EMISSION CONTROL SYSTEM

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[MPI SYSTEM]

[FBC SYSTEM]

GENERAL

SPECIFICATIONS

Components	Function	Remarks
Crankcase Emission Control System Positive crankcase ventilation (PCV) valve	HC reduction	 Variable flow rate type
Evaporative Emission Control System Canister Purge control solenoid valve	HC reduction	 ON/OFF solenoid valve
Exhaust Emission Control System MPI system (air-fuel mixture control device) 3-way catalytic converter Exhaust gas recirculation system EGR valve Thermo valve	 CO, HC, NOx reduction CO, HC, NOx reduction NOx reduction	 Oxygen sensor feedback type Monolith type Single type Bimetal type

SERVICE STANDARD

Purge control solenoid valve	
Coil resistance	36-44Ω [at 20°C (68°F)]
Thermo valve temperature	
Opening temperature	MIN. 50°C (122°F)
Closing temperature	61-69°C (142-156°F)
EGR control solenoid valve	
Coil resistance	36-44Ω [at 20°C (68°F)]

TIGHTENING TORQUE

	Nm	kg.cm	lb.ft
Positive crankcase ventilation valve	8-12	80-120	5.8-8.7
EGR valve installation bolt	10-15	100-150	7-11
Thermo valve	20-40	200-400	14-29
EGR temperature sensor	10-12	100-120	7.3-8.6

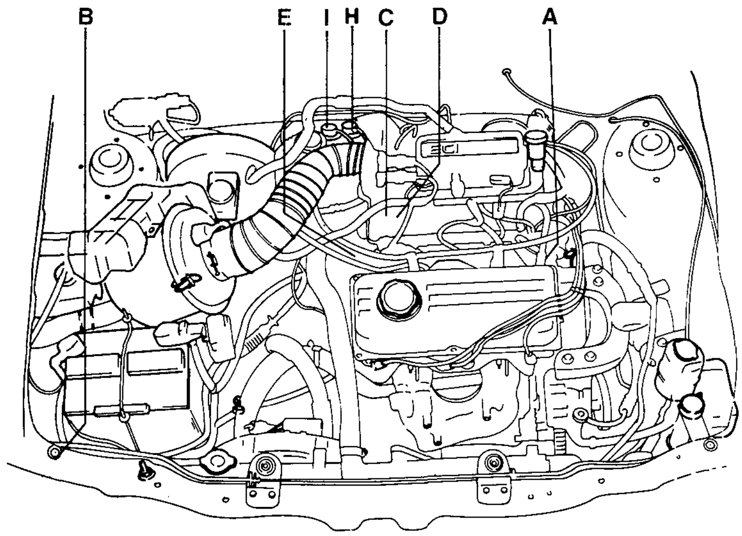
SEALANT

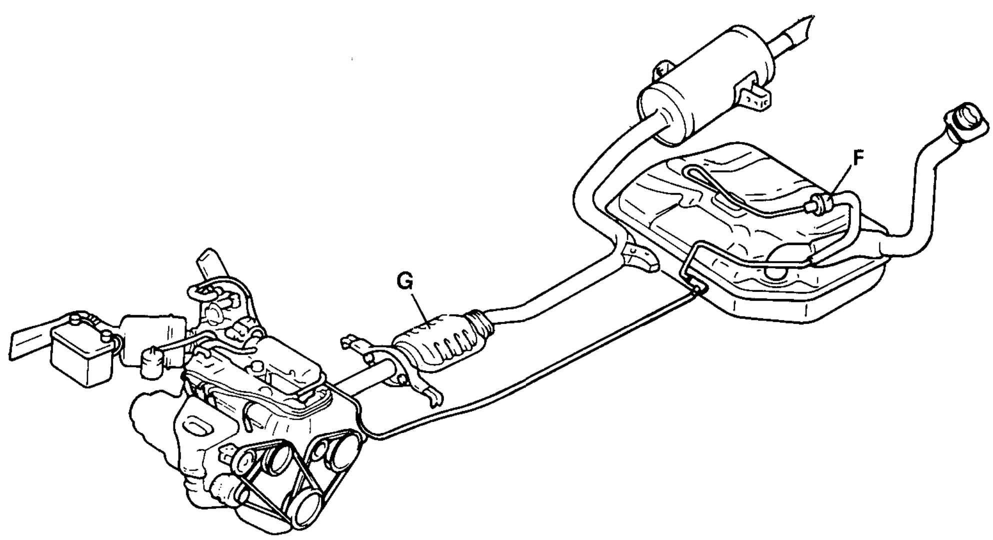
Thermo valve thread portion	LOCTITE 962T or equivalent

TROUBLESHOOTING

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

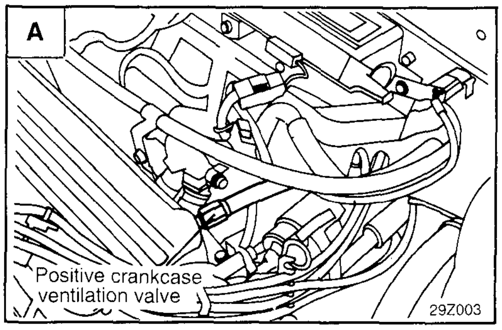
LOCATION OF EMISSION CONTROLS

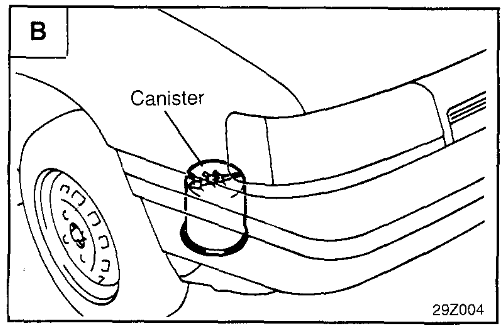


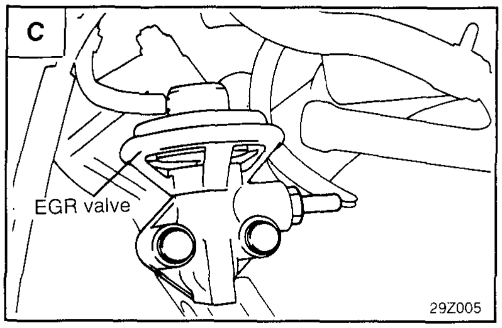


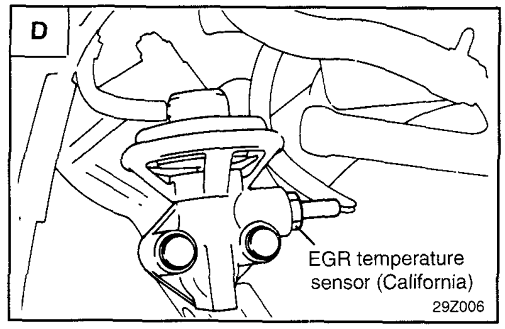
A. PCV valve
B. Canister
C. EGR valve
D. EGR temperature sensor (California only)
E. Thermo valve
F. 2-way valve
G. Catalytic converter
H. Purge control solenoid valve
I. EGR control solenoid valve (California only)

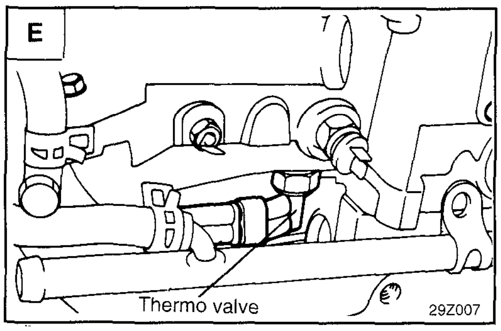
EMISSION CONTROL SYSTEMS

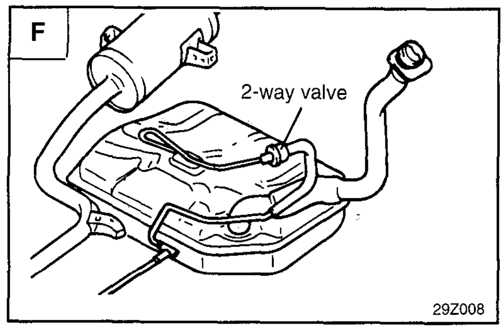


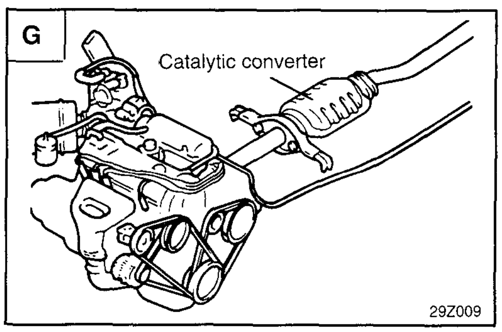


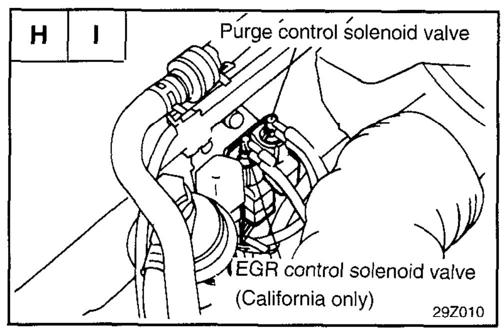




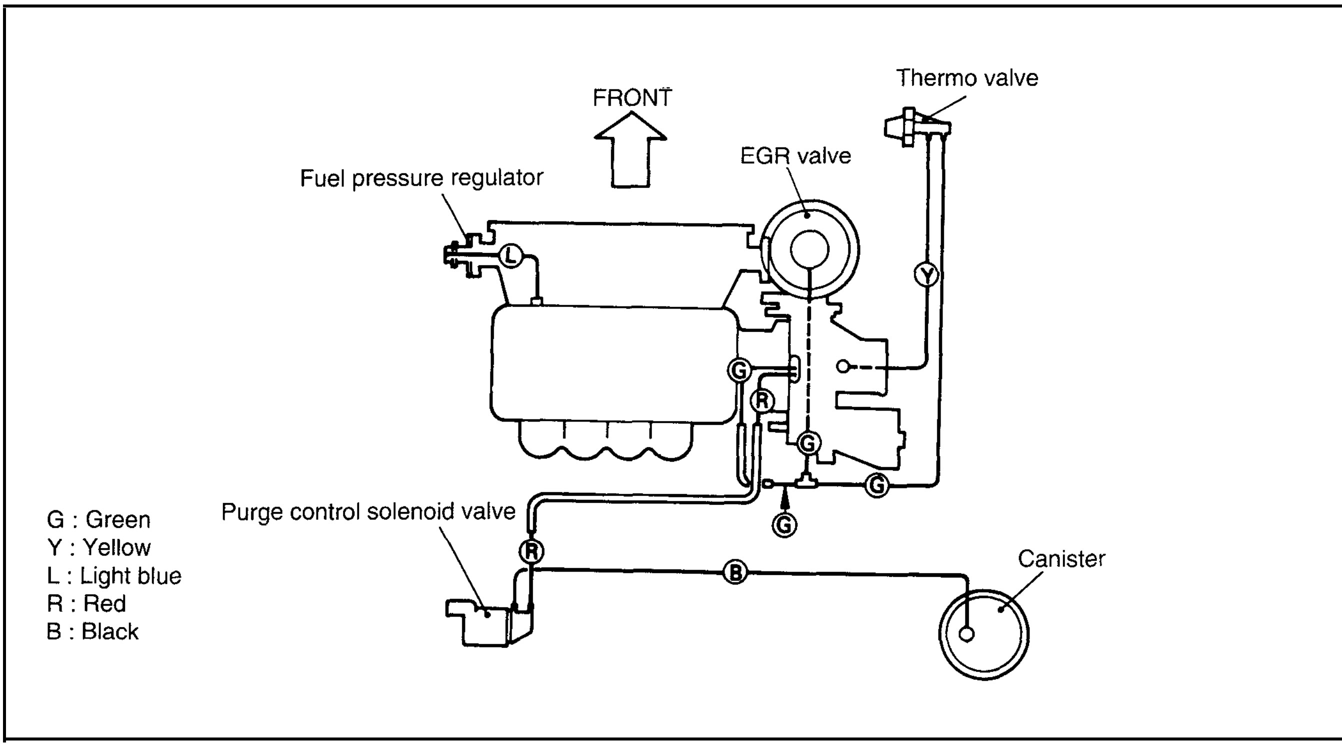




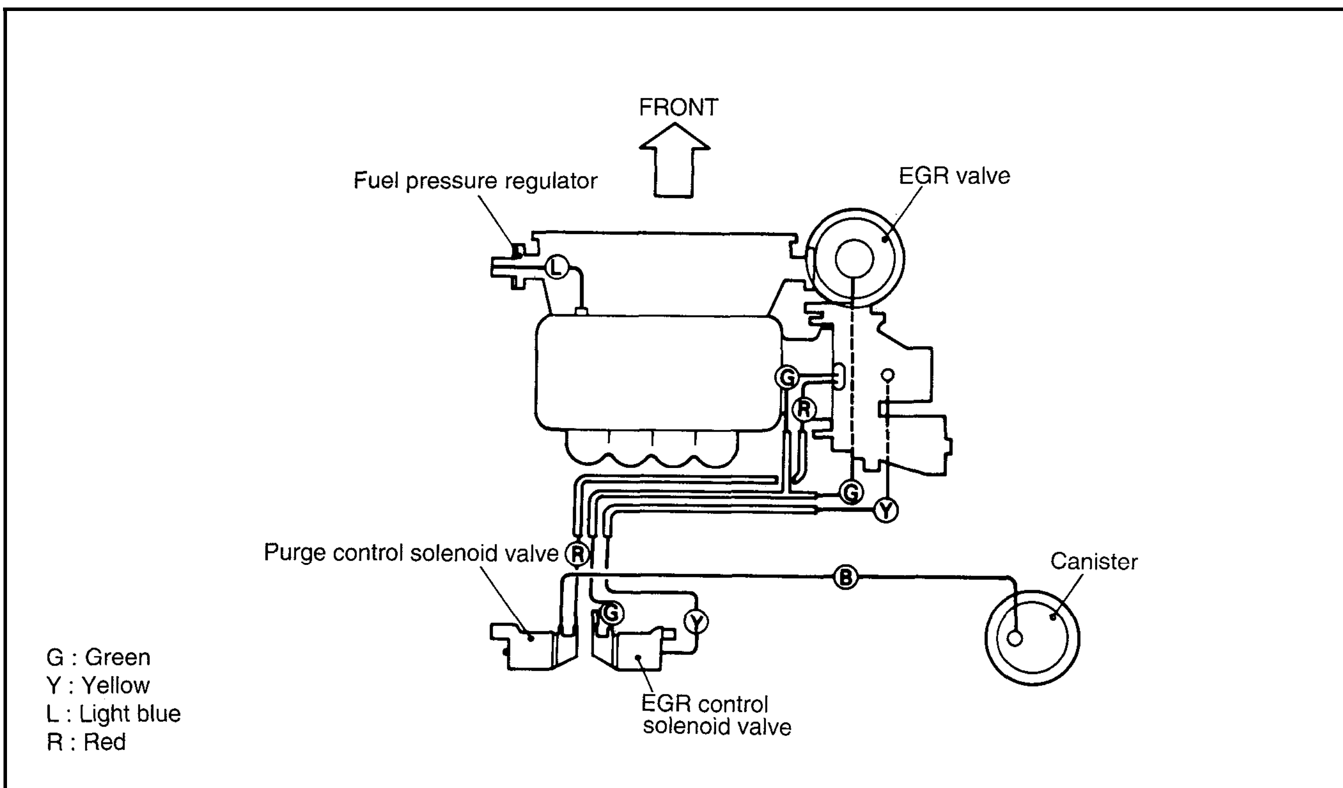




VACUUM HOSE LAYOUT (FEDERAL AND CANADA)



