

FOREWORD

This SUPPLEMENTARY SERVICE MANUAL is a supplement to "SAMURAI 1988 MODEL SERVICE MANUAL".

Applicable model:

1990, 1991 and 1992 SAMURAI 4WD MODEL.

1991 and 1992 SAMURAI 2WD MODEL.

It describes single point Electronic Fuel Injection system and different service information of SAMURAI 1990, 1991 and 1992 MODEL as compared with SAMURAI 1988 MODEL.

Therefore, whenever servicing SAMURAI 1990, 1991 or 1992 MODEL, consult this supplement first. And for any section, item or description not found in this supplement, refer to "SAMURAI 1988 MODEL SERVICE MANUAL".

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. And used as the main subject of description is the vehicle of standard specifications among others. Therefore, note that illustrations may differ from the vehicle being actually serviced. The right is reserved to make changes at any time without notice.

NOTE:

When servicing 2WD MODEL, consult GROUP 2 first. And for any section, item or description not found in GROUP 2, refer to GROUP 1.

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SUZUKI MOTOR CORPORATION

TECHNICAL DEPARTMENT
AUTOMOBILE SERVICE DIVISION

GENERAL PRECAUTIONS

The WARNING and CAUTION below describe some general precautions that you should observe when servicing a vehicle. These general precautions apply to many of the service procedures described in this manual, and they will not necessarily be repeated with each procedure to which they apply.

WARNING:

- Whenever raising a vehicle for service, be sure to follow the instructions under "STANDARD SHOP PRACTICES" on SECTION O of this manual.
- When it is necessary to do service work with the engine running, make sure that the parking brake is set fully and the transmission is in Neutral (for manual transmission vehicles) or Park (for automatic transmission vehicles). Keep hands, hair, clothing, tools, etc. away from the fan and belts when the engine is running.
- When it is necessary to run the engine indoors, make sure that the exhaust gas is forced outdoors.
- Do not perform service work in areas where combustible materials can come in contact with a hot exhaust system. When working with toxic or flammable materials (such as gasoline and refrigerant), make sure that the area you work in is well-ventilated.
- To avoid getting burned, keep away from hot metal parts such as the radiator, exhaust manifold, tailpipe, muffler, etc.

CAUTION:

- Before starting any service work, cover fenders, seats, and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g. buttons) may cause damage to the vehicle's finish.
- When removing parts that are to be reused, be sure to keep them arranged in an orderly manner so that they may be reinstalled in the proper order and position.
- When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.
- When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal covers.
- Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, circlips and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.
- Make sure that all parts used in reassembly are perfectly clean.
- When use of a certain type of lubricant, bond, or sealant is specified, be sure to use the specified type.
- Be sure to use special tools when instructed.
- When disconnecting vacuum hoses, attach a tag describing the correct installation position so that the hoses can be reinstalled correctly.
- After servicing fuel, oil, water, vacuum, exhaust, or brake systems, check all lines related to the system for leaks.
- Be careful not to touch the electrical terminals of parts which use microcomputers (e.g. electronic control unit). The static electricity from your body can damage these parts.
- When taking measurements at electrical connectors using a tester probe, be sure to insert the probe from the wire harness side (backside) of the connector.
- For vehicles equipped with a catalytic converter, be careful not to let a large amount of unburned gasoline enter the converter or it can be damaged. Conduct a spark jump test only when necessary, make it as short as possible, and do not open the throttle. Conduct engine compression checks within the shortest possible time. Avoid situations which can result in engine misfire (e.g. starting the engine when the fuel tank is nearly empty).
- For vehicles equipped with fuel injection systems, never disconnect the fuel line between the fuel pump and injector without first releasing the fuel pressure, or fuel can be sprayed out under pressure.

SECTION 1

PERIODIC MAINTENANCE SERVICE

1

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1-1. MAINTENANCE SCHEDULE

NOTE:

For Federal Specification Vehicles except Californian and Canadian Specification Vehicles, the "CHECK ENGINE" light in the combination meter lights at the mileage of 50,000, 80,000 and 100,000 miles each of which is detected by the mileage sensor. Upon completion of maintenance service of items (8, 9, 10, 11, 13, 14 & 25) required for each mileage, be sure to turn off the "CHECK ENGINE" light cancel switch, referring to SECTION 4A (p. 4A-16) of this manual. Then the mileage sensor will be reset.

	Interval:															
	miles (x 1,000)								km (x 1,000)							
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
This interval should be judged by odometer reading or months, whichever comes first.	12.5	25	37.5	50	62.5	75	87.5	100	112.5	125	137.5	150	162.5	175	187.5	200
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
ENGINE & EMISSION CONTROL																
1. Fan (Water pump) drive belt	—	—	—	I	—	—	—	R	—	—	—	I	—	—	—	R
2. Camshaft timing belt	—	—	—	—	—	—	—	I	—	—	—	I	—	—	—	I
3. Valve lash (clearance)	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
4. Engine oil and oil filter	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
5. Cooling system hoses and connections	—	—	—	**I	—	—	—	I	—	—	—	I	—	—	—	I
6. Engine coolant	—	—	—	**R	—	—	—	R	—	—	—	R	—	—	—	R
7. Exhaust pipes and mountings	—	—	—	**I	—	—	—	I&(R)	—	—	—	I	—	—	—	I&(R)
8. PCV valve	Replace at 50,000 miles (83,000 km) and 100,000 miles (166,000 km)															
9. Oxygen sensor	Replace at 80,000 miles (133,000 km)															
10. Catalytic converter	Inspect at 100,000 miles (166,000 km)															
11. Charcoal canister	Replace at 100,000 miles (166,000 km)															
12. Emission-related hoses & tubes	—	—	—	—	—	—	—	I	—	—	—	—	—	—	—	I
*13. EGR system	Inspect at 50,000 miles (83,000 km) and 100,000 miles (166,000 km)															
14. ECM & associated sensors	Inspect at 100,000 miles (166,000 km)															
15. Wiring harness and connections	—	—	—	—	—	—	—	I	—	—	—	—	—	—	—	I
IGNITION SYSTEM																
16. Spark plugs	—	—	—	R	—	—	—	R	—	—	—	R	—	—	—	R
17. Distributor cap and rotor	—	—	—	—	—	—	—	I	—	—	—	—	—	—	—	I
18. Ignition wiring	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	R
19. Ignition timing	—	—	—	—	—	—	—	I	—	—	—	—	—	—	—	I

NOTES:

• Item 5 **I, Item 6 **R and Item 7 **I are recommended maintenance items.

R : Replace or change

I : Inspect and correct or replace if necessary.

*13 EGR system inspection is a recommended maintenance item for Canadian Specification vehicles although it is one of periodical inspection items for any other specification vehicles.

Interval: This interval should be judged by odometer reading or months, whichever comes first.	miles (x 1,000)															
	km (x 1,000)				months											
	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
FUEL																
20. Fuel tank cap	—	—	—	**I	—	—	—	R	—	—	—	I	—	—	—	R
21. Air cleaner filter element	—	—	—	R	—	—	—	R	—	—	—	R	—	—	—	R
22. Fuel filter	—	—	—	**R	—	—	—	R	—	—	—	R	—	—	—	R
23. Fuel lines and connections	—	—	—	**I	—	—	—	I	—	—	—	I	—	—	—	I
*24. Idle speed	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
25. Fuel injector	Inspect at 100,000 miles (166,000 km)															
CHASSIS AND BODY																
26. Clutch	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
Brake discs and pads (front)	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
27. Brake drums and shoes (rear)	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
28. Brake hoses and pipes	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
29. Brake fluid	—	I	—	I	—	I	—	R	—	I	—	I	—	I	—	R
30. Brake pedal	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
31. Brake lever and cable	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
32. Tires	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
33. Wheel discs and free wheeling hubs (if equipped)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
34. Steering knuckle oil seals	—	—	R	—	—	R	—	—	R	—	—	R	—	—	R	—
35. Wheel bearings	—	I	—	*I	—	I	—	*I	—	I	—	*I	—	I	—	*I
36. Shock absorbers	I	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
37. Propeller shafts	—	I&L	—	I&L	—	I&L	—	I&L	—	I&L	—	I&L	—	I&L	—	I&L
38. Transmission, transfer and differential oil	R	I	I	R	I	I	I	R	I	I	I	R	I	I	I	R
39. Leaf spring	—	—	—	I	—	—	—	I	—	—	—	I	—	—	—	I
40. Suspension bolts and nuts	T	T	—	T	—	T	—	T	—	T	—	T	—	T	—	T
41. Steering system	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
42. Door hinges	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

NOTES:

- Item 20 **I, Item 22 **R and Item 23 **I are recommended maintenance items.
- Item *24 is recommended maintenance item.
- Item 35 *I is applicable to not only rattled wear but also their grease.

R : Replace or change

I : Inspect and correct or replace if necessary.

T : Tighten to the specified torque

L : Lubricate

MAINTENANCE RECOMMENDED UNDER SEVERE DRIVING CONDITIONS

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, it is recommended that applicable maintenance operation be performed at the particular interval as given in the below chart.

Severe condition code

- | | |
|---|---|
| A — Towing a trailer | E — Driving in extremely cold weather and/or salted roads |
| B — Repeated short trips | |
| C — Driving on rough and/or muddy roads | F — Repeated short trips in extremely cold weather |
| D — Driving on dusty roads | |

Severe Condition Code	Maintenance	Maintenance Operation	Maintenance Interval
A — — D E F	Engine oil and oil filter	R	Every 3 000 miles (5 000 km) or 3 months
A B C — E —	Exhaust pipes and mountings	I	Every 6 000 miles (10 000 km) or 6 months
— — — D — —	Air cleaner filter element *1	I	Every 3 000 miles (5 000 km) or 3 months
		R	Every 15 000 miles (25 000 km) or 15 months
— — — — E —	Distributor cap and ignition wiring *2	I	Every 15 000 miles (25 000 km) or 15 months
A B C D — —	Brake discs and pads (Front) Brake drums and shoes (Rear)	I	Every 6 000 miles (10 000 km) or 6 months
A B C — — —	Propeller shafts	I & L	Every 6 000 miles (10 000 km) or 6 months
A — C — — —	Transmission, transfer and differential oil	R	Every 15 000 miles (25 000 km) or 15 months after first replacement at 7 500 miles
— — C — — —	Leaf springs	I	Every 15 000 miles (25 000 km) or 15 months
— — C — — —	Bolts and nuts on chassis	T	Every 6 000 miles (10 000 km) or 6 months
— — C — — —	Steering wheel free play, gear box oil and linkage	I	Every 3 000 miles (5 000 km) or 3 months
— — C — E —	Steering knuckle oil seals	R	Every 15 000 miles (25 000 km) or 15 months

NOTES:

- | | |
|---|---------------------------------|
| I — Inspect and correct or replace if necessary | T — Tighten to specified torque |
| R — Replace or change | L — Lubricate |

*1 Inspect more frequently if the vehicle is used under dusty conditions.

*2 In areas where road salt is used, inspect and clean the distributor cap and ignition wiring more frequently.

1-2. ENGINE AND EMISSION CONTROL

For maintenance service procedure of any item not found in this section, refer to SECTION 1 of '88 MODEL SERVICE MANUAL.

2. CAMSHAFT TIMING BELT INSPECTION

- 1) Disconnect negative battery lead at battery.
- 2) Loosen fan drive belt, and remove radiator fan shroud and cooling fan & clutch at the same time.

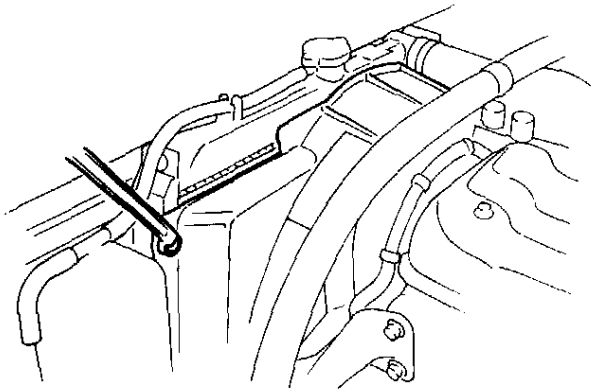


Fig. 1-1 Removing Fan Shroud

- 3) Remove water pump belt and pump pulley.
- 4) Remove crankshaft pulley by removing 4 pulley bolts. The crankshaft timing belt pulley bolt at the center needs not be loosened.

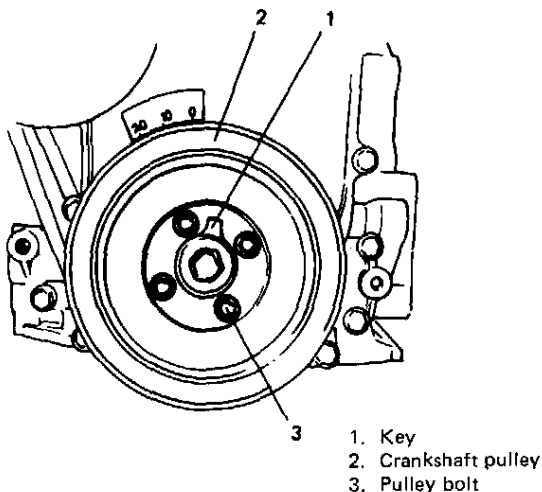


Fig. 1-2 Removing Pulley

- 5) Remove timing belt outside cover. Inspect the belt for damage or wear. When any damage or wear is found on the belt, replace it.

NOTE:

If belt replacement is necessary, be sure to install the belt properly, referring to page 3-6 to page 3-8 of this supplement for installation procedure.

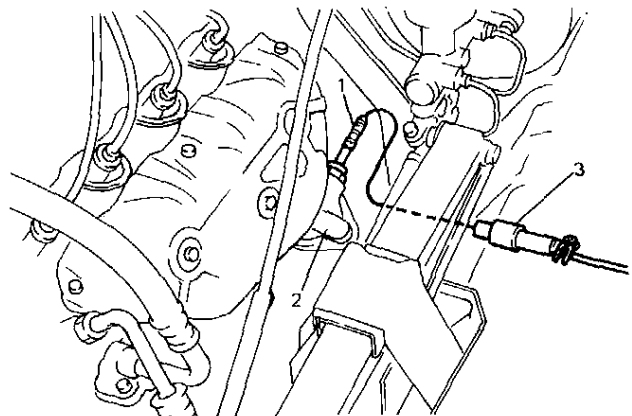
- 6) Install timing belt outside cover and torque bolts and nut to specification.
- 7) Install crankshaft pulley and torque bolts to specification.
- 8) Install water pump pulley and belt.
- 9) Install radiator shroud and cooling fan & clutch
- 10) Adjust water pump belt tension to specification.
- 11) Connect negative battery lead to battery.

9. OXYGEN SENSOR REPLACEMENT

WARNING:

To avoid danger of being burned, do not touch exhaust system when it is still hot. This work should be performed when it is cool.

- 1) Disconnect battery negative cable from battery and disconnect oxygen sensor wire at its coupler.
- 2) Remove oxygen sensor from exhaust manifold.



1. Oxygen sensor
2. Exhaust manifold
3. Coupler

Fig. 1-3 Oxygen sensor

- 3) Install new oxygen sensor, and tighten it to specification.

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

- 4) Connect oxygen sensor wire at the coupler securely and clamp its wire.
- 5) Connect negative cable to battery.
- 6) Start engine and check for gas leak.

NOTE:

With Vehicles of Federal specifications except Californian and Canadian specification ones, be sure to turn off "CHECK ENGINE" light with its cancel switch upon completion of service.

10. CATALYTIC CONVERTER INSPECTION

Inspect exhaust center pipe (catalytic converter) for leakage, loose, connections, dents, and damages.

11. CHARCOAL CANISTER REPLACEMENT

WARNING:

The following cautions should be always observed.

- DO NOT smoke and place "NO SMOKING" signs near work area.
- To release fuel vapor pressure in fuel tank, remove fuel tank cap and then reinstall it.

- 1) Disconnect negative battery cable at battery.
- 2) Disconnect purge (vacuum) hose and tank (vapor) hose from canister.
- 3) Remove canister from vehicle body.
- 4) Install new canister by reversing removal procedure.
- 5) Clamp hoses securely.

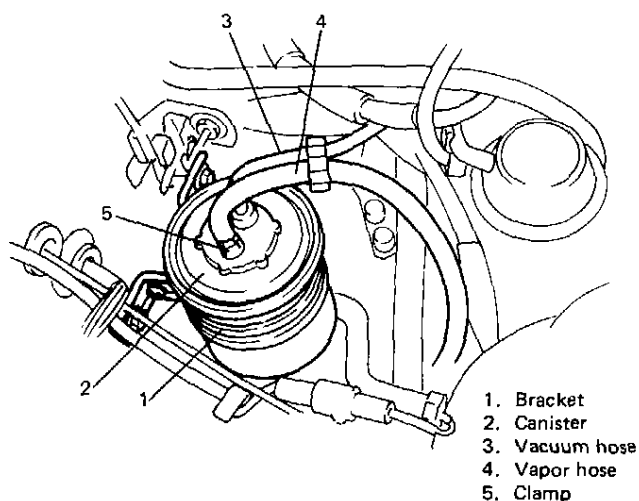


Fig. 1-4 Canister

13. EXHAUST GAS RECIRCULATION (EGR) SYSTEM INSPECTION

Check EGR valve for proper operation. For checking procedures, refer to SECTION 4A of this supplement.

