as it could result in damage to the ignitor and/or ignition coil.
  - As some tachometers are not compatible with this ignition system, it is imperative to confirm the compatibility of your meter before it is used.
- (2) Use the battery as power source for a timing light, tachometer and so forth.
3. If engine misfire takes place, the following measures should be taken.
    - (1) Ensure that the battery terminals, etc. are connected properly.
    - (2) Handle the resistive cords carefully.
    - (3) After completion of repairs, ensure that the ignition coil terminals and other ignition system wires are reconnected securely.
  4. Precautions during oxygen sensor handling
    - (1) Never drop the oxygen sensor or hit it to other objects.
    - (2) Do not submerge the oxygen sensor in water, nor put the oxygen sensor in water for the purpose of cooling it.



WN88E-EF005



WN88E-EF005A



WN88E-EF006

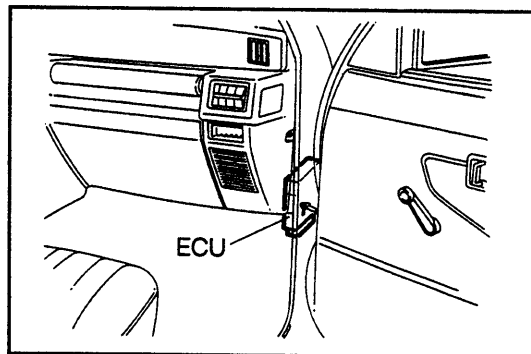
**When the Vehicle is Equipped With Wireless Installation (HAM, CB, etc.):**

The ECU has been so designed that it is resistant to external influence.

However, if a vehicle is equipped with a CB wireless installation and so forth (even if its output is only 10W), it may affect the ECU adversely.

Specifically, if antenna or its cord is located near the ECU, the ECU is liable to be effected adversely. Therefore, observe the following precautions.

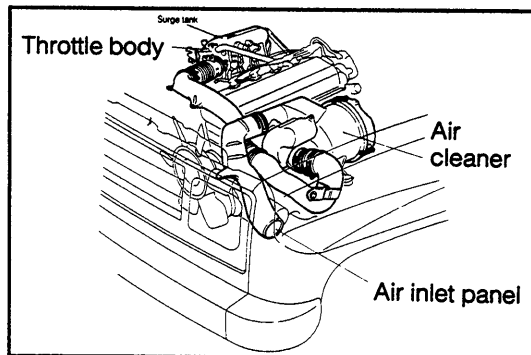
1. Install an antenna at a place as far away as possible from the ECU.  
The ECU is installed at the upper/inner section of the instrument panel in front of the passenger's seat. Therefore, the antenna should be installed at the rear of the vehicle.
2. The antenna cord should be kept at least 20 cm (7.9 inch) away from the engine wire. Never wind the antenna with the engine wire with tapes.
3. Adjust the antenna output correctly.
4. Never install a wireless installation with a high output on the vehicle.



WN88E-EF007

**Air Induction System**

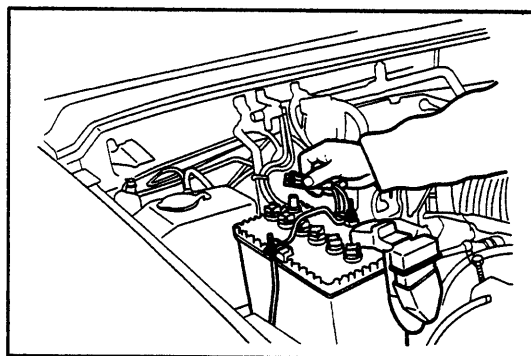
1. Unless all of the oil level gauge, oil filler cap, ventilation hose and so forth are installed securely, engine tune-up can not be performed properly.
2. If air leakage (air admission) is present between the throttle body and the cylinder head, the engine revolution speed can not be adjusted.



WN88E-EF008

**Electronic Control System**

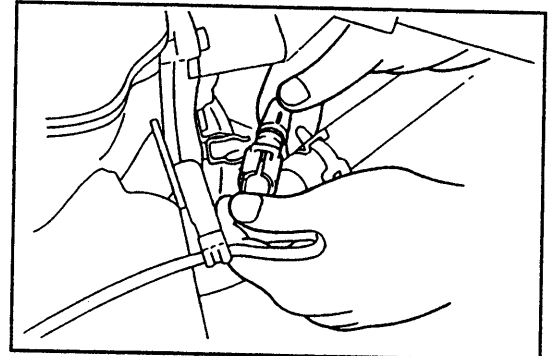
1. When disconnecting the connector of the EFI system wiring, prior to the disconnection, be sure to turn OFF the ignition switch and pull out the back-up fuse. Or disconnect the cable (wire) from the negative battery terminal.  
When disconnecting the ECU connector, be sure to disconnect the cable from the negative battery terminal.



WN88E-EF009

# EFI SYSTEM

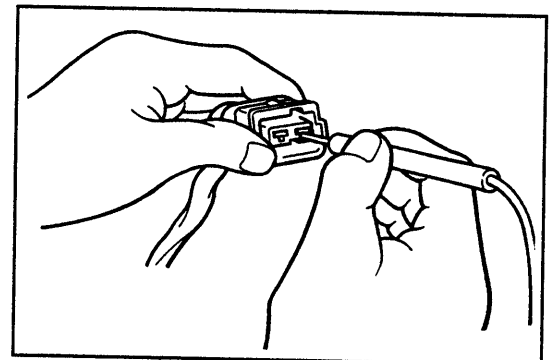
2. When installing the battery, care must be exercised not to mistake the battery polarity.
3. Never apply strong impacts to the parts. Pay utmost attention during the installation/removal.  
It is not permitted to reuse any EFI-related parts which have been dropped or undergone strong impacts.
4. During repairs, do not tamper those terminals other than those specified.  
Slight contact of terminals could damage the transistorized circuits, causing serious malfunctions.
5. Never open the cover of the ECU.
6. When the system is checked on a rainy day, be very careful not to allow water to get into connector terminals.  
When the engine compartment is washed, prevent water from being splashed to the EFI related parts and wiring connectors.
7. Every part should be replaced as an assembly.
8. Before connecting or disconnecting the wiring connector, confirm the lock shape.
  - (1) Release the lock. Disconnect the connector.
  - (2) Insert the connector until the lock is engaged completely.
9. When the connector terminal is checked by means of a circuit tester.  
Avoid applying excessive force so that the terminal may not be deformed.



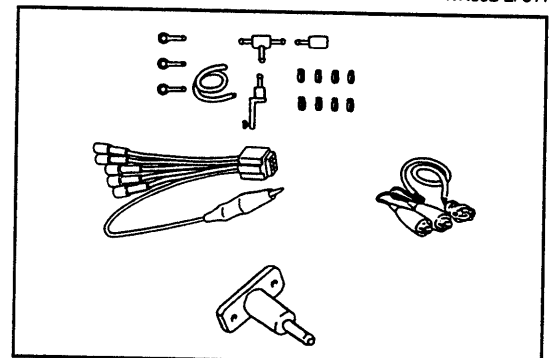
WN88E-EF010

10. When checking the injector and cold start injector, use the following SSTs.

SST: 09268-87702-000  
09842-30070-000  
09991-87702-000  
09283-87703-000



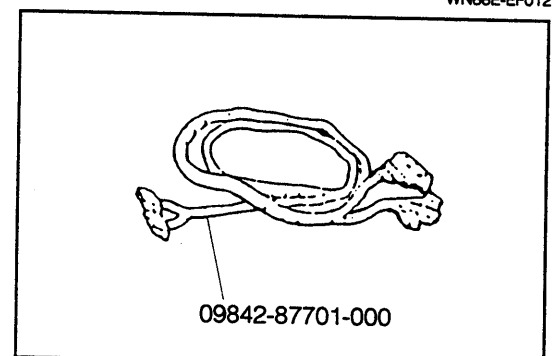
WN88E-EF011



WN88E-EF012

11. When measuring voltages for each system, use the following SST.

SST: 09842-87701-000



WN88E-EF013

**Fuel System**

1. The fuel line is pressurized to a pressure of 2.55 kg/m<sup>2</sup> (36.3 psi). Therefore, when disconnecting part of the fuel line, prevent the fuel from splashing, using a cloth or the like. Since a large amount of gasoline flows out, perform the operation, following the procedure given below.
  - (1) Place an adequate container or a piece of cloth, etc. under a connection.
  - (2) Loosen the connection slowly, while preventing the fuel from splashing, using a cloth or the like.
  - (3) Disconnect the connection.
  - (4) Plug the connection with a rubber plug or the like so that no dust may enter into the fuel line.
2. When connecting the flare nut or union bolt of the high-pressure pipe, observe the following instructions.

[Union bolt type]

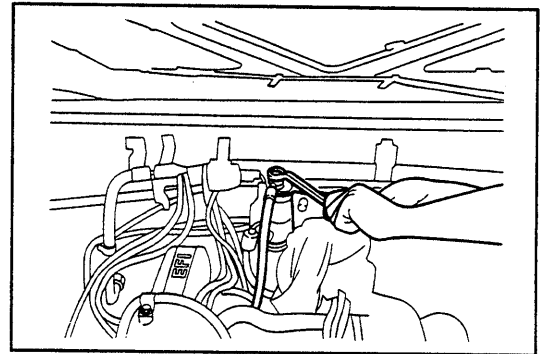
- (1) Always use new gaskets.
- (2) First tighten the union bolt with your fingers.
- (3) Next, tighten the union bolt to the specified torque.  
**Tightening Torque: 3.5 - 4.5 kg-m (25.3 - 32.5 ft-lb)**

[Flare nut type]

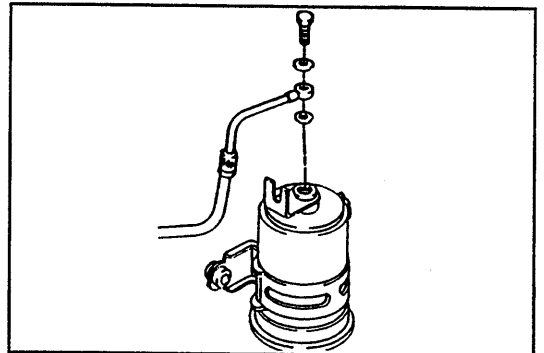
- (1) Coat the flare nut with a thin film of engine oil. Tighten the flare nut fully with your fingers.
- (2) Tighten the flare nut to the specified torque.  
**Tightening Torque: 3.5 - 4.4 kg-m (25.3 - 31.8 ft-lb)**

3. When removing/installing the injector, observe the following instruction.
  - (1) Do not reuse the "O" ring.
  - (2) When installing the "O" ring to the injector, be careful not to damage the "O" ring.
  - (3) Before connecting the injector with the delivery pipe, apply silicon oil or gasoline to the "O" ring.  
 (Never use engine oil, gear oil, brake oil and so forth.)

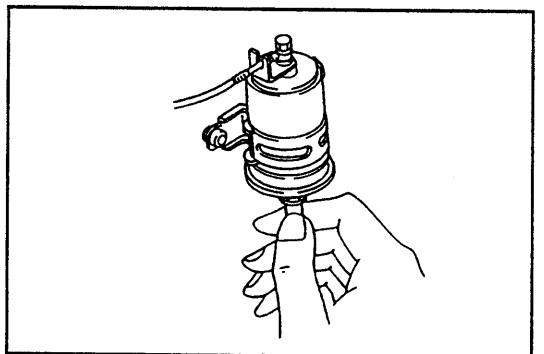
4. Install the injector to the delivery pipe and cylinder head, as shown in the figure.



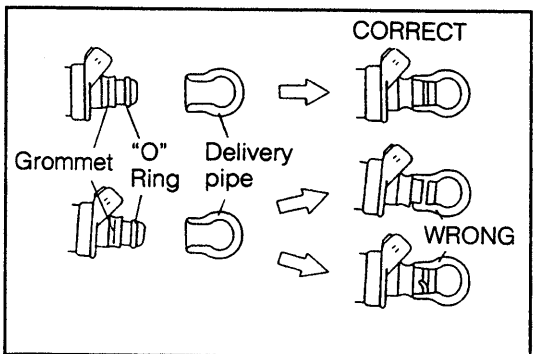
WN88E-EF014



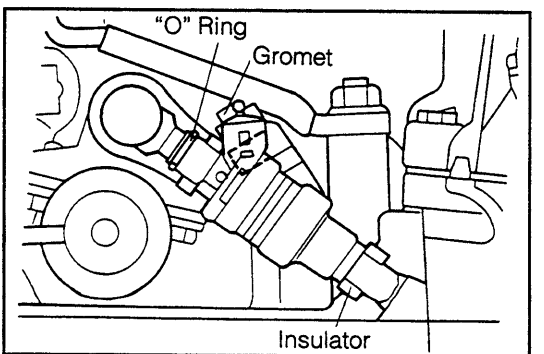
WN88E-EF015



WN88E-EF016



WN88E-EF017



WN88E-EF018

## EFI SYSTEM

5. When part of the fuel line is disconnected, e.g. during repairs, check the fuel line for fuel leakage after the operation has been completed, as follows:

- (1) Short the terminal F (White/Black) with the ground terminal (Black) of the check terminal, using following SST.  
SST: 09991-87702-000

**NOTE:**

The check terminal is located at the fender RH for L.H.D vehicles and the dash board left side for R.H.D vehicles.

**CAUTION:**

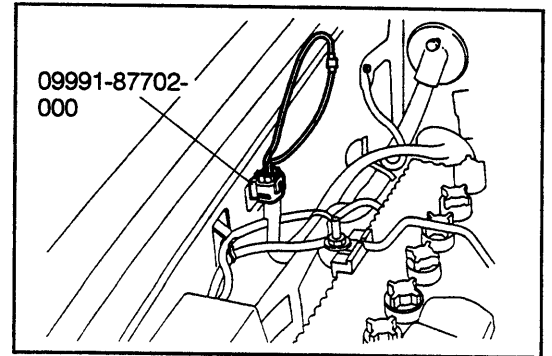
As for the terminals other than those specified, never allow them to be connected or shorted.

- (2) Turn ON the ignition switch. (with the engine in a stopped state)

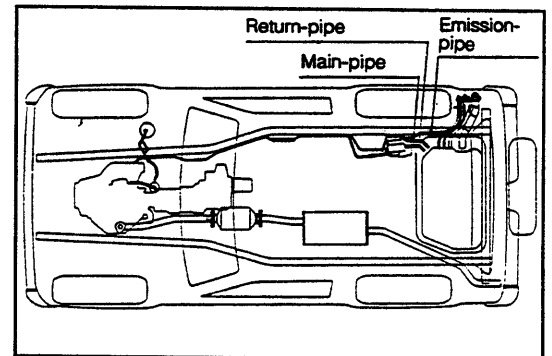
At this time, a fuel pressure of  $2.55 \text{ kg/cm}^2$  (36.3 psi) is being applied to the fuel line.

Under this conditions, check the fuel line system for evidence of leakage.

If any leakage is present at the fuel line system, repair leaky points. Recheck the system for leakage.



WN88E-EF019



WN88E-EF020

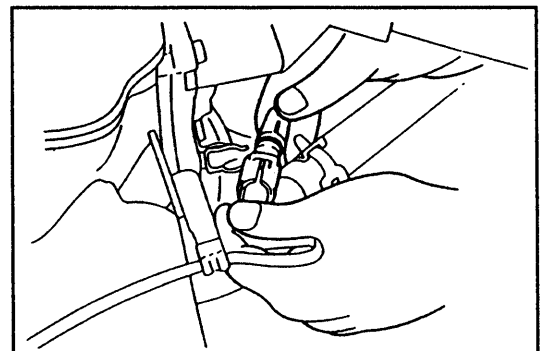
# TROUBLE SHOOTING

## Trouble Shooting Hints

1. In most cases, engine troubles are attributable to systems other than the EFI system. Prior to starting the trouble shooting or the EFI system, check other systems.
  - (1) Power supply
    - Battery voltage
    - Fuse blown
    - Fusible link blown
  - (2) Body ground
  - (3) Fuel supply
    - Fuel leakage
    - Fuel filter clogged
    - Fuel pump malfunctioning
  - (4) Ignition system
    - Spark plugs faulty
    - Resistive cords faulty
    - Distributor and igniter faulty
    - Ignition coil faulty
  - (5) Air induction system
    - Admission of air
  - (6) Others
    - Ignition timing adjusted improperly
    - Idle speed adjusted improperly
    - Idle-up VSV malfunctioning

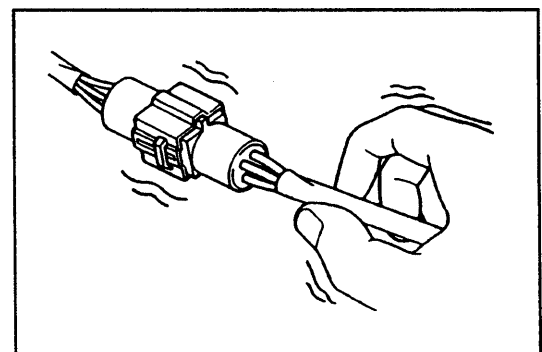
WN88E-EF021

2. Most of troubles related to the EFI system are merely caused by poor wire connections. Ensure that connectors are connected securely. Check connectors, being careful as to the following points.
  - (1) Visually inspect that terminals are not bent.
  - (2) Ensure that connectors are securely connected and locked.



WN88E-EF022

- (3) Check to see if the malfunction phenomenon takes place when applying light vibration to the connector or the wire connected to the connector.



WN88E-EF023

3. Check the ECU thoroughly before replacing the ECU.

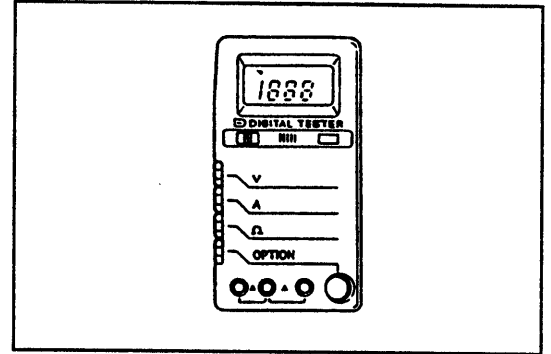
The ECU is an expensive, sophisticated part.

When the ECU has been replaced according to an instruction appearing in the trouble shooting, be sure to reinstall the old ECU and ensure that the malfunction takes place again. In this way, confirm that the malfunction is obviously attributable to the old ECU.

WN88E-EF024

4. For the trouble shooting, use a volt/ohmmeter whose internal resistance is 10 kΩ/V or more.

Use of a volt/ohmmeter whose internal resistance is less than 10 kΩ/V may cause an ECU malfunction or wrong diagnosis. Furthermore, be sure to employ a meter whose resolution is 0.1V or more, 0.5Ω or more and whose accuracy is ±2% or more.



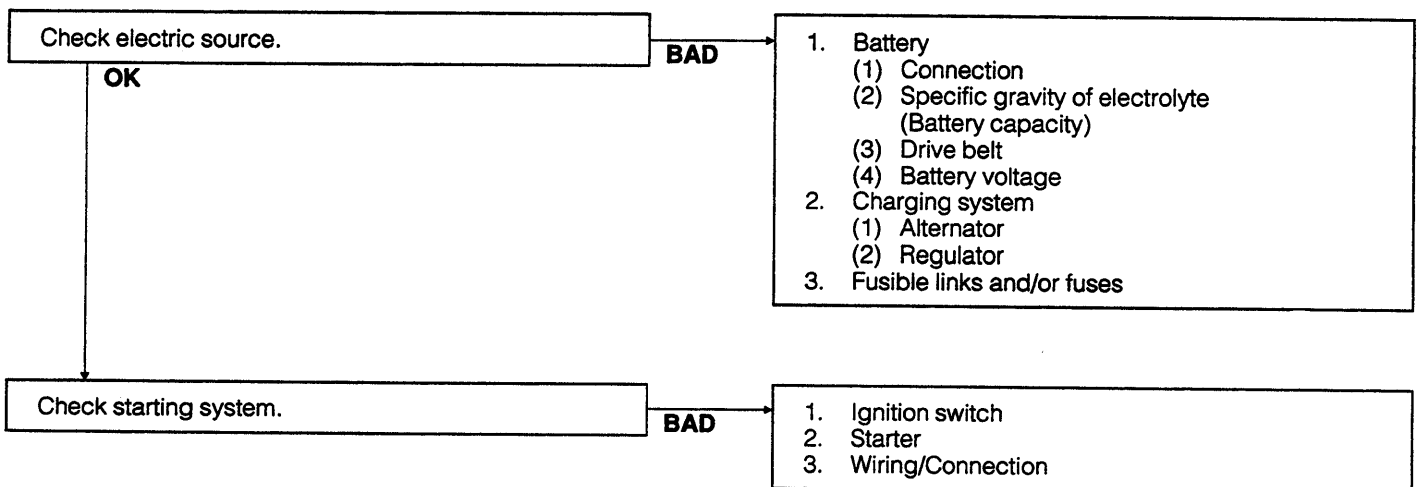
WN88E-EF025

5. In this trouble shooting, no consideration has been made to any displacement of timing belt teeth. Hence, if the trouble persists even after the trouble shooting has been carried out, check to see if the timing belt exhibits any tooth skipping.

WN88E-EF025A

## TROUBLE SHOOTING PROCEDURE

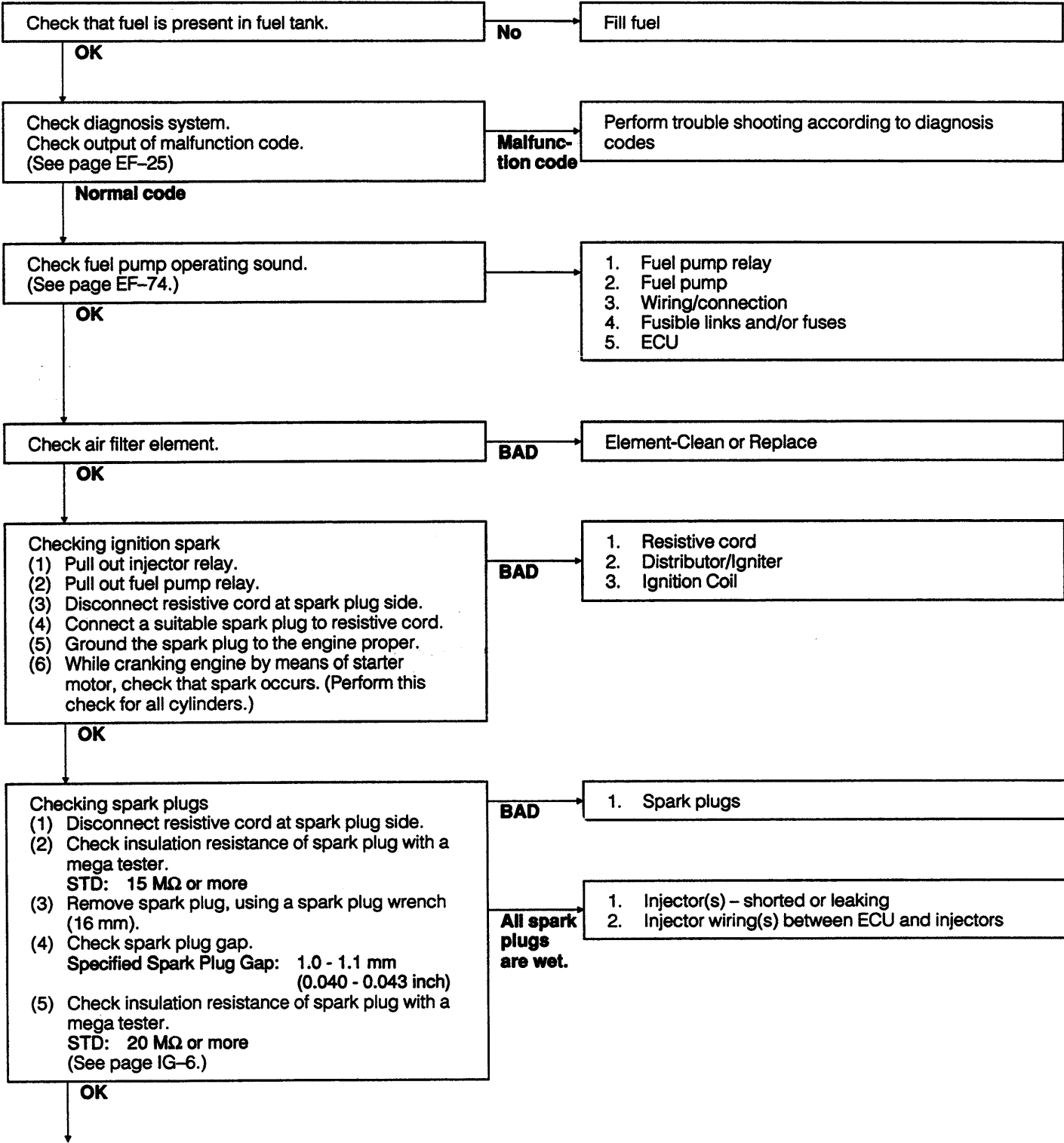
- 1 Symptom .... Engine will not start.  
(Engine will not crank or cranks slowly.)



WN88E-EF026



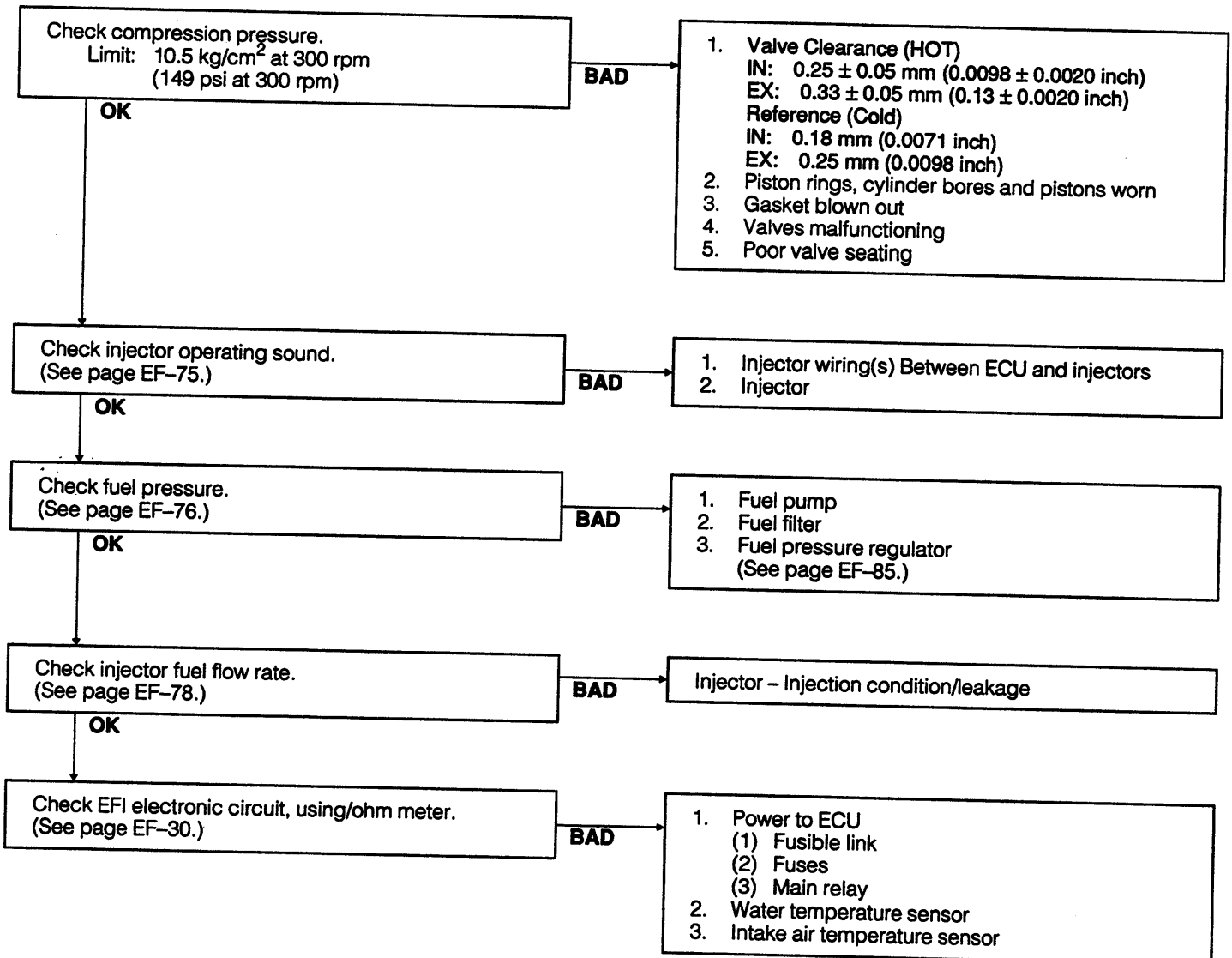
2 Symptom .... Engine will not start.  
(Engine cranks normally.)



WN88E-EF027

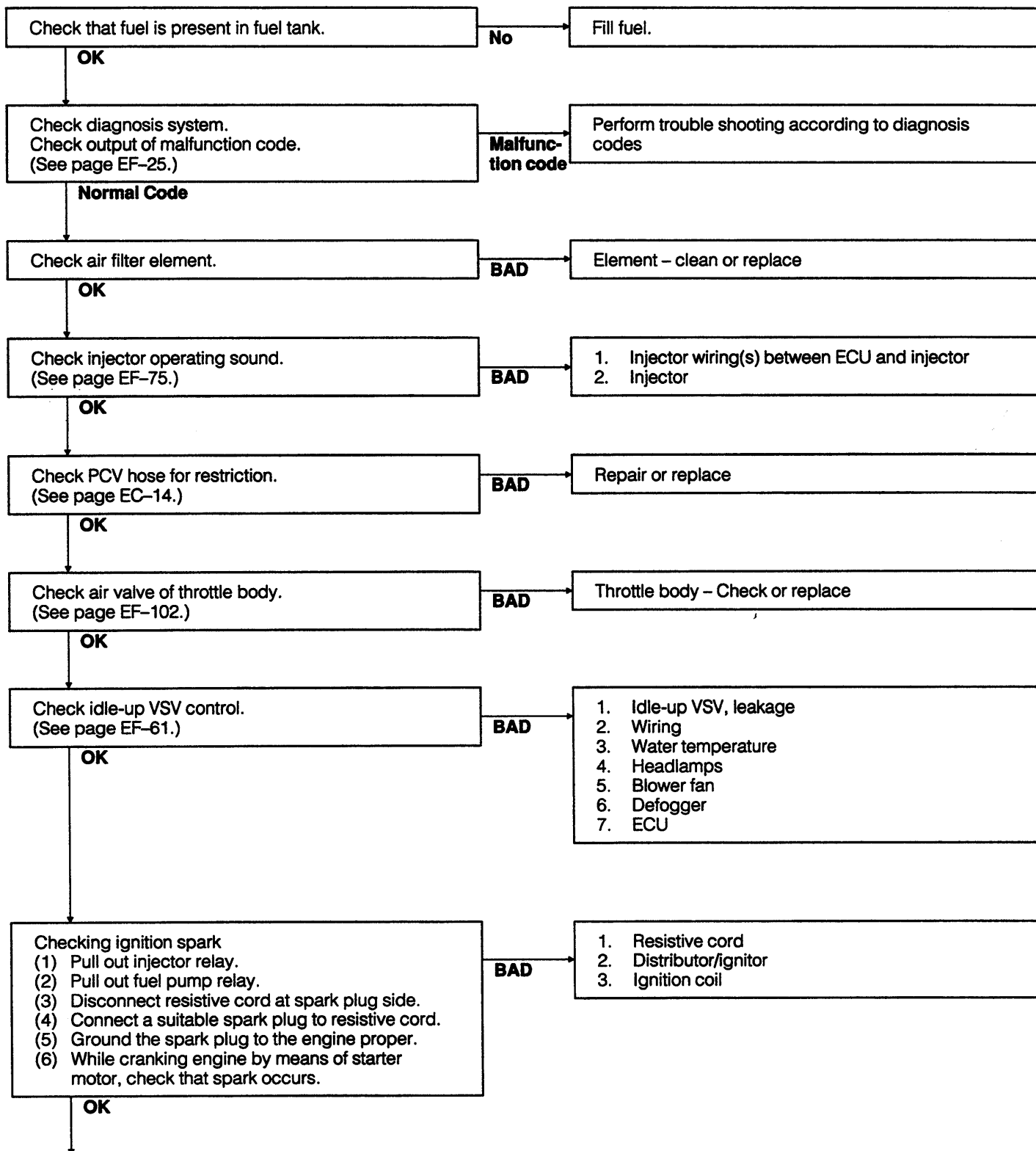
# EFI SYSTEM

(Cont'd)



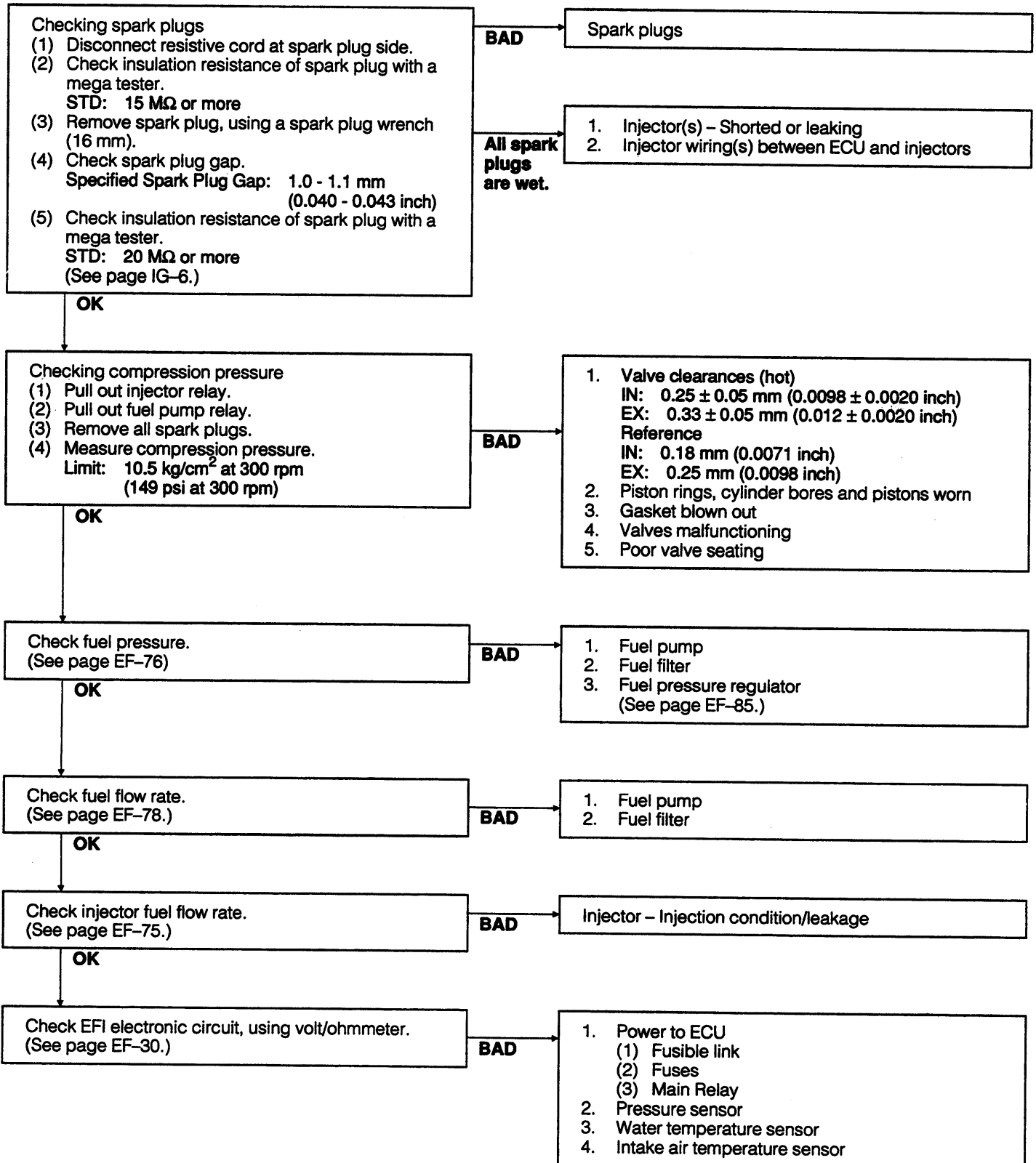
WN88E-EF028

3 Symptom .... Engine stalls immediately after starting.



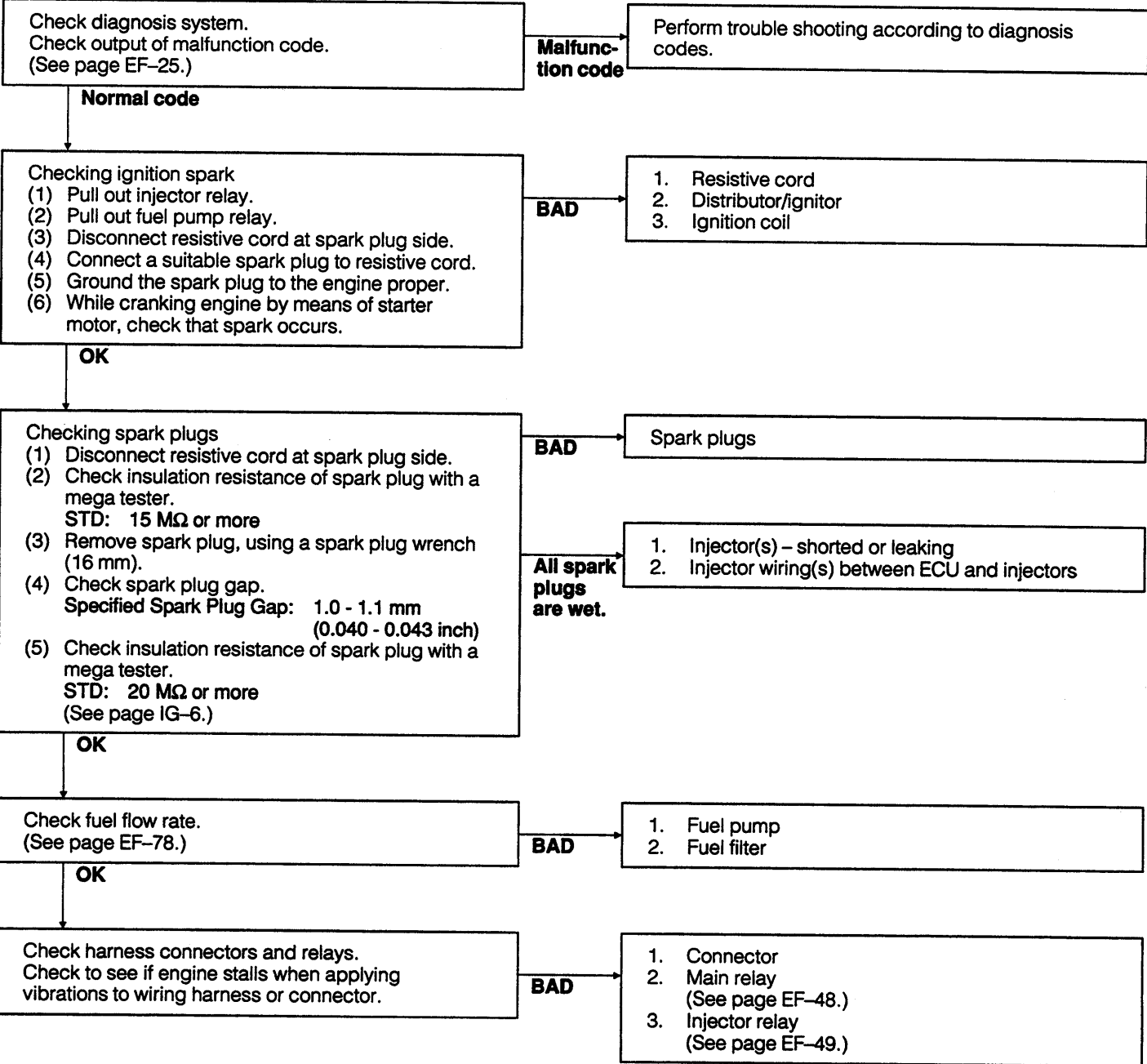
WN88E-EF029

(Cont'd)



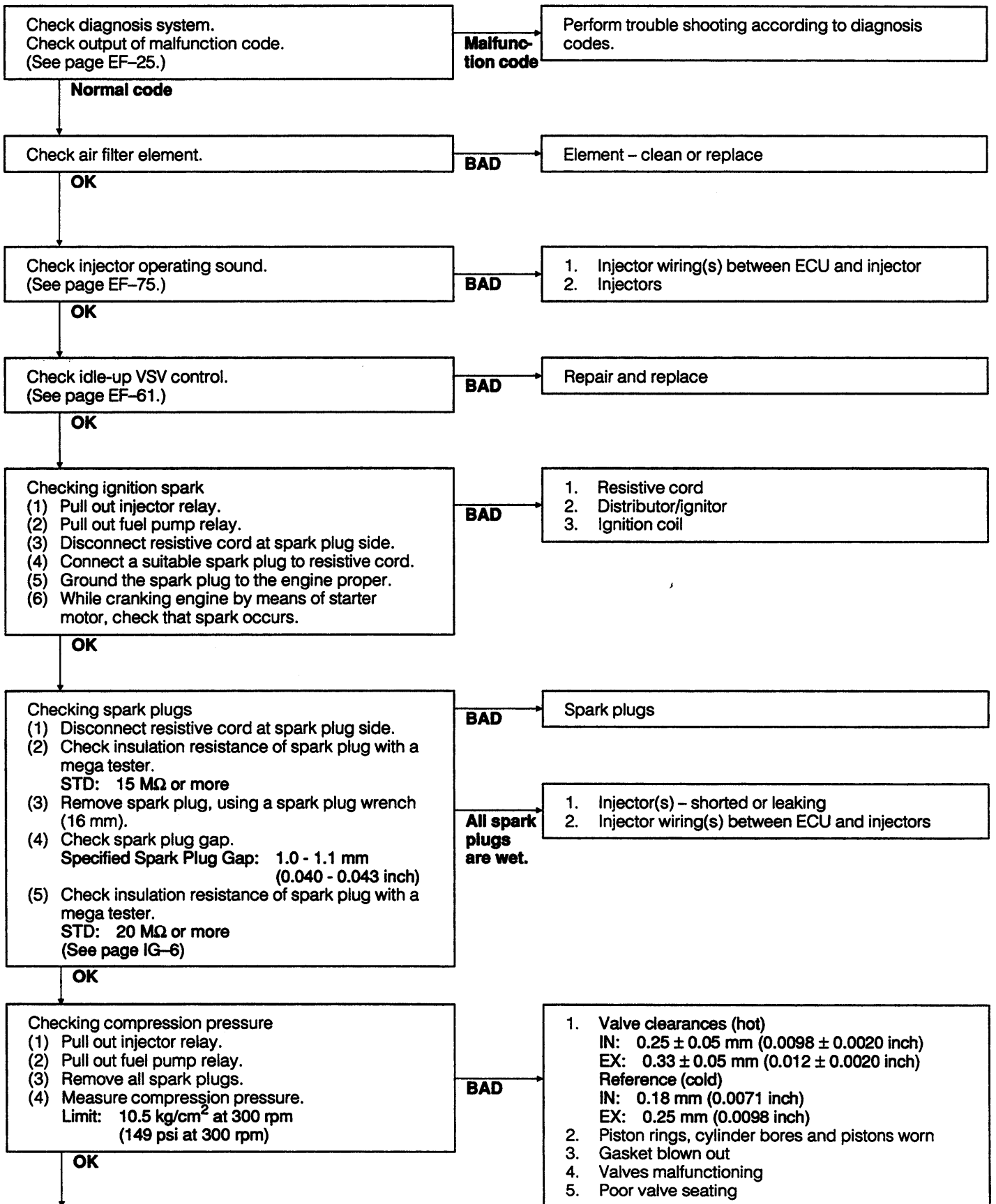
WN88E-EF030

4 Symptom .... Engine often stalls.

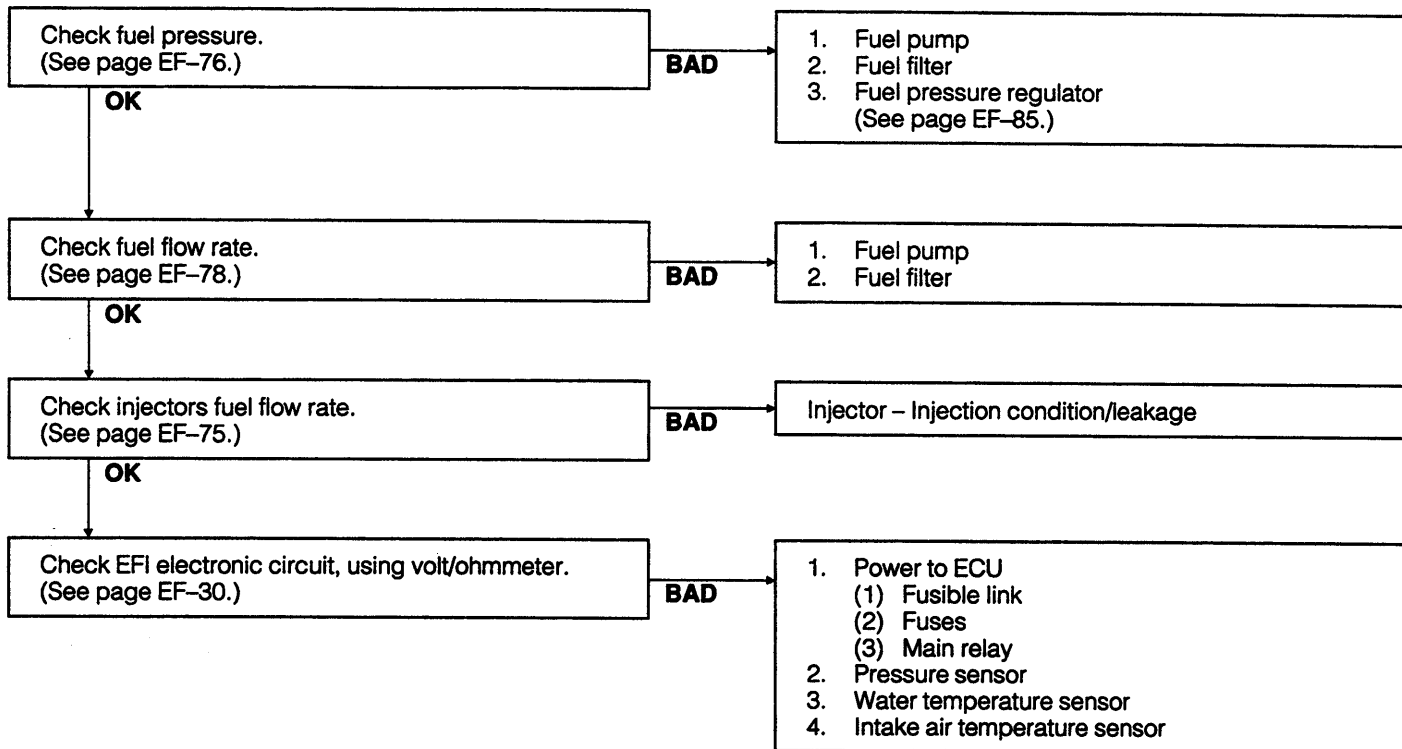


WN88E-EF031

## 5 Symptom .... Hard starting

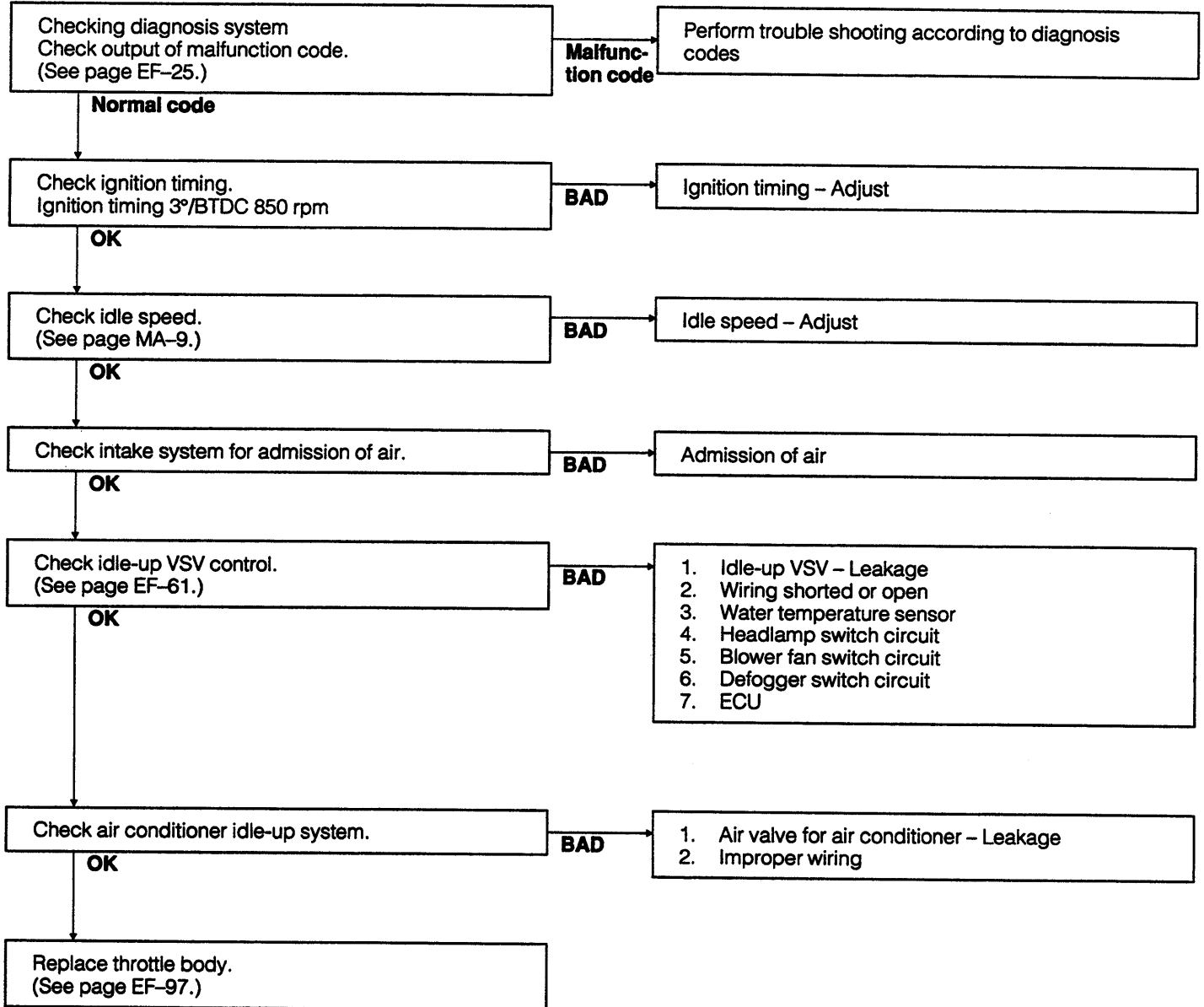


(Cont'd)



WN88E-EF033

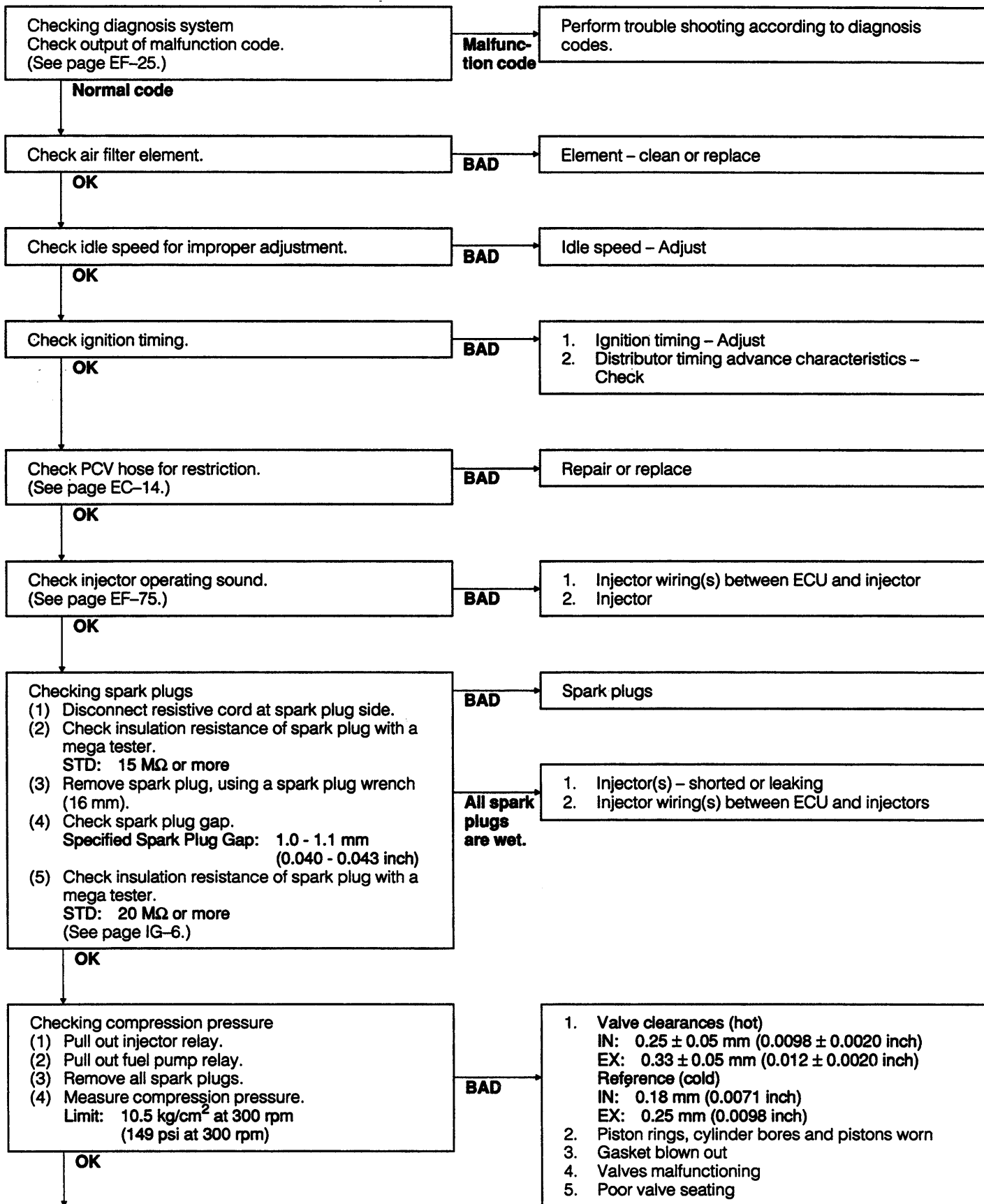
## 6 Symptom .... Engine idle speed too high



WN88E-EF034



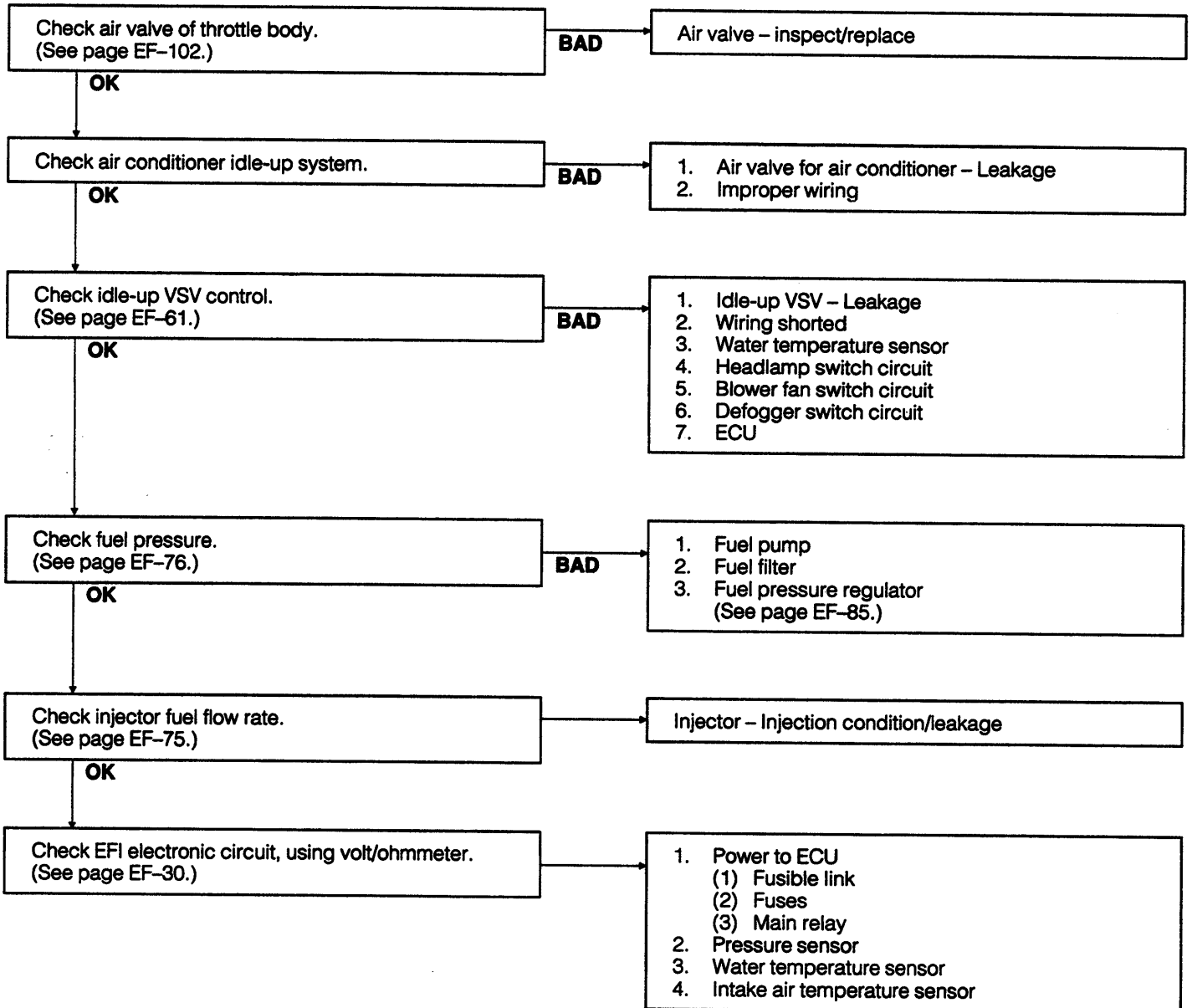
7 Symptom .... Engine idle speed too low and/or rough idling



WN88E-EF035

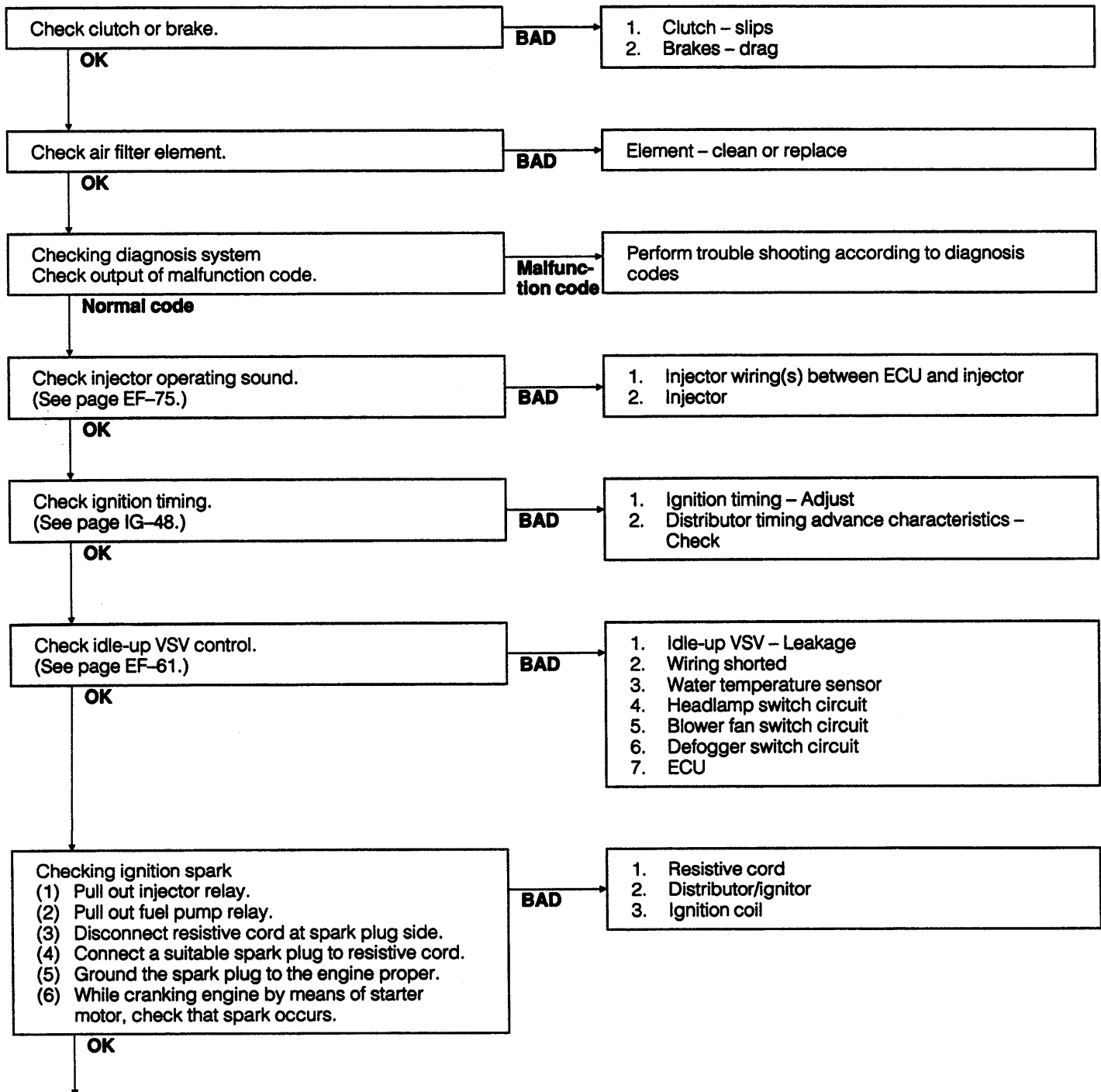
# EFI SYSTEM

(Cont'd)



WN88E-EF036

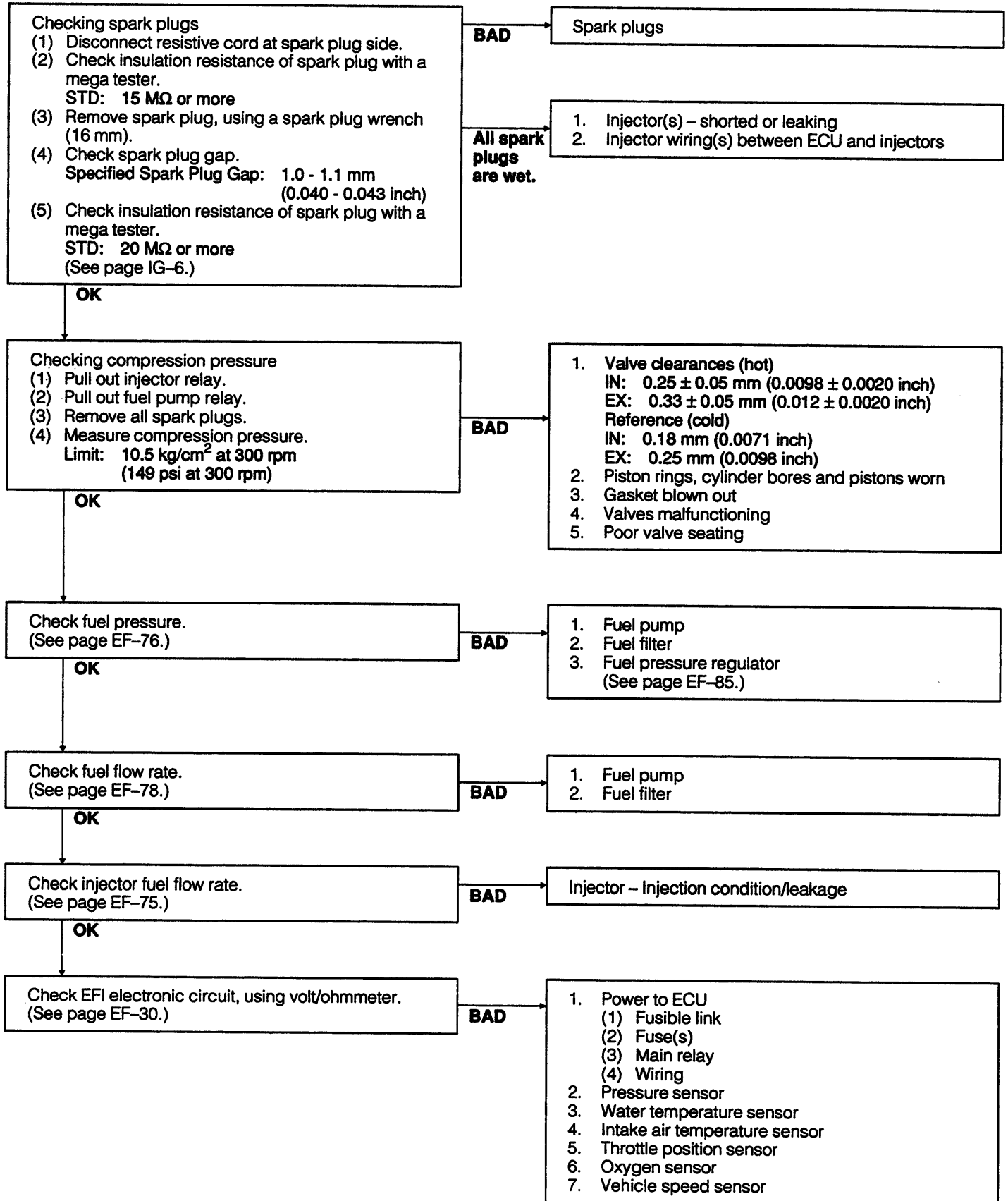
8 Symptom .... Engine hesitation and/or acceleration



WN88E-EF037

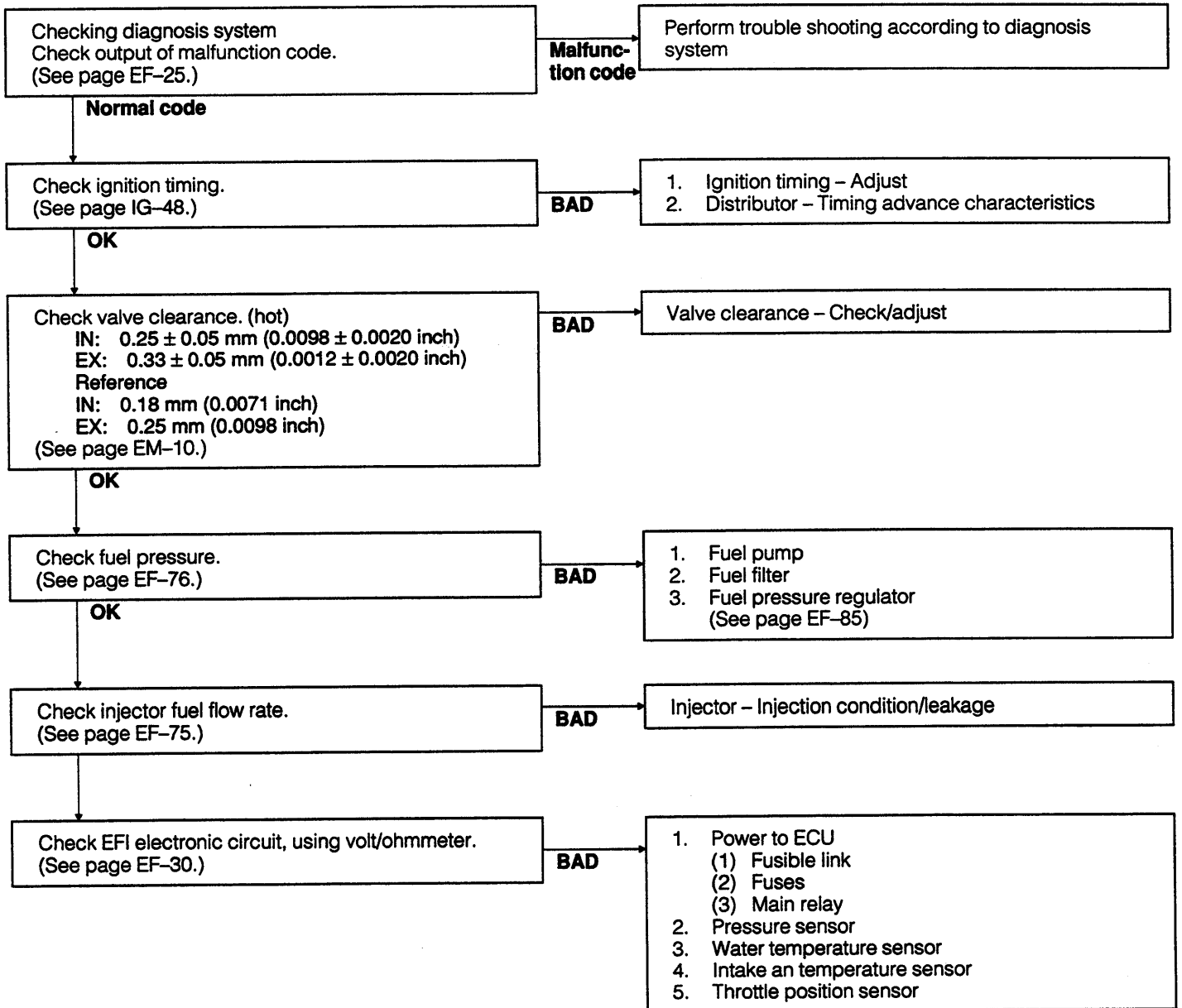
# EFI SYSTEM

(Cont'd)



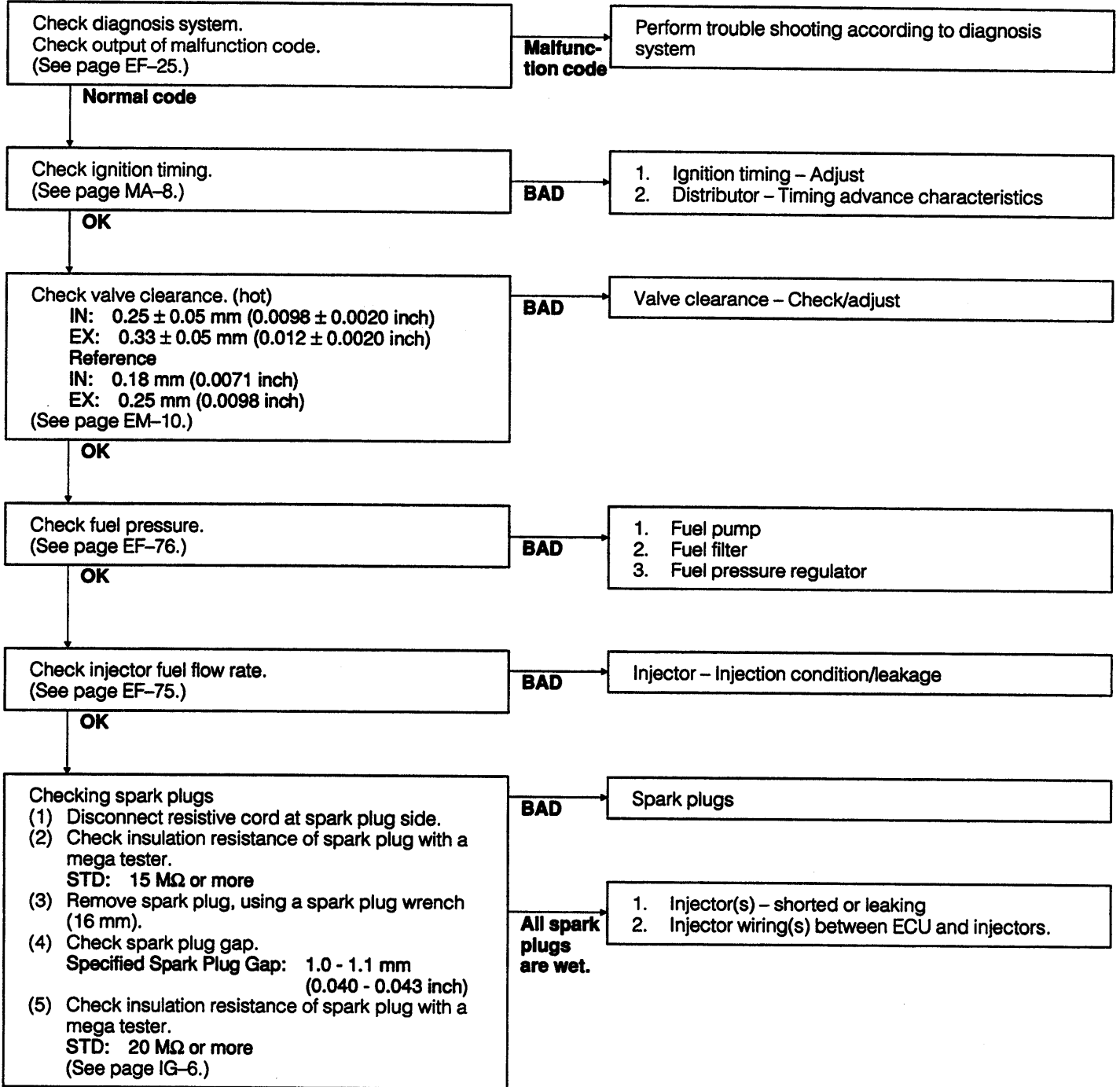
WN88E-EF038

9 Symptom .... Backfire (Lean fuel mixture)



WN88E-EF039

## 10 Symptom .... Afterfire (Rich mixture – Misfire)



WN88E-EF040

## DIAGNOSIS SYSTEM

### Description

A self diagnosis system is built in the ECU. If any abnormality should occur in the signal systems of the various sensors, the self diagnosis system memorizes the malfunction code in the ECU. In respect to important abnormalities, the check engine lamp at the instrument panel goes on, thus warning the driver of the abnormality.

When the abnormality is cleared, the check engine lamp goes out.

When the T terminal of the check terminal is shorted with the ground terminal, the code number of the malfunction code that has been memorized in the ECU will be indicated in a form of flashing of the check engine lamp in the instrument panel while the ignition key is turned ON.

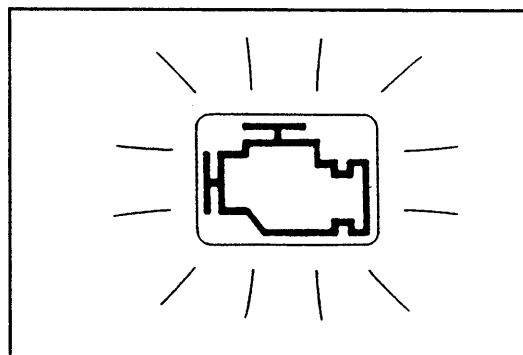
This memorized malfunction code number is erased when the battery ground cable is disconnected from the negative (-) terminal of the battery, or when the back-up fuse in the relay block assembly is disconnected with the ignition key switch turned OFF.

WN88E-EF041

### Check of "Check Engine" Warning Lamp

1. When the ignition switch is turned ON, the check engine lamp goes on.  
(Engine is under a stopped state.)  
If not, see page EF-29.
2. When the engine starts, the check engine lamp goes off.

If the check engine lamp remains illuminated, it indicates that the diagnosis system has detected system malfunctions.



WN88E-EF042

### Output of Diagnosis Codes

1. Initial conditions
  - (1) Battery voltage of 11 volts or more
  - (2) Throttle valve fully closed
  - (3) All accessory switches turned OFF
2. Short the Test terminal of the check terminal with the ground terminal, using the following SST.  
SST: 09991-87702-000

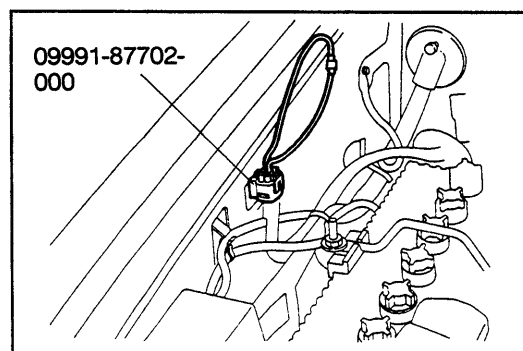
WN88E-EF043

#### NOTE:

The check terminal is located at the fender RH for L.H.D vehicles and the dash board left side for R.H.D vehicles.

#### CAUTION:

Care must be exercised to ensure that no connection is made on terminals except for those specified.



WN88E-EF044

3. Set the ignition switch to ON position. At this time, be careful not to start the engine.
4. Read the diagnosis code by observing the flashing number of the check engine lamp.

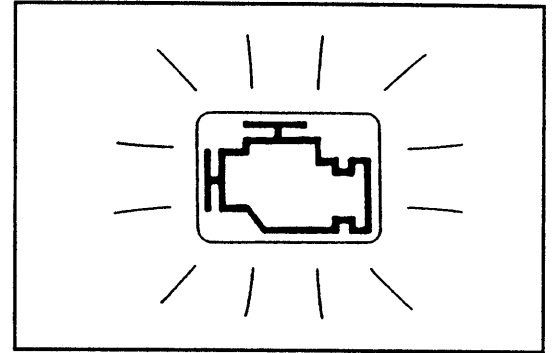
**NOTE:**

If the check engine lamp fails to flash, it is likely that the ECU is malfunctioning. Hence, proceed to inspection of diagnosis system circuit.

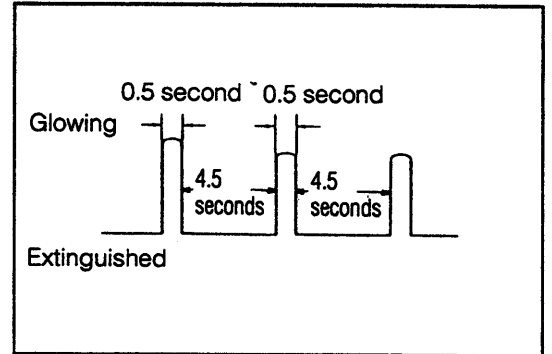
**Output form of diagnosis code**

- (1) Indication of normal code number  
(Code number 1 – normal function)

The check engine lamp glows for 0.5 second, 4.5 seconds later after the ignition key switch has been turned ON. After a lapse of 4.5 seconds, the check engine lamp again glows for 0.5 second. Then, this pattern will be repeated.



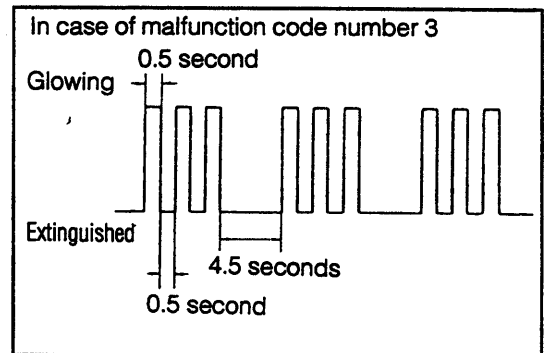
WN88E-EF045



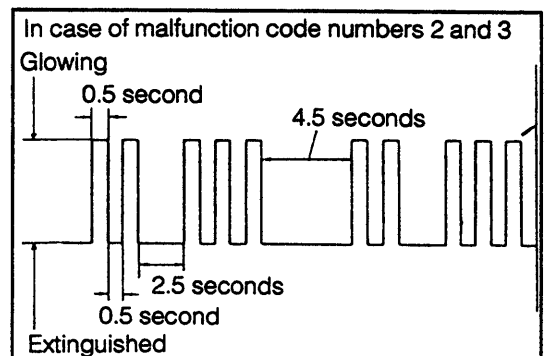
WN88E-EF046

- (2) Indication of malfunction code number

- When one malfunction code number is indicated:  
The check engine lamp repeats glowing the same times as the number of the malfunction code at intervals of 0.5 second, 4.5 seconds later after the ignition key switch is turned ON. After a lapse of 4.5 seconds, the check engine lamp again repeats glowing the same times as the number of the malfunction code at intervals of 0.5 second. Then, this pattern will be repeated.
- When plural malfunction code numbers are indicated:  
The check engine lamp repeats glowing the same times as the number of the first malfunction code at intervals of 0.5 second, 4.5 seconds later after the ignition key switch is turned ON. After a lapse of 2.5 seconds, the check engine lamp repeats glowing the same times as the number of the next malfunction code at intervals of 0.5 second.  
The memorized code numbers are indicated in the sequence of code number, starting from a smaller number.  
The indication of the malfunction codes is repeated 4.5 seconds later after the memorized code numbers have been indicated.



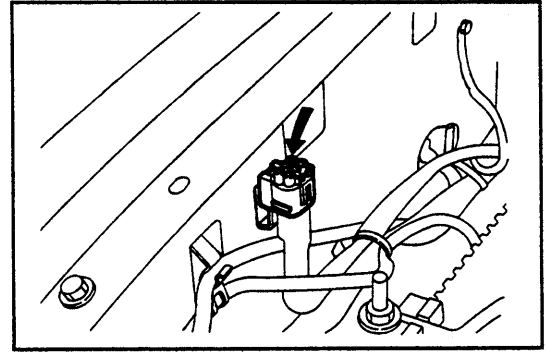
WN88E-EF047



WN88E-EF048



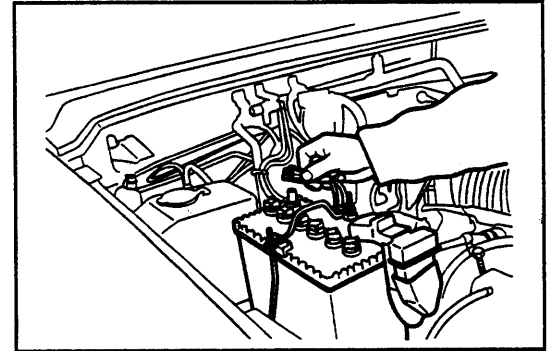
5. After the diagnosis codes have been read, remove the SST from the check terminal.
6. Install the cap on the check terminal.



WN88E-EF049

**Cancelling Diagnosis Code**

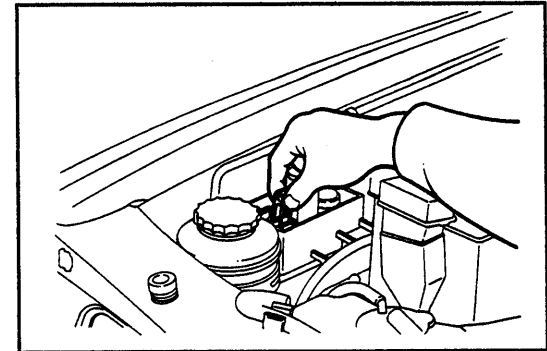
To erase the diagnosis codes memorized in the ECU after malfunctions have been repaired, disconnect the battery ground cable from the negative (-) terminal of the battery. Or disconnect the back-up fuse of the relay block assembly in the engine compartment for at least 10 seconds with the ignition switch turned OFF. (The ambient temperature should be below 20°C (68°F).)



WN88E-EF050

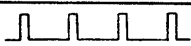

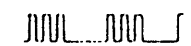







**NOTE:**

When disconnecting the fuse, be sure to use a fuse puller. The fuse puller is located at the upper section of the fuse block in the vehicle interior.

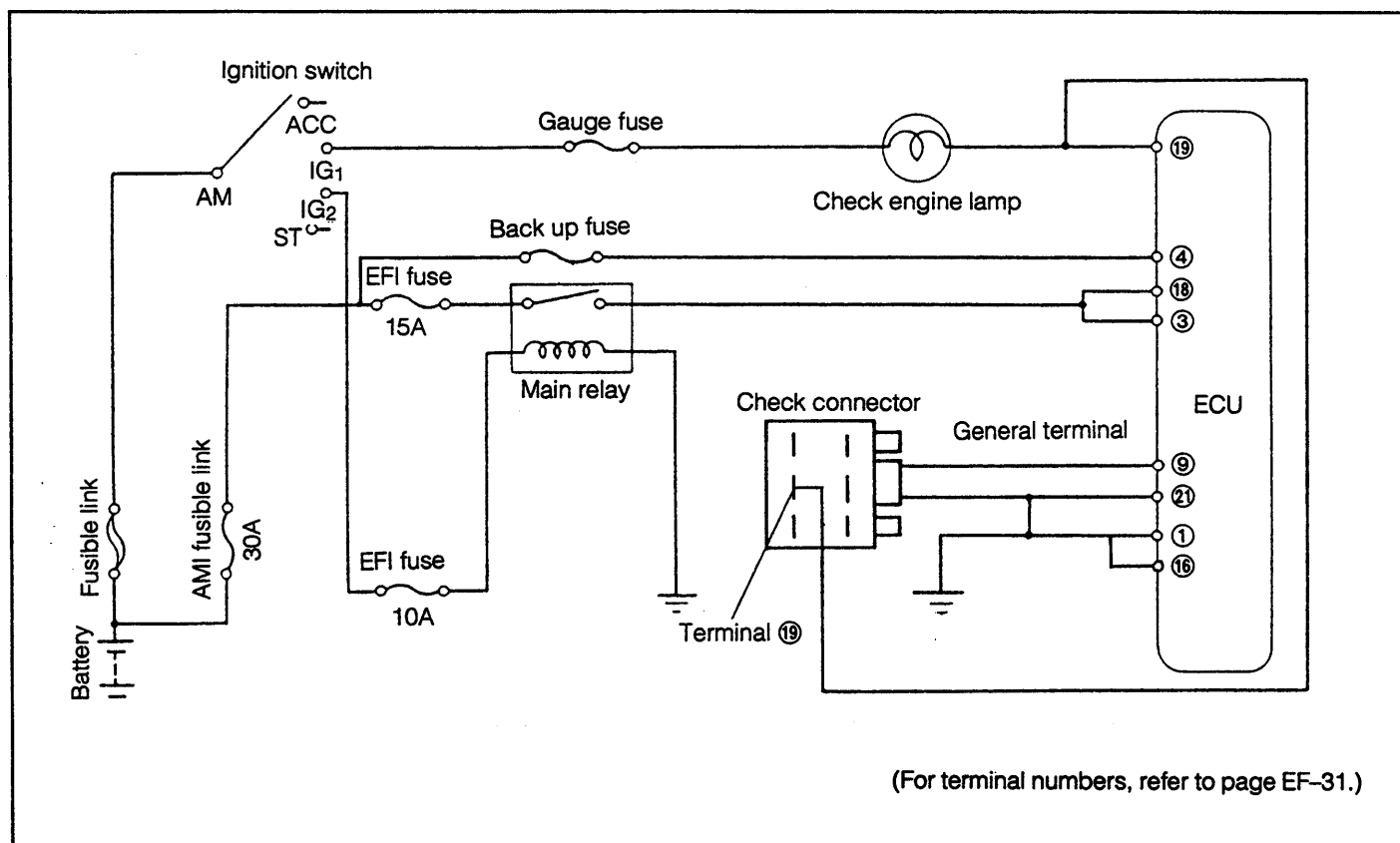


WN88E-EF051

## DIAGNOSIS CODE

Code No.	Number of glowing of check engine lamp	Diagnosis item	Diagnosis contents	Trouble area	See page
1		Normal	—	—	—
2		Pressure sensor	When the signal from pressure sensor becomes open or shorted.	<ol style="list-style-type: none"> <li>1. Pressure sensor circuit</li> <li>2. Pressure sensor</li> <li>3. ECU</li> </ol>	EF-36
3		Ignition signal	When the ignition signal fails to be inputted.	<ol style="list-style-type: none"> <li>1. Ignition circuit</li> <li>2. Ignitor and/or distributor</li> <li>3. ECU</li> </ol>	EF-38
4		Water temperature sensor	When the signal from the water temperature sensor becomes open or shorted.	<ol style="list-style-type: none"> <li>1. Water temperature sensor circuit</li> <li>2. Water temperature sensor</li> <li>3. ECU</li> </ol>	EF-39
5		Oxygen sensor signal and/or abnormal air-to-fuel ratio	<ul style="list-style-type: none"> <li>• When the signal from oxygen sensor becomes open or shorted under certain conditions</li> <li>• When air-to-fuel ratio becomes too lean abnormally:</li> </ul>	<ol style="list-style-type: none"> <li>1. Oxygen sensor circuit</li> <li>2. Oxygen sensor</li> <li>3. ECU</li> <li>4. Fuel system</li> <li>5. Pressure sensor</li> </ol>	EF-40 EF-64
7		Throttle position sensor signal	<ul style="list-style-type: none"> <li>• When both idle switch and power switch enter "ON" conditions:</li> </ul>	<ol style="list-style-type: none"> <li>1. Throttle position sensor circuit</li> <li>2. Throttle position sensor</li> <li>3. ECU</li> </ol>	EF-41
8		Intake air temperature sensor signal	<ul style="list-style-type: none"> <li>• When the signal from the intake air temperature sensor becomes open or shorted.</li> </ul>	<ol style="list-style-type: none"> <li>1. Air temperature sensor circuit</li> <li>2. Air temperature sensor</li> <li>3. ECU</li> </ol>	EF-42
9		Vehicle speed sensor signal	<ul style="list-style-type: none"> <li>• When the vehicle speed sensor signal becomes open or shorted under certain conditions</li> </ul>	<ol style="list-style-type: none"> <li>1. Vehicle speed sensor circuit</li> <li>2. Vehicle speed sensor</li> <li>3. ECU</li> </ol>	EF-43
10		Starter signal	When the starter signal becomes open or shorted: However, it should be noted that this code may be memorized when the vehicle is started by being pushed.	<ol style="list-style-type: none"> <li>1. Starter signal circuit</li> <li>2. ECU</li> </ol>	EF-44
11		Switch signal	<p>When even if one of the following conditions is satisfied with the test terminal shorted with ground terminal:</p> <ul style="list-style-type: none"> <li>• when the idle switch is turned OFF</li> <li>• when the air condition switch is turned ON</li> </ul> <p>However, no memorizing will take place.</p>	<ol style="list-style-type: none"> <li>1. Air conditioner switch circuit</li> <li>2. Idle switch circuit</li> <li>3. Air conditioner switch</li> <li>4. Throttle position sensor (idle switch)</li> <li>5. ECU</li> </ol>	EF-45

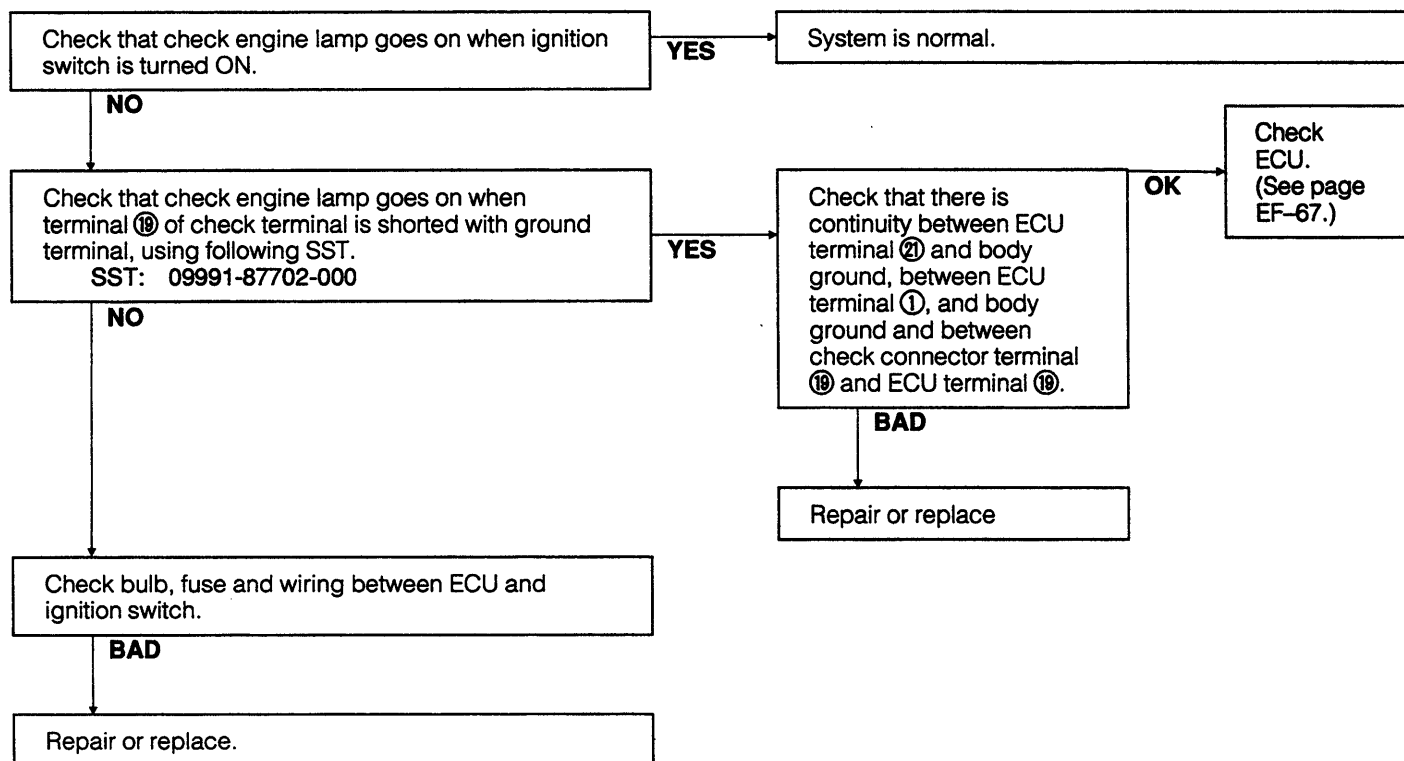
Inspection of Diagnosis System Circuit



WN88E-EF053

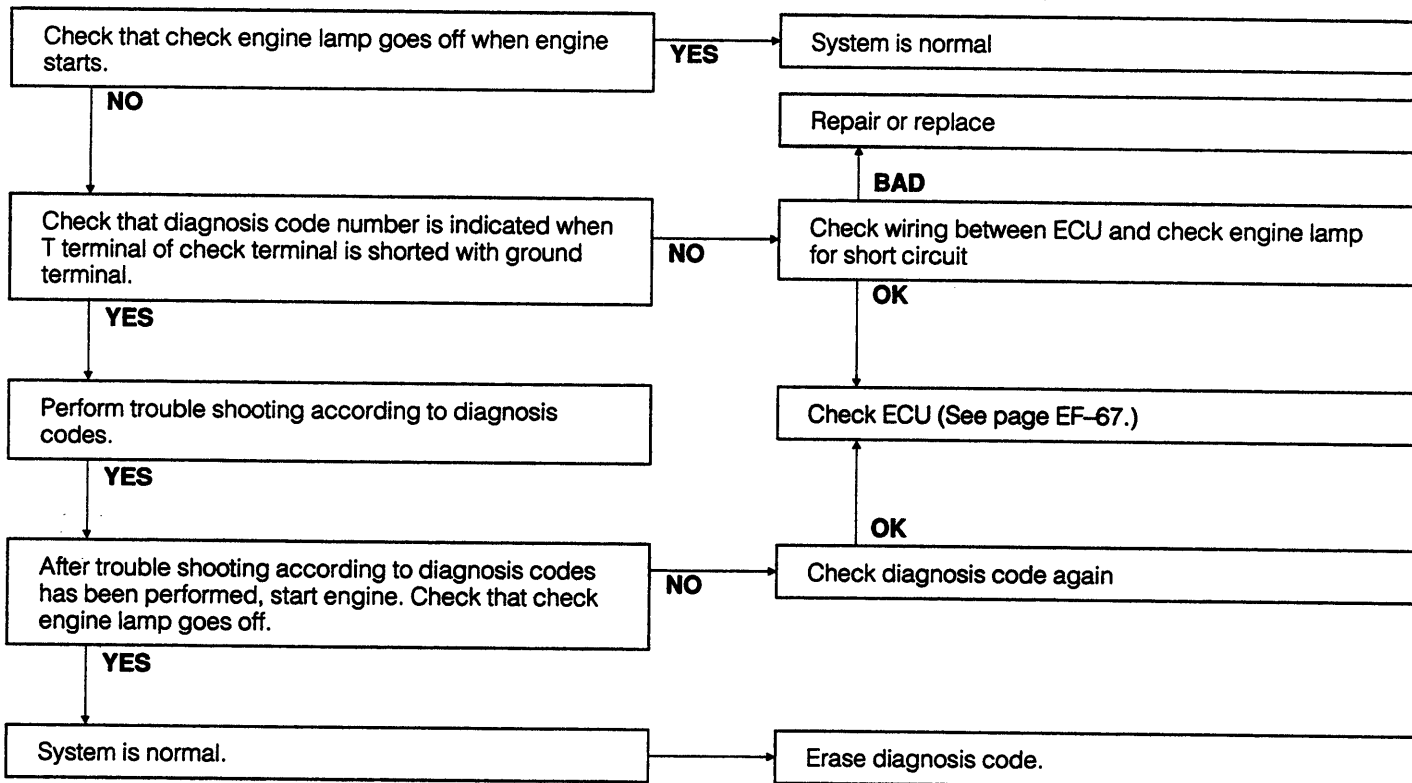
If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

1



WN88E-EF054

2



WN88E-EF055

## TROUBLE SHOOTING WITH VOLT/OHMMETER

### Preparation of Trouble Shooting

1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Remove the ECU cover.
3. Install the SST between the ECU and the engine harness.  
SST: 09842-87701-000

#### NOTE:

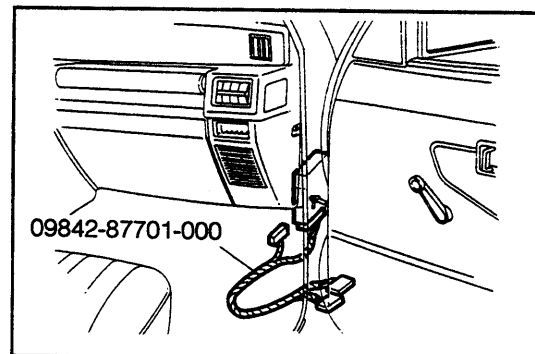
As for the SST, before it is connected, make sure that there is no open circuit or short between its terminal.

4. Reconnect the battery ground cable to the negative (-) terminal of the battery.

#### CAUTION:

After completion of the inspection, before the SST is removed, be sure to disconnect the battery ground cable from the negative (-) battery terminal.

After the ECU and engine harness have been connected, reconnect the battery ground cable to the negative (-) battery terminal.



WN88E-EF056

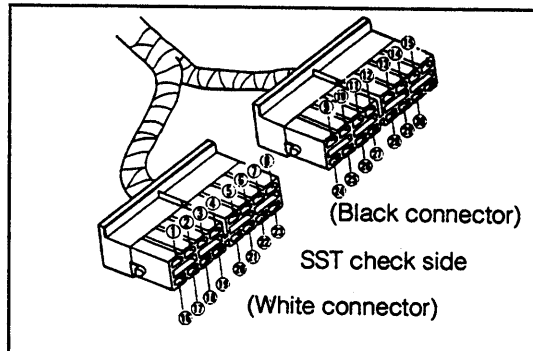
**Check Procedure for EFI System**

**NOTE:**

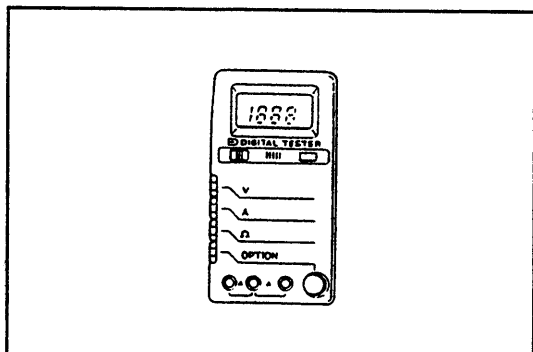
1. The EFI circuit can be checked by measuring the resistance and voltage at the SST terminals.
2. The voltage check should be conducted under a condition where all connectors are connected.
  
3. Make sure that the battery voltage is 11 volts or more when the ignition switch is turned ON.
- For the check, use such a voltmeter (circuit tester) whose internal impedance is 10 kΩ/V or more.  
Furthermore, be sure to employ a meter whose resolution is 0.1V or more, 0.5Ω or more and whose accuracy is ±2% or more.

**NOTE:**

If any problem is encountered during this check, see the section under "Trouble Shooting for EFI Electronic Circuit with Volt/Ohmmeter."



WN88E-EF057

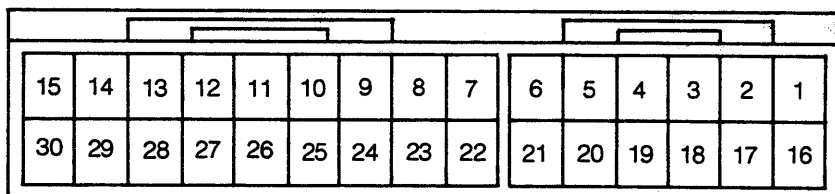


WN88E-EF058

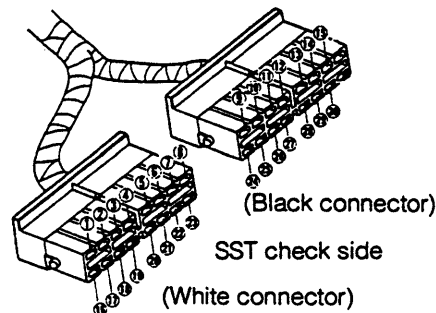
**ECU CONNECTORS**

No.	Contents of connection	No.	Contents of connection
1	Power ground	15	Cooling water temperature sensor
2	Injector	16	Power ground
3	Battery +B (Main relay)	17	Injector
4	Battery +B (Back-up)	18	Battery +B (Main relay)
5	Idle-up VSV	19	Check engine lamp
6	Feedback check terminal	20	Fuel pump relay
7	Ignition coil (negative)	21	Engine ground
8	Starter switch	22	Pressure sensor ground
9	Test terminal	23	Air conditioner magnet clutch
10	Idle switch	26	Vehicle speed sensor
11	Electric load signal	28	Power switch
12	Sensor power supply	29	Oxygen sensor
13	Pressure sensor	30	Sensor ground
14	Intake air temperature sensor		

WN88E-EF059



ECU side



## Voltage at ECU Wiring Connectors

No.	Terminal code (SST terminal)	STD voltage (V)	Conditions		See page
1	④ - ⑳ Negative	10 - 15	All time		EF-34
	⑨ - ⑳		Ignition switch ON		EF-34
	⑱ - ⑳		Ignition switch ON		EF-34
2	⑫ - ㉔	4.5 - 5.5	Ignition switch ON		EF-36
	⑬ - ㉔	3.2 - 3.8	Ignition switch ON	When atmospheric pressure is 760 mmHg (29.9 inchHg)	EF-36
3	⑦ - ㉔	10 - 15	Ignition switch ON		EF-38
4	⑮ - ㉔	0.40 - 0.55	Ignition switch ON	After engine has fully warmed up Cooling water temperature: 80 - 90°C (176 - 194°F)	EF-39
5	㉔ - ㉔	Voltage changes more than 8 times within 10 seconds	Ignition switch ON	When engine speed is held at 3000 rpm for two minutes after engine has fully warmed up:	EF-40
7	㉔ - ㉔	4.5 - 5.5	Ignition switch ON	Throttle valve fully closed	EF-41
		1.0 or less	Ignition switch ON	Throttle valve fully opened	
8	⑭ - ㉔	0.9 - 3.0	Ignition switch ON	Air temperature inside surge tank: 20°C (68°F)	EF-42
9	㉔ - ㉔	0 - 10 to 15	Ignition switch ON	When vehicle is moved: (Voltage changes 4 times while vehicle moves 1.5m)	EF-43
10	⑧ - ㉔	6 - 15	When ignition switch is set to ST position:		EF-44
11	㉔ - ㉔	10 - 15	Ignition switch ON	When engine rotating, air conditioner switch turned ON and compressor operating:	EF-45
	⑩ - ㉔	1.0 or less	Ignition switch ON	Throttle valve fully closed	EF-45
		10 - 15	Ignition switch ON	Throttle valve fully opened	EF-45

# TROUBLE SHOOTING

## EFI ELECTRONIC CIRCUIT WITH VOLT/OHMMETER

**NOTE:**

The trouble shooting procedures described in this section are ones designed for the inspection for each system. Hence, they may differ from actual trouble shooting procedure.

However, it is advisable that the basic approach to trouble shooting is based on the procedure described in this manual.

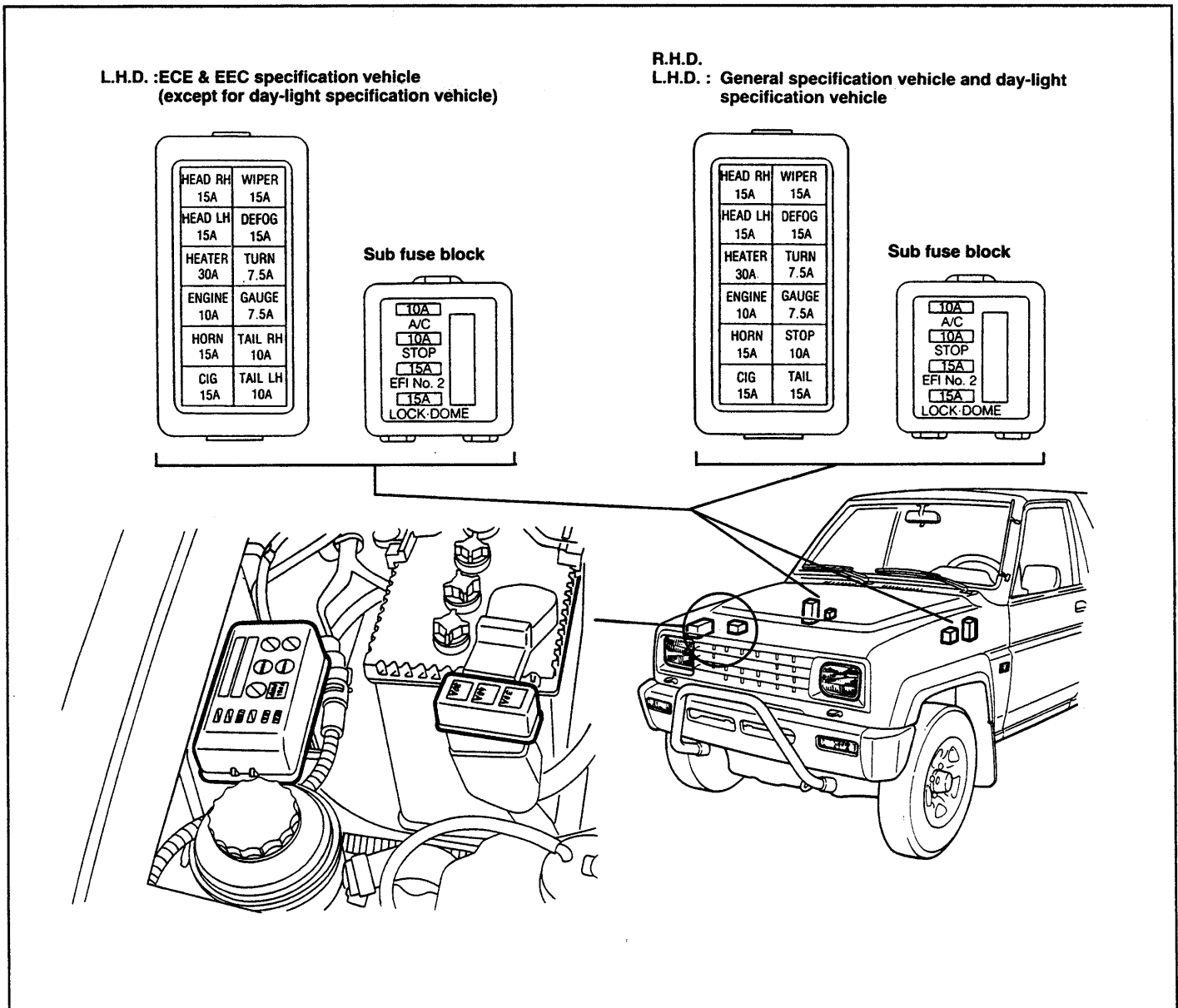
Before you start the inspection, it is a best practice to first make simple checks of the fuses, fusible links and conditions of the connectors.

The following trouble shooting procedure has been prepared on the assumption that troubles are caused by short circuit or open circuits of external components of the computer or short circuits inside the computer.

If engine malfunctions persist even when the terminal voltages of the ECU connectors are normal, the ECU may be faulty. Try the trouble shooting using a new ECU.

However, even when the trouble is solved after the ECU has been replaced, it is imperative to confirm that the trouble was actually attributed to the old ECU by installing the old ECU again.

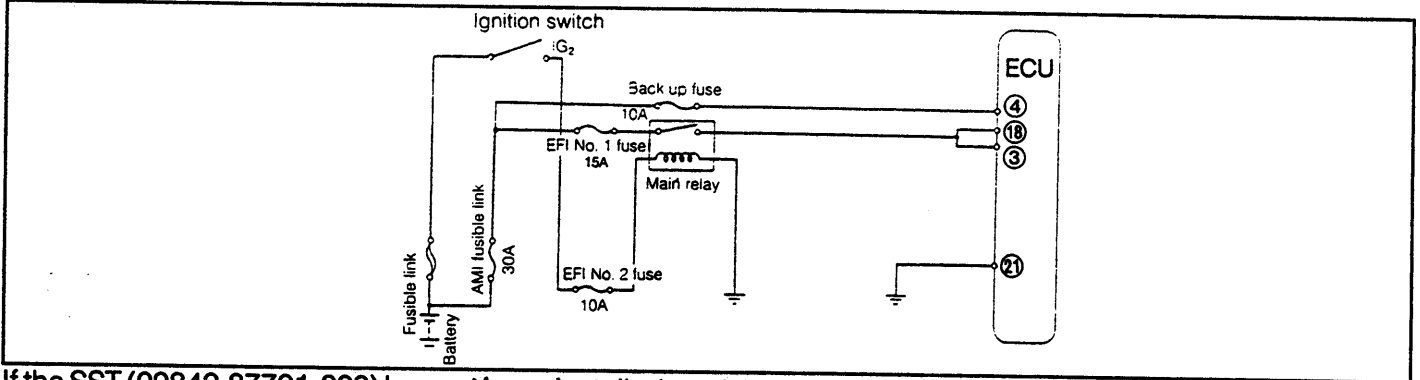
When you perform the inspection of wirings, refer the Wiring Diagram.



