

## 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.

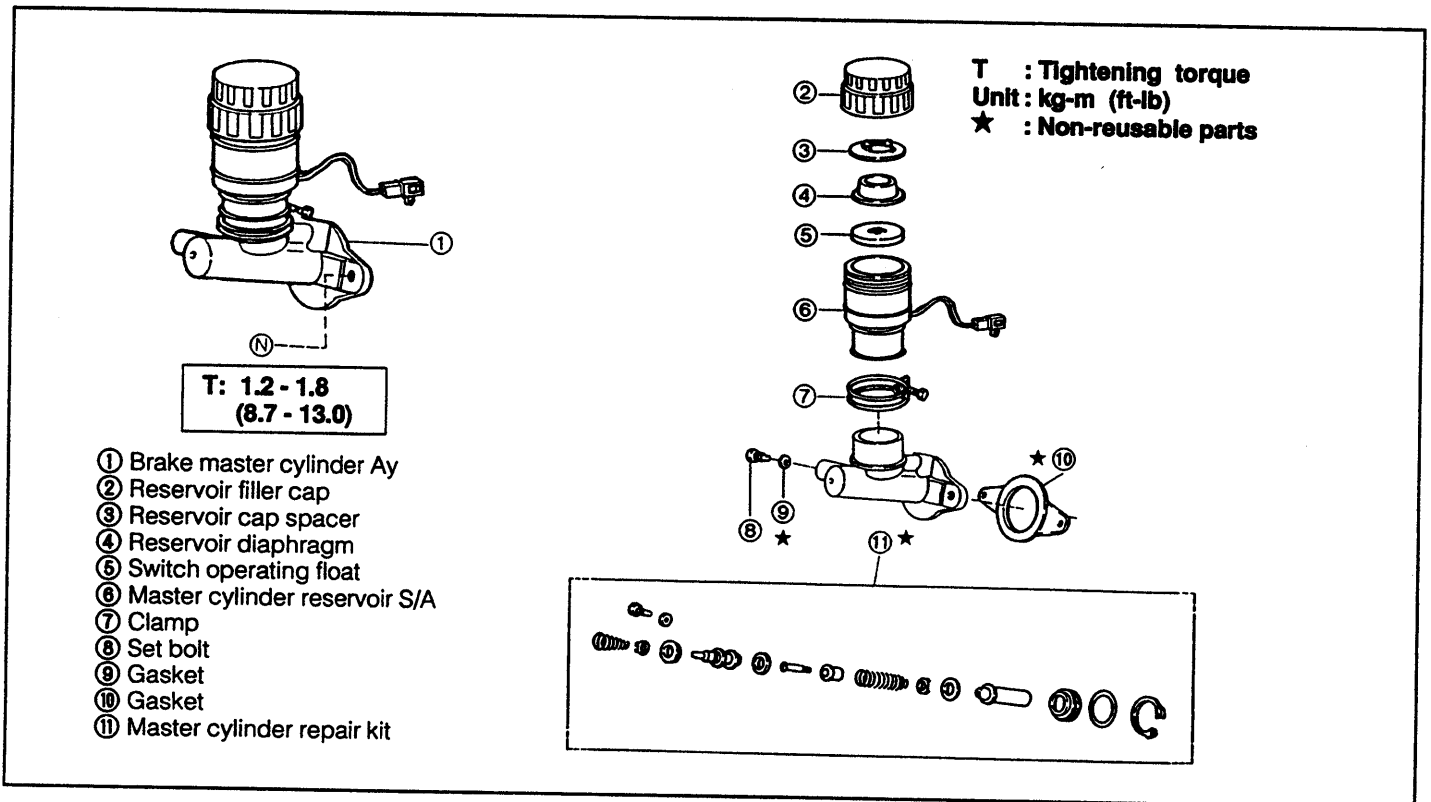
WN88E-GI002

## 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

### 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.

# 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).

**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.

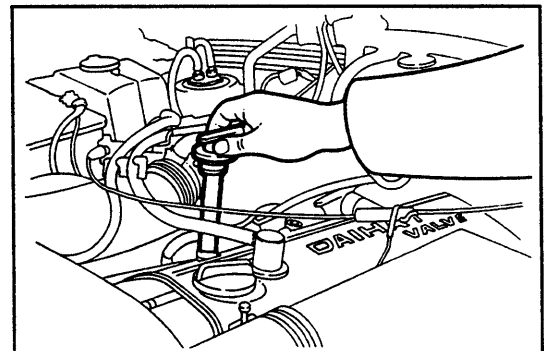
3. Removal of spark plugs

- (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



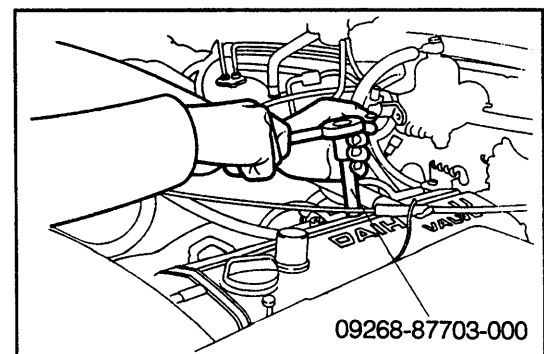
WN88E-EM056

- (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



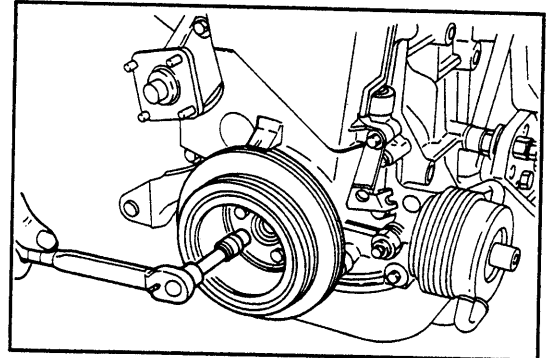
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WN88E-EM057