14. ECM AND ASSOCIATED SENSORS INSPECTION

WARNING:

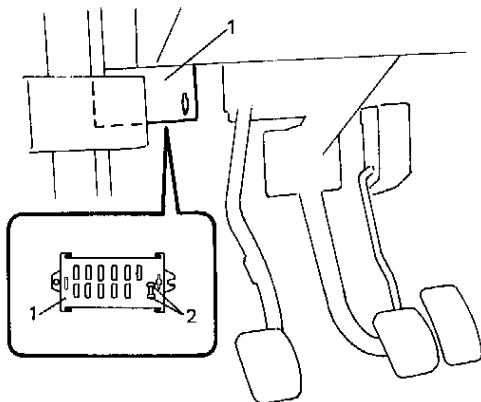
Apply parking brake without fail before this work. With manual transmission vehicle, shift gear shift lever to NEUTRAL position.

- 1) Start engine and warm it up normal operating temperature.

NOTE:

With vehicles of Federal specifications except Californian and Canadian specification ones, be sure to turn off "CHECK ENGINE" light with its cancel switch.

- 2) Stop engine.
- 3) Connect (ground) spare fuse to diagnosis switch terminal.



1. Fuse box
2. Diagnosis switch terminal

Fig. 1-5 Diagnosis Switch Terminal

- 4) Run engine at idle speed and check "CHECK ENGINE" light on meter panel as to which number of diagnostic code it indicates.

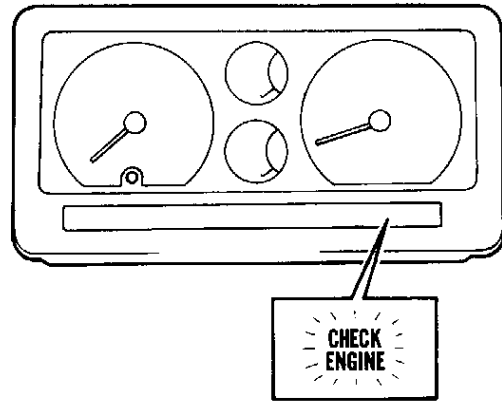


Fig. 1-6 "CHECK ENGINE" Light

- 5) If "CHECK ENGINE" light indicates No. 12 of diagnostic code, ECM and associated sensors are in good condition, but if it indicates any other diagnostic code number, refer to "DIAGNOSIS" of SECTION 4A.
- 6) Stop engine and disconnect spare fuse connected to diagnosis switch terminal in fuse box.

19. IGNITION TIMING INSPECTION

Check to make sure that ignition timing is set properly. If out of specification, adjust it. Refer to SECTION 8 of this supplement for inspection and adjustment procedure.

22. FUEL FILTER REPLACEMENT

WARNING:

This work must be performed in a well ventilated area and away from any open flames (such as gas hot water heaters).

Fuel filter is located at the front part of fuel tank, inside the right-hand side of chassis.

- 1) Disconnect negative cable from battery.
- 2) Replace fuel filter. Be sure to refer to description under FUEL FILTER REMOVAL and INSTALLATION in SECTION 4 (page 4-5) of this supplement for proper procedure.

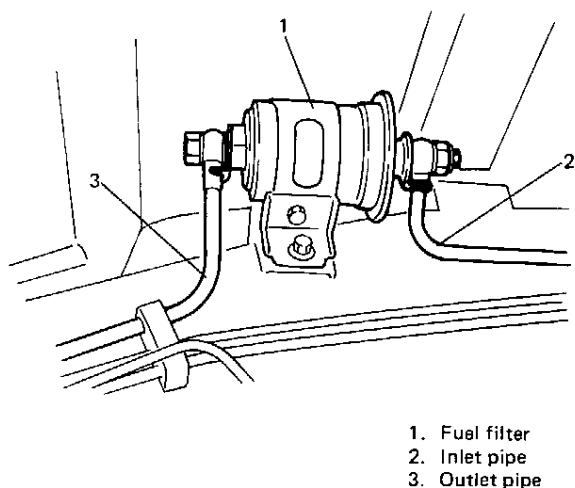


Fig. 1-7 Fuel Filter

NOTE:

Torque pipe fastening bolts to specification.

- 3) Connect negative cable to battery.
- 4) After installation, start engine and check it for leaks.

23. FUEL LINES AND CONNECTIONS INSPECTION

Visually inspect fuel lines and connections for evidence of fuel leakage, hose cracking, and damage. Make sure all clamps are secure.

Repair leaky joints, if any.

Replace hoses that are suspected of being cracked.

24. IDLE SPEED INSPECTION

Check idle speed, and adjust it as necessary.

Refer to ON-VEHICLE SERVICE (page 4A-78) of SECTION 4A of this supplement for procedures to check and adjust idle speed.

25. FUEL INJECTOR INSPECTION

- 1) Check injector for resistance, injecting condition and leakage. For checking procedures, refer to Fuel Injection Inspection in SECTION 4A, ELECTRONIC FUEL INJECTION SYSTEM.
- 2) Start engine and check to ensure that engine runs smoothly as its number of revolutions is increased from idle speed to high speed.
- 3) Stop engine.

SECTION 2

TROUBLE SHOOTING

NOTE:

For the items not found in this section (For trouble shooting other than engine), refer to the same section of '88 MODEL SERVICE MANUAL.

2

CONTENTS

2-1. ENGINE	2-2
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2-1. ENGINE

Condition	Possible Cause	Correction
Hard Starting (Engine cranks OK)	Ignition system out of order.	
	• Blown fuse	Repair or replace.
	• Faulty spark plug	Clean and adjust plug gap or replace.
	• Leaky high-tension cord	Replace.
	• Loose connection or disconnection of high-tension cords or lead wires	Repair or replace.
	• Faulty ESA system	Refer to SECTION 8.
	• Improper ignition timing	Adjust.
	• Faulty ignition coil	Replace.
	• Cracked rotor or cap in distributor	Replace.
	• Faulty noise suppressor	Replace.
	Fuel system out of order.	
	• Lack of fuel in fuel tank	Refill.
	• Dirty fuel filter	Replace.
	• Dirty or clogged fuel hose or pipe	Clean.
	• Malfunctioning fuel pump	Replace.
	• Air inhaling from intake manifold gasket or throttle body gasket	Replace.
	Electronic Fuel Injection system out of order.	Refer to SECTION 4A.
	Low compression.	
	• Poor spark plug tightening or faulty gasket	Tighten to specified torque or replace gasket.
	• Incorrect valve lash	Adjust.
	• Compression leak from valve seat	Remove cylinder head and lap valves.
	• Sticky valve stem	Correct or replace valve and valve guide.
	• Weak or damaged valve springs	Replace valve springs.
	• Compression leak at cylinder head gasket	Repair or replace.
	• Sticking or damaged piston ring	Replace piston rings.
	• Worn piston, ring or cylinder	Replace ring and piston. Rebore or replace cylinder.
	Others	
	• Broken valve timing belt	Replace.
	• Malfunctioning PCV valve	Replace.

Condition	Possible Cause	Correction
Engine has no power.	<p>Low compression.</p> <p>Ignition system out of order.</p> <ul style="list-style-type: none"> • Incorrect ignition timing • Faulty spark plug • Worn distributor terminals • Leaks, loose connection or disconnection of high tension cord • Faulty ESA system <p>Fuel system out of order.</p> <ul style="list-style-type: none"> • Clogged fuel hose or pipe • Dirty or clogged fuel filter • Clogged air cleaner element • Air inhaling from intake manifold gasket or throttle body gasket <p>Electronic Fuel Injection system out of order.</p> <p>Others</p> <ul style="list-style-type: none"> • Loose connection or disconnection of vacuum hoses • Malfunctioning EGR valve • Dragging brakes • Slipping clutch 	<p>Previously outlined.</p> <p>Adjust.</p> <p>Adjust or replace.</p> <p>Dress or replace. Also check rotor.</p> <p>Connect or replace as necessary.</p> <p>Refer to SECTION 8.</p> <p>Clean.</p> <p>Replace.</p> <p>Clean or replace.</p> <p>Replace gasket.</p> <p>Refer to SECTION 4A.</p> <p>Connect securely.</p> <p>Check and replace as necessary.</p> <p>Repair or replace.</p> <p>Adjust or replace.</p>
Improper engine idling or engine fails to idle.	<p>Ignition system out of order.</p> <ul style="list-style-type: none"> • Faulty spark plug • Leaky or disconnected high tension cord • Worn distributor terminals • Improper ignition timing • Cracked cap in distributor, there being leakage inside • Faulty ESA system <p>Fuel system out of order.</p> <ul style="list-style-type: none"> • Shortage of fuel in fuel tank • Clogged air cleaner element • Leaky manifold, throttle body, or cylinder head gasket <p>Electronic Fuel Injection system out of order.</p> <p>Engine overheating.</p> <p>Low compression.</p> <p>Others</p> <ul style="list-style-type: none"> • Loose connection or disconnection of vacuum hoses • Malfunctioning EGR valve • Malfunctioning PCV valve 	<p>Adjust or replace.</p> <p>Connect or replace.</p> <p>Replace.</p> <p>Adjust.</p> <p>Replace.</p> <p>Refer to SECTION 8.</p> <p>Refill.</p> <p>Clean or replace.</p> <p>Replace.</p> <p>Refer to SECTION 4A.</p> <p>Refer to "Overheating" section.</p> <p>Previously outlined.</p> <p>Connect securely.</p> <p>Check and replace as necessary.</p> <p>Check and replace as necessary.</p>

Condition	Possible Cause	Correction
Engine hesitates (Momentary lack of response as accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make the vehicle move, as from a stop sign.)	Ignition system out of order. <ul style="list-style-type: none"> • Improper ignition timing • Spark plug faulty or plug gap as out of adjustment • Leaky high tension cord Fuel system out of order. <ul style="list-style-type: none"> • Clogged air cleaner element • Clogged fuel filter, hose or pipe Electronic Fuel Injection system out of order. Engine overheating. Low compression. Others <ul style="list-style-type: none"> • Malfunctioning EGR valve 	Adjust. Replace or adjust gap. Replace. Clean or replace. Clean or replace. Refer to SECTION 4A. Refer to "Overheating" section. Previously outlined. Check and replace as necessary.
Surges (Engine power variation under steady throttle or cruise. Feels like vehicle speeds up and down with no change in the accelerator pedal.)	Ignition system out of order. <ul style="list-style-type: none"> • Improper ignition timing • Faulty ESA system • Leaky or loosely connected high tension cord • Faulty spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.) • Cracked rotor or cap in distributor Fuel system out of order. <ul style="list-style-type: none"> • Clogged fuel filter • Kinky or damaged fuel hose and lines Electronic Fuel Injection system out of order. Others <ul style="list-style-type: none"> • Malfunctioning EGR valve 	Adjust. Refer to SECTION 8. Check and repair or replace. Check and clean, adjust or replace. Replace. Replace. Check and replace as necessary. Refer to SECTION 4A. Check and replace as necessary.
Excessive detonation (Engine makes sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	Engine overheating. Ignition system out of order. <ul style="list-style-type: none"> • Faulty spark plug • Improper ignition timing • Loose connection of high tension cord 	Refer to the section "Overheating". Replace. Adjust. Connect securely.

Condition	Possible Cause	Correction
	<p>Fuel system out of order.</p> <ul style="list-style-type: none"> • Clogged fuel filter and fuel lines • Air inhaling from intake manifold or throttle body gasket <p>Electronic Fuel Injection system out of order.</p> <p>Others</p> <ul style="list-style-type: none"> • Excessive combustion chamber deposits • Malfunctioning EGR valve 	<p>Replace or clean. Replace.</p> <p>Refer to SECTION 4A.</p> <p>Remove carbon. Check and replace as necessary.</p>
Overheating	<ul style="list-style-type: none"> • Insufficient coolant • Loose water pump belt • Inoperative thermostat • Poor water pump performance • Improper ignition timing • Clogged or leaky radiator • Improper engine oil grade • Clogged oil filter or oil strainer • Not enough oil • Poor oil pump performance • Oil leakage • Dragging brakes • Slipping clutch • Blown cylinder head gasket 	<p>Replenish. Adjust. Replace. Replace. Adjust. Flush, repair or replace. Replace with proper grade oil. Replace or clean (oil strainer). Replenish. Repair or replace. Repair. Repair or replace. Adjust or repair. Replace.</p>
Poor gasoline mileage.	<p>Fuel system out of order.</p> <ul style="list-style-type: none"> • Fuel leakage from fuel tank and lines • Clogged air cleaner element <p>Ignition system out of order.</p> <ul style="list-style-type: none"> • Improper ignition timing • Leaks or loose connection of high tension cord • Faulty spark plug (improper gap, heavy deposits, and burned electrodes, etc..) • Faulty ESA system <p>Electronic Fuel Injection system out of order.</p>	<p>Repair or replace. Clean or replace.</p> <p>Adjust. Repair or replace.</p> <p>Clean, adjust or replace.</p> <p>Refer to SECTION 8.</p> <p>Refer to SECTION 4A.</p>

Condition	Possible Cause	Correction
	Low compression Others <ul style="list-style-type: none"> • Poor valve seating • Dragging brakes • Slipping clutch • Thermostat out of order • Improper tire pressure • Malfunctioning EGR valve 	Previously outlined. Repair or replace. Repair or replace. Adjust or replace. Replace. Adjust. Check and replace as necessary.
Excessive engine oil consumption	Oil leakage <ul style="list-style-type: none"> • Loose oil drain plug • Loose oil pan bolts • Deteriorated or broken oil pan sealant • Leaky crankshaft oil seals • Leaky cylinder head cover gasket • Improper tightening of oil filter • Loose oil pressure switch • Blown cylinder head gasket • Leaky camshaft oil seals Oil entering combustion chamber <ul style="list-style-type: none"> • Sticky piston ring • Worn piston and cylinder • Worn piston ring groove and ring • Improper location of piston ring gap • Worn or damaged valve stem seal • Worn valve stem 	Tighten. Tighten. Replace sealant. Replace. Replace. Tighten. Tighten. Replace. Replace. Remove carbon and replace rings. Replace or rebores cylinder, and replace piston. Replace piston and ring. Reposition ring gap. Replace. Replace.
Low oil pressure	<ul style="list-style-type: none"> • Not enough oil • Improper oil viscosity • Malfunctioning oil pressure switch • Clogged oil strainer • Functional deterioration of oil pump • Worn oil pump relief valve • Excessive clearance in various sliding parts 	Replenish. Use oil of proper viscosity. Replace. Clean. Replace. Replace. Replace worn parts.

Condition	Possible Cause	Correction
Engine noise Note: Before checking mechanical noise, make sure that: <ul style="list-style-type: none"> • Ignition timing is properly adjusted. • Specified spark plug is used. • Specified fuel is used. 	Valve noise <ul style="list-style-type: none"> • Improper valve lash • Worn valve stem and guide • Weak or broken valve spring • Warped or bent valve Piston, ring and cylinder noise <ul style="list-style-type: none"> • Worn piston, ring and cylinder bore Connecting rod noise <ul style="list-style-type: none"> • Worn rod bearing • Worn crank pin • Loose connecting rod nuts • Low oil pressure Crankshaft noise <ul style="list-style-type: none"> • Low oil pressure • Worn bearing • Worn crankshaft journal • Loose bearing cap bolts • Excessive crankshaft thrust play 	Adjust. Replace. Replace. Replace. Rebore or replace cylinder. Replace piston and ring. Replace. Repair by grinding or replace crankshaft. Tighten nuts to specification. Previously outlined. Previously outlined. Replace. Repair by grinding, or replace crankshaft. Tighten bolts to specification. Replace thrust bearing.

SECTION 3

ENGINE

NOTE:

For the items not found in this section, refer to the same section of '88 MODEL SERVICE MANUAL.

3

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WARNING:

The '90 model vehicle is equipped with the Electronic Fuel Injection system. As "3-1. GENERAL DESCRIPTION" provides important information on it and precautions to be taken, read it carefully before servicing the engine and make sure to observe precautions.

3-1. GENERAL DESCRIPTION

As the Electronic Fuel Injection system is used for the '90 model vehicle to improve its engine output, the '90 model engine differs from '88 and '89 model ones. Main differences among others are as follows.

- Crankshaft Piston stroke is different.
- Piston Shape of piston head is different.
- Camshaft Cam height and valve timing are different.
- Tensioner plate Shape is different.

GENERAL INFORMATION ON ENGINE SERVICE

THE FOLLOWING INFORMATION ON ENGINE SERVICE SHOULD BE NOTED CAREFULLY, AS IT IS IMPORTANT IN PREVENTING DAMAGE, AND IN CONTRIBUTING TO RELIABLE ENGINE PERFORMANCE.

- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits. When performing any work where electrical terminals could possibly be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, air intake case, throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.
- When disconnecting couplers, don't pull wire harness but make sure to hold coupler itself. With lock type coupler, be sure to unlock the lock before disconnection. With spring lock type coupler as shown in Fig. 3-1, push out

spring before disconnection, but only within the extent that spring is not deformed. Attempt to disconnect coupler without unlocking may result in damage to coupler. When connecting lock type coupler, insert it till clicking sound is heard and connect it securely.

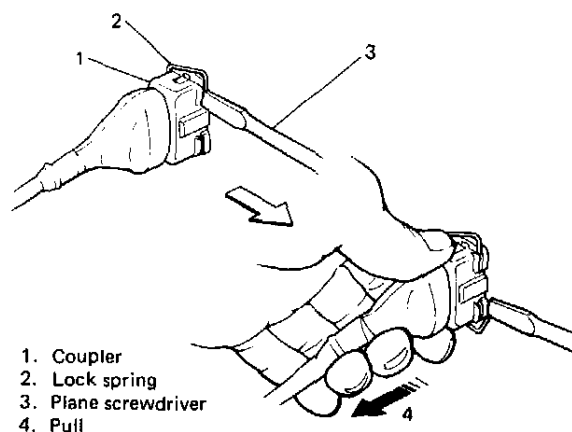


Fig. 3-1 Disconnection of Spring Lock Type Coupler

PRECAUTION ON FUEL SYSTEM SERVICE

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel pressure regulator) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected. Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to "FUEL PRESSURE RELIEF PROCEDURE". A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.

