

B-6 EGR SYSTEM CHECK

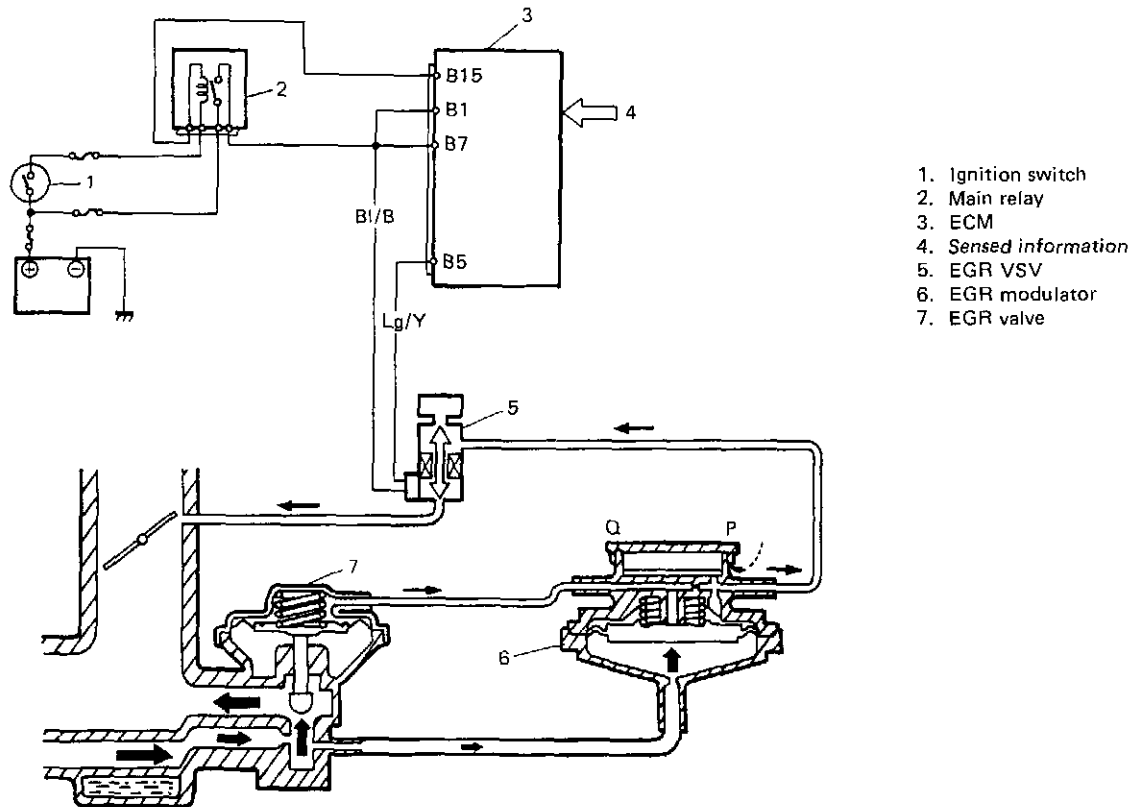


Fig. 4A-97 EGR System

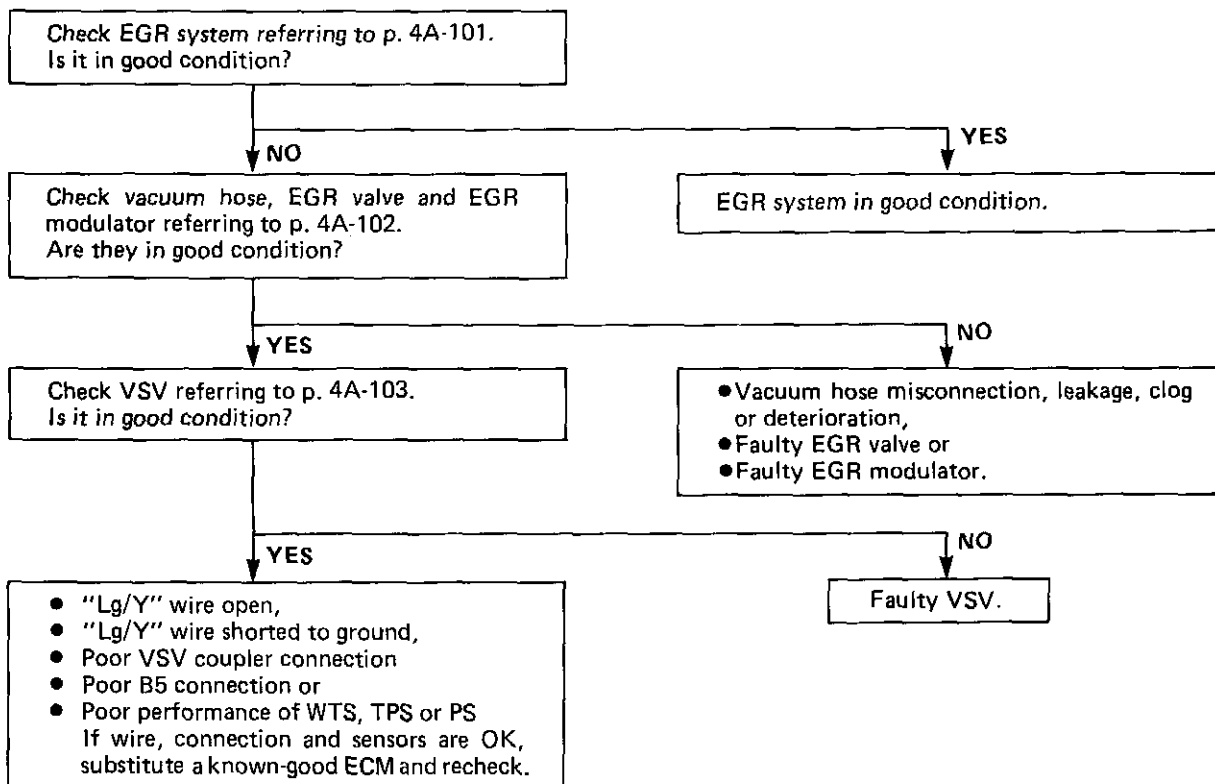


Fig. 4A-98 Diagnostic Flow Chart B-6 For EGR System

ECM AND ITS CIRCUIT CHECK

ECM and its circuits can be checked at ECM wiring couplers by measuring voltage and resistance.

CAUTION:

ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with couplers disconnected from it.

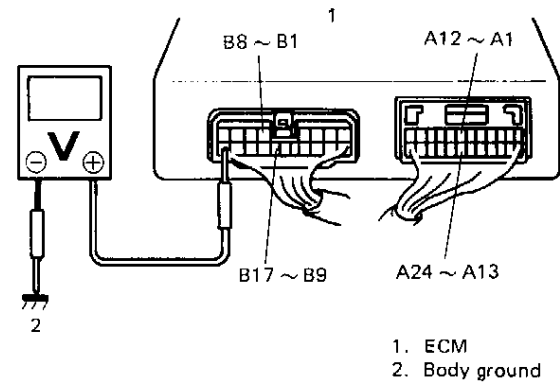


Fig. 4A-99 Checking Voltage

VOLTAGE CHECK

1. Remove ECM from body.
2. Connect ECM couplers to ECM.
3. Check voltage at each terminal of couplers connected.

NOTE:

As each terminal voltage is affected by the battery voltage, confirm that it is 11V or more when ignition switch is ON.

| TER-MINAL | CIRCUIT | NORMAL VOLTAGE | CONDITION |
|-----------|---|----------------|--|
| A1 | Blank | — | — |
| A2 | Air-conditioner circuit (if equipped) | 10 – 14V | Ignition switch ON |
| | | 0 – 1V | With engine running Air-conditioner ON |
| A3 | Diagnosis switch terminal | 10 – 14V | Ignition switch ON |
| | | 0V | Ignition switch ON Diagnosis switch terminal grounded (with spare fuse connected to diagnosis switch terminals) |
| A4 | Ground (for California spec. only) | — | — |
| A5 | 5th switch (Not for California spec. model) | 10 – 14V | Ignition switch ON Gear shift lever at any other position than 5th gear position |
| | | 0V | Ignition switch ON Gear shift lever at 5th gear position |
| A6 | Ignition (fail safe) signal | 3 – 5V | While engine cranking |
| | | 0V | Ignition switch ON |
| A7 | Test switch terminal | 10 – 14V | Ignition switch ON |
| | | 0V | Ignition switch ON Test switch terminal grounded |
| A8 | Blank | — | — |
| A9 | Duty check terminal | — | — |
| A10 | Blank | — | — |

| TER-MINAL | CIRCUIT | NORMAL VOLTAGE | CONDITION |
|-----------|-------------------------|---|---|
| A11 | Blank | — | — |
| A12 | Ignition output signal | 0V | Ignition switch ON |
| | | 2 – 4V | While engine cranking |
| A13 | CAS | Indicator deflection repeated between 0V and about 5V | Ignition switch ON Crankshaft turned slowly |
| A14 | Idle switch of TPS | 0 – 1V | Ignition switch ON Throttle valve is at idle position (with throttle opener rod drawn in by vacuum pump gauge) |
| | | 3 – 5V | Ignition switch ON Throttle valve opens larger than idle position |
| A15 | VSS | Indicator deflection repeated between 0V and 3 – 5V | Ignition switch ON Rear right tire turned slowly with rear left tire locked |
| A16 | REGTS | 3.8 – 4.5V | Ignition switch ON Sensor ambient temperature: 20° C (68° F) |
| A17 | ATS | 2.2 – 3.0V | Ignition switch ON Sensor ambient temperature: 20° C (68° F) |
| A18 | WTS | 0.5 – 0.9V | Ignition switch ON Cooling water temperature: 80° C (176° F) |
| A19 | Oxygen sensor | Refer to Diagnostic Flow Chart for Code No. 13 | |
| A20 | Blank | — | — |
| A21 | TPS | 0.5 – 1.2V | Ignition switch ON Throttle valve at idle position (with throttle opener rod drawn in by vacuum gauge) |
| | | 3.4 – 4.7V | Ignition switch ON Throttle valve at full open position |
| A22 | Pressure sensor | 3.6 – 4.4V | Ignition switch ON Barometric pressure: 760 mmHg |
| A23 | Power source of sensors | 4.75 – 5.25V | Ignition switch ON |
| A24 | Ground of sensors | — | — |
| B1 | Power source | 10 – 14V | Ignition switch ON |
| B2 | Ground | — | — |
| B3 | Ground | — | — |
| B4 | Blank | — | — |
| B5 | EGR VSV | 10 – 14V | Ignition switch ON |

| TER-MINAL | CIRCUIT | NORMAL VOLTAGE | CONDITION |
|-----------|---|----------------|--|
| B6 | ISC solenoid valve | 10 – 14V | Ignition switch ON |
| B7 | Power source | 10 – 14V | Ignition switch ON |
| B8 | Injector ⊕ | — | — |
| B9 | Power source for back-up circuit | 10 – 14V | Ignition switch OFF and ON |
| B10 | Ground | — | — |
| B11 | Engine start switch (Engine start signal) | 6 – 10V | While engine cranking |
| | | 0V | Other than above |
| B12 | Clutch switch | 0V | Ignition switch ON Clutch pedal depressed |
| | | 10 – 14V | Ignition switch ON Clutch pedal released |
| B13 | "CHECK ENGINE" light | 0 – 1V | Ignition switch ON |
| | | 10 – 14V | When engine running |
| B14 | Throttle opener VSV | 10 – 14V | Ignition switch ON |
| B15 | Main relay ground | 0 – 2V | Ignition switch ON |
| B16 | Fuel pump relay ground | 0 – 4V | For 3 sec. after ignition switch ON |
| | | 10 – 14V | When over 3 sec. after ignition switch ON |
| B17 | Injector ⊖ | — | — |

RESISTANCE CHECK

1. Disconnect ECM couplers from ECM with ignition switch OFF.

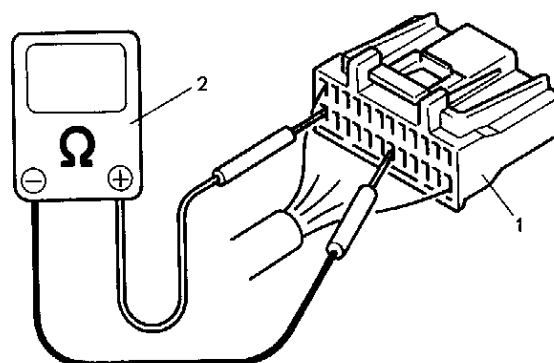
CAUTION:

Never touch terminals of ECM itself or connect voltmeter or ohmmeter.

2. Check resistance between each pair of terminals disconnected couplers as listed in following table.

CAUTION:

- Be sure to connect ohmmeter probe from wire harness side of coupler.
- Be sure to turn OFF ignition switch for this check.
- Resistance in table represents that when parts temperature is 20°C (68°F).

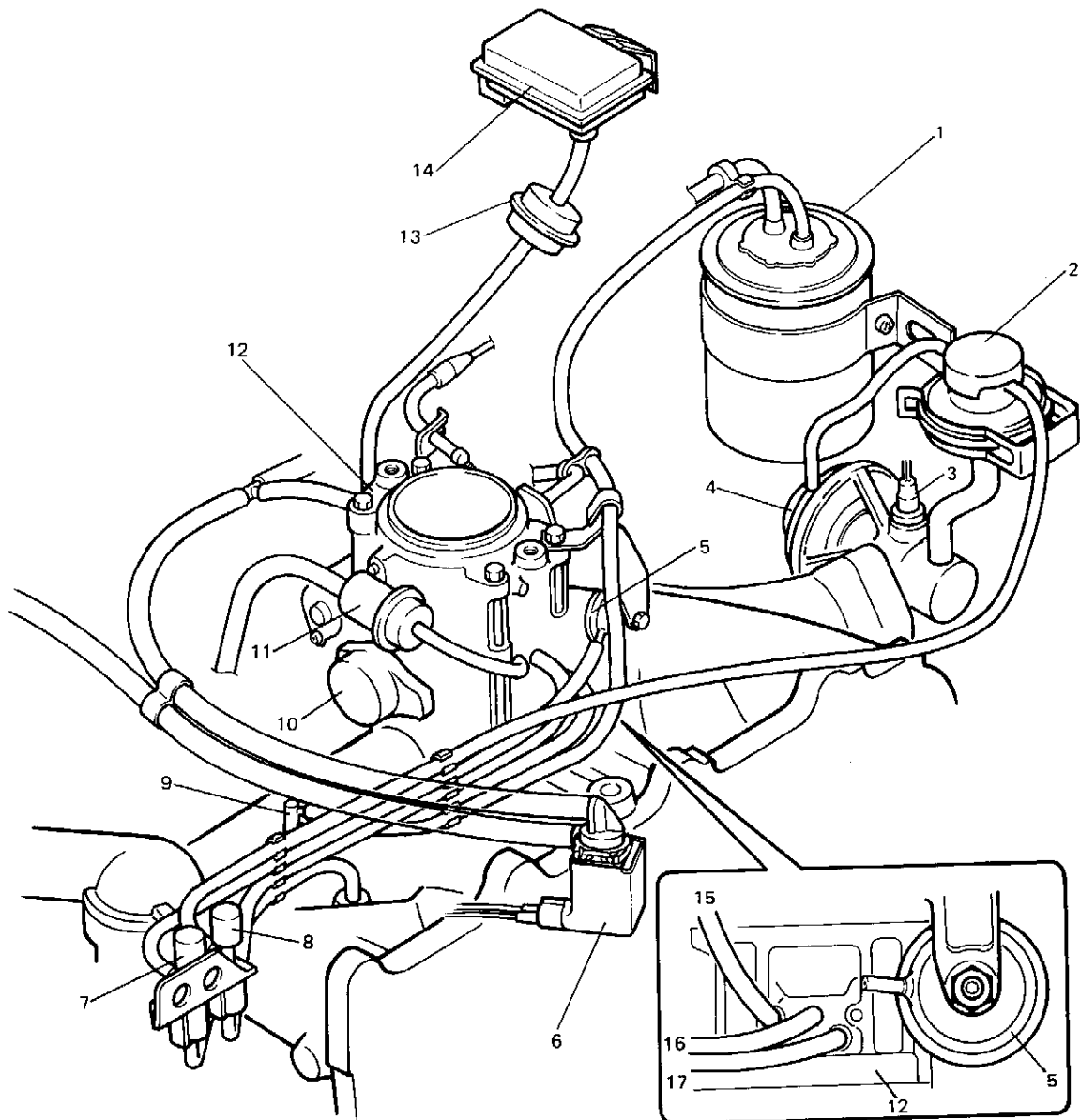


1. ECM coupler disconnected
2. Ohmmeter

Fig. 4A-100 Checking Resistance

| TERMINALS | CIRCUIT | STANDARD RESISTANCE | CONDITION |
|--|---------------------------|--|---|
| A3 – Body ground | Diagnosis switch terminal | ∞ (infinity) | _____ |
| A4 – Body ground (California spec. model only) | ECM ground | 0 (zero) | _____ |
| A5 – Body ground (Not for California spec. model) | 5th switch | ∞ (infinity) | Gear shift lever at any other position than 5th gear position |
| | | 0 (zero) | Gear shift lever at 5th gear position |
| A7 – Body ground | Test switch terminal | ∞ (infinity) | _____ |
| A9 – Body ground | Duty check terminal | ∞ (infinity) | _____ |
| A14 – A24 | Idle switch | 0 (zero) | Throttle valve is at idle position |
| | | ∞ (infinity) | Throttle valve opens larger than idle position |
| A15 – Body ground | VSS | Ohmmeter indicator deflects between 0 and ∞ | Rear right tire turned slowly with rear left tire locked |
| A16 – A24 (California spec. model only) | REGTS | 214 – 313.8 k Ω | Sensor ambient temp. 20°C (68°F) |
| A17 – A24 | ATS | 2.28 – 2.87 k Ω | Sensor ambient temp. 20°C (68°F) |
| A18 – A24 | WTS | 0.29 – 0.35 k Ω | Engine cooling water temp. 80°C (176°F) |
| A21 – A24 | TPS | 0 – 2 k Ω | Throttle valve at idle position |
| | | 2.0 – 6.5 k Ω | Throttle valve at full open position |
| | | | with PS coupler disconnected |
| B5 – B1 | EGR VSV | 33 – 39 Ω | _____ |
| B6 – B1 | ISC solenoid valve | 30 – 33 Ω | _____ |
| B8 – B17 | Fuel injector | 0.8 – 1.8 Ω | _____ |
| B12 – Body ground | Clutch switch | 0 (zero) | Clutch pedal depressed |
| | | ∞ (infinity) | Clutch pedal released |
| B14 – B1 | Throttle opener VSV | 33 – 39 Ω | _____ |
| B15 – B16 | Main and fuel pump relay | 124 – 153 Ω | _____ |

ON VEHICLE SERVICE



- | | |
|--|--------------------------------|
| 1. Charcoal canister | 10. TPS |
| 2. EGR modulator | 11. Fuel pressure regulator |
| 3. REGTS (California spec. model only) | 12. Throttle body |
| 4. EGR valve | 13. Filter |
| 5. Throttle opener | 14. Pressure sensor |
| 6. ISC solenoid valve | 15. To fuel pressure regulator |
| 7. VSV for throttle opener | 16. To EGR VSV |
| 8. VSV for EGR valve | 17. To BVS |
| 9. BVS | |

Fig. 4A-101 Vacuum Hose Routing

GENERAL

When hoses are disconnected and system's component is removed for service, reinstall component properly, and route and connect hoses correctly after service. Refer to Fig. 4A-101 or Vehicle Emission Control Information Label for proper routing of hoses.

ACCELERATOR CABLE ADJUSTMENT

Check accelerator cable for play and adjust if necessary. Cable play should be within specification when accelerator pedal is released and engine is not running.

If not within specification, adjust by loosening lock nut. Be sure to tighten lock nut securely after adjustment.

| | |
|------------------------|-------------------------------|
| Accelerator cable play | 10 – 15 mm (0.4 – 0.6 in.) |
|------------------------|-------------------------------|

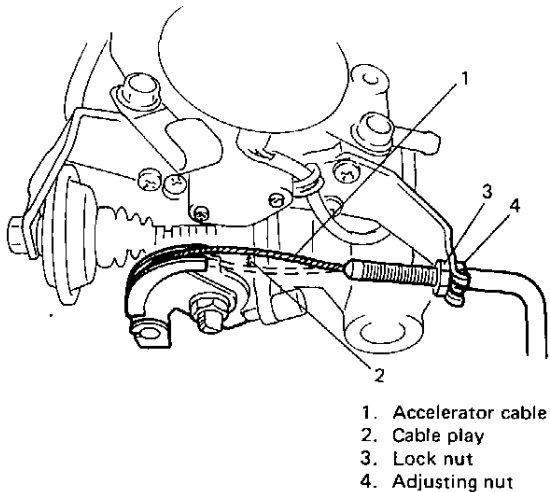


Fig. 4A-102 Accelerator Cable Play

Cable play should be 3 – 5 mm (0.12 – 0.20 in.) when throttle opener rod is pushed back by hand (i.e., throttle valve is at idle position).

IDLE SPEED/ISC DUTY ADJUSTMENT (INCLUDING A/C VSV ADJUSTMENT)

Before idle speed check and adjustment, make sure of the following.