VACUUM HOSE LAYOUT (CALIFORNIA)



SCHEMATIC DRAWING [For Federal]

INPUT

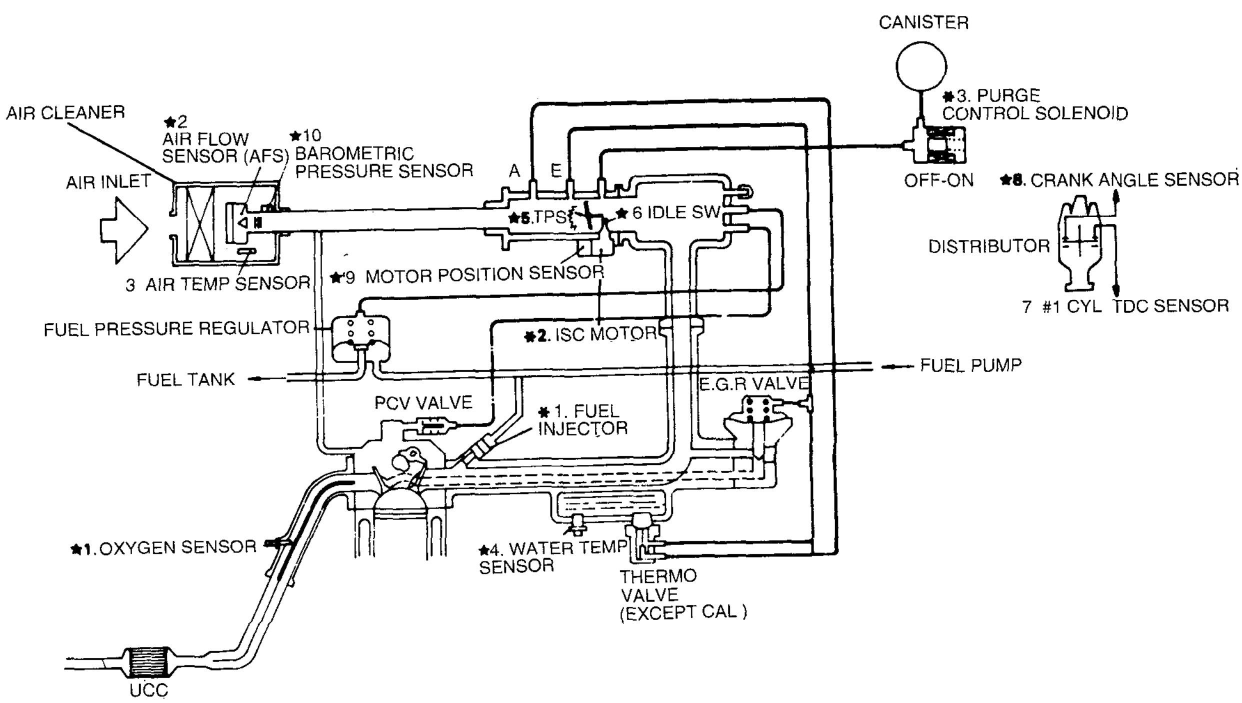
- ★1. Oxygen sensor
- ★2 Air-flow sensor
- ★3 Intake air temperature sensor
- ★4. Water temperature sensor
- ★5. Throttle position sensor
- ★6. Idle switch
- ★7. No. 1 cylinder TDC sensor
- ★8. Crankshaft angle sensor
- ★9. Motor position snesor
- ★10. Barometric pressure sensor
- Battery voltage
- Vehicle speed sensor
- Cooler load signal
- Starter "S" terminal
- Power steering sw

INPUT ➡ ECU ➡ OUTPUT

OUTPUT

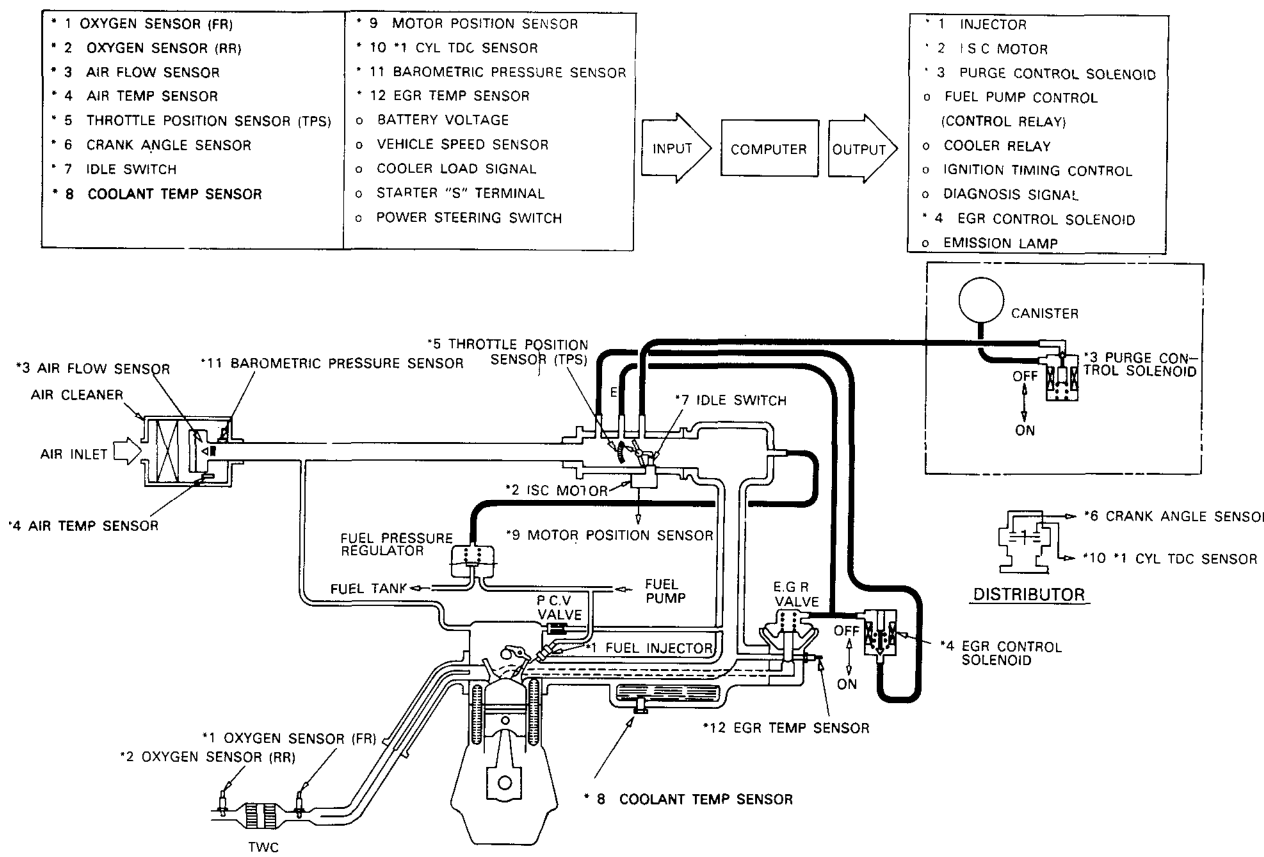
- ★1. Injector
- ★2. ISC motor
- ★3. Purge control solenoid valve
- . Fuel pump control (control relay)
- . Air conditioner power relay
- . Ignition timing control
- . Diagnosis
- Emission lamp (Except canada)

TDC : Top Dead Center
A/T: Vehicles witch automatic transaxle



PCV : Positive Crankcase Ventilation
UCC : Underfloor Catalytic Converter

SCHEMATIC DRAWING [For California]



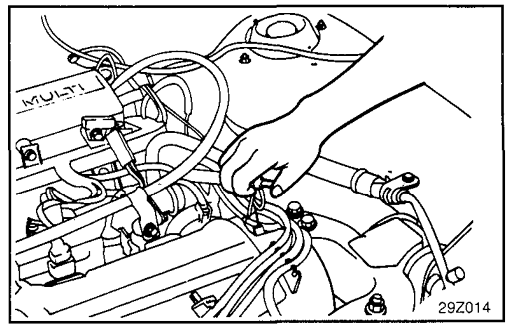
PCV : Positive Crankcase Ventilation
UCC : Underfloor Catalytic Converter

CRANKCASE EMISSION CONTROL SYSTEM

1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.
2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum is felt.

   NOTE

   The plunger inside the PCV valve will move back and forth.
3. If vacuum is not felt, clean the PCV valve and ventilation hose in cleaning solvent or replace if necessary.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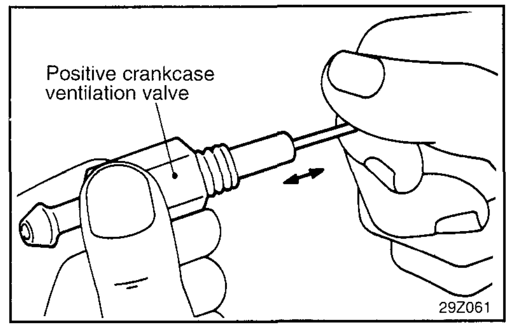
INSPECTION

1, Remove the positive crankcase ventilation valve.
2. Insert a thin stick into the positive crankcase ventilation valve from the threaded side to check that the plunger moves.
3. If the plunger does not move, the positive crankcase ventilation valve is clogged. Clean it or replace.



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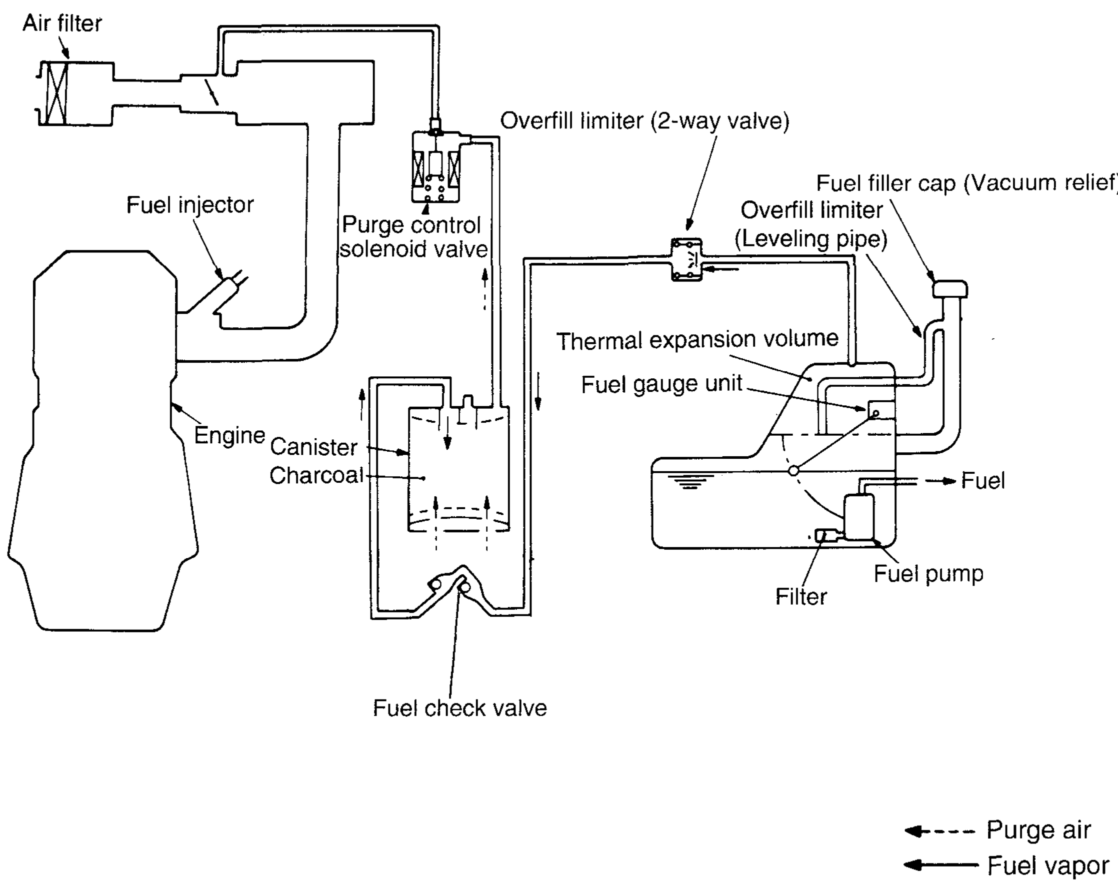
INSTALLATION

Install the positive crankcase ventilation valve and tighten to specified torque.

PCV valve tightening torque . . . .
8-12 Nm (80-120 kg.cm, 5.8-8.7 lb.ft)

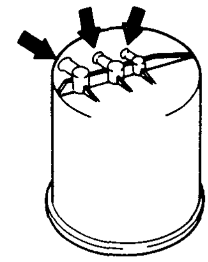
EVAPORATIVE EMISSION CONTROL SYSTEM

COMPONENTS



CANISTER

Inspection



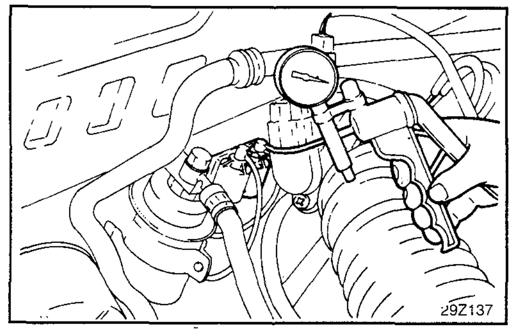
1. Look for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel leakage.
3. After removing the charcoal canister, inspect for cracks or damage.

PURGE CONTROL SOLENOID VALVE

Inspection

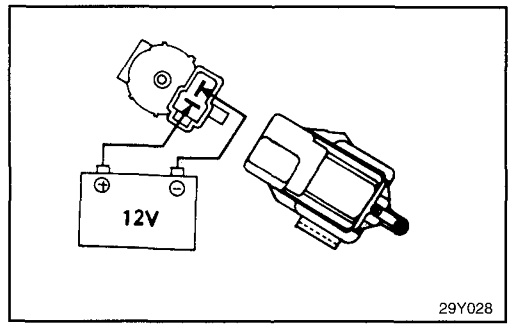
NOTE
When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

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



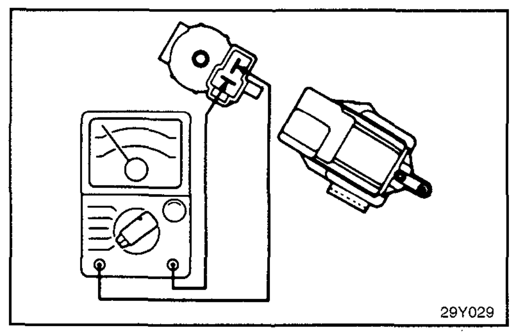
4. Apply vacuum and check when voltage is applied to the purge-control solenoid valve and when the voltage is discontinued.

