# 4 DRIVEABILITY AND EMISSIONS CONTROLS

# EMISSION CONTROLS

## Crankcase Ventilation System

### OPERATION

**➧ See Figures 1, 2, and 3**

All engines are equipped with the Positive Crankcase Ventilation (PCV) system. The PCV system vents crankcase gases into the engine air intake where they are burned with the fuel and air mixture. The PCV system keeps pollutants from being released into the atmosphere. It also helps to keep the engine oil clean, by ridding the crankcase of moisture and corrosive fumes. The PCV system consists of the PCV valve, the nipple in the air intake and the connecting hoses.

Incorrect operation of the PCV system can cause multiple driveability symptoms.

A plugged valve or hose may cause:

- Rough idle
- Stalling or slow idle speed
- Oil leaks

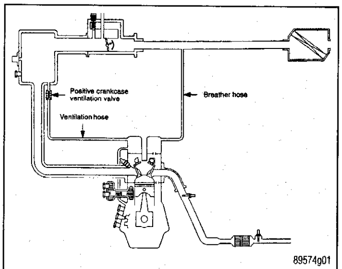

**Fig. 1 Typical PCV system airflow**

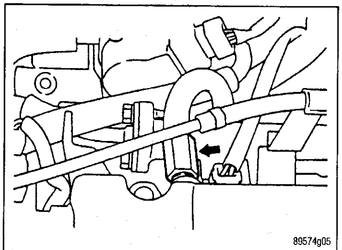

**Fig. 2 The PCV valve can be found either threaded to the valve cover, . . .**

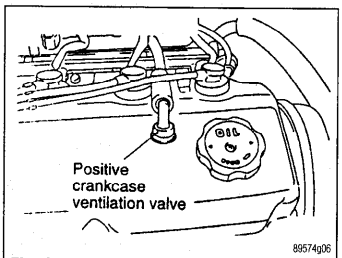

**Fig. 3 . . . or mounted in a grommet on the valve cover**

- Sludge in engine

A leaking valve or hose would cause:

- Rough idle
- Stalling
- High idle speed

### COMPONENT TESTING

**➧ See Figures 4 and 5**

1. Disconnect the ventilation hose from the PCV valve. Remove the PCV valve from the engine. Once removed, reconnect the ventilation hose to the valve.
2. Start the engine and allow to idle. Place a finger over open end of the PCV valve. Make sure intake manifold vacuum is felt on finger.
3. If vacuum is not felt, the PCV valve may be restricted.
4. Turn the engine **OFF** and remove the PCV valve from the hose.
5. Insert a thin stick into the threaded end of the PCV valve. Push on the inner plunger and inspect for movement.
6. If plunger inside the PCV valve is not free to move back and forth, the valve is clogged and will require replacement.

**➡It is possible to clean the valve using the appropriate solvent, but replacement is recommended.**

### REMOVAL & INSTALLATION

For PCV valve removal and installation, please refer to Section 1 of this manual.

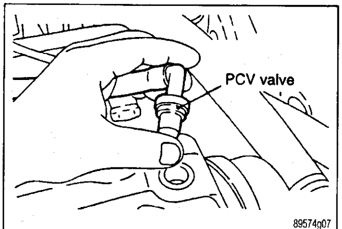

**Fig. 4 With the engine idling, check the end of the PCV valve to see if vacuum is present**

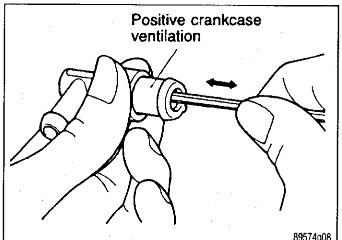

**Fig. 5 Inspect the PCV valve for inner plunger movement. If the plunger is bound or sticking, replace the valve**

## Evaporative Emission Controls

### OPERATION

**➧ See Figures 6 and 7**

Changes in atmospheric temperature cause fuel tanks to breathe, that is, the air within the tank expands and contracts with outside temperature changes. If an unsealed system was used, when the temperature rises, air would escape through the tank vent tube or the vent in the tank cap. The air which escapes contains gasoline vapors.

The Evaporative Emission Control System provides a sealed fuel system with the capability to store and condense fuel vapors. When the fuel evaporates in the fuel tank, the vapor passes through the EVAP emission valve, through vent hoses or tubes to a carbon filled evaporative canister. When the engine is operating the vapors are drawn into the intake manifold and burned during combustion.

A sealed, maintenance free evaporative canister is used. The canister is filled with granules of an activated carbon mixture. Fuel vapors entering the canister are absorbed by the charcoal granules. A vent cap is located on the top of the canister to provide fresh air to the canister when it is being purged. The vent cap opens to provide fresh air into the canister, which circulates through the charcoal, releasing trapped vapors and carrying them to the engine to be burned.

Fuel tank pressure vents fuel vapors into the canister. They are held in the canister until they can be drawn into the intake manifold. The canister purge valve allows the canister to be purged at a pre-determined time and engine operating conditions.

Vacuum to the canister is controlled by the canister purge valve. The valve is operated by the PCM. The PCM regulates the valve by switching the ground circuit on and off based on engine operating conditions. When energized, the valve prevents vacuum from reaching the canister. When not energized the valve allows vacuum to purge the vapors from the canister.

During warm up and for a specified time after hot starts, the PCM energizes (grounds) the valve preventing vacuum from reaching the canister. When the engine temperature reaches the operating level of about 120°F (49°C), the PCM removes the ground from the valve allowing vacuum to flow through the canister and purges vapors through the throttle body. During certain idle conditions, the purge valve may be grounded to control fuel mixture calibrations.

The fuel tank is sealed with a pressure-vacuum relief filler cap. The relief valve in the cap is a safety feature, preventing excessive pressure or vacuum in the fuel tank. If the cap is malfunctioning, and needs to be replaced, ensure that the replacement is the identical cap to ensure correct system operation.

#### OBD-II EVAP System Monitor

Some models have added system components due to the EVAP system monitor incorporated in the OBD-II engine control system. A pressure sensor is mounted on the fuel tank which measures pressure inside the tank, and a purge flow sensor measures the flow of the gases from the canister into the engine.

The PCM can store trouble codes for EVAP system performance, a list of the codes is provided later

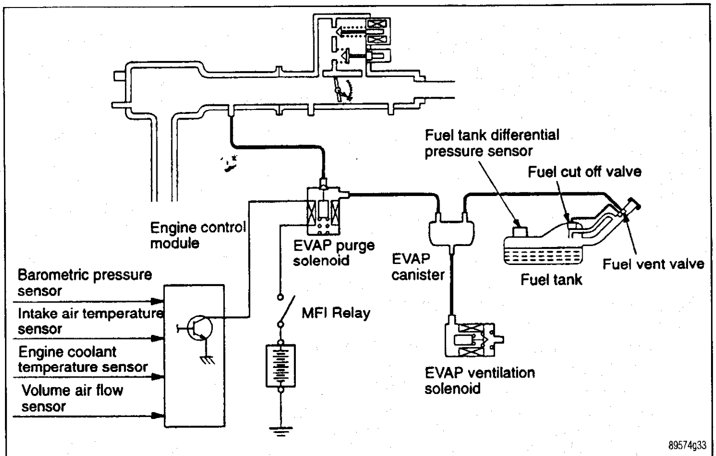


Fig. 6 Typical evaporative emission control system schematic

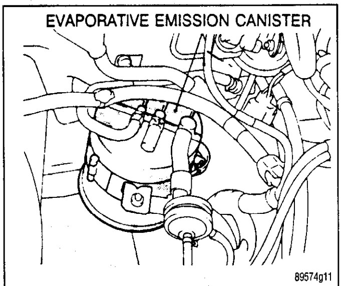


Fig. 7 Evaporative emission canister commonly used on most models

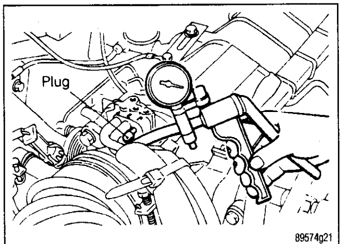


Fig. 8 To test the purge control operation, connect the vacuum hose from the throttle body to a vacuum pump

in this section. Normal testing procedures can be used, see EVAP System Component Testing in this Section.

## COMPONENT TESTING

### Purge Control System Check

#### 1990–93 VEHICLES EXCEPT 1990–92 2.0L DOHC TURBO

**See Figure 8**

1. Disconnect the red striped vacuum hose from the throttle body and connect it to a hand held vacuum pump.
2. Plug the open nipple on the throttle body.
3. Using the hand pump, apply vacuum while the engine is idling. Check that vacuum is maintained or released as outlined below:
   a. With the engine coolant at 140°F (60°C) or less—14.8 in. Hg of vacuum is maintained.
   b. With the coolant at 158°F (70°C) or higher—14.8 in. Hg of vacuum is maintained.
4. With the engine coolant at 158°F (70°C) or higher, run the engine at 3000 rpm within 3 minutes of starting vehicle. Try to apply vacuum using the hand held pump. Vacuum should leak.
5. With the engine coolant at 158°F (70°C) or higher, run the engine at 3000 rpm after 3 minutes have elapsed after starting vehicle. Apply 14.8 in. Hg of vacuum. The vacuum should be maintained momentarily, after which it should leak.

**➡The vacuum will leak continuously if the altitude is 7,200 ft. or higher, or the intake air temperature is 122°F (50°C) or higher.**

6. If the test results differ from the desired results, the purge control system is not operating properly.

#### 1990–92 2.0L DOHC TURBO ENGINES

1. Disconnect the purge air hose from the intake hose and plug the air intake hose.
2. Connect a hand vacuum pump to the purge air hose.
3. Under various engine conditions, inspect the system operation:
   a. Allow the engine to cool to a temperature of 140°F (60°C) or below.
   b. Start the engine and run at idle.
   c. Using the hand pump, apply 14.8 in. Hg of vacuum. In this condition, the vacuum should be maintained.
   d. Raise the engine speed to 3000 rpm.
   e. Using the hand pump, apply 14.8 in. Hg of vacuum. In this condition, the vacuum should be maintained.
4. Run the engine until the coolant temperature reaches 158°F (70°C). Inspect system operations as follows:
   a. Using the hand pump, apply 14.8 in. Hg of vacuum with the engine at idle. In this condition, vacuum should be maintained.
   b. Increase the engine speed to 3000 rpm within 3 minutes of starting the engine. Try applying vacuum. The vacuum should leak.
   c. After 3 minutes have elapsed after starting engine, raise the engine speed to 3000 rpm. Apply 14.8 in. Hg of vacuum. Vacuum should be maintained momentarily, after which it will leak.

**➡The vacuum will leak continuously if the altitude is 7200 ft. or higher or the air temperature is 122°F (50°C) or higher.**

5. If the results of either test differs from specifications, the system is not functioning properly and will require further diagnosis.

#### 1994–00 VEHICLES

**See Figure 9**

**➡This test requires the use of a special purge flow indicator tool, MB991700, or equivalent.**

1. Disconnect the purge hose from the EVAP canister, then connect Purge Flow Indicator MB991700, or equivalent between the canister and the purge hose.
2. The engine should be warmed up to operating temperature, 170–203°F. (80–95°C), with all lights, fans and accessories off. The transaxle should be in Park for automatics or Neutral for manuals.
3. Run the engine at idle for at least 3–4 minutes.
4. Check the purge flow volume when the brake is depressed suddenly a few times. The reading should be 2.5 SCFH (20cm/sec.)
5. If the volume is less than the standard value, check it again with the vacuum hose disconnected from the canister. If the purge flow volume is less than the standard, check for blockages in the vacuum port and vacuum hose, and also inspect the evaporative emission purge solenoid and purge control valve.

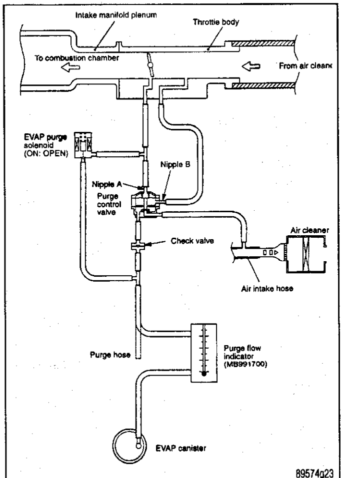


Fig. 9 Purge control system check—2.4L engine

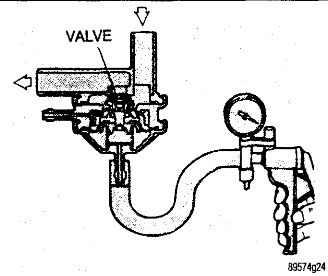


**Fig. 10 Attach a hand vacuum pump to the nipple on the purge control valve**

6. If the purge flow volume is at the standard value, replace the EVAP canister.

**Purge Control Valve**

***1990–93 2.0L TURBO ENGINE***

**➧ See Figure 10**

1. The purge control valve is located to the right side of the battery. Remove the purge control valve from the engine compartment.
2. Connect a hand vacuum pump to the vacuum nipple of the purge control valve.
3. Apply 15.7 in. Hg of vacuum and check air tightness. Blow in air lightly from the evaporative emission canister side nipple and check conditions as follows:
   - If there is no vacuum applied to the valve—air will not pass.
   - When 8.0 in. Hg of vacuum is applied to the valve—air will pass through.
4. Connect a hand vacuum pump to the positive pressure nipple of the purge control valve.
5. Apply a vacuum of 15.7 in. Hg and check for air tightness. The valve should be air tight.
6. If the results differ from the desired outcomes, replace the purge control valve.

**Evaporative Emission Purge Solenoid**

***1990–93 VEHICLES EXCEPT 1990–92 2.0L DOHC TURBO***

**➧ See Figures 11, 12, and 13**

1. Label and disconnect the 2 vacuum hoses from the purge control solenoid valve.
2. Detach the electrical harness connector from the solenoid.
3. Connect a hand vacuum pump to the nipple which the red striped vacuum hose was connected.
4. Check air tightness by applying a vacuum with voltage applied directly from the battery to the evaporative emission purge solenoid and without applying voltage. The desired results are as follows:
   - With battery voltage applied—vacuum should leak
   - With battery voltage not applied—vacuum should be maintained
5. Measure the resistance across the terminals of the solenoid. The desired reading is 36–44 ohms when at 68°F (20°C).
6. If any of the test results differ from the desired outcomes, replace the purge control solenoid.

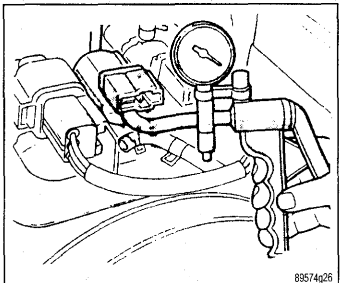


**Fig. 11 Use a hand-held vacuum gauge to check for air-tightness—1990–93 2.0L non-turbo and 1993 2.0L turbo engines**

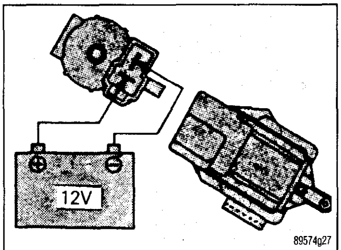


**Fig. 12 Battery voltage applied to the terminals of the evaporative emission purge solenoid**

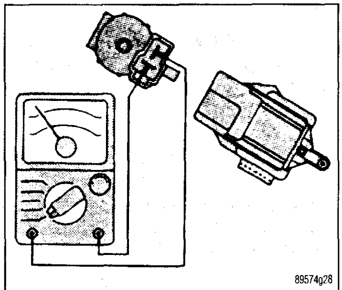


**Fig. 13 Measuring the resistance between the terminals of the evaporative emission purge solenoid**

***1990–92 2.0L DOHC TURBO ENGINE***

1. Label and disconnect the 2 vacuum hoses from the purge control solenoid valve.
2. Detach the electrical harness connector from the solenoid.
3. Connect a hand vacuum pump to the nipple which the red striped vacuum hose was connected.
4. Check air tightness by applying a vacuum with voltage applied directly from the battery to the evaporative emission purge solenoid and without applying voltage. With battery voltage applied, vacuum should be maintained. Without voltage, vacuum should leak
5. Measure the resistance across the terminals of the solenoid. The desired reading is 36–44 ohms when at 68°F (20°C).
6. If any of the test results differ from the specifications, replace the emission purge control solenoid.

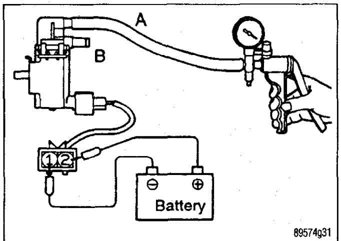


**Fig. 14 Test connections for the evaporative purge solenoid—2.4L engine**

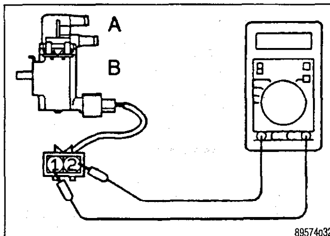


**Fig. 15 Measure the resistance across the terminal of the solenoid valve—2.4L engine shown, others similar**

***1994–00 VEHICLES***

**➧ See Figures 14 and 15**

1. Tag and disconnect the vacuum hoses from the solenoid valve.
2. Detach the harness connector.
3. Attach a hand-held vacuum pump to the nipple (A) of the solenoid valve, as shown in the accompanying figures.
4. Check air tightness by applying a vacuum with voltage applied directly from the battery to the evaporative emission purge solenoid and without applying voltage. The desired results are as follows:
   - With battery voltage applied—vacuum should be maintained
   - With battery voltage not applied—vacuum should leak
5. Measure the resistance across the terminals of the solenoid. The standard values are as follows:
   a. 25–44 ohms when at 68°F (20°C).
6. If any of the test results differ from the specifications, replace the emission purge control solenoid.

## REMOVAL & INSTALLATION

**EVAP Canister**

**➧ See Figure 16**

1. Disconnect the negative battery cable.
2. If necessary, raise and safely support the vehicle, remove the front passenger side wheel, then remove the splash shield.
3. Tag and disconnect all necessary vacuum lines.
4. Unfasten and retaining bolts and/or straps, then remove the canister from the vehicle
5. Installation is the reverse of the removal procedure.

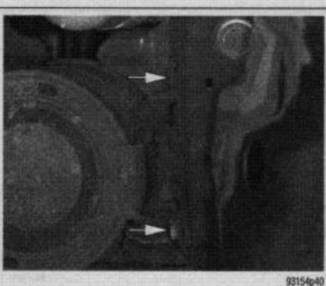

**Fig. 16 Remove the canister retaining bolts and remove the canister**

### Solenoid Valves

▸ **See Figures 17 and 18**

1. Disconnect the negative battery cable.
2. Label and remove the vacuum and electrical harness connections from the purge control solenoid.
3. Remove the solenoid and mounting bracket from the engine compartment.
4. Installation is the reverse of the removal procedure.

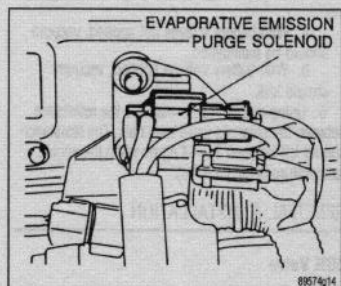

**Fig. 17 Evaporative emission purge solenoid location– 2.0L DOHC engine**

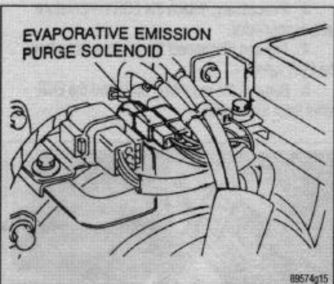

**Fig. 18 Location of the evaporative emission purge solenoid—1990–93 2.0L DOHC turbo engine**

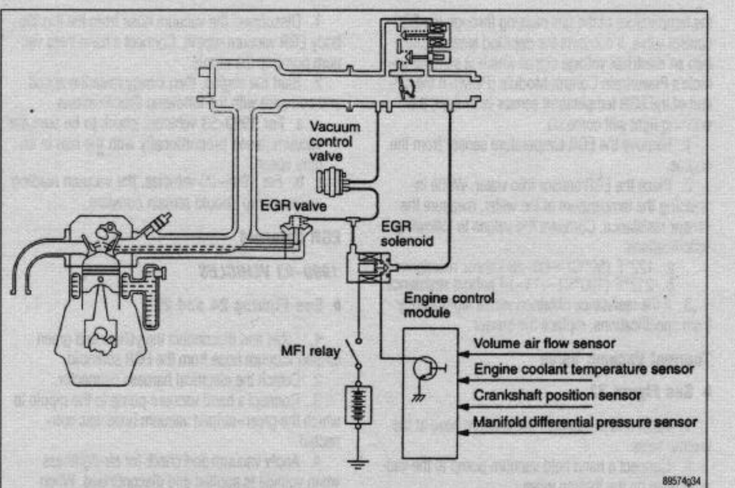

**Fig. 19 Typical EGR system schematic—2.4L engine shown, others similar**

## Exhaust Gas Recirculation System

### OPERATION

▸ **See Figure 19**

The Exhaust Gas Recirculation (EGR) system is designed to reintroduce exhaust gas into the combustion chambers, thereby lowering combustion temperatures and reducing the formation of Oxides of Nitrogen ($NO_x$).

The amount of exhaust gas that is reintroduced into the combustion cycle is determined by several factors, such as: engine speed, engine vacuum, exhaust system backpressure, coolant temperature, throttle position. All EGR valves are vacuum operated. The EGR vacuum diagram for your particular vehicle is displayed on the Vehicle Emission Control Information (VECI) label.

### COMPONENT TESTING

#### EGR Valve

▸ **See Figure 20**

1. Remove the EGR valve from the vehicle. Check for sticking of plunger caused by excess carbon deposits. If such a condition exists, clean with appropriate solvent so the valve seats correctly.

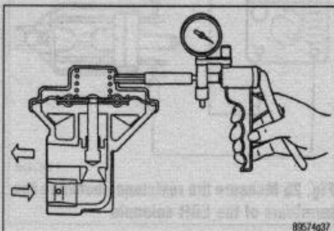

**Fig. 20 Use a vacuum pump to test the EGR**

2. Connect a vacuum pump to the valve and apply 20 in. Hg (67 kPa) of vacuum.
3. Check for air tightness. If the valve has 2 vacuum ports; pick one and plug the other. The vacuum must be retained.
4. For 1990–93 vehicles, blow air from 1 passage of the EGR to check condition as follows:
   a. With 1.8 in. Hg (6 kPa) of vacuum or less applied to the valve, air should not pass through the valve.
   b. With 8.5 in. Hg (28.7 kPa) of vacuum or more applied to the valve, air should pass through the valve.
5. For 1994–00 vehicles, apply vacuum (specified below) and check the passage of air by blowing through either side of the EGR passages, as follows:
   a. With 1.6 in. Hg or less of vacuum applied to the valve, air should blow out of the opposite passage.
   b. With 8.7 in. Hg or more of vacuum applies to the valve, air should not blow out of the opposite passage.
6. If the results are not as described, replace the EGR valve.