- Lead wires and hoses of Electronic Fuel Injection and engine emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Valve lash is checked and adjusted according to maintenance schedule.
- Ignition timing is within specification.
- All accessories (wipers, heater, lights, A/C, etc.) are out of service.
- Air cleaner has been properly installed and is in good condition.

After above items are all confirmed, check idle speed and ISC duty as follows.

NOTE:

Before starting engine, place transmission gear shift lever in "Neutral", and set parking brake and block drive wheels.

1. Warm up engine to normal operating temperature.
2. Connect spare fuse to diagnosis switch terminal in fuse box and make sure that "CHECK ENGINE" light indicate diagnostic code No. 12.

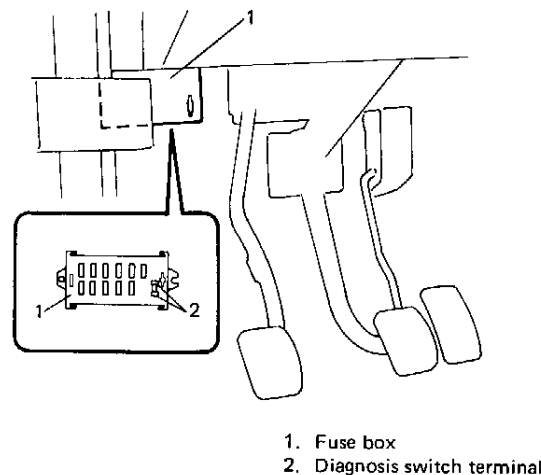
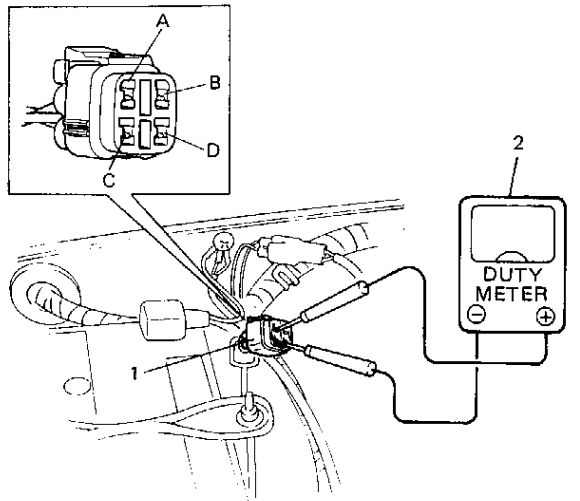


Fig. 4A-103 Grounding Diag. Switch Terminal

3. Stop engine and connect duty meter between duty check terminal and ground terminal of monitor coupler.

The monitor coupler is located beside battery.

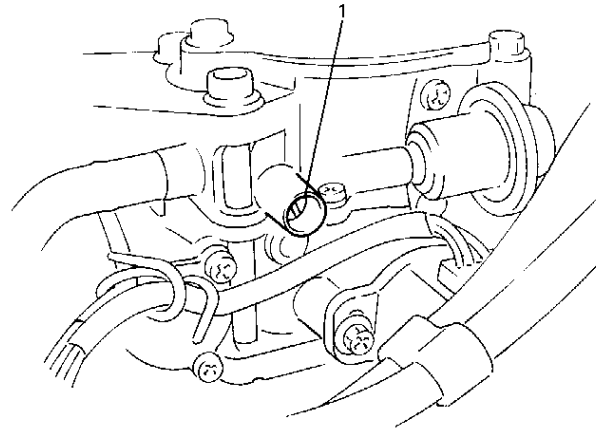


1. Monitor coupler
 2. Duty meter
- A: Duty check terminal
C: Ground terminal

Fig. 4A-104 Connecting Duty Meter

4. Set tachometer.
5. Turn ON ignition switch and wait for 5 seconds. Then restart engine and run it at 2,000 r/min. for 5 minutes to warm it up completely and let it slow down to idle speed.
6. Check ISC duty and idle speed. If duty and/or idle speed is out of specifications, adjust it by turning idle speed adjusting screw.

| | |
|----------------------------------|-----------------|
| Engine idle speed | 800 ± 50 r/min. |
| ISC duty at specified idle speed | 50% |



1. Idle speed adjusting screw

Fig. 4A-105 Idle Speed Adjusting Screw

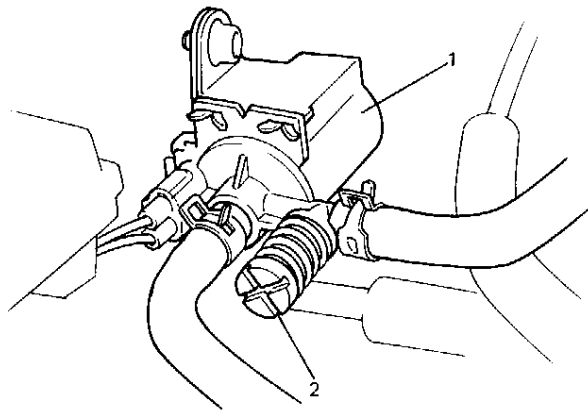
7. Upon completion of adjustment, install adjusting screw cap to throttle body.
8. This step is for checking and/or adjusting engine idle speed and ISC duty when A/C is working.

With vehicles without A/C, advance to steps 9 and 10. With A/C equipped ones, follow procedure described below.

- 1) Turn A/C switch ON and set heater blower switch to low speed position.
- 2) Check to ensure that ISC duty and idle speed are within below specification.

| | |
|----------------------------------|-------------------|
| Engine idle speed with A/C ON | 1,000 ± 50 r/min. |
| ISC duty at specified idle speed | 50% |

- 3) If it is not within specified range, adjust it by turning adjusting screw of A/C VSV.



1. A/C VSV
2. Adjusting screw

Fig. 4A-106 Adjusting Screw of A/C VSV

9. Disconnect spare fuse from diag. switch terminal.
10. Install cap to monitor coupler.

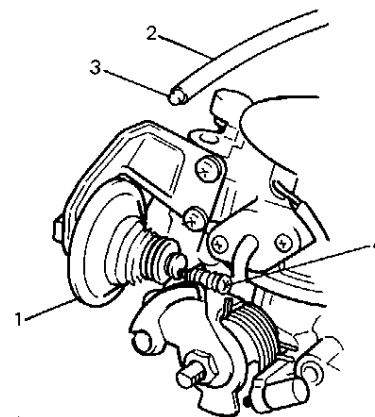
THROTTLE OPENER ADJUSTMENT

NOTE:

Before starting engine, place transmission gear shift lever in "Neutral", and set parking brake and block drive wheels.

1. Turn ignition switch ON and leave it for 5 sec. Run engine at 2000 r/min. for 5 min. after warming up and let it slow down to idle speed.
2. Check to make sure that no electric load is applied to engine.
3. Disconnect vacuum hose from throttle opener and put blind plug in disconnected vacuum hose.
Check that engine speed is within specification then.

| | |
|-------------------------------------|------------------|
| Engine speed while opener operating | 2200 ± 50 r/min. |
|-------------------------------------|------------------|



1. Throttle opener
2. Vacuum hose
3. Blind plug
4. Opener adjusting screw

Fig. 4A-107 Checking and Adjusting Engine Speed for Opener

4. If engine speed is found out of specification in above check, adjust it to specification by turning throttle opener adjusting screw.
5. Upon completion of adjustment, connect vacuum hose to opener securely.

AIR AND FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

1. Relieve fuel pressure in fuel feed line referring to p. 4-2.
2. Hoist vehicle.
3. Remove plug bolt on fuel filter union bolt and connect special tool (fuel pressure gauge set) to fuel filter inlet union bolt.

CAUTION:

A small amount of fuel may be released after fuel line is disconnected. In order to reduce chance of personal injury, cover fitting to be disconnected with a shop cloth. Place that cloth in an approved container when disconnection is completed.

Fuel pressure gauge set
(09912-58412)

- | | |
|---------------|----------------------------|
| 1. Gauge | 5. Filter inlet union bolt |
| 2. Hose | 6. Fuel filter |
| 3. Union bolt | |
| 4. Gasket | |

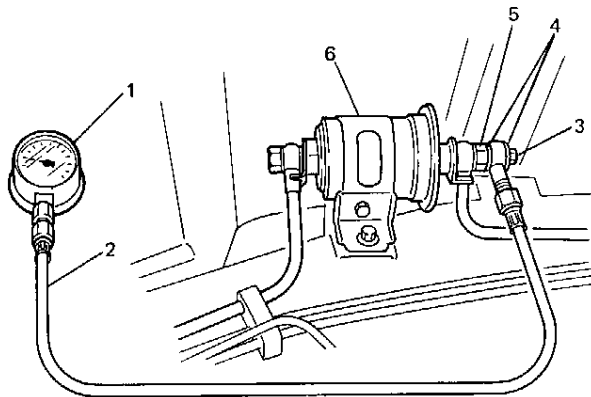


Fig. 4A-108 Connecting Fuel Pressure Gauge

4. Check that battery voltage is above 11V.

5. To operate fuel pump, connect Pink/Black and Black/White wire terminals by using service wire and turn ignition switch ON. Measure fuel pressure.

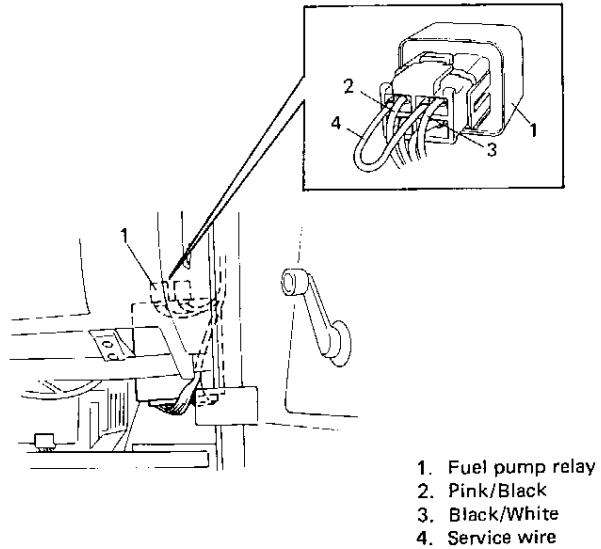


Fig. 4A-109 Operating Fuel Pump

6. Measure fuel pressure under each of following conditions.

| CONDITION | FUEL PRESSURE |
|--|--|
| With fuel pump operating and engine at stop | 2.4 – 2.8 kg/cm ² 240 – 280 kPa 34.1 – 39.8 psi |
| For 1 min. after fuel pump stop (Pressure reduces as time passes) | Over 1.5 kg/cm ² 150 kPa 21.3 psi |

7. Disconnect service wire.
8. Start engine and warm it up to normal operating temperature.
Measure fuel pressure at specified idle speed.

| CONDITION | FUEL PRESSURE |
|-------------------------|--|
| At specified idle speed | 1.7 – 2.1 kg/cm ² 170 – 210 kPa 24.2 – 29.9 psi |

If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Chart B-3" and check each possibly defective part. Replace if found defective.

9. After checking fuel pressure, remove fuel pressure gauge.

CAUTION:

As fuel feed line is still under high fuel pressure, make sure to release fuel pressure according to following procedures.

- Place fuel container under fuel filter.
- Cover union bolt of gauge with rag and loosen union bolt slowly to release fuel pressure gradually.

10. Install plug bolt to fuel filter inlet union bolt. Use new gasket.
Tighten it to specified torque.
11. With engine "OFF" and ignition switch "ON", check for fuel leaks.

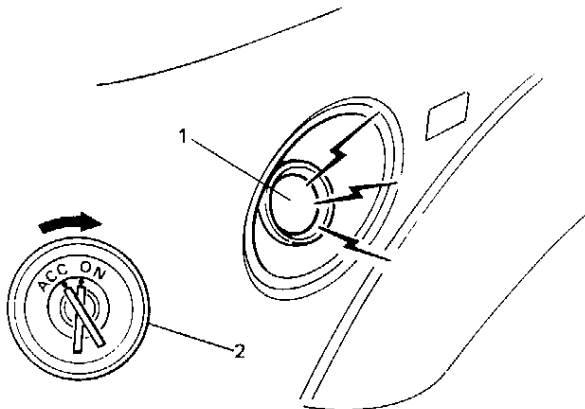
FUEL PUMP

On Vehicle Inspection

CAUTION:

When fuel filler cap is removed in any procedure, work must be done with no smoking, in a well-ventilated area and away from any open flames.

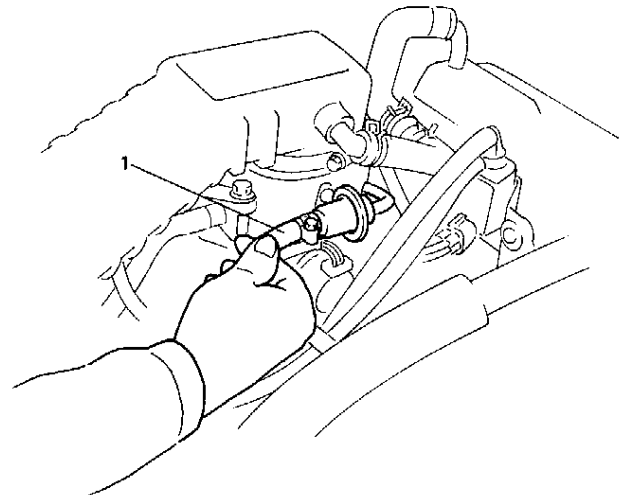
1. Remove filler cap and turn ON ignition switch. Then fuel pump operating sound should be heard from fuel filler for about 3 seconds and stop. Be sure to reinstall fuel filler cap after checking.



1. Fuel filler
2. Ignition switch

Fig. 4A-110 Checking Fuel Pump

- If above check result is not satisfactory, advance to "Diagnostic Flow Chart B-2".
2. Fuel pressure should be felt at fuel return hose for 3 seconds after ignition switch ON.



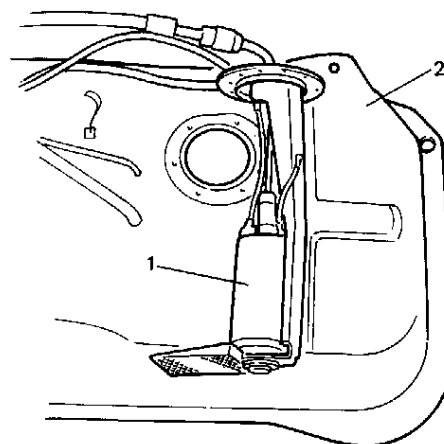
1. Fuel return hose

Fig. 4A-111 Checking Fuel Pressure

If fuel pressure is not felt, advance to "Diagnostic Flow Chart B-3".

Removal

1. Remove fuel tank from body according to procedure described in section 4 and remove fuel pump from fuel tank.



1. Fuel pump
2. Fuel tank

Fig. 4A-112 Removing Fuel Pump

Inspection

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

Installation

1. Install fuel pump to its bracket.
2. Install fuel pump to fuel tank and then install fuel tank to body according to procedure described in section 4.

THROTTLE BODY

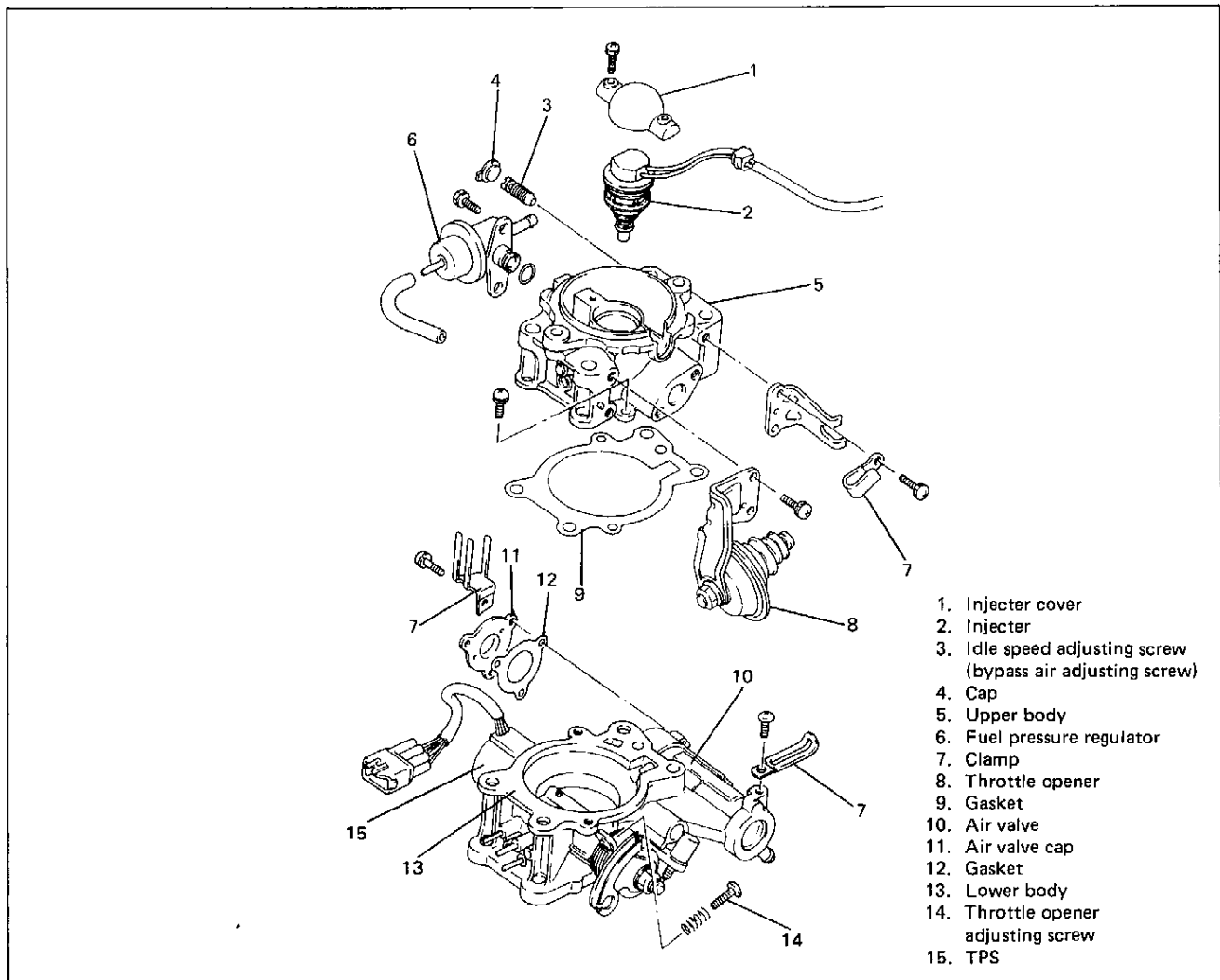


Fig. 4A-113 Throttle Body Parts Identification

On Vehicle Inspection

- Check that the throttle valve lever moves smoothly.
- Vacuum passage inspection
With fingers placed against vacuum nozzles (2 or 3 pcs), increase engine speed a little and check that vacuum is applied.

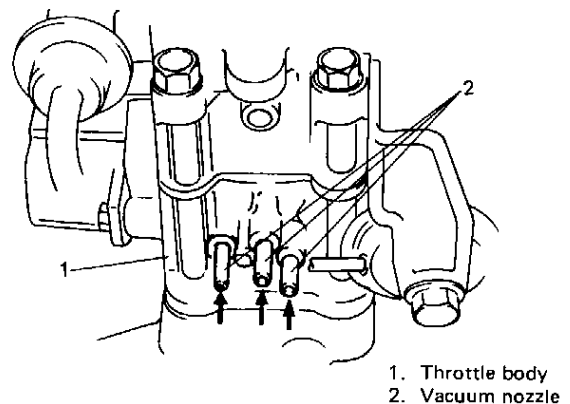


Fig. 4A-114 Checking Vacuum Passage

- Air valve inspection

This is an easy on-vehicle check. For further complete check, remove throttle body and use checking procedure as shown in Fig. 4A-116.

1. Remove air valve cap with engine stopped when engine is cold (engine cooling water temperature is 60°C, 140°F or lower) and checking procedure as shown in Fig. 4A-116.
2. Reinstall air valve cap and warm up engine to its normal operating temperature (engine cooling water temperature is 70°C, 158°F or higher).

Then remove air valve cap again with engine stopped and check visually that air valve is closed.

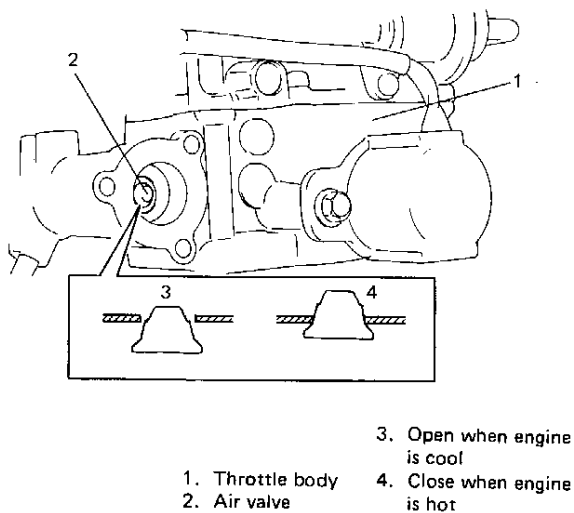


Fig. 4A-115 Inspecting Air Valve

3. Upon completion of checking, be sure to use new gasket when reinstalling air valve cap.

Removal

1. Relieve fuel pressure in fuel feed line referring to p. 3-3.
2. Disconnect negative cable at battery.
3. Drain engine cooling water.
4. Remove air intake case from throttle body and air cleaner case.
5. Disconnect fuel feed pipe from throttle body.
6. Disconnect fuel return hose from fuel pressure regulator.
7. Disconnect accelerator cable from throttle body.
8. Disconnect vacuum hoses from throttle body.
9. Disconnect cooling water hose from throttle body.
10. Disconnect fuel injector and TPS coupler.
11. Remove throttle body from intake manifold.