Battery voltage	Normal condition
When applied	Vacuum is released.
When discontinued	Vacuum is maintained.



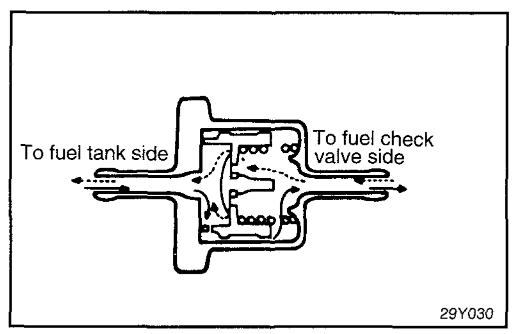
5. Measure the resistance between the terminals of the solenoid valve.

Purge control solenoid valve
Coil resistance 36-44 Ω [at 20°C (68°F)]



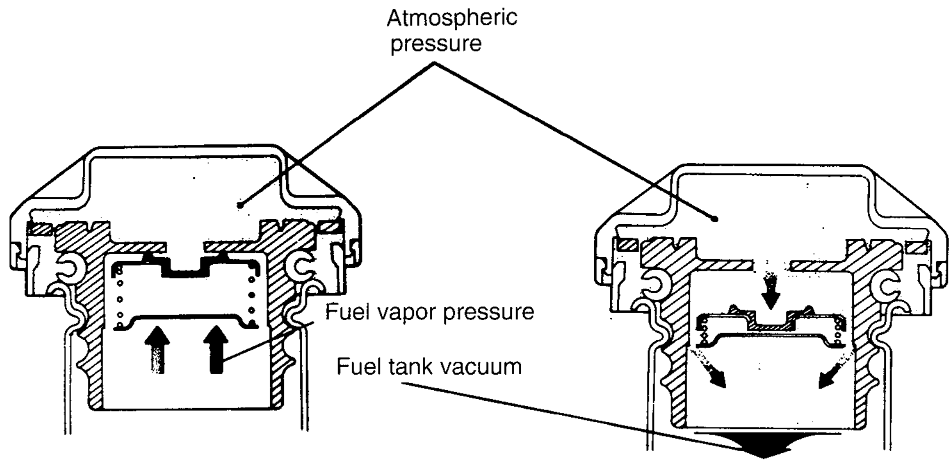
OVERFILL LIMITER (TWO-WAY VALVE)

To inspect the overfill limiter (Two-way valve), refer to Group 31-Fuel tank.



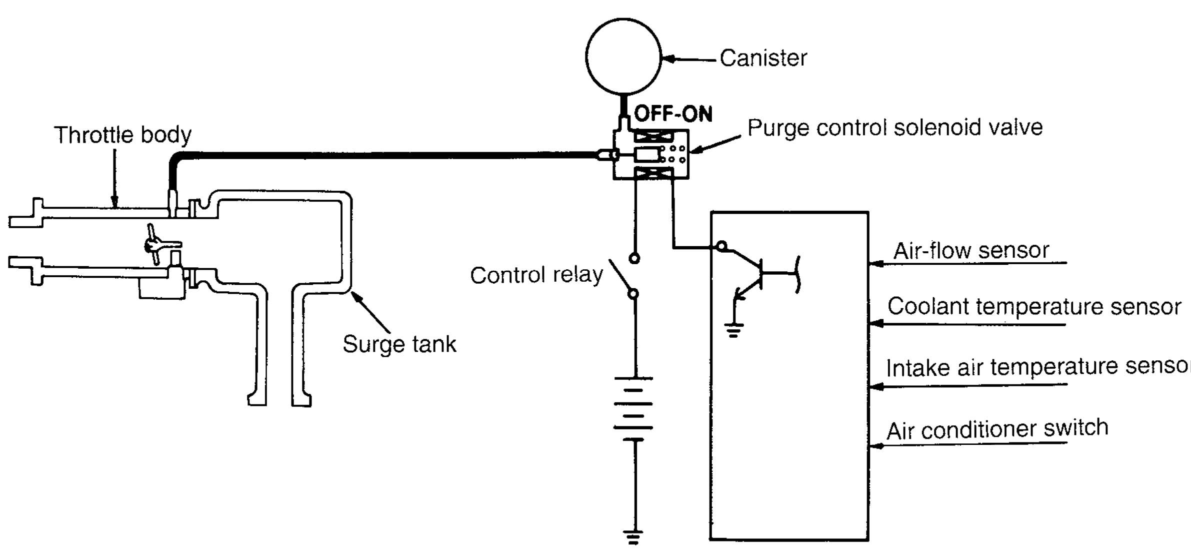
FUEL FILLER CAP

The fuel filler cap is equipped with a vacuum relief valve to prevent the escape of fuel vapor into the atmosphere.

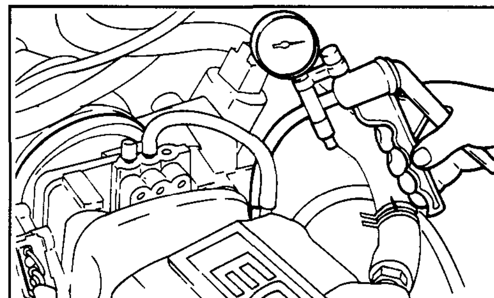


When pressure is in fuel tank **When vacuum is in fuel tank**

CHECKING PURGE CONTROL SYSTEM



Checking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1. Disconnect the vacuum hose (red stripe) from the throttle body, and connect a vacuum pump to the vacuum hose.

2. Check the following points when the engine is cold [coolant temperature 60°C (140°F) or below] and when it is warm [coolant temperature 70°C (158°F) or higher].

When engine is cold

Engine operating condition	Applying vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
3,000 rpm		

When engine is warm

Engine operating condition	Apply vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after engine start 3,000 rpm	Try to apply vacuum	Vacuum is released
After 3 minutes have passed after engine start 3,000 rpm	50 KPa (7.3 psi	Vacuum will be held momentarily, after which, it will be released.

EXHAUST EMISSION CONTROL SYSTEM

Exhaust emissions (CO, HC, NOx) are controlled by a combination of engine modifications and the addition of special control components.

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system. Additional control devices include an exhaust gas recirculation (EGR) system and catalytic converters.

These systems have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

AIR/FUEL MIXTURE RATIO CONTROL SYSTEM [Multi Point Injection (MPI) System]

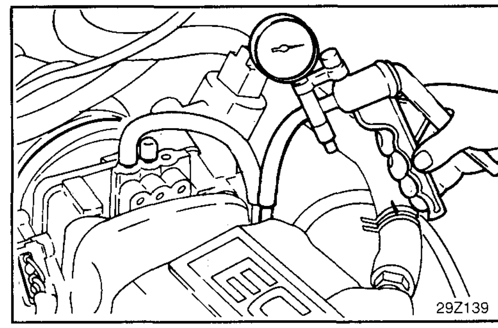
The MPI system is a system which employs the signals from the oxygen sensor to activate and control the injector installed in the manifold for each cylinder, thus precisely regulating the air/fuel mixture ratio and reducing emissions.

This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three-way catalyst. The three-way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There are two operating modes in the MPI system.

1. Open-Loop air/fuel ratio is controlled by information programmed into the ECU.
2. Closed-Loop air/fuel ratio is varied by the ECU based on information supplied by the oxygen sensor.

EXHAUST GAS RECIRCULATION SYSTEM

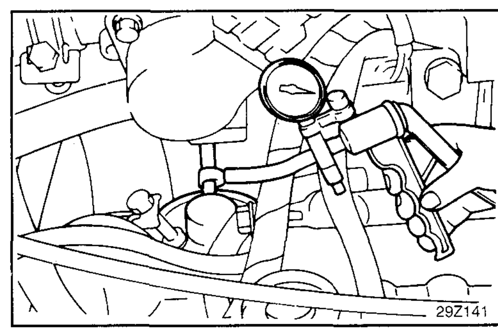
Inspection (Federal, Canada)

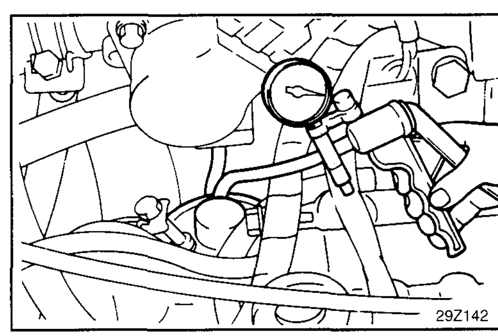


1. Disconnect the vacuum hose (green stripe) from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is both cold [coolant temperature 50°C (122°F) or below] and hot [Coolant temperature 80-95°C (176-205°F) or higher].

Engine coolant temperature	Vacuum	Engine condition	Normal condition
Cold	Apply	Idling	Vacuum is released
Hot	6 KPa (1.7 in.Hg)	Idling	Vacuum is held
	26 kPa (7.5 in.Hg)	Idle is unstable	Vacuum is held

Inspection (California Only)





1. Disconnect the vacuum hose (green stripe) from the EGR valve body, and connect a vacuum pump via the three way terminal
2. Check the following points when the engine is both cold [coolant temperature 20°C (68°F) or below] and warm [Coolant temperature 70°C (158°F) or higher].

[When the engine is cold]

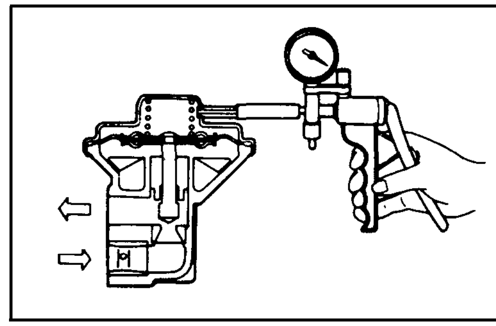
Engine condition	Normal condition
Rev engine	No change in vacuum (atmospheric pressure)

[When the engine is warm]

Engine condition	Normal condition
Rev engine	Vacuum rises temporarily to 14 kPa (3.9 in.Hg) or more.

3. Disconnect the three-way terminal and connect the hand vacuum pump directly to the Exhaust Gas Recirculation (EGR) valve.
4. Check whether the engine stalls or the idling is unstable when a vacuum of 26 kPa (7.5 in.Hg) or higher is applied during idling.

EGR Valve



1. Remove the EGR valve and check for sticking, carbon depos its, etc.
   If such conditions exist, clean with solvent to ensure tight valve seat contact.
2. Connect a manual vacuum pump to the EGR valve.
3. Apply a vacuum of 67 kPa (9.7 psi) and check air tightness.
4. Blow in air from one passage of the EGR to check condition as follows.

Vacuum	Normal condition
7 kPa (1.0 psi) or less	Air does not blow through
23 kPa (3.3 psi) or more	Air blows through

CAUTION
When installing the EGR valve, use a new gasket and tighten to the specified torque.

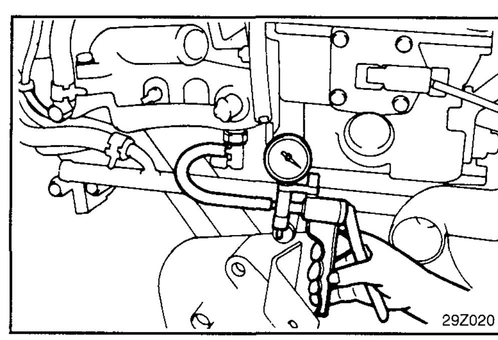
Tightening torque
EGR valve . . . .
10-15 Nm (100-150 kg.cm, 7-9 lb.ft)

Thermo Valve (Federal and Canada Vehicles Only)

CAUTION
1. **Do not use a wrench on the plastic section when removing or installing the thermo valve.**
2. **When installing, apply a coat of sealant to the threads, and tighten to the specified torque.**

Tightening torque
Thermo valve . . . .
20-40 Nm (200-400 kg.cm, 14-29 lb.ft)

3. **When disconnecting the vacuum hose, make an identification mark on it so that it can be re-connected to the original position.**



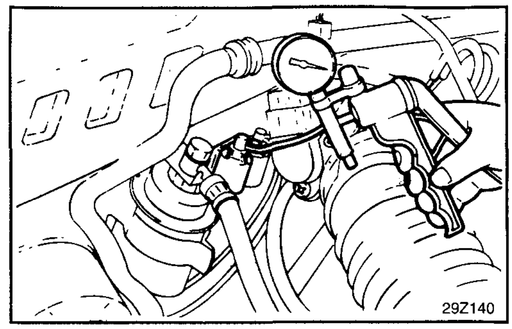
1. Disconnect the vacuum hoses (yellow stripe and green stripe) from the thermo valve, and connect a manual vacuum pump to the thermo valve.
2. Apply a vacuum and check the air passage through the thermo valve.

Engine coolant temperature	Normal condition
50°C (122°F) or less	Vacuum leaks
80°C (176°F) or more	Vacuum is maintained

EGR Control Solenoid Valve (California only)

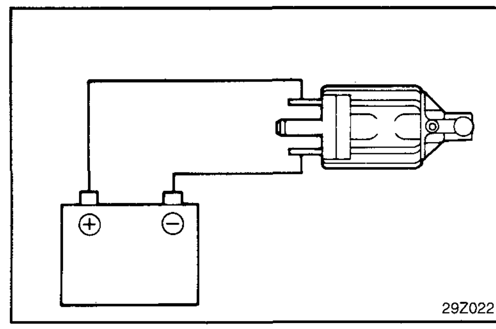
NOTE
When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

1. Disconnect the vacuum hose (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.



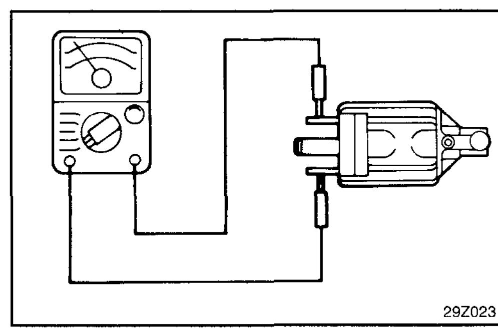
4. Apply a vacuum to check for a maintained vacuum when voltage applied directly to the EGR control solenoid valve. When the voltage is discontinued, the vacuum is released.

Battery voltage	Result
When applied	Vacuum is held.
When discontinued	Vacuum is released.



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

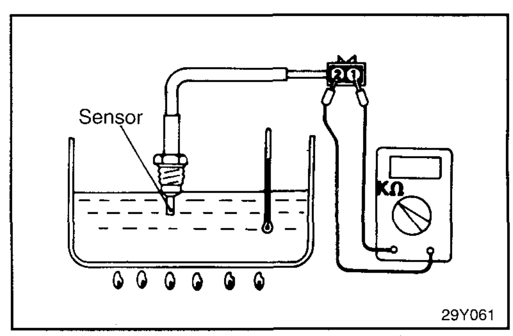
Standard value: 36-44 Ω[at 20°C (68°F)]



EGR Temperature Sensor (California Vehicles Only)

1. Place the EGR temperature sensor in water, and then measure the resistance value between terminals 1 and 2 while increasing the water temperature.
If out of specification, replace the EGR temperature sensor.

Temperature °C (°F)	Resistance (KΩ)
50 (122) 100 (212)	60-83 11-14



CATALYTIC CONVERTER

Refer to the page 00-9.

GENERAL

The emission control system has the following three major systems.