#### EGR Temperature Sensor

▸ **See Figure 21**

The EGR temperature sensor is used on California vehicles only. The EGR temperature sensor detects

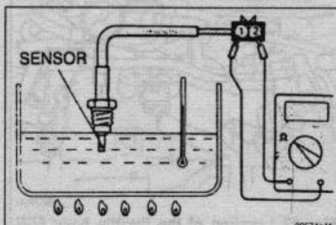

**Fig. 21 Put the EGR temperature sensor in a container of water, then measure resistance as the water temperature is increased**

the temperature of the gas passing through the EGR control valve. It converts the detected temperature into an electrical voltage signal which is sent the vehicle's Powertrain Control Module (PCM). If the circuit of the EGR temperature sensor is broken, the warning light will come on.

1. Remove the EGR temperature sensor from the engine.
2. Place the EGR sensor into water. While increasing the temperature of the water, measure the sensor resistance. Compare the values to following specifications:
   a. 122°F (50°C)—60–83 kohms resistance
   b. 212°F (100°C)—11–14 kohms resistance
3. If the resistance obtained varies significantly from specifications, replace the sensor.

### Thermal Vacuum Valve

➧ See Figure 22

1. Label and disconnect the vacuum hose at the thermo valve.
2. Connect a hand held vacuum pump to the vacuum hose on the thermo valve.
3. Apply vacuum and check the air passage through the thermo valve. Compare results to the following specifications:
   a. Engine coolant temperature of 122°F (50°C) or less—vacuum leaks
   b. Engine coolant temperature of 176°F (80°C) or more—vacuum is maintained
4. If the results differ from the desired specifications, replace the valve.

### EGR Port Vacuum Check

➧ See Figure 23

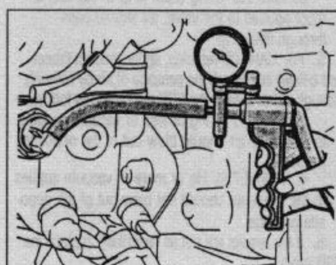
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**Fig. 22 Testing the thermal vacuum valve—2.0L engine (Federal) shown, others similar**

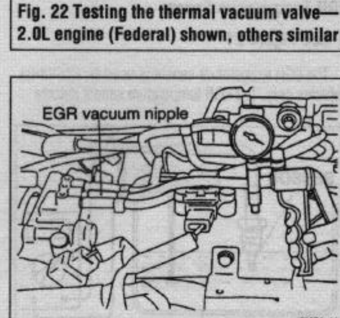

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**Fig. 23 Location of the throttle body EGR valve vacuum nipple—2.4L engine shown**

1. Disconnect the vacuum hose from the throttle body EGR vacuum nipple. Connect a hand-held vacuum pump to the nipple.
2. Start the engine, then slowly raise the speed and compare with the following specifications.
   a. For 1990–93 vehicles, check to be sure the vacuum raised proportionally with the rise in engine speed.
   b. For 1994–00 vehicles, the vacuum reading on the pump should remain constant.

### EGR Solenoid

#### *1990–93 VEHICLES*

➧ See Figures 24 and 25

1. Label and disconnect the yellow and green striped vacuum hose from the EGR solenoid.
2. Detach the electrical harness connector.
3. Connect a hand vacuum pump to the nipple to which the green-striped vacuum hose was connected.
4. Apply vacuum and check for air-tightness when voltage is applied and discontinued. When voltage is applied, the vacuum should be maintained. When voltage is discontinued, vacuum should leak.
5. Measure the resistance between the terminals of the solenoid valve. The resistance should be 36–44 ohms at 68°F (20°C).
6. If the test results differ from the specifications, replace the EGR solenoid.

#### *1994–00 VEHICLES*

➧ See Figure 26

**➡Before disconnecting the vacuum hoses, tag them to assure proper connection during installation**

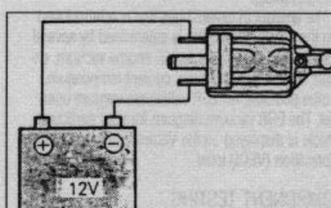

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**Fig. 24 Apply voltage to the EGR solenoid using jumper wires and check for air-tightness using a vacuum pump**

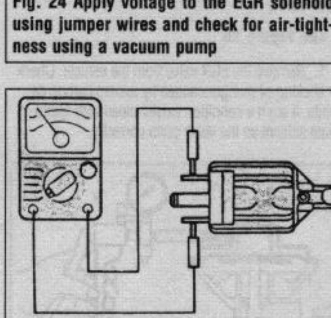
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**Fig. 25 Measure the resistance between the terminals of the EGR solenoid**

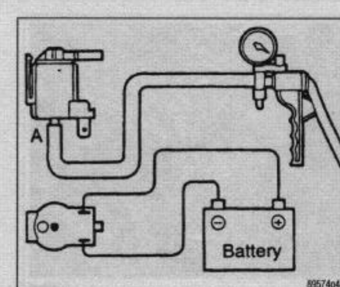

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**Fig. 26 EGR solenoid check connections—2.4L engine**

1. Tag and disconnect the vacuum hose (2.0L turbo engine: yellow stripe, white and green stripe, 2.4L engine: yellow stripe and white stripe) from the solenoid valve.
2. Detach the harness connector.
3. Connect a hand-held vacuum pump to the A nipple.
4. Check air tightness by applying vacuum with voltage applied directly from the battery to the EGR control solenoid valve and without applying voltage.
5. For the 2.4L engines, compare with the following:
   a. With battery voltage not applied, vacuum should be maintained.
   b. With battery voltage applied, vacuum should leak.
6. Using an ohmmeter, measure the resistance between the solenoid valve terminals. The resistance should fall between 36–44 ohms when the engine temperature is 68°F (20°C).

## REMOVAL & INSTALLATION

### EGR Valve

➧ See Figure 27

1. Disconnect the negative battery cable.
2. Remove the air cleaner and intake hoses as required.
3. If necessary, detach the EGR temperature sensor connector.
4. Tag and disconnect the vacuum hose from the EGR valve.
5. Remove the mounting bolts and the EGR valve from the engine.

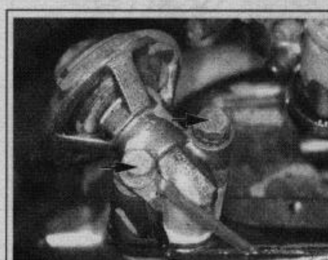
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**Fig. 27 The EGR valve is retained to the intake manifold with two bolts—2.4L engine**

6. Clean the mating surfaces on the valve and the engine. Make sure to remove all gasket material.
7. Inspect the valve for a sticking plunger, caused by excess carbon deposits. If such a condition exists, clean with appropriate solvent so valve seats correctly.

**To install:**

8. Install EGR valve with a new gasket in place.
9. Install the mounting bolts and tighten as follows:
   - 1.5L, 1.6L, and 1.8L engines—7–10 ft. lbs. (10—15 Nm)
   - 2.0L engines—10–15 ft. lbs. (15—22 Nm)
   - 2.4L and 3.5L engines—16 ft. lbs. (22 Nm)
   - 3.0L engines—8 ft. lbs. (11 Nm)
10. Connect the vacuum hose to the EGR valve.
11. If detached, attach the EGR temperature sensor.
12. Install the air cleaner and air intake hoses as required.
13. Connect the negative battery cable.

### EGR Temperature Sensor

1. Disconnect the negative battery cable.
2. Detach the electrical connector from the sensor.
3. Remove the sensor from the engine.

**To install:**

4. Install the sensor to the engine and tighten to 8 ft. lbs. (12 Nm).
5. Attach the electrical connector to the sensor.
6. Connect the negative battery cable.

### Thermal Vacuum Valve

1. Disconnect the negative battery cable.
2. Detach the vacuum line from the thermo valve.
3. Using a wrench, remove the valve from the engine.

**➡When removing or installing the valve, do not allow wrenches or other tool to contact the resin part of the valve. Damage to the valve may occur.**

4. Inspect the vacuum hose for cracks and replace as required.

**To install:**

5. Apply sealant to the threads of the thermo valve and install into the engine.
6. Tighten the valve to 15–30 ft. lbs. (20–40 Nm). When installing the valve, do not allow the wrench to come in contact with the resin part of the valve.
7. Attach the vacuum hose to the valve.
8. Connect the negative battery cable.

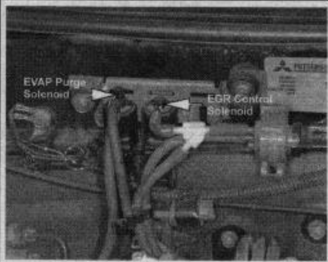
### EGR Solenoid

See Figures 28, 29, 30, 31, and 32

1. Disconnect the negative battery cable.
2. Label and disconnect the vacuum hoses from the EGR solenoid.
3. Disconnect the electrical harness from the solenoid.
4. Remove the solenoid from the mounting bracket and replace as required.

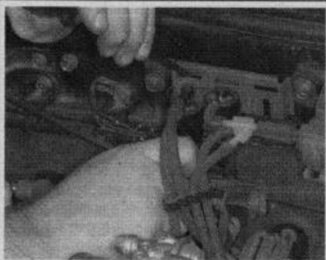
**To install:**

5. Install the solenoid to the mounting bracket and secure in position.
6. Attach the electrical connector.
7. Connect the vacuum hoses to the solenoid making sure they are installed in their original location.
8. Connect the negative battery cable.




93154p15

**Fig. 28 Location of the EGR solenoid—2.4L Galant shown**



91054p19

**Fig. 29 Release the retaining tab and remove the solenoid from the retaining bracket**

93154p26

**Fig. 30 Matchmark the hoses on the solenoid . . .**

93154p17

**Fig. 31 . . . then disconnect the hoses from the solenoid**

93154p16

**Fig. 32 Detach the electrical connector and remove the solenoid from the vehicle**

## ELECTRONIC ENGINE CONTROLS

### Engine Control Unit/Powertrain Control Module (ECU/PCM)

#### OPERATION

The Engine Control Unit/Powertrain Control Module (ECU/PCM) performs many functions on your vehicle. The module accepts information from various engine sensors and computes the required fuel flow rate necessary to maintain the correct amount of air/fuel ratio throughout the entire engine operational range.

Based on the information that is received and programmed into the PCM's memory, the PCM generates output signals to control relays, actuators and solenoids. The PCM also sends out a command to the fuel injectors that meters the appropriate quantity of fuel. The module automatically senses and compensates for any changes in altitude when driving your vehicle.

#### REMOVAL & INSTALLATION

**WARNING**

**A grounded wrist strap should be used to prevent static discharge to the PCM. Static discharge can easily destroy the electronic components inside the PCM.**

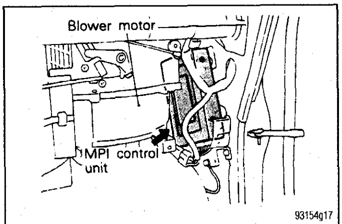


**Fig. 33 PCM mounting location—Mirage**

### Mirage and 1999–00 Galant

**➧ See Figure 33**

**➡The Powertrain Control Module (PCM) is located above the passenger side kickpanel.**

1. Disconnect the negative battery cable.
2. Remove the glove box, right side kickpanel and lower panel assemblies.
3. Unplug the connectors and remove fasteners. Remove the PCM.
4. Installation is the reverse of the removal procedure.

### 1994–98 Galant

**➧ See Figure 34**

1. Disconnect negative battery cable.
2. Remove both center console side panels.
3. Unplug the wiring connector and remove the mounting hardware. Slide the PCM out the side.
4. Installation is the reverse of the removal procedure.

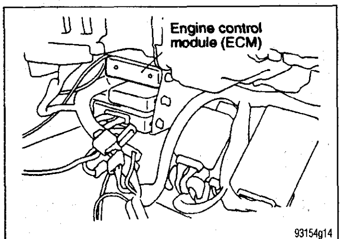


**Fig. 34 PCM mounting location—1994–98 Galant**

### Diamante and 1990–93 Galant

**➧ See Figures 35 and 36**

**➡The Powertrain Control Module (PCM) is located behind the glove box assembly.**

1. If equipped, disarm the air bag system.
2. Remove the passenger side lower instrument panel and shower duct.
3. Remove the glove box striker, glove box, glove box outer casing and the screw below the assembly.
4. Unplug wiring connector and remove mounting hardware. Slide out the PCM.

**To install:**

5. Install the PCM with the mounting hardware.
6. Attach the wire connector.
7. Install the glove box striker, the glove box, the glove box casing and the screw below the assembly.

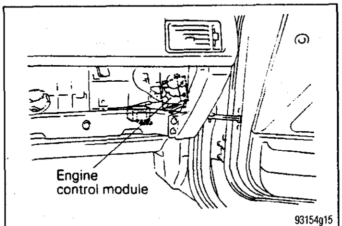


**Fig. 35 PCM mounting location—1990–93 Galant**

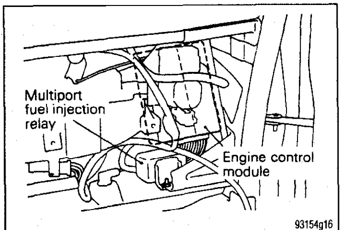


**Fig. 36 PCM mounting location—Diamante**

8. Install the passenger side lower instrument panel and the shower duct.
9. Reconnect the negative battery cable.

## Oxygen Sensor

### OPERATION

The Oxygen (O2) sensor is a device which produces an electrical voltage when exposed to the oxygen present in the exhaust gases. The sensor is mounted in the exhaust system, usually in the manifold or a boss located on the down pipe before the catalyst. The oxygen sensors used on some models are electrically heated internally for faster switching when the engine is started cold. The oxygen sensor produces a voltage within 0 and 1 volt. When there is a large amount of oxygen present (lean mixture), the sensor produces a low voltage (less than 0.4v). When there is a lesser amount present (rich mixture) it produces a higher voltage (0.6–1.0v). The stoichiometric or correct fuel to air ratio will read between 0.4 and 0.6v. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch. The voltage is transmitted to the PCM.

Some models have two sensors, one before the catalyst and one after. This is done for a catalyst efficiency monitor that is a part of the OBD-II engine controls. The one before the catalyst measures the exhaust emissions right out of the engine, and sends the signal to the PCM about the state of the mixture as previously talked about. The second sensor reports the difference in the emissions after the exhaust gases have gone through the catalyst. This sensor reports to the PCM the amount of emissions reduction the catalyst is performing.

The oxygen sensor will not work until a predetermined temperature is reached, until this time the PCM is running in what as known as OPEN LOOP operation. OPEN LOOP means that the PCM has not yet begun to correct the air-to-fuel ratio by reading the oxygen sensor. After the engine comes to operating temperature, the PCM will monitor the oxygen sensor and correct the air/fuel ratio from the sensor's readings. This is what is known as CLOSED LOOP operation.

A Heated Oxygen Sensor (HO2S) has a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into CLOSED LOOP operation sooner.

In CLOSED LOOP operation, the PCM monitors the sensor input (along with other inputs) and adjusts the injector pulse width accordingly. During OPEN LOOP operation, the PCM ignores the sensor input and adjusts the injector pulse to a preprogrammed value based on other inputs.

### TESTING

**➧ See Figure 37**

**Fig. 37 The HO2S can be monitored with an appropriate and Data-stream capable scan tool**

**WARNING**

**Do not pierce the wires when testing this sensor; this can lead to wiring harness damage. Backprobe the connector to properly read the voltage of the HO2S.**

1. Disconnect the HO2S.
2. Measure the resistance between PWR and GND terminals of the sensor. Resistance should be approximately 6 ohms at 68°F (20°C). If resistance is not within specification, the sensor's heater element is faulty.
3. With the HO2S connected and engine running, measure the voltage with a Digital Volt-Ohmmeter (DVOM) between terminals **HO2S** and **SIG RTN** (GND) of the oxygen sensor connector. Voltage should fluctuate between 0.01–1.0 volts. If voltage fluctuation is slow or voltage is not within specification, the sensor may be faulty.

### REMOVAL & INSTALLATION

**➧ See Figures 38, 39, 40, 41, and 42**

1. Disconnect the negative battery cable.
2. Raise and support the vehicle safely.

Fig. 38 Detach the connector from the oxygen sensor

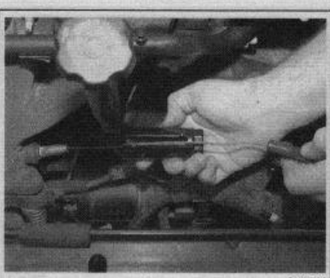


Fig. 39 A special socket is available to remove the oxygen sensor. The socket contains a slot that the wire slides out of

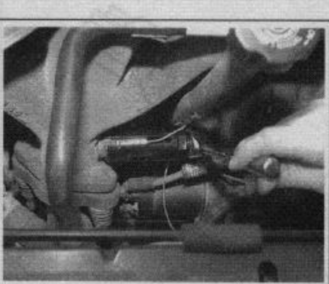


Fig. 40 Use the tool to loosen the sensor . . .

Fig. 41 . . . then remove the sensor from the exhaust manifold/pipe

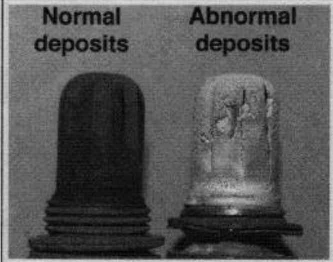



Fig. 42 Inspect the oxygen sensor tip for abnormal deposits

3. Label and disconnect the HO2S from the engine control wiring harness.

➡**Lubricate the sensor with penetrating oil prior to removal.**

4. Remove the sensor using an oxygen sensor wrench or another suitable tool.

**To install:**

5. Install the sensor in the mounting boss and tighten to 27–33 ft. lbs. (37–45 Nm).
6. Connect the engine control wiring harness to the sensor.
7. Lower the vehicle.
8. Connect the negative battery cable.

## Idle Air Control Motor

### OPERATION

The Idle Air Control (IAC) motor is a DC stepper motor controlled by the PCM. The IAC contains a built-in position sensor which detects the amount of opening of the motor. The position sensor outputs a pulse signal that the PCM receives and uses to adjust the motor to properly maintain the correct idle speed of the engine.

### TESTING

▸ **See Figure 43**

Place a stethoscope (a long screwdriver works also, just place the screwdriver on the IAC and place your ear on or near the handle) on the IAC motor. Have an assistant turn the key **ON** with the engine **OFF**, and listen to the IAC motor. Several clicks should be heard as the stepper motor moves. If the clicks are heard, the driver in the PCM and the circuit are OK.

If the driver and circuits test OK, detach the connector from IAC motor. Using an ohmmeter, probe the connector on the IAC motor, NOT THE WIRING HARNESS> between pins **2** and **1**, and pins **2** and **3**. Resistance should measure between 28–33 ohms. If the resistance values are different replace the IAC motor. If the tests between pins **1**, **2**, and **3** are within specification, check the resistance between pins **5** and **4**, and pins **5** and **6**. Resistance should measure between 28–33 ohms. If the resistance values are different replace the IAC motor.

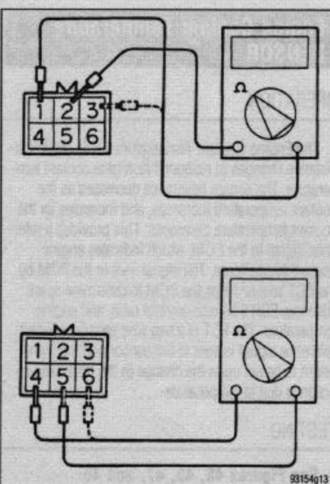



Fig. 43 IAC motor testing and pin locations

### REMOVAL & INSTALLATION

▸ **See Figure 44**

1. Disconnect the negative battery cable.
2. Remove the air cleaner intake hose.
3. Remove any necessary hoses from the IAC motor.
4. Detach the electrical connectors from the IAC motor.
5. Remove the retaining bolts and remove the IAC from the throttle body.
6. The installation is the reverse of removal. Replace the IAC gasket.

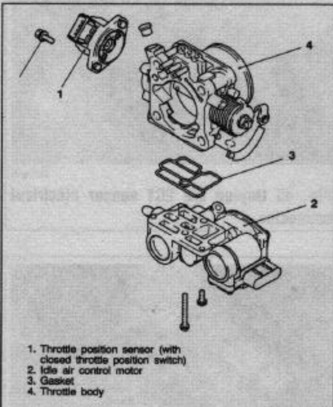



Fig. 44 The IAC motor is usually mounted on the throttle body

## Engine Coolant Temperature SENSOR

### OPERATION

The Engine Coolant Temperature (ECT) sensor resistance changes in response to engine coolant temperature. The sensor resistance decreases as the coolant temperature increases, and increases as the coolant temperature decreases. This provides a reference signal to the PCM, which indicates engine coolant temperature. The signal sent to the PCM by the ECT sensor helps the PCM to determine spark advance, EGR flow rate, air/fuel ratio, and engine temperature. The ECT is a two wire sensor, a 5-volt reference signal is sent to the sensor and the signal return is based upon the change in the measured resistance due to temperature.

### TESTING

**See Figures 45, 46, 47, and 48**

1. Drain the engine coolant to a level below the intake manifold.
2. Disconnect the sensor wiring harness and remove the coolant temperature sensor from the engine.
3. Place the temperature sensing portion of the sensor into a pan of hot water. Use a thermometer to monitor the water temperature.
4. Measure the resistance across the sensor terminals while the sensor is in the water. Compare obtained reading to specifications:

93154p05

**Fig. 45 Unplug the ECT sensor electrical connector**

93154p30

**Fig. 46 Test the resistance of the ECT sensor across the two sensor pins**

tccs4p02

**Fig. 47 Another method of testing the ECT is to submerge it in cold or hot water and check resistance**

91054p10

**Fig. 48 The ECT can be monitored with an appropriate and Data-stream capable scan tool**

a. Water temperature of 32°F (0°C)—5.1–6.5 kilo-ohms present
b. Water temperature of 68°F (20°C)—2.1–2.7 kilo-ohms present
c. Water temperature of 104°F (40°C)—0.9–1.3 kilo-ohms present
d. Water temperature of 176°F (80°C)—0.26–0.36 kilo-ohms present

5. If the resistance differs greatly from standard value, replace the sensor.

### REMOVAL & INSTALLATION

**See Figures 49, 50, 51, and 52**

1. Disconnect the negative battery cable.

89574p09

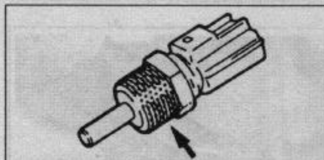
**Fig. 49 Unplug the ECT sensor electrical connector**

89574p10

**Fig. 50 Use a deep socket and an extension to reach the ECT sensor . . .**

89574p11

**Fig. 51 . . . then remove the ECT sensor from the thermostat housing**



89574g59

**Fig. 52 Before installation, coat the threads of the sensor with a suitable sealant**

2. Drain the engine coolant to a level below the intake manifold.
3. Unplug the sensor wiring harness.
4. Unthread and remove the sensor from the engine.

**To install:**

5. Coat the threads of the sensor with a suitable sealant and thread into the housing.
6. Tighten the sensor to 22 ft. lbs. (30 Nm).
7. Refill the cooling system to the proper level.
8. Attach the electrical connector to the sensor securely.
9. Connect the negative battery cable.

