

# EMISSION CONTROL

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110007497

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## GENERAL INFORMATION

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The emission control system consists of the following subsystems:

- Positive crankcase ventilation system
- Evaporative emission control system
- Exhaust gas recirculation system
- Three-way catalytic converter

## SERVICE SPECIFICATIONS

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Items	Standard value
Evaporative emission purge solenoid coil resistance $\Omega$	36–44 [at 20°C (68°F)] <Federal – Up to 1995 model, California – Up to 1994 model> 62–74 [at 20°C (68°F)] <Federal – From 1996 model, California – From 1995 model>
EGR solenoid coil resistance $\Omega$	

## TROUBLESHOOTING

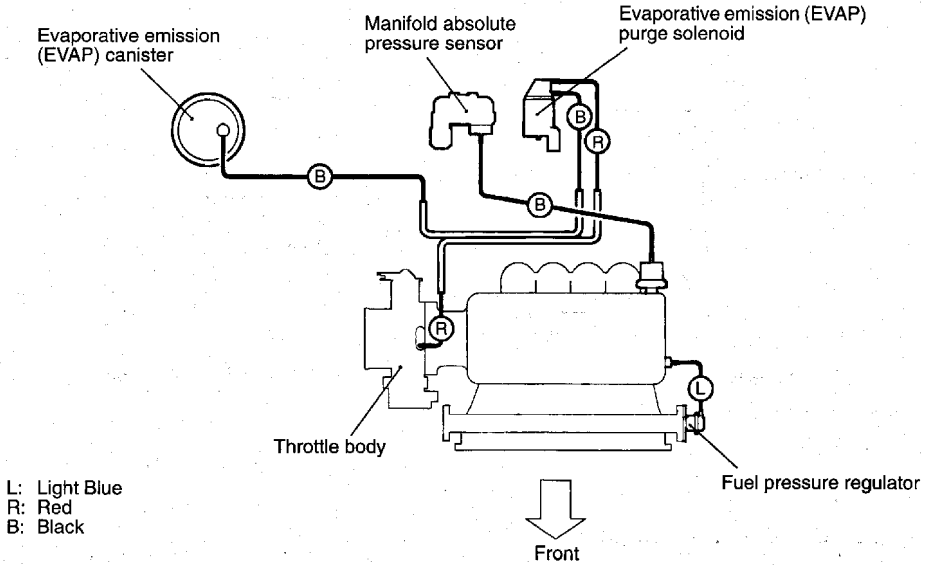
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Symptom	Probable cause	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged.	Repair or replace
	The EGR valve is not closed.	
	Malfunction of the evaporative emission purge solenoid	
Rough idle or engine stalls	The EGR valve is not closed.	Repair or replace
	Vacuum hose disconnected or damaged.	
	Malfunction of the positive crankcase ventilation valve	Replace
	Malfunction of the purge control system	Check the system; if there is a problem, check its component parts.
Engine hesitates or poor acceleration	Malfunction of the exhaust gas recirculation system	Check the system; if there is a problem, check its component parts.
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system.
Poor fuel mileage	Malfunction of the exhaust gas recirculation system	Check the system; if there is a problem, check its component parts.

VACUUM HOSES

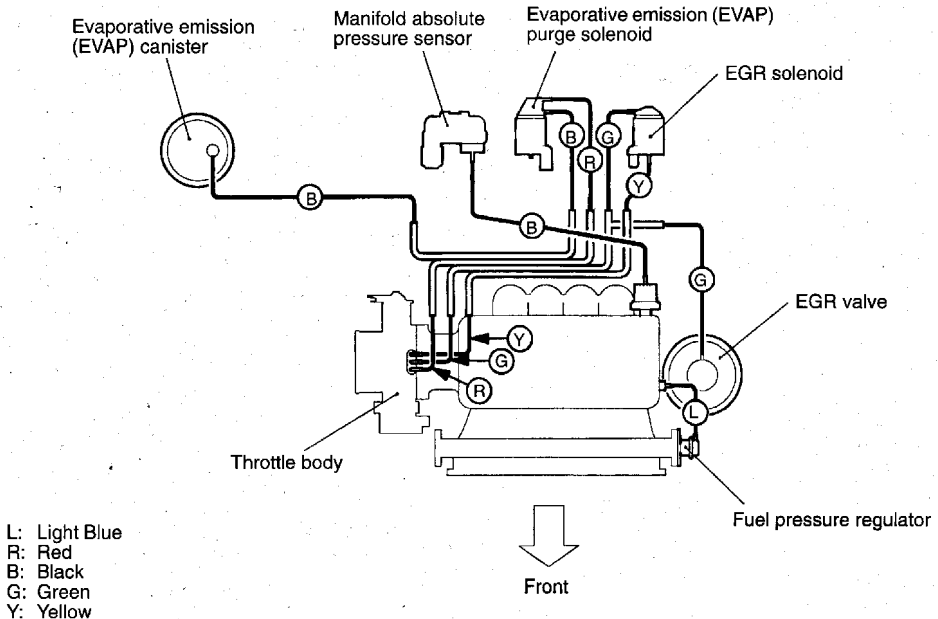
VACUUM HOSES ROUTING

<Federal - 1993 model - 1.5L Engine>



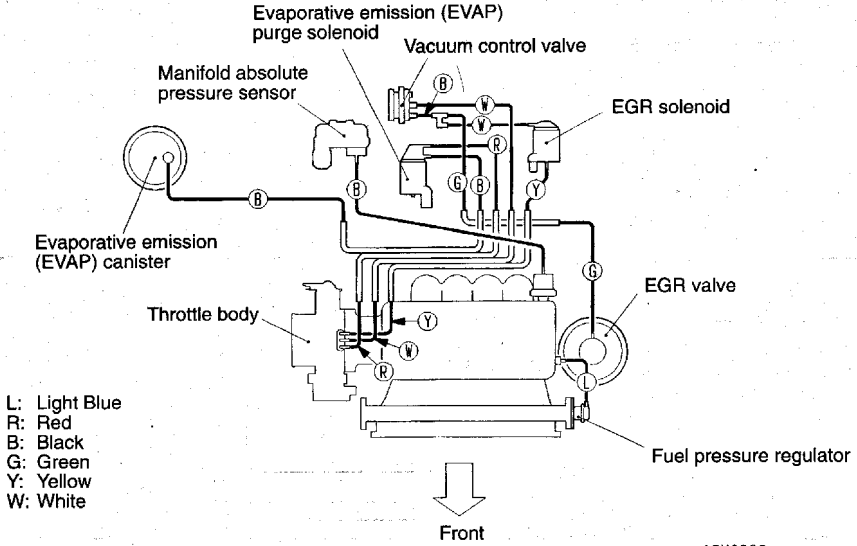
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<Federal - 1994 and 1995 models - 1.5L Engine, California - Up to 1994 model - 1.5L Engine>



