

# ENGINE AND EMISSION CONTROL

## CONTENTS

1710900063

<b>ENGINE CONTROL SYSTEM</b> .....	<b>3</b>	<b>CRANKCASE EMISSION CONTROL SYSTEM</b> .....	<b>10</b>
<b>GENERAL INFORMATION</b> .....	<b>3</b>	General Information .....	10
<b>SERVICE SPECIFICATIONS</b> .....	<b>3</b>	System Diagram .....	10
<b>ON-VEHICLE SERVICE</b> .....	<b>3</b>	Component Location .....	10
Accelerator Cable Check and Adjustment ...	3	Positive Crankcase Ventilation System Check .....	11
<b>ACCELERATOR CABLE AND PEDAL</b> ....	<b>4</b>	PCV Valve Check .....	11
<b>EMISSION CONTROL SYSTEM</b> .....	<b>5</b>	<b>EVAPORATIVE EMISSION CONTROL SYSTEM</b> .....	<b>12</b>
<b>GENERAL INFORMATION</b> .....	<b>5</b>	General Information .....	12
Emission Control Device Reference Table ...	5	System Diagram .....	12
<b>SERVICE SPECIFICATIONS</b> .....	<b>6</b>	Component Location .....	12
<b>VACUUM HOSE</b> .....	<b>6</b>	Purge Control System Check .....	13
Vacuum Hose Piping Diagram .....	6	Purge Port Vacuum Check .....	13
Vacuum Circuit Diagram .....	8	Purge Control Solenoid Valve Check .....	14
Vacuum Hose Check .....	9		
Vacuum Hose Installation .....	9		

**CONTINUED ON NEXT PAGE**

**EXHAUST GAS RECIRCULATION (EGR) SYSTEM** ..... 15

- General Information ..... 15
- Operation ..... 15
- System Diagram ..... 15
- Component Location ..... 15
- Exhaust Gas Recirculation (EGR) Control System Check <4G1> ..... 16
- Exhaust Gas Recirculation (EGR) Control System Check <4G9> ..... 17

- EGR Valve Check ..... 17
- EGR Port Vacuum Check ..... 18
- EGR Control Solenoid Valve Check ..... 19

**CATALYTIC CONVERTER** ..... 20

- General Information ..... 20

**CANISTER AND TWO-WAY VALVE** ..... 21

# ENGINE CONTROL SYSTEM

17100010027

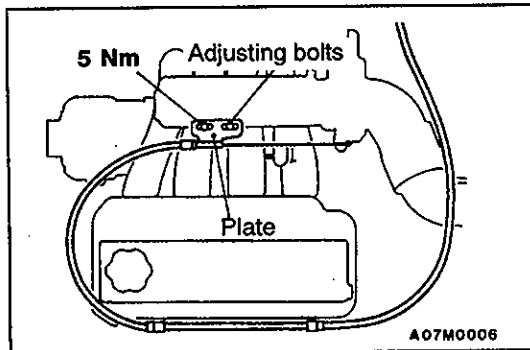
## GENERAL INFORMATION

A cable-type accelerator mechanism and a suspended-type pedal have been adopted.

## SERVICE SPECIFICATIONS

17100030078

Items		Standard value
Accelerator cable play mm		1–2
Engine idle speed r/min	4G1	750 ± 100
	4G9 <except MVV>	800 ± 100
	4G9 <MVV>	700 ± 100



## ON-VEHICLE SERVICE

17100090137

### ACCELERATOR CABLE CHECK AND ADJUSTMENT

1. Turn A/C and lamps OFF.  
Inspect and adjust at no load.
2. Warm engine until stabilized at idle.
3. Confirm idle speed is at prescribed value.

#### Standard value:

- <4G1> 750 ± 100 r/min
- <4G9 (except MVV)> 800 ± 100 r/min
- <4G9 (MVV)> 700 ± 100 r/min

4. Stop engine (ignition switch OFF).
5. Confirm there are no sharp bends in accelerator cable.
6. Check inner cable for correct slack.

#### Standard value: 1–2 mm

7. If there is too much slack or no slack, adjust play by the following procedures.
  - (1) Loosen the adjusting bolt to release the cable.
  - (2) Move the plate until the inner cable play is at the standard value, and then tighten the adjusting bolt to the specified torque.

## ACCELERATOR CABLE AND PEDAL

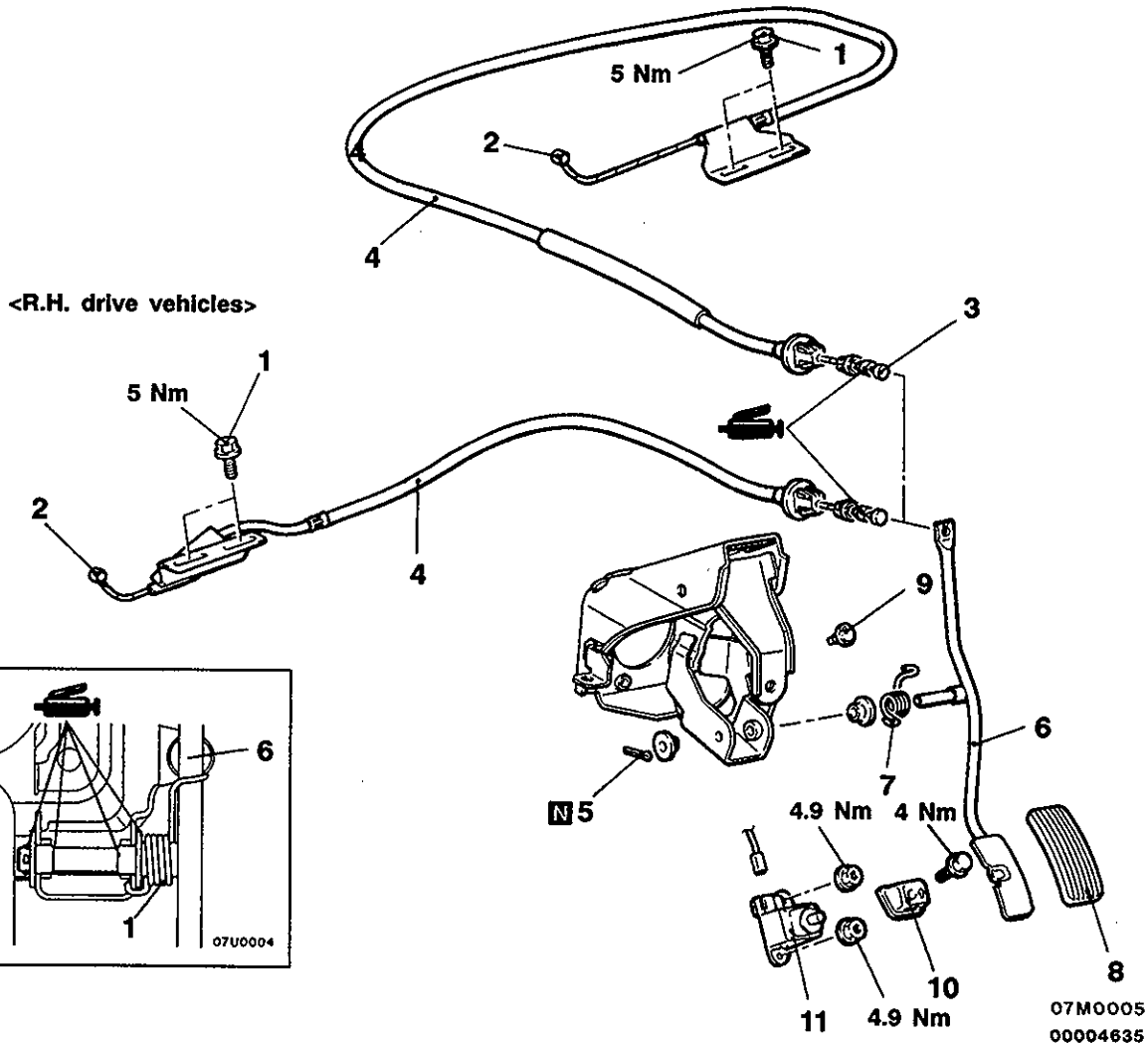
17100120133

## REMOVAL AND INSTALLATION

## Post-Installation Operation

- Adjusting the Accelerator Cable (Refer to P.17-3.)