Inspection

1. Remove air valve cap.
2. Immerse air valve of throttle body in water as shown below. Check visually that air valve closes gradually as water temperature rises and closes fully at higher than about 70°C, 158°F.

NOTE:

- Be very careful to prevent water from entering throttle body bore.
- Be very careful never to put throttle body parts except air valve thermo wax in water or expose them to water splash.

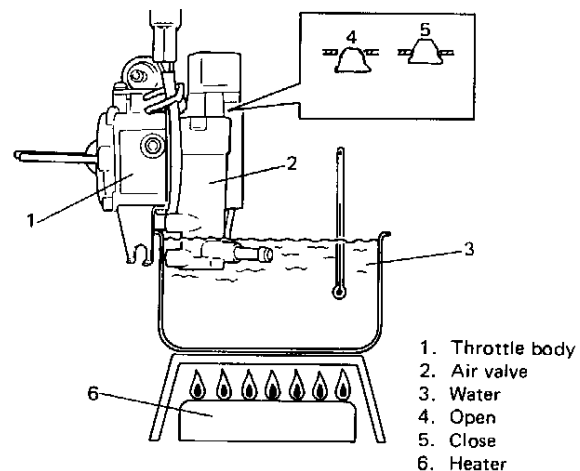


Fig. 4A-116 Inspecting Air Valve

Disassembly

NOTE:

- Be sure to replace gaskets as well as worn or damaged parts.
- While disassembling and assembling throttle body, use special care not to deform levers on throttle valve shaft or cause damage to any other parts.

1. Remove injector from throttle body according to procedure described in p. 4A-88.
2. Remove TPS.
3. Remove fuel pressure regulator from throttle body.
4. After removing screws, separate upper and lower bodies.

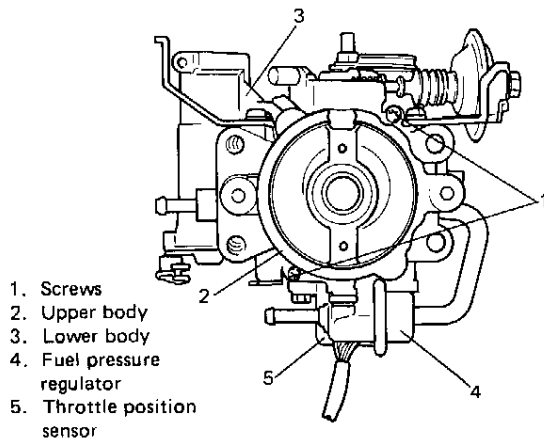


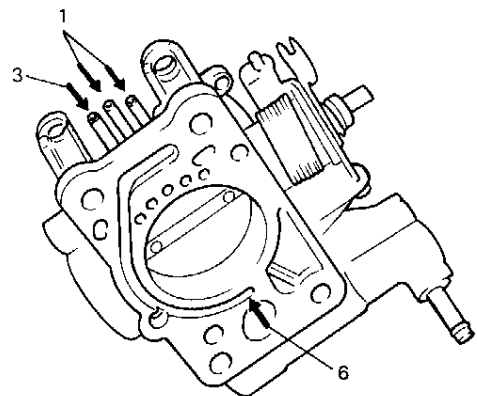
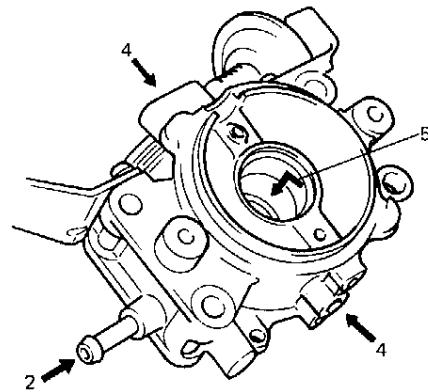
Fig. 4A-117 Disassembling Throttle Body

Cleaning

Clean below passages and fuel injector chamber by blowing compressed air.

NOTE:

- The TPS, fuel pressure regulator, fuel injector, air valve, throttle opener or other components containing rubber must not be placed in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden or get distorted.
- Don't put drills or wires into passages for cleaning. It causes damages in passages.



- | | |
|---|--------------------------|
| 1. Vacuum passage | 4. Fuel passage |
| 2. ISC solenoid valve passage | 5. Injector chamber |
| 3. Vacuum passage for fuel pressure regulator | 6. Air induction passage |

Fig. 4A-118 Cleaning Passage

Assembly

1. Install new gasket to lower body.

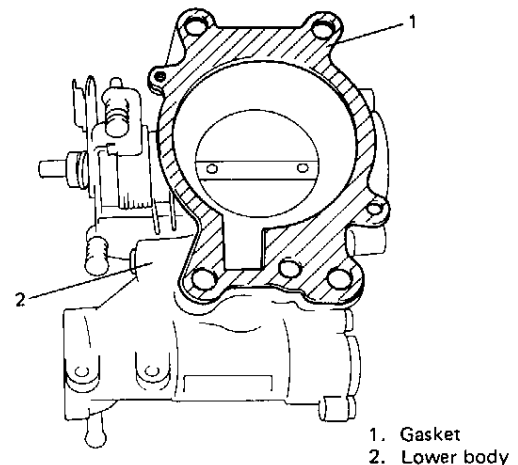


Fig. 4A-119 Installing Gasket

2. Install upper body on gasket, using care not to cause gasket to slip out of place.
3. Tighten screws indicated by "1" in Fig. 4A-117 to specified torque.

| Tightening torque of screw | N·m | kg·m | lb·ft |
|----------------------------|-----|------|-------|
| | 3.5 | 0.35 | 2.5 |

4. Install fuel pressure regulator according to procedure described in p. 4A-89.
5. Install fuel injector according to procedure described on p. 4A-88.
6. Install throttle position sensor according to procedure described on p. 4A-93.
7. Clamp wire harness securely.

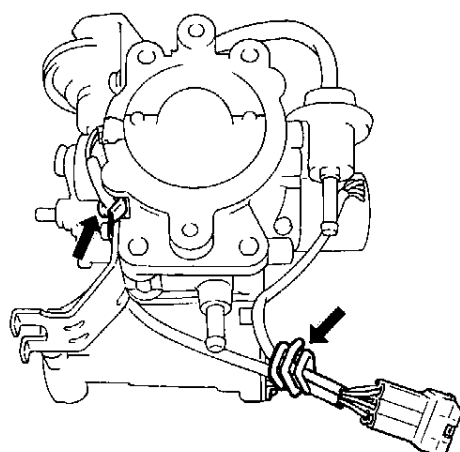


Fig. 4A-120 Clamping Wire Harness

Installation

1. Clean mating surfaces and install throttle body gasket to intake manifold.
Use new gasket.

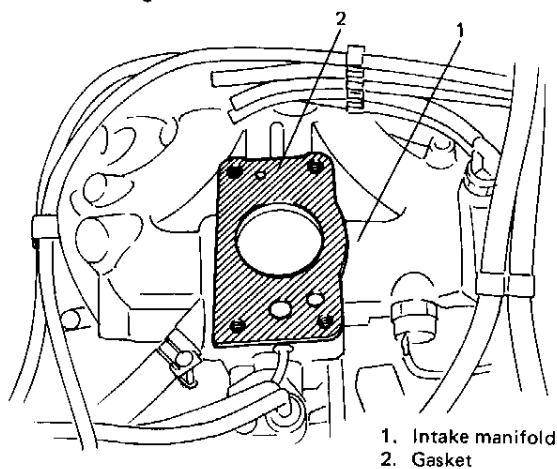


Fig. 4A-121 Gasket Installation

2. Install throttle body to intake manifold and tighten bolts to specified torque.

| Tightening torque for throttle body bolts | N·m | kg·m | lb·ft |
|---|---------|-----------|-------------|
| | 18 – 28 | 1.8 – 2.8 | 13.5 – 20.0 |

3. Connect fuel injector and TPS coupler.
4. Connect cooling water hose to throttle body.
5. Connect vacuum hoses to throttle body.

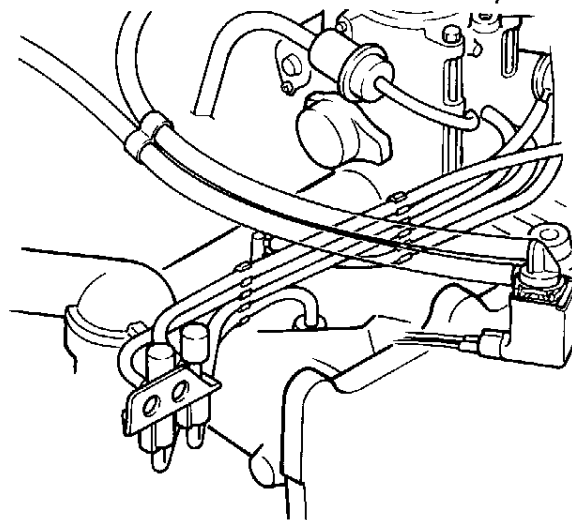


Fig. 4A-122 Connecting Vacuum Hoses

6. Connect accelerator cable to throttle body.
Adjust the cable play to specification according to procedure described in p. 4A-78.
7. Connect fuel return hose to fuel pressure regulator and clamp it securely.
8. Connect fuel feed pipe to throttle body after applying thin coat of spindle oil or gasoline to O ring.
Use a new O ring.
Tighten pipe bolts to specified torque.

| Tightening torque for fuel feed pipe bolts | N·m | kg·m | lb·ft |
|--|--------|-----------|-----------|
| | 8 – 12 | 0.8 – 1.2 | 6.0 – 8.5 |

9. Refill engine cooling system.
10. Connect negative cable at battery.
11. With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.
12. Install air intake case seal and joint to throttle body.

13. Install air intake case to throttle body and air cleaner case.
14. Upon completion of installation, start engine and check for fuel leaks and engine cooling water leaks.

FUEL INJECTOR

On Vehicle Inspection

1. With battery negative cable disconnected, disconnect injector coupler.
2. Connect ohmmeter to each injector terminal and measure resistance.

| | |
|------------------------|--|
| Resistance of injector | 0.8 – 1.8 Ω at 20° C (68° F) |
|------------------------|--|

If resistance is out of specification, replace fuel injector.

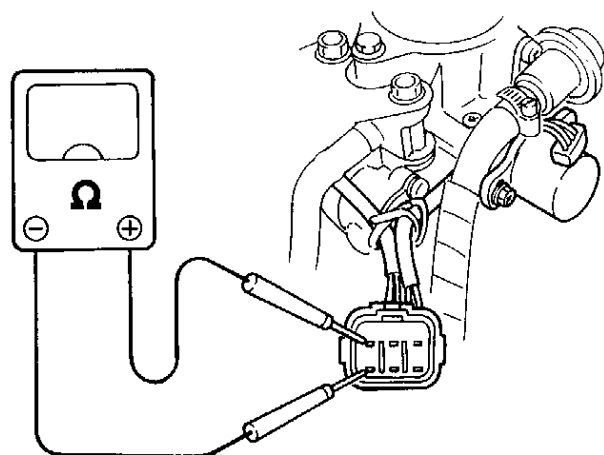


Fig. 4A-123 Checking Resistance of Fuel Injector

3. Connect injector coupler.
4. Remove air intake case.
5. Connect battery negative cable.
6. Make sure that fuel pressure is felt at fuel return hose for 3 seconds after ignition switch ON.
7. Check that fuel is injected out in conical shape from fuel injector when cranking engine or running engine.

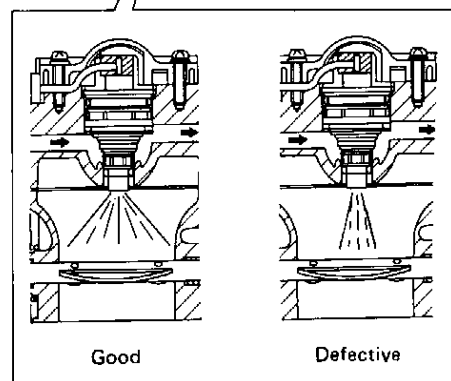
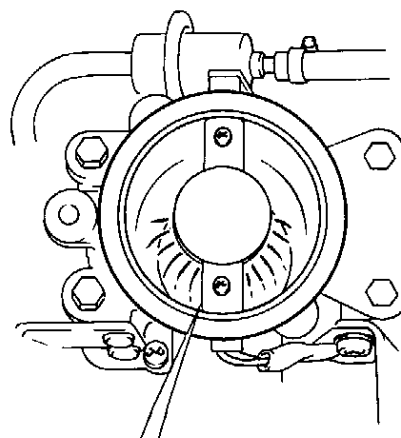


Fig. 4A-124 Checking Fuel Injection

If no fuel is injected, check wiring harness for continuity and couplers for proper connection referring to "Diagnostic Flow Chart B-1". If fuel is not injected out in conical shape, replace injector.

8. Check injector for fuel leakage after injection is stopped (i.e., after cranking or engine stop). Replace if leakage exists.

| | |
|--------------|-----------------------|
| Fuel leakage | Less than 1 drop/min. |
|--------------|-----------------------|

9. Install air intake case.

Removal

1. Relieve fuel pressure in fuel feed line referring to p. 3-3.
2. Disconnect battery negative cable at battery.
3. Remove air intake case and case joint.
4. Remove fuel feed pipe clamp from intake manifold and disconnect fuel feed pipe from throttle body.
5. Remove injector cover.
6. Disconnect injector coupler, release its wire harness from clamp and remove its grommet from throttle body.
7. Place some cloth over injector and hand on top of it. Using air gun, blow about 5 kg/cm² (500 kPa, 71.1 psi) or less compressed air into fuel inlet port of throttle body, and injector can be removed.

WARNING:

Be precise about pressure of compressed air. Blowing air under excessively high pressure may force injector jump out and cause damage not only to injector itself but also to other parts.

NOTE:

Use care when handling fuel injector especially not to damage injector-to-wire harness connection and its needle.

Also, because injector is an electrical component, it should not be immersed in any type of liquid solvent or cleaner, as damage may occur.

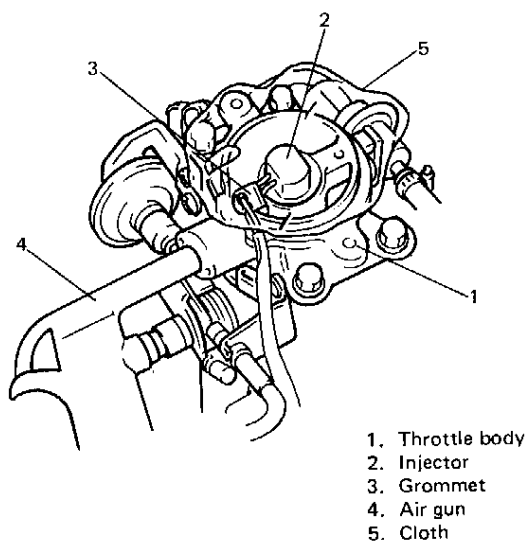


Fig. 4A-125 Removing Injector

8. Pull out fuel injector wire harness terminals from coupler after unlocking terminal lock.

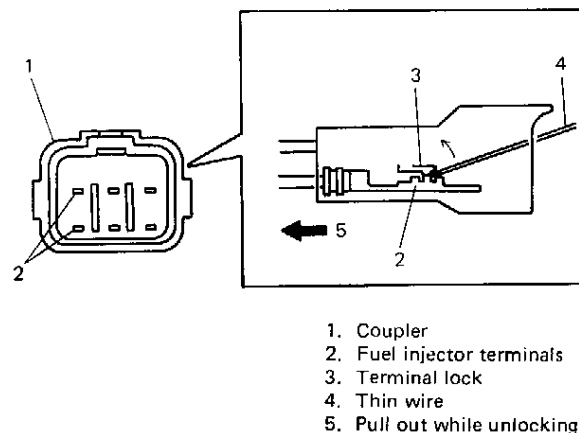


Fig. 4A-126 Removing Terminals

Inspection

Check fuel injector filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel lines and fuel tank.

Installation

1. Make sure that injector O rings are free from any damage and deterioration.
 2. Apply thin coat of spindle oil or gasoline to O rings and then install injector to throttle body.
- Make sure to fit injector wire harness into groove in throttle body securely.

NOTE:

Do not apply force to wire harness-to-injector connection.

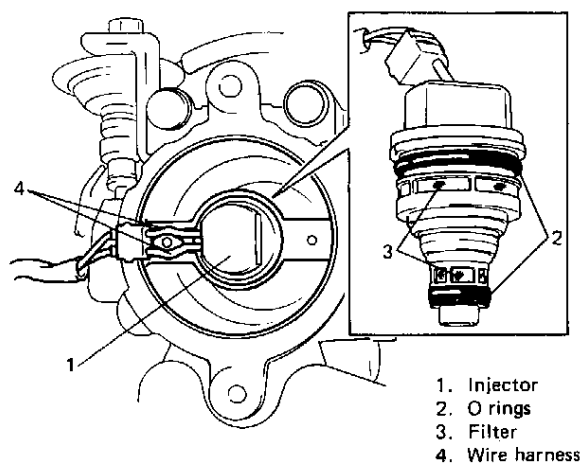


Fig. 4A-127 Installing Injector

3. Install injector cover.

Use new screws and tighten them to specified torque.

| Tightening torque for injector cover screw | N-m | kg-m | lb-ft |
|--|-----|------|-------|
| | 2 | 0.2 | 1.4 |

4. Connect fuel feed pipe to throttle body after applying thin coat of engine oil to O ring.
5. Connect battery negative cable.
6. Repeat ignition switch ON for 3 sec. and OFF until fuel pressure is felt at fuel return hose and check that no fuel leaks from where fuel feed pipe is connected and where injector is installed.
7. Install air intake case and joint.
8. Connect fuel injector terminals into coupler, check to make sure that they are locked securely.

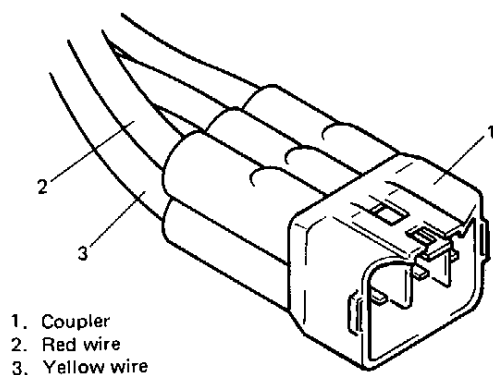


Fig. 4A-128 Connecting Fuel Injector Wires

FUEL PRESSURE REGULATOR

Removal

1. Relieve fuel pressure in the fuel feed line referring to p. 3-3.
2. Disconnect battery negative cable from battery.
3. Disconnect fuel return hose and vacuum hose from fuel pressure regulator.
4. Remove fuel pressure regulator from throttle body.

CAUTION:

A small amount of fuel may be released when regulator is removed. Cover its hole with shop cloth.

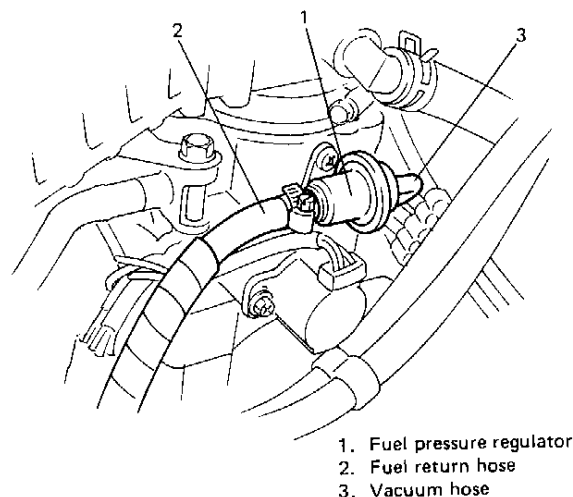


Fig. 4A-129 Fuel Pressure Regulator Removal

Installation

For installation, reverse removal procedure and note following precautions.

- Use new O ring.
- Apply thin coat of spindle oil or gasoline to O ring to facilitate installation.