## Intake Air Temperature Sensor

### OPERATION

**See Figure 53**

The Intake Air Temperature (IAT) sensor determines the air temperature entering the intake mani-

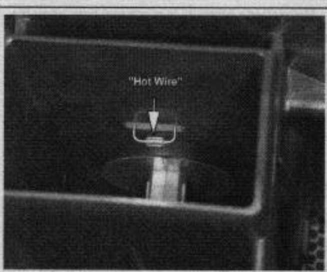



**Fig. 53 The IAT sensor tip is visible when looking into the MAF sensor**

fold. Resistance changes in response to the ambient air temperature. The sensor has a negative temperature coefficient. As the temperature of the sensor rises the resistance across the sensor decreases. This provides a signal to the PCM indicating the temperature of the incoming air charge. This sensor helps the PCM to determine spark timing and air/fuel ratio. Information from this sensor is added to the pressure sensor information to calculate the air mass being sent to the cylinders. The IAT receives a 5-volt reference signal and the signal return is based upon the change in the measured resistance due to temperature.

## TESTING

**See Figures 54, 55, 56, 57, and 58**


**Fig. 54 Testing the resistance of the IAT sensor across the two sensor pins**


**Fig. 55 The IAT sensor can be monitored with an appropriate and Data-stream capable scan tool**

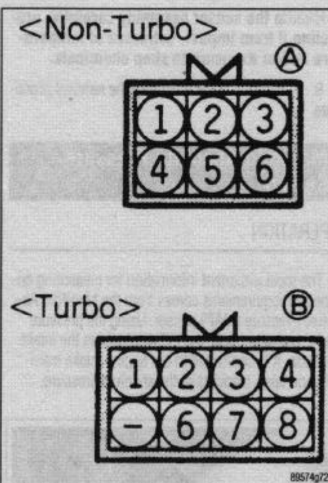



**Fig. 56 IAT sensor terminal identification—1990–93 Galant**

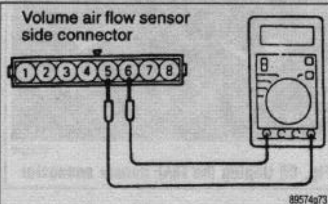



**Fig. 57 IAT sensor terminal identification—2.4L engines**

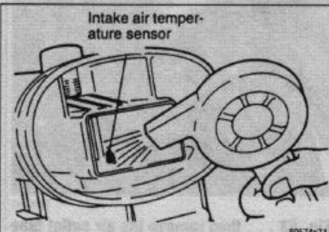



**Fig. 58 Measure the intake air temperature sensor resistance while heating it with a hair drier**

1. Detach the air flow sensor electrical connector.
2. Measure the resistance between terminals No. 4 and No. 6 of the electrical connector, except on the 2.0L DOHC turbo engine.
3. If equipped with the 2.0L DOHC turbo engine, measure the resistance between terminals No. 6 and No. 8 of the sensor electric connector.
4. Compare test readings to the following specifications:
   a. Sensor temperature of 32°F (0°C)—5.3–6.7 kilo-ohms
   b. Sensor temperature of 68°F (20°C)—2.3–3.0 kilo-ohms
   c. Sensor temperature of 176°F (80°C)—0.30–0.42 kilo-ohms
5. Measure the sensor resistance while heating the sensor area with a hair dryer. As the temperature of the sensor increases, sensor resistance should become smaller.
6. If the measured resistance deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.

## REMOVAL & INSTALLATION

The IAT sensor is part of the Mass Air Flow (MAF) sensor. The IAT sensor cannot be replaced separately. Refer to MAF sensor removal and installation in this section.

# Mass Air Flow Sensor

## OPERATION

The Mass Air Flow (MAF) sensor directly measures the mass of air being drawn into the engine. The sensor output is used to calculate injector pulse width. The MAF sensor is what is referred to as a "hot-wire sensor". The sensor uses a thin platinum wire filament, wound on a ceramic bobbin and coated with glass, that is heated to 417°F (200°C) above the ambient air temperature and subjected to the intake airflow stream. A "cold-wire" is used inside the MAF sensor to determine the ambient air temperature.

Battery voltage, a reference signal, and a ground signal from the PCM are supplied to the MAF sensor. The sensor returns a signal proportionate to the current flow required to keep the "hot-wire" at the required temperature. The increased airflow across the "hot-wire" acts as a cooling fan, lowering the resistance and requiring more current to maintain the temperature of the wire. The increased current is measured by the voltage in the circuit, as current increases, voltage increases. As the airflow increases the signal return voltage of a normally operating MAF sensor will increase.

## TESTING

1. Using a multimeter, check for voltage by backprobing the MAF sensor connector.
2. With the ignition key **ON**, and the engine **OFF**, verify that there is at least 10.5 volts between the BATT and GND terminals of the MAF sensor connector. If voltage is not within specification, check power and ground circuits and repair as necessary.
3. With the ignition key **ON**, and the engine **ON**, verify that there is at least 4.5 volts between the SIG and GND terminals of the MAF sensor connector. If voltage is not within specification, check power and ground circuits and repair as necessary.
4. With the ignition key **ON**, and the engine **ON**, check voltage between GND and SIG RTN terminals. Voltage should be approximately 0.34–1.96 volts. If voltage is not within specification, the sensor may be faulty.

### REMOVAL & INSTALLATION

**See Figures 59 thru 67**

1. Disconnect the negative battery cable.
2. Release the retaining clips from the air cleaner housing.
3. Loosen the clamp on the air outlet tube at the throttle body.
4. Remove the breather hose and detach the connector from the MAF sensor.
5. Remove the air outlet tube and upper housing from the lower housing.
6. Loosen the hose clamp and slide the outlet hose off of the MAF sensor.
7. Remove the four sensor-to-air cleaner housing retaining nuts.
8. Remove the sensor from the air cleaner upper housing.

**➡Handle the sensor assembly carefully, protecting it from impact, extremes of temperature and/or exposure to shop chemicals.**

9. Installation is the reverse of the removal procedure.

## Manifold Absolute Pressure Sensor

### OPERATION

The most important information for measuring engine fuel requirements comes from the Manifold Absolute Pressure (MAP) sensor. Using the pressure and temperature data, the PCM calculates the intake air mass. It is connected to the engine intake manifold and takes readings of the absolute pressure.

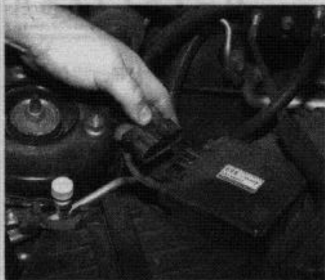
Atmospheric pressure is measured both when the engine is started and when driving fully loaded, then the pressure sensor information is adjusted accordingly.

### TESTING

1. Using a multimeter, check for voltage by backprobing the MAP sensor connector.
2. With the key **ON**, and the engine **OFF**, verify that there is at least 4.8 volts between the SIG and GND terminals of the MAP sensor connector. If voltage is not within specification, check power and ground circuits and repair as necessary.
3. With the key **ON**, and the engine **ON**, check the voltage between GND and SIG RTN terminals. Voltage should be approximately between 0.8 and 2.4 volts. If voltage is not within specification, the sensor may be faulty.

93151p50

**Fig. 59 Release the retaining clips from the air cleaner housing**



93151p47

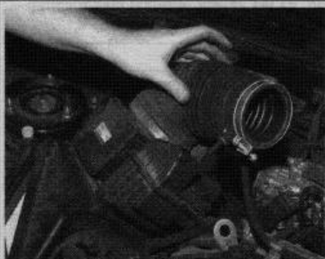
**Fig. 60 Unplug the MAF sensor connector**

93151p46

**Fig. 61 Detach the breather hose from the air inlet tube**

93151p44

**Fig. 62 Loosen the clamp on the air outlet tube at the throttle body . . .**



93151p43

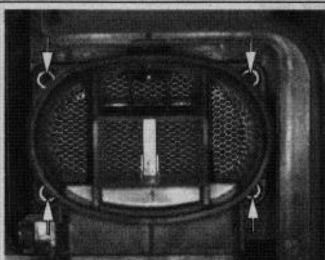
**Fig. 63 . . . then remove the air outlet tube and upper housing from the lower housing**

93154p14

**Fig. 64 Loosen the hose clamp retaining screw . . .**

93154p18

**Fig. 65 . . . then slide the outlet hose off of the MAF sensor**



93154p13

**Fig. 66 Remove the four sensor-to-air cleaner housing retaining nuts . . .**

93154p12

**Fig. 67 . . . then remove the MAF sensor from the air cleaner cover**

4. If the voltage check in step 3 was **OK**, then check the voltage between GND and SIG RTN terminals and suddenly depress the accelerator, the voltage should rise and stay at 2.4 volts. If the voltage does not stay at 2.4 volts, replace the MAP sensor.

### REMOVAL & INSTALLATION

**See Figures 68, 69, and 70**

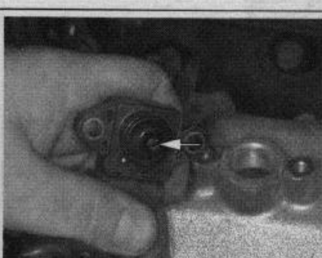
1. Disconnect the negative battery cable.
2. Detach the connector for the MAP sensor.
3. Remove the sensor mounting screws.
4. Lift the sensor up and remove it from the intake manifold.
5. The installation is the reverse of removal.

93154p21

**Fig. 68 Detach the electrical connector from the MAP sensor**

93154p20

**Fig. 69 Remove the two MAP sensor retaining bolts . . .**



93154p22

**Fig. 70 . . . then remove the sensor from the intake manifold. Inspect the tip of the sensor and replace if damaged or plugged**

## Throttle Position Sensor

### OPERATION

The Throttle Position (TP) sensor is a potentiometer that provides a signal to the PCM that is directly proportional to the throttle plate position. The TP sensor is mounted on the side of the throttle body and is connected to the throttle plate shaft. The TP sensor monitors throttle plate movement and position, and transmits an appropriate electrical signal to the PCM. These signals are used by the PCM to adjust the air/fuel mixture, spark timing and EGR operation according to engine load at idle, part throttle, or full throttle. The TP sensor is not adjustable.

The TP sensor receives a 5 volt reference signal and a ground circuit from the PCM. A return signal circuit is connected to a wiper that runs on a resistor internally on the sensor. The further the throttle is opened, the wiper moves along the resistor, at wide open throttle, the wiper essentially creates a loop between the reference signal and the signal return returning the full or nearly full 5 volt signal back to the PCM. At idle, the signal return should be approximately 0.9 volts.

### TESTING

**See Figures 71, 72, 73, and 74**

1. With the engine **OFF** and the ignition **ON**, check the voltage at the signal return circuit of the TP sensor by carefully backprobing the connector using a DVOM.

93154p11

**Fig. 71 Testing the SIG circuit to the TP sensor**

93154p09

**Fig. 72 Testing the SIG RTN circuit of the TP sensor**

93154p10

**Fig. 73 Testing the operation of the potentiometer inside the TP sensor while slowly opening the throttle**

93154p35

**Fig. 74 The TP sensor can be monitored with an appropriate and Data-stream capable scan tool**

2. Voltage should be between 0.2 and 1.4 volts at idle.
3. Slowly move the throttle pulley to the Wide Open Throttle (WOT) position and watch the voltage on the DVOM. The voltage should slowly rise to slightly less than 4.8 volts at WOT.
4. If no voltage is present, check the wiring harness for supply voltage (5.0 volts) and ground (0.3 volts or less), by referring to your corresponding wiring guide. If supply voltage and ground are present, but no output voltage from TP, replace the TP sensor. If supply voltage and ground do not meet specifications, make necessary repairs to the harness or PCM.

### REMOVAL & INSTALLATION

**See Figures 75 and 76**

1. Disconnect the negative battery cable.
2. Disconnect the wiring harness from the TP sensor.
3. Remove the two sensor mounting screws, then pull the TP sensor off of the throttle shaft.

**To install:**

4. Carefully slide the rotary tangs on the sensor into position over the throttle shaft, then rotate the sensor clockwise to the installed position.

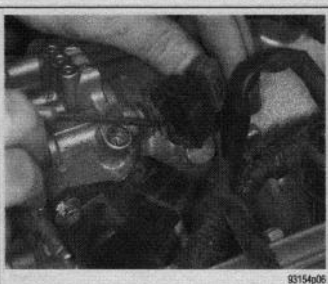


Fig. 75 Unplug the TP sensor connector

Fig. 76 The TP sensor is secured with two retaining bolts

**CAUTION**

**Failure to install the TP sensor in this manner may result in sensor damage or high idle speeds.**

**➡The TP sensor is not adjustable.**

5. Install and tighten the sensor mounting screws.
6. Connect the wiring harness to the sensor.
7. Connect the negative battery cable.

## Camshaft Position Sensor

### OPERATION

The computer control module uses the Camshaft Position (CMP) sensor to determine the position of the No. 1 piston during its power stroke. This signal is used by the computer control module to calculate fuel injection mode of operation.

If the cam signal is lost while the engine is running, the fuel injection system will shift to a calculated fuel injected mode based on the last fuel injection pulse, and the engine will continue to run.

### TESTING

This sensor produces an A/C voltage signal based on information gathered while the engine is running. Testing the CMP sensor requires several special tools that are very expensive to purchase. Due to this fact, we at Chilton have determined testing this sensor to be beyond the scope of the do-it-yourself mechanic. The sensor can be monitored with an appropriate scan tool using a data display or other data stream information. Follow the instructions included with the scan tool for information on accessing the data.

### REMOVAL & INSTALLATION

#### 1.6L, 2.0L DOHC and 1997–00 1.8L Engines

1. Disconnect the negative battery cable.
2. Detach the electrical throttle body stay.
3. Remove the sensor retaining screws.
4. Remove the sensor assembly from the engine.

**To install:**

5. Install the sensor in the opening in the engine and tighten the sensor retaining screws.
6. Install the throttle body stay.
7. Attach the electrical connector to the sensor.
8. Connect the negative battery cable.

#### 1.5L, 2.4L, 3.0L SOHC, 3.5L, and 1993–96 1.8L Engines

**▸ See Figure 77**

The camshaft position sensor on these engines is located in the distributor. Refer to the distributor removal and installation procedure in Section 2.

#### 3.0L DOHC Engine

**▸ See Figure 78**

1. Disconnect the negative battery cable.
2. Remove the timing belt, as outlined in Section 3 of this manual.
3. Unplug the sensor connector.
4. Unfasten the retaining bolts, then remove the sensor from the vehicle.
5. Installation is the reverse of the removal procedure.

## Crankshaft Position Sensor/Crank Angle Sensor

### OPERATION

The Crankshaft Position (CKP) sensor (also referred to as the crank angle sensor) senses the crank angle (piston position) of each cylinder and converts

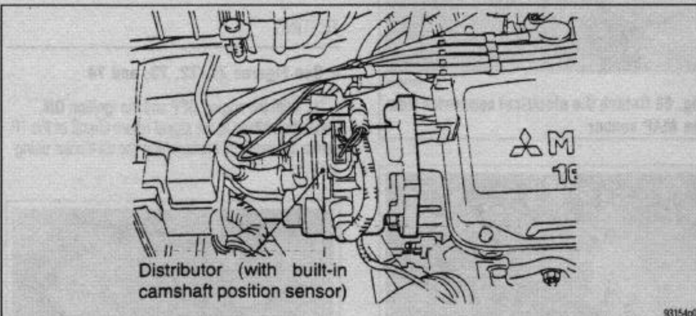



Fig. 77 The CMP sensor is built into the distributor—1.8L engine shown

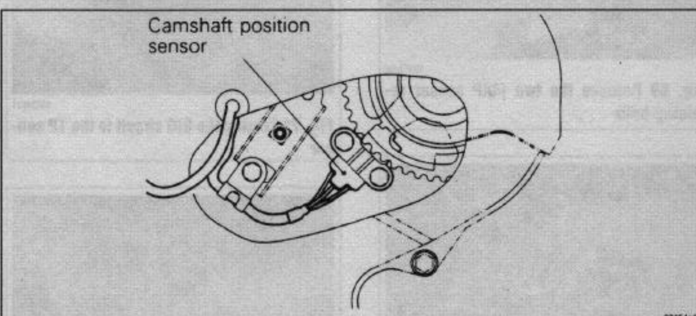



Fig. 78 CMP sensor mounting—3.0L DOHC engine

it into a pulse signal. The PCM receives this signal and then computes the engine speed ad controls the fuel injector timing and ignition timing based on this input.

## TESTING

This sensor produces a pulse signal based on information gathered while the engine is running. Testing the CKP sensor requires several special tools that are very expensive to purchase. Due to this fact, we at Chilton have determined testing this sensor to be beyond the scope of the do-it-yourself mechanic. The sensor can be monitored with an appropriate scan tool using a data display or other data stream information. Follow the instructions included with the scan tool for information on accessing the data.

## REMOVAL & INSTALLATION

### 2.0L SOHC and 1990–96 1.5L Engines

**See Figure 79**

The CKP sensor on these engines is located in the distributor. Refer to the distributor removal and installation procedure in Section 2.

### 1.6L and 2.0L DOHC Engines

**See Figure 80**

1. Disconnect the negative battery cable.
2. Detach the electrical throttle body stay.
3. Remove the sensor retaining screws.
4. Remove the sensor assembly from the engine.

**To install:**

5. Install the sensor in the opening in the engine and tighten the sensor retaining screws.
6. Install the throttle body stay.
7. Attach the electrical connector to the sensor.
8. Connect the negative battery cable.

### 1.8L, 2.4L, 3.0L (SOHC and DOHC), 3.5L, and 1997–00 1.5L Engines

**See Figures 81 and 82**

1. Disconnect the negative battery cable.
2. Remove the timing belt, as outlined in Section 3 of this manual.
3. Unplug the sensor connector.
4. Unfasten the retaining bolts, then remove the sensor from the vehicle.
5. Installation is the reverse of the removal procedure.

