# SECTION 5

## EMISSION CONTROL SYSTEM

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## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1.</td>
<td>GENERAL DESCRIPTION ....................................... 5-4</td>
</tr>
<tr>
<td></td>
<td>POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM .......... 5-5</td>
</tr>
<tr>
<td></td>
<td>THERMOSTATICALLY CONTROLLED AIR CLEANER (TCAC) SYSTEM ........................................ 5-6</td>
</tr>
<tr>
<td></td>
<td>EVAPORATIVE EMISSION CONTROL SYSTEM .............................. 5-7</td>
</tr>
<tr>
<td></td>
<td>HOT IDLE COMPENSATOR (HIC) ........................................ 5-8</td>
</tr>
<tr>
<td></td>
<td>DECELERATION MIXTURE CONTROL SYSTEM ................ 5-9</td>
</tr>
<tr>
<td></td>
<td>COMPUTER CONTROLLED EMISSION CONTROL SYSTEM .......................... 5-10</td>
</tr>
<tr>
<td></td>
<td>BOWL VENTILATION SYSTEM .......................................... 5-12</td>
</tr>
<tr>
<td></td>
<td>FUEL CUT SYSTEM .................................................. 5-13</td>
</tr>
<tr>
<td></td>
<td>EXHAUST GAS RECIRCULATION (EGR) SYSTEM .......................... 5-14</td>
</tr>
<tr>
<td>5-2.</td>
<td>DIAGNOSIS .......................................................... 5-15</td>
</tr>
<tr>
<td>5-3.</td>
<td>MAINTENANCE SERVICE .................................................. 5-18</td>
</tr>
<tr>
<td></td>
<td>GENERAL .......................................................... 5-18</td>
</tr>
<tr>
<td></td>
<td>PCV SYSTEM .......................................................... 5-18</td>
</tr>
<tr>
<td></td>
<td>TCAC SYSTEM ........................................................ 5-19</td>
</tr>
<tr>
<td></td>
<td>EVAPORATIVE EMISSION CONTROL SYSTEM .................. 5-20</td>
</tr>
<tr>
<td></td>
<td>HOT IDLE COMPENSATOR (HIC) ......................................... 5-21</td>
</tr>
<tr>
<td></td>
<td>DECELERATION MIXTURE CONTROL SYSTEM .................. 5-21</td>
</tr>
<tr>
<td></td>
<td>FEED BACK SYSTEM ................................................ 5-22</td>
</tr>
<tr>
<td></td>
<td>SWITCH VENT SOLENOID .............................................. 5-36</td>
</tr>
<tr>
<td></td>
<td>FUEL CUT SYSTEM .................................................. 5-36</td>
</tr>
<tr>
<td></td>
<td>EGR SYSTEM ........................................................ 5-37</td>
</tr>
</tbody>
</table>
Fig. 5-1-1  Engine emission control systems
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Heater fan</td>
</tr>
<tr>
<td>2.</td>
<td>Small, Tail, Side marker &amp; license light</td>
</tr>
<tr>
<td>3.</td>
<td>Rear defogger</td>
</tr>
<tr>
<td>4.</td>
<td>Battery</td>
</tr>
<tr>
<td>5.</td>
<td>Fuse (circuit fuse)</td>
</tr>
<tr>
<td>6.</td>
<td>Ignition switch</td>
</tr>
<tr>
<td>7.</td>
<td>Thermal engine room switch</td>
</tr>
<tr>
<td>8.</td>
<td>High altitude compensator (HAC)</td>
</tr>
<tr>
<td>9.</td>
<td>Ignition coil</td>
</tr>
<tr>
<td>10.</td>
<td>Fuel cut solenoid</td>
</tr>
<tr>
<td>11.</td>
<td>Electronic control module (ECM)</td>
</tr>
<tr>
<td>12.</td>
<td>Air control actuator</td>
</tr>
<tr>
<td>13.</td>
<td>Air cleaner</td>
</tr>
<tr>
<td>14.</td>
<td>Thermo sensor</td>
</tr>
<tr>
<td>15.</td>
<td>Vacuum switching valve (VSV)</td>
</tr>
<tr>
<td>16.</td>
<td>Vacuum transmitting valve (VTV)</td>
</tr>
<tr>
<td>16-1.</td>
<td>Brown side</td>
</tr>
<tr>
<td>17.</td>
<td>Secondary throttle valve actuator</td>
</tr>
<tr>
<td>18.</td>
<td>Wide open micro switch</td>
</tr>
<tr>
<td>19.</td>
<td>Idle micro switch</td>
</tr>
<tr>
<td>20.</td>
<td>Vapor storage canister</td>
</tr>
</tbody>
</table>

| 21. | Check valve (black) |
| 22. | Hot idle compensator (HIC) |
| 23. | Three way solenoid valve (TWSV) |
| 24. | Mixture control valve (MCV) |
| 25. | Choke piston |
| 26. | Idle up actuator |
| 27. | Mixture control solenoid valve (MCSV) |
| 28. | Vent solenoid valve |
| 29. | Distributor |
| 30. | Exhaust gas recirculation (EGR) valve |
| 31. | Three way solenoid valve (TWSV) |
| 32. | EGR modulator |
| 33. | Positive crankcase ventilation (PCV) valve |
| 34. | Bi-metal vacuum switching valve (BVSV) |
| 35. | Thermal switch |
| 36. | Oxygen sensor |
| 37. | Three way catalyst |
| 38. | Fifth switch |
| 39. | Jet (colorless) |

| 39-1. | Gray side |
| 40. | Check connector |
| 41. | "CHECK ENGINE" light |
| 42. | Mileage sensor (U.S.A. specification vehicle) |
| 43. | Cancel switch (U.S.A. specification vehicle) |
| 44. | Check switch (Canadian specification vehicle) |
| 45. | Delay valve (orifice) |
| 46. | To fuel tank |
5-1. GENERAL DESCRIPTION

VEHICLE EMISSION CONTROL INFORMATION LABEL
The Vehicle Emission Control Information Label is located under hood. The label contains important emission specifications and setting procedures, as well as a vacuum hose schematic with emission components identified.
When servicing the engine or emission systems, the Vehicle Emission Control Information Label should be checked for up-to-date information.