- Never run engine with fuel pump relay disconnected when engine and exhaust system are hot.
- Fuel or fuel vapor hose connection varies with each type of pipe. When reconnecting fuel or fuel vapor hose, be sure to connect and clamp each hose correctly referring to Fig. 3-2 Hose Connection. After connecting, make sure that it has no twist or kink.

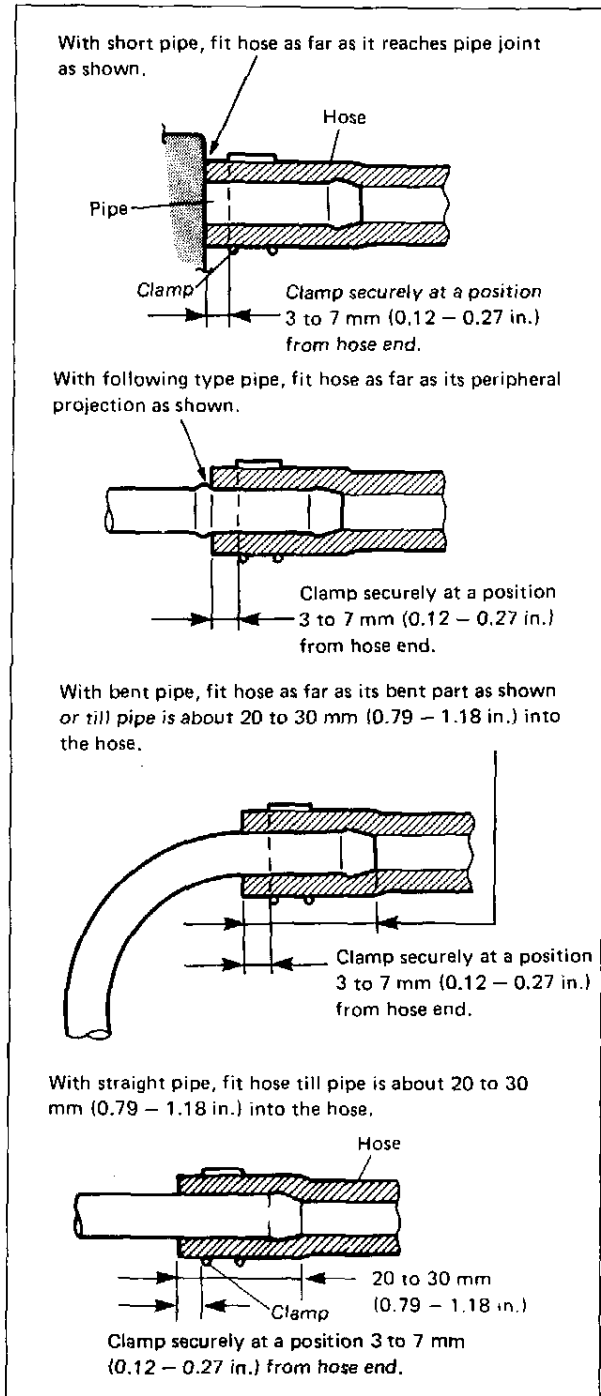


Fig. 3-2 Hose Connection

- When installing fuel filter union bolt or plug bolt on union bolt, always use new gasket and tighten it to specified torque. See Section 4 for specified torque.
- When installing injector, fuel feed pipe or fuel pressure regulator, lubricate its O ring with spindle oil or gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.

FUEL PRESSURE RELIEF PROCEDURE

CAUTION:

This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

After making sure that engine is cold, relief fuel pressure as follows.

1. Place transmission gear shift lever in "Neutral", set parking brake, and block drive wheels.
2. Disconnect coupler from fuel pump relay.
3. Remove fuel filler cap to release fuel vapor pressure in fuel tank and then reinstall it.
4. Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2 – 3 times of about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
5. Upon completion of servicing, connect coupler to fuel pump relay.

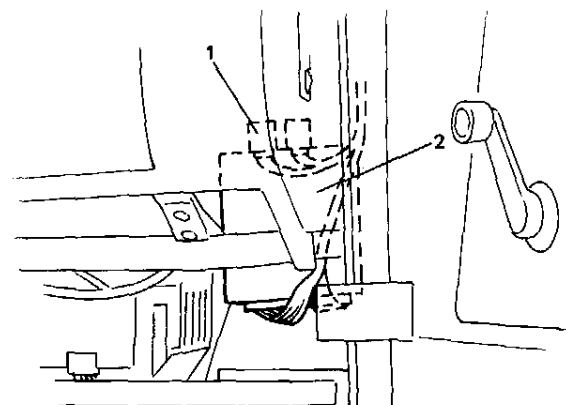


Fig. 3-3 Fuel Pump Relay

FUEL LEAKAGE CHECK PROCEDURE

After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

1. Turn ON ignition switch for 3 seconds (to operate fuel pump) and then turn it OFF. Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line (till fuel pressure is felt by hand placed on fuel return hose).
2. In this state, check to see that there are no fuel leakages from any part of fuel system.

3-5. INSPECTION OF ENGINE COMPONENTS

NOTE:

For the inspection not found in this section, refer to the same section of '88 MODEL SERVICE MANUAL.

Camshaft

- Cam wear:

Using a micrometer, measure height (H) of cam (lobe). If measured height is less than limits, replace camshaft.

Cam height	Standard	Limit
Intake cam	38.136 mm (1.5014 in.)	38.036 mm (1.4975 in.)
Exhaust cam	38.136 mm (1.5014 in.)	38.036 mm (1.4975 in.)

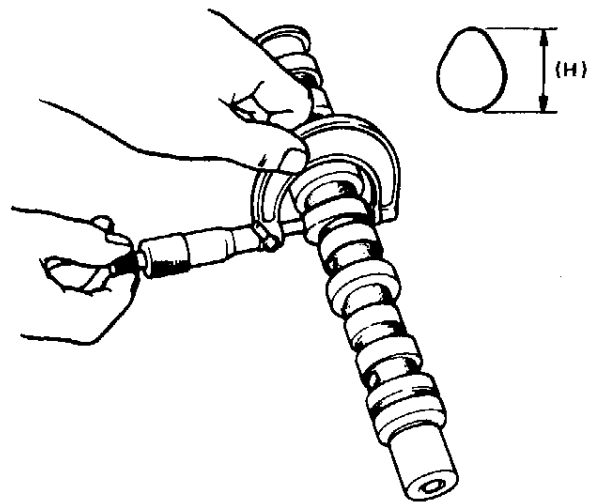


Fig. 3-4 Checking Cam Height

3-6. ENGINE REASSEMBLY

NOTE:

For the assembly procedure not found in this section, refer to the same section of '88 MODEL SERVICE MANUAL.

Piston Ring

- As indicated in figure below, 1st and 2nd rings have "R" or "T" mark. When installing these piston rings to piston, direct marked side of each ring toward top of piston.

NOTE:

There are 2 types of 1st ring, marked and unmarked. When installing a new unmarked 1st ring, it is not necessary to distinguish its top from bottom (i.e., either side can face upward) but when reinstalling a used one, be sure to distinguish its top from bottom as it was installed before removal and direct topside upward.

- 1st ring differs from 2nd ring in thickness, shape and color of surface contacting cylinder wall. Distinguish 1st ring from 2nd ring by referring to figure below.
- When installing oil ring, install spacer first and then two rails.

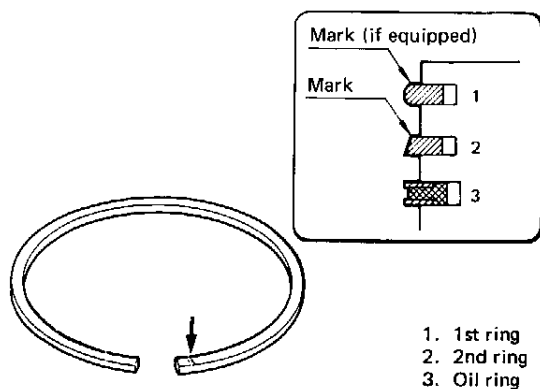
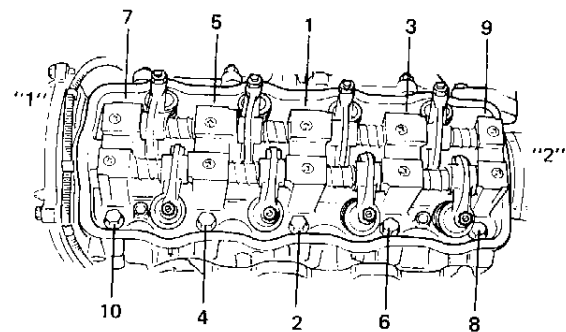


Fig. 3-5 Installing Piston Rings

Cylinder Head

- After applying engine oil to cylinder head bolts, tighten them gradually with a torque wrench, following sequence given in below figure. Finally tighten bolts to specified torque.

Tightening torque for cylinder head bolts	N·m	kg-m	lb-ft
	70 - 75	7.0 - 7.5	51.0 - 54.0



"1" Camshaft pulley side
"2" Distributor side

Fig. 3-6 Tightening Sequence of Cylinder Head Bolts

NOTE:

Whenever installing cylinder head to new cylinder block, use following procedure to tighten cylinder head bolts.

- Tighten cylinder head bolts to specified torque as previously outlined and loosen them once till tightening torque becomes "zero". And then torque them to specification again.

Timing Belt Pulleys, Timing Belt and Tensioner

1. Camshaft timing belt pulley

Install timing belt guide, key, and crankshaft timing belt pulley.

Refer to figure below for proper installation of these parts.

Install timing belt guide in such a way that its concave side faces oil pump.

With crankshaft locked, tighten crankshaft timing belt pulley bolt to specified torque.

Tightening torque for crankshaft timing belt pulley bolt	N·m	kg·m	lb·ft
	105–115	10.5–11.5	76.0–83.0

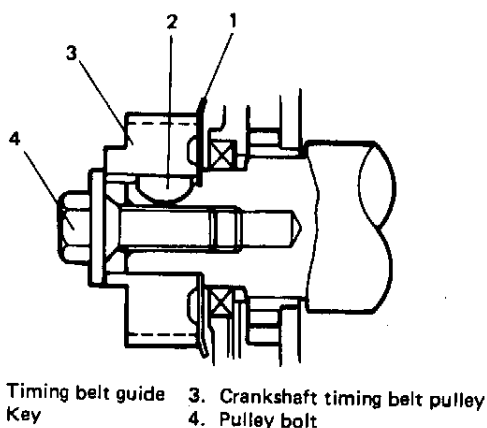


Fig. 3-7 Installing Guide, Key and Pulley

2. Camshaft timing belt pulley.

Fit pulley pin on camshaft into slot on camshaft pulley. With camshaft locked, tighten the pulley bolt to the specified torque.

Tightening torque for camshaft timing belt pulley bolt	N·m	kg·m	lb·ft
	56 – 64	5.6 – 6.4	41.0 – 46.0

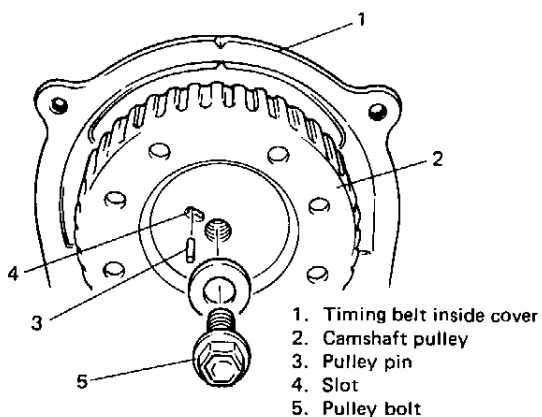


Fig. 3-8 Pulley Pin, Slot and Pulley Bolt

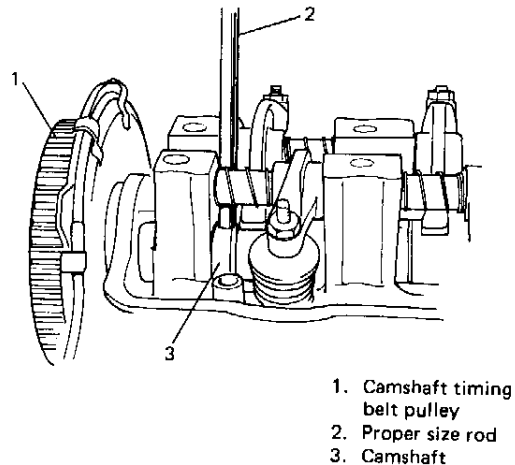


Fig. 3-9 Locking Camshaft

3. Tensioner and timing belt

1) Insert lug of tensioner plate into hole of tensioner.

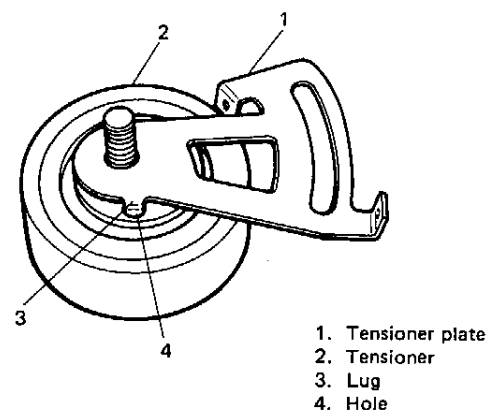


Fig. 3-10 Lug and Hole

2) Tensioner, tensioner plate, spring and spring damper:

Do not tighten the tensioner bolt and stud by wrench yet. Hand tighten only at this time.

Check to ensure that the plate movement in arrow direction as shown in below figure causes the same directional movement of the tensioner.

If no associated movement between plate and tensioner occurs, remove tensioner and plate again and reinsert the plate lug into tensioner hole.

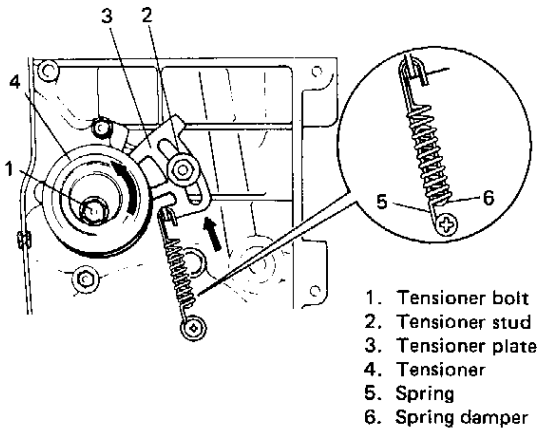


Fig. 3-11 Tensioner Installation

- 3) Before installing timing belt to camshaft timing belt pulley and crankshaft timing belt pulley, loosen all valve adjusting screws of intake and exhaust rocker arms fully, or check to ensure they are loose.

This is to permit free rotation of camshaft for the reason is; when installing timing belt to both pulleys, belt should be correctly tensed by tensioner spring force.

If camshaft does not rotate freely, belt will not be correctly tensed by tensioner.

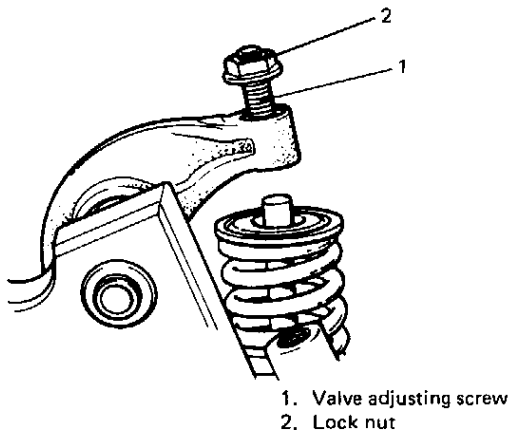


Fig. 3-12 Valve Adjusting Screw and Lock Nut

- 4) After loosening all valve adjusting screws all the way, turn camshaft pulley clockwise and align timing mark on camshaft pulley with "V" mark on the belt inside cover as shown in figure below.

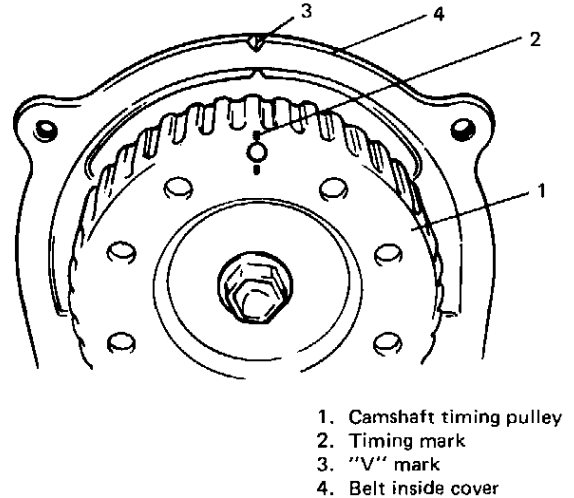


Fig. 3-13 Timing Marks

- 5) Turn crankshaft clockwise, fitting 17 mm wrench to crank timing belt pulley bolt, and align punch mark on timing belt pulley with the arrow mark on oil pump as shown in below figure.

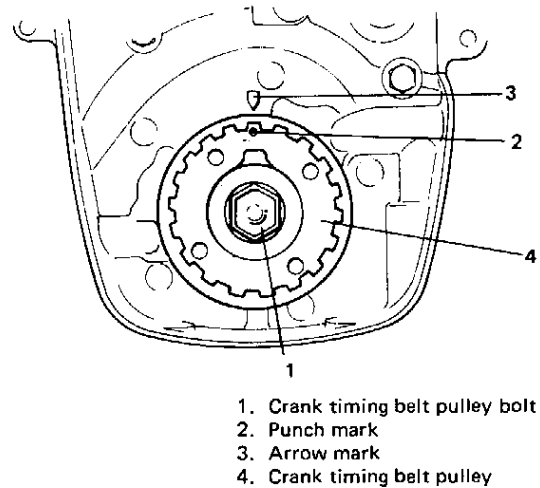


Fig. 3-14 Timing Marks

6) With two sets of marks aligned, install timing belt on two pulleys in such a way that the drive side of belt is free of any slack, and with tensioner plate pushed up by finger.