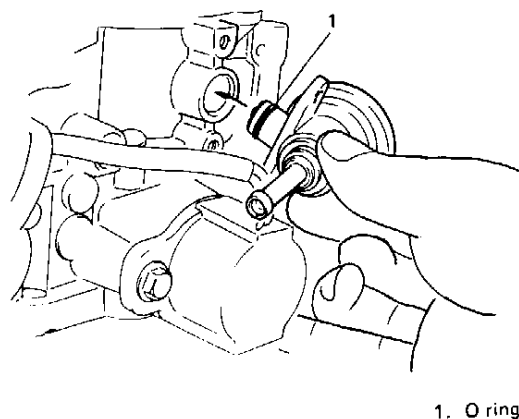


Fig. 4A-130 Installing Fuel Pressure Regulator

- Tighten fuel pressure regulator screws securely to following specified torque.

| Tightening torque for fuel pressure regulator screw | N-m | kg-m | lb-ft |
|---|-----|------|-------|
| | 3.5 | 0.35 | 2.5 |

- Upon completion of installation, check that no fuel leakage exists with applying fuel pressure to fuel feed line.

ELECTRONIC CONTROL SYSTEM

ELECTRONIC CONTROL MODULE (ECM)

CAUTION:

As ECM consists of precision parts, be careful not to expose it to excessive shock.

Removal

1. Disconnect battery negative cable from battery.
2. Remove fuel pump relay and main relay from ECM.
3. Disconnect couplers from ECM while releasing coupler lock.
4. Remove ECM after loosening three screws.

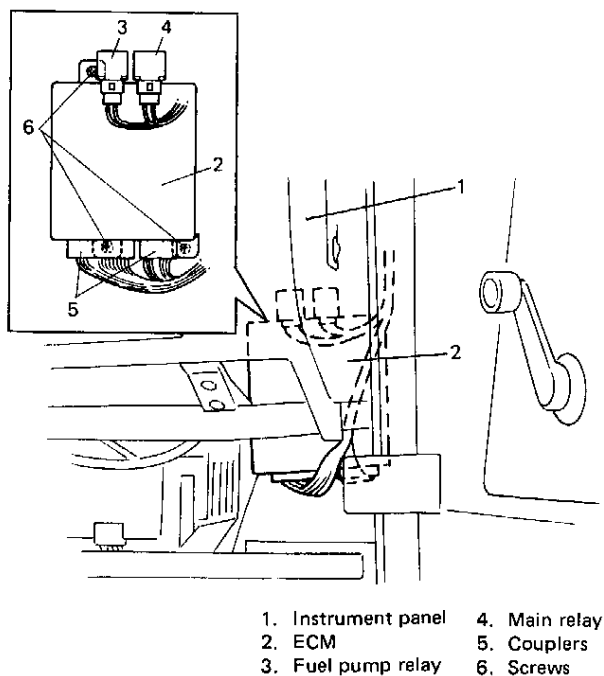


Fig. 4A-131 Removing ECM

Installation

1. Install ECM.
2. Connect couplers to ECM securely.
3. Install fuel pump relay and main relay to ECM.
4. Connect battery negative cable to battery.

PRESSURE SENSOR (PS)

Output Voltage Check

1. Remove package tray under ECM.
2. With coupler connected to ECM, connect digital type voltmeter as shown below and check that ECM supply voltage 4.75 – 5.25V is applied to coupler terminal A23.
3. Check output voltage at coupler terminal A22. Note that it varies with atmospheric pressure and altitude. Also, start engine, if it can, and check if output voltage varies.

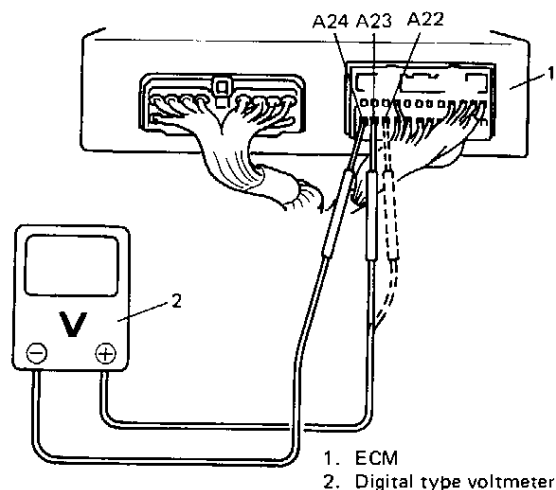


Fig. 4A-132 Checking Pressure Sensor

Output voltage (ECM supply voltage 4.75 – 5.25V)

| ALTITUDE | | BAROMETRIC PRESSURE (mmHg) | OUTPUT VOLTAGE (V) |
|----------|-------|----------------------------------|--------------------------|
| (ft) | (m) | | |
| 0 | 0 | 760 | 3.6 – 4.4 |
| 1 000 | 305 | 733 | 3.5 – 4.2 |
| 2 000 | 610 | 707 | 3.4 – 4.1 |
| 3 000 | 914 | 682 | 3.2 – 4.0 |
| 4 000 | 1 219 | 658 | 3.1 – 3.8 |
| 5 000 | 1 524 | 634 | 3.0 – 3.7 |
| 6 000 | 1 829 | 611 | 2.9 – 3.6 |
| 7 000 | 2 133 | 589 | 2.8 – 3.4 |
| 8 000 | 2 438 | 567 | 2.7 – 3.3 |
| 9 000 | 2 743 | 546 | 2.6 – 3.2 |
| 10 000 | 3 048 | 526 | 2.5 – 3.1 |

NOTE:

Note that atmospheric pressure varies depending on weather conditions as well as altitude.

Take that into consideration when performing above check.

If check result is not satisfactory in previous step 2 or 3, check pressure sensor and its circuit according to Code No. 31 or 32 Diagnostic Flow Chart.

NOTE:

If output voltage does not vary when engine is started, it is possible that vacuum hose and/or filter are clogged. Clean them.

Another possibility is that filter in pressure sensor is clogged from freezing. If it is suspected, leave it at room temperature (20°C, 68°F) for a while and recheck.

4. Upon completion of checking, install package tray.

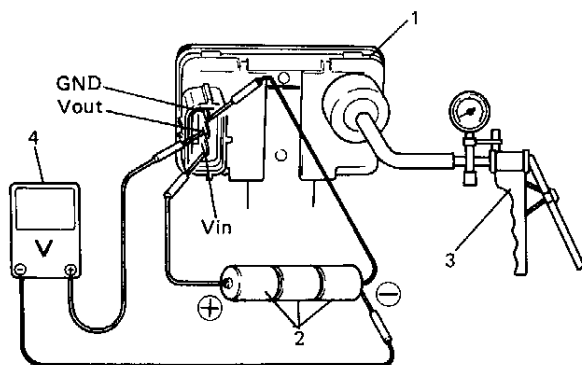
Pressure Sensor Individual Check

1. Disconnect pressure sensor vacuum hose from filter.
2. Disconnect pressure sensor coupler.
3. Remove pressure sensor.
4. Arrange 3 new 1.5V batteries in series and connect its positive terminal to "Vin" terminal of coupler and negative terminal to "Ground" terminal. Then check voltage between "Vout" and "Ground".

Also, check if voltage reduces when vacuum is applied up to 40 cmHg by using vacuum pump.

CAUTION:

As connection to wrong terminal will cause damage to pressure sensor, make absolutely sure to connect properly as shown below.



1. Pressure sensor
2. 1.5V Battery (4.5V in total)
3. Vacuum pump
4. Digital type voltmeter

Fig. 4A-133 Checking Pressure Sensor

Output voltage (Vin voltage 4.5V)

| ALTITUDE | | BAROMETRIC PRESSURE (mmHg) | OUTPUT VOLTAGE (V) |
|----------|-------|-------------------------------|-----------------------|
| (ft) | (m) | | |
| 0 | 0 | 760 | 3.4 – 3.8 |
| 1 000 | 305 | 733 | 3.3 – 3.7 |
| 2 000 | 610 | 707 | 3.1 – 3.6 |
| 3 000 | 914 | 682 | 3.0 – 3.5 |
| 4 000 | 1 219 | 658 | 2.9 – 3.3 |
| 5 000 | 1 524 | 634 | 2.8 – 3.2 |
| 6 000 | 1 829 | 611 | 2.7 – 3.1 |
| 7 000 | 2 133 | 589 | 2.6 – 3.0 |
| 8 000 | 2 438 | 567 | 2.5 – 2.9 |
| 9 000 | 2 743 | 546 | 2.4 – 2.8 |
| 10 000 | 3 048 | 526 | 2.3 – 2.7 |

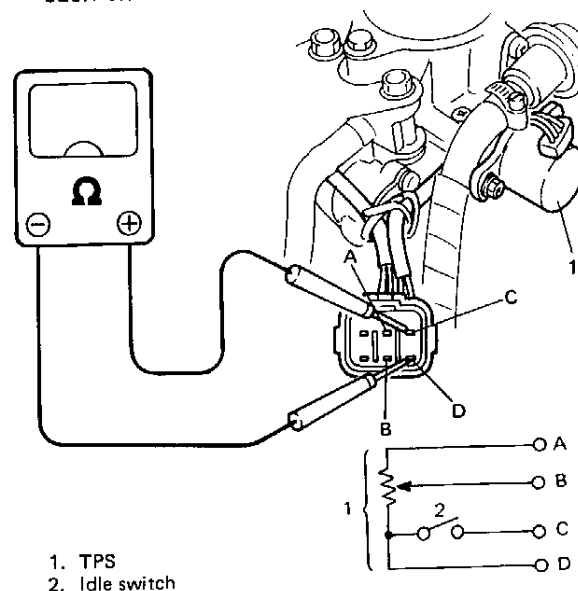
If check result is not satisfactory, replace pressure sensor.

5. Install pressure sensor and connect vacuum hose securely.
6. Connect pressure sensor coupler securely.

THROTTLE POSITION SENSOR (TPS)

Inspection

1. Disconnect negative cable at battery and TPS wires at the coupler.
2. Using ohmmeter, check the resistance between each two terminals.



1. TPS
2. Idle switch

Fig. 4A-134 Checking TPS

| | | |
|--|--|------------------------|
| Resistance between C and D terminals (Idle switch) | When throttle lever-to-stop screw clearance is 0.2 mm (0.008 in) | 0 – 500 Ω |
| | When throttle lever-to-stop screw clearance is 0.4 mm (0.016 in) | ∞ (Infinity) |
| Resistance between A and D terminals | — | 3.5 – 6.5 k Ω |
| Resistance between B and D terminals | When throttle valve is at idle position | 0 – 2 k Ω |
| | When throttle valve is fully open | 2 – 6.5 k Ω |
| NOTE: <ul style="list-style-type: none"> When checking resistance at idle position, apply –50 cmHg vacuum to throttle opener to move throttle valve to idle position. There should be more than 2 kΩ resistance difference between when throttle valve is at idle position and when it is fully open. | | |

If idle switch check result is not satisfactory, adjust installation angle of TPS and then check again.

If found defective in above check, replace.

3. Connect TPS coupler securely and battery negative cable to battery.

Adjustment

1. Disconnect battery negative cable at battery and TPS coupler.
2. Disconnect throttle opener vacuum hose from VSV and connect vacuum pump gauge to hose disconnected.
Apply –50 cmHg vacuum to throttle opener to move throttle valve to idle position.

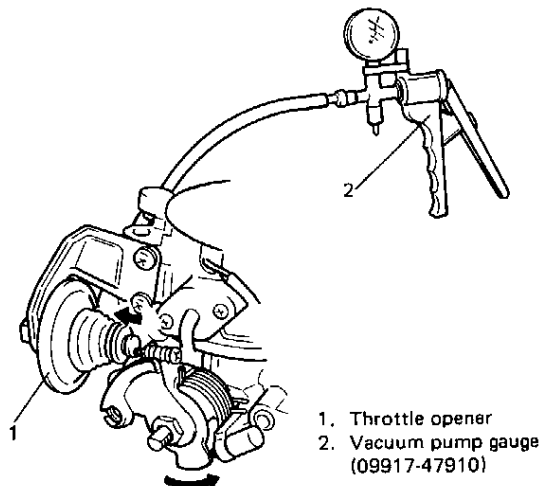


Fig. 4A-135 Applying Vacuum to Throttle Opener

3. Insert 0.3 mm (0.012 in.) thickness gauge between throttle valve lever and throttle stop screw.

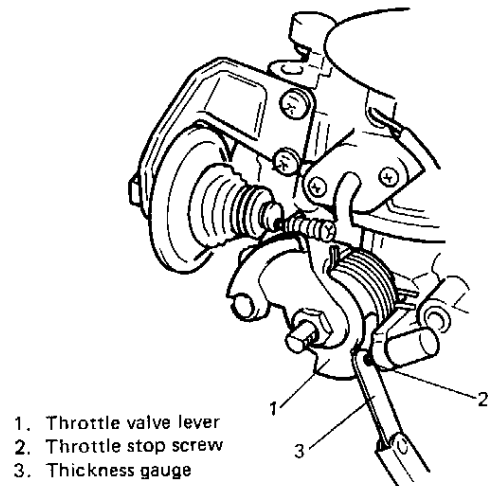


Fig. 4A-136 Inserting Thickness Gauge

4. Loosen TPS mounting bolts.
5. Connect ohmmeter between C and D terminals of TPS coupler.
6. First, turn TPS clockwise fully and then counterclockwise gradually to find position where ohmmeter reading changes from ∞ (infinity) to 0 (zero). Then fix TPS at that position by tightening bolts to specified torque.

| Tightening torque of throttle position sensor bolt | N-m | kg-m | lb-ft |
|--|-----|------|-------|
| | 3.5 | 0.35 | 2.5 |

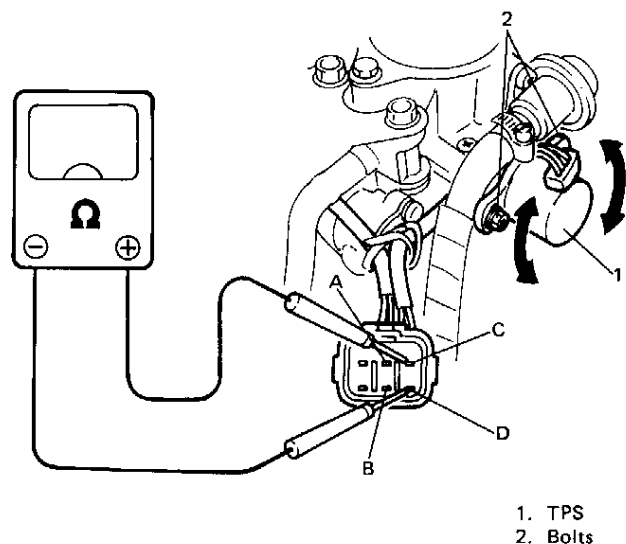


Fig. 4A-137 Adjusting Installation Angle of TPS

7. Check that there is no continuity between terminals C and D when 0.4 mm (0.016 in) thickness gauge is inserted.
8. Check that there is continuity between terminals C and D when 0.2 mm (0.008 in) thickness gauge is inserted.

If check result is unsatisfactory in steps 7 and 8, it means that installation angle of TPS is not adjusted properly. Therefore, start all over again from step 1.

CAUTION:

As throttle stop screw is factory adjusted precisely, don't remove or adjust it.

9. Connect coupler to TPS securely, connect throttle opener vacuum hose to VSV and connect battery negative cable.

Removal

1. Disconnect negative cable at battery.
2. Disconnect TPS coupler.
3. Pull out TPS wire harness terminals from coupler after unlocking terminal lock.

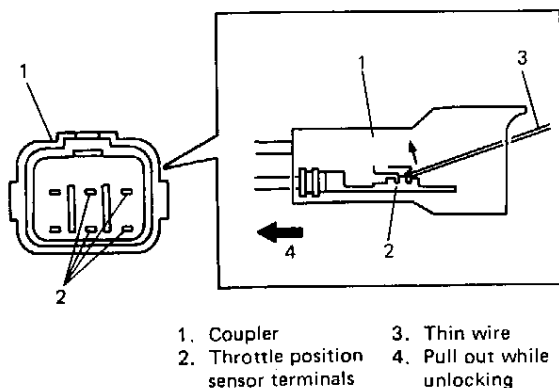


Fig. 4A-138 Removing Terminals

4. Remove TPS from throttle body.

Installation

1. Install TPS to throttle body.

Fit sensor to throttle body in such way that its adjusting holes are a little away from sensor mounting bolt holes as shown in Fig. 4A-139 and turn sensor clockwise so that those holes align. Then hand-tighten sensor mounting bolts in aligned holes.

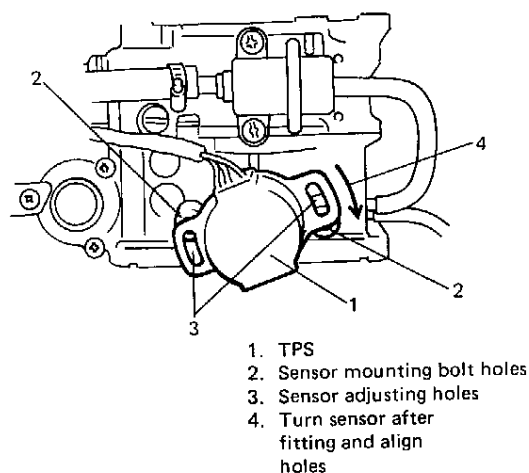


Fig. 4A-139 Installing TPS

2. Insert TPS terminals into coupler and check to make sure that they are locked.

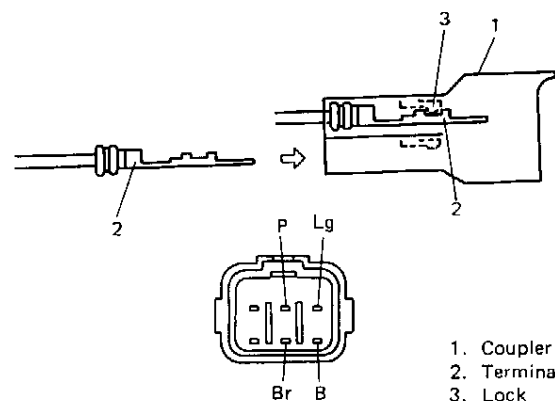


Fig. 4A-140 Inserting Terminals

3. Adjust installation angle of TPS according to procedure described in item "Adjustment".
4. Connect battery negative cable to battery.

AIR TEMPERATURE SENSOR (ATS)

Removal

1. Disconnect negative cable from battery.
2. Disconnect ATS coupler.
3. Remove ATS from intake manifold.

Inspection

Immerse temperature sensing part of ATS in water (or ice) and measure resistance between sensor terminals while heating water gradually. If measured resistance doesn't show such characteristic as shown in Fig. 4A-142, replace air temperature sensor.

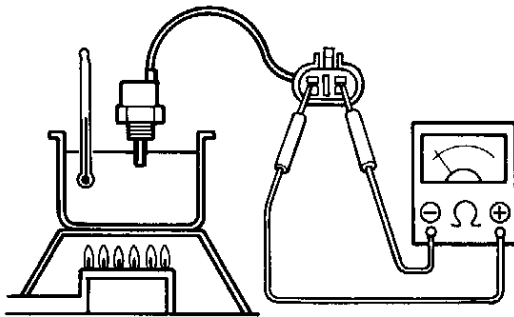


Fig. 4A-141 Checking ATS

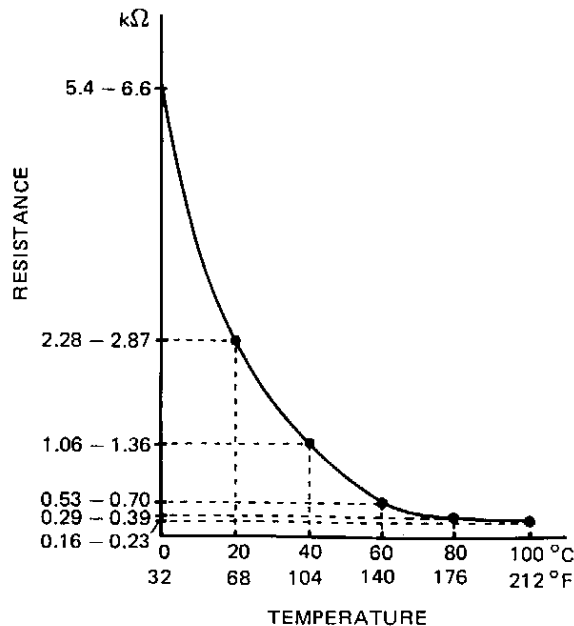


Fig. 4A-142 ATS Characteristic

Installation

Reverse removal procedure noting the following.

- Clean mating surface of sensor and intake manifold.
- Use new gasket.
- Tighten ATS to specified torque.

| Tightening torque for ATS | N·m | kg·m | lb·ft |
|---------------------------|---------|-----------|-------------|
| | 35 – 55 | 3.5 – 5.5 | 25.5 – 39.5 |

- Connect sensor coupler securely.

WATER TEMPERATURE SENSOR (WTS)

Removal

1. Disconnect battery negative cable from battery.
2. Drain cooling system.
3. Disconnect coupler from WTS.
4. Remove WTS from intake manifold.

Inspection

Immerse temperature sensing part of WTS in water and measure resistance between sensor terminals while heating water gradually. If measured resistance doesn't show such characteristic as shown below, replace WTS.