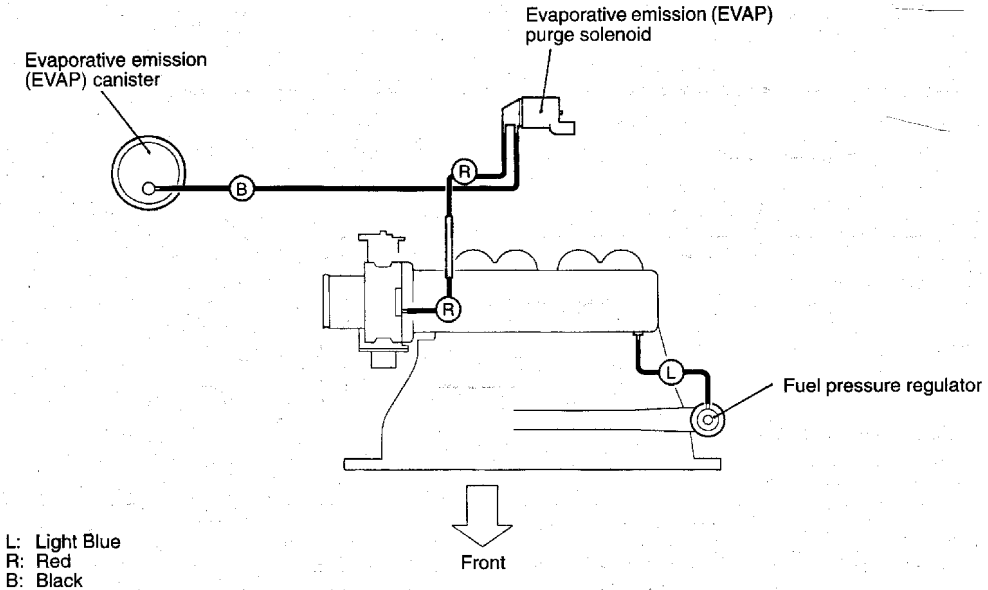
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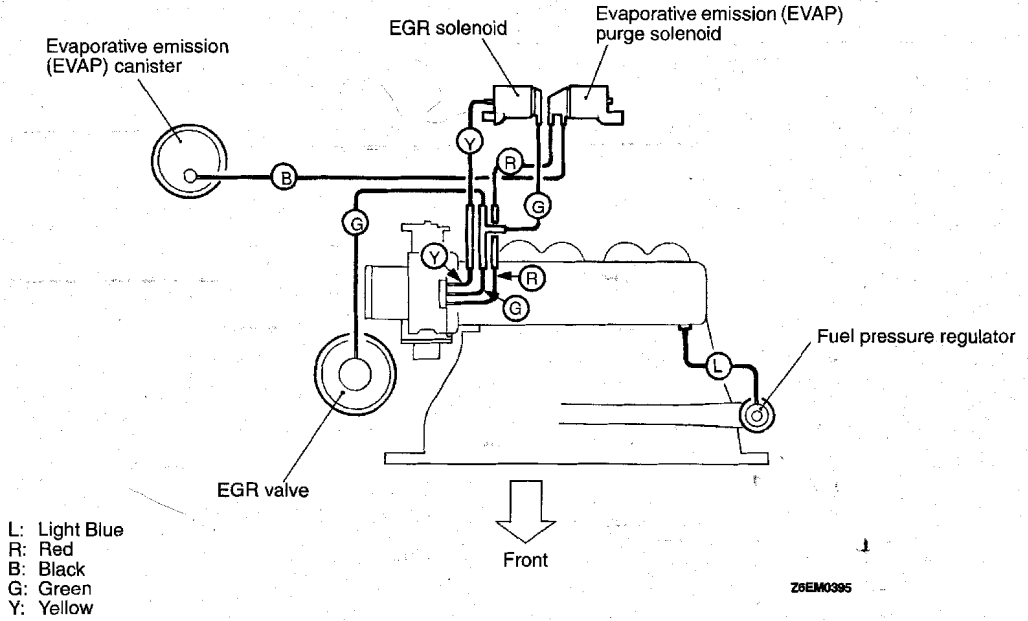


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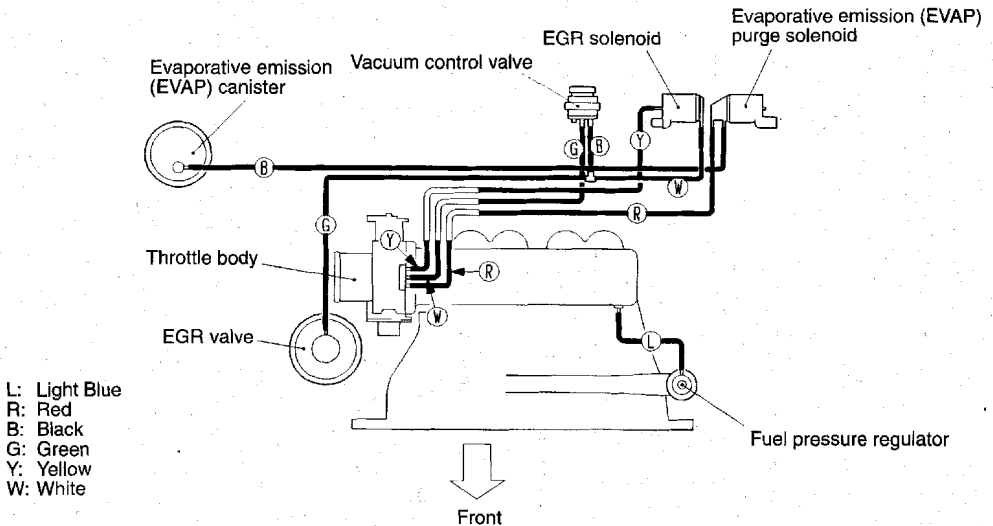
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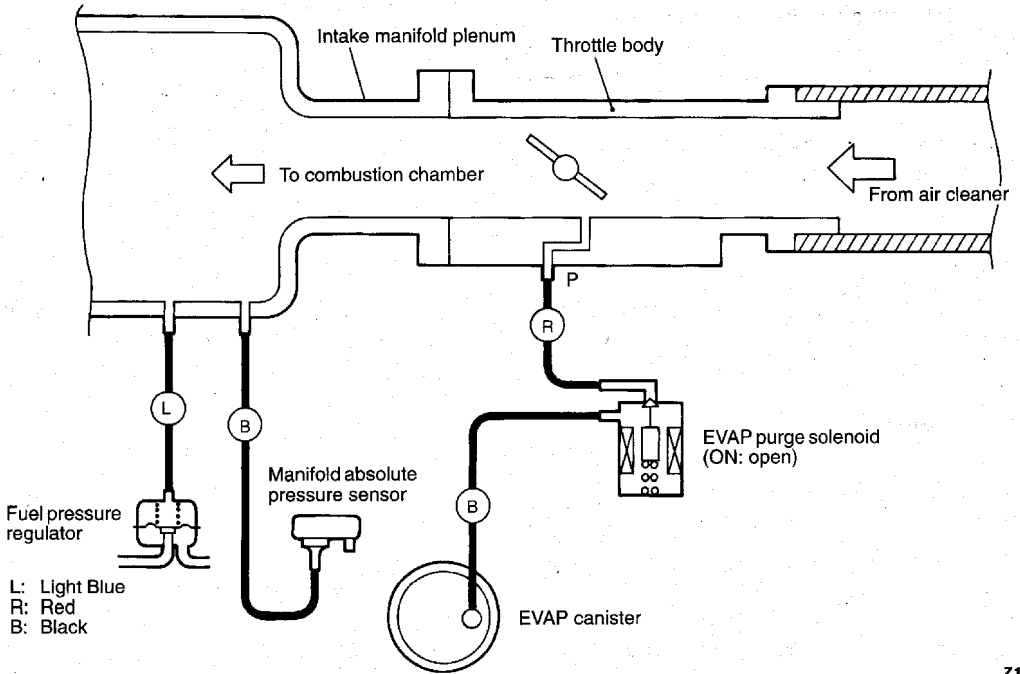