1. Crankcase emission control system.
   The crankcase emission control system is a system adopting a closed-type crankcase ventilation to prevent blow-by gases from escaping into the atmosphere. The blow-by gases in the crankcase are routed back to the intake manifold for combustion.
2. Evaporative emission control system.
   The evaporative emission control system prevents the emission of fuel vapour from the fuel tank, carburetor into the atmosphere. It consists of various components (a canister, purge control valve, 2-way valve and so no) which collect and lead fuel vapour to the combustion chamber for combustion.
3. Exhaust emission control system.
   The exhaust emission control system consists of an air-fuel ratio control unit (FBC system), three way catalytic converter, exhaust gas recirculation (EGR) system, secondary air supply system to reduce emission of CO, HC and NOx.

EMISSION CONTROL COMPONENTS

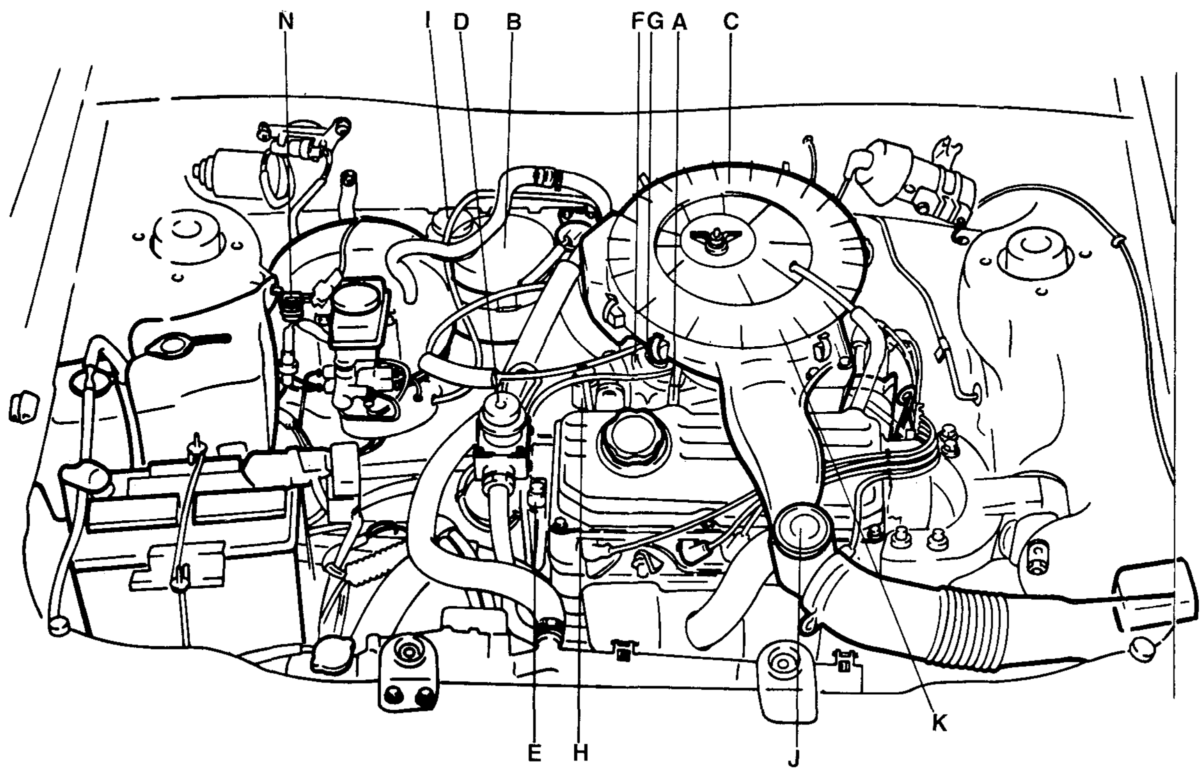
Components	Function	Remarks
Crankcase Emission Control System		
Positive crankcase ventilation (PCV) valve	HC emission control	Variable flow rate type
Evaporative Emission Control System		
Canister		
2-way valve (Overfill limiter)		
Purge control valve (PCV)	HC emission control	Single diaphragm type
Bowl vent valve (BW)		vacuum type
Fuel filler cap		With relief valve
Fuel check valve		
Exhaust Emission Control System		
Jet air system	CO emission control	jet swirl type
FBC system (Air-fuel ratio control system)	CO, HC, NOx emission control	Oxygen sensor feedback type
Catalytic converter	CO, HC, NOx emission control	Three-way type
Secondary air supply system	CO, HC emission control	
Reed valve		With air control valve
Secondary air control solenoid valve		On-off solenoid valve
Exhaust gas recirculation system	NOx emission control	
EGR valve		Single type
Vacuum regulator valve (VRV)		With vacuum control
Thermo valve		Wax pellet type
High altitude compensation system	CO, HC emission control	For Federal
High altitude compensator (HAC)		Bellows type
Heated air intake system	CO, HC emission control	Vacuum control type
Mixture control valve (MCV)	CO, HC emission control	Differential pressure type valve

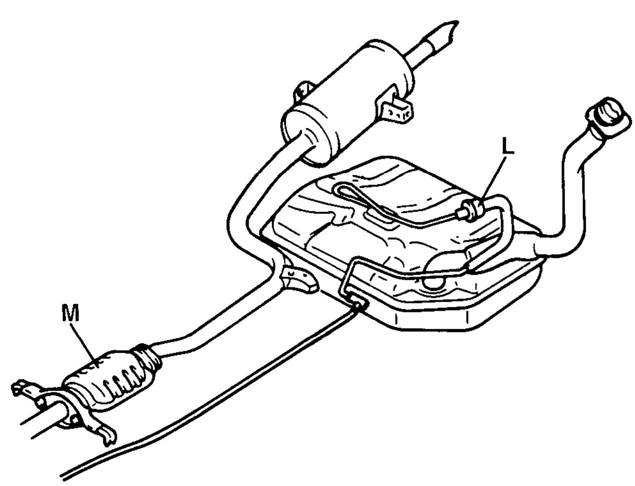
FBC : Feedback Carburetor

TROUBLESHOOTING

Symptom	Probable cause	Remedy
Engine will not start or is hard to start (Cranking possible)	Mixture control valve kept open Vacuum hose disconnected or damaged EGR valve kept open	Replace Repair or replace Repair or replace
Rough idle or engine stalls	EGR valve kept open High altitude compensation system faulty Vacuum hose disconnected or damaged Faulty purge control system Faulty bowl vent valve Mixture control valve kept open Faulty PCV valve	Repair or replace Troubleshoot the system and check components under suspicion Repair or replace Troubleshoot the system and check components under suspicion Replace Replace Replace
Engine hesitates or poor acceleration	Exhaust gas recirculation system faulty High altitude compensation system faulty Thermo valve faulty-cold engine Intake air temperature control system faulty	Troubleshoot the system and check each component under suspicion Troubleshoot the system and check components under suspicion Replace Troubleshoot the system and check components under suspicion
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system
Poor fuel mileage	Intake air temperature control system faulty Exhaust gas recirculation system faulty High altitude compensation system faulty	Troubleshoot the system and check components under suspicion Troubleshoot the system and check components under suspicion Troubleshoot the system and check components under suspicion

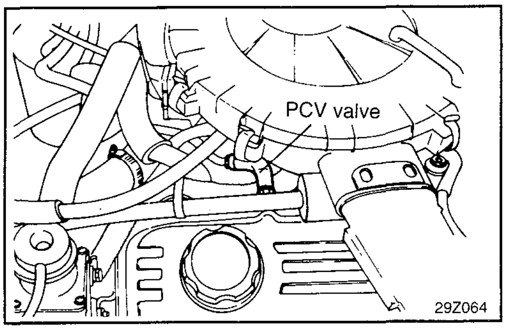
LOCATION OF EMISSION COMPONENTS



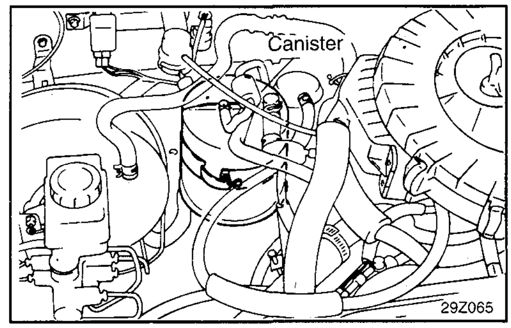


EMISSION CONTROL SYSTEMS

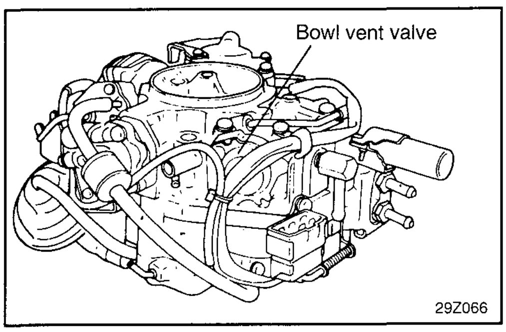
A. PCV valve



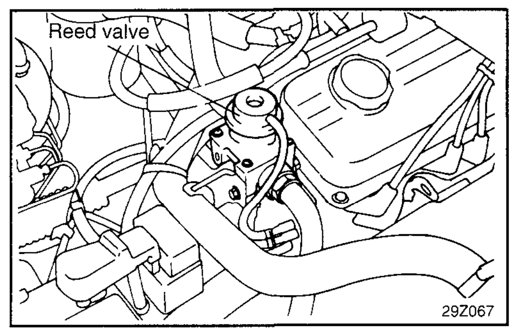
B. Canister



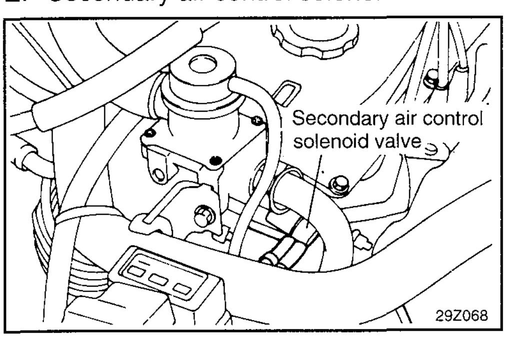
C. Bowl vent valve (BVV)



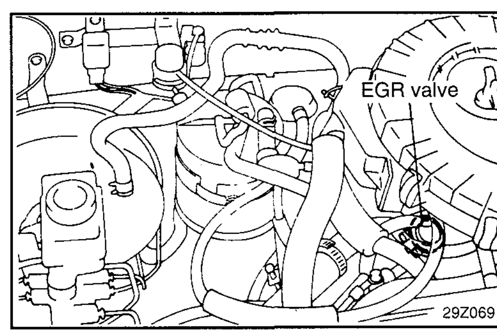
D. Reed valve



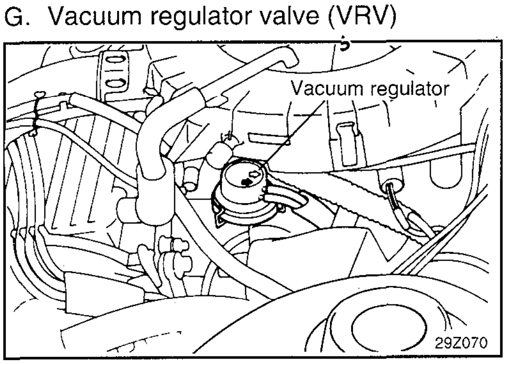
E. Secondary air control solenoid valve



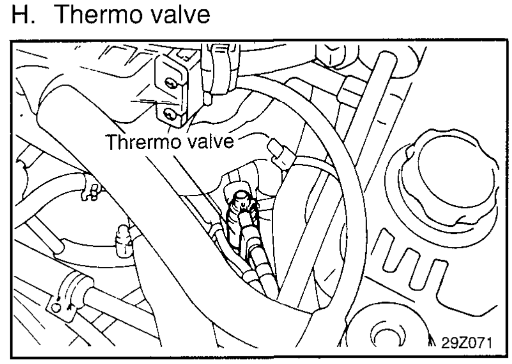
F. EGR valve



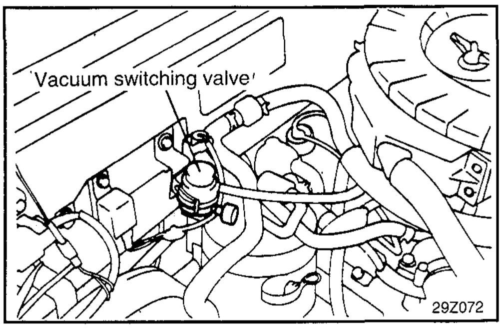
G. Vacuum regulator valve (VRV)



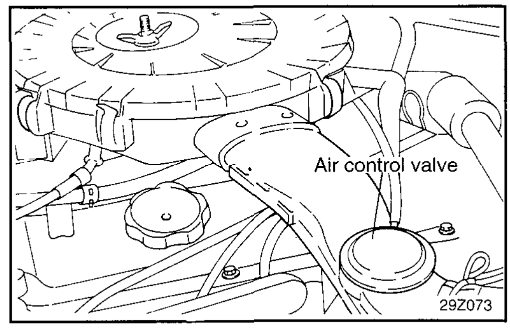
H. Thermo valve



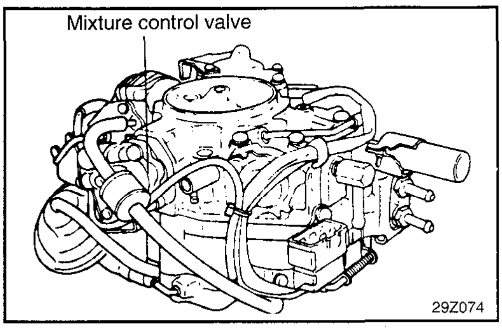
I. Vacuum switching valve



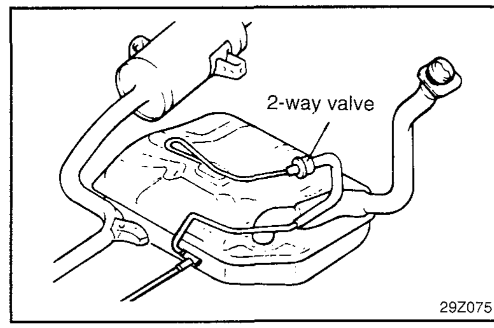
J. Air control valve



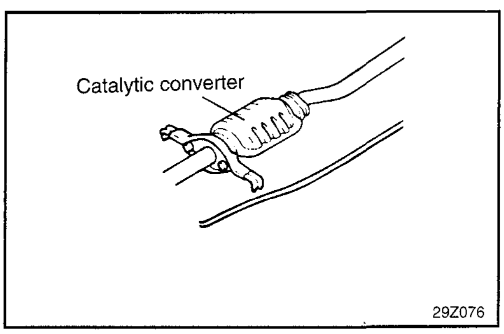
K. Mixture control valve (MCV)