# EFI SYSTEM

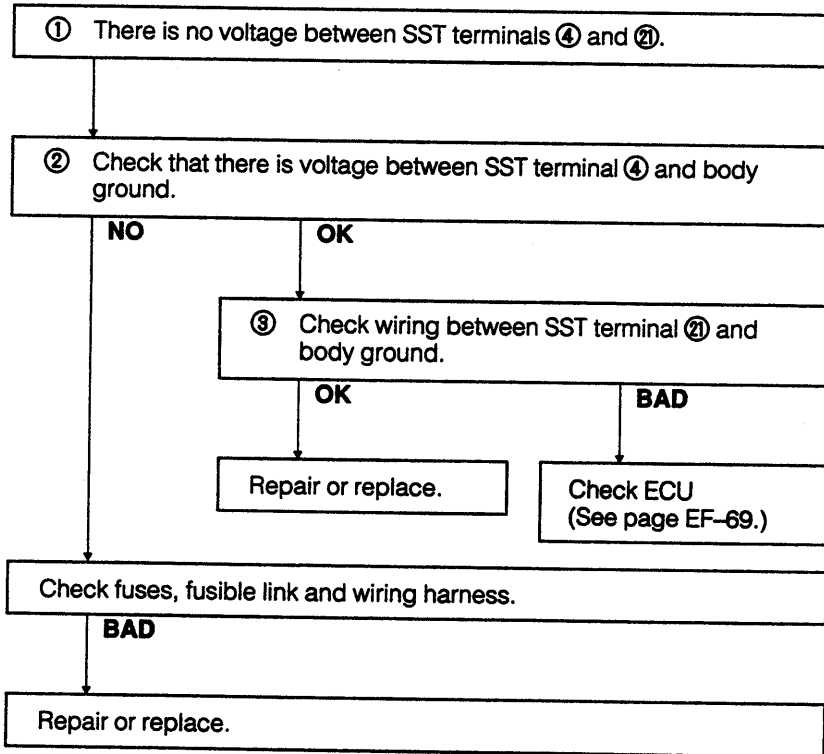
No.	Terminals	Trouble	Conditions	STD voltage
1	④ - ②①	No voltage	At all times (But, voltage drops during engine starting period.)	10 - 15
	③ - ②①	No voltage	Ignition switch ON	10 - 15
	⑩ - ②①			

WN88E-EF062

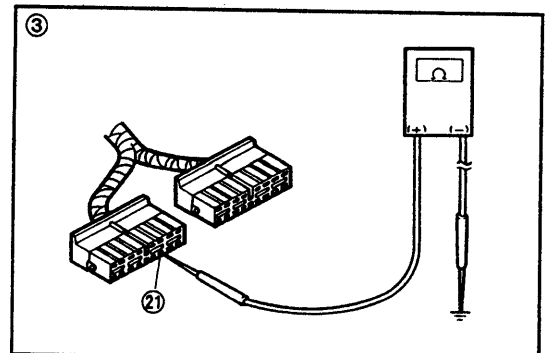
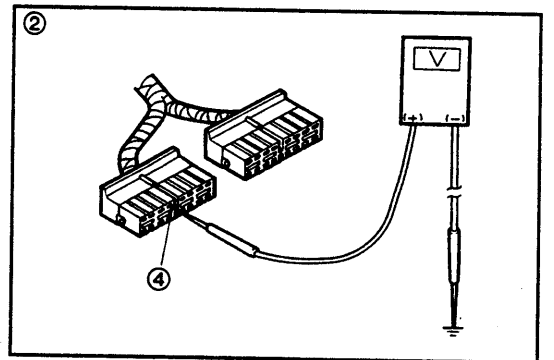
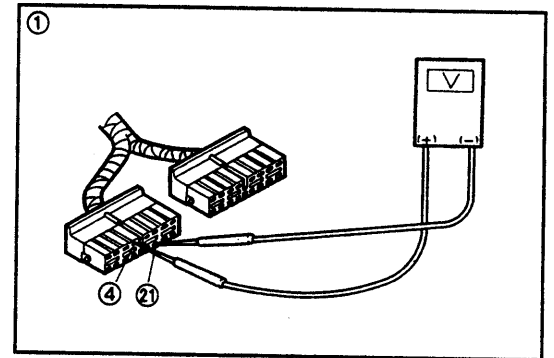


If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

• ④ - ②①



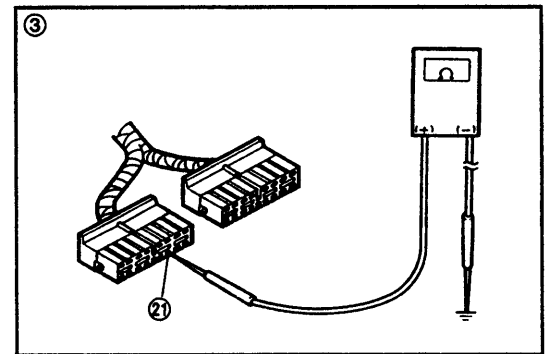
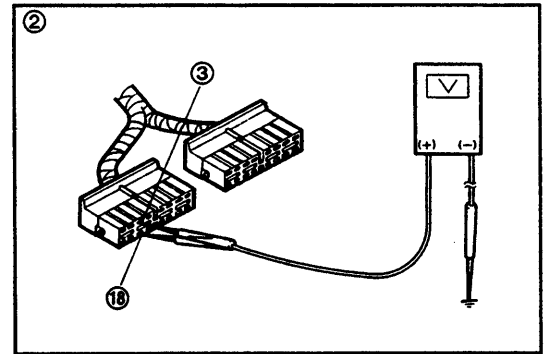
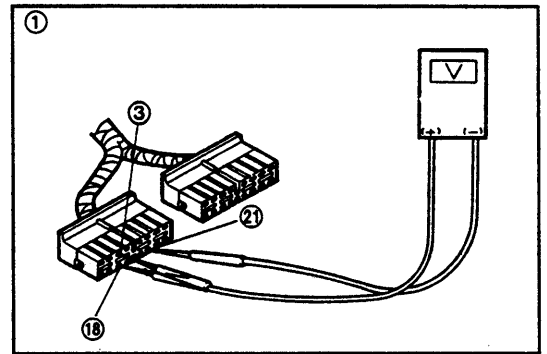
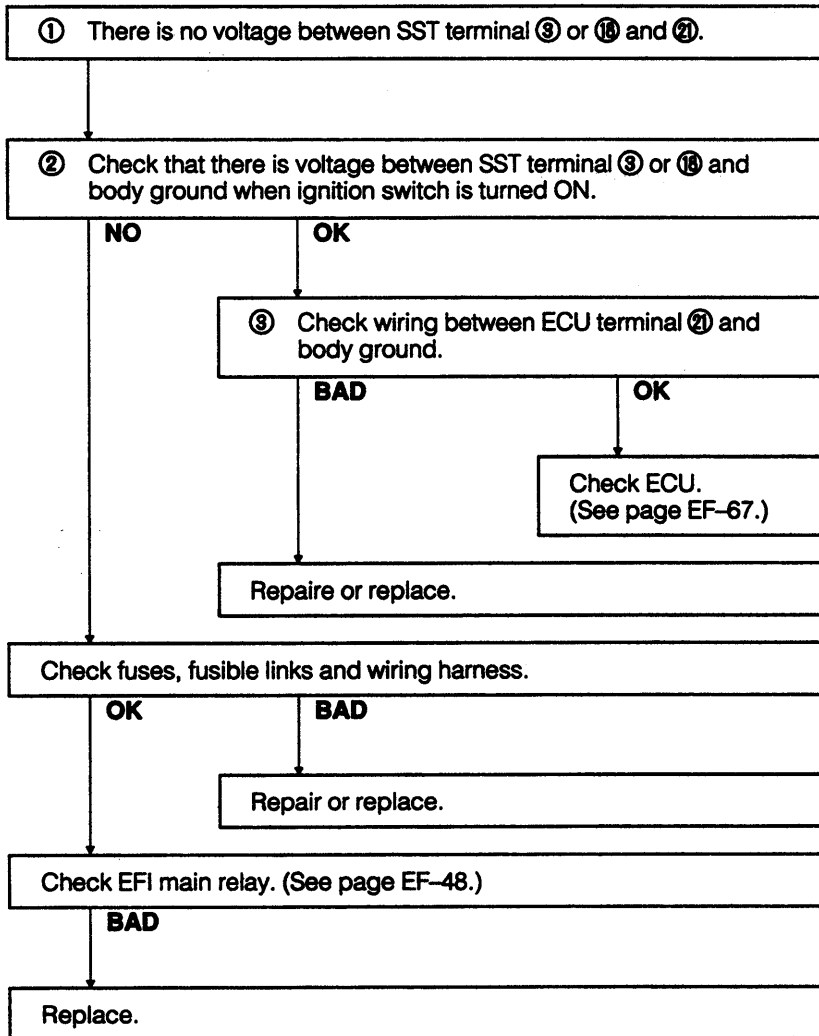
WN88E-EF063



WN88E-EF064



• ③ or ⑬ - ⑳

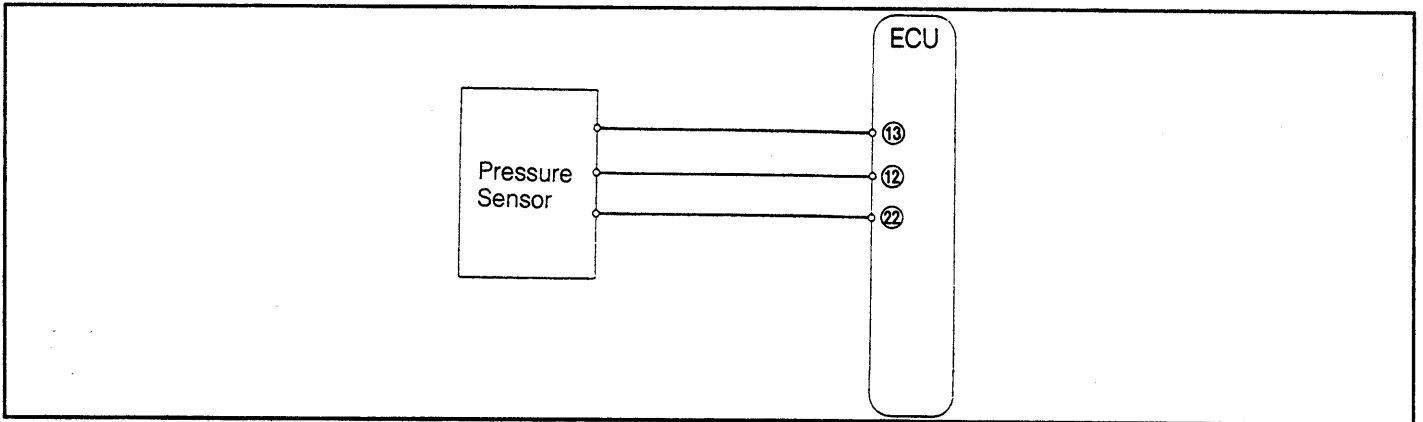


WN88E-EF065

# EFI SYSTEM

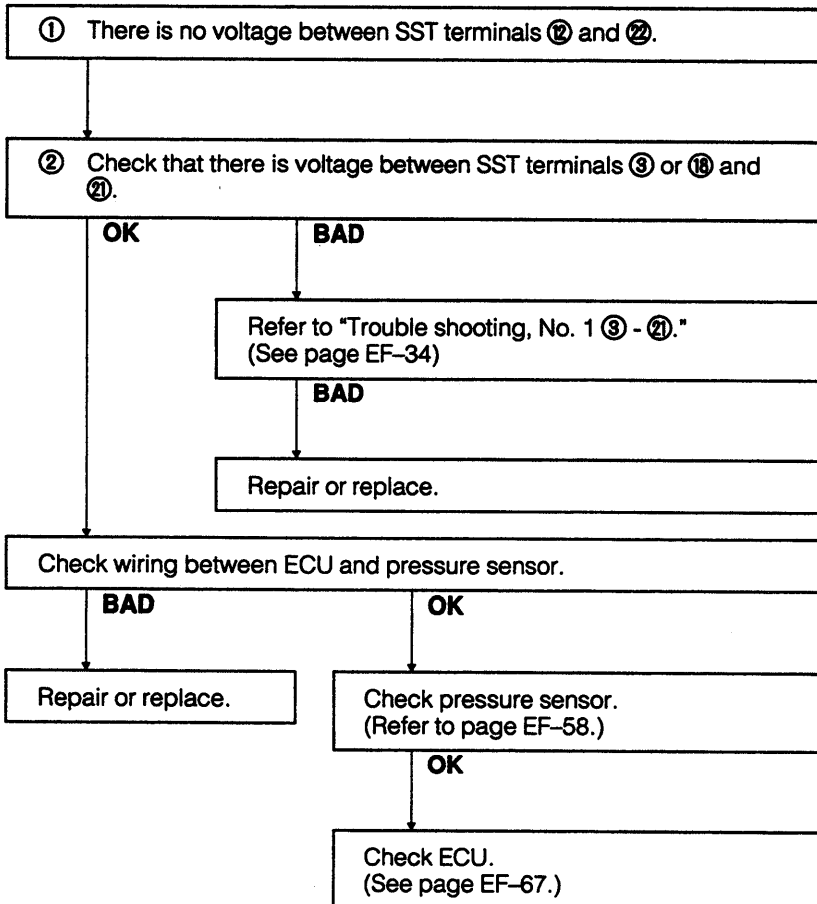
No.	Terminals	Trouble	Conditions	STD voltage
2	⑫ - ⑳	No voltage	Ignition switch ON	4.5 - 5.5
	⑬ - ⑳		Ignition switch ON At time of atmospheric pressure of 760 mmHg	3.2 - 3.8

WN88E-EF066

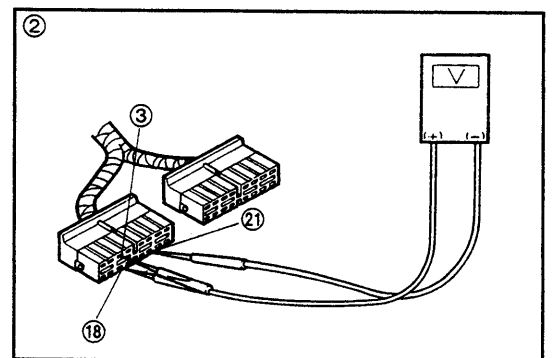
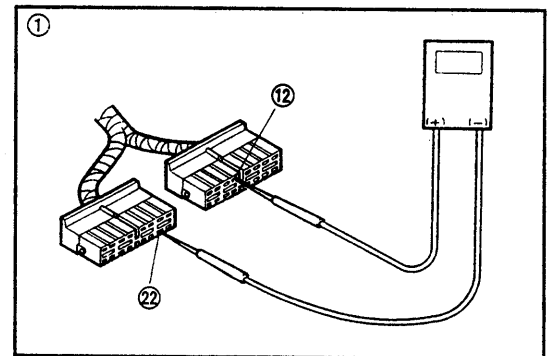


If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

• ⑫ - ⑳

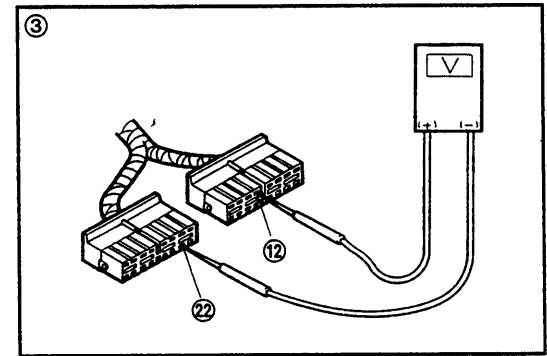
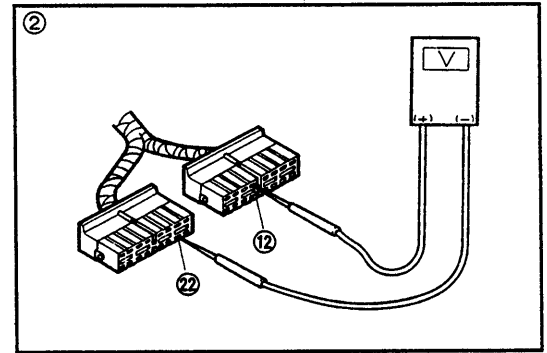
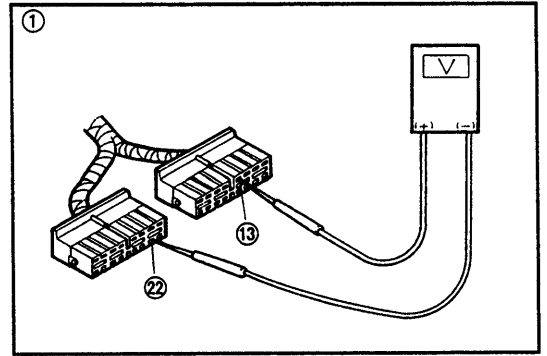
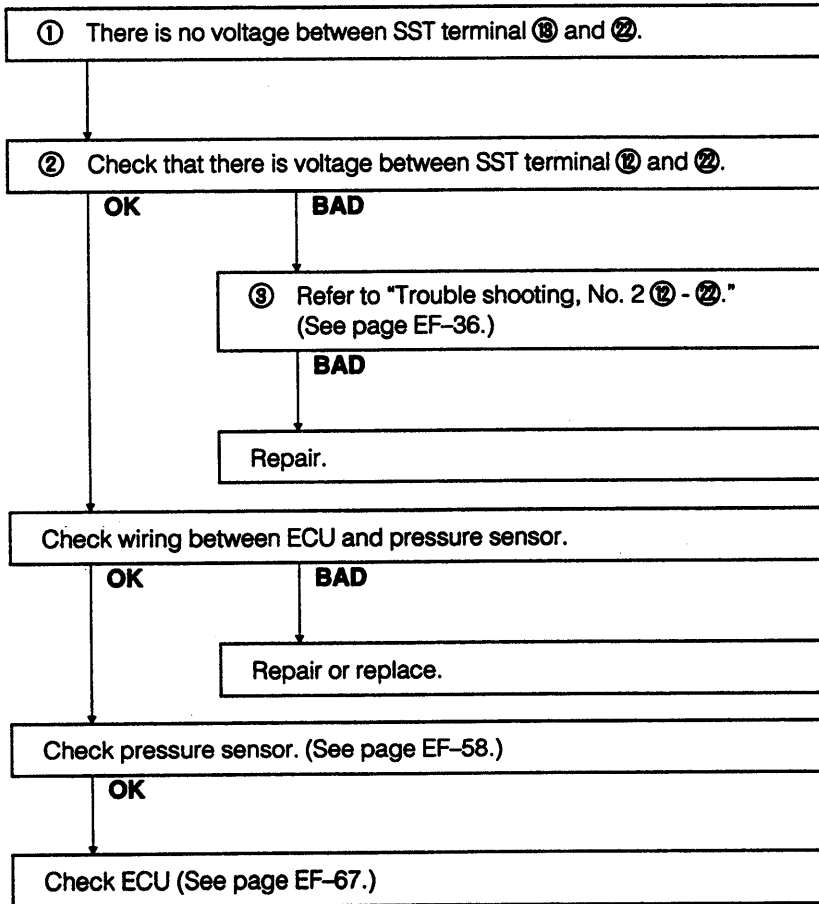


WN88E-EF067



WN88E-EF068

• 13 - 22

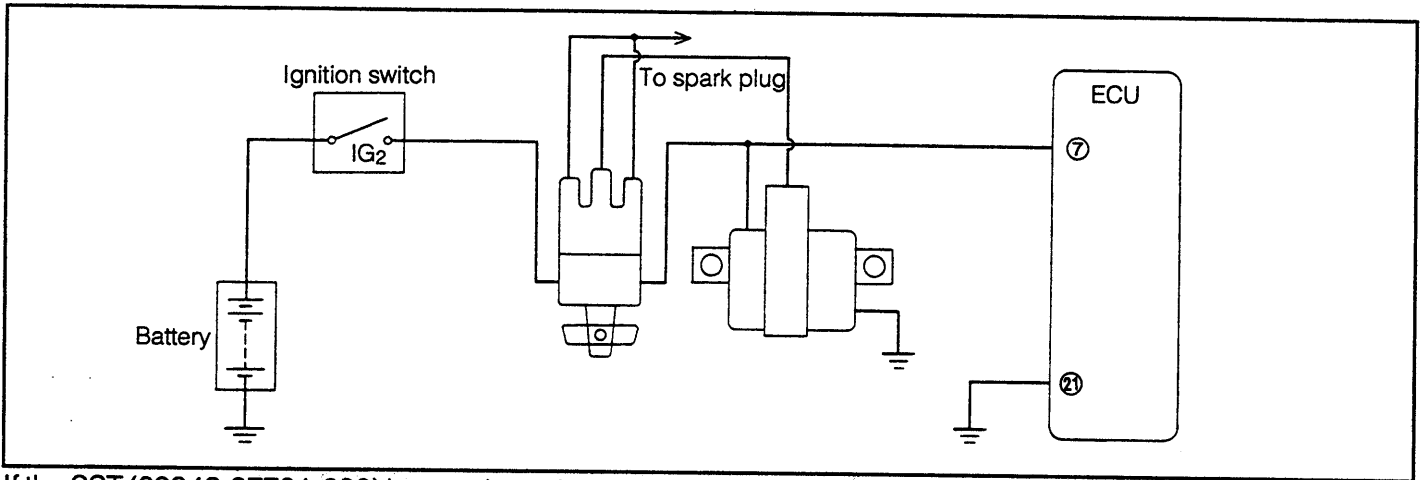


WN88E-EF069

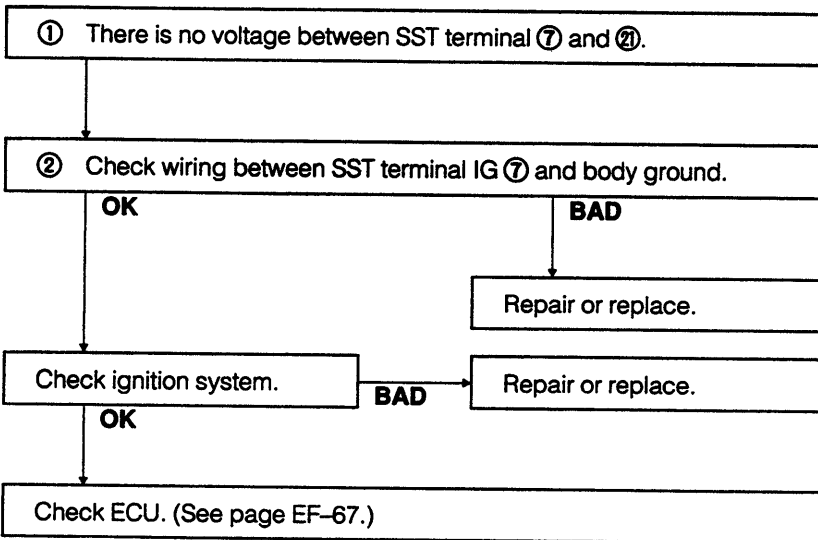
# EFI SYSTEM

No.	Terminals	Trouble	Conditions	STD voltage
3	⑦ - ⑳ Ground	No voltage	Ignition switch ON	10 - 15

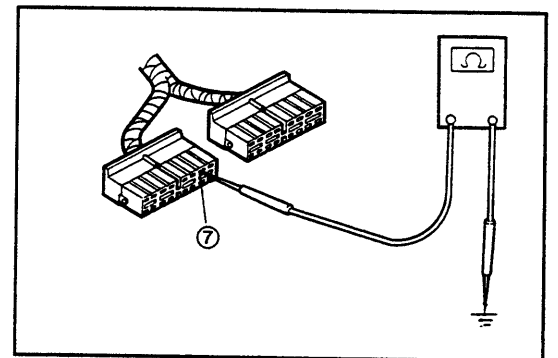
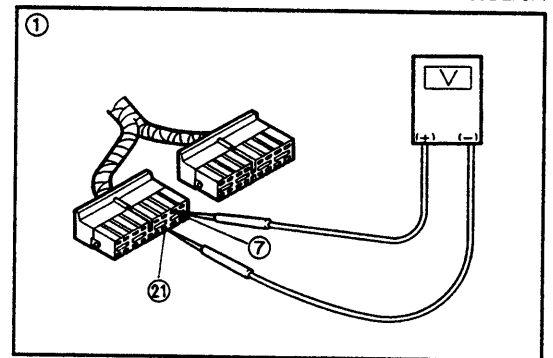
WN88E-EF070



If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.



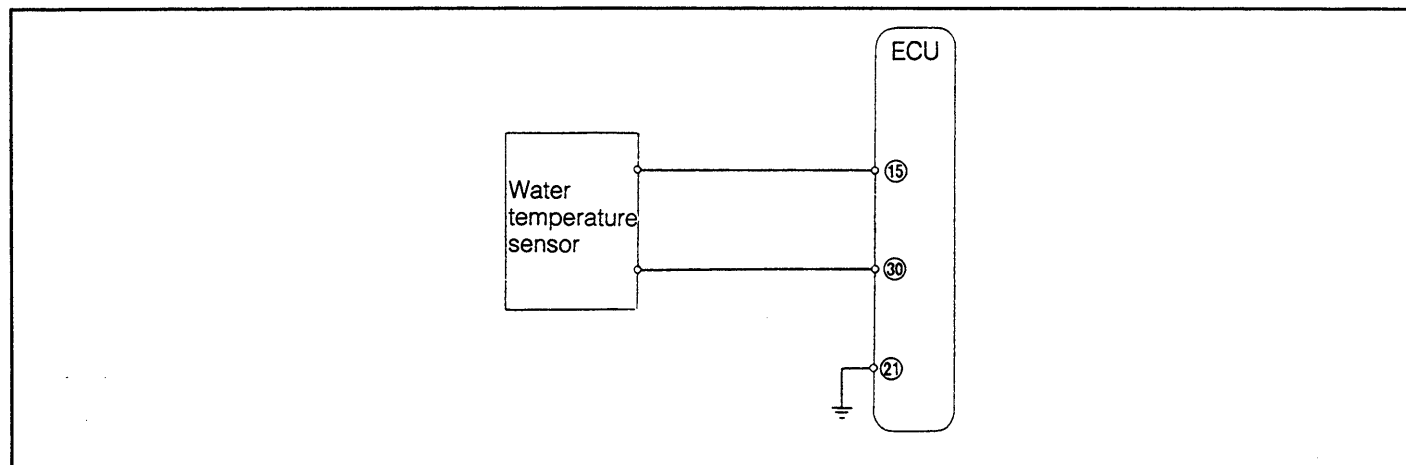
WN88E-EF071



WN88E-EF072

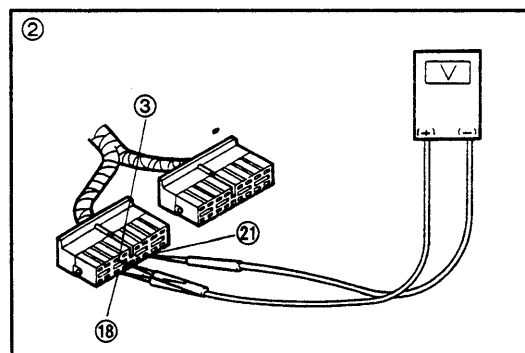
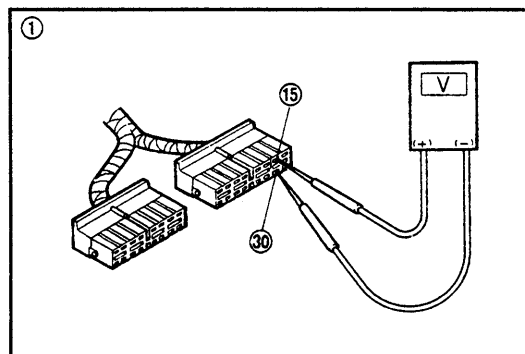
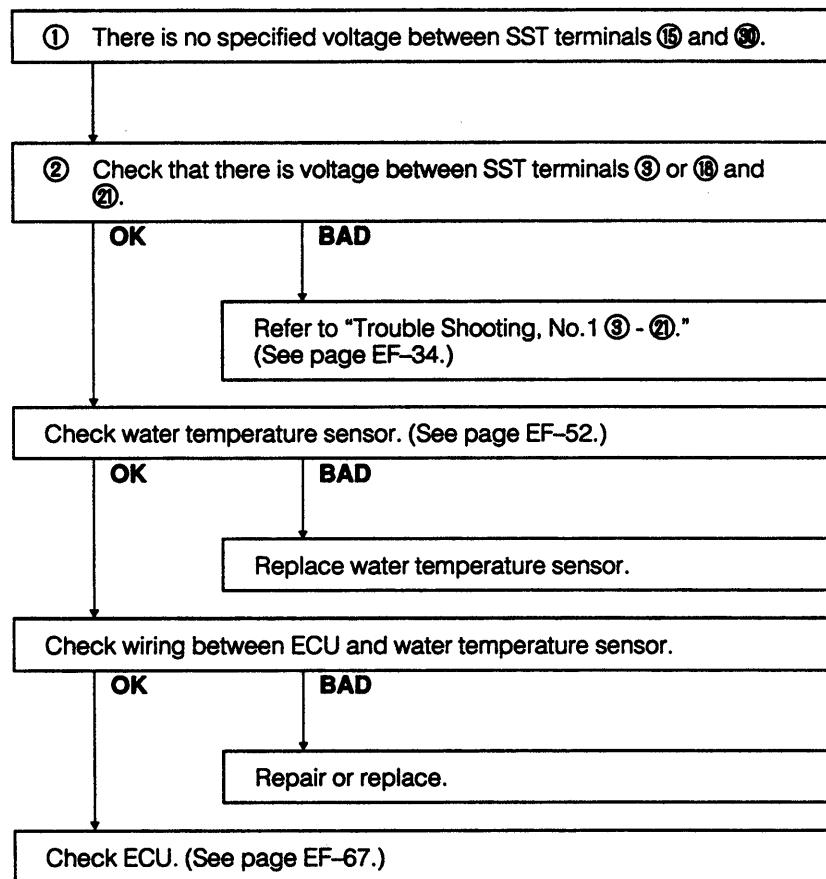
No.	Terminals	Trouble	Conditions		STD voltage
4	15 - 30	No voltage	Ignition switch ON	Coolant temperature 80 - 90°C (176 - 194°F)	0.40 - 0.55

WN88E-EF073



If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

WN88E-EF074

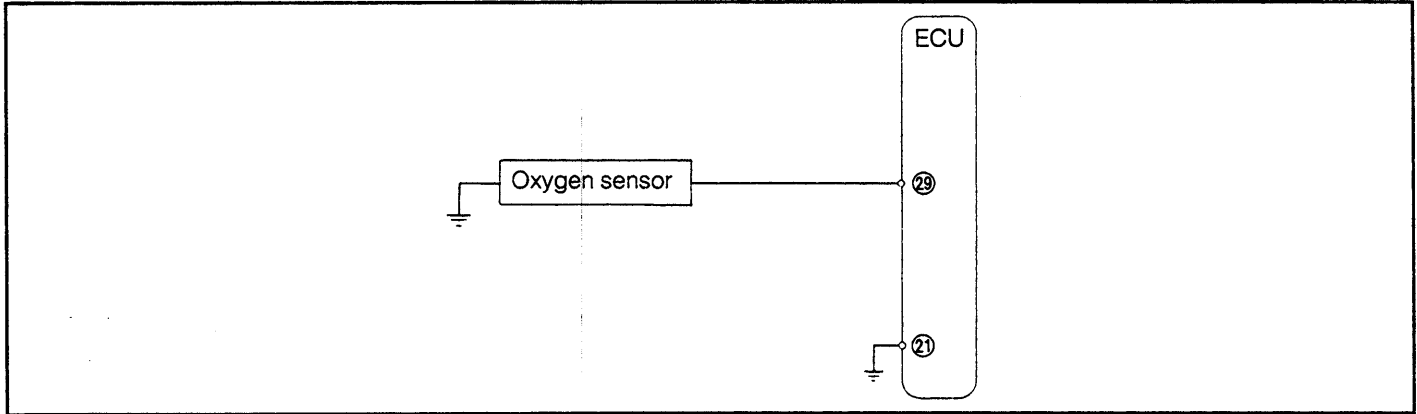


WN88E-EF075

# EFI SYSTEM

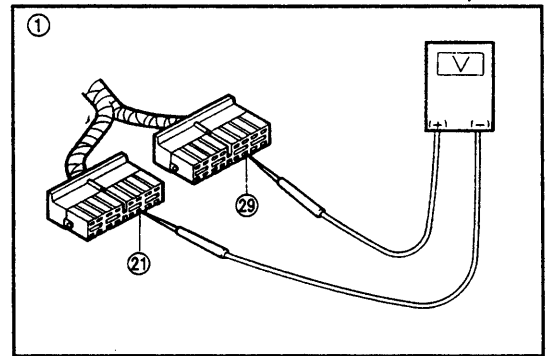
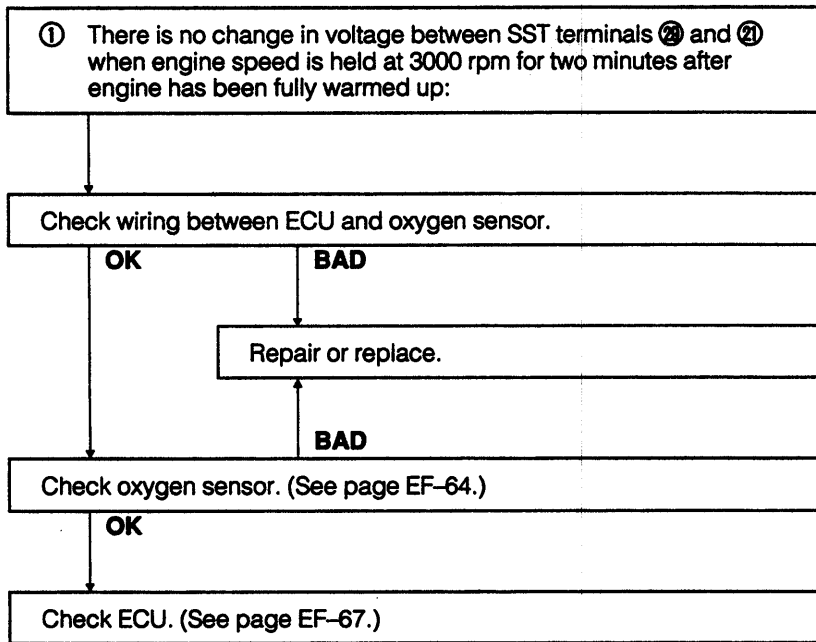
No.	Terminals	Trouble	Conditions		STD voltage
5	⑳ - ㉑	No voltage changes	Ignition switch ON	When engine speed is held at 3000 rpm for two minutes after engine has been fully warmed up:	Voltage changes more than 8 times within 10 seconds.

WN88E-EF076



If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

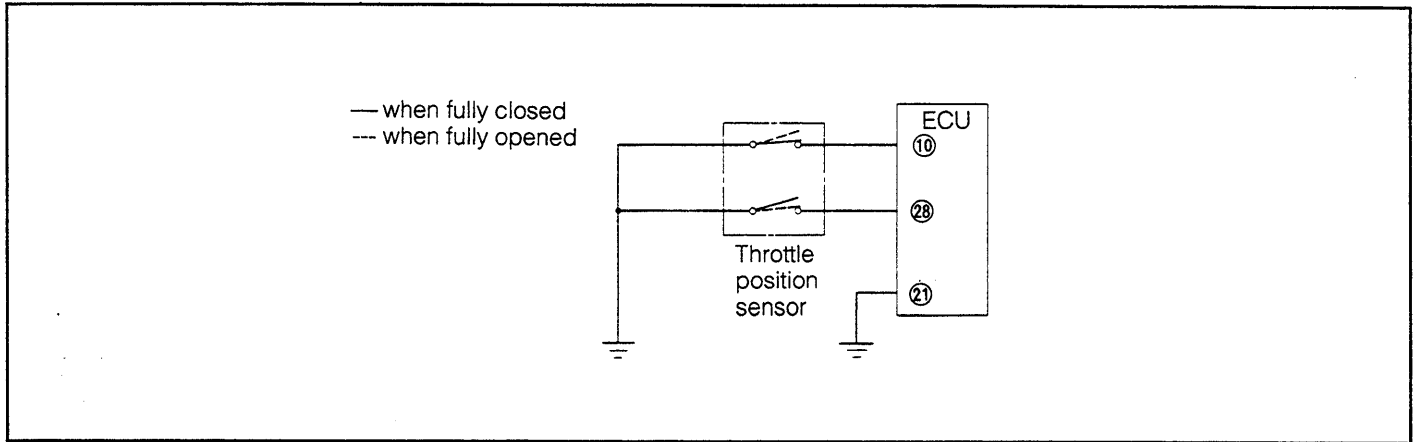
WN88E-EF077



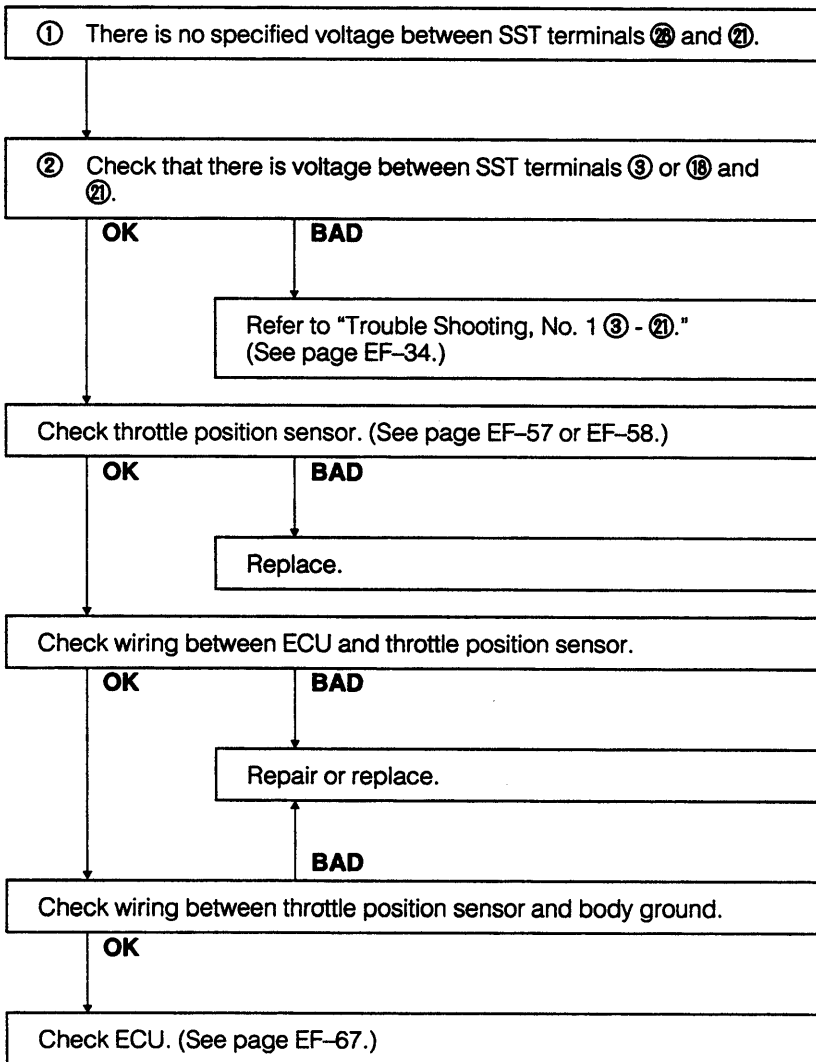
WN88E-EF078

No.	Terminals	Trouble	Conditions		STD voltage
7	⑳ - ㉑	No voltage	Ignition switch ON	Throttle valve fully closed	4.5 - 5.5
		1.0V or more	Ignition switch ON	Throttle valve fully opened	1.0 or less

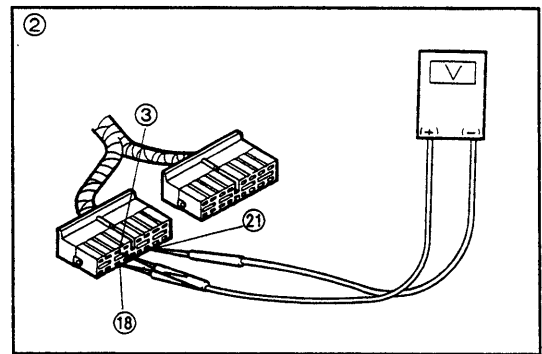
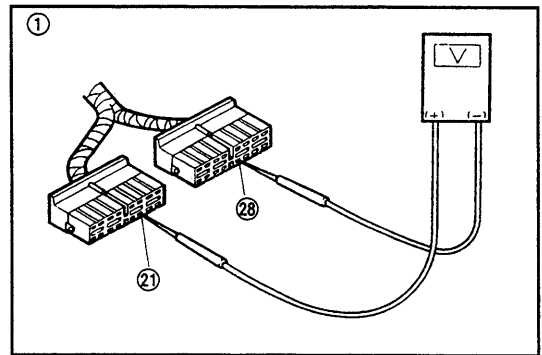
WN88E-EF079



If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.



WN88E-EF080

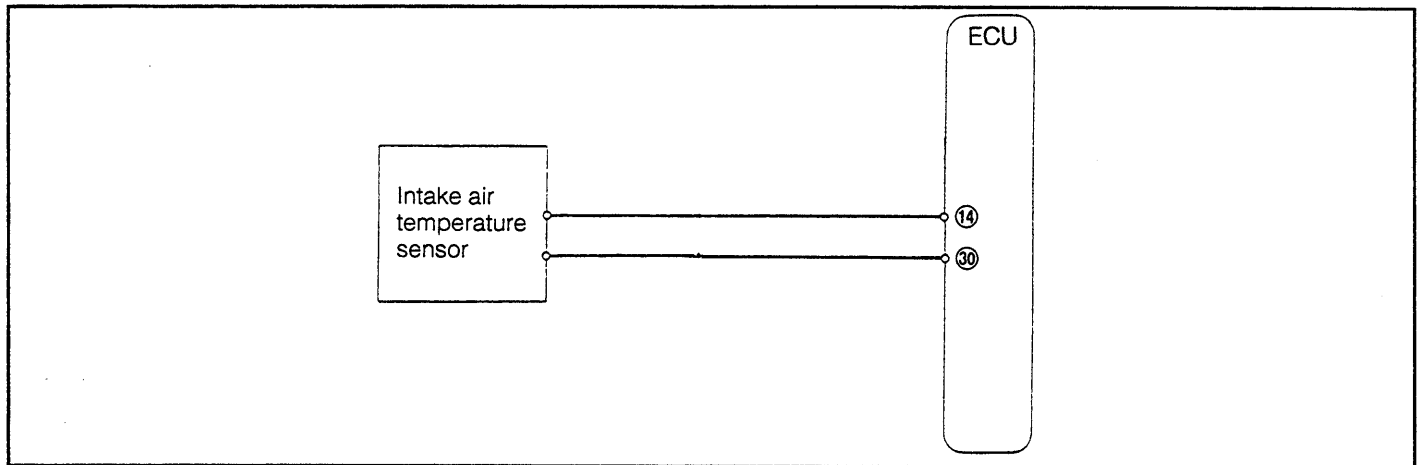


WN88E-EF081

# EFI SYSTEM

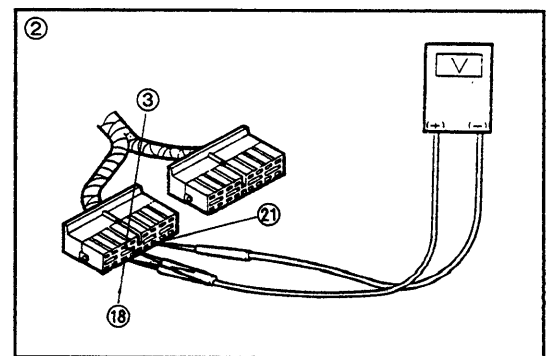
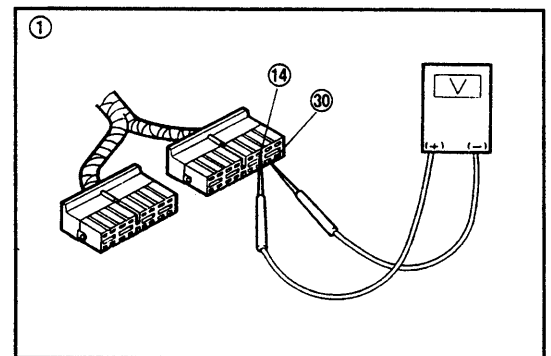
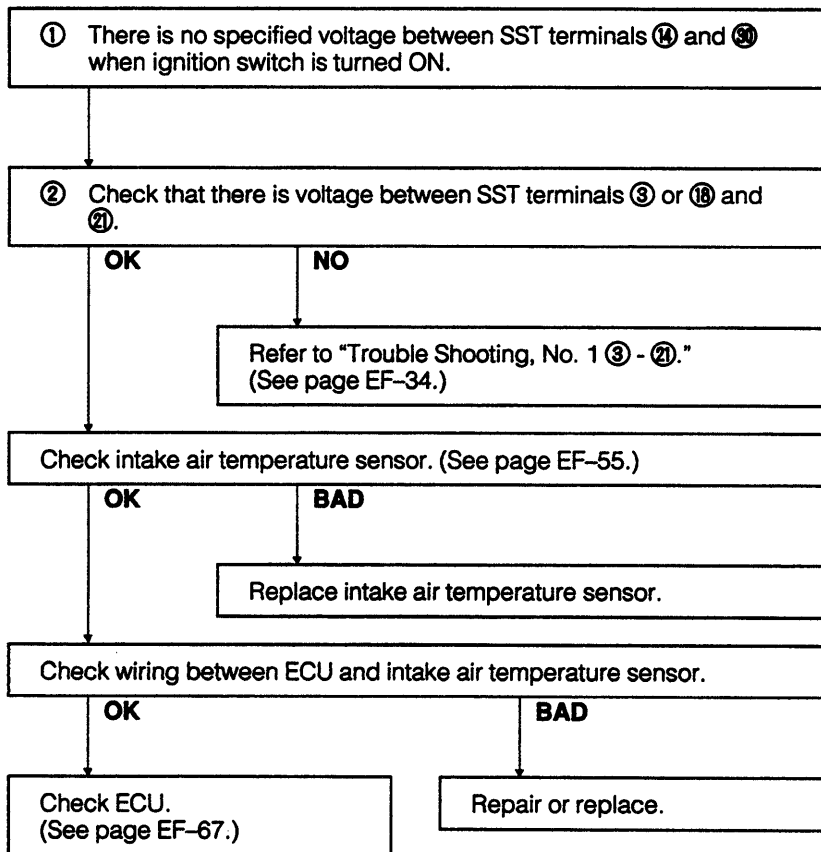
No.	Terminals	Trouble	Conditions		STD voltage
8	⑭ - ⑳	No voltage	Ignition switch ON	Air temperature inside surge tank 20°C (68°F)	0.9 - 3.0

WN88E-EF082



If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

WN88E-EF083

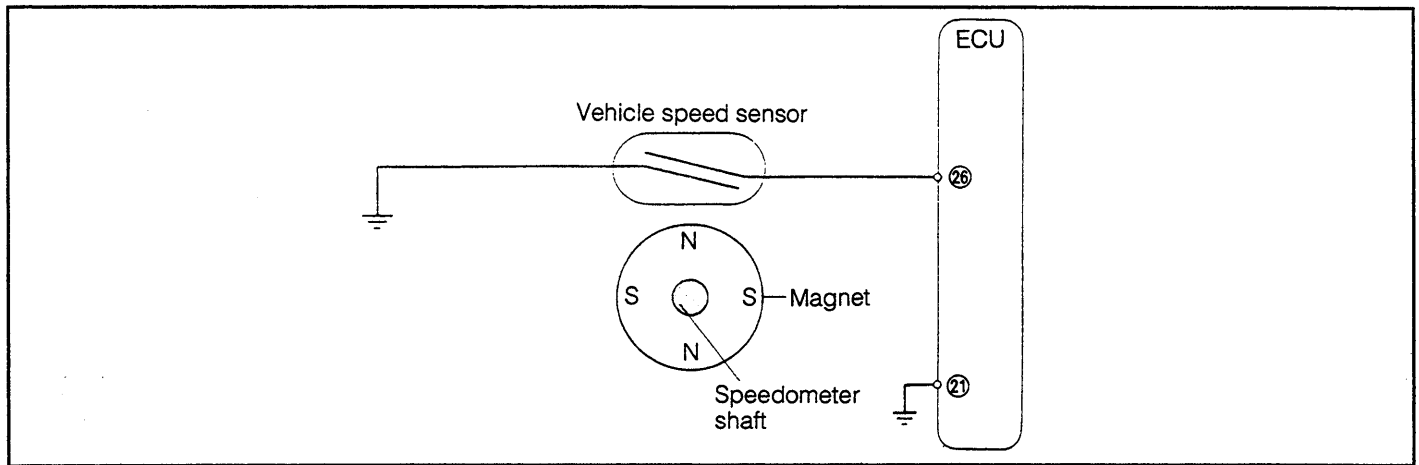


WN88E-EF084



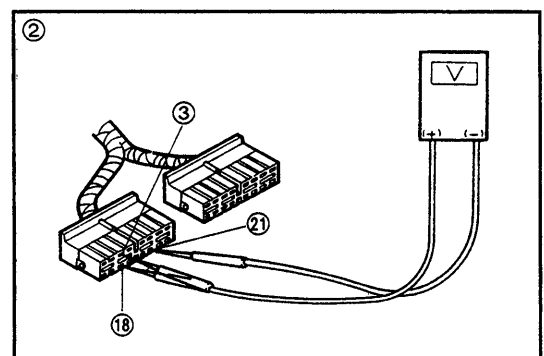
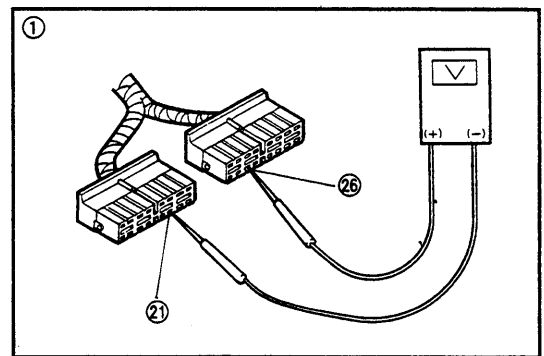
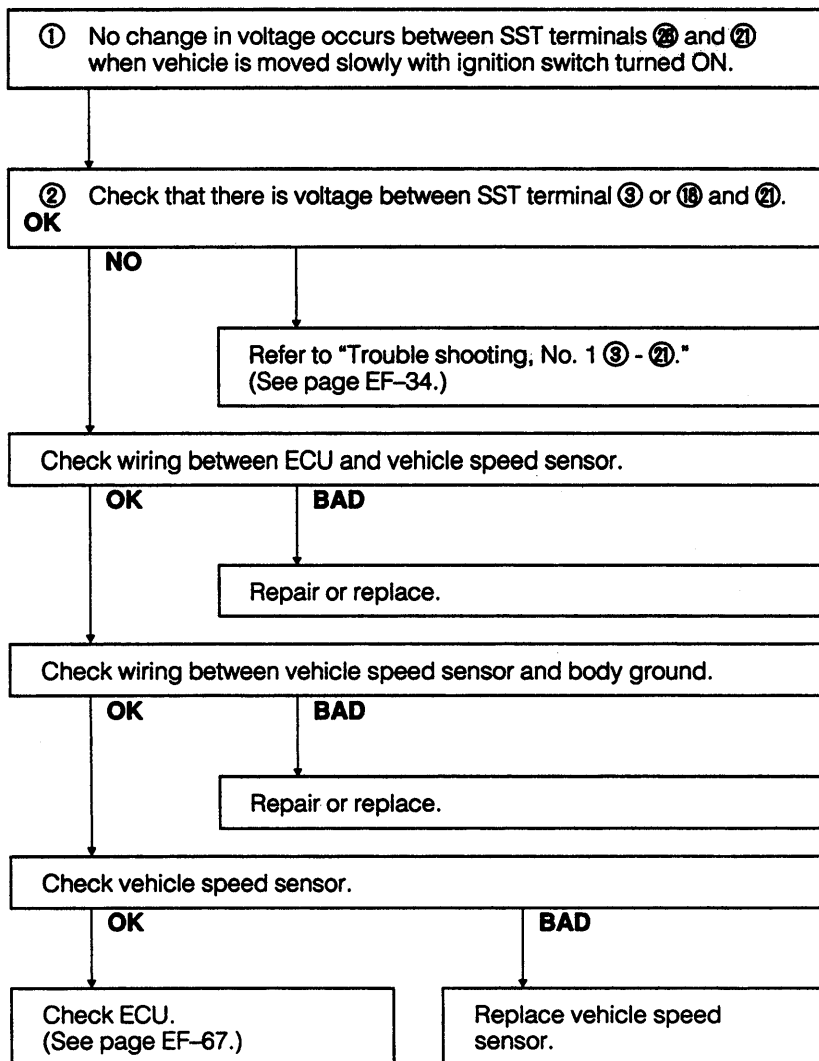
No.	Terminals	Trouble	Conditions		STD voltage
9	⑳ - ㉑	No voltage changes	Ignition switch ON	When vehicle is moved slowly:	0 to 10 - 15

WN88E-EF085



If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

WN88E-EF086

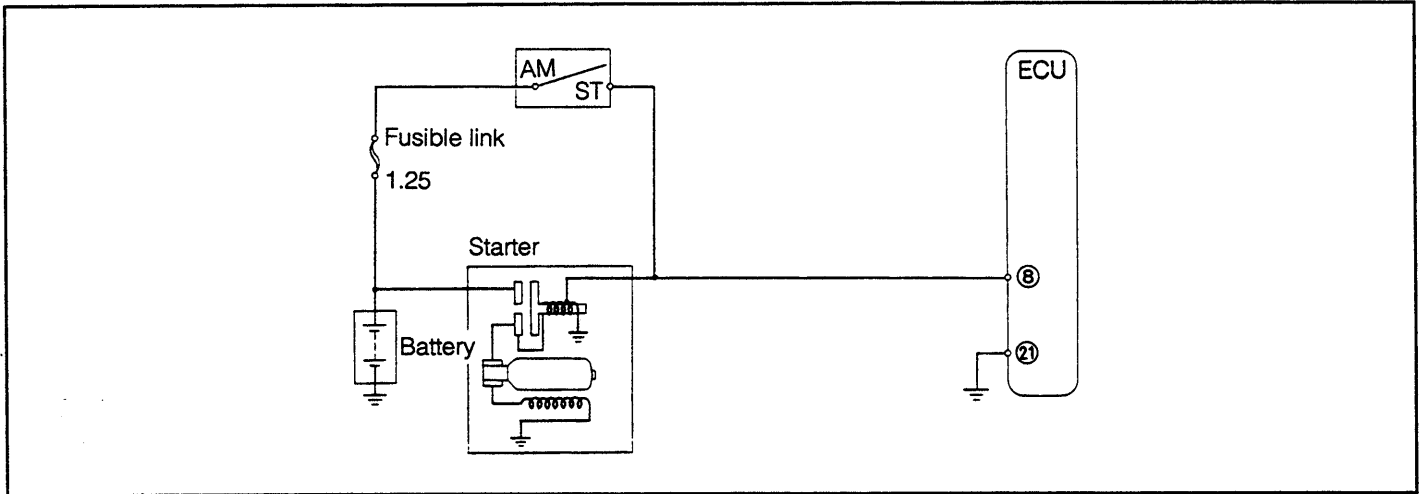


WN88E-EF087

# EFI SYSTEM

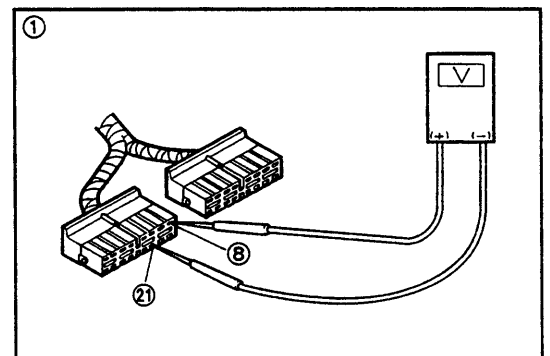
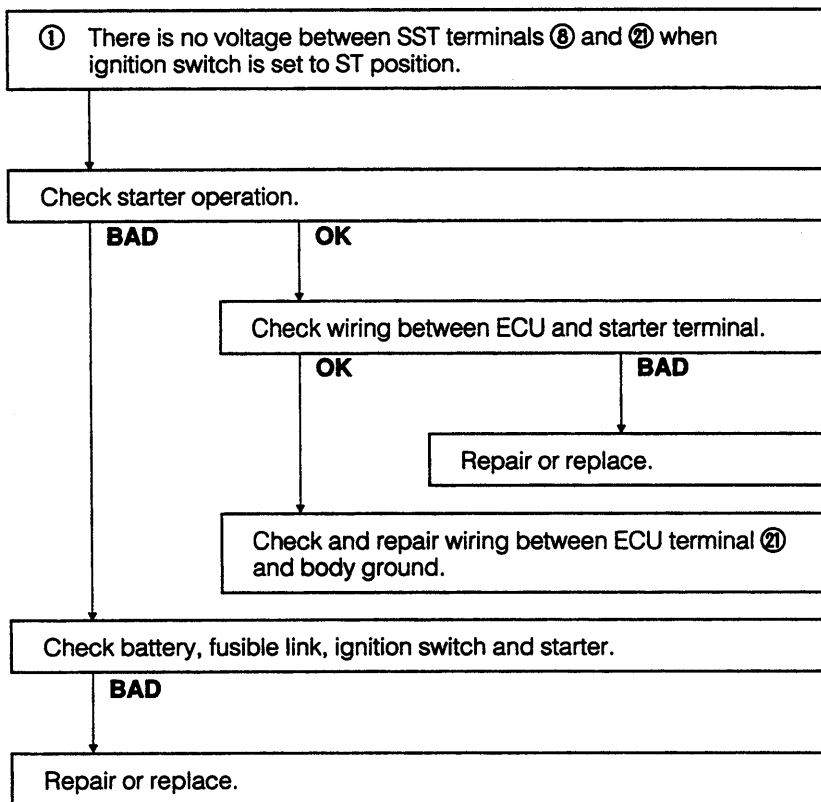
No.	Terminals	Trouble	Conditions	STD voltage
10	Ⓑ - ⑳	No voltage	Ignition switch ST position	6 - 15

WN88E-EF088



If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

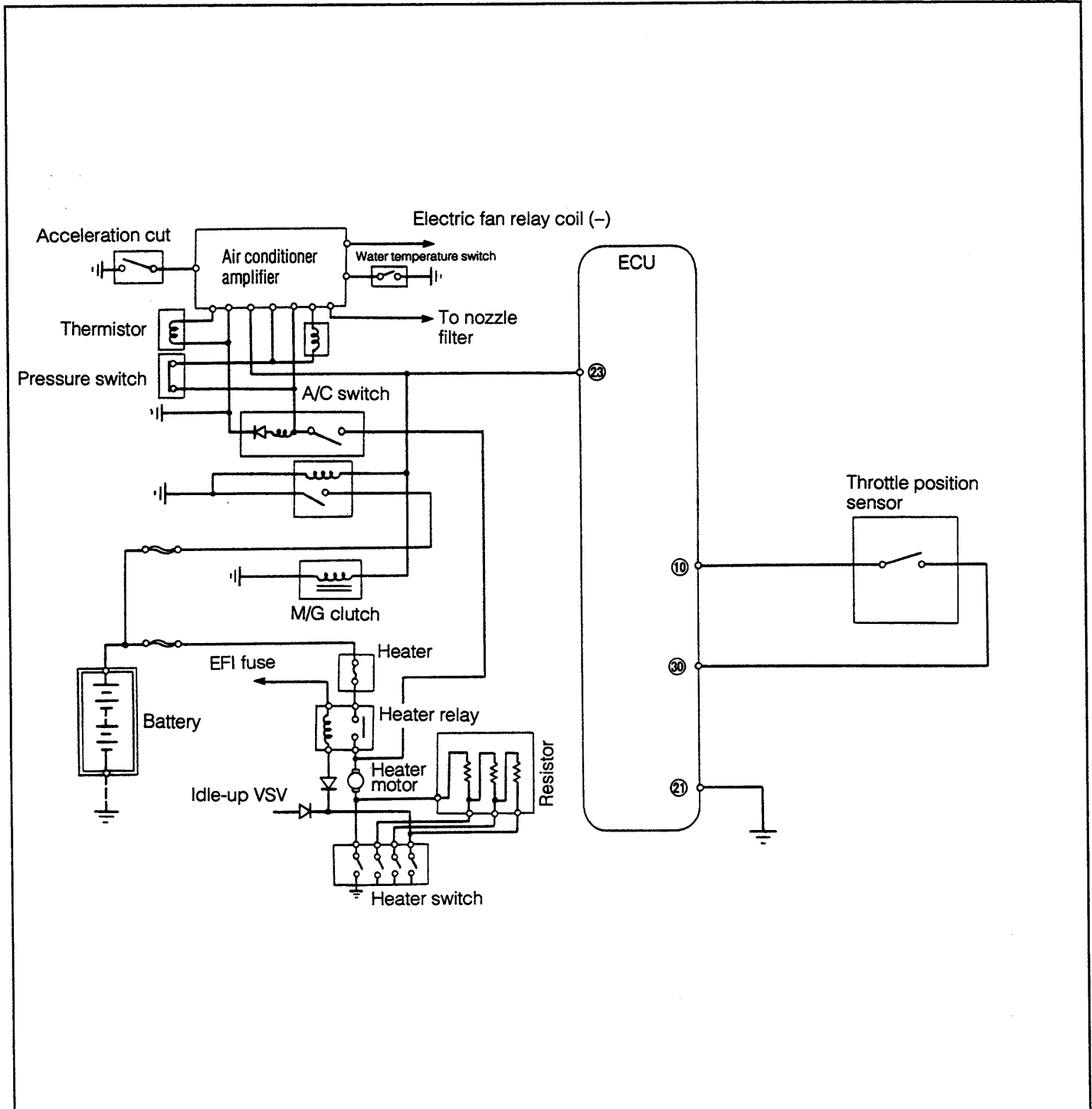
WN88E-EF089



WN88E-EF090

No.	Terminals	Trouble	Conditions		STD voltage
11	23 - 21	No voltage	Ignition switch ON	With engine rotating, air conditioner switch turned ON and magnet clutch turned ON:	10 - 15
	10 - 30	No specified voltage	Ignition switch ON	Throttle valve fully closed	0 - 0.6
Ignition switch ON			Throttle valve fully opened	10 - 15	

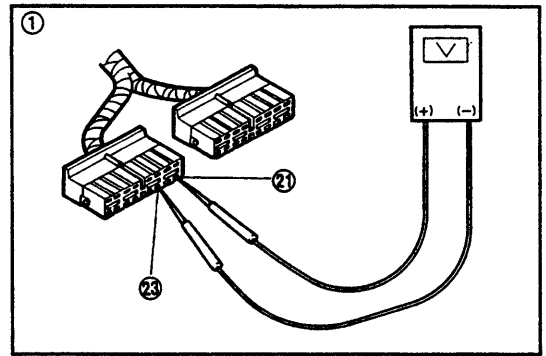
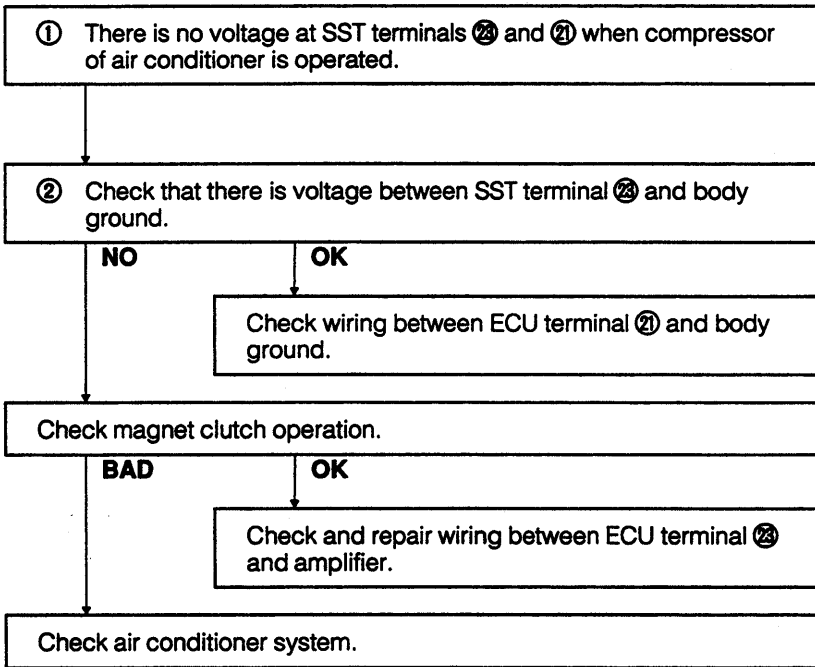
WN88E-EF091



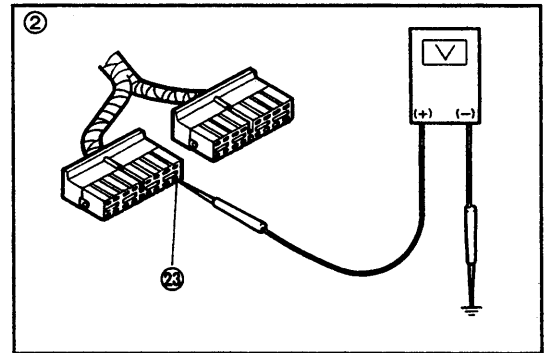
If the SST (09842-87701-000) has not been installed yet, install the SST, referring to the section under "Preparation of Trouble-shooting" at page EF-30.

WN88E-EF092

• 23 - 21

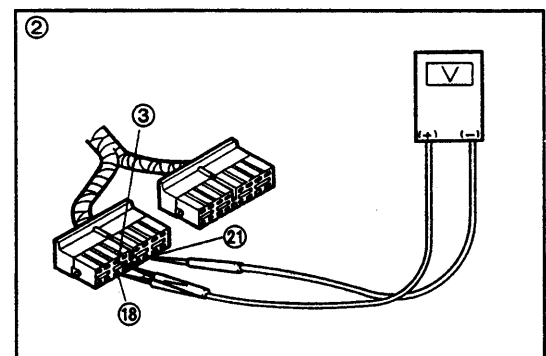
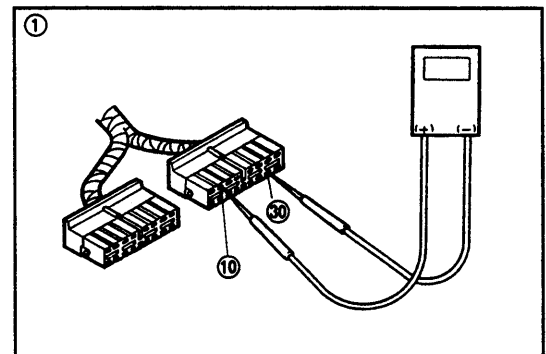
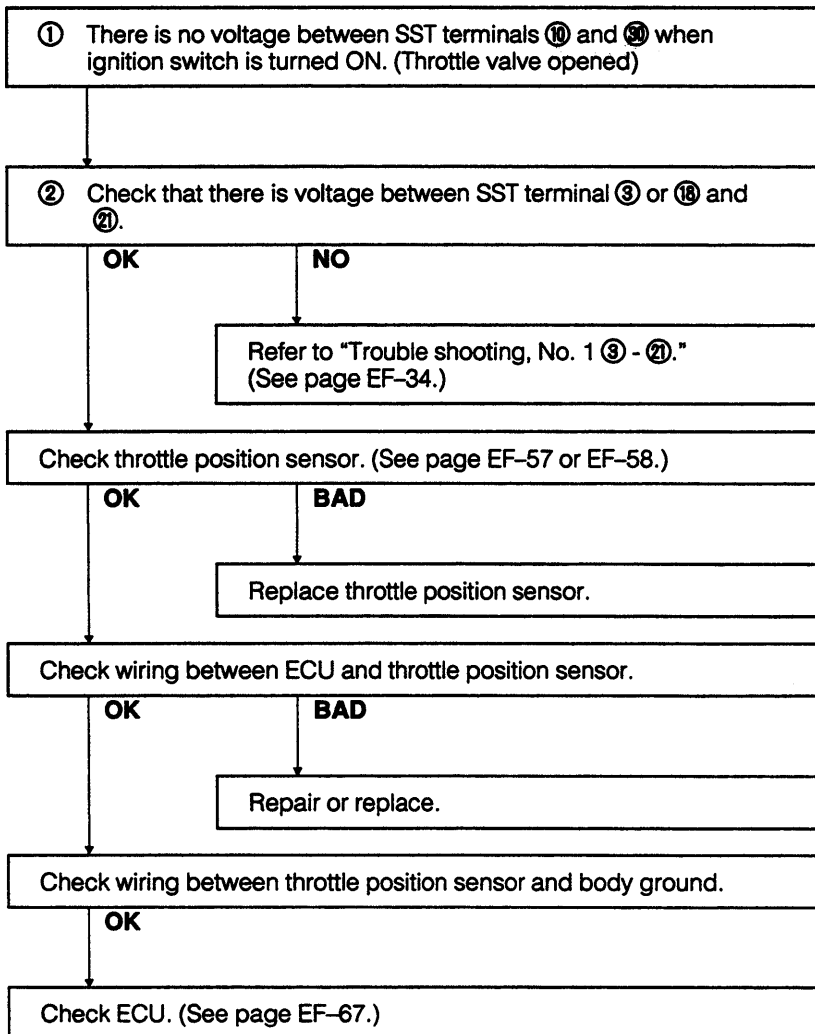


WN88E-EF057



WN88E-EF093

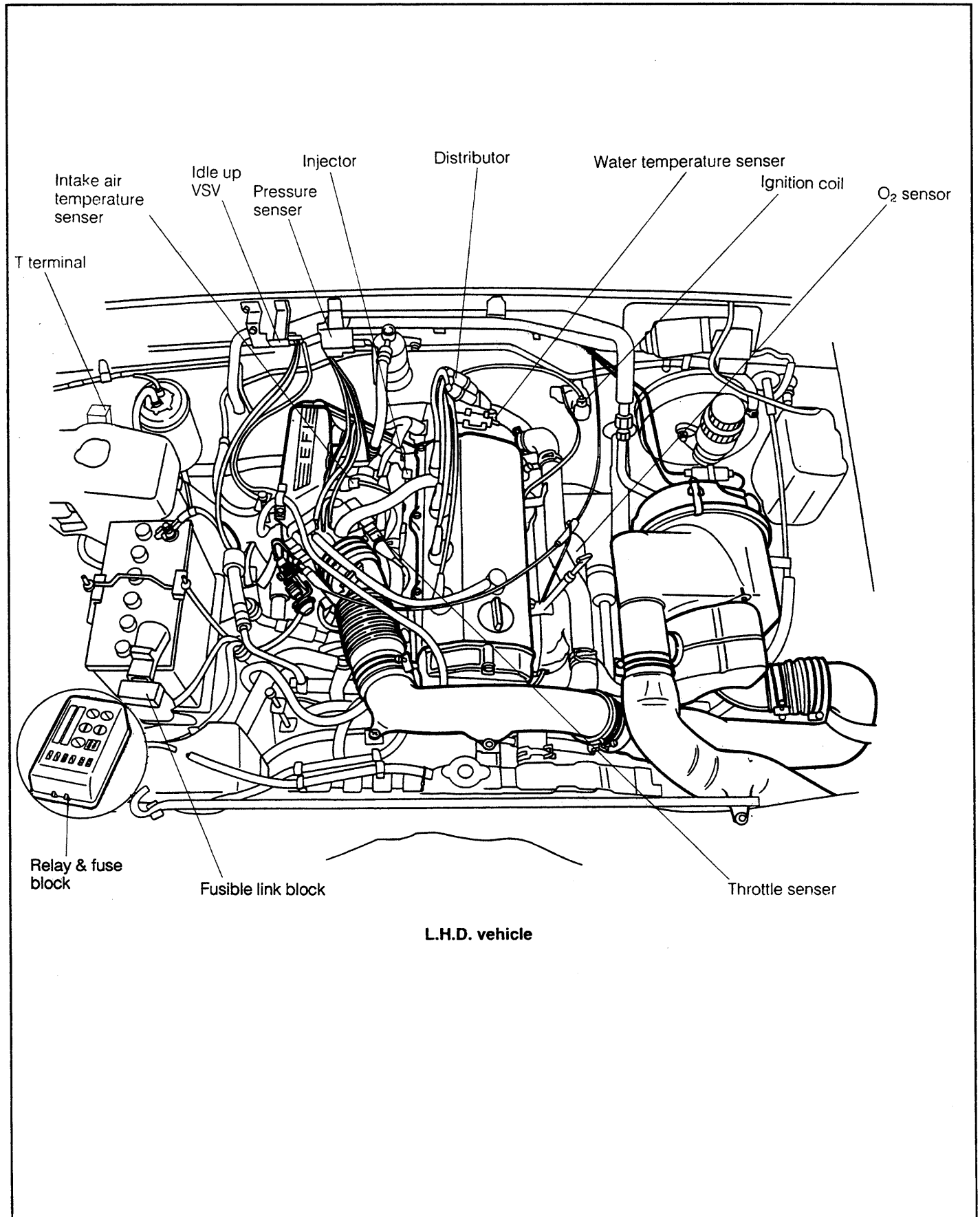
• 10 - 30



WN88E-EF094

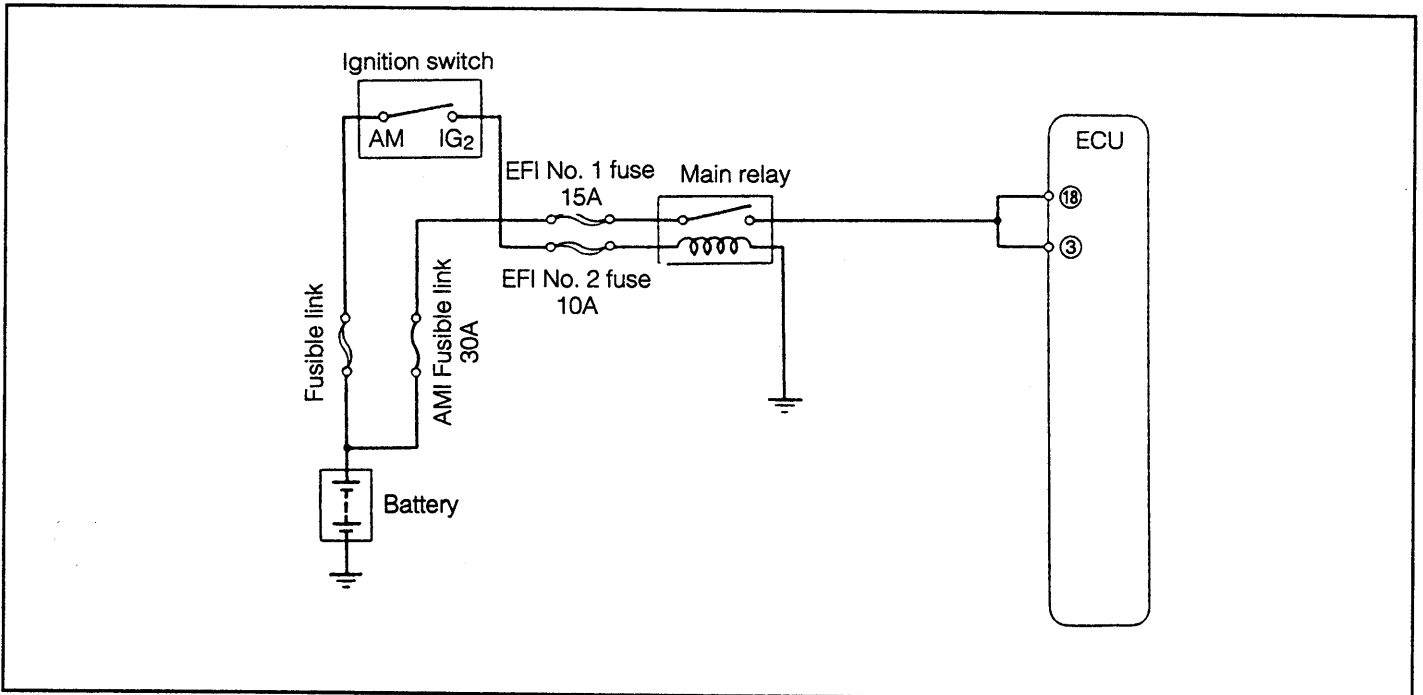
# ELECTRONIC CONTROL SYSTEM

## LOCATION OF ELECTRONIC CONTROL PARTS



L.H.D. vehicle

## MAIN RELAY



WN88E-EF098

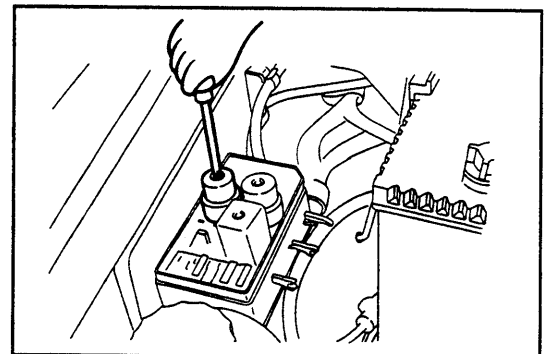
### Inspection of EFI Main Relay

#### 1. Check of main relay operation

When the ignition switch is turned ON, check to see if the relay emits an operating sound. Or check to see if you will feel an operating vibration with a screwdriver or the like placed on the relay.

#### CAUTION:

The relay may become very hot during the operation. Hence, do not touch the relay by your hand.



WN88E-EF099

#### 2. Inspection of relay continuity

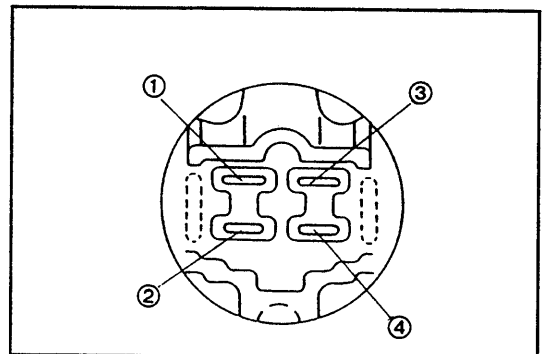
(1) Check that there is the specified resistance between the terminals ① and ②

Resistance: 60 - 85Ω at 20°C (68°F)

(2) Check that there is no continuity between the terminals ③ and ④.

(3) Check that there is no continuity between the terminals ① and ③ and also between the terminals ① and ④.

(4) Check that there is no continuity between the terminals ② and ③ and also between the terminals ② and ④.



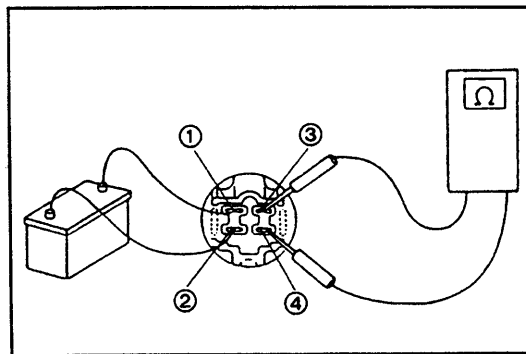
WN88E-EF100

If the continuity test results do not conform to specifications, replace the relay.

3. Inspection of relay operation

- (1) Apply the battery voltage across the terminals ① and ②.
- (2) Check that there is continuity between the terminals ③ and ④.

If the operation test results do not conform to specifications, replace the relay.



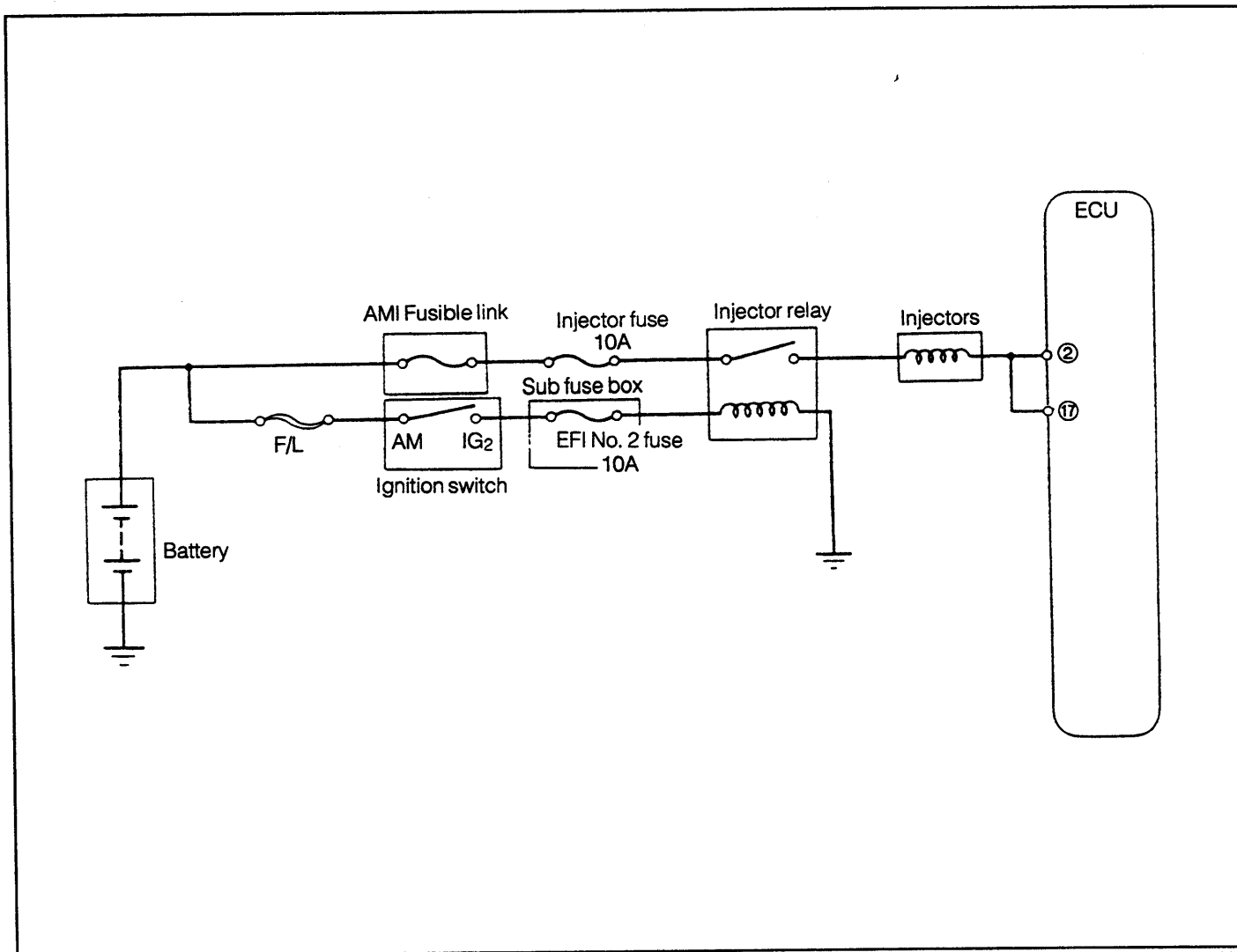
WN88E-EF101

4. If the main relay persists to be inoperative after the checks 1 through 3 have been performed satisfactorily, check the following items.

- (1) Fusible links
- (2) Ignition switch
- (3) Fuses
- (4) Wiring and wiring connector

WN88E-EF101A

INJECTOR RELAY



WN88E-EF102

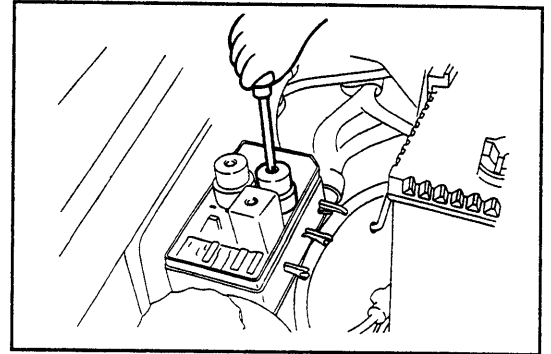
## Inspection of injector relay

### 1. Check of injector relay operation

When the ignition switch is turned ON, check to see if the relay emits an operating sound. Or check to see if you will feel an operating vibration with a screwdriver or the like placed on the relay.

#### CAUTION:

The relay may become very hot during the operation. Hence, do not touch the relay by your hand.



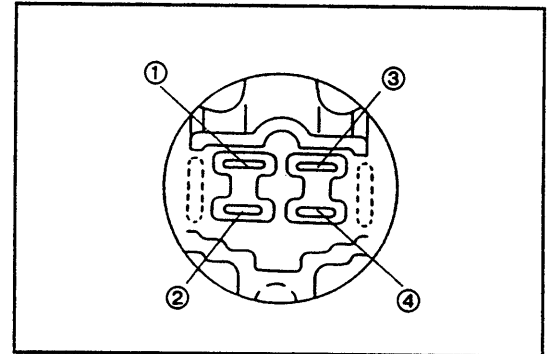
WN88E-ER103

### 2. Inspection of relay continuity

(1) Check that there is the specified resistance between the terminals ① and ②.

Resistance: 60 - 85Ω at 20°C (68°F)

(2) Check that there is no continuity between the terminals ③ and ④.

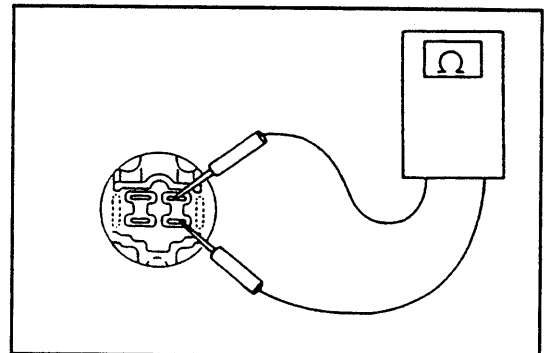


WN88E-EF104

(3) Check that there is no continuity between the terminals ① and ③ and also between the terminals ① and ④.

(4) Check that there is no continuity between the terminals ② and ③ and also between the terminals ② and ④.

If the continuity test results do not conform to specifications, replace the relay.



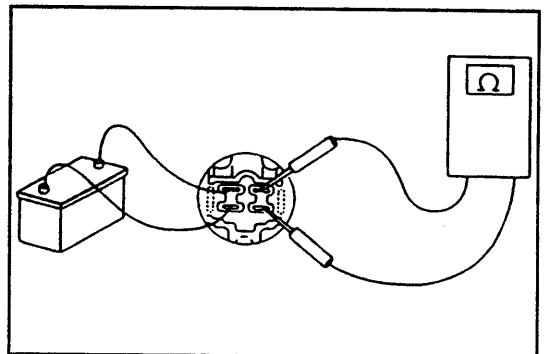
WN88E-EF105

### 3. Inspection of relay operation

(1) Apply the battery voltage across the terminals ① and ②.

(2) Check that there is continuity between the terminals ③ and ④.

If the operation test results do not conform to specifications, replace the relay.



WN88E-EF106

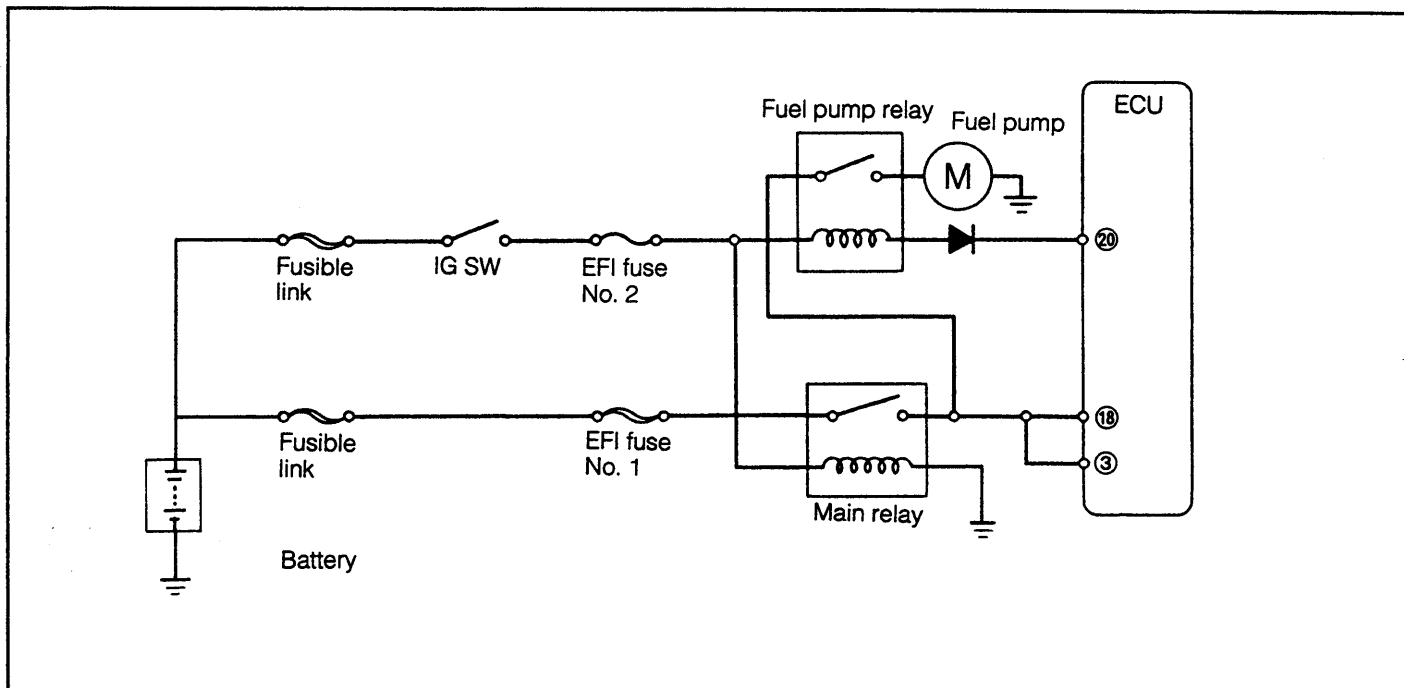
4. If the injector relay persists to be inoperative after the checks 1 through 3 have been performed satisfactorily, check the following items.

- (1) Fusible links
- (2) Fuses
- (3) Ignition switch
- (4) Wiring and wiring connector

WN88E-EF107



**FUEL PUMP RELAY**



WN88E-EF108

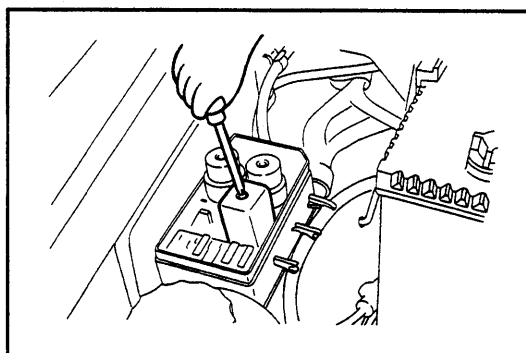
**Inspection of Fuel Pump Relay**

1. Check of fuel pump relay operation.

When the ignition switch is set to the ON position, check to see if the relay emits an operating sound. Or check to see if you will feel an operating vibration with a screwdriver or the like placed on the relay.

**CAUTION:**

The relay may become very hot during the operation. Hence, do not touch the relay by your hand.



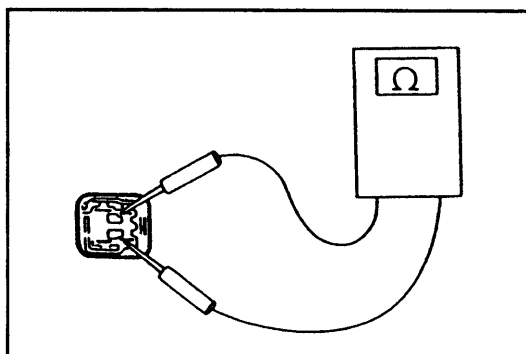
WN88E-EF110

2. Inspection of relay continuity

(1) Check that there is the specified resistance between the terminals ① and ②.

Resistance: 70 - 90Ω at 20°C (68°F)

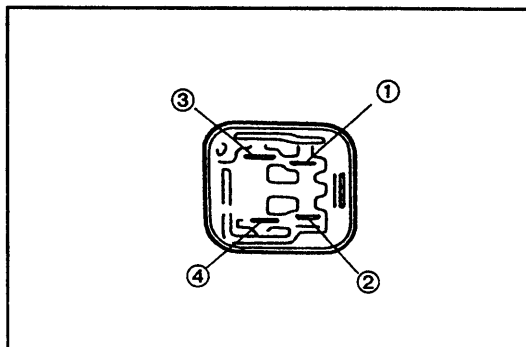
(2) Check that there is no continuity between the terminals ③ and ④.



WN88E-EF111

(3) Check that there is no continuity between the terminals ① and ③ and also between the terminals ① and ④.

(4) Check that there is no continuity between the terminals ② and ③ and also between the terminals ② and ④.



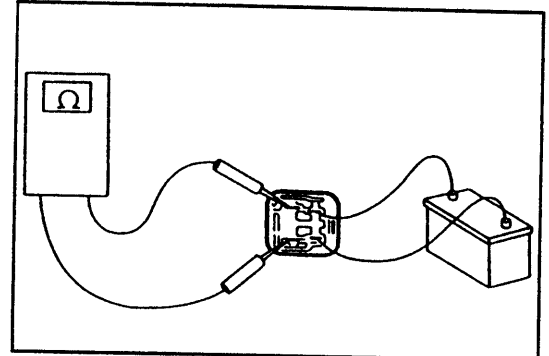
WN88E-EF112

If the continuity test results do not conform to specifications, replace the relay.

### 3. Inspection of relay operation

- (1) Apply the battery voltage across the terminals ① and ②.
- (2) Check that there is continuity between the terminals ③ and ④.

If the operation test results do not conform to specifications, replace the relay.



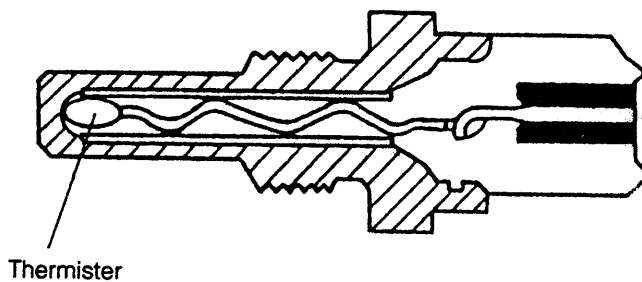
WN88E-EF113

### 4. If the fuel pump relay persists to be inoperative after the checks 1 through 3 have been performed satisfactorily, check the following items.

- (1) Fusible links
- (2) Ignition switch
- (3) Fuses
- (4) Main relay (See page EF-48.)
- (5) Wiring and wiring connector
- (6) ECU (See page EF-67.)

## WATER TEMPERATURE SENSOR

WN88E-EF114



### Specification

Water temperature °C (°F)	Resistance kΩ
80 (176)	0.322 ± 0.1
60 (140)	0.584 ± 0.2
40 (104)	1.140 ± 0.3
20 ( 68)	2.450 ± 0.5
0 ( 32)	5.88 ± 1.5
-20 ( -4)	16.2 ± 1.6

WN88E-EF115

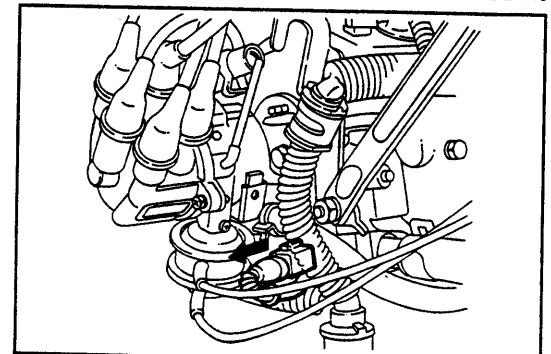
### Inspection of Water Temperature Sensor

#### Measurement of Resistance of Water Temperature Sensor

1. Disconnect the connector.

#### NOTE:

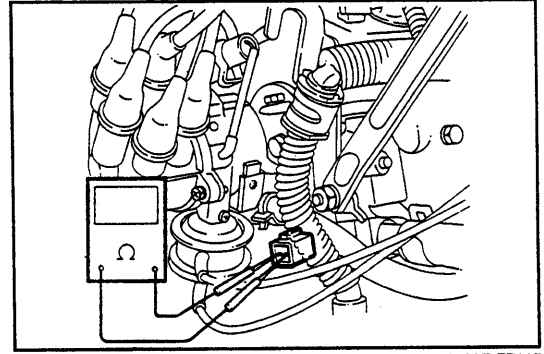
Be sure to un-lock the lock of connector, when disconnect or connect the connector.



WN88E-EF116

2. Start the engine. Read the resistance at the time when the engine is warmed up completely.  
Resistance:  $0.32 \pm 0.1 \text{ k}\Omega$

If the measured resistance will not conform to the specification, remove the water temperature sensor and perform the unit inspection.

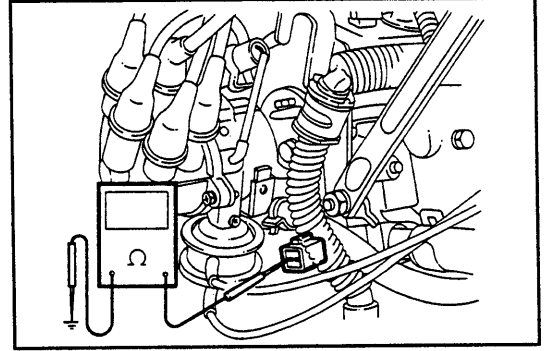


WN88E-EF117

3. Check that there is no continuity between each terminal of the water temperature sensor and the body. If there is continuity, replace the water temperature sensor.

**NOTE:**

- Before the water temperature sensor is removed, drain the coolant.
- After completion of the sensor replacement, refill the coolant. (See page CO-3.)



WN88E-EF118

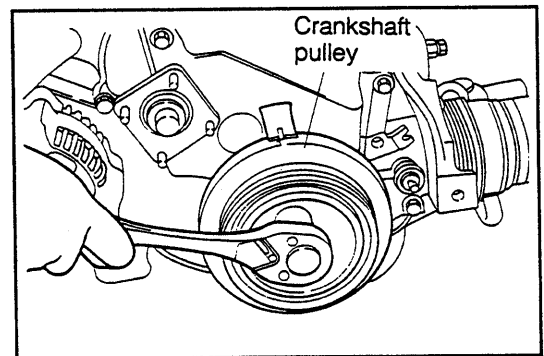
**Water Temperature Sensor Unit Test**

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Drain the cooling water. (See page CO-3.)

WN88E-EF119

3. Distributor removal

- (1) Turn the crankshaft, until the mark on the crankshaft timing belt pulley is aligned with the indicator mark on the timing belt cover. (Ensure that the rocker arms of the cylinder No.1 at the timing belt side are in a free state. If the rocker arms are not in a free state, turn the crankshaft one more complete turn (360°).

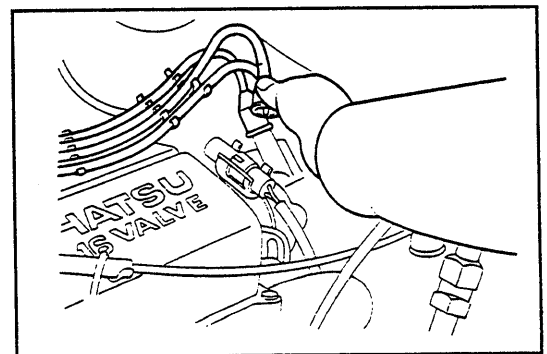


WN88E-EF120

- (2) Remove the high-tension cords from distributor cap.

**NOTE:**

Be sure to remove the high-tension cord by holding the rubber grommet. Never pull out the cord section.



WN88E-EF121

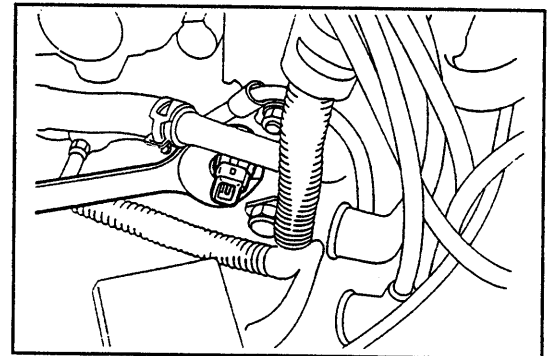
- (3) Disconnect the distributor connector.
- (4) Disconnect the vacuum hoses from vacuum advancer.
- (5) Remove the distributor by removing the distributor set bolts.

**NOTE:**

Since the oil flows out during the removal, place a suitable cloth underneath the distributor.

WN88E-EF122

4. Removal of water temperature sensor
  - (1) Remove the water temperature sensor connector.
  - (2) Remove the water temperature sensor.

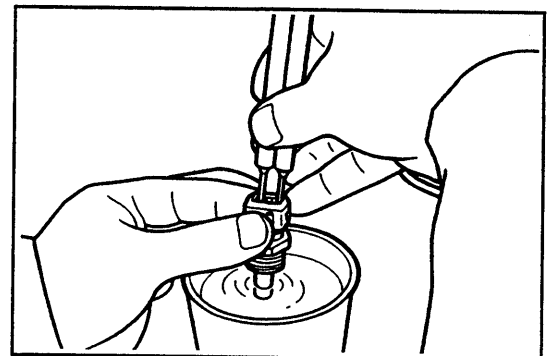


WN88E-EF123

5. Unit check
  - (1) Immerse the heat sensing section of the water temperature sensor in water. Raise the water temperature gradually. Check to see if the resistance varies within the specified values in accordance with the table below.

**Specifications**

Water temperature °C (°F)	Resistance (kΩ)
80 (176)	0.322 ± 0.1
60 (140)	0.584 ± 0.2
40 (104)	1.140 ± 0.3
20 ( 68)	2.450 ± 0.5



WN88E-EF124

If the resistance will not conform to the specifications, replace the water temperature sensor.

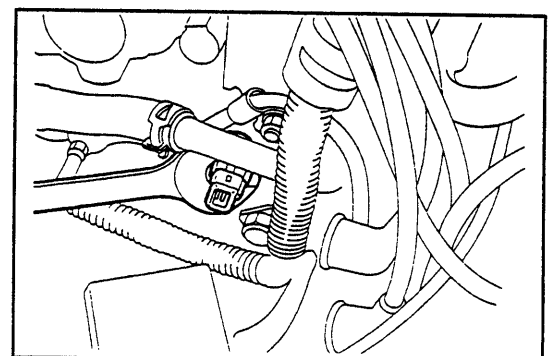
- (2) Check that there is no continuity between each terminal of the water temperature sensor and sensor body. If there is continuity, replace the intake air temperature sensor.

6. Installation of water temperature sensor
  - (1) Wind sealing tape to the water temperature sensor switch and install it to the cylinder. Connect the connector.

**Tightening Torque: 2.5 - 3.5 kg-m (18.1 - 25.3 ft-lb)**

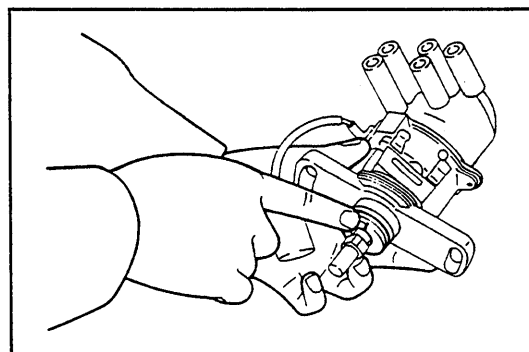
**NOTE:**

The new sensor is coated with sealer, therefore seal tape is unnecessary if the sensor is replaced with new one.

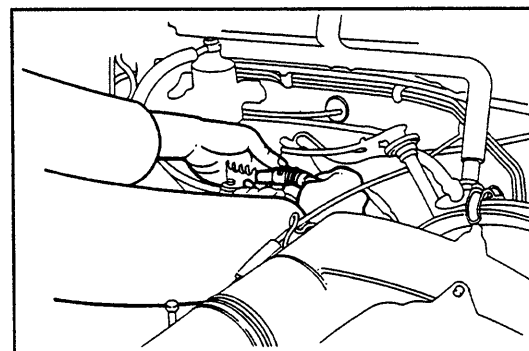


WN88E-EF125

- (2) Distributor installation (See page IG-47)
- ① Replace the distributor "O" ring with a new part.
  - ② With the coupling cut-out section of the distributor aligned with the cut-out section of the distributor body, insert the distributor into the cylinder head. At this time, ensure that the distributor attaching bolt hole of the cylinder head comes at the center of the elongated hole for the distributor bolt. Then, torque the distributor set bolt.
  - ③ Connect the vacuum hoses to the vacuum advancer.
  - ④ Connect the distributor connector. Install the connector to the clamp.
  - ⑤ Connect the high-tension cords to the distributor cap.



WN88E-EF126

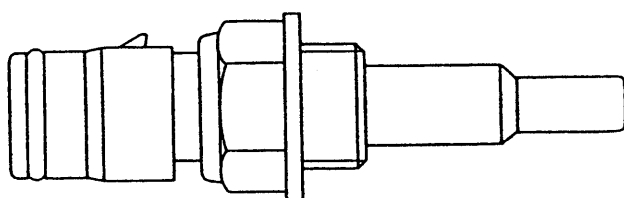


WN88E-EF127

- (3) Connect the ground cable terminal to the battery negative (-) terminal.
- (4) Fill cooling water. (See page CO-3.)
- (5) Adjust the ignition timing. (See page MA-8.)
- (6) Start the engine. Ensure that no water or oil leakage is present.
- (7) Check the oil level. (See page LU-2.)

WN88E-EF128

## INTAKE AIR TEMPERATURE SENSOR



### Specification

Intake air temperature °C (°F)	Resistance kΩ
80 (176)	0.322 ± 0.1
60 (140)	0.584 ± 0.2
40 (104)	1.140 ± 0.3
20 ( 68)	2.450 ± 0.5
0 ( 32)	5.88 ± 1.5
-20 ( -4)	16.2 ± 1.6

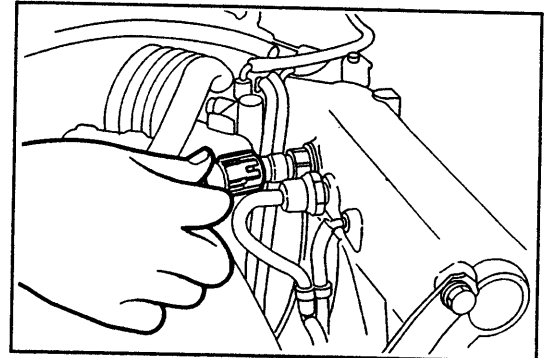
WN88E-EF129

## Inspection of Intake Air Temperature Sensor Measurement of Resistance of Intake Air Temperature Sensor

1. Disconnect the connector.

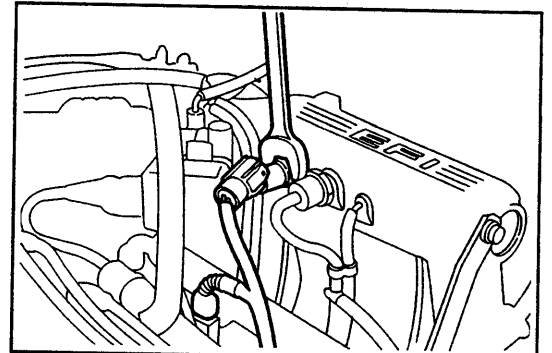
**NOTE:**

Do not pull out the lead wire. While holding the connector section, unlock the lock and pull out the connector.



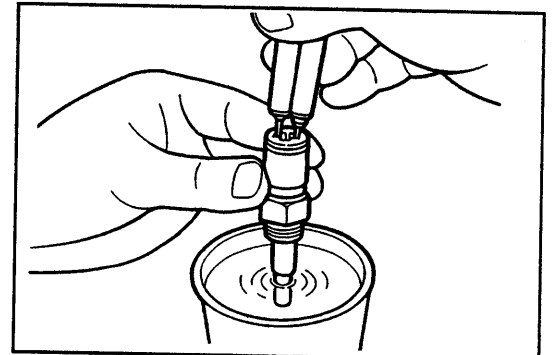
WN88E-EF130

2. Remove the intake air temperature sensor.



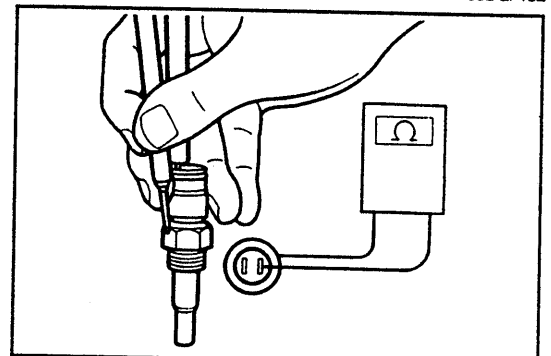
WN88E-EF131

3. Immerse the heat sensing section of the water temperature sensor in water. Raise the water temperature gradually. Check to see if the resistance varies within the specified values in accordance with the table in the preceding page. If the measured resistance will not conform to the specifications, replace the intake air temperature sensor.



WN88E-EF132

4. Check that there is no continuity between each terminal of the intake air temperature sensor and the sensor body. If there is continuity, replace the intake air temperature sensor.

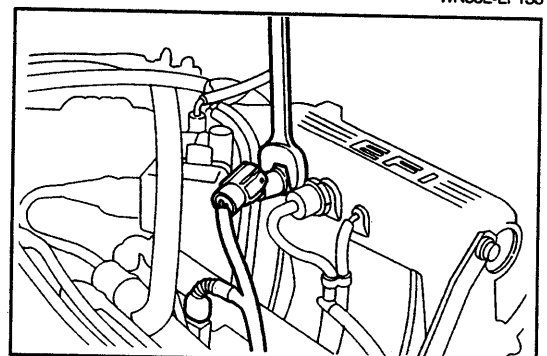


WN88E-EF133

5. Install the intake air temperature sensor to the surge tank with a new gasket interposed.

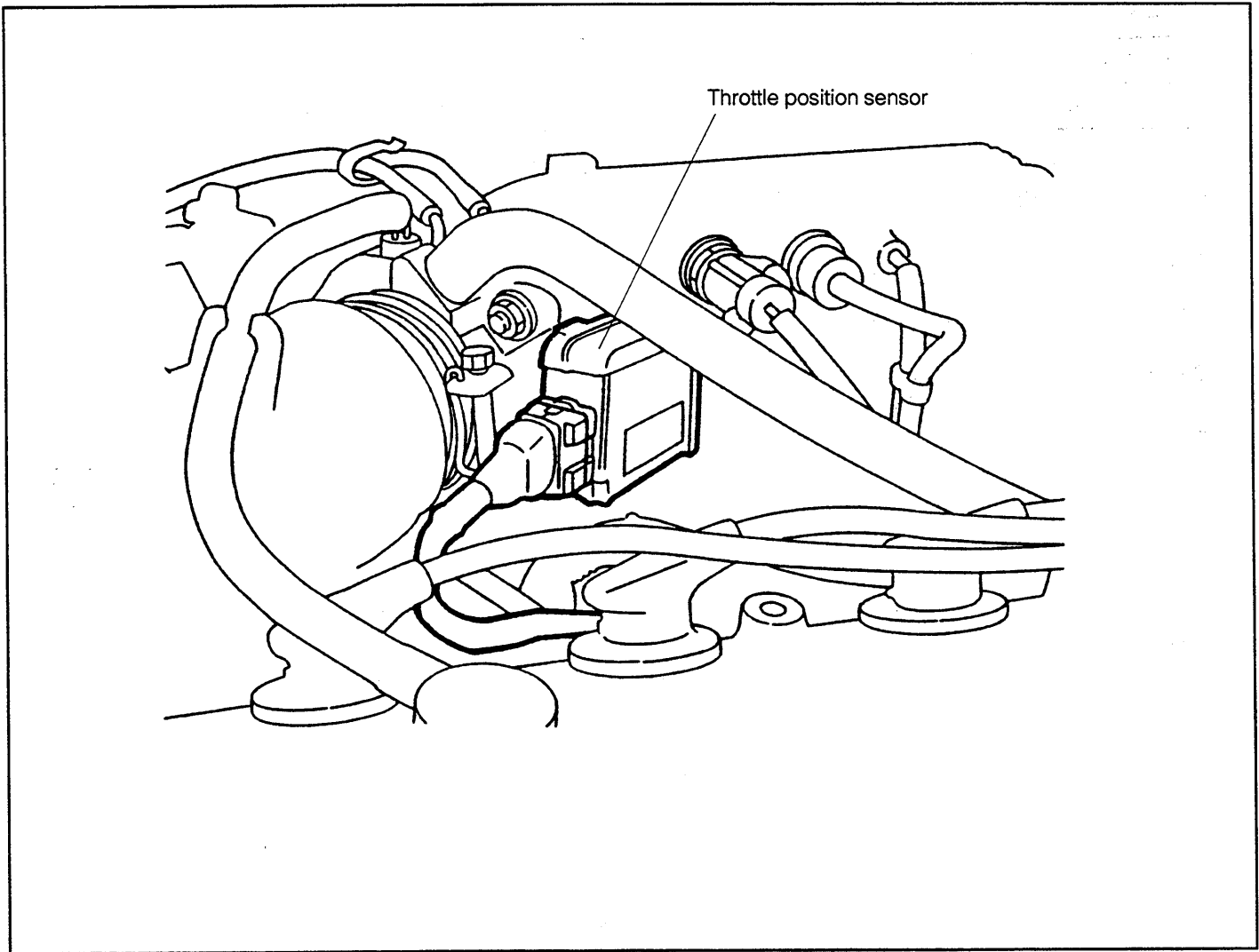
**Tightening Torque: 3.0 - 4.0 kg-m (21.7 - 28.9 ft-lb)**

6. Connect the intake air temperature sensor connector.



WN88E-EF134

## THROTTLE POSITION SENSOR



WN88E-EF135

### Inspection of Throttle Position Sensor

1. Unlock the throttle position sensor connector and disconnect it.

**CAUTION:**

When disconnecting the connector, care must be exercised to ensure that no excessive load is applied to the throttle position sensor.