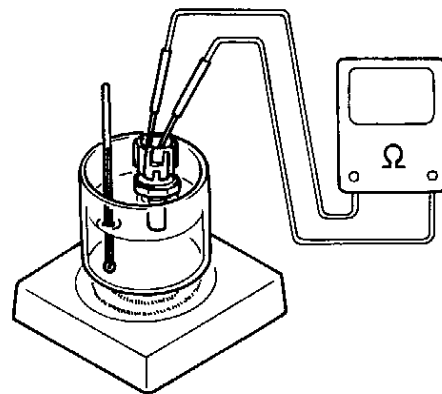


Fig. 4A-143 Checking WTS

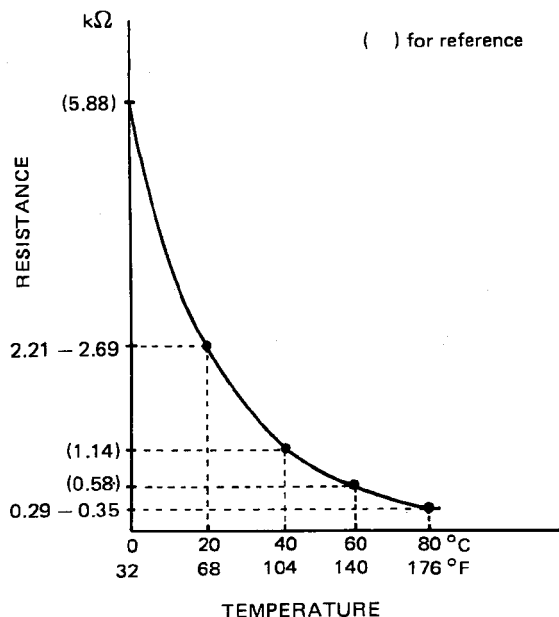


Fig. 4A-144 WTS Characteristic

Installation

Reverse removal procedure noting the following.

- Clean mating surfaces of sensor and intake manifold.
- Use new gasket.
- Tighten WTS to specified torque.

| Tightening torque for water temperature sensor | N·m | kg·m | lb·ft |
|--|---------|-----------|-------------|
| | 35 – 55 | 3.5 – 5.5 | 25.5 – 39.5 |

- Connect coupler to sensor securely.
- Refill cooling system.

RECIRCULATED EXHAUST GAS TEMPERATURE SENSOR (REGTS) (California spec. model only)

Removal

1. Disconnect battery negative cable.
2. Disconnect REGTS coupler.
3. Remove REGTS.

Inspection

Immerse temperature sensing part of the sensor in water and measure resistance between sensor terminals while heating water gradually.

If measured resistance doesn't show such characteristic as shown in Fig. 4A-146, replace.

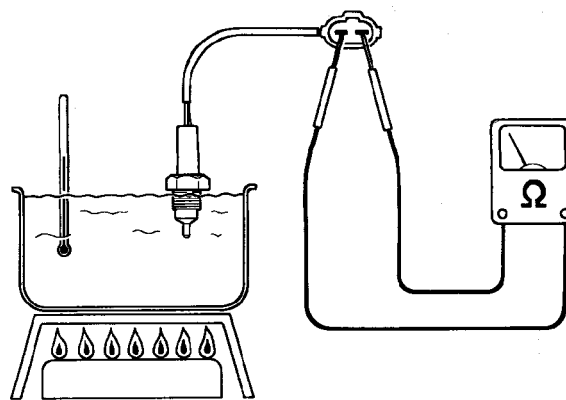


Fig. 4A-145 Checking REGTS

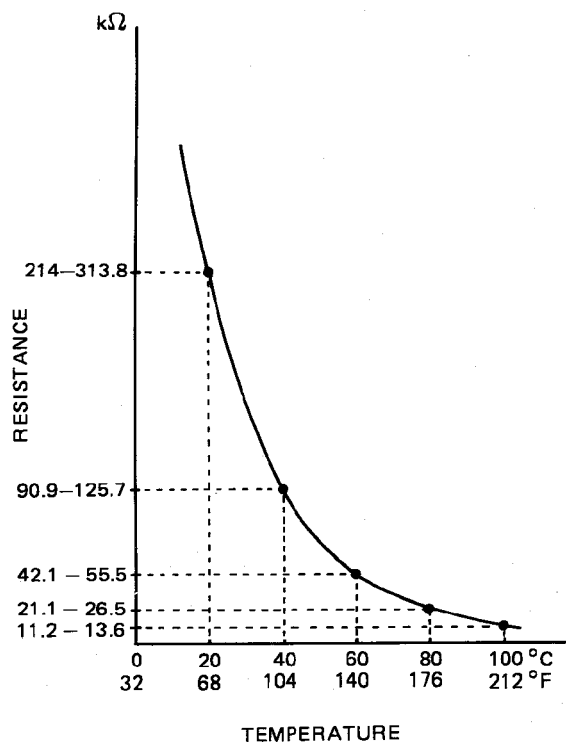


Fig. 4A-146 REGTS Characteristic

Installation

Reverse removal procedure noting the following.

- Tighten REGTS to specified torque.

| Tightening torque for REGTS | N·m | kg·m | lb·ft |
|-----------------------------|---------|-----------|------------|
| | 10 – 20 | 1.0 – 2.0 | 7.5 – 14.0 |

- Connect sensor coupler securely.

OXYGEN SENSOR

Removal

WARNING:

To avoid danger of being burned, do not touch exhaust system when system is hot. Oxygen sensor removal should be performed when system is cool.

1. Disconnect negative cable from battery.
2. Disconnect coupler of oxygen sensor.
3. Remove oxygen sensor from exhaust manifold.

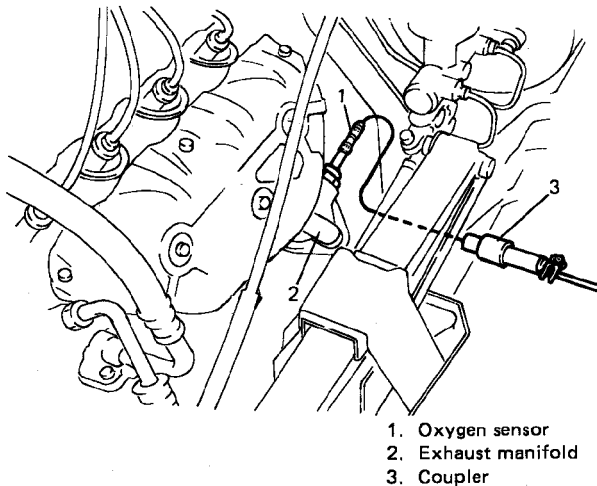


Fig. 4A-147 Removing Oxygen Sensor

Installation

Reverse removal procedure noting the following.

- Tighten oxygen sensor to specified torque.

| Tightening torque for oxygen sensor | N-m | kg-m | lb-ft |
|-------------------------------------|---------|-----------|-------------|
| | 45 – 55 | 4.5 – 5.5 | 33.0 – 39.5 |

- Connect coupler of oxygen sensor and clamp wire harness securely.
- After installing oxygen sensor, start engine and check that no exhaust gas leakage exists.

VEHICLE SPEED SENSOR (VSS)

Inspection

1. Disconnect negative cable at battery.
2. Remove combination meter from instrument panel.
3. Connect ohmmeter between "GND" screw and "RSW" screw of combination meter and turn cable joint of speedometer with a screwdriver. Ohmmeter indicator should move back

and forth between 0 (zero) and ∞ (infinity) 4 times while cable joint is turned one full revolution.

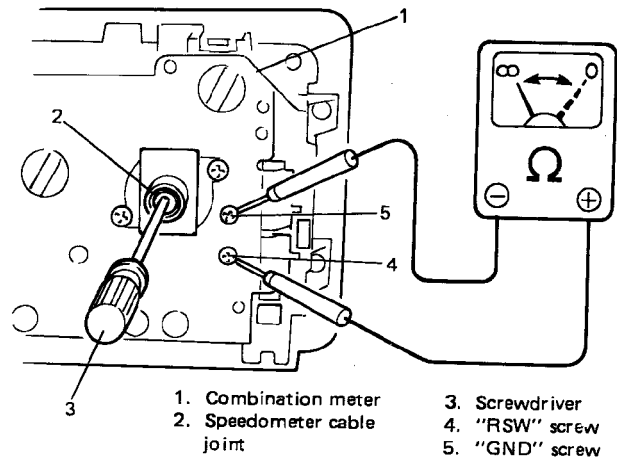


Fig. 4A-148 Checking Speed Sensor

Replace speedometer if check result is not satisfactory.

4. Install combination meter to instrument panel.
5. Connect negative cable to battery.

5TH SWITCH (Not for California Spec. Model)

Inspection

1. Disconnect negative cable from battery.
2. Disconnect 5th switch coupler.

The coupler is located beside igniter.

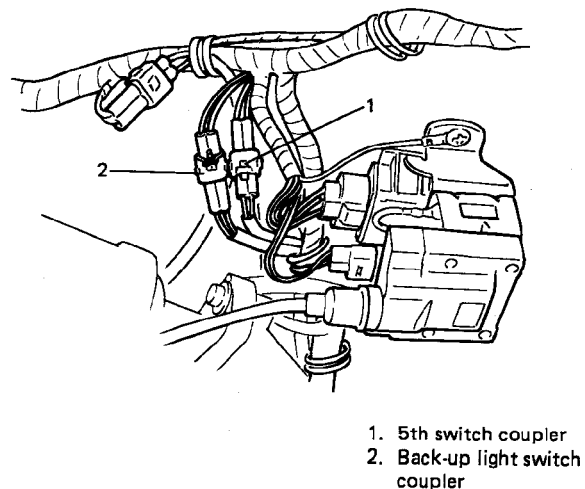


Fig. 4A-149 5th Switch Coupler Location

3. Connect ohmmeter to 5th switch terminals of disconnected coupler and check for continuity.

| CONDITION | METER INDICATION |
|--|------------------------|
| Shift lever in 5th gear position | 0 (Zero) |
| Shift lever in any other position than 5th gear position | ∞ (Infinity) |

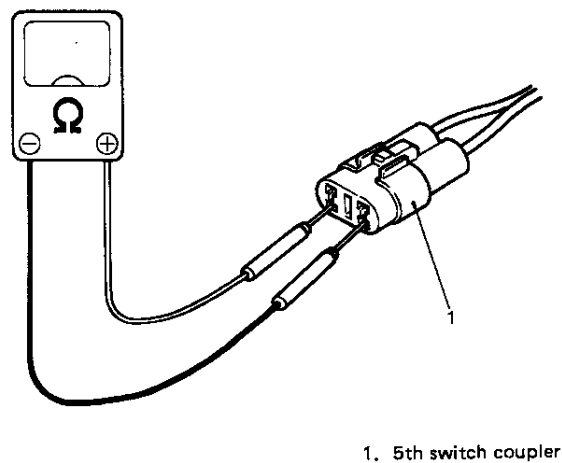


Fig. 4A-150 Checking 5th Switch

- If check result is not satisfactory, replace 5th switch or repair wire harness.
4. Connect 5th switch coupler and battery negative cable.

CLUTCH SWITCH

Inspection

1. Disconnect clutch switch coupler.
2. Connect ohmmeter to clutch switch coupler terminals ans check for continuity.
Replace as necessary.

| CONDITION | METER INDICATOR |
|------------------|---------------------|
| Clutch released | ∞ (Infinity) |
| Clutch depressed | 0 (Zero) |

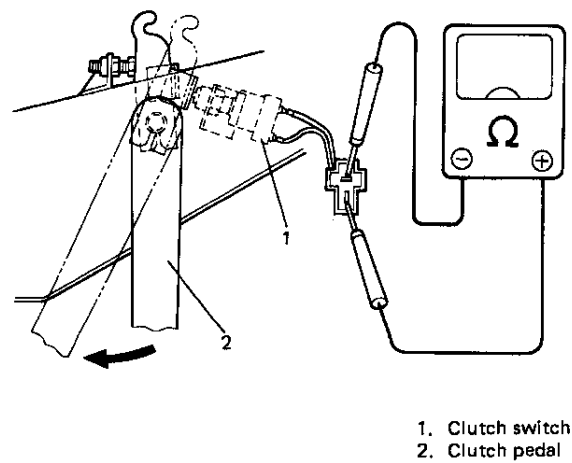
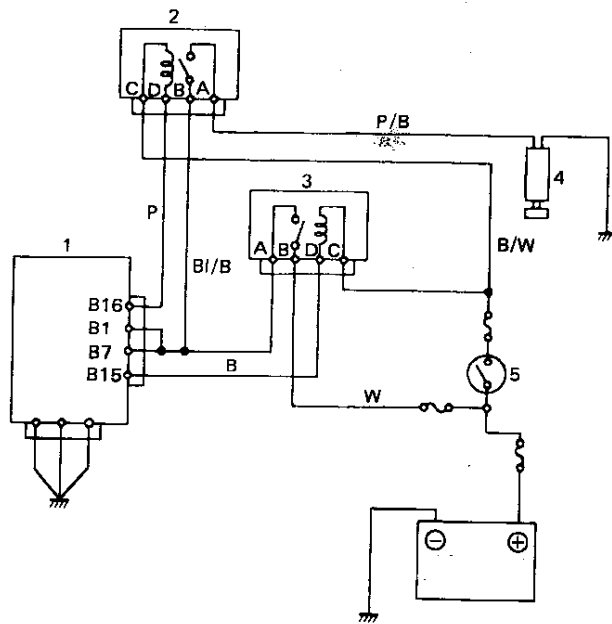


Fig. 4A-151 Checking Clutch Switch

4. Connect coupler securely.

MAIN RELAY



- 1. ECM
- 2. Fuel pump relay
- 3. Main relay
- 4. Fuel pump
- 5. Ignition switch

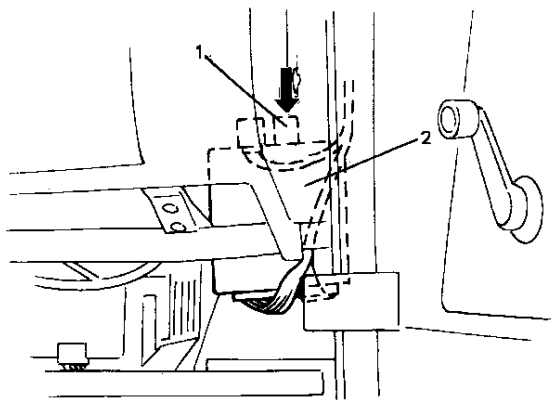
Fig. 4A-152 Main Relay and Fuel Pump Relay Circuits

NOTE:

Distinguish between main relay and fuel pump relay by wire colors.

Inspection

1. Disconnect negative cable at battery.
2. Remove main relay from ECM after disconnecting its coupler.



- 1. Main relay
- 2. ECM

Fig. 4A-153 Removing Main Relay

3. Check resistance between each two terminals as in table below.

If check results are as specified, proceed to next operation check. If not, replace.

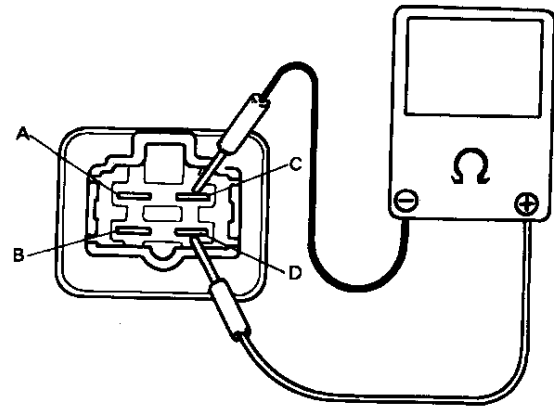


Fig. 4A-154 Checking Main Relay Resistance

| TERMINALS | RESISTANCE |
|-----------------|--------------|
| Between A and B | ∞ (infinity) |
| Between C and D | 56 – 84 Ω |

4. Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D".

If found defective, replace.

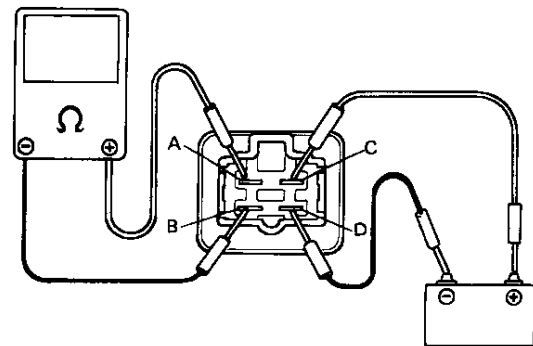


Fig. 4A-155 Checking Main Relay Operation

FUEL PUMP RELAY

Inspection

1. Remove fuel pump relay in the same way as main relay.
 2. Structure of fuel pump relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.
- If found defective, replace.

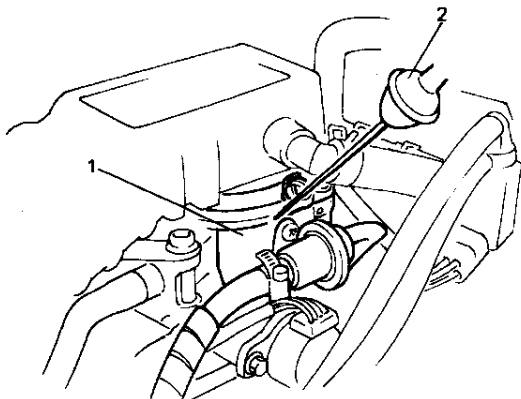
FUEL CUT OPERATION

Inspection

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position, and that parking brake lever is pulled all the way up.

1. Warm up engine to normal operating temperature.
2. While listening to sound of injector by using sound scope or such, increase engine speed to higher than 3,000 r/min.
3. Check to make sure that sound to indicate operation of injector stops when throttle valve is closed instantly and it is heard again when engine speed is reduced to less than about 1,900 r/min.



1. Throttle body
2. Sound scope

Fig. 4A-156 Checking Fuel Cut Operation

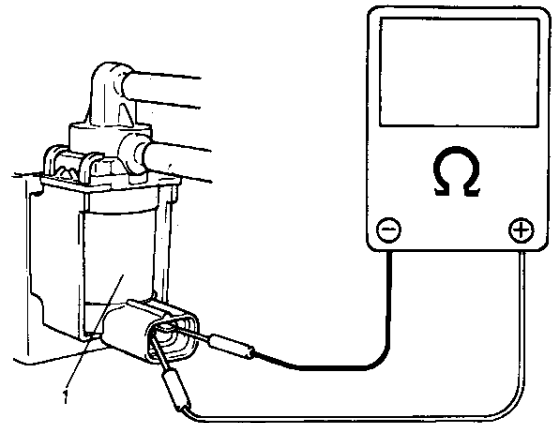
ISC SOLENOID VALVE

Inspection

1. With ignition switch "OFF", disconnect ISC solenoid valve coupler.
2. Check resistance between each two terminals of ISC solenoid valve.

| | |
|----------------------------------|------------------|
| Resistance of ISC solenoid valve | 30 – 33 Ω |
|----------------------------------|------------------|

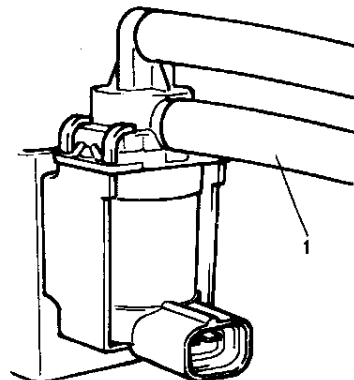
If it is within specification, proceed to next operation check. If not, replace.



1. ISC solenoid valve

Fig. 4A-157 Checking Resistance

3. Warm up engine to normal operating temperature.
4. With engine running and ISC solenoid valve coupler disconnected, disconnect ISC solenoid valve hose from air cleaner case. In this state, check that air is not drawn into the hose.



1. Hose from air cleaner case

Fig. 4A-158 Checking ISC Solenoid Valve (1)

5. Under above condition, connect 12V-battery to ISC solenoid valve terminals and check that air is drawn into the hose.

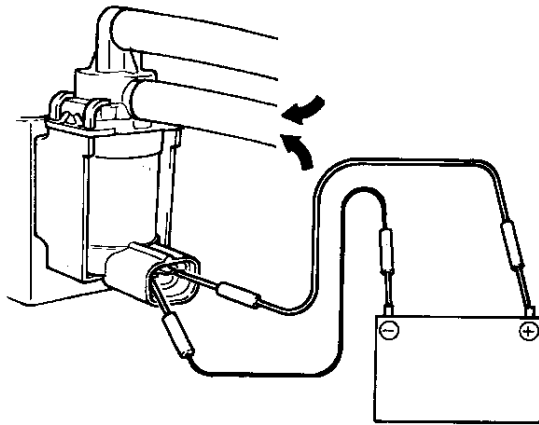


Fig. 4A-158-1 Checking ISC Solenoid Valve (2)

If check result is not satisfactory, replace ISC solenoid valve.

6. Connect hose and coupler securely.

THROTTLE OPENER SYSTEM

System Inspection

1. Warm up engine to normal operating temperature.
2. Check that there is clearance between throttle stop screw and throttle lever at engine stop and cranking and that 0 — 1.0 second after engine start, throttle opener rod retracts and clearance disappears.