# 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)**

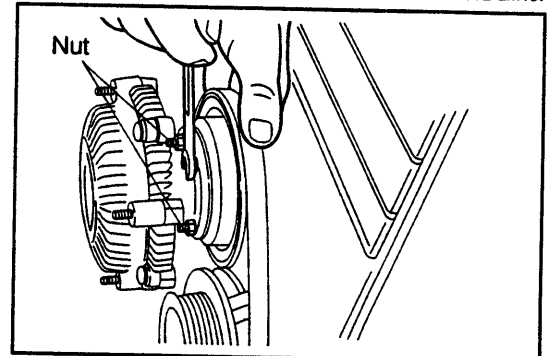


## 6. Installation of fluid coupling and fan shroud

- (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:

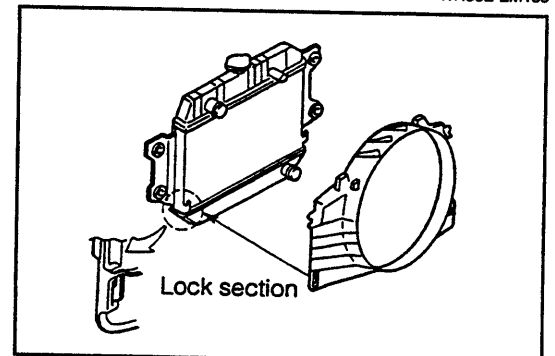
Be sure that the water pump pulley is not ride to the spigot section of the water pump pulley seat.



- (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)**



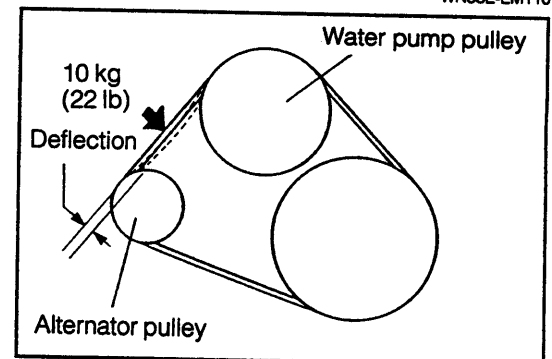
- (4) Insert the lock section of fan shroud to the radiator. Then, tighten the two attaching bolts of the radiator upper side.
- (5) Connect the water hose to the radiator upper tank.

## 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



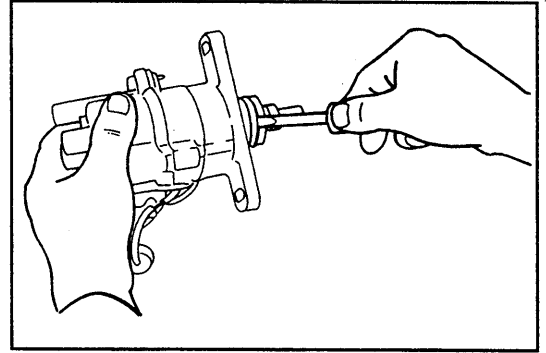
### NOTE

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

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

**NOTE:**

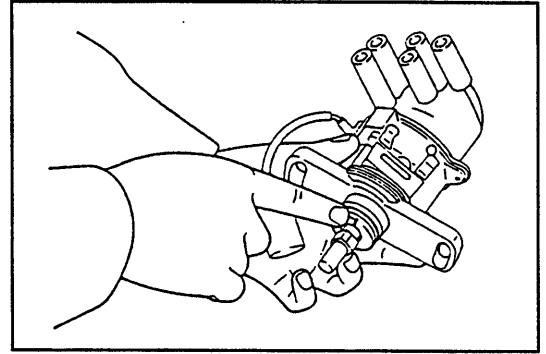
Care must be exercised to avoid scratching the new "O" ring.



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.

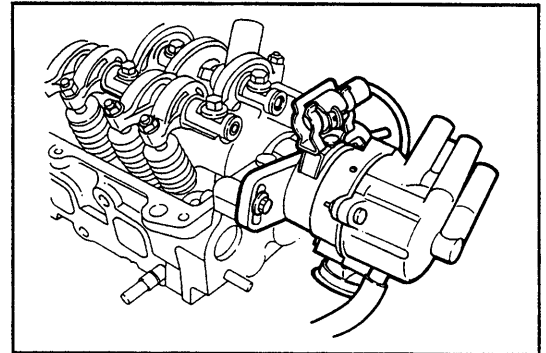
During this installation, the aligned cutout sections must come at the top side of the engine.



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.

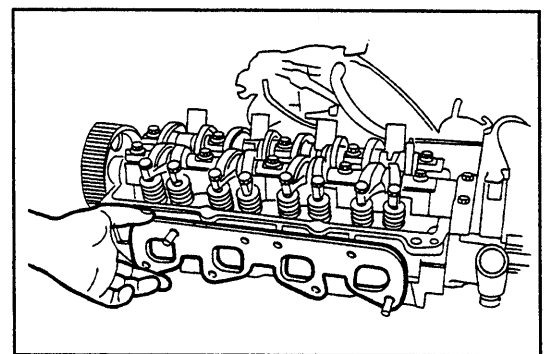
WN88E-EM231

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:**

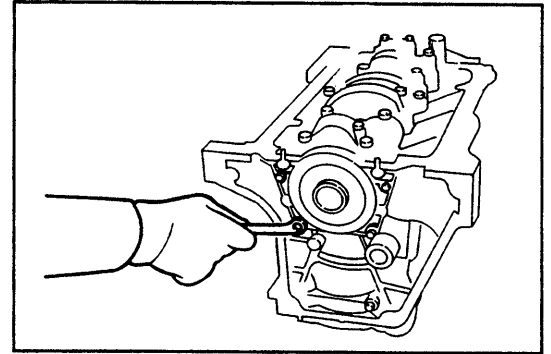
The exhaust manifold gasket should be installed in such a direction that the side where the grommet turned-out section is bulged may come at the exhaust manifold.