2. Measure the resistance between the terminals of the throttle position sensor.

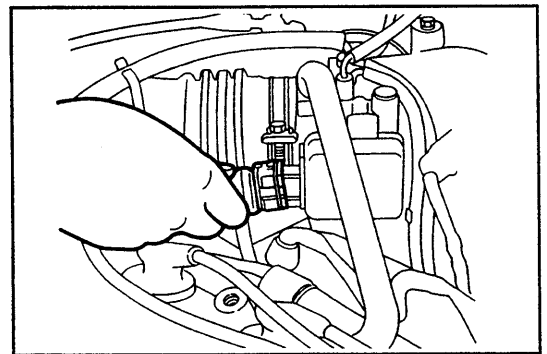
- (1) Measure the resistance between ⑩ and ⑪ under the following conditions.

Throttle valve closed fully	0.2Ω or less at 20°C (68°F)
Throttle valve opened fully	10 kΩ or more

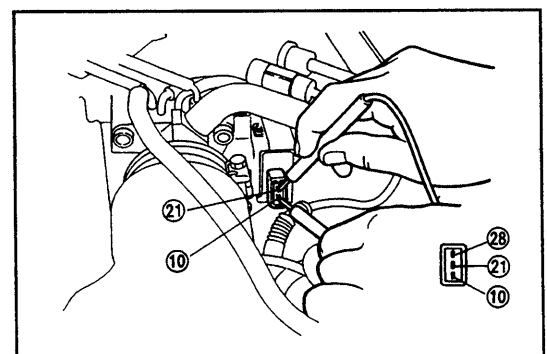
If the measured resistance does not conform to the specification, replace the throttle body. (See page EF-97.)

**CAUTION:**

Be very careful not to damage the terminal.



WN88E-EF136



WN88E-EF137

## EFI SYSTEM

(2) Measure the resistance between ⑳ and ㉑ under the following conditions.

Throttle valve closed fully	10 k $\Omega$ or more
Throttle valve opened fully	5 $\Omega$ or less

If the measured resistance does not conform to the specification, replace the throttle body. (See page EF-97.)

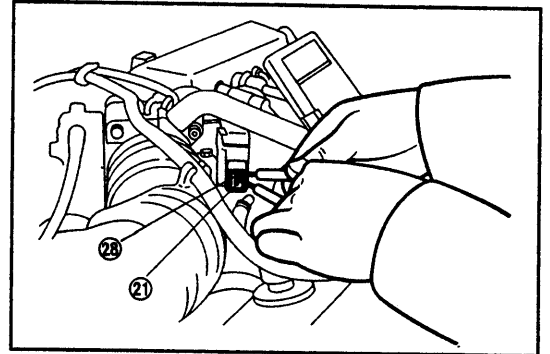
**CAUTION:**

Be very careful not to damage the terminal.

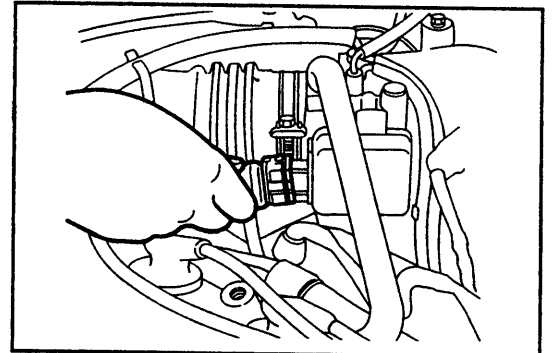
3. Connect the throttle position sensor connector.

**CAUTION:**

When connecting the connector, care must be exercised to ensure that no excessive load is applied to the throttle position sensor.

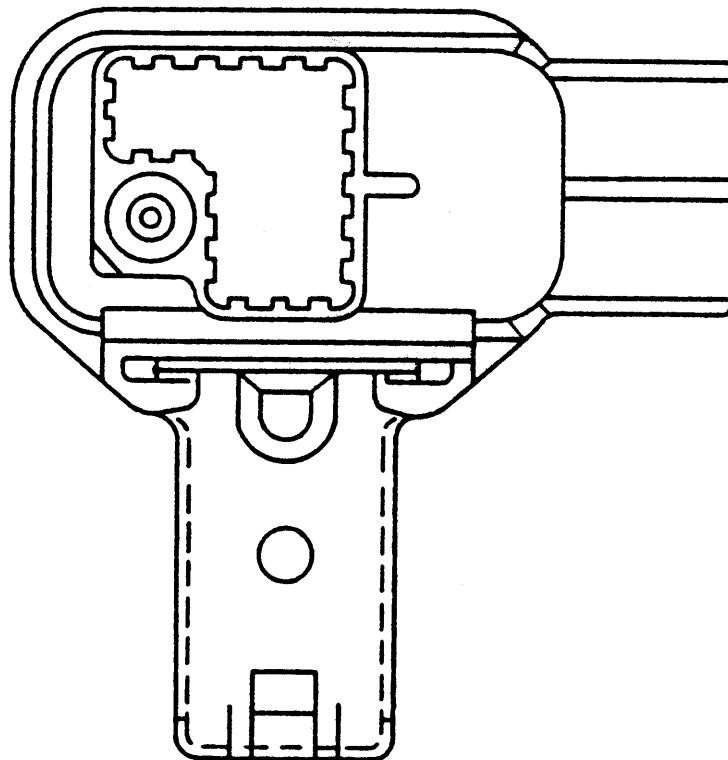


WN88E-EF138



WN88E-EF139

## PRESSURE SENSOR



Surge tank pressure

WN88E-EF144

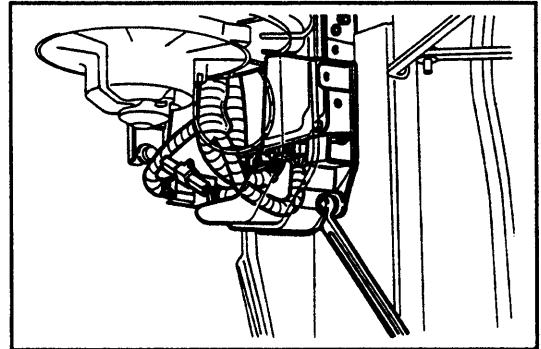


**Inspection of Pressure Sensor**  
**Measurement of Output Voltage of Pressure Sensor**

1. Connection of SST

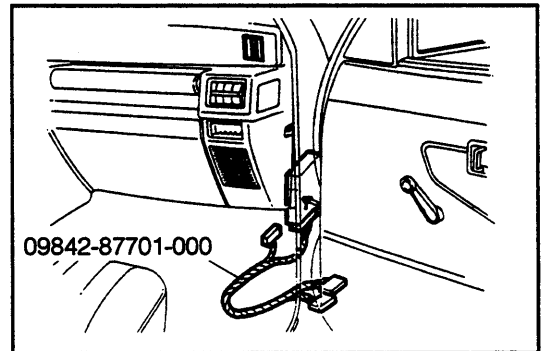
WN88E-EF145

- (1) Disconnect the ground cable terminal from the negative (-) terminal of the battery.
- (2) Remove the ECU cover.



WN88E-EF146

- (3) Connect the following SST between the ECU and the engine wire.  
 SST: 09842-87701-000



WN88E-EF147

**NOTE:**  
 Before the SST is installed, be sure to perform continuity and short tests between SST terminals.

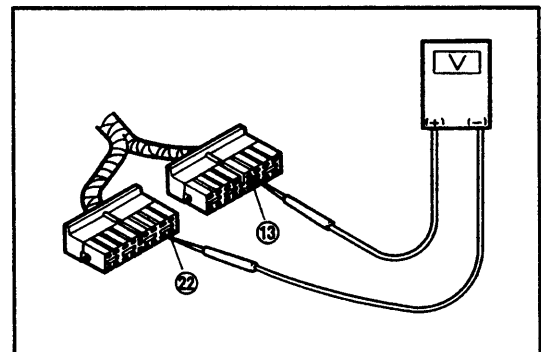
- (4) Reconnect the ground cable terminal to the negative (-) terminal of the battery.

2. Check of output of pressure sensor

- (1) Measure the voltage between the SST terminals ⑬ and ⑳ when the ignition switch is turned ON.

**Specified Value**

Measuring point	Atmospheric pressure	Voltage V
Altitude (height above sea level) m (ft)	mmHg (inchHg)	
0 (0)	760 (29.92)	3.3 - 3.9
500 (1640)	716 (28.19)	3.2 - 3.8
1000 (3280)	674 (26.54)	3.0 - 3.6



WN88E-EF148

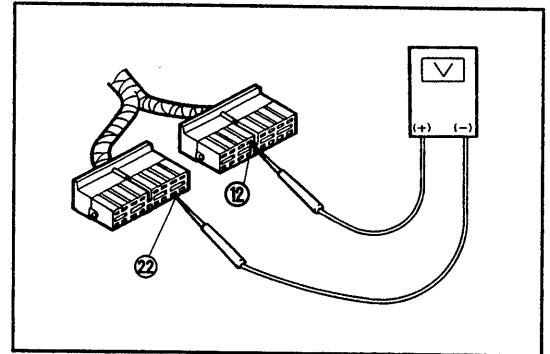
If the measured voltage does not conform to the specification, measure the voltage between the SST terminals ⑫ and ⑳. Ensure that the measured voltage is within a range of 4.5 to 5.5 volts. Then, proceed to replace the pressure sensor. When the pressure sensor is replaced, it is necessary to replace the gas filter, too.

If the measured voltage between the SST terminals ⑫ and ⑳ does not conform to the specification, check the wiring between the ECU and the pressure sensor. If there is no trouble with the wiring, check the ECU. (See page EF-69.)

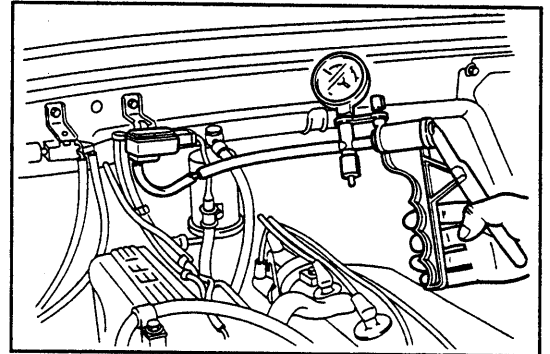
- (2) Disconnect the rubber hose connected to the pressure sensor. Apply a negative pressure of 200 mmHg (7.87 inchHg) to the pressure sensor, using a MityVac. Check that the measured voltage between the SST terminals ⑬ and ⑳ drops by 0.65 - 0.95, compared with the voltage measured in the step (1).

If the measured voltage fails to drop by the specified value, replace the pressure sensor.

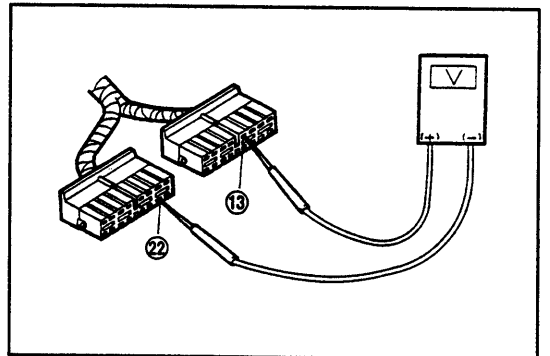
When the pressure sensor is replaced, it is necessary to replace the gas filter, too.



WN88E-EF149



WN88E-EF150



- (3) Remove the MityVac from the pressure sensor.
- (4) Connect the rubber hose disconnected in the step (2) to the pressure sensor.

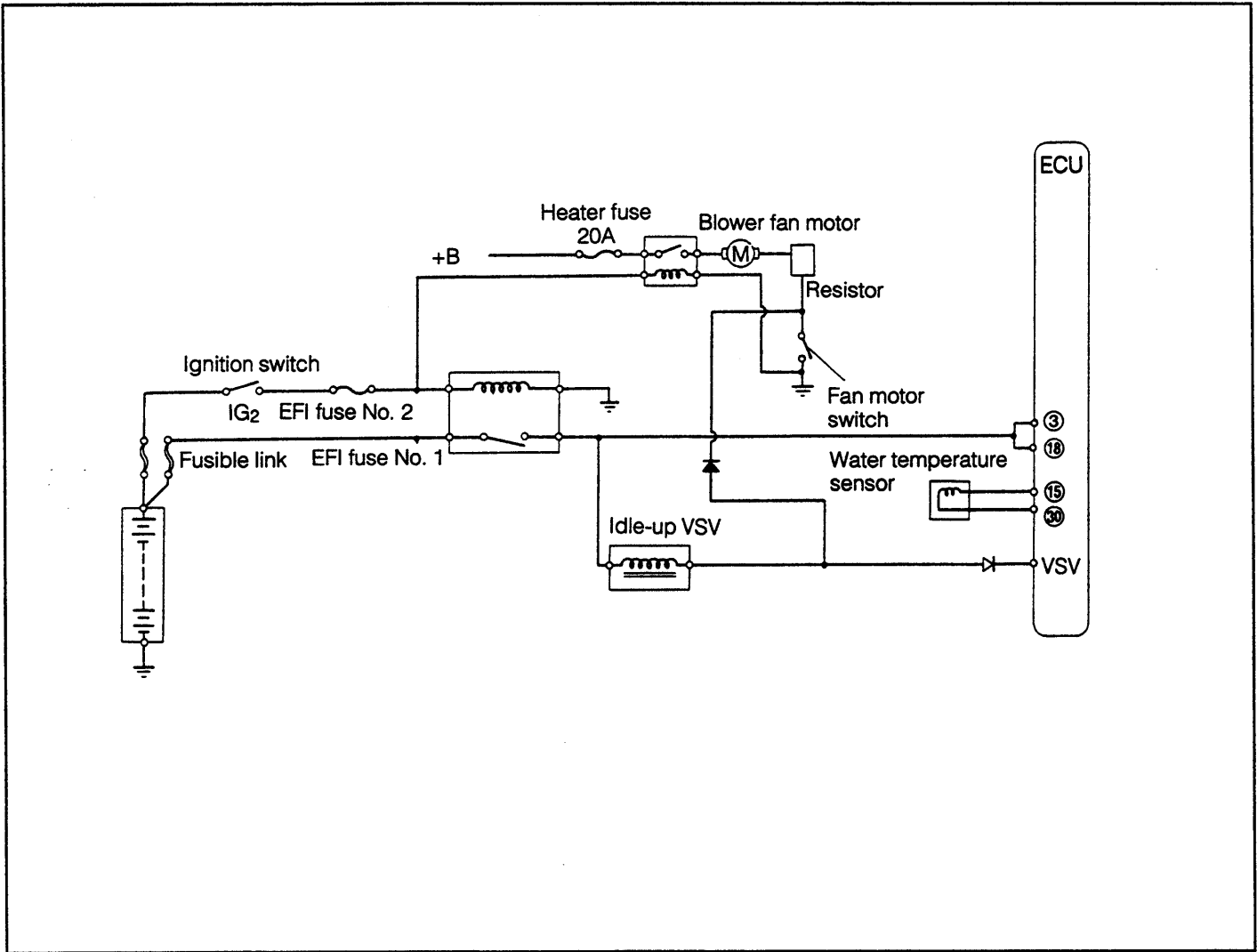
WN88E-EF151

### 3. SST removal

- (1) Disconnect the ground cable terminal from the negative (-) terminal of the battery.
- (2) Remove the SST by disconnecting the ECU and engine wire connectors of the SST.
- (3) Connect the engine wire to the ECU.
- (4) Install the ECU cover onto the position.
- (5) Reconnect the ground cable terminal to the negative (-) terminal of the battery.

WN88E-EF152

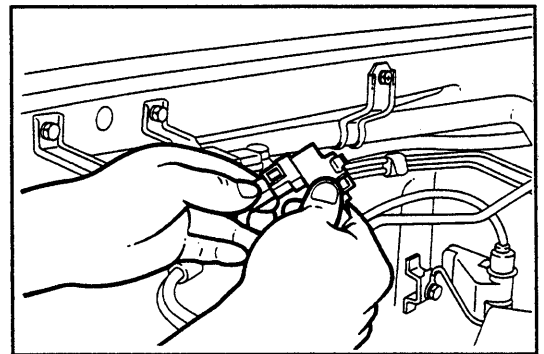
**IDLE-UP VSV**



WN88E-EF153

**Unit Inspection of Idle-up VSV**

1. Detach the idle-up VSV assembly from the bracket. Disconnect the idle-up VSV connector.

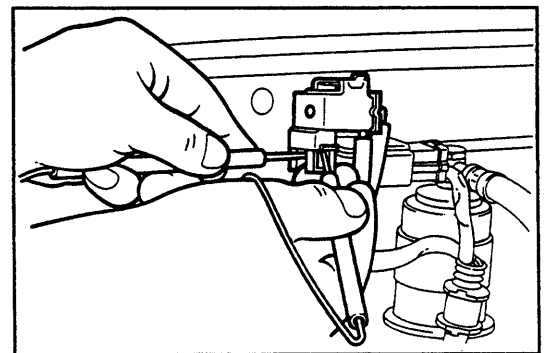


WN88E-EF154

2. Measure the resistance between the idle-up VSV terminals.

Specified value	30 - 50Ω at 20°C (68°F)
-----------------	-------------------------

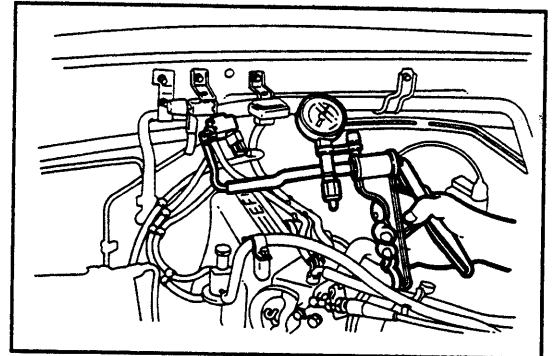
If the resistance will not conform to the specification, replace the idle-up VSV.



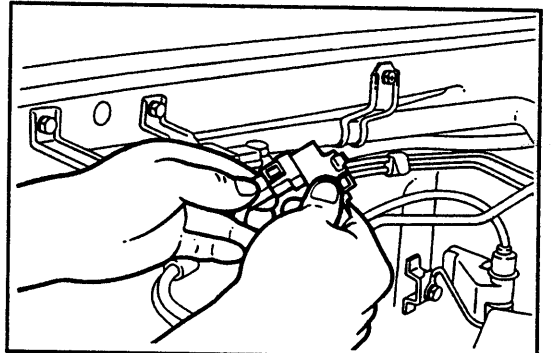
WN88E-EF155

## EFI SYSTEM

3. Disconnect the rubber hose connected to the idle-up VSV and connect a MityVac or a vacuum pump. Apply a negative pressure of 100 mmHg (3.94 inchHg).  
If no negative pressure is applied, replace the idle-up VSV.
4. Connect the idle-up VSV connector and turn ON the ignition key switch. Check to see if the negative pressure applied in the step 3 becomes zero.  
During this check, a voltage should be applied to the connector side.
5. Connect the disconnected rubber hose to the idle-up VSV.  
Attach the idle-up VSV to the bracket.



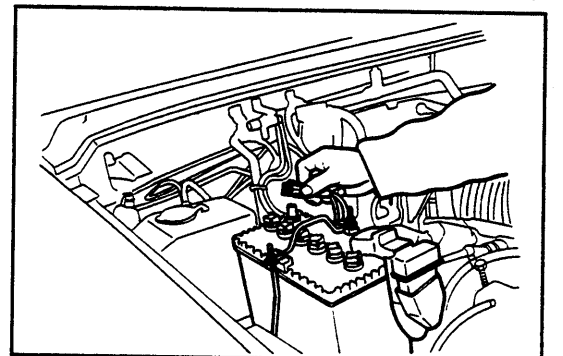
WN88E-EF156



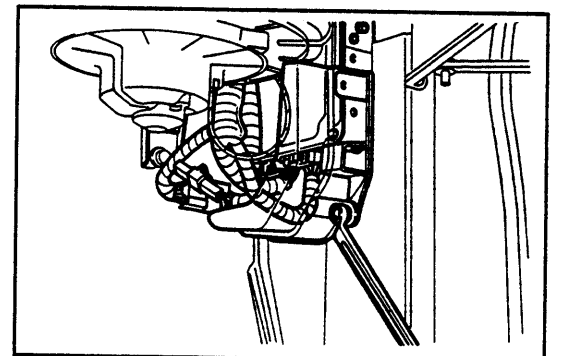
WN88E-EF157

### Check of Idle-up VSV Control

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Remove the ECU cover.
3. Connect the following SST between the ECU and the engine wire.  
SST: 09842-87701-000



WE88-EF158

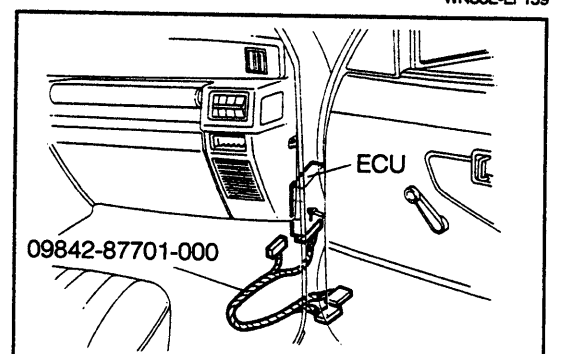


WN88E-EF159

3. Connect the following SST between the ECU and the engine wire.  
SST: 09842-87701-000

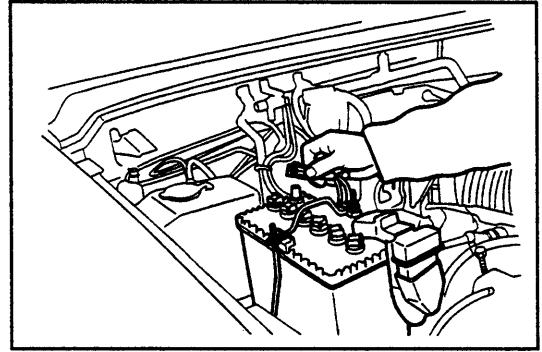
### NOTE:

Before the SST is installed, be sure to perform continuity and short tests between SST terminals.



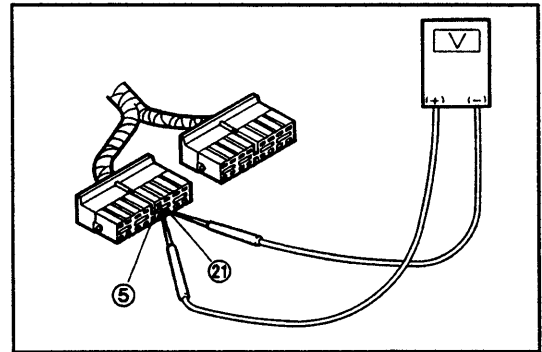
WN88E-EF160

4. Reconnect the ground cable terminal to the negative (-) terminal of the battery.



WN88E-EF161

5. With the engine running, measure the voltage across the SST terminals ⑤ and ⑳.



WN88E-EF162

No.	Condition	Measured voltage
1	Engine has warmed up fully after starting.	3V or less
2	Defogger ON	
3	Headlamps ON	
4	Blower fan motor operating	

The measurement should not be performed when plural conditions of those described above are met concurrently.

If the check results will not conform to the requirements given in the table above, check and repair the following sections.

WN88E-EF163

No.	Check item
1	Check water temperature sensor-related parts. (See page EF-39.) Check ECU. (See page EF-67.)
2, 3	Check to see if battery voltage is applied to between SST terminals ⑪ and ⑳ when defogger switch and/or headlamp switch is turned ON. If battery voltage is applied, check ECU. If no battery voltage is applied, check wiring from ECU ⑪ terminal to defogger switch and/or headlamp switch.
4	Check and repair wiring between blower fan motor switch and idle-up VSV.

WN88E-EF164

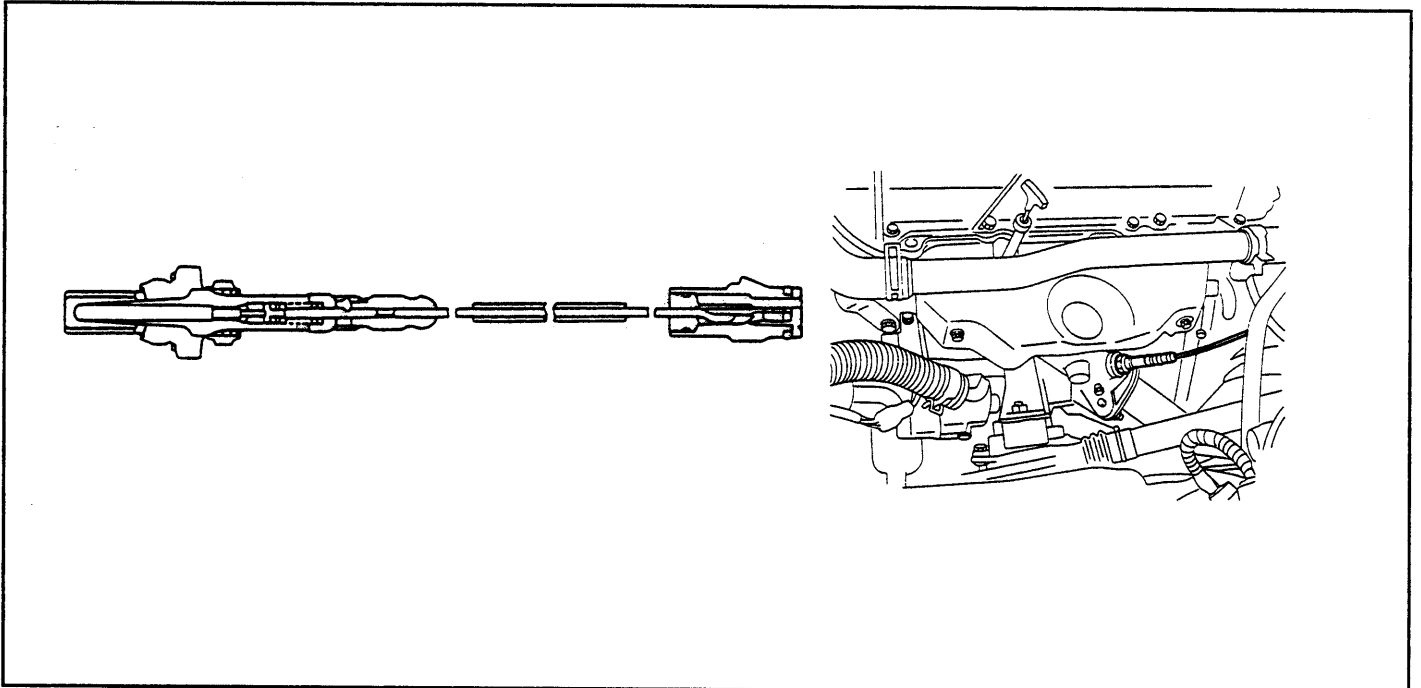
# EFI SYSTEM

## 6. SST removal

- (1) Disconnect the ground cable terminal from the negative (-) terminal of the battery.
- (2) Remove the SST by disconnecting the ECU and engine wire connectors of the SST.
- (3) Connect the engine wire to the ECU.
- (4) Install the ECU cover.
- (5) Reconnect the ground cable terminal to the negative (-) terminal of the battery.

WN88E-EF165

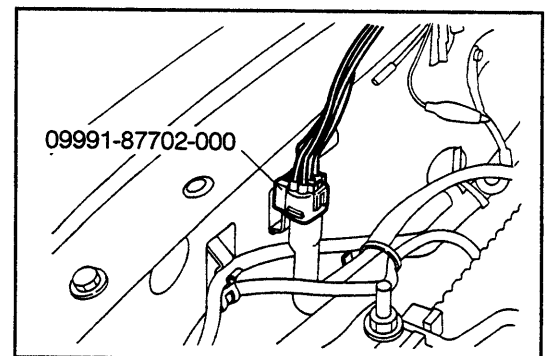
## OXYGEN SENSOR



WN88E-EF166

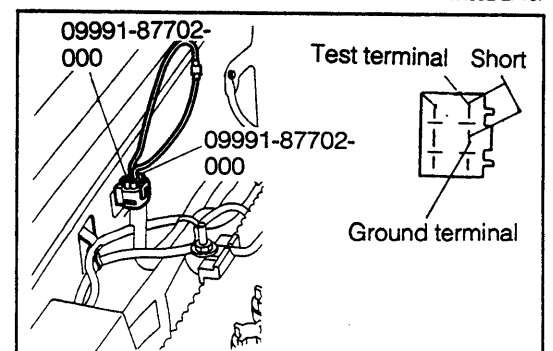
### Inspection of Oxygen Sensor

1. Install the SST to the check terminal.  
SST: 09991-87702-000



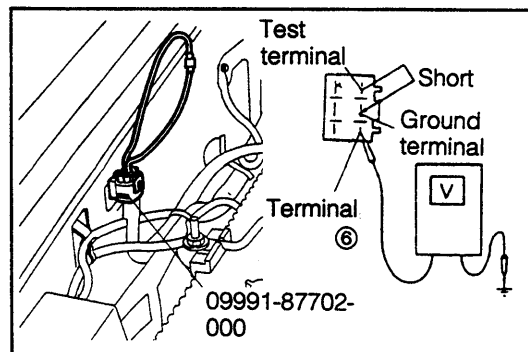
WN88E-EF167

2. Warm up the engine.
3. After the engine has been warmed up, hold the engine speed for two minutes at 3000 rpm.
4. Short the SST Test terminal (brown) with the ground terminal (black).



WN88E-EF168

5. Connect a voltmeter between the SST terminal ⑥ (green) and the engine ground.



WN88E-EF169

6. Hold the engine speed at around 3000 rpm. Ensure that the reading of the voltmeter hooked up in the step 5 changes eight times or more for 10 seconds. When the change in voltage occurs eight times or more, the oxygen sensor is functioning normally.

If the change in voltage fails to occur eight times or more in the check described in the step 6, perform trouble shooting following the instruction given below.

In case that the change in voltage occurs less than eight times:

Proceed to Step 7.

In case that no change in voltage occurs at all:

Proceed to Step 10.

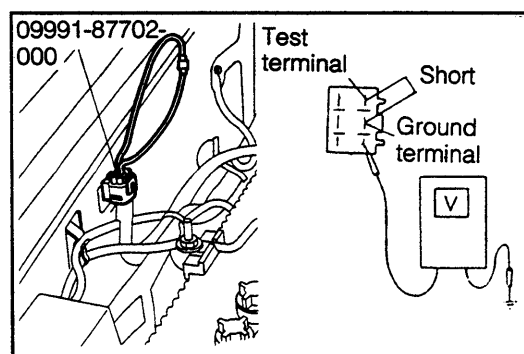
7. Release the short between the SST Test terminal and the ground terminal.

WN88E-EF170

8. Again hold the engine speed for two minutes at 3000 rpm.

Afterwards, while holding the engine speed at around 3000 rpm, short the SST Test terminal with the ground terminal.

SST: 09991-87702-000



WN88E-EF171

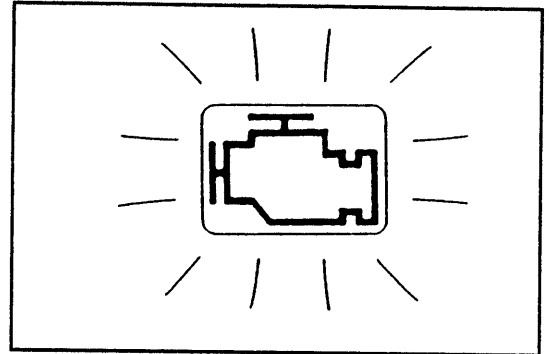
9. Check that the change in voltage between the SST terminal VF and the engine ground occurs eight times or more. If the change in voltage occurs eight times or more, the oxygen sensor is functioning normally.

If the change in voltage occurs less than than eight times, replace the oxygen sensor.

In case that no change in voltage occurs at all, proceed to the step 10.

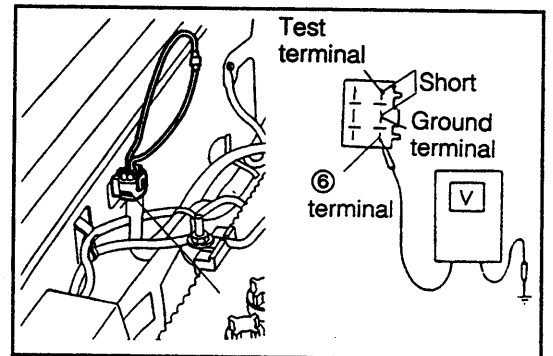
WN88E-EF172

10. Perform the diagnosis check. Read the diagnosis code.  
(See page EF-28.)  
If any code or codes other than the normal code are indicated, carry out the trouble shooting according to diagnosis codes.  
When the normal code is indicated, proceed to the step 11.



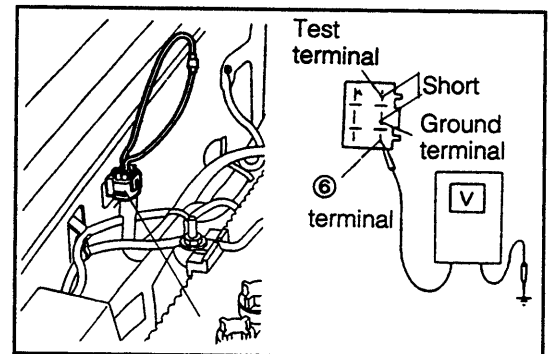
WN88E-EF173

11. Start the engine and warm it up.
12. Hold the engine speed for two minutes at 3000 rpm. Then, hold the engine speed at around 3000 rpm. Short the Test terminal with the ground terminal.



WN88E-EF174

13. While the operation described in the step (12) is being performed, measure the voltage between the SST terminal ⓐ and the engine ground.  
If the measured voltage is more than 0V, it means that the air-to-fuel ratio of the fuel mixture is too rich. Remedy the cause for the too rich fuel mixture.  
If the measured voltage is 0V and the engine is idling normally, replace the oxygen sensor.



WN88E-EF175

If the measured voltage is 0V and the engine is not idling normally, remedy the cause for the too lean fuel mixture.

14. Remove the SST from the check connector.
15. Install the cap to the check connector.



## ELECTRONIC CONTROL UNIT (ECU)

### Inspection of ECU

#### 1. Measurement of ECU voltage

**NOTE:**

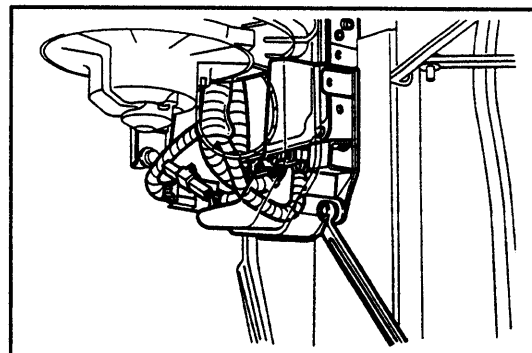
- The wiring circuit of the EFI can be checked by measuring the voltage and resistance at the ECU terminals.
- The measurement of voltage should be conducted while all of the connectors are connected.
- Make sure that the battery voltage is 11 volts or more when the ignition switch is turned ON.

#### (1) Preparation of measurement

- ① Disconnect the ground cable terminal from the negative terminal (-) of the battery.

WN88E-EF176

- ② Remove the ECU cover.



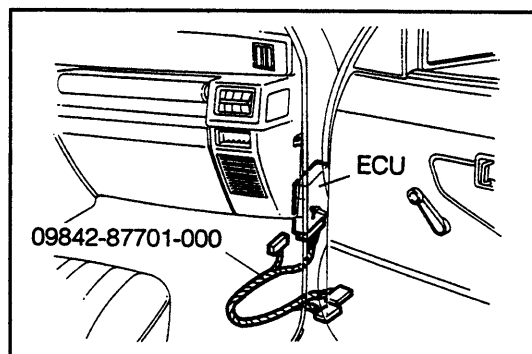
WN88E-EF177

- ③ Connect the SST between the ECU and the engine wire.

SST: 09842-87701-000

**NOTE:**

Before the SST is installed, be sure to perform continuity and short tests between SST terminals.



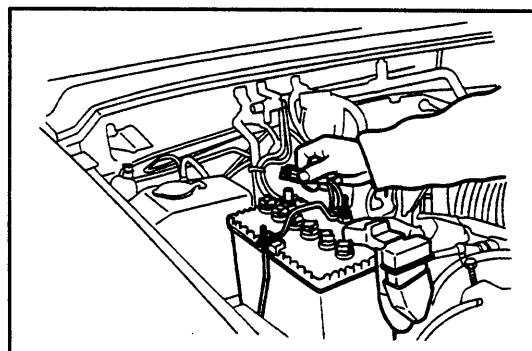
WN88E-EF178

- ④ Connect the ground cable terminal to the negative terminal (-) of the battery.

**NOTE:**

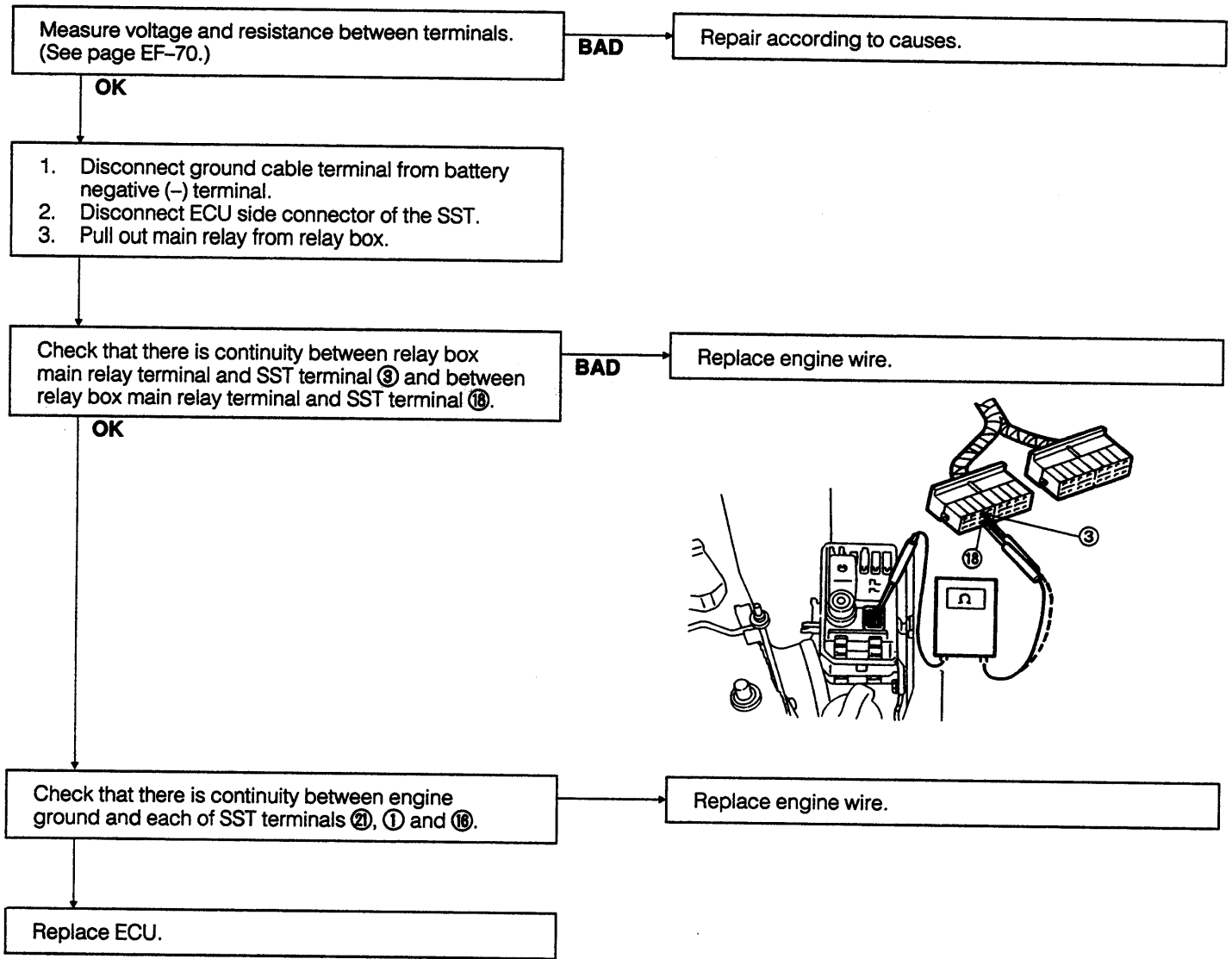
After completion of the inspection, before the SST is removed, be sure to disconnect the battery ground cable from the negative (-) battery terminal.

After the ECU and engine wire have been connected, reconnect the battery ground cable to the negative (-) battery terminal.



WN88E-EF179

(2) Measure the voltage and resistance between each terminal. Check that the measured voltage and resistance conform to the specifications. Perform the check and repair in accordance with the flow chart given below.



### NOTE:

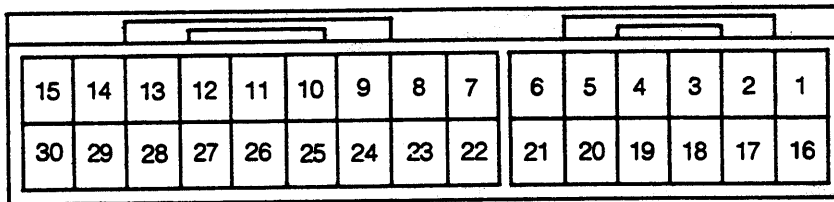
Even when the trouble has been solved by replacing the ECU, be sure to install the old ECU again. Thus, confirm that the trouble was attributable to the old ECU.

WN88E-EF180

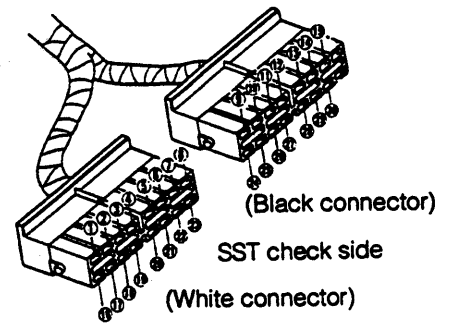
**ECU CONNECTORS**

No.	Contents of connection	No.	Contents of connection
1	Power ground	15	Cooling water temperature sensor
2	Injector	16	Power ground
3	Battery +B (Main relay)	17	Injector
4	Battery +B (Back-up)	18	Battery +B (Main relay)
5	Idle-up VSV	19	Check engine lamp
6	Feedback check terminal	20	Fuel pump relay
7	Ignition coil (negative)	21	Engine ground
8	Starter switch	22	Pressure sensor ground
9	Test terminal	23	Air conditioner magnet clutch
10	Idle switch	26	Vehicle speed sensor
11	Electric load signal	28	Power switch
12	Sensor power supply (approx. 5V)	29	Oxygen sensor
13	Pressure sensor	30	Sensor ground
14	Intake air temperature sensor		

WN88E-EF181



ECU side



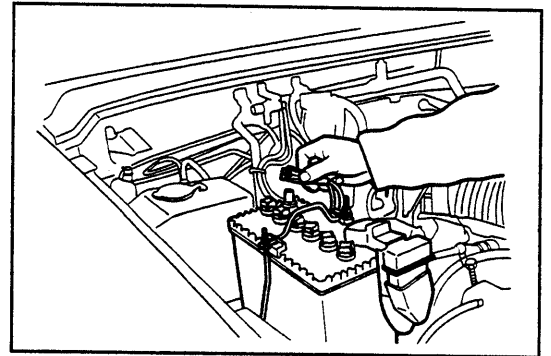
## Voltage or Resistance at ECU Wiring Connectors

Terminals	STD voltage or resistance	Conditions	Remedies
① - ⑳	1Ω or less	Ignition switch OFF	Proceed to flow chart ②.
② - ㉑	1V or less	Ignition switch OFF (after more than one minute)	Check power supply.
	10 - 15V	Ignition switch ON	
③ - ㉑	0.1V or less	Ignition switch OFF (after more than ten seconds)	Check power supply.
	10 - 15V	Ignition switch ON	
④ - ㉑	10 - 15V	At all times (Measured voltage is lower than specified voltage only at during starting period.)	Check power supply.
⑤ - ㉑	10 - 15V	Engine fully warmed up. All accessory switches turned OFF.	Check power supply.
	3.0V or less	Idle-up VSV ON	Check idle-up VSV control.
⑥ - ㉑	4.5 - 5.5V	Ignition switch ON. Terminal T shorted with ground terminal. Throttle valve fully closed.	Proceed to flow chart ②.
	1V or less		Check diagnosis code.
	0 - 4.5 to 5.5V (Measured voltage varies.)	Ignition switch ON. Terminal T shorted with ground terminal. Engine revolution speed held at 3000 rpm after it has fully warmed up.	Oxygen sensor system
⑦ - ㉑	0.1V or less	Ignition switch OFF	Check power supply.
	10 - 15V	Ignition switch ON	
⑧ - ㉑	0.1V or less	Ignition switch OFF	Check power supply.
	6 - 15V	When ignition switch is set to ST position	
⑨ - ㉑	0.1V or less	Ignition switch OFF	Check T-terminal wiring.
	10 - 15V	Ignition switch ON	
⑩ - ㉑	0.5V or less	Ignition switch ON. Throttle valve fully closed.	Throttle position sensor system.
	10 - 15V	Ignition switch ON. Throttle valve fully opened.	
⑪ - ㉑	0.1V or less	Ignition switch ON. Headlamp switch and/or defogger switch OFF.	Check idle-up VSV control.
	9 - 15V	Ignition switch ON. Headlamp switch and/or defogger switch ON.	
⑫ - ㉑	0.1V or less	Ignition switch OFF	Check VCC wiring.
	4.5 - 5.5V	Ignition switch ON	
⑬ - ㉑	3.2 - 3.8V	Ignition switch ON. Atmospheric pressure is 760 mmHg (29.9 inchHg).	Check pressure sensor.
⑭ - ㉑	0.9 - 3.0V	Ignition switch ON. Air temperature inside surge tank: 20°C (68°F)	Check intake air temperature sensor.
⑮ - ㉑	0.4 - 0.5V	Ignition switch ON. After engine has been warmed up fully. (Cooling water temperature: 80 - 90°C (176 - 194°F))	Check cooling water temperature sensor.

Terminals	STD voltage or resistance	Conditions	Remedies
⑩ - ①	1Ω or less	Ignition switch OFF	Proceed to flow chart ②.
⑪ - ⑫	1V or less	Ignition switch OFF (after more than one minute)	Check/repair injector power supply.
	10 - 15V	Ignition switch ON	
⑬ - ⑭	0.1V or less	Ignition switch OFF	Check and repair ECU power supply.
	10 - 15V	Ignition switch ON	
⑮ - ⑯	3V or less	Ignition switch ON (Check engine lamp illuminated.)	Check power supply for check engine lamp.
	10 - 15V	Engine is rotating. (Check engine lamp not illuminated.)	
⑰ - ⑱	1V or less	Ignition switch ON. Fuel pump is operating.	Check/repair fuel pump power supply.
	10 - 15V	Ignition switch ON. Fuel pump is stopped.	
⑲ - Engine ground	0.2Ω or less	Ignition switch OFF	Check ground wiring.
⑳ - ⑱	0.5Ω or less	Ignition switch OFF	Replace ECU.
㉑ - ⑱	10 - 15V	Engine is rotating. Air conditioner compressor is rotating. (Genuine air conditioner-equipped vehicle)	Check air conditioner wiring.
㉒ - ⑱	0 - 10 to 15V	Ignition switch ON When vehicle is moved. (Measured voltage changes 4 times for movement of 1.5m.)	Check speed sensor.
㉓ - ⑱	4.5 - 5.5V	Ignition switch ON. Throttle valve fully closed.	Check throttle position sensor.
	0.5V or less	Ignition switch ON. Throttle valve fully opened.	
㉔ - ⑱	0.1V or less	Ignition switch ON (after more than 60 seconds)	Check oxygen sensor.
	Voltage varies within 0 - 1.0V	After engine has warmed up fully. When engine revolution is held at 3000 rpm for more than 2 minutes:	Check fuel system.
㉕ - ⑱	1Ω or less	Ignition switch ON	Proceed to flow chart ②.

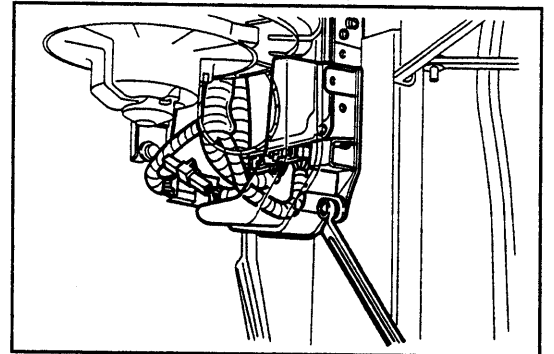
## ECU Replacement

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.



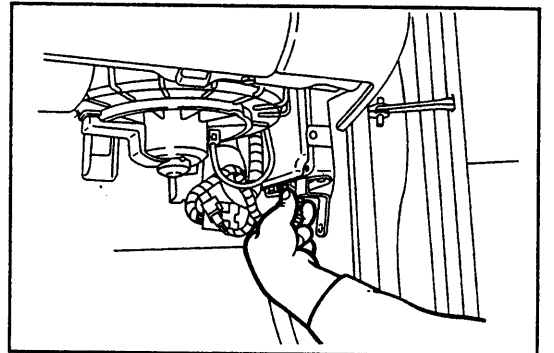
WN88E-EF185

2. Remove the ECU cover.



WN88E-EF186

3. Disconnect the engine wire connector from the ECU.

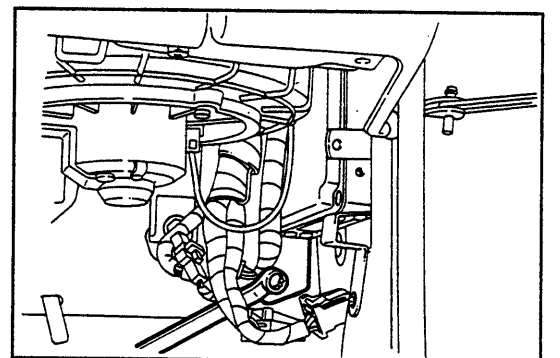


WN88E-EF187

4. Remove the ECU from the cowl panel by removing the attaching screws.
5. Install a new ECU to the cowl panel.

**CAUTION:**

Do not touch with the bracket screws mounted on the ECU proper. This tampering will cause an ECU malfunction.



WN88E-EF188

6. Connect the engine wire connector to the ECU.
7. Install the ECU cover on the cowl panel.
8. Connect the ground cable terminal to the negative (-) terminal of the battery.

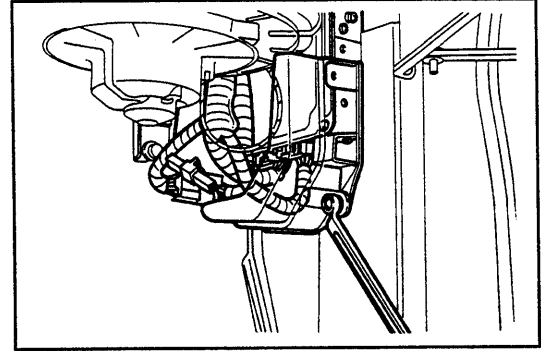
WN88E-EF190

**SST Removal**

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Disconnect the connectors of the ECU and engine wire from the SST so as to remove the SST.
3. Connect the engine wire connector to the ECU.

WN88E-EF191

4. Install the ECU cover on the cowl panel.



WN88E-EF192

5. Reconnect the ground cable terminal to the negative (-) terminal of the battery.

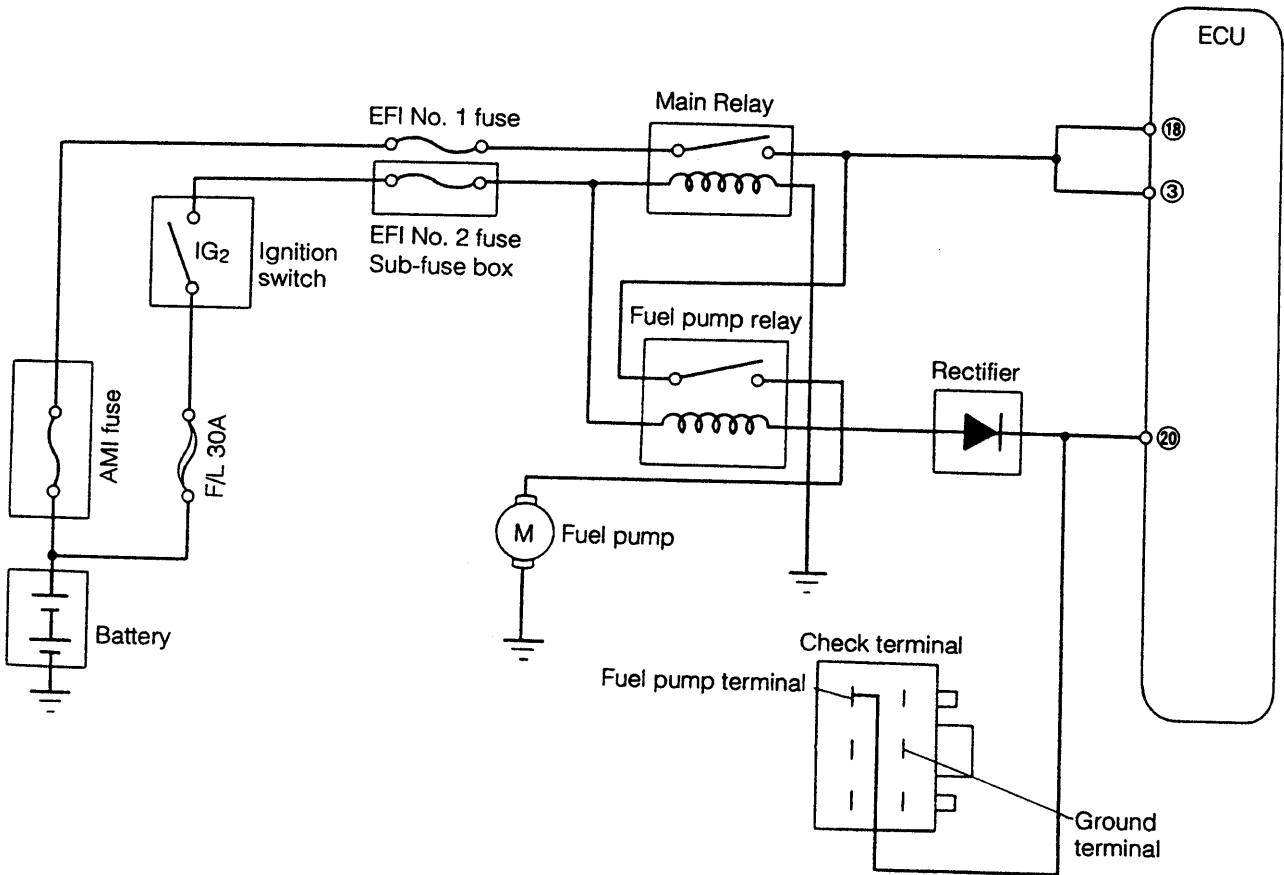
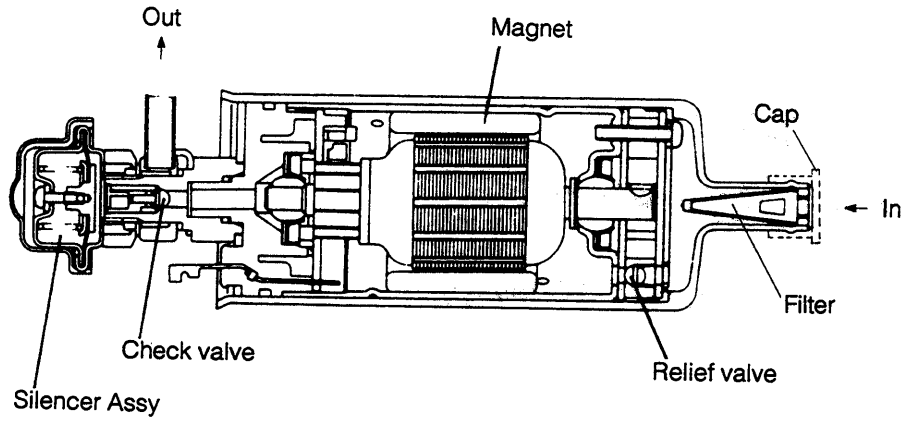
WN88E-EF193

# FUEL SYSTEM

## FUEL PUMP

**WARNING:**

When working on the fuel system, never smoke nor allow any open flame to be brought near the working site.



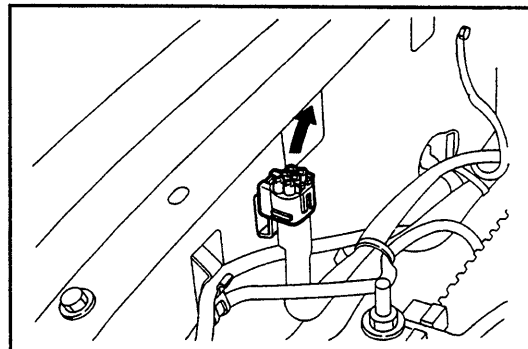


**IN-VEHICLE INSPECTION**

**Check of Fuel Pump Operation**

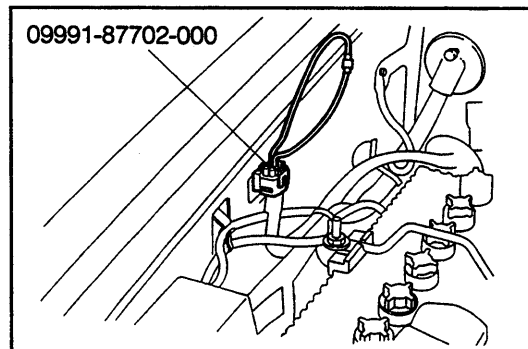
1. Connection of SST (09991-87702-000)

(1) Detach the check terminal cap.



WR88-EF195

(2) Connect the SST to the check connector. Connect the SST terminal F (white/black) to the ground terminal (black).



WR88-EF196

2. Check of fuel flowing sound

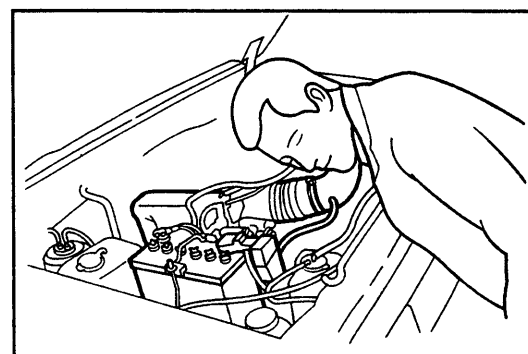
(1) Turn ON the ignition key switch.

WR88-EF197

(2) Check to see if you can hear fuel flowing sound around the pressure regulator.

(3) If you can hear no fuel flowing sound, check the following parts. Repair them, as required.

- Fusible links
- Fuses
- Main relay
- Fuel pump relay
- Fuel pump
- Wiring and wiring connections



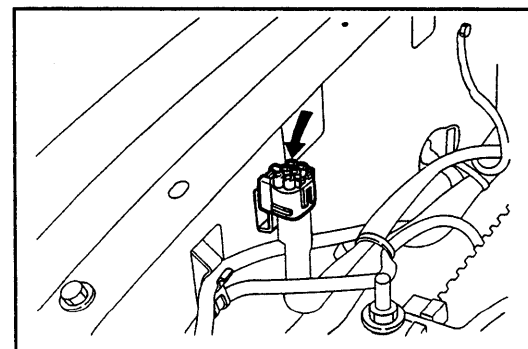
WR88-EF198

3. SST Removal

(1) Turn OFF the ignition switch.

(2) Remove the SST from the check terminal.

(3) Attach the cap on the check terminal.



WR88-EF200

## Check of Fuel Pressure

1. Ensure that the battery voltage is 12 volts or more.
2. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
3. Place a suitable container or cloth, etc. under the fuel filter.

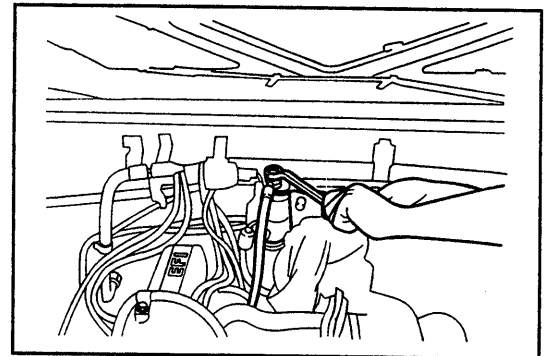
WR88-EF201

4. Loosen the union bolt gradually.

### CAUTION:

The fuel pressure at the inside of the fuel line is approximately  $2.55 \text{ kg/cm}^2$  (36.27 psi) higher than the atmospheric pressure. Hence, be sure to gradually loosen the union bolt so as to prevent fuel from splashing.

Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the fuel filter so that no fuel may get to the resin or rubber parts of the vehicle.

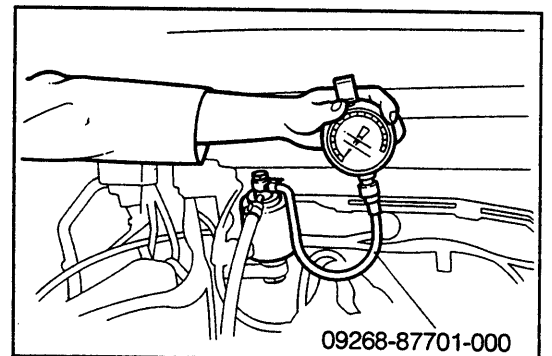


WR88-EF202

5. Install the SST (fuel pressure gauge) between the fuel hose No. 1 and the fuel filter by means of the union bolt with a new gasket interposed.

SST: 09268-87701-000

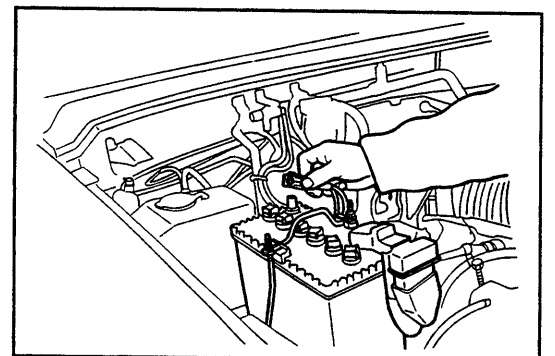
Tightening Torque: 3.5 - 4.5 kg-m (25.3 - 32.5 ft-lb)



09268-87701-000

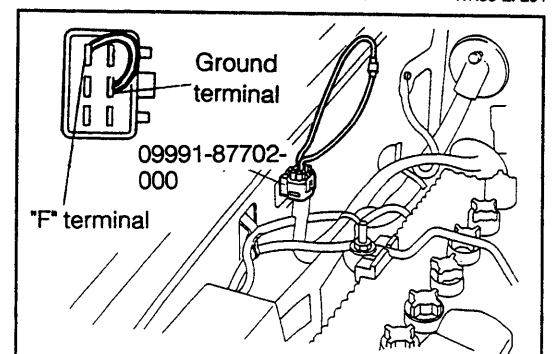
WR88-EF203

6. Reconnect the ground cable terminal to the negative (-) terminal of the battery.



WR88-EF204

7. Connection of SST (09991-87702-000)
  - (1) Remove the cap on the check terminal.
  - (2) Connect the SST to the check connector.
  - (3) Connect the SST terminal F (white/black) to the ground terminal (black).
8. Turn ON the ignition switch.



WR88-EF205

9. Check to see if the fuel pressure conforms to the specified pressure.

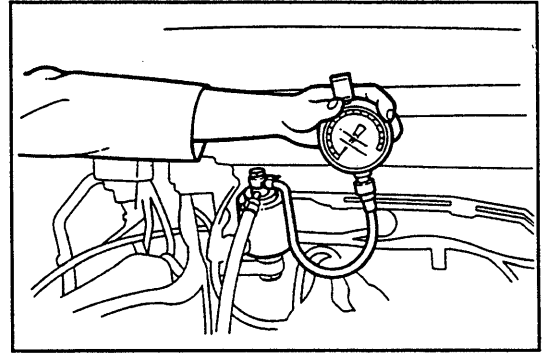
**Specified Fuel Pressure: 2.3 - 2.8 kg/cm<sup>2</sup> (33 - 40 psi)**

If the fuel pressure is higher than the specified pressure, check and/or repair the following items.

- (1) Fuel return hose and/or pipe for restriction or damage.
- (2) Rubber hose connected between pressure regulator and surge tank for restriction.
- (3) If the check results of (1) and (2) are satisfactory, replace the pressure regulator. (See page EF-85.)

If the fuel pressure is lower than the specified pressure, check and/or repair the following items.

- (1) Fuel hose and/or pipe for restriction or damage or leakage.
- (2) Fuel filter for restriction. (See page EF-82.)
- (3) Check fuel flow rate. (See page EF-79.)
- (4) Pressure regulator. (See page EF-85.)



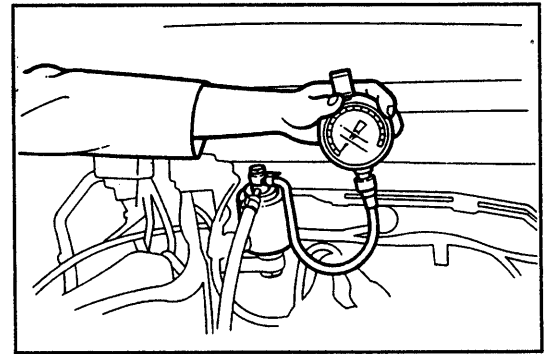
WN88E-EF196

10. Turn OFF the ignition switch. After a lapse of three minutes, check to see if the fuel pressure is the specified pressure or more.

**Specified Fuel Pressure: 1.8 kg/cm<sup>2</sup> or more  
(25.6 psi or more)**

If the fuel pressure is lower than the specified pressure, check and/or repair the following items.

- (1) Injector (See page EF-93.)
- (2) Pressure regulator (See page EF-85.)
- (3) Fuel hose and/or pipe for damage or leakage.
- (4) If the check results of (1) and (2) are satisfactory, replace the fuel pump.



WN88E-EF197

#### 11. SST Removal

- (1) Turn OFF the ignition key switch.
- (2) Disconnect the ground cable terminal from the negative terminal (-) of the battery.
- (3) Loosen the fuel filter union bolt gradually.

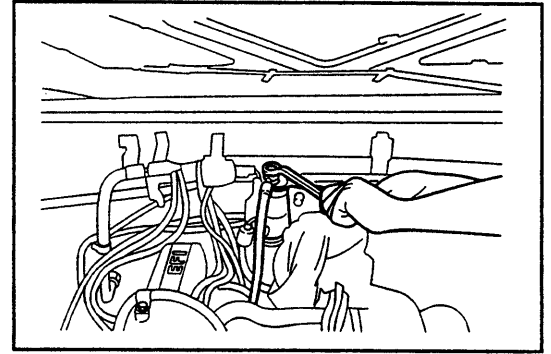
**CAUTION:**

The fuel pressure at the inside of the fuel line is approximately 2.5 atm. higher than the atmospheric pressure. Hence, be sure to gradually loosen the union bolt so as to prevent fuel from splashing. Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the fuel filter so that no fuel may get to the resin or rubber parts of the vehicle.

- (4) Remove the SST (fuel pressure gauge).  
SST: 09268-87701-000

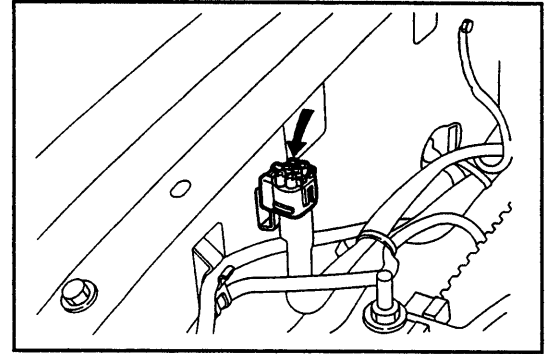
WR88-EF208

- (5) Install the fuel hose No. 1 to the fuel filter by means of the union bolt with a new gasket interposed.  
Tightening Torque: 3.5 - 4.5 kg-m (25.3 - 32.5 ft-lb)



WR88-EF209

- (6) Remove the SST from the check connector.  
(7) Attach the cap on the check connector.  
(8) Reconnect the ground cable terminal to the negative (-) terminal of the battery.



WR88-EF210

## 12. Check of Fuel Leakage

Start the engine. Check to see if any fuel leakage is present.  
Repair any defective part if the fuel leakage exists.

WR88-EF211

## Check of Fuel Flow Rate

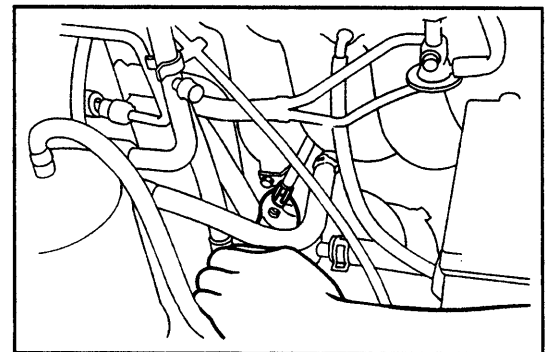
1. Ensure that the battery voltage is 12 volts or more.
2. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
3. Place a suitable container or cloth, etc. under the pressure regulator.

WR88-EF212

4. Disconnect the fuel return hose connected to the pressure regulator.

### CAUTION:

Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the fuel return hose.



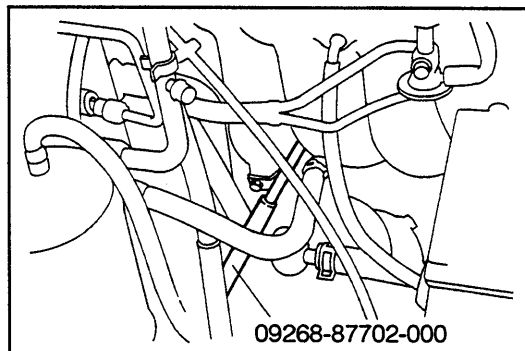
WR88-EF213

- Connect a suitable fuel hose (about 2 meter long) to the pressure regulator.

**Reference:**

**This fuel hose is included in the SST (09268-87702-000).**

- Insert one end of the fuel hose in a measuring cylinder.
- Detach the check connector cap.
- Connect the SST (09991-87702-000) to the check connector. Connect the SST terminal F (White/Black) to the ground terminal (Black).
- Connect the ground cable terminal to the negative (-) terminal of the battery.
- Turn ON the ignition switch for 15 seconds. Then, turn OFF the switch.



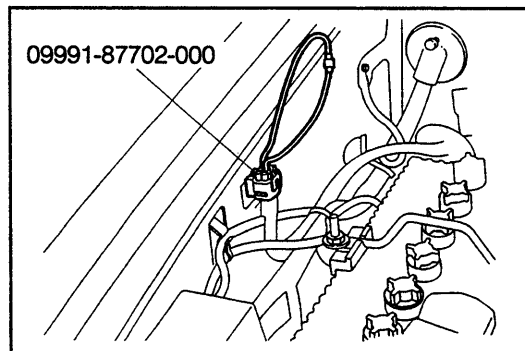
WN88E-EF198

- Measure the amount of fuel collected in the measuring cylinder.

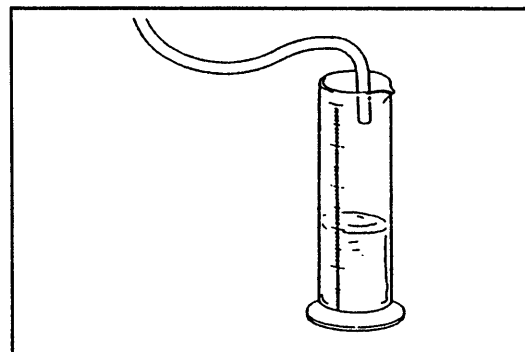
**Specified Amount of Fuel: 235 cc or more  
(14.34 cub inch or more)**

If the fuel amount is less than the specified amount, check the fuel filter.

- Disconnect the ground cable terminal from the negative (-) terminal of the battery.
- Remove the SST (09991-87702-000) from the check connector.
- Attach the cap on the check connector.
- Disconnect the fuel hose connected to the pressure regulator.

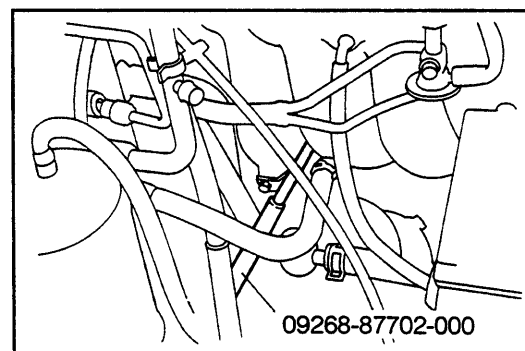


WR88-EF217

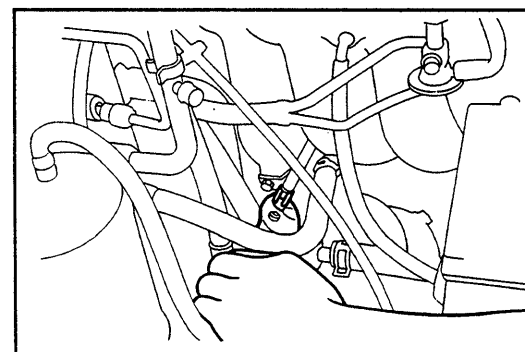


WN88E-EF199

- Connect the fuel return hose to the pressure regulator. Attach the clips.
- Reconnect the ground cable terminal to the negative (-) terminal of the battery.
- Start the engine. Check to see if any fuel leakage is present. Repair any defective part if fuel leakage exists.

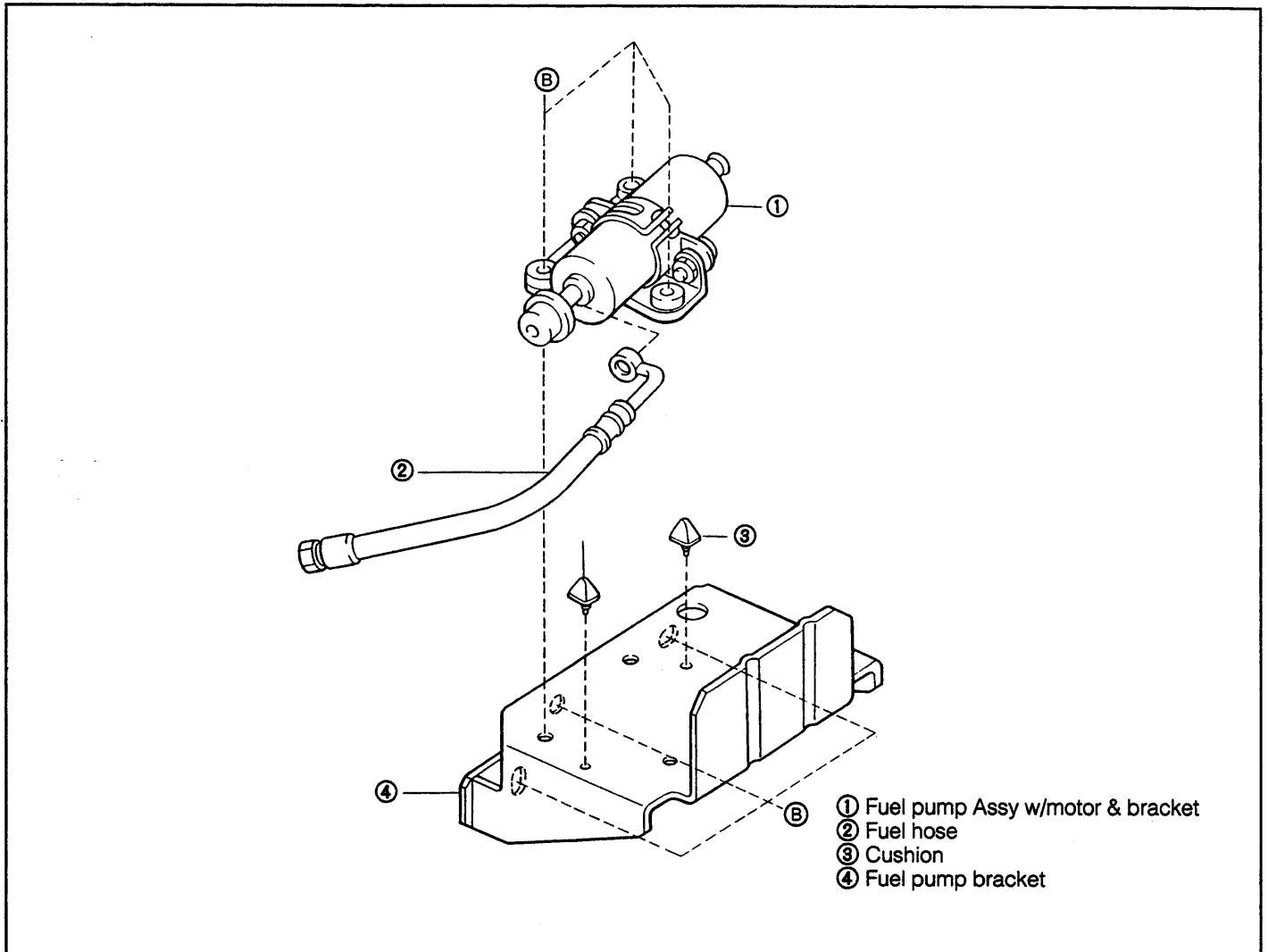


WN88E-EF200



WR88-EF221

## REMOVAL OF FUEL PUMP



WN88E-EF201

### WARNING:

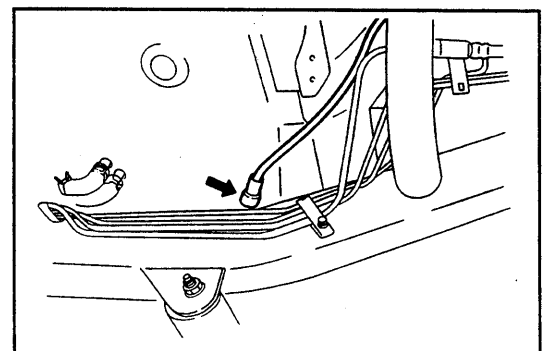
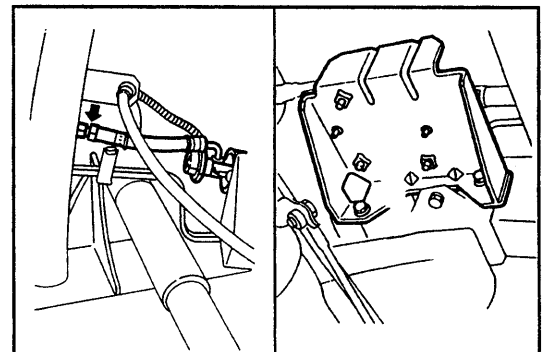
When working on the fuel system, never smoke nor allow any open flame to be brought near the working site.

1. Disconnect the fuel hose front and rear side from the fuel pump.

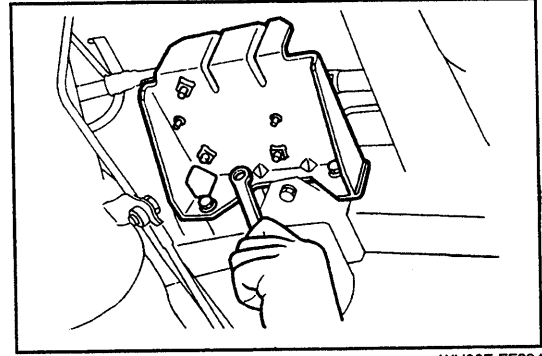
### CAUTION:

Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the fuel pump.

2. Disconnect the fuel pump coupler.



3. Detach the fuel pump bracket by removing the three bolts.
4. Detach the fuel pump bracket from fuel pump by removing the three bolts.



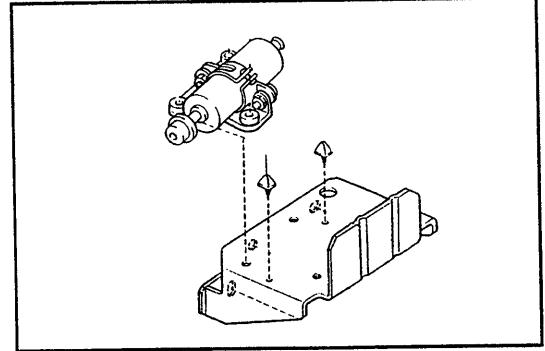
WN88E-EF204

**INSTALLATION OF FUEL PUMP**

1. Install the fuel pump bracket to the fuel pump by tighten the three bolts.

**NOTE:**

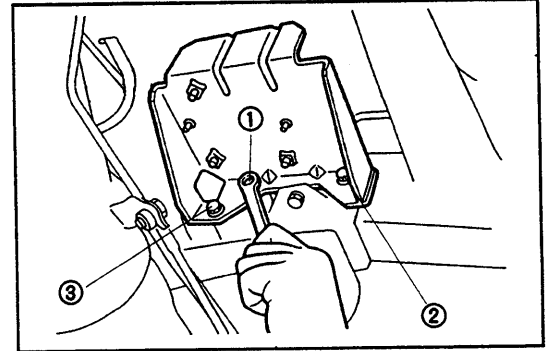
Ensure that the two cushions are installed as correct position.



WN88E-EF205

2. Installation of bracket

- (1) Temporarily tighten bolt No. 1.
- (2) Tighten the bolt No.1 and No. 2.
- (3) Securely tighten the bolt No. 1.

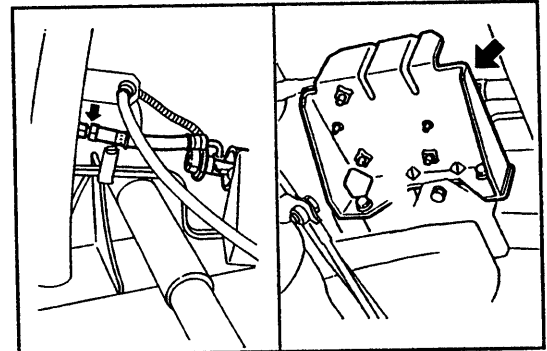


WN88E-EF206

3. Connect the fuel hose front and rear side to the fuel pump.

**NOTE:**

Ensure that the filter is installed at the fuel pump inlet port.

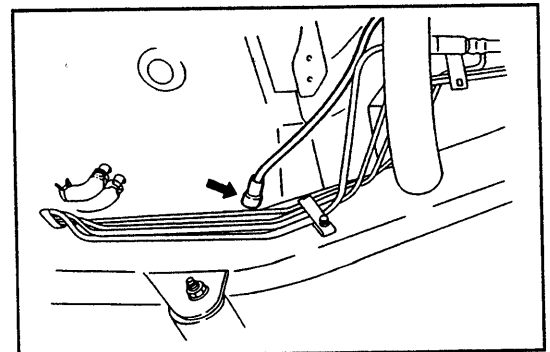


WN88E-EF207

4. Connect the fuel pump coupler.

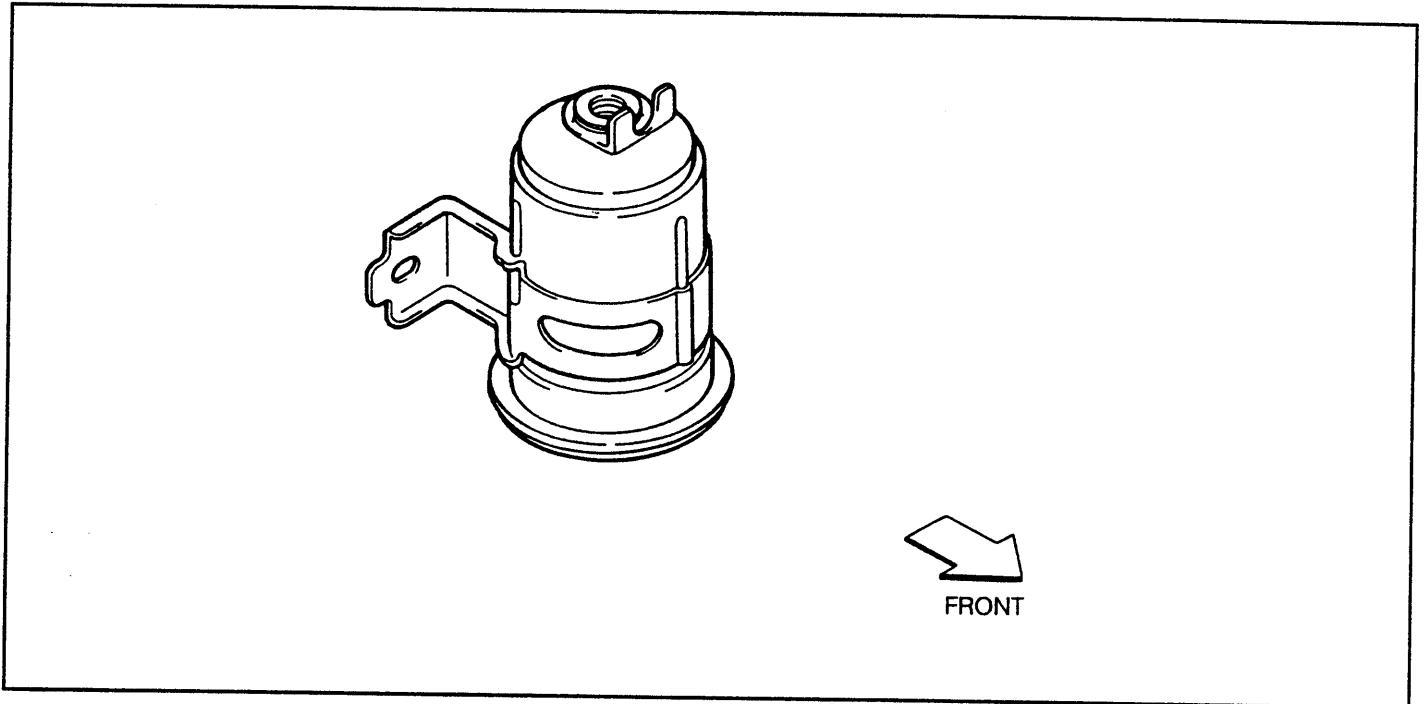
**NOTE:**

Ensure that the lead wire is clamped at two position.



WN88E-EF208

## FUEL FILTER ELEMENT



WR88-EF272

### Check of Fuel Filter Element

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.

WR88-EF273

2. Disconnect the fuel return hose connected to the pressure regulator. Connect a suitable fuel hose (about 2 meter long) to the pressure regulator.

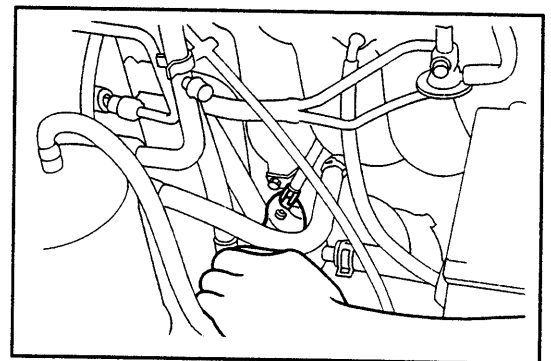
#### Reference:

This fuel hose is included in the SST (09268-87702-000).

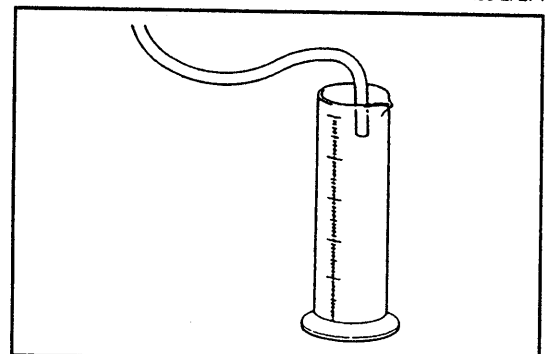
#### CAUTION:

Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the pressure regulator so as to prevent fuel splashing.

3. Insert one end of the fuel hose in a measuring cylinder.



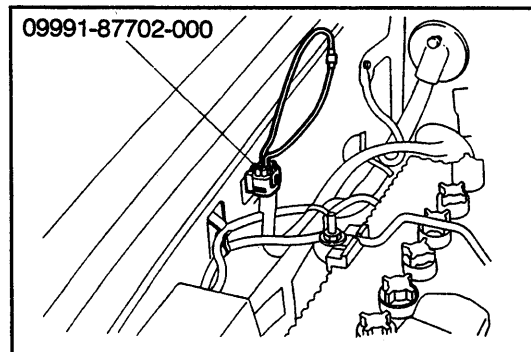
WR88-EF274



WR88-EF275



4. Connection of SST (09991-87702-000)
  - (1) Detach the cap from the check connector.
  - (2) Connect the SST to the check connector.
  - (3) Short the SST terminal F (White/Black) to the ground terminal (Black).
5. Connect the ground cable terminal to the negative (-) terminal of the battery.
6. Turn ON the ignition switch for 15 seconds. Then, turn OFF the switch.



WR88-EF276

7. Measure the amount of fuel collected in the measuring cylinder. Check to see if the measured amount conforms to the specification.

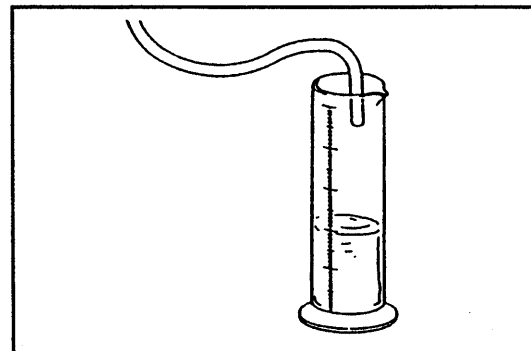
**Specified Amount of Fuel:** 235 cc or more  
(14.34 cub inch or more)

**NOTE:**

If it becomes necessary to bleed air, be sure to conduct the measurement at least twice.

If the fuel amount conforms to the specification, perform the operation, starting from the step 20 onward.

If the fuel amount is less than the specified amount, perform the operation, starting from the step 8 onward.



WR88-EF209

8. Disconnect the ground cable terminal from the negative (-) terminal of the battery.

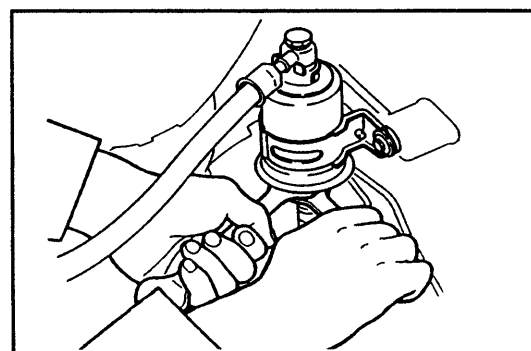
WR88-EF278

9. Loosen the fuel flare nut gradually.

**CAUTION:**

The fuel pressure at the inside of the fuel line is approximately 2.5 kg/cm<sup>2</sup> (36 psi) higher than the atmospheric pressure. Hence, be sure to gradually loosen the flare nut and use a cloth, etc. so as to prevent fuel from splashing.

Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the fuel filter so that no fuel may get to the resin or rubber parts or electrical parts of the vehicle.



WR88-EF279

10. Connect a suitable fuel hose (about 2 meter long) to the fuel pipe.

**Reference:**

This fuel hose is included in the SST (09268-87702-000).

11. Insert one end of the fuel hose in a measuring cylinder.  
12. Reconnect the ground cable terminal to the negative (-) terminal of the battery.  
13. Turn ON the ignition switch for 15 seconds. Then, turn OFF the switch.

14. Measure the amount of fuel collected in the measuring cylinder.

**Specified Amount of Fuel: 235 cc or more  
(14.34 cub inch or more)**

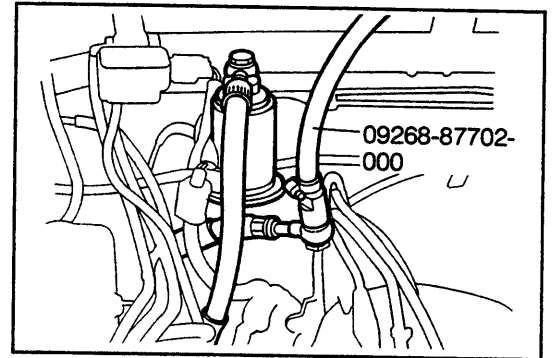
If the fuel amount conforms to the specification, replace the fuel filter.

If the fuel amount is less than the specified amount, check the fuel pump filter for restriction. Then, replace the fuel pump as required. (See page EF-82.)

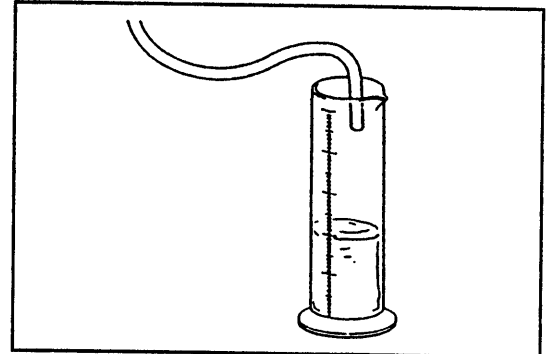
15. Disconnect the ground cable terminal from the negative (-) terminal of the battery.  
16. Coat the flare nut with a thin film of engine oil. Screw in the flare nut into the fuel filter fully by your hand.  
17. Tighten the flare nut.  
**Tightening Torque: 3.5 - 4.4 kg-m (25.3 - 31.8 ft-lb)**

18. Disconnect the fuel hose connected to the pressure regulator.  
19. Connect the fuel return hose to the pressure regulator. Attach the clips.

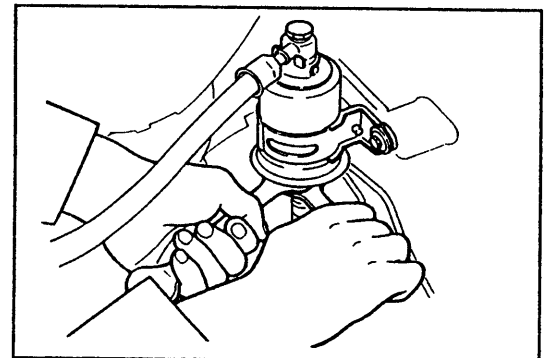
20. Remove the SST from the check connector.  
21. Attach the cap on the check connector.  
22. Reconnect the ground cable terminal to the negative (-) terminal of the battery.  
23. Start the engine. Check to see if any fuel leakage is present. Repair any defective part if fuel leakage exists.



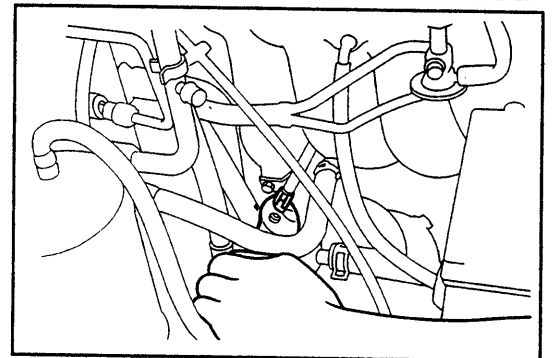
WN88E-EF210



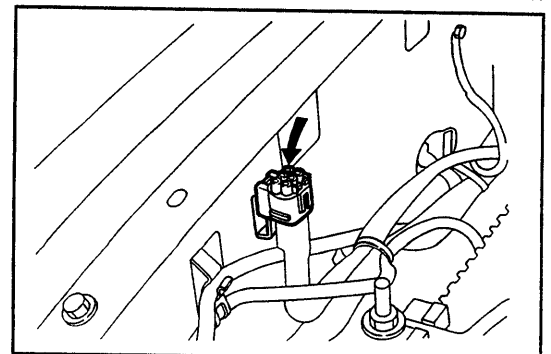
WN88E-EF211



WR88-EF284

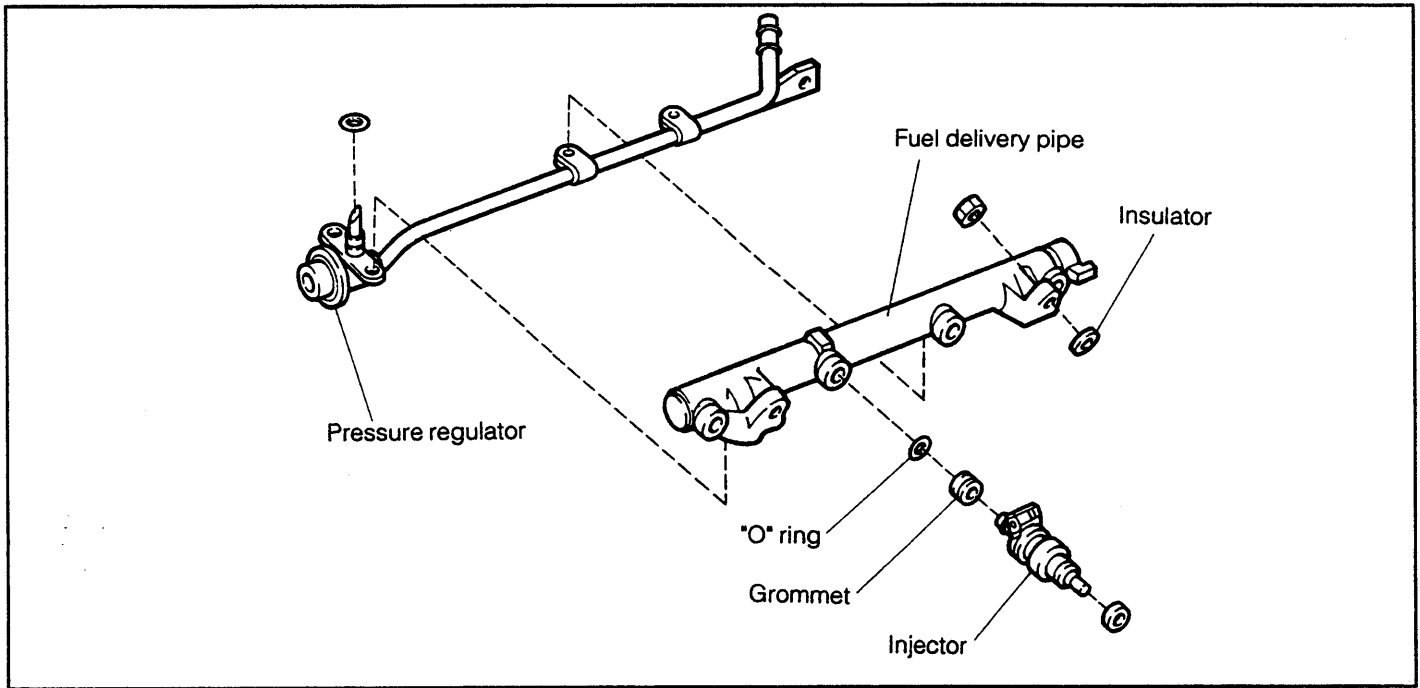


WR88-EF285



WN88E-EF212

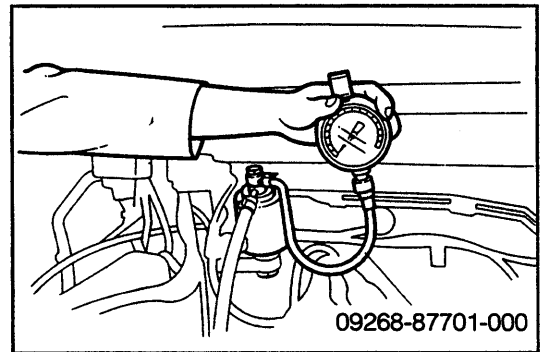
## PRESSURE REGULATOR



WR88-EF288

### In-Vehicle Inspection

Check the fuel pressure. (See page EF-78.)  
SST: 09268-87701-000



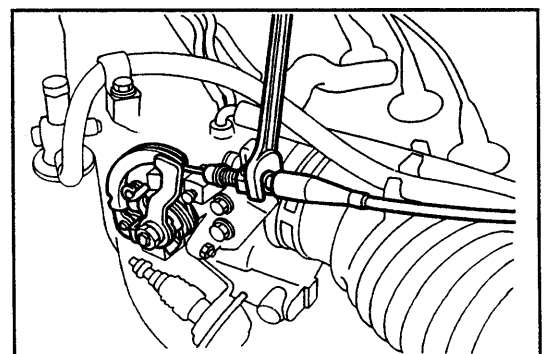
WR88-EF289

### Removal of Pressure Regulator

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.

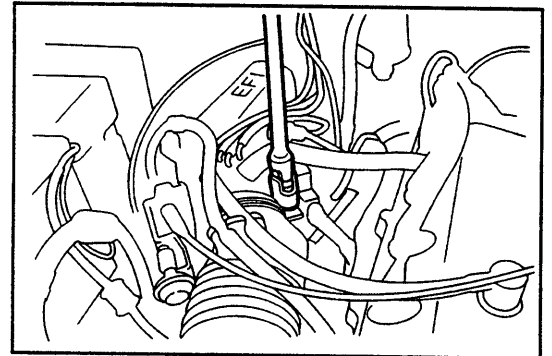
WR88-EF290

2. Detach the accelerator cable from the throttle body.



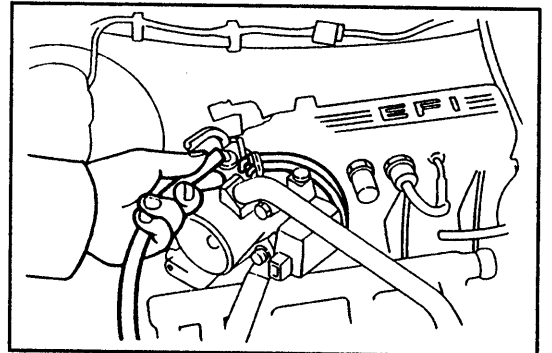
WR88-EF291

3. Remove the air cleaner hose from the throttle body.



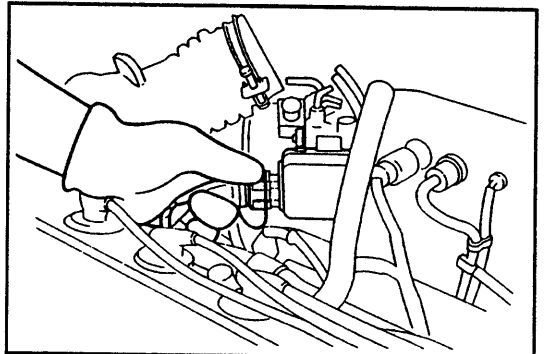
WN88E-EF213

4. Disconnect the rubber hoses from the throttle body.



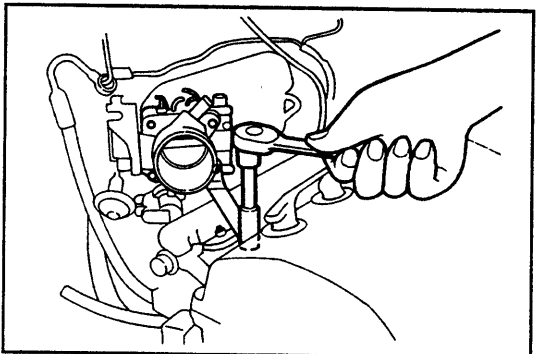
WN88E-EF214

5. Disconnect the throttle position sensor connector.



WN88E-EF215

6. Remove the attaching bolts and nuts of the throttle body surge tank stay No. 1.

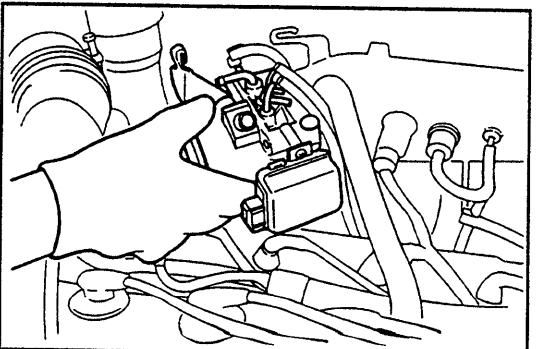


WN88E-EF216

7. Remove the throttle body from the surge tank.

**NOTE:**

Be very careful not to damage the cooling water hose during the removal.



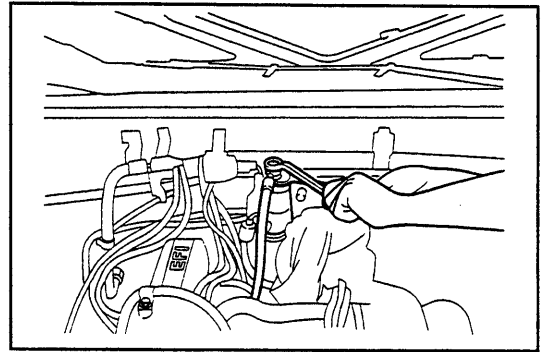
WN88E-EF217

8. Disconnect the fuel hose No. 1 at the fuel filter side.

**CAUTION:**

The fuel pressure at the inside of the fuel line is approximately 2.5 kg/cm<sup>2</sup> (36 psi) higher than the atmospheric pressure. Hence, be sure to gradually loosen the union bolt so as to prevent fuel from splashing.

Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the fuel filter so that no fuel may get to the resin or rubber parts of the vehicle.

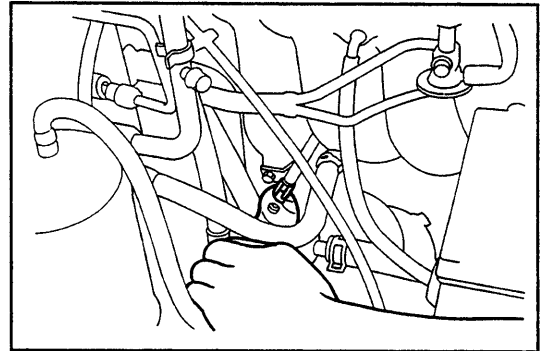


WN88E-EF218

9. Disconnect the fuel return hose from the pressure regulator.

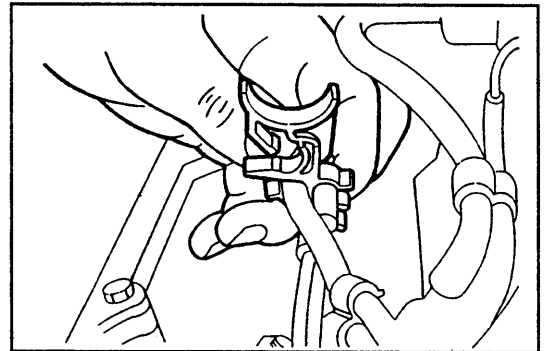
**CAUTION:**

Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the connection so as to prevent fuel from splashing.



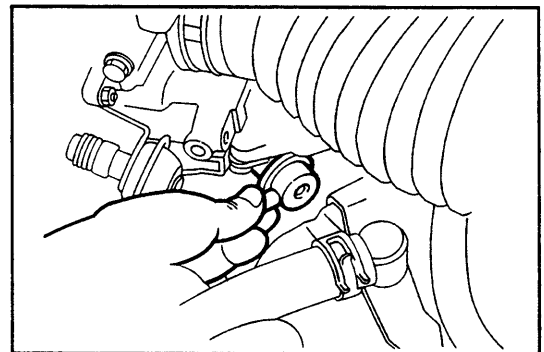
WN88E-EF219

10. Detach the rubber hose clamps from the delivery pipe and pressure regulator.



WN88E-EF220

11. Disconnect the vacuum hose from the pressure regulator.

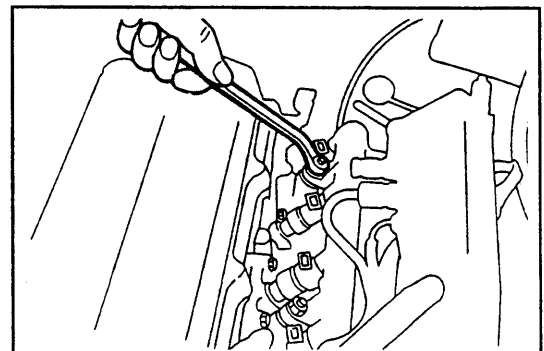


WN88E-EF221

12. Disconnect the delivery pipe.

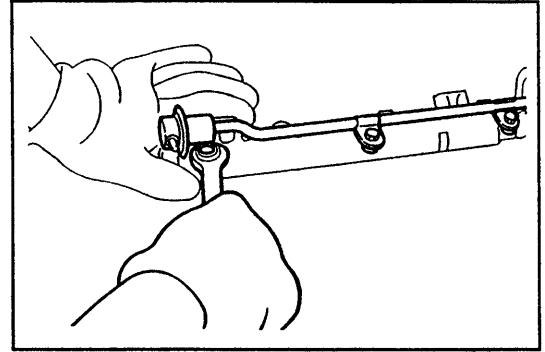
**NOTE:**

- Care must be exercised to ensure that no fuel gets to the alternator, starter, or any rubber, vinyl or plastic parts.
- Leave the injector at the manifold side. (Be very careful not to drop the injector.)