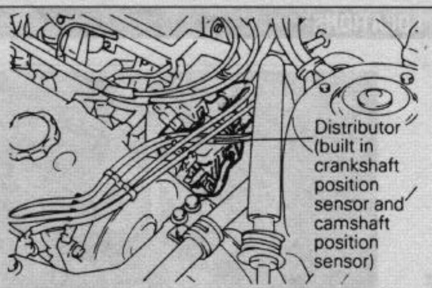



**Fig. 79 On the 1.5L engine the crankshaft and camshaft position sensors are built into the distributor**

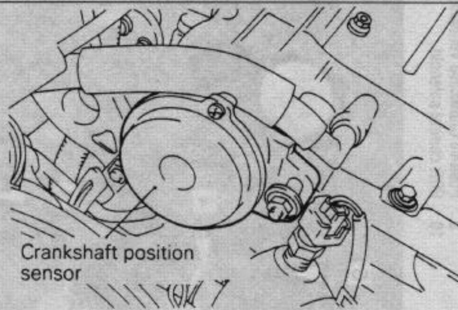


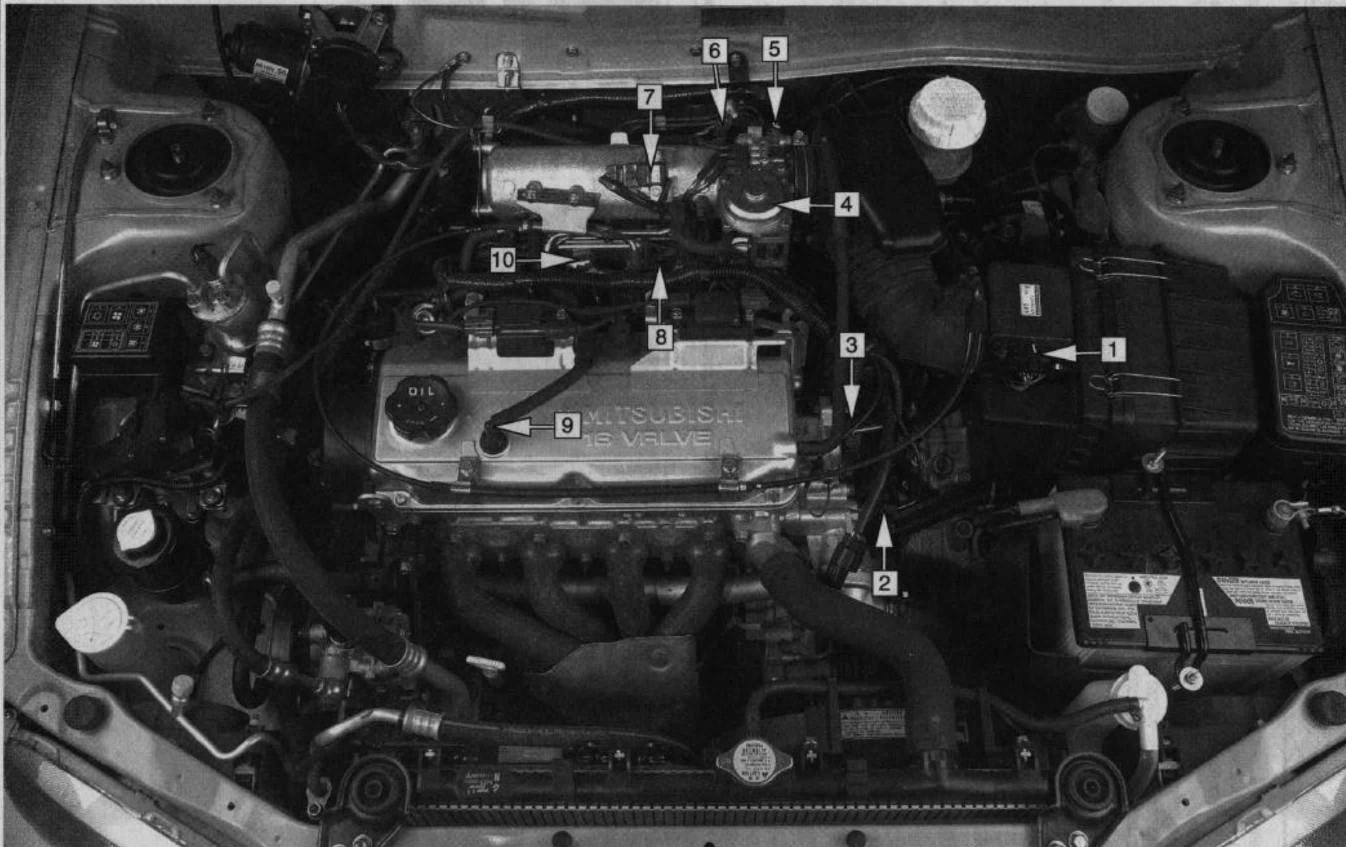

**Fig. 80 Crankshaft position sensor mounting—2.0L DOHC engine shown**


**Fig. 81 Remove the two CKP sensor retaining bolts—2.4L engine shown, others similar**


**Fig. 82 Remove the sensor and slide the reluctor wheel off of the crankshaft—2.4L engine shown, others similar**

## EMISSIONS AND ELECTRONIC CONTROL COMPONENT LOCATIONS—1.8L ENGINE

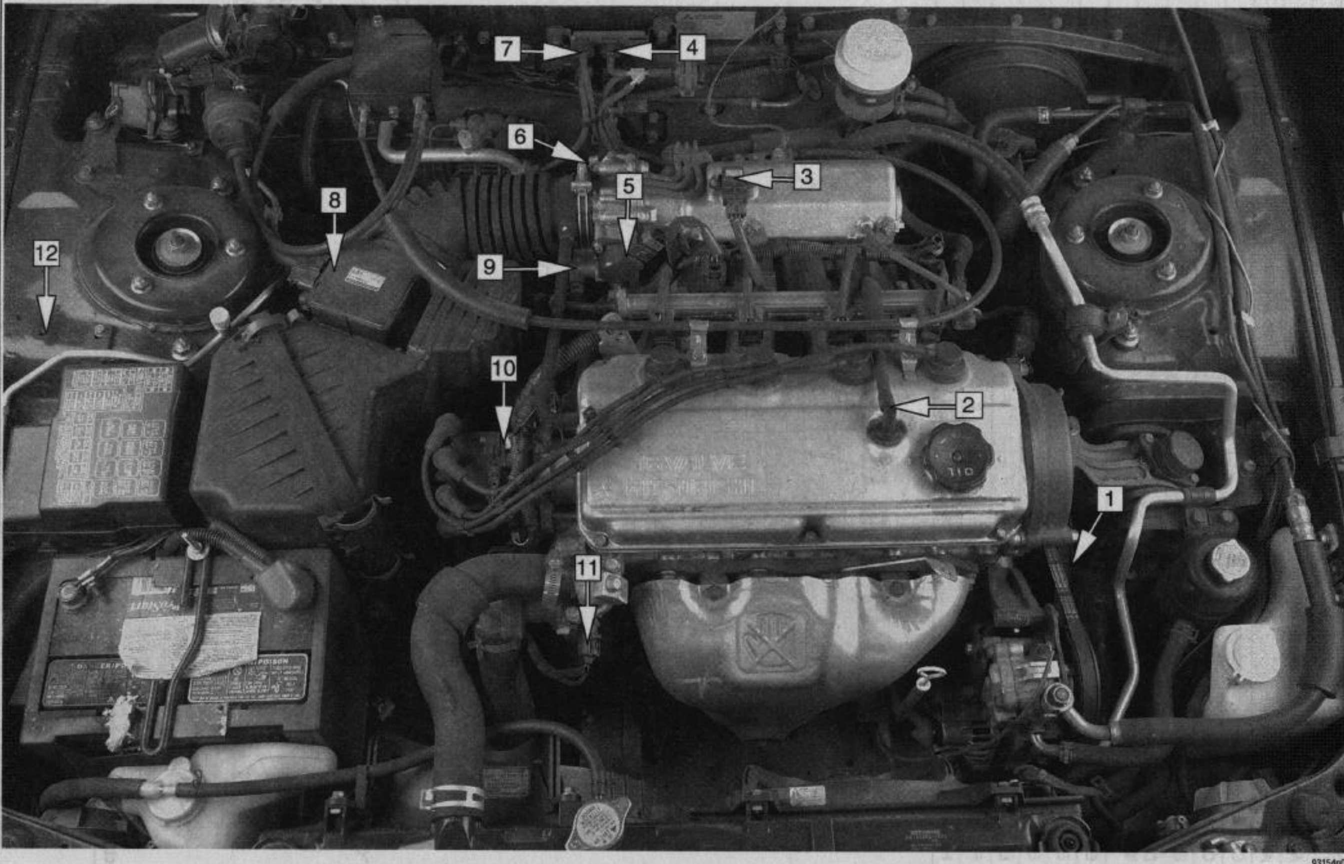
1. Mass Air Flow (MAF) sensor w/integrated Intake Air Temperature (IAT) sensor
2. Engine Coolant Temperature (ECT) sensor
3. Camshaft Position (CMP) sensor
4. Exhaust Gas Recirculation (EGR) valve
5. Idle Air Control (IAC) valve (located on underside of throttle body)
6. Throttle Position (TP) sensor
7. Manifold Absolute Pressure (MAP) sensor
8. Evaporative emissions purge solenoid
9. Positive Crankcase Ventilation (PCV) valve
10. EGR control solenoid



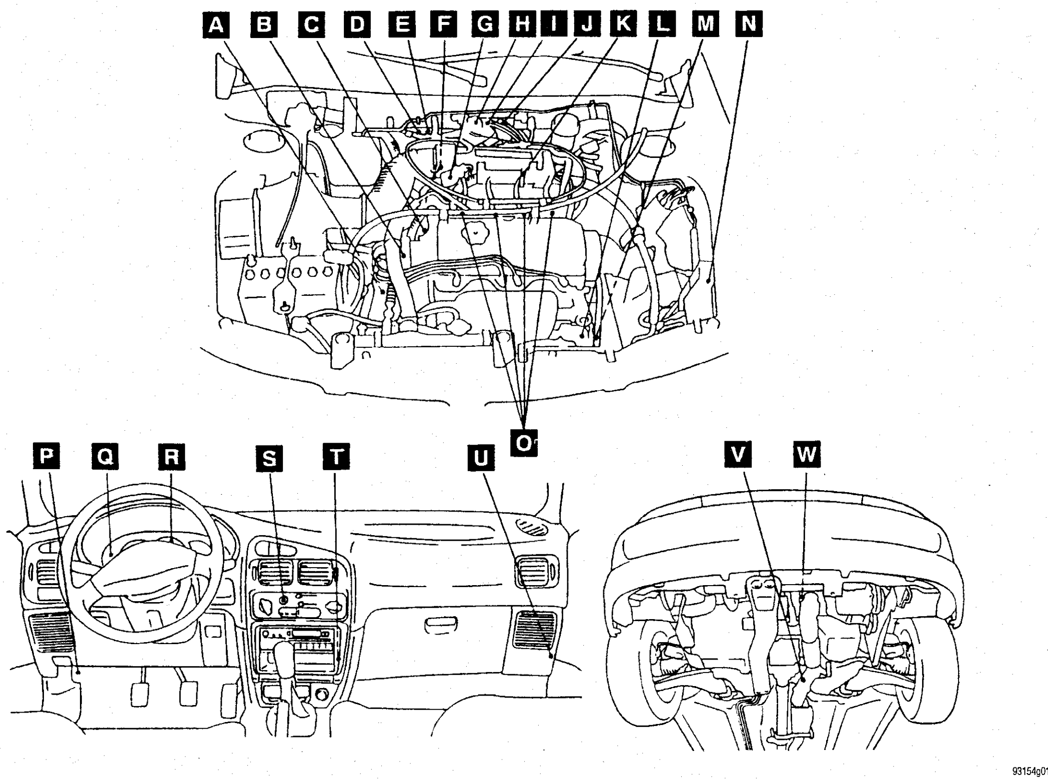

93154p02

## EMISSIONS AND ELECTRONIC CONTROL COMPONENT LOCATIONS—2.4L ENGINE

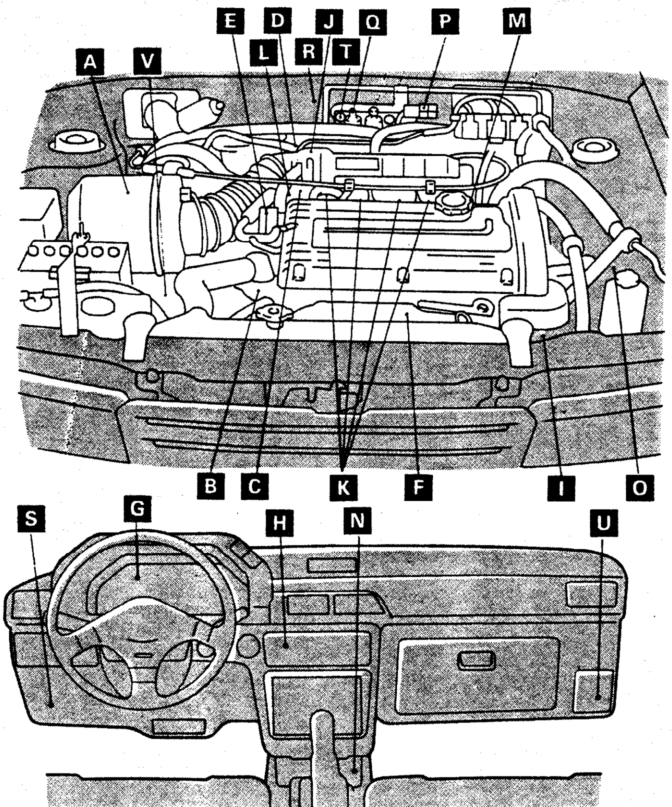
1. Crankshaft Position (CKP) sensor
2. Positive Crankcase Ventilation (PCV) valve
3. Manifold Absolute Pressure (MAP) sensor
4. Exhaust Gas Recirculation (EGR) solenoid
5. Throttle Position (TP) sensor
6. Exhaust Gas Recirculation (EGR) valve (located on underside of throttle body)
7. Evaporative emissions purge solenoid
8. Mass Air Flow (MAF) sensor w/integrated Intake Air Temperature (IAT) sensor
9. Idle Air Control (IAC) valve (located on underside of throttle body)
10. Camshaft Position (CMP) sensor (located inside distributor)
11. Engine Coolant Temperature (ECT) sensor
12. EVAP canister (located under fender)



| Name | Symbol | Name | Symbol |
|---|---|---|---|
| Air conditioning compressor clutch relay | N | Heated oxygen sensor (Rear) | V |
| Air conditioning switch | S | Idle air control motor | F |
| Check engine/Malfunction indicator lamp | Q | Ignition timing adjustment connector | D |
| Crankshaft position sensor | M | Injector | O |
| Data link connector | P | Intake air temperature sensor | K |
| Distributor (with built-in camshaft position sensor, ignition coil and ignition power transistor) | B | Manifold absolute pressure sensor | H |
| | | Multiport fuel injection (MFI) relay | T |
| EGR solenoid | J | Park/Neutral position switch | A |
| Engine control module | U | Power steering pressure switch | L |
| Engine coolant temperature sensor | C | Throttle position sensor (with built-in closed throttle position switch) | G |
| Evaporative emission purge solenoid | I | | |
| Fuel pump check terminal | E | Vehicle speed sensor (reed switch) | R |
| Heated oxygen sensor (Front) | W | – | – |



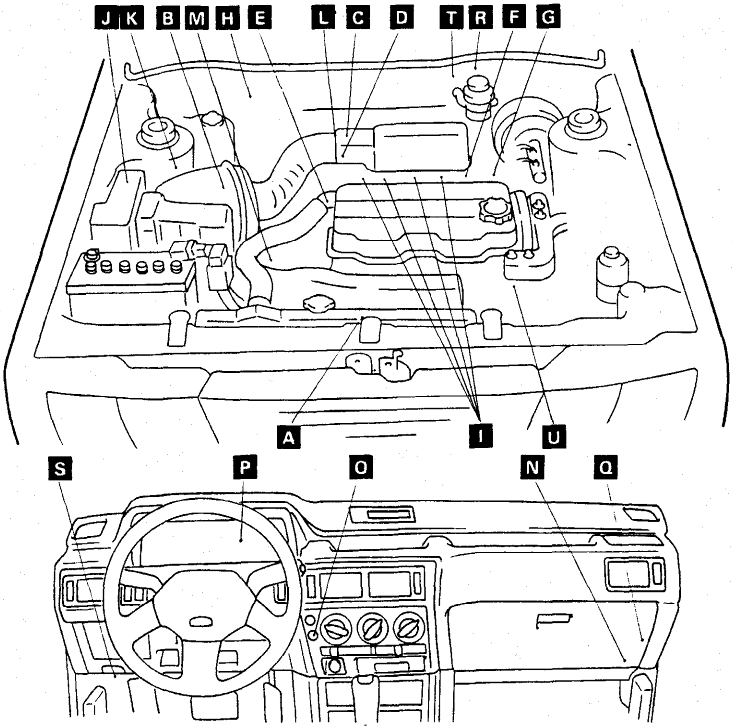

**Electronic engine control component locations—1.5L engine**




| Name | Symbol | Name | Symbol |
|---|---|---|---|
| Air conditioner relay | O | Ignition coil (power transistor) | M |
| Air conditioner switch | H | Ignition timing adjustment terminal | R |
| Air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor) | A | Inhibitor switch <A/T> | V |
| Crank angle sensor and top dead center sensor | E | Injector | K |
| EGR control solenoid valve <California> | Q | MPI control relay | N |
| EGR temperature sensor <California> | J | Oxygen sensor | F |
| Engine control unit | U | Power steering oil pressure switch | I |
| Engine coolant temperature sensor | B | Purge control solenoid valve | P |
| Fuel pump check terminal | T | Self-diagnosis terminal | S |
| Idle position switch | D | Throttle position sensor | C |
| Idle speed control servo (stepper motor) | L | Vehicle speed sensor (reed switch) | G |

93154g02

**Electronic engine control component locations—1.6L engine**

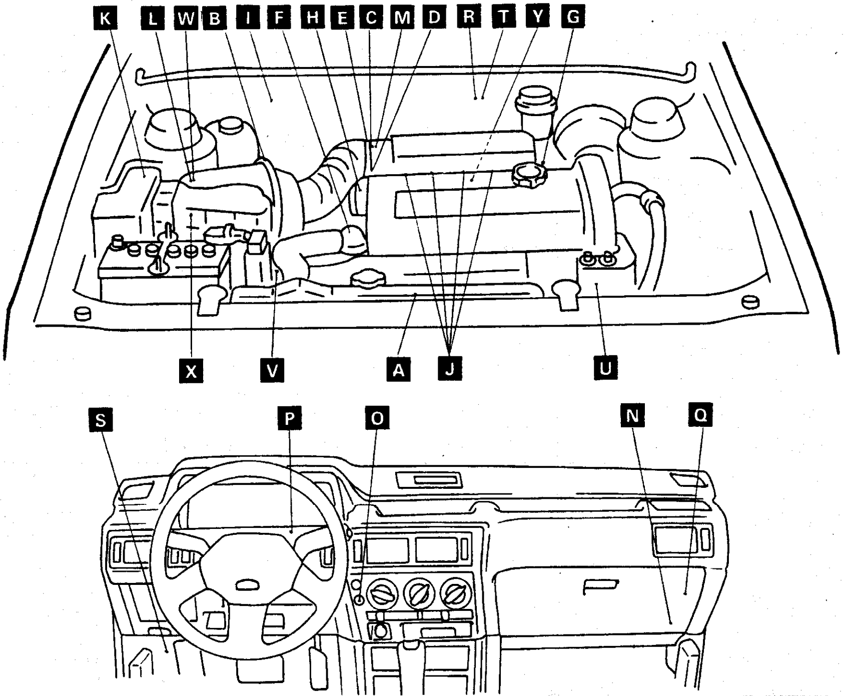



| Name | Symbol |
|---|---|
| Air conditioning compressor clutch relay | J |
| Air conditioning switch | O |
| Crankshaft position sensor and camshaft position sensor | G |
| Data link connector | S |
| EGR solenoid <California> | K |
| EGR temperature sensor <California> | L |
| Engine control module | Q |
| Engine coolant temperature sensor | E |
| Evaporative emission purge solenoid | H |
| Fuel pump check terminal | T |
| Idle speed control motor (closed throttle position switch, idle speed control motor position sensor) | C |

| Name | Symbol |
|---|---|
| Ignition coil (ignition power transistor) | F |
| Ignition timing adjustment terminal | R |
| Injector | I |
| Multiport fuel injection relay | N |
| Oxygen sensor | A |
| Park/neutral position switch <A/T> | M |
| Power steering pressure switch | U |
| Throttle position sensor | D |
| Vehicle speed sensor (reed switch) | P |
| Volume air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor) | B |

93154g03

**Electronic engine control component locations—2.0L SOHC engine**



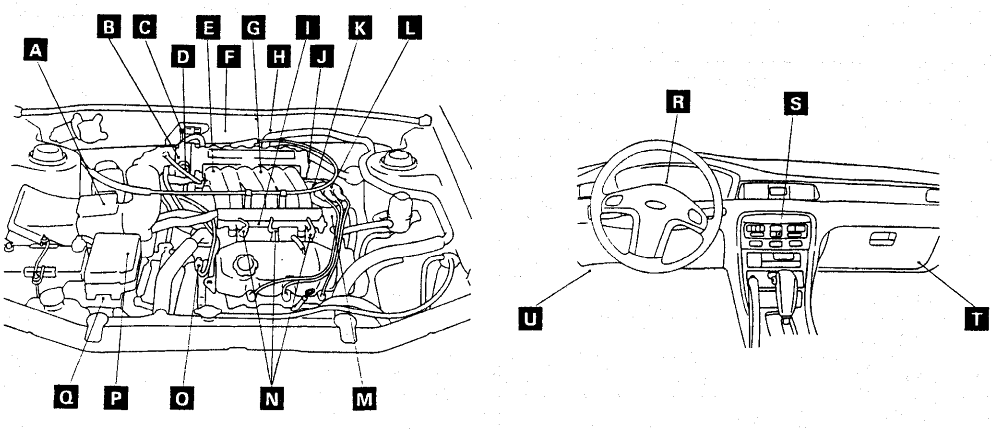

| Name | Symbol |
|---|---|
| Air conditioning compressor clutch relay | K |
| Air conditioning switch | O |
| Closed throttle position switch (fixed SAS) | E |
| Crankshaft position sensor and camshaft position sensor | H |
| Data link connector | S |
| Engine control module | Q |
| Engine coolant temperature sensor | F |
| EGR solenoid | L |
| EGR temperature sensor | M |
| Evaporative emission purge solenoid | I |
| Fuel pressure solenoid | W |
| Fuel pump check terminal | T |
| Heated oxygen sensor | A |
| Idle air control motor (stepper motor) | C |
| Ignition coil (ignition power transistor) | G |
| Ignition timing adjustment terminal | R |
| Injector | J |
| Knock sensor | Y |
| Multiport fuel injection relay | N |
| Park/neutral position switch <A/T> | V |
| Power steering pressure switch | U |
| Throttle position sensor | D |
| Turbocharger waste gate solenoid | X |
| Vehicle speed sensor (reed switch) | P |
| Volume air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor) | B |

NOTE
The "Name" column is arranged in alphabetical order.

93154g04

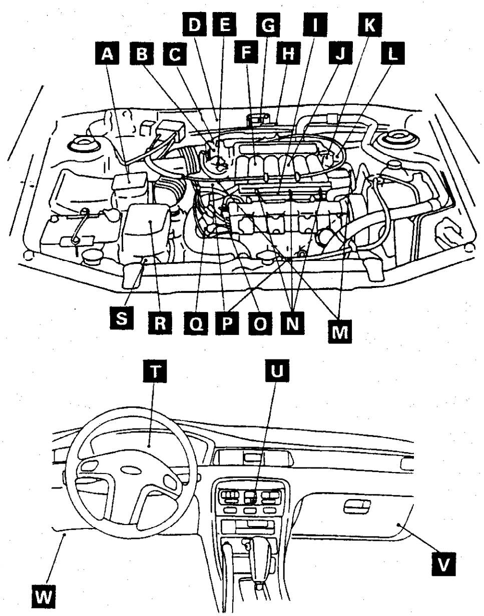
**Electronic engine control component locations—2.0L DOHC engine**

| Name | Symbol | Name | Symbol |
|---|---|---|---|
| Air conditioning compressor clutch relay | P | Ignition timing adjusting terminal | H |
| Air conditioning switch | S | Idle air control motor (stepper motor) | B |
| Camshaft position sensor and crankshaft position sensor | L | Injector | N |
| Check engine/malfunction indicator lamp | R | Knock sensor | I |
| Diagnostic output terminal and diagnostic test mode control terminal | U | Multiport fuel injector (MFI) relay | T |
| EGR solenoid <For California and for Federal from 1995 models> | F | Park/neutral position switch | Q |
| EGR temperature sensor <For California and for Federal from 1995 models> | E | Power steering pressure switch | M |
| Engine control module | T | Throttle position sensor (with built-in closed throttle switch) | D |
| Engine coolant temperature sensor | O | Variable induction control motor (DC motor) (with built-in induction control valve position sensor) | J |
| Evaporative emission purge solenoid | C | Vehicle speed sensor (reed switch) | R |
| Heated oxygen sensor | G | Volume air flow sensor (with built-in intake air temperature sensor and barometric pressure sensor) | A |
| Ignition coil (ignition power transistor) | K | | |




**Electronic engine control component locations—3.0L SOHC engine**

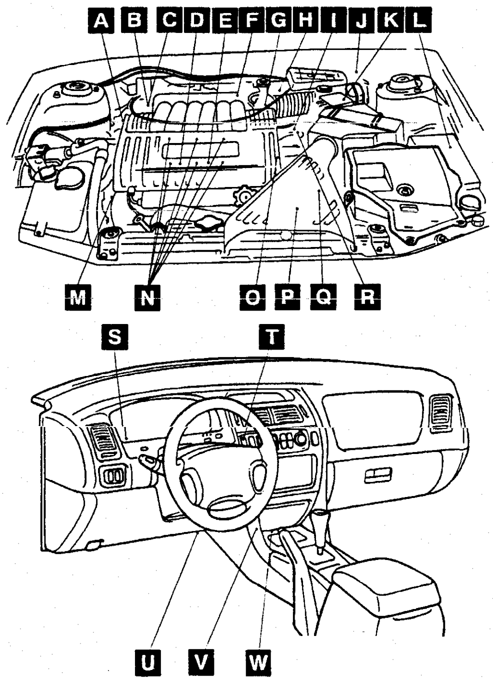
| Name | Symbol | Name | Symbol |
|---|---|---|---|
| Accelerator pedal position sensor (with built-in closed throttle position switch) <Vehicles with TCL> | C | Ignition coil (ignition power transistor) | Q |
| Air conditioning compressor clutch relay | R | Ignition timing adjusting terminal | H |
| Air conditioning switch | U | Injector | N |
| Camshaft position sensor | M | Knock sensor | I |
| Check engine/malfunction indicator lamp | T | Multiport fuel injection (MFI) relay | V |
| Crankshaft position sensor | P | Park/neutral position switch | S |
| Diagnostic output terminal and diagnostic test mode control terminal | W | Power steering pressure switch | L |
| EGR solenoid <California> | G | Throttle position sensor <Vehicles with TCL> | E |
| EGR temperature sensor <California> | F | Throttle position sensor (with built-in closed throttle position switch) <Except for vehicles with TCL> | E |
| Engine control module | V | Traction control vacuum solenoid and traction control ventilation solenoid <Vehicles with TCL> | D |
| Engine coolant temperature sensor | O | Variable induction control motor (DC motor) (with built-in induction control valve position sensor) | K |
| Evaporative emission purge solenoid | D | Vehicle speed sensor (reed switch) | T |
| Heated oxygen sensor | J | Volume air flow sensor (with built-in intake air temperature sensor and barometric pressure sensor) | A |
| Idle air control motor (stepper motor) | B | | |