WN88E-EM232

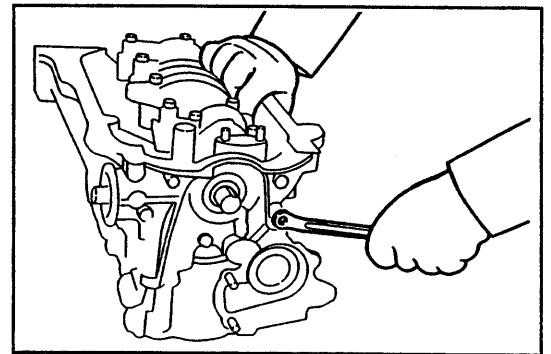
# ENGINE MECHANICALS

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.

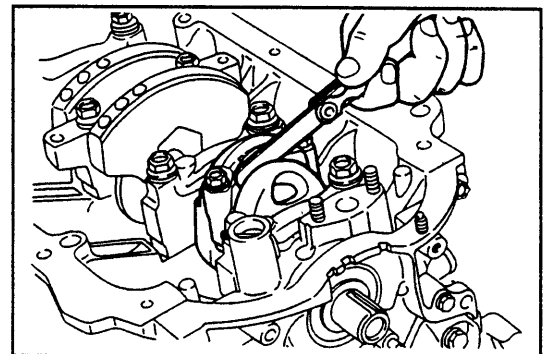
Thrust clearance:

Standard 0.15 - 0.4 mm (0.0060 - 0.015 inch)

Maximum 0.45 mm (0.017 inch)

**NOTE:**

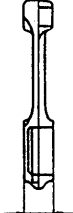
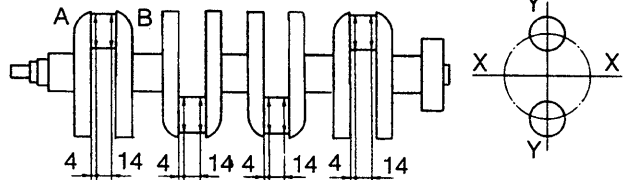
The thrust clearance should be measured while the connecting rod is being pushed against either side of the crankshaft in the axial direction. Measure the thrust clearance at the opposite side.



WN88-EM353

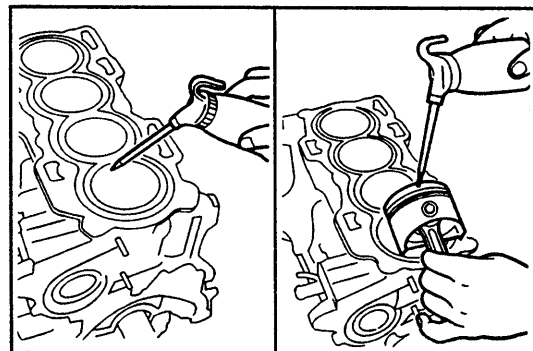
If the clearance exceeds the specified value, replace the connecting rod or the crankshaft, or both of them, referring to the width of the big end of the connecting rod in the thrust direction and the side width of the crankpin journal.

**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

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



WR88-EM884

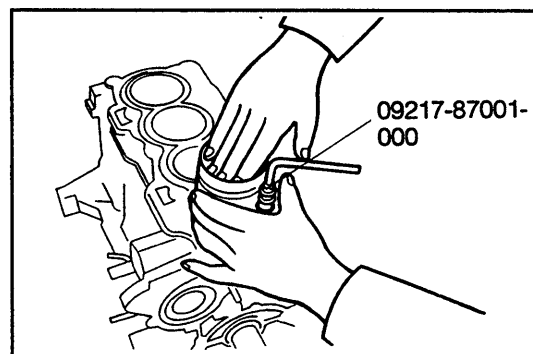
- (10) Compress the piston rings by means of the piston ring compressor SST, making sure that the piston ring ends will not move during the installation.

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

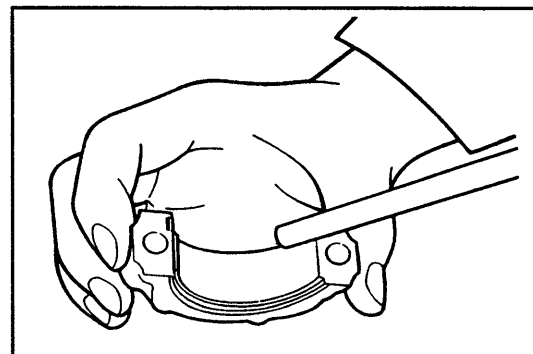
- (12) Push the piston by hand until the connecting rod reaches the crankpin journal.

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

**NOTE:**

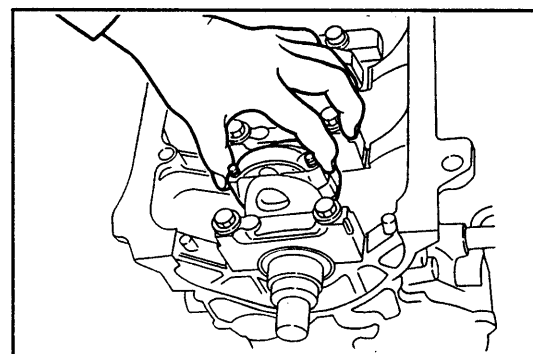
Do not touch with the bearing front surface.