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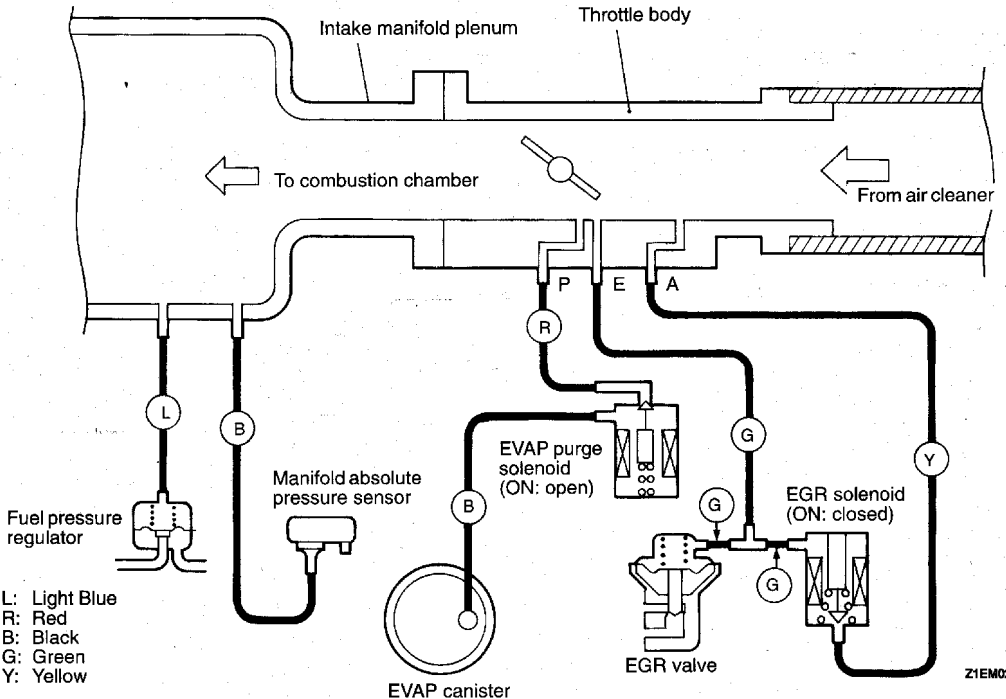
VACUUM CIRCUIT DIAGRAM

<Federal - 1993 model - 1.5L Engine>



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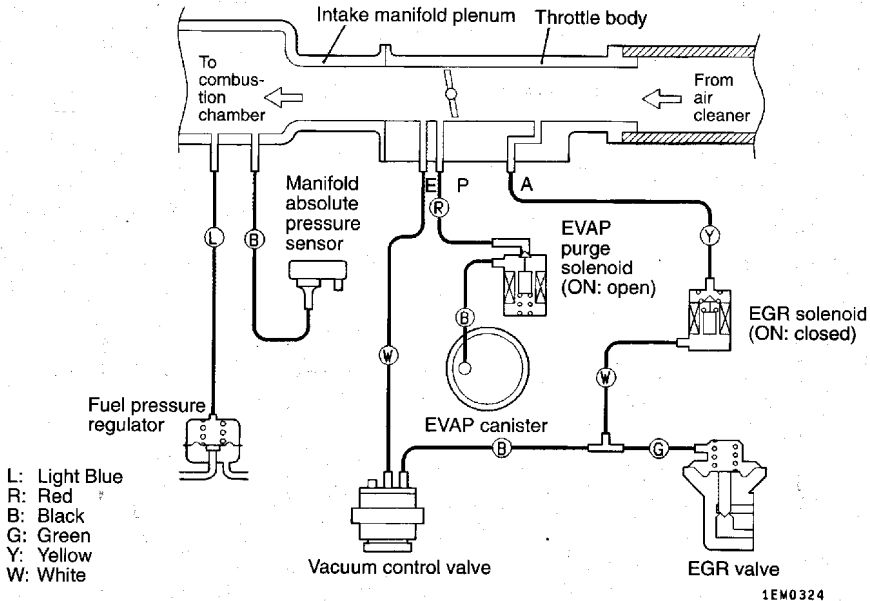
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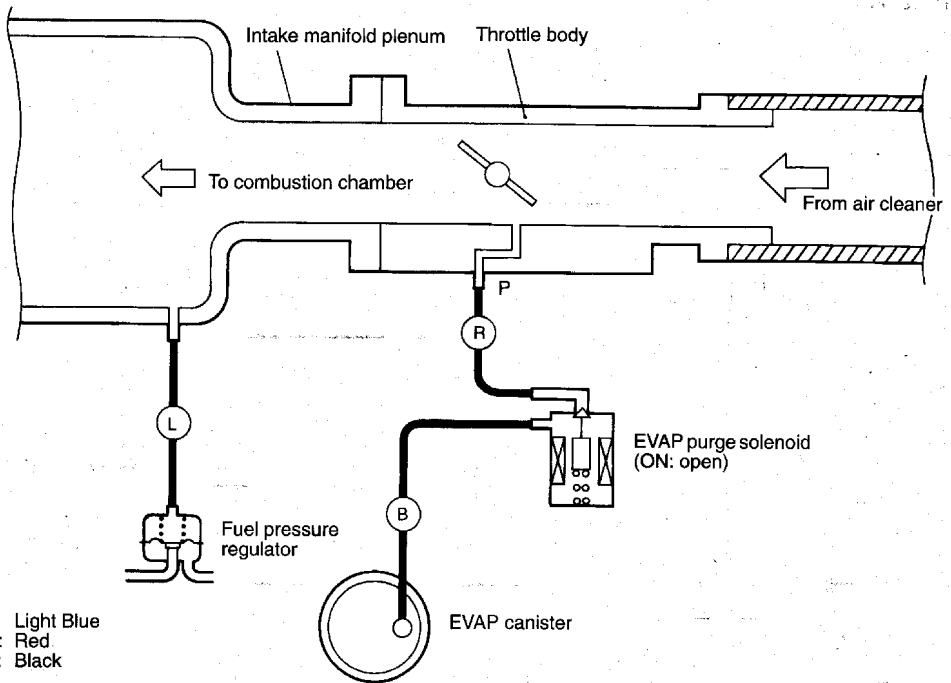
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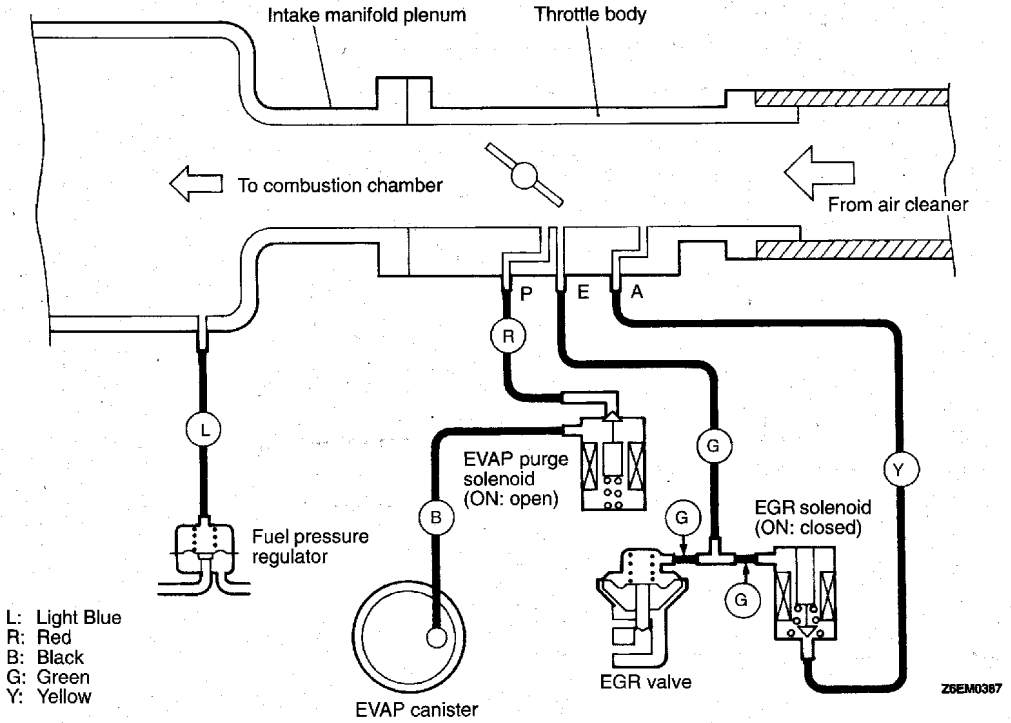