93154g08

**Electronic engine control component locations—3.0L DOHC engine**

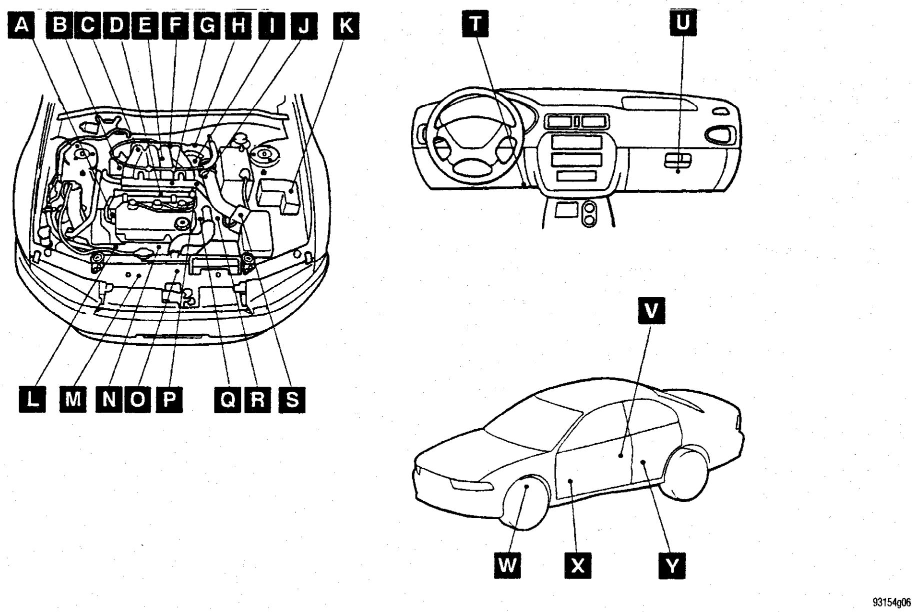
| Name | Symbol | Name | Symbol |
|---|---|---|---|
| Air conditioning compressor clutch relay | L | Heated oxygen sensor (Rear) | C |
| Air conditioner switch | T | Idle air control motor | H |
| Camshaft position sensor | I | Ignition coil (Ignition power transistor) | R |
| Check engine/malfunction indicator lamp | S | Injector | N |
| Crankshaft position sensor | M | Manifold differential pressure sensor | F |
| Data link connector | U | Multiport fuel injection (MFI) relay/Fuel pump relay | V |
| EGR solenoid | E | Park/Neutral position switch | Q |
| Engine control module | W | Power steering pressure switch | A |
| Engine coolant temperature sensor | O | Throttle position sensor (with built-in closed throttle position switch) | G |
| Evaporative emission purge solenoid | D | Vehicle speed sensor | P |
| Fuel pump check terminal | J | Volume air flow sensor (with built-in intake air temperature sensor and barometric pressure sensor) | K |
| Heated oxygen sensor (Front) | B | | |




93154g05

Electronic engine control component locations—3.5L engine

| NAME | SYMBOL | NAME | SYMBOL |
|---|---|---|---|
| Air conditioning compressor clutch relay | K | Knock sensor | D |
| Crankshaft position sensor | A | Left bank heated oxygen sensor (front) <California> | N |
| Data link connector | T | Left bank heated oxygen sensor (rear) <California> | M |
| Distributor (built-in camshaft position sensor and ignition coil) | J | Manifold differential pressure sensor | F |
| EGR solenoid | B | Multiport fuel injection (MFI) relay/fuel pump relay | K |
| Engine coolant temperature sensor | Q | Park/neutral position switch | R |
| Evaporative emission purge solenoid | B | Powertrain control module | U |
| Evaporative emission ventilation solenoid | Y | Power steering pressure switch | L |
| Fan controller | O | Right bank heated oxygen sensor (front) <California> | C |
| Fuel tank differential pressure sensor | V | Right bank heated oxygen sensor (rear) <California> | E |
| Heated oxygen sensor (front) <Federal> | W | Throttle position sensor | H |
| Heated oxygen sensor (rear) <Federal> | X | Vehicle speed sensor | P |
| Idle air control motor | I | Volume air flow sensor (with built-in intake air temperature sensor and barometric pressure sensor) | S |
| Injector | G | | |




**Electronic engine control component locations—1999–00 Galant with the 3.0L SOHC engine**

# OBD-I TROUBLE CODES

## General Information

The Powertrain Control Module (PCM) monitors the signals of input and output sensors, some all the time and others at certain times and processes each signal. When the PCM notices that an irregularity has continued for a specified time or longer from when the irregular signal was initially monitored, the PCM judges that a malfunction has occurred and will memorize the malfunction code. The code is then stored in the memory of the PCM and is accessible through the data link (diagnostic connector) with the use of an electronic scan tool or a voltmeter.

### CHECK ENGINE/MALFUNCTION INDICATOR LIGHT

Among the on-board diagnostic items, a check engine/malfunction indicator light comes on to notify the driver of a emission control component irregularity. If the irregularity detected returns to normal or the PCM judges that the component has returned to normal, the check engine/malfunction indicator light will be turned off. Moreover, if the ignition is turned **OFF** and then the engine is restarted, the check engine/malfunction indicator light will not be turned on until a malfunction is detected.

The check engine/malfunction indicator light will come on immediately after the ignition switch is turned **ON**. The light should stay lit for 5 seconds and then will go off. This indicates that the check engine/malfunction indicator lamp is operating normally. This does not signify a problem with the system.

**➡The check engine/malfunction indicator lamp will come on when the terminal for the ignition timing adjustment is shorted to ground. Therefore, it is not abnormal that the light comes on even when the terminal for ignition timing is shorted at time of ignition timing adjustment.**

To test the light, perform the following:

1. Turn the ignition switch **ON**. Inspect the check engine/malfunction indicator lamp for illumination.
2. The light should be lit for 5 seconds and then should go out.
3. If the lamp does not illuminate, check for open circuit in the harness, blown fuse or blown bulb.

### SERVICE PRECAUTIONS

- Before attaching or detaching the PCM harness connectors, make sure the ignition switch is **OFF** and the negative battery cable is disconnected to avoid the possibility of damage to the PCM.
- When performing PCM input/output signal diagnosis, remove the pin terminal retainer from the connectors to make it easier to insert tester probes into the connector.
- When attaching or detaching pin connectors from the PCM, take care not to bend or break any pin terminals. Check that there are no bends or breaks on PCM pin terminals before attempting any connections.
- Before replacing any PCM, perform the PCM input/output signal diagnosis to make sure the PCM is functioning properly.
- When measuring supply voltage of PCM-controlled components with a circuit tester, separate 1 tester probe from another. If the 2 tester probes accidentally make contact with each other during measurement, a short circuit will result and damage the PCM.

## Reading Codes

➧ **See Figures 83 and 84**

Remember that the diagnostic trouble code identification refers only to the circuit, not necessarily to a specific component. For example, fault code 14 may indicate an error in the throttle position sensor circuit; it does not necessarily mean the TPS sensor has failed. Testing of all related wiring, connectors and the sensor itself may be required to locate the problem.

The PCM memory is capable of storing multiple codes. During diagnosis the codes will be transmitted in numerical order from lowest to highest, regardless of the order of occurrence. If multiple codes are stored, always begin diagnostic work with the lowest numbered code.

Make a note of the following:

1. When battery voltage is low, no detection of failure is possible. Be sure to check the battery voltage and other conditions before starting the test.
2. Diagnostic items are erased if the battery or the engine controller connection is detached. Do not disconnect either of these components until the diagnostic material present in the PCM has been read completely.
3. Be sure to attach and detach the scan tool to the data link connector with the ignition key **OFF**. If the scan tool in connected or disconnected with the ignition key **ON**, diagnostic trouble codes may be falsely stored and the engine warning light may be illuminated.

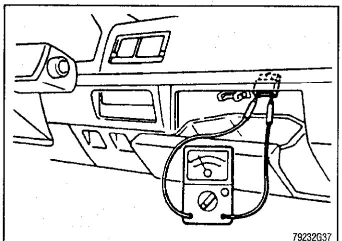



**Fig. 83 Diagnosis terminal connector location—Galant**

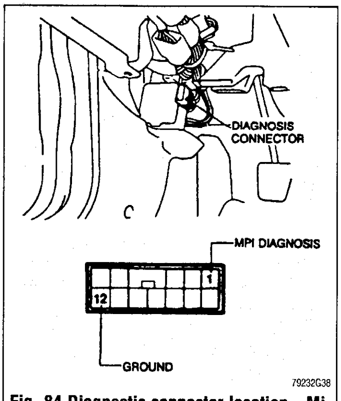



**Fig. 84 Diagnostic connector location—Mirage**

### WITH A SCAN TOOL

➧ **See Figures 85 and 86**

The procedure listed below is to be used only as a guide, when using Mitsubishi's MUT-II, or equivalent scan tool. For specific operating instructions, follow the directions supplied with the particular scan tool being used.

1. Remove the underdash cover, if equipped. Attach the scan tool to the data link connector, located on the left underside of the instrument panel.
2. Using the scan tool, read and record the on-board diagnostic output.
3. Diagnose and repair the faulty components as required.
4. Turn the ignition switch **OFF** and then turn it **ON**.
5. Erase the diagnostic trouble code.
6. Recheck the diagnostic trouble code and make sure that the normal code is output.

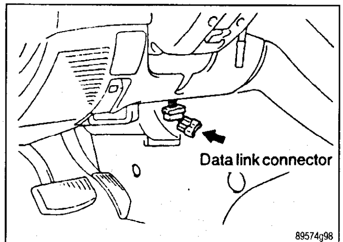



**Fig. 85 The data link connector is located on the left under side of the instrument panel**

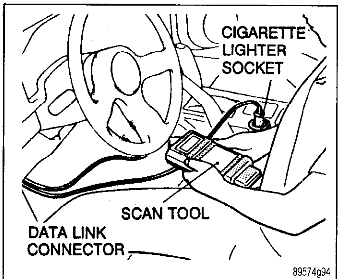



**Fig. 86 Proper connection of the scan tool to read codes on OBD-I vehicles**

### WITHOUT A SCAN TOOL

**See Figure 87.**

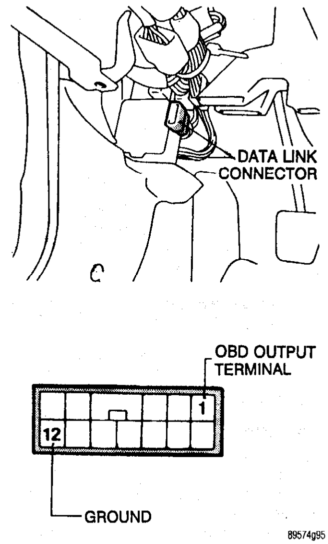



**Fig. 87 Location of the On-Board Diagnostic (OBD) output and ground terminal locations on the data link connector**

1. Remove the under dash cover, if equipped.
2. Attach an analog voltmeter between the on-board diagnostic output terminal of the data link connector and the ground terminal.
3. Turn the ignition switch **ON**.
4. Read the on-board diagnostic output pattern from the voltmeter and record.
5. Diagnose and repair the faulty components as required.
6. Erase the trouble code.
7. Turn the ignition switch **ON**, and read the diagnostic trouble codes, checking that a normal code is output.

## Clearing Codes

**➡To erase diagnostic trouble codes with a scan tool, follow the directions given by the tools manufacturer.**

1. Turn the ignition switch **OFF**.
2. Disconnect the negative battery cable from the battery for 1 minute or more, then reattach it.
3. Turn **ON** the ignition switch and read the diagnostic trouble codes checking that a normal code is output.

## Diagnostic Trouble Codes

**Code 11** Oxygen sensor
**Code 12** Air flow sensor
**Code 13** Intake Air Temperature Sensor
**Code 14** Throttle Position Sensor (TPS)
**Code 15** SC Motor Position Sensor (MPS)
**Code 21** Engine Coolant Temperature Sensor
**Code 22** Crank angle sensor
**Code 23** No. 1 cylinder TDC (camshaft position) Sensor
**Code 24** Vehicle speed sensor
**Code 25** Barometric pressure sensor
**Code 31** Knock sensor (KS)
**Code 32** Manifold pressure sensor
**Code 36** Ignition timing adjustment signal
**Code 39** Oxygen sensor (rear - turbocharged)
**Code 41** Injector
**Code 42** Fuel pump
**Code 43** EGR-California
**Code 44** Ignition Coil; power transistor unit (No. 1 and No. 4 cylinders) on 3.0L
**Code 52** Ignition Coil; power transistor unit (No. 2 and No. 5 cylinders) on 3.0L
**Code 53** Ignition Coil; power transistor unit (No. 3 and No. 6 cylinders) on 3.0L
**Code 55** AC valve position sensor
**Code 59** Heated oxygen sensor
**Code 61** Transaxle control unit cable (automatic transmission)
**Code 62** Warm-up control valve position sensor (non-turbo)

# OBD-II TROUBLE CODES

## General Information

The Powertrain Control Module (PCM) is given responsibility for the operation of the emission control devices, cooling fans, ignition and advance and in some cases, automatic transaxle functions. Because the PCM oversees both the ignition timing and the fuel injection operation, a precise air/fuel ratio will be maintained under all operating conditions. The PCM is a microprocessor, or small computer, which receives electrical inputs from several sensors, switches and relays on and around the engine.

Based on combinations of these inputs, the PCM controls outputs to various devices concerned with engine operation and emissions. The control module relies on the signals to form a correct picture of current vehicle operation. If any of the input signals is incorrect, the PCM reacts to whatever picture is painted for it. For example, if the coolant temperature sensor is inaccurate and reads too low, the PCM may see a picture of the engine never warming up. Consequently, the engine settings will be maintained as if the engine were cold. Because so many inputs can affect one output, correct diagnostic procedures are essential on these systems.

One part of the PCM is devoted to monitoring both input and output functions within the system. This ability forms the core of the self-diagnostic system. If a problem is detected within a circuit, the control module will recognize the fault, assign it a Diagnostic Trouble Code (DTC), and store the code in memory. The stored code(s) may be retrieved during diagnosis.

While the OBD-II system is capable of recognizing many internal faults, certain faults will not be recognized. Because the control module sees only electrical signals, it cannot sense or react to mechanical or vacuum faults affecting engine operation. Some of these faults may affect another component which will set a code. For example, the PCM monitors the output signal to the fuel injectors, but cannot detect a partially clogged injector. As long as the output driver responds correctly, the computer will read the system as functioning correctly. However, the improper flow of fuel may result in a lean mixture. This would, in turn, be detected by the oxygen sensor and noticed as a constantly lean signal by the PCM. Once the signal falls outside the pre-programmed limits, the control module would notice the fault and set a trouble code.

Additionally, the OBD-II system employs adaptive fuel logic. This process is used to compensate for normal wear and variability within the fuel system. Once the engine enters steady-state operation, the control module watches the oxygen sensor signal for a bias or tendency to run slightly rich or lean. If such a bias is detected, the adaptive logic corrects the fuel delivery to bring the air/fuel mixture towards a centered or 14.7:1 ratio. This compensating shift is stored in a non-volatile memory which is retained by battery power even with the ignition switched **OFF**. The correction factor is then available the next time the vehicle is operated.

## Reading Codes

### WITH A SCAN TOOL

**See Figures 88, 89, 90, and 91**

The Diagnostic Link Connector (DLC), under the left-hand side of the instrument panel, must be located to retrieve any DTC's.

Reading the control module memory is on of the first steps in OBD II system diagnostics. This step should be initially performed to determine the general nature of the fault. Subsequent readings will determine if the fault has been cleared.

Reading codes can be performed by any of the methods below:

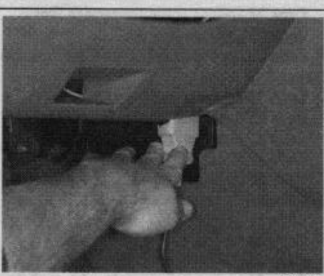
- Read the control module memory with the Generic Scan Tool (GST)
- Read the control module memory with the vehicle manufacturer's specific tester

To read the fault codes, connect the scan tool or tester according to the manufacturer's instructions. Follow the manufacturer's specified procedure for reading the codes.

### WITHOUT A SCAN TOOL

**See Figure 92**

The Diagnostic Link Connector (DLC), under the left-hand side of the instrument panel, must be located to retrieve any DTC's.

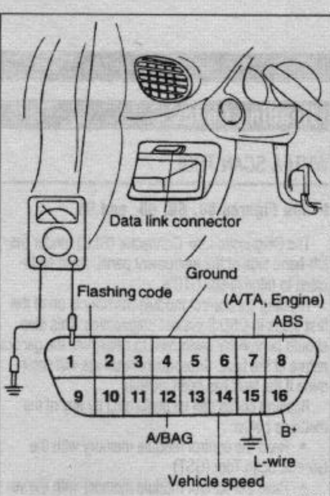


93154p31

Fig. 88 Plug the scan tool into the DLC under the driver's side of the instrument panel


93154p37

Fig. 90 In this case, we would choose 1-Trouble Codes to retrieve the DTC's




89446g35

Fig. 92 For OBD II code retrieval without using a scan tool on Mitsubishi models, connect the DVOM and jumper wire as shown

In 1996, all Mitsubishi switched from an arbitrary code listing and format, to the federally regulated On Board Diagnostics 2nd Generation (OBD II) code system. Normally, OBD II equipped vehicles do not have the option of allowing the person servicing the vehicle to flash the codes out with a voltmeter; usually a scan tool is necessary to retrieve OBD II codes. Mitsubishi, however, does provide this option.

93154p32

Fig. 89 Follow the directions on the scan tool screen to retrieve the DTC's


93154p38

Fig. 91 The PCM in this vehicle contains no DTC's

The Federal government decided that it was time to create a standard for vehicle diagnostic systems codes for ease of servicing and to insure that certain of the vehicle's systems were being monitored for emissions purposes. Since OBD II codes are standardized (they all contain one letter and four numbers), they are easy to decipher.

The OBD II system in the Mitsubishi models is designed so that it will flash the DTC's out on a voltmeter (even though a scan tool is better). However, the first two characters of the code are not used. This is because the transaxle is a part of the powertrain, so all transaxle related codes will begin with a P. Also, since there are no overlapping numbers between SAE and Mitsubishi codes, the second digit is also not necessary.

The system flashes the codes out in a series of flashes in three groups, each group corresponding to one of the three last digits of the OBD II code. Therefore, Code P0753 would be flashed out in seven flashes, followed by five flashes, then by three flashes. Each group of flashes is separated by a brief pause. All of the flashes are of the same duration, with the only exception being zero. Zero is represented by a long flash. Therefore, seven flashes, one long flash, two flashes would indicate a P0702 code (shorted TP sensor circuit).

To retrieve the codes, perform the following:

1. Perform the preliminary inspection, located earlier in this section. This is very important, since a loose or disconnected wire, or corroded connector terminals can cause a whole slew of unrelated DTC's to be stored by the computer; you will waste a lot of time performing a diagnostic "goose chase."
2. Grab some paper and a pencil or pen to write down the DTC's when they are flashed out.
3. Locate the Diagnostic Link Connector (DLC), which is usually under the left-hand side of the instrument panel.
4. Start the engine and drive the vehicle until the transaxle goes into the failsafe mode.
5. Park the vehicle, but do not turn the ignition **OFF**. Allow it to idle.
6. Attach a voltmeter (analog or digital) to the test terminals on the Diagnostic Link Connector (DLC). The negative lead should be attached to terminal 4 and the positive lead to terminal 1.
7. Observe the voltmeter and count the flashes (or arm sweeps if using an analog voltmeter); note the applicable codes.
8. After all of the DTC(s) have been retrieved, fix the applicable problems, clear the codes, drive the vehicle, and perform the retrieval procedure again to ensure that all of the codes are gone.

## Clearing Codes

### WITH A SCAN TOOL

Control module reset procedures are a very important part of OBD II System diagnostics.

This step should be done at the end of any fault code repair and at the end of any driveability repair.

Clearing codes can be performed by any of the methods below:

- Clear the control module memory with the Generic Scan Tool (GST)
- Clear the control module memory with the vehicle manufacturer's specific tester

**➡The MIL will may also be de-activated for some codes if the vehicle completes three consecutive trips without a fault detected with vehicle conditions similar to those present during the fault.**

### WITHOUT A SCAN TOOL

If there are still codes present, either the codes were not properly cleared (Are the codes identical to those flashed out previously?), or the underlying problem is still there (Are only some of the codes the same as previously?).