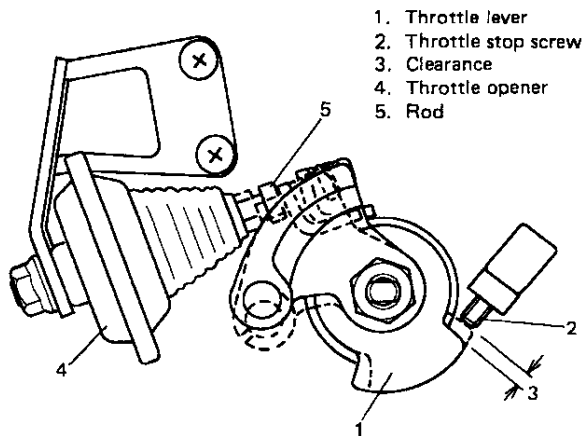


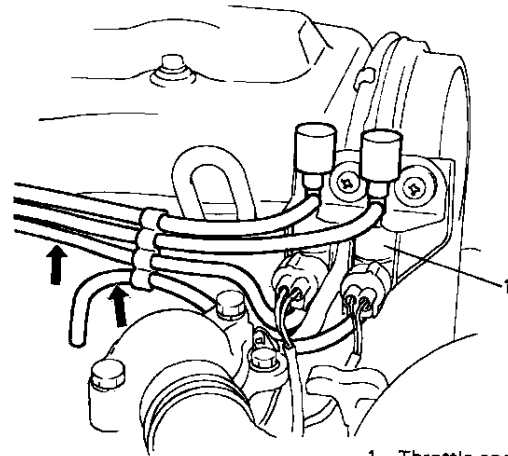
Fig. 4A-159 Checking Throttle Opener Operation

4A-100

If check result is not satisfactory, check vacuum hoses, throttle opener, VSV and system electric circuit.

Vacuum Hoses Inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

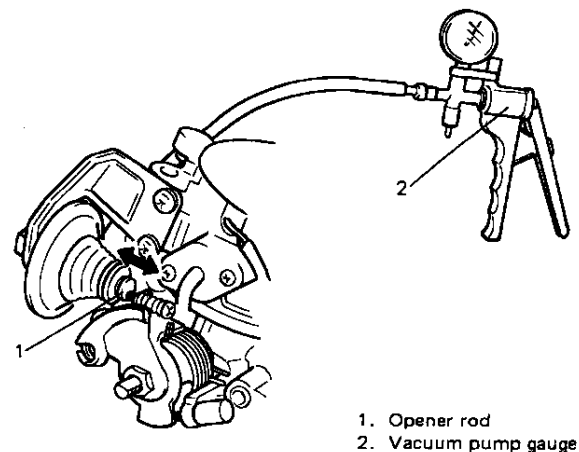


1. Throttle opener VSV

Fig. 4A-160 Checking Vacuum Hoses

Throttle Opener Inspection

1. Disconnect vacuum hose from VSV.
2. Connect vacuum pump gauge to hose disconnected in Step 1.
3. Check that opener rod moves smoothly and that it is held at the same position when 50 cmHg vacuum is applied to opener.



1. Opener rod
2. Vacuum pump gauge

Fig. 4A-161 Checking Throttle Opener

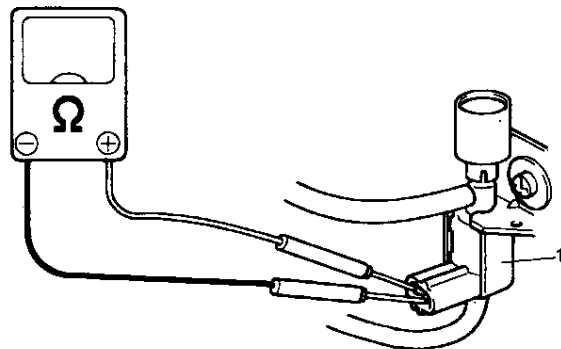
If rod doesn't move smoothly, or it isn't held at the same position, replace.

VSV (Vacuum Switching Valve) Inspection

1. With ignition switch OFF, disconnect coupler from VSV.
2. Check resistance two terminals of VSV.

| | |
|-----------------------------------|------------------|
| Resistance of throttle opener VSV | 33 – 39 Ω |
|-----------------------------------|------------------|

If resistance is as specified, proceed to next operation check. If not, replace.



1. VSV (Brown)

Fig. 4A-162 Checking Resistance

3. Disconnect vacuum hoses from throttle opener and intake manifold.
4. Blow into hose "A". Air should come out of hose "B" and not out of filter.

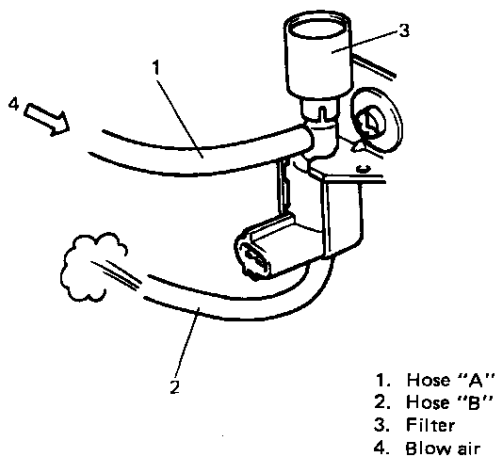


Fig. 4A-163 Checking Opener VSV (1)

5. Connect 12V battery to VSV terminals. In this state, blow hose "A". Air should come out of filter and not out of hose "B".

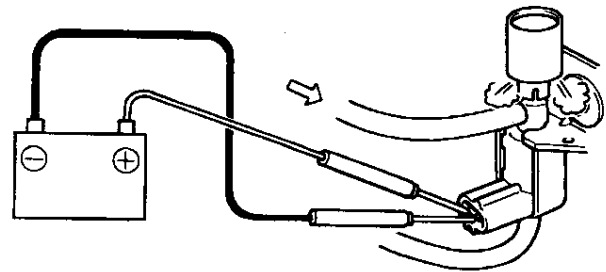


Fig. 4A-164 Checking Opener VSV (2)

If check result is not as described above, replace VSV.

6. Connect VSV coupler securely.
7. Connect vacuum hoses securely.

EGR SYSTEM

NOTE:

Before inspecting EGR system, be sure to confirm the following.

- Altitude is 3,870 ft, 1,180 m above sea level or lower and atmospheric pressure is 660 mmHg or higher.
- WTS, TPS and pressure sensor are in good condition.
- 5th switch signal is not fed into ECM (not for California spec. model).

If even one of the above conditions do not apply, EGR valve don't operate.

System Inspection

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position and that parking brake lever is pulled all the way up.

1. When engine is cool (cooling water temperature is below 53°C, 127°F), start engine and race it, and check that EGR valve diaphragm is not operating in this state, by touching diaphragm with finger.

CAUTION:

If EGR valve is hot, it may be necessary to wear gloves to avoid burning fingers.

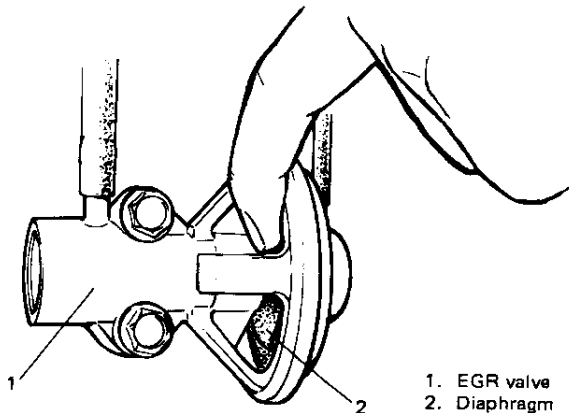


Fig. 4A-165 Checking EGR Valve Diaphragm

2. Warm up engine to normal operating temperature and race it after warming up. Then check to be sure that diaphragm moves toward 1 in Fig. 4A-166 during acceleration and toward 2 during deceleration.

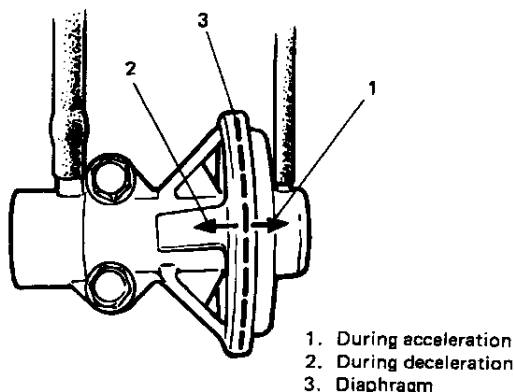


Fig. 4A-166 Movement of EGR Valve Diaphragm

If EGR valve fails to operate properly, check vacuum hoses EGR valve, EGR modulator, VSV, wire harness and ECM.

3. Keep engine running at idle speed and open EGR valve by hand, and engine should either stop or reduce its speed. If neither occurs, EGR passage is clogged. Clean it.

Vacuum Hose Inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

EGR Valve Inspection

1. Disconnect vacuum hose from EGR modulator.
2. Connect vacuum pump gauge to its hose.
3. Check that EGR valve diaphragm moves smoothly and that it is held at the same position when 20 cmHg vacuum is applied to EGR valve.

If diaphragm doesn't move smoothly, or it isn't held at the same position, replace EGR valve.

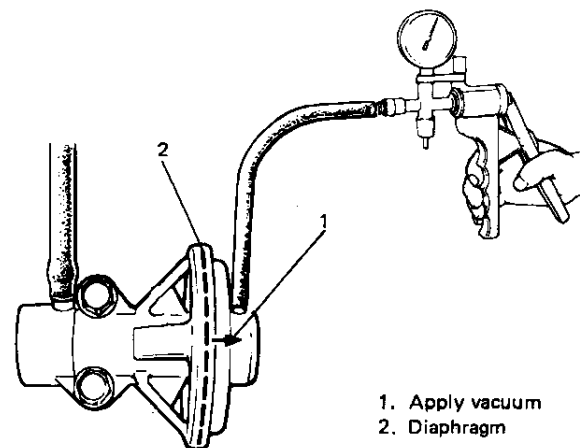


Fig. 4A-167 Checking EGR Valve

4. After checking, be sure to connect vacuum hose.

EGR Modulator Inspection

1. Check filter for contamination and damage.
Using compressed air, clean filter.

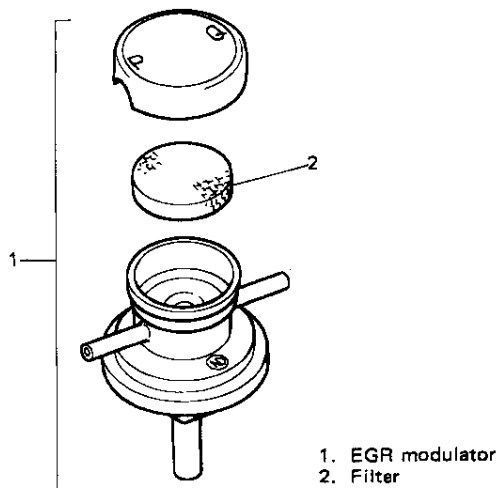


Fig. 4A-168 Filter of EGR Modulator

2. Remove EGR modulator and plug nozzle with finger. Blow air into another nozzle and check that air passes through to air filter side freely.

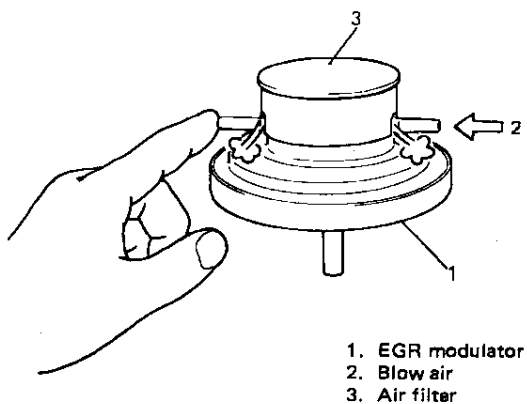


Fig. 4A-169 Checking EGR Modulator (1)

3. Connect vacuum pump gauge to nozzle "P" and plug nozzle "Q" with finger. While blowing air into nozzle "A", operate vacuum pump gauge and check that vacuum is applied to modulator. Then stop blowing nozzle "A" and check that vacuum pump gauge indicates "0" (zero). If check result is not satisfactory, replace EGR modulator.

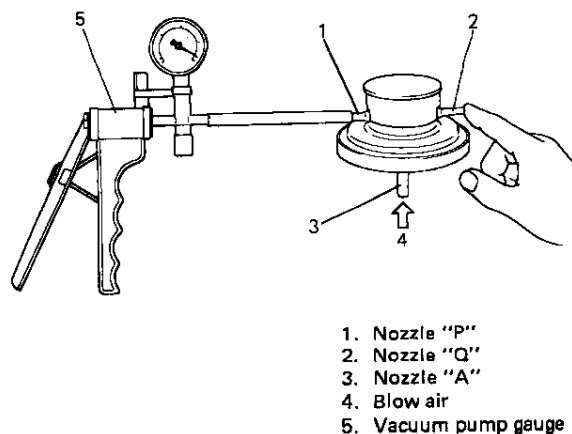


Fig. 4A-170 Checking EGR Modulator (2)

4. After checking, install modulator and connect hoses securely. Refer to emission control information label for connection.

VSV (Vacuum Switching Valve) Inspection

1. With ignition switch OFF, disconnect coupler from VSV.
2. Check resistance between two terminals of VSV.

| | |
|-----------------------|-----------|
| Resistance of EGR VSV | 33 — 39 Ω |
|-----------------------|-----------|

If resistance is as specified, proceed to next operation check. If not, replace.

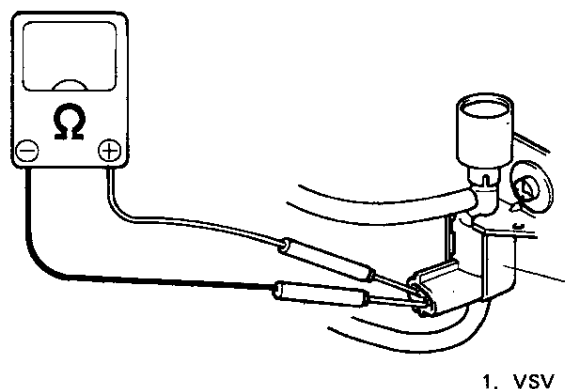


Fig. 4A-171 Checking Resistance

3. Disconnect vacuum hoses from EGR modulator and throttle body.
4. Blow into hose "A". Air should come out of hose "B" and not out of filter.

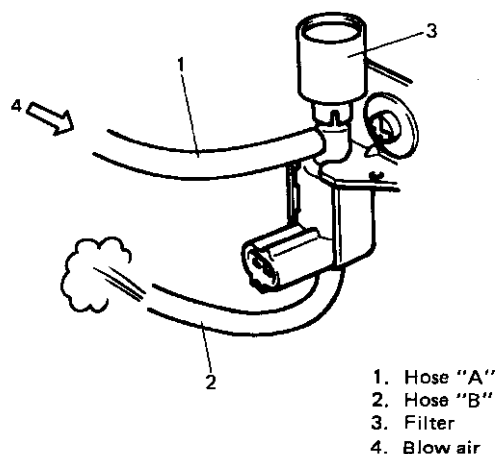


Fig. 4A-172 Checking Opener VSV (1)

5. Connect 12V-battery to VSV terminals. In this state, blow hose "A". Air should come out of filter and not out of hose "B".

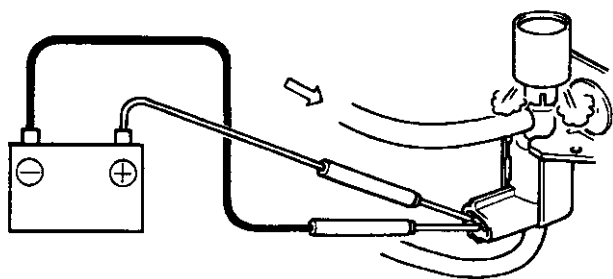
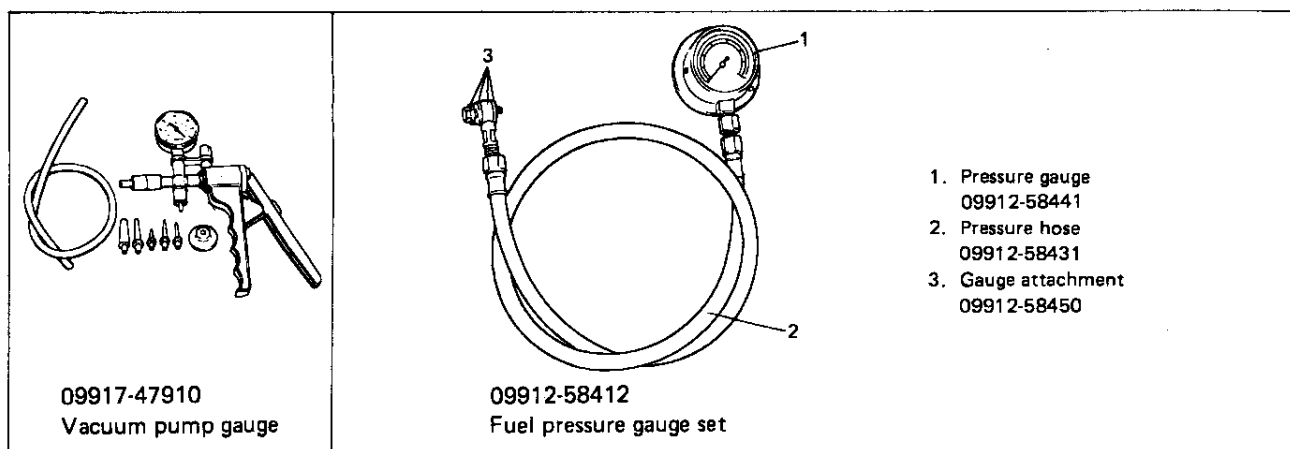


Fig. 4A-173 Checking Opener VSV (2)

If check result is not as described above, replace VSV.

6. Connect VSV coupler securely.
7. Connect vacuum hoses securely.

SPECIAL TOOLS



RECOMMENDED TORQUE SPECIFICATIONS

| Fastening parts | Tightening torque | | |
|---------------------------------------|-------------------|-----------|-------------|
| | N·m | kg·m | lb·ft |
| Throttle body mounting bolt | 18 – 28 | 1.8 – 2.8 | 13.5 – 20.0 |
| Fuel inlet pipe bolt of throttle body | 8 – 12 | 0.8 – 1.2 | 6.0 – 8.5 |
| Throttle upper and lower body screw | 3.5 | 0.35 | 2.5 |
| Fuel pressure regulator screw | 3.5 | 0.35 | 2.5 |
| Injector cover screw | 2.0 | 0.2 | 1.4 |
| TPS bolt | 3.5 | 0.35 | 2.5 |
| ATS | 35 – 55 | 3.5 – 5.5 | 25.5 – 39.5 |
| WTS | 35 – 55 | 3.5 – 5.5 | 25.5 – 39.5 |
| REGTS | 10 – 20 | 1.0 – 2.0 | 7.5 – 14.0 |
| Oxygen sensor | 45 – 55 | 4.5 – 5.5 | 33.0 – 39.5 |

SECTION 5

EMISSION CONTROL SYSTEM

CONTENTS

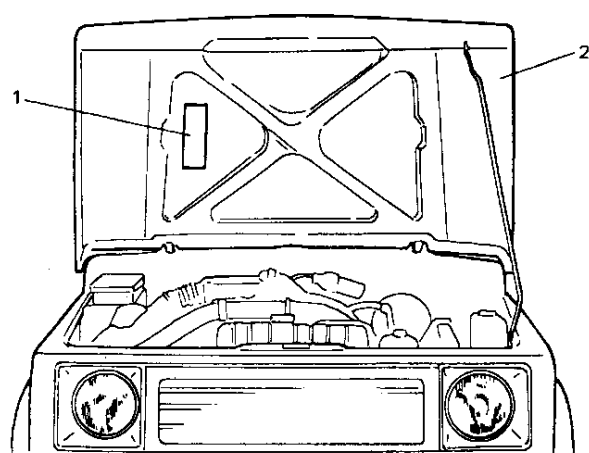
| | |
|---|--|
| GENERAL DISCRIPTION | 5-2 |
| Vehicle Emission Control Information Label | 5-2 |
| Positive Crankcase Ventilation (PCV) System | 5-2 |
| Evaporative Emission Control System | 5-3 |
| Three-Way Catalyst | 5-4 |
| Exhaust Gas Recirculation (EGR) System] | Refer to SECTION 4A in this SUPPLEMENT. |
| Fuel Feed Back System (Compensation)] | |
| DIAGNOSIS | Refer to SECTION 2 and SECTION 4A in this SUPPLEMENT. |
| ON VEHICLE SERVICE | 5-4 |
| General | 5-4 |
| PCV System | 5-4 |
| Evaporative Emission Control System | 5-5 |
| EGR System] | Refer to SECTION 4A in this SUPPLEMENT. |
| Fuel Feed Back System (Oxygen sensor)] | |

GENERAL DESCRIPTION

VEHICLE EMISSION CONTROL INFORMATION LABEL

The Vehicle Emission Control Information Label is located under hood. The label contains important emission specifications and setting procedures, as well as a vacuum hose schematic with emission components identified.

When servicing the engine or emission systems, the Vehicle Emission Control Information Label should be checked for up-to-date information.