Fig. 5-1-2 Vehicle emission control information label
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM
(Blow-by gas recycling system)
The blow-by gas in the crankcase flows through the passage in the cylinder block into the cylinder head. The oil particles are separated from the blow-by gas by the oil separating unit in the cylinder head cover. The gas is then returned together with the fresh air coming from the air cleaner through the PCV valve into the intake manifold for recombustion.

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

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

Fig. 5-1-3 PCV system operation
THERMOSTATICALLY CONTROLLED AIR CLEANER (TCAC) SYSTEM

This system helps to improve fuel vaporization by controlling the temperature of the intake air almost at a constant level automatically regardless of driving conditions and outside temperature, to distribute the mixture to each cylinder evenly and to stabilize the air/fuel mixture ratio.

It consists of the thermo sensor (thermo valve) and the Air Control Actuator (ACA). The thermo sensor located in the air cleaner case senses the temperature of the intake air and controls the vacuum line by opening and closing its passage to the ACA. According to this opening and closing operation, the vacuum in the intake manifold actuates the damper through the diaphragm in the ACA. For the warm air, the air is warmed up in the exhaust manifold cover and for the cold air, the outside air is drawn through the fresh air passage and both enter the air cleaner.

![Diagram of TCAC system operation](image)

**FIG. 5-1-4 TCAC system operation**

**System Operation**

When engine is started in cold weather, the thermo valve is closed because the temperature of the intake air in the air cleaner is low. Therefore, the vacuum is transmitted to the ACA diaphragm, which then pulls up the damper linked to the diaphragm to open the warm air duct fully. As the engine is warmed up, the temperature of the intake air coming into the air cleaner from the warm air duct rises and the thermo valve starts opening. As a result, the vacuum transmitted to the ACA diaphragm decreases, and the damper pushed down by the spring force lessens the warm air duct opening. In this state, warm air and cold air are mixed together and enters the air cleaner.

When the engine is operating at high rpm and under high load condition, the temperature of the air coming from the warm air duct rises very high, causing the thermo valve opening to become even larger and the damper opening smaller. That is, the amount of the warm air coming from the warm air hose decreases and the cold air amount increases.

In this way, this system serves to maintain the temperature of the intake air going into the carburetor almost at a constant level.
EVAPORATIVE EMISSION CONTROL SYSTEM

An evaporative emission control system is used to prevent emission of fuel vapors from the vehicle fuel system.

The system allows evaporating fuel vapors to be stored, when the engine is not running.

This is accomplished by venting the fuel tank and carburetor float chamber through a vapor storage canister containing activated charcoal.

The major system components are vapor storage canister, vent solenoid, and liquid vapor separator.

The fuel vapor from the fuel tank is led into the canister and stored there when the engine is not running.

The fuel vapor from the carburetor float chamber is also stored in the canister when the ignition switch is “OFF”.

When engine runs, the fuel vapor stored in the canister is drawn into the carburetor together with fresh air.

For vent solenoid valve operation, refer to item of “BOWL VENTILATION SYSTEM.”

Fig. 5-1-5 Evaporative emission control system
HOT IDLE COMPENSATOR (HIC)

HIC attached to the air intake case serves to provide the optimum air/fuel mixture during hot idle so as to ensure stable idle speed.

HIC has a bimetal which warps as the heat transferred to it rises higher than about 55°C (131°F). Caused by this, the valve in HIC starts to open and it reaches to the full open state at about 70°C (158°F).

While the engine at idle, the throttle valve is closed and the vacuum in the intake manifold stays high. As the HIC valve opens in this state, the air from the air cleaner is drawn through the HIC valve into the intake manifold to prevent the air/fuel mixture getting richer during hot idle, thus maintaining a stable idle speed.
DECELERATION MIXTURE CONTROL SYSTEM
This system consists of a MCV (Mixture Control Valve), jet and vacuum hoses. This system is designed to introduce fresh air into the intake manifold to reduce generation of excessive HC and CO emission caused by temporary rich air-fuel ratio while rapid deceleration. The MCV has a pressure balancing orifice and check valve on its diaphragm, and closes when manifold vacuum is constant. As manifold vacuum increases according to rapid deceleration, manifold vacuum applies to MCV chamber “B” through jet, the MCV opens and introduces fresh air into the intake manifold. When manifold vacuum becomes constant, pressure difference between two sectioned chambers “A” and “B” gradually diminishes through pressure balancing orifice, then the MCV closes.

1. Carburetor
2. Intake manifold
3. MCV
4. Chamber “A”
5. Orifice
6. Chamber “B”
7. Valve
8. Filter
9. Jet (Colorless)
9-1. Gray side
10. Diaphragm
11. Check valve

Fig. 5-I-7 Deceleration mixture control system
COMPUTER CONTROLLED EMISSION CONTROL SYSTEM

[Feedback system]
A prime purpose of this system is to maintain a controlled air fuel ratio, allowing the catalyst to reduce oxides of nitrogen, hydrocarbons, carbon monoxide and to improve fuel economy simultaneously.
The electronic control module (ECM) and the oxygen sensor are provided in this system.
The oxygen sensor mounted on the exhaust manifold monitors the exhaust gas air fuel ratio and signals to the ECM.
The ECM processes the oxygen sensor signal and controls carburetor air fuel ratio by the operation of the mixture control solenoid in the carburetor.
Thus the signal of the exhaust gas air fuel ratio sensed by the oxygen sensor is fed back to ECM and the carburetor air fuel ratio is controlled.

[Electronic control module (ECM)]
The ECM controls the fuel cut system, idle-up system, bowl vent system, EGR system and secondary throttle valve system, as well as the feedback system. The ECM is located under the glove box of the instrument main panel. Refer to Fig. 5-1-9.

Fig. 5-1-8 Computer controlled emission control system
The ECM sensed parameters are as follows:

- **Exhaust Oxygen Concentration.**
  It is sensed by the oxygen sensor installed on the exhaust manifold.

- **Engine coolant temperature.**
  It is sensed by the thermal switch installed on the intake manifold.

- **Engine speed.**
  It is computed by the ECM based on the electrical signal received from the ignition system.

- **Electric load.**
  The ECM senses electric loads of the following items to provide idle speed compensation:
  a. Small, tail, side marker, license light.
  b. Rear defogger (if equipped).
  c. Heater fan.
• Gear position.
  It is sensed by the fifth switch located on the transmission. The switch turns “ON” when the gear shift lever is shifted to fifth gear position and “OFF” when shifted to positions other than fifth gear position.