- (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

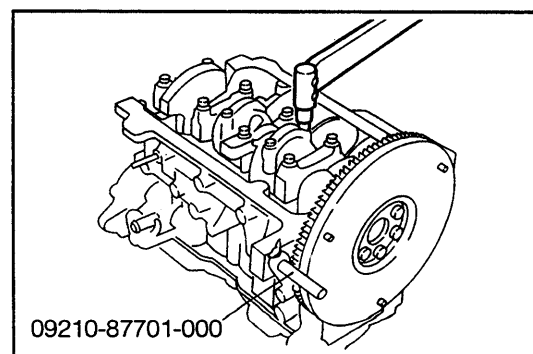
- (16) Prevent the crankshaft from turning, using the following SST.

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.



09210-87701-000

WN88-EM396



8. Harness Around Battery

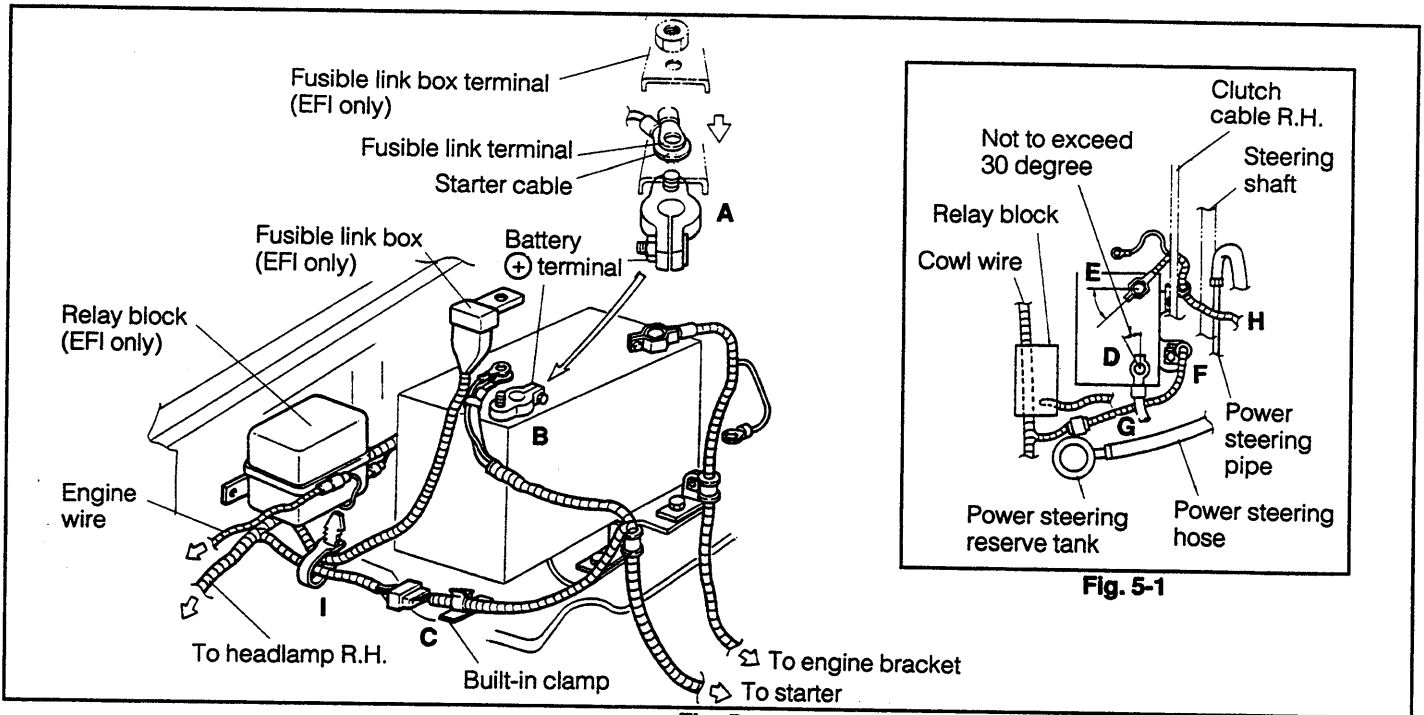
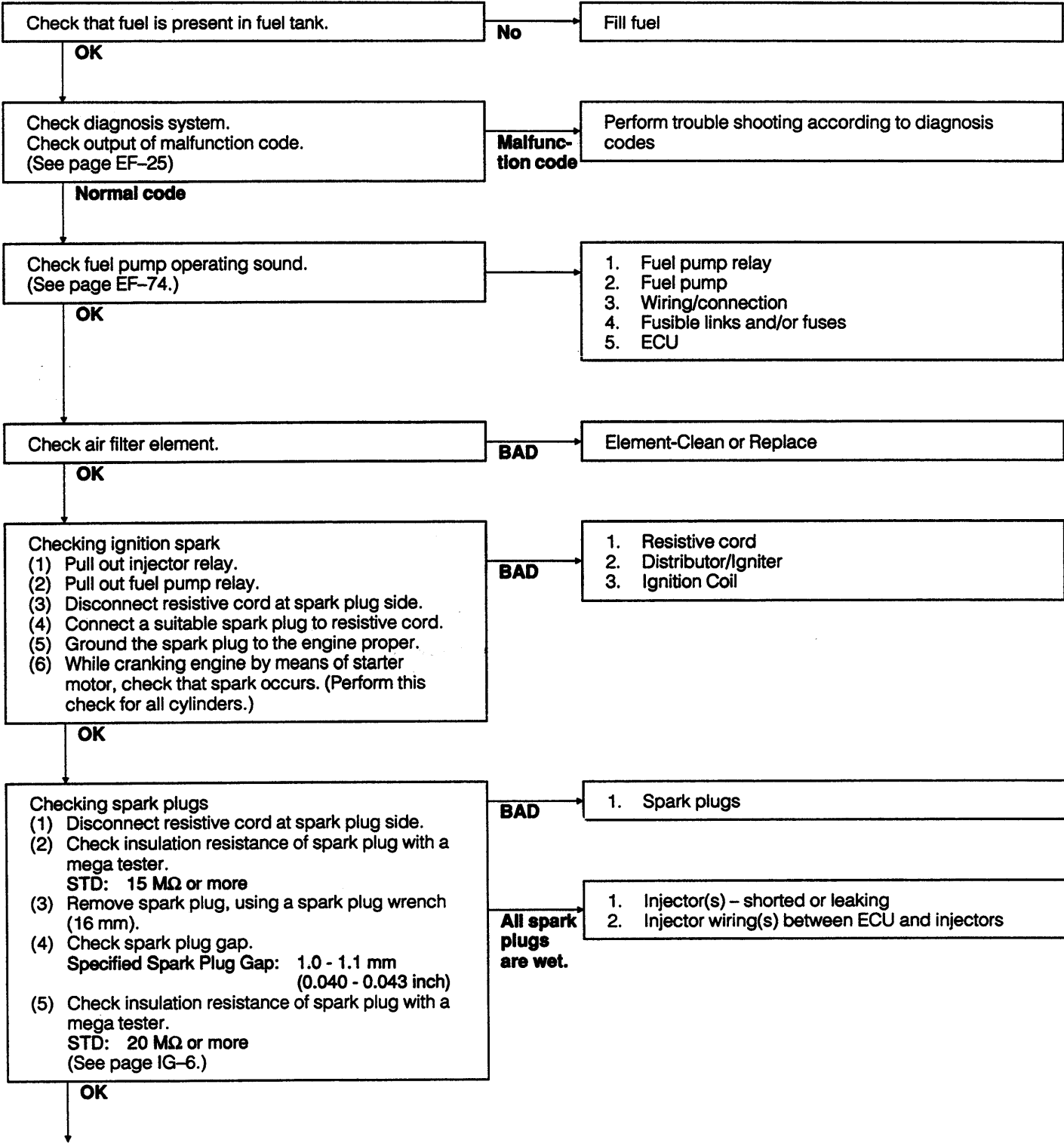