&lt;L.H. drive vehicles&gt;



## Removal steps

1. Adjusting bolts
2. Inner cable connection (Throttle body side)
3. Inner cable connection (Accelerator pedal side)
4. Accelerator cable
5. Split pin
6. Accelerator pedal
7. Spring

8. Pedal pad
9. Stopper
10. Accelerator pedal stopper <M/T>
11. Wide open throttle switch <A/T>

# EMISSION CONTROL SYSTEM

17300010122

## GENERAL INFORMATION

The emission control system consists of the following subsystems:

- Crankcase emission control system
- Evaporative emission control system
- Exhaust emission control system

Items	Name	Specification
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister Purge control solenoid valve	Equipped ON/OFF type solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device—MPI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system <ul style="list-style-type: none"> <li>● EGR valve</li> <li>● EGR control solenoid valve</li> </ul>	Equipped Single type ON/OFF type solenoid valve <4G1> Duty cycle type solenoid valve <4G9> (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

## EMISSION CONTROL DEVICE REFERENCE TABLE

Related parts	Crankcase emission control system	Evaporative emission control system	Air/fuel ratio control system	Catalytic converter	Exhaust gas recirculation system	Reference page
PCV valve	×					17-11
Purge control solenoid valve		×				17-14
MPI system component		×	×			GROUP 13A
Catalytic converter				×		17-20
EGR valve					×	17-17
EGR control solenoid valve					×	17-18

**SERVICE SPECIFICATIONS**

17300030135

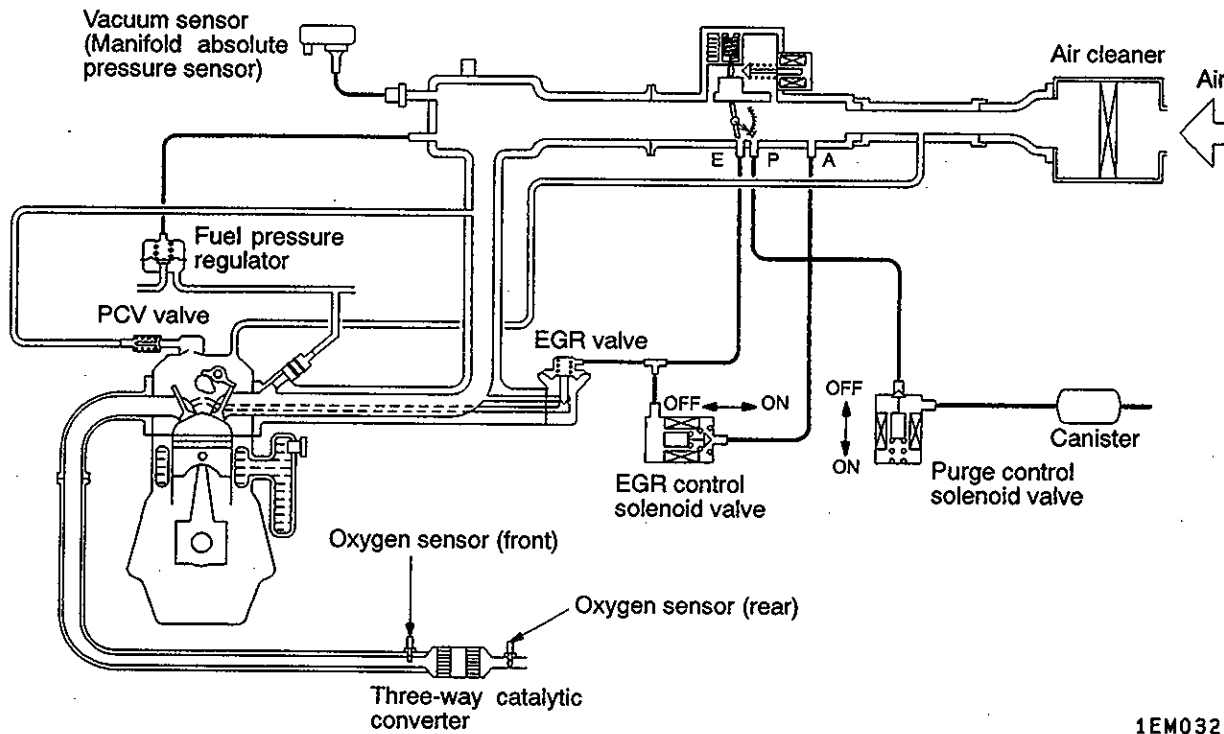
Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	36 – 44
EGR control solenoid valve coil resistance (at 20°C) Ω	36 – 44