## Diagnostic Trouble Codes

### SCAN TOOL CODES

**P0000** No Failures

**P0100** Mass or Volume Air Flow Circuit Malfunction

**P0101** Mass or Volume Air Flow Circuit Range/Performance Problem

**P0102** Mass or Volume Air Flow Circuit Low Input

**P0103** Mass or Volume Air Flow Circuit High Input

**P0104** Mass or Volume Air Flow Circuit Intermittent

**P0105** Manifold Absolute Pressure/Barometric Pressure Circuit Malfunction

**P0106** Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance Problem

**P0107** Manifold Absolute Pressure/Barometric Pressure Circuit Low Input

**P0108** Manifold Absolute Pressure/Barometric Pressure Circuit High Input
**P0109** Manifold Absolute Pressure/Barometric Pressure Circuit Intermittent
**P0110** Intake Air Temperature Circuit Malfunction
**P0111** Intake Air Temperature Circuit Range/Performance Problem
**P0112** Intake Air Temperature Circuit Low Input
**P0113** Intake Air Temperature Circuit High Input
**P0114** Intake Air Temperature Circuit Intermittent
**P0115** Engine Coolant Temperature Circuit Malfunction
**P0116** Engine Coolant Temperature Circuit Range/Performance Problem
**P0117** Engine Coolant Temperature Circuit Low Input
**P0118** Engine Coolant Temperature Circuit High Input
**P0119** Engine Coolant Temperature Circuit Intermittent
**P0120** Throttle Position Sensor/Switch "A" Circuit Malfunction
**P0121** Throttle Position Sensor/Switch "A" Circuit Range/Performance Problem
**P0122** Throttle Position Sensor/Switch "A" Circuit Low Input
**P0123** Throttle Position Sensor/Switch "A" Circuit High Input
**P0124** Throttle Position Sensor/Switch "A" Circuit Intermittent
**P0125** Insufficient Coolant Temperature For Closed Loop Fuel Control
**P0126** Insufficient Coolant Temperature For Stable Operation
**P0130** O2 Circuit Malfunction (Bank no. 1 Sensor no. 1)
**P0131** O2 Sensor Circuit Low Voltage (Bank no. 1 Sensor no. 1)
**P0132** O2 Sensor Circuit High Voltage (Bank no. 1 Sensor no. 1)
**P0133** O2 Sensor Circuit Slow Response (Bank no. 1 Sensor no. 1)
**P0134** O2 Sensor Circuit No Activity Detected (Bank no. 1 Sensor no. 1)
**P0135** O2 Sensor Heater Circuit Malfunction (Bank no. 1 Sensor no. 1)
**P0136** O2 Sensor Circuit Malfunction (Bank no. 1 Sensor no. 2)
**P0137** O2 Sensor Circuit Low Voltage (Bank no. 1 Sensor no. 2)
**P0138** O2 Sensor Circuit High Voltage (Bank no. 1 Sensor no. 2)
**P0139** O2 Sensor Circuit Slow Response (Bank no. 1 Sensor no. 2)
**P0140** O2 Sensor Circuit No Activity Detected (Bank no. 1 Sensor no. 2)
**P0141** O2 Sensor Heater Circuit Malfunction (Bank no. 1 Sensor no. 2)
**P0142** O2 Sensor Circuit Malfunction (Bank no. 1 Sensor no. 3)
**P0143** O2 Sensor Circuit Low Voltage (Bank no. 1 Sensor no. 3)
**P0144** O2 Sensor Circuit High Voltage (Bank no. 1 Sensor no. 3)
**P0145** O2 Sensor Circuit Slow Response (Bank no. 1 Sensor no. 3)
**P0146** O2 Sensor Circuit No Activity Detected (Bank no. 1 Sensor no. 3)
**P0147** O2 Sensor Heater Circuit Malfunction (Bank no. 1 Sensor no. 3)
**P0150** O2 Sensor Circuit Malfunction (Bank no. 2 Sensor no. 1)
**P0151** O2 Sensor Circuit Low Voltage (Bank no. 2 Sensor no. 1)
**P0152** O2 Sensor Circuit High Voltage (Bank no. 2 Sensor no. 1)
**P0153** O2 Sensor Circuit Slow Response (Bank no. 2 Sensor no. 1)
**P0154** O2 Sensor Circuit No Activity Detected (Bank no. 2 Sensor no. 1)
**P0155** O2 Sensor Heater Circuit Malfunction (Bank no. 2 Sensor no. 1)
**P0156** O2 Sensor Circuit Malfunction (Bank no. 2 Sensor no. 2)
**P0157** O2 Sensor Circuit Low Voltage (Bank no. 2 Sensor no. 2)
**P0158** O2 Sensor Circuit High Voltage (Bank no. 2 Sensor no. 2)
**P0159** O2 Sensor Circuit Slow Response (Bank no. 2 Sensor no. 2)
**P0160** O2 Sensor Circuit No Activity Detected (Bank no. 2 Sensor no. 2)
**P0161** O2 Sensor Heater Circuit Malfunction (Bank no. 2 Sensor no. 2)
**P0162** O2 **Sensor Circuit Malfunction (Bank no. 2 Sensor no. 3)**
**P0163** O2 **Sensor Circuit Low Voltage (Bank no. 2 Sensor no. 3)**
**P0164** O2 **Sensor Circuit High Voltage (Bank no. 2 Sensor no. 3)**
**P0165** O2 **Sensor Circuit Slow Response (Bank no. 2 Sensor no. 3)**
**P0166** O2 **Sensor Circuit No Activity Detected (Bank no. 2 Sensor no. 3)**
**P0167** O2 **Sensor Heater Circuit Malfunction (Bank no. 2 Sensor no. 3)**
**P0170** Fuel Trim Malfunction (Bank no. 1 )
**P0171** System Too Lean (Bank no. 1 )
**P0172** System Too Rich (Bank no. 1 )
**P0173** Fuel Trim Malfunction (Bank no. 2 )
**P0174** System Too Lean (Bank no. 2 )
**P0175** System Too Rich (Bank no. 2 )
**P0176** Fuel Composition Sensor Circuit Malfunction
**P0177** Fuel Composition Sensor Circuit Range/Performance
**P0178** Fuel Composition Sensor Circuit Low Input
**P0179** Fuel Composition Sensor Circuit High Input
**P0180** Fuel Temperature Sensor "A" Circuit Malfunction
**P0181** Fuel Temperature Sensor "A" Circuit Range/Performance
**P0182** Fuel Temperature Sensor "A" Circuit Low Input
**P0183** Fuel Temperature Sensor "A" Circuit High Input
**P0184** Fuel Temperature Sensor "A" Circuit Intermittent
**P0185** Fuel Temperature Sensor "B" Circuit Malfunction
**P0186** Fuel Temperature Sensor "B" Circuit Range/Performance
**P0187** Fuel Temperature Sensor "B" Circuit Low Input
**P0188** Fuel Temperature Sensor "B" Circuit High Input
**P0189** Fuel Temperature Sensor "B" Circuit Intermittent
**P0190** Fuel Rail Pressure Sensor Circuit Malfunction
**P0191** Fuel Rail Pressure Sensor Circuit Range/Performance
**P0192** Fuel Rail Pressure Sensor Circuit Low Input
**P0193** Fuel Rail Pressure Sensor Circuit High Input
**P0194** Fuel Rail Pressure Sensor Circuit Intermittent
**P0195** Engine Oil Temperature Sensor Malfunction
**P0196** Engine Oil Temperature Sensor Range/Performance
**P0197** Engine Oil Temperature Sensor Low
**P0198** Engine Oil Temperature Sensor High
**P0199** Engine Oil Temperature Sensor Intermittent
**P0200** Injector Circuit Malfunction
**P0201** Injector Circuit Malfunction—Cylinder no. 1
**P0202** Injector Circuit Malfunction—Cylinder no. 2
**P0203** Injector Circuit Malfunction—Cylinder no. 3
**P0204** Injector Circuit Malfunction—Cylinder no. 4
**P0205** Injector Circuit Malfunction—Cylinder no. 5
**P0206** Injector Circuit Malfunction—Cylinder no. 6
**P0214** Cold Start Injector no. 2 Malfunction
**P0215** Engine Shutoff Solenoid Malfunction
**P0216** Injection Timing Control Circuit Malfunction
**P0217** Engine Over Temperature Condition
**P0218** Transmission Over Temperature Condition
**P0219** Engine Over Speed Condition
**P0220** Throttle Position Sensor/Switch "B" Circuit Malfunction
**P0221** Throttle Position Sensor/Switch "B" Circuit Range/Performance Problem
**P0222** Throttle Position Sensor/Switch "B" Circuit Low Input
**P0223** Throttle Position Sensor/Switch "B" Circuit High Input
**P0224** Throttle Position Sensor/Switch "B" Circuit Intermittent
**P0225** Throttle Position Sensor/Switch "C" Circuit Malfunction
**P0226** Throttle Position Sensor/Switch "C" Circuit Range/Performance Problem
**P0227** Throttle Position Sensor/Switch "C" Circuit Low Input
**P0228** Throttle Position Sensor/Switch "C" Circuit High Input
**P0229** Throttle Position Sensor/Switch "C" Circuit Intermittent
**P0230** Fuel Pump Primary Circuit Malfunction
**P0231** Fuel Pump Secondary Circuit Low
**P0232** Fuel Pump Secondary Circuit High
**P0233** Fuel Pump Secondary Circuit Intermittent
**P0261** Cylinder no. 1 Injector Circuit Low
**P0262** Cylinder no. 1 Injector Circuit High
**P0263** Cylinder no. 1 Contribution/Balance Fault
**P0264** Cylinder no. 2 Injector Circuit Low
**P0265** Cylinder no. 2 Injector Circuit High
**P0266** Cylinder no. 2 Contribution/Balance Fault
**P0267** Cylinder no. 3 Injector Circuit Low
**P0268** Cylinder no. 3 Injector Circuit High
**P0269** Cylinder no. 3 Contribution/Balance Fault
**P0270** Cylinder no. 4 Injector Circuit Low
**P0271** Cylinder no. 4 Injector Circuit High
**P0272** Cylinder no. 4 Contribution/Balance Fault
**P0273** Cylinder no. 5 Injector Circuit Low
**P0274** Cylinder no. 5 Injector Circuit High

**P0275** Cylinder no. 5 Contribution/Balance Fault
**P0276** Cylinder no. 6 Injector Circuit Low
**P0277** Cylinder no. 6 Injector Circuit High
**P0278** Cylinder no. 6 Contribution/Balance Fault
**P0300** Random/Multiple Cylinder Misfire Detected
**P0301** Cylinder no. 1—Misfire Detected
**P0302** Cylinder no. 2—Misfire Detected
**P0303** Cylinder no. 3—Misfire Detected
**P0304** Cylinder no. 4—Misfire Detected
**P0305** Cylinder no. 5—Misfire Detected
**P0306** Cylinder no. 6—Misfire Detected
**P0320** Ignition/Distributor Engine Speed Input Circuit Malfunction
**P0321** Ignition/Distributor Engine Speed Input Circuit Range/Performance
**P0322** Ignition/Distributor Engine Speed Input Circuit No Signal
**P0323** Ignition/Distributor Engine Speed Input Circuit Intermittent
**P0325** Knock Sensor no. 1—Circuit Malfunction (Bank no. 1 or Single Sensor)
**P0326** Knock Sensor no. 1—Circuit Range/Performance (Bank no. 1 or Single Sensor)
**P0327** Knock Sensor no. 1—Circuit Low Input (Bank no. 1 or Single Sensor)
**P0328** Knock Sensor no. 1—Circuit High Input (Bank no. 1 or Single Sensor)
**P0329** Knock Sensor no. 1—Circuit Input Intermittent (Bank no. 1 or Single Sensor)
**P0330** Knock Sensor no. 2—Circuit Malfunction (Bank no. 2 )
**P0331** Knock Sensor no. 2—Circuit Range/Performance (Bank no. 2 )
**P0332** Knock Sensor no. 2—Circuit Low Input (Bank no. 2 )
**P0333** Knock Sensor no. 2—Circuit High Input (Bank no. 2 )
**P0334** Knock Sensor no. 2—Circuit Input Intermittent (Bank no. 2 )
**P0335** Crankshaft Position Sensor "A" Circuit Malfunction
**P0336** Crankshaft Position Sensor "A" Circuit Range/Performance
**P0337** Crankshaft Position Sensor "A" Circuit Low Input
**P0338** Crankshaft Position Sensor "A" Circuit High Input
**P0339** Crankshaft Position Sensor "A" Circuit Intermittent
**P0340** Camshaft Position Sensor Circuit Malfunction
**P0341** Camshaft Position Sensor Circuit Range/Performance
**P0342** Camshaft Position Sensor Circuit Low Input
**P0343** Camshaft Position Sensor Circuit High Input
**P0344** Camshaft Position Sensor Circuit Intermittent
**P0350** Ignition Coil Primary/Secondary Circuit Malfunction
**P0351** Ignition Coil "A" Primary/Secondary Circuit Malfunction
**P0352** Ignition Coil "B" Primary/Secondary Circuit Malfunction
**P0353** Ignition Coil "C" Primary/Secondary Circuit Malfunction
**P0354** Ignition Coil "D" Primary/Secondary Circuit Malfunction
**P0355** Ignition Coil "E" Primary/Secondary Circuit Malfunction
**P0356** Ignition Coil "F" Primary/Secondary Circuit Malfunction
**P0357** Ignition Coil "G" Primary/Secondary Circuit Malfunction
**P0358** Ignition Coil "H" Primary/Secondary Circuit Malfunction
**P0359** Ignition Coil "I" Primary/Secondary Circuit Malfunction
**P0360** Ignition Coil "J" Primary/Secondary Circuit Malfunction
**P0361** Ignition Coil "K" Primary/Secondary Circuit Malfunction
**P0362** Ignition Coil "L" Primary/Secondary Circuit Malfunction
**P0370** Timing Reference High Resolution Signal "A" Malfunction
**P0371** Timing Reference High Resolution Signal "A" Too Many Pulses
**P0372** Timing Reference High Resolution Signal "A" Too Few Pulses
**P0373** Timing Reference High Resolution Signal "A" Intermittent/Erratic Pulses
**P0374** Timing Reference High Resolution Signal "A" No Pulses
**P0375** Timing Reference High Resolution Signal "B" Malfunction
**P0376** Timing Reference High Resolution Signal "B" Too Many Pulses
**P0377** Timing Reference High Resolution Signal "B" Too Few Pulses
**P0378** Timing Reference High Resolution Signal "B" Intermittent/Erratic Pulses
**P0379** Timing Reference High Resolution Signal "B" No Pulses
**P0385** Crankshaft Position Sensor "B" Circuit Malfunction
**P0386** Crankshaft Position Sensor "B" Circuit Range/Performance
**P0387** Crankshaft Position Sensor "B" Circuit Low Input
**P0388** Crankshaft Position Sensor "B" Circuit High Input
**P0389** Crankshaft Position Sensor "B" Circuit Intermittent
**P0400** Exhaust Gas Recirculation Flow Malfunction
**P0401** Exhaust Gas Recirculation Flow Insufficient Detected
**P0402** Exhaust Gas Recirculation Flow Excessive Detected
**P0403** Exhaust Gas Recirculation Circuit Malfunction
**P0404** Exhaust Gas Recirculation Circuit Range/Performance
**P0405** Exhaust Gas Recirculation Sensor "A" Circuit Low
**P0406** Exhaust Gas Recirculation Sensor "A" Circuit High
**P0407** Exhaust Gas Recirculation Sensor "B" Circuit Low
**P0408** Exhaust Gas Recirculation Sensor "B" Circuit High
**P0410** Secondary Air Injection System Malfunction
**P0411** Secondary Air Injection System Incorrect Flow Detected
**P0412** Secondary Air Injection System Switching Valve "A" Circuit Malfunction
**P0413** Secondary Air Injection System Switching Valve "A" Circuit Open
**P0414** Secondary Air Injection System Switching Valve "A" Circuit Shorted
**P0415** Secondary Air Injection System Switching Valve "B" Circuit Malfunction
**P0416** Secondary Air Injection System Switching Valve "B" Circuit Open
**P0417** Secondary Air Injection System Switching Valve "B" Circuit Shorted
**P0418** Secondary Air Injection System Relay "A" Circuit Malfunction
**P0419** Secondary Air Injection System Relay "B" Circuit Malfunction
**P0420** Catalyst System Efficiency Below Threshold (Bank no. 1 )
**P0421** Warm Up Catalyst Efficiency Below Threshold (Bank no. 1 )
**P0422** Main Catalyst Efficiency Below Threshold (Bank no. 1 )
**P0423** Heated Catalyst Efficiency Below Threshold (Bank no. 1 )
**P0424** Heated Catalyst Temperature Below Threshold (Bank no. 1)
**P0430** Catalyst System Efficiency Below Threshold (Bank no. 2 )
**P0431** Warm Up Catalyst Efficiency Below Threshold (Bank no. 2 )
**P0432** Main Catalyst Efficiency Below Threshold (Bank no. 2)
**P0433** Heated Catalyst Efficiency Below Threshold (Bank no. 2 )
**P0434** Heated Catalyst Temperature Below Threshold (Bank no. 2 )
**P0440** Evaporative Emission Control System Malfunction
**P0441** Evaporative Emission Control System Incorrect Purge Flow
**P0442** Evaporative Emission Control System Leak Detected (Small Leak)
**P0443** Evaporative Emission Control System Purge Control Valve Circuit Malfunction
**P0444** Evaporative Emission Control System Purge Control Valve Circuit Open
**P0445** Evaporative Emission Control System Purge Control Valve Circuit Shorted
**P0446** Evaporative Emission Control System Vent Control Circuit Malfunction
**P0447** Evaporative Emission Control System Vent Control Circuit Open
**P0448** Evaporative Emission Control System Vent Control Circuit Shorted
**P0449** Evaporative Emission Control System Vent Valve/Solenoid Circuit Malfunction
**P0450** Evaporative Emission Control System Pressure Sensor Malfunction
**P0451** Evaporative Emission Control System Pressure Sensor Range/Performance
**P0452** Evaporative Emission Control System Pressure Sensor Low Input
**P0453** Evaporative Emission Control System Pressure Sensor High Input
**P0454** Evaporative Emission Control System Pressure Sensor Intermittent
**P0455** Evaporative Emission Control System Leak Detected (Gross Leak)
**P0460** Fuel Level Sensor Circuit Malfunction
**P0461** Fuel Level Sensor Circuit Range/Performance
**P0462** Fuel Level Sensor Circuit Low Input
**P0463** Fuel Level Sensor Circuit High Input
**P0464** Fuel Level Sensor Circuit Intermittent
**P0465** Purge Flow Sensor Circuit Malfunction
**P0466** Purge Flow Sensor Circuit Range/Performance
**P0467** Purge Flow Sensor Circuit Low Input

**P0468** Purge Flow Sensor Circuit High Input
**P0469** Purge Flow Sensor Circuit Intermittent
**P0470** Exhaust Pressure Sensor Malfunction
**P0471** Exhaust Pressure Sensor Range/Performance
**P0472** Exhaust Pressure Sensor Low
**P0473** Exhaust Pressure Sensor High
**P0474** Exhaust Pressure Sensor Intermittent
**P0475** Exhaust Pressure Control Valve Malfunction
**P0476** Exhaust Pressure Control Valve Range/Performance
**P0477** Exhaust Pressure Control Valve Low
**P0478** Exhaust Pressure Control Valve High
**P0479** Exhaust Pressure Control Valve Intermittent
**P0480** Cooling Fan no. 1 Control Circuit Malfunction
**P0481** Cooling Fan no. 2 Control Circuit Malfunction
**P0482** Cooling Fan no. 3 Control Circuit Malfunction
**P0483** Cooling Fan Rationality Check Malfunction
**P0484** Cooling Fan Circuit Over Current
**P0485** Cooling Fan Power/Ground Circuit Malfunction
**P0500** Vehicle Speed Sensor Malfunction
**P0501** Vehicle Speed Sensor Range/Performance
**P0502** Vehicle Speed Sensor Circuit Low Input
**P0503** Vehicle Speed Sensor Intermittent/Erratic/High
**P0505** Idle Control System Malfunction
**P0506** Idle Control System RPM Lower Than Expected
**P0507** Idle Control System RPM Higher Than Expected
**P0510** Closed Throttle Position Switch Malfunction
**P0520** Engine Oil Pressure Sensor/Switch Circuit Malfunction
**P0521** Engine Oil Pressure Sensor/Switch Range/Performance
**P0522** Engine Oil Pressure Sensor/Switch Low Voltage
**P0523** Engine Oil Pressure Sensor/Switch High Voltage
**P0530** A/C Refrigerant Pressure Sensor Circuit Malfunction
**P0531** A/C Refrigerant Pressure Sensor Circuit Range/Performance
**P0532** A/C Refrigerant Pressure Sensor Circuit Low Input
**P0533** A/C Refrigerant Pressure Sensor Circuit High Input
**P0534** A/C Refrigerant Charge Loss
**P0550** Power Steering Pressure Sensor Circuit Malfunction
**P0551** Power Steering Pressure Sensor Circuit Range/Performance
**P0552** Power Steering Pressure Sensor Circuit Low Input
**P0553** Power Steering Pressure Sensor Circuit High Input
**P0554** Power Steering Pressure Sensor Circuit Intermittent
**P0560** System Voltage Malfunction
**P0561** System Voltage Unstable
**P0562** System Voltage Low
**P0563** System Voltage High
**P0565** Cruise Control On Signal Malfunction
**P0566** Cruise Control Off Signal Malfunction
**P0567** Cruise Control Resume Signal Malfunction
**P0568** Cruise Control Set Signal Malfunction
**P0569** Cruise Control Coast Signal Malfunction
**P0570** Cruise Control Accel Signal Malfunction
**P0571** Cruise Control/Brake Switch "A" Circuit Malfunction
**P0572** Cruise Control/Brake Switch "A" Circuit Low
**P0573** Cruise Control/Brake Switch "A" Circuit High
**P0574 Through P0580** Reserved for Cruise Codes
**P0600** Serial Communication Link Malfunction
**P0601** Internal Control Module Memory Check Sum Error
**P0602** Control Module Programming Error
**P0603** Internal Control Module Keep Alive Memory (KAM) Error
**P0604** Internal Control Module Random Access Memory (RAM) Error
**P0605** Internal Control Module Read Only Memory (ROM) Error
**P0606** PCM Processor Fault
**P0608** Control Module VSS Output "A" Malfunction
**P0609** Control Module VSS Output "B" Malfunction
**P0620** Generator Control Circuit Malfunction
**P0621** Generator Lamp "L" Control Circuit Malfunction
**P0622** Generator Field "F" Control Circuit Malfunction
**P0650** Malfunction Indicator Lamp (MIL) Control Circuit Malfunction
**P0654** Engine RPM Output Circuit Malfunction
**P0655** Engine Hot Lamp Output Control Circuit Malfunction
**P0656** Fuel Level Output Circuit Malfunction
**P0700** Transmission Control System Malfunction
**P0701** Transmission Control System Range/Performance
**P0702** Transmission Control System Electrical
**P0703** Torque Converter/Brake Switch "B" Circuit Malfunction
**P0704** Clutch Switch Input Circuit Malfunction
**P0705** Transmission Range Sensor Circuit Malfunction (PRNDL Input)
**P0706** Transmission Range Sensor Circuit Range/Performance
**P0707** Transmission Range Sensor Circuit Low Input
**P0708** Transmission Range Sensor Circuit High Input
**P0709** Transmission Range Sensor Circuit Intermittent
**P0710** Transmission Fluid Temperature Sensor Circuit Malfunction
**P0711** Transmission Fluid Temperature Sensor Circuit Range/Performance
**P0712** Transmission Fluid Temperature Sensor Circuit Low Input
**P0713** Transmission Fluid Temperature Sensor Circuit High Input
**P0714** Transmission Fluid Temperature Sensor Circuit Intermittent
**P0715** Input/Turbine Speed Sensor Circuit Malfunction
**P0716** Input/Turbine Speed Sensor Circuit Range/Performance
**P0717** Input/Turbine Speed Sensor Circuit No Signal
**P0718** Input/Turbine Speed Sensor Circuit Intermittent
**P0719** Torque Converter/Brake Switch "B" Circuit Low
**P0720** Output Speed Sensor Circuit Malfunction
**P0721** Output Speed Sensor Circuit Range/Performance
**P0722** Output Speed Sensor Circuit No Signal
**P0723** Output Speed Sensor Circuit Intermittent
**P0724** Torque Converter/Brake Switch "B" Circuit High
**P0725** Engine Speed Input Circuit Malfunction
**P0726** Engine Speed Input Circuit Range/Performance
**P0727** Engine Speed Input Circuit No Signal
**P0728** Engine Speed Input Circuit Intermittent
**P0730** Incorrect Gear Ratio
**P0731** Gear no. 1 Incorrect Ratio
**P0732** Gear no. 2 Incorrect Ratio
**P0733** Gear no. 3 Incorrect Ratio
**P0734** Gear no. 4 Incorrect Ratio
**P0735** Gear no. 5 Incorrect Ratio
**P0736** Reverse Incorrect Ratio
**P0740** Torque Converter Clutch Circuit Malfunction
**P0741** Torque Converter Clutch Circuit Performance or Stuck Off
**P0742** Torque Converter Clutch Circuit Stuck On
**P0743** Torque Converter Clutch Circuit Electrical
**P0744** Torque Converter Clutch Circuit Intermittent
**P0745** Pressure Control Solenoid Malfunction
**P0746** Pressure Control Solenoid Performance or Stuck Off
**P0747** Pressure Control Solenoid Stuck On
**P0748** Pressure Control Solenoid Electrical
**P0749** Pressure Control Solenoid Intermittent
**P0750** Shift Solenoid "A" Malfunction
**P0751** Shift Solenoid "A" Performance or Stuck Off
**P0752** Shift Solenoid "A" Stuck On
**P0753** Shift Solenoid "A" Electrical
**P0754** Shift Solenoid "A" Intermittent
**P0755** Shift Solenoid "B" Malfunction
**P0756** Shift Solenoid "B" Performance or Stuck Off
**P0757** Shift Solenoid "B" Stuck On
**P0758** Shift Solenoid "B" Electrical
**P0759** Shift Solenoid "B" Intermittent
**P0760** Shift Solenoid "C" Malfunction
**P0761** Shift Solenoid "C" Performance Or Stuck Off
**P0762** Shift Solenoid "C" Stuck On
**P0763** Shift Solenoid "C" Electrical
**P0764** Shift Solenoid "C" Intermittent
**P0765** Shift Solenoid "D" Malfunction
**P0766** Shift Solenoid "D" Performance Or Stuck Off
**P0767** Shift Solenoid "D" Stuck On
**P0768** Shift Solenoid "D" Electrical
**P0769** Shift Solenoid "D" Intermittent
**P0770** Shift Solenoid "E" Malfunction
**P0771** Shift Solenoid "E" Performance Or Stuck Off
**P0772** Shift Solenoid "E" Stuck On
**P0773** Shift Solenoid "E" Electrical
**P0774** Shift Solenoid "E" Intermittent
**P0780** Shift Malfunction
**P0781** 1–2 Shift Malfunction
**P0782** 2–3 Shift Malfunction
**P0783** 3–4 Shift Malfunction
**P0784** 4–5 Shift Malfunction