WN88E-EF222

13. Remove the pressure regulator from the delivery pipe.



WN88E-EF223

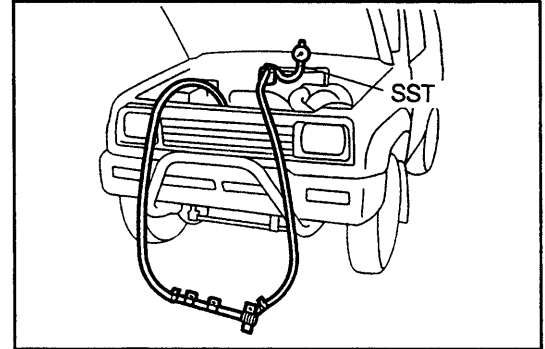
## Inspection of Pressure Regulator

1. Using the following SSTs, connect the pressure regulator, as indicated in the figure.

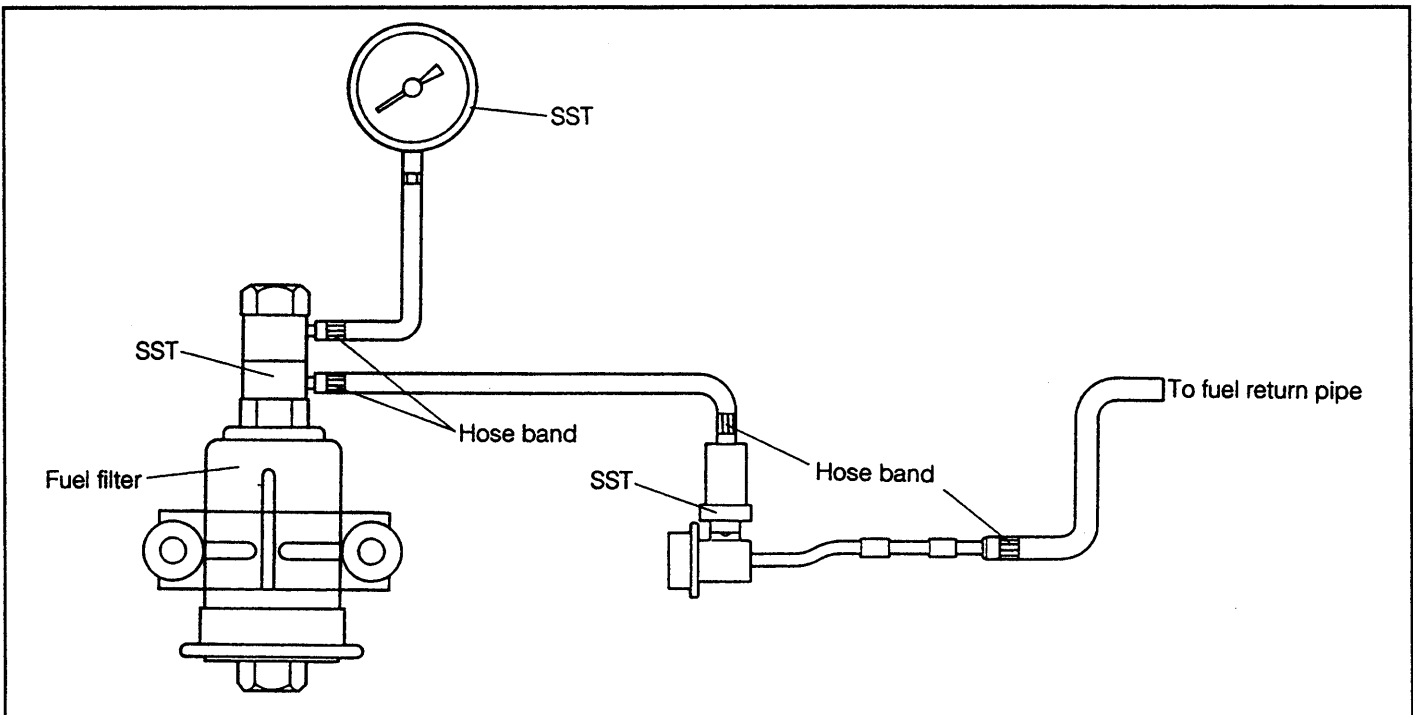
SSTs: 09268-87701-000  
09268-87702-000  
09283-87703-000

### NOTE:

When connecting the pressure regulator, install a new gasket to the union bolt connection and a new "O" ring to the "O" ring seal section. Also, attach hose bands to the hose connections.

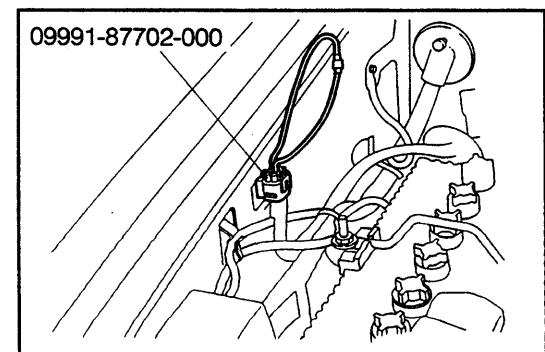


WR88-EF304



WR88-EF305

2. Connect the ground cable terminal to the negative (-) terminal of the battery.
3. Connection of SST (09991-87702-0000)
  - (1) Detach the cap from the check connector.
  - (2) Connect the SST to the check connector.
  - (3) Short the SST terminal F (White/Black) to the ground terminal (Black).
4. Turn ON the ignition key switch.



WR88-EF306

5. Check to see if the fuel pressure conforms to the specification.

**Specified Fuel Pressure:** 2.3 - 2.8 kg/cm<sup>2</sup> (33 - 40 psi)

If the fuel pressure fails to conform to the specification, replace the pressure regulator.

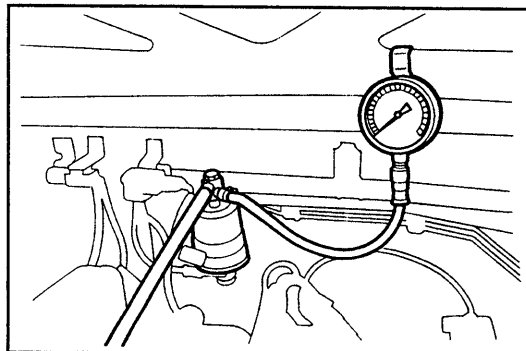
6. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
7. Remove the SSTs from the respective parts.

**NOTE:**

Attach the cap on the check connector.

**Assembly of Pressure Regulator**

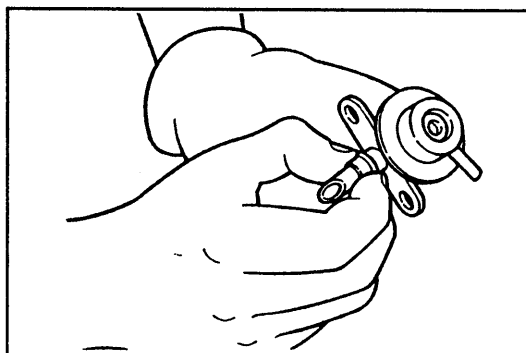
1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Disconnect the following SST from the check connector.  
**SST: 09991-87702-000**
3. Attach the check connector cap in place.



WR88-EF307

WR88-EF308

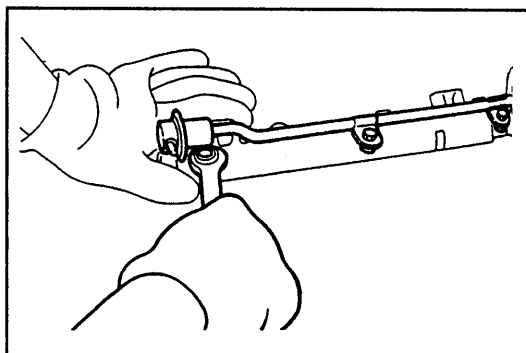
4. Replace the pressure regulator "O" ring with a new part.



WR88-EF309

5. Apply silicon oil or gasoline to the "O" ring of the pressure regulator. Install the "O" ring to the delivery pipe and tighten the attaching bolts.

**Tightening Torque:** 1.5 - 2.2 kg-m (10.9 - 15.9 ft-lb)

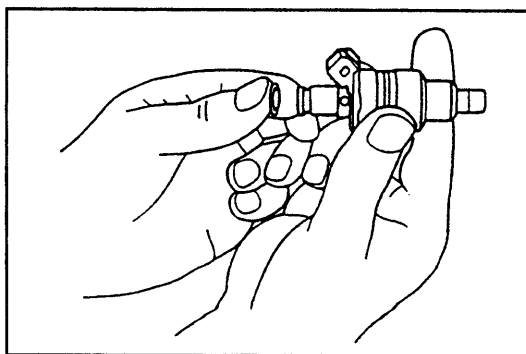


WR88-EF310

6. Replace the injector "O" ring with a new part.

**NOTE:**

Visually inspect the grommets and insulators of the injectors for any evidence of damage. Replace any defective parts if they exhibit damage.



WR88-EF311

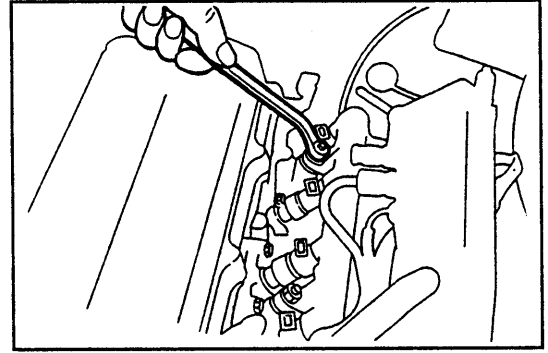
## EFI SYSTEM

7. Apply silicon oil or gasoline to the "O" ring of the injector. Install the delivery pipe.

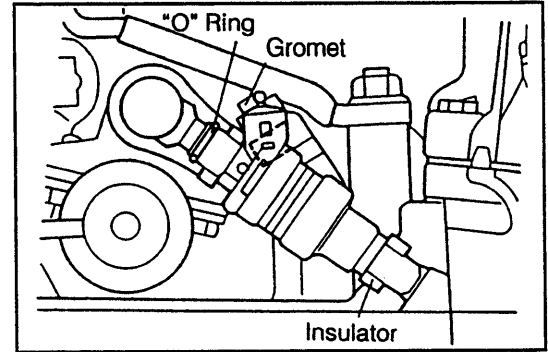
**Tightening Torque:** 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

**NOTE:**

- Be very careful not to damage the injector "O" ring during the installation.
- When connecting the delivery pipe and injector, make sure that they are installed straight, not in a tilted state.



WR88-EF312



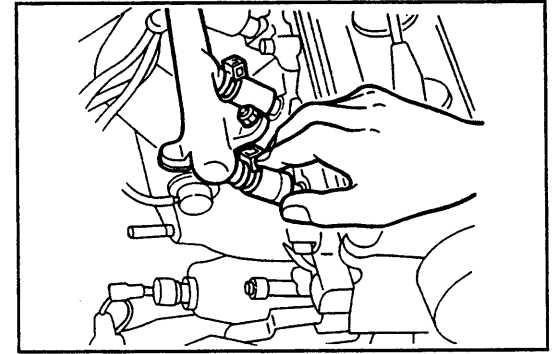
WR88-EF313

8. Ensure that the injector can rotate by your hand.

If the injector can not be rotated smoothly, most likely the injector is installed in a tilted state. It is, therefore, necessary to reassemble the injector using a new injector "O" ring.

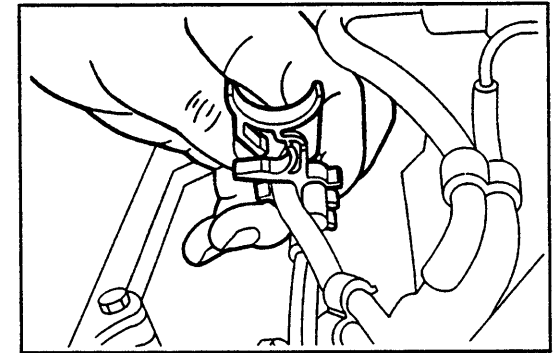
**NOTE:**

Never push the injector toward the insulator side or the grommet side. Failure to observe this caution will cause fuel leakage.



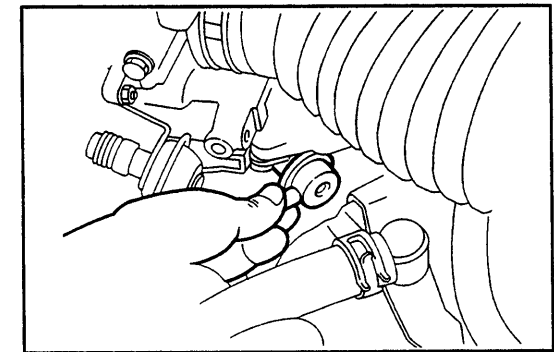
WR88-EF314

9. Connect the rubber hose clamps to the delivery pipe and pressure regulator.



WR88-EF315

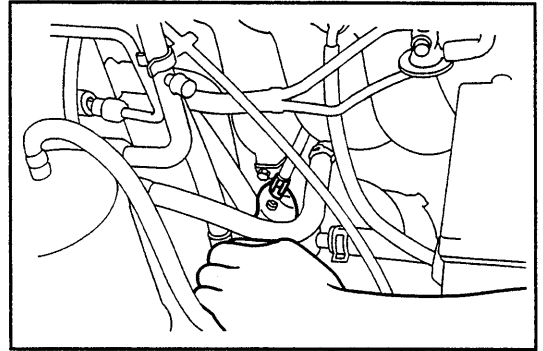
10. Connect the vacuum hose to the pressure regulator.



WR88-EF316



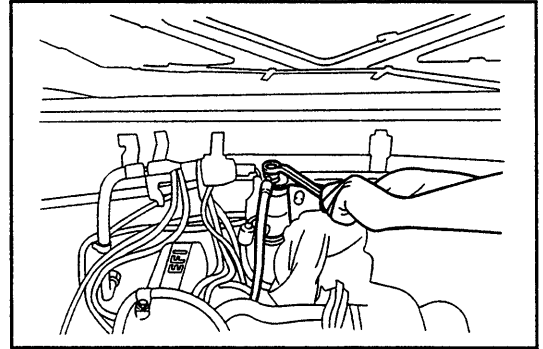
11. Connect the fuel return hose to the pressure regulator. Attach the hose clamps.



WR88-EF317

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

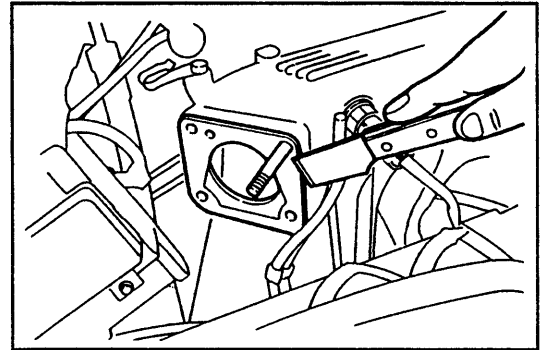
**Tightening Torque:** 3.5 - 4.5 kg-m (25.4 - 32.5 ft-lb)



WR88-EF318

13. Remove the gasket material from the throttle body and surge tank, using a gasket scraper.

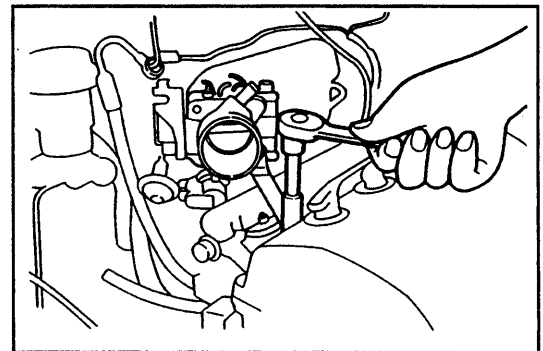
14. Install a new throttle body gasket on the surge tank.



WR88-EF319

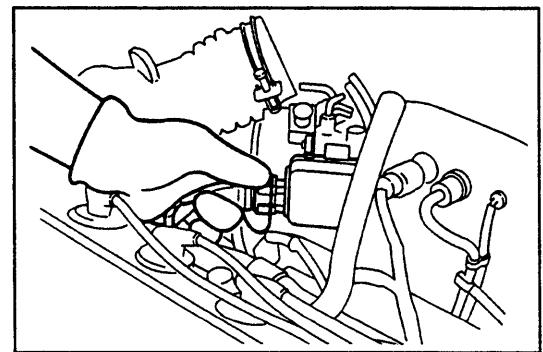
15. Install the throttle body surge tank stay. Install it on the surge tank.

**Tightening Torque:** 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)



WR88-EF320

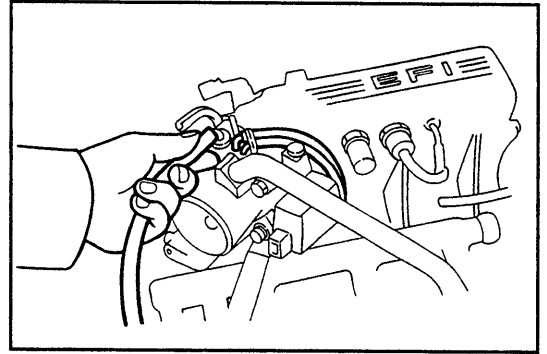
16. Connect the throttle position sensor connector.



WR88-EF321

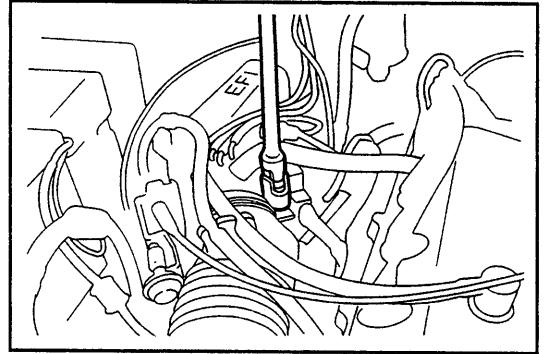
## EFI SYSTEM

17. Connect the rubber hose to the throttle body. (See page EC-22.)



WR88-EF322

18. Connect the air cleaner hose to the throttle body. Tighten the hose bands.



WR88-EF323

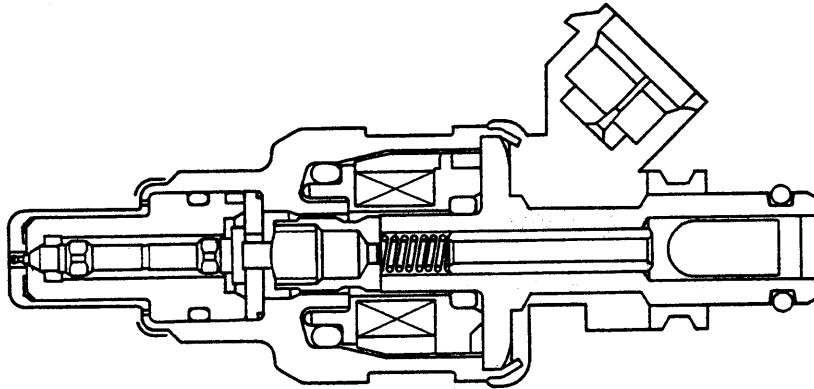
19. Connect the accelerator cable to the throttle body. Perform the adjustment so that the play in the axial direction may become 3 to 8 mm (0.12 to 0.31 inch).  
20. Connect the ground cable terminal to the negative (-) terminal of the battery.

WN88E-EF224

21. Repeat the turning ON/OFF of the ignition key switch four to five times at intervals of two seconds.  
22. Start the engine. Check the engine for fuel leakage or water leakage.  
Repair the leaky points if leakage exists.

WN88E-EF225

## INJECTORS



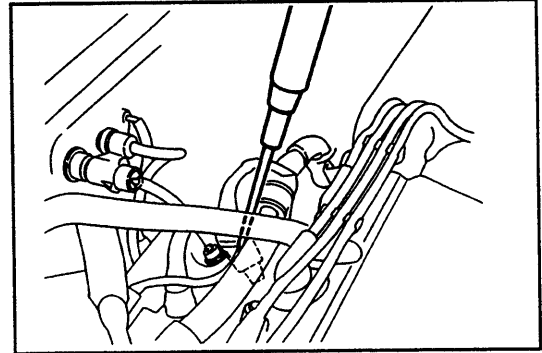
WR88-EF326

**In-Vehicle Inspection**

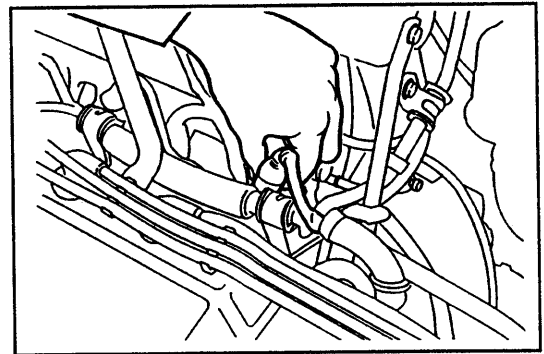
1. Check of injector operation
  - (1) Using a sound scope, check to see if each injector emits an operating sound when the engine is being started or cranked.
  - (2) If a sound scope is not available apply a screw driver or the like to the injector and check to see if you can feel an operating vibration.

If the injector emits no operating sound or emits an abnormal sound, check the wiring, wiring connector or injector.

2. Measurement of resistance of injector
  - (1) Disconnect the injector connector of the engine wire.



WR88-EF327

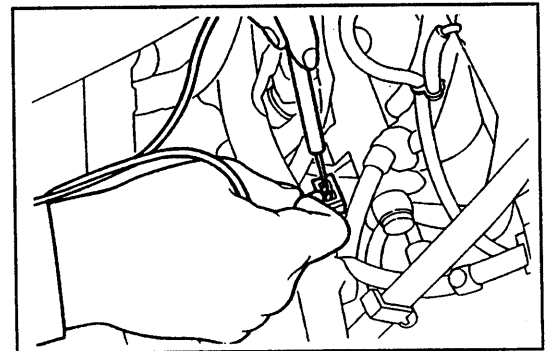


WR88-EF328

- (2) Measure the resistance between the terminals of each injector.

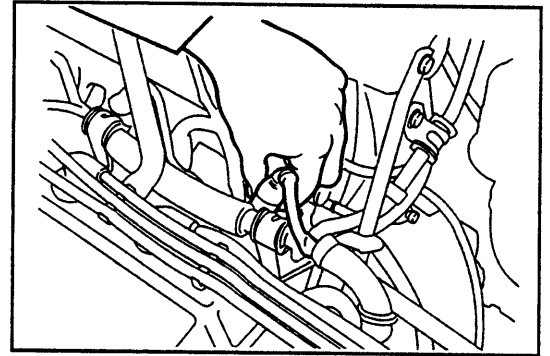
**Specified Resistance: 12 - 16Ω (at 20°C)**

If the resistance between the terminals is not within the specification, replace the injector.



WR88-EF329

- (3) Connect the injector connector of the engine wire to the injector.



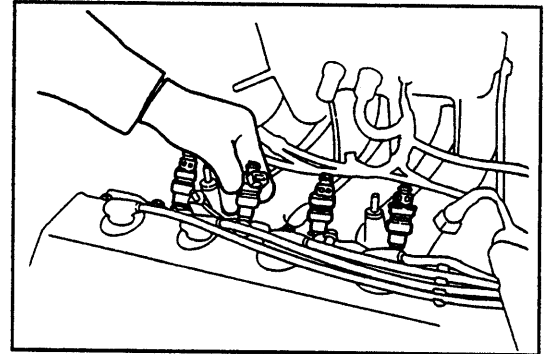
WR88-EF330

## Removal of Injector

1. Remove the pressure regulator. (See page EF-85.)
2. Disconnect the injector connector.
3. Remove the injector.

### NOTE:

Do not remove the injector cover.



WN88E-EF226

## Inspection of Injector

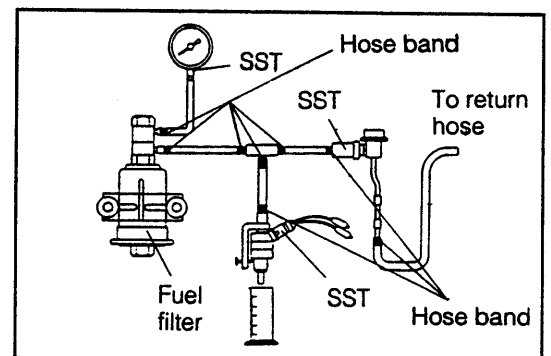
1. Using the following SSTs, connect the injector, as indicated in the figure. Insert the injector in the measuring cylinder.

- SST: (1) 09268-87701-000  
 (2) 09268-87703-000  
 (3) 09268-87702-000  
 (4) 09842-30070-000

WN88E-EF227

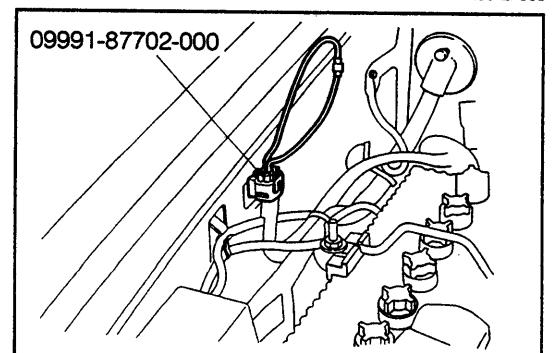
### NOTE:

- Install a new gasket to the union bolt connection.
- Install a new "O" ring to the "O" ring seal section.
- Attach the hose bands to the rubber hose connections.
- Attach a suitable vinyl hose to the tip-end of the injector so as to prevent fuel from splashing.
- Remove the injector grommet. Check to see if the injector grommet exhibits any damage.



WR88-EF333

2. Remove the check connector cap.
3. Connect the SST to the check connector.  
 SST: 09991-87702-000
4. Connect the terminal F (white/black) of the check connector to the ground terminal (Black).
5. Connect the ground cable terminal to the negative (-) terminal of the battery.
6. Turn ON the ignition switch.



WR88-EF334

7. Perform energizing for 60 seconds by means of the SST (09842-30070-000).
8. Measure the amount of fuel collected in the measuring cylinder.  
specified pressure.

**Specified Amount of Fuel:**

Approx. 176 - 188 cc (Approx. 10.74 - 11.47 cub inch)

**Variation between Each Injector:**

5 cc or less (0.3 cub inch or less)

**NOTE:**

- Conduct the measurement two or three times for each injector.
- Before the injector is pulled out, make certain to turn OFF the ignition key.
- When removing the injector, use a suitable cloth or the like so as to prevent fuel from splashing.
- Prior to the test, perform air bleeding for the fuel hose.

If the amount of fuel fails to conform to the specification, replace the injector.

9. Leakage check

With the SST (09842-30070-000) in not energized state, turn ON the ignition key switch. Check any fuel leakage from the injector nozzle.

**Fuel Leakage: Less Than one Drop of Fuel per Minute**

If the leakage exceeds the specified value, replace the injector.

**NOTE:**

Prior to the test, remove the vinyl hose that was attached on the injector.

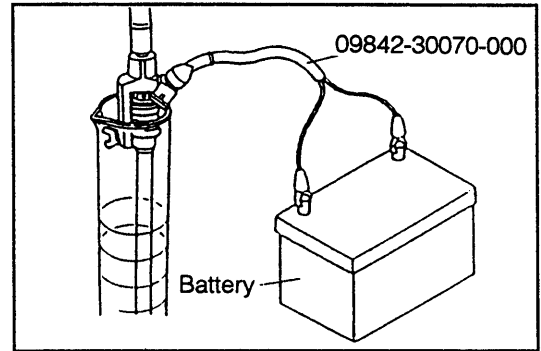
11. Turn OFF the ignition key.
12. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
13. Disconnect the SST.

**NOTE:**

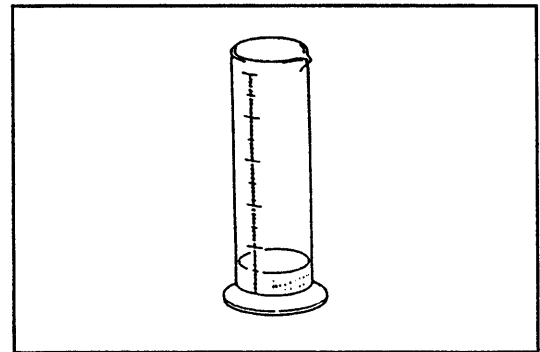
Care must be exercised as to fuel splashing or fuel flowing.

**Installation of Injector**

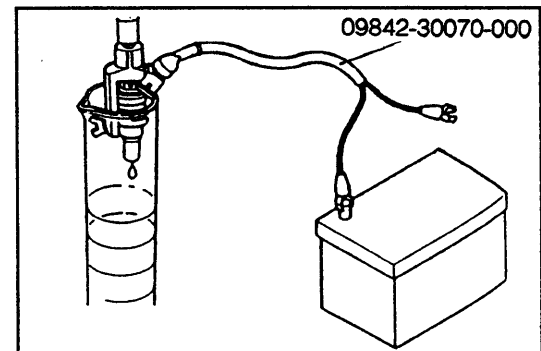
1. Check the insulator and grommet of each injector for damage.  
Replace the insulator and/or grommet if damage exists.



WN88E-EF228



WR88-EF337



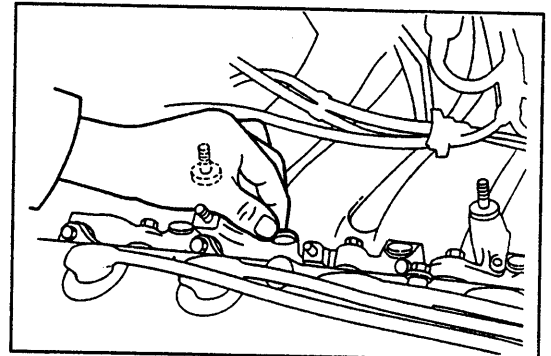
WN88E-EF229

WR88-EF339

WR88-EF340

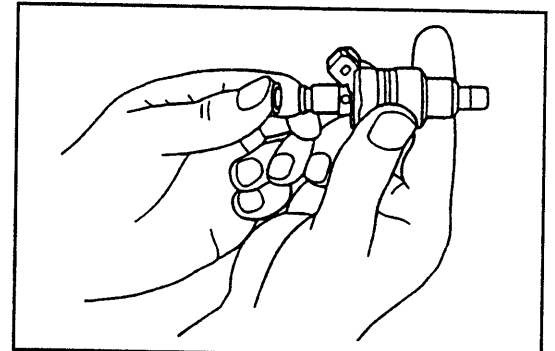
# EFI SYSTEM

2. Install the insulator on the manifold section.



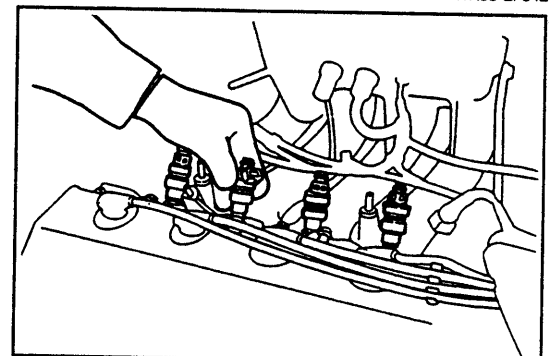
WR88-EF341

3. Install the grommet on the injection.  
4. Replace the injector "O" ring with a new part.  
**NOTE:**  
Be very careful to avoid damaging the "O" ring.



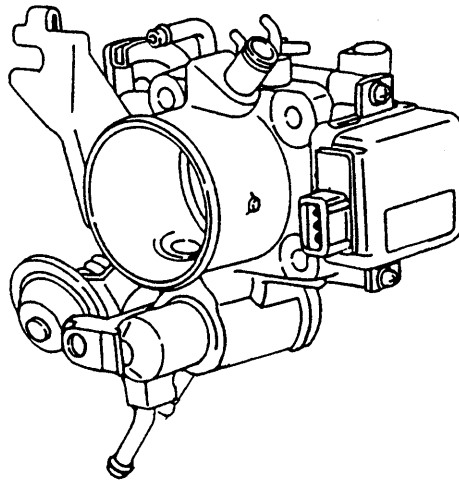
WR88-EF342

5. Insert the injector into the insulator.  
6. Install the delivery pipe. (See page EF-90.)



WN88E-EF230

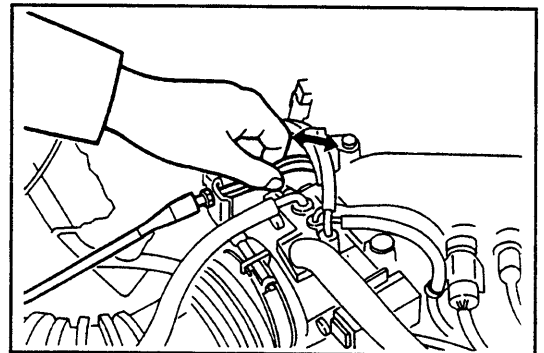
## AIR INDUCTION SYSTEM THROTTLE BODY



WR88-EF344

### In-Vehicle Inspection Check of Throttle Body

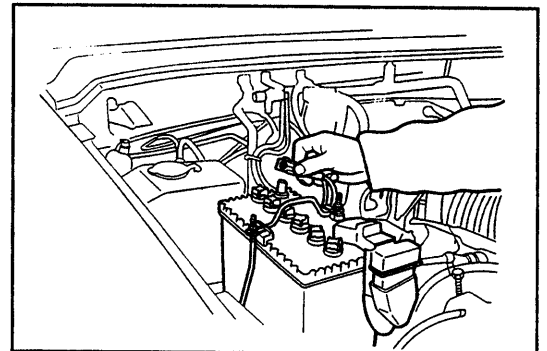
1. Ensure that the throttle linkage operates smoothly.  
Replace the throttle body if the throttle lever fails to operate smoothly.
2. Check the throttle position sensor.  
(See page EF-57.)
3. Check the throttle positioner.  
(See page MA-10.)



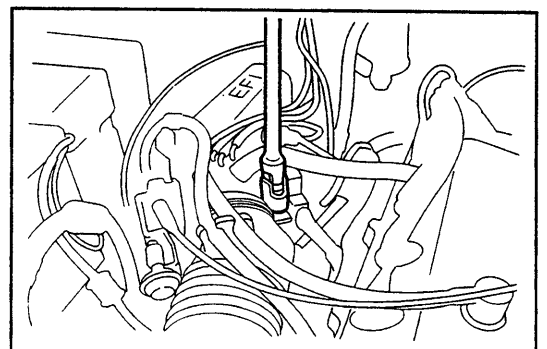
WN88E-EF231

### Removal of Throttle Body

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Disconnect the air cleaner hose from the throttle body.

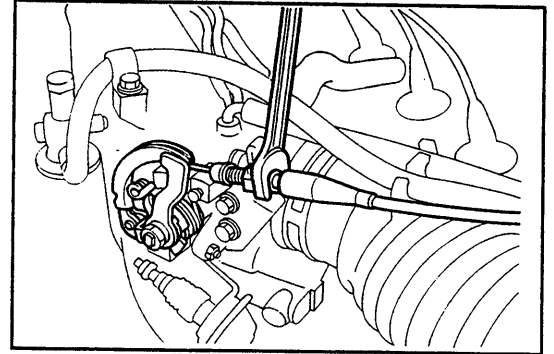


WR88-EF346



WR88-EF347

3. Disconnect the accelerator cable.

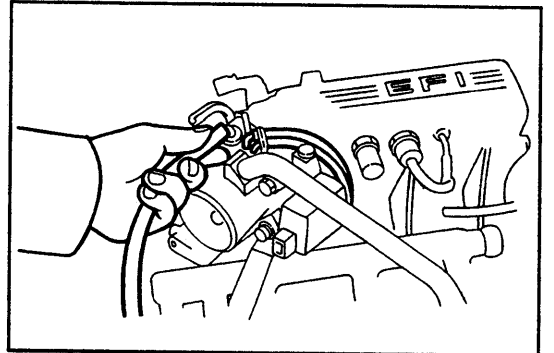


WR88-EF348

4. Disconnect the vacuum hoses.

**NOTE:**

Prior to the disconnection, put a tag on each vacuum hose so that the original installation position may be known readily during the installation.

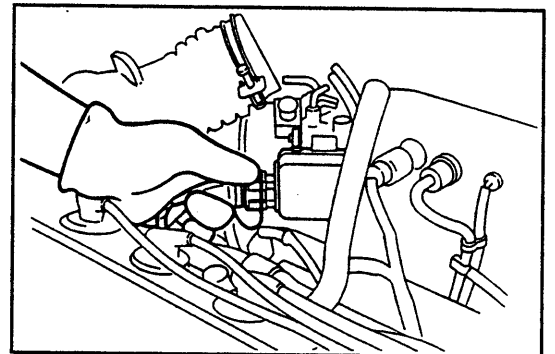


WN88E-EF232

5. Disconnect the connector of the throttle positioner sensor.

**NOTE:**

It should be noted that the position and shape of the connector differ on the automatic transmission vehicle.

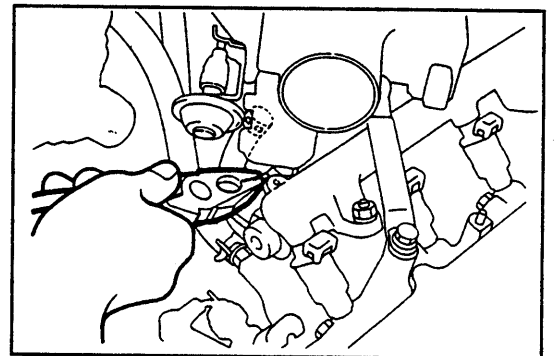


WN88E-EF233

6. Disconnect the water hoses from the throttle body.

**NOTE:**

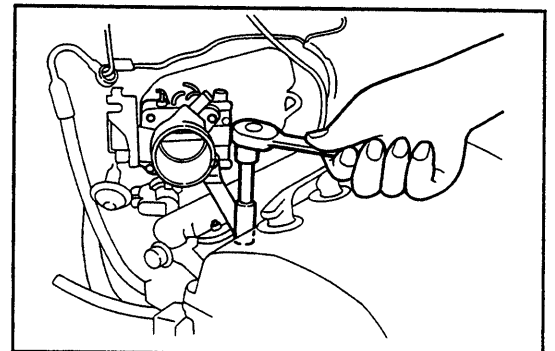
- Using a suitable cloth, take a precautionary measure so that no water gets to the electrical equipment of the vehicle.
- Be sure to plug the disconnected water hoses by suitable plug to prevent the water from flowing out.



WN88E-EF234

7. Removal of throttle body

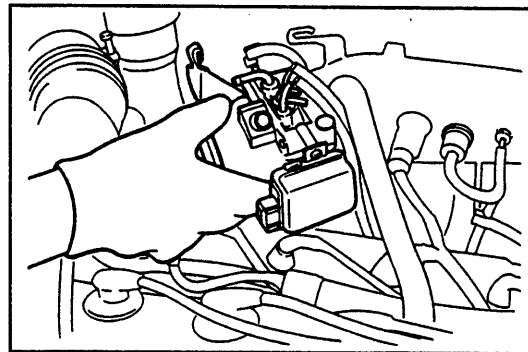
- (1) Remove the attaching bolts and nuts of the surge tank stay No. 1.



WN88E-EF235



- (2) Remove the attaching bolts and nuts of the throttle body.
- (3) Remove the throttle body.



WR88-EF354

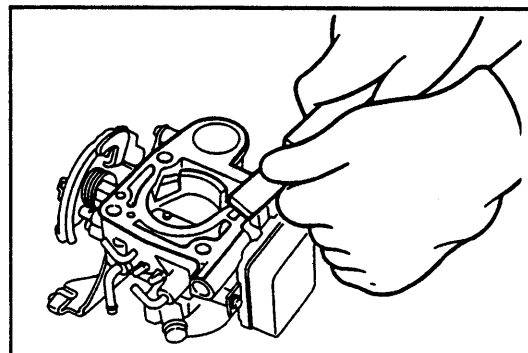
**Inspection of Throttle Body**

1. Cleaning of throttle body prior to inspection

- (1) Clean the cast part with a soft brush, a wet cloth or the like.

WR88-EF355

- (2) Remove the gasket material from the surge tank attached surface of the throttle body.

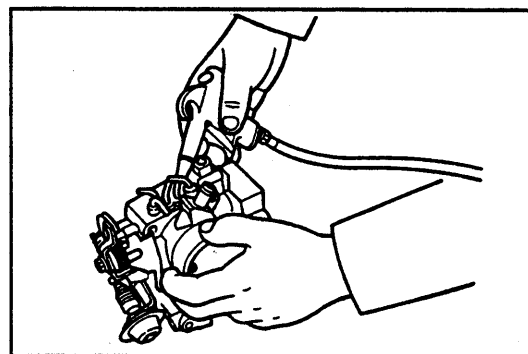


WR88-EF356

- (3) Clean all passages by blowing compressed air.

**WARNING:**

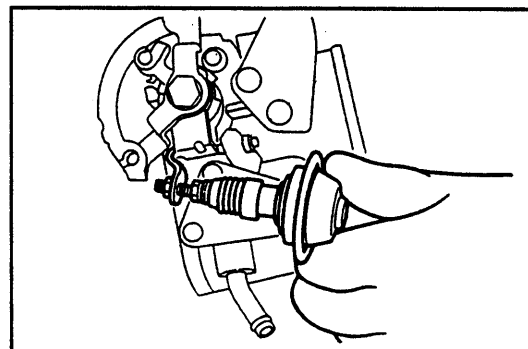
Be sure to protect your eyes, wearing goggles.



WR88-EF357

2. Check of throttle valve

- (1) Check that the throttle lever is in full contact with the dashpot.
- (2) When the throttle lever is opened, check to see if the dashpot lever comes out.



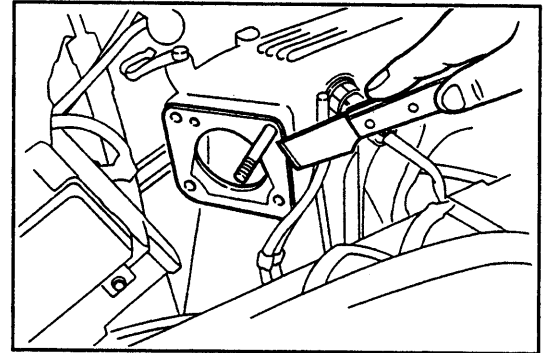
WR88-EF358

- (3) Check the throttle position sensor.  
(See page EF-57.)  
Replace the throttle body if it exhibits any defect.

WN88E-EF236

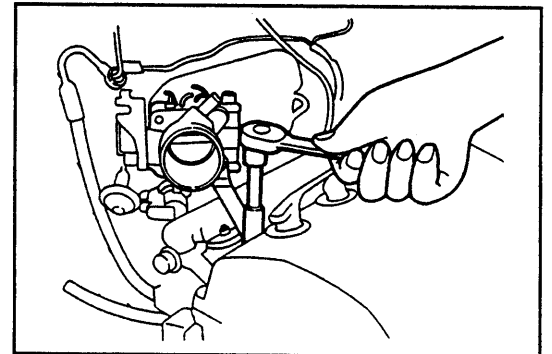
## Installation of Throttle Body

1. Remove any gasket material from the throttle body attaching surface of the surge tank.



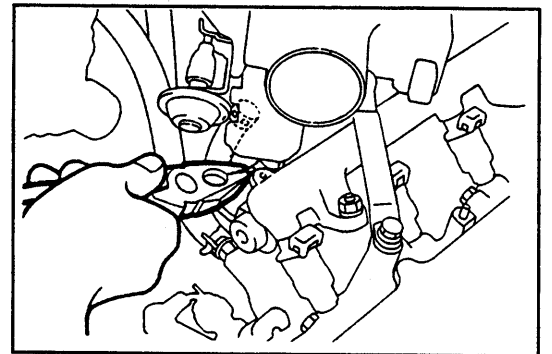
WR88-EF360

2. Install the throttle body on the surge tank with a new gasket interposed. Attach the surge tank stay No. 1.  
3. Tighten the attaching bolts and nuts of the throttle body and surge tank stay No. 1.  
Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)



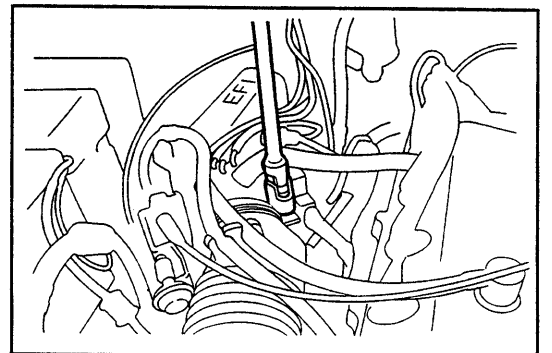
WR88-EF361

4. Connect the water hoses to the throttle body. Attach the hose clips.



WR88-EF362

5. Connect the air cleaner hose to the throttle body. Attach the hose bands.

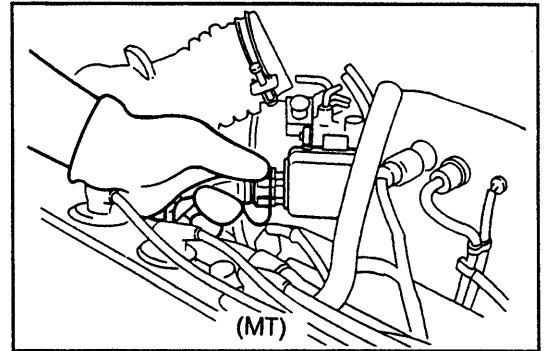


WR88-EF363

6. Connect the throttle position sensor connector.

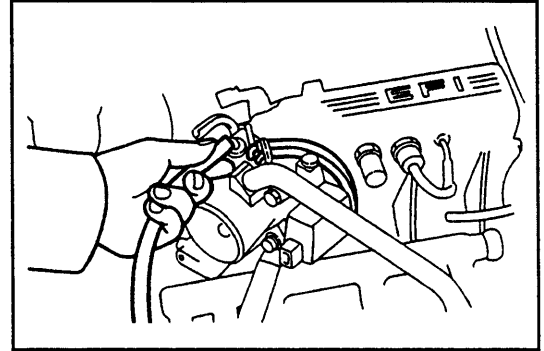
**NOTE:**

It should be noted that the position and shape of the connector differ on the automatic transmission vehicle.



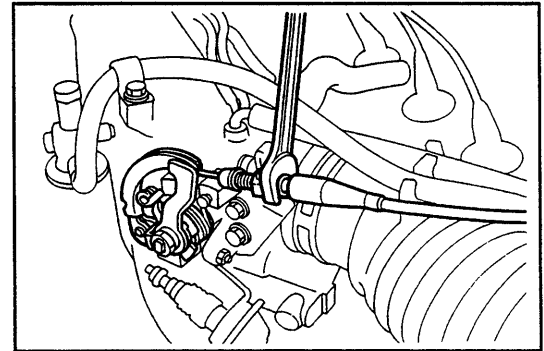
WR88-EF364

7. Connect the vacuum hoses to the throttle body.



WR88-EF365

8. Connect the accelerator cable to the throttle body. Perform the adjustment so that the play in the axial direction may become 3 to 8 mm (0.12 to 0.31 inch).

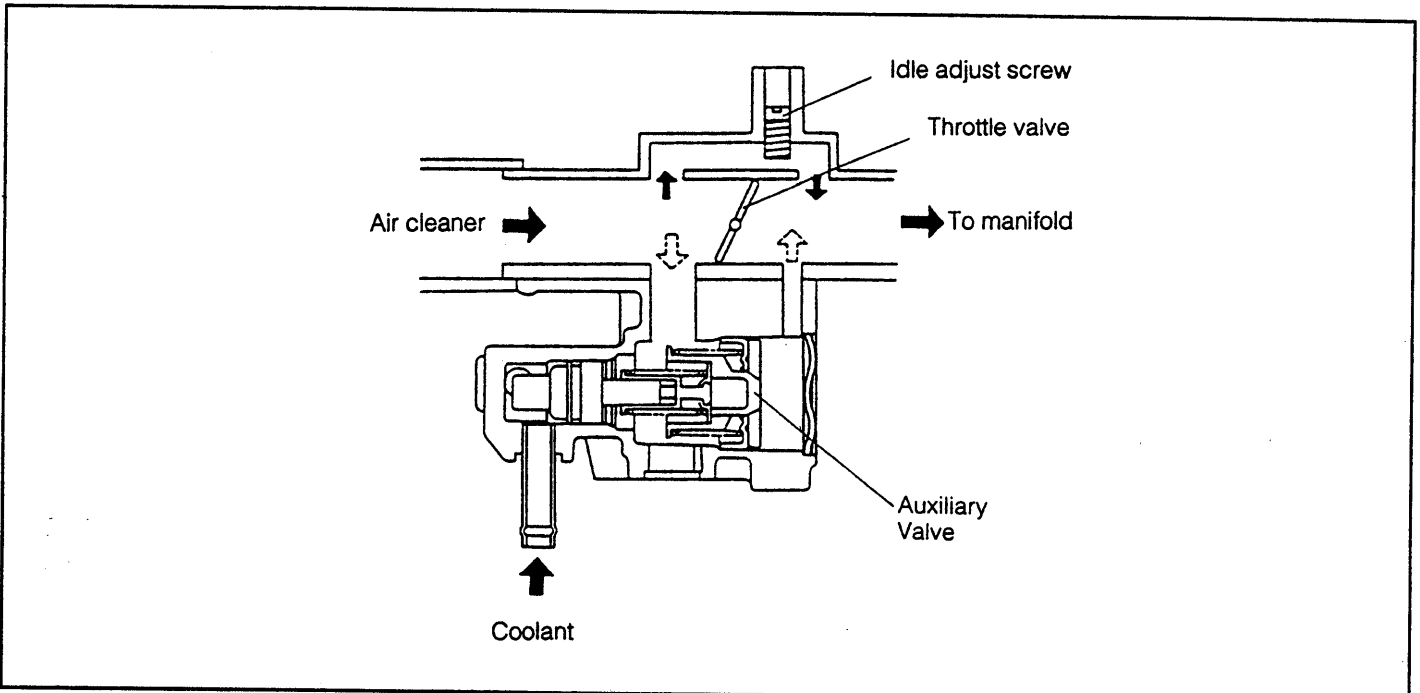


WR88-EF366

9. Fill coolant.  
(See page CO-3.)
10. Connect the ground cable terminal to the negative (-) terminal of the battery.
11. Start the engine. Recheck the engine for water leakage.  
Repair the leaky point if water leakage exists.

WN88E-EF237

**AUXILIARY AIR VALVE**

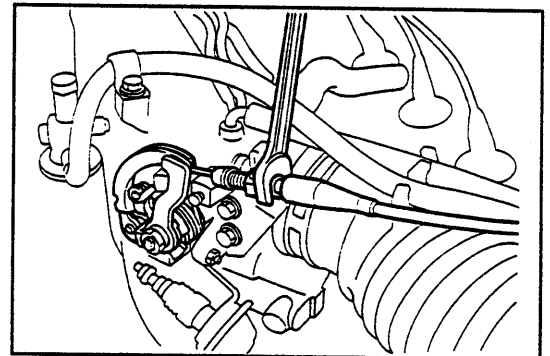


WR88-EF368

**In-Vehicle Inspection**

**Check Operation**

1. Disconnect the air cleaner hose from the throttle body.



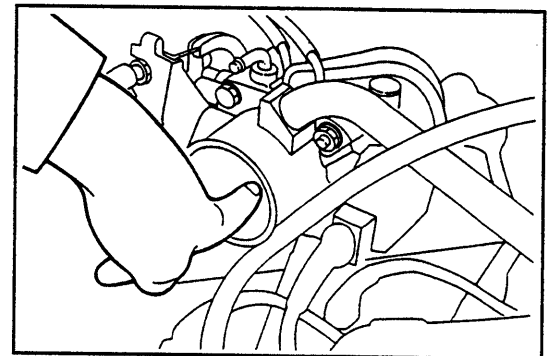
WR88-EF369

2. Start the engine. Check that there is air continuity at the auxiliary air valve port under the following conditions. Perform the check, following the procedures given below.

When the cooling water temperature is below 50°C (122°F) apply your finger to the auxiliary air valve port. Ensure that the engine speed drops.

When the cooling water temperature is above 80°C (176°F) apply your finger to the auxiliary air valve port. Ensure that the engine speed does not change.

If the auxiliary air valve exhibits any malfunction, replace the throttle body.



WR88-EF370

**Removal of Auxiliary Air Valve**

Remove the throttle body.

(See page EF-97.)

WN88E-EF238

**Installation of Auxiliary Air Valve**

Installation of throttle body

(See page EF-100.)

WN88E-EF239

# **DAIHATSU**

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# **F300**

[HD-ENGINE]

## **FUEL SYSTEM (HD-C Engine)**

**FU**

<b>PRECAUTIONS .....</b>	<b>FU- 2</b>
<b>TROUBLE SHOOTING .....</b>	<b>FU- 2</b>
<b>IN-VEHICLE INSPECTION .....</b>	<b>FU- 3</b>
<b>CARBURETOR .....</b>	<b>FU- 7</b>
<b>FUEL PUMP .....</b>	<b>FU-28</b>
<b>FUEL FILTER .....</b>	<b>FU-32</b>

WN88E-FU001

## PRECAUTIONS

1. Before working on the fuel system, be sure to disconnect the ground cable from the negative (-) terminal of the battery.
2. When working on the fuel system, never allow any naked fire to be brought near the working site. Also, never smoke cigarette or the like.
3. Do not allow the fuel to get to any parts made of rubber or resin.
4. Do not work on the fuel system of more than one vehicle at the same time.
5. Be certain to keep each part of the fuel system from contamination.
6. Be very careful not to allow any dirt or the like be mixed into the fuel system during the servicing operation.
7. Make sure to keep the working site clean. Also, be sure not to loose any part, specifically small parts.
8. Never loose nor mix up those pins, clips and springs with each other.

WR88-FU002

## TROUBLE SHOOTING

Problem	Possible cause	Remedy	Page
Engine will not start/hard to start (Only case where cranking by startor motor is normal)	Carburetor problems <ul style="list-style-type: none"> <li>• Choke operation</li> <li>• Needle valve sticking or clogged</li> <li>• Vacuum hose disconnected or damage</li> <li>• Fuel cut solenoid vlave not open</li> <li>• Outer vent valve not open</li> </ul>	Check choke system Check float and needle  Check fuel cut solenoid valve Check outer vent valve	FU-4 FU-16 EC-3  FU-4, FU-17 FU-5, FU-17
Rough idle or stalls	Carburetor problems <ul style="list-style-type: none"> <li>• Idle speed incorrect</li> <li>• Slow jet clogged</li> <li>• Idle mixture incorrect</li> <li>• Fuel cut solenoid valve not open</li> <li>• Fast idle speed setting incorrect (Cold engine)</li> <li>• Choke valve open (Cold engine)</li> <li>• Fuel pump faulty</li> <li>• Fuel filter clogged</li> <li>• Fuel line clogged</li> <li>• Fuel line bent or kinked</li> </ul>	Adjust idle speed  Adjust idle mixture Check fuel cut solenoid valve Adjust fast idle speed  Check choke system	MA-9 FU-17 EM-15 FU-5, FU-17 EM-17  FU-4, FU-17 FU-29 FU-32
Engine hesitates/poor acceleration	Carburetor problems <ul style="list-style-type: none"> <li>• Float level too low</li> <li>• Accelerator pump faulty</li> <li>• Power valve faulty</li> <li>• Power piston faulty</li> <li>• Choke valve closed (hot engine)</li> <li>• Choke valve stuck open (cold engine)</li> </ul>	Adjust float level  Check power valve Check power piston Check choke system	FU-22 FU-4 FU-17 FU-17 FU-4

WN88E-FU002

Problem	Possible cause	Remedy	Page
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>• Fuel line clogged</li> <li>• Fuel pump faulty</li> <li>• Fuel filter clogged</li> <li>• Fuel line bent or kinked</li> </ul>	Check fuel line Check fuel pump Replace fuel filter Replace fuel line	FU-29 FU-32
Engine dieseling (Runs after ignition switch is turned off)	Carburetor problems <ul style="list-style-type: none"> <li>• Linkage stiking</li> <li>• Idle speed out of adjustment</li> <li>• Fuel cut solenoid faulty</li> </ul>	Adjust idle speed Check fuel cut solenoid valve	FU-3 MA-9 FU-5, FU-17
Poor fuel mileage	Carburetor problems <ul style="list-style-type: none"> <li>• Choke faulty</li> <li>• Idle speed too high</li> <li>• Power valve always open</li> <li>• Idle mixture incorrect</li> </ul> Fuel leak	Check choke system Adjust idle speed Check power piston and valve Adjust idle mixture  Repair as necessary	FU-4 MA-9 FU-17 EM-15
Unpleasant odor	Outer vent valve always open	Check outer vent valve	FU-5, FU-17

WN88E-FU003

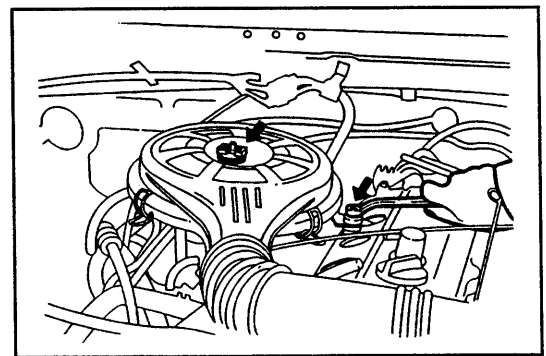
## IN-VEHICLE INSPECTION

### 1. Removal of air cleaner

**NOTE:**

Before starting the engine, plug the ITC valve hoses, etc. to prevent rough idling.

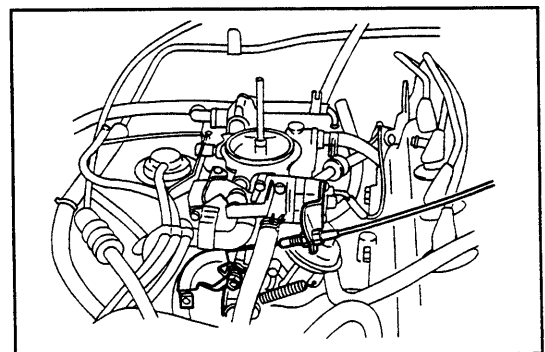
- (1) Remove the following hoses:
  - Vacuum hose to BSVV
  - ITC vacuum hose to carburetor
  - PCV gas hose
  - Hot air intake hose
  - Cool air intake hose
- (2) Remove the air cleaner.



WR88-FU005

### 2. Inspection of carburetor and linkage

- (1) Ensure that each screw plug is installed correctly.
- (2) Check each linkage for evidence of excessive wear. Also, check to see if any snap ring is missing.
- (3) With the acceleration pedal fully depressed, check to see if the throttle valve opens fully.

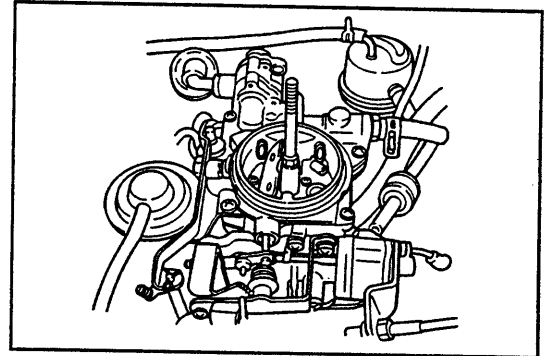


WR88-FU006

## 3. Inspection of choke system

Check that choke valve is completely closed when engine is cold.

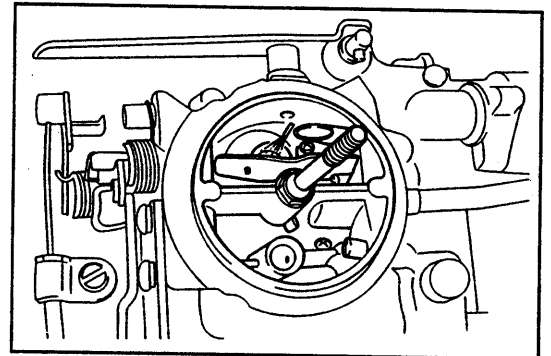
Then, start the engine, check that choke valve is gradually opened in accordance with the warning-up condition of the engine.



WN88E-FU004

## 4. Inspection of acceleration pump

Check to see if the fuel spurts out from the acceleration nozzle when throttle valve is opened quickly.

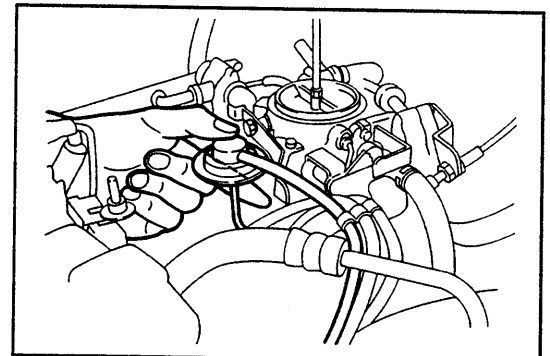


WR88-FU010

## 5. Inspection of solenoid valve

(1) Check to see if you can feel the operation of the solenoid valve when the ignition switch is turned ON/OFF.

If the solenoid valve remains inoperative, check the power supply for the solenoid valve. Then, proceed to the check described in the step (2) below.

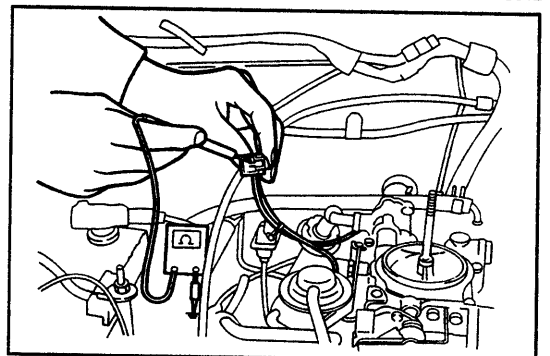


WR88-FU012

(2) Disconnect the connector from the carburetor. Check to see if the resistance between the solenoid valve terminal and the carburetor proper conforms to the specification.

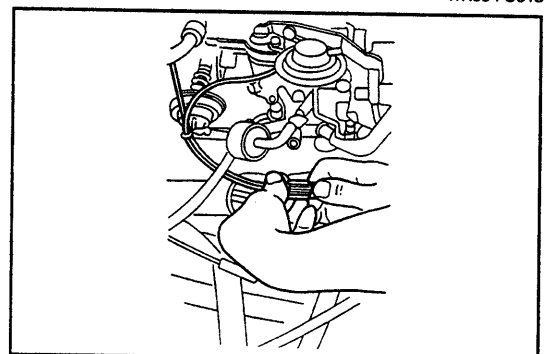
**Specified Resistance: 80 - 100Ω at 20°C (68°F)**

If the resistance fails to conform to the specification, replace the solenoid valve.



WR88-FU013

(3) Reconnect the connector.

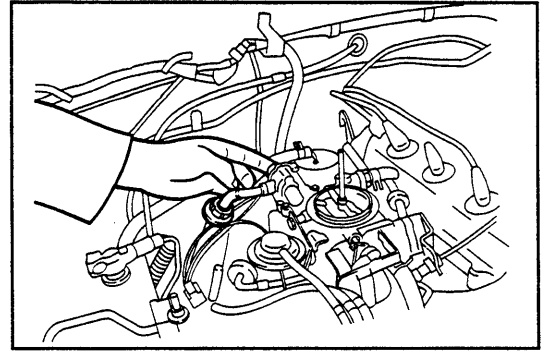


WR88-FU014



## 6. Inspection of outer vent valve

- (1) Check to see if you can feel the operation of the outer vent valve when the ignition switch is turned ON/OFF. If the outer vent valve remains inoperative, check the power supply for the outer vent valve. Then, proceed to the check described in the step (2) below.

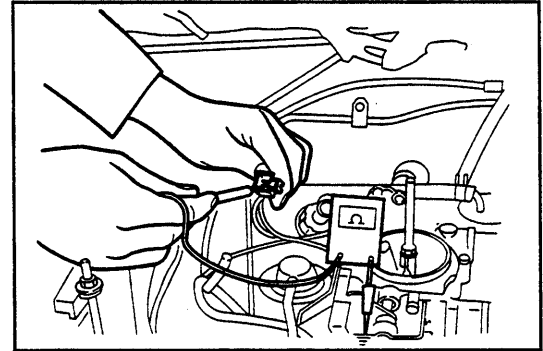


WR88-FU015

- (2) Disconnect the connector from the carburetor. Check to see if the resistance between the outer vent valve terminal and the carburetor proper conforms to the specification.

**Specified Resistance:** 30 - 40Ω at 20°C (68°F)

If the resistance fails to conform to the specification, replace the outer vent valve.



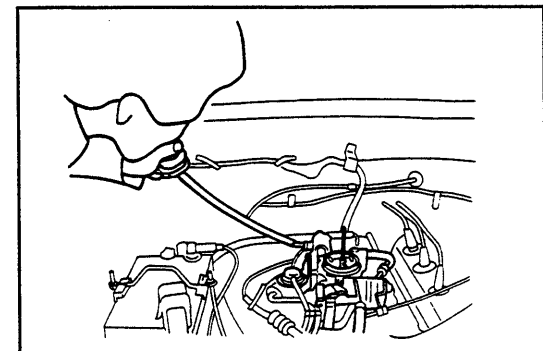
WR88-FU016

- (3) Reconnect the outer vent valve connector.  
 (4) Disconnect the outer vent hose from the BVSV. Turn ON the ignition key switch.

WR88-FU017

- (5) Blow air from the outer vent hose. Ensure that no air continuity exists. If air continuity exists, replace the outer vent valve.

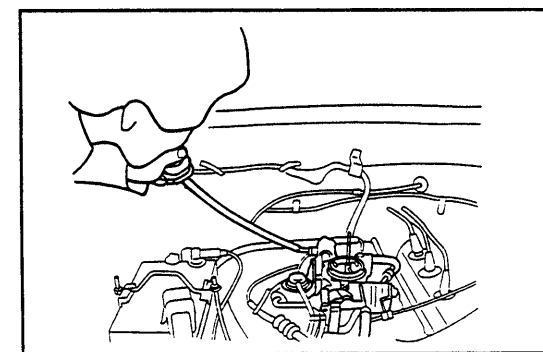
**WARNING:**  
 Be very careful not to inhale the air.



WR88-FU018

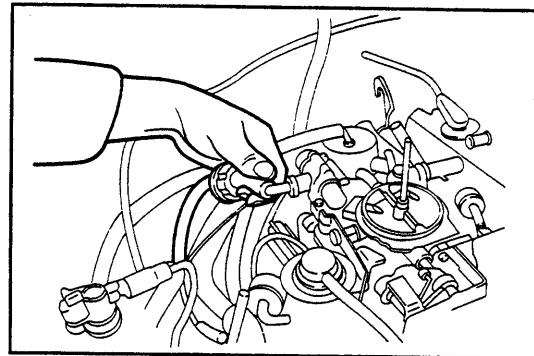
- (6) Turn OFF the ignition key switch.  
 (7) Blow air from the outer vent hose. Ensure that air continuity exists. If no air continuity exists, replace the outer vent valve.

**WARNING:**  
 Be very careful not to inhale the air.



WR88-FU019

(8) Connect the outer vent hose to the BVSV.



WR88-FU020

### **7. Inspection of choke braker**

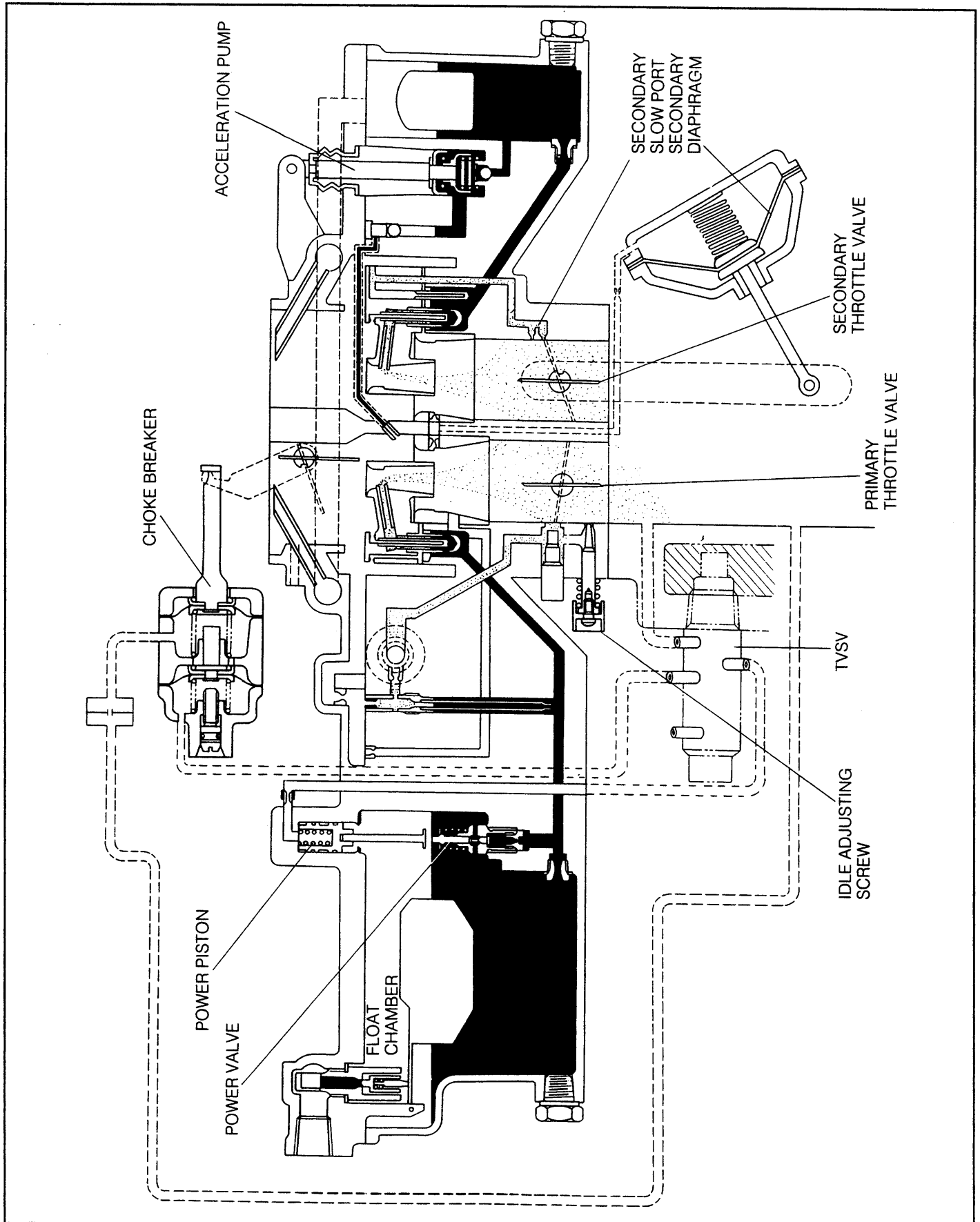
(See page FU-4, MA-5)

### **8. Inspection of throttle positioner**

(See page MA-10)

WN88E-FU005

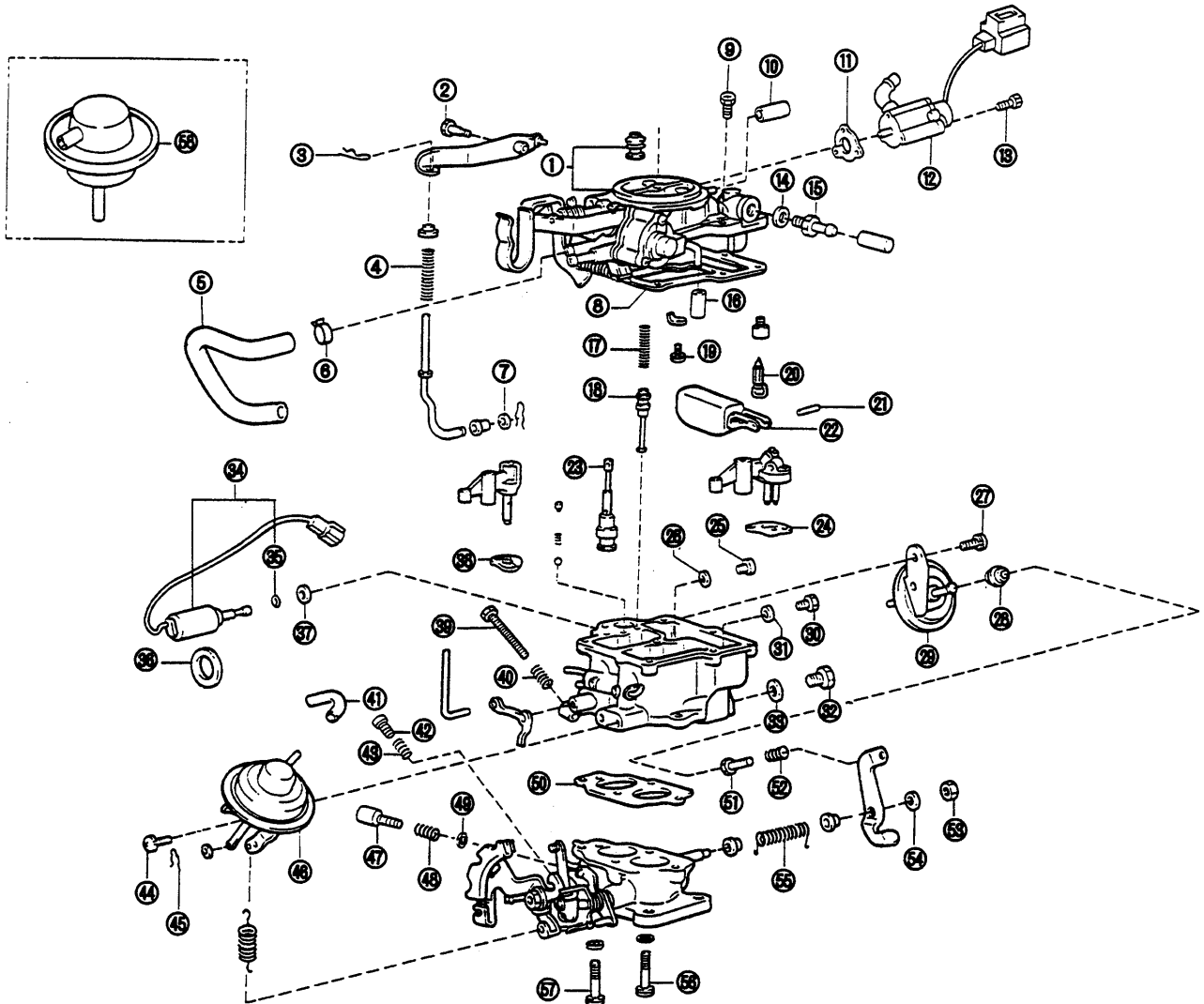
# CARBURETOR SCHEMATIC DIAGRAM



WN88E-FU006

# FUEL SYSTEM

## COMPONENTS



- ① Air horn
- ② Pump arm set screw
- ③ Clip
- ④ Spring
- ⑤ Hose No. 2
- ⑥ Clip
- ⑦ Washer
- ⑧ Gasket
- ⑨ Bolt
- ⑩ Hose
- ⑪ Gasket
- ⑫ Outer vent valve
- ⑬ Bolt
- ⑭ Washer
- ⑮ Union nipple
- ⑯ Vacuum hose No. 2
- ⑰ Spring
- ⑱ Power piston
- ⑲ Needle valve

- ⑳ Float lever pin
- ㉑ Float assembly
- ㉒ Pump plunger
- ㉓ Venturi gasket No. 2
- ㉔ Main jet
- ㉕ Main jet gasket
- ㉖ Bolt
- ㉗ Boot
- ㉘ Positioner
- ㉙ 2nd main jet
- ㉚ 2nd main jet gasket
- ㉛ Main passage plug
- ㉜ Main passage plug gasket
- ㉝ solenoid valve
- ㉞ O ring
- ㉟ Gasket
- ㊱ Solenoid valve gasket
- ㊲ Venturi gasket
- ㊳ Throttle adjusting screw
- ㊴ Spring

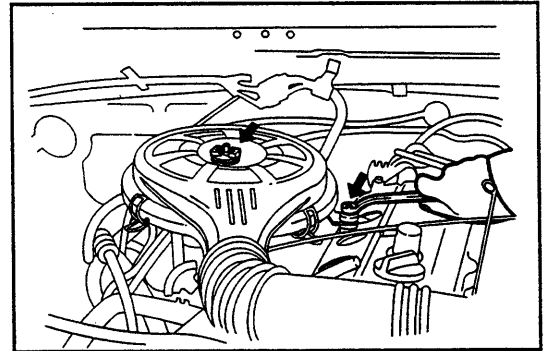
- ㊵ Vacuum hose
- ㊶ Screw
- ㊷ Throttle adjusting spring
- ㊸ Diaphragm hosing set screw
- ㊹ Snap ring No. 1
- ㊺ Diaphragm sub assembly
- ㊻ Idle mixture adjusting screw
- ㊼ Idle adjusting spring
- ㊽ Washer
- ㊾ Body flange gasket
- ㊿ Adjusting screw
- 1 Adjusting screw spring
- 2 Throttle lever set screw
- 3 Lock washer
- 4 Return spring
- 5 Set screw
- 6 Set screw
- 7 Diaphragm

## REMOVAL OF CARBURETOR

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Drain the coolant. (See page CO-3)

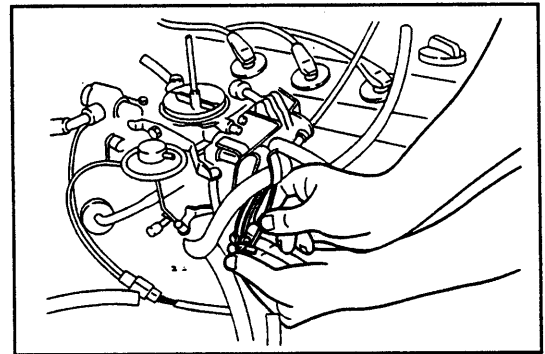
WN88E-FU008

3. Removal of air cleaner
  - (1) Remove the following rubber hoses:
    - 1) Vacuum hose to BVSV
    - 2) ITC vacuum hose to carburetor
    - 3) Blow-by gas hose
    - 4) Cool air intake hose
    - 5) Hot air intake hose
  - (2) Remove the air cleaner.



WR88-FU025

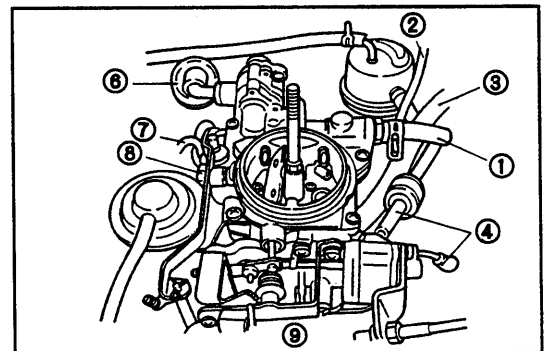
4. Disconnect the accelerator cable from the carburetor.



WN88E-FU009

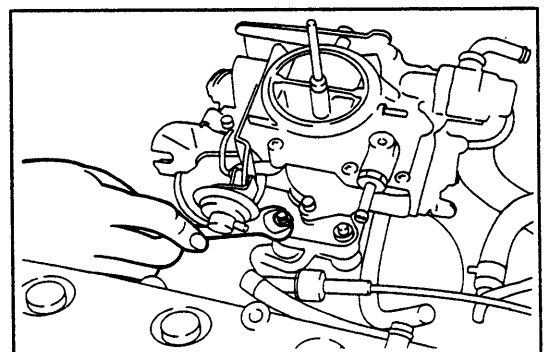
5. Remove the following hoses from the carburetor:

- ① Fuel inlet hose
- ② ITC vacuum hose
- ③ PCV gas hose
- ④ Choke braker vacuum hose
- ⑤ Vacuum hoses to gas filter
- ⑥ Outer vent hose
- ⑦ Throttle positioner vacuum hose
- ⑧ Vacuum hose to distributor
- ⑨ Coolant circulating hoses



WN88E-FU010

6. Disconnect the solenoid valve outer vent valve connector.
7. Remove the four attaching nuts of the carburetor. Remove the carburetor.



WN88E-FU011

# FUEL SYSTEM

## DISASSEMBLY OF CARBURETOR

### NOTE:

The following operations have been arranged in such a way that checks are performed for a certain single unit alone at a time. This will avoid any occurrence of wrong assembling of similar subassemblies which would likely occur when operations were carried out concurrently.

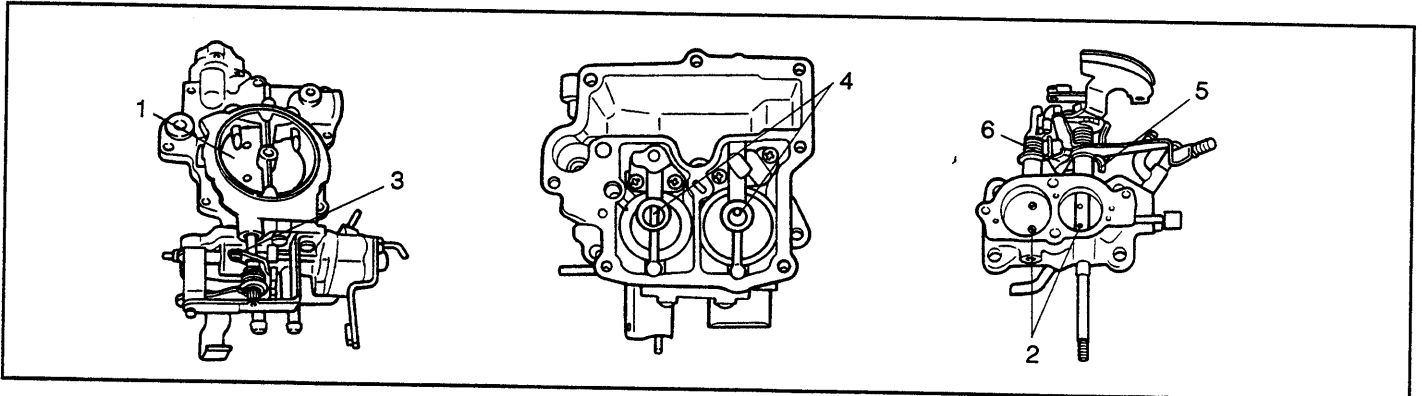
- (1) Be sure to arrange the disassembled parts in order that reassembling may be performed readily.
- (2) Do not mix up those balls, clips, springs and so forth.
- (3) Be sure to employ the following SST, a set of screwdrivers for carburetor use.

SST: 09860-87201-000

WR88-FU029

### Do not disassemble the following sections.

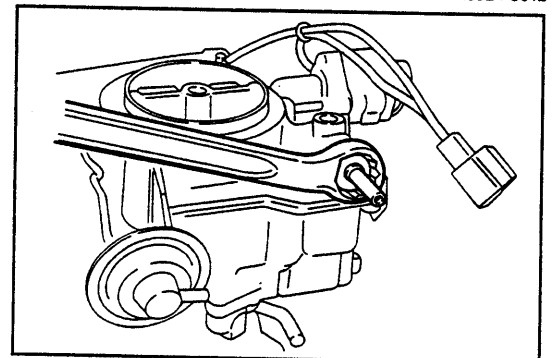
1. Choke valve set screw
2. Throttle valve set screw
3. Automatic choke mechanism
4. Small venturis
5. Fast idle adjust screw
6. Acceleration lever, link connecting nut



WN88E-FU012

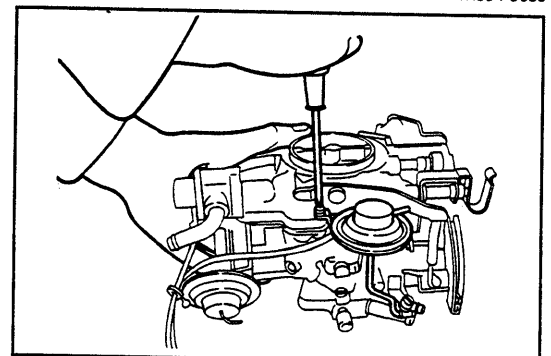
## DISASSEMBLY OF AIR HORN

1. Remove the air cleaner set bolt.
2. Removal of air horn assembly
  - (1) Remove the fuel inlet union and gasket.



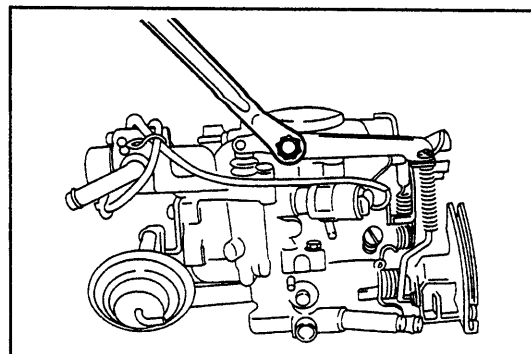
WR88-FU030

- (2) Remove the idle-up actuator for power steering. (only for power steering equipped vehicle)



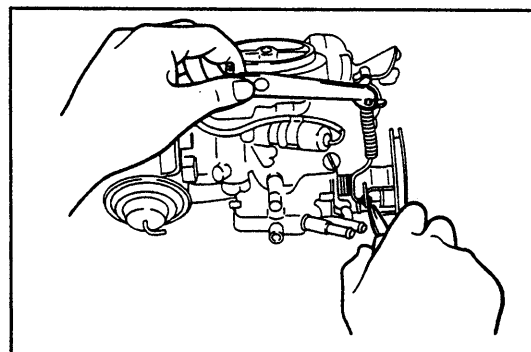
WN88E-FU013

(3) Remove the accelerator pump arm set screw.



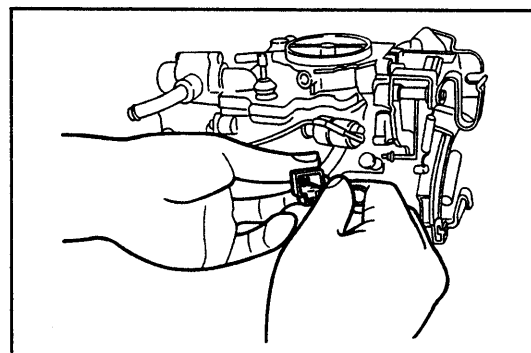
WN88E-FU014

(4) Remove the accelerator pump rod and lever.



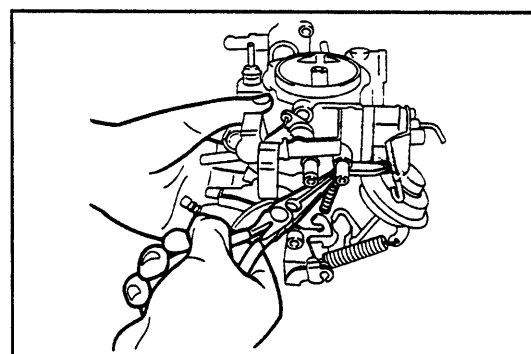
WN88E-FU015

3. disconnect the outer vent valve connector from the socket.



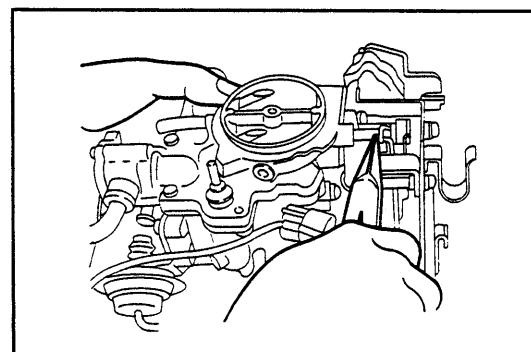
WN88E-FU016

4. Remove the spring from the carburetor.



WN88E-FU017

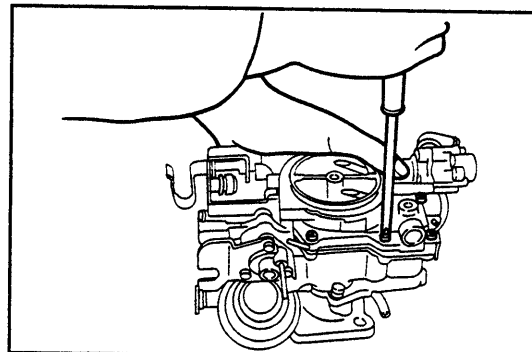
5. Disconnect the choke lever linkage at the upper side.



WN88E-FU018

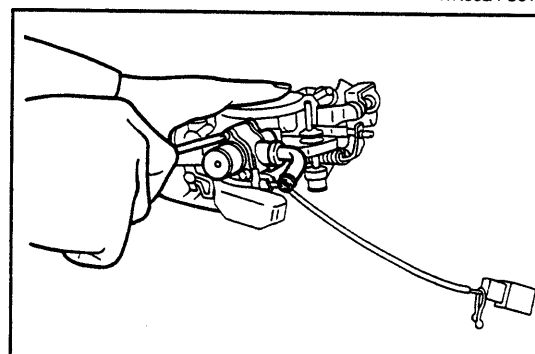
## FUEL SYSTEM

6. Remove the 7 screws (5 screws, in case of idle-up actuator equipped model) and disassemble the air horn assembly.



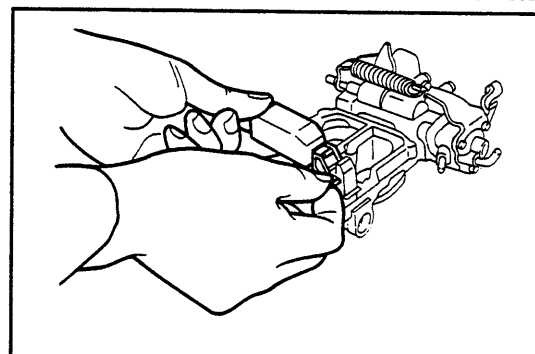
WN88E-FU019

7. Remove the outer vent valve assembly by removing the three screws.



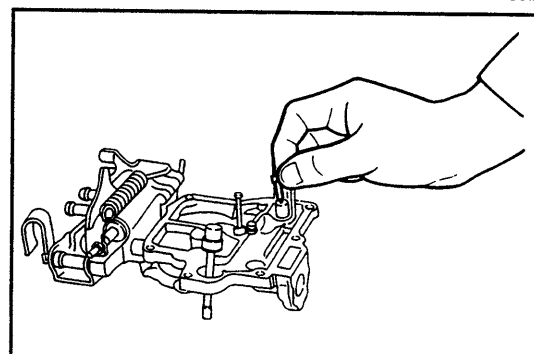
WN88E-FU020

8. Remove the float.



WN88E-FU021

9. Remove the needle valve.

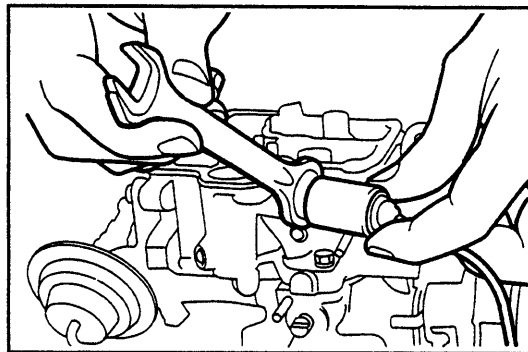


WN88E-FU022



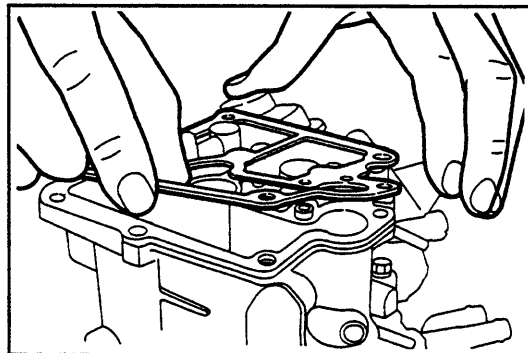
**DISASSEMBLY OF CARBURETOR**

1. Remove the solenoid valve wire clamp.
2. Remove the solenoid valve.



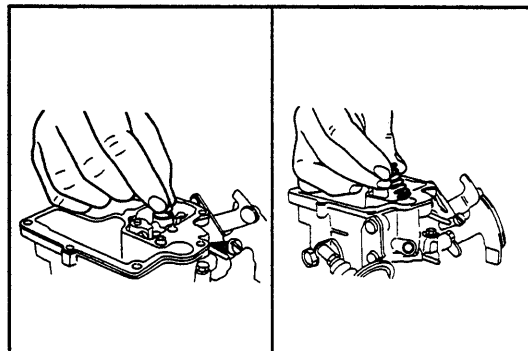
WN88E-FU023

3. Remove the gasket.



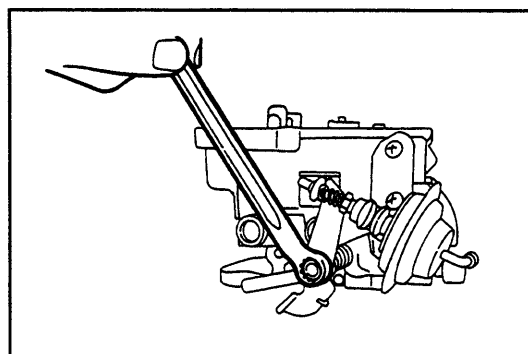
WN88E-FU024

4. Remove the discharge weight and spring ball.
5. Remove the acceleration pump return spring.



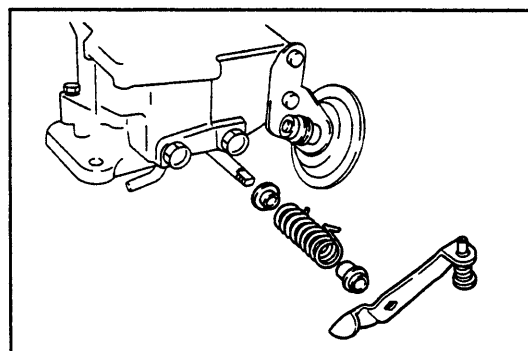
WN88E-FU025

6. Removal of throttle positioner
  - (1) Remove the throttle lever set nut.



WN88E-FU026

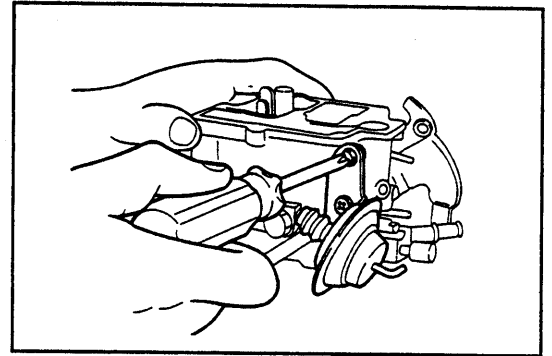
- (2) Remove the throttle positioner lever.
  - (3) Remove the collars and spring.



WN88E-FU027

# FUEL SYSTEM

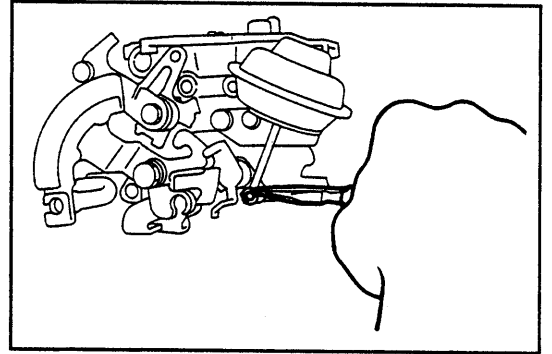
(4) Remove the throttle positioner.



WN88E-FU028

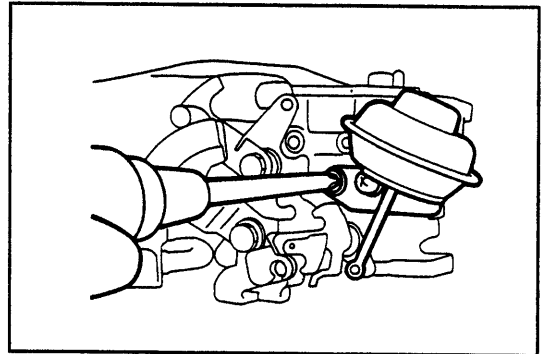
7. Removal of secondary throttle valve diaphragm

- (1) Remove the spring.
- (2) Remove the pin. Disconnect the link.



WN88E-FU029

- (3) Remove the secondary throttle valve.
- (4) Remove the rubber hose.

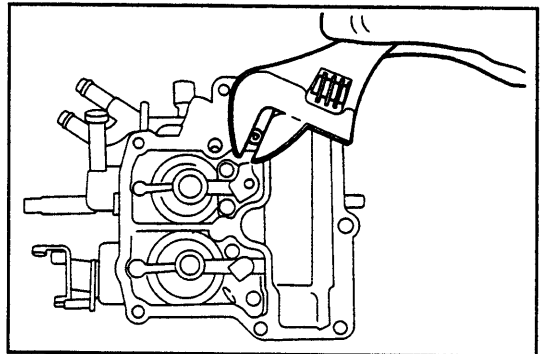


WN88E-FU030

8. Remove the slow jet.

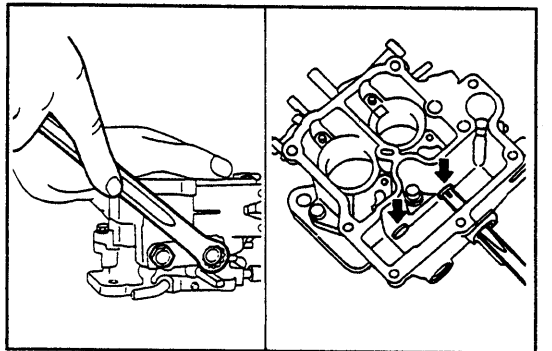
**NOTE:**

Never reuse the "O" ring.



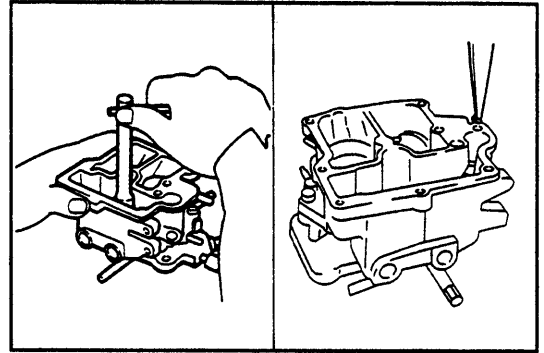
WN88E-FU031

9. Remove the main passage plugs. Remove the primary and secondary main jets.



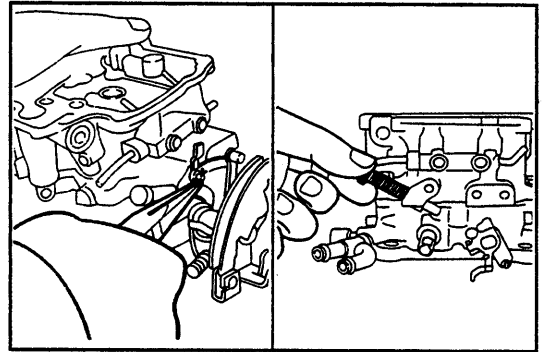
WN88E-FU032

10. Remove the power valve, using the SST.
11. Remove the acceleration pump check ball retainer.



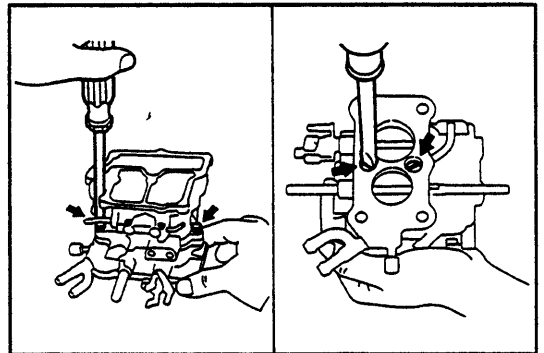
WN88E-FU033

12. Remove the auto choke linkage.
13. Remove the throttle adjusting screw.



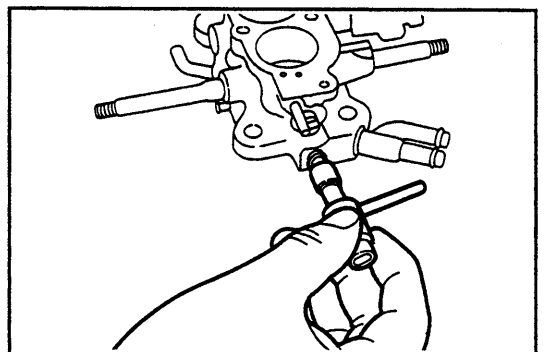
WN88E-FU034

14. Disassembly of the carburetor body and flange.
  - (1) Remove the attaching bolts and nuts.
  - (2) Disassemble the carburetor body and flange.



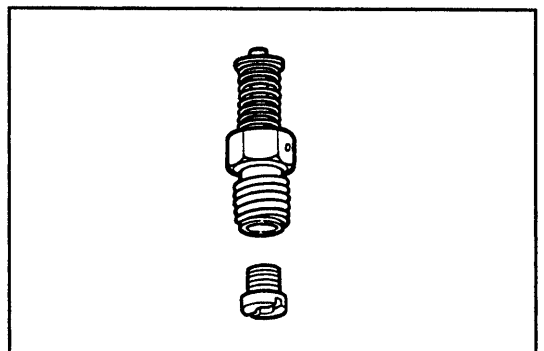
WN88E-FU035

15. Remove the idle mixture adjusting screw, using the SST.



WN88E-FU036

16. Remove the power jet from the power valve.



WN88E-FU037

# FUEL SYSTEM

## CLEANING OF EACH PARTS

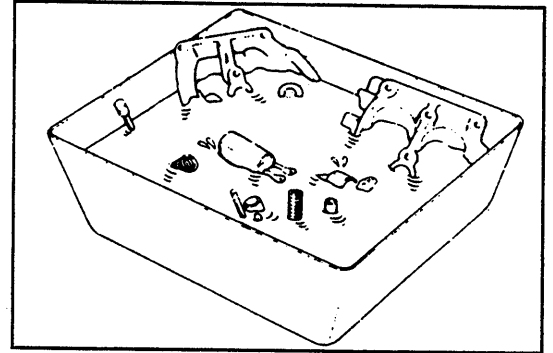
1. Clean the carburetor parts except for the diaphragms and electrical parts, using carburetor cleaner and a soft brush.
2. Remove carbon deposits by means of a soft brush.
3. Clean each of the jets and nozzles, using compressed air.

### NOTE:

Never clean the jets or orifices with a piece of wire or a drill. This could enlarge the openings and result in poor fuel mileage.

### WARNING:

Be sure to protect your eyes with safety goggles, when using compressed air.

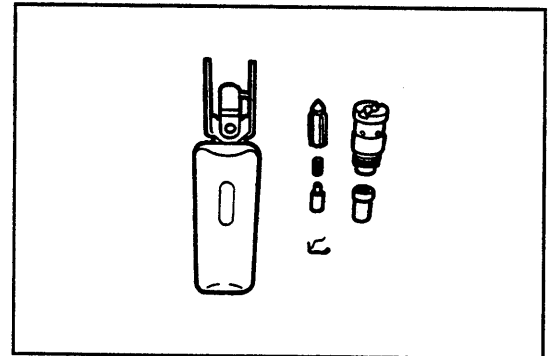


WR88-FU073

## INSPECTION OF CARBURETOR

### 1. Inspection of float and needle valve

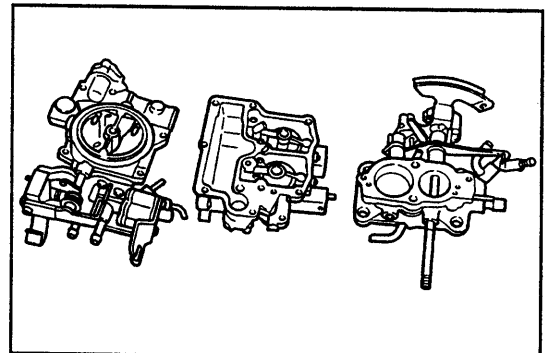
- (1) Inspect the float lever pin for scratches excessive wear, and damage.
- (2) Inspect the float for broken lip or damage.
- (3) Inspect the valve and plunger for wear or damage.
- (4) Inspect the spring for deformation.
- (5) Inspect the strainer for breakage, restriction or damage.
- (6) Inspect the valve seat for wear or damage.



WN88E-FU038

### 2. Inspection of air horn, body and flange

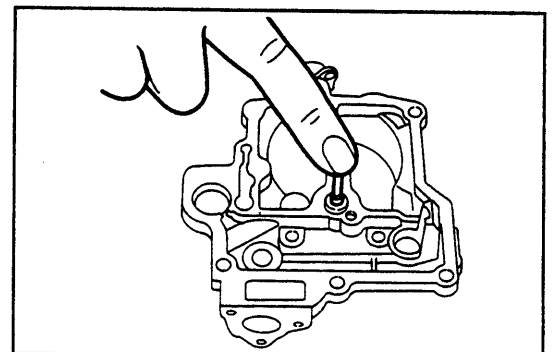
- (1) Check each part for cracks, wear or damage.
  - (2) Check to see if each valve functions smoothly.
  - (3) Check each air passage for restriction.
- Replace any defective part, as required.



WN88E-FU039

### 3. Inspection of power piston

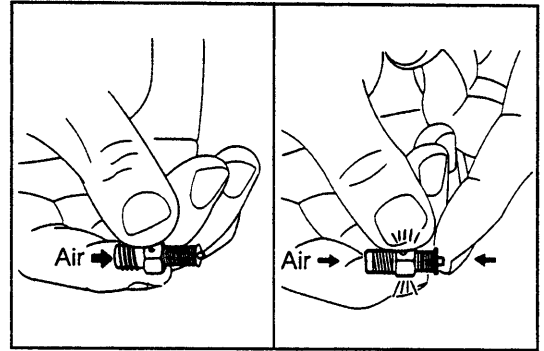
Check to see if the power piston functions smoothly.



WN88E-FU040

## 4. Inspection of power valve

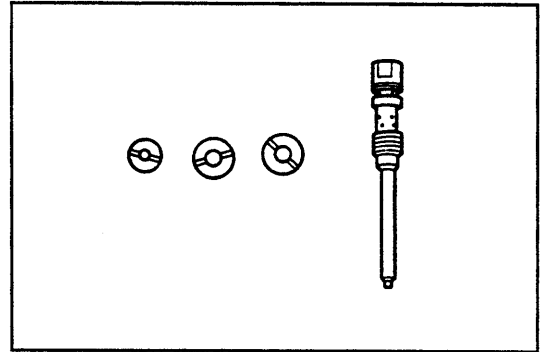
Ensure that air continuity exists when the valve is pushed. Also, ensure that no air continuity exists when the valve is not pushed.



WR88-FU077

## 5. Inspection of jets

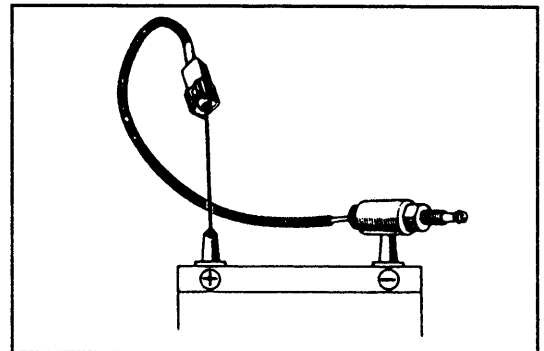
Check each jet for restriction or damage.



WR88-FU078

## 6. Inspection of solenoid valve

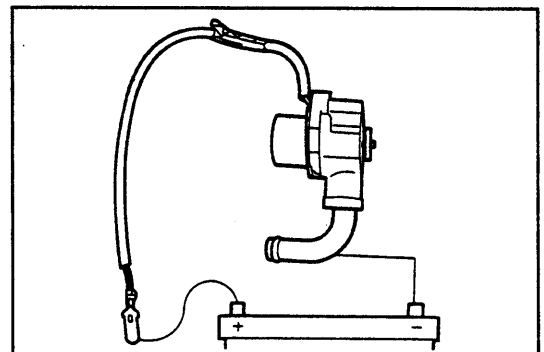
Ensure that the valve is opened when the solenoid valve is energized. Also, ensure that the valve is closed when the solenoid valve is not energized.



WR88-FU079

## 7. Inspection of outer vent valve

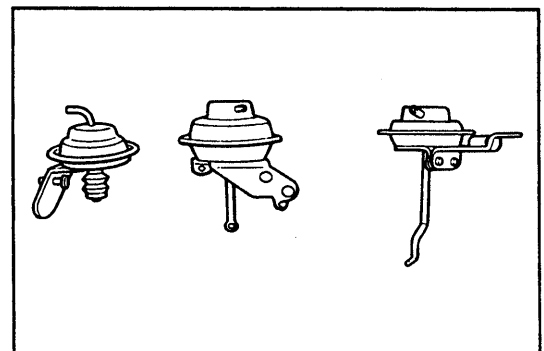
Ensure that the valve is closed when the solenoid valve is energized. Also, ensure that the valve is opened when the solenoid valve is not energized.



WR88-FU080

## 8. Inspection of each diaphragm

Ensure that the rod is drawn into the diaphragm chamber when a negative pressure is applied to each diaphragm.

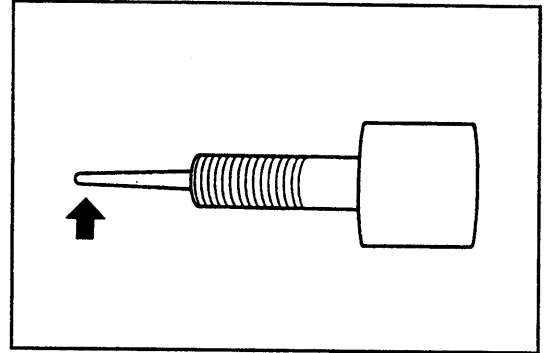


WR88-FU081

# FUEL SYSTEM

## 9. Inspection of idle mixture adjusting screw

Check to see if any damage or wear is present at the tip end of the adjusting screw.



WR88-FU082

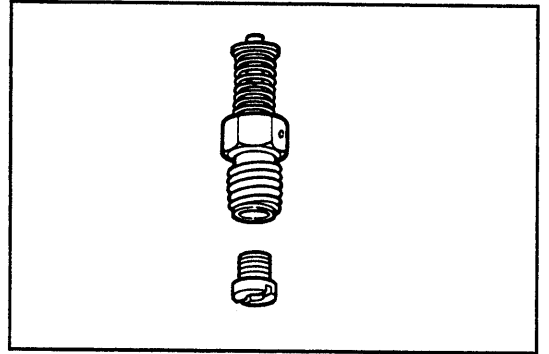
## ASSEMBLY OF CARBURETOR

### NOTE:

Be sure to use new gaskets and "O" rings.

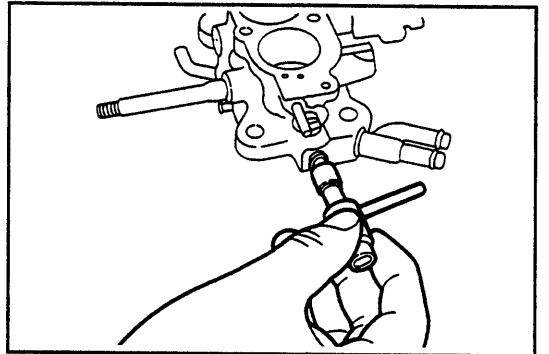
## ASSEMBLY OF CARBURETOR BODY & FLANGE

1. Install the power jet in the power valve.
2. Screw in the idle mixture adjusting screw fully into the flange, using the SST. Then, back off the adjusting screw four turns.  
**NOTE:**  
Care must be exercised to ensure that no damage may be made to the tip-end of the adjusting screw by tightening the idle mixture adjusting screw excessively.