**VACUUM HOSE**

17300090140

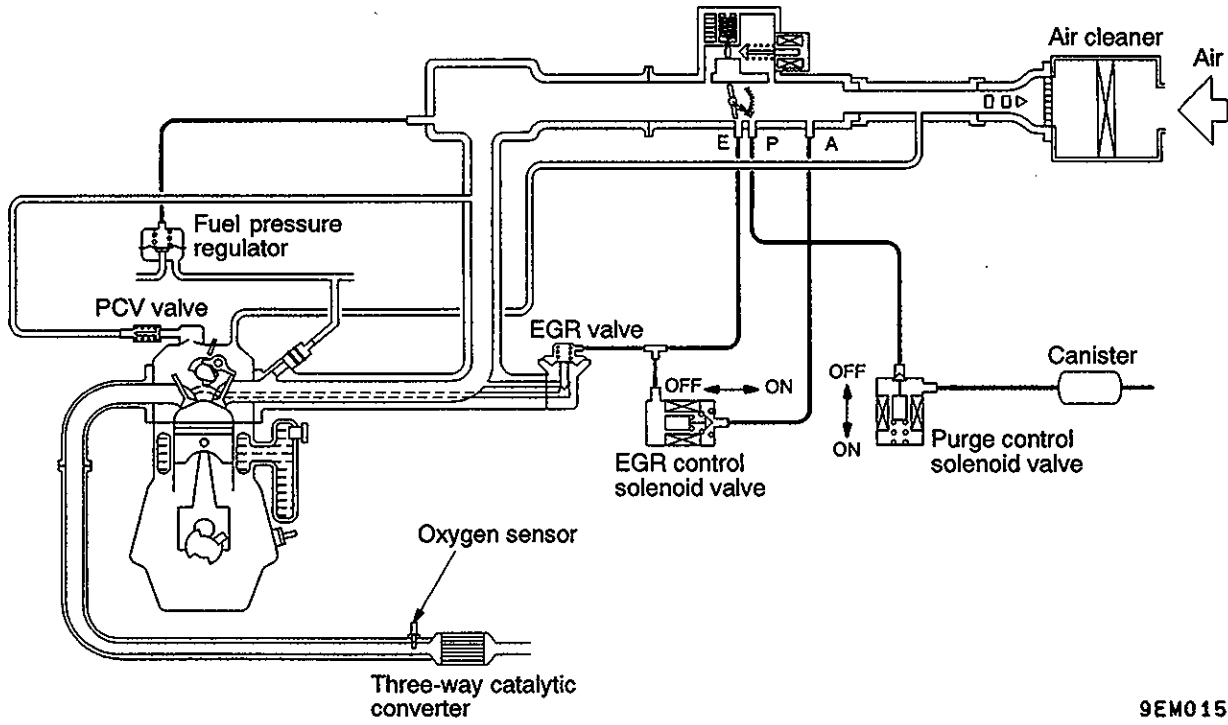
**VACUUM HOSE PIPING DIAGRAM**

<4G1>



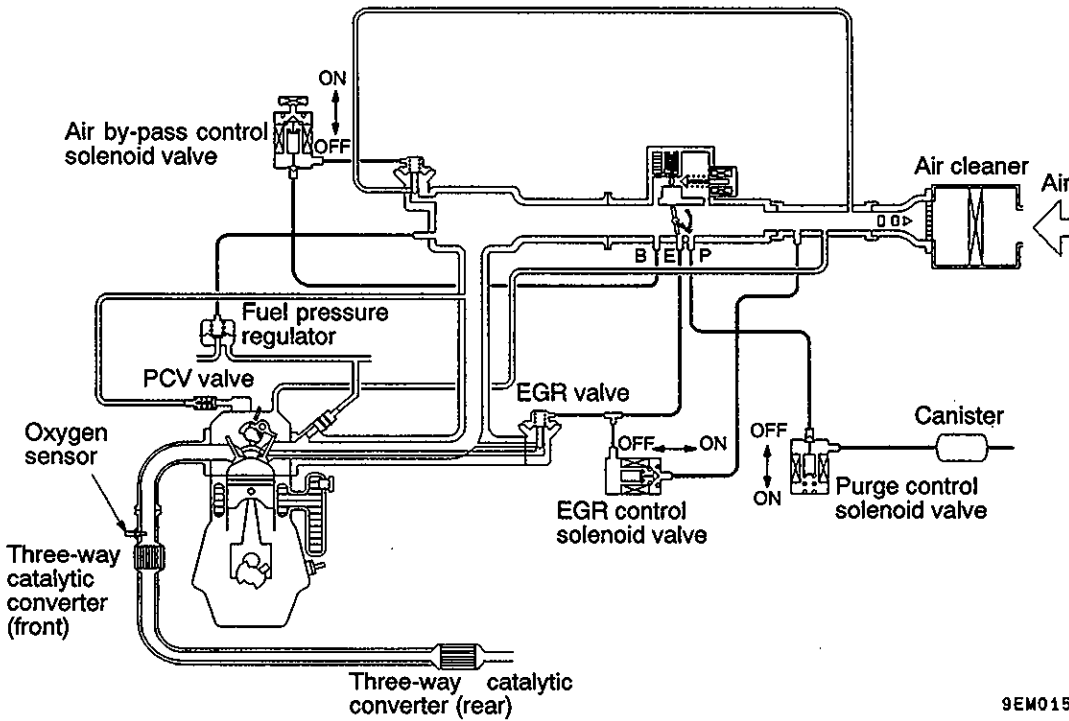
1EM0326

<4G9-except MVV>



9EM0152

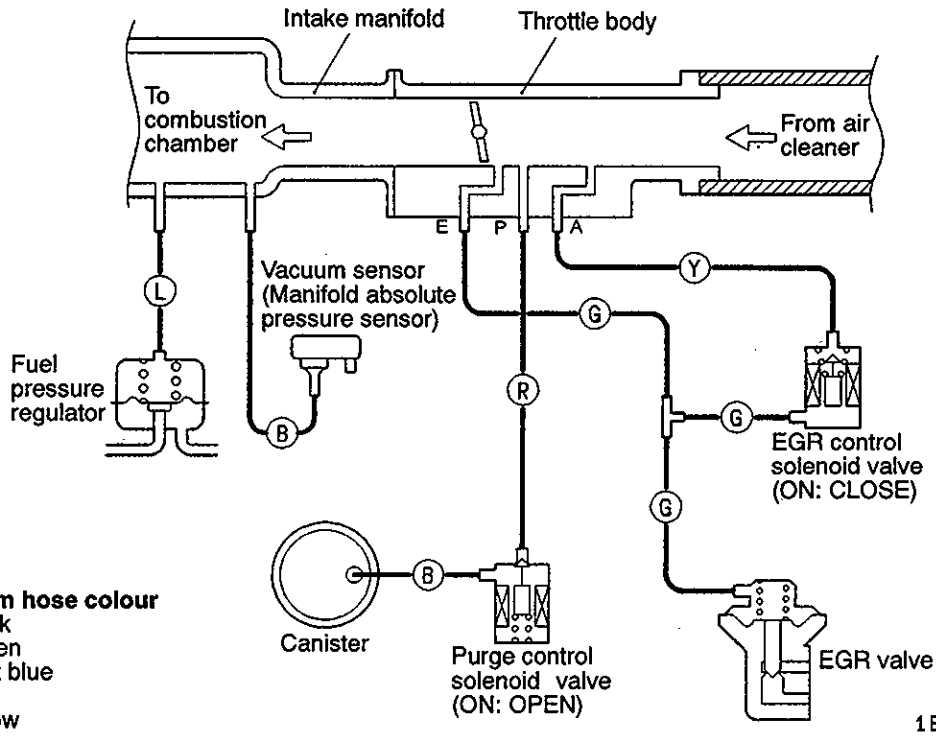
<4G9-MVV>



9EM0154

VACUUM CIRCUIT DIAGRAM

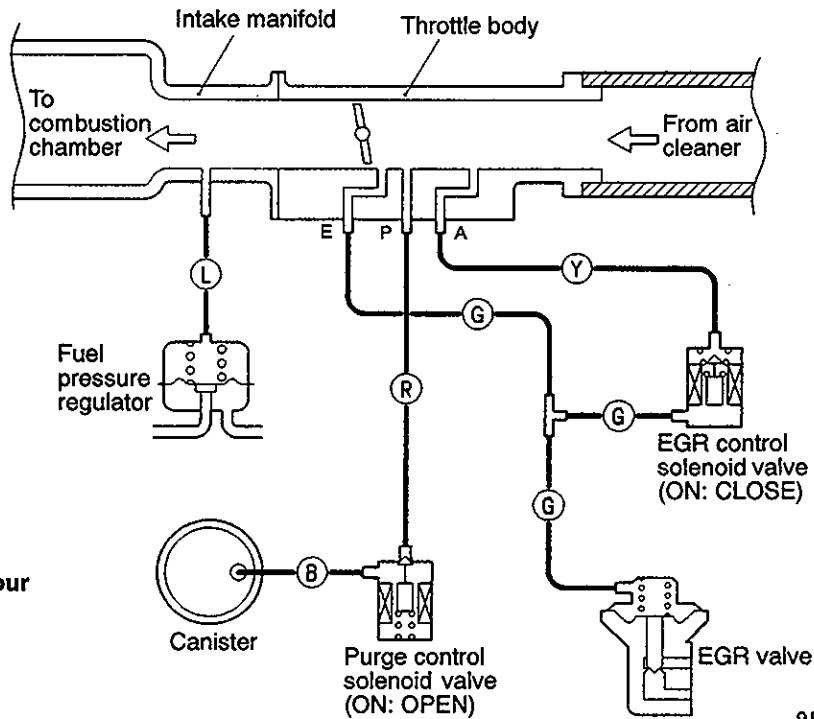
<4G1>



**Vacuum hose colour**  
 B: Black  
 G: Green  
 L: Light blue  
 R: Red  
 Y: Yellow

1EM0339

<4G9-EXCEPT MVV>

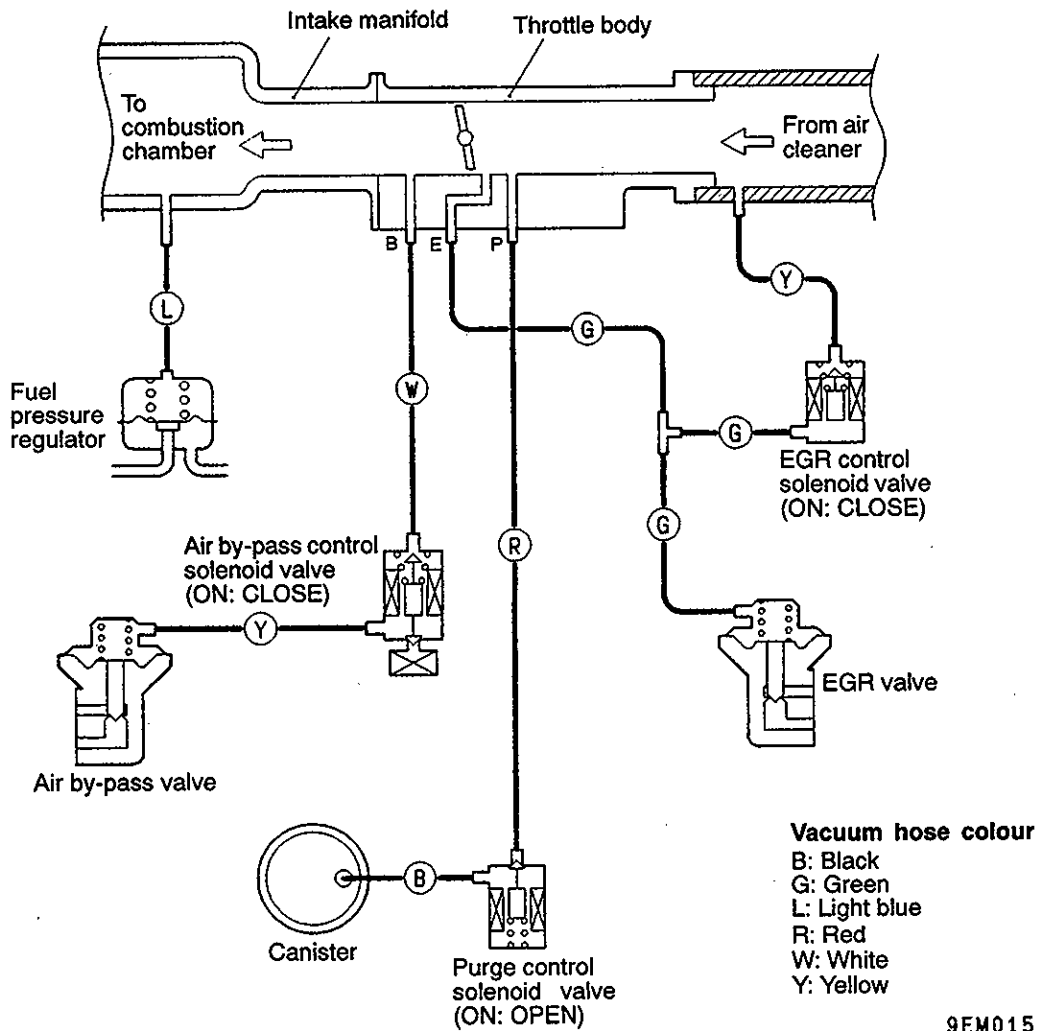


**Vacuum hose colour**  
 B: Black  
 G: Green  
 L: Light blue  
 R: Red  
 Y: Yellow

9EM0155



&lt;4G9-MVV&gt;



9EM0156

### VACUUM HOSE CHECK

1. Using the piping diagram as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses, (removed, loose, etc.) and check to be sure that there are no bends or damage.

### VACUUM HOSE INSTALLATION

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the vacuum hose piping diagram as a guide.

# CRANKCASE EMISSION CONTROL SYSTEM

17300500124

## GENERAL INFORMATION

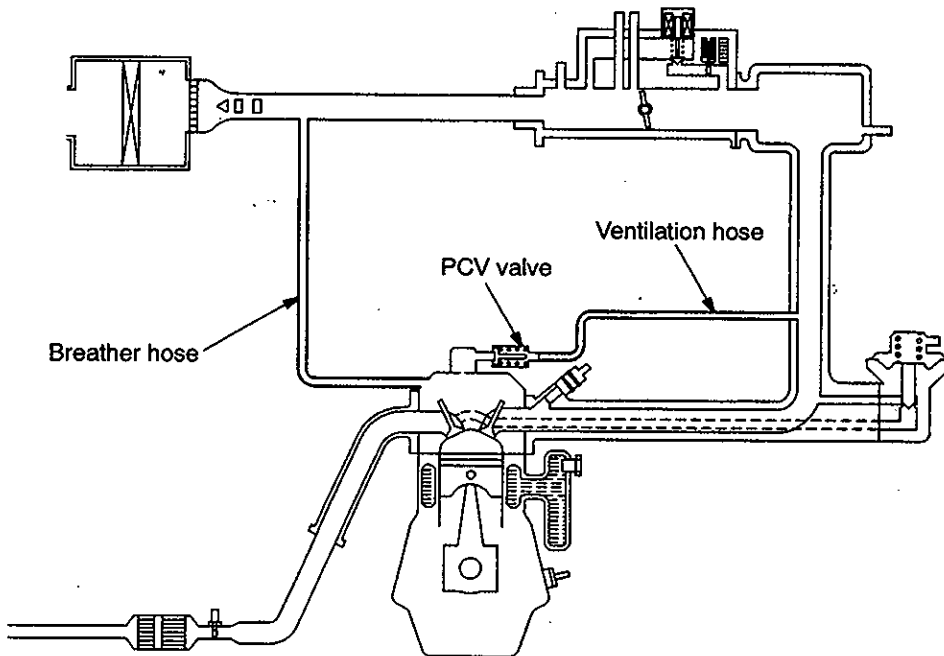
The crankcase emission control system prevents blow-by gases from escaping inside the crankcase into the atmosphere.