NOTE:

- When installing timing belt, match arrow mark (⇒) on timing belt with rotating direction of crankshaft.
- In this state, No. 4 piston is at top dead center of compression stroke.

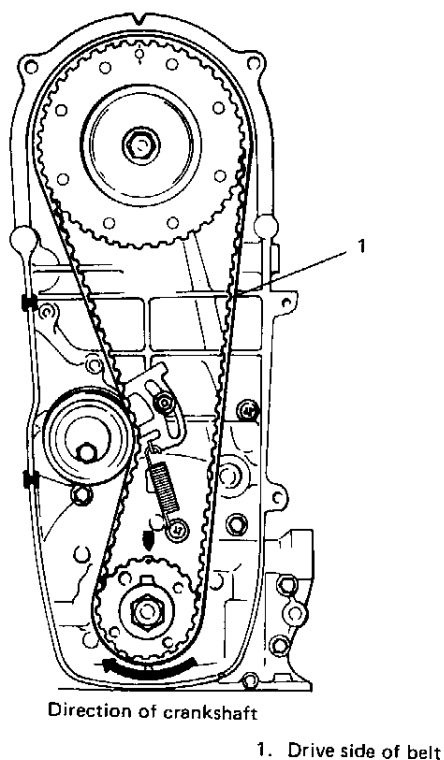


Fig. 3-15 Installing Timing Belt

7) To take up slack of timing belt, turn crankshaft two rotations clockwise after installing it. After making sure that belt is free from slack, tighten tensioner stud first and then tensioner bolt to each specified torque.

Then confirm again that two sets of marks are aligned respectively.

Tightening torque	N·m	kg·m	lb·ft
for tensioner stud	9 – 12	0.9 – 1.2	7.0 – 8.5
for tensioner bolt	24 – 30	2.4 – 3.0	17.5 – 21.5

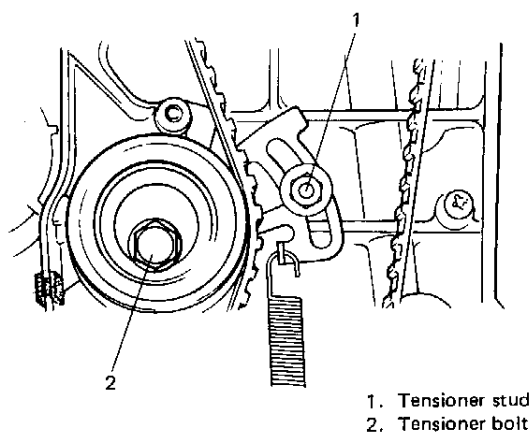


Fig. 3-16 Tensioner Bolt and Stud

3-8. ENGINE MAINTENANCE SERVICE

NOTE:

For the maintenance service procedure not found in this section, refer to the same section of '88 MODEL SERVICE MANUAL.

Compression Pressure Measurement

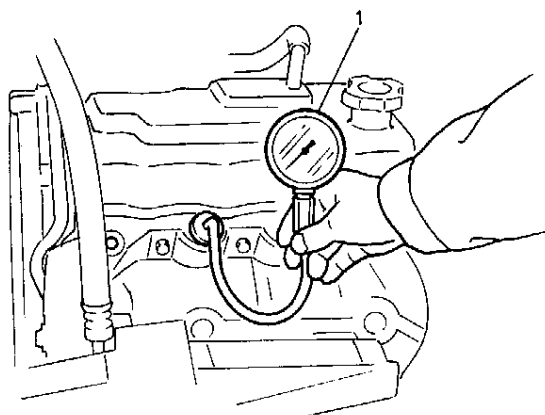
Check compression pressure on all four cylinders as follows:

1. Warm up engine.
2. Stop engine after warming up.
3. Disconnect CAS coupler.

WARNING:

Failure in disconnecting CAS coupler can cause spark to occur in engine room possibly resulting in a dangerous explosion.

4. Remove all 4 spark plugs.
5. Install special tool (Compression gauge) into spark plug hole.



1. Special tool (Compression gauge 09915-64510)

Fig. 3-17 Installing Compression Gauge

6. Disengage clutch to lighten starting load on engine and depress accelerator pedal all the way to make throttle fully open.
7. Crank engine with fully charged battery, and read the highest pressure on compression gauge.

NOTE:

For measuring compression pressure, crank engine at least 250 r/min by using fully charged battery.

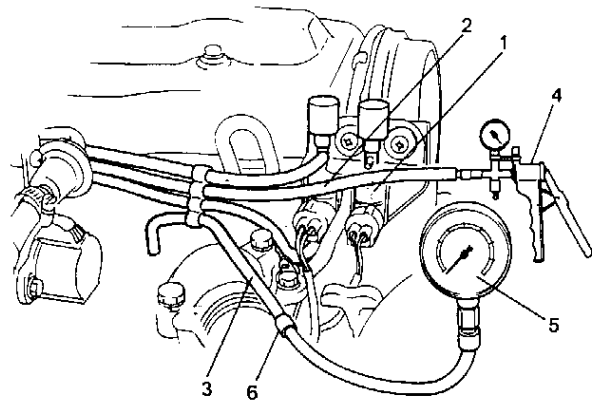
Compression pressure at sea level	
Standard	14.0 kg/cm ² (199.0 psi, 1400 kPa)
Limit	12.0 kg/cm ² (170.0 psi, 1200 kPa)
Max. difference between any two cylinders	1.0 kg/cm ² (14.2 psi, 100 kPa)

8. Carry out steps 5 through 7 on each cylinder to obtain four readings.
9. After checking, install spark plugs, high-tension cords and connect CAS coupler.

Vacuum Measurement

The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

1. Warm up engine to normal operating temperature and make sure that engine idle speed is within specification.
2. Stop engine and disconnect vacuum hoses from throttle opener VSV.
3. Connect vacuum pump to vacuum hose of opener side.
4. Connect special tools (vacuum gauge and hose joint) to vacuum hose of intake manifold side.



- | | |
|--|-------------------------------|
| 1. Throttle opener VSV | 4. Vacuum pump (09917-47910) |
| 2. Vacuum hose of opener side | 5. Vacuum gauge (09915-67310) |
| 3. Vacuum hose of intake manifold side | 6. Hose joint (09918-08210) |

Fig. 3-18 Installing Vacuum Gauge

5. Start engine and apply -40 cmHg vacuum to throttle opener to run engine at specified idle speed, and read vacuum gauge. Vacuum should be within specification.

Vacuum specification (sea level)	45 – 55 cm Hg (17.7 – 21.6 in. Hg) at 800 r/min
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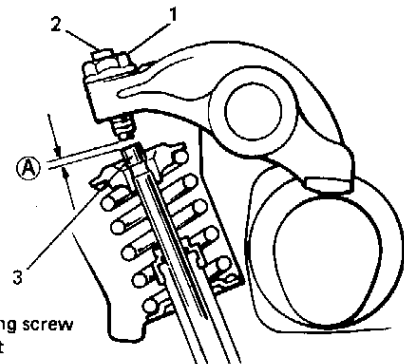
6. After checking, remove vacuum pump, vacuum gauge and hose joint.
7. Connect vacuum hoses to throttle opener VSV.

Valve Lash (Clearance)

Valve lash specifications

Valve lash refers to gap between rocker arm adjusting screw and valve stem. Use a thickness gauge to measure this gap (A).

Valve lash (gap A) specification		When cold (Coolant temperature is 15 – 25°C or 59 – 77°F)	When hot (Coolant temperature is 60 – 68°C or 140 – 154°F)
	Intake	0.13 – 0.18 mm (0.0051 – 0.0071 in)	0.23 – 0.27 mm (0.009 – 0.011 in)
	Exhaust	0.15 – 0.21 mm (0.0059 – 0.0083 in)	0.26 – 0.30 mm (0.0102 – 0.0118 in)

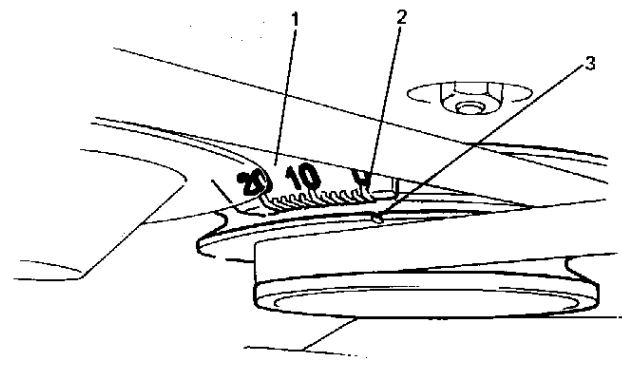


1. Adjusting screw lock nut
2. Adjusting screw
3. Valve stem

Fig. 3-19

Checking and adjusting procedures

1. Disconnect negative cable at battery.
2. Turn crankshaft pulley clockwise until "V" mark on pulley aligns with "0" (zero) on timing belt cover.



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

Fig. 3-20 Aligning Marks

3. Remove distributor cap, and check if rotor is positioned as shown in figure. (i.e. No. 1 piston is at TDC of compression stroke). If rotor is out of place, turn crankshaft clockwise once (360°).

In this state, check valve lashes at valves ①, ②, ⑤, and ⑦.

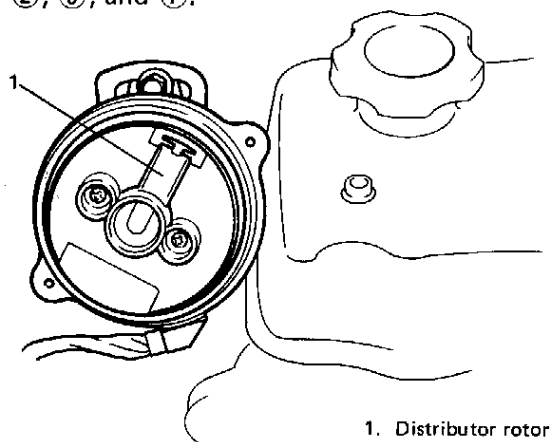


Fig. 3-21 Checking Rotor Position

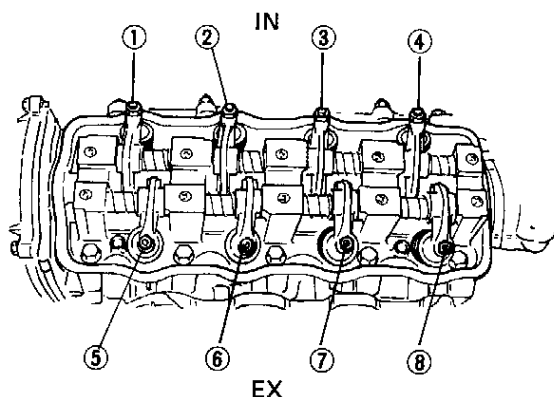


Fig. 3-22 Valve Identification

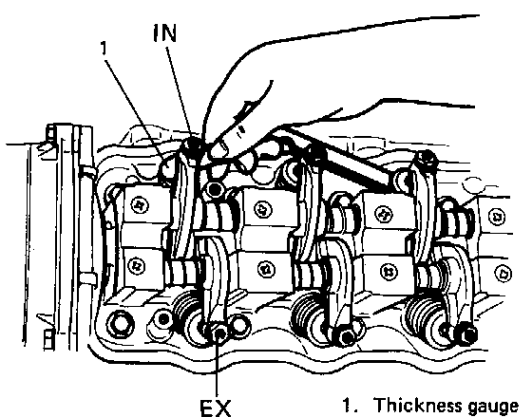


Fig. 3-23 Checking Valve Lashes

4. If valve lash is out of specification, adjust it to specification by turning adjusting screw after loosening lock nut. After adjustment, tighten lock nut to specified torque while holding adjusting screw stationary with screwdriver, and then make sure again that valve lash is within specification.

Tightening torque for adjusting screw lock nut	N·m	kg·m	lb·ft
	15 - 19	1.5 - 1.9	11.0 - 13.5

5. After checking and adjusting valve lashes at valves ①, ②, ⑤ and ⑦, rotate crankshaft exactly one full turn (360°), and check the same at valves ③, ④, ⑥ and ⑧. Adjust them as necessary.
6. After checking and adjusting all valves, install cylinder head cover and distributor cap.

3-9. RECOMMENDED TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
1. Cylinder head bolt	70 – 75	7.0 – 7.5	51.0 – 54.0
2. Cylinder head cover bolt	4 – 5	0.4 – 0.5	3.0 – 3.5
3. Spark plug	20 – 30	2.0 – 3.0	14.5 – 21.5
4. Distributor gear case	8 – 12	0.8 – 1.2	6.0 – 8.5
5. Rocker arm shaft screw	9 – 12	0.9 – 1.2	7.0 – 8.5
6. Valve adjusting screw lock nut	15 – 19	1.5 – 1.9	11.0 – 13.5
7. Crankshaft main bearing cap bolt	50 – 57	5.0 – 5.7	36.5 – 41.0
8. Oil filter stand	20 – 25	2.0 – 2.5	14.5 – 18.0
9. Oil filter Ass'y	12 – 16	1.2 – 1.6	9.0 – 11.5
10. Oil pressure switch	12 – 15	1.2 – 1.5	9.0 – 10.5
11. Oil drain plug	30 – 40	3.0 – 4.0	22.0 – 28.5
12. Oil pan bolt and nut	9 – 12	0.9 – 1.2	7.0 – 8.5
13. Oil pump strainer bolt	9 – 12	0.9 – 1.2	7.0 – 8.5
14. Water pump bolt and nut	9 – 12	0.9 – 1.2	7.0 – 8.5
15. Cooling fan nut	8 – 12	0.8 – 1.2	6.0 – 8.5
16. Flywheel bolt	57 – 65	5.7 – 6.5	41.5 – 47.0
17. Oil seal housing bolt	9 – 12	0.9 – 1.2	7.0 – 8.5
18. Connecting rod bearing cap nut	33 – 37	3.3 – 3.7	24.0 – 26.5
19. Crankshaft pulley bolt	10 – 13	1.0 – 1.3	7.5 – 9.0
20. Crankshaft timing belt pulley bolt	105 – 115	10.5 – 11.5	76.0 – 83.0
21. Timing belt cover bolt and nut	9 – 12	0.9 – 1.2	7.0 – 8.5
22. Camshaft timing pulley bolt	56 – 64	5.6 – 6.4	41.0 – 46.0
23. Timing belt tensioner bolt	24 – 30	2.4 – 3.0	17.5 – 21.5
24. Timing belt tensioner stud	9 – 12	0.9 – 1.2	7.0 – 8.5
25. Oil pump case bolt	9 – 12	0.9 – 1.2	7.0 – 8.5
26. Oil pump rotor plate screw	9 – 12	0.9 – 1.2	7.0 – 8.5
27. Inlet & exhaust manifold nut	18 – 28	1.8 – 2.8	13.5 – 20.0
28. Engine mounting bracket frame side bolt	40 – 60	4.0 – 6.0	29.0 – 43.0
29. Engine mounting bracket engine side bolt	50 – 60	5.0 – 6.0	36.5 – 43.0
30. Engine mounting nut	40 – 50	4.0 – 5.0	29.0 – 36.0
31. Transmission mounting bracket bolt	18 – 28	1.8 – 2.8	13.5 – 20.0
32. Transmission mounting bolt	18 – 28	1.8 – 2.8	13.5 – 20.0
33. Transmission mounting and frame bolt	18 – 28	1.8 – 2.8	13.5 – 20.0
34. Propeller shaft flange bolt and nut	50 – 60	5.0 – 6.0	36.5 – 43.0

SECTION 4

FUEL SYSTEM

NOTE:

For the items not found in this section, refer to the same section of '88 MODEL SERVICE MANUAL.

4

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Fuel Pump	Refer to section 4A of this supplement.
Fuel Filter	4-5
Fuel Lines	4-5
Fuel Tank	4-6
RECOMMENDED TORQUE SPECIFICATIONS	4-8

CAUTION:

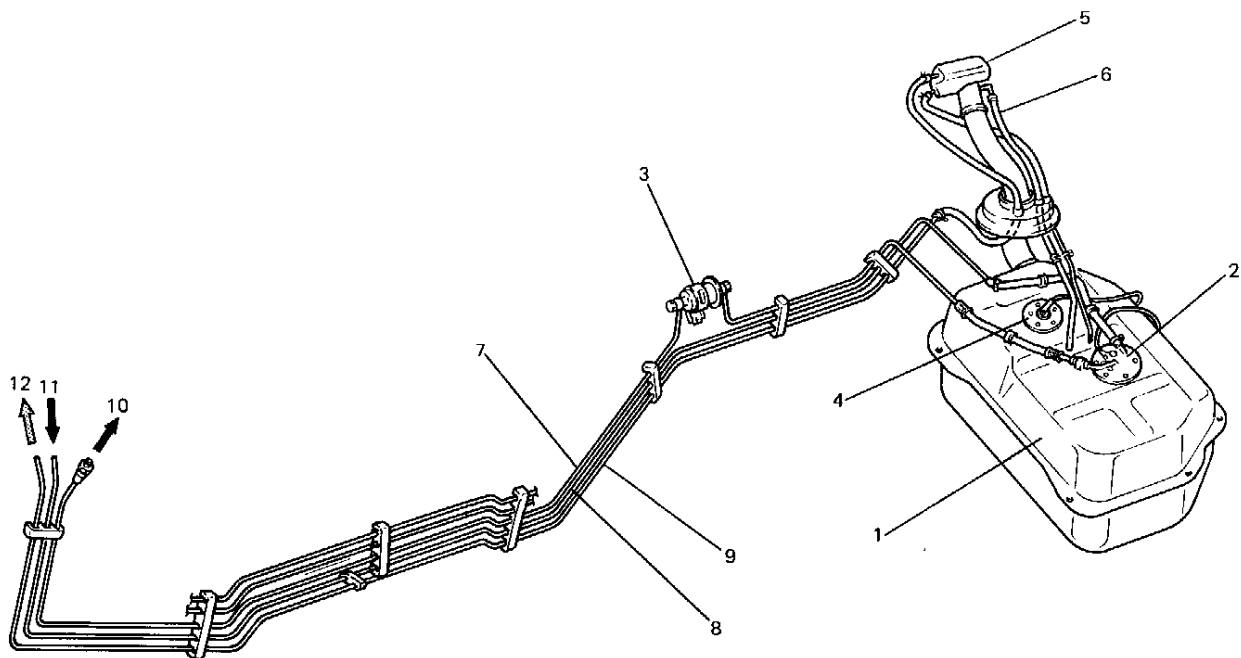
THE ENGINE OF THIS VEHICLE REQUIRES THE USE OF UNLEADED FUEL ONLY. USE OF LEADED AND/OR LOW LEAD FUEL CAN RESULT IN ENGINE DAMAGE AND REDUCE THE EFFECTIVENESS OF THE EMISSION CONTROL SYSTEMS.