**P0785** Shift/Timing Solenoid Malfunction
**P0786** Shift/Timing Solenoid Range/Performance
**P0787** Shift/Timing Solenoid Low
**P0788** Shift/Timing Solenoid High
**P0789** Shift/Timing Solenoid Intermittent
**P0790** Normal/Performance Switch Circuit Malfunction
**P0801** Reverse Inhibit Control Circuit Malfunction
**P0803** 1–4 Upshift (Skip Shift) Solenoid Control Circuit Malfunction
**P0804** 1–4 Upshift (Skip Shift) Lamp Control Circuit Malfunction
**P1100** Induction Control Motor Position Sensor Fault
**P1101** Traction Control Vacuum Solenoid Circuit Fault
**P1102** Traction Control Ventilation Solenoid Circuit Fault
**P1105** Fuel Pressure Solenoid Circuit Fault
**P1294** Target Idle Speed Not Reached
**P1295** No 5-Volt Supply To TP Sensor
**P1296** No 5-Volt Supply To MAP Sensor
**P1297** No Change In MAP From Start To Run
**P1300** Ignition Timing Adjustment Circuit
**P1390** Timing Belt Skipped One Tooth Or More
**P1391** Intermittent Loss Of CMP Or CKP Sensor Signals
**P1400** Manifold Differential Pressure Sensor Fault
**P1443** EVAP Purge Control Solenoid "2" Circuit Fault
**P1486** EVAP Leak Monitor Pinched Hose Detected
**P1487** High Speed Radiator Fan Control Relay Circuit Fault
**P1490** Low Speed Fan Control Relay Fault
**P1492** Battery Temperature Sensor High Voltage
**P1494** EVAP Ventilation Switch Or Mechanical Fault
**P1495** EVAP Ventilation Solenoid Circuit Fault
**P1496** 5-Volt Supply Output Too Low
**P1500** Generator FR Terminal Circuit Fault
**P1600** PCM-TCM Serial Communication Link Circuit Fault
**P1696** PCM Failure- EEPROM Write Denied
**P1715** No CCD Messages From TCM
**P1750** TCM Pulse Generator Circuit Fault
**P1791** Pressure Control, Shift Control, TCC Solenoid Fault
**P1899** PCM ECT Level Signal to TCM Circuit Fault
**P1989** High Speed Condenser Fan Control Relay Fault

## FLASH OUT CODE LIST

**See Figures 93, 94, 95, and 96**

| Code | Output pattern (for voltmeter) | Cause | Remedy |
|---|---|---|---|
| P1702 |  A5AT005E | Shorted throttle position sensor circuit | o Check the throttle position sensor connector<br>o check the throttle position sensor itself<br>o Check the closed throttle position switch<br>o Check the throttle position sensor wiring harness<br>o Check the wiring between ECM and throttle position sensor |
| P1701 |  A5AT005F | Open throttle position sensor circuit | |
| P1704 |  A5AT005H | Throttle position sensor malfunction<br>Improperly adjusted throttle position sensor | |
| P0712 |  A5AT005I | Open fluid temperature sensor circuit | o Fluid temperature sensor connector inspection<br>o Fluid temperature sensor inspection<br>o Fluid temperature sensor wiring harness inspection |
| P0713 |  A5AT005J | Shorted fluid temperature sensor circuit | |
| P1709 |  A5AT005K | Open kickdown servo switch circuit<br>Shorted kickdown servo switch circuit | o Check the kickdown servo switch connector<br>o Check the kickdown servo switch<br>o Check the kickdown servo switch wiring harness |

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**Fig. 93 Mitsubishi flash out DTC's, 1 of 4—Type 4 (OBD II) Codes**

| Code | Output pattern (for voltmeter) | Cause | Remedy |
|---|---|---|---|
| P0727 |  A5AT005L | Open ignition pulse pickup cable circuit | o Check the ignition pulse signal line<br>o Check the wiring between ECM and ignisiton system |
| P1714 |  A5AT005M | Short-circuited or improperly adjusted closed throttle position switch | o Check the closed throttle position switch connector<br>o Check the closed throttle position switch itself<br>o Adjust the closed throttle position switch<br>o Check the closed throttle position switch wiring harness |
| P0717 |  A5AT005N | Open-circuited pulse generator A | o Check the pulse generator A and pulse generator B<br>o Check the vehicle speed reed switch (for chattering)<br>o Check the pulse generator A and B wiring harness |
| P0722 |  A5AT005O | Open-circuited pulse generator B | |
| P0707 |  A5AT005Z | No input signal | o Check the transaxle range switch<br>o Check the transaxle range wiring harness<br>o Check the manual control cable |
| P0708 |  A5ATA05A | More than two input signals | |
| P0752 |  A5AT005P | Open shift control solenoid vave A circuit | o Check the solenoid valve connector<br>o Check the shift control solenoid valve A<br>o Check the shift control solenoid valve A wiring harness |
| P0753 |  A5AT005Q | Shorted shift control solenoid valve A circuit | |
| P0757 |  A5AT005R | Open shift control solenoid valve B circuit | o Check the shift control solenoid valve connector<br>o Check the shift control solenoid valve B wiring harness<br>o Check the shift control solenoid valve B |
| P0758 |  A5AT005S | Short shift control solenoid valve B circuit | |
| P0747 |  A5AT005T | Open pressure control solenoid valve circuit | o Check the pressure control solenoid valve<br>o Check the pressure control solenoid valve wiring harness |
| P0748 |  A5AT005U | Shorted pressure control solenoid valve circuit | |

89446g28

**Fig. 94 Mitsubishi flash out DTC's, 2 of 4—Type 4 (OBD II) Codes**

| Code | Output pattern (for voltmeter) | Cause | Remedy |
|---|---|---|---|
| P0743 |  A5AT005V | Open circuit in damper clutch control solenoid valve<br>Short circuit in damper clutch control solenoid valve<br>Defect in the damper clutch system | o Inspection of solenoid valve connector<br>o Individual inspection of damper clutch control solenoid valve<br>o Check the damper clutch control solenoid valve wiring harness<br>o Chck the TCM<br>o Inspection of damper clutch hydraulic system |
| P0742 |  A5AT005W | | |
| P0740 |  A5AT005X | | |
| P1744 |  A5AT005Y | | |
| P0731 |  A5ATA05B | Shifting to first gear does not match the engine speed | o Check the pulse generator A and pulse generator B connector<br>o Check the pulse generator A and puls generator B<br>o Check the one way clutch or rear clutch<br>o Check the pulse generator wiring harness<br>o Kickdown brake slippage |
| P0732 |  A5ATA05C | Shifting to second gear does not match the engine speed | |
| P0733 |  A5ATA05D | Shifting to third gear does not match the engine speed | o Check the rear clutch or control system<br>o Check the pulse generator A and pulse generator B connector<br>o Check the pulse generator A and pulse generator B<br>o Check the pulse generator wiring harness<br>o Check the rear clutch slippage or control system<br>o Check the front clutch slippage or control system |
| P0734 |  A5ATA05E | Shifting to fourth gear does not match the engine speed | o Check the pulse generator A and B connector<br>o Check the pulse generator A and B<br>o Kickdown brake slippage<br>o Check the end clutch or control system<br>o Check the pulse generator wiring harness |
| - | | Normal | |

89446g29

Fig. 95 Mitsubishi flash out DTC's, 3 of 4—Type 4 (OBD II) Codes

## FAIL-SAFE ITEM

| Code No. | Output code: Output pattern (for voltmeter) | Description | Fail-safe | Note (relation to diagnostic trouble code) |
|---|---|---|---|---|
| P0717 |  A5AT005N | Open-circuited pulse generator A | Locked in third (D) or second (2,L) | When code No.0717 is generated fourth time |
| P0722 |  A5AT005O | Open-circuited pulse generator B | Locked in third (D) or second (2,L) | When code No.0722 is generated fourth time |
| P0752 |  A5AT005P | Open-circuited or shorted shift control solenoid valve A | Lock in third | When code No.0752 or 0753 is generated fourth time |
| P0753 |  A5AT005Q | | | |
| P0757 |  A5AT005R | Open-circuited or shorted shift control solenoid valve B | Lock in third gear | When code No.0757 or 0758 is generated fourth time |
| P0758 |  A5AT005S | | | |
| P0747 |  A5AT005T | Open-circuited or shorted pressure control solenoid valve | Locked in third (D) or second (2,L) | When code No.0747 or 0748 is generated fourth time |
| P0748 |  A5AT005U | | | |
| P0731 |  A5ATA05B | Gear shifting does not match the engine speed | Locked in third (D) or second (2,L) | When either code No.0731, 0732, 0733 or 0734 is generated fourth time |
| P0732 |  A5ATA05C | | | |
| P0733 |  A5ATA05D | | | |
| P0734 |  A5ATA05E | | | |

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**Fig. 96 Mitsubishi flash out DTC's, 4 of 4—Type 4 (OBD II) Codes**

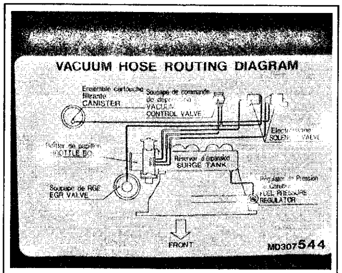
## VACUUM DIAGRAMS

Following are vacuum diagrams for most of the engine and emissions package combinations covered by this manual. Because vacuum circuits will vary based on various engine and vehicle options, always refer first to the vehicle emission control information label, if present. Should the label be missing, or should vehicle be equipped with a different engine from the vehicle's original equipment, refer to the diagrams below for the same or similar configuration.

If you wish to obtain a replacement emissions label, most manufacturers make the labels available for purchase. The labels can usually be ordered from a local dealer.

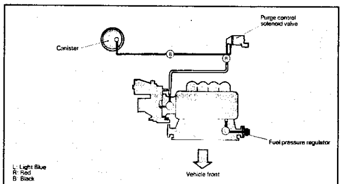

93154p03

**The Emission Control Label contains information about the vehicle's emissions systems, along with other pertinent service information**



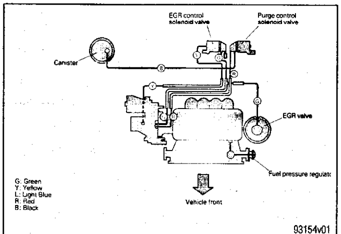

93154p04

**A vacuum diagram is typically affixed to a label in the engine compartment**



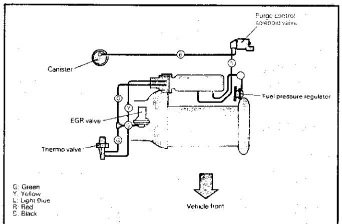

93154v01

**Emission control system vacuum hose routing—1990–92 1.5L engine, Federal emissions**



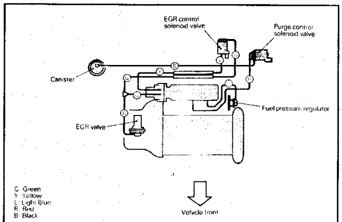

93154v01

**Emission control system vacuum hose routing—1990–92 1.5L engine, California emissions**



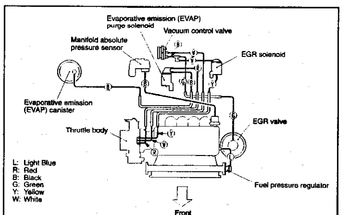

93154v03

**Emission control system vacuum hose routing—1990–92 1.6L engine, Federal emissions**



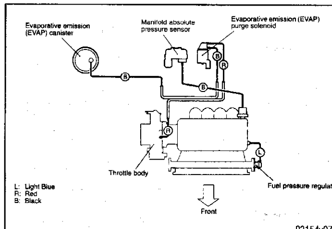

93154v04

**Emission control system vacuum hose routing—1990–92 1.6L engine, California emissions**



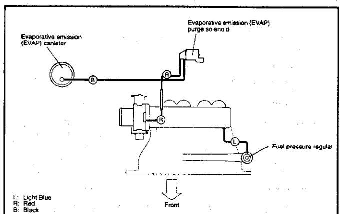

93154v05

**Emission control system vacuum hose routing—1993 1.5L engine, California emissions**



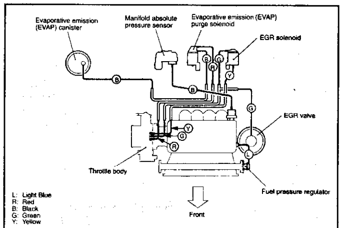

93154v07

**Emission control system vacuum hose routing—1993 1.5L engine, Federal emissions**



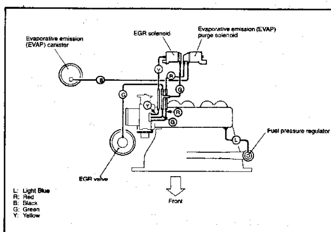

93154v06

**Emission control system vacuum hose routing—1993 1.8L engine, Federal emissions**



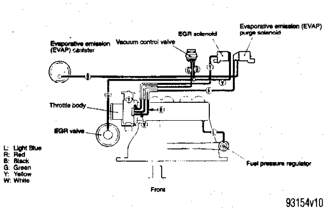

93154v08

**Emission control system vacuum hose routing—1994–96 1.5L engine, California and Federal emissions**

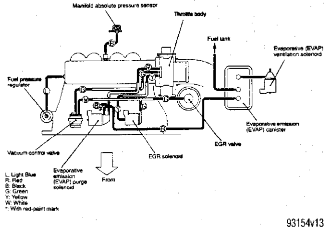



93154v09

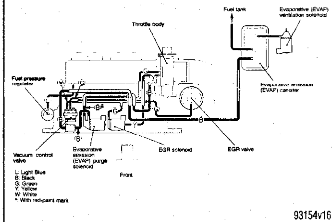
**Emission control system vacuum hose routing—1994–96 1.8L engine, Federal emissions; 1994 California emissions**



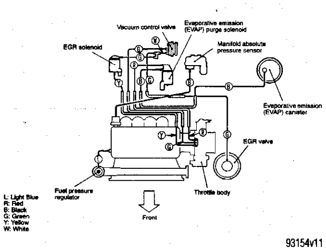

Emission control system vacuum hose routing—1995-96 1.8L engine, California emissions



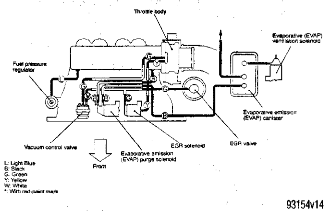

Emission control system vacuum hose routing—1998 1.5L engine, California and Federal emissions



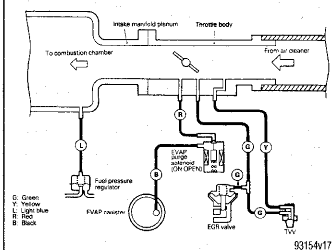

Emission control system vacuum hose routing—1999-00 1.8L engine, California and Federal emissions



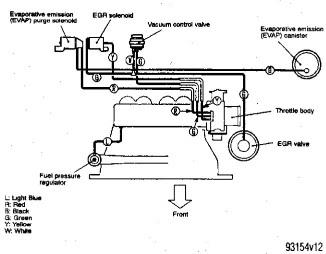

Emission control system vacuum hose routing—1997 1.5L engine, California and Federal emissions



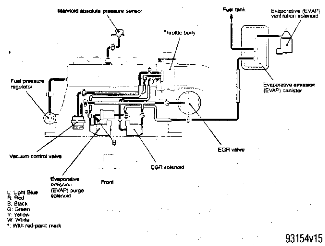

Emission control system vacuum hose routing—1998 1.8L engine, California and Federal emissions



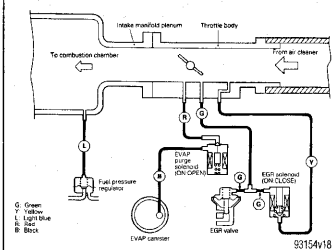

Emission control system vacuum hose routing—1990-93 2.0L SOHC engine, Federal emissions



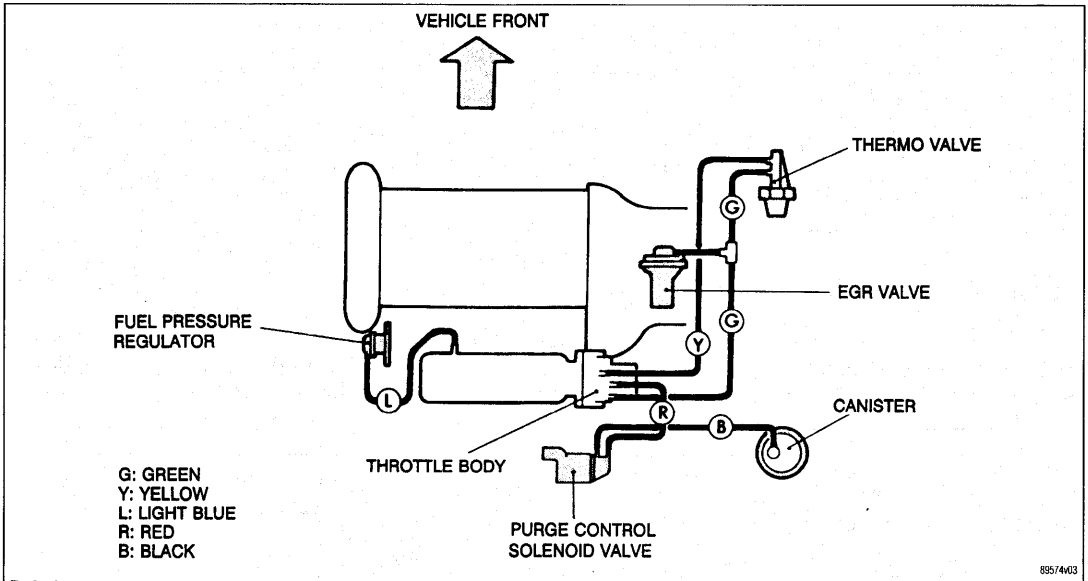

Emission control system vacuum hose routing—1997 1.8L engine, California and Federal emissions



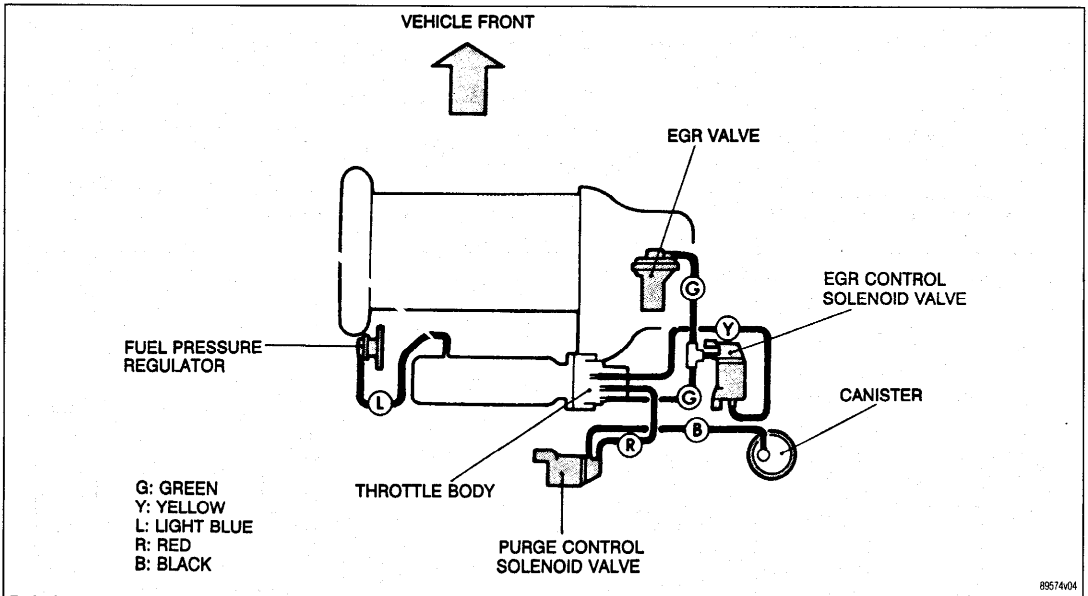

Emission control system vacuum hose routing—1999-00 1.5L engine, California and Federal emissions



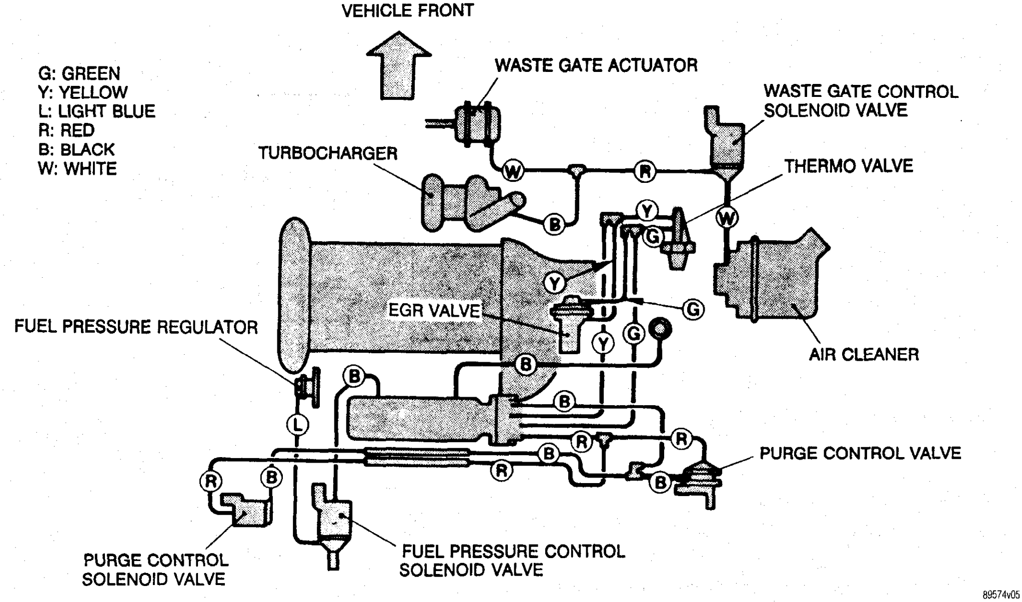

Emission control system vacuum hose routing—1990-93 2.0L SOHC engine, California emissions