- 1. Vehicle emission control information label
- 2. Hood

Fig. 5-1 Vehicle Emission Control Information Label

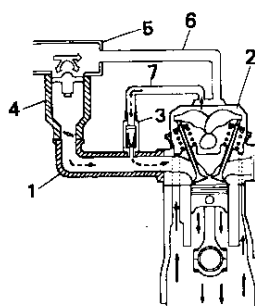
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

The term "blow-by gas" stands for the compressed gas and exploded gas which blow through cylinder-to-piston clearance, which contain a large amount of unburned gases such as CO and HC. The PCV (Positive Crankcase Ventilation) system is provided to prevent the blow-by gas from being emitted into atmosphere and it operates as follows.

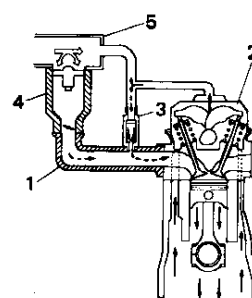
When the vacuum in the intake manifold is low (throttle valve open), the PCV valve is wide open due to its spring force. Thus a large amount of the blow-by gas is drawn into the intake manifold.

On the other hand, when the vacuum in the manifold is high, the PCV valve opening is limited due to the high vacuum. Thus the amount of the blow-by gas drawn into the intake manifold is small.

For '91, '92 model



For '90 model



- ← 8
- ← 9
- ← -- 10

- | | |
|------------------------|---------------------------------------|
| 1. Intake manifold | 7. PCV hose |
| 2. Cylinder head cover | 8. Blow-by gas |
| 3. PCV valve | 9. Fresh air |
| 4. Throttle body | 10. Blow-by gas and fresh air mixture |
| 5. Air intake case | |
| 6. Breather hose | |

Fig. 5-2 PCV System Operation

EVAPORATIVE EMISSION CONTROL SYSTEM

An evaporative emission control system is used to prevent emission of fuel vapor.

The vapor generated in the fuel tank while driving or the engine at a stop enters the charcoal canister where the charcoal absorbs and stores the fuel vapor.

Only when the following conditions are all satisfied, fuel vapor in the canister is sucked into throttle body together with fresh air.

- Engine is running
- Engine cooling water temp. is high (Normal operating temperature)
- Throttle valve opens larger than idle position.

In this state, the canister is purged or cleaned by air drawn through the filter at the bottom of the canister.

When engine cooling water temp. is low, purge passage is closed by BVSV.

In this state, the canister is not purged.

The check valves ("A" and "B") are provided to keep the pressure in the fuel tank constant. When the pressure in the fuel tank becomes positive and reaches its specified value, it opens the valve "A" to let the vapor flow into the charcoal canister. On the other hand, when the pressure in the fuel tank becomes negative and reaches its specified value, it opens the valve "B" to let the air flow into the fuel tank.

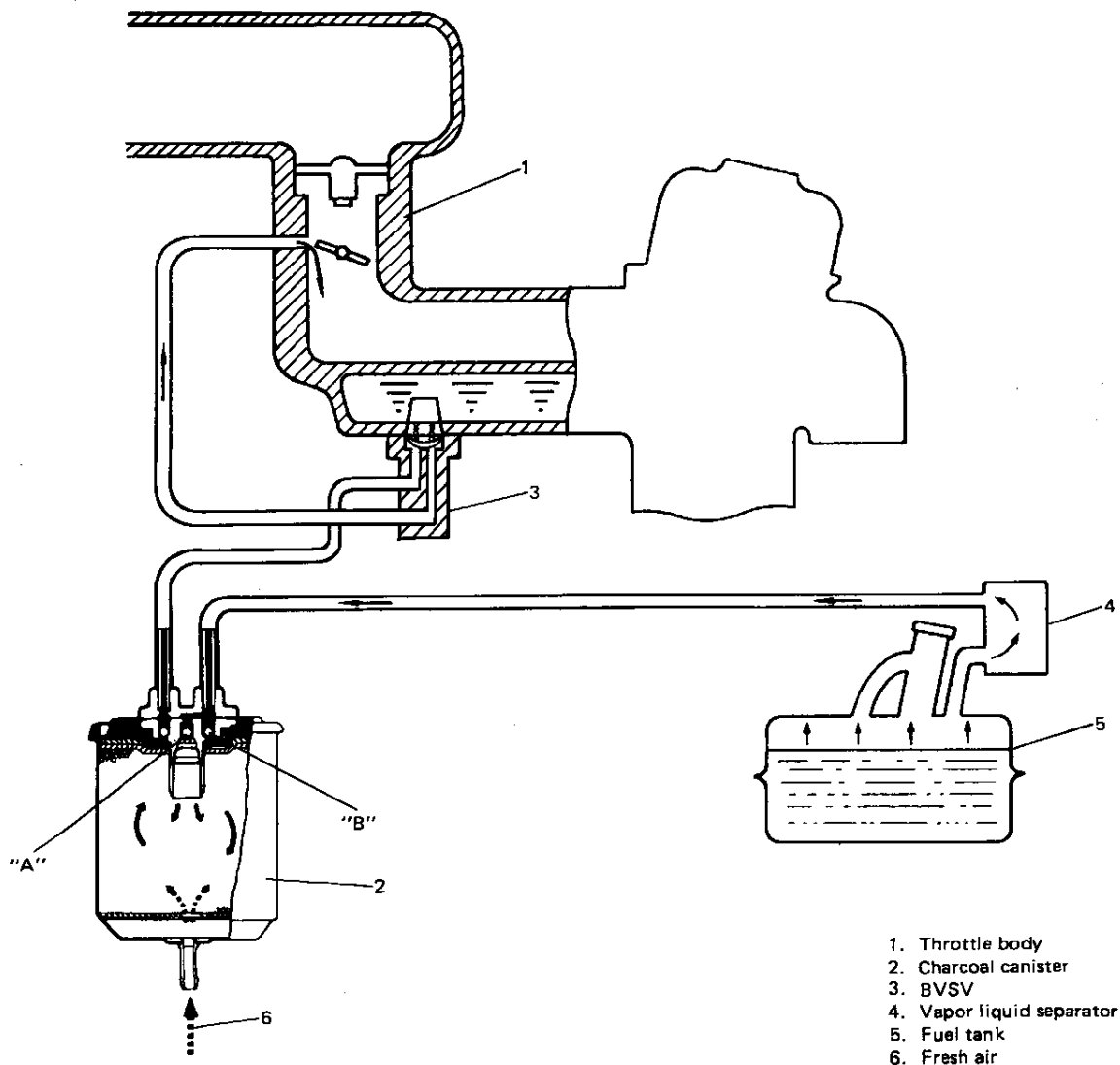


Fig. 5-3 Evaporative Emission Control System

THREE-WAY CATALYST

The three-way catalyst is provided in the exhaust system (exhaust center pipe). The function of the catalyst is to reduce the emission of CO, HC and NO_x in the exhaust gas by oxidizing or converting them into CO₂, H₂O and N₂ respectively.

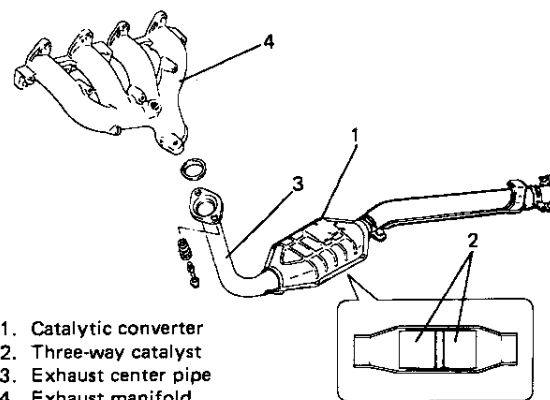


Fig. 5-4 Catalytic Converter

ON VEHICLE SERVICE

GENERAL

When the emission control hoses are disconnected and the system's component is removed for service, reinstall the component properly, and route and connect hoses correctly after service. Refer to Fig. 4A-101, and Vehicle Emission Control Information Label for proper routing of hoses.

PCV SYSTEM

NOTE:

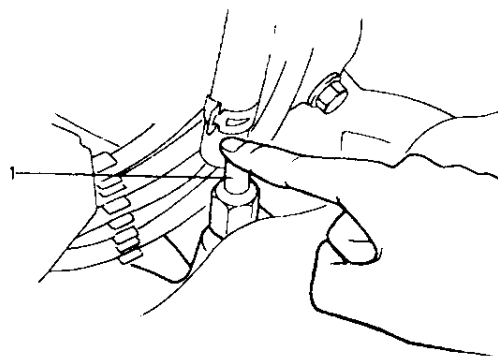
Be sure to check that there is no obstruction in PCV valve or its hoses before adjusting engine idle speed, for obstructed PCV valve or hose hampers its accurate adjustment.

PCV HOSE

Check hoses for connection, leakage, clog, and deterioration. Replace as necessary.

PCV VALVE

1. Disconnect PCV hose from PCV valve.
2. Run engine at idle.
3. Place your finger over end of PCV valve to check for vacuum. If there is no vacuum, check for clogged valve. Replace as necessary.



1. PCV valve

Fig. 5-5 Checking Vacuum

4. After checking vacuum, stop engine and check PCV valve for sticking.

With engine stopped, connect a new hose to PCV valve.

Blow air into new hose and check that air flows with difficulty from cylinder head side to intake manifold side. If air flows without difficulty, valve is stuck in "Open" position. Replace PCV valve.

WARNING:

Do not suck air through PCV valve. Petroleum substances inside the valve and fuel vapor inside the intake manifold are harmful.

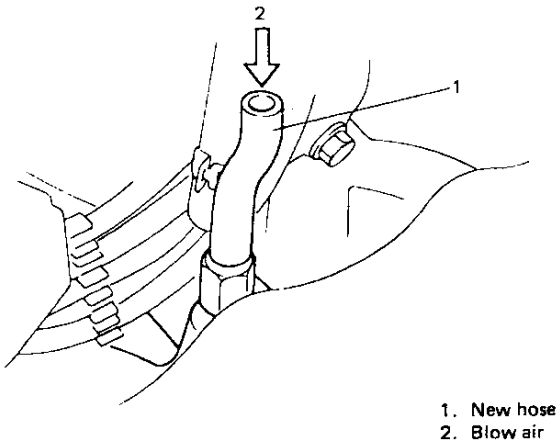


Fig. 5-6 Checking PCV Valve for Sticking

5. Connect PCV hose and clamp securely.

EVAPORATIVE EMISSION CONTROL SYSTEM

VACUUM HOSES

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

CHARCOAL CANISTER

WARNING:

DO NOT SUCK nozzles on canister. Fuel vapor inside canister is harmful.

1. Disconnect hoses from canister.

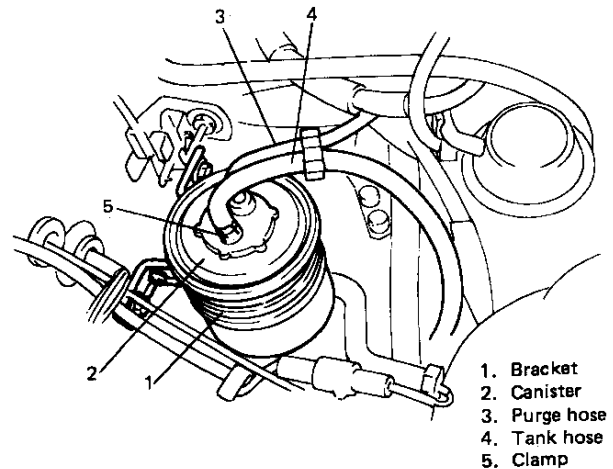


Fig. 5-7 Canister Hoses

2. Remove canister.
3. With pipe "C" plugged with finger blow air into pipe "A" strongly, and air should come out from pipe "B".
4. When air is blown into pipe "B", air should not pass through pipe "A" and "C".
5. When air is blown into pipe "C", air should come out from pipes "A" and "B".

If operation differs from above description, canister must be replaced.

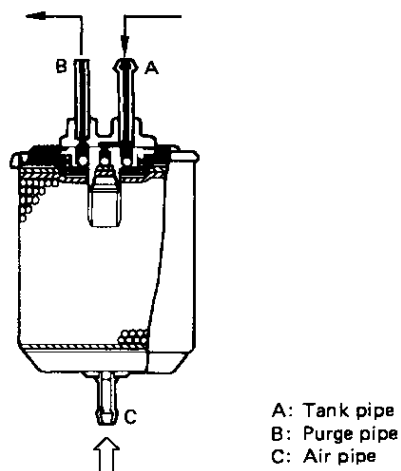


Fig. 5-8 Checking Canister

6. Install canister and connect hoses.

BVSV (Bi-metal Vacuum Switching Valve)

NOTE:

For rough operation check, BVSV needs not be removed from intake manifold. It can be checked by cooling and warming up engine to obtain test conditions as in Steps 3 and 4 below. (For such check, other steps are not applicable.)

1. Drain cooling system when engine is cold.
2. Disconnect vacuum hoses and remove BVSV from intake manifold.
3. While keeping BVSV cool (below 55°C 131°F), blow nozzle "3". Air should not come out of nozzle "4".

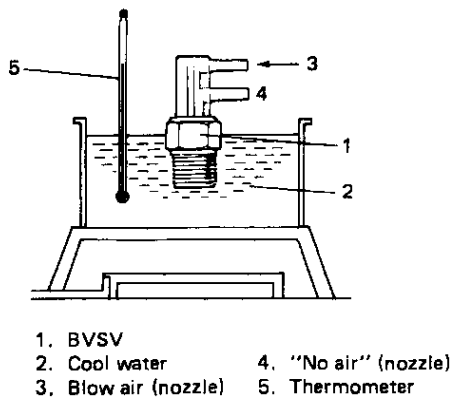


Fig. 5-9 Checking BVSV (1)

4. While keeping BVSV warm (above 65°C 149°F) in hot water, blow nozzle "3". Air should come out of nozzle "4".

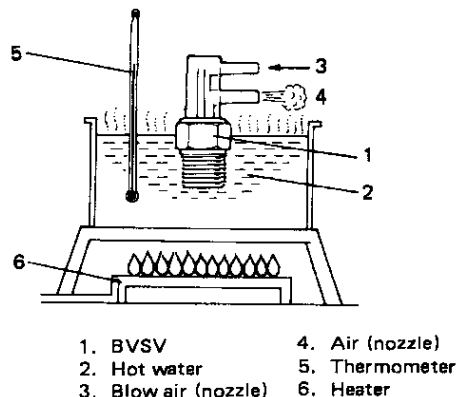


Fig. 5-10 Checking BVSV (2)

5. Reinstall BVSV to intake manifold. Before installing, wind sealing tape on its thread.
6. Connect vacuum hoses. Refer to Fig. 4A-101 for connection.

SECTION 8

IGNITION SYSTEM

CONTENTS

| | |
|--|------------|
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| High Tension Cords | 8-4 |
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| Ignition Coil | 8-5 |
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| DISTRIBUTOR UNIT | 8-8 |
| Important Reminders for Reassembly | 8-8 |
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GENERAL DESCRIPTION

The ignition system used for this vehicle has an ESA (Electronic Spark Advance) system and consists of the following parts.

- ECM

It detects the engine condition through the signals from the sensors, determines the most suitable ignition timing and time for electricity to flow to the primary coil and sends a signal to the power unit.

- Igniter (Power unit)

It turns ON and OFF the primary current of the ignition coil according to the signal from ECM. At the same time, it send ignition signal (fail safe signal) to ECM. If no fail safe signal is transmitted to the ECM while engine is running, fuel cut operation is executed.

- Ignition coil

When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary winding.

- Distributor

It distributes a high voltage current to each plug.

- High-tension cords and spark plugs

- CAS (Crank Angle Sensor)

Located in the distributor, it converts the crank angle into voltage variation and sends it to ECM. For its details, refer to Section 4A.

- Pressure sensor, TPS WTS and test switch terminal

For their details, refer to Section 4A.

In ESA system, the ECM is programmed for the best ignition timing under every engine condition. Receiving signals which indicate the engine condition from the sensors, e.g., engine revolution, intake air volume, coolant temperature, etc., it selects the most suitable ignition timing from its memory and operates the igniter.

Thus ignition timing is controlled to yield the best engine performance.

For more information, refer to Section 4A.

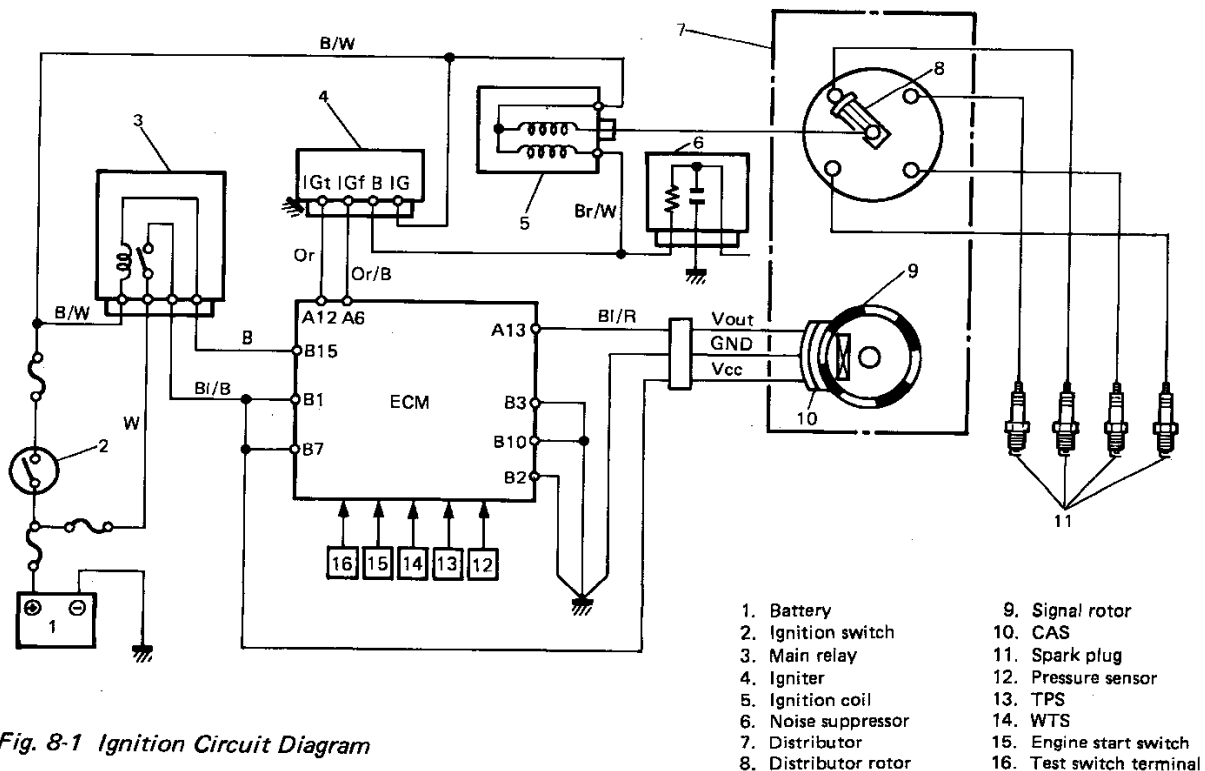


Fig. 8-1 Ignition Circuit Diagram

DIAGNOSIS

| Condition | Possible cause | Correction |
|--|--|--|
| Engine cranks, but will not start or hard to start | No spark <ul style="list-style-type: none"> Faulty spark plug(s) Blown fuse for ignition coil Loose connection or disconnection of lead wires or high-tension cord(s) Faulty high-tension cord(s) Cracked rotor or cap Faulty ignition coil Faulty noise suppressor Faulty CAS Faulty igniter Faulty ECM Maladjusted ignition timing | Adjust, clean or replace Replace Connect securely Replace Replace Replace Replace Replace Replace Replace Adjust |
| Poor fuel economy or engine performance | <ul style="list-style-type: none"> Incorrect ignition timing Faulty spark plug(s) or high tension cord(s) Faulty ECM | Adjust Adjust, clean or replace Replace |

SELF-DIAGNOSIS

- To insure correct diagnosis, check to confirm that battery voltage is within standard value when engine is standstill.
- Turn on ignition switch and make sure that "CHECK ENGINE" light lights.
- If engine will not start but cranking is possible, crank it for more than 3 seconds.
- While ignition switch is ON, insert a spare fuse to DIAG SW in fuse box and then read diagnostic code (observe "CHECK ENGINE" light).

DIAGNOSTIC CODE NO. 42



ECM indicates that no CAS signal is inputted for more than 3 seconds while engine is being cranked.

Diagnose trouble according to "Diagnostic Flow Chart for Code No. 42" in Section 4A.

DIAGNOSTIC CODE NO. 41



ECM indicates that no ignition signal is inputted while engine is running or being cranked.

Diagnose trouble according to "Diagnostic Flow Chart for Code No. 41" in Section 4A.