Fig. 5-l-13 Fifth switch

1. Fifth switch
2. Transmission

• Engine room temperature compensation.
  Sensing the air temperature in the engine room the thermal engine room switch sends an electric signal to ECM to compensate the air/fuel ratio of the mixture. When the air temperature in the engine room is low, the switch operates to make the mixture rich. When the air temperature in the engine room is high, the switch stops operating, which means, the air/fuel ratio of the mixture is not controlled by the switch. Refer to Fig. 5-l-14 for the thermal engine room switch.

[Three-way catalyst]
The three-way catalyst is provided in the exhaust system (exhaust center pipe). The function of the catalyst is to reduce the emission of CO, HC and NO\textsubscript{x} in the exhaust gas by oxidizing or converting them into CO\textsubscript{2}, H\textsubscript{2}O and N\textsubscript{2} respectively.

BOWL VENTILATION SYSTEM
This system has a switch vent solenoid which is operated by the ignition switch and the ECM. It prevents the fuel vapor in the float chamber from flowing out into the atmosphere both when the engine is at a stop and at work. When the ignition switch is at “OFF” position or when cranking the engine (engine not started), the vent passage is closed by the solenoid valve, and therefore, the vapor flows from the float chamber into the vapor storage canister. When the engine is operating, the solenoid receives an electrical signal from the ECM and its valve keeps the inner vent passage open. As a result, the vapor passes through the passage into the carburetor and is drawn into the engine.

Fig. 5-1-14 High altitude compensator and thermal engine room switch

1. High altitude compensator
2. Thermal engine room switch

Fig. 5-1-15 Bowl ventilation system
FUEL CUT SYSTEM
As shown in the figure, the fuel cut solenoid valve is provided in the primary slow system of the carburetor to open and close the fuel passage of the slow system. As turning the ignition switch “OFF” cuts off the electric current to the solenoid, the solenoid closes the fuel passage. Thus this system contributes to preventing dieseling of the engine after the ignition switch is turned “OFF”. Also, during the deceleration and provided that all below listed three conditions exist, the fuel cut solenoid valve operates to cut the fuel feed to the engine temporarily by closing the fuel passage when it received a signal from the ECM.
Such operation of this system prevents the three-way catalyst from getting heated high and improves fuel economy.

Three conditions:
- The coolant temperature is normal.
- The idle micro switch is in “ON” position. In other words, the primary throttle valve is closed.
- The engine revolution is more than 2,400 rpm.

Fig. 5-1-16 Fuel cut system
EXHAUST GAS RECIRCULATION (EGR) SYSTEM

This system controls the formation of NOx emission by recirculating the exhaust gas into the combustion chamber through the intake manifold.

The diaphragm mounted in the EGR modulator is operated by back pressure of the exhaust gas to open and close the valve. By this opening and closing action of the valve, the EGR modulator controls the vacuum transmitted to the EGR valve.

Under a low load condition such as low speed driving, the exhaust pressure is low. In this state, the diaphragm in the EGR modulator is pushed down by the spring force and the modulator valve opens to allow the air into the vacuum passage from the outside.

As a result, the vacuum transmitted to the EGR valve becomes smaller and so does the opening of the EGR valve. Thus, less amount of exhaust gas is recirculated to the intake manifold.

Under a high load condition such as high speed driving, on the other hand, the exhaust pressure is high. By the high exhaust pressure, the diaphragm in the modulator is pushed up and closes its valve. As the air does not enter the vacuum passage in this state, the vacuum transmitted to the EGR valve grows larger and so does the opening of the EGR valve. Thus, larger amount of exhaust gas is recirculated to the intake manifold.

Under any one of the following conditions, the vacuum passage is closed by the TWSV or BVSV and the vacuum is not transmitted to the EGR valve which, therefore, doesn’t operate.

- When the coolant temperature is low. (BVSV is closed)
- When the gear shift lever is shifted to fifth gear position and fifth switch is turned on. (TWSV is closed)
- When HAC is turned on. (TWSV is closed)

Other than the above, EGR valve opens and closes in accordance with the EGR modulator operation.

---

**Fig. 5.1.17 EGR system operation**
5.2. DIAGNOSIS

POSSIBLE CAUSES OF EMISSIONS TEST FAILURES

<table>
<thead>
<tr>
<th>Excessive Emission</th>
<th>Explanation</th>
<th>Possible Causes</th>
</tr>
</thead>
</table>
| Hydrocarbons (HC)   | Excessive hydrocarbons are caused by an air/fuel mixture that is not burning completely. | • Engine not at normal operating temperature  
• Disconnected, obstructed, leaking, or misrouted vacuum hoses  
• Vacuum leaks  
• Maladjusted idle mixture  
• Improperly adjusted/sticking choke  
• Maladjusted initial spark timing  
• Defective spark plugs, wires or distributor cap  
• Malfunctioning MCV  
• Lead contamination of catalytic converter  
• Malfunctioning feed back system |
| Carbon monoxide (CO)| Excessive carbon monoxide emissions are due to a mixture that is rich. | • Engine not at normal operating temperature  
• Maladjusted idle mixture  
• Improperly adjusted/sticking choke  
• Lead contamination of catalytic converter  
• Leaking carburetor fuel passages or gaskets  
• Carburetor float level  
• Restricted air cleaner element  
• Malfunctioning feed back system |
| Oxides of nitrogen (Nox) | Excessive oxides of nitrogen are generally due to high temperatures in the combustion chamber. | • Obstructed/leaking/misrouted vacuum lines  
• Improper operation of the EGR system  
• Plugged EGR passages  
• Inoperative BVSV or TWSV  
• Lead contamination of catalytic converter  
• Malfunctioning feed back system |
### EGR Diagnosis