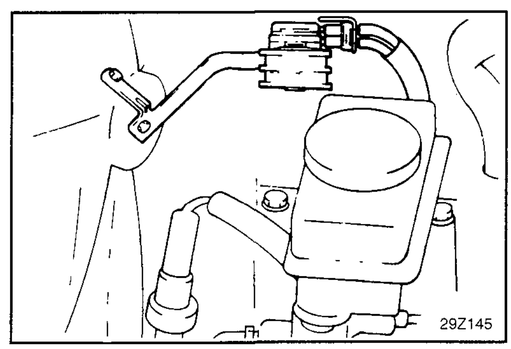
L. 2-way valve



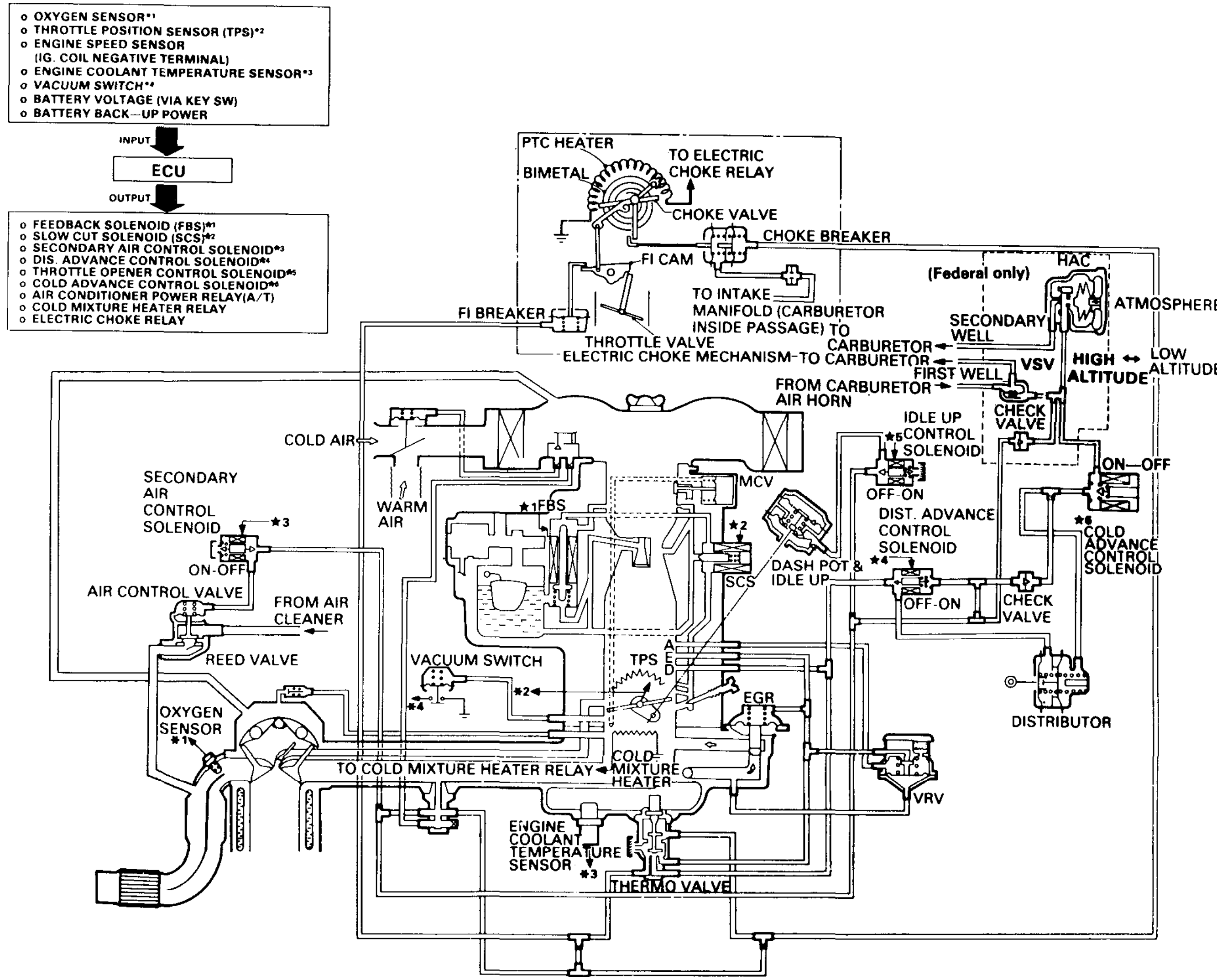
M. Catalytic converter



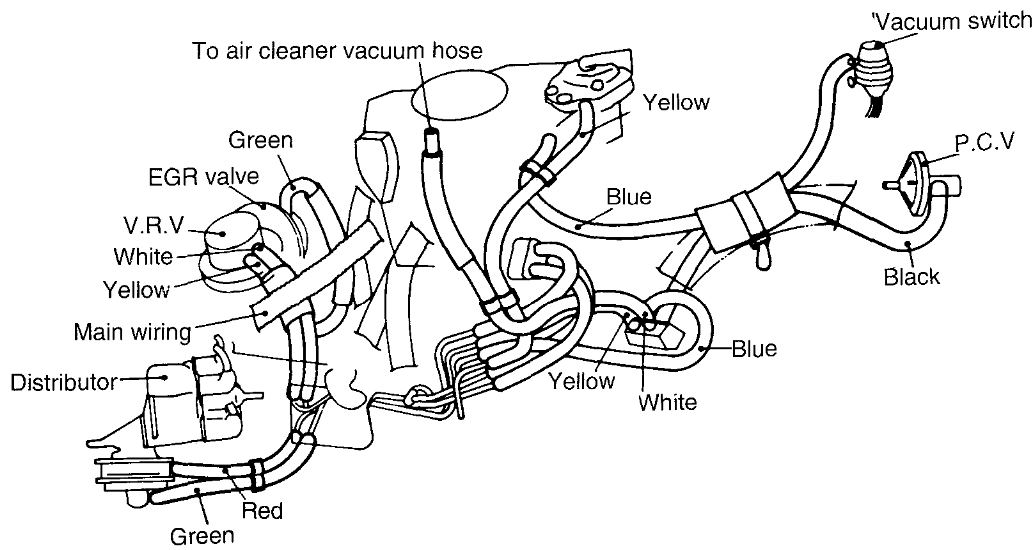
N. High altitude compensator (HAC) (Fed. only)

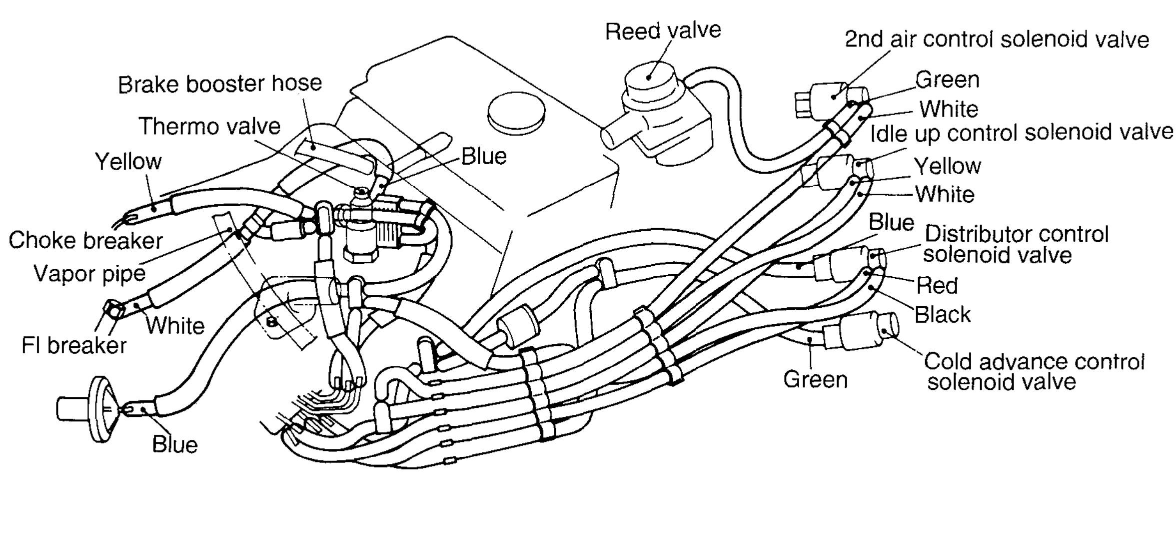


SCHEMATIC DRAWING

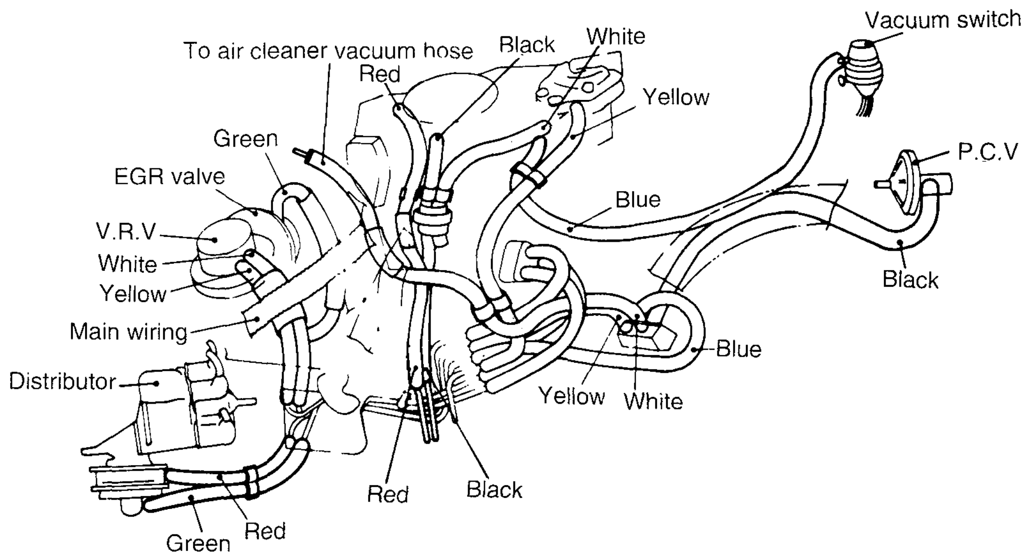


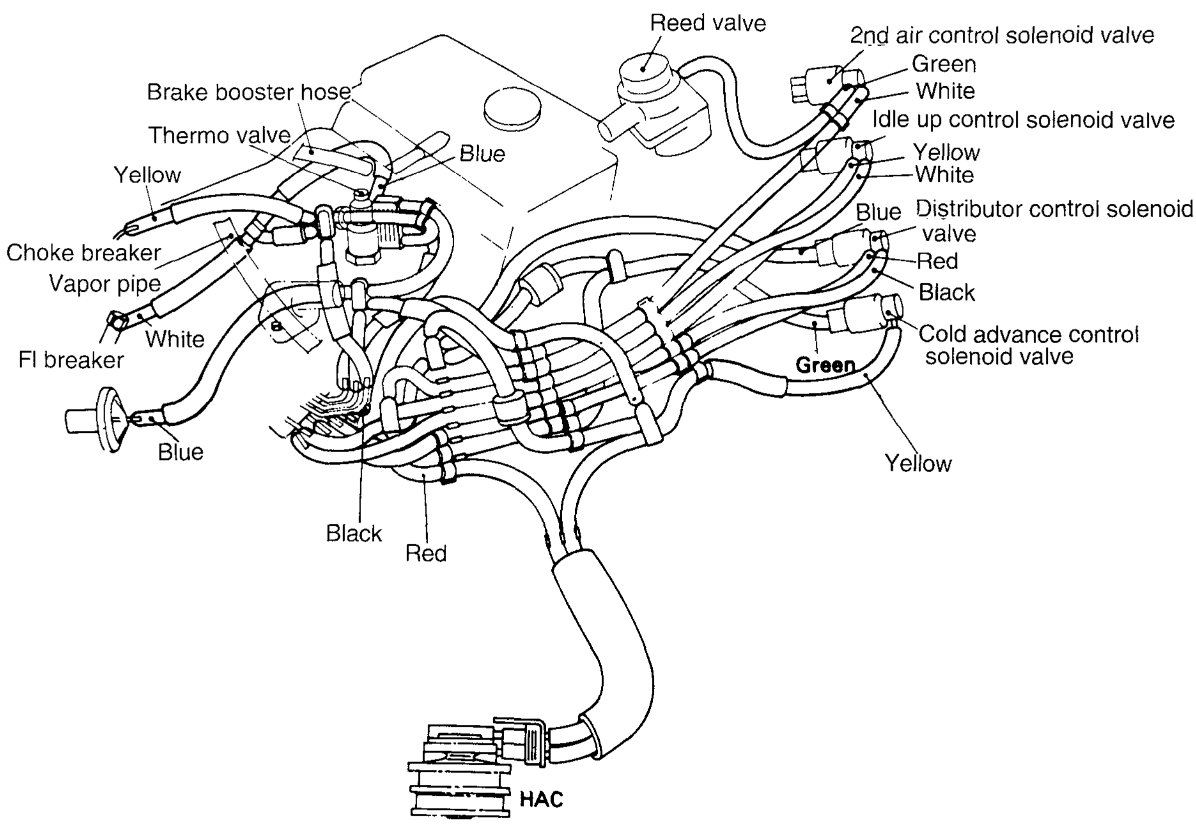
VACUUM HOSE INSTALLING (FOR CANADA)





VACUUM HOSE INSTALLING (FOR FEDERAL)





CRANKCASE EMISSION CONTROL SYSTEM

GENERAL DESCRIPTION

This closed-type crankcase emission control system is composed of a positive crankcase ventilation (PCV) valve and related hoses. This system prevents the blow-by gases from escaping into the atmosphere. The blow-by gases, which are burned gases past the piston rings during combustion. The exhaust gases include HC, CO and NOx.

The system supplies fresh air to the crankcase through the air cleaner. Inside the crankcase, the fresh air is mixed with blow-by gases, which pass through the PCV valve into the induction system.

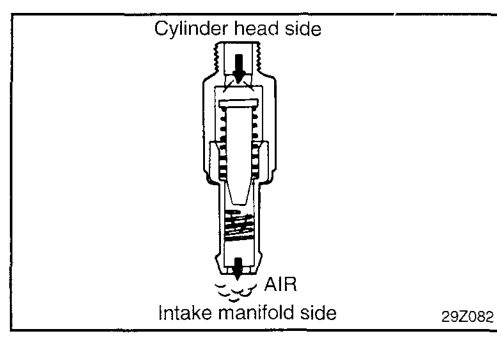
The PCV valve has a metered orifice through which the mixture of fresh air and blow-by gases are drawn into the intake manifold in response to the intake manifold vacuum. The valve capacity is adequate for normal driving conditions.

Under heavy acceleration of high-speed driving, there is less intake manifold vacuum available, and the blow-by gases are back up into the air cleaner through the breather hose.

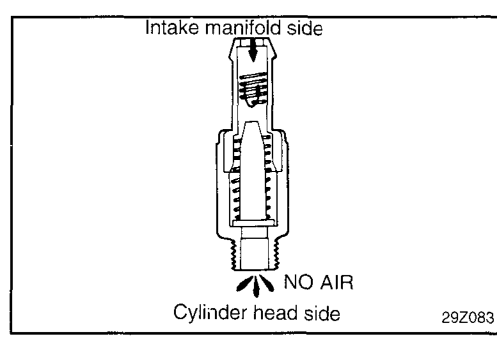
INSPECTION

1. Remove PCV valve from the rocker cover.
2. Attach a clean hose to the PCV valve cylinder head side.
3. Check that the air passes through easily when you blow on the PCV valve cylinder head side.

CAUTION
Do not suck air through the valve. Petroleum substances inside the valve are harmful.