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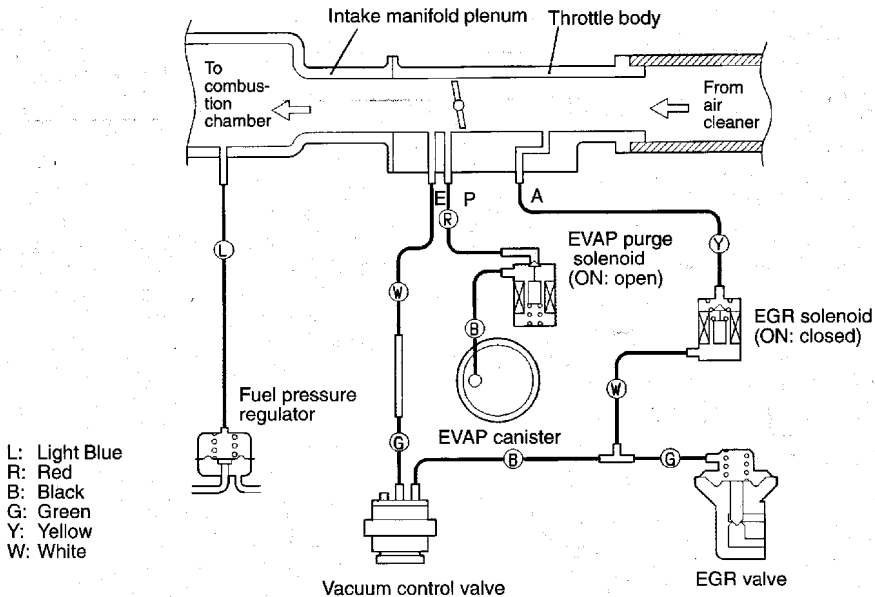
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<Federal – 1994 and 1995 models – 1.8L Engine, California – Up to 1994 model – 1.8L Engine>



<Federal – From 1996 model – 1.8L Engine, California – From 1995 model – 1.8L Engine>



## INSPECTION

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- (1) Referring to the VACUUM HOSES ROUTING, confirm that the vacuum hoses are properly connected.
- (2) Check the hoses for irregularities (disconnection, looseness, etc.) and confirm that there is no breakage or damage.

## INSTALLATION

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- (1) When connecting a hose, firmly press it onto the nipple.
- (2) Referring to the VACUUM HOSES ROUTING, connect the hoses correctly.

## POSITIVE CRANKCASE VENTILATION SYSTEM

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### GENERAL INFORMATION

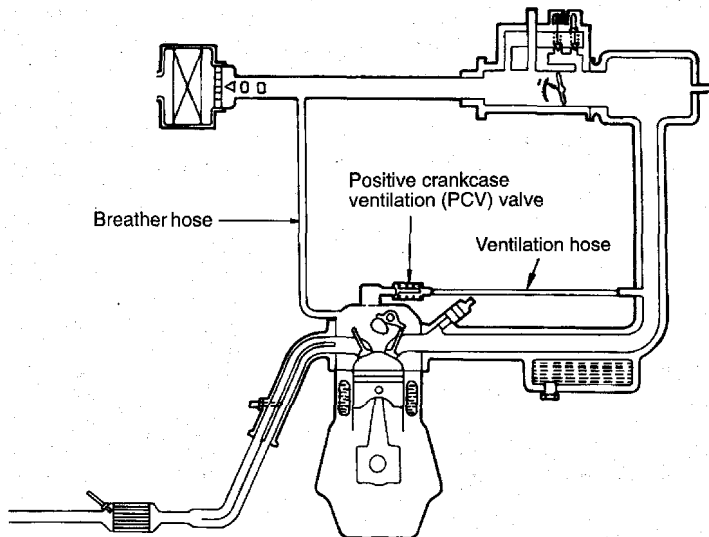
The positive crankcase ventilation system prevents blowby gases enter from inside the crankcase into the atmosphere.

Fresh air is sent from the air cleaner into the crankcase through the breather hose to be mixed with the blowby gases inside the crankcase.

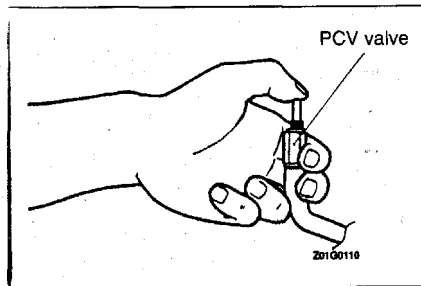
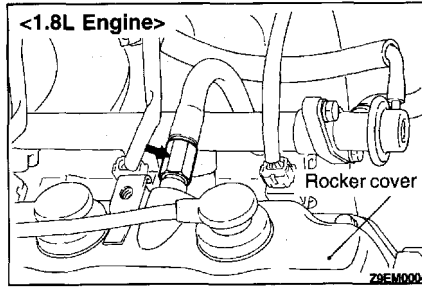
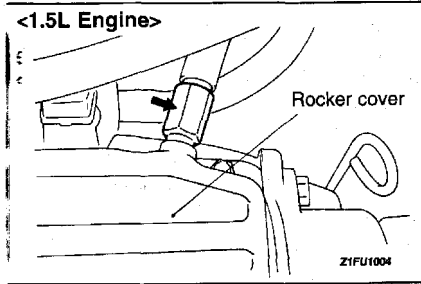
The blowby gas inside the crankcase is drawn into the intake manifold through the positive crankcase ventilation valve.

The positive crankcase ventilation valve is designed to lift the plunger according to the intake manifold vacuum so as to regulate the flow of blowby gas properly.

In other words, the blowby gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.



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**COMPONENT LOCATION****Positive crankcase ventilation valve****CRANKCASE VENTILATION SYSTEM INSPECTION**

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- (1) Remove the ventilation hose from the positive crankcase ventilation valve.
- (2) Remove the positive crankcase ventilation valve from the rocker cover.
- (3) Reinstall the positive crankcase ventilation valve at the ventilation hose.
- (4) Start the engine and run at idle.
- (5) Place a finger at the opening of the positive crankcase ventilation valve and confirm that vacuum of the intake manifold is felt.

**NOTE**

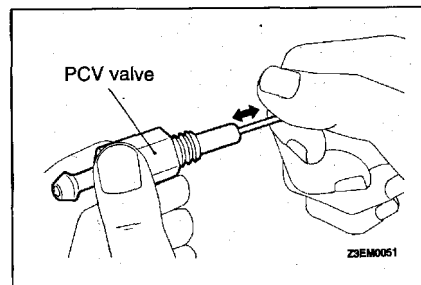
At this moment, the plunger in the positive crankcase ventilation valve moves forward and backward.

- (6) If vacuum is not felt, clean the positive crankcase ventilation valve or replace it.

**POSITIVE CRANKCASE VENTILATION (PCV) VALVE INSPECTION**

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- (1) Slide in a narrow stick at the threaded side of the positive crankcase ventilation valve and make sure that the plunger moves.
- (2) If the plunger does not move, there is a clogging in the positive crankcase ventilation valve. In this case, clean or replace the valve.

**INSTALLATION**

Install positive crankcase ventilation valve and tighten to specified torque.