<table>
<thead>
<tr>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine idles abnormally rough and/or stalls.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR valve vacuum hoses mis-routed.</td>
</tr>
<tr>
<td>Leaking EGR valve.</td>
</tr>
<tr>
<td>EGR valve gasket failed or loose</td>
</tr>
<tr>
<td>Improper vacuum to EGR valve at idle.</td>
</tr>
<tr>
<td>Sticky EGR valve</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check EGR valve vacuum hose routing. Correct as required.</td>
</tr>
<tr>
<td>Check EGR valve for correct operation.</td>
</tr>
<tr>
<td>Check EGR attaching bolts for tightness. If no loose, remove EGR valve and inspect gasket.</td>
</tr>
<tr>
<td>Check vacuum from carburetor EGR port with engine at stabilized operating temperature and at idle speed.</td>
</tr>
</tbody>
</table>

| Engine runs rough on light throttle acceleration and has poor part load performance. |

<table>
<thead>
<tr>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR valve vacuum hose mis-routed.</td>
</tr>
<tr>
<td>Loose EGR attaching bolts</td>
</tr>
<tr>
<td>Sticky or binding EGR valve.</td>
</tr>
<tr>
<td>EGR modulator valve blocked or air flow restricted.</td>
</tr>
<tr>
<td>Wrong or no EGR gasket.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check EGR valve vacuum hose routing. Correct as required.</td>
</tr>
<tr>
<td>Torque bolts.</td>
</tr>
<tr>
<td>Same as listing in “Engine idles Abnormally Rough and/or Stalls” condition.</td>
</tr>
<tr>
<td>Clean EGR passage deposits. Perform EGR System Check.</td>
</tr>
<tr>
<td>Check EGR modulator valve operation.</td>
</tr>
<tr>
<td>Install new gasket, torque attaching parts.</td>
</tr>
</tbody>
</table>

| Engine stalls on decelerations. |

<table>
<thead>
<tr>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR modulator valve blocked of air flow restricted.</td>
</tr>
<tr>
<td>Restriction in EGR vacuum line.</td>
</tr>
<tr>
<td>VSV filter plugged.</td>
</tr>
<tr>
<td>Sticking or binding EGR valve.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check EGR modulator valve operation.</td>
</tr>
<tr>
<td>Check EGR vacuum lines for kinks, bends, etc. Remove or replace hoses as required.</td>
</tr>
<tr>
<td>Check VSV for correct operation.</td>
</tr>
<tr>
<td>Check EGR valve for excessive deposits causing sticky or binding operation.</td>
</tr>
</tbody>
</table>

| Part throttle engine detonation. |

**NOTE:**
Non-functioning EGR valve could contribute to part throttle detonation. Detonation can be caused by several other engine variables. Perform ignition and carburetor related diagnosis.

<table>
<thead>
<tr>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR modulator valve blocked of air flow restricted.</td>
</tr>
<tr>
<td>Insufficient exhaust gas recirculation flow during part throttle accelerations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check internal control valve operation.</td>
</tr>
<tr>
<td>Check EGR valve hose routing. Check EGR valve operation. Repair or replace as required. Replace valve as required. Check EGR passages and valve for excessive deposit.</td>
</tr>
<tr>
<td>Clean as required. Check VSV operation.</td>
</tr>
<tr>
<td>Condition</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Engine starts but immediately stalls when cold.</td>
</tr>
</tbody>
</table>

**NOTE:**
Stalls after start can also be caused by carburetor problems.

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**PCV SYSTEM DIAGNOSIS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Possible Cause</th>
<th>Correction</th>
</tr>
</thead>
</table>
5-3. MAINTENANCE SERVICE

GENERAL
If the emission control hoses were disconnected and any system component was removed for service, be sure to reinstall the component properly and route and connect hoses correctly after service. Refer to Fig. 5-1-l for hose connection.

PCV SYSTEM
Checking PCV System
NOTE:
If the engine is idling rough, this may be caused by a stuck PCV valve, plugged hoses or vacuum leakage of PCV line, therefore, never adjust the carburetor idle without first checking the PCV valve and hoses.

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

[ PCV valve]
1) Disconnect PCV hoses at three way joint.
2) Run engine at idle.
3) Place your thumb over the end of disconnect-ed PCV hose to check for vacuum. If there is no vacuum, check for clogged hose or valve. Replace as necessary.

4) After checking vacuum, stop engine and check PCV valve for sticking.
With engine stopped, remove PCV hose and connect a new hose to PCV valve.
Blow air into new hose and check that air flows with difficulty from cylinder head side to intake manifold side. If air flows without difficulty, the valve is stuck in “Open” position. Replace PCV valve. Before installing new PCV valve to intake manifold, wind sealing tape on thread of the valve.

WARNING:
Do not suck air through PCV valve. The petroleum substances inside the valve and fuel vapor inside intake manifold are harmful.

5) Connect PCV hose securely.

Fig. 5-3-1 Checking vacuum

Fig. 5-3-2 Checking PCV valve for sticking
TCAC SYSTEM

Checking TCAC System

1) Check vacuum hose for connection, deterioration or damage. Replace as necessary.

2) With engine at a stop, make sure that the valve indicated in figure is completely closed (closing warm air side). This check should be carried out by putting finger into duct after removing warm air hose from it.

3) Check that when engine is started (and run at idle speed) under the condition that air cleaner is cool, valve on warm air side becomes fully open and one on fresh air inhaling side is completely closed.

4) If nothing was found faulty in the above step, connect warm air hose.

If found defective in above step 2) or 3), inspect following parts according to each procedure.

[Air control actuator]
1) Disconnect vacuum hose from thermo sensor.
2) Make sure that damper opens fully when more than 20 cmHg (7.87 in.Hg) vacuum is applied to ACA.

Also, make sure that damper is held at the same position when a constant vacuum is applied to it.

If damper doesn’t open or close smoothly, or it isn’t held at the same position, replace ACA.

[Thermo sensor]
1) Remove air cleaner case cap.
2) Disconnect two vacuum hoses from thermo sensor.
3) Measure the temperature around thermo sensor.
4) Close a nozzle with finger and then blow air into nozzle. If measured temperature is above 40°C (104°F), air should come out of thermo sensor valve (valve is open) as shown in Fig. 5-3-6.

If the temperature is below 25°C (77°F), air should not come out (valve is closed).

Replace defective parts.
NOTE:
- To check thermo sensor for operation at higher than 40°C (104° F) temperature when thermo sensor is lower than 25°C (77° F), remove thermo sensor from air cleaner cap and warm it up with hair drier or photo light before checking.
- Never touch bimetal or valve in thermo sensor.