4-3. FUEL TANK, PUMP, FILTER AND LINES

GENERAL DESCRIPTION

The main components of the fuel system are fuel tank, fuel pump, fuel filter and fuel level gauge and it includes three lines; fuel feed line, fuel return line and fuel vapor line.

For the details of fuel flow and fuel vapor flow, refer to SECTION 4A "ELECTRONIC FUEL INJECTION SYSTEM" and SECTION 5 "EMISSION CONTROL SYSTEM" respectively.



1. Fuel tank
2. Fuel pump
3. Fuel filter
4. Fuel level gauge
5. Vapor liquid separator
6. Breather hose
7. Fuel feed line
8. Fuel return line
9. Fuel vapor line
10. To throttle body
11. From fuel pressure regulator
12. To canister

Fig. 4-1 Fuel Lines

FUEL TANK

The fuel tank is located under the rear of the vehicle. The fuel pump and fuel level gauge are installed on the upper part of the fuel tank.

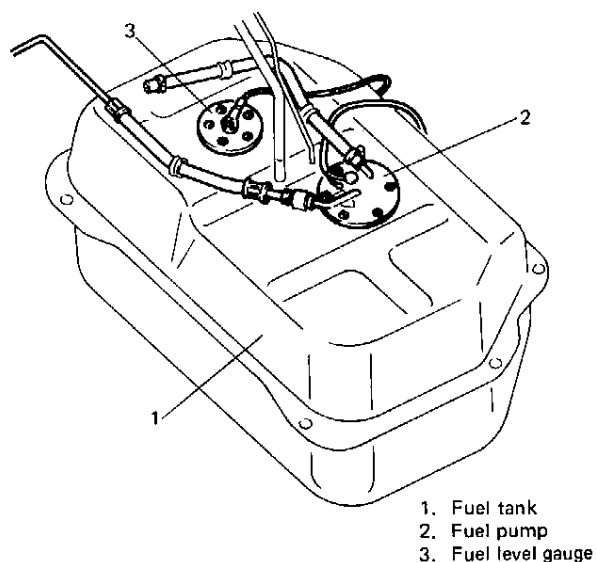


Fig. 4-2 Fuel Tank

FUEL FILTER

The fuel filter is installed on the chassis frame and filters the fuel sent under pressure from the fuel pump.

As it can't be disassembled, it should be replaced as an assembly. Note that letters indicating the fuel inlet and outlet ports are stamped on the fuel filter. Refer to them for proper hose connection.

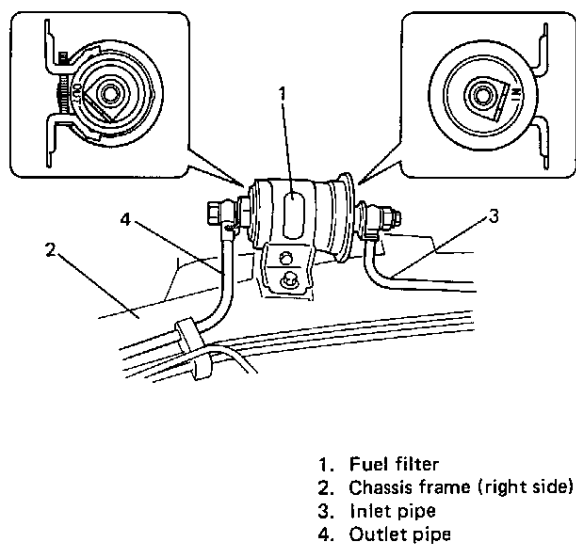


Fig. 4-3 Fuel Filter

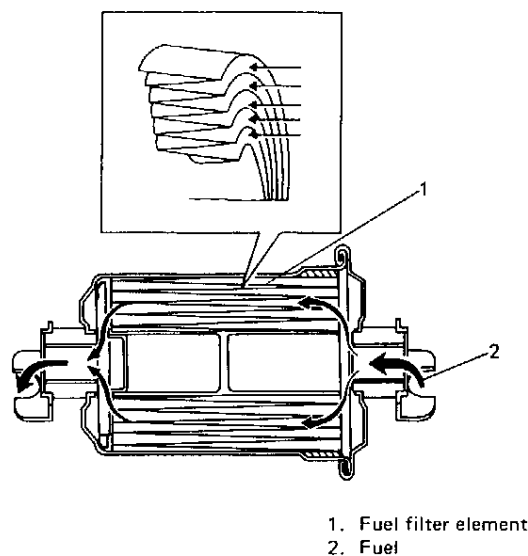


Fig. 4-4 Fuel Filter Element

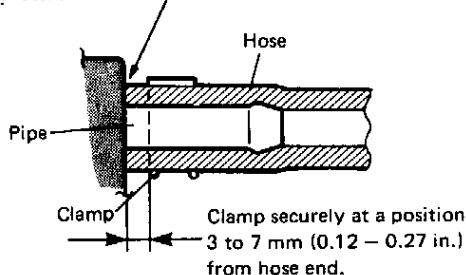
ON VEHICLE SERVICE

WARNING:

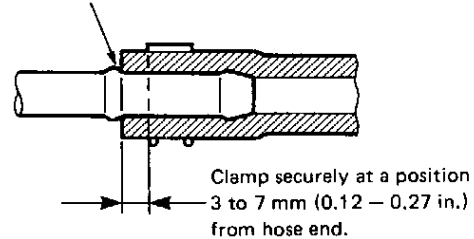
Before attempting service of any type on fuel system, following cautions should be always observed.

- Disconnect negative cable at battery.
- DO NOT smoke, and place "NO SMOKING" signs near work area.
- Be sure to have CO₂ fire extinguisher handy.
- Be sure to perform work in a well-ventilated area and away from any open flames (such as gas hot heater).
- Wear safety glasses.
- To release fuel vapor pressure in fuel tank, remove fuel filler cap from fuel filler neck and then reinstall it.
- As fuel feed line is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected. Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to "FUEL PRESSURE RELIEF PROCEDURE" in p. 3-3. A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.
- Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to the following.

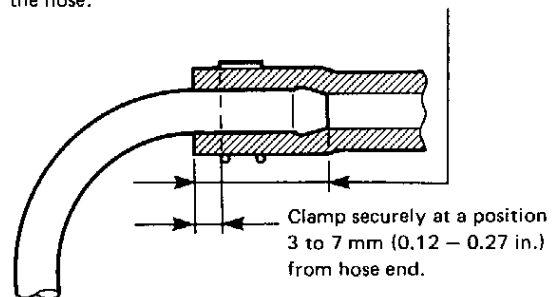
With short pipe, fit hose as far as it reaches pipe joint as shown.



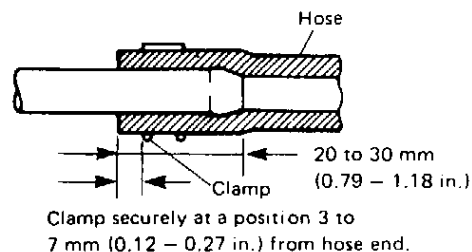
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as far as its bent part as shown or till pipe is about 20 to 30 mm (0.79 to 1.18 in.) into the hose.



With straight pipe, fit hose till pipe is about 20 to 30 mm (0.79 to 1.18 in.) into the hose.



- When connecting fuel feed hose to throttle body, lubricate its O ring with spindle oil or gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.

FUEL FILTER

Remove or Disconnect

1. After making sure that engine is cold, release fuel pressure in fuel feed line referring to "FUEL PRESSURE RELIEF PROCEDURE" in p. 3-3.

CAUTION:

This work must not be done when engine is hot.

2. Negative cable at battery.
3. Fuel filter cap from fuel filler neck to release fuel vapor pressure in fuel tank. After releasing, reinstall cap.
4. Hoist vehicle.
5. Place fuel container under fuel filter.
6. Inlet and outlet pipes from fuel filter by using two wrenches.

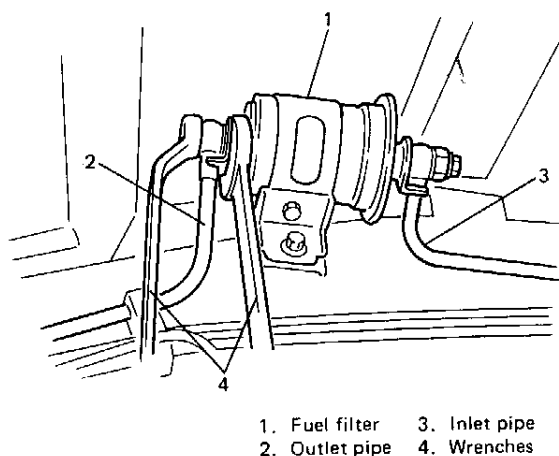


Fig. 4-5 Disconnecting Pipes

7. Fuel filter from chassis frame.

Install or Connect

Reverse removal procedure noting the following.

- Use new gaskets.
- Make sure that gasketed surfaces are free from any damage.
- Inlet and outlet pipes should come into recess of plate as shown below.

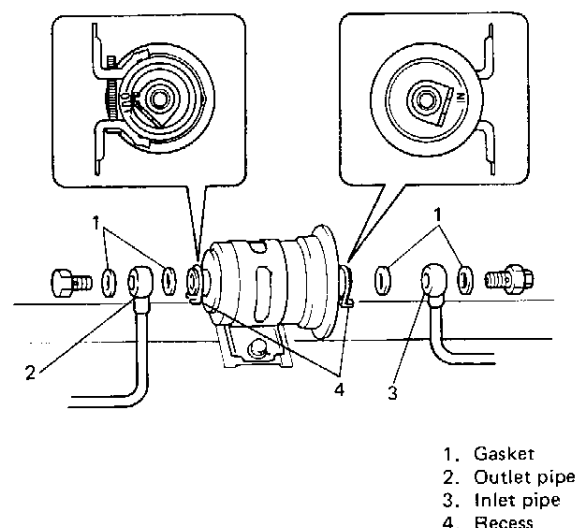


Fig. 4-6 Fuel Filter Installation

- Tighten union bolts to specified torque.

Tightening torque of fuel filter union bolts	N·m	kg·m	lb·ft
	30 - 40	3.0 - 4.0	22.0 - 28.5

- Upon completion of installation, verify that there is no fuel leakage at each connection according to procedure described in p. 3-4.

FUEL LINES

Due to the fact that fuel feed line is under high pressure, this system requires special consideration for service.

The feed pipe uses screw couplings.

Any time these fittings are loosened to service or replace components, ensure that:

- Backup wrench is used while loosening and tightening fitting.
- First tighten fittings (flare nut) by hand and then tighten it to specified torque.

Tightening torque for pipe fitting (flare nut)	N·m	kg·m	lb·ft
	30 - 40	3.0 - 4.0	22.0 - 28.5

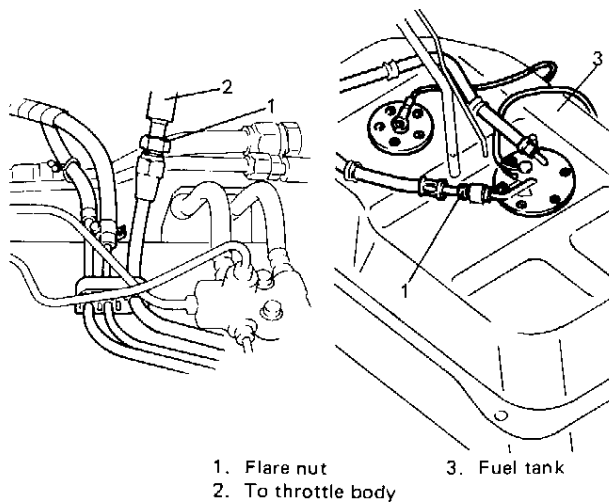


Fig. 4-7 Fuel Pipe Screw Couplings

Inspect

Visually inspect fuel lines for evidence of fuel leakage, hose cracking and deterioration, or damage. Make sure all clamps are secure. Replace parts as needed.

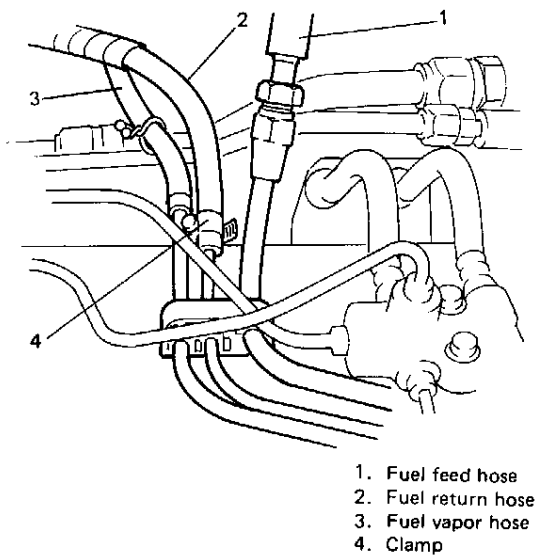


Fig. 4-8 Fuel Lines Inspection

FUEL TANK

Remove or Disconnect

1. Release fuel pressure in fuel feed line referring to "FUEL PRESSURE RELIEF PROCEDURE" in p. 3-3.
2. To release pressure in fuel tank, remove fuel filler cap and then, reinstall it.
3. Negative cable at battery.
4. Fuel level gauge and fuel pump lead wire couplers.

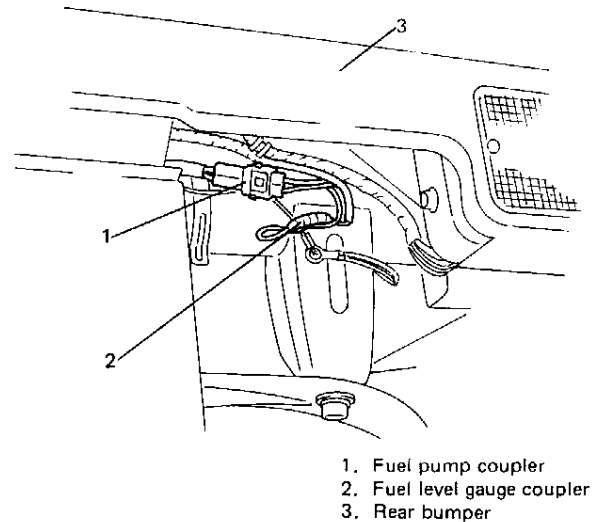


Fig. 4-9 Fuel Pump and Level Gauge Couplers

5. Breather hose from filler neck and vapor hose from separator after removing upper protector.

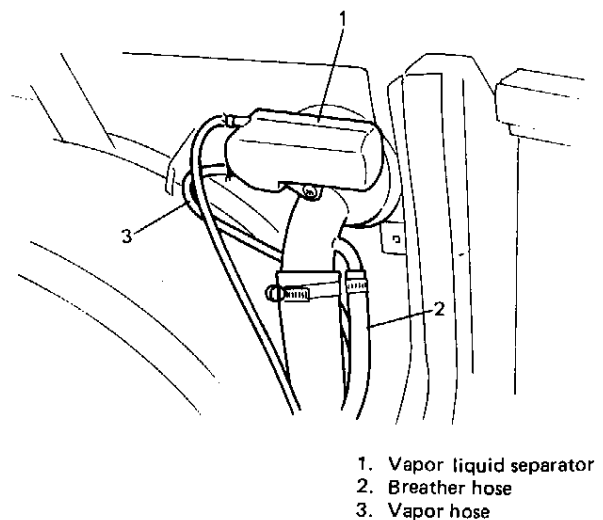


Fig. 4-10 Vapor Hose and Breather Hose

6. Filler hose from fuel tank after removing lower protector.

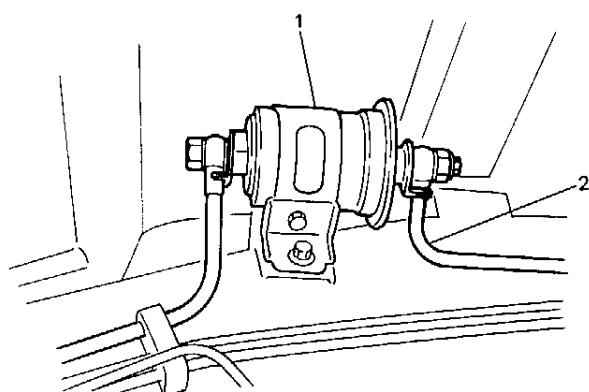
7. Due to absence of fuel tank drain plug, drain fuel tank by pumping fuel out through fuel tank filler.