Fresh air is sent from the air cleaner into the crankcase through the breather hose. The air becomes mixed with the blow-by gases inside the crankcase.

The blow-by gas inside the crankcase is drawn into the intake manifold through the positive crankcase ventilation (PCV) valve.

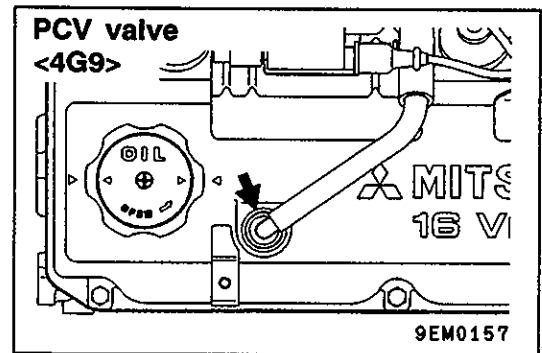
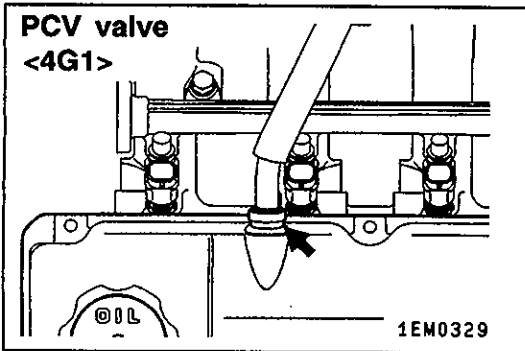
The PCV valve lifts the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly. In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

## SYSTEM DIAGRAM



9EM0133

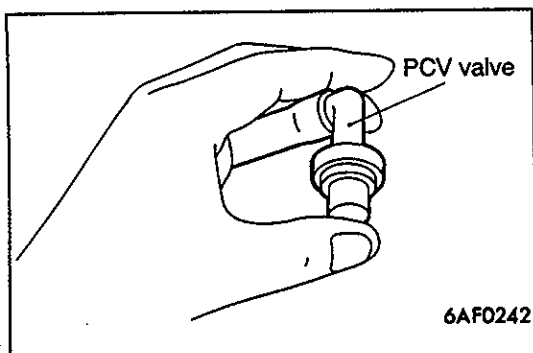
## COMPONENT LOCATION



**POSITIVE CRANKCASE VENTILATION SYSTEM CHECK**

17300110136

1. Remove the ventilation hose from the PCV valve.
2. Remove the PCV valve from the rocker cover.
3. Reinstall the PCV valve at the ventilation hose.
4. Start the engine and run at idle.

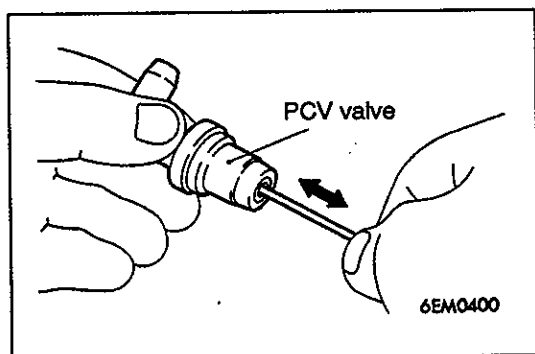


5. Place a finger at the opening of the PCV valve and check that vacuum of the intake manifold is felt.

**NOTE**

At this moment, the plunger in the PCV valve moves back and forth.