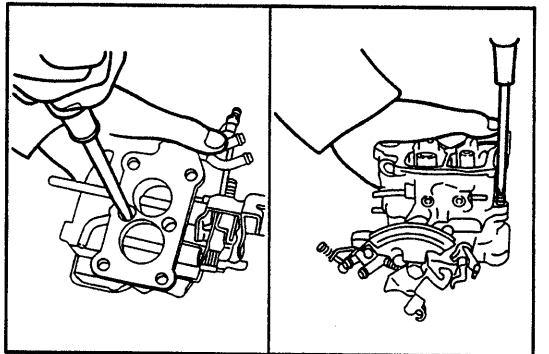
WR88-FU084

3. Assembly of carburetor body and flange  
Install the throttle body with a new gasket interposed.

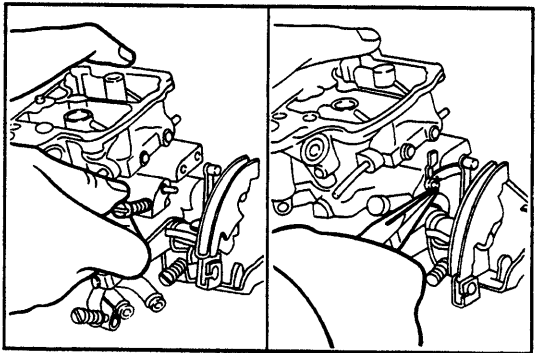


WR88-FU085

4. Install the throttle adjusting screw.
5. Install the auto choke linkage.

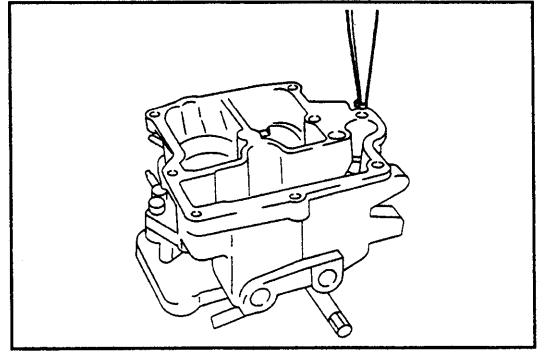


WR88-FU086



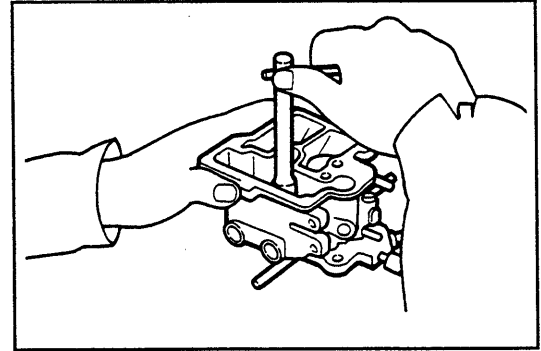
WN088E-FU041

6. Install the check ball retainer with the acceleration pump check ball inserted in place.



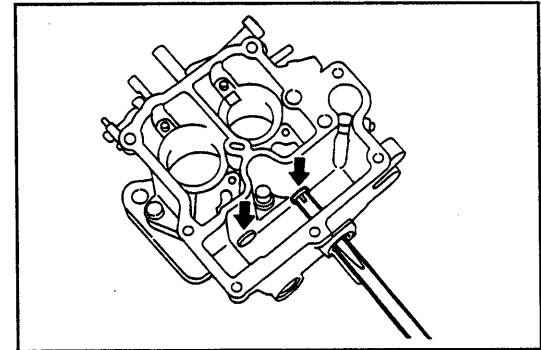
WN88E-FU042

7. Install the power valve, using the SST.



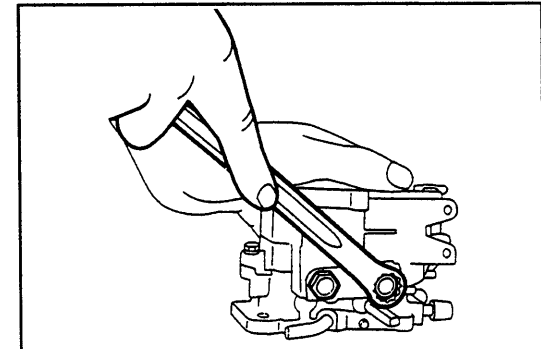
WN88E-FU043

8. Install the primary and secondary main jets.  
**NOTE:**  
Be sure to use new gaskets.



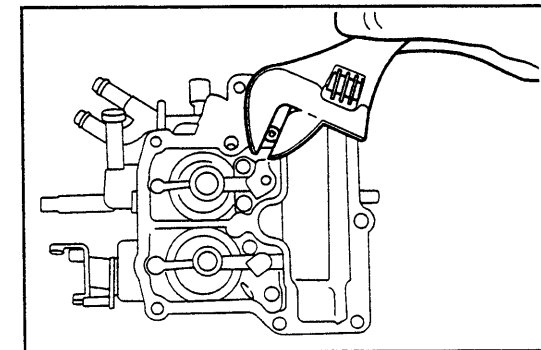
WN88E-FU044

9. Install the main passage plug.  
**NOTE:**  
Be sure to use a new gasket.



WN88E-FU045

10. Install the slow jet, with a new "O" ring.

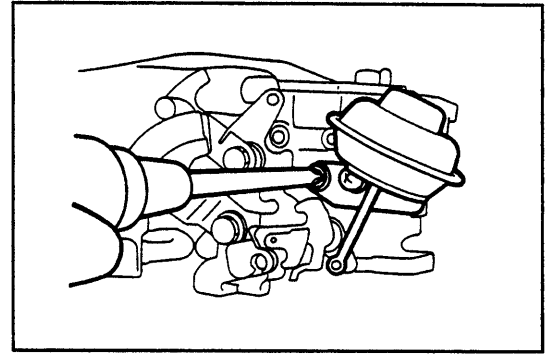


WN88E-FU046

## FUEL SYSTEM

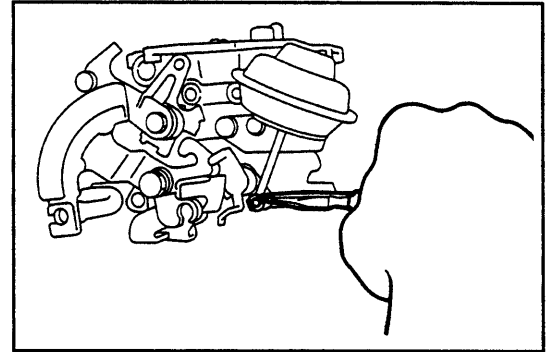
### 11. Installation of secondary throttle diaphragm

- (1) Connect the rubber hose to the diaphragm.
- (2) Install the diaphragm to the carburetor body.
- (3) Install the rubber hose to the carburetor body.



WN88E-FU047

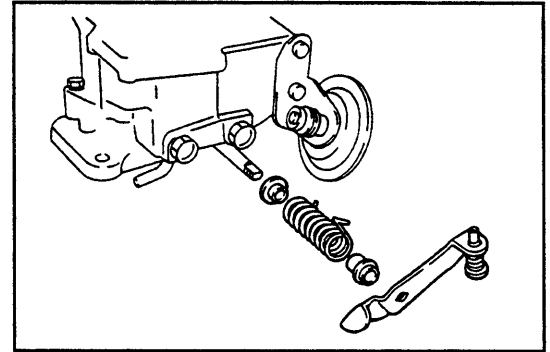
12. Connect the diaphragm rod and install the washer snap ring.
13. Install the spring.



WN88E-FU048

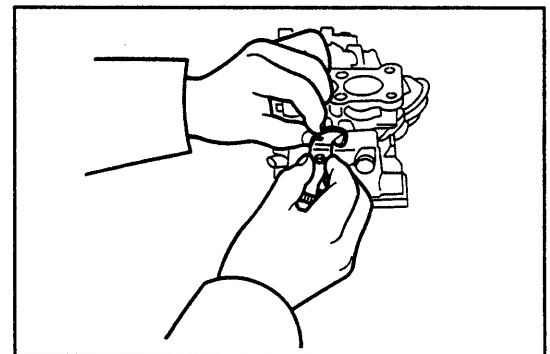
### 14. Installation of the throttle positioner

- (1) Install the collar, throttle return spring and thrust washer onto the throttle shaft.



WN88E-FU049

- (2) While installing the dashpot lever on the throttle shaft, attach the return spring to the dashpot lever.
- (3) Install the spring washer, then tighten the nut.

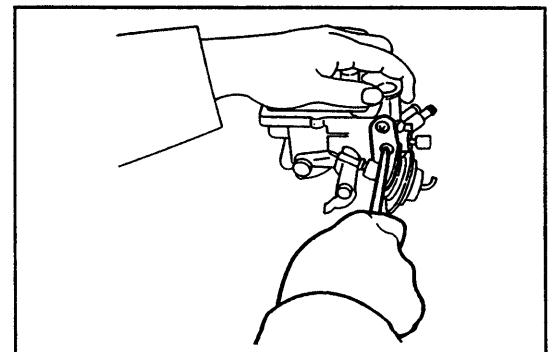


WN88E-FU050

- (4) Install the throttle positioner.

#### NOTE:

Be careful not to damage the rubber boot section during the installation.

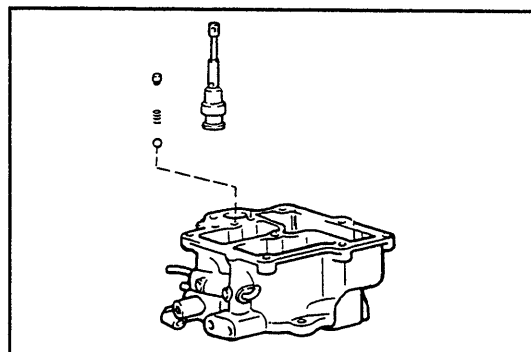


WN88E-FU051



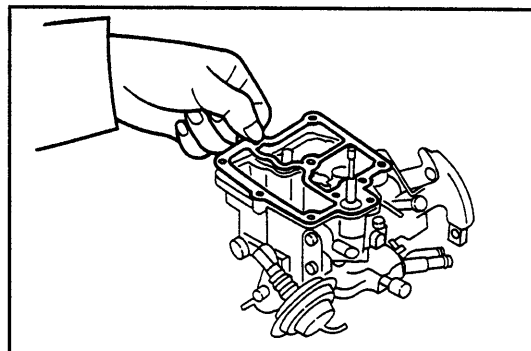
## 15. Assembly of the acceleration pump

- (1) Install the return spring for the acceleration pump.
- (2) Install the ball, spring and discharge weight.
- (3) Assemble the acceleration pump to the carburetor.



WN88E-FU052

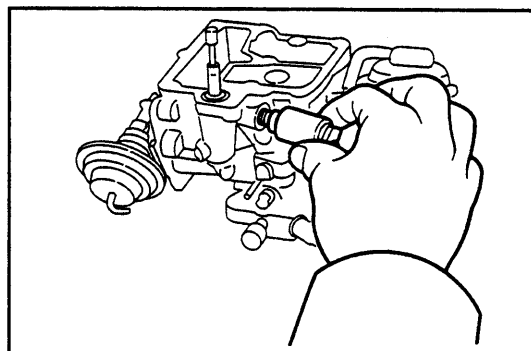
## 16. Install the gasket.



WN88E-FU053

## 17. Install the solenoid valve.

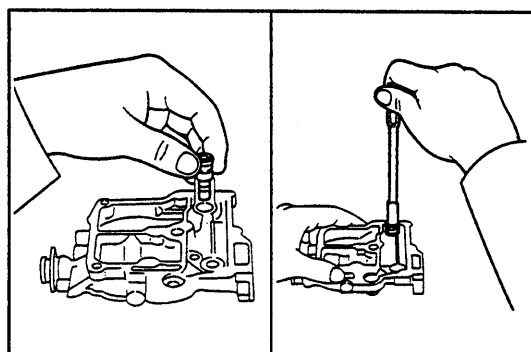
## 18. Install the solenoid valve wire clamp in place.



WN88E-FU054

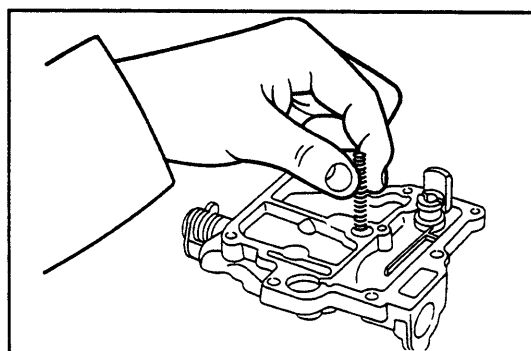
## ASSEMBLY OF AIR HORN

### 1. Install the needle valve seat to the air horn with a new gasket interposed.



WR88-FU128

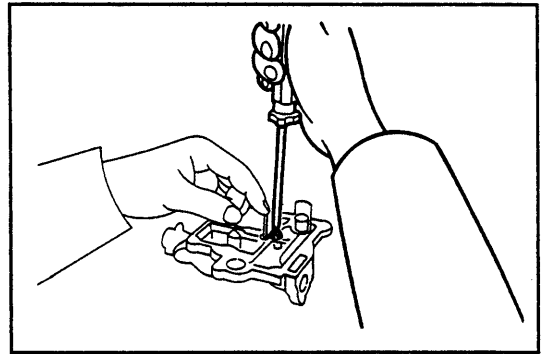
### 2. Insert the power piston spring into the air horn.



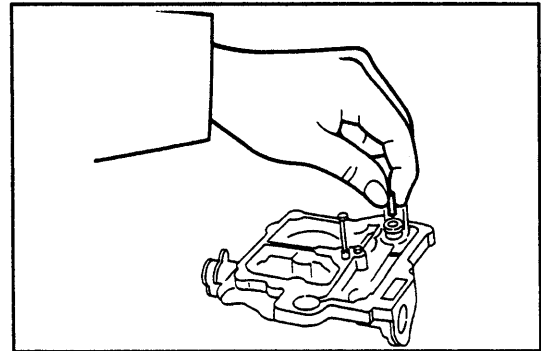
WR88-FU129

# FUEL SYSTEM

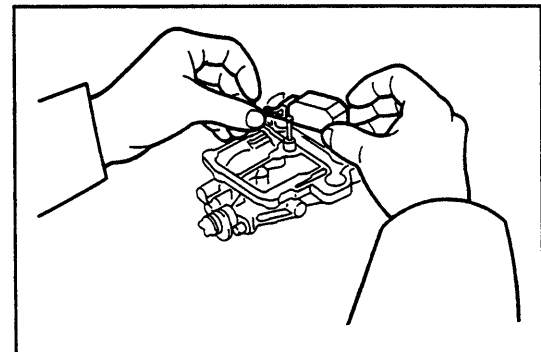
3. While inserting the power piston into the air horn, install the lock plate.



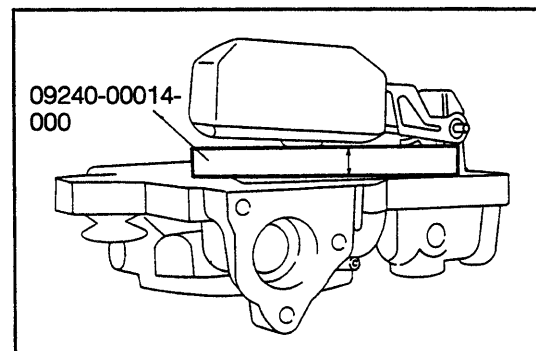
4. Remove the snap pin for pulling-off needle valve use. Insert the snap pin into the valve seat.



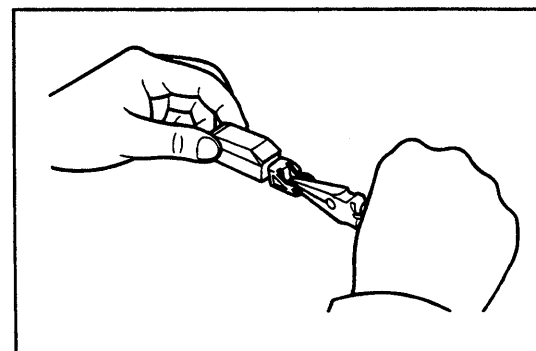
5. Install the float.



6. Adjustment of float level  
(1) Check the dimension under the float's own weight, using the following SST.  
**Dimension under Float's Own Weight:**  
8 mm (0.315 inch)  
SST: 09240-00014-000



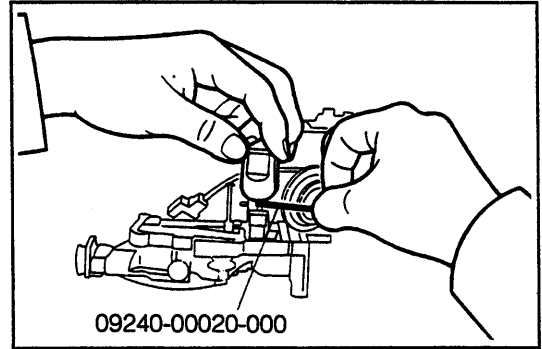
Adjust the dimension under the float's own weight by bending the lip section of the float if the measured value fails to conform to the specified value.



(2) Check the lip dimension using the following SST.

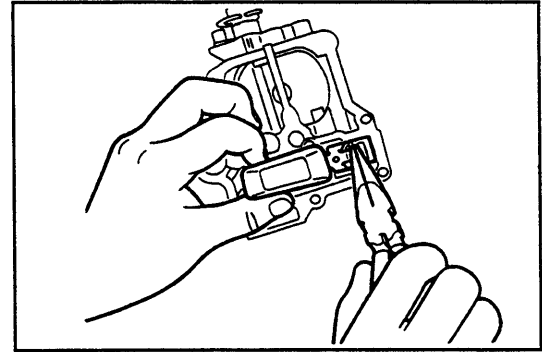
Lip Dimension: 1.6 mm (0.063 inch)

SST: 09240-00020-000



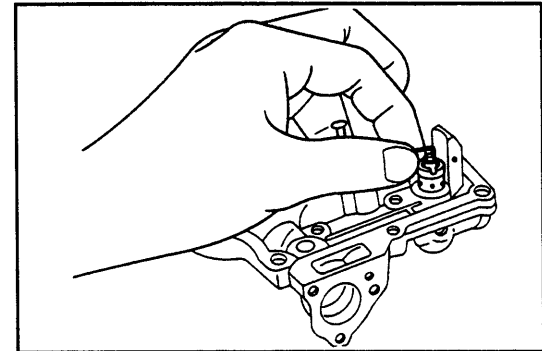
WR88-FU135

Adjust the lip dimension by bending the lever of the float if the measured value fails to conform to the specified value.



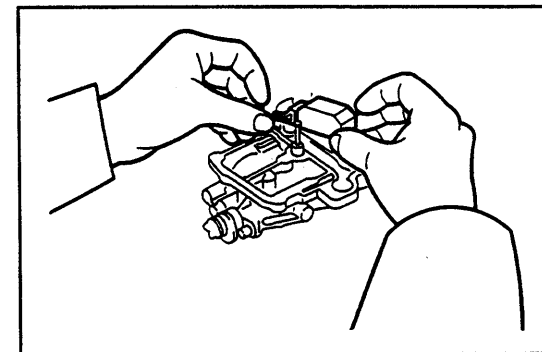
WR88-FU136

(3) Remove the float. Install the snap pin for pulling-off use to the needle valve.



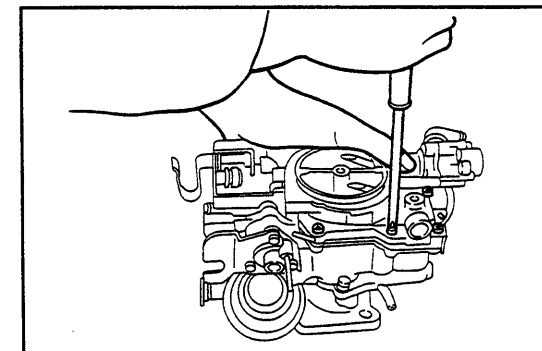
WR88-FU137

(4) Install the float.



WN88E-FU055

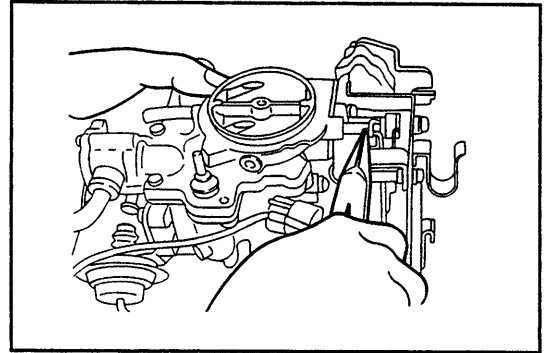
7. Install the air horn assembly onto the carburetor body.
8. Tighten the 7 screws (5 screws in case of the idle-up actuator equipped model) of the air horn.



WN88E-FU056

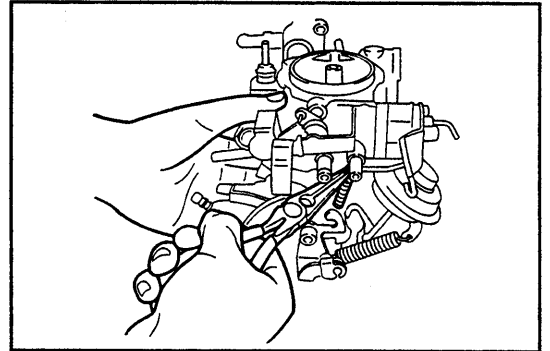
# FUEL SYSTEM

9. Connect the choke lever linkage at the upper side.



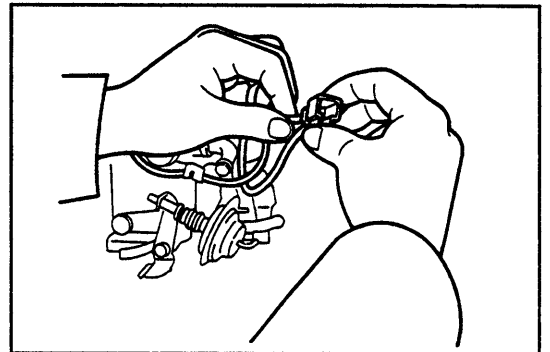
WN88E-FU057

10. Install the spring to the carburetor.



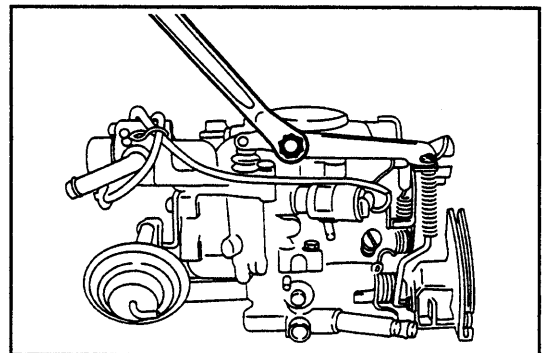
WN88E-FU058

11. Connect the outer vent terminal to the connector.



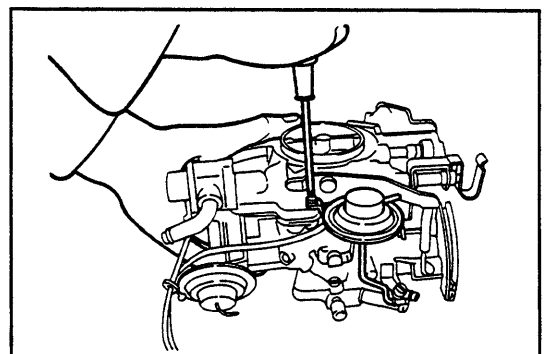
WN88E-FU059

12. Install the accelerator pump and lever.  
Tighten the accelerator pump arm set screw.



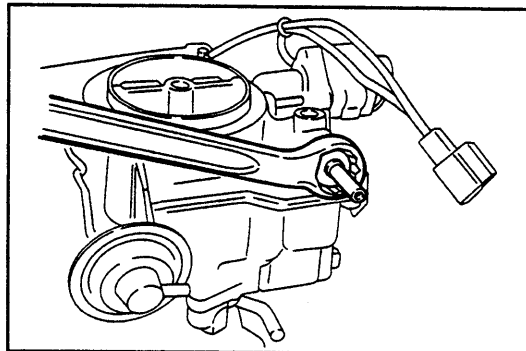
WN88E-FU060

13. Install the idle-up actuator to the carburetor.  
(only for the power steering-equipped vehicle).



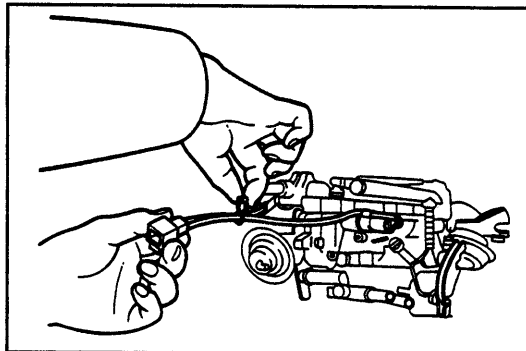
WN88E-FU061

14. Install the gasket and fuel inlet union.
15. Install the air cleaner set bolt.



WN88E-FU062

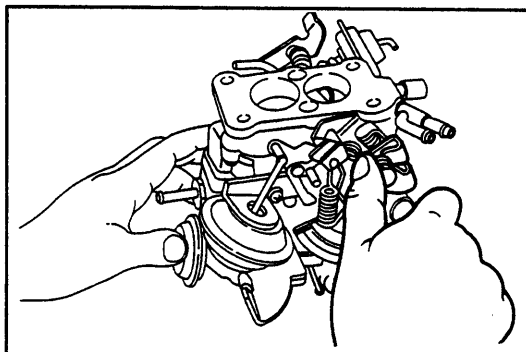
16. Attach the harness clamp.



WN88E-FU063

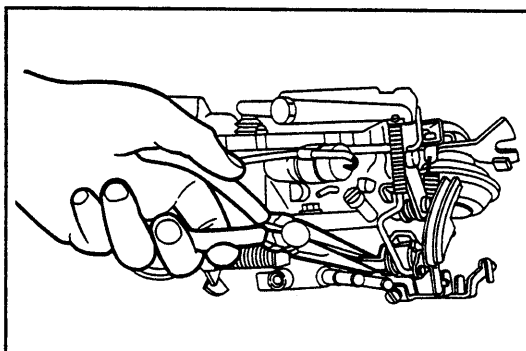
**ADJUSTMENT OF CARBURETOR**

1. Inspection of throttle valve opening angle
  - (1) Visually inspect the valve opening angle when the primary throttle valve is opened fully.  
Full Opening Angle: 90°



WR88-FU151

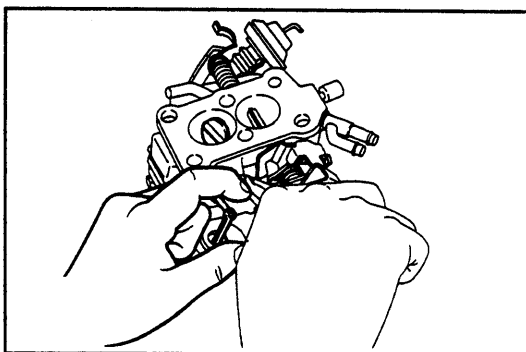
Adjust the opening angle by bending the throttle lever stopper if the measured value fails to conform to the specified value.



WR88-FU152

- (2) Visually inspect the valve opening angle when the secondary throttle valve is opened fully.  
Full Opening Angle: 80°

Adjust the opening angle by bending the throttle lever stopper if the measured value fails to conform to the specified value.



WR88-FU153

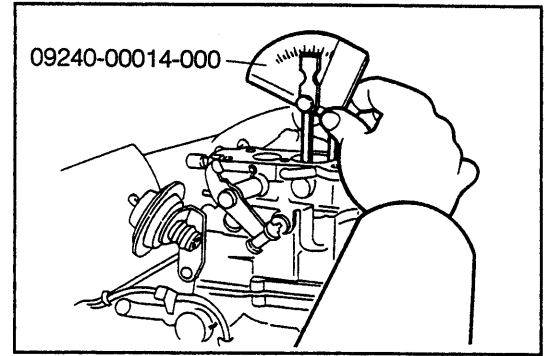
## FUEL SYSTEM

### 2. Inspection of kick-up opening angle

Measure the opening angle of the secondary valve when the primary throttle valve is opened fully, using the following SST.

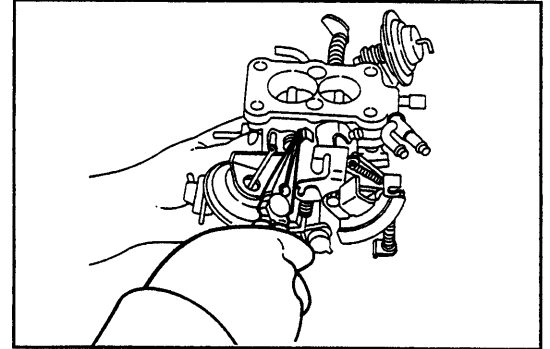
SST: 09240-00014-000

Kick-Up Opening Angle: 23°



WR88-FU154

Adjust the kick up opening angle by bending the secondary throttle lever if the measured value fails to conform to the specified value.

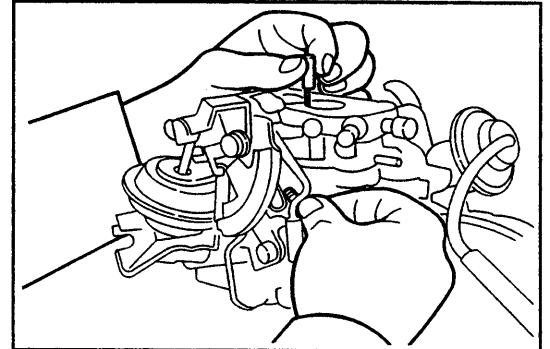


WR88-FU155

### 3. Adjust the throttle adjusting screw so that the throttle valve opening angle may become 0.3 mm (0.0118 inch).

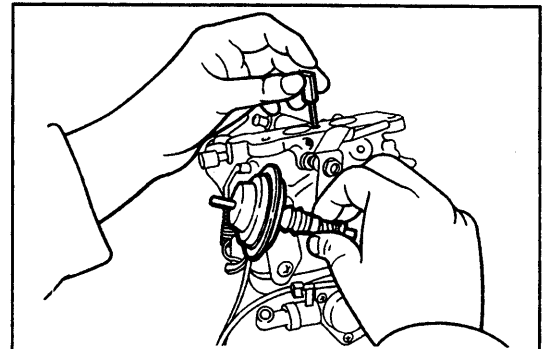
#### NOTE:

Be sure to apply a negative pressure to the throttle positioner so as to keep it in an operating state.



WN88E-FU064

### 4. Under the condition that a negative pressure is not applied to the throttle positioner, adjust the opening angle of the throttle valve to about 0.45 mm (0.0177 inch).



WN88E-FU065

5. Ensure that each part operates smoothly.
6. Install the air cleaner set bolt.

## INSTALLATION OF CARBURETOR

1. Inspection of heat insulator  
Visually inspect the gasket surface of the heat insulator. Replace the heat insulator if it exhibits damage.
2. Install the carburetor to the intake manifold with the heat insulator interposed. Tighten the attaching nuts to the specified torque.

Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

3. Connect the outer vent valve connector of the solenoid valve and the throttle position sensor connector.
4. Connect the following hoses to the carburetor.

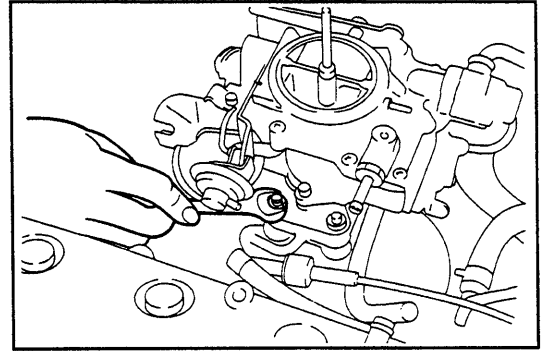
- ① Fuel inlet hose
- ② ITC vacuum hose
- ③ PCV gas hose
- ④ Choke braker vacuum hose
- ⑤ Vacuum hoses to gas filter
- ⑥ Outer vent hose
- ⑦ Throttle position vacuum hose
- ⑧ Vacuum hose to distributor
- ⑨ Coolant circulating hoses

**NOTE:**

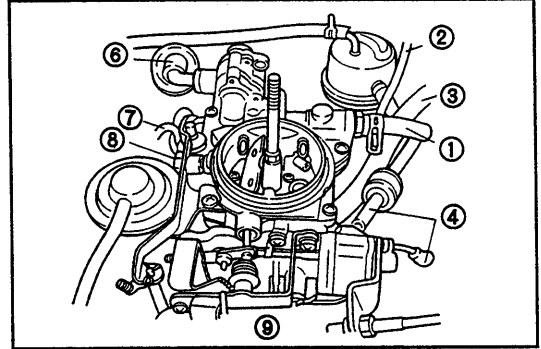
Ensure that the hose clamp is installed at correct position as indicated at right figure.

5. Connect the accelerator cable to the carburetor. Adjust the axial play of the accelerator cable to 3 - 8 mm (0.12 - 0.31 inch).

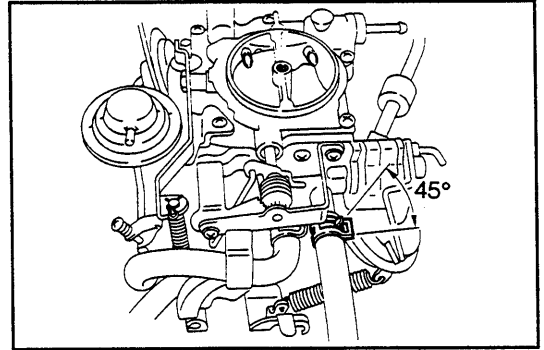
6. Install the air cleaner.
7. Connect the following rubber hoses to the air cleaner.
  - (1) Vacuum hose to BSVS
  - (2) ITC vacuum hose to carburetor
  - (3) Blow-by gas hose
  - (4) Cool air intake hose
  - (5) Hot air intake hose



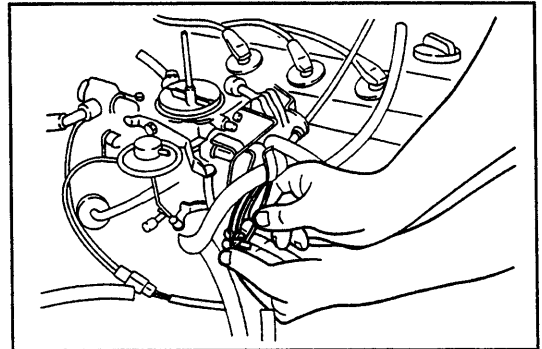
WR88-FU162



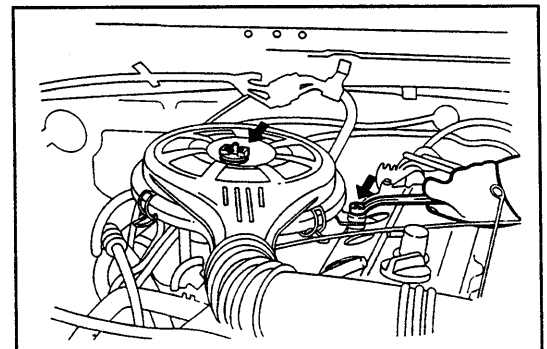
WR88-FU163



WN88E-FU067



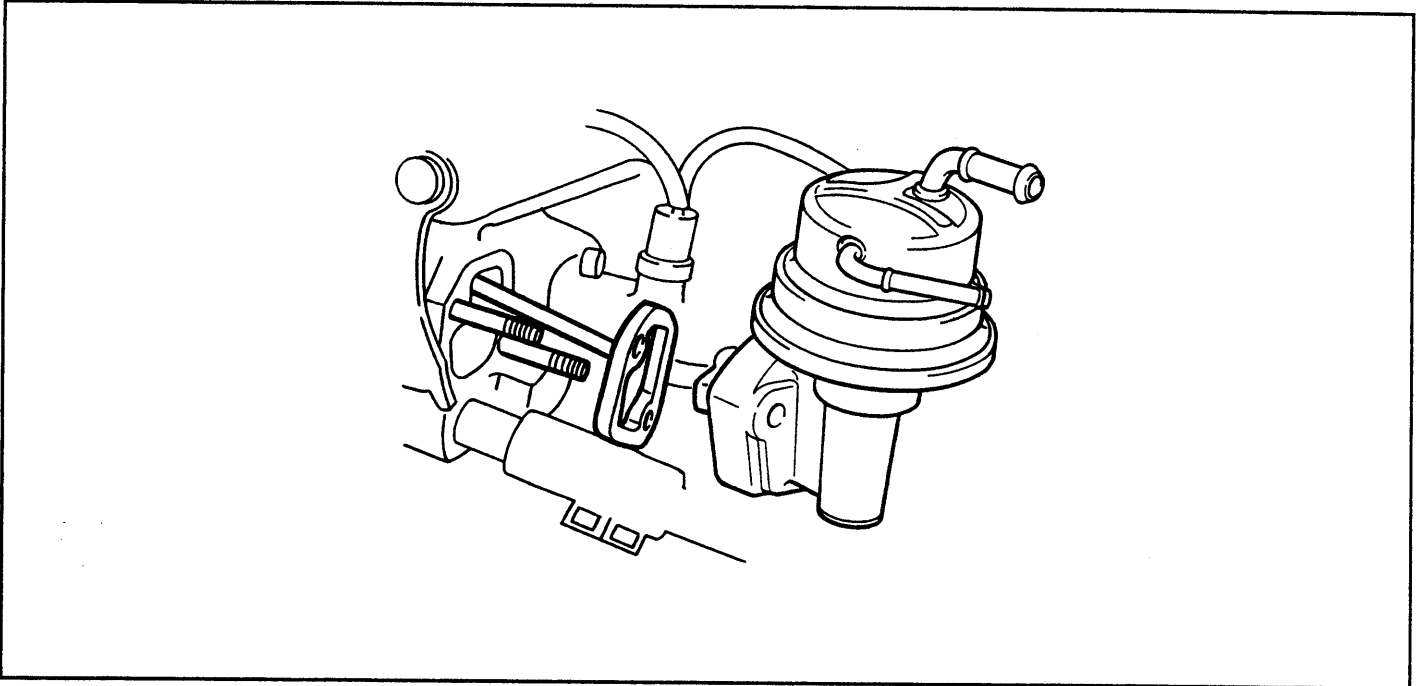
WN88E-FU067



WN88E-FU068

8. Fill coolant.  
(See page CO-3.)
9. Connect the ground cable to the negative (-) terminal of the battery.
10. Tune up the engine.

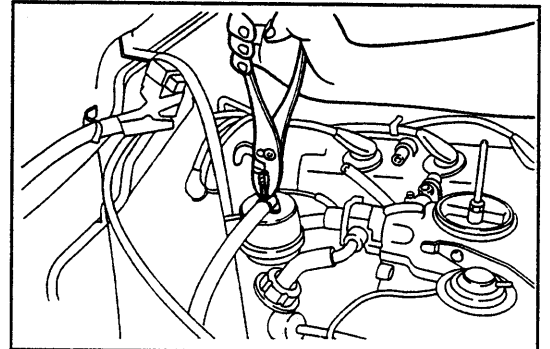
## FUEL PUMP



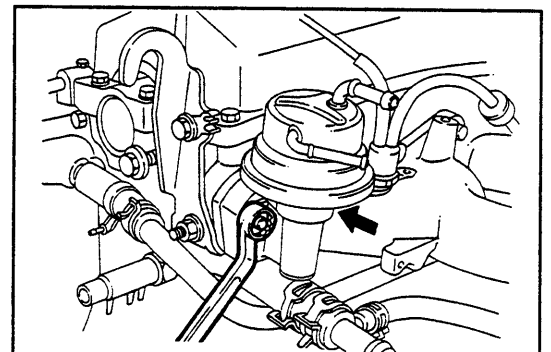
WN88E-FU070

### REMOVAL OF FUEL PUMP

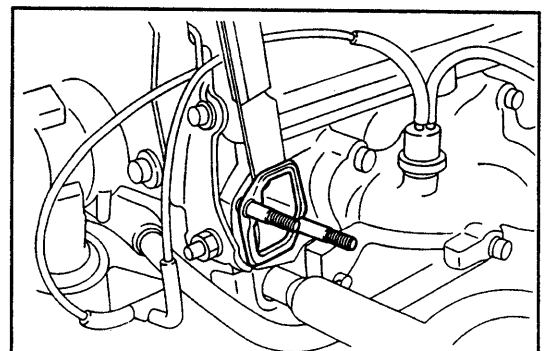
1. Disconnect the fuel hoses from the fuel pump.  
**NOTE:**  
Plug the disconnected hose so that no fuel will flow out.
2. Remove the fuel pump by removing the attaching nuts.  
**NOTE:**  
Since the engine oil will flow out, be sure to put a suitable cloth so that no engine oil may splash on the starter and so forth.
3. Remove the insulator.  
**NOTE:**  
Never reuse the insulator.
4. Cut the gasket along the intake manifold. Remove any gasket material remaining on the fuel pump installation section, using a gasket scraper.  
**NOTE:**  
This cutting of the gasket is required only when the gasket used at the assembly line in the manufacturer has been installed.  
Be very careful not to damage the gasket installation surface during the operations.



WN88E-FU071



WN88E-FU072



WN88E-FU073



## INSPECTION

### 1. Inspection of fuel pump

#### CAUTION:

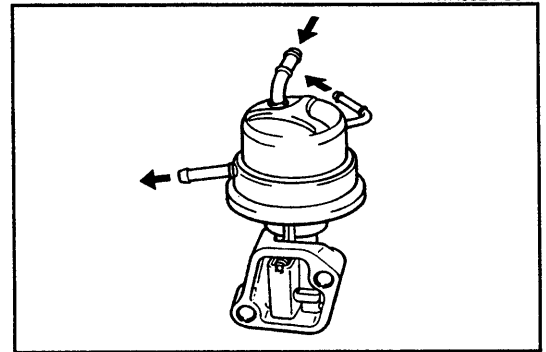
- Prior to the check, fill a small amount of fuel into the fuel pump. Thus, the inspection should be performed under a condition that the valve is wet. When the valve is dry, the following inspection can not be performed correctly.

#### WARNING:

- Never work on the fuel system in proximity of a fire.
- Never allow any fire to be brought near the working site.

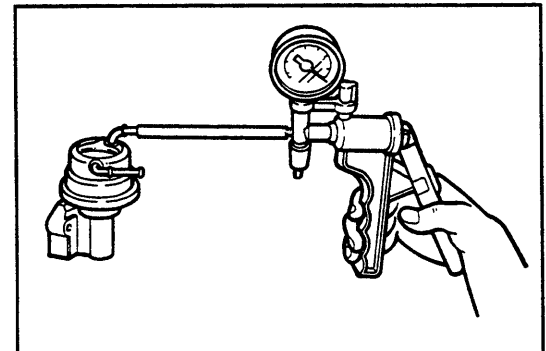
- (1) Blow air from the inlet side of the fuel pump. Ensure that air continuity exists.  
Replace the fuel pump if no air continuity exists.

WN88E-FU074



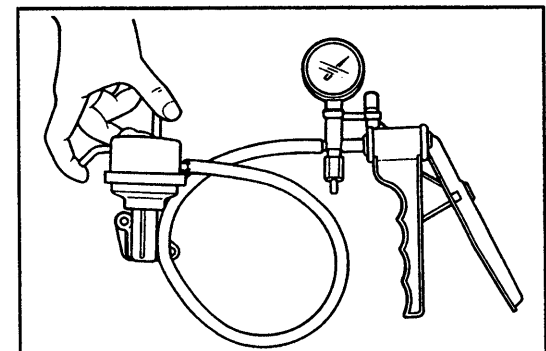
WR88-FU176

- (2) Install a MityVac to the inlet side of the fuel pump and apply a negative pressure. Ensure that the applied pressure is retained.  
Replace the fuel pump if the pressure is not retained.



WR88-FU177

- (3) Plug the inlet pipe and return pipe of the fuel pump. Install a MityVac to the outlet pipe and apply a negative pressure. Ensure that the applied pressure is retained.  
Replace the fuel pump if the pressure is not retained.



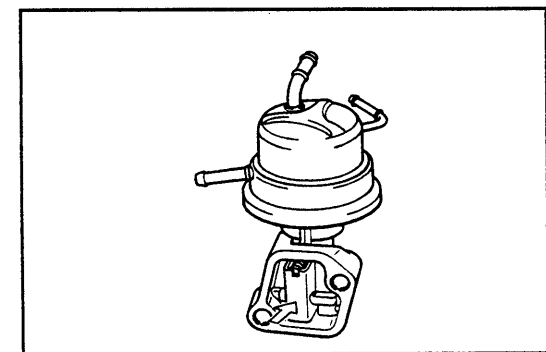
WR88-FU178

- (4) Visually inspect the push rod-contact-surface of the fuel pump.

#### NOTE:

When the contact surface is not a mirror-like surface, it means that the contact surface is worn out.

Replace the fuel pump if the contact surface exhibits wear.



WR88-FU179

# FUEL SYSTEM

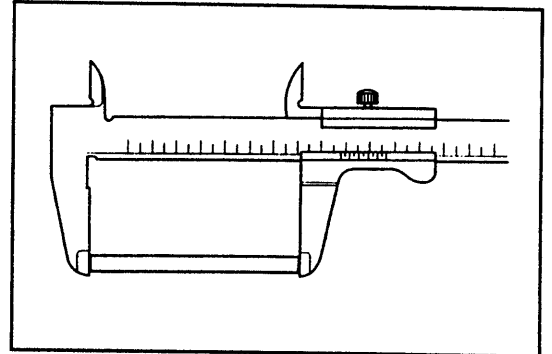
2. Inspection of fuel pump push rod  
Ensure that the overall length of the push rod is the specified value or more.

**Minimum Length:** 87.00 mm (3.425 inch)

**Reference**

**STD:** 87.95 - 88.25 mm (3.463 - 3.474 inch)

Replace the push rod if its overall length is less than the specified value.

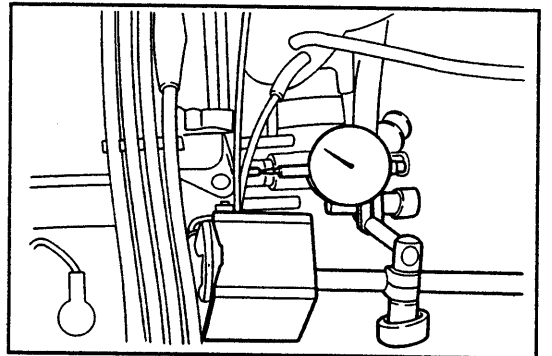


WN88E-FU075

4. Checking fuel pump cam for wear
  - (1) Insert the push rod of the fuel pump into the cylinder head. Set a dial gauge.
  - (2) Turn the crankshaft two turns. Measure the stroke of the push rod of the fuel pump. Ensure that the stroke is the specified value or more.

**Minimum Stroke:** 4.8 mm (0.189 inch)

Replace the camshaft if the stroke is less than the specified value.

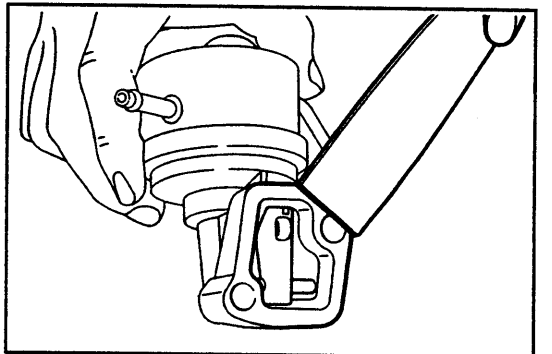


WN88E-FU076

## INSTALLATION OF FUEL PUMP

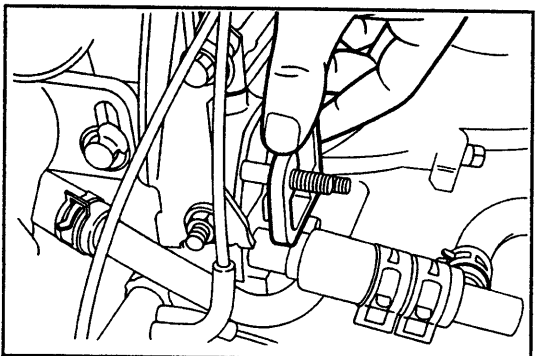
1. Remove any remaining gasket material from the insulator installation surface of the fuel pump, using a gasket scraper.  
**NOTE:**  
Be very careful not to damage the gasket contact surface.

2. Wipe off any oil from the oil pump installation surface of the cylinder head.



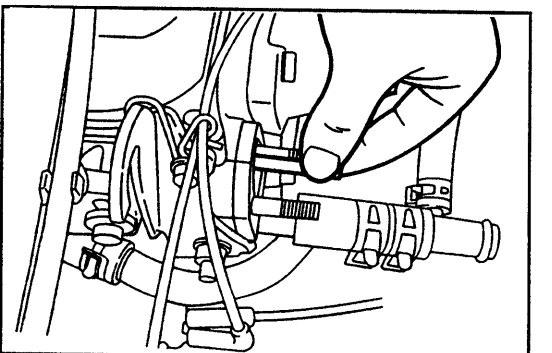
WR88-FU183

3. Install a new insulator to the cylinder head.  
**NOTE:**  
Never reuse the insulator.



WR88-FU185

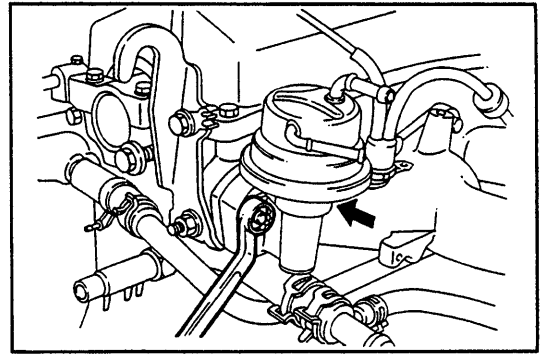
4. Insert the fuel pump push rod into the cylinder head.



WR88-FU185A

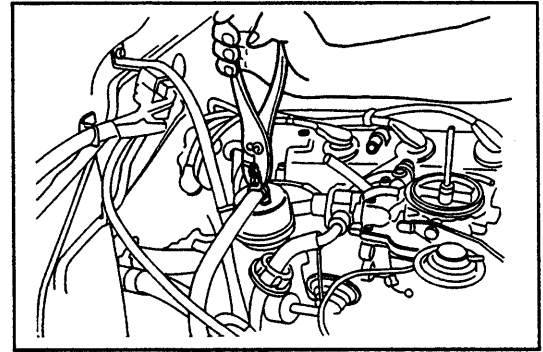
5. Install the fuel pump to the cylinder head. Tighten the attaching nuts.

Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)



WR88-FU186

6. Connect the fuel hose to the fuel pump. Attach the hose bands.

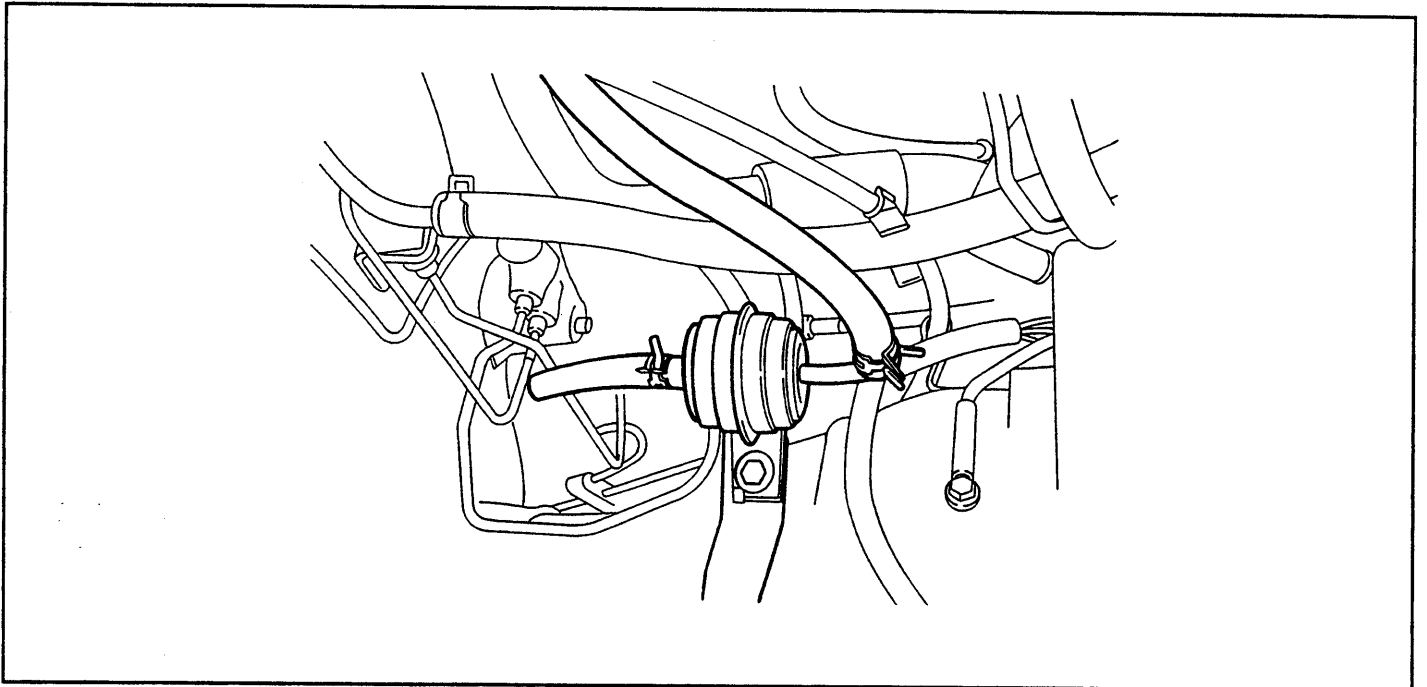


WR88-FU187

7. Connect the connector of the distributor.
8. Start the engine. Ensure that the engine exhibits no fuel leakage.  
Repair any leaky points, as required.

WR88-FU188

## FUEL FILTER



WN88E-FU077

### REPLACEMENT OF FUEL FILTER

#### WARNING:

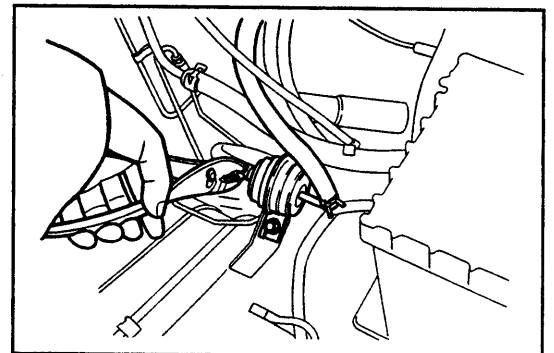
- Never work on the fuel system in proximity of a fire.
- Never allow any fire to be brought near the working site.

1. Disconnect the fuel hose from the fuel filter.

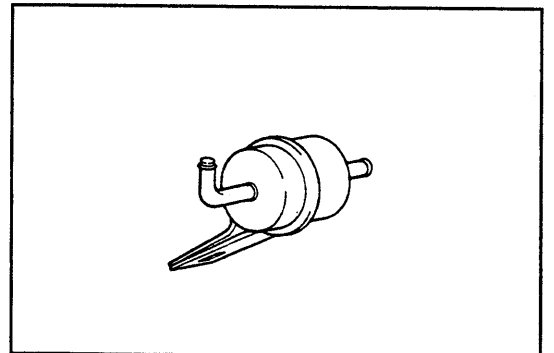
#### NOTE:

Plug the disconnected hose so that no fuel may flow out.

2. Remove the fuel filter by removing the attaching bolt.
3. Install a new fuel filter. Tighten the attaching bolts.

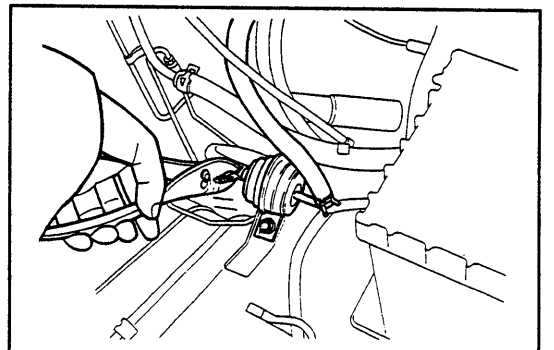


WN88E-FU078



WN88E-FU079

4. Connect the fuel hose to the fuel filter. Attach the hose bands.
5. Start the engine. Ensure that the engine exhibits no fuel leakage. Repair any leaky points, as required.



WN88E-FU080

# **DAIHATSU**

# **F300**

[HD-ENGINE]

## **COOLING SYSTEM**

<b>TROUBLE SHOOTING .....</b>	<b>CO- 2</b>
<b>PRECAUTIONS .....</b>	<b>CO- 2</b>
<b>CHECK &amp; CHANGE OF ENGINE</b>	
<b>COOLANT .....</b>	<b>CO- 2</b>
<b>WATER PUMP .....</b>	<b>CO- 4</b>
<b>THERMOSTAT .....</b>	<b>CO- 7</b>
<b>RADIATOR .....</b>	<b>CO- 9</b>

WN88E-CO001



## TROUBLE SHOOTING

Problem	Possible cause	Remedies	Page
Engine overheats	Poor quality coolant	Replenish coolant.	CO-2
	Water pump drive belt loose or missing	Adjust or replace belt.	CH-23
	Dirt, leaves or insects on radiator	Clean radiator.	CO-9
	Leaky hoses, water pump, the thermostat housing, radiator, heater, core plugs or head gasket	Repair as necessary.	
	Thermostat faulty	Check thermostat.	CO-7
	Ignition timing retarded	Set timing.	IG-22
	Radiator hose plugged or deteriorated	Replace hose.	
	Water pump faulty	Replace water pump.	CO-4
	Radiator plugged or cap faulty	Check radiator.	CO-9
Cylinder head or block cracked or plugged	Repair as necessary.	CO-10	

WN88E-CO002

## PRECAUTIONS

- As regards water to be used as cooling water, use soft water which does not contain salts of minerals, calcium, magnesium and so forth.
- If the coolant gets to the vehicle body, immediately flush away the coolant using water.
- Never open the radiator cap when the cooling water is still hot.
- The inside of the radiator is under a pressurized condition when the cooling water is hot. Therefore, if the radiator cap should be removed, the cooling water will blow off, possibly causing injuries such as scald.

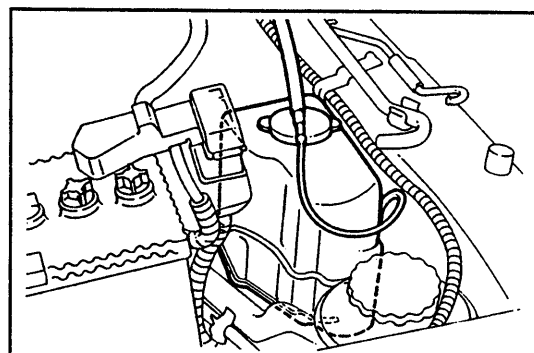
WR88-CO003

## CHECK & CHANGE OF ENGINE COOLANT

### 1. Check of coolant level

Check to see if the coolant level is between the LOW and FULL lines of the reserve tank.

If the coolant level is near the low level or below the low level, add the coolant up to the full level.



WR88-CO004

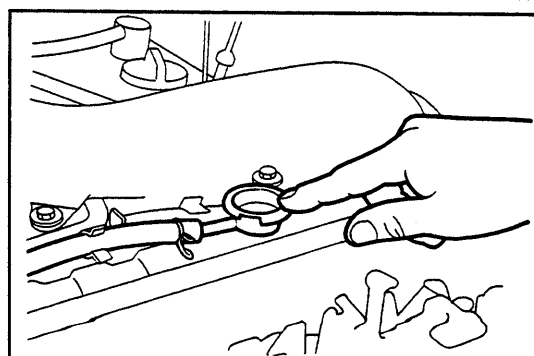
### 2. Check of coolant quality

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

Change the coolant if it is excessively dirty.

#### CAUTION:

Never open the radiator cap when the engine is still hot.



WR88-CO005

## 3. Change of engine coolant

(1) Remove the radiator cap.

### CAUTION:

Never open the radiator cap and/or the drain plug when the engine is still hot. Care must be exercised to avoid getting scalded.

WR88-C0006

(2) Place an adequate container, below the radiator drain plug. Drain the coolant by removing the drain plug.

(3) Close the drain plug.

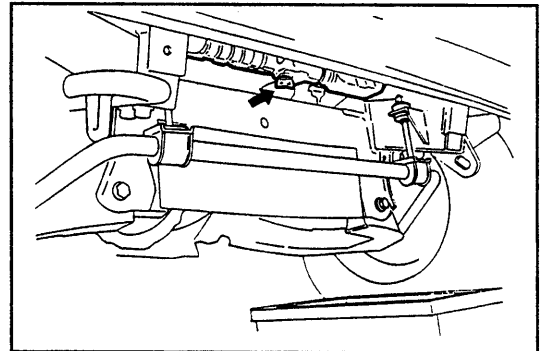
(4) Fill the system with water.

(5) Start the engine, and stop it.

(6) Repeat the steps (1) through (5) two to three times.

### NOTE:

Replace the drain plug gasket with a new one.



WR88-C0007

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

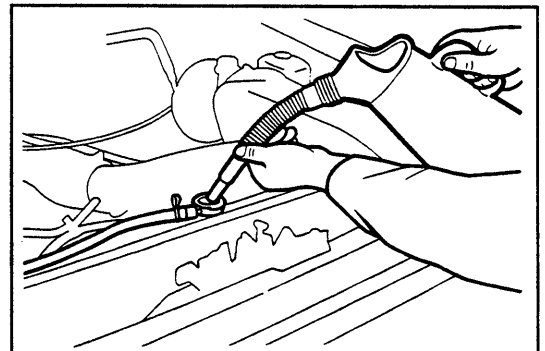
### CAUTION:

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

Coolant capacity (Vehicle with front heater):

5.5 liter (4.8 IMP qt)

[excluding 1.0 liter (0.8 IMP qt) for reserve tank]



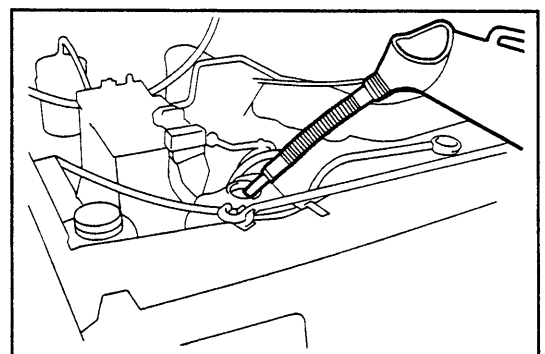
WN88E-C0003

(8) Fill the system with water.

(9) Start the engine. Check the coolant level. Add water, as required.

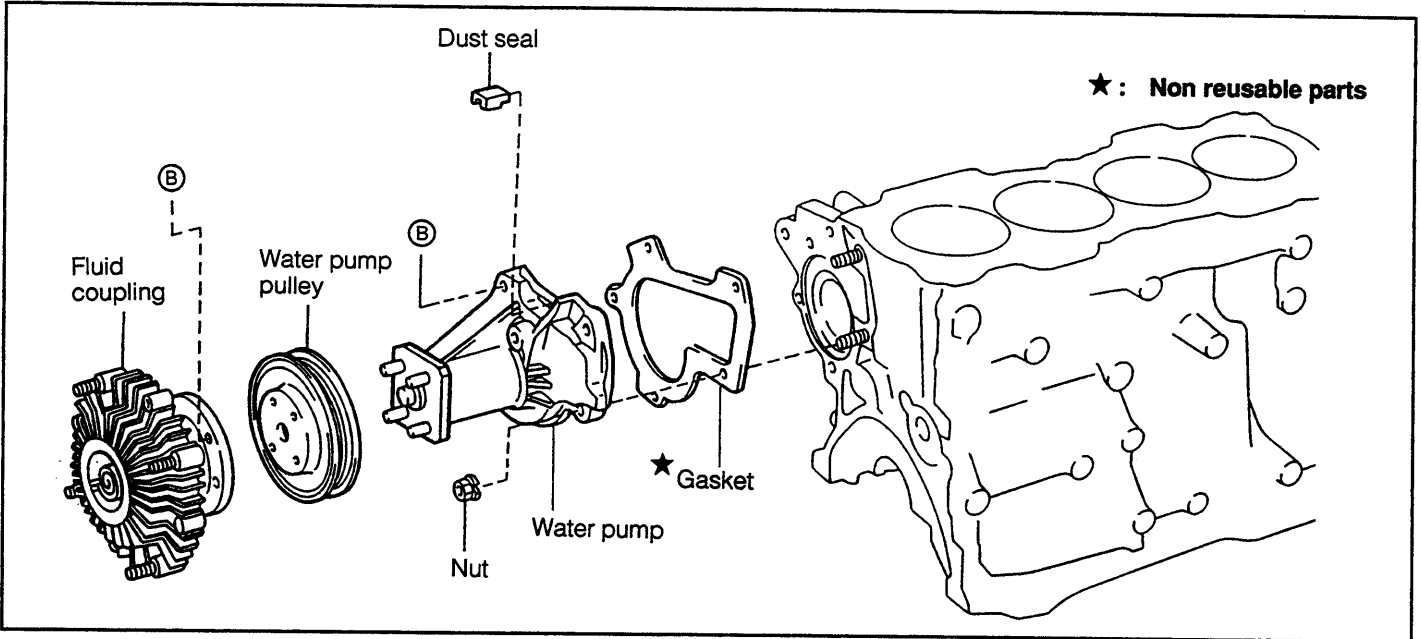
(10) Tighten the radiator cap.

(11) Warm the engine, until the radiator fan motor starts to rotate. Afterwards, allow the coolant to cool down to normal temperature. Recheck the coolant level at reserve tank. Add water to the full level, as required.



WR88-C0009

## WATER PUMP COMPONENTS



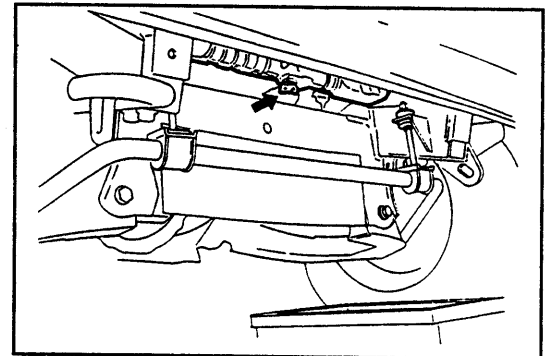
WN88E-CO004

### REMOVAL OF WATER PUMP

1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Drain the coolant as follows.  
Open the radiator cap and drain plug, and allow the coolant to drain into a clean container.

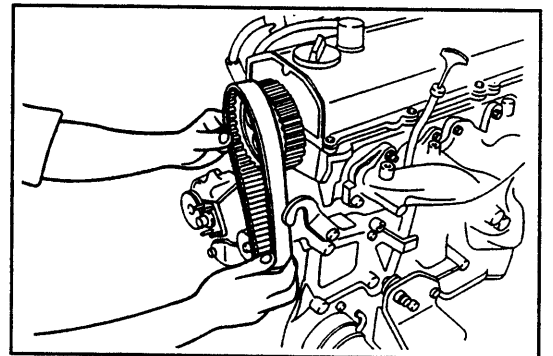
**CAUTION:**

**Never open the radiator cap and/or drain plug. When the engine is still hot.**



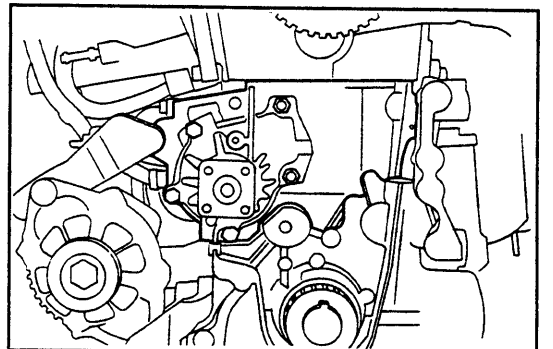
WR88-CO011

3. Remove the timing belt.  
(See pages EM-21)



WN88E-CO005

4. Remove the water pump by removing the attaching bolts and nuts of the water pump.

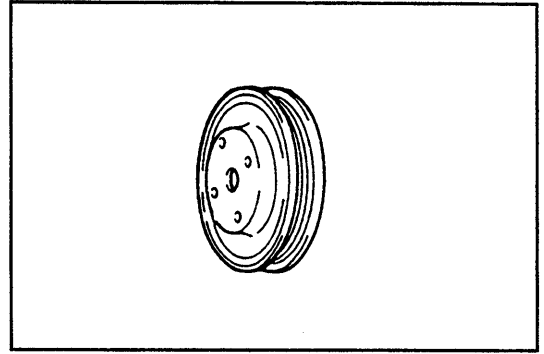


WR88-CO013

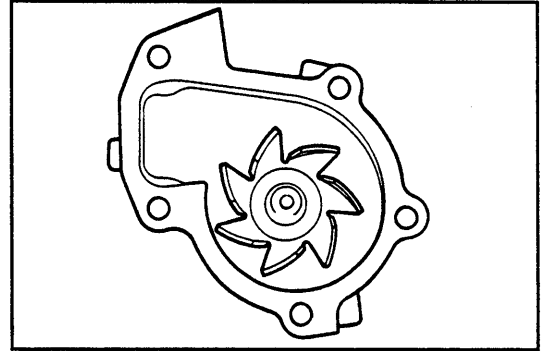


**INSPECTION OF WATER PUMP-RELATED PARTS**

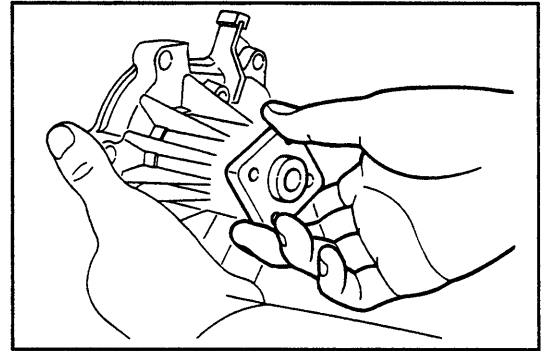
1. Check the water pump pulley for damage or deformation.  
Replace the water pump if it exhibits damage or deformation.
2. Visually inspect the water pump rotor for damage or deformation.  
Replace the water pump if the water pump rotor exhibits damage or deformation.
3. Ensure that the water pump rotates smoothly by hand.  
Replace the water pump if it will not rotate smoothly.
4. Check the water pump cover section of the cylinder block for damage or wear.  
Replace the cylinder block if the water pump cover section exhibits damage or wear.



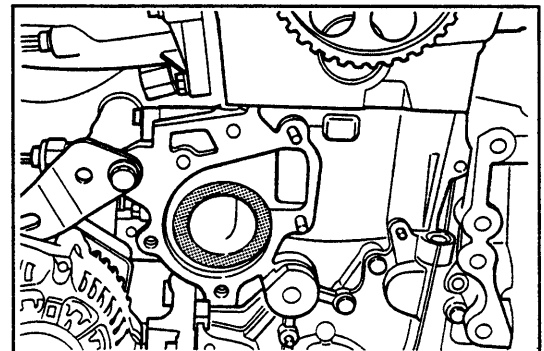
WR88-CO014



WR88-CO015



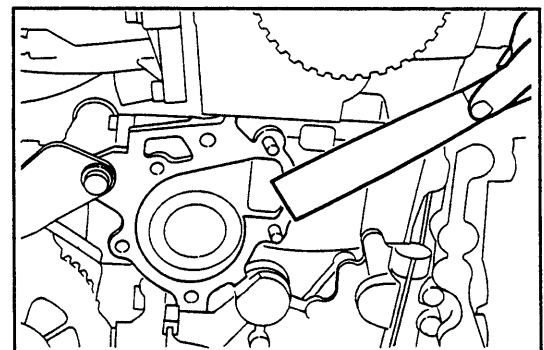
WR88-CO016



WN88E-CO006

**INSTALLATION OF WATER PUMP**

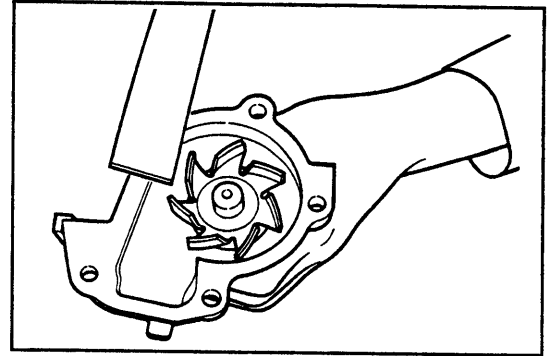
1. Remove the gasket material from the water pump installing surface of the cylinder block, using a gasket scraper.



WR88-CO018

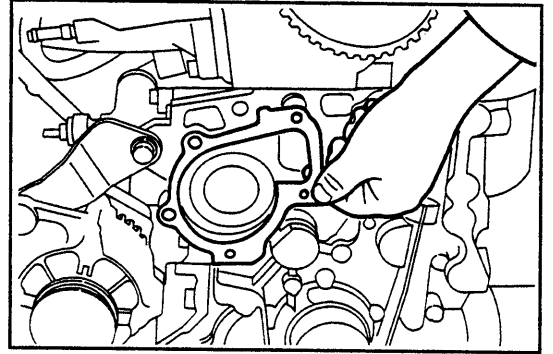
## COOLING SYSTEM

2. Remove the gasket material from the water pump, using a gasket scraper.



WR88-CO019

3. Install a new gasket to the cylinder block.



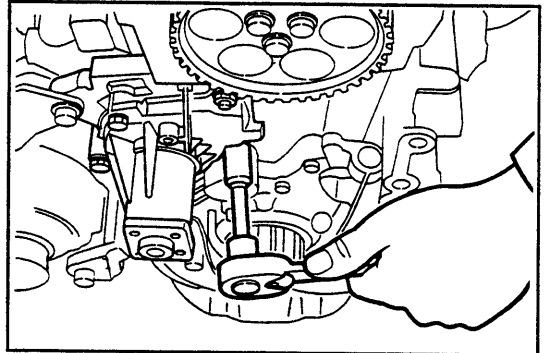
WR88-CO020

4. Install the water pump to the cylinder block. Tighten the attaching bolts evenly over two or three stages to the specified torque.

**Tightening Torque:** 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)

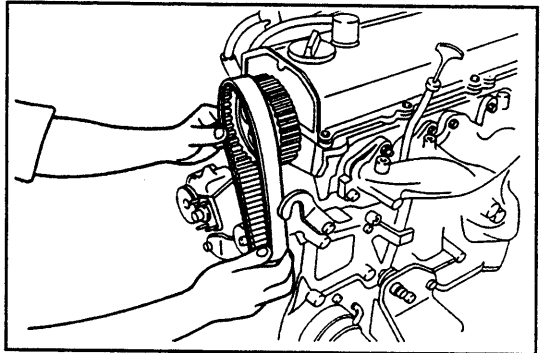
**NOTE:**

After tightening bolts, ensure that the water pump rotates smoothly by hand.



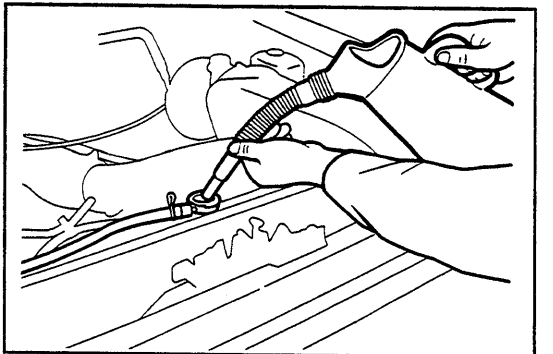
WR88-CO021

5. Install the timing belt.  
(See page EM-29.)



WN88E-CO007

6. Fill coolant.  
(See page CO-3.)



WN88E-CO008

## THERMOSTAT

### REMOVAL OF THERMOSTAT

1. Drain the coolant  
(See page CO-3).

**CAUTION:**

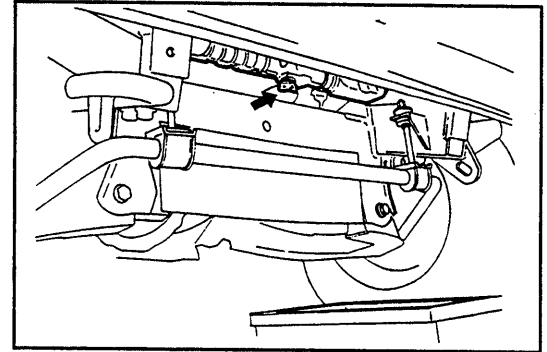
Never open the radiator cap and/or drain plug when the coolant is still hot.

2. Remove the radiator hose No. 2 from the water inlet.

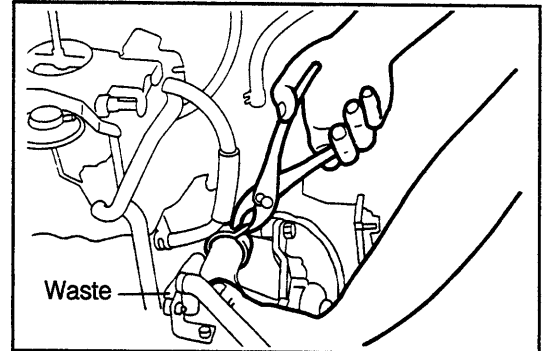
**WARNING:**

Cover the alternator to prevent entering the cooling water into the alternator.

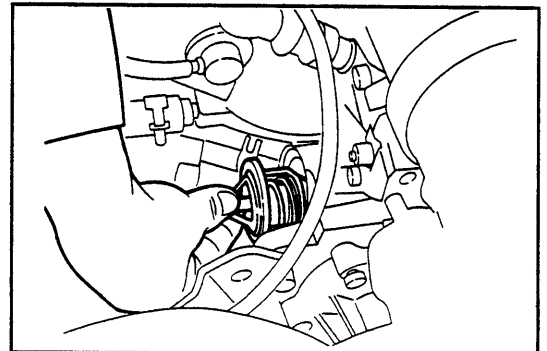
3. Remove the thermostat by removing the water inlet.



WN88E-CO009



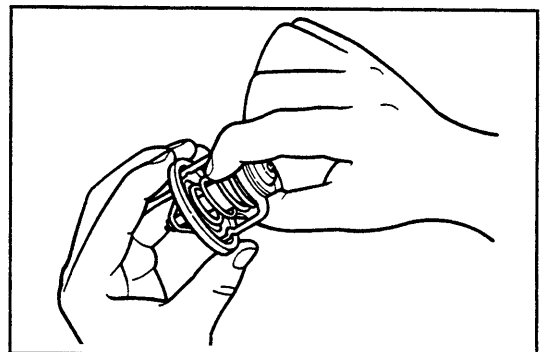
WN88E-CO010



WN88E-CO011

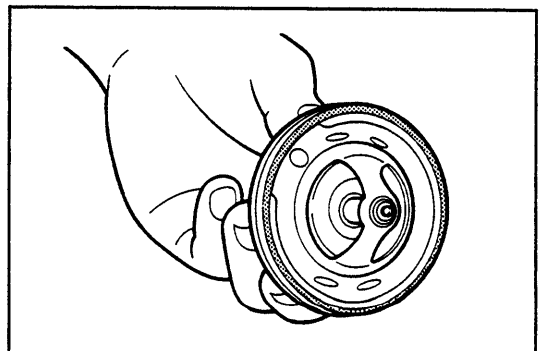
### INSPECTION OF THERMOSTAT

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.



WR88-CO028

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



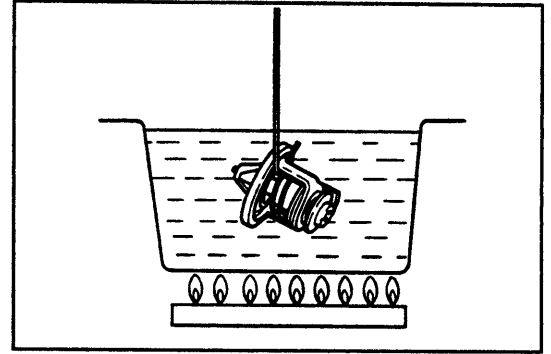
WR88-CO029

# COOLING SYSTEM

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
General specifications	76 - 80 (168.8 - 176)	8.5 mm or more at 91°C (0.34 inch or more at 195.8°F)
ECE & EEC specifications	82 - 86 (179.6 - 186.8)	8.5 mm or more at 98°C (0.34 inch or more at 208.4°F)

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



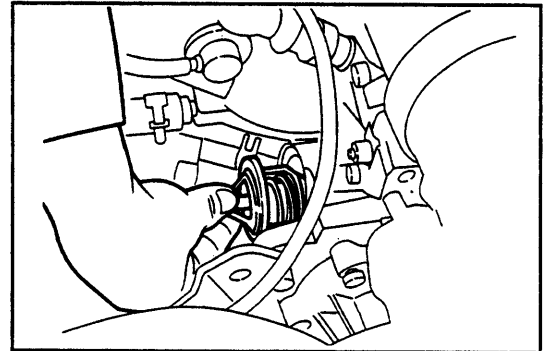
WR88-CO030

## INSTALLATION OF THERMOSTAT

1. Assemble the thermostat in such a way that the jiggle pin comes exactly at the top of the engine.

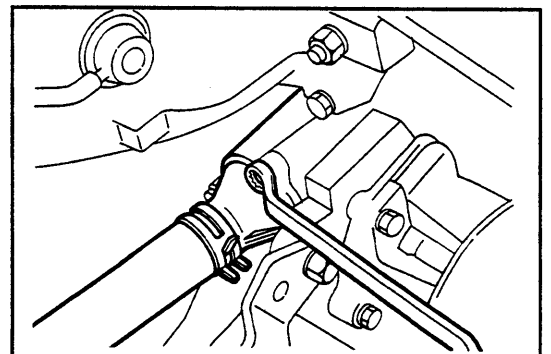
### NOTE:

The thermostat should be installed in such a way the jiggle pin may face upward. Failure to observe this caution may cause engine malfunction.



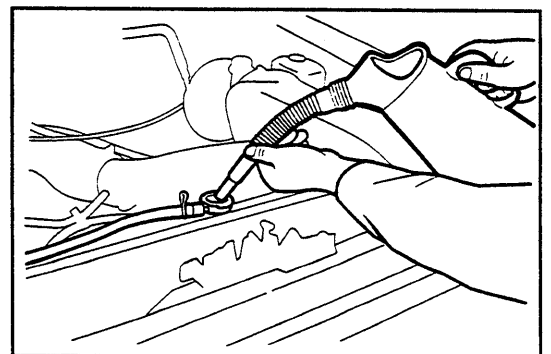
WR88-CO031

2. Install the water inlet.  
Tightening Torque: 0.6 - 0.9 kg-m (4.3 - 6.5 ft-lb)



WR88-CO032

3. Fill coolant.  
(See page CO-3.)
4. Start the engine and check it for leakage.  
Repair the leaky point if the leakage exists.



WN88E-CO012

## RADIATOR

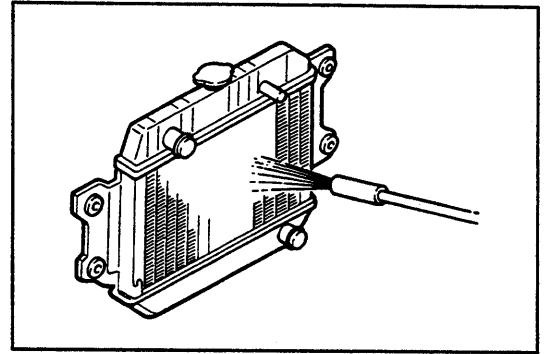
### CLEANING OF RADIATOR

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

**CAUTION:**

When using a high pressure type cleaner, be careful not to deform radiator core fins.

Keep a distance of more than 40 - 50 cm (15.75 - 19.69 inch) between the radiator core and cleaner nozzle when the cleaner nozzle pressure is 30 - 50 kg/cm<sup>2</sup> (427 - 711 psi). Also, the injection angle of pressurized water should be right angles to the radiator.



WR88-CO034

### INSPECTION OF RADIATOR

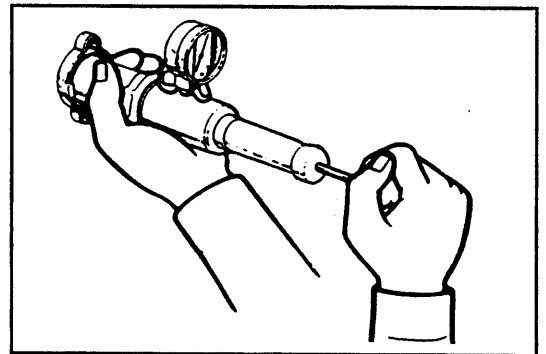
#### 1. Check of radiator cap

(1) Check the radiator cap by means of a radiator cap tester to see if the relief valve opens at a pressure of 0.6 - 1.05 kg/cm<sup>2</sup> (8.53 - 14.9 psi).

If the radiator cap does not conform to the specification, replace the radiator cap.

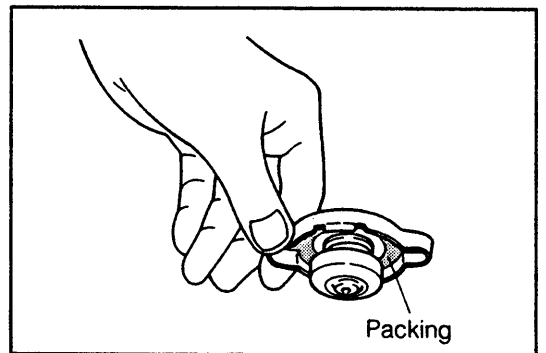
**CAUTION:**

Never open the radiator cap when the engine is still hot.



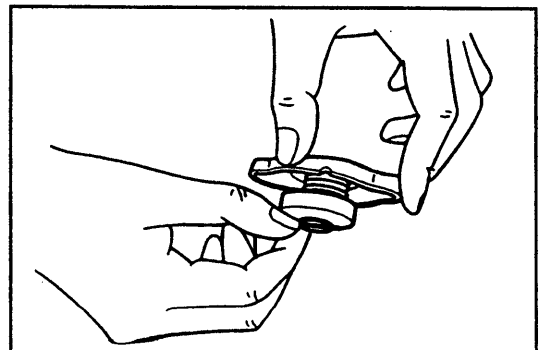
WR88-CO036

(2) Check the seal packing of the radiator cap for damage. Replace the radiator cap with a new one, if any damage exists.



WR88-CO037

(3) Lift the valve at the vacuum side with your fingers. Ensure that the valve is functioning properly. Replace the radiator cap with a new one, if the valve fails to function.



WR88-CO038

## COOLING SYSTEM

### 2. Check of cooling system for leakage

- (1) Fill the radiator with coolant. Attach a radiator cap tester.
- (2) Warm up the engine.
- (3) Apply a pressure of 1.2 kg/cm<sup>2</sup> (17 psi) to the cooling system by means of a radiator tester.

If the pressure drops, check the hoses, radiator, water pump and heater for evidence of leakage.

If no external leakage is found, check the heater core, cylinder block, cylinder head, oil cooler and throttle body for evidence of leakage.

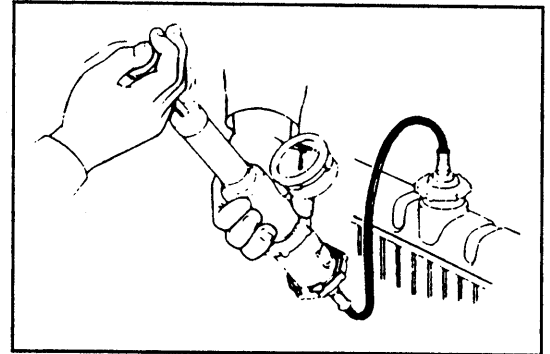
Check the hoses for deterioration, cracks, bulge or damage.

Replace the defective part(s) if necessary.

- (4) Remove the radiator cap tester from the radiator.

#### CAUTION:

Never remove the radiator cap tester when the coolant temperature is still high.



WR88-CO039

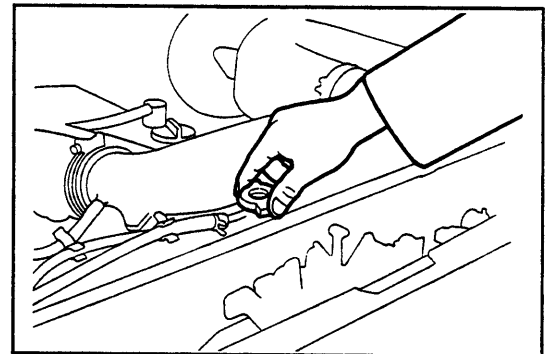
### REMOVAL OF RADIATOR

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Drain the coolant as follows:
  - (1) Remove the radiator cap.

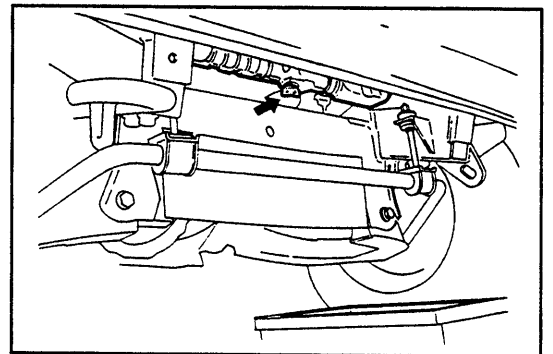
#### CAUTION:

Never open the radiator cap and/or drain cap when the coolant is still hot.

- (2) Place a suitable container below the radiator drain plug.  
Drain the coolant by removing the drain plug.
- (3) Tighten the drain plug.



WR88-CO040

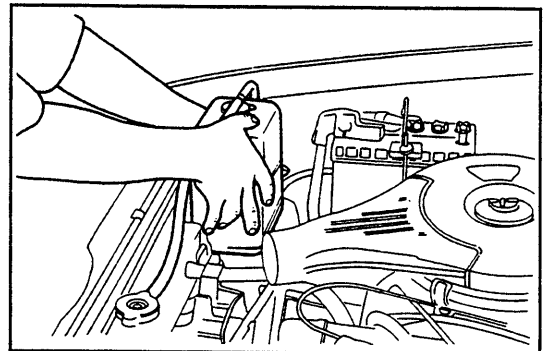


WR88-CO041

3. Removal of radiator
  - (1) Remove the reserve tank.
  - (2) Remove the radiator hose No. 1 and No. 3 at radiator side.

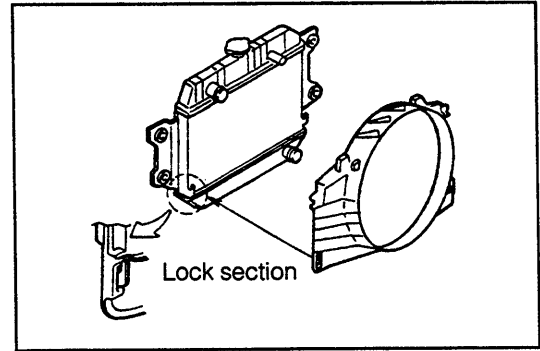
#### CAUTION:

When the radiator hose is loosened, be sure to protect the alternator because the coolant flows out.



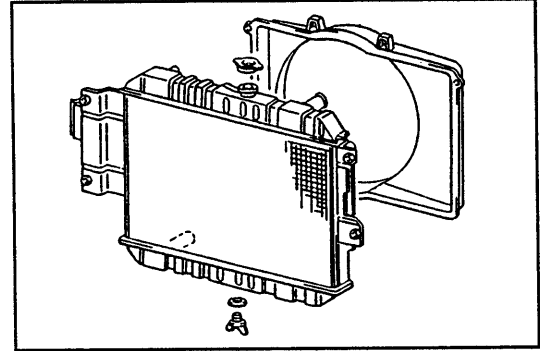
WN88E-CO013

- (3) Disconnect the small water hose from the radiator upper tank.
- (4) Remove the two clamps for clutch cable on the fan shroud.
- (5) Remove the two attaching bolts of the fan shroud. Then, disconnect the lock section of the fan shroud from radiator.



WN88E-CO014

- (6) Remove the radiator grill.  
(See page CO-3).
- (7) Remove the radiator by removing the four attaching bolts.
- (8) Remove the fan shroud.

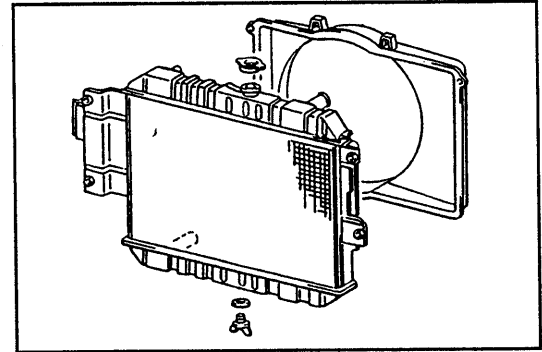


WN88E-CO015

## INSTALLATION OF RADIATOR

### 1. Radiator installation

- (1) Place the radiator fan shroud to the cooling fan side.
- (2) Install the radiator in the engine room. Then, tighten the attaching bolts.

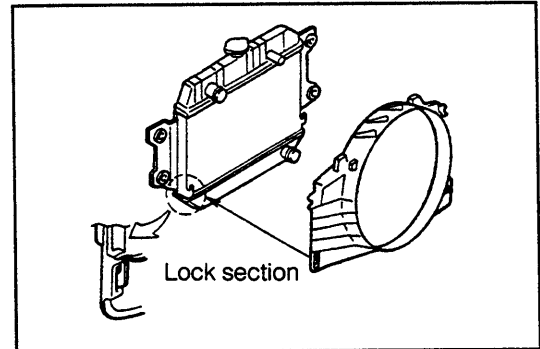


WN88E-CO016

- (3) Install the radiator fan shroud with two attaching bolts.

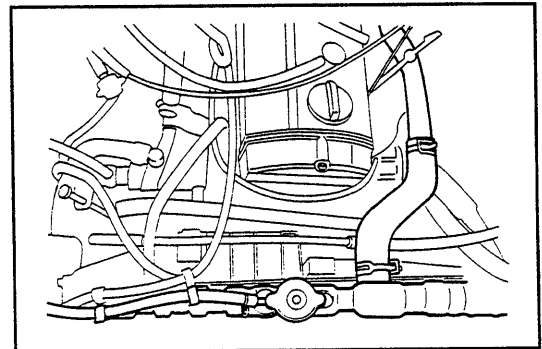
#### NOTE:

Before attaching the fan shroud to the radiator, insert the lock section of the fan shroud to the lower section of the radiator.



WN88E-CO017

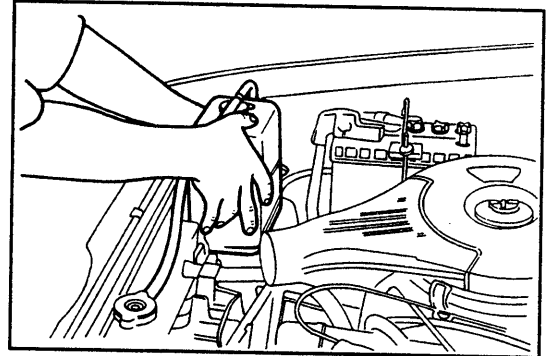
- (4) Connect the radiator hose No. 1 to the radiator upper tank.
- (5) Connect the radiator hose No. 3 from the intake manifold to the radiator upper tank.



WN88E-CO018

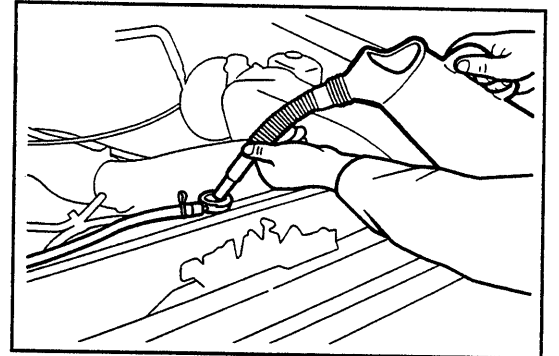
## COOLING SYSTEM

- (6) Clamp the clutch cable on the fan shroud with the two clamps.
- (7) Install the reserve tank to the radiator.
- (8) Install the air cleaner hose into the position.



WN88E-CO019

2. Fill the coolant.  
(See page CO-3).
3. Start the engine and check it for leakage.  
Repair the leaky point if leakage exists.



WN88E-CO020



# **DAIHATSU**

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# **F300**

[HD-ENGINE]

## **LUBRICATION SYSTEM**

<b>TROUBLE SHOOTING .....</b>	<b>LU-2</b>
<b>OIL PRESSURE CHECK .....</b>	<b>LU-2</b>
<b>ENGINE OIL CHANGE &amp; OIL FILTER</b>	
<b>REPLACEMENT .....</b>	<b>LU-4</b>
<b>OIL COOLER .....</b>	<b>LU-6</b>

WN88E-LU001



## TROUBLE SHOOTING

Problem	Possible causes	Remedies	Page
Oil leakage	Cylinder head, cylinder block oil cooler or oil pump body damaged or cracked Oil seal faulty Gasket faulty	Repair, if necessary.  Replace oil seal. Replace gasket.	
Low oil pressure	Oil leakage Relief valve faulty Oil pump faulty Poor quality engine oil Crankshaft bearing faulty Connecting rod bearing faulty Oil filter clogged Low oil level	Repair, as necessary. Replace relief valve. Repair oil pump. Change engine oil Replace bearing. Replace bearing. Replace oil filter. Check oil level	EM-108 EM-107 LU-2 EM-90 EM-87 LU-4 LU-2
High oil pressure	Relief valve faulty	Replace relief valve.	EM-108

WN88-LU002

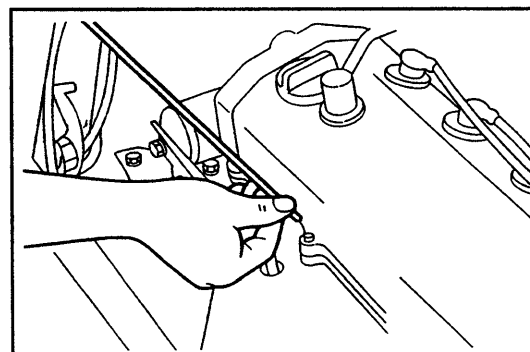
## OIL PRESSURE CHECK

### 1. Oil quality check

Check the oil for deterioration, ingress of water, discoloring or dilution.

If oil quality is poor, change the oil.

Use API grade SE or higher multigrade viscosity, fuel-efficient oil. (See page LU-5)



WR88-LU003

### 2. Oil level check

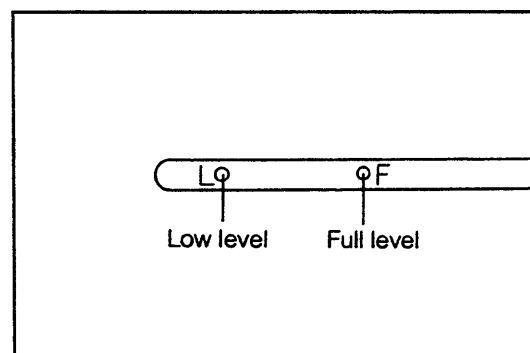
The oil level should be between the L and F levels on the dipstick.

If the level is low, check to see if any oil leakage is present.

Add oil to the F level.

#### NOTE:

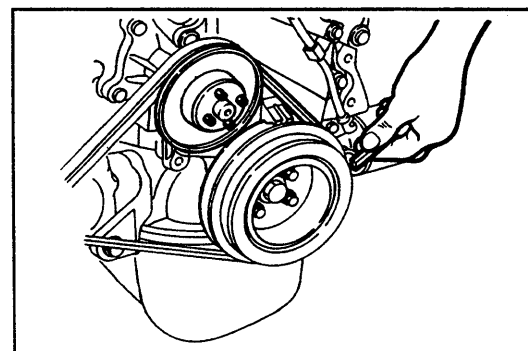
The amount of oil between the [L] level and the [F] equals to one liter (0.22 Imp. gal.).



WR88-LU004

### 3. Oil pressure check

(1) Disconnect the oil pressure switch connector.

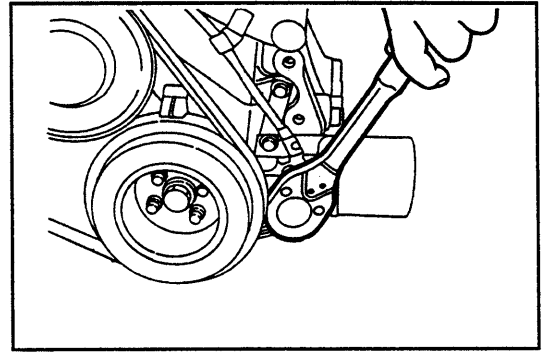


WR88-LU005

(2) Remove the oil pressure switch.

**NOTE:**

Use a hexagonal long box wrench for the removal.



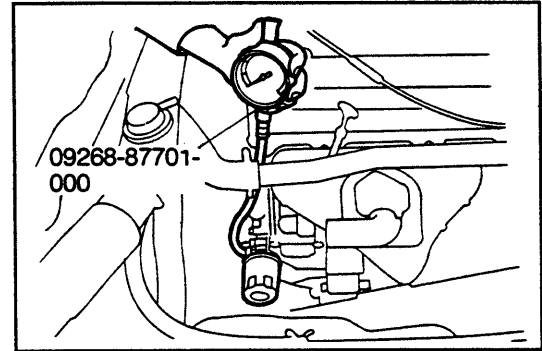
WR88-LU006

(3) Install the oil pressure gauge.

**NOTE:**

The pressure gauge is available as a SST.

SST: 09268-87701-000



WR88-LU007

(4) Starting engine

Start the engine and warm it to the normal operating temperature.

At Idle Speed: More Than  $0.2 \text{ kg/cm}^2$  (2.8 psi)

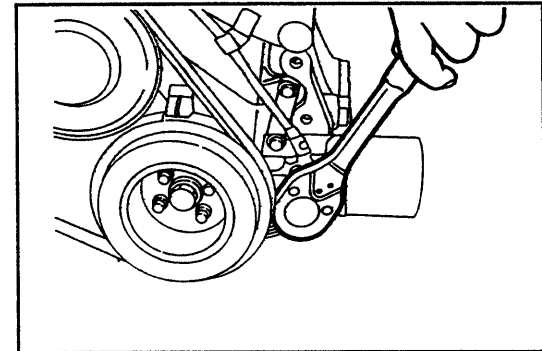
At 3000 rpm:  $2.5 - 5.0 \text{ kg/cm}^2$  (35.6 - 71.0 psi)

If the measured value fails to conform to the specified value, check and repair the oil pump.

(See the section under "Cylinder Block of Engine Mechanicals.")

(5) Stop the engine.

(6) Remove the oil pressure gauge.



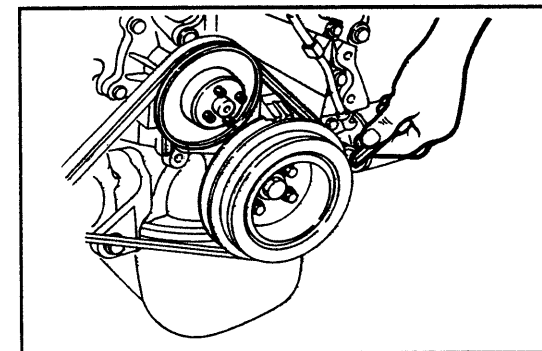
WR88-LU009

(7) Clean the threaded portion of the oil pressure switch. Wind seal tape around the threaded portion. Install the oil pressure switch in the oil pump.

Tightening Torque:  $1.2 - 2.0 \text{ kg-m}$  (8.7 - 14.5 ft-lb)

**NOTE:**

- Use a hexagonal long box wrench for the installation.
- The new oil pressure switch is coated with sealing materials.



WR88-LU010

(8) Connect the connector of the oil pressure switch.

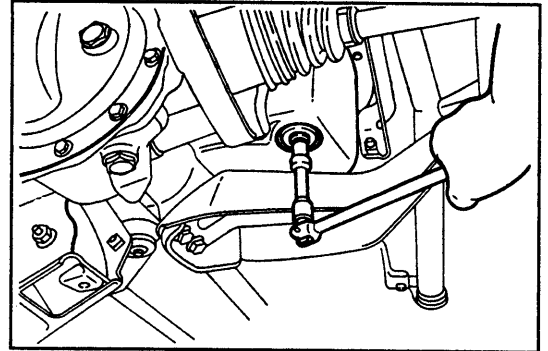
(9) Start the engine and check it for oil leakage.

Repair the leaky point if oil leakage exists.

WR88-LU011

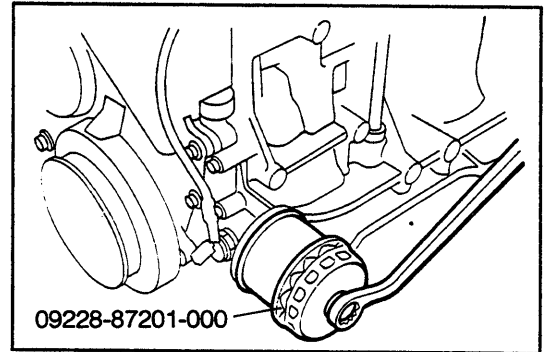
## ENGINE OIL CHANGE & OIL FILTER REPLACEMENT

1. Drain the engine oil as follows:
  - (1) Place a suitable container under the oil drain plug.
  - (2) Drain the oil by removing the oil drain plug.**CAUTION:**  
When the oil is still hot, care must be exercised to avoid getting scalded.

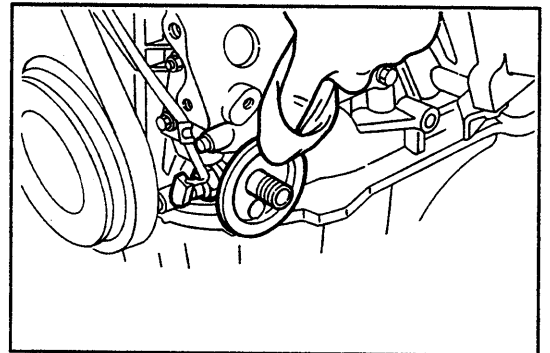


2. Oil filter replacement
  - (1) Remove the oil filter element, using the following SST.  
SST: 09228-87201-000

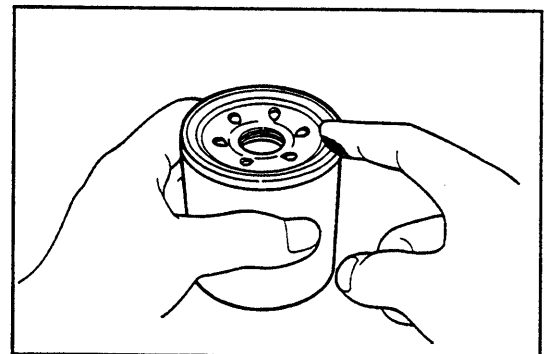
**NOTE:**  
Place a suitable container under the oil filter because the engine oil flows out.



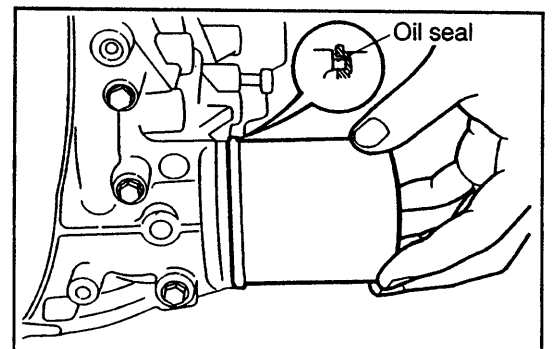
- (2) Inspect and clean the oil filter installation surface.



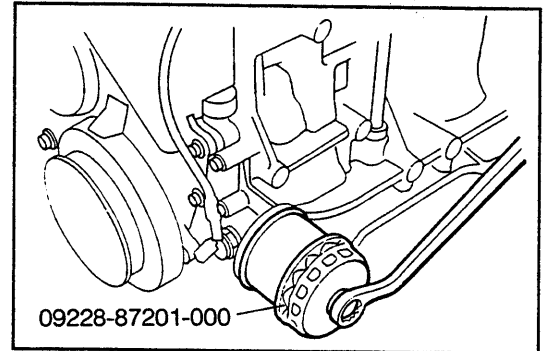
- (3) Thinly apply engine oil to the "O" ring of a new oil filter.



- (4) Screw in the oil filter by hand, until the "O" ring of the oil filter contacts the oil filter installing surface.



- (5) Tighten the oil filter three fourths to one complete turn, using the following SST.  
**SST: 09228-87201-000**



WR88-LU017

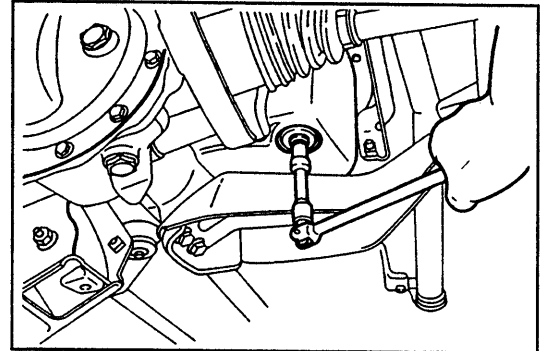
### 3. Filling engine oil

- (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)**



WR88-LU018

- (2) Fill the engine with engine oil.  
 The oil should be API grade SE or higher multigrade viscosity, fuel-efficient oil.