Use hand operated pump device to drain fuel tank.

CAUTION:

Never drain or store fuel in an open container due to possibility of fire or explosion.

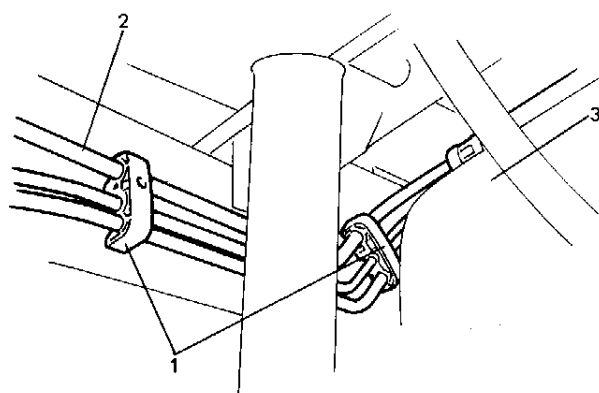
8. Fuel filter inlet pipe from filter.



1. Fuel filter
2. Inlet pipe

Fig. 4-11

9. Detach fuel pipe clamps from chassis, and fuel filter inlet pipe from clamp.



1. Clamps
2. Inlet pipe
3. Fuel tank

Fig. 4-12 Pipe Clamps

10. Fuel return hose from pipe with fuel tank and cover lowered slightly.

11. Fuel tank and cover from vehicle.

Inspect

After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check fuel pump and level gauge gaskets for leaks, visually inspect fuel tank for leaks and damage.

Replace any damaged or malfunctioned parts.

FUEL TANK PURGING PROCEDURE

CAUTION:

This purging procedure will NOT remove all fuel vapor. Do not attempt any repair on tank where heat or flame is required, as an explosion resulting in personal injury could occur.

The following procedure is used for purging the fuel tank.

1. After removing fuel tank, remove all hoses, fuel pump and fuel level gauge from fuel tank.
2. Drain all remaining fuel from tank.
3. Move tank to flushing area.
4. Fill tank with kerosene or trichloro ethylene, and agitate vigorously and drain. Repeat this washing until inside of tank is clean. Replace tank if its inside is rusty.
5. Completely flush out remaining fluid after washing.

Install or Connect

Reverse removal procedure for installation using care for the following.

- Refer to Fig. 4-1 for piping and clamp positions.
- Clamp hoses securely.
- If pipe clamp is broken, replace it with new one.
- Use new gaskets for fuel filter inlet pipe and tighten union bolt to specified torque.
- Upon completion of installation, check fuel system for leakage according to procedure described in p. 3-4.

Throttle Body

The throttle body consists of the main bore, air bypass passage, fuel passage, vacuum passage (for EGR system and canister purge system) and the following parts.

- Injector which injects fuel according to the signal from ECM
- Fuel pressure regulator which maintains the fuel pressure to the injector a certain amount higher than the pressure in the intake manifold
- Throttle valve which is interlocked with the accelerator pedal and controls the amount of the air fuel mixture drawn into the combustion chamber
- Throttle opener which controls the throttle valve opening so that it is a little wider when the engine is starting than when the engine is idling
- TPS which detects the throttle valve opening and sends a signal to ECM
- Air valve which supplies the bypass air when the engine is cold
- Idle speed adjusting screw which controls the amount of bypass air to adjust engine idle speed

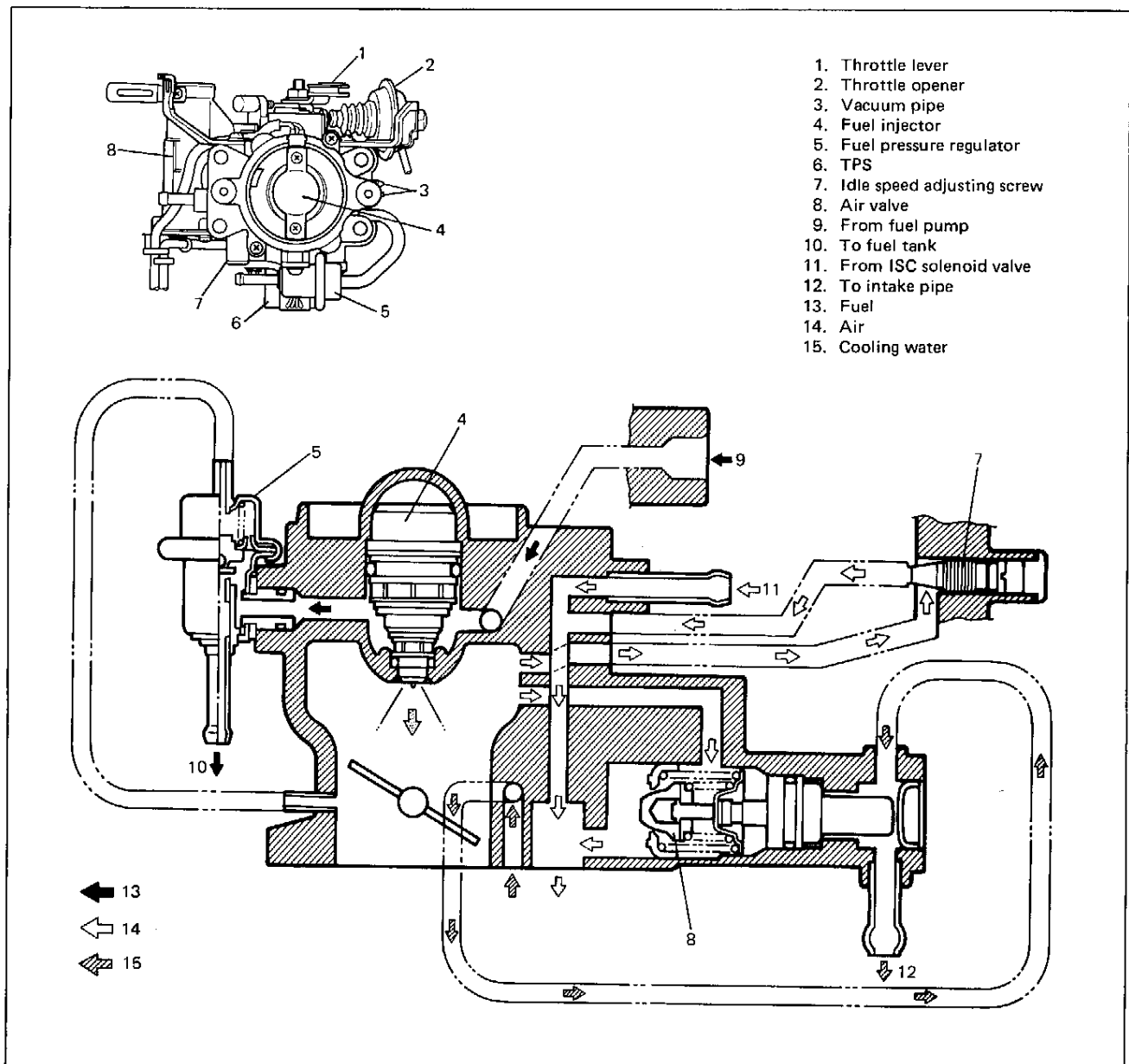


Fig. 4A-5 Throttle Body Cross-Section

Fuel Injector

It is an electromagnetic type injection nozzle which injects fuel in the throttle body bore according to the signal from ECM.

Operation

When the solenoid coil of the injector is energized by ECM, it becomes an electromagnet and attracts the plunger. At the same time, the needle valve which is incorporated with the plunger opens and the injector which is under the fuel pressure injects fuel in conic dispersion. As the lift stroke of the needle valve of the injector is set constant, the amount of fuel injected at one time is determined by the length of time during which the solenoid coil is energized (injection time).

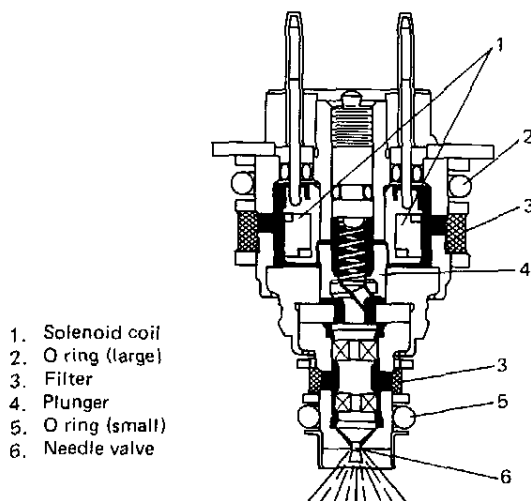


Fig. 4A-6 Injector Cross-Section

Fuel Pressure Regulator

The fuel pressure regulator keeps the fuel pressure applied to the injector 2.65 kg/cm^2 (265 kPa) higher than that in the intake manifold at all times.

The pressure applied to the chamber "A" of fuel pressure regulator is intake manifold pressure and that to the chamber "B" is fuel pressure.

When the fuel pressure rises more than 2.65 kg/cm^2 (265 kPa) higher than the intake manifold pressure, the fuel pushes the valve in the regulator open and excess fuel returns to the fuel tank via the return pipe.

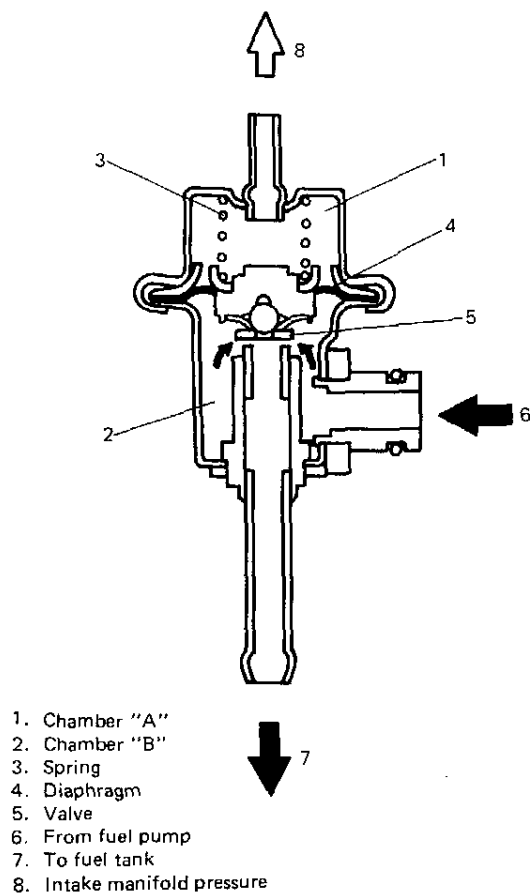


Fig. 4A-7 Pressure Regulator Cross-Section

Air Valve

The air valve consists of thermo-wax, springs and valve.

When the engine is cold, it sends the air from the air cleaner to the intake manifold without letting it pass through the throttle valve to increase the engine speed, and thus the engine is warmed up.

Operation

When the engine is cold (or engine cooling water is lower than about 60°C (140°F)), the thermo-wax contracts.

In this state, the valve is pushed to the left by the spring force and opens the air passage, allowing the air from the air cleaner to be drawn into the intake manifold. Thus the amount of intake air increases even when the throttle valve is at the idle position and the engine speed rises to the fast idle state which is higher than the idle speed.

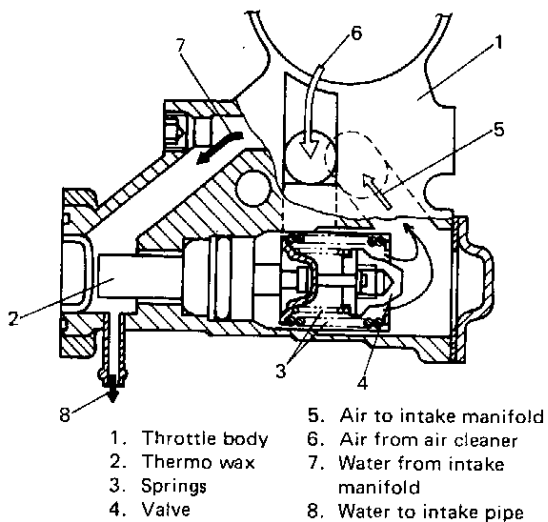


Fig. 4A-8 Air Valve Open

As the engine is warmed up, the thermo-wax expands gradually, then the piston is pushed to move the valve to the right gradually, and the amount of air passing through the air passage decreases and so does the engine speed. When the engine cooling water temperature reaches about 60°C (140°F), the valve is fully closed and the engine speed is back to the normal idle speed.

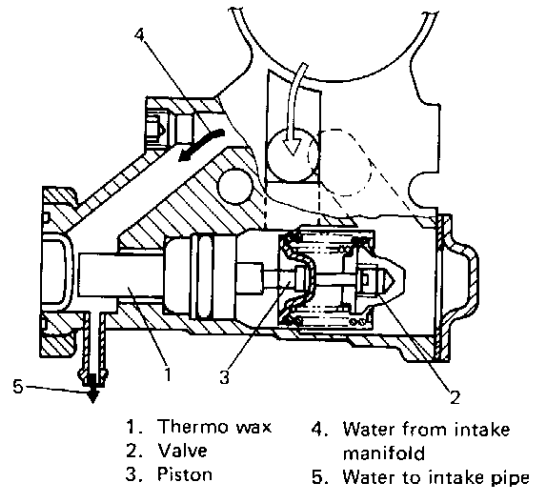


Fig. 4A-9 Air Valve Close

ISC (Idle Speed Control) Solenoid Valve

The ISC solenoid valve opens and closes air by-pass passage according to the signal from ECM. When it opens, the air is supplied to the intake manifold.

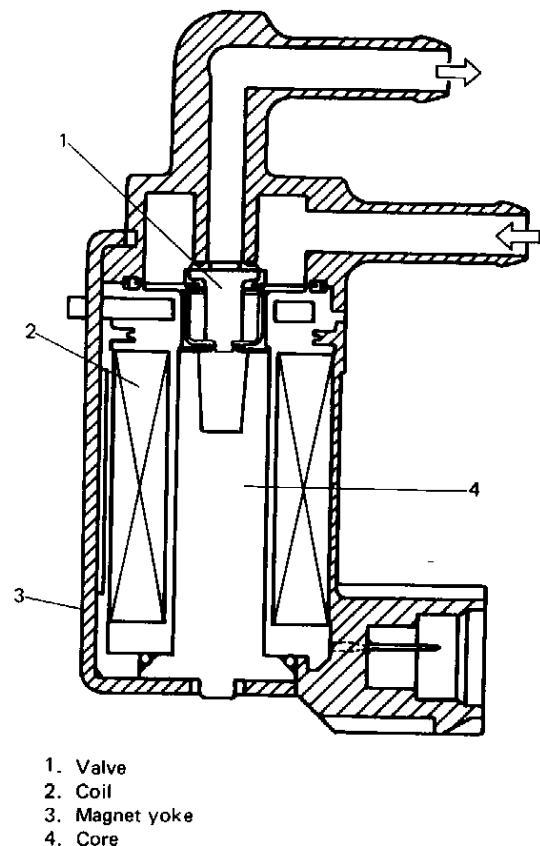


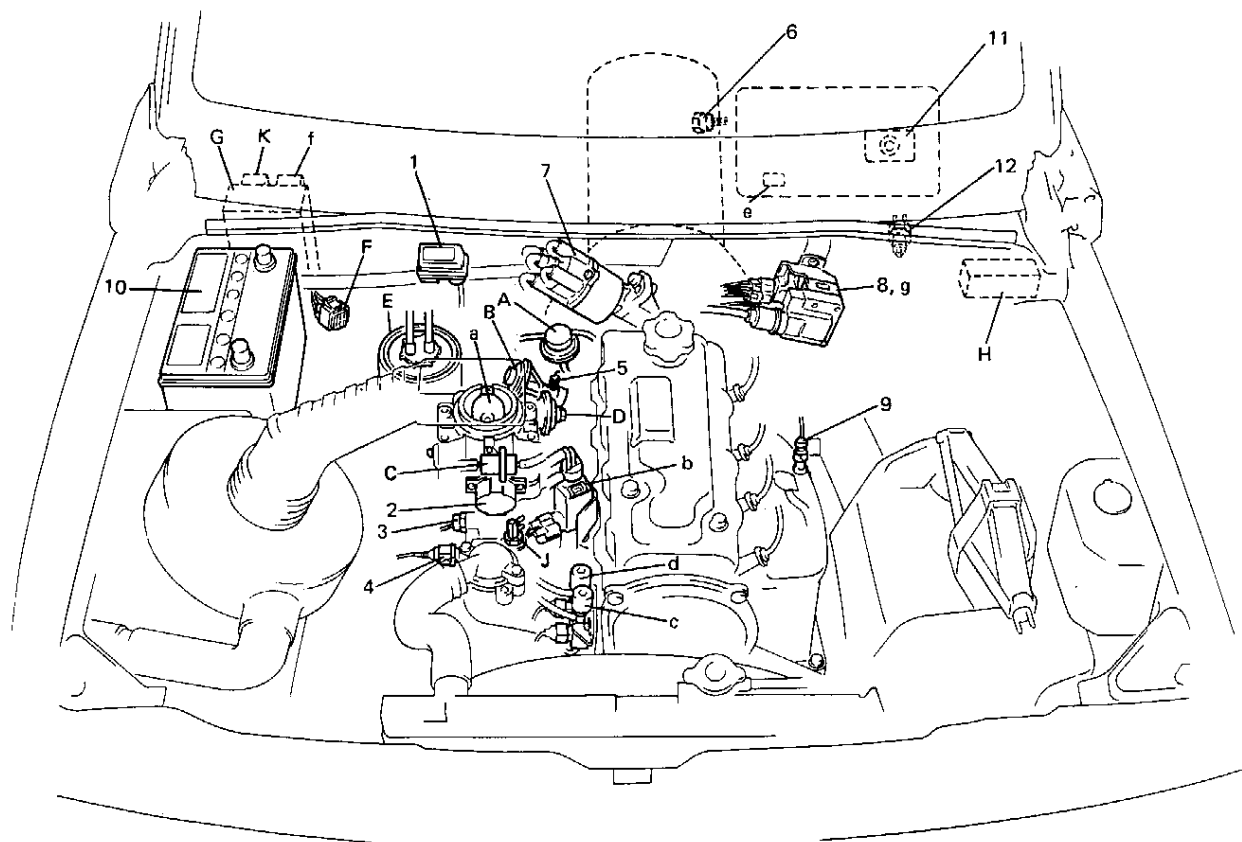
Fig. 4A-10 ISC Solenoid Valve Cross-Section

ELECTRONIC CONTROL SYSTEM

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.