3) Install check valve with its orange side directed toward thermo valve.

EVAPORATIVE EMISSION CONTROL SYSTEM

Checking vapor storage canister

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

1) Disconnect negative cable at battery.
2) Disconnect 3 hoses from canister.
3) Remove canister.
   - air into pipe A strongly, and air should come out from pipe B.
   - pass through pipe A, C or D.
6) When air is blown into pipe C, air should come out from pipe A, B and D.

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

7) Install canister and connect hoses and battery negative cable.

5-20
Visually inspect hoses and pipe for cracks, damage, or excessive bends, and hose connection for tightness.

Fig. 5-3-9

HOT IDLE COMPENSATOR (HIC)
Checking Hot Idle Compensator
1) Remove air intake case with hose.
2) Check temperature around HIC with thermometer.
3) If temperature is below 45°C (113°F), air should not come out of HIC when air is blown into hose. If temperature is above 65°C (149°F), air comes out of HIC. Replace HIC if defective.
4) After checking, install air intake case and connect hose to intake manifold.

NOTE:
- To check HIC for operation at higher than 65°C (149°F) temperature when HIC (bimetal) temperature is lower than 45°C (113°F), warm it up with hair drier or photolight before checking.
- Never touch bimetal or valve in HIC.

Fig. 5-3-10

DECELERATION MIXTURE CONTROL SYSTEM
Checking
[Hoses]
Inspect each hose for pinholes, cracks or damage. Also check to ensure that each joint is securely connected. Any part found defective must be corrected or replaced.

Fig. 5-3-11

[Mixture control valve (MCV)]
1) Warm up the engine to normal operating temperature.
2) Disconnect hose ① and reconnect it. At this time, check that air is drawn into MCV.

NOTE:
At this time, the engine will idle rough or die, but this is normal.

Fig. 5-3-12

If the above checks show anything wrong, replace it.

Fig. 5-3-13
[Jet]
1) Remove jet.
2) When blowing air into pipe ①, air should come out of pipe ②.
   Replace clogged jet.
3) Install jet with its gray side directed toward MCV.

**FEED BACK SYSTEM**
Whether feed back system including oxygen sensor and ECM (Electronic Control Module) is in good condition or not, can be judged by checking for operation of “CHECK ENGINE” light in instrument cluster.

[U.S.A. specification vehicle]
As previously outlined, “CHECK ENGINE” light automatically flashes at 50,000 miles, 80,000 miles and 100,000 miles indicated on odometer when running warmed up engine. And this automatical flashing at above mileages proves that system is in good condition. Should any of following malcondition occur, the system check can be performed according to “System check flow chart”, even when mileage indicated by odometer is not any of 50,000 miles, 80,000 miles and 100,000 miles.

[Canadian specification vehicle]
Should any of following malconditions occur, the system check can be performed according to “System check flow chart”.
- Fuel consumption increases excessively even in normal driving.
- Engine tends to stall.
- Engine is hard to start.

---

**Fig. 5-3-13**
[Diagram: System check flow chart]

---

**Fig. 5-3-14**  *System check flow chart*
Checking feedback system

1) Operate (turn ON) cancel switch or check switch located at the place shown in below figure.

![Image of cancel switch or check switch](image)

Fig. 5-3-15 Cancel switch or check switch

2) Turn ignition switch ON without running engine. At this time, "CHECK ENGINE" light should light (should not flash). If it does not light, check electric circuit of the light, namely light for blow off and lead wire for disconnection.

![Image of check engine light](image)

Fig. 5-3-16 "CHECK ENGINE" light

3) After lighting of the light is confirmed, start engine and warm it up to normal operating temperature.

4) When engine is warmed up, run engine at 1,500 – 2,000 rpm. In this state, make sure that “CHECK ENGINE” light flashes. Flashing of light proves that system is in good condition. If light does not flash, it can be caused by one of the following. Check them and replace or adjust as necessary.

- Defective oxygen sensor
- Defective mixture control solenoid valve
- Defective carburetor or maladjusted idle mixture
- Defective thermal switch
- Disconnected or loosely connected electric lead wires of emission control systems
- Defective ECM
- Defective micro switches (idle and wot)

5) After making sure that “CHECK ENGINE” light flashes, turn cancel switch OFF. Light should go off.

6) Stop engine.

Checking idle and wide open micro switches

Check idle and wide open micro switches according to the following procedures.

1. Warm up engine to normal operating temperature and stop engine.

2. For this check, use check terminal coming from the lower right of instrument panel as shown. Connect negative prod of ohmmeter to check terminal and positive prod to body.

![Image of check terminal](image)

Fig. 5-3-17

3. Turn ignition switch to “ON” position.

4. Observe ohmmeter indicator reaction to make sure for the following movement for each throttle valve position.
<table>
<thead>
<tr>
<th>THROTTLE VALVE POSITION</th>
<th>INDICATOR MOVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idle position</td>
<td>Swing</td>
</tr>
<tr>
<td>1/2 open</td>
<td>Stay after deflection</td>
</tr>
<tr>
<td>Full open</td>
<td>Swing</td>
</tr>
</tbody>
</table>

NOTE:
If indicator doesn't deflect at all, reverse above connection, that is, negative prod to body and positive one to check terminal, and carry out the same check.

3) Connect ohmmeter to terminals of idle micro switch. Check for continuity between terminals. When throttle valve is at idle position, ohmmeter should indicated "zero" ohm.

4) Open throttle valve by 1/4 to 1/2, and ohmmeter indicator should indicate infinity. If check results in steps 3) and 4) are not satisfactory, replace idle micro switch with a new one.

If check results are not satisfactory, check idle and wide open micro switches as follows or their circuits for continuity referring to item "checking sensors and their lead wires " (p. 5-32).

[Idle micro switch]
1) Remove carburetor following normal service procedures.
2) Turn fast idle cam counterclockwise and insert a suitable pin available then into holes in cam and bracket to lock the cam.

5) Open throttle valve slowly till throttle valve-to-carburetor bore clearance becomes 0.36 — 0.62 mm (0.014 — 0.024 in) and check that ohmmeter indicator moves from "zero" ohm to infinity then.