6. If vacuum is not felt, clean the PCV valve or replace it.

**PCV VALVE CHECK**

17300120122

1. Insert a thin rod into the PCV valve from the side shown in the illustration (rocker cover installation side), and move the rod back and forth to check that the plunger moves.
2. If the plunger does not move, there is clogging in the PCV valve. In this case, clean or replace the PCV valve.

# EVAPORATIVE EMISSION CONTROL SYSTEM

17300510189

## GENERAL INFORMATION

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

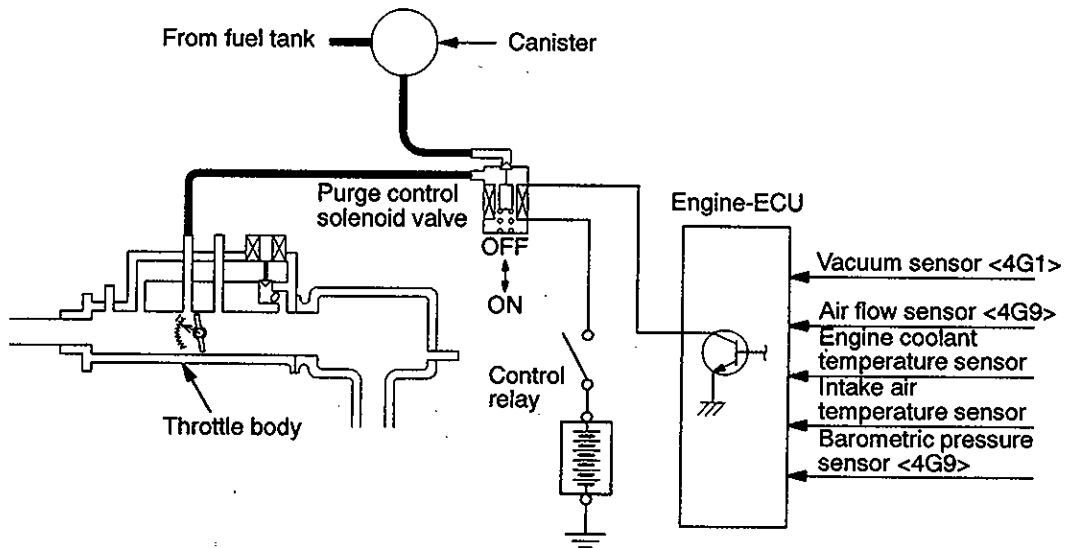
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister. When driving the vehicle, fuel vapours stored in the canister flow through the purge solenoid and purge port and go into the intake manifold to be

sent to the combustion chamber.

When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control unit turns the purge solenoid off to shut off the fuel vapour flow to the intake manifold.

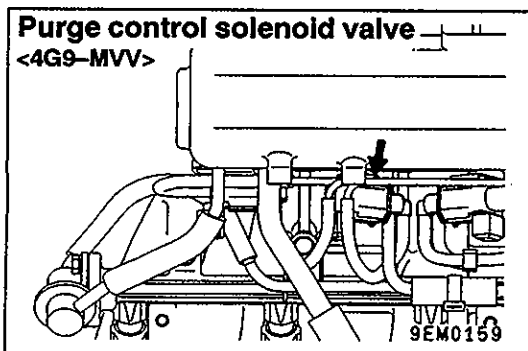
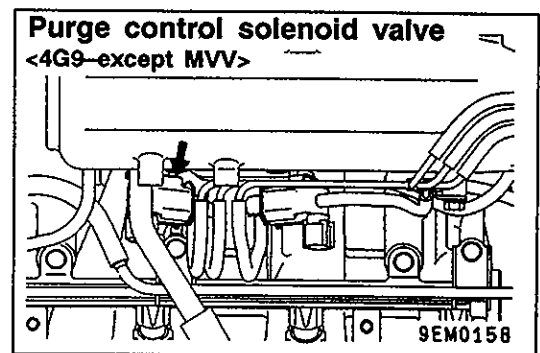
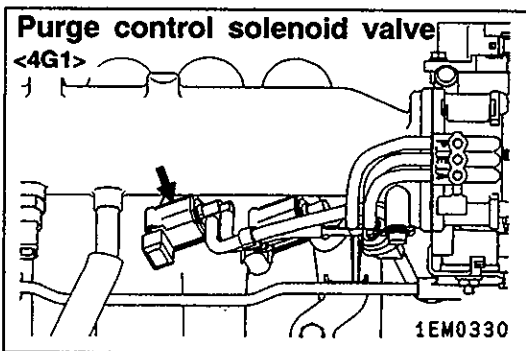
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

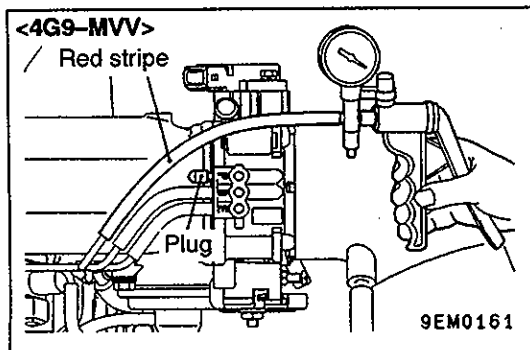
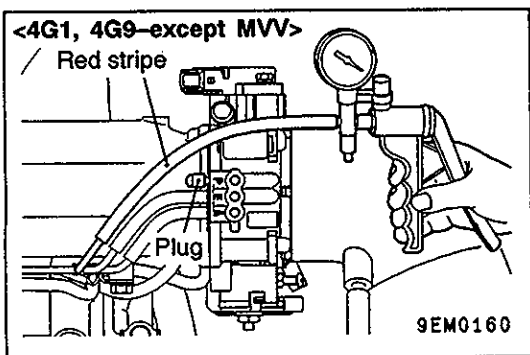
## SYSTEM DIAGRAM



9EM0167

## COMPONENT LOCATION





**PURGE CONTROL SYSTEM CHECK**

17300140166

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

**When engine is cold**

**(Engine coolant temperature: 40°C or less)**

Vacuum	Engine condition	Normal condition
53 kPa	3,000 r/min	Vacuum is maintained

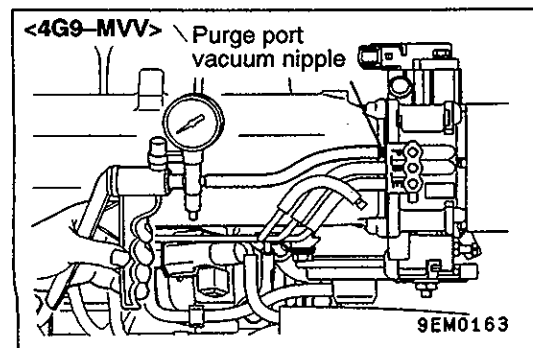
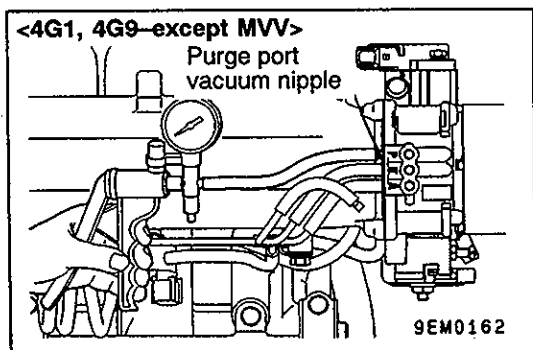
**When engine is hot**

**(Engine coolant temperature: 80°C or higher)**

Vacuum	Engine condition	Normal condition
53 kPa	At idle	Vacuum is maintained
	3,000 r/min	Vacuum will leak for approximately 3 minutes after the engine is started. After 3 minutes have passed, the vacuum will be maintained momentarily, after which it will again leak.*

**NOTE**

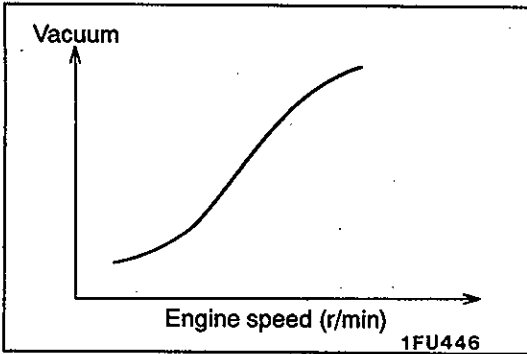
\*: The vacuum will leak continuously if the atmospheric pressure is approximately 77 kPa or less, or the temperature of the intake air is approximately 50°C or higher.