Functionally, it is divided into six sub systems:

- Fuel injection control system
- ISC solenoid valve control system
- Fuel pump control system
- Throttle opener control system
- EGR control system
- ESA control system



INFORMATION SENSORS

1. Pressure sensor
2. TPS
3. ATS
4. WTS
5. REGTS
(California spec. model only)
6. 5th switch
(Not for California spec. model)
7. CAS (in distributor)
8. Igniter (Power unit)
9. Oxygen sensor
10. Battery
11. VSS
12. Clutch switch

CONTROLLED DEVICES

- a : Injector
- b : ISC solenoid valve
- c : Throttle opener
VSV (Brown)
- d : EGR VSV (Blue)
- e : "CHECK ENGINE" light
- f : Fuel pump relay
- g : Igniter (Power unit)

OTHERS

- A : EGR modulator
- B : EGR valve
- C : Fuel pressure regulator
- D : Throttle opener
- E : Canister
- F : Monitor coupler
- G : ECM
- H : Fuse box (Diagnosis switch terminal)
- J : BVS
- K : Main relay

Fig. 4A-11 Component Parts Location

TERMINAL POSITION OF PARTS
SIDE COUPLER

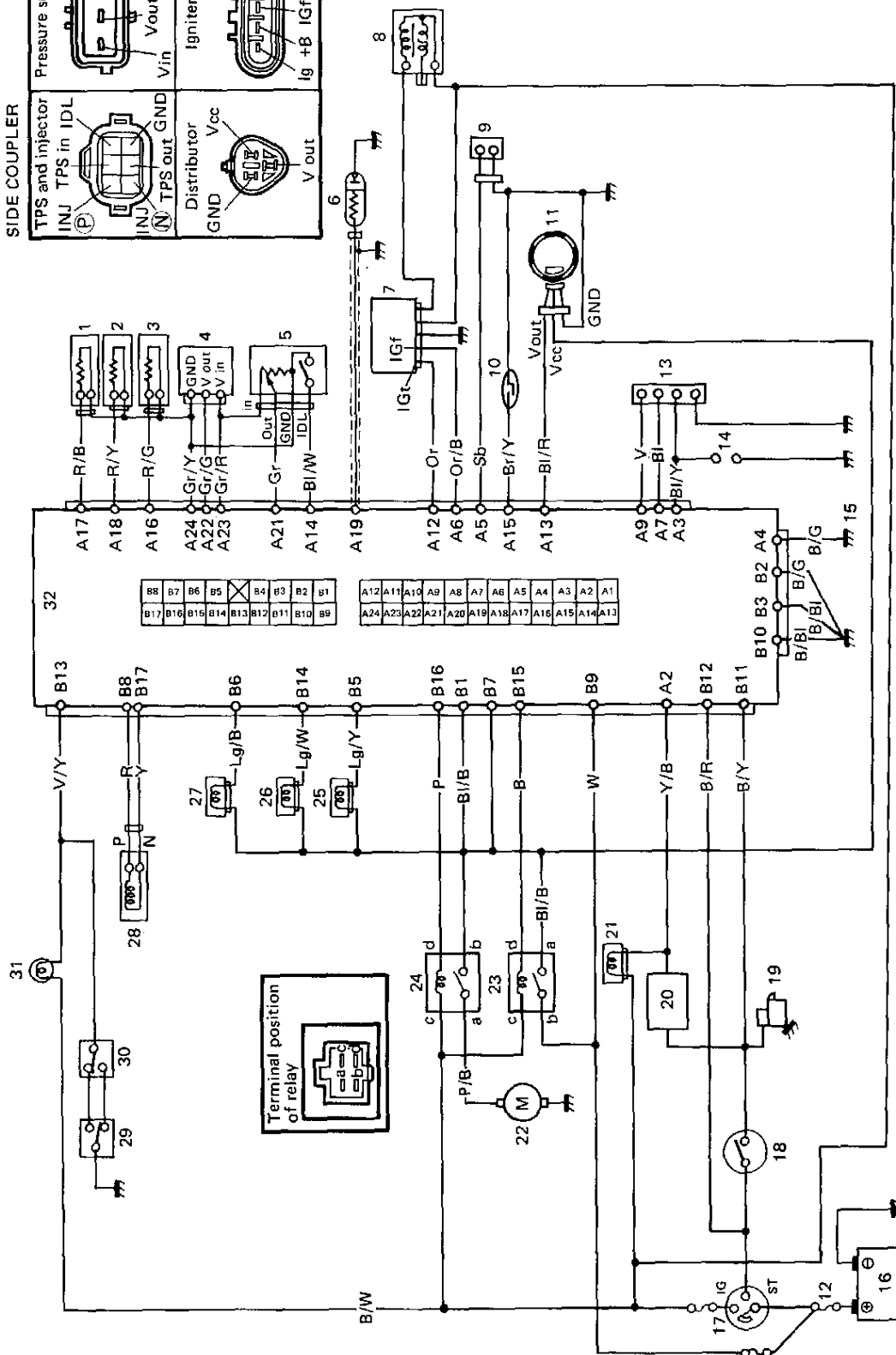
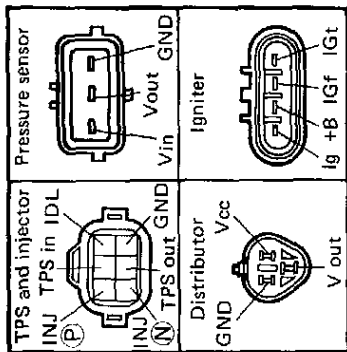


Fig. 4A-12 System Wiring Diagram

1. ATS	16. Battery	Wire color
2. WTS	17. Main switch	B/Bl Black/Blue
3. REGTS	18. Clutch switch	B/G Black/Green
(California spec. model only)	19. Starter magnetic switch	B/Y Black/Yellow
4. Pressure sensor	20. A/C amplifier (if equipped)	Bl Blue
5. TPS	21. A/C VSV (if equipped)	Bl/B Blue/Black
6. Oxygen sensor	22. Fuel pump	Bl/R Blue/Red
7. Igniter (Power unit)	23. Main relay	Bl/W Blue/White
8. Ignition coil	24. Fuel pump relay	Bl/Y Blue/Yellow
9. 5th switch	25. EGR VSV	Bl/O Blue/Orange
(Not for California spec. model)	26. Throttle opener VSV	Br/B Brown/Black
10. VSS	27. ISC solenoid valve	Br/Y Brown/Yellow
11. CAS (in distributor)	28. Fuel injector	Gr Gray
12. Fusible link	29. Mileage sensor	Gr/G Gray/Green
13. Monitor coupler	30. Cancel switch	Gr/R Gray/Red
14. Diag. switch terminal	31. "CHECK ENGINE" light	Gr/Y Gray/Yellow
(in fuse box)	32. ECM	Lg Lightgreen
15. Ground		Lg/B Lightgreen/Black
(California spec. model only)		Lg/W Lightgreen/White
		Lg/Y Lightgreen/Yellow
		P Pink
		R Red
		R/B Red/Black
		R/G Red/Green
		R/Y Red/Yellow
		Sb Skyblue
		V Violet
		V/Y Violet/Yellow
		W White
		Y Yellow
		Y/B Yellow/Black
		R/Bl Red/Blue

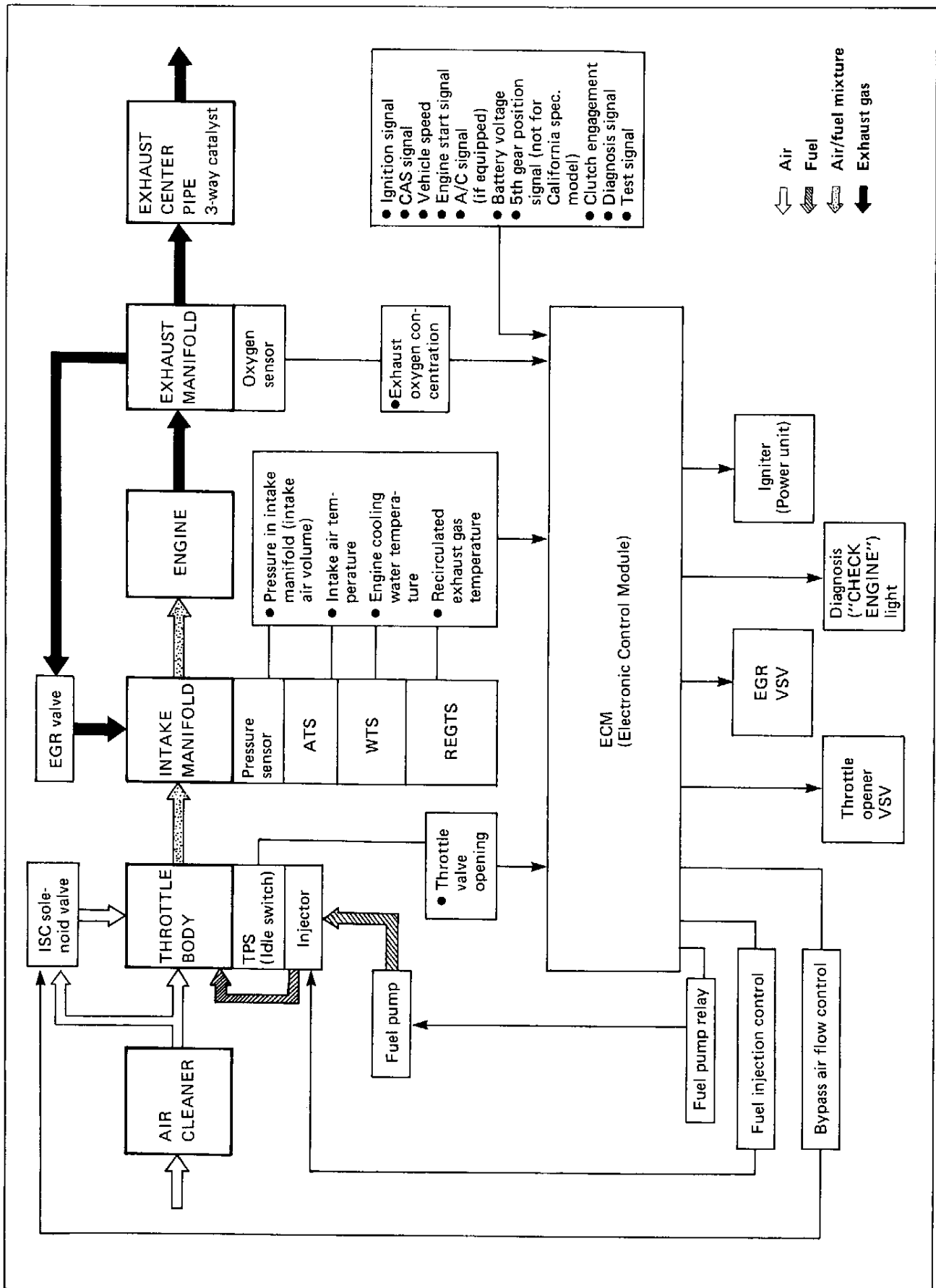


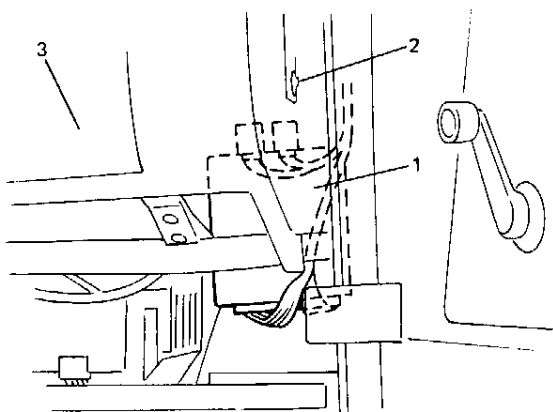
Fig. 4A-13 System Schematic

Electronic Control Module (ECM)

ECM is installed under the glove box of the instrument panel.

ECM is a precision unit consisting of one chip microcomputer, A/D (Analog/Digital) converter, I/O (Input/Output) unit and etc..

It is an essential part of the electronic control system, for its functions include not only such a major function as to control fuel injector, ISC solenoid valve, throttle opener VSV, etc. but also self-diagnosis function, fail safe function and back-up function as described in the following section.



- 1. ECM
- 2. Instrument main panel
- 3. Glove box

Fig. 4A-14 ECM Location

Self-diagnosis function

When any of such troubles as listed below occurs in Electronic Fuel Injection system, ECM activates "CHECK ENGINE" light while engine is running to warn the driver of occurrence of such trouble and stores the data on defective area (where trouble occurred) in its back-up memory. (The memory is kept as it is even if the trouble was only temporary and disappeared immediately. And it is not erased unless the power to ECM is shut off for 20 seconds or longer.) ECM also indicated defective area in memory by means of flashing of "CHECK ENGINE" light at the time of inspection (i.e. when diagnosis switch terminal is grounded and ignition switch is turned ON).

- When ECM received a defect informing signal from any one of following sensors and circuits or no signal whatever
 - *Oxygen sensor
 - *ATS
 - *Pressure sensor
 - *WTS
 - *TPS
 - *VSS
 - *Idle switch
 - *CAS
 - *5th switch (Not for California spec. model)
 - *Ignition circuit
 - *Ground circuit (California spec. model only)
- When a trouble exists in EGR system (or re-circulated exhaust gas temperature sensor is defective) . . . For California spec. model only
- When CPU (Central Processing Unit) of ECM fails to operate

NOTE:

- Even when a trouble occurs in CAS, 5th switch circuit or idle switch circuit (circuit open), ECM does not indicate it (or activate "CHECK ENGINE" light) while engine is running. And when that troubled circuit regains good condition, the memory of defective area will be erased automatically even if the power circuit to ECM is not opened as described above.

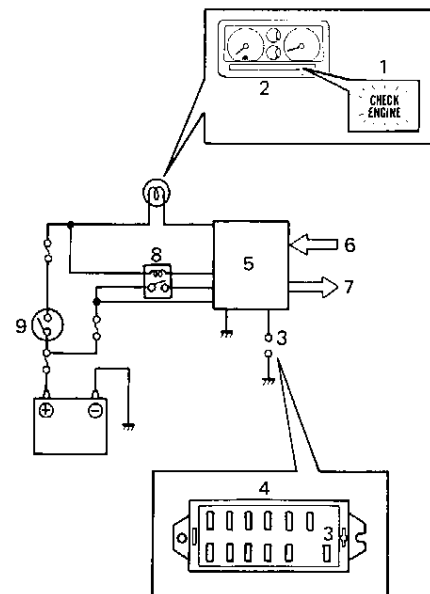
- Only ignition circuit trouble (code No. 41 among the above areas is not stored in back-up memory of ECM. (In other words, even if ECM has detected a trouble in ignition circuit, once ignition switch is turned OFF, code No. 41 will not be indicated even when diagnosis switch terminal is grounded and ignition switch is turned ON.).

Therefore, to check diagnostic code when engine fails to start, crank engine and then ground diagnosis switch terminal with ignition switch ON.

["CHECK ENGINE" light]

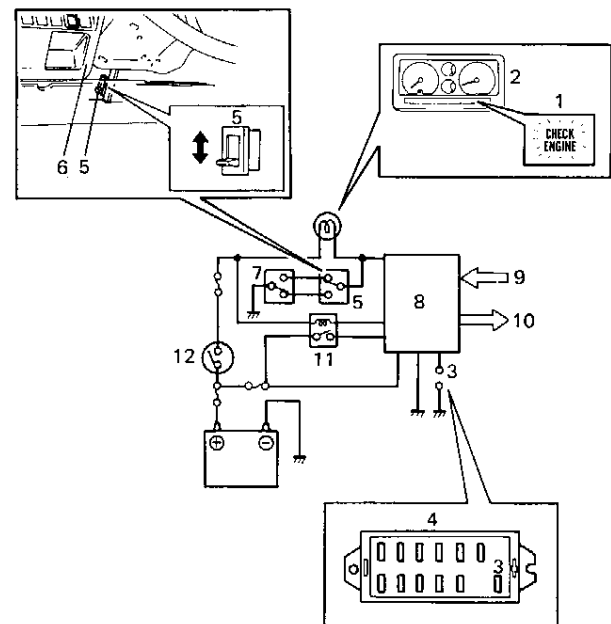
"CHECK ENGINE" light is located among the instrument cluster. It indicates each result of diagnosis done by ECM's self-diagnosis function. It also lights under the conditions as described below regardless of Electronic Fuel Injection system condition.