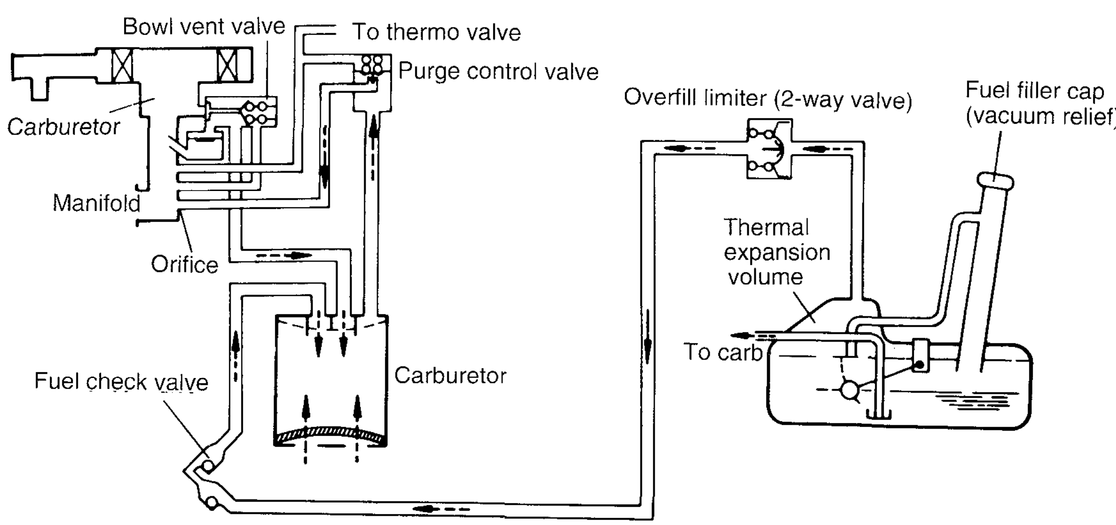
4. Next, attach a clean hose to the PCV valve intake manifold side.
5. Check that air passes through with difficulty when you blow.
6. If the PCV valve fails either of the checks, replace it.



EVAPORATIVE EMISSION CONTROL SYSTEM

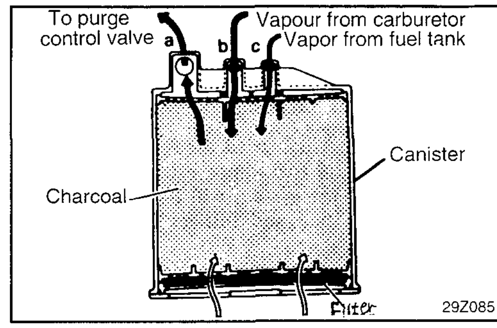
GENERAL DESCRIPTION

This evaporative emission control system is employed to prevent the emission of fuel vapours from the fuel tank and the carburetor, from being discharged into the atmosphere. And this system consists of charcoal canister, a bowl vent valve, a purge control valve.



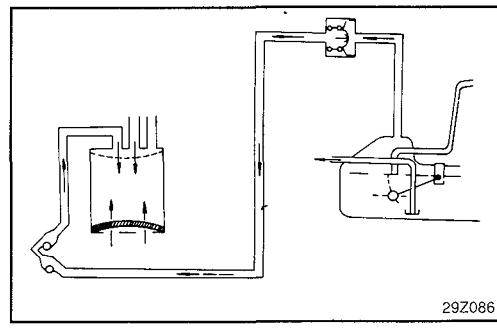
Condition	Coolant temperature °C (°F)	Thermo valve	Engine rpm	Purge control valve	Check valve in fuel filler cap	Evaporated fuel (HC)
Idle and low speed	Below **63 ± 3** (145 ± 5)	Open	-	Closed	-	HC from fuel tank is absorbed into the canister
High speed driving	Above **65 ± 2** (149 ± 4)	Closed	Below 1450 rpm	Closed	-	
			Above 1450 rpm	Open	-	HC from canister is led into carburetor
High pressure in fuel tank	-	-	-	-	Closed	HC from fuel tank is absorbed in the canister
High vacuum in fuel tank	-	-	-	-	Open	Air is vented into the fuel tank

CANISTER

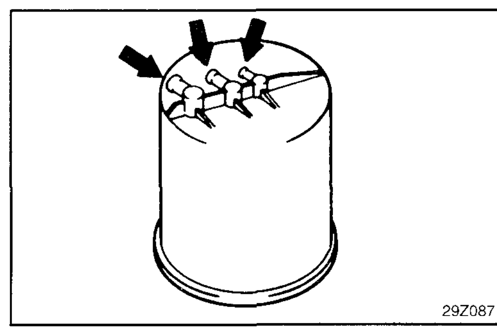


While the engine is inoperative, fuel vapours generated inside the fuel tank and the carburetor float chamber are absorbed and stored in canister.
When the engine is running, the fuel vapours absorbed in canister are drawn into the intake manifold through the purge control valve, and an orifice.
and the carburetor bowl vapours flow into the carburetor through the bowl vent valve.

Inspection

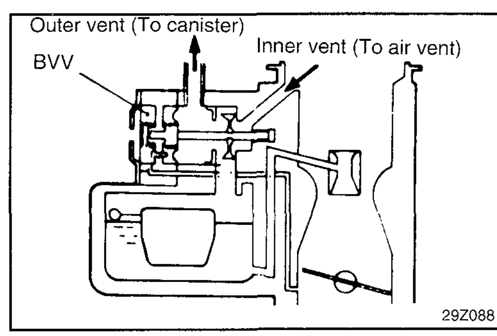


1. Look for loose connections, sharp bends or damage in the fuel vapour lines.
2. Look for deformation, cracks or fuel leakage.



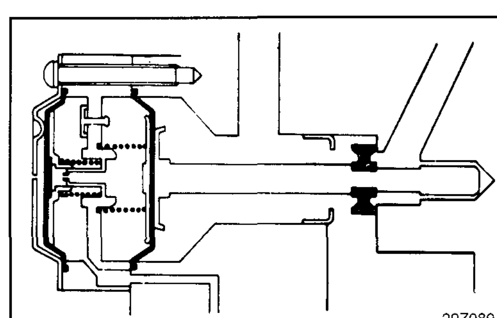
3. After removing charcoal canister, inspect for cracks or damage.

BOWL VENT VALVE



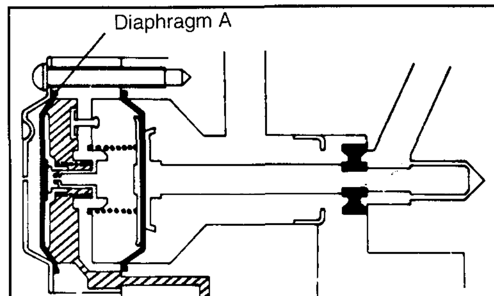
The bowl vent valve controls vapour in the carburetor bowl. While the engine is running, the intake manifold vacuum acts on the diaphragm to close the bowl vent valve so that the carburetor bowl connects to the air vent.
When the engine stops, the bowl vent valve opens to connect the carburetor bowl to the canister, causing fuel vapour to be absorbed by the canister.

Operating Principle



1. When the engine is not running, fuel vapour flow to the canister through outer vent passage (To canister). In this condition, the valve closes to disconnect inner vent passage (To air vent) by spring force.

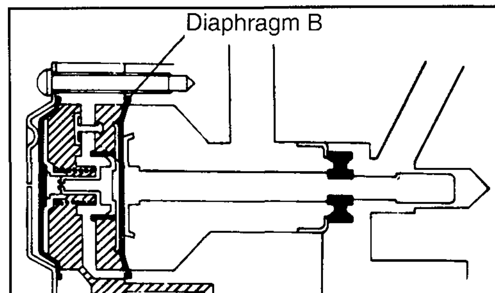
2. When the intake manifold vacuum reaches more than 1.2 in.Hg (4 kPa, 0.6 psi) after the engine operating, diaphragm B is pulled to right side and seat the valve as shown in illustration.



29Z090

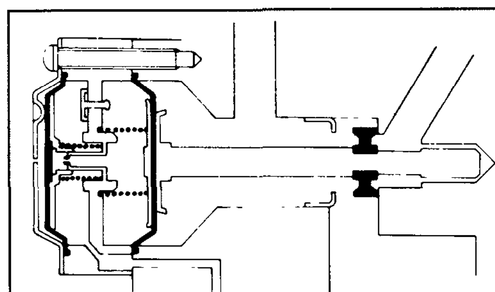
3. In case of more than 50 mmHg, Diaphragm A is pulled to left side and inner vent passage is opened.

NOTE
Even if the intake manifold vacuum decreases when the engine is operating, the check valve always remains more than 2.0 in.Hg (6.7 kPa, 1.0 psi) vacuum to maintain atmospheric pressure at float chamber.



29Z091

4. If intake manifold vacuum is less than 0.4 in.Hg (1.3 kPa, 0.2 psi) because of stopping the engine, diaphragm B gets out of seat and diaphragm A is concurrently shifted to right side causing inner vent passage to be disconnected.

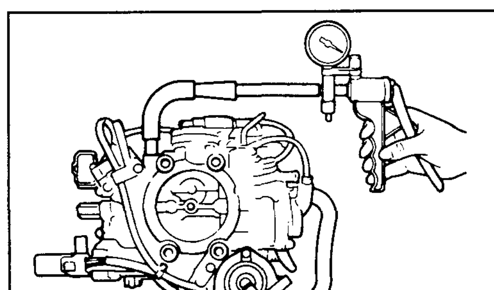


29Z089

Inspection

1. Remove the air cleaner.
2. Disconnect the bowl vapor hose from the bowl vent valve (BVV) nipple and connect a hand vacuum pump to the BVV to check the condition as follows.
3. Apply a vacuum of 20 kPa (3.0 psi) to the BVV to check the condition as follows.

Engine condition	Normal condition
Operating Non-operating	Vacuum holding Vacuum leaking

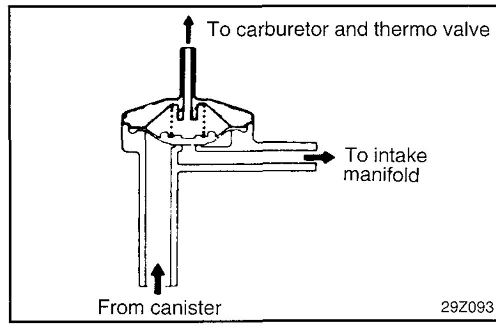


29Z092

CAUTION
Check after the engine is cool. If the engine is not cold, fuel may gush out from the BVV nipple.

PURGE CONTROL VALVE

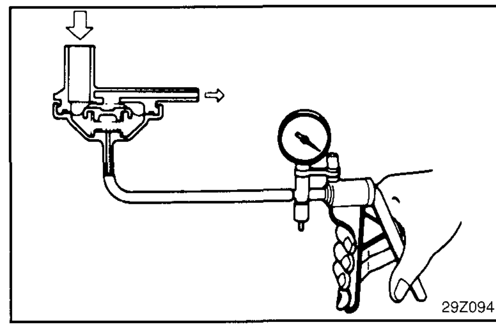
The purge control valve is closed during idle to prevent vaporized fuel from entering into the intake manifold. This is a particular problem under high ambient temperatures condition. Once ported vacuum exceeds the pre-set value, the purge control valve is opened.



Inspection

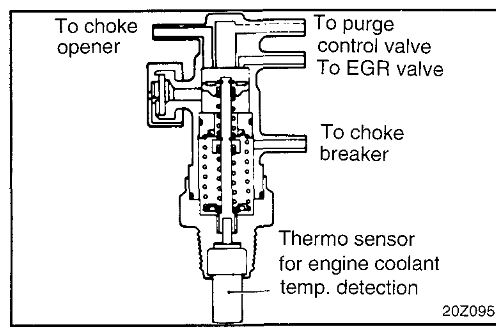
1. Remove the purge control valve.
2. Connect a hand vacuum pump to the vacuum nipple of the PCV.
3. Blow in air lightly from the canister side nipple to check conditions as follows.

PCV operating vacuum . . . . More than 1.4 in.Hg
Flow quantity . . . . More than 35 lit/min (At 3.3 in.Hg vacuum)



THERMO VALVE

The thermo valve, for sensing the engine coolant temperature at the intake manifold, closes the purge control valve when the engine coolant temperature is lower than the pre-set value.
This reduces CO and HC emissions under engine warm-up conditions, and opens the purge control valve when the engine coolant temperature is above the pre-set temperature.



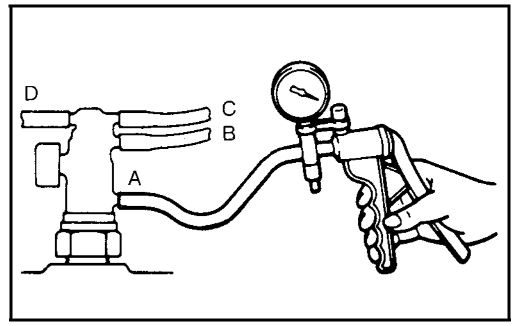
Thermo valve opening temperature (To atmosphere)
- Nipple to purge control valve..........Below 63±3°C (145±5°F)
- Nipple to EGR control valve...........Below 63±3°C (145±5°F)
- Nipple to choke opener.. ....Below 63±3°C (145±5°F)
- Nipple to choke breaker.. ....Below 16±3°C (61±5°F)

Thermo valve closing temperature (To atmosphere)
- Nipple to purge control valve..........Above 65±2°C (149±4°F)
- Nipple to EGR control valve...........Above 65±2°C (149±4°F)
- Nipple to choke opener.. ....Above 65±2°C (149±4°F)
- Nipple to choke breaker.. ....Above 18±2°C (64±4°F)

Inspection

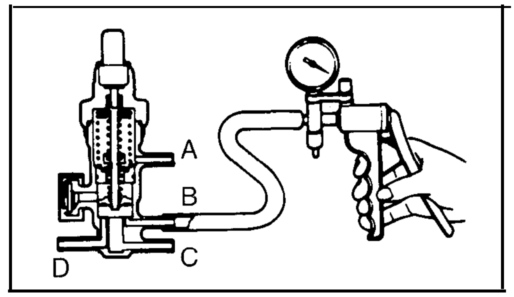
NOTE
This thermo valve also controls the choke breaker, EGR and choke opener.

CAUTION
1) **When removing or installing the thermo valve, do not use wrenches or other tools on the resin part.**
2) **When installing, apply sealant to the threads and tighten to 20 to 40 Nm (14 to 29 Ib.ft)**
3) **When disconnecting the vacuum hose, put a mark on the hose so that it may be reconnected at original position.**



1. Disconnect the vacuum hose connected to nipple (A) from the thermo valve and connect a hand vacuum pump to the nipple (A).
2. Apply vacuum to check thermo valve conditions as follows.