**Specified torque: 10 Nm (7.2 ft.lbs.)**

# EVAPORATIVE EMISSION CONTROL SYSTEM

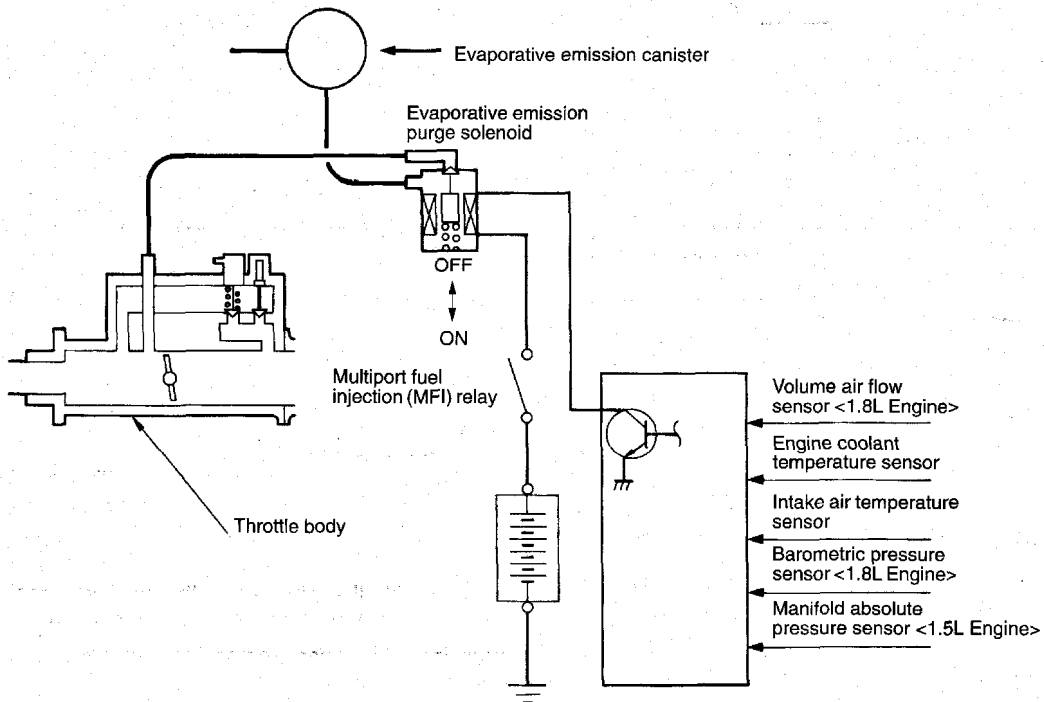
## GENERAL INFORMATION

The evaporative emission control system prevents fuel vapors generated in the fuel tank from escaping into the atmosphere.

Fuel vapors from the fuel tank flow through the fuel tank pressure control valve and vapor pipe/hose to be stored temporarily in the EVAP canister.

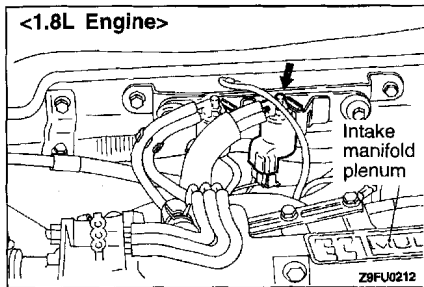
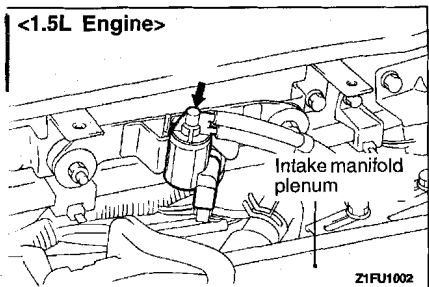
When the vehicle is in operation, fuel vapors stored in the EVAP canister flow through the EVAP purge solenoid and purge port and go into the intake manifold plenum to be sent to the combustion chamber.

When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control module brings the EVAP purge solenoid into the OFF state to shut off the fuel vapor flow to the intake manifold plenum. This not only insures the driveability when the engine is cold or running under low load but also stabilizes the emission level.

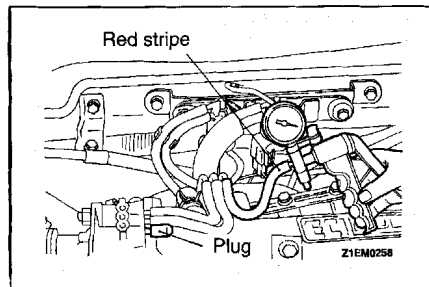
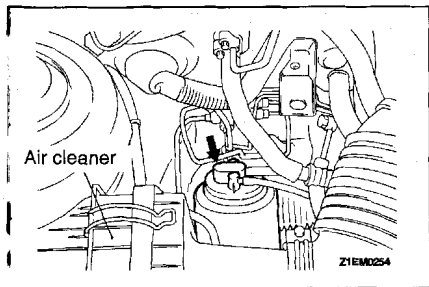


**COMPONENT LOCATION**

**Evaporative emission (EVAP) purge solenoid**



**Evaporative emission (EVAP) canister**



**PURGE CONTROL SYSTEM INSPECTION**

- (1) Disconnect the vacuum hose (red stripes) from the throttle body and connect it to a hand vacuum pump.
- (2) Plug the nipple from which the vacuum hose was removed.
- (3) When the engine is cold and hot, apply a vacuum while the engine is idling, and check the condition of the engine and the vacuum.

**When engine is cold**

**[Coolant temperature: 40°C (104°F) or less]**

Vacuum	Engine status	Normal condition
400 mmHg (15.7 in.Hg)	3,500 r/min	Vacuum is maintained

**When engine is hot**  
**[Coolant temperature: 80°C (176°F) or higher]**

Vacuum	Engine status	Normal condition
400 mmHg (15.7 in.Hg)	Idling	Vacuum is maintained
	3,500 r/min	Vacuum will leak for approximately 3 minutes after the engine is started. After 3 minutes have elapsed, the vacuum will be maintained momentarily, after which it will again leak.*

**NOTE**

\* The vacuum will leak continuously if the atmospheric pressure is approximately 580 mmHg (22.8 in.Hg) or less, or the temperature of the intake air is approximately 50°C (122°F) or higher.

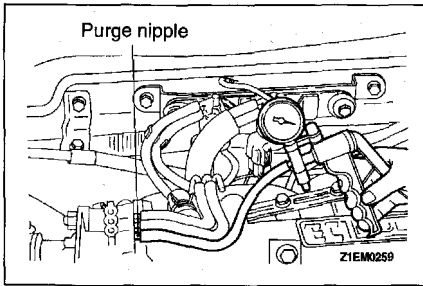
**PURGE PORT VACUUM INSPECTION**

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**CHECK CONDITION**

**Coolant temperature: 80–95°C (176–203°F)**

- (1) Disconnect the vacuum hose (red stripe) from the throttle body purge vacuum nipple and connect a hand vacuum pump to the nipple.

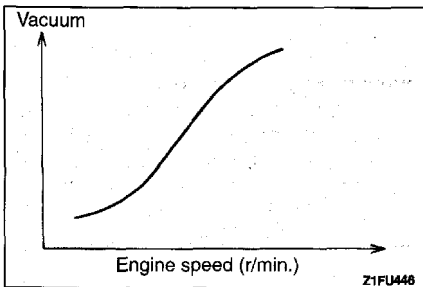


**<Federal – Up to 1995 model, California – Up to 1994 model>**

- (2) Start the engine and check to see that, after raising the engine speed by racing the engine, purge vacuum raises proportionately with the rise in engine speed.

**NOTE**

If there is a problem with the change in vacuum, it is possible that the throttle body purge port may be clogged and require cleaning.

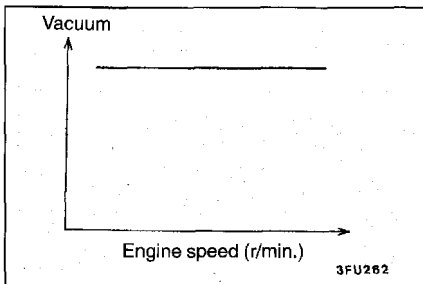


**<Federal – From 1996 model, California – From 1995 model>**

Start the engine and check to see that, after raising the engine speed by racing the engine, purge vacuum is kept constant regardless of the increased engine speed.