**PURGE PORT VACUUM CHECK**

17300150138

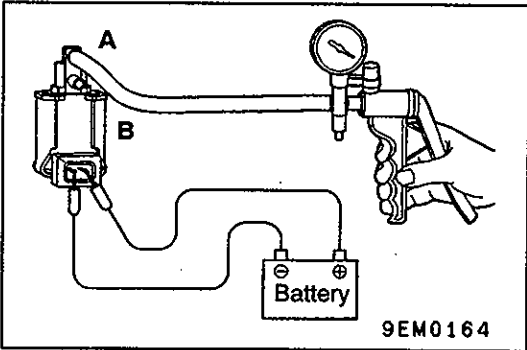
1. Disconnect the vacuum hose (red stripe) from the throttle body purge vacuum nipple and connect a hand vacuum pump to the nipple.



2. Start the engine and check that, after raising the engine speed by racing the engine, purge vacuum raises according to engine speed.

**NOTE**

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



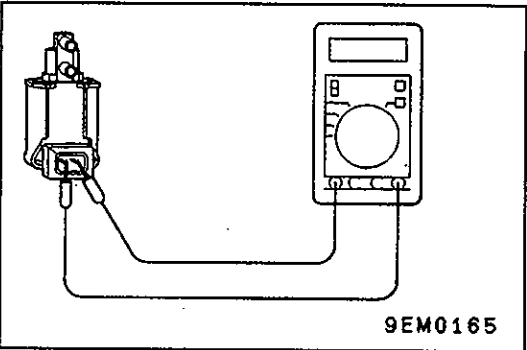
**PURGE CONTROL SOLENOID VALVE CHECK**

17300170127

**NOTE**

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

1. Disconnect the vacuum hose (black stripe, red stripe) from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.



Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained

5. Measure the resistance between the terminals of the solenoid valve.

**Standard value: 36–44 Ω (at 20°C)**

# EXHAUST GAS RECIRCULATION (EGR) SYSTEM

17300520137

## GENERAL INFORMATION

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

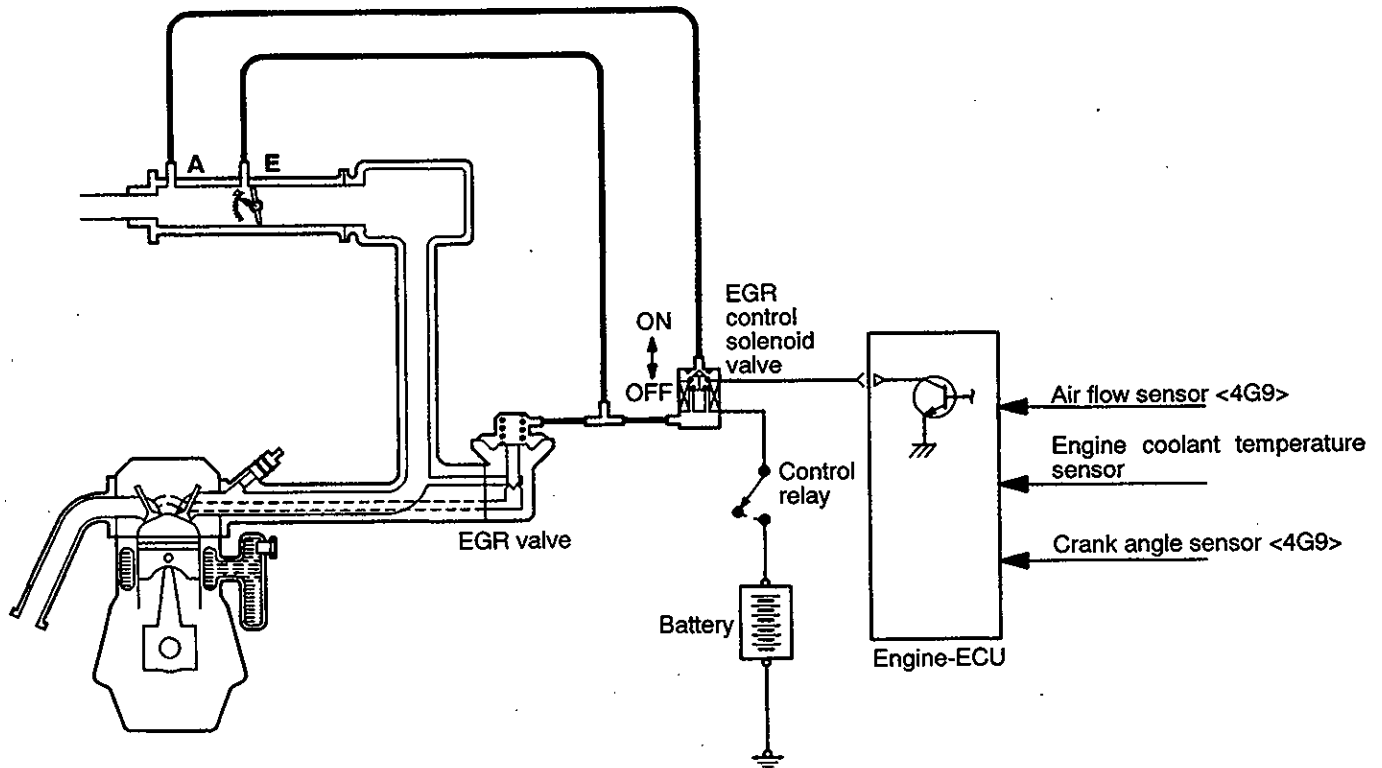
the exhaust port of the cylinder head to the combustion chamber through the intake manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx. The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

## OPERATION

The EGR valve is being closed and does not recirculate exhaust gases under one of the following conditions. Otherwise, the EGR valve is opened and recirculates exhaust gases.

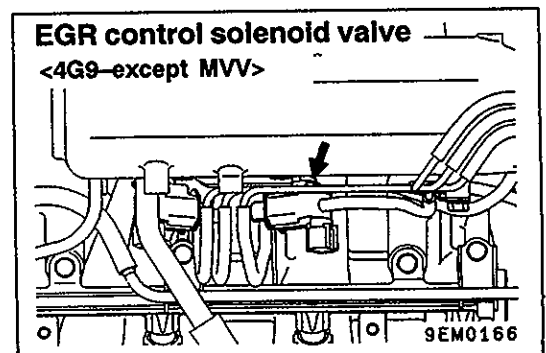
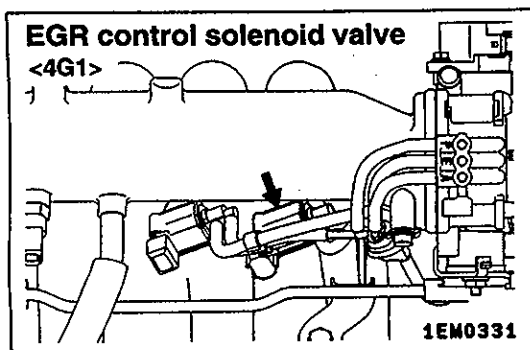
- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