Fig. 5

Fig. 5-1

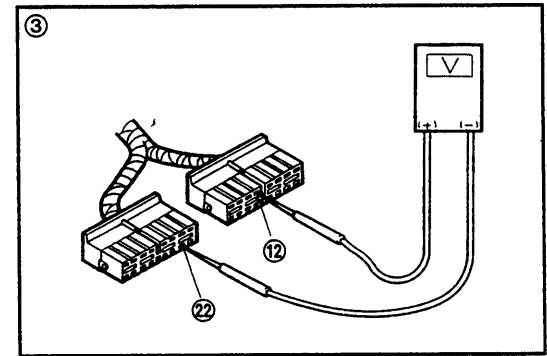
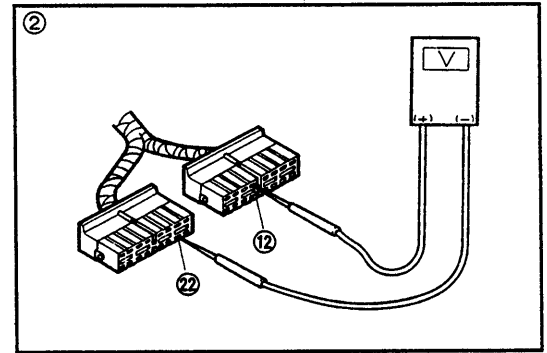
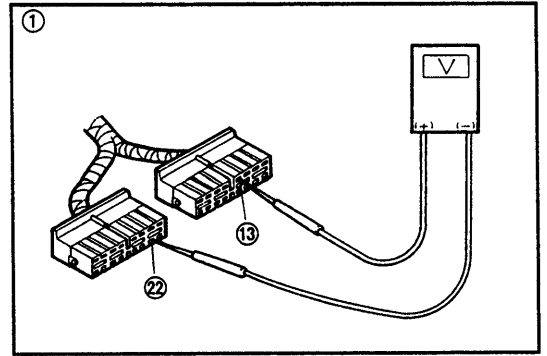
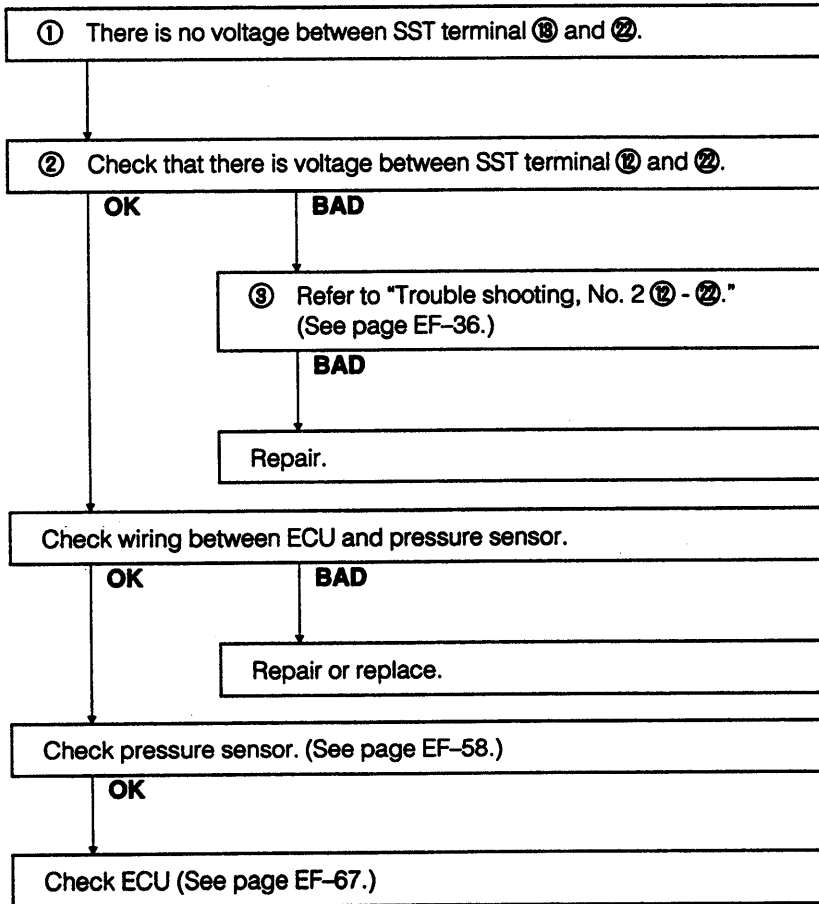
No.	Work procedure	Parts	Control item
1	Perform assembly so that the bent member [ ] of the fusible link box terminal may not ride on the starter cable and fusible link terminal. (Fig. 6)	A	Ensure that the terminal does not ride on other parts.
2	Install the following parts to the battery ⊕ terminal 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.