If the above indicator movement does not occur within specified range, make adjustment by bending lever shown in below figure. Bend lever down when clearance is below specification and up when over specification.
[Wide open micro switch]
1) Connect ohmmeter to wide open micro switch as indicated in below figure. At this time, ohmmeter indicator should indicate “zero” ohm.
2) When throttle valve is fully opened, ohmmeter should indicate infinity. If any defect, replace.

3) Open throttle valve gradually until the ohmmeter indicates infinity. Then, using a vernier, measure the clearance between throttle valve and carburetor bore as shown in below figure. The clearance should be within 6.0 – 7.2 mm (0.24 – 0.28 in). If the clearance is out of specified range, make adjustment by bending the lever in below figure.
4) Using couplers of the same shape as that mentioned in step 3) or 1p couplers, connect only mixture control solenoid valve wire terminals (Yellow/Black terminal of coupler ① and Black/White terminal of coupler ②, White terminal of coupler ① and Blue/Red terminal of coupler ②).

NOTE:
- Couplers must be used to connect each terminal.
- Use special care when connecting terminals as wrong connection may cause damage to other parts.

5) Remove cap of duty check coupler located on dash panel and connect terminals with a lead wire to short them.

6) Turn ignition switch “ON” and “OFF” repeatedly (without starting engine) and check if MCSV operating sound is heard as ignition switch is operated.

Operating sounds prove its proper operation.

7) Upon completion of checks, re-connect disconnected couplers to original positions securely.

Checking thermal switch

NOTE:
For the rough check of the operation, thermal switch can be checked by warming up (above 46.5°C, 116°F) or cooling down (below 30°C, 86°F) the engine without being removed from the intake manifold.

The check procedure is the same as the following except item 1), 2), 5) and 6).

1) Drain cooling system.
2) Remove thermal switch from intake manifold.
3) Cool switch to below 30°C (86°F), and using an ohmmeter, check that there is continuity between terminals.
4) Heat switch to above 46.5°C (116°F), and check that there is no continuity between terminals.

5) Reinstall switch to intake manifold. Before installing, wind sealing tape on its thread.
6) Refill cooling system.

Checking thermal engine room switch
1) Disconnect connector of switch and connect ohmmeter between terminals on switch side.
2) Make sure that switch is “ON” (ohmmeter indicates “Zero” ohm) when atmospheric temperature is below 7°C (44°F) and “OFF” (ohmmeter indicates infinity) when above 19.5°C (67°F).
Checking oxygen sensor

1) Warm up the engine to normal operating temperature.
2) Disconnect the connector of the oxygen sensor.

3) Connect the voltmeter between the oxygen sensor side terminal of the disconnected connector and the ground as shown in below figure.

**NOTE:**
- Be sure to use a voltmeter whose inner resistance is more than some MΩ per IV or a digital type voltmeter. Any other voltmeter should not be used because accurate measurements are not obtained.
- NEVER apply voltage to the oxygen sensor as it may cause damage to the sensor.
- NEVER connect ohmmeter to the oxygen sensor as it may cause damage to the sensor.

4) While keeping the engine running at 1,500 — 2,000 rpm, turn the wide open micro switch "OFF" by moving the lever with the finger as shown in below figure. Then take the reading of the voltmeter to make sure it is about 0.8V.

5) With the engine running at 1,000 — 1,500 rpm, disconnect the vacuum hose at the intake manifold as shown in below figure. At this time, check to ensure that the voltmeter indicator is below 0.2V.

6) After checking, reconnect the vacuum hose to the intake manifold and the connector of oxygen sensor.
Checking feedback system circuits

When the feedback system does not seem to operate properly even after each of its components has been checked and proved normal, it is necessary to check each circuit of the feedback system. The checking procedure of each circuit is described here.

[Checking ECM ground circuits]
The ECM is grounded both at the dash panel and the intake manifold. If either grounding is not made securely, the feedback system will not operate. Therefore, check if the ECM is properly grounded at these two points according to the following procedure.

1) Turn OFF the ignition switch.
2) Disconnect the coupler from the ECM.
3) Connect an ohmmeter between the terminal \( \_1 \) of the disconnected coupler (on the wiring harness side) and the body (ground) as shown in below figure, and measure the resistance. Then repeat the same with the terminal \( \_2 \).

---

![Diagram 1](image1.png)

**Fig. 5-3-38 ECM and coupler**

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![Diagram 2](image2.png)

**Fig. 5-3-39 Checking ECM ground circuit**

---

1. Coupler (Viewed from wire harness side)
2. "B" (Black) lead wire
3. "B/G" (Black/Green) lead wire
4. Body ground
5. Engine ground
4) If the measured resistance between each terminal (1 and 2) and the body is “ZERO (0)” ohm, the ECM is grounded securely at two points. If the resistance is not “ZERO (0)” ohm, the possibility is that the lead wire between the terminal (1 or 2) and the ground is not securely grounded or disconnected.

The below figures show the particular points where “B” and “B/G” wires are grounded. Check for their secure grounding by referring to these figures.

![Fig. 5-3-40 Body ground](image1)

1. Body ground  
2. Black/Green lead wire  
3. Dash panel  
4. Battery

![Fig. 5-3-41 Engine ground](image2)

1. Engine ground  
2. Black lead wire  
3. Thermostat cap  
4. Intake manifold

5) After checking, connect the coupler to ECM securely.
[Checking ECM power circuits]
Connected to the ECM are the ignition coil and solenoids or solenoid valves. If a disconnection or a failure of contact occurs within a circuit (power circuit) including any of these coil or solenoids or solenoid valves, signals will not be sent to the ECM and as a result, the feedback system will not operate properly. Therefore, check the power circuits according to the following procedure.

1) Disconnect the coupler connected to the ECM.
2) Turn ON the ignition switch but be sure not to run the engine.
3) Connect a voltmeter between the terminal of the disconnected coupler (on the wiring harness side) and the body (ground) as shown in the figure and measure the voltage. And then repeat the same with each of the terminals 3, 4, 5, 6, 7, 8, and 9. If the measured voltage between each terminal and the body is about 12V, each circuit is in good condition.
4) If about 12V is not obtained in the above check, the particular circuit may be disconnected or out of contact. Check the circuit for such conditions.
5) After checking, connect the coupler to ECM securely.