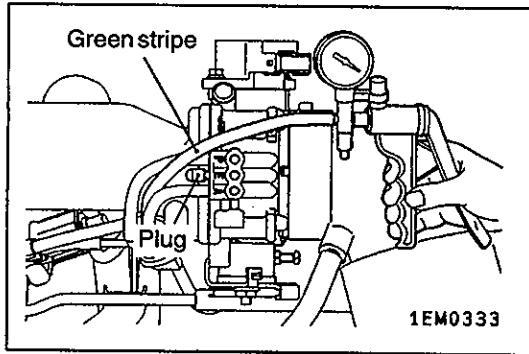
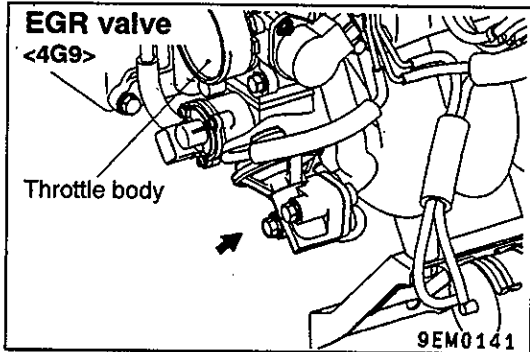
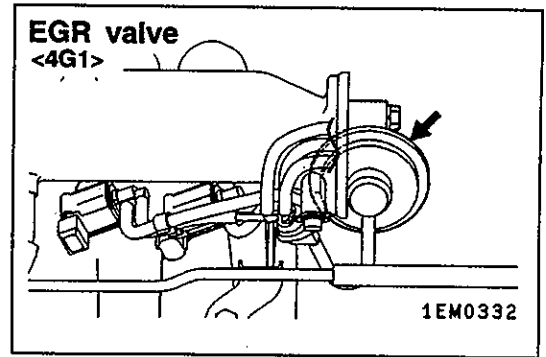
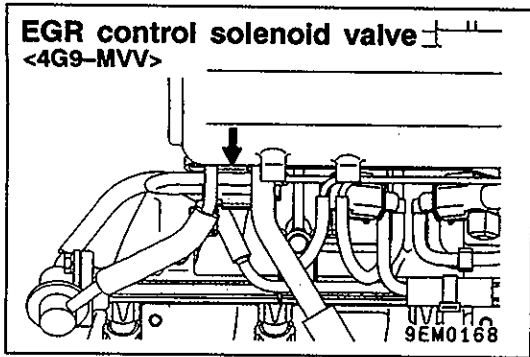
## SYSTEM DIAGRAM



9EM0130

## COMPONENT LOCATION





**EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK <4G1>**

17300280152

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

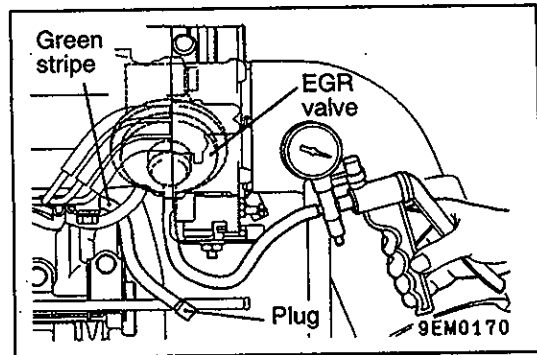
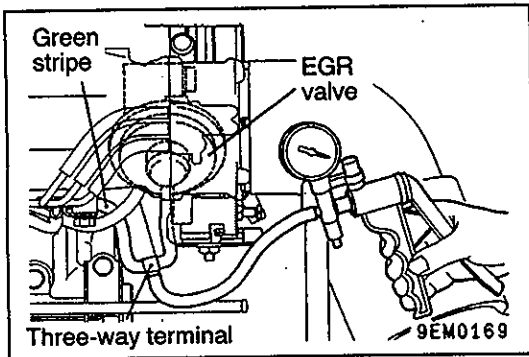
**When engine is cold (Engine coolant temperature: 40°C or less)**

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

**When engine is hot (Engine coolant temperature: 80°C or higher)**

Hand vacuum pump	Normal engine condition	Normal vacuum condition
5.3 kPa	No change	Vacuum is maintained
27 kPa	Idling becomes slightly unstable or engine stalls.	Vacuum is maintained





### EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK <4G9>

17300260145

1. Disconnect the vacuum hose (green stripe) from the EGR valve, and then connect a hand vacuum pump via the three-way terminal.
2. When the engine is hot or cold, check the condition of vacuum by racing the engine.

**When engine is cold**  
(Engine coolant temperature: 20°C or less)

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

**When engine is hot**  
(Engine coolant temperature: 80°C or higher)

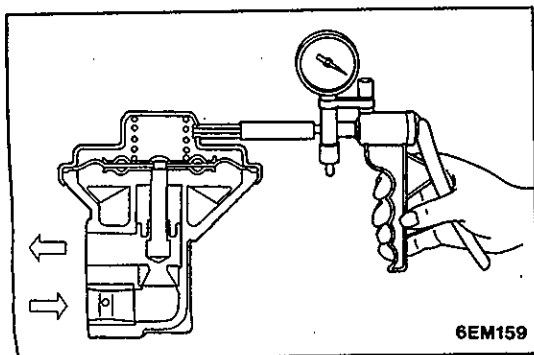
Throttle valve	Normal vacuum condition
Open quickly	It will momentarily rise over 13 kPa

3. Disconnect the three-way terminal.
4. Connect the hand vacuum pump to the EGR valve.
5. Check whether the engine stalls or the idling is unstable when a vacuum of 30 kPa or higher is applied during idling.

### EGR VALVE CHECK

17300280110

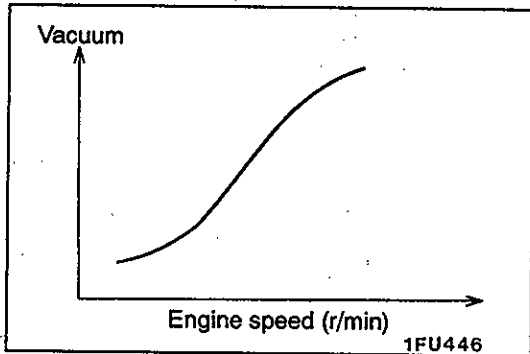
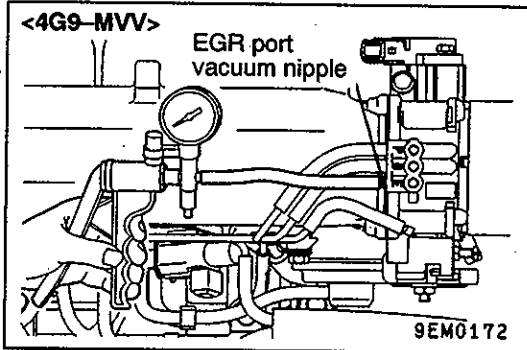
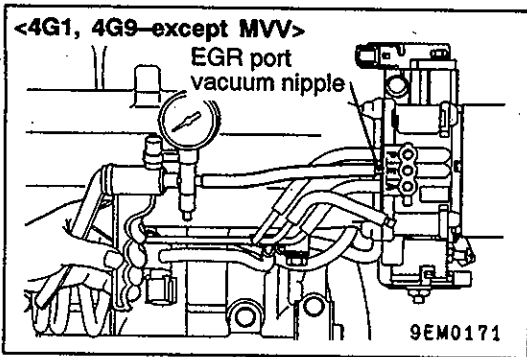
1. Remove the EGR valve and inspect for sticking, carbon deposits, etc. If found, clean with a suitable solvent so that the valve seats correctly.
2. Connect a hand vacuum pump to the EGR valve.
3. Apply 67 kPa of vacuum, and check that the vacuum is maintained.



4. Apply a vacuum and check the passage of air by blowing through one side of the EGR passage.

Vacuum	Passage of air
5.3 kPa or less	Air is not blown out
27 kPa or more	Air is blown out

5. Replace the gasket, and tighten to the specified torque.  
**Specified torque: 22 Nm**



## EGR PORT VACUUM CHECK

17300290106

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

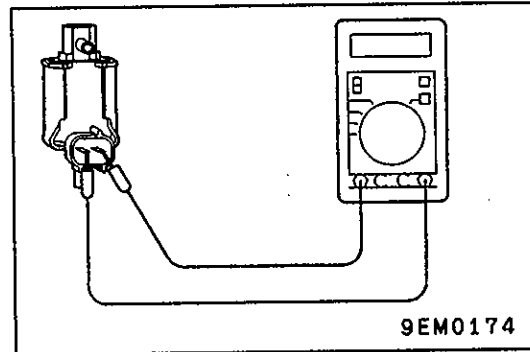
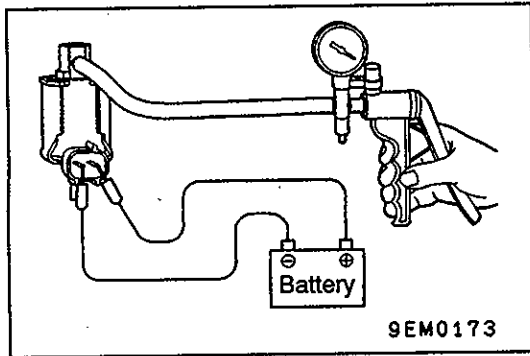
2. Start the engine and check to see that, after raising the engine speed by racing the engine, EGR vacuum raises proportionately with the rise in engine speed.