2 Symptom .... Engine will not start.  
(Engine cranks normally.)



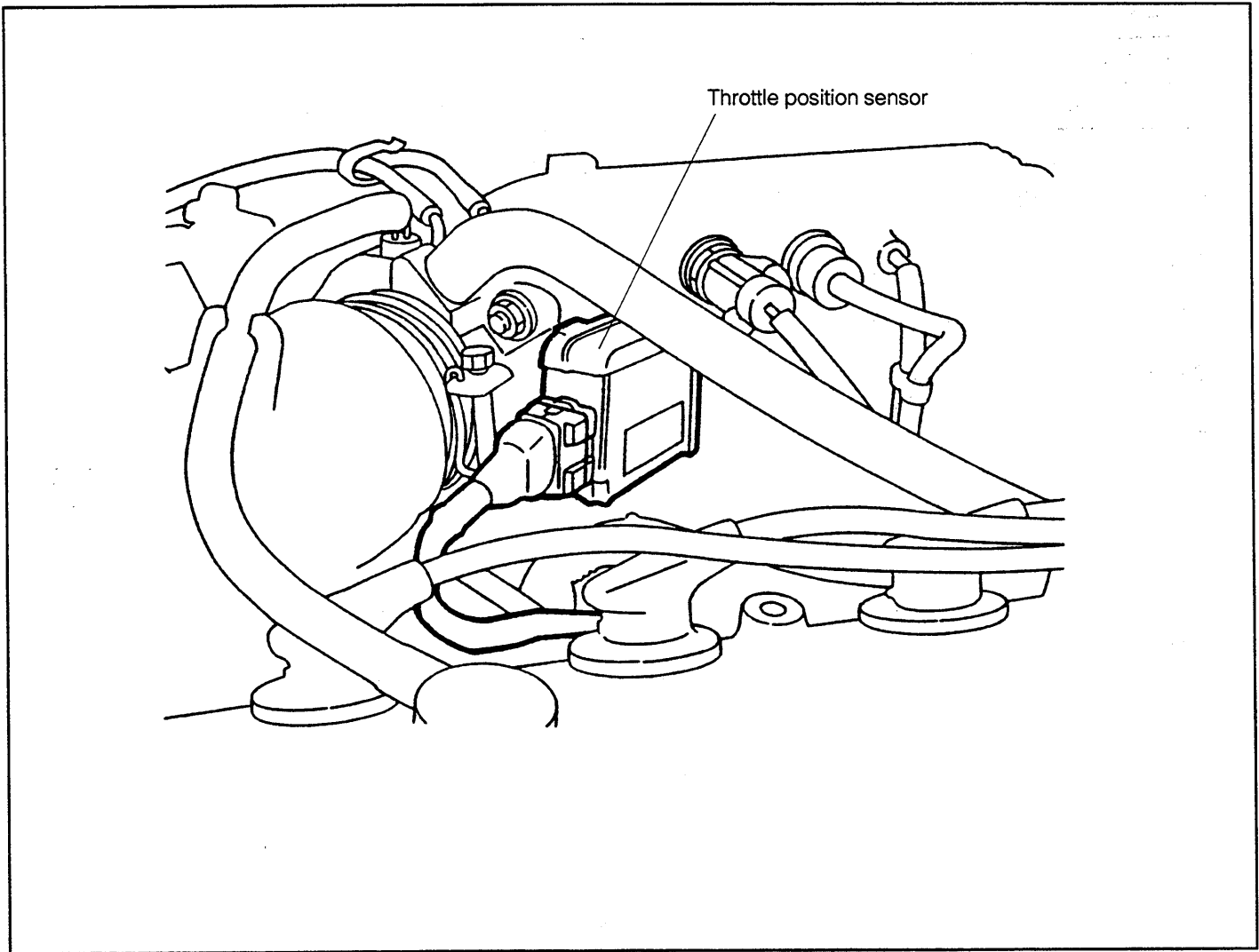
WN88E-EF027

• 13 - 22



WN88E-EF069

## 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.

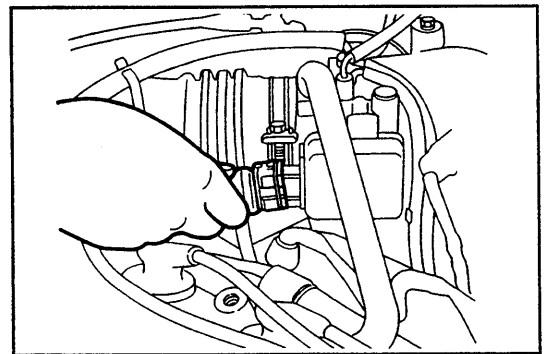
(1) Measure the resistance between ⑩ and ⑪ under the following conditions.