Engine coolant temperature	Normal condition
Below 16±3°C (61±5°F) Above 18±2°C (64±4°F)	Vacuum leaks Vacuum holds



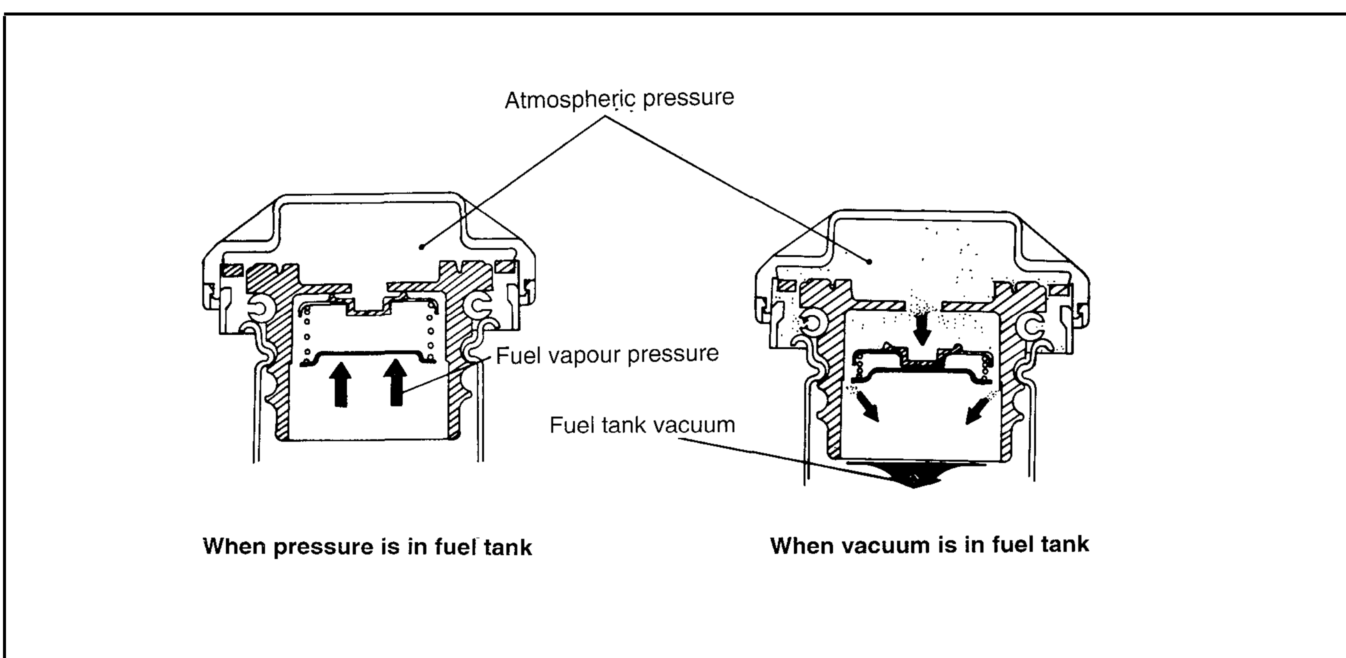
3. Disconnect all vacuum hoses from the thermo valve.
4. Connect a hand vacuum pump to nipple (B) to (C) or (D) and apply vacuum to check thermo valve condition as follows.

NOTE
Plug nipples other than one to which the hand vacuum pump is connected.

Engine coolant temperature	Normal condition
Below 63±3°C (145±5°F) Above 65±2°C (149±4°F)	Vacuum leaks Vacuum holds

FUEL FILLER CAP

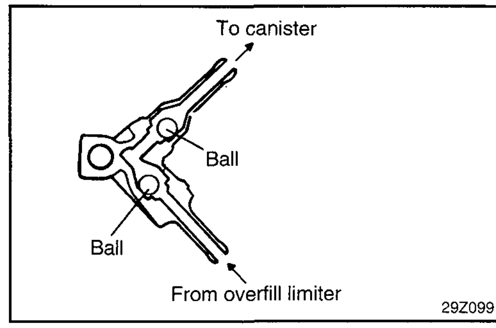
The fuel filler cap is equipped with a vacuum relief valve to prevent the escape of fuel vapour into the atmosphere.



FUEL CHECK VALVE

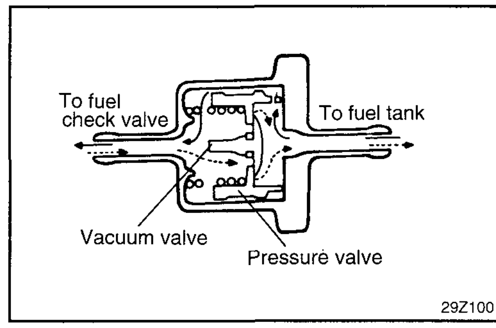
The fuel check valve is used to prevent fuel leaks, when the car suddenly roll over. This valve is connected in the fuel vapor line (between canister and overfill limiter) and is mounted on the firewall.

The fuel check valve contains two balls as shown in the illustration. Under normal conditions, the gasoline vapour passage in the valve is opened, but if roll-over occurs one of the balls closes the fuel passage, thus preventing fuel leakage.



OVERFILL LIMITER (TWO-WAY VALVE)

The overfill limiter consists of a pressure valve and a vacuum valve. The pressure valve is designed to open when the fuel tank internal pressure has increased over the normal pressure and the vacuum valve opens when a lower pressure exit in the tank.



EXHAUST EMISSION CONTROL SYSTEM

GENERAL DESCRIPTION

Exhaust emission (CO, HC, NO) are controlled by a combination of engine modifications and the addition of special control components.

Modifications to the combustion chamber, intake manifold, carburetor and ignition system form the basic control system. Additional control devices include a jet air system, an exhaust gas recirculation (EGR) system, catalytic converters, a secondary air supply system, a dash pot, a heated air intake system. These systems have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

JET AIR SYSTEM

The combustion chamber is a cross-flow type hemispherical combustion chamber. In addition to the intake valve and exhaust valve, a jet valve which provides a super lean mixture or air into the combustion chamber. The jet valve assembly consists of the jet valve, jet body and spring and is screwed into the jet piece which is press-fitted in the cylinder head with its jet opening toward the spark plug.

A jet air passage is provided in the carburetor, intake manifold and cylinder head. Air flows through the intake openings provided near the primary throttle valve of the carburetor then through the passage in the intake manifold and cylinder head, and finally through the jet valve and the jet opening into the combustion chamber.

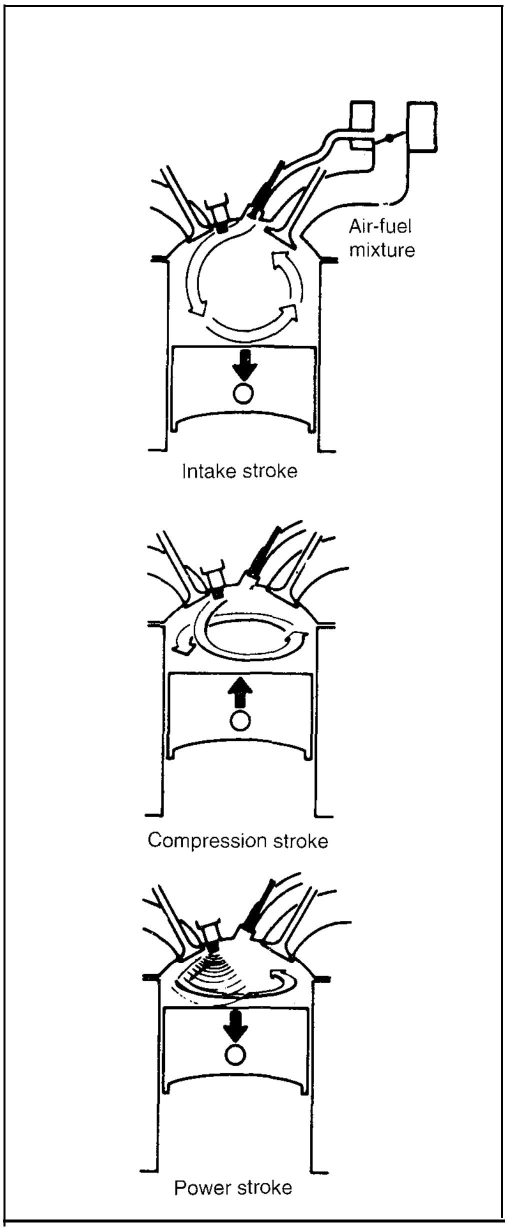
The jet valve is actuated by the same cam as the intake valve and by a common rocker arm so that the jet valve and intake valve open and close almost simultaneously.

On the intake stroke, the air-fuel mixture flows through the intake valve port into the combustion chamber. At the same time, jet air flows into the combustion chamber because of the pressure difference produced between the two ends of the jet air passage (between the jet air intake openings in the carburetor throttle bore and the jet opening of the jet piece) as the piston moves down.

When the throttle valve opening is small during idle or light load, a large pressure difference is produced as the piston goes down, causing jet air to flow into the combustion chamber rapidly. The jet air flowing out of the jet opening scavenges the residual gases around the spark plug and promotes a good ignition.
This strong swirl in the combustion chamber continues throughout the compression stroke and improves flame propagation after ignition, assuring high combustion efficiency.

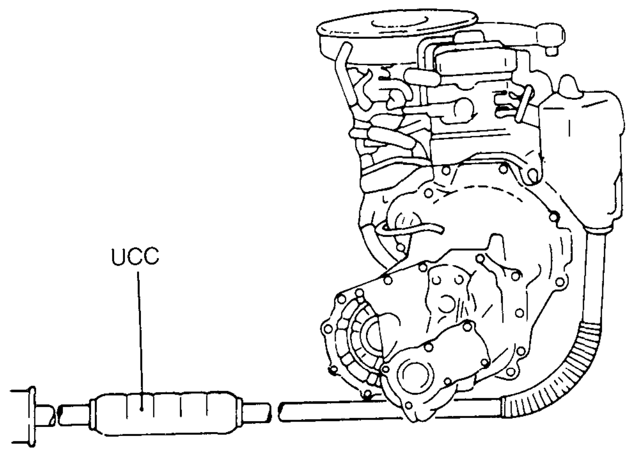
When the throttle valve opening increases, more air-fuel mixture is drawn in from the intake valve port so that the pressure difference is reduced and less jet air is drawn in.

The jet air swirl dwindles with increased throttle valve opening.



CATALYTIC CONVERTERS

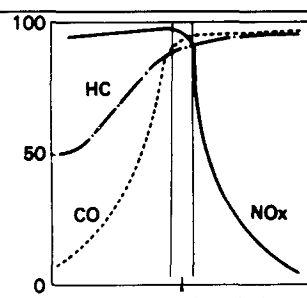
A monolithic type three way catalytic converter is used to reduce vehicle emission. The converter working in combination with the air-fuel ratio feedback control oxidizes CO and HC and reduces NOx.



UCC : Underfloor Catalytic Converter

Function

The three way catalytic converter removes CO, HC and NOx most effectively in the vicinity of the stoichiometric ratio.
The air-fuel ration feedback from in the oxygen sensor, controls the air-fuel mixture to the stoichiometric ratio. The catalytic converter promotes both oxidation and reduction of resultant exhaust gas to make it clean before it is released to atmosphere.

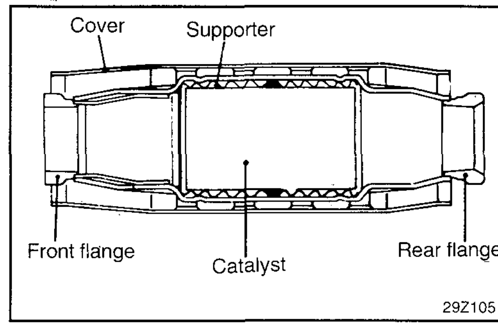


CAUTION

The catalytic converters require the use of unleaded gasoline only. Leaded gasoline will destroy the effectiveness of the catalysts as an emission control device.
Under normal operating conditions, the catalytic converters will not require maintenance. However, it is important to keep the engine properly tuned. If the engine is not kept properly tuned, the catalytic converter may overheat. This situation can also occur during diagnostic testing if any spark plug cables are removed and the engine is allowed to run for a prolonged period of time.

Underfloor Catalytic Converter (UCC)

This type catalytic converter looks like a muffler. It mainly promotes the oxidation of HC, CO.



FEEDBACK CARBURETOR (FBC) SYSTEM (AIR-FUEL RATIO CONTROL SYSTEM)

The FBC system is essentially an emission control system which utilizes an electronic signal, generated by an exhaust gas oxygen sensor to precisely control the air-fuel mixture ratio in the carburetor. This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three-way catalyst.
The three-way catalyst is designed to convert the three pollutants (HC, CO and NOx) into harmless substances.
There are two operating modes in the FBC system:

1. Open Loop
   Air fuel ratio is controlled by information programmed into the ECU.
2. Closed Loop
   Air fuel ration is varied by the ECU based on information supplied by the oxygen sensor.

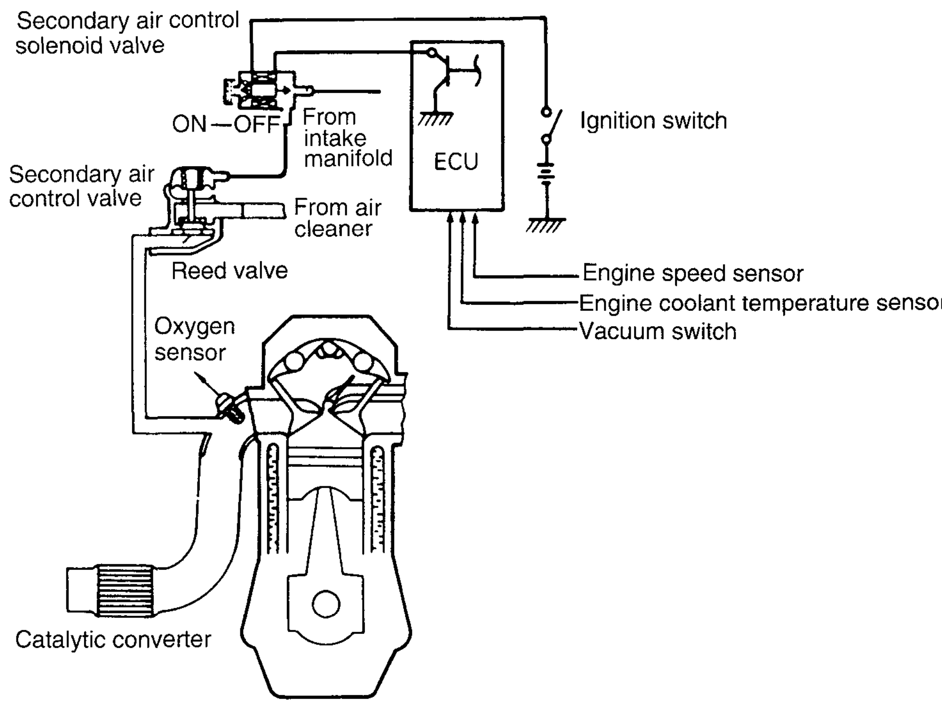
SECONDARY AIR SUPPLY SYSTEM

The secondary air supply system consists of a reed valve, a secondary air control valve, a secondary air control solenoid valve, an ECU and sensors.

The reed valve supplies secondary air into the exhaust manifold for the purpose of promoting oxidation of exhaust emissions during the engine warm-up, deceleration and hot start operation.

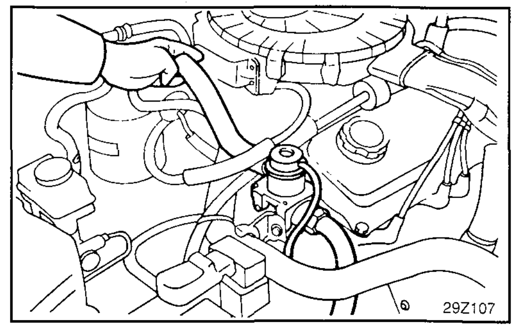
The reed valve is actuated by exhaust vacuum from pulsations in the exhaust manifold. Additional air is supplied into the exhaust manifold through the secondary air control valve.