### NOTE

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

**EGR CONTROL SOLENOID VALVE CHECK**

17300310123

**NOTE**

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

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

Battery voltage	Normal condition
Not applied	Vacuum leaks
Applied	Vacuum maintained

5. Measure the resistance between the terminals of the solenoid valve.

**Standard value: 36–44Ω (at 20°C)**

# CATALYTIC CONVERTER

17300530055

## GENERAL INFORMATION

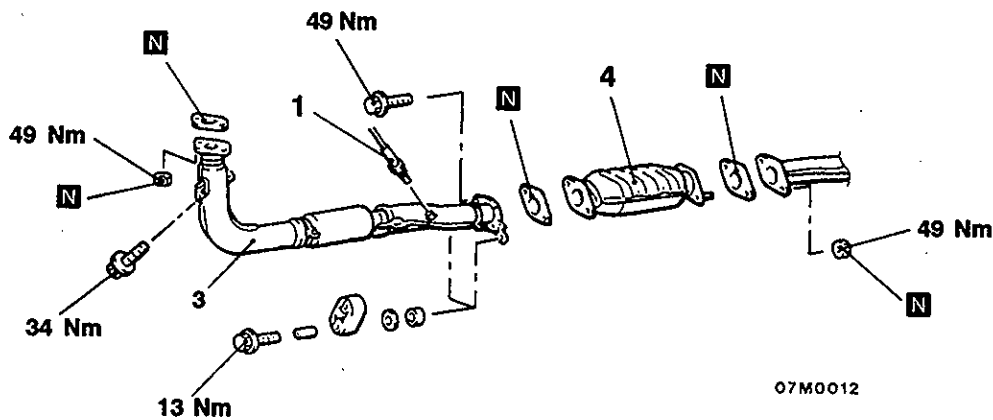
The three-way catalytic converter, together with the closed loop air-fuel ratio control based on the oxygen sensor signal, oxidizes carbon monoxides (CO) and hydrocarbons (HC) and reduces nitrogen oxides (NOx).

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

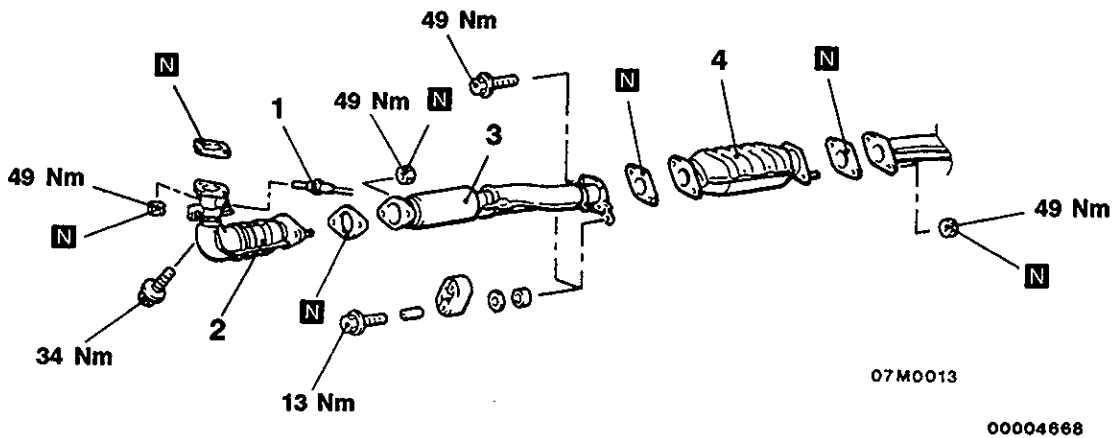
## REMOVAL AND INSTALLATION

17300390110

<Except 4G9-MVV>



<4G9-MVV>

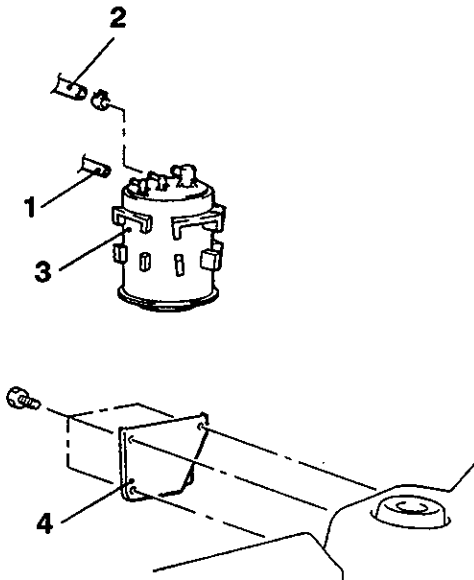


### Removal steps

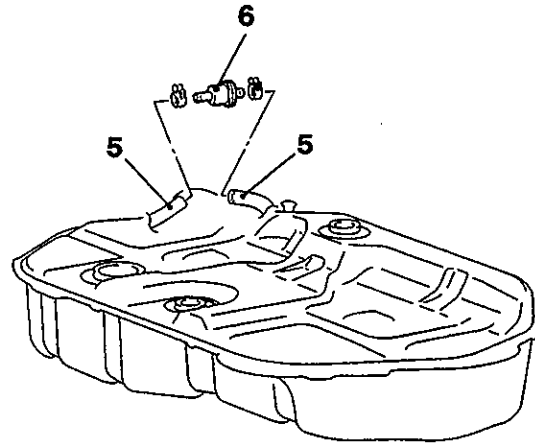
1. Oxygen sensor  
(Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)
2. Catalytic converter (front)  
<4G9-MVV>
3. Front exhaust pipe
4. Catalytic converter  
<except 4G9-MVV> or  
catalytic converter (rear)  
<4G9-MVV>

# CANISTER AND TWO-WAY VALVE REMOVAL AND INSTALLATION

17300480107



03M0013



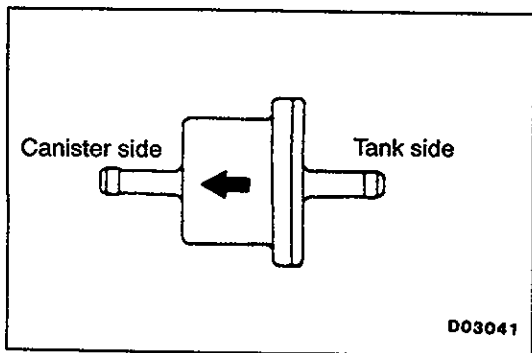
03M0015  
00004634

### Canister removal steps

1. Vapour hose
2. Purge hose
3. Canister
4. Canister bracket

### Two-way valve removal steps

- Fuel tank  
(Refer to GROUP 13F – Fuel tank.)
5. Vapour hose
  6. Two-way valve

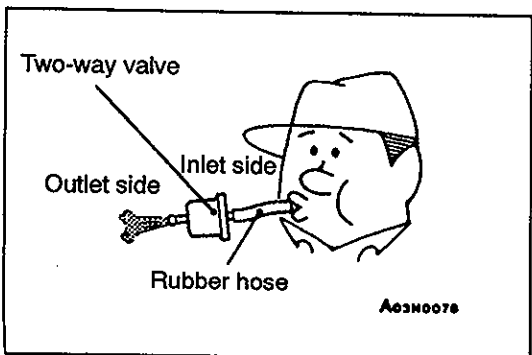


D03041

## INSTALLATION SERVICE POINT

### ▶◀ TWO-WAY VALVE INSTALLATION

Be careful about the installation direction of the two-way valve.



A03H0078

## INSPECTION

17300490049

### TWO-WAY VALVE SIMPLE CHECK

Attach a clean hose and check the operation of the two-way valve.

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

---

**NOTES.**