---

Fig. 5-3-42 Checking ECM power circuits

1. Coupler (Viewed from wire harness side)
2. Battery
3. Ignition switch (ON)
4. Ignition coil
5. Vacuum switching valve (secondary throttle valve)
6. Three way solenoid valve (Idle-up)
7. Mixture control solenoid
8. Switch vent solenoid
9. Fuel cut solenoid valve
10. Three way solenoid valve (EGR system)
11. Br (Brown) lead wire
12. BI/R (Blue/Red) lead wire
13. B/W (Black/White) lead wire
14. Br/W (Brown/White) lead wire
15. BI/B (Blue/Black) lead wire
16. BI/Y (Blue/Yellow) lead wire
17. BI/W (Blue/White) lead wire
18. BI/G (Blue/Green) lead wire
[Checking sensors and their lead wires]
The sensors constituting the feed back system are: wide open micro switch, idle micro switch, thermal switch, high altitude compensator, thermal engine room switch and fifth switch. If any of the above sensors malfunctions or if the sensor circuit has some trouble, signals are not sent to the ECM and consequently the feed back system will not function properly. Therefore, check each sensor and its circuit according to the following procedure.

1) Turn OFF the ignition switch.
2) Disconnect the coupler from the ECM.
3) Connect the ohmmeter between the terminal ④ of the disconnected coupler and the terminal ① (ground) as shown in below figure and measure the resistance. And then repeat the same with each of the terminals ⑤, ①, ⑩, ⑪ and ⑬.

4) If each ohmmeter reading is as given below, the sensor and its circuit are in good condition. But if not, the sensor itself may be defective or the lead wire disconnected or out of contact. After checking, connect the coupler to ECM securely.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Terminal</th>
<th>Ohmmeter reading(Ω)</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal switch</td>
<td>④</td>
<td>0</td>
<td>When coolant temp. is low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>∞</td>
<td>When coolant temp. is above 46.5°C(116°F).</td>
</tr>
<tr>
<td>Idle micro switch</td>
<td>⑩</td>
<td>0</td>
<td>When engine is warm and accelerator pedal is not depressed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>∞</td>
<td>When accelerator pedal is depressed a little.</td>
</tr>
<tr>
<td>High altitude compensator</td>
<td>⑪</td>
<td>∞</td>
<td>When altitude is below 1,220 m (4,000 ft.).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>When altitude is above 1,220 m (4,000 ft.).</td>
</tr>
<tr>
<td>Thermal engine room switch</td>
<td>⑪</td>
<td>0</td>
<td>When temp. in engine room is low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>∞</td>
<td>When temp. in engine room is above 19.5°C (67°F).</td>
</tr>
<tr>
<td>Wide open micro switch</td>
<td>⑤</td>
<td>0</td>
<td>When accelerator pedal is not depressed or depressed only a little.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>∞</td>
<td>When accelerator pedal is depressed all the way.</td>
</tr>
<tr>
<td>Fifth switch</td>
<td>⑬</td>
<td>∞</td>
<td>When gear shift lever is shifted to low, second, third, forth or reverse gear position.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>When gear shift lever is shifted to fifth gear position.</td>
</tr>
</tbody>
</table>

Fig. 5-3-43 Checking sensors and their circuits
If oxygen sensor fails to send signal to the ECM, the feedback system does not operate. While the feedback system is at work, the ECM sends out the feedback signal, and in this condition, after warming up engine to normal operating temperature, when the cancel switch or check switch, is turned ON, the “CHECK ENGINE” light in the instrument cluster flashes. If the “CHECK ENGINE” light does not flash in such conditions as described above, check the feedback system for function according to the following procedure.

**NOTE:**
Except for Canadian specification vehicle, also when mileage sensor is turned ON (the odometer indicates 50,000, 80,000 or 100,000 miles), the “CHECK ENGINE” light flashes. If the “CHECK ENGINE” light does not flash in such condition, check the feedback system for function according to the following procedure.

1) Remove the ECM from the instrument main panel.
2) Connect the coupler to the ECM.
   *(Don’t disconnect the coupler from the ECM if connected)*
3) Warm up the engine to the normal operating temperature and keep it at idle.
4) Connect voltmeter between the terminals $@i$ (oxygen sensor signal) and $@j$ (ground) as shown in below figure.
5) If the voltmeter indicator deflects between $0V$ and $0.8V$ while racing the engine at a speed between idling and $1,500 - 2,000$ rpm, the feedback system is in good condition.

6) If the indicator does not deflect between $0V$ and $0.8V$, possible causes are as follows.

<table>
<thead>
<tr>
<th>Voltmeter indicator:</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remains at “Zero (0)”V</td>
<td>• Oxygen sensor lead wire is disconnected or out of contact.</td>
</tr>
<tr>
<td></td>
<td>• Intake system is leaky or air/fuel mixture is too lean due to malfunction of carburetor,</td>
</tr>
<tr>
<td></td>
<td>• Inner resistance of voltmeter is too small.</td>
</tr>
<tr>
<td></td>
<td>• Oxygen sensor is defective.</td>
</tr>
<tr>
<td>Indicates about $0.8V$ and does not deflect.</td>
<td>• Choke is operating because engine is not warmed up fully.</td>
</tr>
<tr>
<td></td>
<td>• Thermal switch is defective.</td>
</tr>
<tr>
<td></td>
<td>• Wide open micro switch is defective.</td>
</tr>
<tr>
<td></td>
<td>• Lead wire of mixture control solenoid is disconnected.</td>
</tr>
<tr>
<td></td>
<td>• Mixture control solenoid valve is defective.</td>
</tr>
</tbody>
</table>

**NOTE:**
Never connect ohmmeter as it may cause damage to the oxygen sensor.

---

Fig. 5-3-44 Checking oxygen sensor signal

1. ECM
2. Coupler (Connected to ECM)
3. Oxygen sensor
4. Sealed wire
5. W (White) lead wire
6. B (Black) lead wire
7. Br/B (Brown/Black) lead wire
8. Cancel switch
9. “CHECK ENGINE” light
10. Ignition switch (ON)
11. Battery
12. Mileage sensor
13. Check switch
7) After it is confirmed through steps 1) to 5) that oxygen sensor sends signals to ECM properly, check feed back signal according to the following procedure. If feed back system operates properly, ECM should send out feed back signal.
   a) Connect an ohmmeter between terminal ⑩ and body (ground). Be sure to connect positive (+) prod of the ohmmeter to body (ground) and negative (−) prod to terminal ⑬ as shown in below figure and never connect the other way around.