Throttle valve closed fully	0.2Ω or less at 20°C (68°F)
Throttle valve opened fully	10 kΩ or more

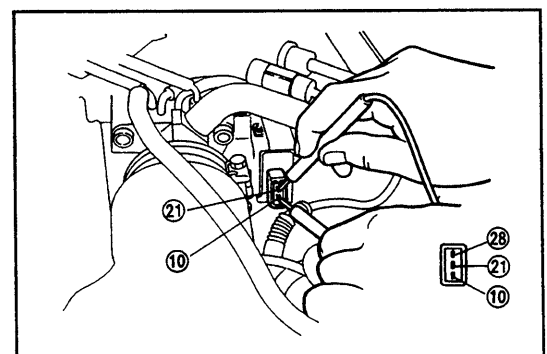
If the measured resistance does not conform to the specification, replace the throttle body. (See page EF-97.)

**CAUTION:**

Be very careful not to damage the terminal.



WN88E-EF136



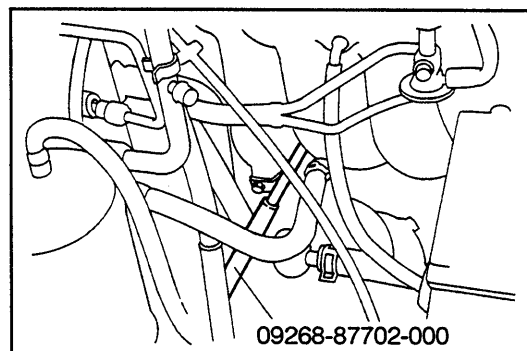
WN88E-EF137

- 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.



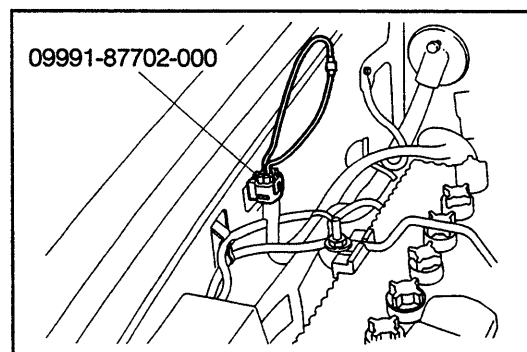
WN88E-EF198

- Measure the amount of fuel collected in the measuring cylinder.

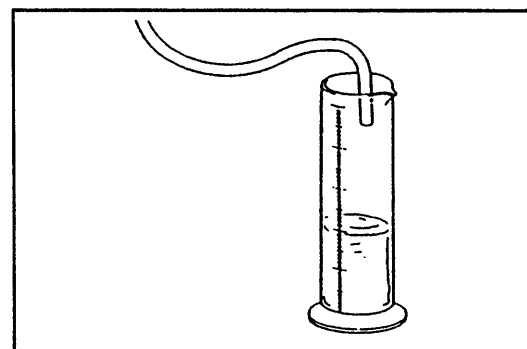
**Specified Amount of Fuel: 235 cc or more  
(14.34 cub inch or more)**

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.

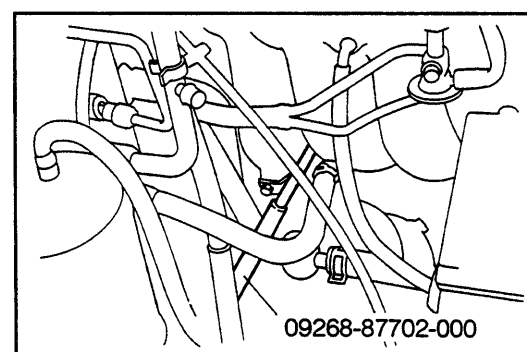


WR88-EF217

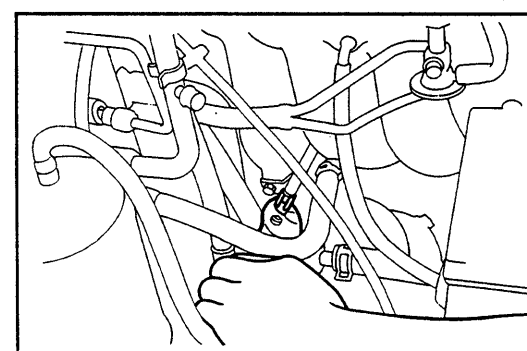


WN88E-EF199

- 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.