**Oil capacity**

**When only engine oil is changed:**

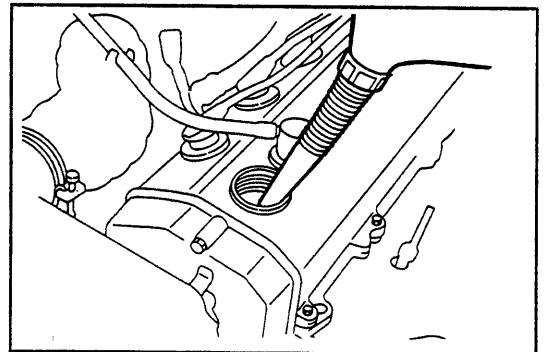
**3.3 liter (2.9 IMP qt)**

**When engine oil is changed and oil filter is replaced:**

**3.5 liter (3.08 IMP qt)**

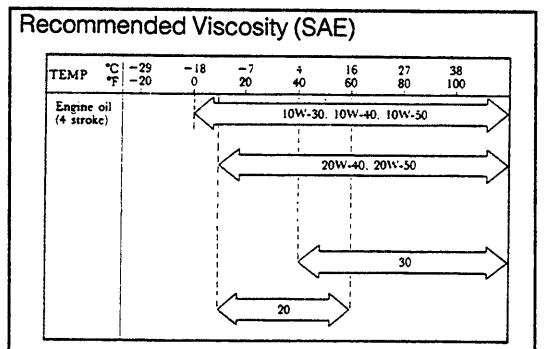
**After engine has been overhauled or when engine oil has been drained completely from engine:**

**3.8 liter (3.52 IMP qt)**



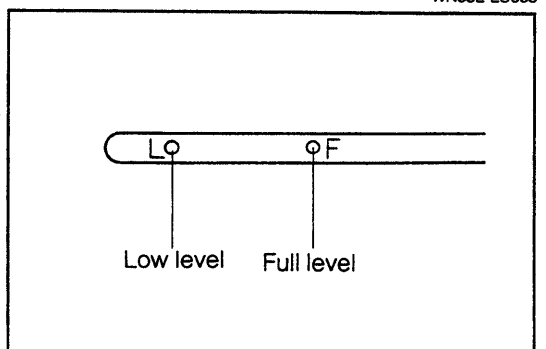
**NOTE:**

On the oil cooler-equipped vehicle, the oil capacity is 79 cc greater than the amount specified above,



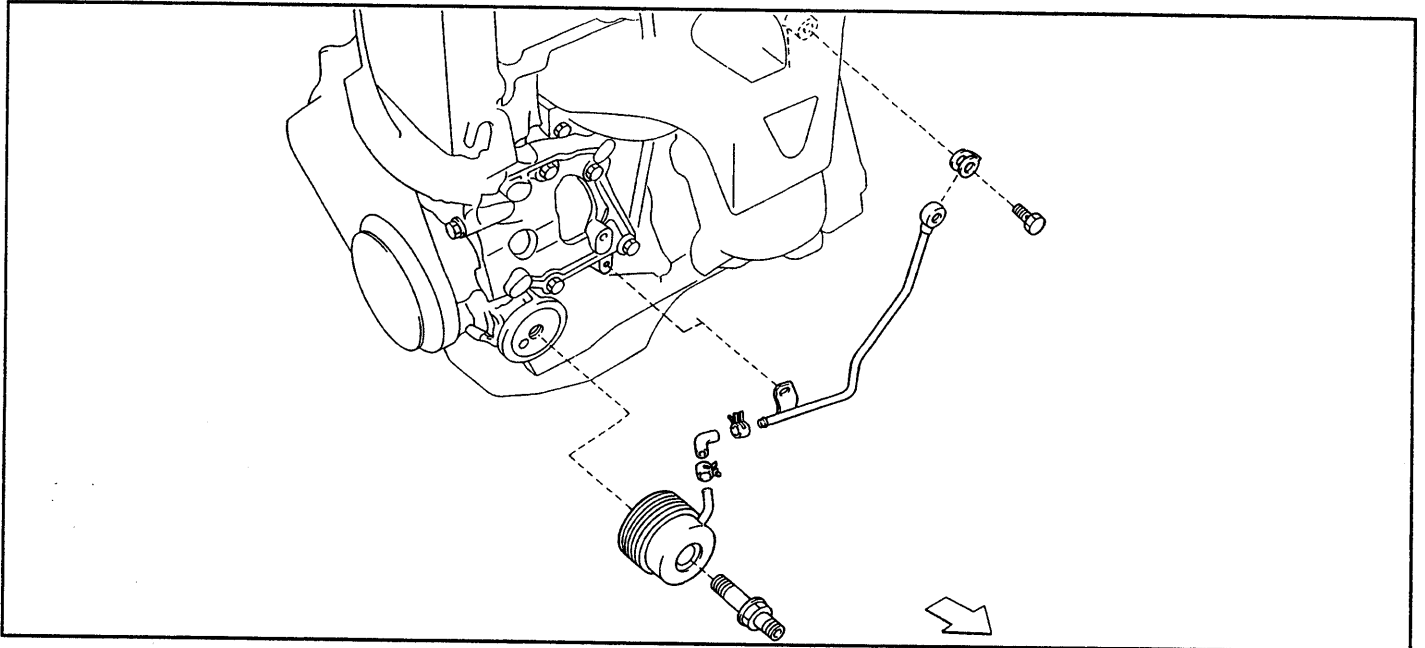
WN88E-LU003

- (3) Start the engine and check it for leakage.  
 Repair the leaky point if oil leakage exists.
- (4) Stop the engine. After a lapse of two or three minutes, check the oil level.  
 If oil level is less than the high level, replenish the oil to the full level.



WR88-LU021

## OIL COOLER (Oil Cooler-Equipped Vehicle Only) COMPONENTS



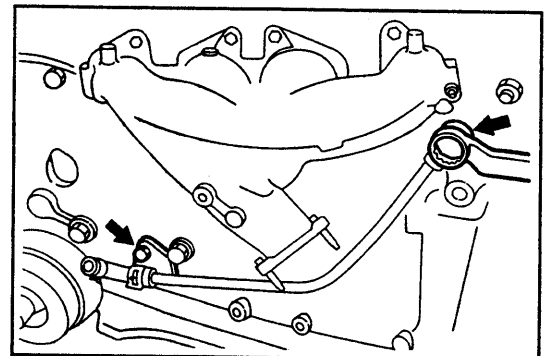
WR88-LU022

### REMOVAL OF OIL COOLER

1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Drain the coolant. (See page CO-3.)
3. Remove the oil filter. (See page LU-4.)
4. Disconnect the oil cooler hose at the radiator side.

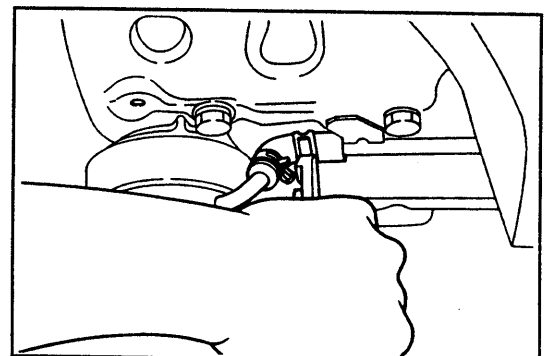
WR88-LU023

5. Disconnect the oil cooler pipe from the cylinder block.



WR88-LU023A

6. Remove the oil cooler pipe from the hose by sliding the hose bands.



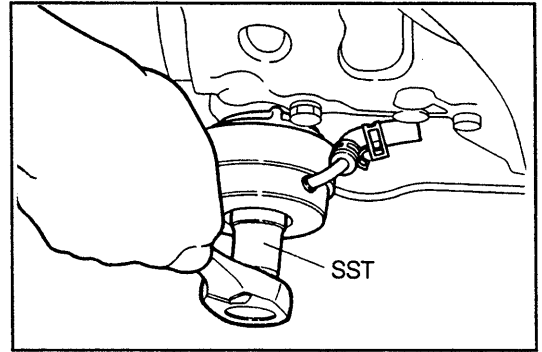
WR88-LU023B

- Remove the oil cooler, using the following SST.  
SST: 09268-87704-000

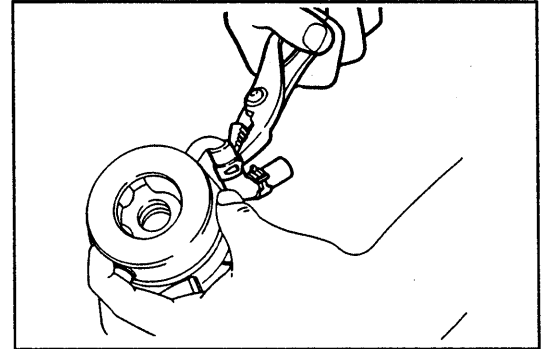
**NOTE:**

Place a suitable container below the oil cooler attaching section so as to receive any oil and water flowing from the oil cooler.

- Disconnect the water hose from the oil cooler.



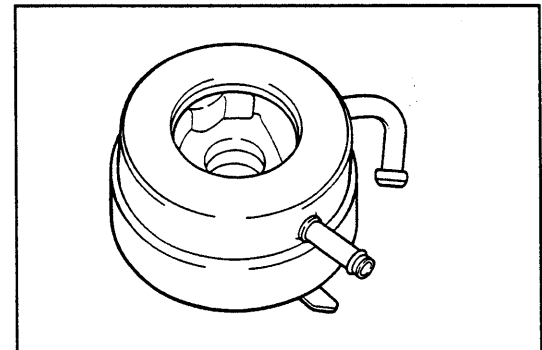
WR88-LU023C



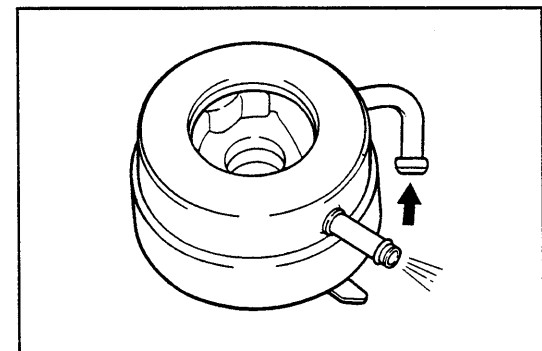
WR88-LU024

## INSPECTION OF OIL COOLER

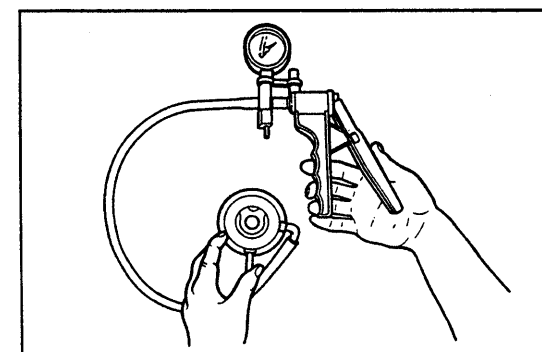
- Check the oil cooler for damage.  
Replace the oil cooler if the oil cooler exhibits damage.
- Blow air from one end of the oil cooler pipe. Ensure that air continuity exists.
- With one end of the oil cooler pipe plugged with your finger, apply a negative pressure of 100 mmHg (3.937 inchHg) to the other end, using a MityVac or a vacuum pump. Ensure that the applied negative pressure is retained.  
If the negative pressure is not kept, replace the oil cooler.



WR88-LU025



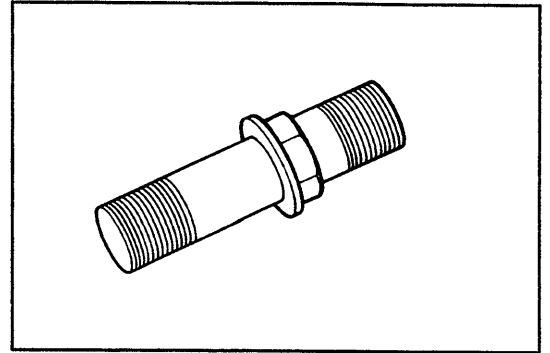
WR88-LU026



WR88-LU027

## LUBRICATION SYSTEM

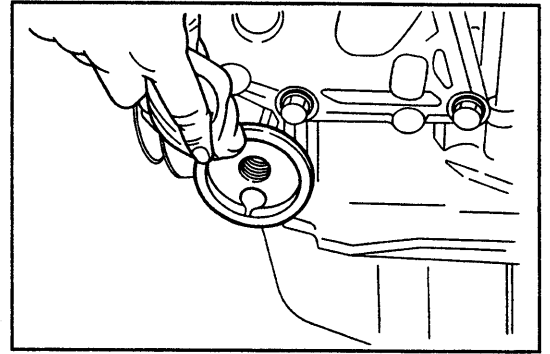
4. Check the oil cooler set bolt for damage.  
Replace the oil cooler set bolt if it exhibits damage.



WR88-LU028

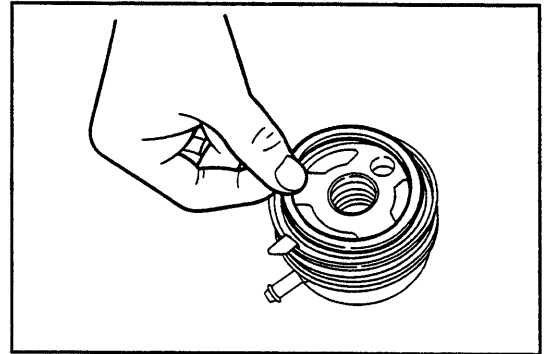
## INSTALLATION OF OIL COOLER

1. Clean the oil cooler attaching surface of the oil pump.



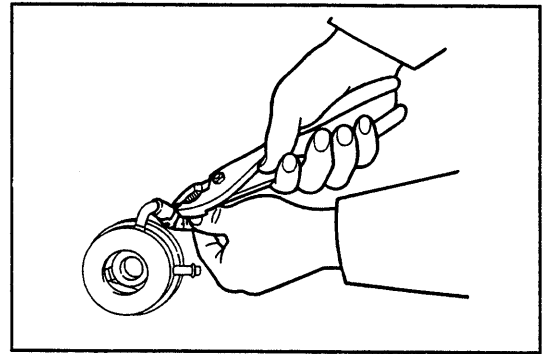
WR88-LU029A

2. Install the new "O" ring on the cooler.



WR88-LU029B

3. Connect the water hose to the oil cooler. Attach the hose bands.

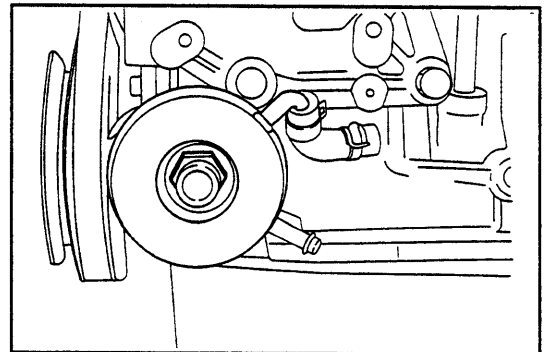


WR88-LU030

4. Using the set bolts, install the oil cooler by making the locating rib of the oil cooler contact with the cylinder block.

### NOTE:

Care must be exercised to ensure that the "O" ring may not be displaced during the installation.



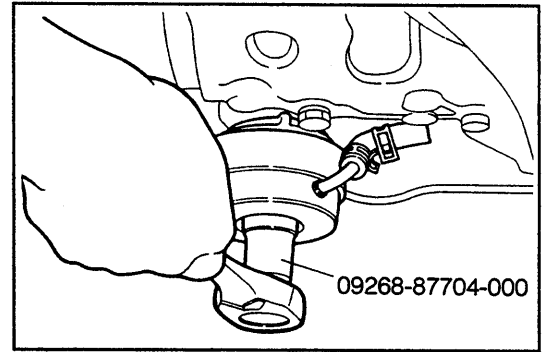
WR88-LU031A



5. 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)

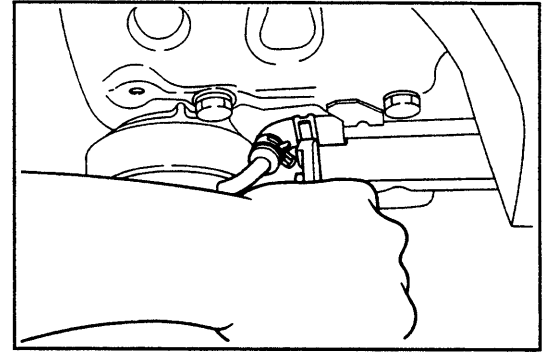


WR88-LU031B

6. Connect the oil cooler inlet pipe to the oil cooler hose that has been installed on the oil cooler.

**NOTE:**

Install the oil cooler pipe, by taking into consideration an angle at which it is mounted on the cylinder block.



WR88-LU031C

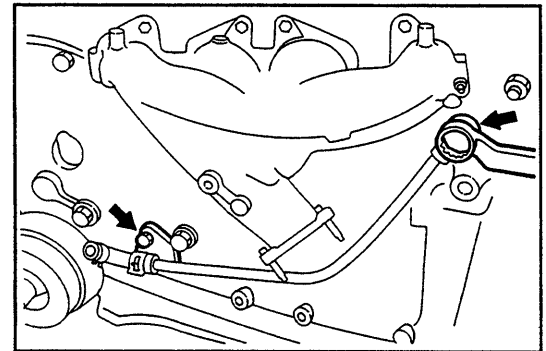
7. Install the oil cooler pipe on the cylinder block with a new gasket interposed.

Tightening Torque (Union bolt):

2.5 - 3.5 kg-m (18.1 - 25.3 ft-lb)

**NOTE:**

Never reuse the gasket.



WR88-LU032

8. Installation of oil filter

(1) Clean the oil filter installation surface of the oil cooler.

(2) Install the oil filter. (See page LU-5.)

9. Connect the oil cooler hose at the radiator side. Attach the hose bands.

10. Fill coolant. (See page CO-3.)

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

12. Start the engine. Check to see if any oil leakage or fuel leakage is present.

If the engine exhibits any defect, repair it or replace the defective part, as required.

13. Stop the engine. After two or three minutes, check the engine oil level, using the oil level gauge. Replenish engine oil to the FULL level, as required. (See page LU-5.)

(1) Screw in the oil filter by hand, until the "O" ring of the oil filter contacts the oil filter installing surface.

(2) Screw in the oil filter third fourths to one turn, using the following SST.

SST: 09228-87201-000

WR88-LU034

# **DAIHATSU**

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# **F300**

[HD-ENGINE]

## **IGNITION SYSTEM**

<b>PRECAUTIONS .....</b>	<b>IG-2</b>
<b>TROUBLE SHOOTING .....</b>	<b>IG-2</b>
<b>IGNITION SYSTEM .....</b>	<b>IG-3</b>
<b>DISTRIBUTOR .....</b>	<b>IG-9</b>

WN88E-IG001



## PRECAUTIONS

1. Do not leave the ignition key switch turned ON for more than ten minutes while the engine is stopped.
2. When a tachometer is connected to the system, connect the test probe of the tachometer to the negative (-) terminal of the ignition coil.
3. As some tachometers are not compatible with this ignition system, it is recommended to confirm the compatibility of your unit before using.
4. Never allow the ignition coil terminals to touch ground. It could result in damage to the igniter and/or the ignition coil.
5. Do not disconnect the battery cable when the engine is running.
6. Make sure that the igniter is properly grounded to the body.

WN88E-IG002

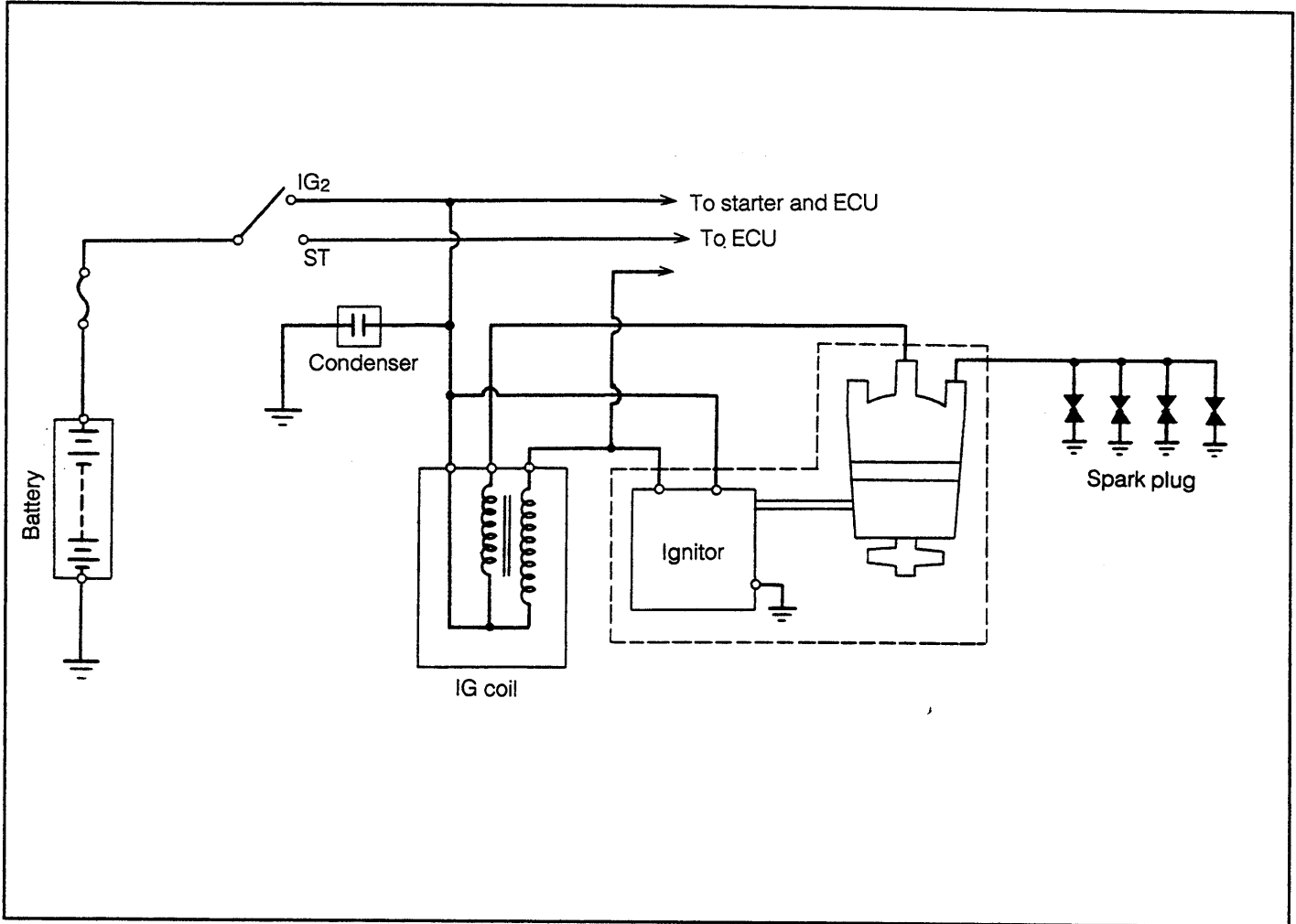
## TROUBLE SHOOTING

Problem	Possible causes	Remedies	Page
Engine will not start/hard to start. (Engine crank normally.)	Incorrect ignition timing Ignition coil faulty Igniter faulty Distributor faulty Resistive cords faulty Spark plugs faulty Ignition wiring disconnected or broken	Reset timing. Inspect coil. Inspect igniter. Inspect distributor. Inspect resistive cords. Inspect plugs. Inspect wiring.	IG-29 IG-8 IG-3, IG-5 IG-10, IG-15 IG-5 IG-6
Rough idle or engine stalls.	Spark plugs faulty Ignition wiring faulty Incorrect ignition timing Ignition coil faulty Igniter faulty Distributor faulty Resistive cords faulty	Inspect plugs. Inspect wiring. Reset timing. Inspect coil. Inspect igniter. Inspect distributor. Inspect resistive cords.	IG-6 IG-29 IG-8 IG-3, IG-5 IG-10, IG-15 IG-5
Engine hesitation/poor acceleration	Spark plugs faulty Ignition wiring faulty Incorrect ignition timing	Inspect plugs. Inspect wiring. Reset timing.	IG-6 IG-29
Engine dieseling (Engine runs after ignition witch is turned OFF.)	Incorrect ignition timing	Reset timing.	IG-29
Muffler explosion (after fire) all the time	Incorrect ignition timing	Reset timing.	IG-29
Engine backfire	Incorrect ignition timing	Reset timing.	IG-29
Poor fuel economy	Spark plugs faulty Incorrect ignition timing	Inspect plugs. Reset timing.	IG-6 IG-29
Engine overheating	Incorrect ignition timing	Reset timing.	IG-29

WN88E-IG003

# IGNITION SYSTEM

## IGNITION SYSTEM CIRCUIT



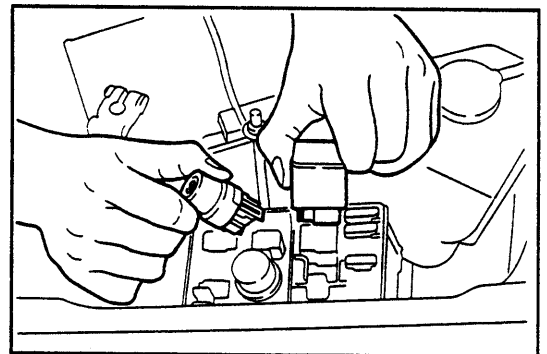
WN88E-IG004

## IN-VEHICLE INSPECTION

### Spark Test

(Check as see if spark occurs)

1. Turn OFF the ignition key switch.
2. Disconnect the fuel pump relay and injector relay from the relay box. (Only for HD-E engine)



WN88E-IG005

3. Connect a timing light to the resistive cord between the distributor and the ignition coil.

WR88-IG017

# IGNITION SYSTEM

4. Ensure that the timing light flashes while the engine is being cranked by the starter motor.

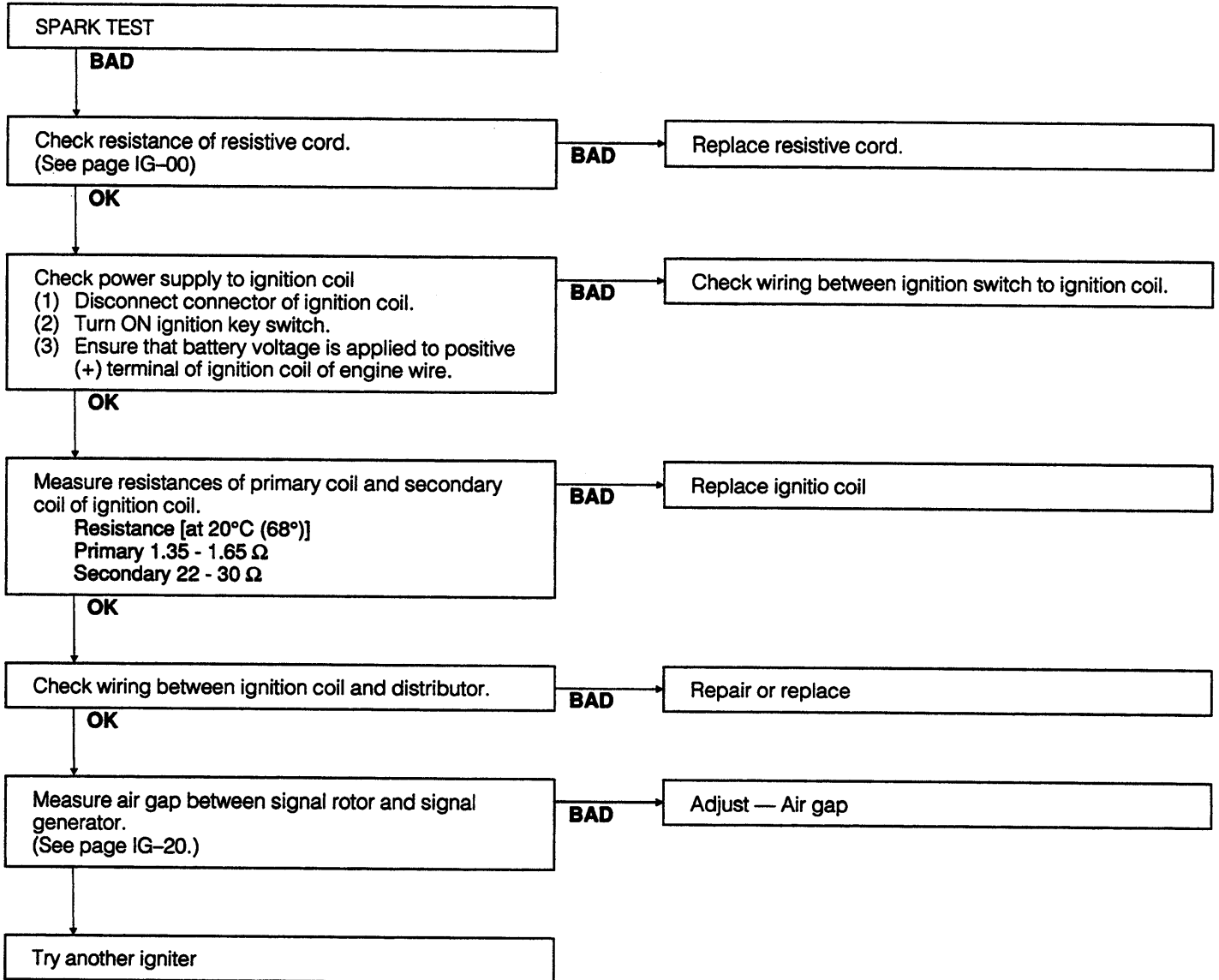
If the timing light flashes, check the resistive cord and spark plug.

If the timing light will not flash, perform the check according to the chart given below.

**NOTE:**

After completion of the inspection, reconnect the fuel pump relay and injector relay to the relay box. (Only for HD-E engine)

WN88E-IG006



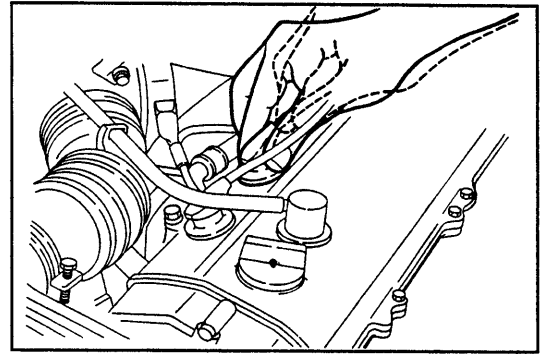
WN88E-IG007

## INSPECTION OF RESISTIVE CORDS

1. Carefully remove the resistive cords from the spark plugs and ignition coil by holding their rubber boots.

**CAUTION:**

Do not hold the cord portion or bend the cord. Otherwise, the conductor inside the cord may be damaged.



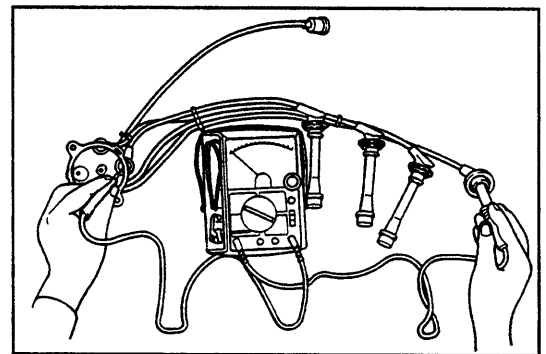
WR88-IG020

2. Disconnect the distributor connector from the connector clamp.
3. Remove the distributor cap.

WR88-IG021

4. Inspection of resistance of resistive cord and distributor cap terminal

**Maximum resistance: 15 kΩ per cord**



WR88-IG022

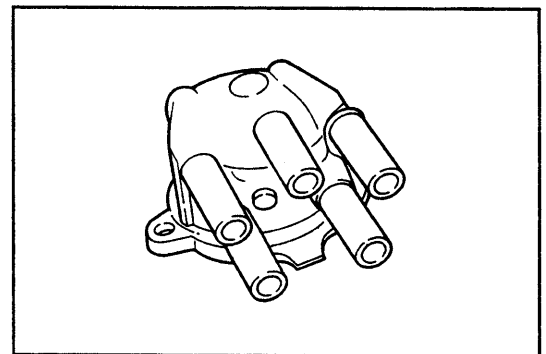
If the resistance exceeds the maximum limit, check the distributor cap terminals.

Replace the resistive cord and/or distributor cap, as required.

5. Install the distributor cap with distributor cap gasket interposed.

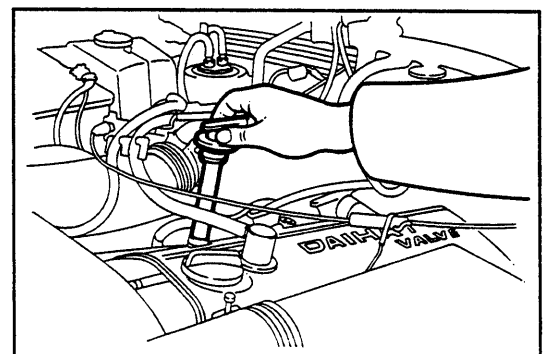
**NOTE:**

If the distributor gasket is damaged, replace it with a new one.



WR88-IG023

6. Connect the resistive cords to the spark plugs and ignition coil.



WR88-IG024

# IGNITION SYSTEM

## INSPECTION OF SPARK PLUG

1. Carefully remove the resistive cords from the spark plugs by holding their rubber boots.
2. Inspection of electrode
  - (1) When a megger (Insulation resistance meter) is used:  
Measure the insulation resistance of the spark plug.  
**Minimum Insulation Resistance: 15 MΩ**

If the measured insulation resistance is less than 15 MΩ, proceed to the step 3.

- (2) When a megger is not available:
  - ① Start the engine. Warm up the engine completely.
  - ② Race the engine at 4000 rpm for five seconds.
  - ③ Remove the spark plug, using the following SST.  
**SST: 09268-87703-000**

### CAUTION:

Since the spark plugs are hot, care must be exercised to avoid getting scalded.

- ④ Visually inspect the spark plug.  
If the electrode is dry: Satisfactory  
If the electrode is wet: Proceed to the step 4.

3. Removal of spark plug  
Remove the spark plug, using the following SST.  
**SST: 09268-87703-000**

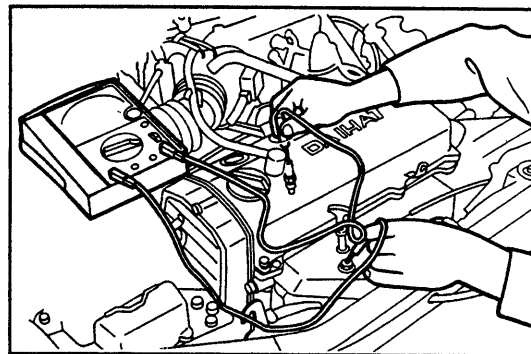
4. Visual inspection of spark plug  
Visually inspect the spark plug for electrode wear, thread or insulator damage.  
Replace the spark plug if it exhibits damage.

### Recommended Spark Plug

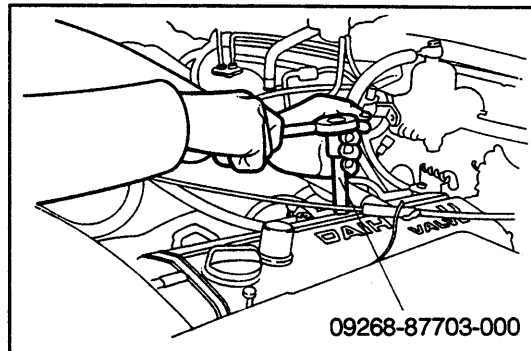
	CHAMPION	NIPPON DENSO	NGK
HD-C	RC9YC4	K20PR-U11	BKR6E-11
HD-E	RC9YC4	K20PR-U11	BKR6E-11

### NOTE:

All four spark plugs should have the same heat range and be ones manufactured by the same manufacturer.

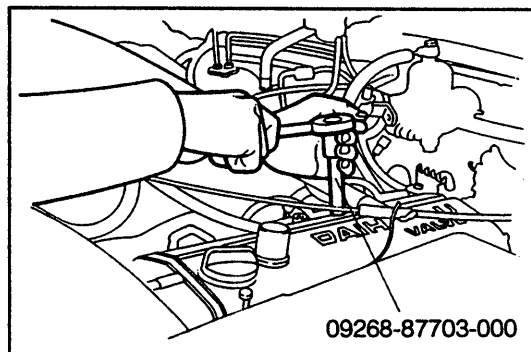


WR88-IG025



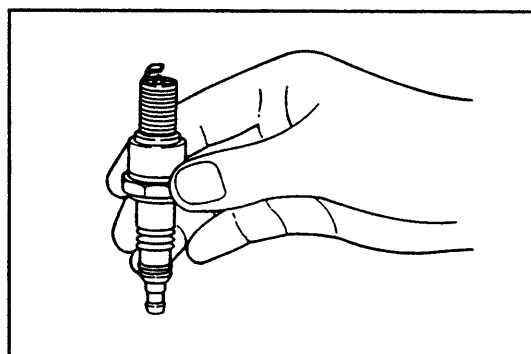
09268-87703-000

WR88-IG026



09268-87703-000

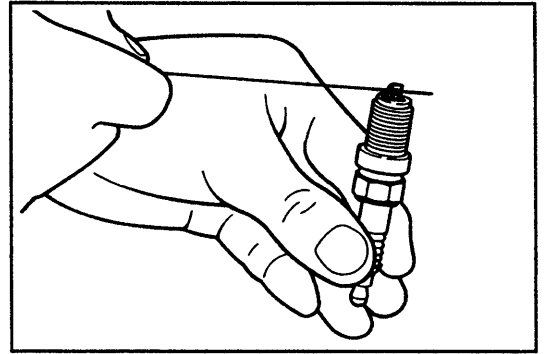
WR88-IG027



WN88E-IG008

5. Inspection of electrode gap  
 Measure the electrode gap, using a plug gap gauge.  
**Electrode Gap: 1.0 - 1.1 mm (0.040 - 0.043 inch)**

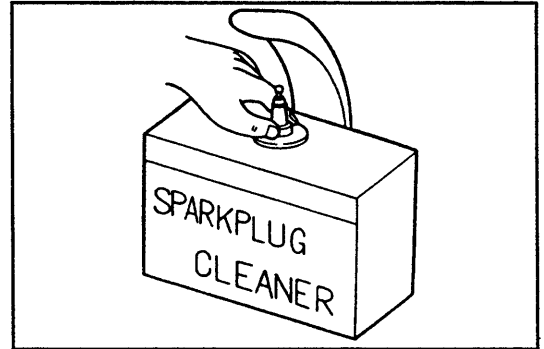
If the electrode gap of a used spark plug is not within the specification, replace the spark plug with a new one.  
 If the electrode gap of a new spark plug is not within the specification, adjust the gap by bending the base of the ground electrode, being careful not to touch the tip.



WR88-IG029

6. Cleaning of spark plug  
 If the electrode has traces of wet carbon, dry the electrode and clean it with a spark plug cleaner.  
**Air Pressure: Not to Exceed 6 kg/cm<sup>2</sup> (85 psi)**  
**Duration: Less Than 20 Seconds**

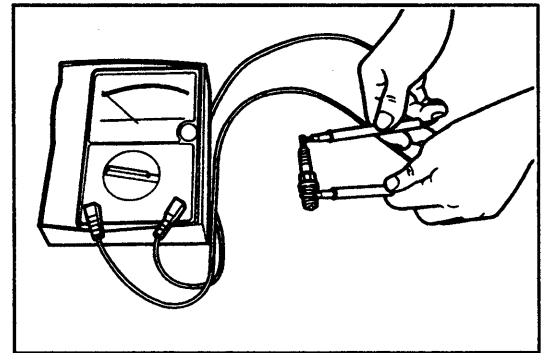
**NOTE:**  
 If there are traces of oil, remove it with gasoline before the spark plug is cleaned by the spark plug cleaner.



WR88-IG030

7. Inspection of spark plug insulation resistance  
**More Than 20 MΩ**

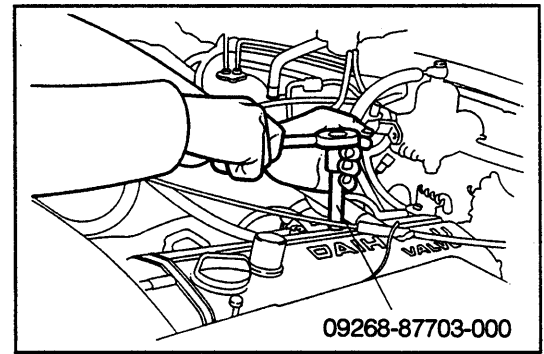
If the insulation resistance is less than the specified value, replace the spark plug.



WR88-IG031

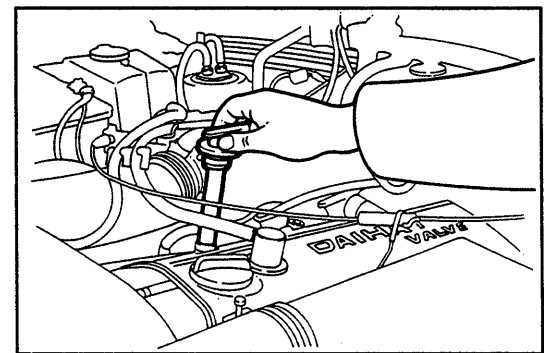
8. Installation of spark plug  
 Install the spark plugs. Tighten them to the specified torque, using the following SST.  
**SST: 09268-87703-000**  
**Tightening Torque: 1.5 - 2.2 kg-m (10.8- 15.9 ft-lb)**

**NOTE:**  
 Since the insulator strength of a small spark plug is comparatively smaller than that of regular spark plugs, when tightening, be sure to use the tool exclusively used for this application. Also, when tightening, never use the wrench in a crooked way.



WR88-IG032

9. Connect the resistive cord to the spark plug.



WR88-IG033



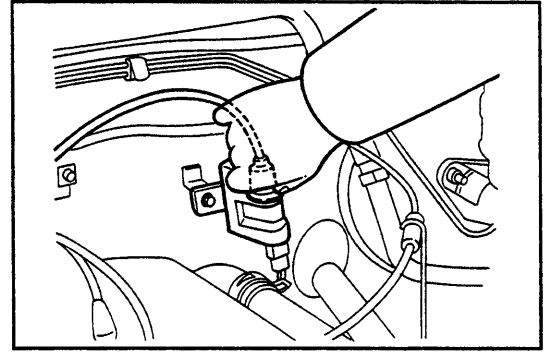
# IGNITION SYSTEM

## INSPECTION OF IGNITION COIL

1. Disconnect the resistive cord from the ignition coil.

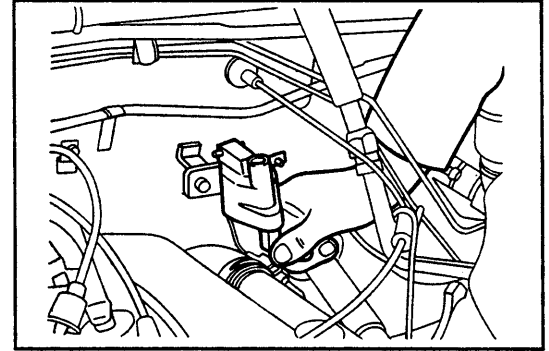
**NOTE:**

Do not hold the cord portion during disconnection. Be sure to disconnect the cord by holding the rubber boot.



WN88-IG009

2. Disconnect the coil wire connector from the ignition coil.



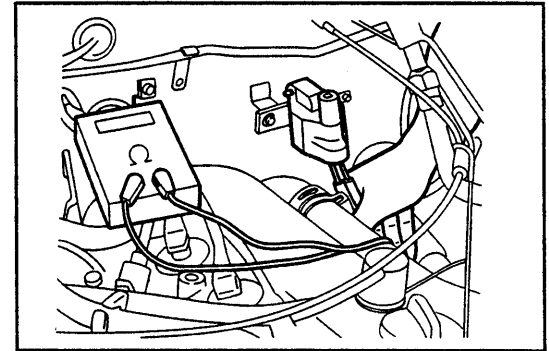
WR88-IG035

3. Check of primary coil resistance

Measure the resistance of the primary coil across the ignition coil terminals, as shown in the right figure.

**Primary Coil Resistance at 20°C (68°F):**  
1.35 - 1.65 Ω

If the measured value fails to conform to the specification, replace the ignition coil.



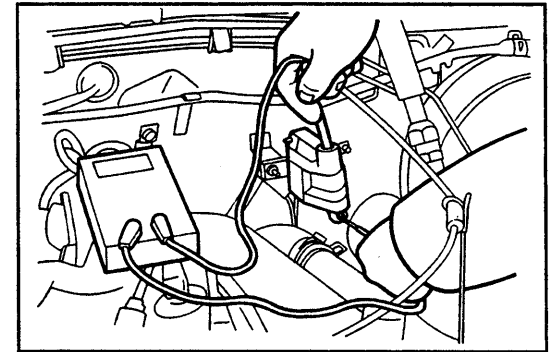
WR88-IG036

4. Check of secondary coil resistance

Measure the resistance of the secondary coil between the positive (+) terminal of the ignition coil and the resistive cord terminal, as shown in the right figure.

**Secondary Coil Resistance at 20°C (68°F):**  
22 - 30 kΩ

If the measured value fails to conform to the specification, replace the ignition coil.



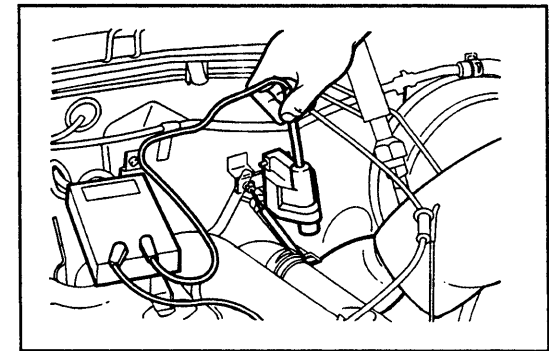
WR88-IG037

5. Check of insulation resistance

Measure the insulation resistance between positive (+) terminal of the ignition coil and coil case.

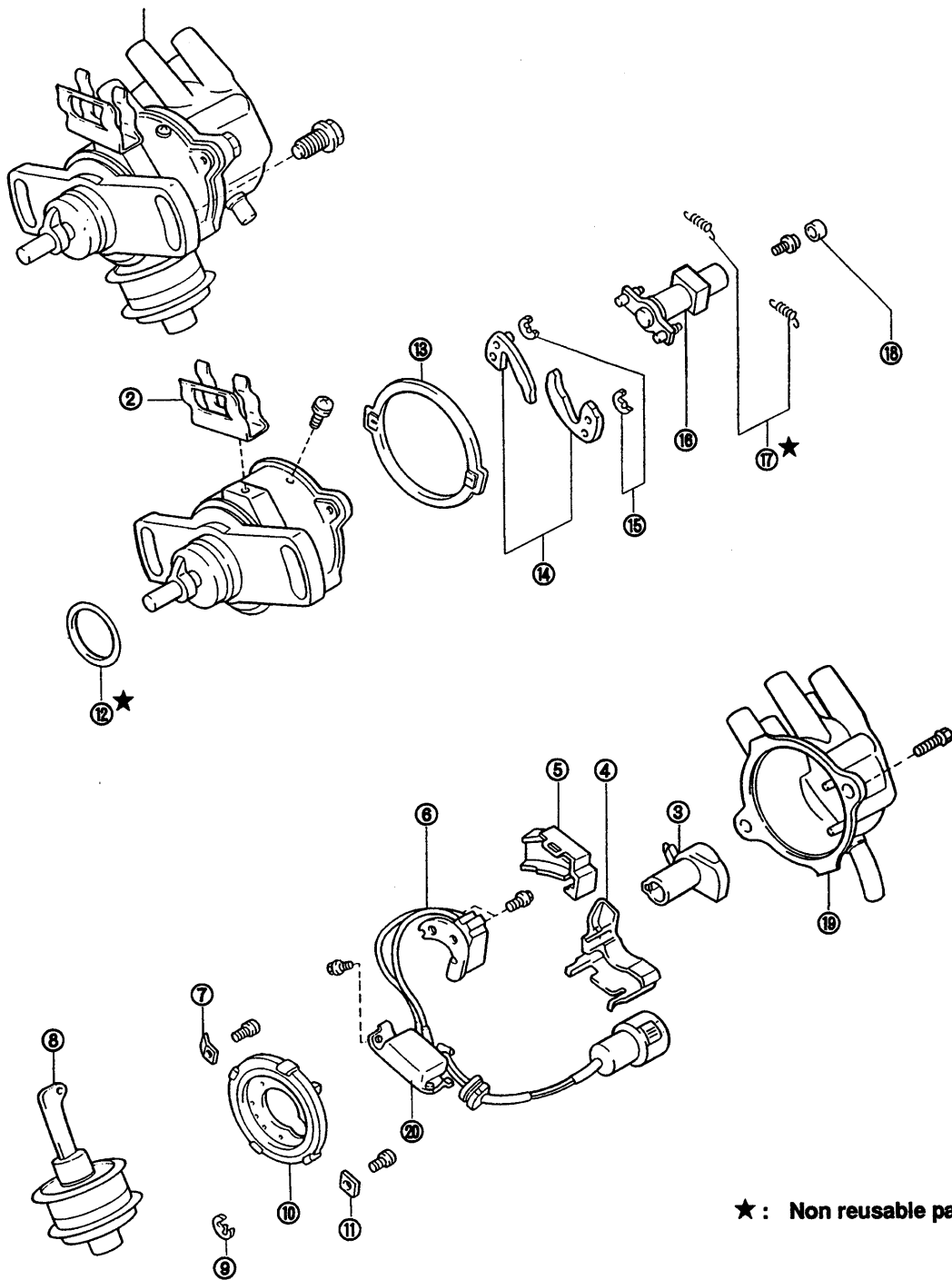
**Insulation resistance: More than 1000 kΩ**  
(Infinity)

If the measured value fails to conform to the specification, replace the ignition coil.



WR88-IG038

**DISTRIBUTOR  
COMPONENTS**



★ : Non reusable parts

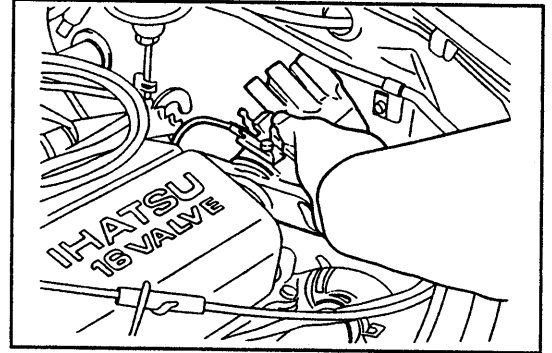
- ① Distributor assembly
- ② Distributor connector clamp
- ③ Distributor rotor
- ④ Dust-proof cover
- ⑤ Dust-proof cover
- ⑥ Pick-up coil
- ⑦ Plate washer
- ⑧ Distributor vacuum advancer
- ⑨ Snap washer
- ⑩ Stationary plate

- ⑪ Plate washer
- ⑫ "O" ring
- ⑬ Distributor gasket
- ⑭ Governor weight
- ⑮ Snap washer
- ⑯ Signal rotor assembly
- ⑰ Governor spring
- ⑱ Grease stopper
- ⑲ Distributor cap
- ⑳ Ignitor

## INSPECTION OF DISTRIBUTOR

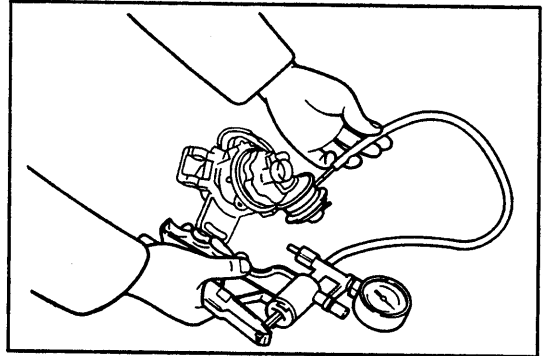
### Check and Adjustment of Air Gap

1. Remove the resistive cord from the distributor cap.
2. Remove the distributor. (See page IG-12.)
3. Remove the distributor cap.



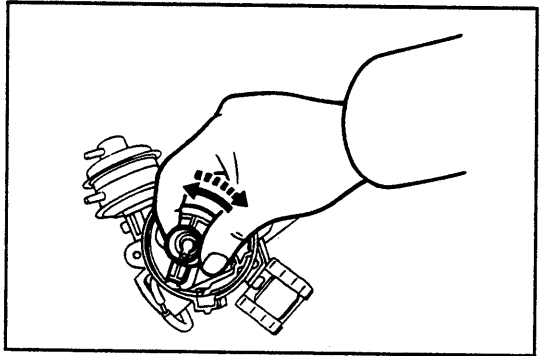
WN88E-IG011

4. Check of vacuum advancer  
Apply a negative pressure of more than 150 mmHg (7.87 inchHg).  
Ensure that vacuum advancer operates.  
Repair or replace the vacuum advancer, as required, if it will not operate.



WN88E-IG012

5. Check of governor advancer
  - (1) Turn the rotor clockwise and release it. Ensure that the rotor returns counterclockwise rapidly.  
Repair or replace the rotor, as required, if it will not return to the original position.
  - (2) Check the rotor for excessive play.
6. Pull out the rotor.

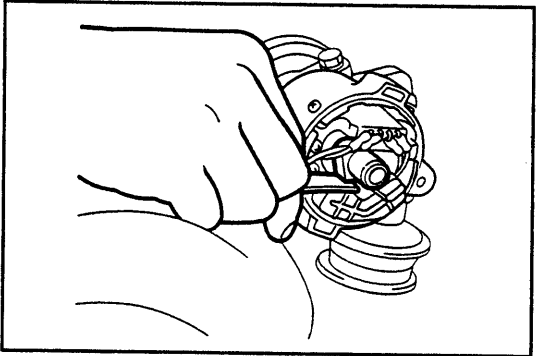


WN88E-IG013

7. Turn the crankshaft until the signal generator faces toward the signal rotor.
8. At all four points check to see if the air gap between the signal generator and the signal rotor conforms to the specified value.

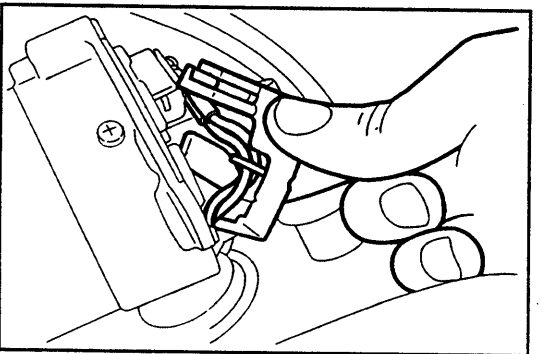
**Specified Gap: 0.2 - 0.4 mm (0.0079 - 0.015 inch)**

If the air gap fails to conform to the specified value, adjust the air gap.



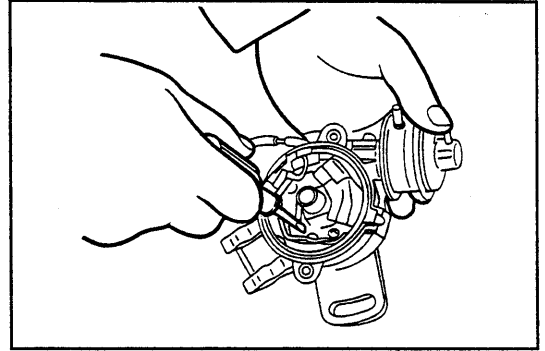
WN88E-IG014

9. Adjustment of air gap
  - (1) Remove the lock, being very careful not to damage the ignitor dust-proof cover. Then, pull out the wire from the signal generator, making sure that no damage is made to the wire.
  - (2) From the dust-proof cover, remove the wire led from the signal generator. Be very careful not to damage the wire.



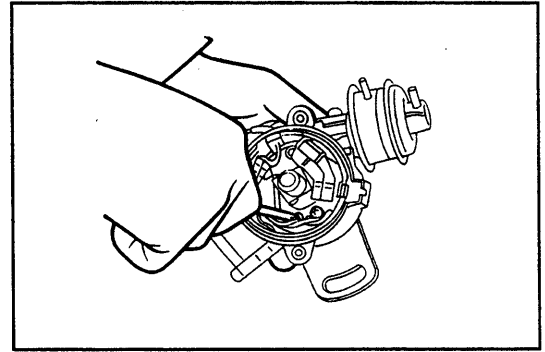
WN88E-IG015

- (3) Loosen the attaching screws of the signal generator.
- (4) Adjust the air gap between the signal generator and the signal rotor to the specified value.



WN88E-IG016

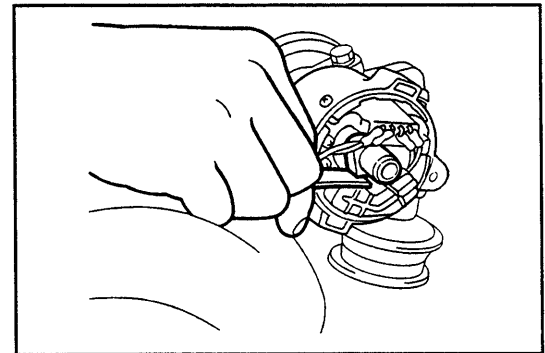
- (5) Tighten the attaching screws of the signal generator.  
Specified Value: 12 - 21 kg-cm



WN88E-IG017

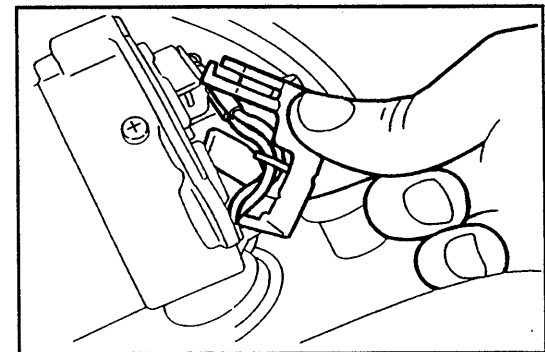
- (6) Check the air gap.  
Specified Value: 0.2 - 0.4 mm (0.0079 - 0.015 inch)

If the air gap fails to conform to the specified value, adjust the air gap again.



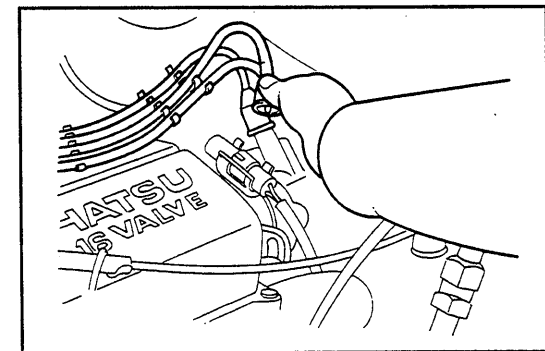
WN88E-IG018

10. Install the wire from the signal generator to dust proof cover.
11. Install the dust proof cover to the ignitor.
12. Install the rotor.
13. Check the distributor cap gasket for cracks or damage.  
If it exhibits cracks or damage, replace the gasket with new one.



WN88E-IG019

14. Install the distributor cap gasket and distributor cap.
15. Install the distributor to the cylinder head. (See page IG-22.)
16. Connect the distributor connector.
17. Connect the resistive cord to the distributor cap.
18. Perform the ignition timing adjustment.  
(See page IG-23.)



WN88E-IG020

# IGNITION SYSTEM

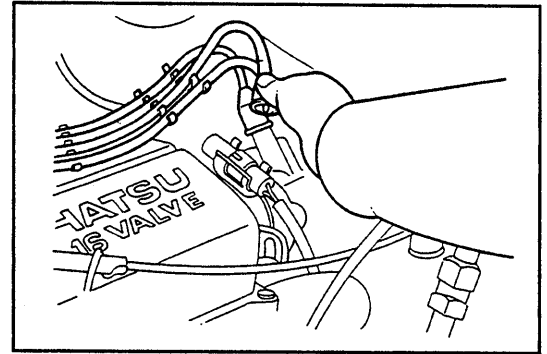
## REMOVAL OF DISTRIBUTOR

1. Disconnect the battery ground cable from the negative terminal of the battery.

2. Disconnect the resistive cords from the distributor cap.

**NOTE:**

Do not hold the cord during disconnection. Be sure to disconnect the cord by holding the rubber boot.



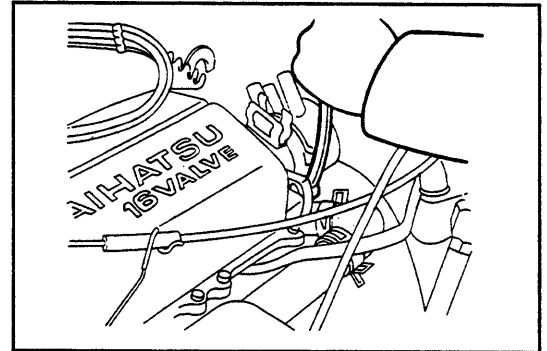
WR88-IG113

3. Disconnect the distributor connector.
4. Disconnect the vacuum advancer hoses.

**NOTE:**

Prior to the disconnection, put a tag so that the original installation position may be identified readily.

5. Remove the distributor set bolt.

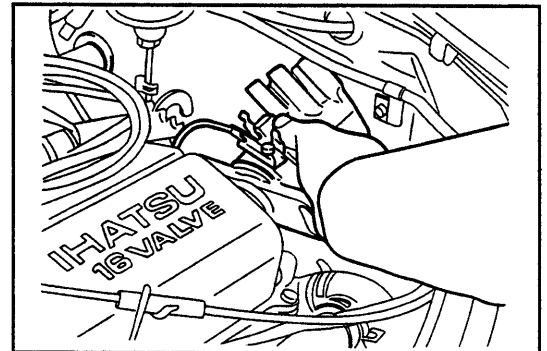


WN88E-IG021

6. Pull out the distributor from the cylinder head.

**NOTE:**

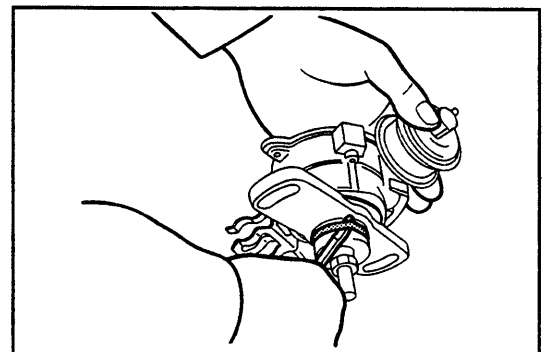
Since the engine oil flows out, insert a suitable cloth under the distributor connecting section.



WR88-IG117

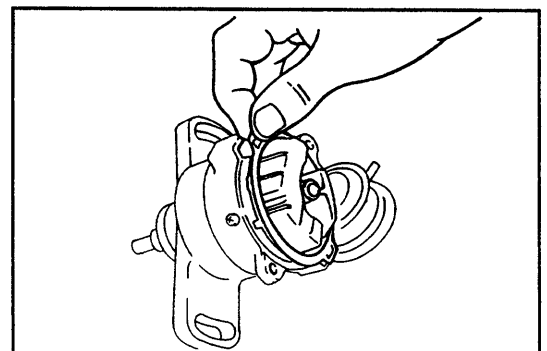
## DISASSEMBLY OF DISTRIBUTOR

1. Remove the "O" ring from the distributor housing.
2. Remove the distributor cap from the distributor housing.



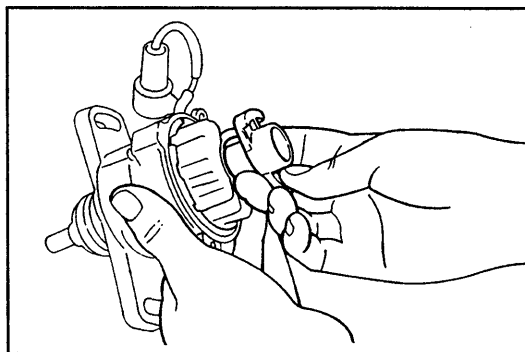
WR88-IG118

3. Remove the distributor cap gasket.



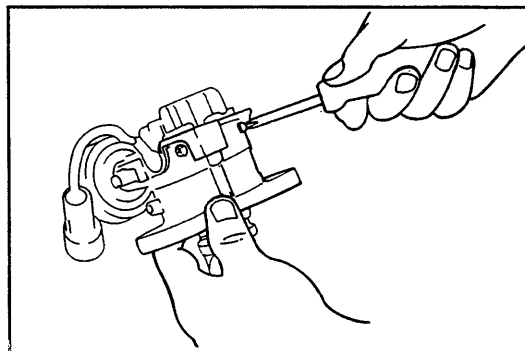
WR88-IG119

4. Remove the rotor.



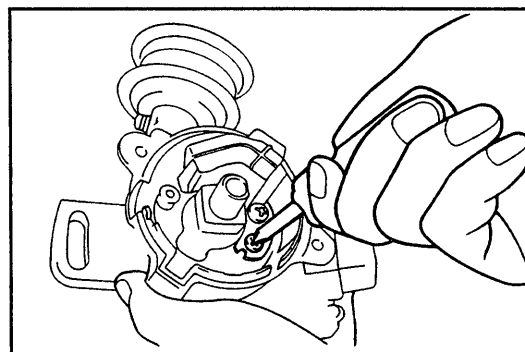
WR88-IG120

5. Remove the ignitor by removing the two attaching screws.



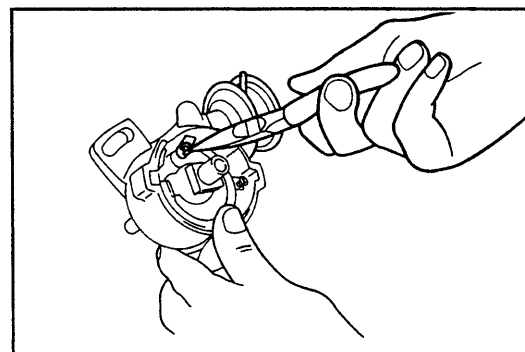
WR88-IG121

6. Remove the signal generator by removing the two attaching screws.



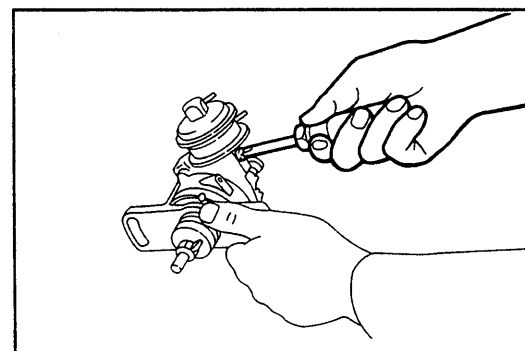
WR88-IG122

7. Remove the snap washer of the vacuum advancer.



WR88-IG123

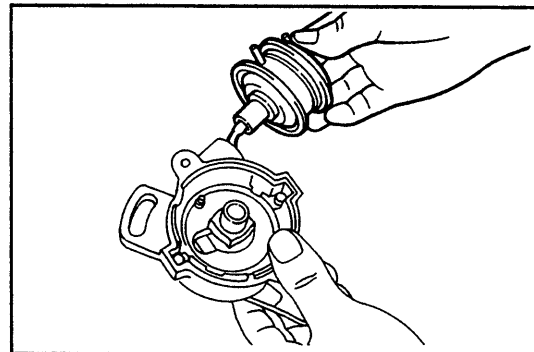
8. Remove the attaching screw of the vacuum advancer.



WR88-IG124

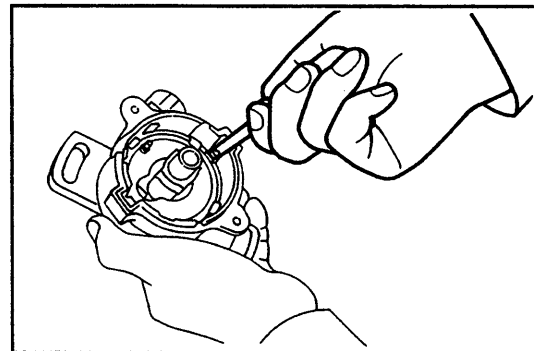
# IGNITION SYSTEM

9. Remove the "E" ring and remove the vacuum advancer from the pin of the stationary plate.  
Pull out the vacuum advancer from the distributor housing.



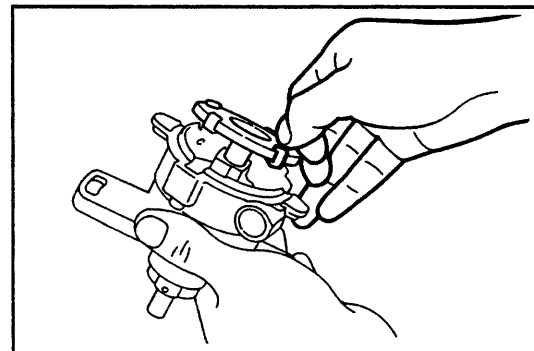
WR88-IG125

10. Remove the attaching screws and plate of the distributor stationary plate.



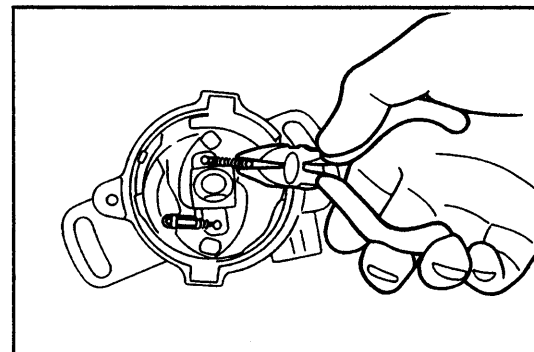
WR88-IG126

11. Remove the stationary plate from the distributor housing.



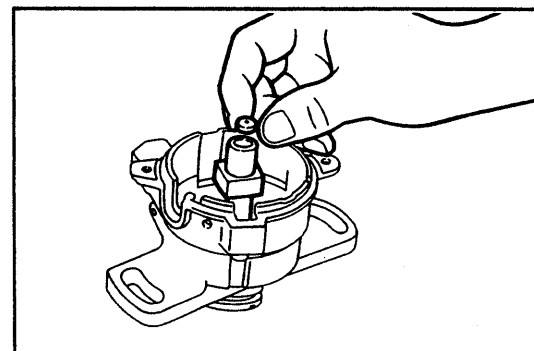
WR88-IG127

12. Remove the governor springs.



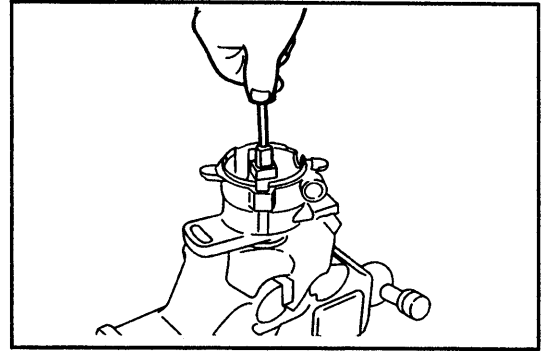
WR88-IG128

13. Removal of signal rotor assembly  
(1) Remove the grease stopper.



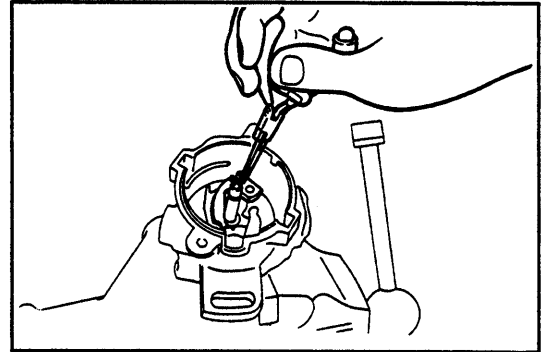
WR88-IG129

- (2) Remove the attaching screws of the signal rotor assembly.
- (3) Remove the signal rotor assembly.



WR88-IG131

14. Remove the snap washer of the governor weight. Remove the governor weight.

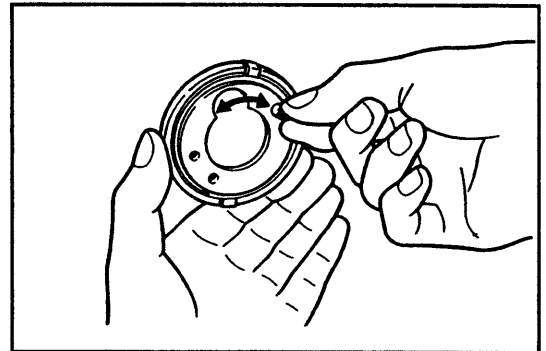


WR88-IG132

## INSPECTION OF DISTRIBUTOR COMPONENTS

### 1. Inspect the stationary plate.

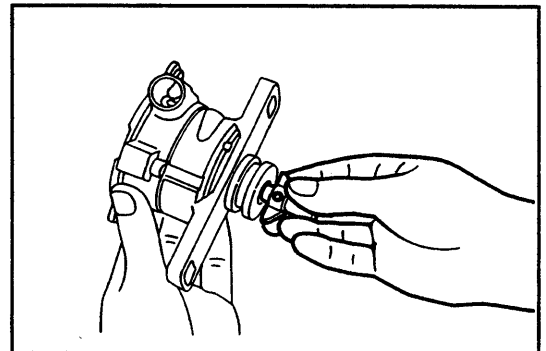
Check to see if the stationary inner plate rotates on the outer plate smoothly.  
If the inner plate will not rotate smoothly, replace the stationary plate.



WR88-IG133

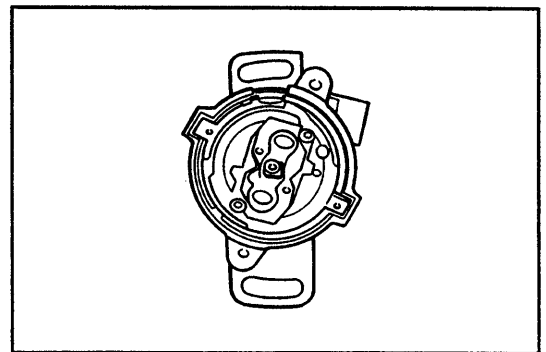
### 2. Inspection of Distributor Housing

(1) Check to see if the governor shaft rotates smoothly.  
If it will not rotate smoothly, replace the distributor housing.



WR88-IG134

(2) Check the sliding section of the governor weight for wear or damage.  
Replace the distributor housing if it exhibits wear or damage.

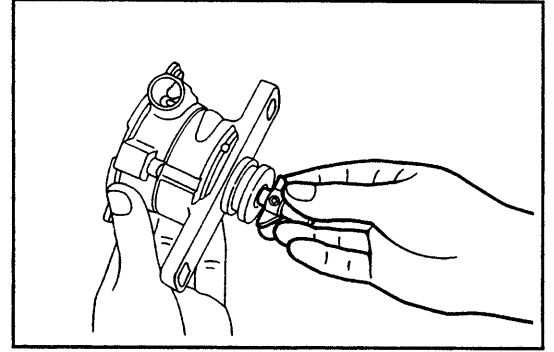


WR88-IG135



# IGNITION SYSTEM

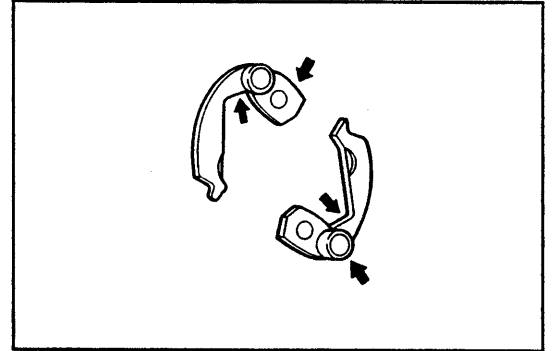
- (3) Check the coupling section of the governor shaft for wear or damage. Also, check to see if any excessive play is present in the turning direction.  
Replace the distributor housing if it exhibits wear, damage and/or excessive play in the turning direction.



WR88-IG136

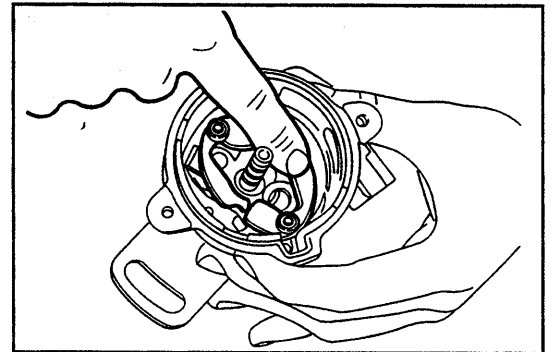
### 3. Inspection of Governor Weight for Damage or Wear

- (1) Visually inspect the governor weight for damage or wear.  
Replace the governor weight if it exhibits damage or wear.



WR88-IG137

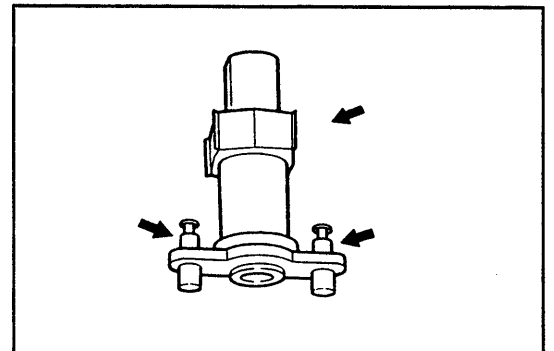
- (2) Install the governor weight to the governor shaft. Check to see if any excessive play is present.  
If excessive play is present, replace the governor weight and/or distributor housing, as required.



WR88-IG138

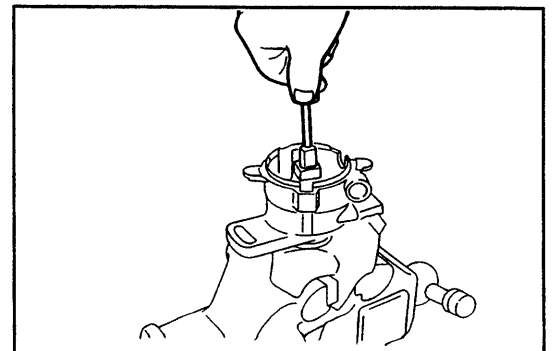
### 4. Inspection of Signal Rotor Assembly

- (1) Visually inspect the signal rotor for damage.  
Replace the signal rotor assembly if it exhibits damage.
- (2) Check the pin section of the signal rotor assembly for wear or damage.  
Replace the signal rotor assembly if the pin section exhibits wear or damage.



WR88-IG139

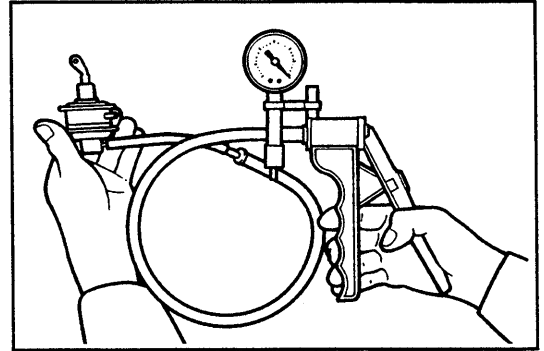
- (3) Install the signal rotor assembly to the governor shaft temporarily. Check to see if the signal rotor is tilted.  
Replace the signal rotor assembly and/or distributor housing if it is tilted.



WR88-IG140

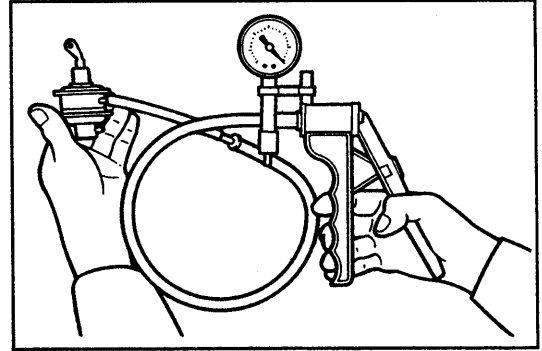
## 5. Inspection of Vacuum Advancer

- (1) Gradually apply a negative pressure to the main diaphragm of the vacuum advancer. Ensure that the rod of the vacuum advancer is drawn into the diaphragm room side, corresponding to the negative pressure. Replace the vacuum advancer if the rod will not be drawn.



WR88-IG141

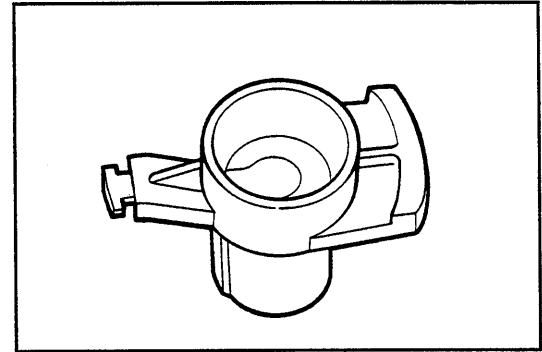
- (2) Gradually apply a negative pressure to the sub diaphragm of the vacuum advancer. Ensure that the rod of the vacuum advancer is drawn into the diaphragm room side, corresponding to the negative pressure. Replace the vacuum advancer if the rod will not be drawn.



WR88-IG142

## 6. Inspection of Rotor

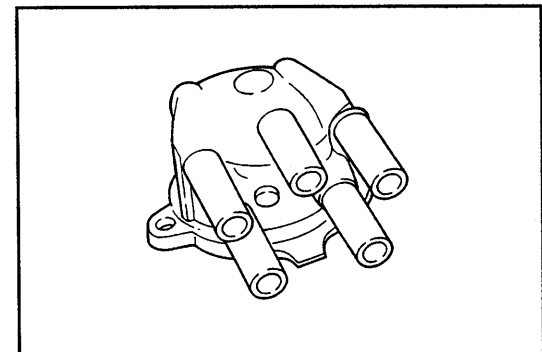
Check the center carbon contacting surface and electrode for damage, such as wear, electrolytic corrosion and cracks. If the surface or electrode exhibits damage, replace the rotor, as required.



WR88-IG143

## 7. Inspection of Distributor Cap

Check the distributor cap for cracks. Also, check the electrode and center carbon for damage, such as wear. Replace the distributor cap if the cap, electrode or carbon exhibits damage.



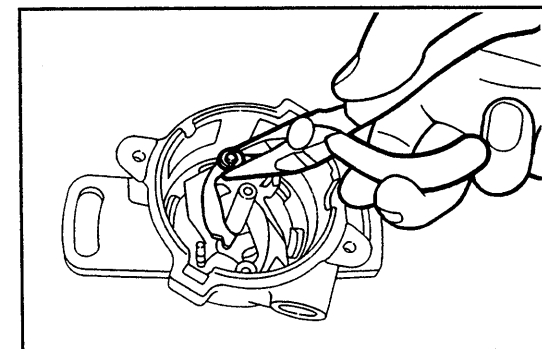
WR88-IG144

## ASSEMBLY OF DISTRIBUTOR

1. Install the governor weight to the distributor housing. Install the snap washer.

### NOTE:

Thinly apply high-temperature grease to the sliding section.

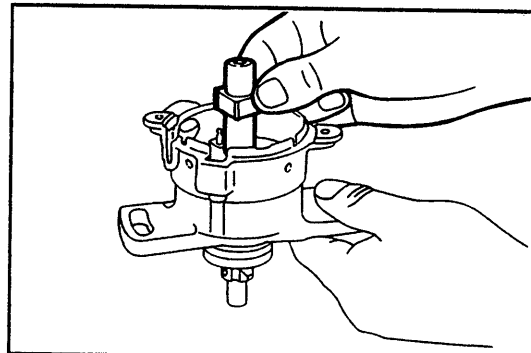


WR88-IG145

# IGNITION SYSTEM

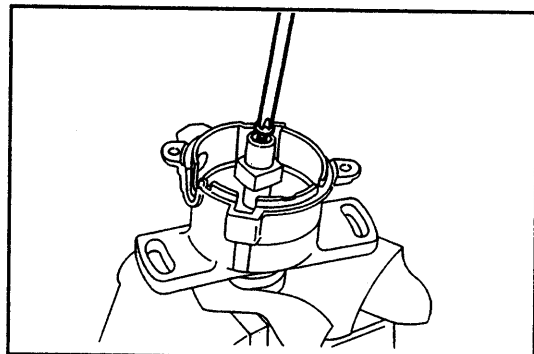
## 2. Installation of signal rotor assembly

(1) Thinly apply high-temperature grease to the sliding section of the signal rotor assembly. Install the signal rotor assembly to the distributor housing.



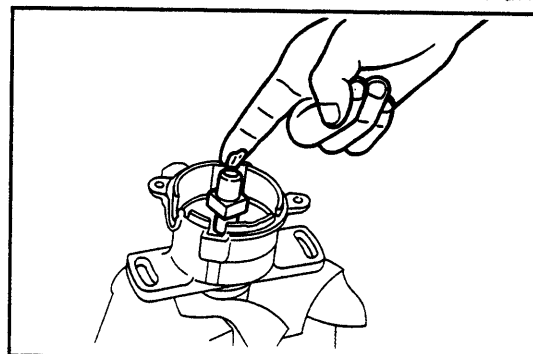
WR88-IG146

(2) Tighten the attaching screw.



WR88-IG147

(3) Pack high-temperature grease in the signal rotor assembly.

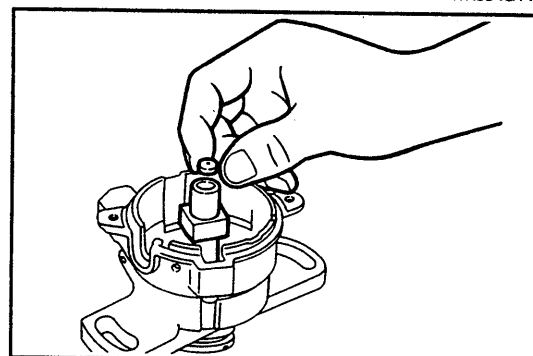


WR88-IG148

(4) Press the grease stopper by your hand.

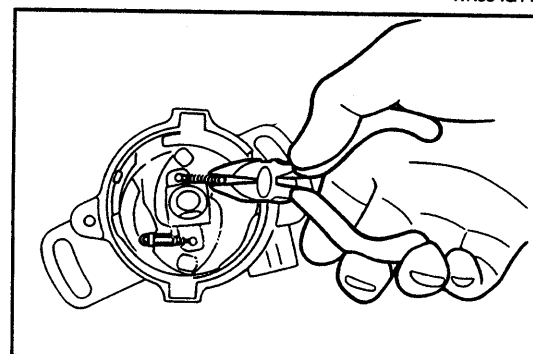
**NOTE:**

Wipe off any excess grease which has oozed out.



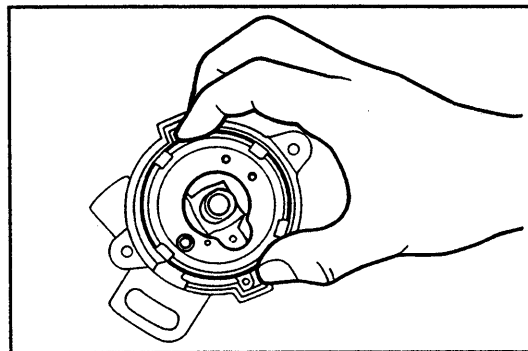
WR88-IG149

3. Install the new governor spring to the distributor.



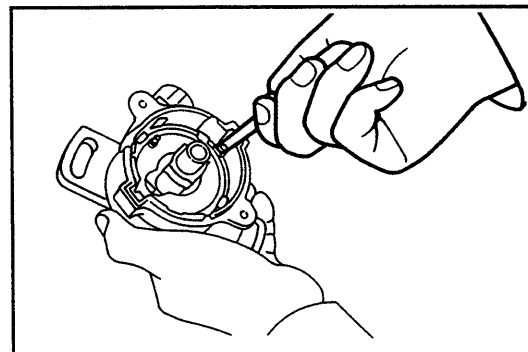
WR88-IG150

4. Assemble the stationary plate, lining up the cut-out section of the distributor housing.



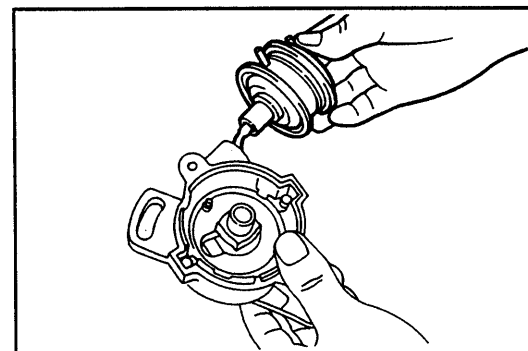
WR88-IG151

5. Secure the stationary plate installation seat and stationary plate with the screws.



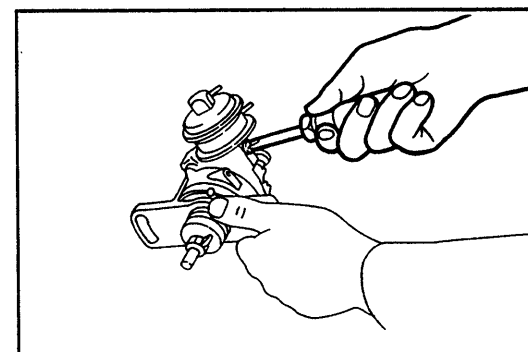
WR88-IG152

6. Insert the vacuum advancer into the distributor housing. Connect it to the pin of the stationary inner plate.



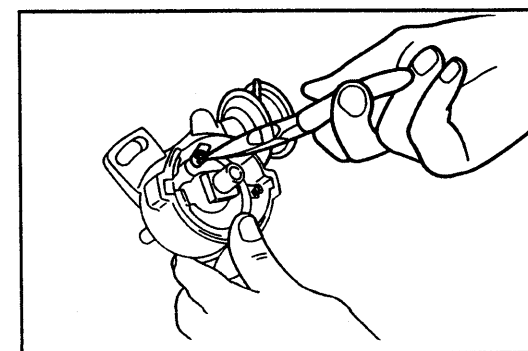
WR88-IG153

7. Align the screw hole of the vacuum advancer with the screw hole of the distributor housing. Install and tighten the attaching screw.



WR88-IG154

8. Attach the snap washer of the vacuum advancer.

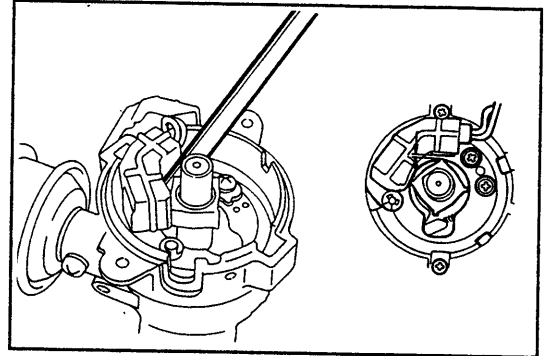


WR88-IG155

# IGNITION SYSTEM

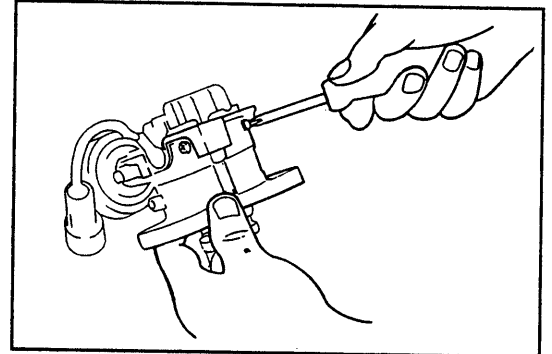
9. Installation of signal generator

Install the signal generator to the stationary plate. Adjust the air gap in such a way that the air gap in relation to the signal rotor is 0.2 - 0.4 mm (0.0079 - 0.015 inch).



WR88-IG156

10. Install the ignitor to the distributor with the screw.



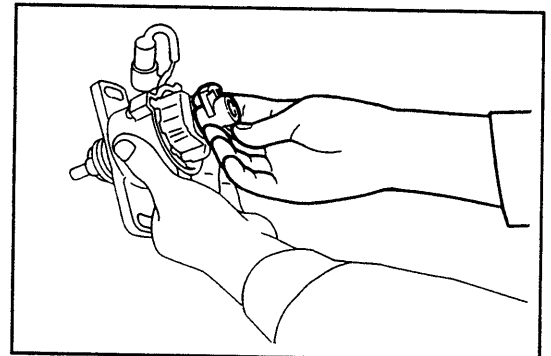
WR88-IG157

11. Attach the rotor.

12. Install a distributor cap gasket to distributor body.

**NOTE:**

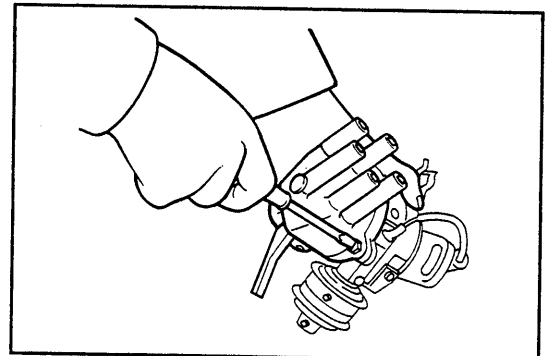
If the gasket is damaged, replace it with a new one.



WR88-IG159

13. Install the distributor cap to the distributor housing.

Also, tighten the clamp of the distributor connector, too, at the vacuum advancer side of the distributor cap attaching screw.

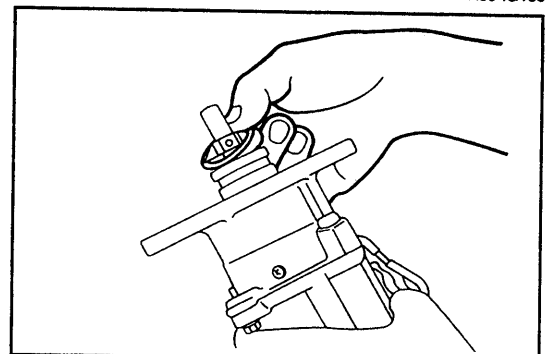


WR88-IG160

14. Install a new "O" ring to the distributor housing.

**NOTE:**

- Be very careful not to damage the "O" ring.
- When the distributor is pulled from the cylinder head once, be sure to replace the "O" ring with a new part.



WR88-IG161

## INSTALLATION OF DISTRIBUTOR

1. Turn the crankshaft, until the No.1 cylinder (at the timing belt side) comes at the top dead center at the end of the compression stroke.  
Under this conditions, the crankshaft timing marks should be aligned and the valve rocker arms should be inoperative (the rocker arms actuated by the camshaft are not pushing down the valves).

**NOTE:**

Ensure that the No.1 rocker arms are not operating. This check can be performed by moving the rocker arms with your fingers after removing the oil filler cap.

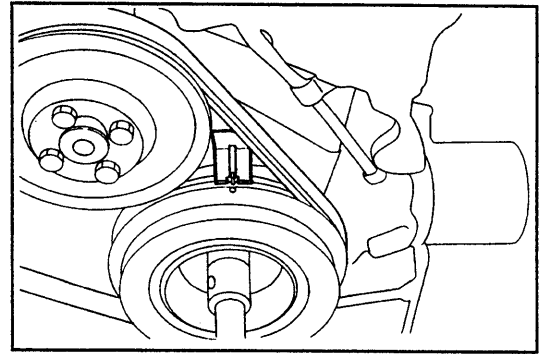
2. Align the cut-out section of the distributor housing with the cut-out section of the coupling.

3. Insert the distributor into the cylinder head. At this time, ensure that the distributor attaching hole of the cylinder head comes at the center of the elongated hole for the distributor bolt.

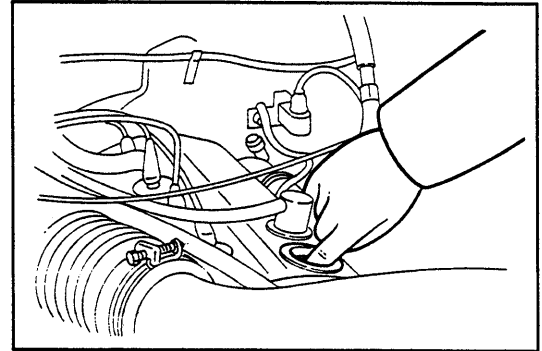
4. Tighten the distributor attaching bolts temporarily.

**NOTE:**

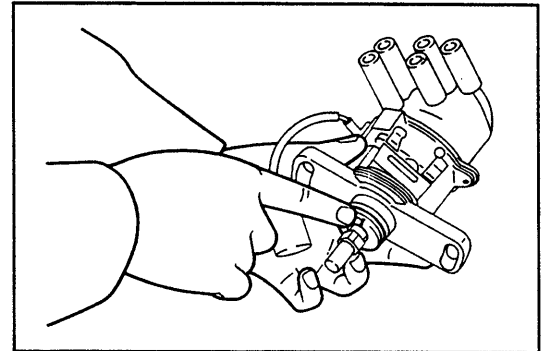
The final tightening should be performed after the check and adjustment of the ignition timing have been completed.



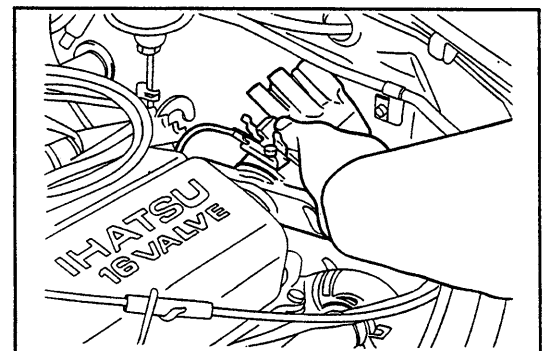
WR88-IG162



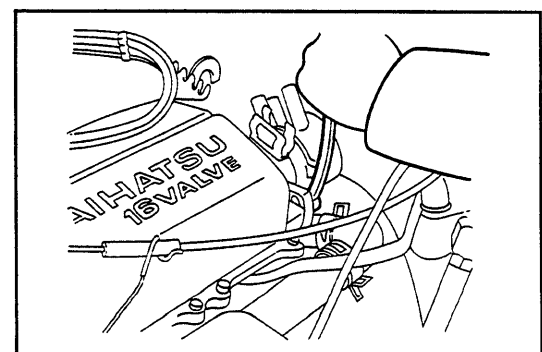
WR88-IG163



WR88-IG164



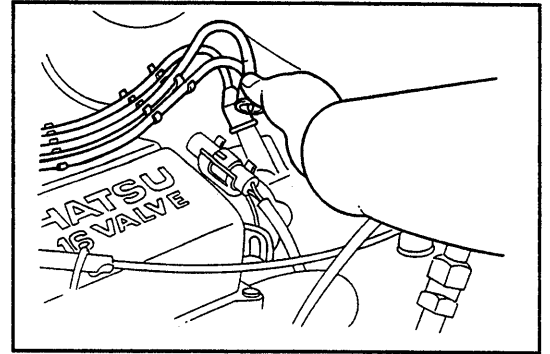
WR88-IG165



WR88-IG166

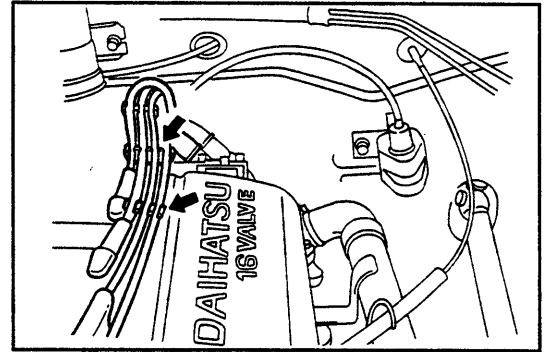
# IGNITION SYSTEM

5. Connect the vacuum advancer hoses.
6. Connect the distributor connector. Install it to the clamp.
7. Connect the resistive cords to the distributor cap.



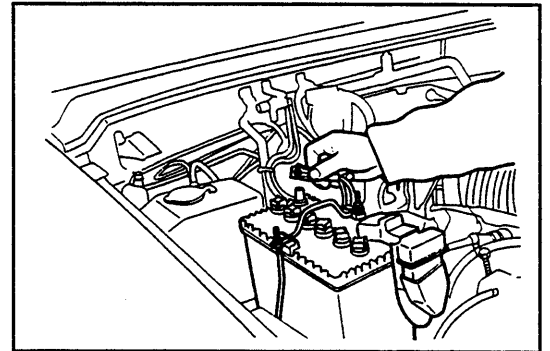
WN88E-IG022

8. Install the clamp to the resistive cord.



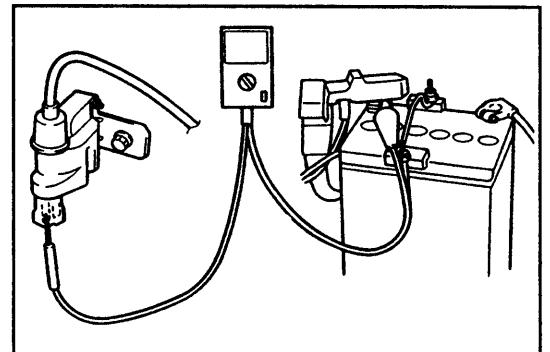
WR88-IG170

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



WR88-IG171

10. Check and adjustment of ignition timing
  - (1) Start the engine. Warm up the engine.
  - (2) Connection of tachometer and timing light
    - 1) Connect the cable for measuring tachometer use to the negative terminal of the ignition coil.



WR88-IG172

## NOTE:

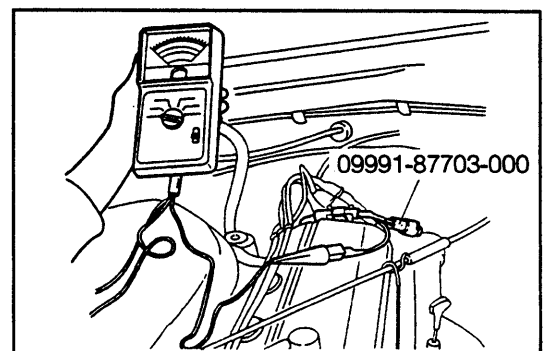
Fully use the following SST which is capable of connecting tachometers other than a clamp-on type tachometer.

SST: 09991-87703-000

## CAUTION:

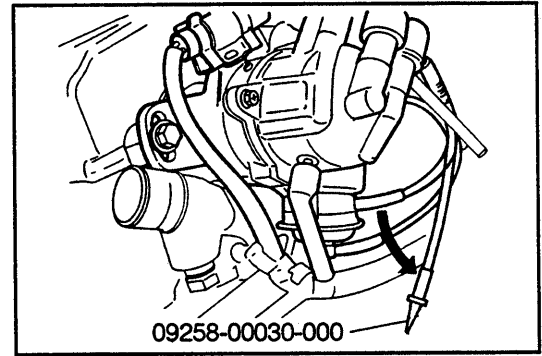
- Never allow the tachometer terminal to touch ground. It could result in damage to the ignitor and/or ignition coil.
- As some tachometers are not compatible with this ignition system, it is recommended to confirm the compatibility of your unit before using.

- 2) Connect the timing light to the resistive cord of the No.1 cylinder (at the timing belt side).



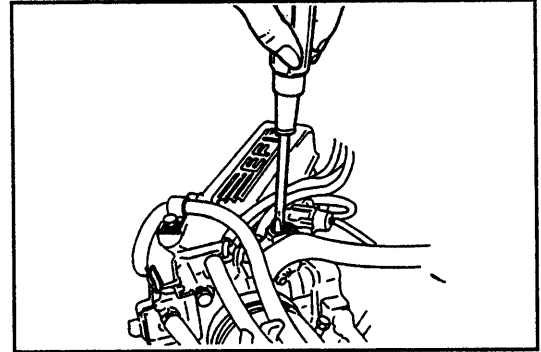
WR88-IG173

- (3) Disconnect the vacuum hose at the sub side of the vacuum advancer of the distributor. Plug the disconnected vacuum hose, using the following SST (stopper).  
SST: 09258-00030-000



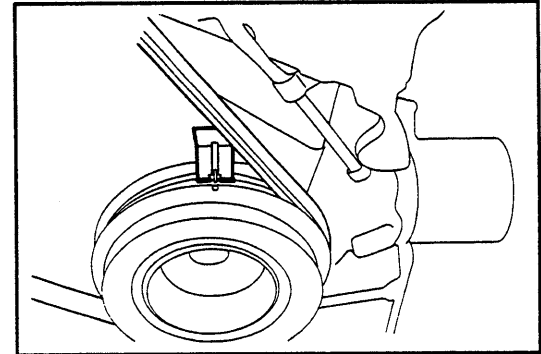
WR88-IG174

- (4) Ensure that the engine revolution is under 1000 rpm and stable.  
If the engine revolution exceeds 1000 rpm or is unstable, adjust the engine idle speed.  
(See page MA-10.)



WR88E-IG023

- (5) Check to see if the ignition timing mark of the crankshaft pulley is aligned with the indicator of the timing belt cover.  
Tighten the distributor attaching bolts to the specified torque if the ignition timing mark is aligned with the indicator.

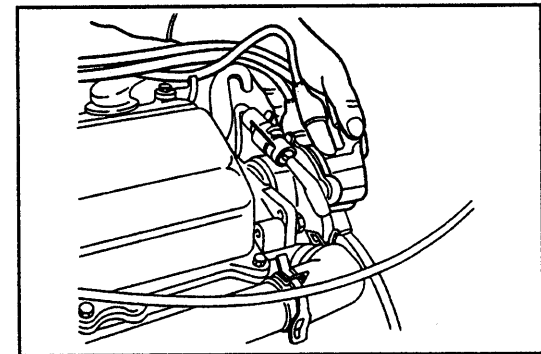


WR88-IG176

- (6) Loosen the distributor attaching bolts. Adjust the distributor installation position, until the ignition timing mark of the crankshaft pulley is aligned with the indicator of the timing belt cover.

### Reference

If the distributor is turned clockwise, the timing will be advanced. Conversely, if the distributor is turned counterclockwise, the timing will be retarded.

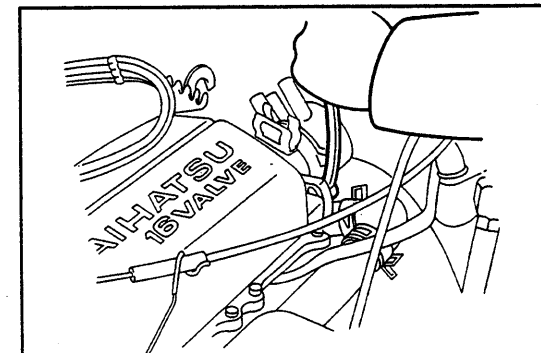


WR88-IG177

- (7) Tighten the distributor attaching bolts to the specified torque, making sure that the ignition timing is not disturbed.

**Tightening Torque: 1.5 - 2.2 kg-m (10.8 - 15.9 ft-lb)**

11. Connect the vacuum hose at the sub side of the vacuum advancer to the vacuum advancer.



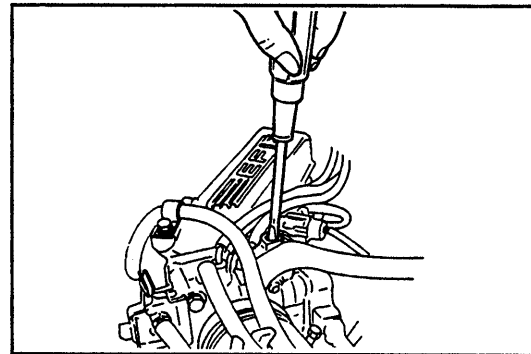
WR88-IG178



## IGNITION SYSTEM

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12. Adjust the engine idle speed.  
(See page MA-10.)
13. Check the oil level.  
(See page LU-2.)



WN88E-IG024

# **DAIHATSU**

# **F300**

[HD-ENGINE]

## **STARTING SYSTEM**

<b>TROUBLE SHOOTING .....</b>	<b>ST- 2</b>
<b>STARTING SYSTEM CIRCUIT .....</b>	<b>ST- 2</b>
<b>STARTER .....</b>	<b>ST- 3</b>

WN88E-ST001

**ST**

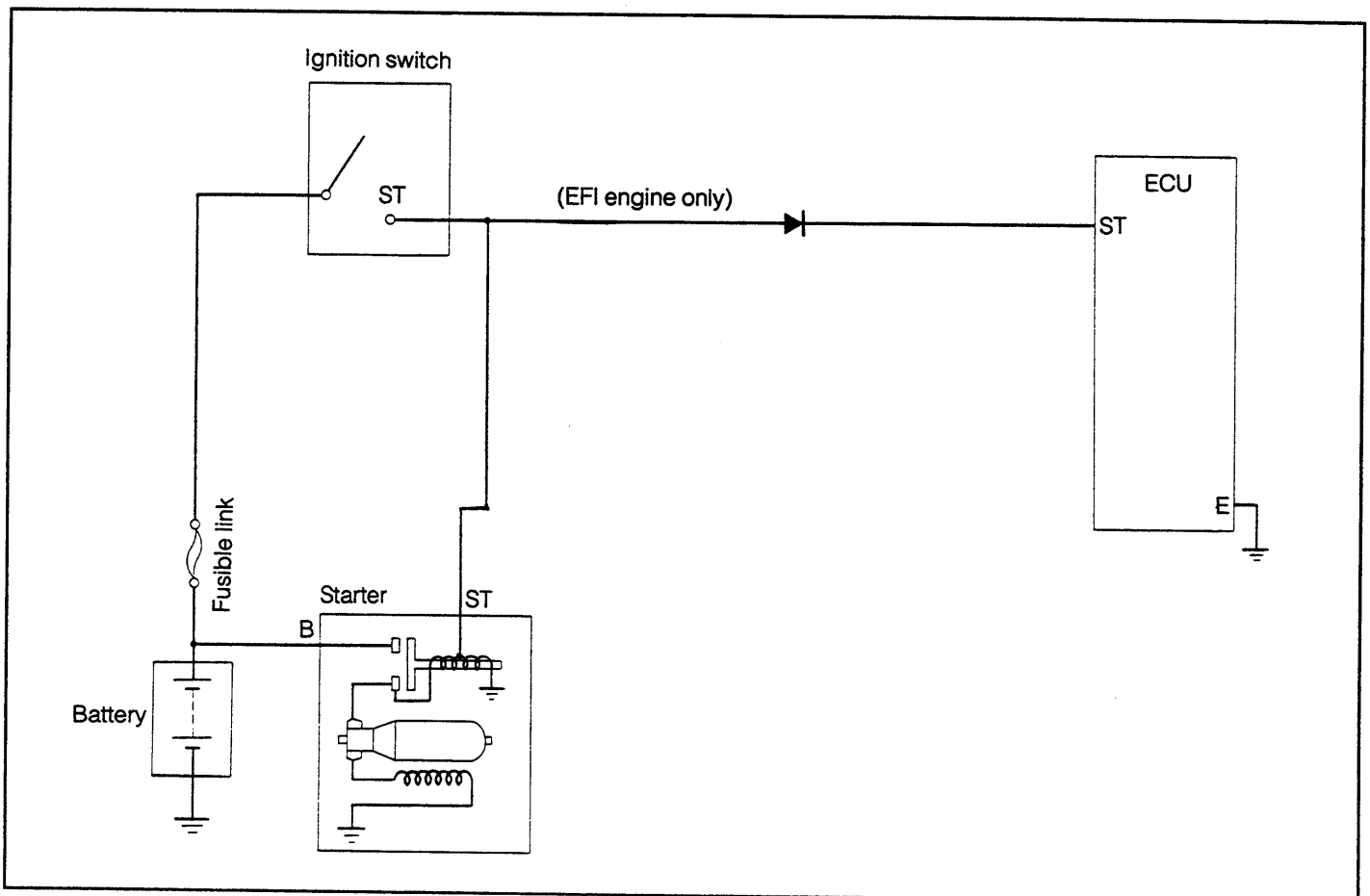
# STARTING SYSTEM

## TROUBLE SHOOTING

Problem	Possible cause	Remedies	Page
Engine will not crank	Battery not fully charged	Check specific gravity of battery electrolyte. Charge or replace battery.	CH-4
	Battery cables loose, corroded or worn	Repair or replace cables.	CH-4
	Shift position switch faulty	Adjust or replace shift position switch.	
	Fusible link blown	Replace fusible link.	
	Starter faulty	Repair starter.	ST-3
Engine cranks slowly	Ignition switch faulty	Replace ignition switch.	
	Starter faulty	Repair starter.	ST-3
Starter keeps running	Pinion gear teeth broken or faulty starter	Repair starter.	ST-3
	Ignition switch faulty	Replace ignition switch.	
	Short in wiring	Repair wiring.	
Starter spins – engine will not crank	Starter faulty	Repair starter	ST-3
	Flywheel teeth broken	Replace flywheel.	