**NOTE**

If there is no vacuum created, it is possible that the throttle body purge port may be clogged and require cleaning.



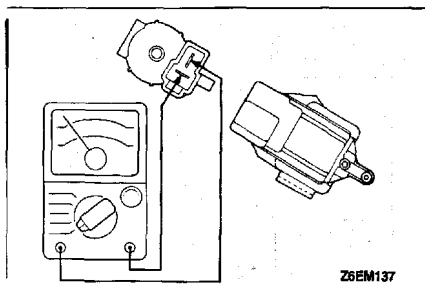
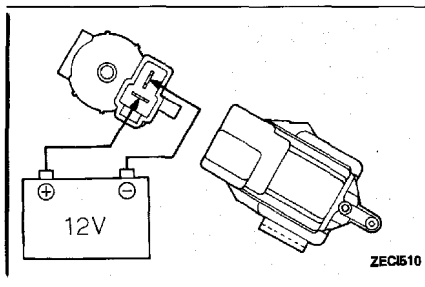
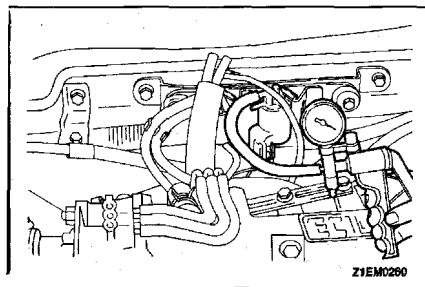
**EVAPORATIVE EMISSION PURGE SOLENOID INSPECTION**

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**NOTE**

When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

- (1) Disconnect the vacuum hose (black, red stripes) from the solenoid valve.
- (2) Disconnect the harness connector.
- (3) Connect a hand vacuum pump to the nipple to which the vacuum hose with red-stripes was connected.



- (4) Check airtightness by applying a vacuum with voltage applied directly from the battery to the evaporative emission purge solenoid and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained

- (5) Measure the resistance between the terminals of the solenoid valve.

**Standard value:**

36–44  $\Omega$  [at 20°C (68°F)]

<Federal – Up to 1995 model, California – Up to 1994 model>

62–74  $\Omega$  [at 20°C (68°F)]

<Federal – From 1996 model, California – From 1995 model>

**VOLUME AIR FLOW SENSOR, ENGINE COOLANT TEMPERATURE SENSOR AND INTAKE AIR TEMPERATURE SENSOR**

110007722

To inspect these parts, refer to GROUP 13A – On Vehicle Inspection of MFI Components.

**AIR CONDITIONING SWITCH**

110007723

To inspect the air conditioning switch, refer to GROUP 55 – Air Conditioning Switch.

# EXHAUST GAS RECIRCULATION (EGR) SYSTEM <Federal - From 1994 model, California>

11000772

## GENERAL INFORMATION

The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NOx) emission level. When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber. Therefore, this system recirculates part of emission gas from the exhaust

port of the cylinder head to the combustion chamber through the intake manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx.

The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

## OPERATION

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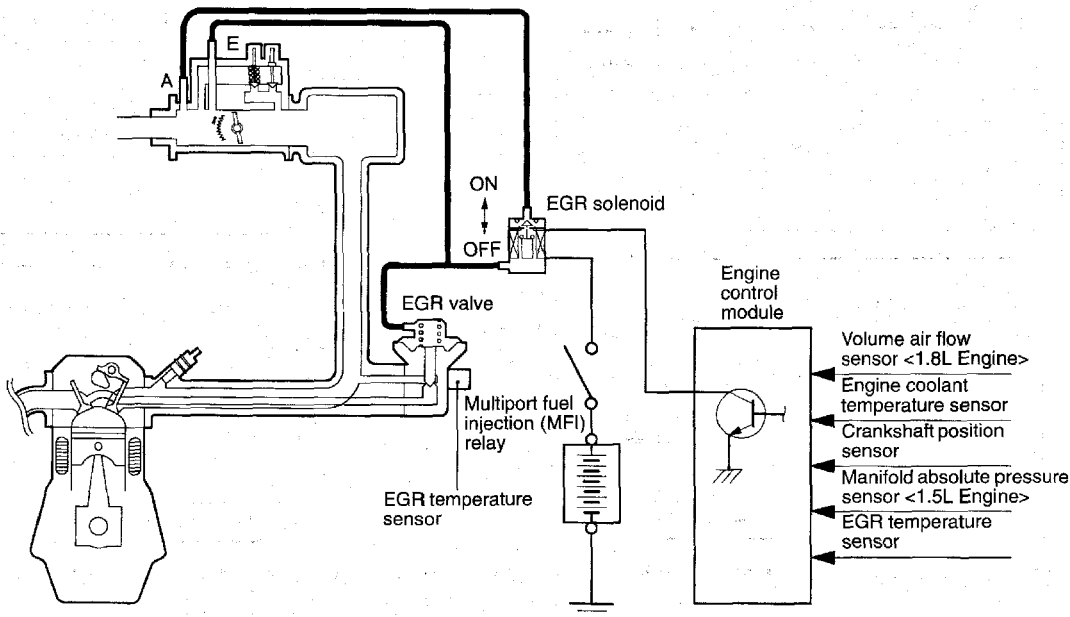
The EGR valve is being closed under one of the following conditions:

- When the engine coolant temperature is low.
- When the engine is at idle.
- When the throttle valve is widely opened.

In order to recirculate exhaust gases, the EGR valve opens under the other conditions after warming up the engine.

In addition, the engine control module monitors the EGR system and illuminates the check engine/malfunction indicator light to let the driver know that there is a malfunction.