ON-CAR SERVICE

IGNITION SPARK TEST

1. Disconnect injector coupler.

WARNING:

Without disconnection of injector coupler, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

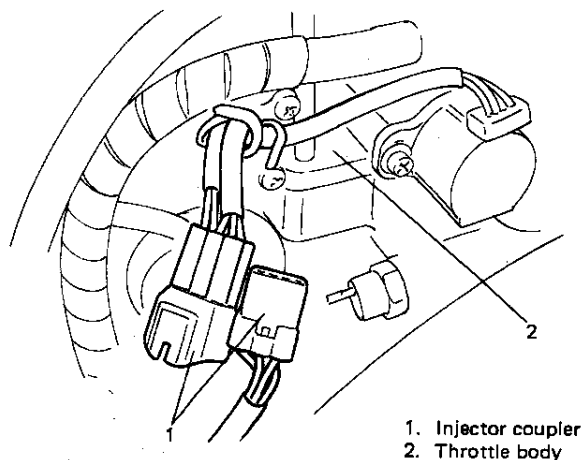


Fig. 8-2 Disconnecting Injector Coupler

2. Remove spark plugs and connect them to high tension cords, and then ground spark plugs.
3. Crank engine and check if each spark plug sparks.
4. If no spark is emitted, inspect high tension cords, spark plugs, ignition coil, distributor, etc.

HIGH TENSION CORDS

1. Remove high tension cord at ignition coil while gripping its cap.
2. Remove distributor cap installed with high tension cords.
3. Pull out high tension cords from spark plugs while gripping each cap.
4. Remove high tension cord clamp from cylinder head cover.

CAUTION:

- Removal of high tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).
- For the same reason, pull out each connection by gripping cap portion.

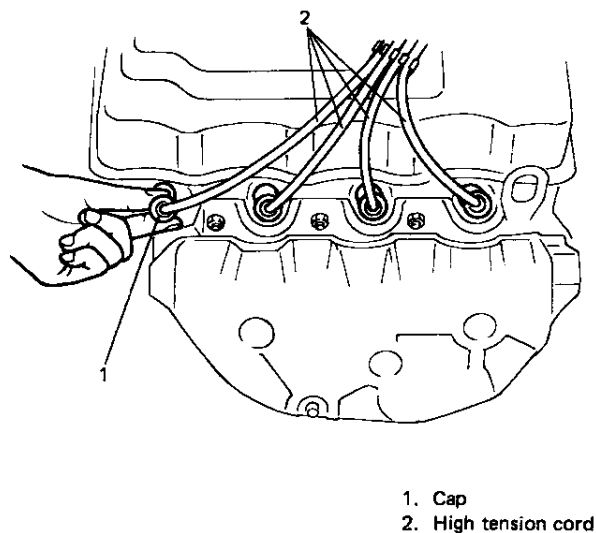


Fig. 8-3 Removing High Tension Cord

5. Measure resistance of high tension cord by using ohmmeter.

| | |
|------------------------------|---|
| High tension cord resistance | 10 – 22 k Ω /m 3.0 – 6.7 k Ω /ft |
|------------------------------|---|

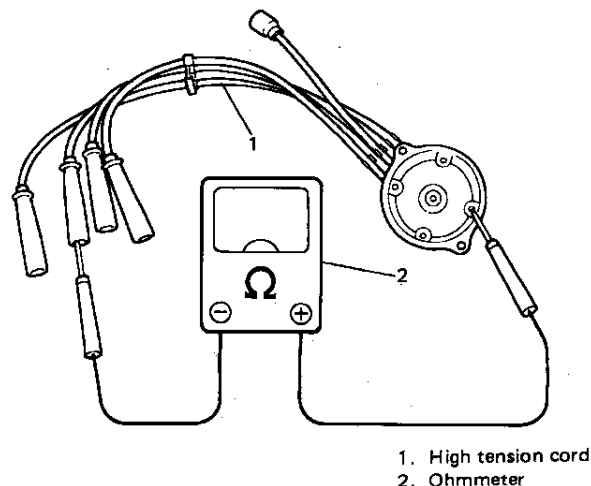


Fig. 8-4 Measuring High Tension Cord Resistance

- If resistance exceeds specification, inspect distributor terminal and replace high tension cord(s) and/or distributor cap as required.

CAUTION:

- Never attempt to use metal conductor high tension cords as replacing parts.
- Insert each cap portion fully when installing high tension cords.

SPARK PLUGS

- Pull out high tension cords by gripping their caps and then remove spark plugs.
- Inspect them for:
 - Electrode wear
 - Carbon deposits
 - Insulator damage
- If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.

| | | |
|-----------------|----------------------------------|----------|
| Spark plug type | NGK | BPR5ES |
| | NIPPON DENSO | W20EPR-U |
| Air gap A | 0.7 – 0.8 mm 0.027 – 0.031 in | |

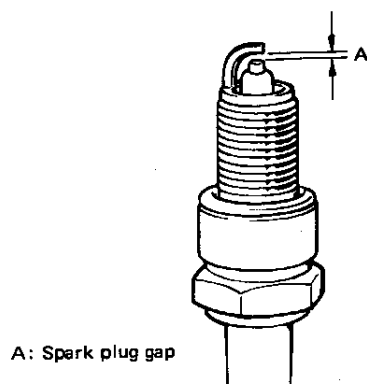


Fig. 8-5 Checking Spark Plug Gap

- Install spark plugs and torque them to specification.

| | | | |
|------------------------------|---------|-----------|-------------|
| Spark plug tightening torque | N·m | kg·m | lb·ft |
| | 25 – 30 | 2.5 – 3.0 | 18.0 – 21.5 |

- Install high tension cords securely by gripping their caps.

NOISE SUPPRESSOR

- Disconnect coupler of noise suppressor.
- Using ohmmeter, check to be sure that condenser is not conductive and resistor has resistance of about 2.2 kΩ.
- If check result is not satisfactory, replace noise suppressor.

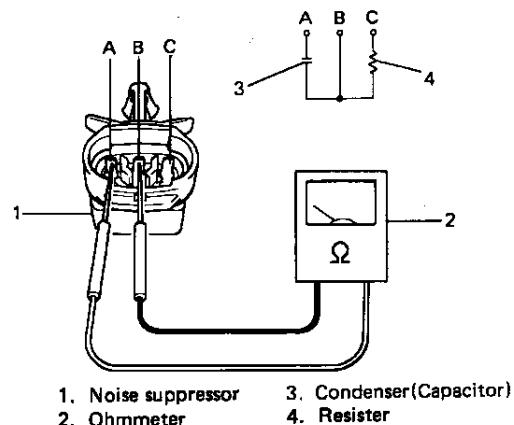


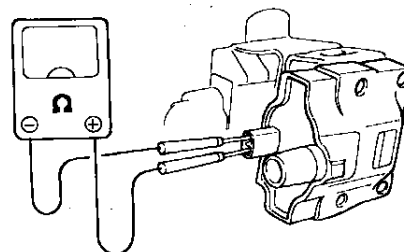
Fig. 8-6 Checking Noise Suppressor

IGNITION COIL

- Pull out high tension cord by gripping its cap.
- Disconnect ignition coil coupler.
- Measure primary and secondary coil resistances.

| | | |
|--|-----------|----------------|
| Ignition coil resistance (at 20°C, 68°F) | Primary | 0.9 – 1.1 Ω |
| | Secondary | 10.2 – 13.8 kΩ |

PRIMARY



SECONDARY

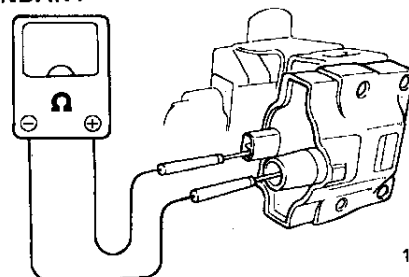


Fig. 8-7 Measuring Ignition Coil Resistance

4. If resistance is out of specification, replace coil with new one.

DISTRIBUTOR

Distributor Cap and Rotor

Check cap and rotor for crack and their terminals for corrosion and wear. Replace as necessary.

CAS

1. With ignition switch OFF, disconnect ECM coupler (Yellow).
2. Connect voltmeter between "B1" terminal of green coupler (connected) and "A13" terminal of yellow coupler (disconnected).

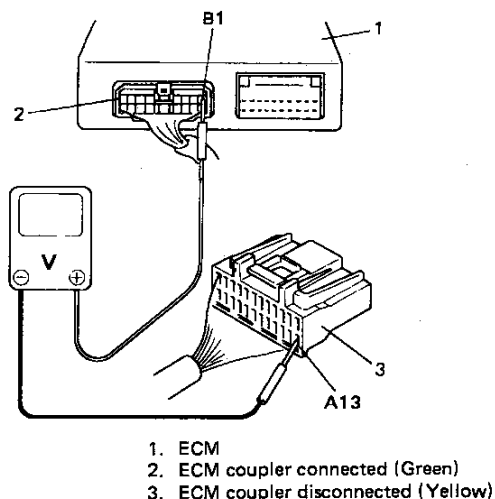


Fig. 8-8 Connecting Voltmeter

3. Remove distributor cap, rotor and shield cover.

NOTE:

Check to make sure that magnet is free from any metal particles.

4. Check voltage with signal rotor inserted between hall element and magnet ("A") and without it ("B") respectively.

| | |
|-----|-----------------|
| "A" | Battery voltage |
| "B" | 0 V |

"A" : Magnetic flux cut off

"B" : Magnetic flux applied

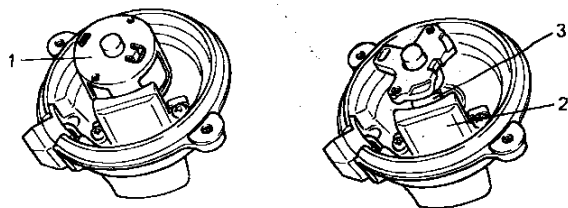


Fig. 8-9 Magnetic Flux Conditions for Voltage Check

If check result is not satisfactory, repair wire harness or replace CAS.

5. After checking, connect ECM coupler securely and install distributor cap.

IGNITION TIMING

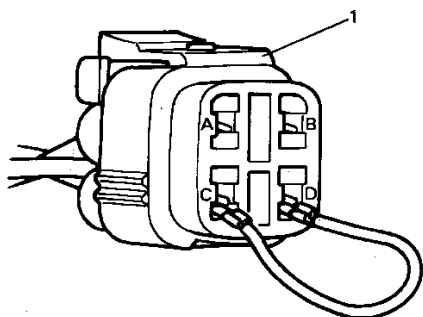
INSPECTION AND ADJUSTMENT

1. Start engine and warm it up to normal operating temperature.
2. Stop engine once, keep ignition switch ON for 5 seconds and then start engine again.
3. Run engine at 2,000 r/min. for 5 minutes so that it is fully warmed and then keep it running at idle speed.
4. Make sure that all of electrical loads except ignition are switched off.
5. Check to be sure that idle speed is within specification.
6. Set timing light to No. 1 high tension cord.
7. Remove cap from monitor coupler beside battery.

Connect "C" and "D" terminals of monitor coupler by using service wire so that ignition timing is fixed.

NOTE:

- "CHECK ENGINE" light lights at this time. This does not mean anything faulty but that "D" terminal (test switch terminal) is grounded.
- Using timing light, check to make sure that ignition timing doesn't change even when engine speed is increased. If it does, that indicates ungrounded "D" terminal which prevents accurate inspection and adjustment. Therefore, be sure to ground it securely.



1. Monitor coupler
A: Duty check terminal
B: Diagnosis switch terminal
C: Ground
D: Test switch terminal

Fig. 8-10 Fixing Ignition Timing

8. Using timing light, check that timing is within specification.

| | |
|---|------------------------------------|
| Initial ignition timing (Test switch terminal grounded) | $8 \pm 1^\circ$ BTDC at 800 r/min. |
| Ignition order | 1 - 3 - 4 - 2 |

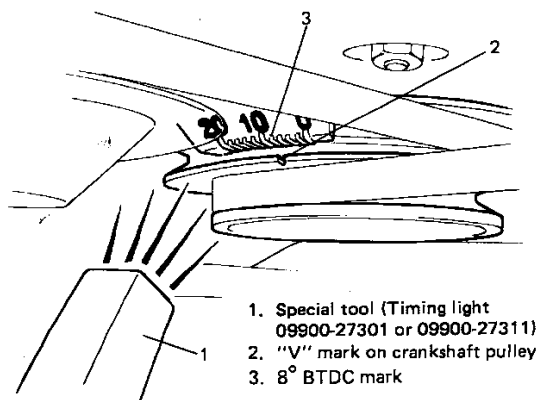
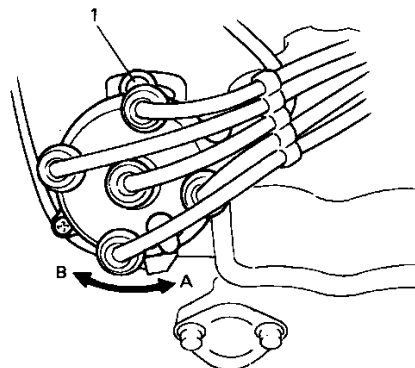


Fig. 8-11 Checking Ignition Timing

9. If ignition timing is out of specification, loosen flange bolts, adjust timing by turning distributor assembly while engine is running, and then tighten bolts.
10. After tightening distributor flange bolts, recheck that ignition timing is within specification.



1. Distributor flange bolt
A: To be advanced
B: To be retarded

Fig. 8-12 Adjusting Ignition Timing

11. After checking and/or adjusting, disconnect service wire from monitor coupler.

CAUTION:

Driving with test switch terminal grounded will cause damage to catalyst. Be sure to disconnect service wire after adjustment.

NOTE:

In this state, ignition timing may vary more or less of 8° BTDC but it is nothing abnormal.

12. Check that increasing engine speed advances ignition timing. If not, check TPS (idle switch), test switch terminal circuit, engine start signal circuit and ECM.

DISTRIBUTOR UNIT

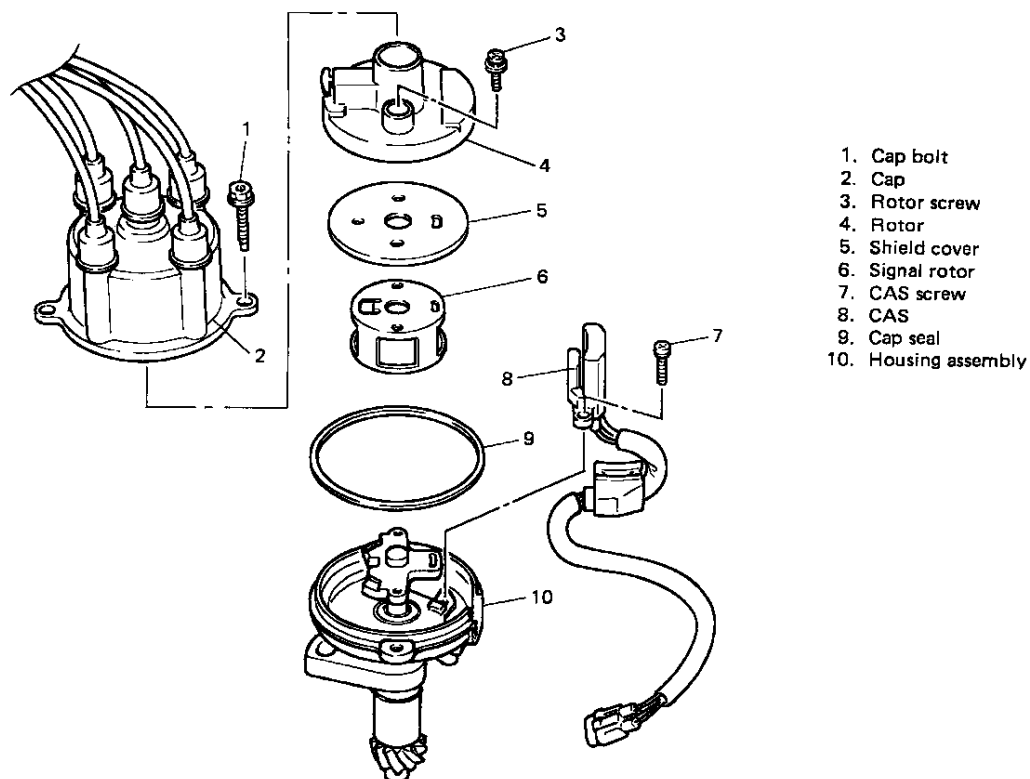


Fig. 8-13 Distributor Components

IMPORTANT REMINDERS FOR RE-ASSEMBLY

- Check to make sure that CAS magnet is free from any metal particles after installing CAS.
- When installing signal rotor, shield cover and rotor to shaft, be sure to fit lug "A" on rotor in oblong holes "B" in cover, signal rotor and shaft.

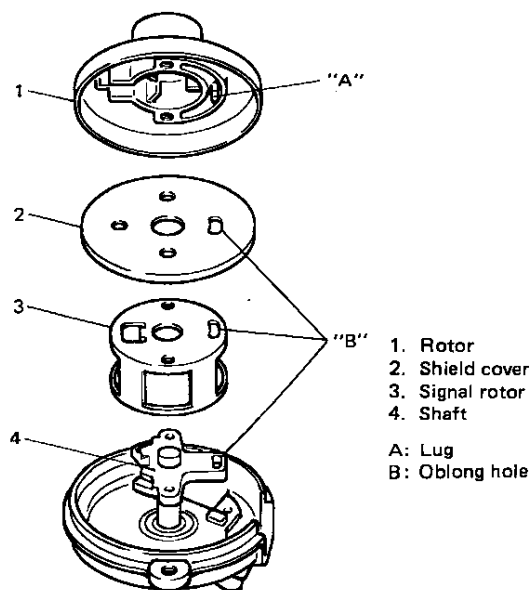


Fig. 8-14 Installing Signal Rotor

REMOVAL

1. Disconnect negative cable at battery.
2. Disconnect distributor (CAS) coupler.
3. Remove distributor cap.
4. Remove distributor flange bolt.
5. Pull out distributor housing assembly.

INSTALLATION

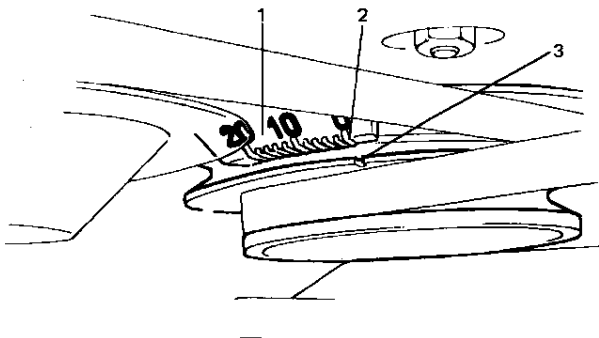
NOTE:

- Before installing distributor, check to make sure that its O ring is in good condition.
- If new O ring is installed, apply oil.

1. Turn over crankshaft in normal direction (clockwise as viewed from crankshaft pulley side) until "V" mark on pulley aligns with timing mark "0" (zero) on timing tab.

CAUTION:

After aligning two marks, remove cylinder head cover to visually confirm that the rocker arms are not riding on the camshaft cams at No. 1 cylinder. If the arms are found to be riding on the cams, turn over crankshaft 360° to align the two marks anew.



1. Timing tab
2. "0" mark
3. "V" mark (Timing notch) on crankshaft pulley

Fig. 8-15 Crankshaft Position

2. Turn rotor to make the center of rotor align with the cap bolt hole center on distributor housing as shown in Fig. 8-16.

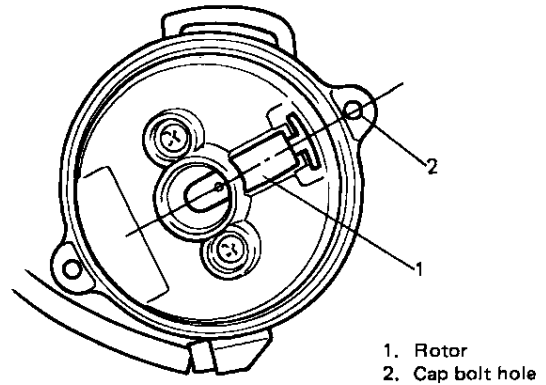


Fig. 8-16 Distributor Rotor Position

3. Insert the distributor into the gear case in such a way that the center of distributor flange will coincide with the distributor mounting screw hole provided in the distributor gear case. When inserting the distributor completely, position of distributor rotor becomes as shown in Fig. 8-17. Secure the distributor in place tentatively by making the mounting screw finger-tight.

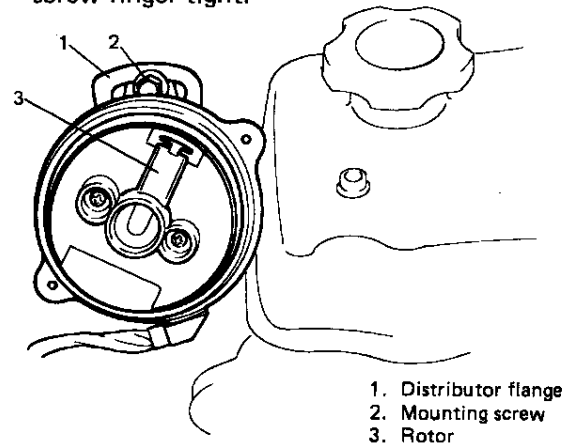


Fig. 8-17 Inserting Distributor

4. Check to make sure that rotor is in good condition.
5. Inspect distributor cap and clean or replace as required.
6. Make sure that distributor cap seal is placed properly and install cap, and then fasten it with screws.
7. Connect distributor coupler.
8. Connect negative cable at battery.
9. Check and adjust ignition timing as previously outlined.