WN88E-ST002

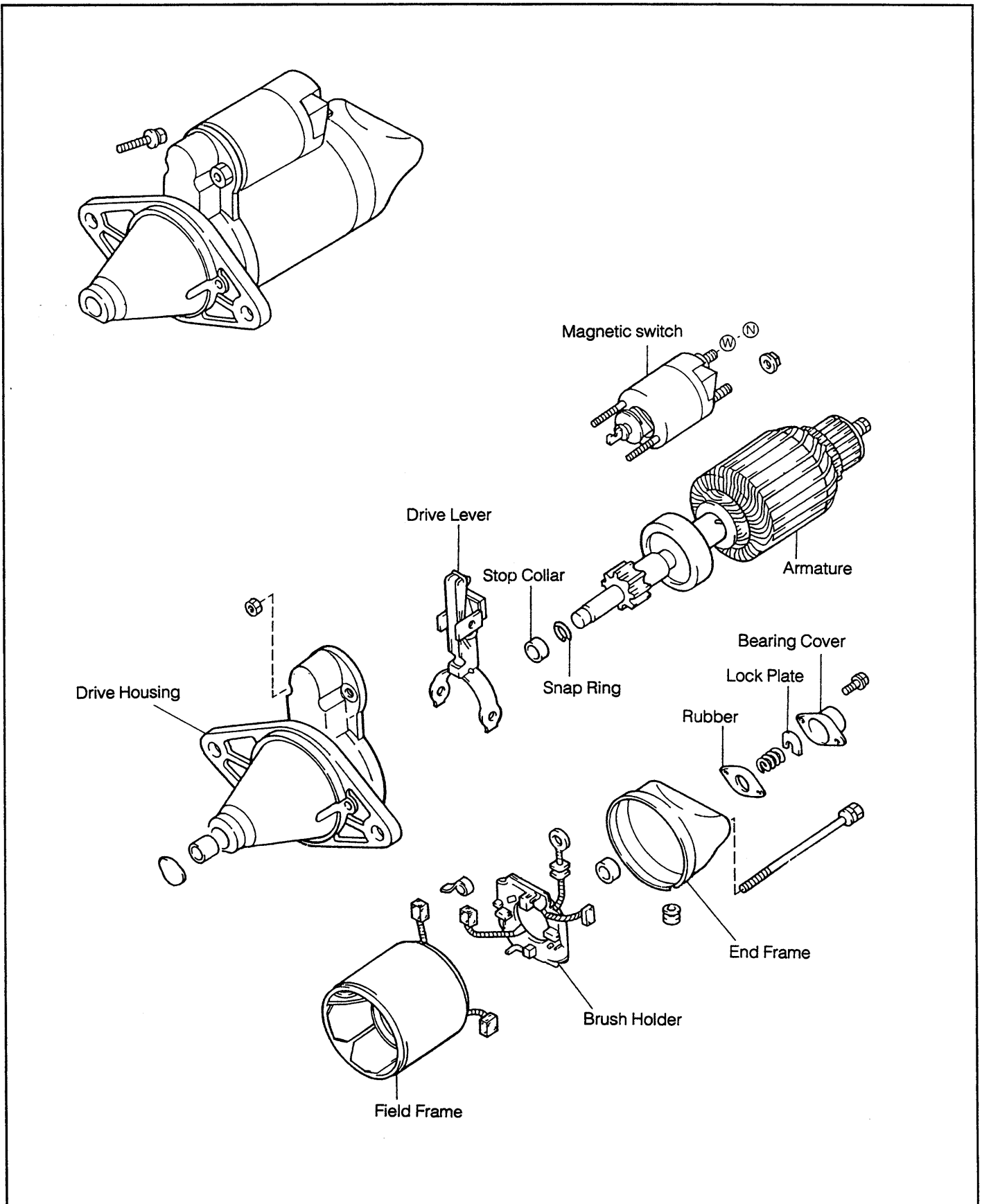
## STARTING SYSTEM CIRCUIT



WN88E-ST003

# STARTER COMPONENTS

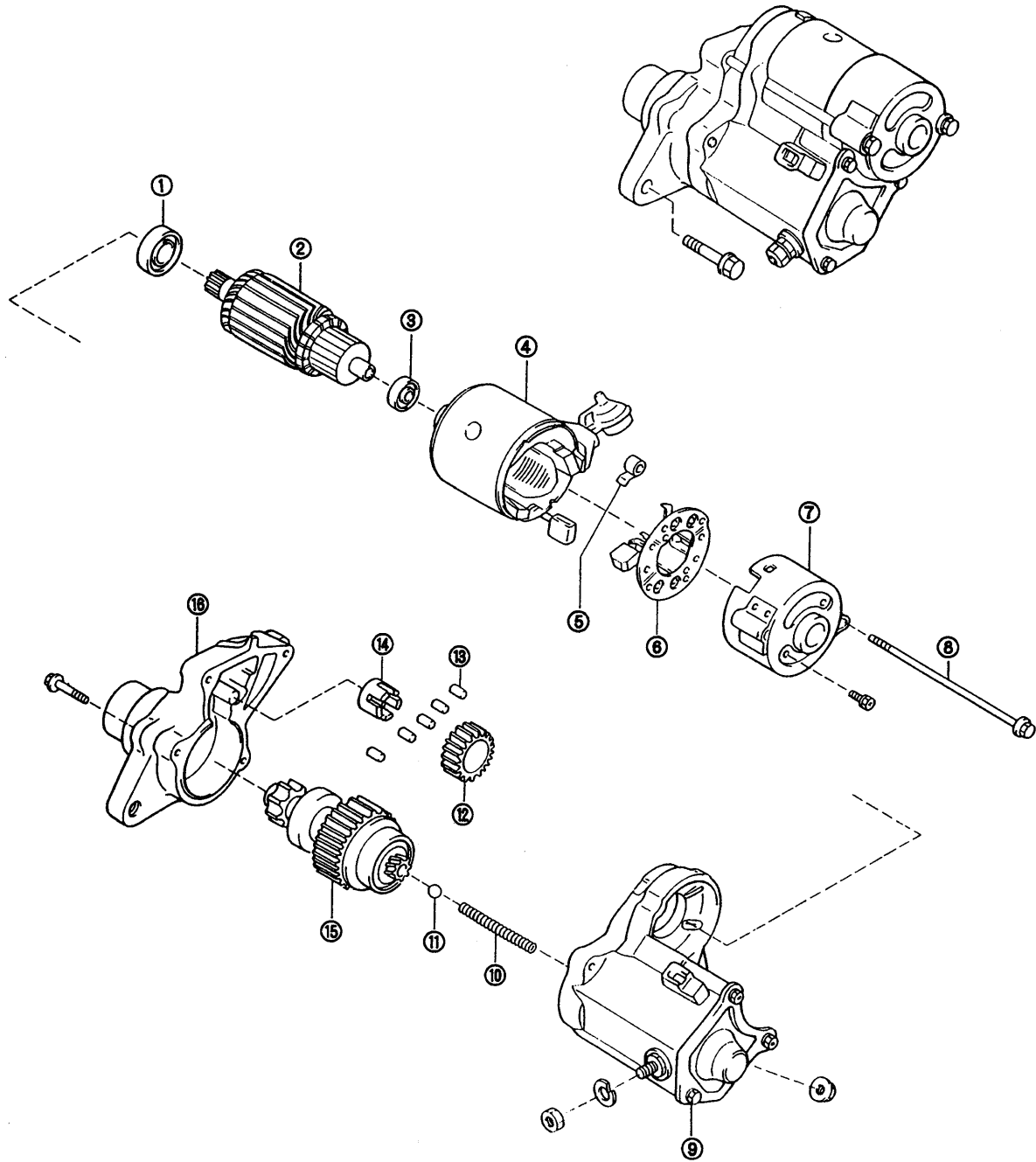
0.9 kW Conventional Starter Motor



WN88E-ST004

# STARTING SYSTEM

## 1.0 kW Reduction Type Starter Motor

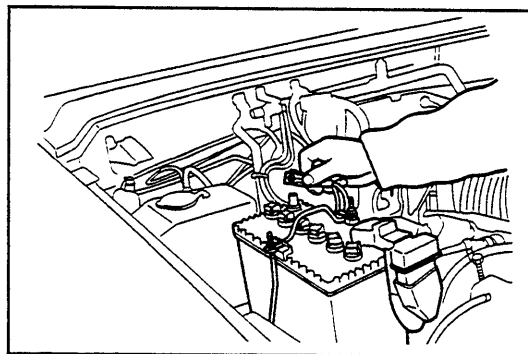


- ① Bearing
- ② Armature
- ③ Bearing
- ④ Field frame
- ⑤ Spring
- ⑥ Brush holder
- ⑦ End cover
- ⑧ Through bolt

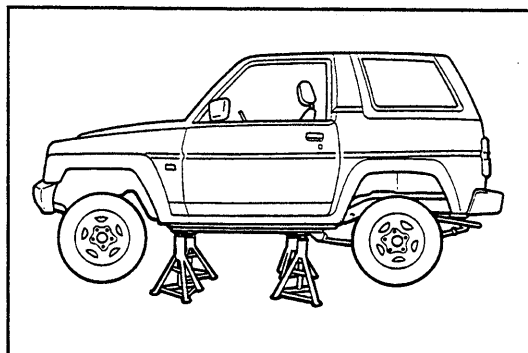
- ⑨ Magnet switch assembly
- ⑩ Spring
- ⑪ Ball
- ⑫ Idle gear
- ⑬ Bearing housing
- ⑭ Bearing housing
- ⑮ Clutch assembly
- ⑯ Starter housing

## REMOVAL OF STARTER MOTOR

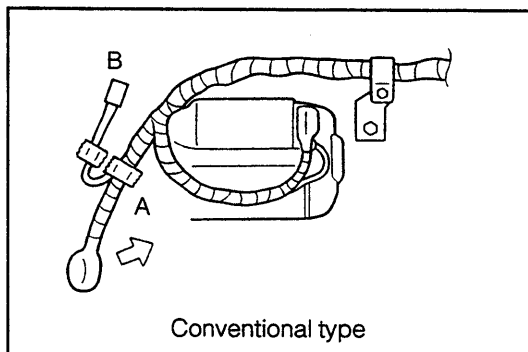
1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.



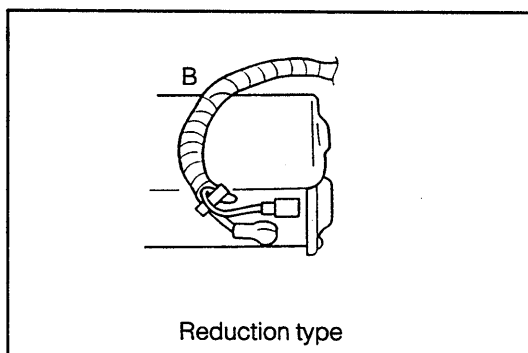
2. Jack up the vehicle and support it with safety stands. (See page GI-9.)



3. Disconnection of two wires from starter  
(1) Disconnect the starter terminal ST of the alternator wire from the starter.



- (2) Disconnect the starter terminal B of the alternator wire from the starter.



4. Detach the wire harness from the clamp by removing the wire harness clamp bolt.

WR88-ST010

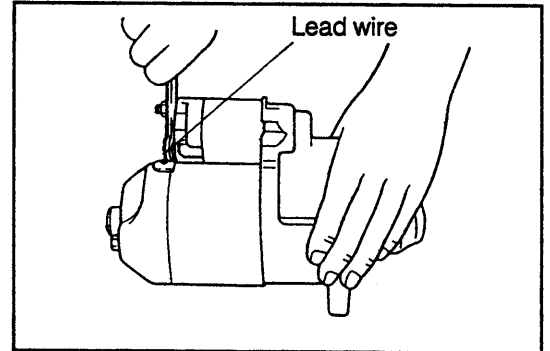
## STARTING SYSTEM

5. Removal of starter motor attaching bolts
  - (1) Remove the upper attaching bolt.
  - (2) Remove the lower attaching bolt from the underside of the vehicle.
6. Remove the starter motor.

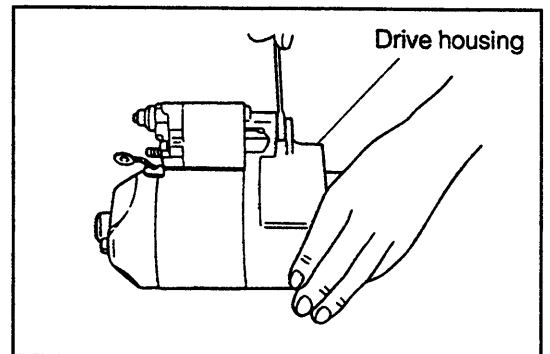
WN88E-ST007

### DISASSEMBLY OF CONVENTIONAL STARTER MOTOR

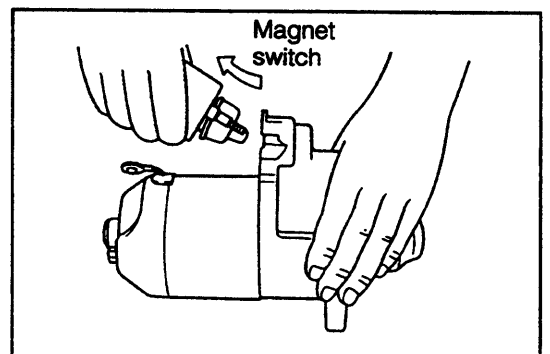
1. Disconnect the lead wire from the magnetic switch.
2. Remove the attaching nut of the magnetic switch from the drive housing.
3. Remove the magnetic switch from the drive housing.
4. Remove the end frame cover by removing the two screws.



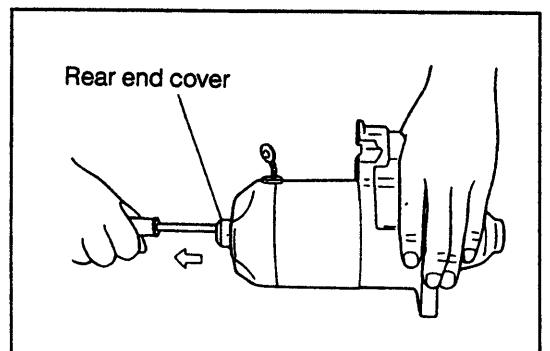
WR88-ST014



WR88-ST015



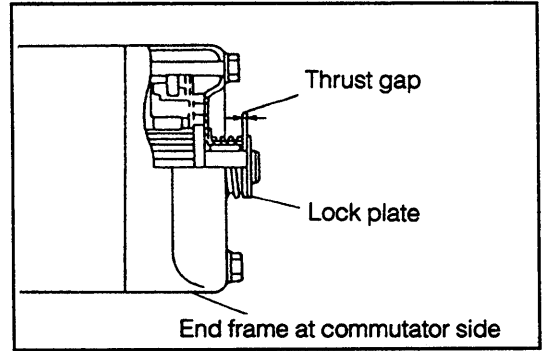
WR88-ST016



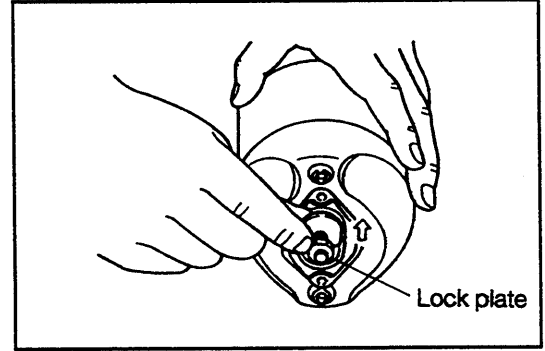
WR88-ST017

- Using a thickness gauge, measure the thrust clearance of the armature shaft at a point between the lock plate and the end frame.

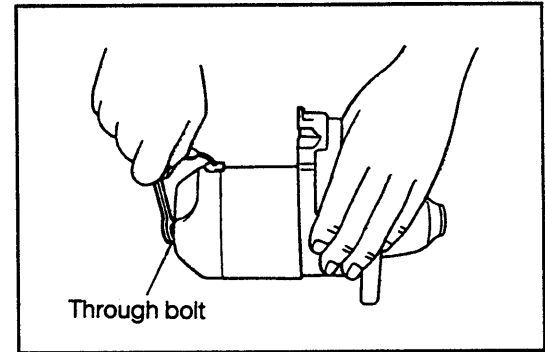
Thrust Clearance: 0.05 - 0.60 mm (0.002 - 0.024 inch)



- Remove the lock plate, brake spring and rubber from the commutator end frame.



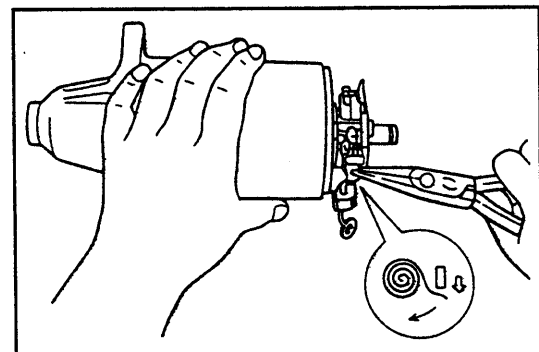
- Remove the commutator end frame from the field frame by removing the two through bolts.



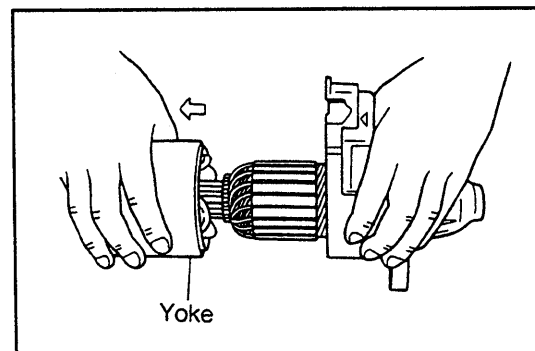
- Remove the brushes from the brush holder by lifting the brush springs by means of nose pliers or the like.

**NOTE:**

Care must be exercised not to scratch the commutator during the removal.



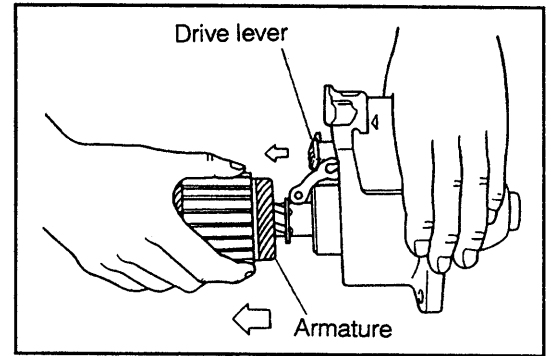
- Remove the yoke from the armature.





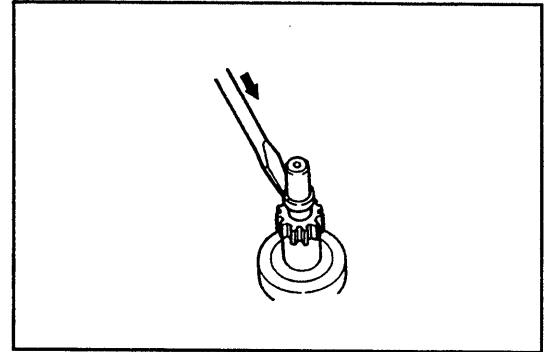
# STARTING SYSTEM

10. Remove the drive lever and armature from the drive housing.



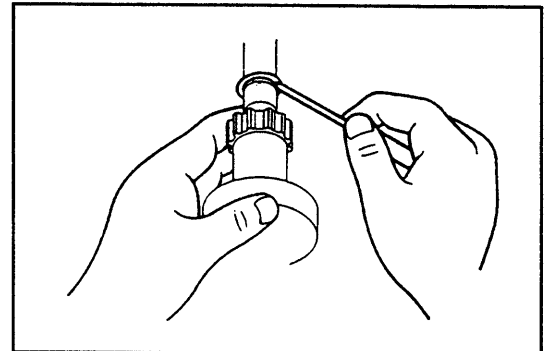
WR88-ST023

11. Remove the stop collar from the snap ring by tapping the collar with a screwdriver or the like placed on it.



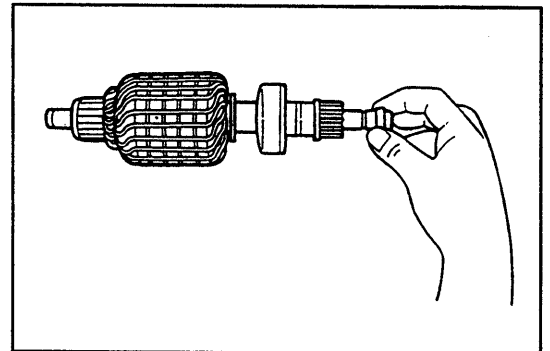
WR88-ST024

12. Remove the snap ring by prying it off with a screwdriver.



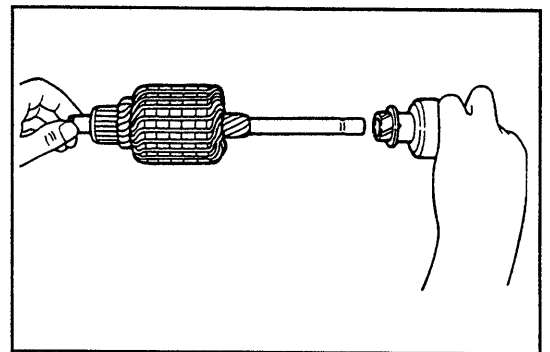
WR88-ST025

13. Remove the collar.



WR88-ST026

14. Remove the clutch.

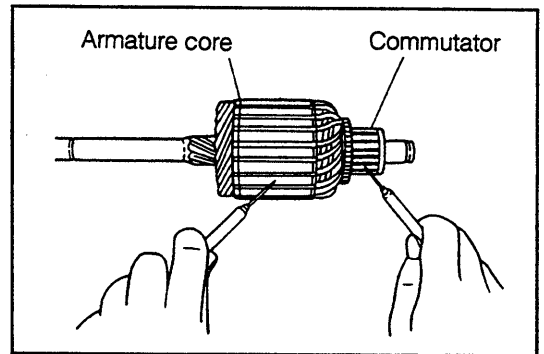


WR88-ST027

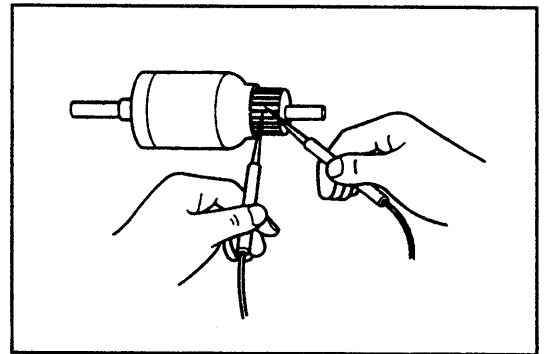
## INSPECTION OF CONVENTIONAL STARTER

### Armature Coil

1. Check of armature insulation  
Ensure that no continuity exists between the commutator and the armature coil, using an ohmmeter.  
If continuity exists, replace the armature.
2. Check of commutator continuity  
Check continuity between each adjacent segment of the commutator, using an ohmmeter.  
If no continuity exists between any adjacent segments, replace the armature.



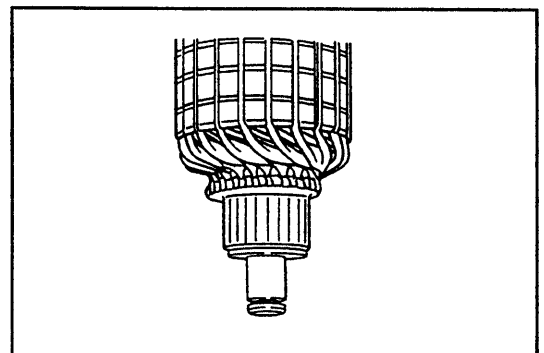
WR88-ST028



WR88-ST029

### Commutator

1. Check each contact surface of the commutator segments with the brushes for burning.  
If the surfaces are dirty or burnt, correct the commutator surfaces, using abrasive paper (No. 400) or a lathe.

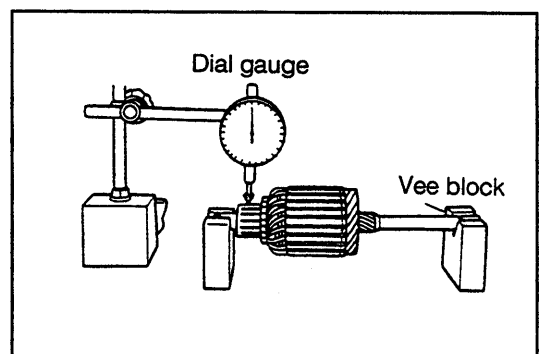


WR88-ST030

2. Check of commutator for circle runout  
Support the armature at its both ends on a Vee block.  
Check the commutator for circle runout, using a dial gauge.  
**Circle Runout Limit: 0.40 mm (0.016 inch)**

If the circle runout exceeds the allowable limit, turn down the commutator on a lathe.

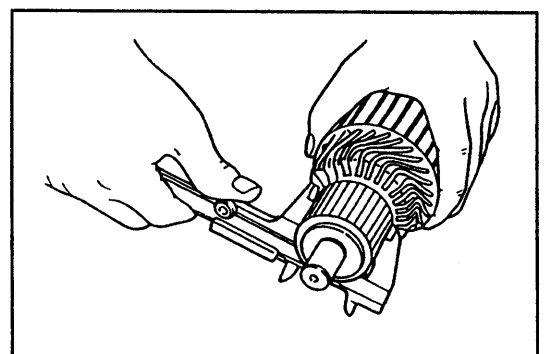
At this point, care must be exercised to ensure that the commutator diameter is not less than the minimum requirement diameter of 27 mm (1.063 inch).



WR88-ST031

3. Measurement of commutator diameter  
Measure the commutator diameter by means of a micrometer or vernier caliper.  
**Standard Diameter: 28 mm (1.102 inch)**  
**Minimum diameter: 27 mm (1.063 inch)**

If the commutator diameter is less than the minimum diameter, replace the armature.

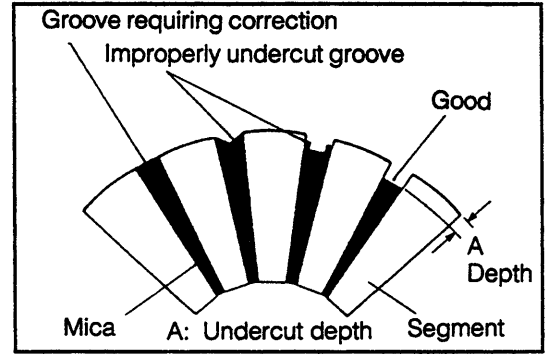


WR88-ST032

# STARTING SYSTEM

## 4. Check of commutator undercut

If the depth of the insulator groove between commutator segments is less than 0.2 mm (0.0079 inch). It is necessary to undercut the insulator so that the groove depth may become 0.5 - 0.8 mm (0.020 - 0.031 inch).

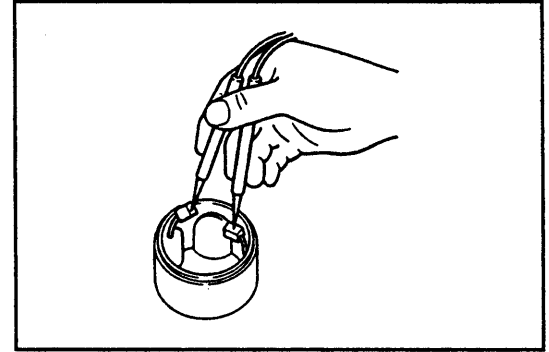


WR88-ST033

## Yoke

### 1. Field coil continuity test

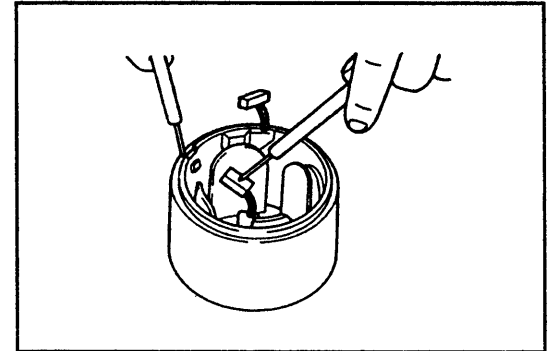
Perform field coil continuity test at a point between the lead wire and the brush, using an ohmmeter. If no continuity exists, replace the yoke



WR88-ST034

### 2. Field coil short test

Perform field coil short test at a point between the brush and the yoke proper, using an ohmmeter. If no continuity exists, replace the yoke.



WR88-ST035

## Brushes

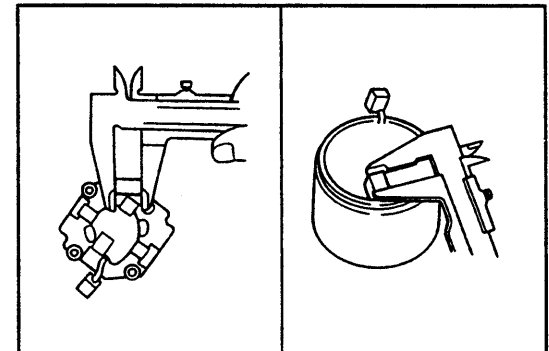
### Measurement of brush length

Measure the brush length, using vernier calipers.

**Standard Length:** 16 mm (0.63 inch)

**Minimum length:** 10.5 mm (0.41 inch)

If the length is less than the minimum requirement, replace the brush holder or the yoke, as required.



WR88-ST036

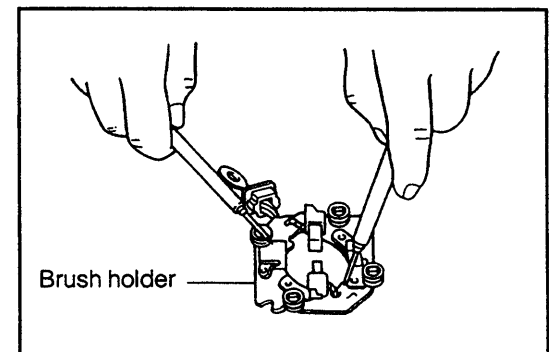
## Brush Holder

### Check of brush holder for insulation

Measure the insulation between the positive and negative terminals of the brush holder, using an ohmmeter.

**Insulation Resistance:** 100 MΩ or more

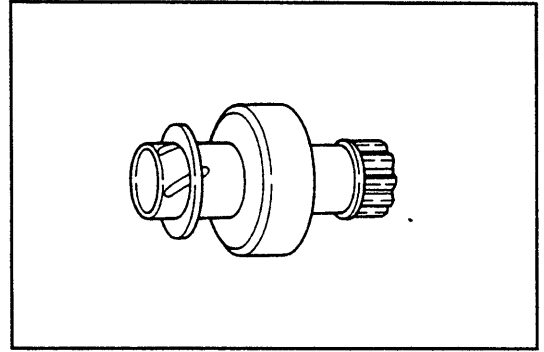
If the insulation resistance is less than the specification, replace the brush holder.



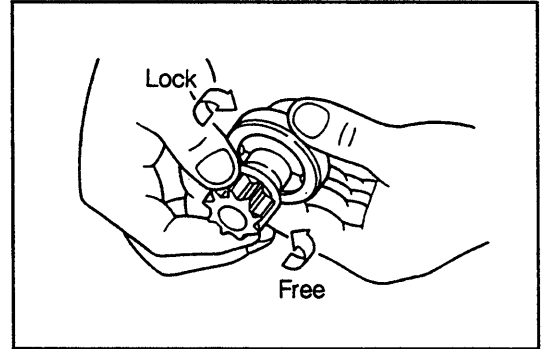
WR88-ST-037

## Clutch

1. Inspection of pinion gear and spline teeth  
Check the teeth of the pinion gear and spline for wear or damage.  
If the teeth exhibit any damage, replace the clutch. Also, inspect the flywheel ring gear for wear or damage.
2. Check of starter clutch  
While holding the clutch, turn the pinion clockwise. Ensure that the pinion turns smoothly.  
Turn the pinion counterclockwise. Ensure that the pinion is locked.  
If the check results are unsatisfactory, replace the starter clutch.



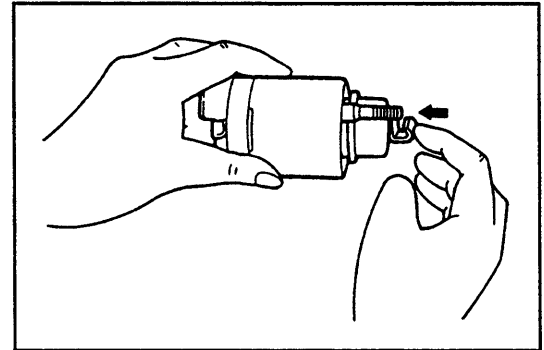
WR88-ST038



WR88-ST039

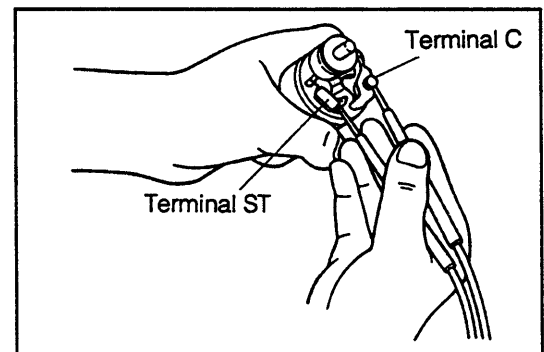
## Magnetic Switch

1. Plunger check  
Push in the plunger with your fingers and release your fingers. Ensure that the plunger returns quickly to the original position. If the plunger exhibits poor returning or fails to return, replace the magnetic switch.
2. Pull-in coil open circuit test  
Using an ohmmeter, ensure that continuity exists between the terminal ST and terminal C.  
If no continuity exists, replace the magnetic switch.

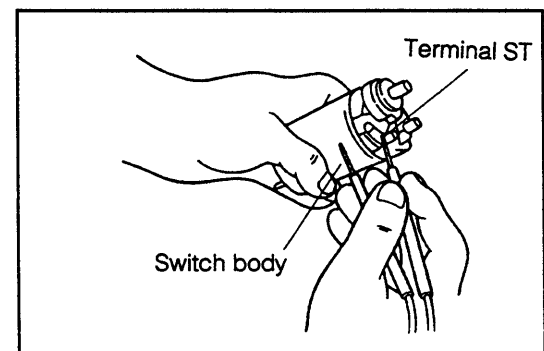


WR88-ST040

3. Hold-in coil open circuit test  
Ensure that continuity exists between the terminal ST and the switch body.  
If no continuity exists, replace the magnetic switch.



WR88-ST041

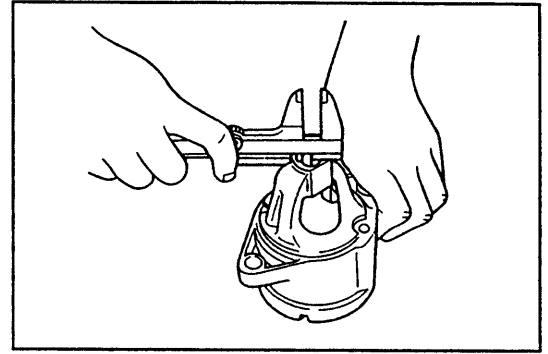


WR88-ST042

# STARTING SYSTEM

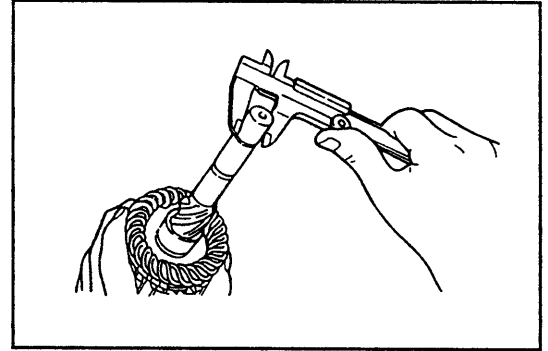
## Check of Bush-To-Shaft Clearance

1. Measure the inner diameters of the bushes of the drive housing and commutator end frame.



WR88-ST043

2. Measure the outer diameter of the armature bearing section.



WR88-ST044

3. Determine the clearance by subtracting the outer diameter of the armature bearing section from the inner diameter of the drive shaft.

**Clearance Limit: 0.2 mm (0.0079 inch)**

If the clearance exceeds the limit, replace the drive housing bearing.

WR88-ST045

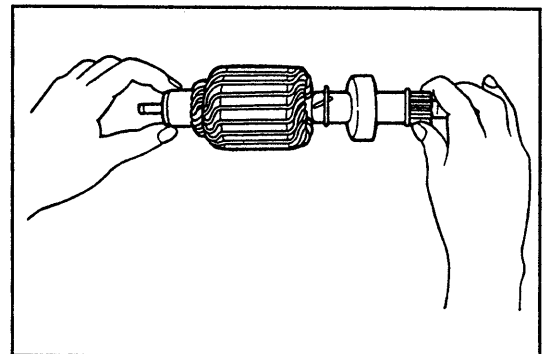
## ASSEMBLY OF CONVENTIONAL STARTER

(See page ST-3.)

### NOTE:

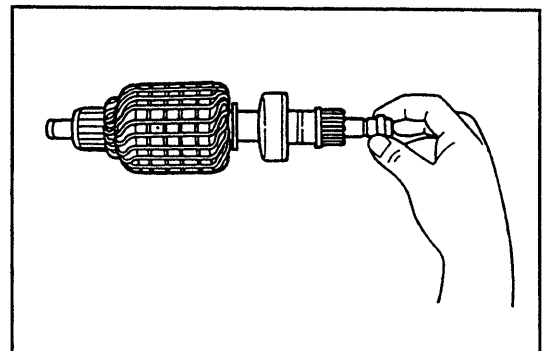
Use high-temperature grease to lubricate the bearings and sliding parts when assembling the starter.

1. Install the clutch on the armature shaft.



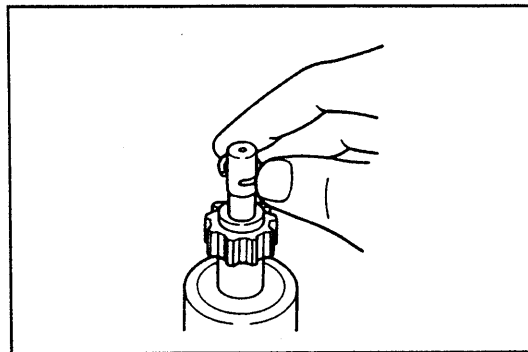
WR88-ST046

2. Install the collar on the armature shaft.



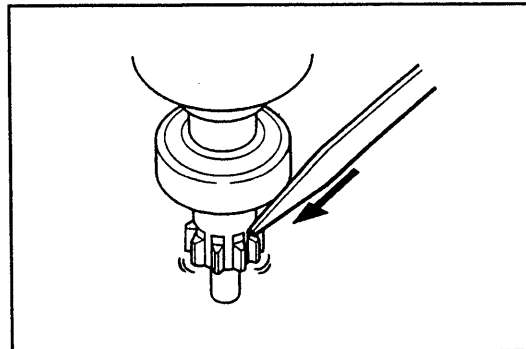
WR88-ST047

3. Fit the snap ring onto the armature shaft.



WR88-ST048

4. Tap the pinion so that the collar may come onto the snap ring, using a screwdriver.

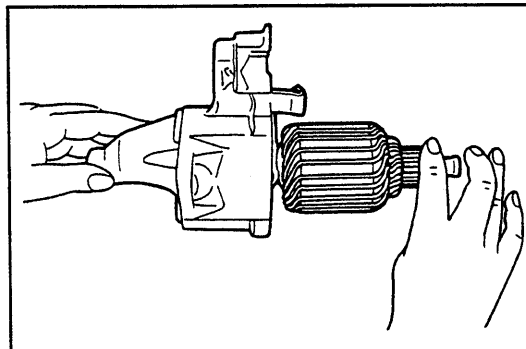


WR88-ST049

5. Install the drive lever and armature in the drive housing.

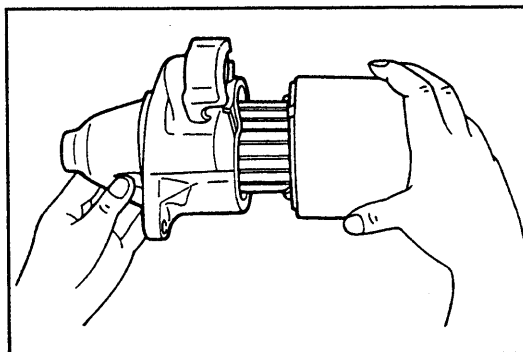
**NOTE:**

Apply high-temperature grease to the sliding sections of the armature shaft and drive lever.



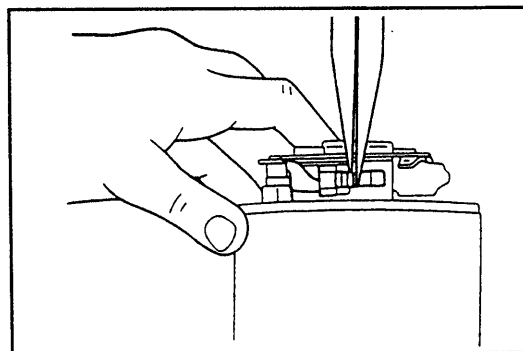
WR88-ST050

6. Install the yoke in the drive housing.



WR88-ST051

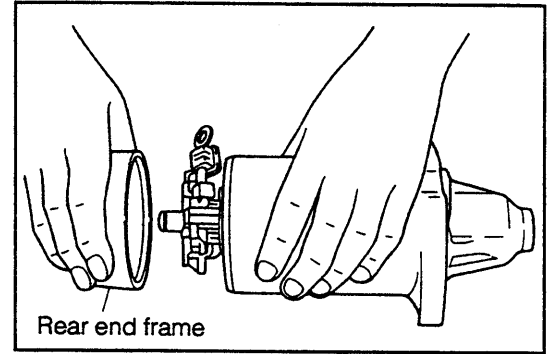
7. Install the brush holder over the armature shaft.
8. While the brush springs are held in a raised state by means of nose pliers or a piece of wire, install the brushes (four pieces) in the brush holder.



WR88-ST052

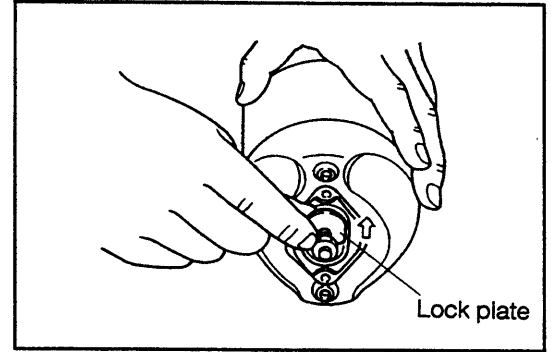
## STARTING SYSTEM

9. Attach the commutator end frame to the stator yoke assembly with the two through bolts.



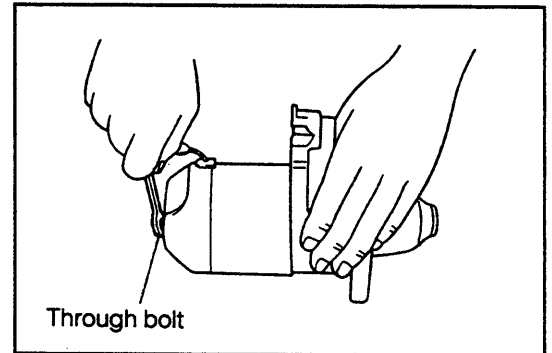
WR88-ST053

10. Install the rubber, brake spring and lock plate in this order onto the armature shaft.



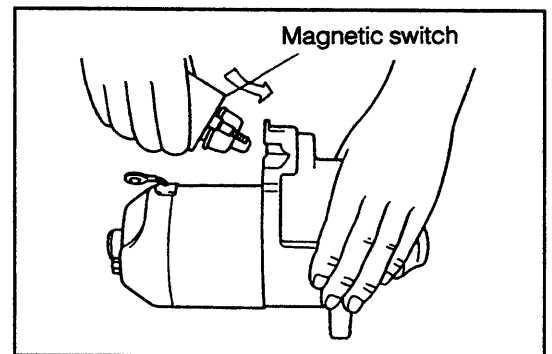
WR88-ST054

11. Install the rear end frame cover in place with the two screws.



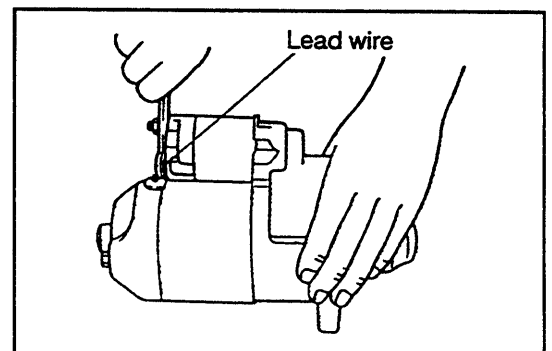
WR88-ST055

12. While hooking the magnetic switch over the drive lever, install the magnetic switch onto the drive housing. Secure the magnetic switch with the two nuts.



WR88-ST056

13. Connect the lead wire to the magnetic switch.



WR88-ST057

## PERFORMANCE TEST OF CONVENTIONAL STARTER MOTOR

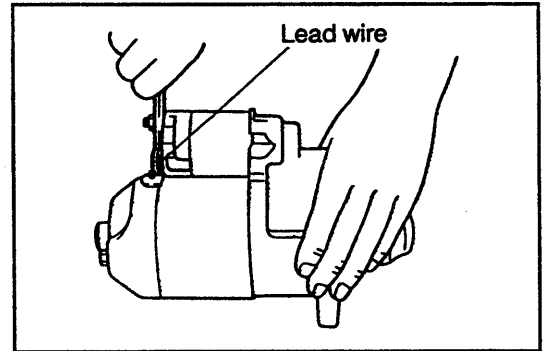
### CAUTION:

Each of the following tests must be performed within three to five seconds. If you fail to observe this caution and the starter is energized for more than this duration, the coil may be burnt out.

WR88-ST058

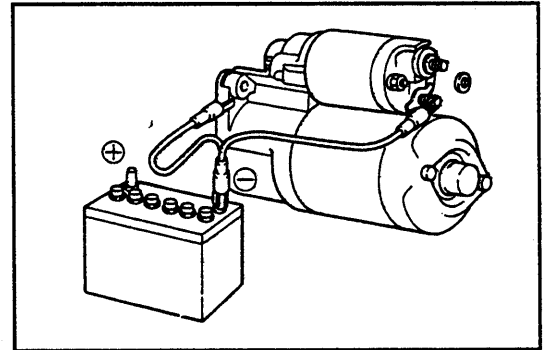
### 1. Pull-in Test

- (1) Disconnect the lead wire from the magnetic switch terminal.



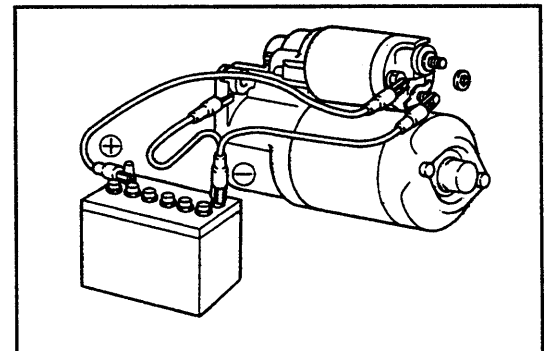
WR88-ST059

- (2) Connect the negative (-) terminal of the battery to the starter body and magnetic switch terminal.



WR88-ST060

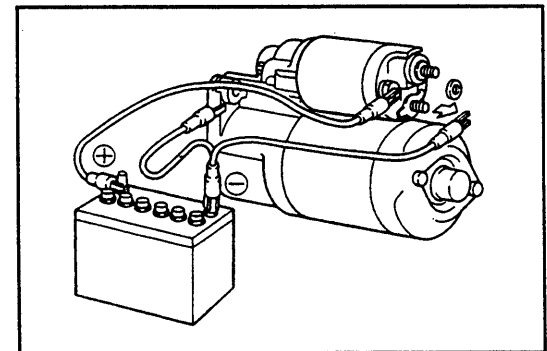
- (3) Connect the positive (+) terminal to the terminal ST. Ensure that the pinion is pushed outward. If the drive pinion fails to move out, replace the magnetic switch.



WR88-ST061

### 2. Hold-in Test

After the check has been performed following the same procedure as with the pull-in test, disconnect the negative terminal of the magnetic switch terminal. Ensure that the drive pinion is held in a pushed-out state. If the drive pinion fails to be held, replace the magnetic switch.



WR88-ST062

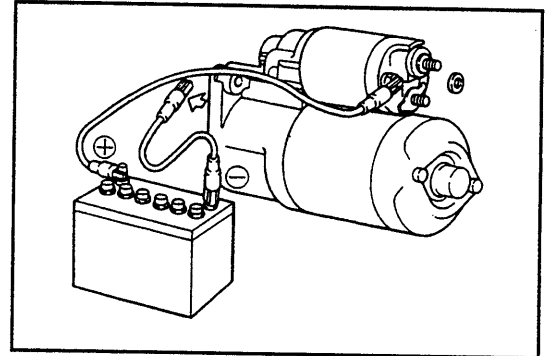


# STARTING SYSTEM

## 3. Inspection of Plunger Return

After the check has been performed following the same procedure as with the hold-in test, disconnect the ground terminal of the starter body. Ensure that the drive pinion is drawn into the drive housing.

If the drive pinion fails to be drawn, replace the magnetic switch.



WR88-ST063

## 4. No-load Performance Test

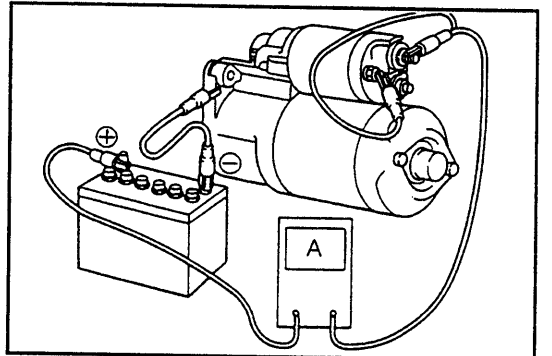
Connect the battery and an ammeter to the starter as shown in the right figure. Ensure that the starter rotates smoothly with the pinion moving out.

Measure the current the starter is drawing.

Specified Current: Less Than 50A at 11V

### NOTE:

Prior the test, be sure to connect the lead wire to the magnetic switch.

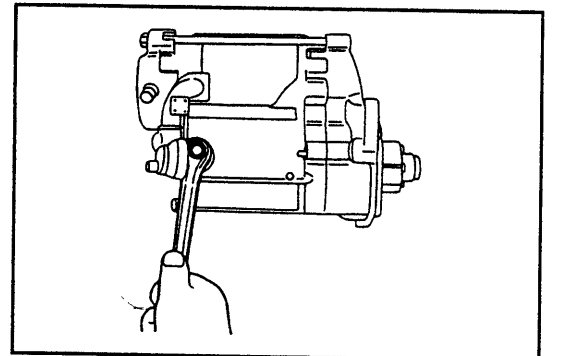


WR88-ST064

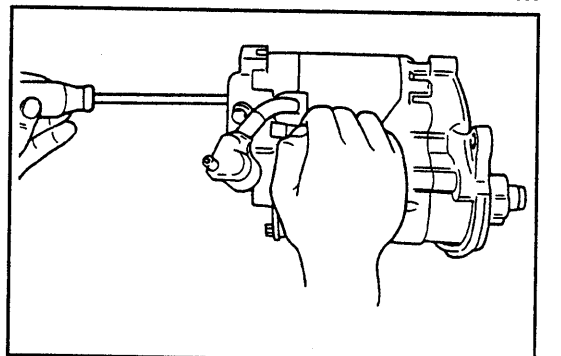
## DISASSEMBLY OF REDUCTION TYPE STARTER MOTOR

(See page ST-4.)

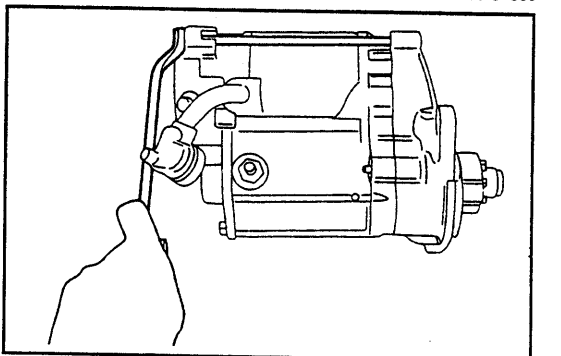
1. Disconnect the lead wire from the magnetic switch.
2. Remove the brush holder retaining screws from the commutator end frame.
3. Remove the two through bolts from the commutator end frame.



WN88E-ST008

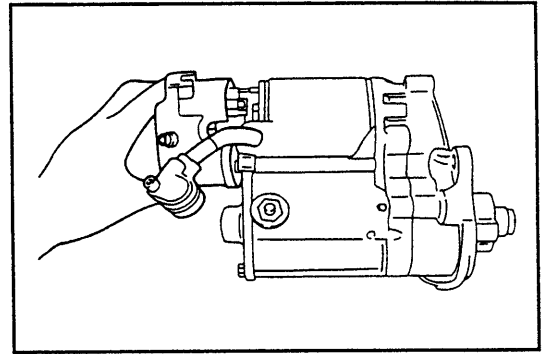


WR88-ST066

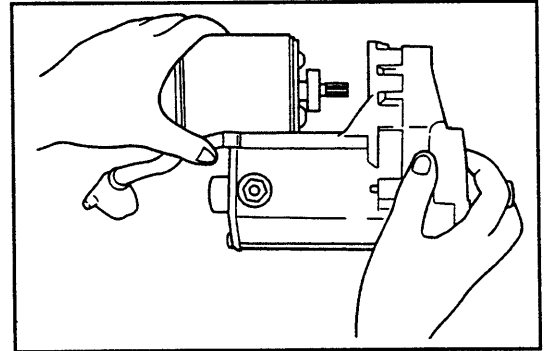


WR88-ST067

4. Remove the commutator end frame and "O" ring.



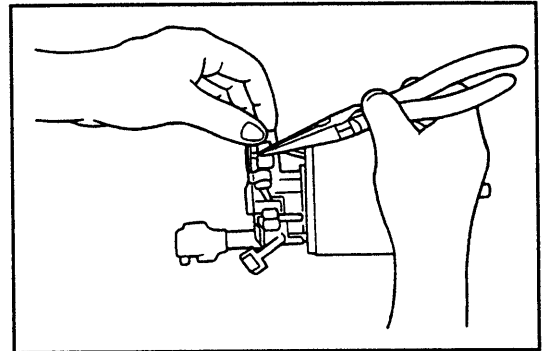
5. Remove the yoke together with the armature from the drive housing.
6. Remove the "O" ring.



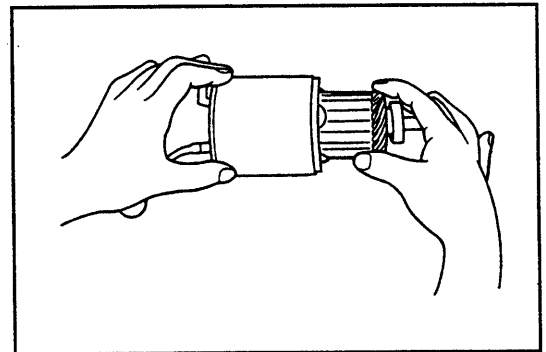
7. Remove the brushes from the brush holder by means of nose pliers or the like.

**NOTE:**

Care must be exercised not to damage the brushes during the removal.

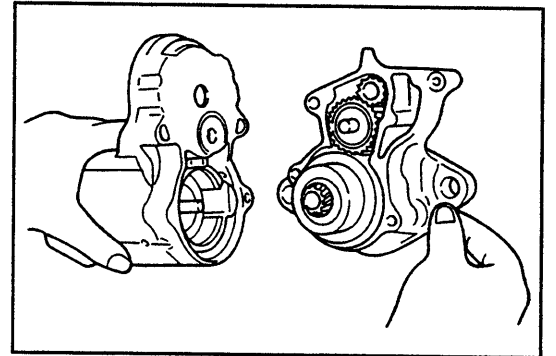
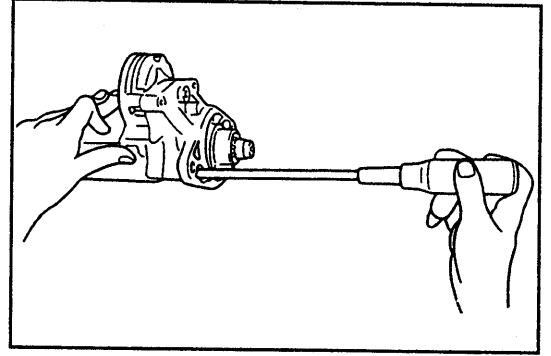


8. Remove the armature from the yoke, being very careful not to damage the brushes.



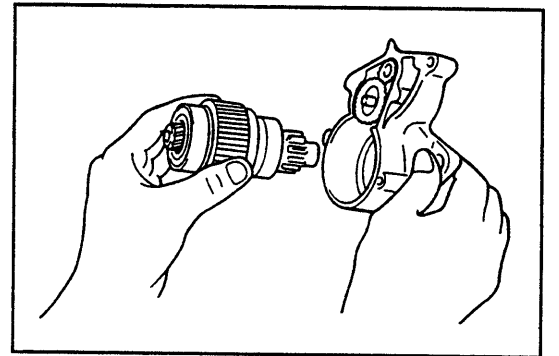
# STARTING SYSTEM

9. Remove the starter switch assembly from the drive housing by removing the two screws.



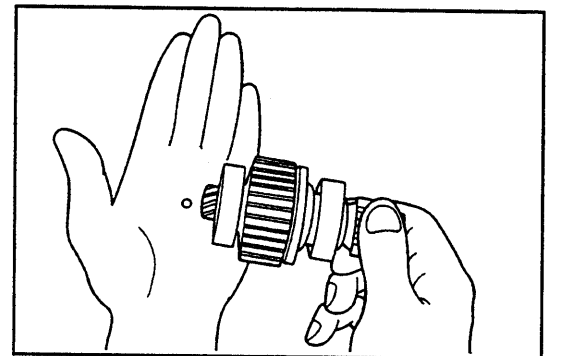
WR88-ST072

10. Remove the clutch assembly from the drive housing.



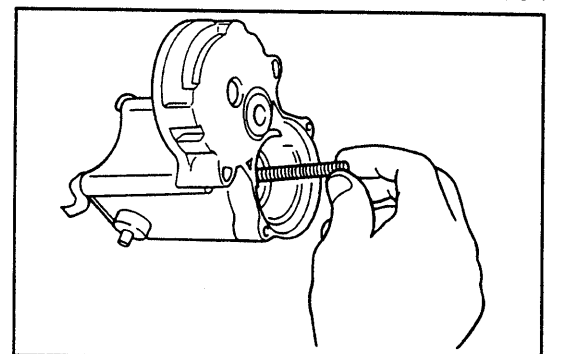
WR88-ST073

11. Remove the steel ball from the clutch assembly.



WR88-ST074

12. Remove the return spring from the starter switch assembly.

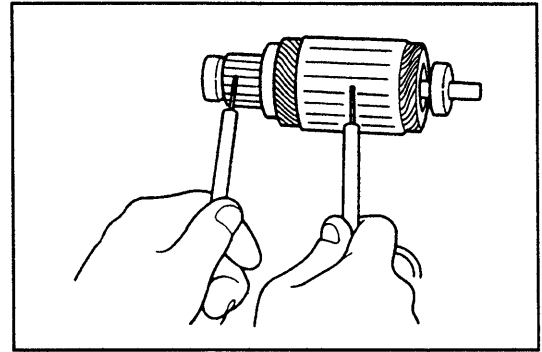


WR88-ST075

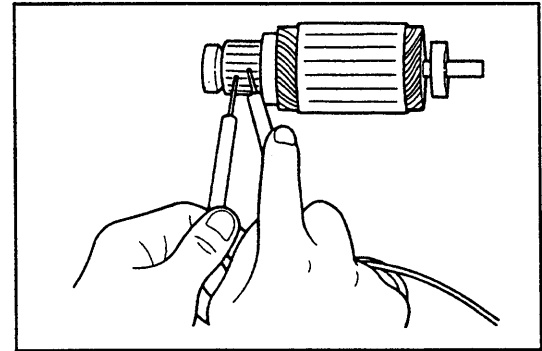
**INSPECTION OF REDUCTION TYPE STARTER MOTOR**

**Armature Coil**

1. Check of armature insulation  
 Ensure that no continuity exists between the commutator and the armature coil, using an ohmmeter.  
 If continuity exists, replace the armature.
  
2. Check of commutator continuity  
 Check continuity between each adjacent segment of the commutator, using an ohmmeter.  
 If no continuity exists between any adjacent segments, replace the armature.



WR88-ST076



WR88-ST077

**Commutator**

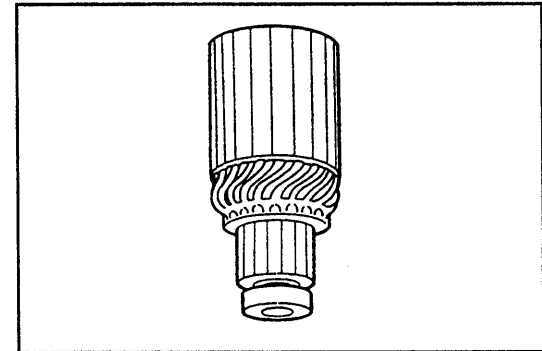
1. Check each contact surface of the commutator segments with the brushes for burning.  
 If the surfaces are dirty or burnt, correct the commutator surfaces, using abrasive paper (No. 400) or a lathe.
  
2. Check of commutator for circle runout  
 Support the armature at its both ends on a Vee block.  
 Check the commutator for circle runout, using a dial gauge.  
**Circle Runout Limit: 0.05 mm (0.0020 inch)**

If the circle runout exceeds the allowable limit, turn down the commutator on a lathe.

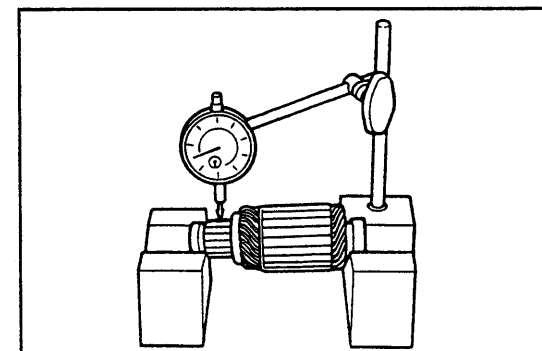
At this point, care must be exercised to ensure that the commutator diameter is not less than the minimum requirement diameter of 29.0 mm (1.142 inch).

3. Measurement of commutator diameter  
 Measure the commutator diameter by means of a micrometer or vernier caliper.  
**Standard Diameter: 30.0 mm (1.181 inch)**  
**Minimum Diameter: 29.0 mm (1.142 inch)**

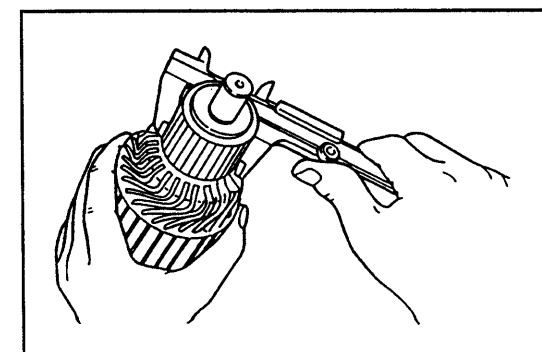
If the commutator diameter is less than the minimum diameter, replace the armature.



WR88-ST078



WR88-ST079

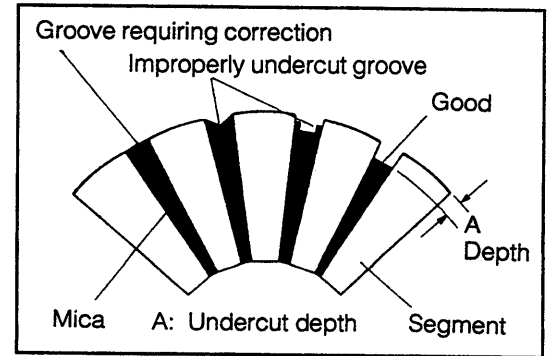


WR88-ST080

# STARTING SYSTEM

## 4. Check of commutator undercut

If the depth of the insulator groove between commutator segments is less than 0.2 mm (0.0079 inch), it is necessary to undercut the insulator so that the groove depth may become 0.6 mm (0.024 inch).

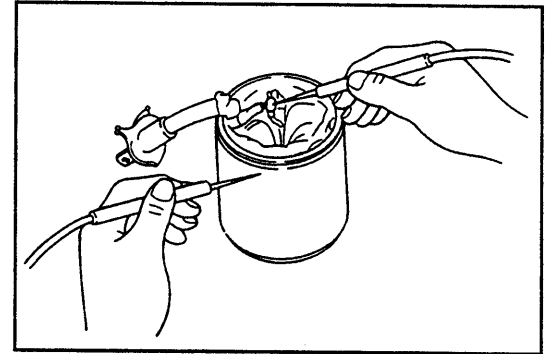


WR88-ST081

## Yoke

### 1. Field coil continuity test

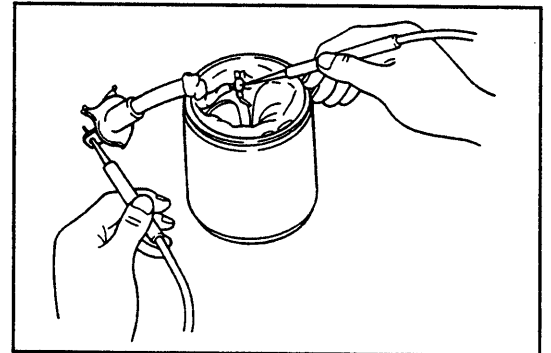
Perform field coil continuity test at a point between the lead wire and the brush, using an ohmmeter. If no continuity exists, replace the yoke.



WR88-ST082

### 2. Field coil short test

Perform field coil short test at a point between the brush and the yoke proper, using an ohmmeter. If no continuity exists, replace the yoke.



WR88-ST083

## Brushes

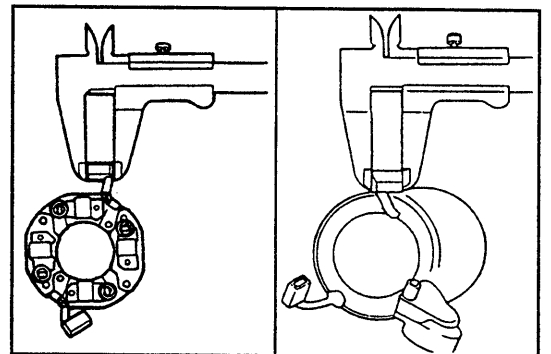
### Measurement of brush length

Measure the brush length, using vernier calipers.

**Standard Length:** 13.0 mm (0.51 inch)

**Minimum Length:** 8.5 mm (0.33 inch)

If the length is less than the minimum requirement, replace the brush holder or the yoke, as required.



WR88-ST084

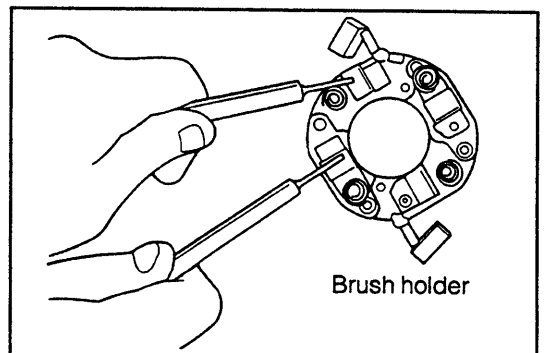
## Brush Holder

### Check of brush holder for insulation

Measure the insulation between the positive and negative terminals of the brush holder, using an ohmmeter.

**Insulation Resistance:** 100 MΩ or more

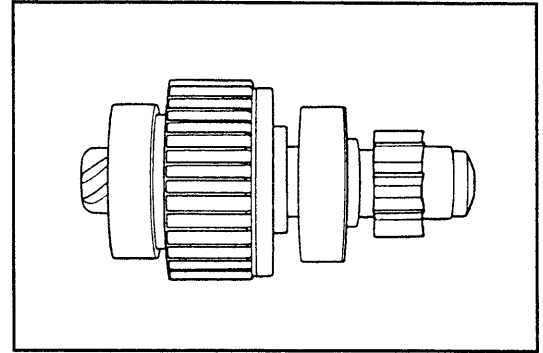
If the insulation resistance is less than the specification, replace the brush holder.



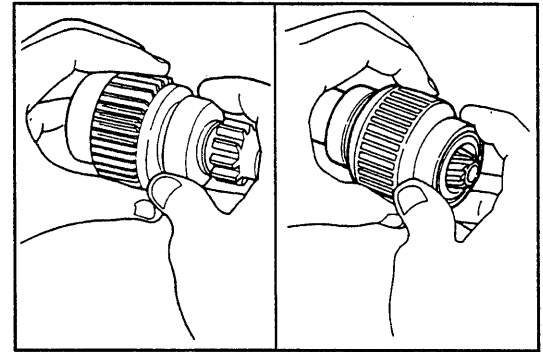
WR88-ST085

## Clutch

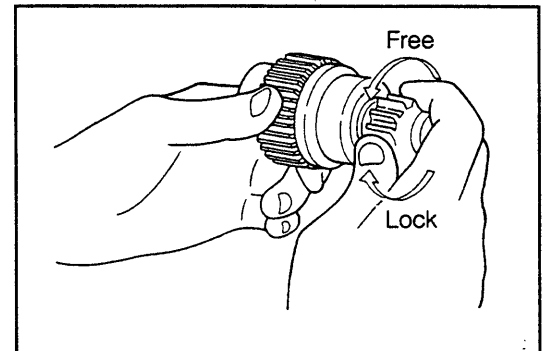
1. Inspection of pinion gear and spline teeth  
Check the teeth of the pinion gear and spline for wear or damage.  
If the teeth exhibit any damage, replace the clutch. Also, inspect the flywheel ring gear for wear or damage.
2. Bearing check  
Lightly turn the bearing hand. Ensure that the bearing turns smoothly.
3. Check of starter clutch  
While holding the clutch, turn the pinion clockwise. Ensure that the pinion turns smoothly.  
Turn the pinion counterclockwise. Ensure that the pinion is locked.  
If the check results are unsatisfactory, replace the starter clutch.



WR88-ST086



WR88-ST087



WR88-ST088

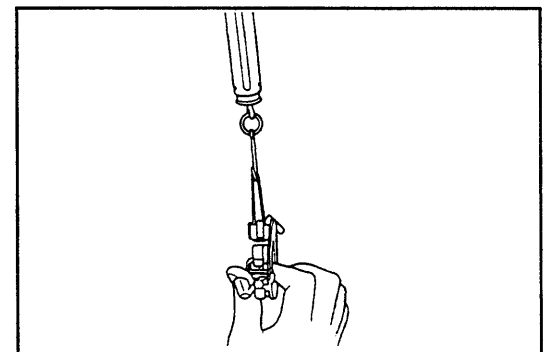
## Brush Spring

Measure the brush spring tension, using spring scale.

**Tension with Spring Installed:**

1.785 - 2.415 kg (3.94 - 5.32 lb)

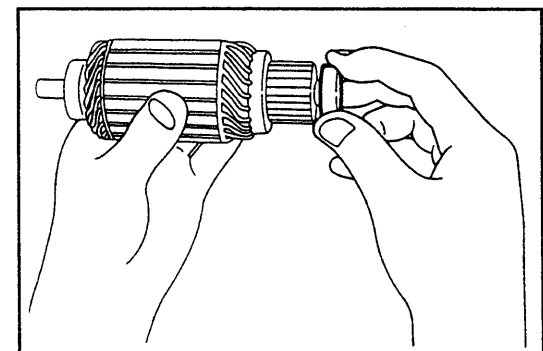
If the spring tension is less than the specification, replace the spring.



WR88-ST089

## Bearing

1. Inspection of bearings  
Turn the bearing while applying a force to it by your hand.  
Ensure that the bearing turns smoothly. If the bearing fails to turn smoothly, replace the bearing.

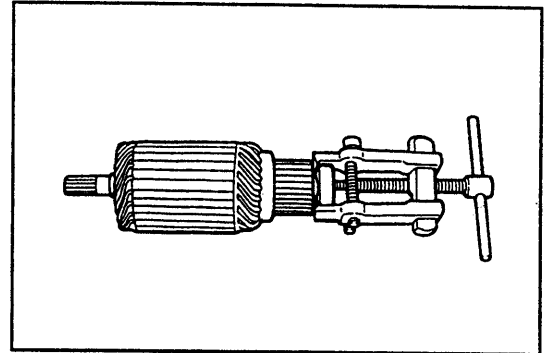


WR88-ST090

# STARTING SYSTEM

## 2. Bearing replacement (Only when bearing is faulty)

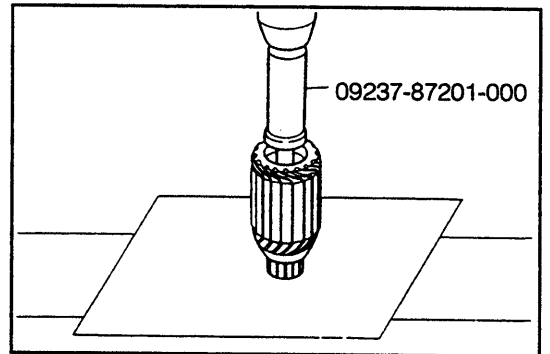
(1) Remove the bearing, using a armature bearing puller.



WR88-ST091

(2) Press the bearing into the armature shaft, using a press in conjunction with the SST.

SST: 09237-87201-000



09237-87201-000

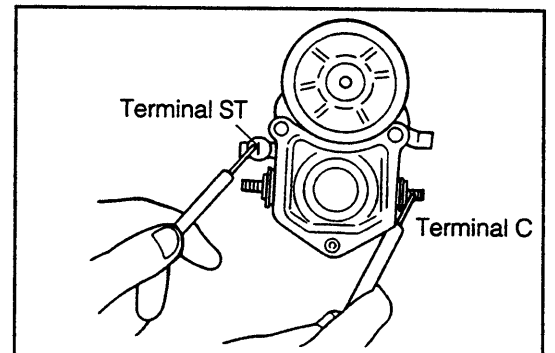
WR88-ST092

## Magnetic Switch

### 1. Pull-in coil test

Using an ohmmeter, ensure that continuity exists between the terminal ST of the starter and the terminal C.

If no continuity exists, replace the magnetic switch.

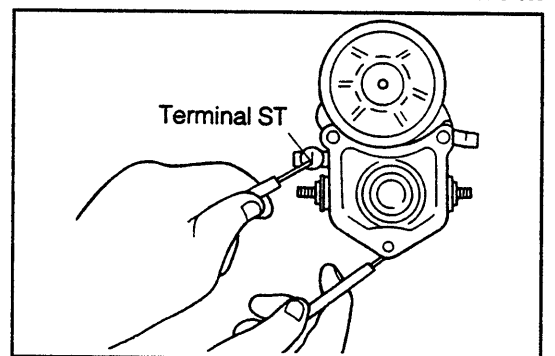


WR88-ST093

### 2. Hold-in coil test

Ensure that continuity exists between the terminal ST of the magnetic switch and the switch body.

If no continuity exists, replace the magnetic switch.

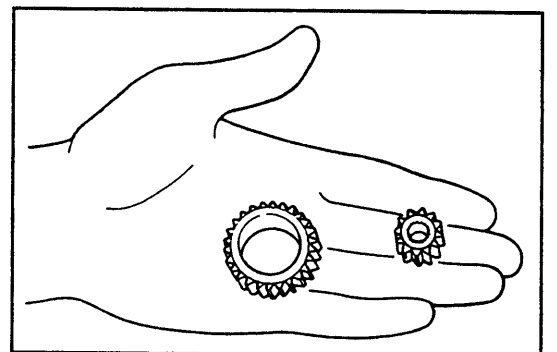


WR88-ST094

## Gears

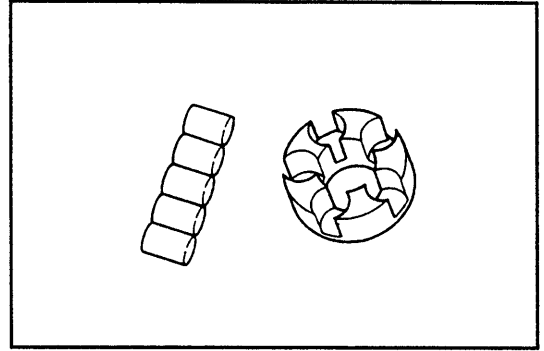
1. Check the starter drive pinion and starter idle gear for damage or wear.

Replace the gear which exhibits damage or wear.



WR88-ST095

2. Check the starter idle gear clutch and clutch retainer for damage or wear.  
Replace the clutch or retainer, as required.



WR88-ST096

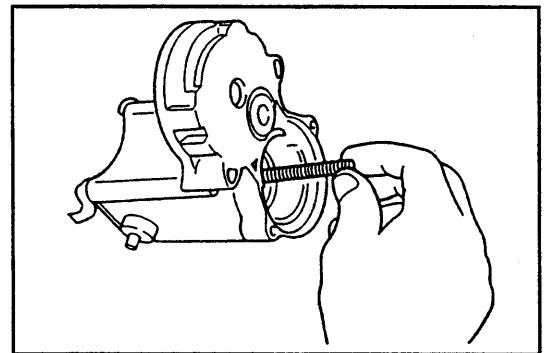
## ASSEMBLY OF REDUCTION TYPE STARTER MOTOR

(See page ST-4.)

### NOTE:

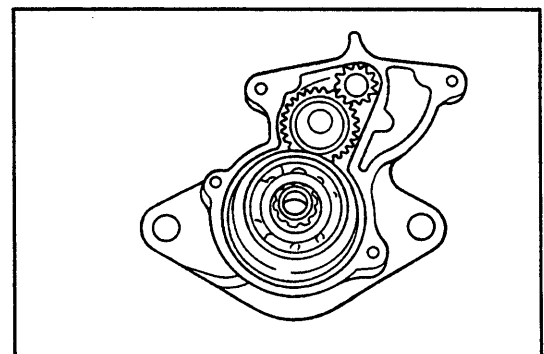
Use high-temperature grease to lubricate the bearings and gears when assembling the starter.

1. Install the return spring in the starter switch assembly.



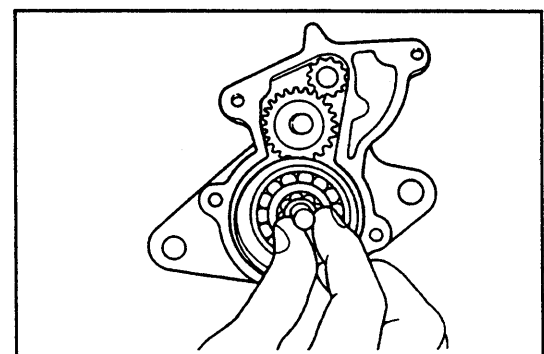
WR88-ST097

2. Fit the steel ball in the starter clutch assembly.



WR88-ST098

3. Assemble the starter clutch housing, idle gear clutch retainer, idle gear clutch roller and starter drive pinion in the starter drive housing.



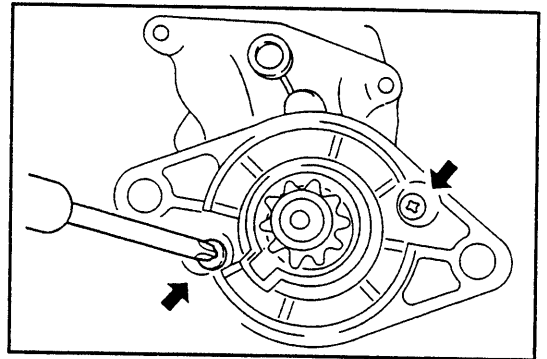
WR88-ST099

WR88-ST100



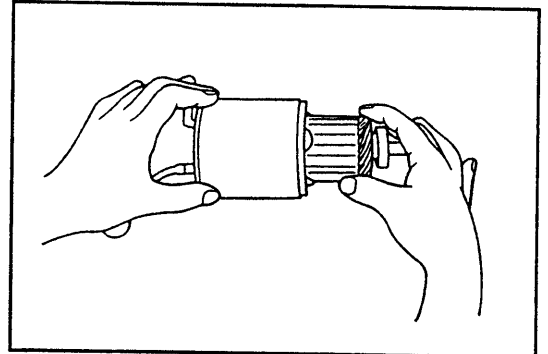
## STARTING SYSTEM

4. Install the starter magnetic switch assembly in the starter drive housing. Secure the switch assembly with the two screws.



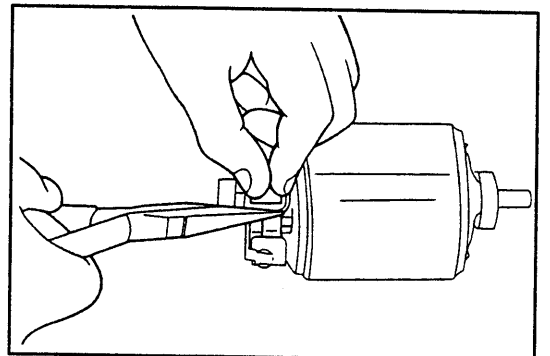
WR88-ST101

5. Insert the armature into the yoke.



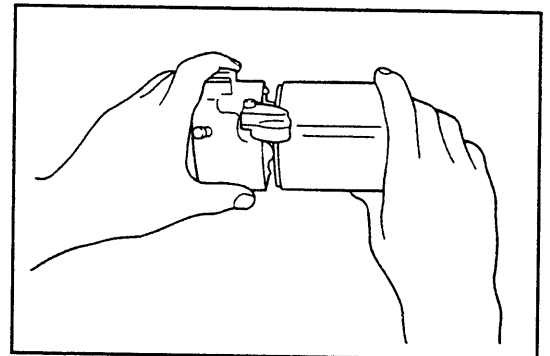
WR88-ST102

6. While the brush holder is held in a raised state by means of a screwdriver or nose pliers, insert the brushes.



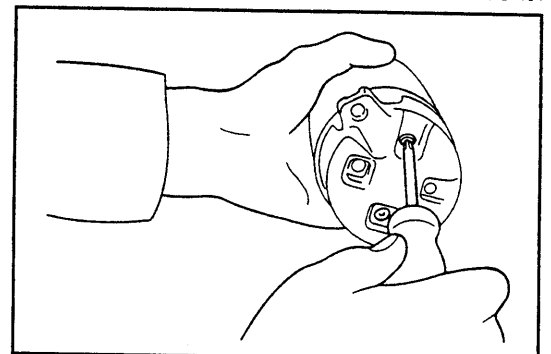
WR88-ST103

7. Attach the commutator end frame to the yoke with a new "O" ring interposed.



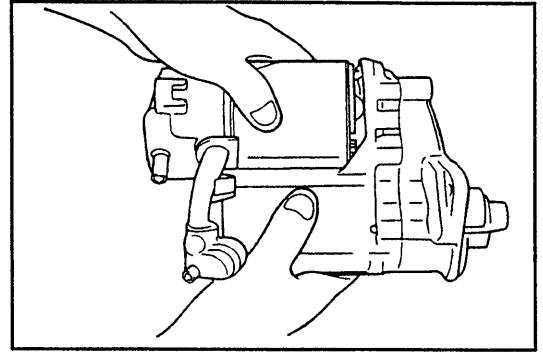
WR88-ST104

8. Install the brush holder on the end frame, using the two screws.



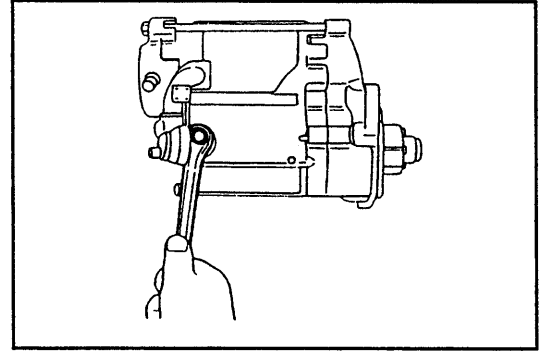
WR88-ST105

9. Install the yoke on the drive housing with a new "O" ring interposed. Make sure that the cut-out marks are aligned with each other. Secure the yoke with the two through bolts.



WR88-ST106

10. Connect the lead wire to the magnetic switch terminal.



WR88-ST107

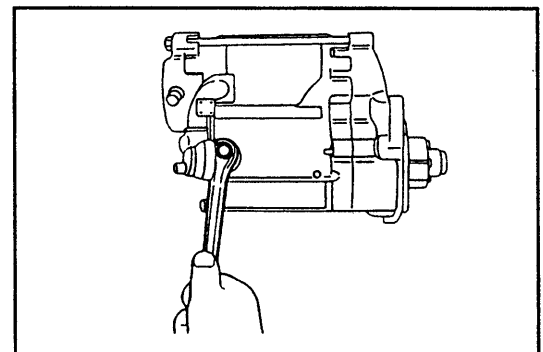
## PERFORMANCE TEST OF REDUCTION TYPE STARTER MOTOR

### CAUTION:

Each of the following tests must be performed within three to five seconds. If you fail to observe this caution and the starter is energized for more than this duration, the coil may be burnt out.

### 1. Pull-in Test

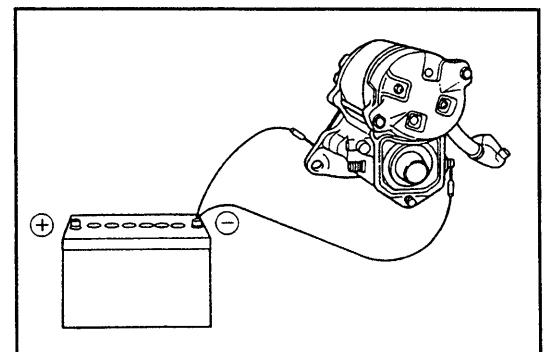
- (1) Disconnect the lead wire from the magnetic switch terminal.



WR88-ST108

WR88-ST109

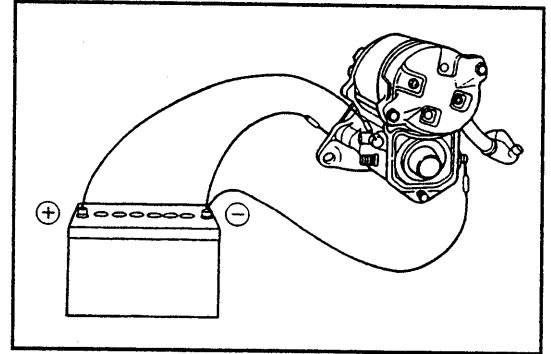
- (2) Connect the negative (-) terminal of the battery to the starter body and magnetic switch terminal.



WR88-ST110

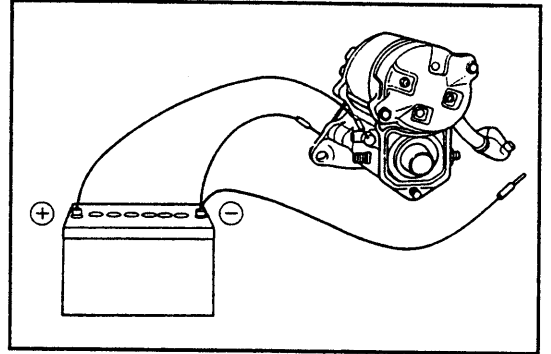
# STARTING SYSTEM

- (3) Connect the positive (+) terminal to the terminal ST.  
Ensure that the pinion is pushed outward.  
If the drive pinion fails to move out, replace the magnetic switch.



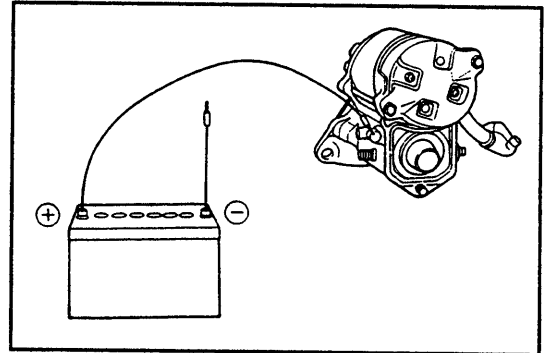
## 2. Hold-in Test

After the check has been performed following the same procedure as with the pull-in test, disconnect the negative terminal of the magnetic switch terminal. Ensure that the drive pinion is held in a pushed-out state. If the drive pinion fails to be held, replace the magnetic switch.



## 3. Inspection of Plunger Return

After the check has been performed following the same procedure as with the hold-in test, disconnect the ground terminal of the starter body. Ensure that the drive pinion is drawn into the drive housing. If the drive pinion fails to be drawn into the drive housing, replace the clutch assembly and return spring.



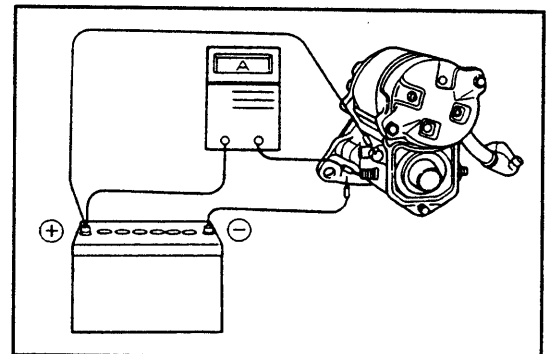
## 4. No-load Performance Test

Connect the battery and an ammeter to the starter as shown in the right figure. Ensure that the starter rotates smoothly with the pinion moving out.

Measure the current the starter is drawing:  
Specified Current: Less Than 90A at 11.5V

### NOTE:

Prior to test, be sure to connect the lead wire to the magnetic switch.



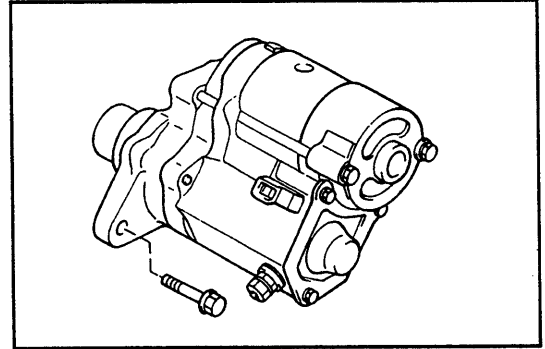
## INSTALLATION OF REDUCTION TYPE STARTER MOTOR

1. Install the starter motor to the bell housing.

WR88-ST115

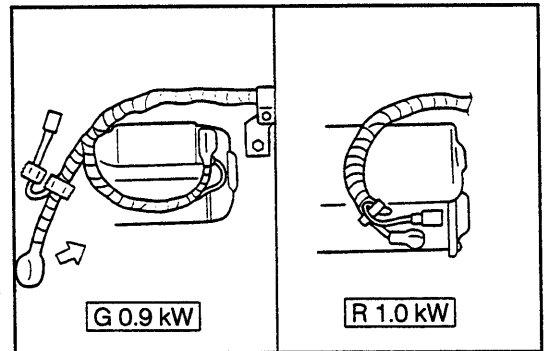
2. Tighten the attaching bolts of the starter motor to the specified torque.

**Tightening Torque: 5.0 - 7.0 kg-m (36.2 - 50.6 ft-lb)**



WR88-ST116

3. Jack up the vehicle and remove the safety stands.
4. Attach the wire harness to the clamp. Tighten the clamp bolt.
5. Connect the starter terminal B of the alternator wire to the starter.



WN88E-ST009

6. Connect the starter terminal ST of the alternator wire to the starter.
7. Connect the ground cable terminal to the negative (-) terminal of the battery.

WR88-ST120

# **DAIHATSU**

# **F300**

[HD-ENGINE]

## **CHARGING SYSTEM**

<b>PRECAUTIONS .....</b>	<b>CH- 2</b>
<b>TROUBLE SHOOTING .....</b>	<b>CH- 2</b>
<b>IN-VEHICLE INSPECTION .....</b>	<b>CH- 4</b>
<b>ALTERNATOR .....</b>	<b>CH-12</b>

WN88E-CH001

**CH**

# CHARGING SYSTEM

## PRECAUTIONS

1. Prior to the inspection, make sure that the battery cables are connected securely.
2. When a quick charging operation is carried out, first be sure to disconnect the battery cables.
3. Never use a high-voltage insulation resistance tester for the purpose of conducting this inspection.
4. Under no circumstances should the battery cables be disconnected while the engine is rotating.

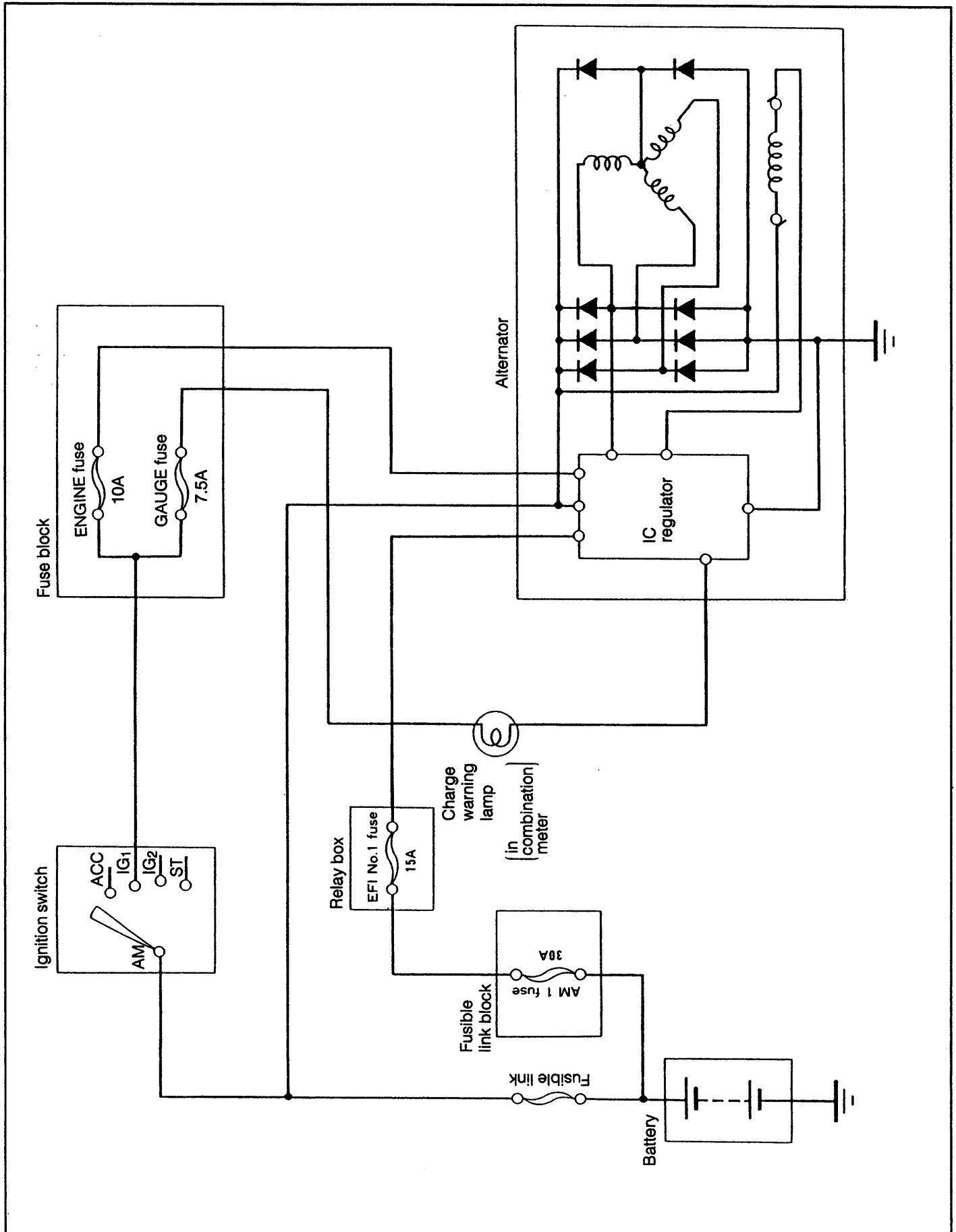
WR88-CH002

## TROUBLE SHOOTING

Problem	Possible causes	Remedies	Page
Charge warning lamp will not glow even if ignition switch is turned ON.	Fuse blown Lamp bulb burnt Poor connection of wiring Open wire IC regulator faulty	Check gauge fuse. Replace bulb. Repair poor connection of wiring. Repair or replace. Replace regulator assembly.	CH-7
Charge warning lamp will not go out even if engine has started.	Drive belt loose or worn Battery cables loose, corroded or worn Fuse blown Fusible link blown IC regulator or alternator faulty Wiring faulty	Adjust or replace. Repair or replace cables. Check gauge fuse. Replace fusible link. Check charging system. Repair or replace.	CH-5 CH-5 CH-7

WN88E-CH002

CHARGING SYSTEM CIRCUIT



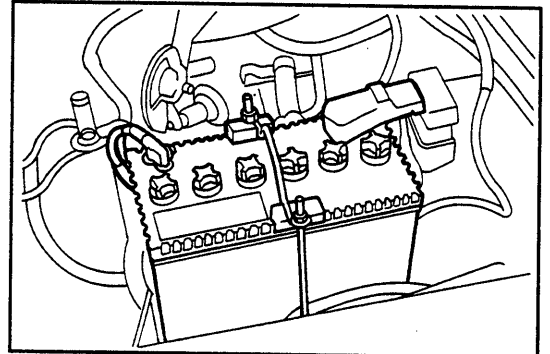
## IN-VEHICLE INSPECTION

### CAUTION:

- Never touch at the battery terminals immediately after the vehicle has been operated.
- Be certain to turn OFF the ignition key switch during the inspection.

WR88-CH005

1. Check the battery case for proper installing condition and cracks.  
If the batter case exhibits improper installing condition or cracks, replace or repair the battery, as required.

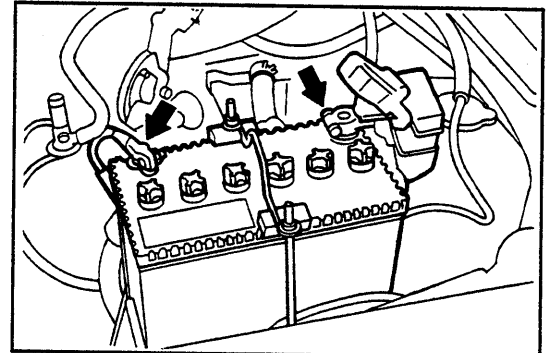


WR88-CH006

2. Check to see if the battery terminals exhibit corrosion and/or loose condition.  
If the battery terminals exhibit corrosion and/or loose condition, remove the battery cable terminals from the terminal of the battery. Remove any rust, using a wire brush or a fine abrasive paper. After the battery terminals have been connected, coat these terminal with a thin film of lithium grease.

### NOTE:

After the battery terminals have been cleaned, make sure that no rust particle remains on the terminals.



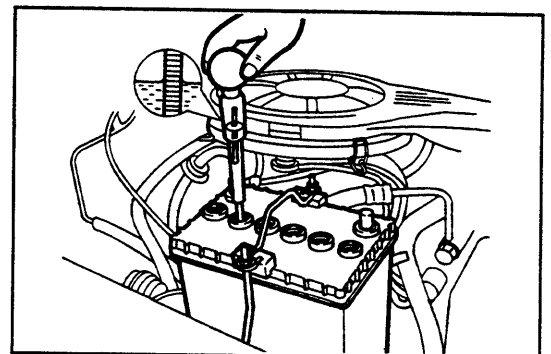
WR88-CH008

3. Check of specific gravity of battery electrolyte  
Measure the specific gravity of the electrolyte of each cell, using a hydrometer. Ensure that the specific gravity is within the specified value.

**Standard specific gravity:**

**When fully charged at 20 °C (68 °F)**

**1.25 or more**



WR88-CH009



If the specific gravity is not within the specified value, check the electrolyte level and/or replenish distilled water. Then, charge the battery until the specific gravity reaches the specified value. (See page CH-4.)

<Reference>

$$\text{Specific gravity at standard temperature} = \text{Measured specific gravity} + 0.0007 \times (\text{Electrolyte temperature at time of measurement} - 20)$$

**CAUTION:**

Utmost care must be exercised as to the handling of electrolyte. Be very careful not to allow the electrolyte to touch with your skin, clothes or any parts of the vehicle.

WN88-CH004

- First-aid treatment for dilute sulfuric acid

Nature of accident	First-aid treatment
Acid gets to vehicle body.	Immediately flush the affected area using a large amount of clean running water, until no acid content remains any more.
* Acid gets into your eyes.	Immediately flush your eyes using a large amount of clean running water for at least 15 minutes with your eyes in open state.
* Acid gets to your skin or clothes.	Immediately flush the affected area using a large amount of clean running water, until no acid content remains any more. Afterwards, neutralize them with a soap. Finally flush them with water.
Acid is spilled.	Immediately flush the affected area using a large amount of water, until no acid content remains any more. Afterwards, neutralize the area with slaked lime, sodium or the like.
* Acid is swallowed.	Immediately flush the mouth with clean water. Let him drink raw eggs, milk or a large amount of water. Let him lie quietly.

\* After the aforesaid first-aid treatment has been done, call a physician immediately.

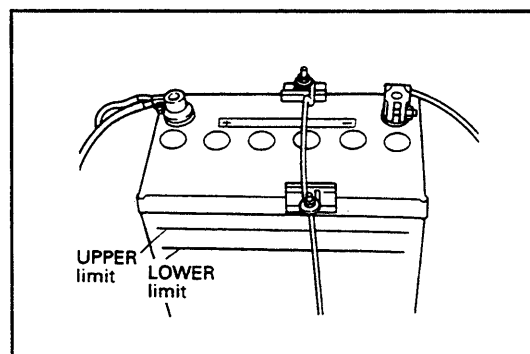
WR88-CH011

4. Inspection of battery electrolyte level

Ensure that the battery electrolyte level is the highest level. If the battery electrolyte level of any cell is not the highest level, replenish distilled water to the highest level.

**NOTE:**

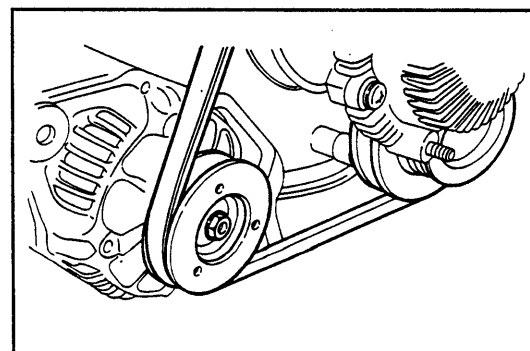
- Never add city tap water or sulfuric acid, etc. instead of distilled water.
- If the electrolyte level of each battery cell differs greatly, it is advisable to inspect to see if any electrolyte leakage is present.



WR88-CH012

5. Inspection of drive belt

- (1) Visually check the belt for separation of the adhesive rubber above and below the core, core separation from the adhesive rubber, cracking or separation of the ribs, torn or worn ribs or cracks in the inner ridges of the ribs. If necessary replace the drive belt.



WR88-CH013

## CHARGING SYSTEM

### (2) Measurement of amount of belt deflection

Push the midpoint of the drive belt between the alternator pulley and the water pump pulley by applying a force of 10 kg (22 lb). Measure the deflection of the drive belt.

#### Specified Belt Deflection

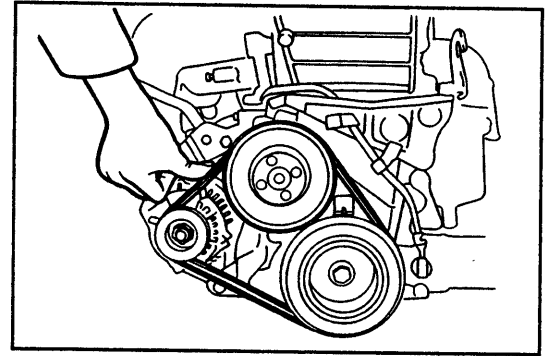
**New belt:** 5.0 - 7.0 mm (0.20 - 0.28 inch)

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

**Used belt:** 6.0 - 8.0 mm (0.24 - 0.31 inch)

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

Adjust the drive belt tension, if necessary.



WR88-CH014

#### NOTE:

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After replacing the drive belt, check that it fits properly in the ribbed grooves, especially in the places difficult to see.
- After installing a new belt, run the engine for about 5 minutes and then recheck the tension.

### 6. Check of fuses for continuity

Fusible link

Fusible link block

EFI No.1 fuse

Engine fuse

Gauge fuse

### 7. Checking alternator wiring and listening for abnormal noises

(1) Check to see if the alternator wire is connected properly to the alternator.

(2) Ensure that the alternator emits no abnormal noise while the engine is running.

WR88-CH015

### 8. Check of charge warning lamp circuit

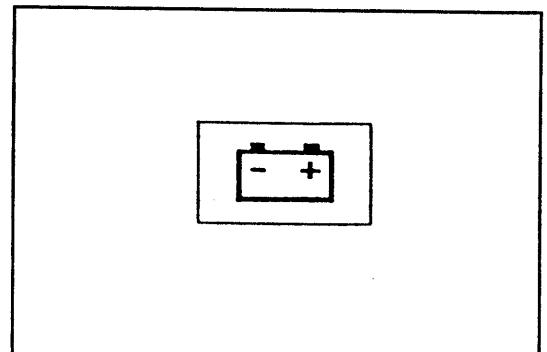
(1) Turn OFF all accessory switches.

(2) Start the engine and warm up the engine thoroughly. Turn OFF the ignition switch.

(3) When the ignition switch is turned ON, ensure that the charge warning lamp goes on.

(4) After the engine has started, ensure that the charge warning lamp goes out.

If the warning lamp does not function as specified, troubleshoot the warning lamp circuit.



WR88-CH016

## 9. Check of charging circuit under no-loaded state

### NOTE:

If a battery/alternator tester is available, connect such tester to the charging circuit according to the manufacturer's instructions.

(1) If such a tester is not available, connect a voltmeter and an ammeter to the alternator wiring and alternator as follows:

- Disconnect the battery ground cable from the negative (-) terminal of the battery.
- Connect an ammeter in series between the alternator wire terminal B and the alternator as indicated in the right figure.
- Connect the positive (+) terminal of a voltmeter to the terminal B as indicated in the right figure.
- Connect the negative (-) terminal of the voltmeter to the engine ground.
- Wind vinyl tape around each connection section so as to prevent short.
- Reconnect the battery ground cable to the negative (-) terminal of the battery.

(2) Check the charging circuit as follows:

- (1) Start the engine and warm it up.
- (2) Raise the engine speed from the idle speed to 2000 rpm. Take the readings of the ammeter and voltmeter.

**Standard Amperage:** Not to exceed 10 A

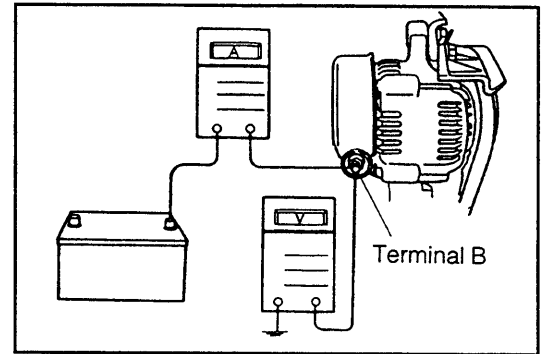
**Standard Voltage:** Standard Amperage 14.2 - 14.8 V

If the voltage reading is greater than the standard voltage, replace IC regulator.

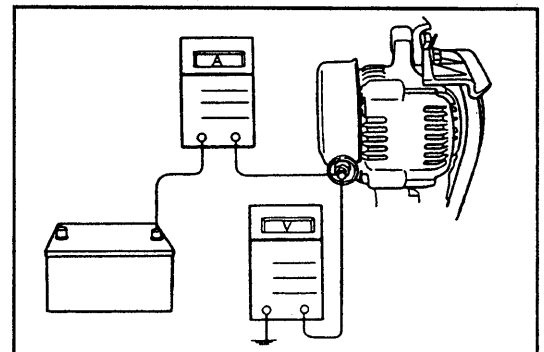
If the voltage reading is less than the standard voltage, ground the terminal F as indicated in the right figure. Proceed to start the engine.

If the voltage reading becomes greater than the standard voltage under this setting, replace the IC regulator.

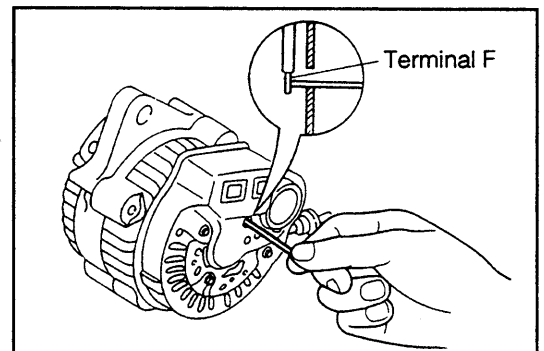
If the voltage reading is still less than the standard voltage under this setting, check the alternator.



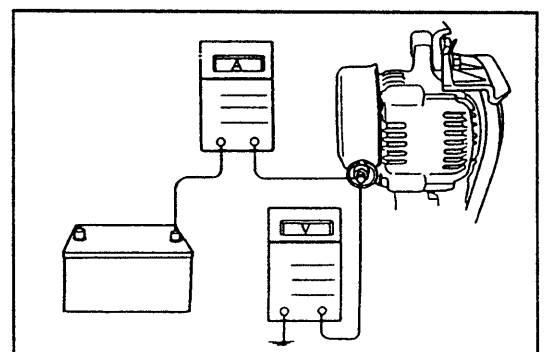
WR88-CH017



WR88-CH018



WR88-CH019



WR88-CH020

## 10. Check of charging circuit under loaded state

(1) Start the engine. Maintain the engine speed at 2000 rpm. Turn ON the high beams of the headlamps and set the blower fan motor switch to the Hi position. Take the reading of the ammeter.

**Standard Amperage:** 30 A or more

If the ammeter reading is less than 30A, repair the alternator. (See page CH-15.)

### NOTE:

When the battery is in a fully charged state, the ammeter reading may be less than 30 A during the aforesaid test.

# CHARGING SYSTEM

## BATTERY REMOVAL

### CAUTION:

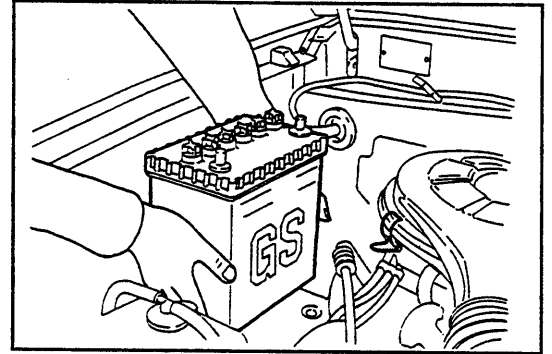
- Never touch at the battery terminals immediately after the vehicle has been operated.
- Be certain to turn OFF the ignition key.
- Never allow any fire to be brought near the battery.

### NOTE:

Be very careful not to drop the battery or apply strong vibration to the battery.

WR88-CH021

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Disconnect the positive terminal from the positive (+) terminal of the battery.
3. Remove the battery hold-down clamp.
4. Remove the battery.



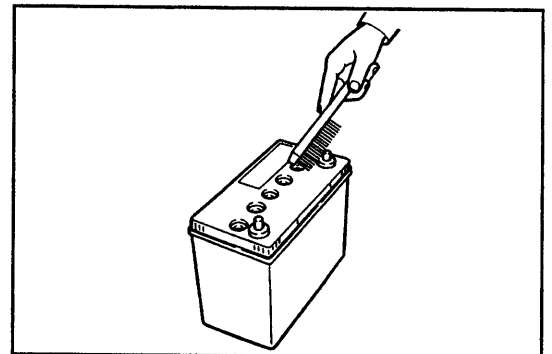
WR88-CH022

## CLEANING, INSPECTION & CHARGING OF BATTERY

1. Remove any rust from the battery terminals by means of a wire brush or a fine abrasive paper, or sodium water and a soft brush.

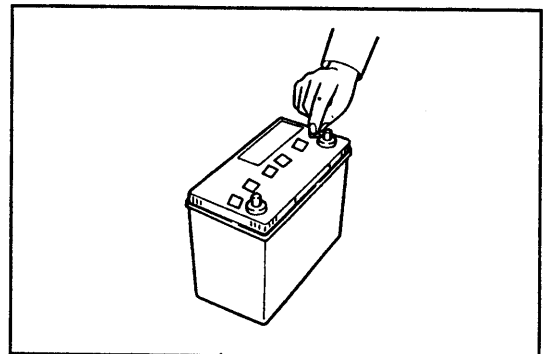
### NOTE:

After the battery terminals have been cleaned, make sure that no rust particle remains on the terminals.