<Federal - Up to 1995 model, California - Up to 1994 model>

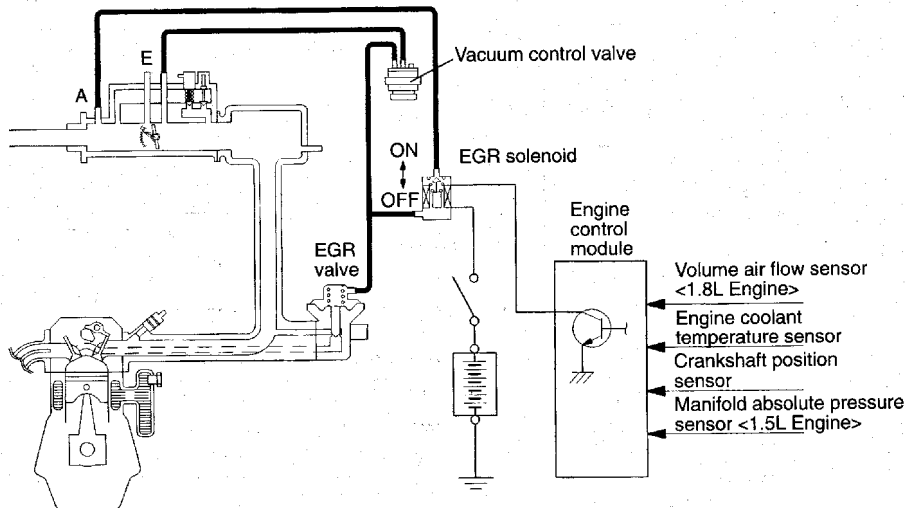


# Exhaust Gas Recirculation (EGR) System

## EMISSION CONTROL – <Federal – From 1994 model, California>

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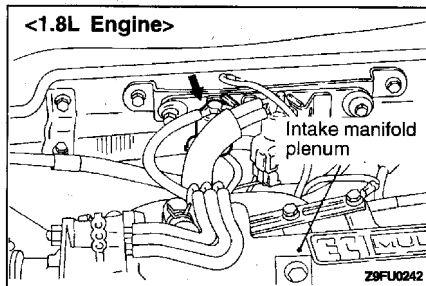
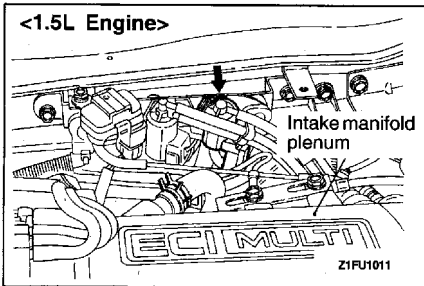
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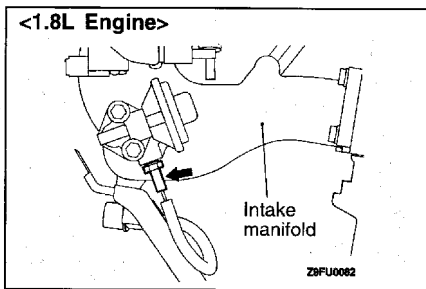
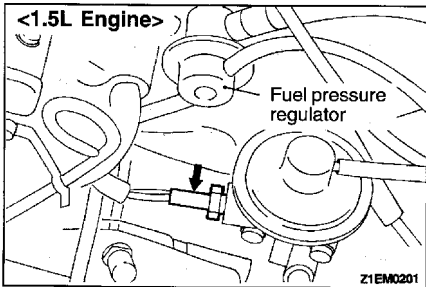
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## COMPONENT LOCATION

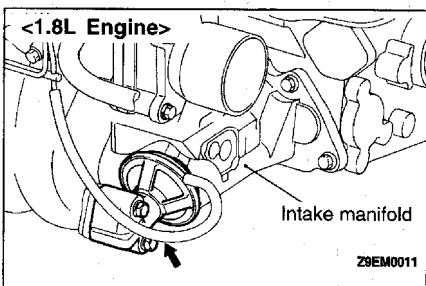
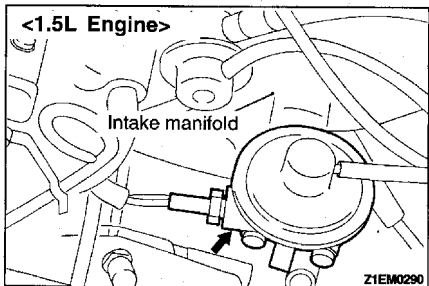
## EGR solenoid

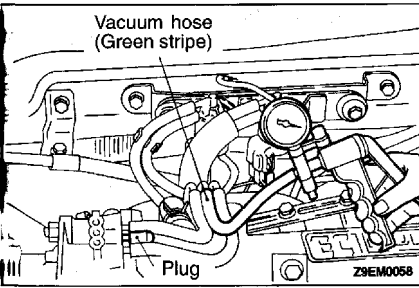


## EGR temperature sensor &lt;Federal – Up to 1995 model, California – Up to 1994 model&gt;



## EGR valve





**EGR SYSTEM INSPECTION**

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**<1.5L Engine - Federal - Up to 1995 model, 1.5L Engine - California - Up to 1994 model>**

- (1) Disconnect the vacuum hose (green stripe) from the throttle body, and connect a hand vacuum pump to the vacuum hose.
- (2) Plug the nipple from which the vacuum hose was disconnected.
- (3) When the engine is cold and hot, apply a vacuum while the engine is idling, and check the condition of the engine and the vacuum.

**When engine is cold**

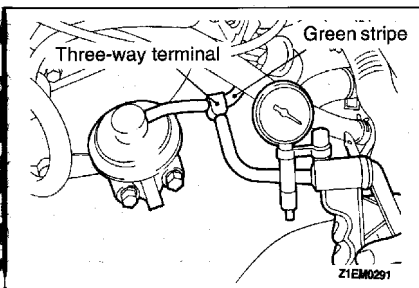
**[Engine coolant temperature: 40°C (104°F) or less]**

Hand vacuum pump	Normal engine condition	Normal vacuum condition
Vacuum is applied	No change	Vacuum leaks

**When engine is hot**

**[Engine coolant temperature: 80°C (176°F) or higher]**

Hand vacuum pump	Normal engine condition	Normal vacuum condition
40 mmHg (1.6 in.Hg) of vacuum is applied	No change	Vacuum is maintained
200 mmHg (7.9 in.Hg) of vacuum is applied	Idling becomes slightly unstable	



**<1.5L Engine - Federal - From 1996 model, 1.5L Engine - California - From 1995 model, 1.8L Engine>**

- (1) Disconnect the vacuum hose (green striped) from the exhaust gas recirculation (EGR) valve, and then connect a hand vacuum pump via the three-way terminal.
- (2) Regarding the engine in cold and hot conditions, check the condition of vacuum when a rapid racing has been performed by opening the throttle valve quickly.

**When engine is cold**

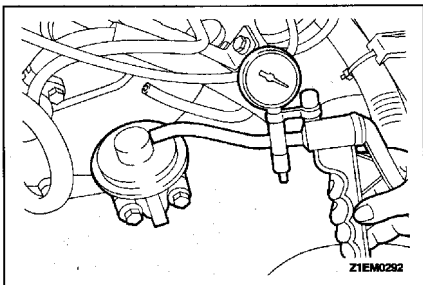
**[Engine coolant temperature: 20°C (68°F) or less]**

Throttle valve	Normal vacuum condition
Open quickly	No vacuum will generate (remained as barometric pressure).

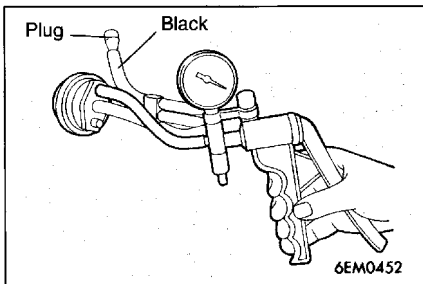
**When engine is hot**

**[Engine coolant temperature: 70°C (158°F) or higher]**

Throttle valve	Normal vacuum condition
Open quickly	It will momentarily rise over 100 mmHg (3.9 in.Hg).



- (3) Disconnect the three-way terminal.
- (4) Connect the hand vacuum pump directly to the exhaust gas recirculation (EGR) valve.
- (5) Check whether the engine stalls or the idling is unstable when a vacuum of 200 mmHg (7.9 in.Hg) or higher is applied during idling.



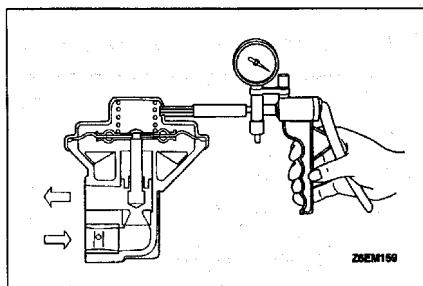
## VACUUM CONTROL VALVE INSPECTION

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<Federal – From 1996 model, California – From 1995 model>

- (1) Disconnect the vacuum hose (Black) from the vacuum control valve and connect the hand vacuum pump to the vacuum control valve.
- (2) Put the blind plug to the removed vacuum hose.
- (3) Start the engine and run at idle.
- (4) Check the vacuum condition.