NOTE:
For this check, cancel switch must be OFF ("CHECK ENGINE" light off).
   b) If indicator of ohmmeter deflects when connected as described in the above step, it means that ECM sends out feed back signal, that is, feed back system operates properly.

NOTE:
If indicator doesn’t deflect at all, reverse connection (positive prod to terminal ⑩ and negative prod to body) and check.
   In this state, turning ON cancel or check switch causes "CHECK ENGINE" light to flash. If "CHECK ENGINE" light does not flash, wire harness, bulb of light or cancel/check switch may be defective.

8) After checking, install ECM to instrument main panel, and make sure coupler is connected to ECM securely.

---

![Fig. 5-3-45 Checking feed back signal](image-url)
[Checking idle-up signal]
The idle-up system operates when any of the small lights (such as tail light, side marker light and license light), heater fan and rear defogger is put in operation. If the idle-up actuator fails to operate even when any of such equipments is put in operation, check if signal is sent to the ECM according to the following procedure.
1) Disconnect the coupler from the ECM.
2) Turn ON the ignition switch but don’t run the engine.
3) Connect a voltmeter between the ⑦ terminal and the body (ground) as shown in below figure. If the voltmeter indicates 11 — 14V when each equipment is operated individually, it means that idle-up signal is sent to the ECM.
   If the voltmeter does not indicate 11 — 14V, the particular circuit is disconnected or in poor contact. Check the circuit for such conditions.
4) After checking, connect the coupler to ECM securely.

Fig. 5-3-46 Checking idle-up signal
If a malcondition such as those listed below still occurs even after confirming proper function and condition of the sensors of the feed back system and their circuits through the above checks, a trouble may exist within the ECM. In such a cause, replace the ECM.
- Fuel consumption increases even in normal driving.
- Engine tends to stall.
- Engine is hard to start.

**SWITCH VENT SOLENOID**

**Checking switch vent solenoid**
1) Disconnect canister hose from switch vent solenoid and connect a new hose to the pipe of solenoid.
2) Blow air into new hose with ignition switch at both “OFF” and “ON” (but without starting engine) and check to be sure that air passes through solenoid in both cases.
3) Warm up engine to normal operating temperature.
4) Increase engine revolution to 3,000—3,500 rpm. Under these conditions, check to be sure that engine rpm changes when idle micro switch lever on carburetor is moved as shown in below figure.

**Fig. 5-3-47 Checking switch vent solenoid**

**WARNING:**
Do not suck the hose. The fuel vapor in float chamber is harmful.

3) Start engine and run it at idle speed. Then check to be sure that air does not pass through solenoid when blowing air into new hose.
4) Remove new hose and connect original hose to switch vent solenoid.

**FUEL CUT SYSTEM**

**Checking fuel cut system**
1) Make sure that fuel cut solenoid valve makes a clicking sound when ignition switch is turned to “ON” or “OFF” without cranking engine.

**Fig. 5-3-48 Fuel cut solenoid valve**

2) Warm up engine to normal operating temperature.
3) Increase engine revolution to 3,000—3,500 rpm. Under these conditions, check to be sure that engine rpm changes when idle micro switch lever on carburetor is moved as shown in below figure.

**Fig. 5-3-49 Idle micro switch lever**

If found defective in above checks 1) and 3), check fuel cut solenoid circuit referring to item “checking feed back system circuits” in p. 5-29.
EXHAUST GAS RECIRCULATION (EGR) SYSTEM

Checking EGR system

NOTE:
• Before checking, confirm that altitude is not higher than 1,220 m (4,000 ft) (atmospheric pressure is below 680mmHg) and gear shift lever is at neutral position.
• When performing this check at higher than 1,220 m (4,000 ft) altitude, be sure to disconnect HAC coupler.

1) Run engine when it is cool (coolant temperature is below 55°C (131°F)) and check that EGR valve diaphragm is not operating in this state, by touching diaphragm with finger.

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

2) Warm up engine to normal operating temperature and race it after warming up. Then check to be sure that diaphragm moves toward ① in below figure during acceleration and toward ② during deceleration.

![Fig. 5-3-50 Checking EGR valve diaphragm](image)

If found defective in above step 1) or 2), inspect following parts according to each procedure.

NOTE:
Refer to item “CHECKING SENSOR AND THEIR LEAD WIRES” in page 5-32 for checking HAC, fifth switch and their circuit.

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

[EGR valve]
1) Disconnect vacuum hose from TWSV.
2) Connect vacuum pump gauge to its hose.
3) Check that EGR valve diaphragm moves smoothly and that it is held at the same position when more than 20 cmHg vacuum is applied to EGR valve.
If diaphragm doesn’t move smoothly, or it isn’t held at the same position, replace EGR valve.

![Fig. 5-3-51 Movement of EGR valve diaphragm](image)

4) After checking, be sure to connect vacuum hose to TWSV.
[Bi-metal vacuum switching valve (BVSV)]

NOTE:
For the rough check of the operation, BVSV can be checked by warming up or cooling down the engine without being removed from the intake manifold.
The check procedure is the same as the following except item 1), 2) and 5).
1) Drain cooling system when engine is cold.
2) Disconnect vacuum hoses and remove BVSV from intake manifold.
3) While keeping BVSV cool (below 53°C (127°F)), blow nozzle "3". Air should not come out of nozzle "4".

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

5) Reinstall BVSV to intake manifold. Before installing, wind sealing tape on its thread.
6) Connect vacuum hoses.
3) Connect vacuum pump gauge to nozzle 1 and plug nozzle 2 with your finger. While blowing air into nozzle 3, operate vacuum pump gauge and check that vacuum is applied to modulator then.

4) After checking, install modulator and connect hoses securely. Refer to Fig. 5-l-l for connecting.

[Three way solenoid valve (TWSV)]
1) Disconnect 2 vacuum hoses from EGR modulator and EGR valve.
2) Blow hose 1. Air should come out of hose 2 and not out of filter.

3) Disconnect coupler and connect 12V-battery to TWSV terminals. In this state, blow hose 1. Air should come out of filter and not out of hose 2.

4) After checking, be sure to connect vacuum hoses and coupler.