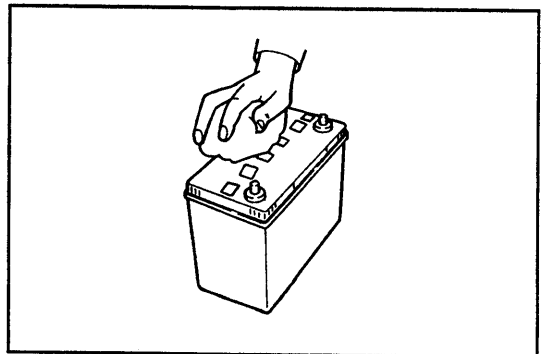
WR88-CH023A

2. Using adhesive tape or the like, seal the vent hole of each cell plug. Flush the battery with clean water, using a soft brush.



WR88-CH023B

3. Wipe off the battery surface using a cloth dampened by clean water. Proceed to dry the battery.



WR88-CH024A

## 4. Battery capacity check

### (1) Check by hydrometer

Measure the specific gravity of the electrolyte of each cell, using a hydrometer. Ensure that the specific gravity is within the specified value.

**Standard Specific Gravity:**

**When fully charged at 20 °C (68 °F)**

If the specific gravity is not within the specified value, check the electrolyte level and/or replenish distilled water. Then, charge the battery until the specific gravity reaches the specified value.

If the battery is prone to be discharged (the specific gravity drops) even after the battery has been charged, despite the fact that the charging system of the vehicle has no malfunction, it is necessary to replace the battery. However, make sure that the wiring harness of the vehicle has no defect.

### Reference

**Specific gravity at standard temperature** = **Measured specific gravity** + 0.0007

[Temperature of electrolyte at time of measurement : 20 °C (68 °F)]

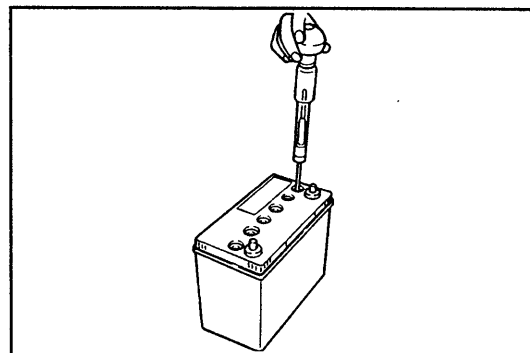
### (2) Reserve capacity check by battery tester

Connect a battery tester to the battery so as to check the capacity.

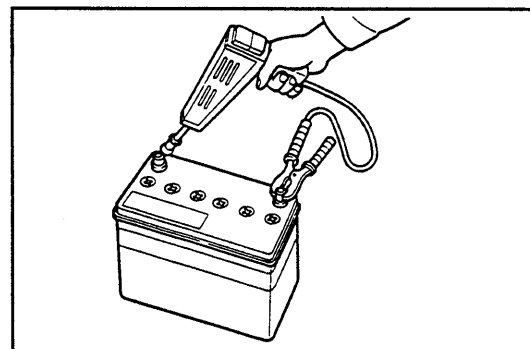
### NOTE:

The battery tester should be operated in accordance with the operating instructions set forth by the manufacturer.

If the battery capacity is not within the specified value, check the electrolyte level and/or replenish distilled water. Then, charge the battery until the battery capacity reaches the specified level. (See page CH-4.)



WR88-CH024



WR88-CH025

# CHARGING SYSTEM

## 5. Battery recharging

### CAUTION:

- Never perform quick charging for the MF (Maintenance Free) battery.
- Care must be exercised to ensure that the electrolyte temperature will not rise above 45 °C (113 °F) during the charging. If the electrolyte temperature will likely exceed this level, suspend the charging or reduce the charging current to a half level.
- Never allow any fire to be brought near the battery.
- Make sure that the charging side is well ventilated during the charging or immediately after the charging.
- If the battery is charged with the battery mounted on the vehicle, be certain to turn OFF the ignition switch. Then, disconnect the battery ground cable from the battery negative (-) terminal.
- The switch of the battery charger should be turned OFF first, whenever it is connected or disconnected from the battery.
- Do not use a battery tester or a hydrometer during the charging.
- If it is necessary to approach the battery during the charging or immediately after the charging, be sure to wear goggles. Also, keep your face away from the battery, whenever possible. As for the removal type battery cell plugs, remove them. Care must be exercised not to lose them.
- If the electrolyte level is low, be sure to replenish distilled water. (See page CH-5.)
- Under no circumstances should the battery charger be connected to the battery reversely. Upon completion of the charging, positively install each cell plug. Flush the battery with clean water.

### (1) Determination of charging current

The charging should be carried out using a current that is one tenth of the five-hour rate capacity.

Example:

50 AH(5-hour rate)

$$\text{Charging current (A)} = \frac{\text{Battery capacity (5-hour rate)}}{10}$$

WR88-CH027

### (2) Determination of charging time

The charging time can be determined, using the following formula given below:

$$\text{Charging time (hour)} = \frac{\text{Discharge amount (AH)}}{\text{Charging current (A)}}$$

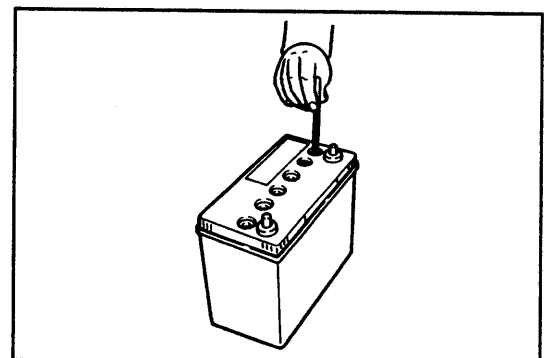
WR88-CH028

### (3) Connection of battery charger

- (1) Ensure that the charger switch is turned OFF.
- (2) Insert a thermometer into the battery.
- (3) Connect the charger to the battery.
- (4) Set the timer of the charger. Turn ON the switch.

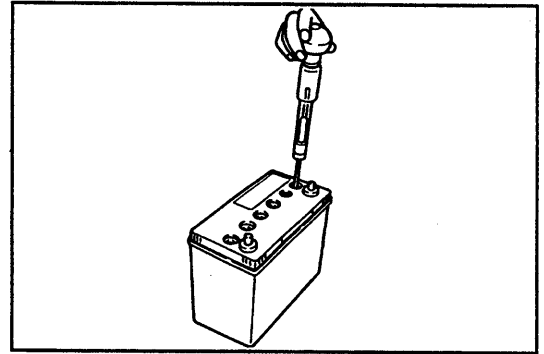
### CAUTION

Care must be exercised to ensure that the electrolyte temperature will not rise above 45 °C (113 °F) during the charging.



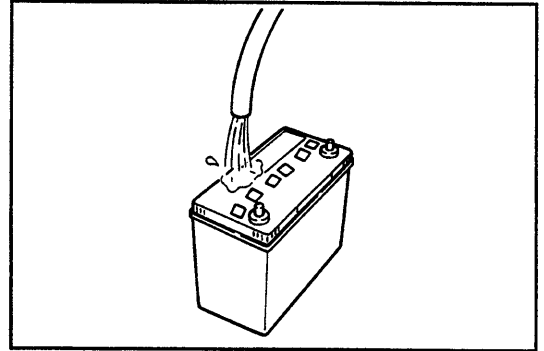
WR88-CH029

- (4) Check the battery capacity.  
(See page CH-9.)  
If the battery fails to reach the specified specific gravity even after the battery has been recharged several times, replace the battery.



WR88-CH030

- (5) Flush the battery with water.  
(See page CH-8.)



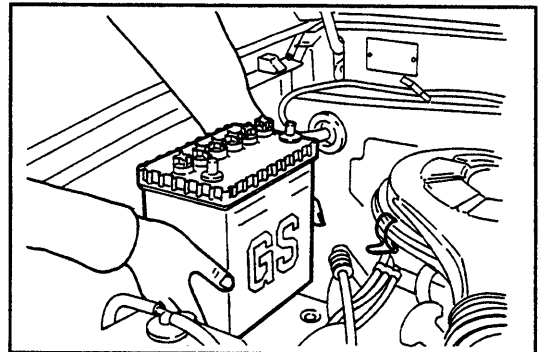
WR88-CH031

## BATTERY INSTALLATION

1. Remove any dust from the battery carrier.
2. Install the battery on the battery carrier in such a direction that the negative (-) terminal of the battery may come at the front side of the vehicle.
3. Install the battery hold-down clamp.

### NOTE:

- Be very careful not to tighten the hold-down clamp excessively.
- Install the battery carrier in such a direction that the claw of the hold-down clamp faces toward the front of the vehicle.



WN88E-CH005

4. Connect the positive terminal to the positive (+) terminal of the battery.

### NOTE:

Ensure that the terminal at the wiring exhibits no rust or the like. If any rust is present, remove the rust using a wire brush or a fine abrasive paper.

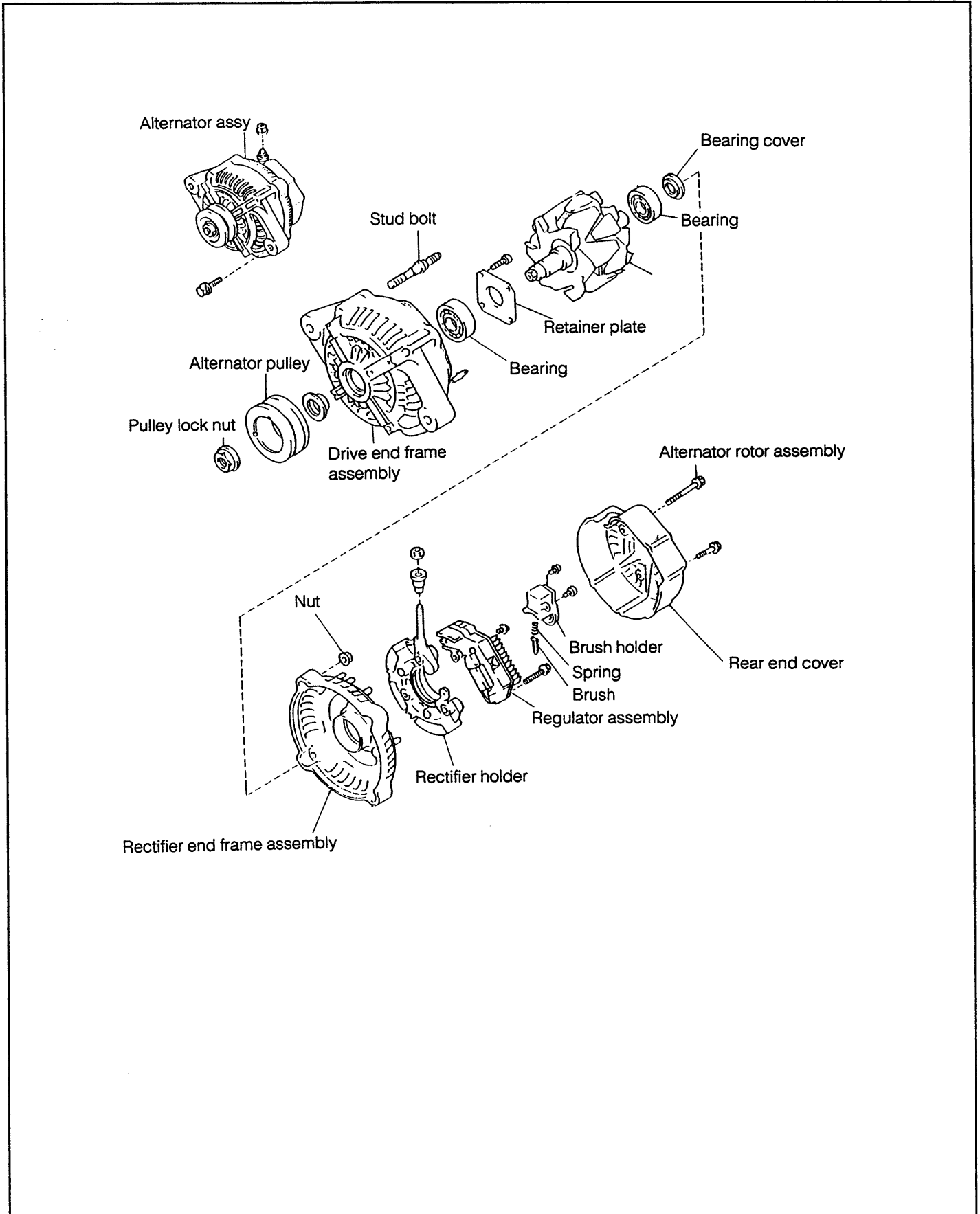
5. Connect the ground cable terminal to the negative (-) terminal of the battery.

### NOTE:

Ensure that the terminal at the wiring exhibits no rust or the like. If any rust is present, remove the rust using a wire brush or a fine abrasive paper.

WR88-CH032

ALTERNATOR  
COMPONENTS



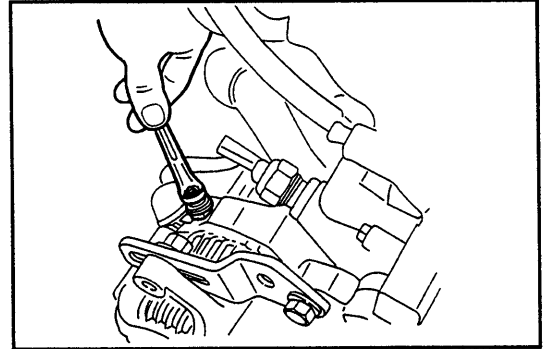


## REMOVAL OF ALTERNATOR

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.

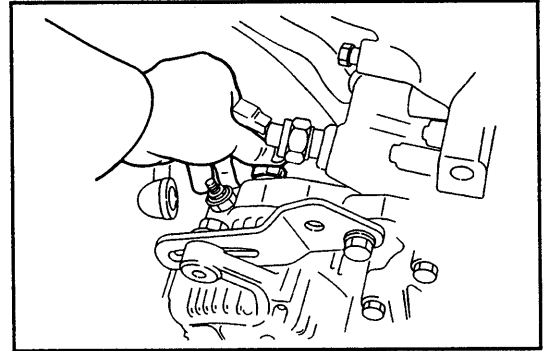
WR88-CH034

2. Disconnection of wires from alternator
  - (1) Remove the nut and wire from the alternator.



WR88-CH035

- (2) Disconnect the connector from the alternator.



WR88-CH036

3. Removal of alternator drive belt  
Loosen the alternator attaching bolts. Remove the drive belt.
4. Removal of alternator
  - (1) Remove the alternator attaching bolts.

WR88-CH037

- (2) Remove the alternator from the engine compartment.

WR88-CH038

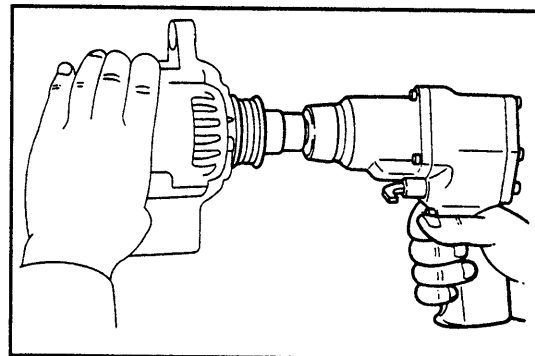
# CHARGING SYSTEM

## DISASSEMBLY OF ALTERNATOR

1. Remove the alternator pulley lock nut by means of an impact wrench.

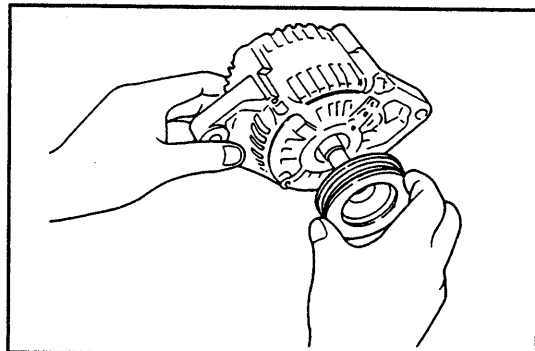
**NOTE:**

Be sure to use an impact wrench having a hexagonal hole.



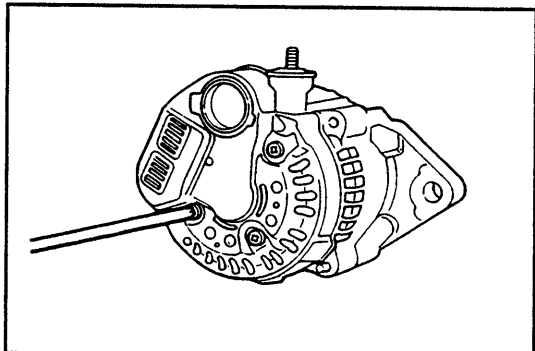
WR88-CH039

2. Remove the alternator pulley.



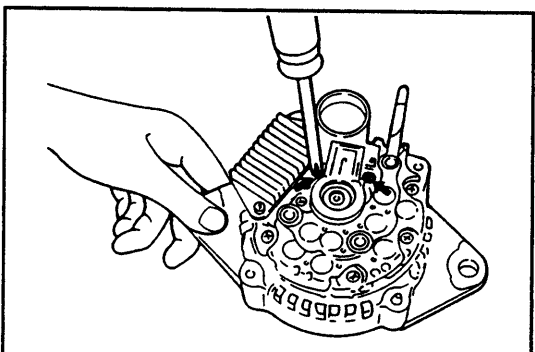
WR88-CH040

3. Removal of rear end cover
  - (1) Remove the nut and terminal insulator.
  - (2) Remove the three nuts and cover.



WR88-CH041

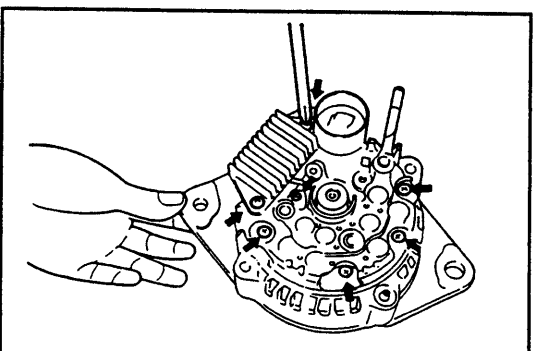
4. Remove the brush holder.



WR88-CH042

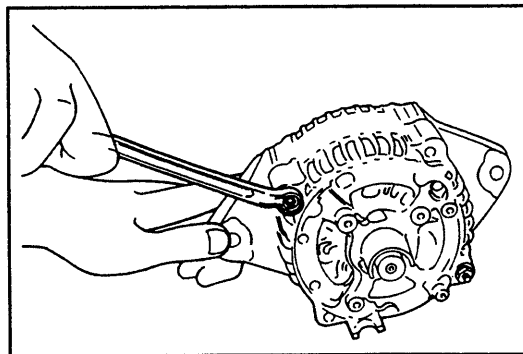
5. Remove the rectifier holder and regulator assembly.

**NOTE:**  
Before the rectifier holder is removed, be sure to straighten the stator wire.



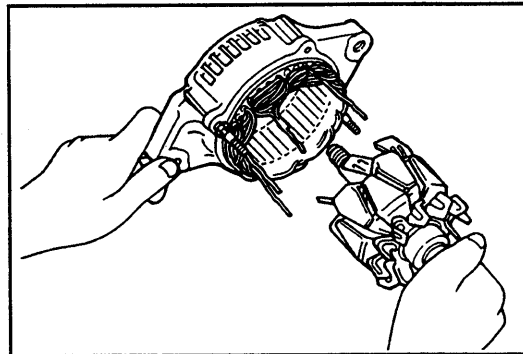
WR88-CH043

- Remove the rectifier end frame assembly.



WR88-CH044

- Remove the rotor from the drive end frame assembly.



WR88-CH045

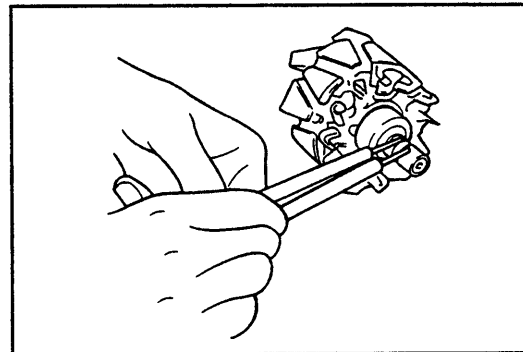
## INSPECTION OF ALTERNATOR

### Rotor

- Inspection of rotor for open circuit  
Using an ohmmeter, check to see if specified resistance exists between the rotor slip rings.

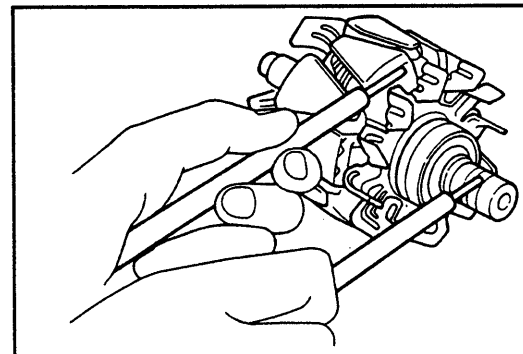
**Standard Resistance:  $2.9 \pm 0.2 \Omega$**

If no specified resistance exists, replace the rotor.



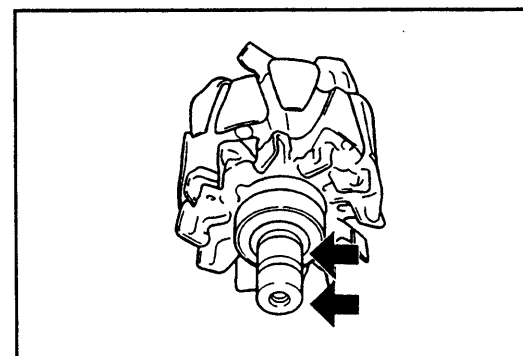
WR88-CH046

- Inspection of rotor for ground  
Ensure that no continuity exists between the rotor slip rings and the rotor core.  
If continuity exists, replace the rotor.



WR88-CH047

- Inspection of slip rings  
(1) Check to see if the slip ring surface exhibits roughness, abnormal wear and/or burning.  
Replace the rotor, if necessary.



WR88-CH048

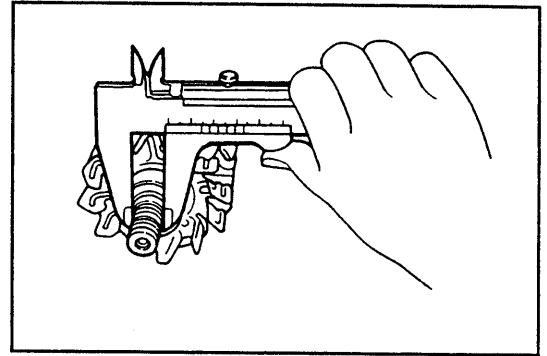
# CHARGING SYSTEM

- (2) Measure the outer diameter of the slip ring, using vernier calipers.

**Standard diameter:** 14.4 mm (0.57 inch)

**Minimum diameter:** 14 mm (0.55 inch)

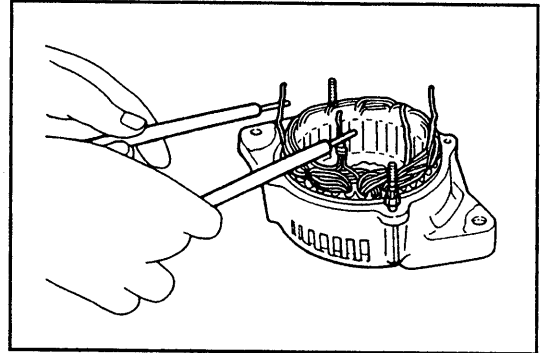
If the slip ring diameter is less than the minimum diameter, replace the rotor assembly.



WR88-CH049

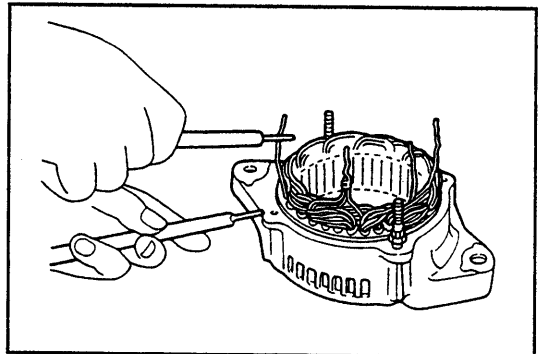
## Stator

1. Inspection of stator for open circuit  
Using an ohmmeter, check to see if any open circuit of the stator coil is present between the leads.  
If no continuity exists, replace the end frame assembly.



WR88-CH050

2. Inspection of stator for short circuit  
Using an ohmmeter, check to see if any short circuit of the stator coil is present between the coil lead and the drive end frame.  
If continuity exists, replace the drive end frame assembly.

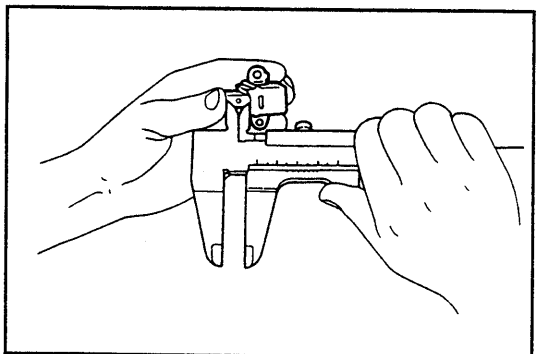


WR88-CH051

## Brush and Brush Holder

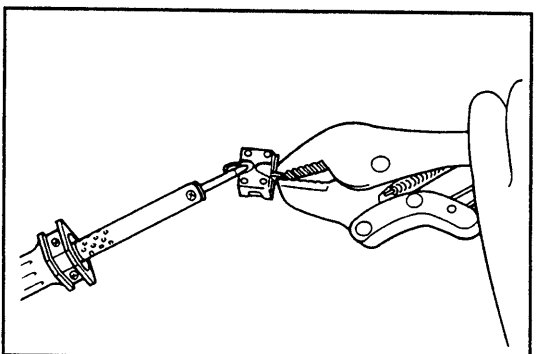
1. Measurement of exposed brush length  
Measure the exposed brush length, using a scale.  
**Standard exposed length:** 10.5 mm (0.41 inch)  
**Minimum exposed length:** 1.5 mm (0.06 inch)

If the exposed length is less than the minimum requirement, replace the brushes.



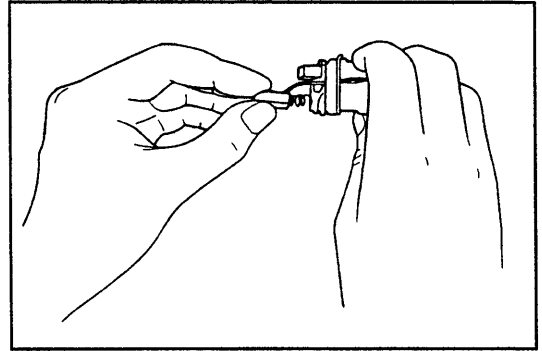
WR88-CH052

2. Replacement of brushes (If necessary)
  - (1) Remove the brush and spring from the brush holder by melting the solder by means of a soldering iron.



WR88-CH053

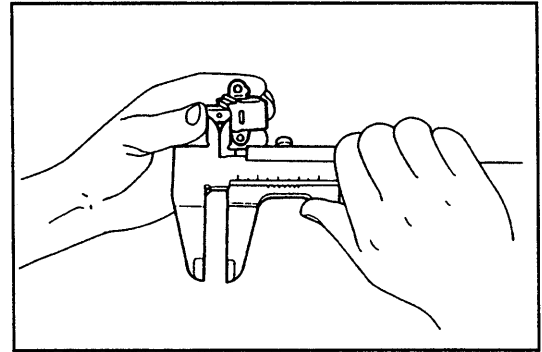
- (2) Install the brush cord in the brush holder with the spring fitted in place.



WR88-CH054

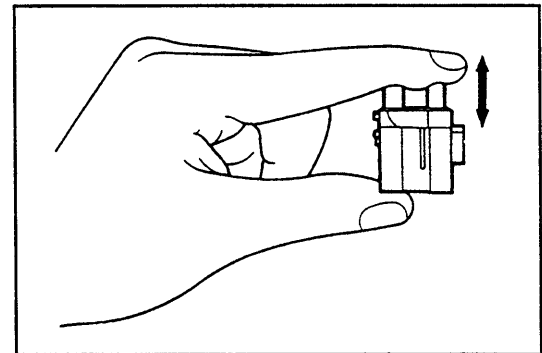
- (3) Solder the brush cord in the brush holder in such a way that the exposed length of the brush meets the specification.

Standard exposed length: 10.5 mm (0.41 inch)



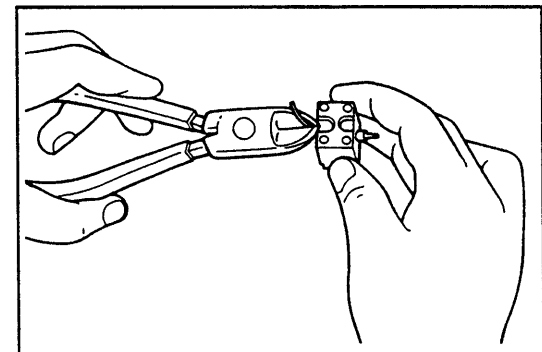
WR88-CH055

- (4) Ensure that the brush moves freely in the brush holder.



WR88-CH056

- (5) Cut off any excess remaining wire and apply an insulation paint.

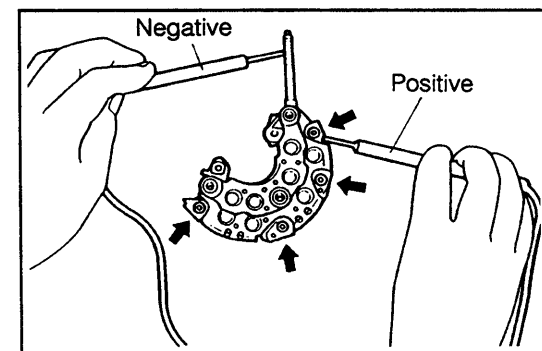


WR88-CH057

## Rectifier

### 1. Inspection of rectifier at positive side

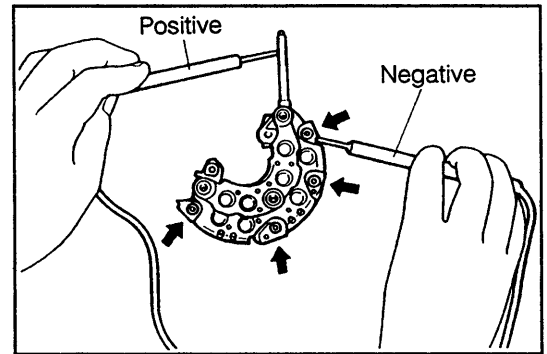
- (1) Ensure that continuity exists between the positive stud bolt of the rectifier holder and the rectifier terminal by connecting an ohmmeter as indicated in the right figure. If no continuity exists, replace the rectifier holder.



WR88-CH058

## CHARGING SYSTEM

- (2) Ensure that no continuity exists between the positive stud bolt of the rectifier holder and the rectifier terminal by connecting an ohmmeter as indicated in the right figure. If continuity exists, replace the rectifier holder.



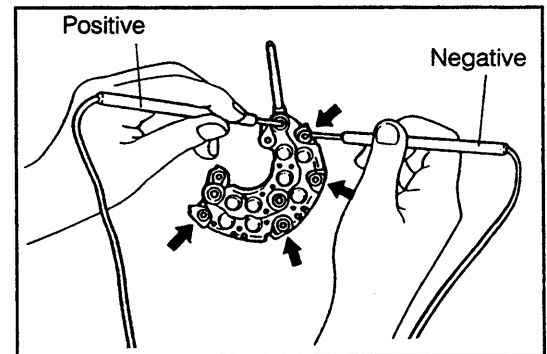
WR88-CH059

2. Inspection of rectifier at negative side
  - (1) Ensure that continuity exists between each of the negative terminals of the rectifier holder and each rectifier terminal by connecting an ohmmeter as indicated in the right figure.

If no continuity exists, replace the rectifier holder.

### REFERENCE

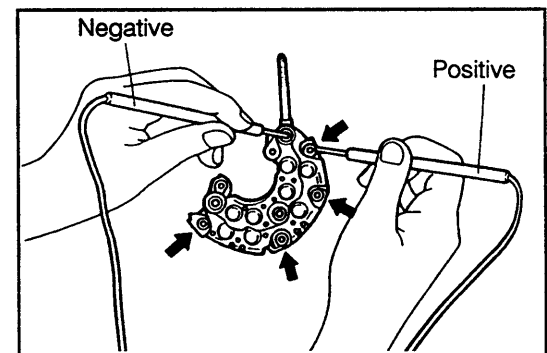
Resistance about 900 k $\Omega$



WR88-CH060

- (2) Ensure that no continuity exists between each of the negative terminals of the rectifier holder and each rectifier terminal by connecting an ohmmeter as indicated in the right figure.

If continuity exists, replace the rectifier holder.

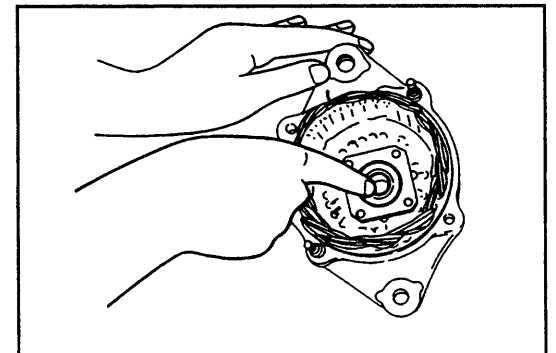


WR88-CH061

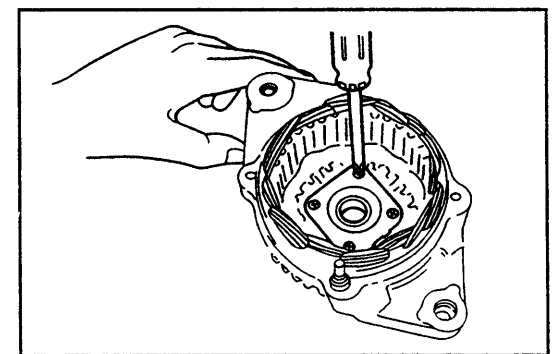
## Bearings

1. Inspection of front bearing

Ensure that the bearing turns smoothly.  
Replace the bearing, if necessary.
2. Replacement of front bearing (If necessary)
  - (1) Remove the four screws and retainer plate.

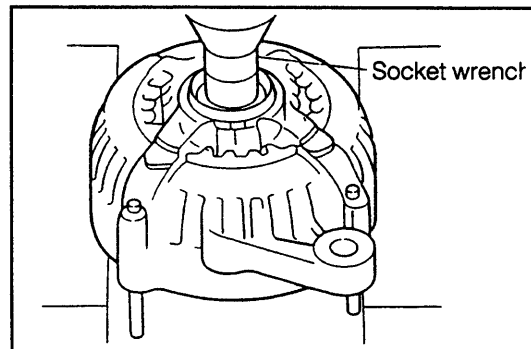


WR88-CH062

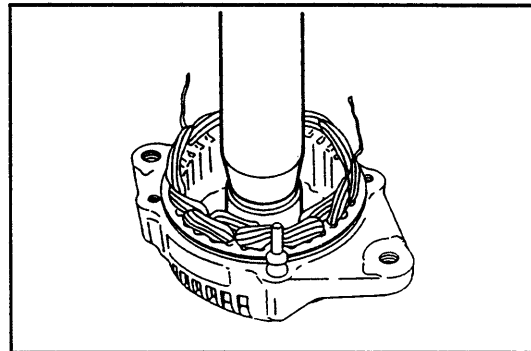


WR88-CH063

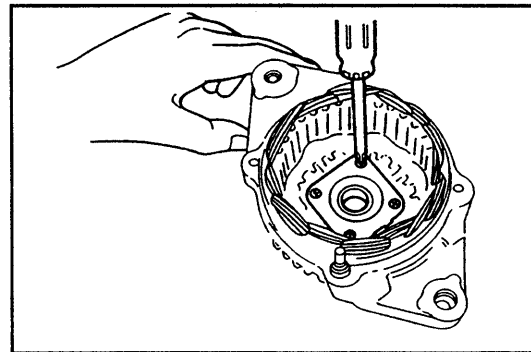
- (2) Remove the front bearing from the drive end frame, using a socket wrench in conjunction with a press.



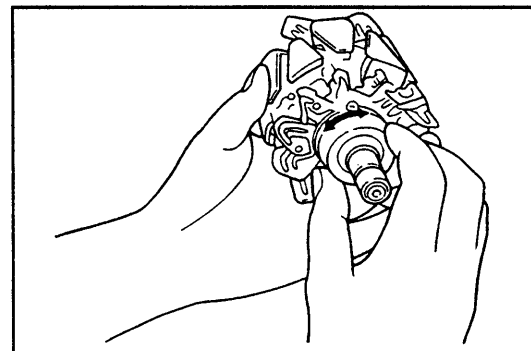
- (3) Press the new front bearing into the drive end frame, using suitable socket wrench.



- (4) Attach the retainer plate to the drive end frame with the four screws.



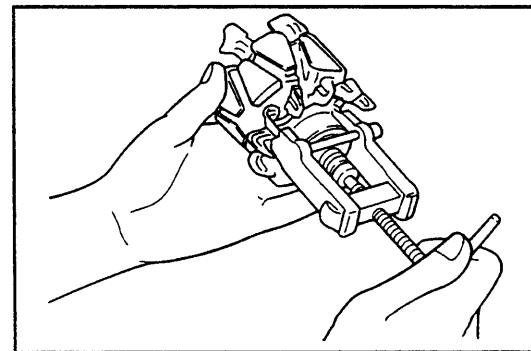
3. Inspection of rear bearing  
Ensure that the bearing turns smoothly.  
Replace the bearing, if necessary.



4. Replacement of rear bearing (if necessary)  
(1) Remove the rear bearing and bearing cover from the rotor, using the armature bearing puller.

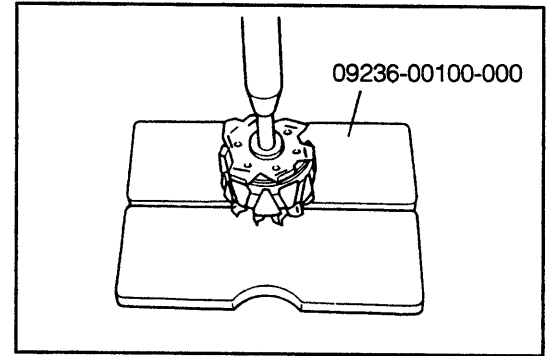
**NOTE:**

Be very careful not to damage the fan during the removal.



# CHARGING SYSTEM

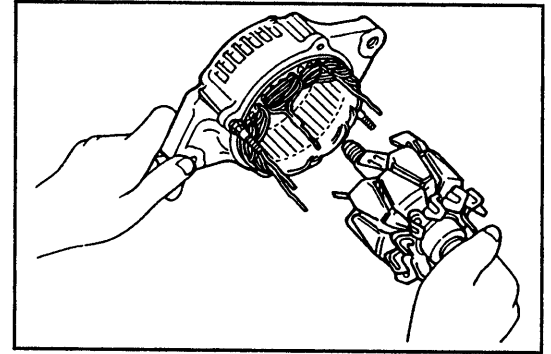
- (2) Press a new rear bearing and bearing cover, using a hydraulic press in combination with the following SST.  
SST: 09236-00100-000



WR88-CH069

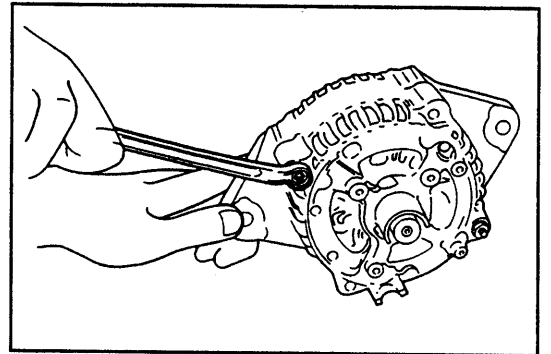
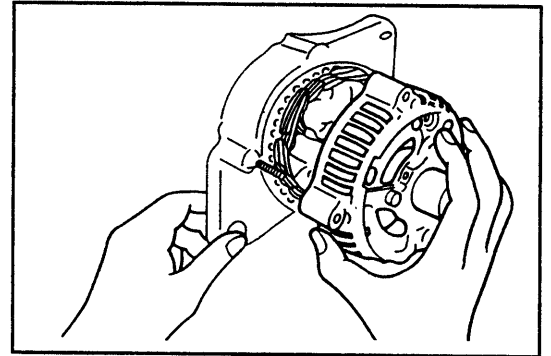
## ASSEMBLY OF ALTERNATOR

1. Install the rotor in the drive end frame assembly.



WR88-CH070

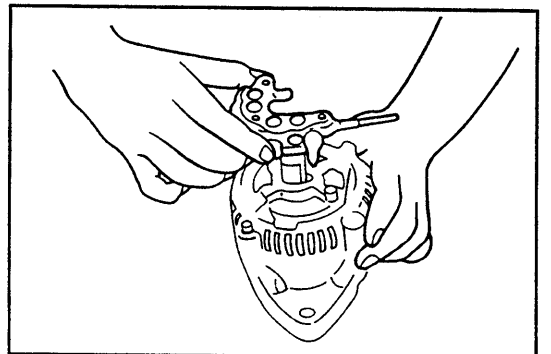
2. Installation of rectifier end frame on drive end frame  
Install the rectifier end frame on the drive end frame with the two bolts and two nuts.  
Be very careful not to damage the coil cord during the installation.



WR88-CH071

3. Installation of rectifier holder, regulator assembly and brush holder

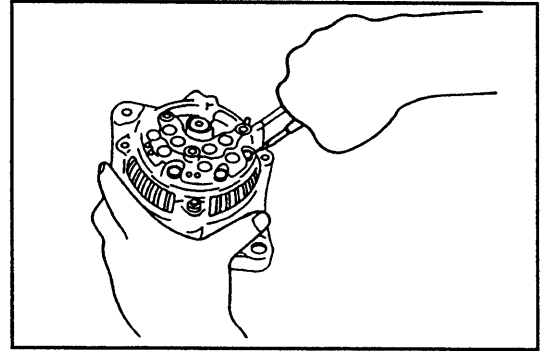
- (1) Attach the rectifier holder to the end frame with the coil wires passed through the aperture of the rectifier holder.



WR88-CH072

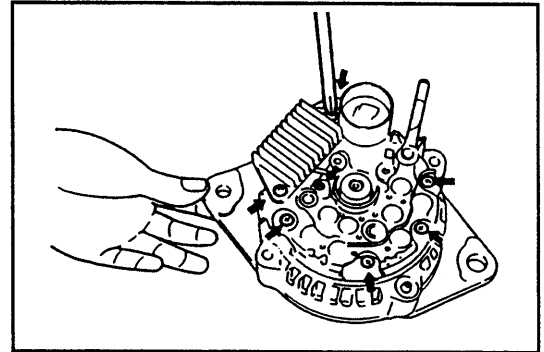


- (2) Wind the coil wire around the installing section of the rectifier attaching bolt.



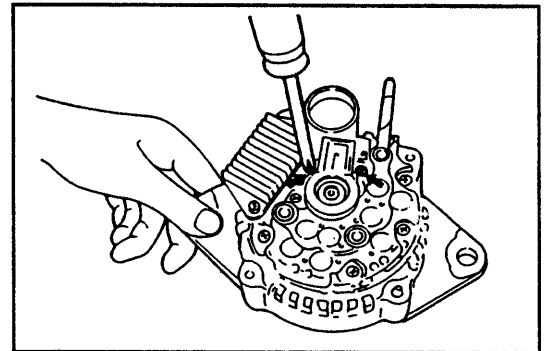
WR88-CH073

- (3) Install the regulator assembly and rectifier holder. Secure them with the attaching screws.



WR88-CH074

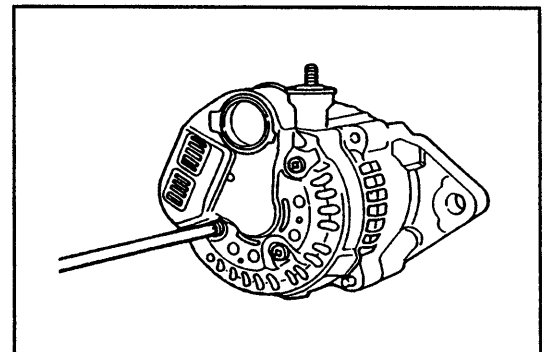
- (4) Install the brush holder in such a way that a gap of at least 1 mm (0.04 inch) is provided between the brush holder and the regulator assembly. Secure the brush holder with the two screws.



WR88-CH075

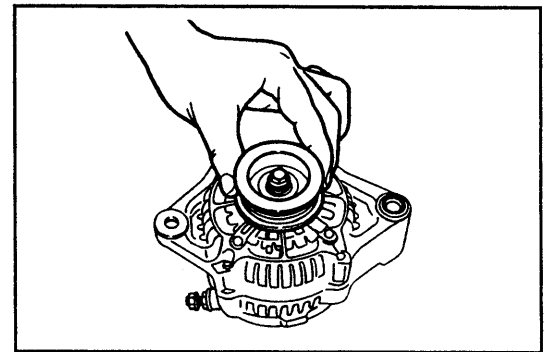
#### 4. Installation of rear end cover

- (1) Install the rear end cover with the three nuts.  
(2) Install the terminal insulator and tighten it with the nut.



WR88-CH076

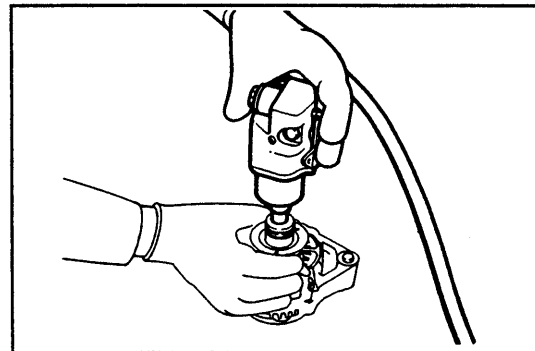
#### 5. Attach the pulley to the rotor shaft.



WR88-CH077A

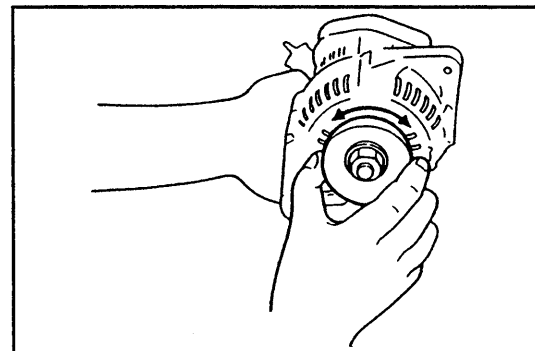
## CHARGING SYSTEM

6. Install the pulley lock nut by means of an impact wrench.  
**NOTE:**  
Be sure to use an impact wrench having a hexagonal hole.



WR88-CH077B

7. Ensure that the rotor turns smoothly.



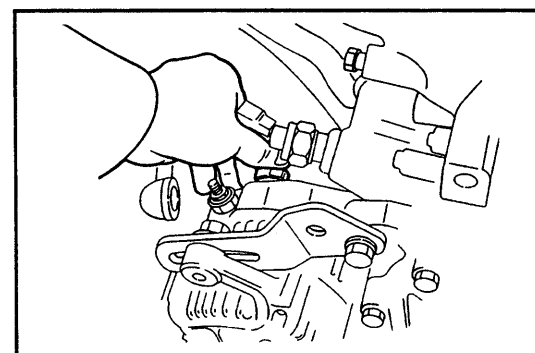
WR88-CH078

## INSTALLATION OF ALTERNATOR

1. Installation of alternator on vehicle  
Install the alternator on the engine with the two attaching bolts.

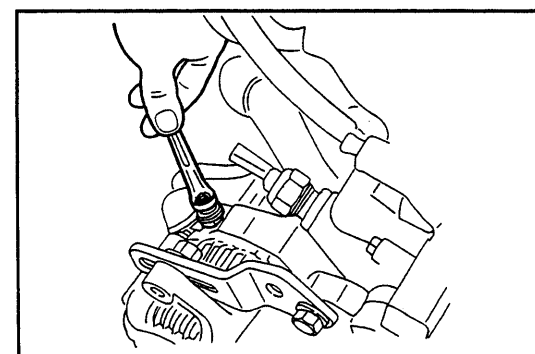
WR88-CH079A

2. Connection of wire to alternator  
(1) Connect the connectors to the alternator.



WR88-CH079B

- (2) Install the wire and nut to the alternator.

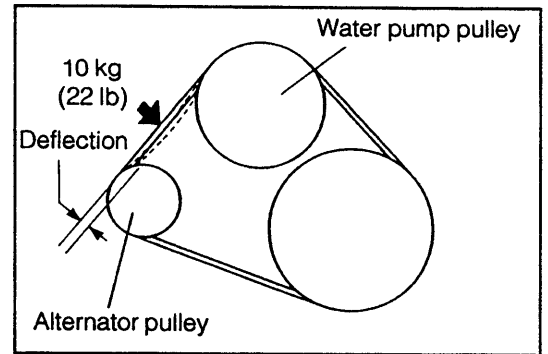


WR88-CH079C

### 3. Installation of alternator drive belt

- (1) Install the alternator drive belt properly.
- (2) Tension adjustment of drive belt

Adjust the belt tension in such a way that the deflection of the drive belt meets the specification when you push the midpoint of the drive belt between the alternator pulley and the water pump pulley by applying a force of 10 kg (22 lb).



WN88E-CH006

#### Specified Belt Deflection

**New belt:** 5.0 - 7.0 mm (0.20 - 0.28 inch)

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

**Used belt:** 6.0 - 8.0 mm (0.24 - 0.31 inch)

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

#### NOTE:

- "New belt" refers to a belt with has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine 5 minutes or more.
- If belt replaced with new one, run the engine for about 5 minutes and then recheck the tension.

WR88-CH082

4. Reconnect the ground cable terminal to the negative (-) terminal of the battery.

WR88-CH083

# **DAIHATSU**

# **F300**

[HD-ENGINE]


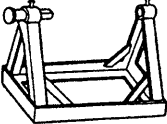
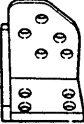

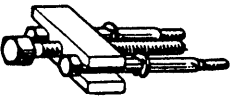

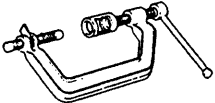

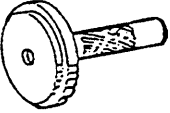
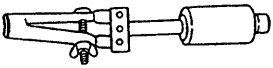
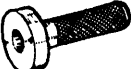


## **SSTs**

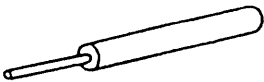
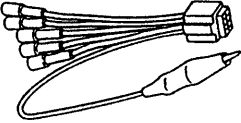



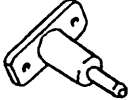
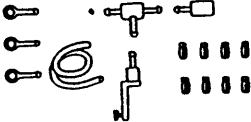

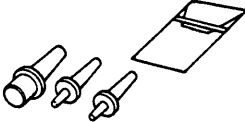

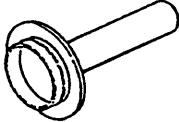
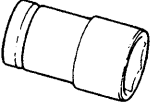
SSTs .....A-2

WR88-SST001

**A**


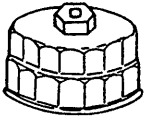
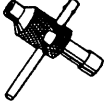


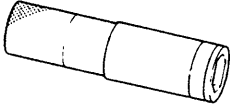

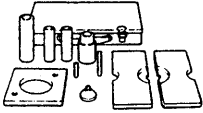
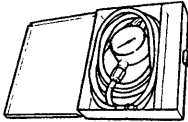
## SST (Special Service Tools)

Shape	Part No. and Name	Purpose	Remarks
	* <sup>5</sup> 09090-04010-000 Engine sling device	Removal and installation of engine	
	* <sup>5</sup> 09219-87202-000 Engine overhaul stand	Stand for engine overhaul	This stand is to be used in combination with engine overhaul attachment.
	* <sup>1</sup> * <sup>5</sup> 09219-87701-000 Engine overhaul attachment	Attaching engine to overhaul stand (However, it is necessary to modify attachment.)	This attachment is to be used in combination with engine overhaul stand.
	09210-87701-000 Flywheel holder	Preventing crankshaft from turning	
	09609-20011-000 Steering wheel puller	Removal of crankshaft timing belt pulley	
	09636-20010-000 Upper ball joint dust cover replacer	Installation of camshaft oil seal	
	* <sup>5</sup> 09202-87002-000 Valve cotter remover & replacer	Installation and removal of valves	
	* <sup>5</sup> 09217-87001-000 Piston replacing guide	Guiding piston during insertion	
	09223-41010-000 Crankshaft rear oil seal replacer	Installation of crankshaft rear oil seal	
	09201-87704-000 Valve stem oil seal cover	Removal of valve stem oil seals	
	09310-87102-000 Counter shaft front bearing replacer	Installation of crankshaft front oil seal	
	* 09221-87704-000 Piston pin remover & replacer body	Removal and installation of piston pins	This remover & replacer body is to be used in combination with piston pin remover & replacer guide.
	* 09221-87705-000 Piston pin remover & replacer guide	Removal and installation of piston pins	This remover & replacer guide is to be used in combination with piston pin remover & replacer body.

Shape	Parts No. and Name	Purpose	Remarks
 *	09201-87705-000 Valve guide bush remover & replacer	Removal and installation of valve guide bushes	
	09991-87702-000 Engine control system inspection sub harness	* Shorting terminal T * Actuating fuel pump, etc.	Only for HD-E engine
	09842-87701-000 EFC-II computer check sub harness	Inspection of computer input/output voltage	Only for HD-E engine
 *	09842-30070-000 EFI inspection wire F	Inspection of fuel injectors	Only for HD-E engine
	09268-87701-000 EFI fuel pressure gauge	Inspection of fuel pressure	Only for HD-E engine
 *	09283-87703-000 Pressure regulator adopter	* Inspection of injectors * Inspection of pressure regulator * Inspection of fuel pressure	Only for HD-E engine
	09268-87702-000 Injection measuring tool set	* Inspection of injectors * Inspection of pressure regulator * Inspection of fuel pressure	Only for HD-E engine
 *	09301-87601-000 Clutch guide tool	Assembling clutch	
	09258-00030-000 Plug set	Plugging rubber hoses	
	09860-11011-000 Carburetor screwdriver set	Overhaul of carburetor	Only for HD-C engine
 *	09388-87702-000 Transfer replacer	Press-fitting of rubber grommets	
 *	*2 09268-87704-000 Oil cooler set bolt box wrench	Removal and installation of oil cooler (only for oil cooler-equipped vehicle)	Only for oil cooler-equipped vehicle

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# SSTs

Shape	Parts No. and Name	Purpose	Remarks
	09032-00100-000 Oil pan seal cutter	Removal of oil pan	
	09228-87201-000 Oil filter wrench	Removal and installation of oil filter	
	09243-00020-000 Idle adjust wrench	Adjustment of idle mixture adjusting screw	Only for HD-C engine
	09240-00020-000 Wire gauge set	Adjustment of carburetor	Only for HD-C engine
	09240-00014-000 Carburetor adjusting gauge set	Adjustment of carburetor	Only for HD-C engine
 *	*3 *5 09268-87703-000 Plug wrench	Removal and installation of spark plugs	
 *	*4 09991-87703-000 Tacho pulse pick-up wire	Connecting engine tachometer	Only for HD-C engine
	09236-00100-000 Water pump overhaul tool	Assembling alternator rear bearing cover	
	*5 09990-87702-000 Engine oil pressure gauge	Measurement of engine oil pressure	

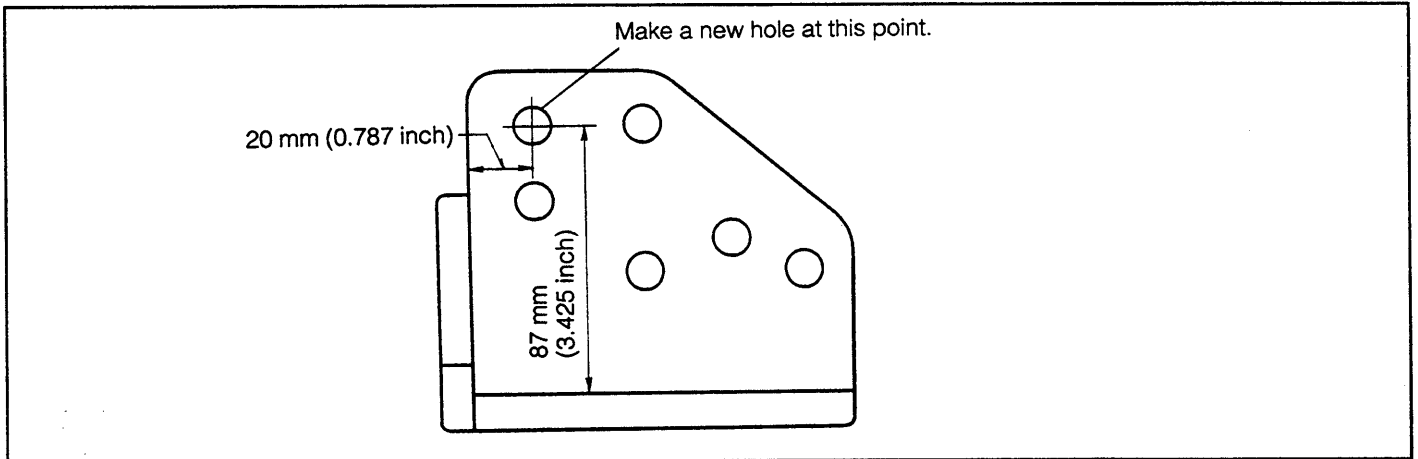
WN88E-SST002

**NOTE:**

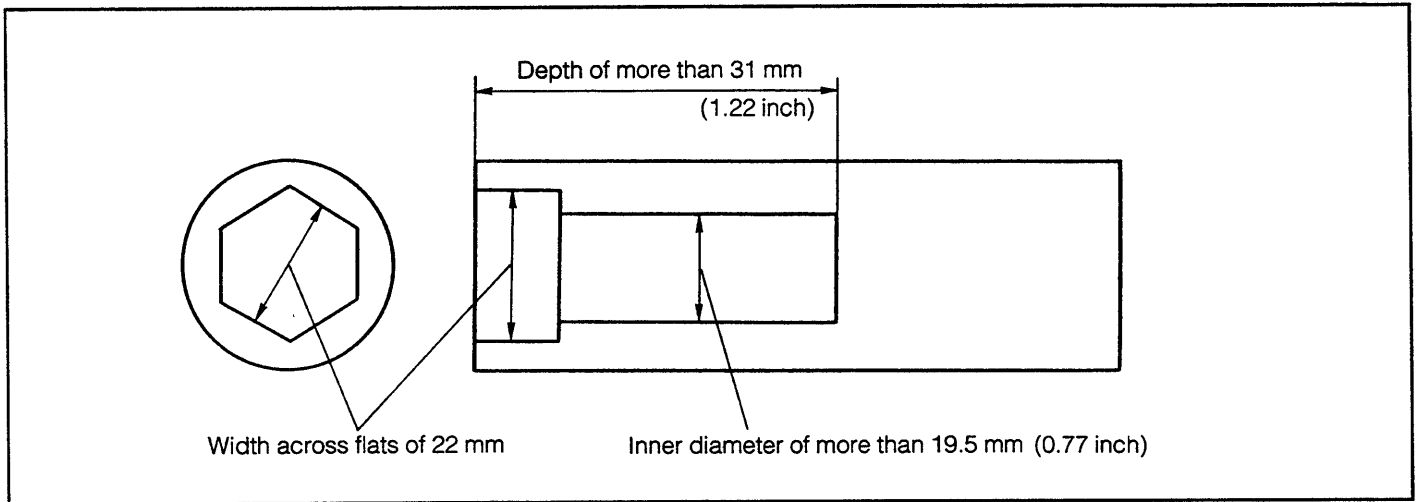
\* Newly provided SST

\*1 Modification required for engine overhaul attachment

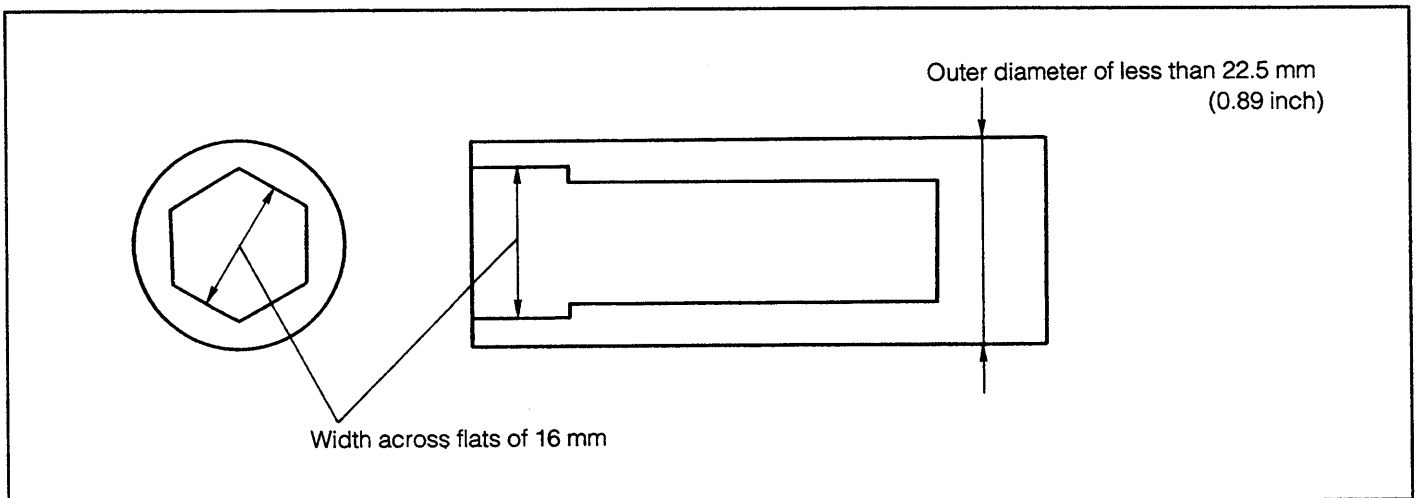
It is necessary to modify the engine overhaul attachment as indicated below.



\*2 There is no need for the oil cooler set bolt if your box wrench satisfies the following requirements.



\*3 There is no need for the spark plug wrench if your spark plug box wrench satisfies the following requirements.



\*4 Not required, if your tachometer is a clamp-on type.

\*5 Commercially-available



**Reference:**

**LIST OF EQUIPMENT AND OTHER TOOLS REQUIRED**

**General Tools**

**General Service Equipment**

- Two-post lift
- Garage jack
- Safety stands
- Valve refacer
- Valve seat cutters
- Hydraulic press
- Ridge reamer
- Air compressor
- Reamer

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**Measuring Equipment**

- Torque wrench
- Vernier calipers
- Dial gauge (with magnet base)
- Dial caliper gauge (for bore measurement use)
- Micrometers (for bore measurement use and depth measurement use)
- Thickness gauge
- Tachometer and dwell angle tester
- Ohmmeter, ammeter and voltmeter (Circuit tester)
- Straightedge
- Surface plate
- Spring tester
- Compression gauge
- Hydrometer
- Battery tester
- Square gauge
- Megger (ohmmeter)
- Spring scale
- Connecting rod aligner

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**Consuming Articles**

- Plastigauge
- Blue lead or red lead
- Dye penetrant
- Compound (for valve lapping)
- Solvent
- Engine oil (10W-30/SE or higher)

WR88-SST008

**Liquid Gasket**

Nomenclature	Application	Part number
Three Bond 1104	Camshaft bearing cap and cylinder head cover gasket section (arched section), etc.	999-04808-U9-005
Three Bond 1377B	Spark plug tube, heater outlet pipe and heater union	999-04808-U9-004
Three Bond 1207C	Oil pan, rear oil seal retainer and oil pump	999-6313-6323-00
Three Bond 1324	Flywheel bolt	999-04808-U9-006

WR88-SST009

# **DAIHATSU**

# **F300**

[HD-ENGINE]

## **ENGINE SPECIFICATIONS**

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**B**

# ENGINE SPECIFICATIONS

## ENGINE SPECIFICATIONS

Item		Engine type		HD-C	HD-E	
Engine proper	Type		Petrol, 4-cycle		Petrol, 4-cycle	
	Mounting location		Front		Front	
	Cylinder No. and arrangement		4-cylinder-in-line, mounted longitudinally		4-cylinder-in-line, mounted longitudinally	
	Combustion chamber type		Pent roof type		Pent roof type	
	Valve mechanism		Belt-driven, SOHC		Belt-driven, SOHC	
	Bore × stroke		mm (inch)		76 × 87.6 (2.99 × 3.45)	76 × 87.6 (2.99 × 3.45)
	Compression ratio		9.5		9.5	
	Compression pressure		kg/cm <sup>2</sup> -rpm (psi-rpm)		14 - 300 (199.1 - 300)	14 - 300 (199.1 - 300)
	Maximum output	SAE net	kW/rpm	General specifications	63/6000	—
		EEC	kW/rpm	Australian specifications	—	70/5700
		EEC DIN	kW/rpm	ECE & EEC specifications	63/6000	70/5700
	Maximum torque	SAE net	Nm/rpm	General specifications	126/3500	—
		EEC	Nm/rpm	Australian specifications	—	128/4800
		EEC DIN	Nm/rpm	ECE & EEC specifications	126/3500	128/4800
	Engine dimensions [Length × width × height]		mm (inch)		*693 × 596 × 685 (27.3 × 23.5 × 27.0)	693 × 537 × 673 (27.3 × 21.2 × 26.5)
	Service engine weight		kg (lb)		96 (212)	95 (209)
	Number of piston rings	Compression ring		2		2
		Oil ring		1		1
	Valve timing	Intake	Open	2° BTDC		2° BTDC
			Close	48° ABDC		48° ABDC
Exhaust		Open	43° BBDC		43° BBDC	
		Close	1° ATDC		1° ATDC	
Valve clearance [HOT]	mm (inch)	Intake	0.25 (0.0098)		0.25 (0.0098)	
		Exhaust	0.33 (0.0130)		0.33 (0.0130)	
Idling speed		rpm		850 ± 50	850 ± 50	
Blow-by gas recirculating system		Closed type		Closed type	Closed type	
Lubricating System	Lubricating method		Fully-forced feed method		Fully-forced feed method	
	Oil Pump type		Trochoid type		Trochoid type	
	Oil filter type		Full-flow filter type, filter paper type		Full-flow filter type, filter paper type	
	Lubrication oil capacity	ℓ	Whole	3.8		3.8
			When only oil is changed	3.3		3.3
When oil and oil filter are changed			3.5		3.5	
Oil cooler type		Water-cooled type		Water-cooled type		
Cooling System	Cooling method		V-belt driven type		V-belt driven type	
	Radiator type		Corrugation type forced circulation		Corrugation type forced circulation	
	Coolant capacity (Vehicle with front heater)		liter		5.5 ℓ (excluding 1.0 ℓ in reserve tank)	5.5 ℓ (excluding 1.0 ℓ in reserve tank)
	Water pump type		Centrifugal type, "V" belt-driven tank		Centrifugal type, "V" belt driven type	
	Thermostat type		Wax pellet type		Wax pellet type	
Air cleaner	Type		Filter unwoven fabric type		Filter paper	
	Number		1		1	

\* For GCC specifications: 693 × 602 × 685 (27.3 × 23.7 × 27.0)

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# ENGINE SPECIFICATIONS

Item		Engine type	HD-C	HD-E				
Fuel System	Fuel tank	Capacity	60	60				
		Location	Underneath rear seat floor	Underneath rear seat floor				
	Fuel pipe material		Rubber and steel tube	Rubber and steel tube				
	Fuel pump type		Diaphragm type	Electromotor type				
	Fuel filter type		Filter paper type	Filter paper type				
	Carburetor	Manufacturer		Aisan industry	—			
		Type		Down draft, 2-barrel type	—			
		Venturi diameter	mm (inch)	21 (0.83), 28 (1.10)	—			
		Choke valve type		Wax type auto choke	—			
	Fuel injection device		—	Electronic type				
	Injection nozzle or injector	Type of nozzle retainer		—	With cushion rubber type			
		Nozzle type		—	Electronic controlled throttle type			
Injection pressure		kg/cm <sup>2</sup> (psi)	—	2.55 (1.84)				
Engine electrical system	Ignition system	Voltage		V	12 [Negative ground]	12 [Negative ground]		
		Type		Battery ignition type		Battery ignition type		
		Ignition timing		B.T.D.C. 3° ± 2°/850 ± 50 rpm		B.T.D.C. 3° ± 2°/850 ± 50 rpm		
		Firing order		1-3-4-2		1-3-4-2		
	Distributor	Distributor type		Full-transistorized type		Full-transistorized type		
		Breaker type		—		—		
		Performance of timing advancing mechanism	Centrifugal type	0°/600 rpm, 10°/1,800 rpm		0°/600 rpm, 9.5°/2,077 rpm		
	Vacuum type		0°/-100 mmHg, 4.9°/-240 mmHg		0°/-370 mmHg, 3.5°/-440 mmHg			
	Spark plug	Manufacturer		CHAMPION	DENSO	NGK		
		Type		RC9YC4	K20PR-U11	BKR6E-11		
		Thread		M14 × 1.25	M14 × 1.25	M14 × 1.25		
		Spark plug gap	mm (inch)	1.0 - 1.1 (0.039 - 0.043)	1.0 - 1.1 (0.039 - 0.043)	1.0 - 1.1 (0.039 - 0.043)		
	Battery	Type	General specifications		36B20R (*155B24R)		36B20R (*155B24R)	
			ECE & EEC specifications		36B20R (*155B24R)		36B20R (*155B24R)	
			Australian specifications		36B20R		36B20R	
		Capacity AH (5 Hr)	General specifications		28 (*136)		28 (*136)	
			ECE & EEC specifications		28 (*136)		28 (*136)	
Australian specifications			28		28			
Alternator	Type		3-Phase alternating current commutating type		3-Phase alternating current commutating type			
	Output	V-A	12-45		12-50			
	Regulator type		Contact-pointless type		Contact-pointless type			
Starter	Type		Magneto engaging type		Magneto engaging type			
	Output	V-KW	12-0.9, *12-1.0		12-0.9, *12-1.0			
Radio noise suppressing device		Resistive cord		Resistive cord				

\*1: Option for cold region specifications

WN88E-B003

# ENGINE SPECIFICATIONS

## SERVICE SPECIFICATIONS

### TUNE-UP

Drive belt deflection with a pressed force of 10 kg (22 lb) Alternator		New belt Used belt	5.0 - 7.0 mm (0.20 - 0.28 inch) 6.0 - 8.0 mm (0.24 - 0.31 inch)
Coolant capacity w/heater [Excluding 1.0 liter for reserve tank]			5.5 liters [5.8 liters for tropical specifications]
Engine oil capacity Whole amount When only oil is changed When oil and filter are changed		Full level Low level	3.8 liters (3.52 IMP qt) 3.3 liters (2.9 IMP qt) 2.3 liters (2.02 IMP qt) 3.5 liters (3.08 IMP qt) <b>NOTE</b> If oil cooler equipped engine, add 79 cc (4.82 cub inch) for whole amount.
Valve clearances (hot) [Reference (cold)]		Intake Exhaust Intake Exhaust	0.25 ± 0.05 mm (0.0098 ± 0.0020 inch) 0.33 ± 0.05 mm (0.012 ± 0.0020 inch) 0.18 mm (0.0071 inch) 0.25 mm (0.0098 inch)
Spark plugs			
Manufacturer		DENSO NGK CHAMPION	
Type		K20PR-U11 BKR6E-11 RC9YC4	
Thread		M14 × 1.25	
Spark plug gap mm (inch)		1.0 - 1.1 (0.040 - 0.043)	
Ignition timing		B.T.D.C. 3 ± 2°/1000 rpm or less (However, engine revolution must be stable.)	
Idle speed			
Engine type		HD-C HD-E	
Idle speed		850 ± 50 rpm 850 ± 50 rpm	
Fast idle speed adjustment (HD-C)		Full position	1300 - 2000 rpm
Throttle positioner touch revolution (rpm)			
HD-C		HD-E	
1500 ± 50		1800 ± 100	
Throttle positioner operating time		HD-C HD-E	0.5 - 5.0 seconds 1.0 - 5.0 seconds
Compression pressure (at 300 rpm)		Standard Minimum Difference between cylinders	14.0 kg/cm <sup>2</sup> (199.1 psi) 10.5 kg/cm <sup>2</sup> (149.3 psi) 1.5 kg/cm <sup>2</sup> (21.3 psi)

WN88E-B004

**ENGINE MECHANICALS**

Timing belt pulley	Wear limit	Camshaft	119.80 mm (4.717 inch)
		Crankshaft	59.37 mm (2.335 inch)
Timing belt tension spring		Free length	46.5 mm (1.83 inch)
		Installation load	3 kg at 50.9 mm (6.6 lb at 2.00 inch)
Camshaft	Oil clearance (cylinder head-to-camshaft)		0.035 - 0.076 mm (0.0014 - 0.0029 inch)
	Maximum limit		0.17 mm (0.0067 inch)
	Thrust clearance		0.1 - 0.25 mm (0.0040 - 0.0098 inch)
	Maximum limit		0.45 mm (0.018 inch)
	Journal diameter		
	Fuel pump cam diameter	Minimum	42.65 mm (1.68 inch)
	Fuel pump cam stroke	Standard	5.0 mm (0.197 inch)
		Minimum	4.8 mm (0.189 inch)
	Valve cam lobe height		
	Intake	Standard	33.08 - 33.28 mm (1.302 - 1.310 inch)
		Minimum	32.9 mm (1.295 inch)
Exhaust	Standard	33.00 - 33.20 mm (1.299 - 1.307 inch)	
	Minimum	32.85 mm (1.293 inch)	
	Maximum circle run out		0.03 mm (0.0012 inch)
Cylinder head	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)
	Valve seat angle	Intake	30° - 45° - 70°
		Exhaust	20° - 45° - 70°
	Valve contacting angle		45°
	Valve seat contacting width	Standard	1.4 mm (0.055 inch)
	Allowance	1.2 - 1.6 mm (0.048 - 0.062 inch)	
	Maximum valve seat recession		0.5 mm (0.0197 inch)
Valves	Valve stem diameter	Intake valve	6.560 - 6.580 mm (0.2583 - 0.2590 inch)
		Exhaust valve	6.555 - 6.575 mm (0.2581 - 0.2588 inch)
	Valve length	Intake valve	112.8 mm (4.441 inch)
		Exhaust valve	114.5 mm (4.508 inch)
	Valve face angle		45.5°
	Valve stock thickness (Minimum)		
	Intake		0.8 mm (0.0315 inch)
	Exhaust		1.0 mm (0.0394 inch)
	Valve stem oil clearance		
	Intake	Standard	0.020 - 0.060 mm (0.0008 - 0.0023 inch)
	Maximum	0.080 mm (0.0031 inch)	
Exhaust	Standard	0.025 - 0.065 mm (0.0010 - 0.0025 inch)	
	Maximum	0.090 mm (0.0035 inch)	

WN88E-B005

# ENGINE SPECIFICATIONS

Valve springs	Free length	Standard	45.2 - 46.0 mm (1.78 - 1.81 inch)	
		Minimum	44.3 mm (1.74 inch)	
	Installed tension at 38.0 mm (1.50 inch)		26.4 kg (58.2 lb)	
	Maximum out-of-squareness		1.6 mm (0.063 inch)	
Valve rocker arm and valve rocker shaft	Oil clearance	Standard	0.012 - 0.053 mm (0.0005 - 0.0020 inch)	
		Maximum	0.08 mm (0.0031 inch)	
	Valve rocker arm bore diameter		19.500 - 19.521 (0.7678 - 0.7685 inch)	
	Valve rocker shaft outer diameter		19.468 - 19.488 mm (0.7665 - 0.7672 inch)	
Valve rocker arm spacer	Free width		22.00 mm (0.867 inch)	
Exhaust manifold	Warpage		0.1 mm (0.0039 inch)	
Intake manifold	Warpage	Cylinder head side	0.1 mm (0.0039 inch)	
Cylinder block	Maximum cylinder head surface warpage		0.1 mm (0.0039 inch)	
	Cylinder bore diameter	Standard	76.000 - 76.030 mm (2.9922 - 2.9933 inch)	
		O/S 0.25	76.250 - 76.280 mm (3.0020 - 3.0031 inch)	
		Bore honing angle		35° ± 5°
	Coarse degree		1 - 4 Z	
Piston, piston pin and piston rings	Piston-to-cylinder bore clearance	Standard	0.045 - 0.065 mm (0.0018 - 0.0025 inch)	
		Maximum limit	0.11 mm (0.0043 inch)	
	Piston ring groove-to-piston ring side clearance	Standard.	No. 1	0.03 - 0.07 mm (0.0012 - 0.0027 inch)
			No. 2	0.02 - 0.06 mm (0.00079 - 0.0023 inch)
		Maximum		0.12 mm (0.0047 inch)
	Piston ring thickness	Standard	No. 1	1.17 - 1.19 mm (0.0461 - 0.0468 inch)
			No. 2	1.47 - 1.49 mm (0.0579 - 0.0586 inch)
Piston, piston pin and piston rings	Piston ring end gap	Standard	No. 1	0.27 - 0.42 mm (0.011 - 0.016 inch)
			No. 2	0.35 - 0.50 mm (0.0138 - 0.0196 inch)
			0.1	0.20 - 0.70 mm (0.0079 - 0.027 inch)
	Maximum	No. 1	0.7 mm (0.028 inch)	
		No. 2	0.8 mm (0.031 inch)	
		0.1	1.0 mm (0.039 inch)	
	Piston pin-to-connecting rod interference fit		0.012 - 0.044 mm (0.0005 - 0.0017 inch)	
Piston-to-piston pin clearance		0.005 - 0.011 mm (0.0002 - 0.0004 inch)		
Flywheel	Runout	Maximum	0.1 mm (0.0039 inch)	
Connecting rod	Big end thrust clearance	Standard	0.15 - 0.4 mm (0.006 - 0.015 inch)	
		Maximum	0.45 mm (0.018 inch)	
	Maximum bend		0.05 mm (0.0020 inch)	
	Maximum twist		0.05 mm (0.0020 inch)	

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## ENGINE SPECIFICATIONS

Crankshaft	Crankpin journal oil clearance	0.020 - 0.044 mm (0.0008 - 0.0017 inch)	
	Main journal oil clearance	0.024 - 0.042 mm (0.0010 - 0.0016 inch)	
	Crankpin journal diameter	44.975 - 45.000 mm (1.7707 - 1.7716 inch)	
	Main journal diameter	49.975 - 50.000 mm (1.9676 - 1.9685 inch)	
	Thrust clearance	Standard Maximum limit	0.02 - 0.22 mm (0.0008 - 0.0086 inch) 0.30 mm (0.012 inch)
	Runout	Maximum	0.06 mm (0.0024 inch)
Thermostat valve (HD-C)	Operating temperature		
		ON OFF	63°C (145.4°F) or more 55°C (131.0°F) or less

WN88E-B007



# ENGINE SPECIFICATIONS

## FUEL SYSTEM SPECIFICATIONS

Carburetor	Float level	Dimension assumed by its own weight	8 mm (0.315 inch)
		Lip dimension	1.6 mm (0.063 inch)
	Throttle valve closed angle	Primary	9°
		Secondary	20°
	Throttle valve fully opened angle	Primary	90°
		Secondary	80°
	Kick-up angle		23°
	Secondary touch angle		50°
	Throttle valve-to-body clearance with throttle valve opened fully		0.3 mm (0.012 inch)
	Throttle valve-to-body clearance during dash-pot operating period		0.45 mm (0.018 inch)
	Number of backing-off of idle mixture adjusting screw		4
Solenoid valve resistance		80 - 100 Ω	
Outer vent resistance		30 - 45 Ω	
Fuel pump (HD-C)	Suction force at 300 rpm		100 mm Hg or more (3.9 inch Hg or more)
	Push rod length	Standard	87.95 - 88.25 mm (3.463 - 3.474 inch)
		Minimum	87.000 mm (3.425 inch)
	Push rod stroke	Standard	5.0 mm (0.197 inch)
Minimum		4.8 mm (0.189 inch)	

WN88E-B008

## LUBRICATION SYSTEM

Oil pump	Compression spring free length		57 mm (2.24 inch)
	Body clearance		0.20 - 0.28 mm (0.0079 - 0.011 inch)
	Tip clearance		0.16 - 0.24 mm (0.0063 - 0.0094 inch)
	Side clearance		0.035 - 0.085 mm (0.0014 - 0.0033 inch)
	Oil pressure	idling	
at 3000 rpm			0.25 - 5.0 kg/cm <sup>2</sup> (3.56 - 71.1 psi)

WN88E-B009

**COOLING SYSTEM**

Radiator cap	Relief valve opening pressure	
	Standard	0.75 - 1.05 kg/cm <sup>2</sup> (10.7 - 14.9 psi)
	Minimum	0.6 kg/cm <sup>2</sup> (8.5 psi)
Thermostat	Valve opening temperature	
	General specifications	82 - 86°C (179.6 - 186.8°F)
	ECE & EEC specifications	76 - 80°C (168.8 - 176.0°F)
	Valve lift	
	General specifications	8.5 mm or more at 98°C (0.34 inch or more at 208.4°F)
	ECE & EEC specifications	8.5 mm or more at 91°C (0.34 inch or more at 195.8°F)

WN88E-B010

**IGNITION SYSTEM**

Ignition timing	No sub vacuum timing advance takes place. (Engine revolution must be stable at 1000 rpm or less.)	BTDC 3 ± 2°
High-tension cord	Resistance Maximum	15 kΩ per cord
Distributor	Air gap between signal rotor and signal generator	0.2 - 0.4 mm (0.0079 - 0.015 inch)
Ignition coil	Primary coil	1.35 - 1.65 Ω at 20°C (68°F)
	Secondary coil	22 - 30 k Ω at 20° (68°F)

WN88E-B011

# ENGINE SPECIFICATIONS

## STARTING SYSTEM

Conventional type starter motor	Rating voltage and output power	12 V 0.9 kW
	No-load characteristic at 11.0 V	
	Amperage	Less than 50 A
	rpm	More than 5,000 rpm
	Brush length	
	Standard	16.0 mm (0.63 inch)
	Minimum	10.5 mm (0.41 inch)
	Commutator	
	Outer diameter	
	Standard	28 mm (1.102 inch)
Minimum	27 mm (1.063 inch)	
Undercut depth		
Standard	0.5 - 0.8 mm (0.0197 - 0.0314 inch)	
Minimum	0.2 mm (0.0079 inch)	
Maximum circle runout	0.4 mm (0.016 inch)	
Reduction type starter motor	Rating voltage and output power	12 V 1.0 kW
	No-load characteristic at 11.5 V	
	Amperage	Less than 90 A
	rpm	More than 3,000
	Brush length	
	Standard	13.0 mm (0.51 inch)
	Minimum	8.5 mm (0.33 inch)
	Commutator	
	Outer diameter	
	Standard	30 mm (1.18 inch)
Minimum	29 mm (1.14 inch)	
Undercut depth		
Standard	0.6 mm (0.024 inch)	
Minimum	0.2 mm (0.0079 inch)	
Maximum circle runout	0.05 mm (0.0020 inch)	
Spring installed load	1.785 - 2.415 kg (3.94 - 5.32 lb)	

WN88E-B012

## CHARGING SYSTEM

Battery specific gravity		1.25 - 1.27	
Alternator	Rated output	Amperage	45 A/50 A
	Rotor coil resistance		$2.9 \pm 0.2 \Omega$ at 20°C (68°F)
	Slip ring diameter	Standard	14.4 mm (0.57 inch)
		Minimum	14.0 mm (0.55 inch)
	Brush exploded length	Standard	10.5 mm (0.41 inch)
			1.5 mm (0.06 inch)
IC regulating voltage		14.2 - 14.8 V	

WN88E-B013

**EFI SYSTEM**

Fuel pressure regulator	Fuel pressure at No. vacuum	2.3 - 2.8 kg/cm <sup>2</sup> (32.8 - 39.8 psi)															
Injector	Resistance at 20°C (68°F) (approx.)	11.0 - 15.0 Ω															
	Injection amount (approx.)	152 - 168 cc/60 seconds at 20°C (68°F) (9.28 - 10.2 cub inch)															
	Difference between each injector	5 cc or less (0.31 cub inch or less)															
	Fuel leakage	Less than one drop of fuel per minute															
EFI main relay Injector relay	Between terminals ① - ② ③ - ④	60 - 85 Ω Infinity															
Fuel pump relay	Between terminals ① - ② ③ - ④	70 - 90 Ω Infinity															
Idle-up VSV	Resistance	30 - 50 Ω at 20°C (68°F)															
Throttle position sensor	Resistance																
	Between terminals ⑩ - ⑪ Throttle valve closed fully	0.2 Ω or less at 20°C (68°F)															
	Throttle valve opened fully	10 kΩ or more at 20°C (68°F)															
	Between terminals ⑫ - ⑬ Throttle valve closed fully	10 kΩ or more at 20°C (68°F)															
Throttle valve opened fully	5 Ω or less at 20° (68°F)																
Fuel pump	Fuel flow amount	235 cc or more/15 seconds (14.34 cub inch or more)															
Water temperature sensor Intake air temperature sensor	Cooling water temperature	Resistance															
	80°C (176°F)	0.322 ± 0.1 kΩ															
	60°C (140°F)	0.584 ± 0.2 kΩ															
	40°C (104°F)	1.14 ± 0.3 kΩ															
	20°C (68°F)	2.45 ± 0.5 kΩ															
	0°C (32°F)	5.88 ± 1.5 kΩ															
-20°C (-4°F)	16.2 ± 3.2 kΩ																
Pressure sensor Output between SST terminals ⑬ - ⑭ (ground) (When engine is stopped.)																	
<table border="1"> <thead> <tr> <th>Measuring point</th> <th>Atmospheric pressure mm Hg (inch Hg)</th> <th>Voltage V</th> </tr> </thead> <tbody> <tr> <td>Altitude (height above sea level) m (ft)</td> <td></td> <td></td> </tr> <tr> <td>0 (0)</td> <td>760 (29.92)</td> <td>3.3 - 3.9</td> </tr> <tr> <td>500 (1640)</td> <td>716 (28.19)</td> <td>3.2 - 3.8</td> </tr> <tr> <td>1000 (3280)</td> <td>674 (26.54)</td> <td>3.0 - 3.6</td> </tr> </tbody> </table>			Measuring point	Atmospheric pressure mm Hg (inch Hg)	Voltage V	Altitude (height above sea level) m (ft)			0 (0)	760 (29.92)	3.3 - 3.9	500 (1640)	716 (28.19)	3.2 - 3.8	1000 (3280)	674 (26.54)	3.0 - 3.6
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1000 (3280)	674 (26.54)	3.0 - 3.6															

WN88E-B014

# ENGINE SPECIFICATIONS

## VOLTAGES AT ECU WIRING CONNECTORS

Terminals	STD voltage or resistance	Conditions	Remedies
(1) - (21)	1 $\Omega$ or less	Ignition switch OFF.	Proceed to flow chart (2).
(2) - (21)	1V or less	Ignition switch OFF (after more than one minute).	Check power supply.
	10 - 15V	Ignition switch ON.	
(3) - (21)	0.1V or less	Ignition switch OFF (after more than ten seconds).	Check power supply.
	10 - 15V	Ignition switch ON.	
(4) - (21)	10 - 15V	At all times. (Measured voltage is lower than specified voltage only at during starting period.)	Check power supply.
(5) - (21)	10 - 15V	Engine fully warmed up. All accessory switches turned OFF.	Check power supply.
	3.0V or less	Idle-up VSV ON.	Check idle-up VSV control.
(6) - (21)	4.5 - 5.5V	Ignition switch ON. T-terminal shorted with ground terminal. Throttle valve fully closed.	Proceed to flow chart (2).
	1V or less		Check diagnosis code.
	0 - 4.5 to 5.5V (Measured voltage varies)	Ignition switch ON. T-terminal shorted with ground terminal. Engine revolution speed build at 300 rpm after it has fully warmed up.	Oxygen sensor system.
(7) - (21)	0.1V or less	Ignition switch OFF.	Check power supply.
	10 - 15V	Ignition switch ON.	
(8) - (21)	0.1V or less	Ignition switch OFF.	Check power supply.
	6 - 15V	When ignition switch is set to ST position.	
(9) - (21)	0.1V or less	Ignition switch OFF.	Check T-terminal wiring.
	10 - 15V	Ignition switch ON.	
(10) - (21)	0.5V or less	Ignition switch ON. Throttle valve fully closed.	Throttle position sensor system.
	10 - 15V	Ignition switch ON. Throttle valve fully opened.	
(11) - (21)	0.1V or less	Ignition switch ON. Headlamp switch and/or defogger switch OFF.	Check idle-up VSV control.
	9 - 15V	Ignition switch ON. Headlamp switch and/or defogger switch ON.	
(12) - (22)	0.1V or less	Ignition switch OFF.	Check VCC wiring.
	4.5 - 5.5V	Ignition switch ON.	
(13) - (22)	3.2 - 3.8V	Ignition switch ON. Atmospheric pressure is 760 mmHg (29.9 inchHg).	Check pressure sensor.
(14) - (30)	0.9 - 3.0V	Ignition switch ON. Air temperature inside surge tank: 20°C (68°F).	Check intake air temperature sensor.
(15) - (30)	0.4 - 0.5V	Ignition switch ON. After engine has been warmed up fully. (Cooling water temperature: 80 - 90°C (176 - 194°F).	Check cooling water temperature sensor.
(16) - (1)	1 $\Omega$ or less	Ignition switch OFF.	Proceed to flow chart (2).
(17) - (21)	1V or less	Ignition switch OFF (after more than one minute).	Check/repair injector power supply.
	10 - 15V	Ignition switch ON.	

WN88E-B015

# ENGINE SPECIFICATIONS

Terminals	STD voltage or resistance	Conditions	Remedies
(18) - (21)	0.1V or less	Ignition switch OFF.	Check/repair ECU power supply.
	10 - 15V	Ignition switch ON.	
(19) - (21)	3V or less	Ignition switch ON. (Check engine lamp illuminated.)	Check power supply for check engine lamp.
	10 - 15V	Engine is rotating. (Check engine lamp not illuminated).	
(20) - (21)	1V or less	Ignition switch ON. Fuel pump is operating.	Check/repair fuel pump power supply.
	10 - 15V	Ignition switch ON. Fuel pump is stopped.	
(21) - Engine ground	0.2Ω or less.	Ignition switch OFF.	Check ground wiring.
(22) - (21)	0.5Ω or less.	Ignition switch OFF.	Replace ECU.
(23) - (21)	10 - 15V	Engine is rotating. Air conditioner compressor is rotating. (Genuine air conditioner-equipped vehicle.)	Check air conditioner wiring.
(26) - (21)	0 - 10 to 15V	Ignition switch ON. When vehicle is moved. (Measured voltage changes 4 times for movement of 1.5 m.)	Check speed sensor
(28) - (21)	4.5 - 5.5V	Ignition switch ON. Throttle valve fully closed.	Check throttle position sensor.
	0.5V or less	Ignition switch ON. Throttle valve fully opened.	
(29) - (21)	0.1V or less	Ignition switch ON (after more than 60 seconds).	Check oxygen sensor.
	Voltage varies within 0 - 1.0V	After engine has warmed up fully. When engine revolution is held as 3000 rpm for more than 2 minutes:	Check fuel system.
(30) - (21)	1Ω or less	Ignition switch ON.	Proceed to flow chart (2).

WN88E-B016

# **DAIHATSU**

# **F300**

[HD-ENGINE]

## **TIGHTENING TORQUE**

### **TIGHTENING TORQUES FOR MAIN**

<b>COMPONENTS .....</b>	<b>C-2</b>
METHOD TO IDENTIFY STRENGTH	
DIVISION OF BOLTS .....	<b>C-2</b>
TIGHTENING TORQUE TABLE FOR	
GENERAL STANDARD BOLTS .....	<b>C-3</b>
ENGINE .....	<b>C-4</b>

WRC88-C001

**C**

# TIGHTENING TORQUES


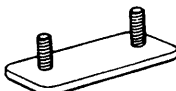





## TIGHTENING TORQUE FOR MAIN COMPONENTS

1. When you want to find out a suitable tightening torque for a bolt, first determine the strength division of the said bolt, using the table below. Then, locate suitable tightening torque in the tightening torque table described later.
2. As for the tightening torque for a nut, find out suitable tightening torque in the same way as with the paragraph 1 above, based on the mating bolt.
3. Tightening torque posted in the workshop manual is a standard value for steel fasteners. It is, therefore, necessary to modify these tightening torque when you tighten fasteners made of materials other than steel. This rule also applies to such instances where bolts are undergoing heat or other stress, such as vibratory loads and so forth.

WRC88-C002

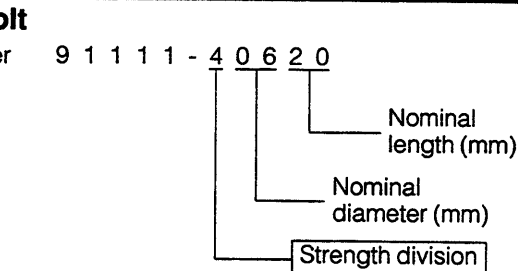
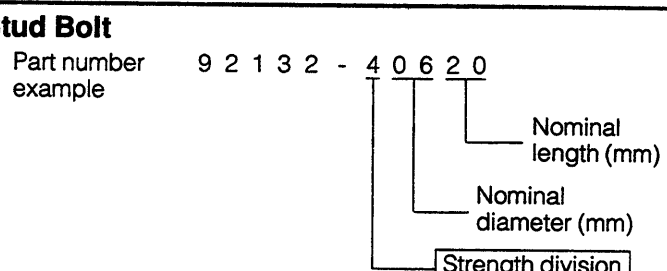
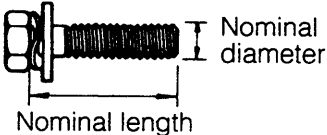
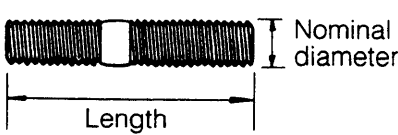
## METHOD TO IDENTIFY STRENGTH DIVISION OF BOLTS

### 1. Identification Method by Checking Bolts Themselves

	Configuration and how to determine strength division		Strength division		Configuration and how to determine strength division		Strength division
<b>Hexagon bolt</b>		Bolt having an embossed or stamped figure at its head section	4 = 4T 5 = 5T 6 = 6T 7 = 7T	<b>Welded bolt</b>			4T
		No mark	4T		<b>Stud bolt</b>		No mark
		Bolt having two embossed lines at its head section	5T 6T			Bolt having about 2 mm deep recess at one end or both ends	
		Bolt having three embossed lines at its head section	7T				

WRC88-C003

### 2. Identification Method by Part Numbers

<b>Hexagon Bolt</b>		<b>Stud Bolt</b>	
Part number example	9 1 1 1 1 - 4 0 6 2 0	Part number example	9 2 1 3 2 - 4 0 6 2 0
			
			

WRC88-C004



**[Tightening Torque Table for General Standard Bolts]**

Category	Nominal diameter	Pitch	Standard tightening torque kg-m (ft-lb)	
			Standard torque	Tightening range
<b>4T</b> (Bolt having a mark of "4" at its head section) Example of part number (91○○○ - 4○○○○)	6	1	0.47 ( 3.4)	0.4 - 0.7 ( 2.9 - 5.1)
	8	1.25	1.11 ( 8.0)	1.0 - 1.6 ( 7.2 - 11.6)
	10	1.25	2.25 ( 16.3)	1.9 - 3.1 ( 14 - 22.5)
	10	1.5	2.14 ( 15.5)	1.8 - 3.0 ( 13 - 22 )
	12	1.25 (ISO)	4.40 ( 31.8)	3.5 - 5.5 ( 25 - 40 )
	12	1.5	3.89 ( 28.1)	3.5 - 5.5 ( 25 - 40 )
	12	1.75	3.74 ( 27.1)	3.0 - 5.0 ( 22 - 36 )
	13	1.5	5.08 ( 36.7)	4.5 - 7.0 ( 33 - 51 )
	14	1.5	6.33 ( 45.8)	5.0 - 8.0 ( 36 - 58 )
	14	2	5.93 ( 42.9)	4.7 - 7.7 ( 34 - 56 )
	16	1.5	9.57 ( 69.2)	7.5 - 11.0 ( 54 - 80 )
16	2	9.10 ( 65.8)	7.1 - 10.6 ( 51 - 77.5)	
<b>5T</b> (Bolt having a mark of "5" at its head section) Example of part number (91○○○ - 5○○○○)	6	1	0.71 ( 5.1)	0.6 - 0.9 ( 4.3 - 6.5)
	8	1.25	1.66 ( 12.0)	1.5 - 2.2 ( 11 - 16 )
	10	1.25	3.37 ( 24.4)	3.0 - 4.5 ( 22 - 33 )
	10	1.5	3.20 ( 23.1)	2.7 - 4.2 ( 19.5 - 30.5)
	12	1.25 (ISO)	5.84 ( 42.2)	5.0 - 7.0 ( 36 - 51 )
	12	1.5	5.84 ( 42.2)	5.0 - 7.0 ( 36 - 51 )
	12	1.75	5.60 ( 40.5)	4.8 - 6.8 ( 34 - 49 )
	13	1.5	7.63 ( 55.2)	6.5 - 9.0 ( 47 - 65 )
	14	1.5	9.50 ( 68.7)	7.5 - 11.0 ( 54 - 79.5)
	14	2	8.90 ( 64.4)	7.0 - 10.5 ( 51 - 76 )
	16	1.5	14.36 (103.9)	12.0 - 17.0 ( 87 - 123 )
16	2	13.58 ( 98.2)	11.5 - 16.5 ( 83 - 119 )	
<b>6T</b> (Bolt having a mark of "6" at its head section) Example of part number (91○○○ - 6○○○○)	6	1	0.71 ( 5.1)	0.6 - 0.9 ( 4.3 - 6.5)
	8	1.25	1.66 ( 12.0)	1.5 - 2.2 ( 11 - 16 )
	10	1.25	3.37 ( 24.4)	3.0 - 4.5 ( 22 - 33 )
	10	1.5	3.20 ( 23.1)	2.7 - 4.2 ( 19.5 - 30.5)
	12	1.25 (ISO)	5.84 ( 42.2)	5.0 - 7.0 ( 36 - 51 )
	12	1.5	5.84 ( 42.2)	5.0 - 7.0 ( 36 - 51 )
12	1.75	5.61 ( 40.6)	4.8 - 6.8 ( 35 - 49 )	
<b>7T</b> (Bolt having a mark of "7" at its head section) Example of part number (91○○○ - 7○○○○)	6	1	0.95 ( 6.87)	0.8 - 1.2 ( 5.8 - 8.7)
	8	1.25	2.20 ( 15.9)	2.0 - 3.0 ( 14.5 - 22 )
	10	1.25	4.50 ( 32.5)	4.0 - 5.5 ( 29 - 40 )
	10	1.5	4.30 ( 31.1)	3.7 - 5.2 ( 27 - 38 )
	12	1.25 (ISO)	7.78 ( 56.3)	7.0 - 9.0 ( 51 - 65 )
	12	1.5	7.78 ( 56.3)	7.0 - 9.0 ( 51 - 65 )
	12	1.75	7.48 ( 54.1)	6.0 - 8.5 ( 43 - 61.5)
	13	1.5	10.17 ( 73.6)	8.0 - 12.0 ( 58 - 88 )
	14	1.5	12.67 ( 91.6)	10.0 - 15.0 ( 72 - 108 )
	14	2	11.86 ( 85.8)	9.5 - 14.0 ( 69 - 101 )
	16	1.5	19.15 (138.5)	15.0 - 23.0 (108 - 169 )
16	2	18.11 (131.0)	14.9 - 22.0 (108 - 159 )	

WRC88-C005

# TIGHTENING TORQUES

## ENGINE

Unit: kg-m (ft-lb)

Tightening component	Tightening torque
Cylinder head × Spark plug	1.5 - 2.2 (10.8 - 15.9)
Cylinder head × Cylinder head cover	0.3 - 0.5 (2.2 - 3.6)
Cylinder head × Rocker shaft	M10 Bolt 2.9 - 3.7 (21.0 - 26.8) M8 Bolt 1.3 - 1.7 (9.4 - 12.3)
Cylinder head × Cylinder block	6.0 - 6.8 (43.4 - 49.2)
Cylinder head × Water temperature sensor (HD-E engine only)	2.5 - 3.5 (18.1 - 25.3)
Cylinder head × BVSV (HD-C engine only)	2.5 - 3.5 (18.1 - 25.3)
Cylinder head × Water temperature sender gauge	1.2 - 2.0 (8.7 - 14.5)
Cylinder head × Distributor	1.5 - 2.2 (10.8 - 15.9)
Cylinder head × Exhaust manifold	3.0 - 4.5 (21.7 - 32.5)
Cylinder head × Intake manifold	1.5 - 2.2 (10.8 - 15.9)
Cylinder head × Fuel pump (HD-C engine only)	1.5 - 2.2 (10.8 - 15.9)
Cylinder block × Water inlet	0.6 - 0.9 (4.3 - 6.5)
Cylinder block × Crankshaft main bearing cap	4.5 - 5.5 (32.5 - 39.8)
Cylinder block × Oil pump	0.6 - 0.9 (4.3 - 6.5)
Cylinder block × Rear oil seal retainer	0.6 - 0.9 (4.3 - 6.5)
Cylinder block × Water pump	1.5 - 2.2 (10.8 - 15.9)
Cylinder block × Engine mounting bracket	4.0 - 5.5 (28.9 - 39.8)
Cylinder block × Transmission	5.0 - 7.0 (36.2 - 50.6)
Cylinder block × Oil cooler pipe	2.5 - 3.5 (18.1 - 25.3)
Surge tank × Intake air temperature sensor	3.0 - 4.0 (21.7 - 28.9)
Surge tank × Gas filter	1.2 - 2.0 (8.7 - 14.5)
Surge tank × Throttle body	1.5 - 2.2 (10.8 - 15.9)
Crankshaft × Flywheel	8.0 - 10.0 (57.9 - 72.0)
Crankshaft × Crankshaft timing belt pulley	9.0 - 10.0 (65.1 - 72.0)
Intake manifold × Delivery pipe	1.5 - 2.2 (10.8 - 15.9)
Intake manifold × Carburetor (HD-C engine only)	1.5 - 2.2 (10.8 - 15.9)
Exhaust manifold × Exhaust pipe	3.5 - 5.0 (25.3 - 36.2)
Exhaust pipe clamp	3.0 - 4.5 (21.7 - 32.5)
Engine mounting bracket × Engine mounting (bolt)	3.0 - 4.5 (21.7 - 32.5)
Engine mounting bracket × Engine mounting (nut)	3.5 - 5.5 (25.3 - 39.8)

WN88E-C001

# TIGHTENING TORQUES

Unit: kg-m (ft-lb)

Tightening component	Tightening torque
Oil pump body × Oil cooler	2.5 - 3.5 (18.1 - 25.3)
Oil pump × Oil pressure switch	1.2 - 2.0 (8.7 - 14.5)
Oil pan	0.7 - 1.2 (5.1 - 8.7)
Oil pan × Drain plug	2.0 - 3.0 (14.5 - 21.7)
Oil pump body × Oil pump cover	0.8 - 1.3 (5.8 - 9.4)
Oil level gauge guide	1.9 - 3.1 (13.7 - 22.4)
Surge tank stay No. 1	1.5 - 2.2 (10.8 - 15.9)
Surge tank stay No. 2	1.9 - 3.1 (13.7 - 22.4)
Surge tank stay No. 3	2.0 - 3.0 (8.7 - 14.5)
Camshaft × Camshaft timing belt pulley	1.5 - 2.2 (10.8 - 15.9)
Timing belt cover	0.2 - 0.4 (1.4 - 2.9)
Timing belt tensioner	3.0 - 4.5 (21.7 - 32.5)
Crankshaft timing belt pulley × Crankshaft pulley	2.0 - 3.0 (14.5 - 21.7)
Fluid coupling × Water pump pulley × Water pump	1.0 - 1.8 (7.2 - 13.0)
Cooling fan × Fluid coupling	0.5 - 0.6 (3.6 - 4.3)
Fuel filter × Fuel hose No. 1	3.5 - 4.5 (25.3 - 32.5)
Fuel filter × Fuel pipe	3.5 - 4.4 (25.3 - 31.8)
Fuel hose No. 1 × Delivery pipe	3.5 - 4.5 (25.3 - 32.5)
Connecting rod × Connecting rod cap	3.5 - 4.5 (25.3 - 32.5)
Clutch cover × Flywheel	1.5 - 2.2 (10.8 - 15.9)
Transmission × Starter motor	5.0 - 7.0 (36.2 - 50.6)
Front pipe × Rear pipe	3.7 - 5.2 (26.8 - 37.6)
Fuel pump × Fuel pipe	3.5 - 4.4 (25.3 - 31.8)

WN88E-C002

# **DAIHATSU**

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# **F300**

[HD-ENGINE]

## **WIRING DIAGRAM**

**WIRING DIAGRAM ..... D-2**

WN88E-D001

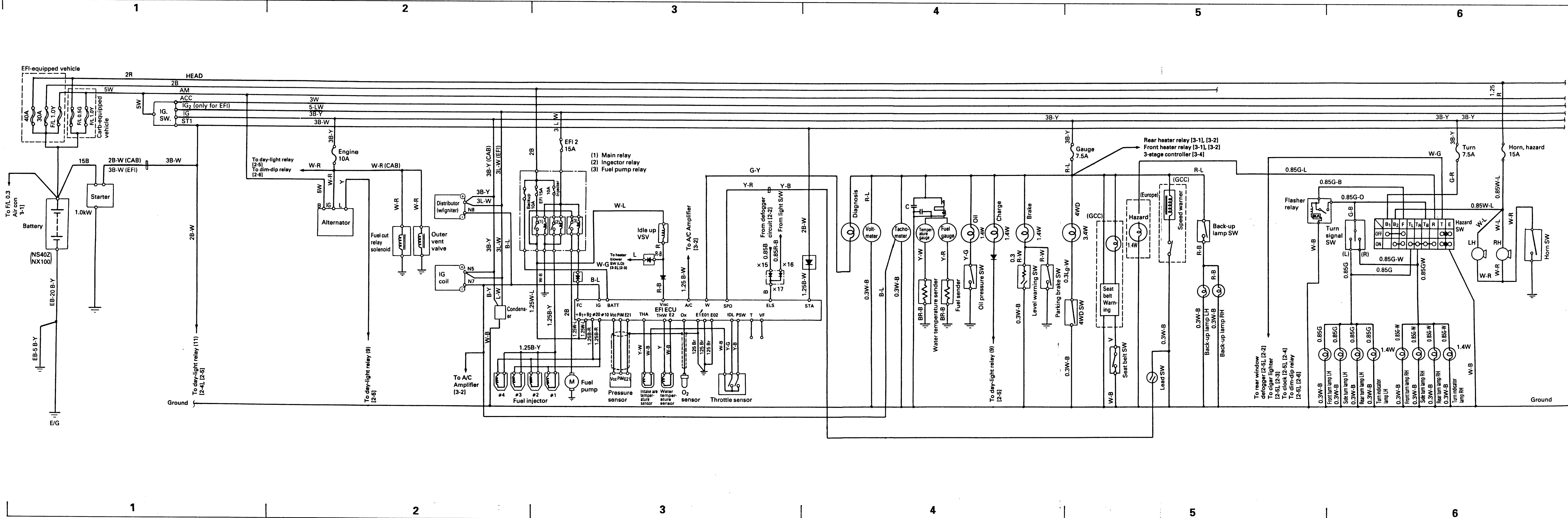
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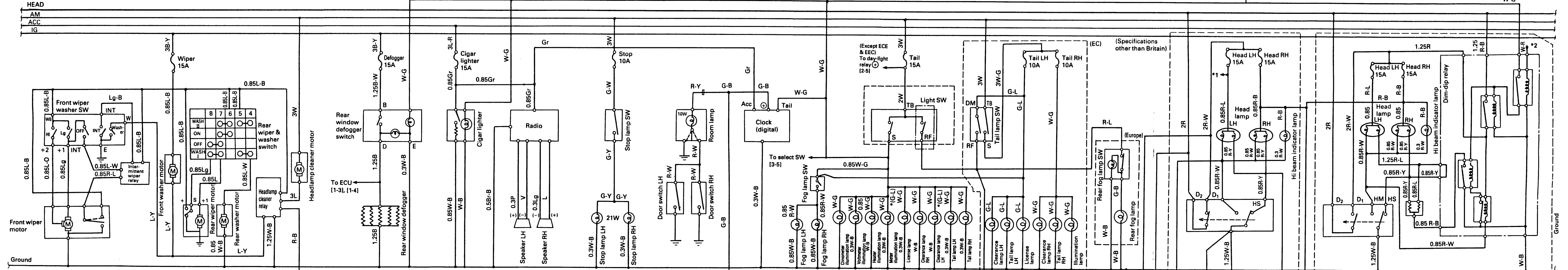
# WIRING DIAGRAM

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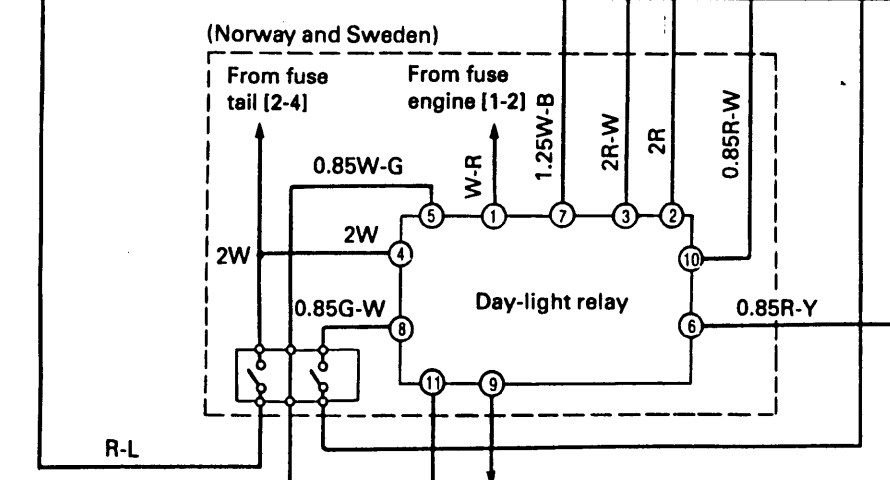
WN88-11025





\*1: To ECU [1-3]  
 ? : From fuse engine [1-2]

\*On specifications other than EC (Britain day-light specifications), wire color of blower wire differs.



(For U.K. specification)

From fuse lock dome [3-1]

From IG switch (ST1) [1-1]

From fuse tail [2-4]

From alternator (L) [1-2]  
 From charge lamp [1-4]