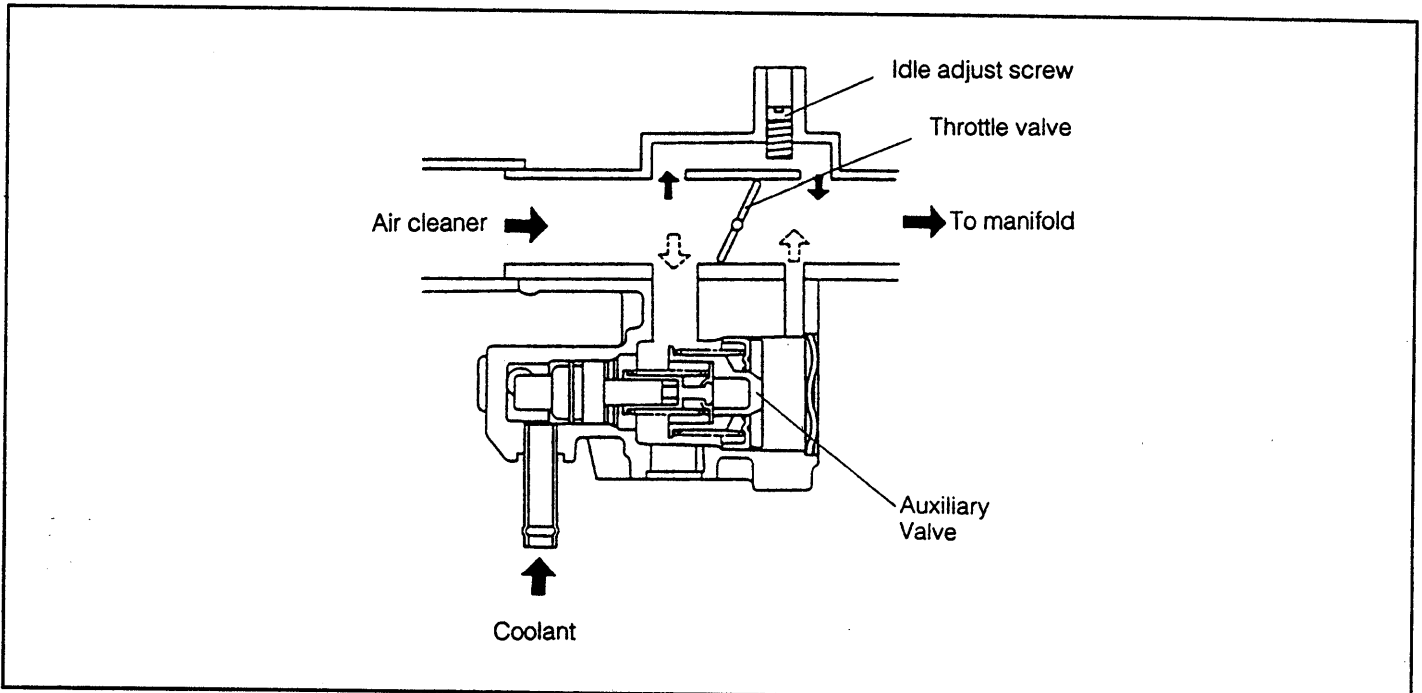


WN88E-EF200



WR88-EF221

**AUXILIARY AIR VALVE**



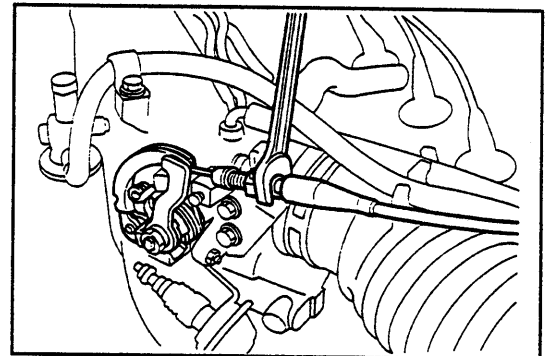
WR88-EF368

**In-Vehicle Inspection**

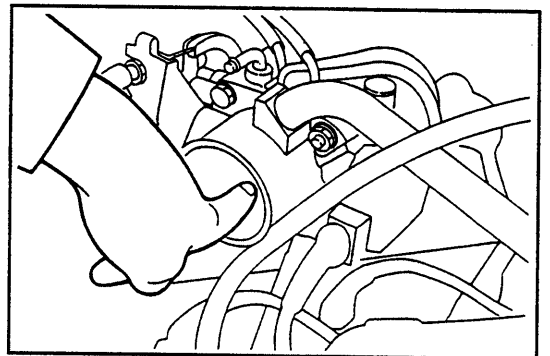
**Check Operation**

1. Disconnect the air cleaner hose from the throttle body.

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-EF369



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

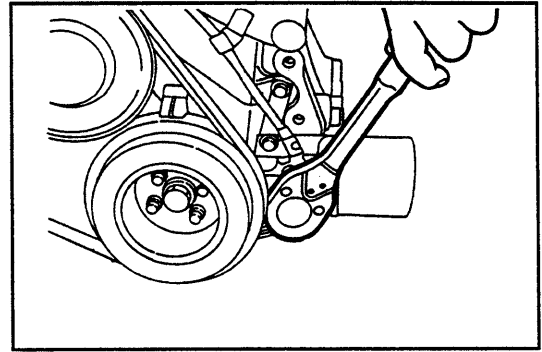
(See page EF-100.)

WN88E-EF239

(2) Remove the oil pressure switch.

**NOTE:**

Use a hexagonal long box wrench for the removal.



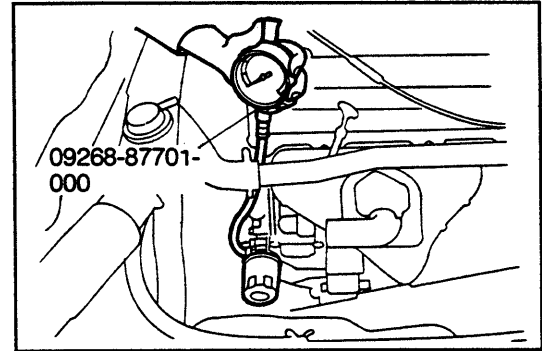
WR88-LU006

(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)

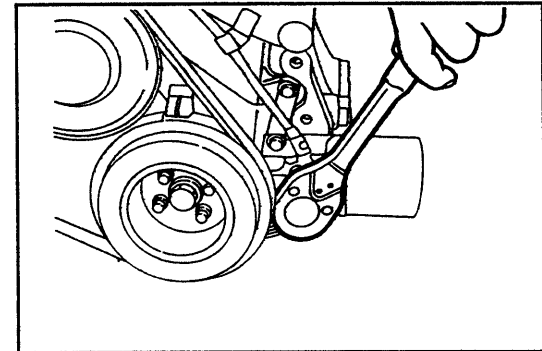
At 3000 rpm:  $2.5 - 5.0 \text{ kg/cm}^2$  (35.6 - 71.0 psi)

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.



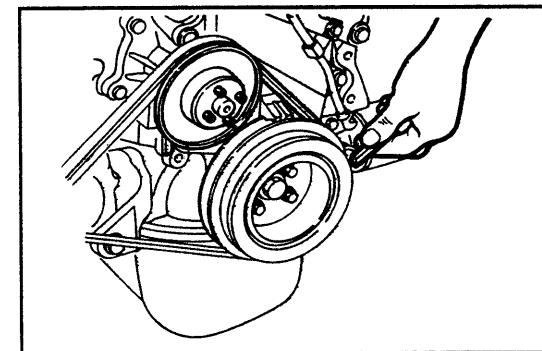
WR88-LU009

(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