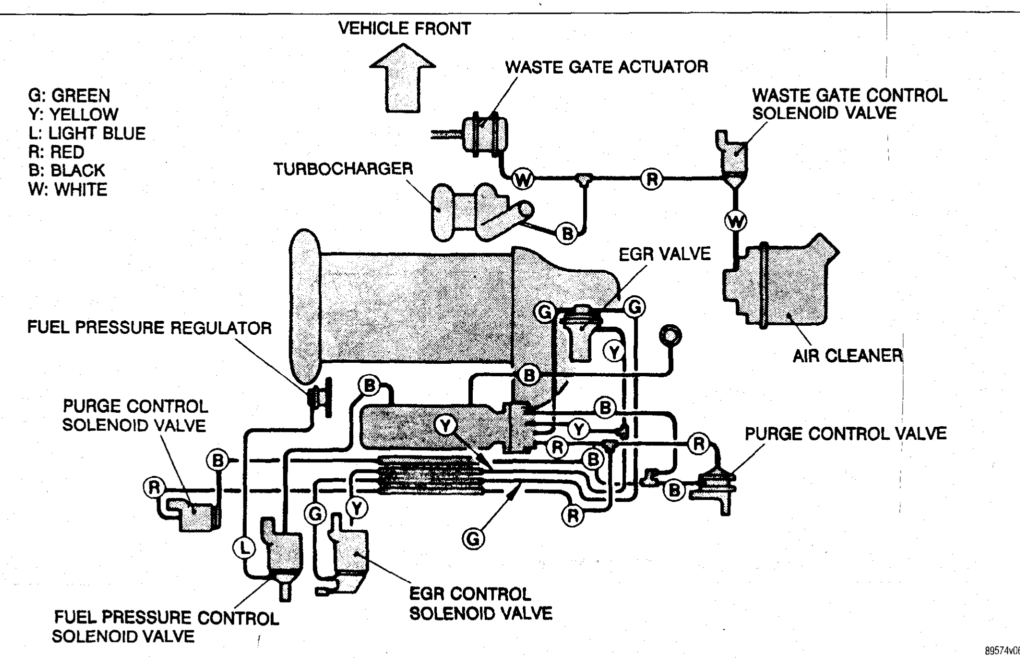

Emission control system vacuum hose routing—1990 2.0L DOHC non-turbo engine, Federal



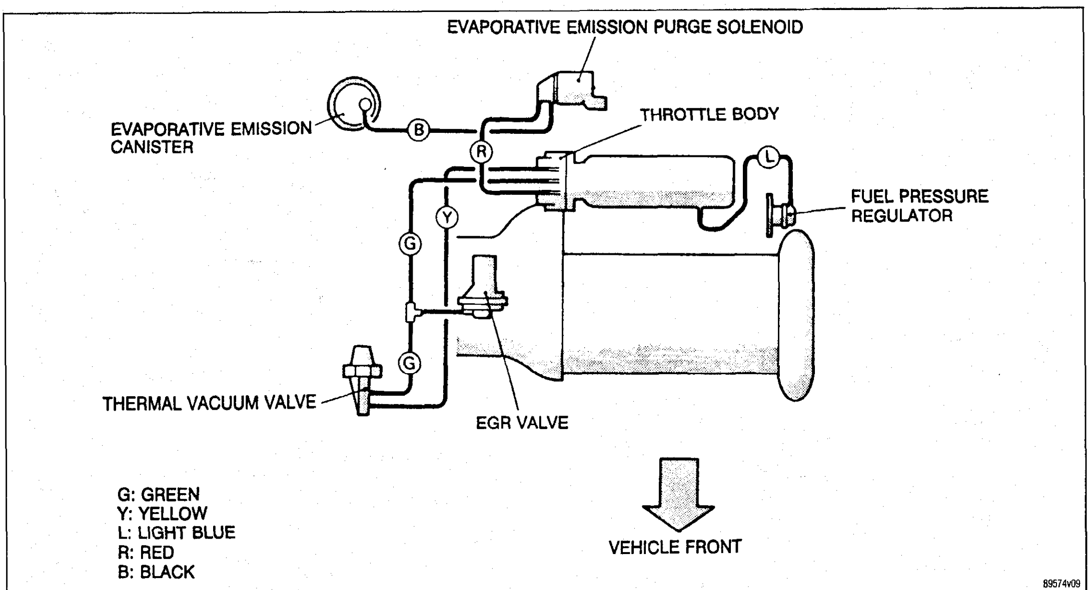

Emission control system vacuum hose routing—1990 2.0L DOHC non-turbo engine, California



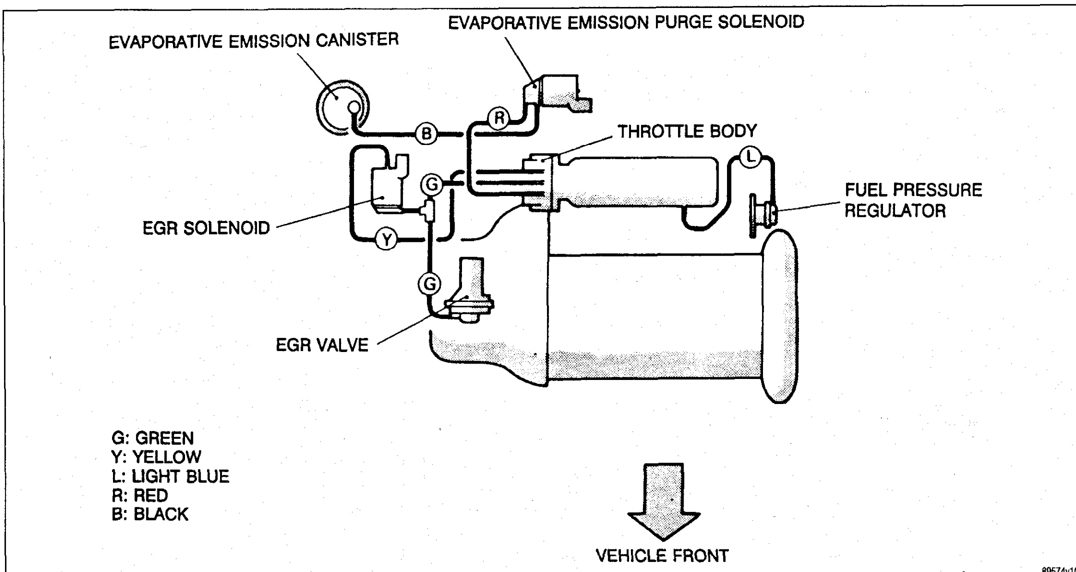

Emission control system vacuum hose routing—1990 2.0L DOHC turbo engine, Federal



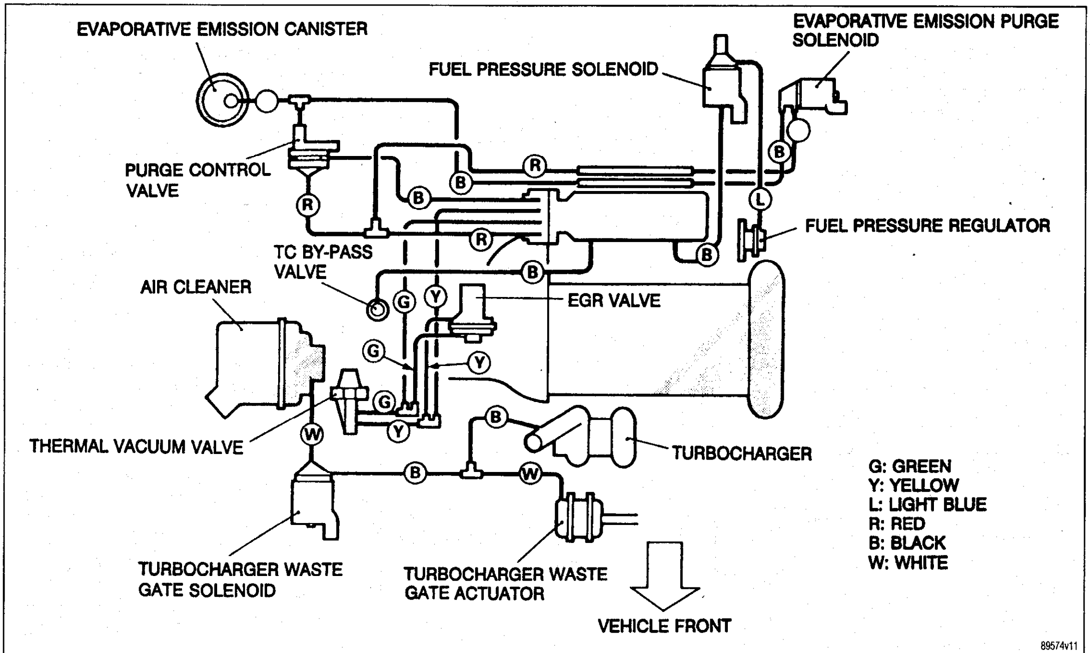

Emission control system vacuum hose routing—1990 2.0L DOHC turbo engine, California



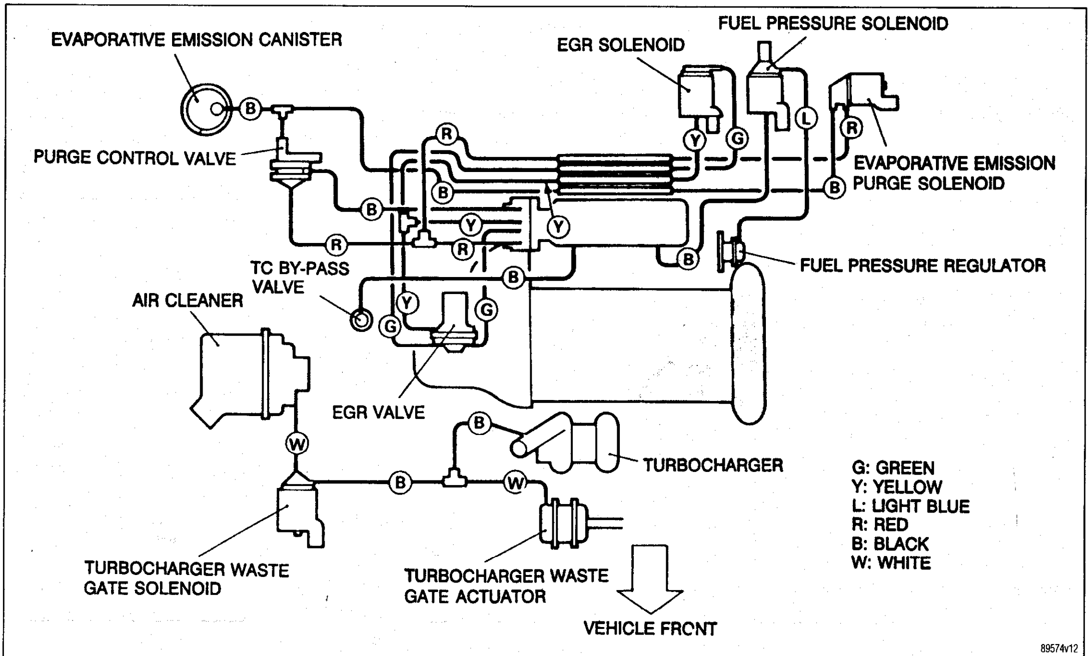

Emission control system vacuum hose routing—1991–93 2.0L DOHC non-turbo engine, Federal



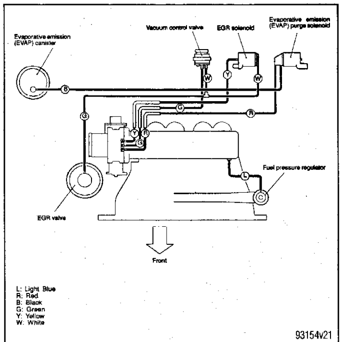

Emission control system vacuum hose routing—1991–93 2.0L DOHC non-turbo engine, California



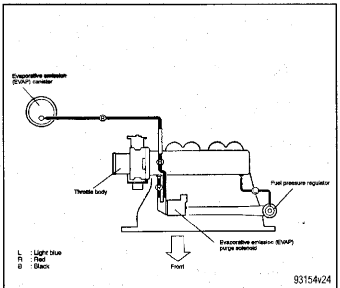

Emission control system vacuum hose routing—1991–93 2.0L DOHC turbo engine, Federal



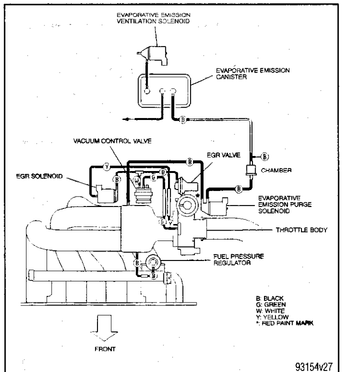

Emission control system vacuum hose routing—1991–93 2.0L DOHC turbo engine, California



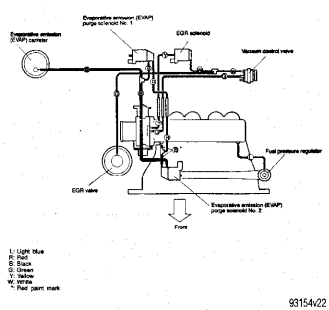

**Emission control system vacuum hose routing—1994–96 2.4L engine, Federal emissions**



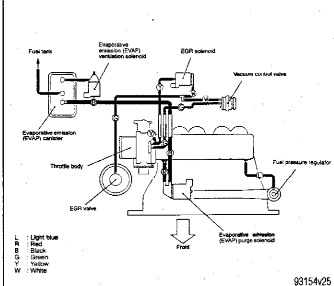

**Emission control system vacuum hose routing—1997 2.4L engine, California emissions**



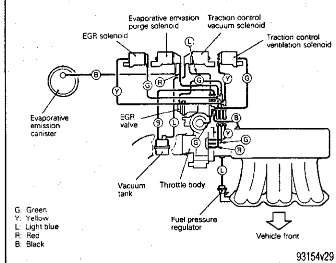

**Emission control system vacuum hose routing—1999–00 2.4L engine**



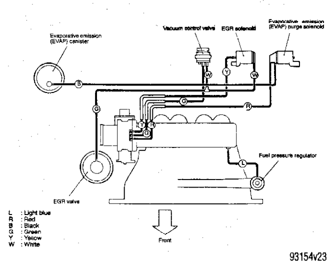

**Emission control system vacuum hose routing—1994–96 2.4L engine, California emissions**



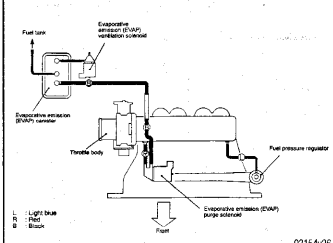

**Emission control system vacuum hose routing—1998 2.4L engine, Federal emissions**



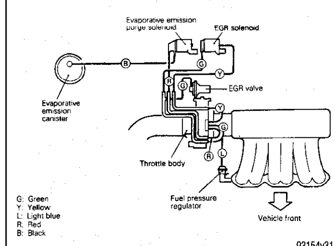

**Emission control system vacuum hose routing—1992 3.0L engines (SOHC and DOHC) w/traction control, California emissions**



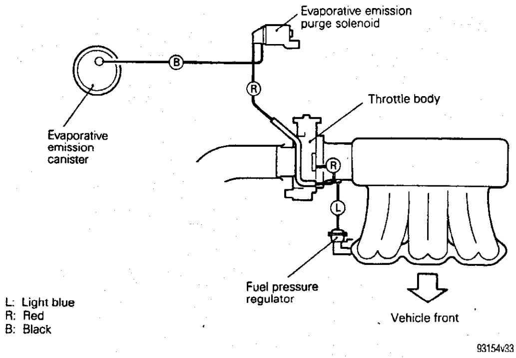

**Emission control system vacuum hose routing—1997 2.4L engine, Federal emissions**



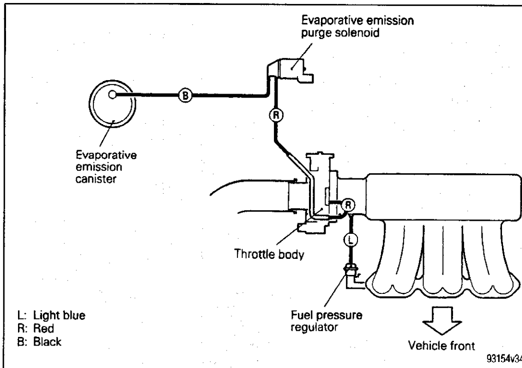

**Emission control system vacuum hose routing—1998 2.4L engine, California emissions**



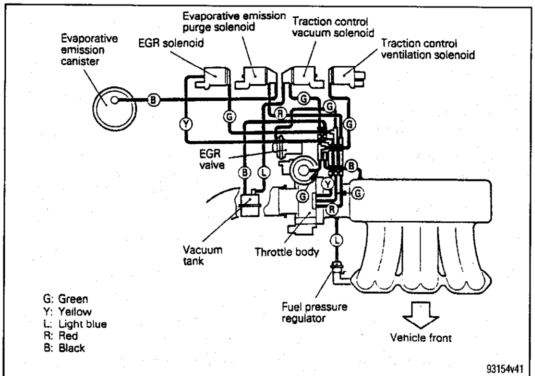

**Emission control system vacuum hose routing—1992 3.0L engines (SOHC and DOHC) w/out traction control, California emissions**



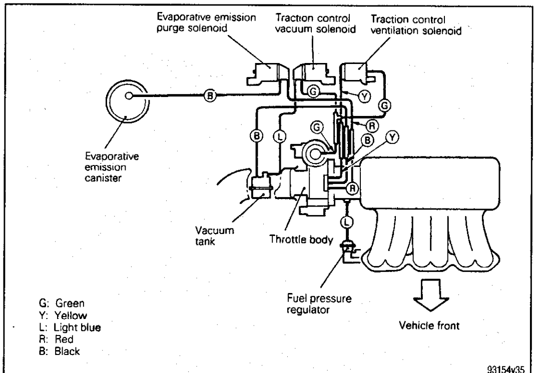

**Emission control system vacuum hose routing—1992 3.0L engines (SOHC and DOHC) w/out traction control, Federal emissions**



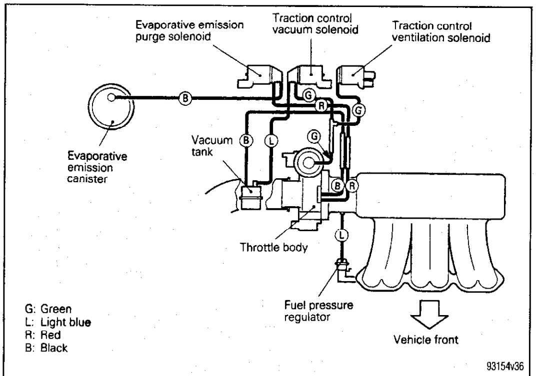

**Emission control system vacuum hose routing—1993–94 3.0L engines (SOHC and DOHC) w/out traction control, Federal emissions**



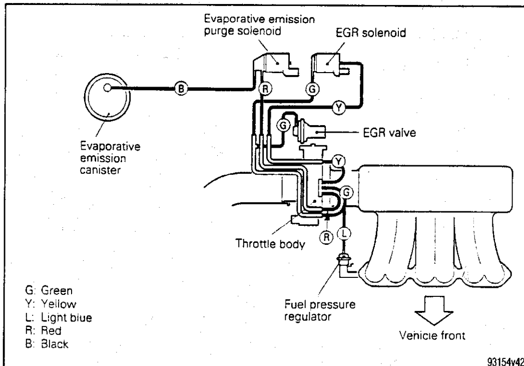

**Emission control system vacuum hose routing—1995–96 3.0L engines (SOHC and DOHC) w/traction control, Federal emissions**



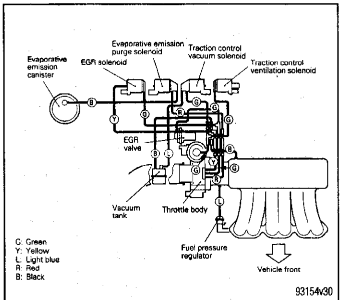

**Emission control system vacuum hose routing—1992 3.0L engines (SOHC and DOHC) w/traction control, Federal emissions**




**Emission control system vacuum hose routing—1993–94 3.0L engines (SOHC and DOHC) w/traction control, Federal emissions**

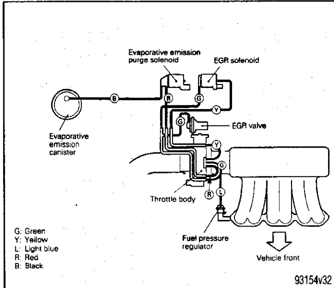



**Emission control system vacuum hose routing—1995–96 3.0L engines (SOHC and DOHC) w/out traction control, Federal emissions**



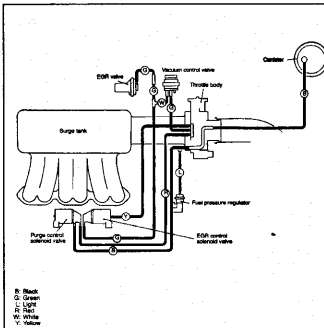

93154v30

**Emission control system vacuum hose routing—1993–96 3.0L engines (SOHC and DOHC) w/traction control, California emissions**



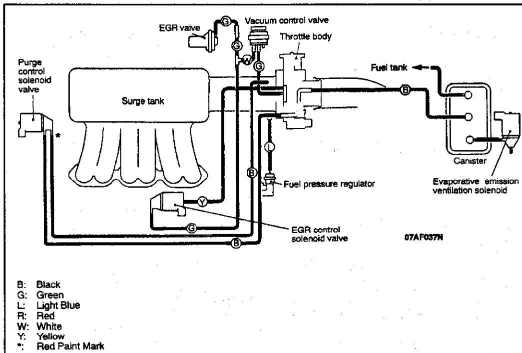

93154v32

**Emission control system vacuum hose routing—1993–96 3.0L engines (SOHC and DOHC) w/out traction control, California emissions**



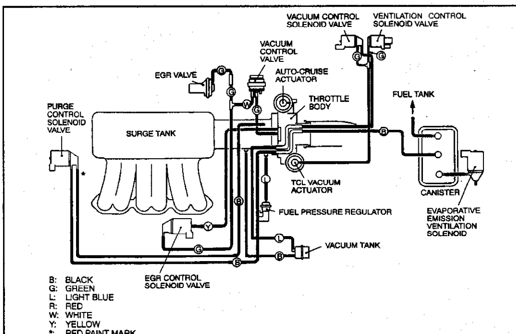

93154v37

**Emission control system vacuum hose routing—1997 3.5L engine**



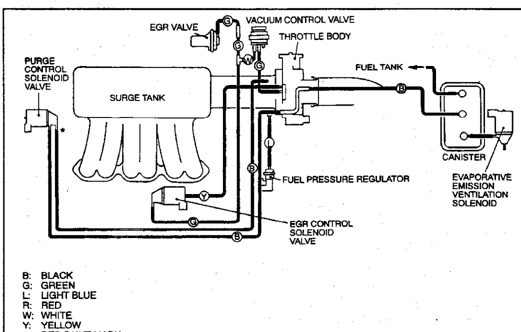

93154v38

**Emission control system vacuum hose routing—1998 3.5L engine**



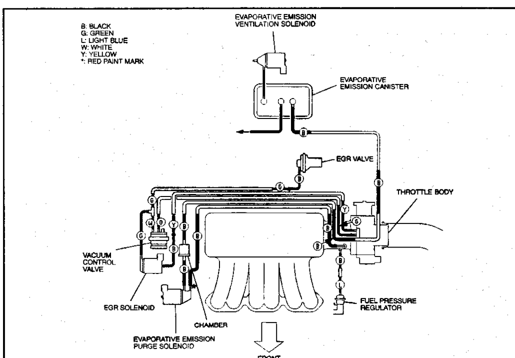

93154v40

**Emission control system vacuum hose routing—1999–00 3.5L engine w/traction control**




93154v39

**Emission control system vacuum hose routing—1999–00 3.5L engine w/out traction control**




93154v28

**Emission control system vacuum hose routing—1999–00 3.0L engine**