- When ignition switch is turned ON, engine is at a stop (When engine speed is lower than 500 r/min.) and diagnosis switch terminal is ungrounded, "CHECK ENGINE" light turns ON for the purpose of light and its circuit check but turns OFF once engine is started (When engine speed is higher than 500 r/min.) as far as Electronic Fuel Injection system is in good condition.
- Only federal spec. model except California and Canada has mileage sensor and cancel switch in its "CHECK ENGINE" light circuit. When mileage reaches 50,000, 80,000 and 100,000 miles respectively (i.e. mileage sensor turns ON) "CHECK ENGINE" light turns ON even while engine is running. This is to warn the driver that it is time for periodical inspection. In this case, turn OFF "CHECK ENGINE" light with its cancel switch upon completion of inspection.



- | | |
|------------------------------|-----------------------|
| 1. "CHECK ENGINE" light | 5. ECM |
| 2. Cluster | 6. Sensed information |
| 3. Diagnosis switch terminal | 7. Output |
| 4. Fuse box | 8. Main relay |
| | 9. Ignition switch |

Fig. 4A-15 "CHECK ENGINE" Light Circuit for California and Canada spec. Model



- | | |
|------------------------------|-----------------------|
| 1. "CHECK ENGINE" light | 8. ECM |
| 2. Cluster | 9. Sensed information |
| 3. Diagnosis switch terminal | 10. Output |
| 4. Fuse box | 11. Main relay |
| 5. Cancel switch | 12. Ignition switch |
| 6. Instrument panel | |
| 7. Mileage sensor | |

Fig. 4A-16 "CHECK ENGINE" Light Circuit for Federal Spec. Model Except California and Canada

Fail-safe function

When a failure occurs in any of the sensors listed below and their circuits, a signal indicating such failure is fed to ECM, which judges that signal as such.

Even then, however, control over the injector, ISC solenoid valve and others is maintained on the basis of the standard signals prestored in the memory of ECM while ignoring that failure signal. This function is called "fail-safe function". Thus, with this function, a certain level of engine performance is available even when some failure occurs in these sensors or their circuits and disability in running is avoided.

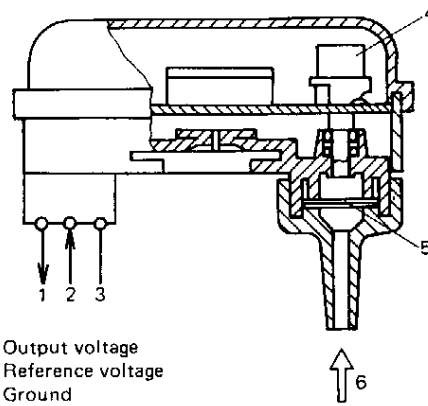
- WTS
- TPS
- ATS
- Pressure sensor

Back-up function

Even when CPU in ECM fails to operate properly, the back-up circuit in ECM controls operation of the injector on the basis of the signals from pressure sensor so as to least impair driving performance.

Pressure (Intake manifold absolute pressure) Sensor (PS)

This sensor senses pressure change in the intake manifold and converts it into voltage change. It consists of a semi-conductor type pressure converting element which converts a pressure change into an electrical change and an electronic circuit which amplifies and corrects the electric change. The ECM sends a 5-volt reference voltage to the pressure sensor. As the manifold pressure changes, the electrical resistance of the sensor also changes. By monitoring the sensor output voltage, ECM knows the manifold pressure (intake air volume).



1. Output voltage
2. Reference voltage
3. Ground
4. Semi-conductor type pressure converting element
5. Filter
6. Intake manifold pressure (Vacuum)

Fig. 4A-17 Pressure Sensor

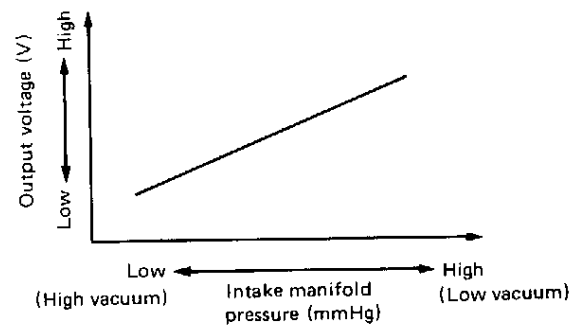


Fig. 4A-18 Output Characteristic

ECM uses the voltage signal from the pressure sensor as one of the signals to control fuel injection time, ISC solenoid valve operation EGR VSV operation and ignition timing.

Throttle Position Sensor (TPS)

The throttle position sensor consisting of a contact point (idle switch) and a potentiometer is connected to the throttle valve shaft on the throttle body, and detects the throttle valve opening.

The throttle opening in the idle state is detected by means of the contact point which turns ON in that state.

But beyond that the full opening is detected by the potentiometer as follows.

A 5-volt reference voltage is applied to the sensor from ECM and as its brush moves over the print resistance according to the throttle valve opening, the output voltage varies accordingly.

By monitoring the sensor output voltage, ECM detects the throttle valve opening and its change.

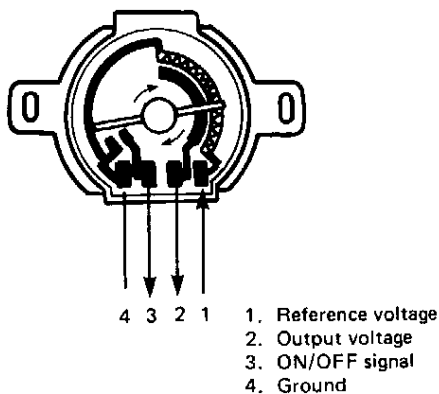


Fig. 4A-19 Throttle Position Sensor

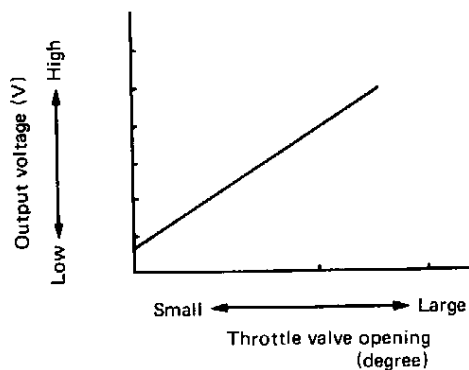


Fig. 4A-20 Output Characteristic

Air Temperature Sensor (ATS)

Located at the side of intake manifold, this sensor constantly measures the temperature of the air entering there and converts a change in the air temperature into that in resistance through its thermister. That is, as air temperature lowers, resistance increases and as it rises, resistance decreases. As air density of the intake air varies with variation in temperature, ECM, by monitoring the resistance, adjusts the amount of fuel injection according to the air temperature.

Water Temperature Sensor (WTS)

Located at the side of intake manifold, this sensor measures the temperature of the engine cooling water and converts its change into that in resistance through the thermister like the air temperature sensor.

That is, as cooling water temperature lowers, resistance increases and as it rises, resistance decreases.

By monitoring the resistance of the water temperature sensor, ECM detects the engine cooling water temperature and that affects most systems under the control of ECM.

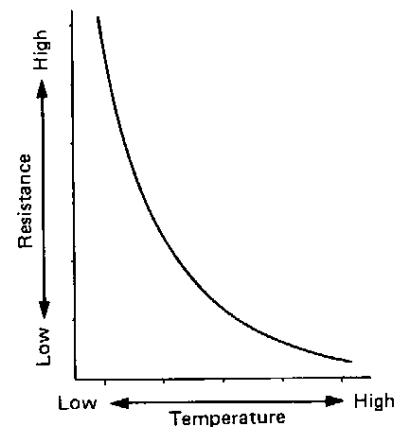


Fig. 4A-21 Air/Water Temperature Sensor Characteristic

Recirculated Exhaust Gas Temperature Sensor (REGTS) (For California spec. model only)

This sensor is located at the EGR valve. Like the air and water temperature sensors described previously, it measures the temperature of the gas which was recirculated through the EGR valve and converts a change in the exhaust gas temperature into that in resistance to send it to ECM.

ECM uses it for diagnosing a trouble in the EGR system.

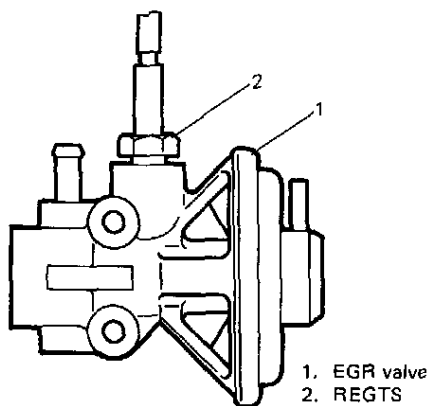


Fig. 4A-22 REGTS

Oxygen Sensor

The oxygen sensor is located on the exhaust manifold to detect the concentration of oxygen in the exhaust gases.

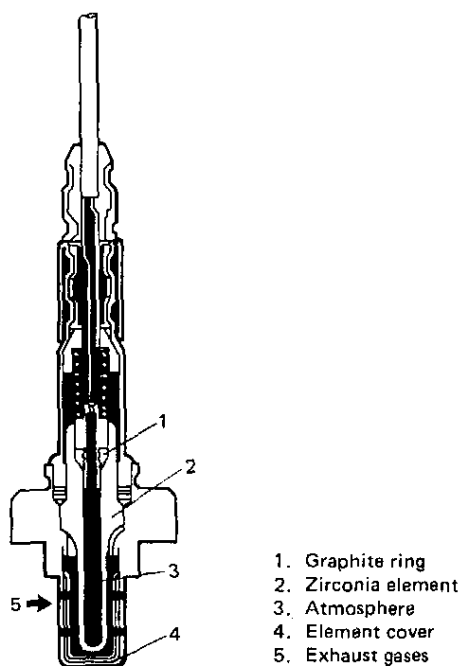


Fig. 4A-23 Oxygen Sensor

Vehicle Speed Sensor (VSS)

The VSS consisting of the lead switch and magnet is built in the speedometer. As the magnet turns with the speedometer cable, its magnetic force causes the lead switch to turn ON and OFF. Such ON/OFF frequency increases or decreases in proportion with the vehicle speed and is sent to ECM as pulse signals.

ECM uses it as one of the signals to control the ISC solenoid valve.

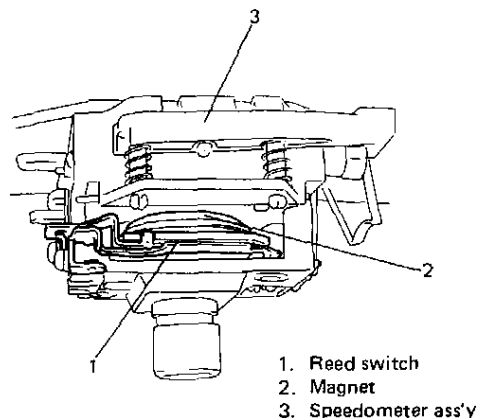


Fig. 4A-24 VSS

Crank Angle Sensor (CAS)

The crank angle sensor located in the distributor consists of the signal generator (hall element and magnet) and signal rotor.

As the signal rotor turns, it causes the magnetic flux from the magnet to be applied to the hall element intermittently. The hall element generates the voltage in proportion with the magnetic flux as shown below. This voltage is wave-shaped into the pulse signal (sensor signal) by the comparator.

This pulse signal (4 pulses/revolution) is sent to ECM where it is used to calculate the engine speed and also as one of the signals to control fuel injector and ignition timing.

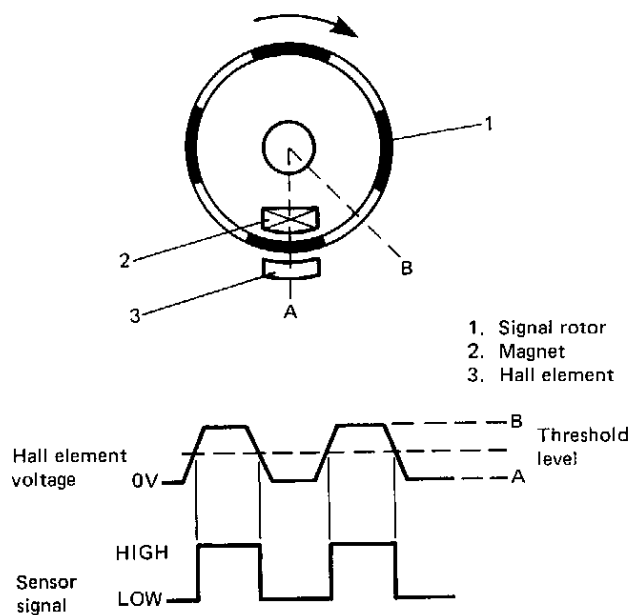


Fig. 4A-25 CAS

Ignition Signal (ignition fail safe signal)

This signal is sent from the igniter.

ECM uses it as one of the signals for controlling fuel injector.

Engine Start Signal

This signal is sent from the engine starter circuit. Receiving it, ECM judges whether the engine is cranking or not and uses it as one of the signals to control fuel injection timing, injection time, ISC solenoid valve operation and throttle opener VSV operation.

5th Switch (Not for California spec. model)

Located on the transmission, it turns ON when the gear shift lever is shifted to the 5th gear position and OFF when it is at any other position. The ON/OFF signal from this switch is one of the signals that ECM uses to control EGR VSV.

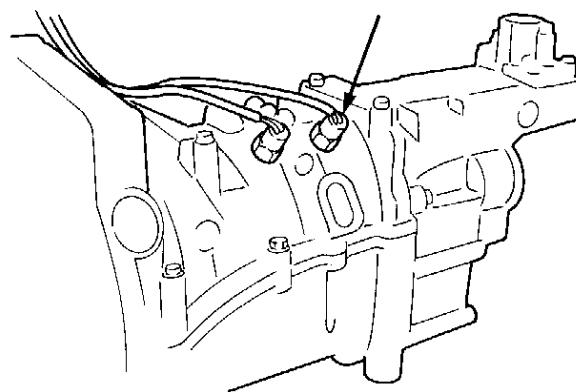


Fig. 4A-26 5th Switch

Clutch Switch

Located above the clutch pedal, it turns ON when clutch pedal is depressed and OFF when released. ECM uses it as one of the signals for controlling fuel injector.

Air-Conditioner Signal (For vehicle with A/C)

This signal is sent from the air-conditioner circuit. ECM detects whether the air-conditioner is operating or not through the signal and uses it as one of the signals for controlling ISC solenoid valve operation.

Battery Voltage

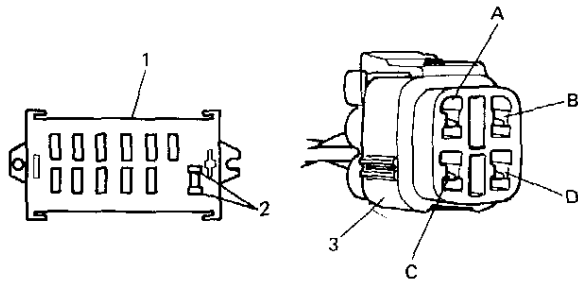
The fuel injector is driven by its solenoid coil based upon the ECM output signal.

There is some delay called as "Ineffective injection time", which doesn't provide fuel, between ECM signal and valve action.

As the ineffective injection time depends on the battery voltage, ECM takes voltage information to compensate it in fuel injection time.

Diagnosis Switch Terminal

There are two diagnosis switch terminals; one included in the fuse box and the other in the monitor coupler in the engine room. When either diagnosis switch terminal is grounded, a diagnosis signal is fed to ECM which then outputs self-diagnosis code and at the same time outputs ISC duty through duty check terminal.



- | | |
|------------------------------|------------------------------|
| 1. Fuse box | A: Duty check terminal |
| 2. Diagnosis switch terminal | B: Diagnosis switch terminal |
| 3. Monitor coupler | C: Ground terminal |
| | D: Test switch terminal |

Fig. 4A-27 Diagnosis and Test Switch Terminals

Test Switch Terminal

The test switch terminal is included in the monitor coupler. When this terminal is grounded, ECM sets the ignition timing to the specification and turn "CHECK ENGINE" light ON even when engine is running.

When both test switch terminal and diagnosis switch terminal are grounded, ECM outputs A/F duty through the duty check terminal and "CHECK ENGINE" light indicates diagnostic code No. 71, but it is nothing abnormal.

FUEL INJECTION CONTROL SYSTEM

In this system, ECM controls the time (amount) and timing of the fuel injection from the fuel injector into the throttle body according to the signals from the various sensors so that suitable air/fuel mixture is supplied to the engine in each driving condition.

Injection Timing

- At start

Fuel is injected at a certain cycle starting immediately after the initial CAS signal is inputted.

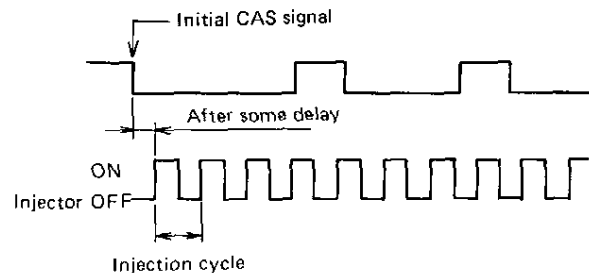


Fig. 4A-28 Injection Timing at Start

- In normal driving (Standard injection timing)

Fuel is injected at every ignition signal (ignition fail safe signal) synchronously.

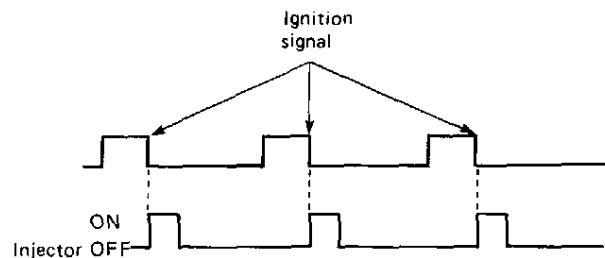


Fig. 4A-28-1 Injection Timing in Normal Driving

- When accelerating (Additional injection timing)

Fuel is injected in addition to the above standard injection timing whenever the throttle valve opening exceeds the specified opening.