Engine condition	Normal vacuum condition
Idling	Approx. 170 mmHg (6.7 in.Hg)



## EGR VALVE INSPECTION

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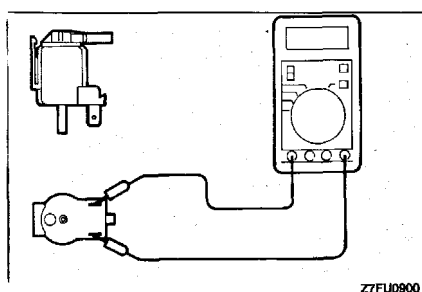
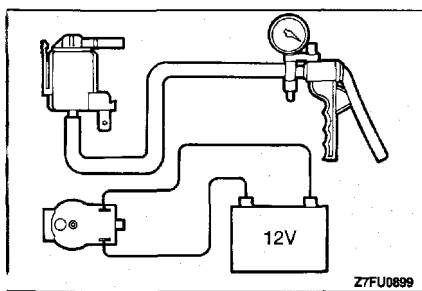
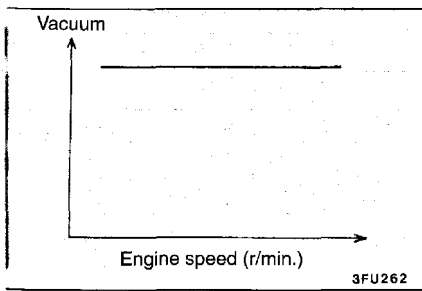
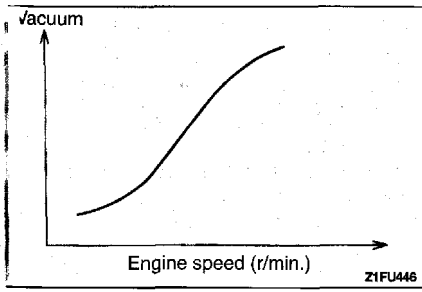
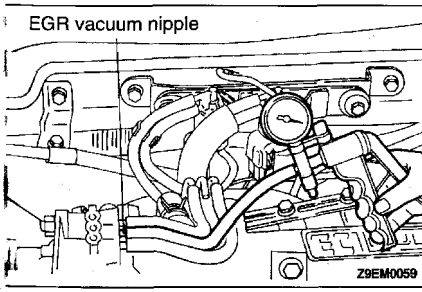
- (1) Remove the EGR valve and inspect for sticking, carbon deposits, etc. If found, clean with a suitable solvent so that the valve seats correctly.
- (2) Connect a hand vacuum pump to the EGR valve.
- (3) Apply 500 mmHg (20 in.Hg) of vacuum, and check to be sure that the vacuum is maintained.
- (4) Apply a vacuum and check the passage of air by blowing through one side of the EGR passage.

Vacuum	Passage of air
40 mmHg (1.6 in.Hg) or less	Air is not blown out
200 mmHg (7.9 in.Hg) or more	Air is blown out

## INSTALLATION

Use a new gasket, and tighten to the specified torque.

**Specified torque: 22 Nm (16 ft.lbs.)**



**EGR PORT VACUUM INSPECTION**

110007728

**CHECK CONDITION**

**Coolant temperature: 85-95°C (176-203°F)**

- (1) Disconnect the vacuum hose (green stripe) from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.

- (2) <Federal - Up to 1995 model, California - Up to 1994 model>

Start the engine and check to see that, after raising the engine speed by racing the engine, EGR vacuum raises proportionately with the rise in engine speed.

**NOTE**

If there is a problem with the change in vacuum, it is possible that the throttle body EGR port may be clogged and require cleaning.

- <Federal - From 1996 model, California - From 1995 model>

Start the engine and check to see that, after raising the engine speed by racing the engine, vacuum remains fairly constant.

**EGR SOLENOID INSPECTION**

110007491

**NOTE**

When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

- (1) Disconnect the vacuum hose (yellow stripe, green stripe) from the solenoid valve.
- (2) Disconnect the harness connector.
- (3) Connect a hand vacuum pump to the nipple to which the green-striped vacuum hose was connected.
- (4) Check airtightness by applying a vacuum with voltage applied directly from the battery to the EGR solenoid and without applying voltage.

Batter voltage	Normal condition
Applied	Vacuum maintained
Not applied	Vacuum leaks

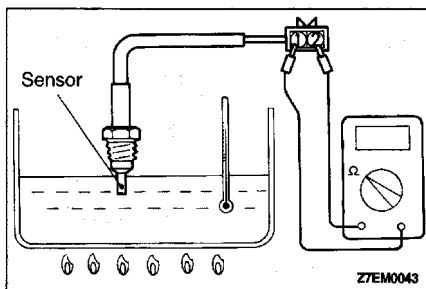
- (5) Measure the resistance between the terminals of the solenoid valve.

**Standard value:**36–44  $\Omega$  [at 20°C (68°F)]

&lt;Federal – Up to 1995 model, California – Up to 1994 model&gt;

62–74  $\Omega$  [at 20°C (68°F)]

&lt;Federal – From 1996 model, California – From 1995 model&gt;

**EGR TEMPERATURE SENSOR INSPECTION**

110007725

&lt;Federal – Up to 1995 model, California – Up to 1994 model&gt;

- (1) Remove the EGR temperature sensor.
  - (2) Place the EGR temperature sensor in water, and then measure the resistance value between terminals (1) and (2) while increasing the water's temperature.
- Replace the EGR temperature sensor if there is a significant deviation from the standard value.

Temperature [°C (°F)]	Resistance (k $\Omega$ )
50 (122)	60–83
100 (212)	11–14

**INSTALLATION**

Install the EGR temperature sensor, and tighten to specified torque.

**Specified tightening torque: 10–12 Nm (7.3–8.6 ft.lbs.)**

**CATALYTIC CONVERTER**

110007493

**GENERAL INFORMATION**

The three-way catalytic converter, together with the closed loop air-fuel ratio control based on the oxygen sensor signal, oxidizes carbon monoxides (CO) and hydrocarbons (HC) and reduces nitrogen oxides (NOx).

When the mixture is controlled at stoichiometric air-fuel ratio, the three-way catalytic converter provides the highest purification against the three constituents, namely, CO, HC and NOx.

**REMOVAL AND INSTALLATION**

110007730

For removal and installation procedures, refer to GROUP 15 – Exhaust Pipes and Main Muffler.

**INSPECTION**

110007495

Inspect for damage, cracking or deterioration. Replace if faulty.

**Caution**

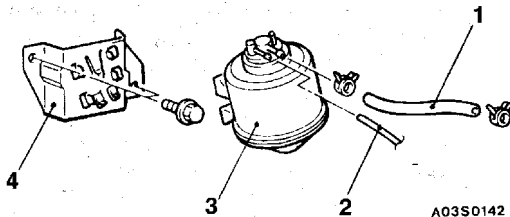
- 1. Stop the engine immediately if engine misfiring occurs, otherwise an abnormally hot exhaust system will damage the catalytic converter or other under-body parts.**
- 2. Correct and repair the ignition or fuel system if there are malfunctions, otherwise engine misfiring may occur which will damage the catalytic converter.**
- 3. Observe manufacturer's specifications when doing service work.**

# EVAPORATIVE EMISSION CANISTER

## REMOVAL AND INSTALLATION

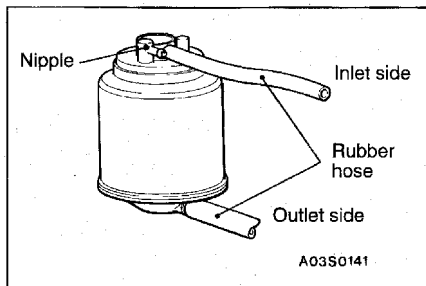
### Pre-removal and Post-installation Operation

- Air Cleaner Removal and Installation  
(Refer to GROUP 15 – Air Cleaner.)



### Removal steps

1. Vapor hose
2. Purge hose
3. Evaporative emission canister
4. Canister bracket



## INSPECTION

### SIMPLE INSPECTION OF CHECK VALVE INSIDE CANISTER

- (1) Connect clean rubber hoses to the nipples on the inlet side and outlet side.
- (2) Close off the other nipple with your finger and then check the operation of the check valve.

Inspection procedure	Normal condition
Lightly blow from inlet side (fuel tank side).	Air passes through with a slight feeling of resistance.
Lightly blow from outlet side (atmosphere side).	Air passes through.