The secondary air control valve is opened by the intake manifold vacuum when the solenoid valve is energized by the ECU based on information on coolant temperature, engine speed, time and idle position.



Inspection

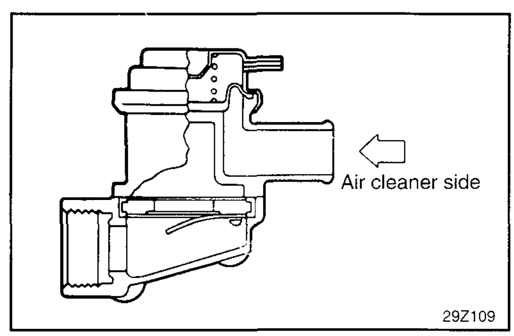
1. Disconnect the air supply hose from the air cleaner and check for vacuum by placing your thumb over the end of the air supply hose.



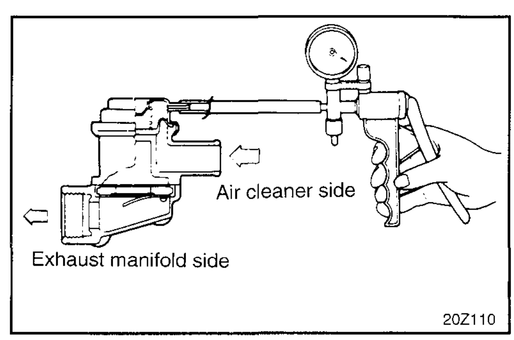
Engine coolant temperature	Engine state	Air suction
18-63°C (64-145°F)	Idling	Yes
63°C (145°F) or more		Yes (with 70 seconds after start)
		No 70 seconds or more after start)
	Rapid deceleration from 4,000 rpm	**Yes**

CAUTION
Note that if secondary air control valve is broken, emission may blow back.

2. Remove the secondary air control valve.
3. Blow in air from the air cleaner side of the valve to check that air does not flow.
4. Connect a hand vacuum pump to the secondary air control valve nipple.
5. Apply a vacuum of 5.9 in.Hg (20 kPa, 3.0 psi) and blow in air to check condition as follows.



Air blow direction	Normal condition
Air cleaner side to exhaust manifold side	Air blows through
Exhaust manifold side to air cleaner side	Air does not blow through

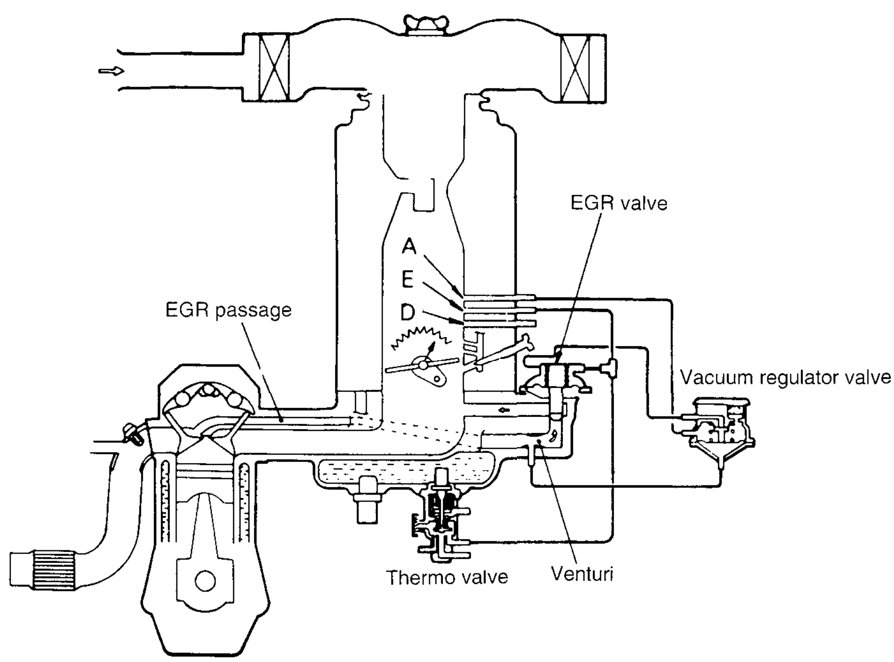


6. If any fault is found in above checks, replace the secondary air control valve.

Tightening torque
Secondary air control valve . . . .
51-61 Nm (510-610 kg.cm, 37-44 ft.lbs.)

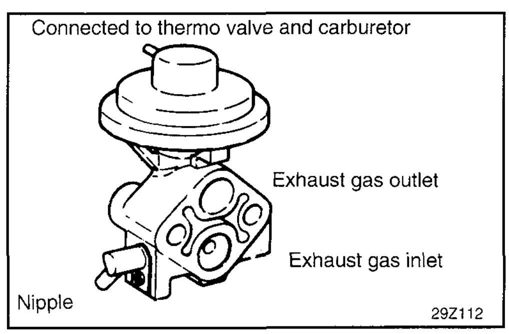
EXHAUST GAS RECIRCULATION SYSTEM

Exhaust Gas Recirculation (EGR) system is designed to reduce oxides of nitrogen in the vehicle exhaust.
In this system, the exhaust gas is partially recirculated from an exhaust port in the cylinder head into a port located at the intake manifold. The EGR flow is controlled by an EGR control valve, a vacuum regulator vale (VRV), and a thermo valve.

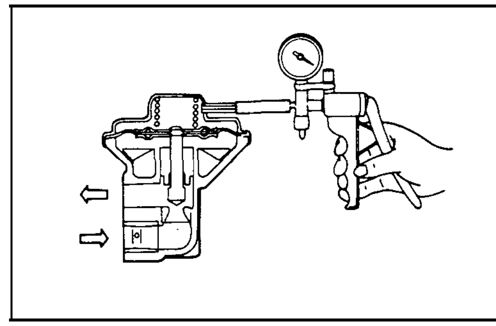


EGR Valve

EGR valve is a venturi pressure type. It is controlled by a ported vacuum signal from the carburetor by way of vacuum regulator valve (VRV) in response to the throttle valve openings. The EGR flow is suspended at idle and wide open throttle operations due to a low ported vacuum.



EGR Valve Inspection



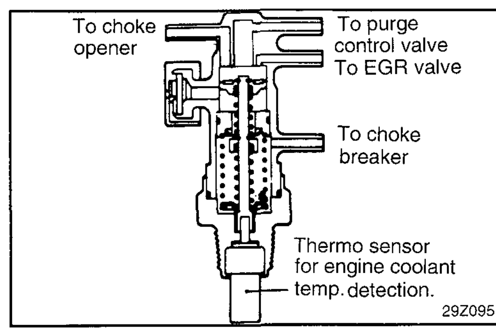
1. Remove the EGR vale and check if for sticking, deposit of carbon, etc.
   If such condition exists, clean with adequate solvent to ensure tight valve seat contact.
2. Connect a hand vacuum pump to the EGR valve.
3. Apply a vacuum of 19.8 in.Hg (67 kPa, 10 psi) and check air tightness.
4. Blow in air from one passage of the EGR to check condition.

Vacuum	Normal condition
2.4 in.Hg (8 kPa, 1.2 psi)	Air does not blow through
6.8 in.Hg (23 kPa, 3.3 psi)	Air blows through

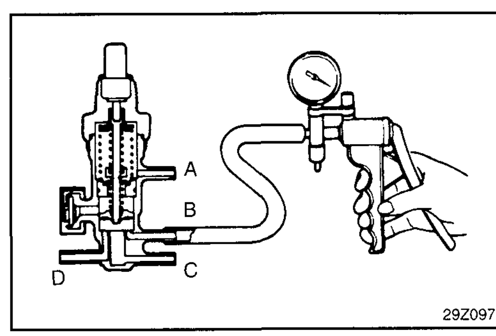
CAUTION
When installing the EGR valve, use a new gasket and tighten to 19-27 Nm (190-280 kg.cm, 14-20 lb.ft.)

Thermo Valve

Thermo valve in the EGR vacuum supply line is a switch sensitive to engine temperature. Thermo valve eliminates the vacuum signal to the EGR valve during warm-up when less NOx is generated.



Thermo Valve Inspection

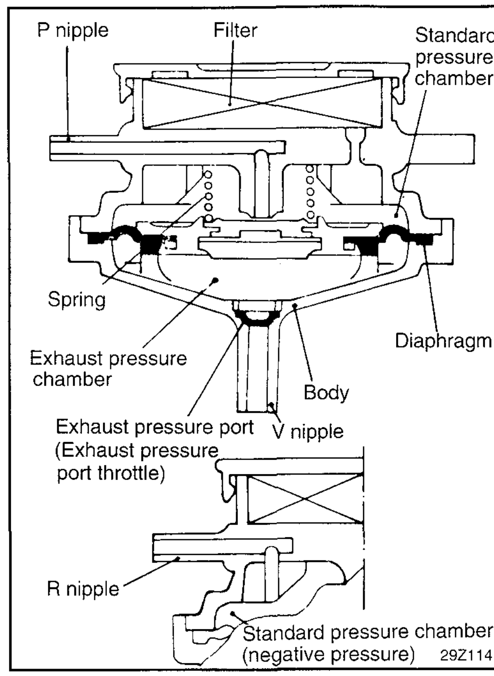


1. Disconnect all vacuum hoses from the thermo valve.
2. Connect a hand vacuum pump to nipple (B) and apply vacuum to check thermo valve condition as follows.

NOTE
Plug nipples other than one to which the hand vacuum pump is connected.

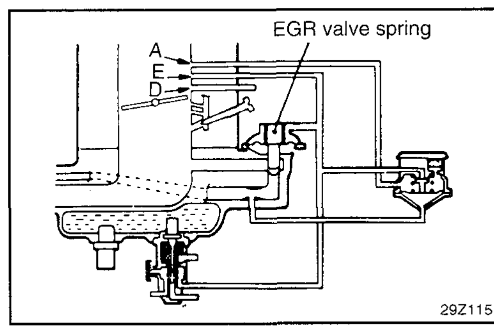
Engine coolant temperature	Normal condition
Below 63±3ºC (145±5ºF) Above 65±2ºC (149±4ºF)	Vacuum leaks Vacuum holds

Vacuum Regulator Valve (VRV)



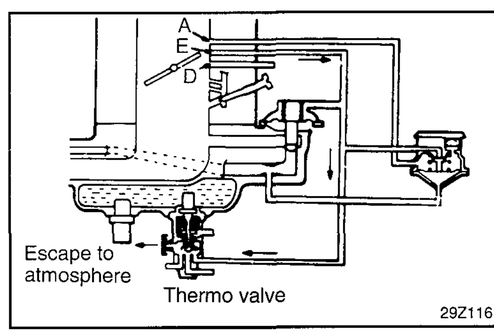
The vacuum signal to the EGR valve is modulated by a vacuum regulator valve. The vacuum regulator valve reduces the EGR vacuum signal by air bleed within the vacuum regulator valve when the pressure applied to the regulator valve is lower than the preset value (i.e. low engine load operation).
The pressure applied to the regulator valve is the total pressure of exhaust pressure and venturi vacuum.
The air bleed is closed when the pressure applied to the vacuum regulator valve is higher than the per-set value (i.e. high engine load operation) and the EGR valve motion responds to an unmodified vacuum signal.

Operating Principle



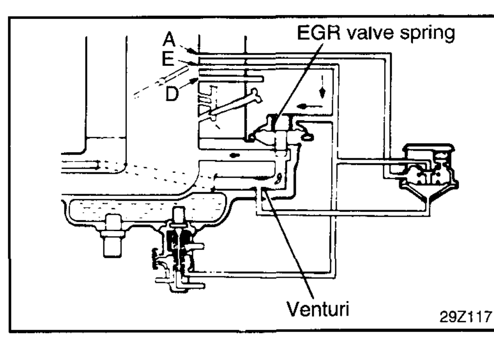
1. During Idle or Throttle Wide Open Operation
   In this case, the E port vacuum is low and the EGR valve is closed by spring force. As a result, EGR gas does not flow.

   NOTE
   The EGR is closed to ensure stable idle operation.



2. When Engine Coolant is Cold
   In this case, the thermo valve opens to allow the E port vacuum to escape to atmosphere. As a result, the EGR valve does not operate.

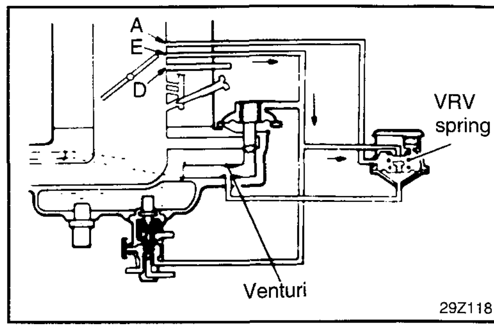
   NOTE
   The EGR is shut off to secure driveability when the engine is cold.



3. During Light to Moderate Load Operation
   1) As the throttle valve is opened, the E port vacuum increases to overcome the spring force of the EGR valve. as a result, the EGR valve opens allowing exhaust gas to recirculate to the intake manifold, causing a drop in venturi vacuum.

2) When the venturi pressure drops to near the atmospheric pressure, the VRV opens to allow the E port vacuum to escape to atmosphere allowing the EGR valve closes.
By repeating this cycle (closed loop control), EGR flow rate proportional to the intake air volume can be obtained.

NOTE
By controlling the EGR rate to optimum level, exhaust emission (NOx) is minimized without loss of driveability.



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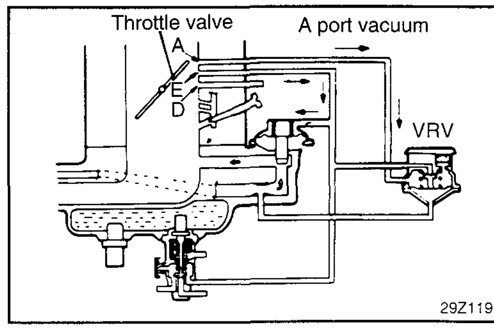
4. During Heavy Load Operation
During heavy load acceleration or other conditions in which much NOx is produced. Ported vacuum acts on the VRV to shut off E vacuum's escape passage to atmosphere and to stop EGR exhaust pressure control action.
As a result, the EGR valve is controlled by E vacuum and the EGR flow rate increases.



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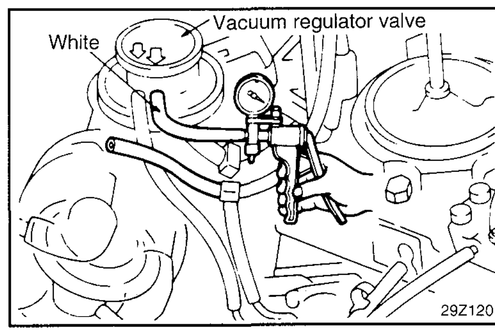
Vacuum Regulator Valve (VRV) inspection

1. Disconnect the vacuum hose (white stripe) from the VRV and connect a hand vacuum pump to the VRV.
2. Apply a vacuum of 53 kPa (7.7 psi) and check VRV condition as follows.

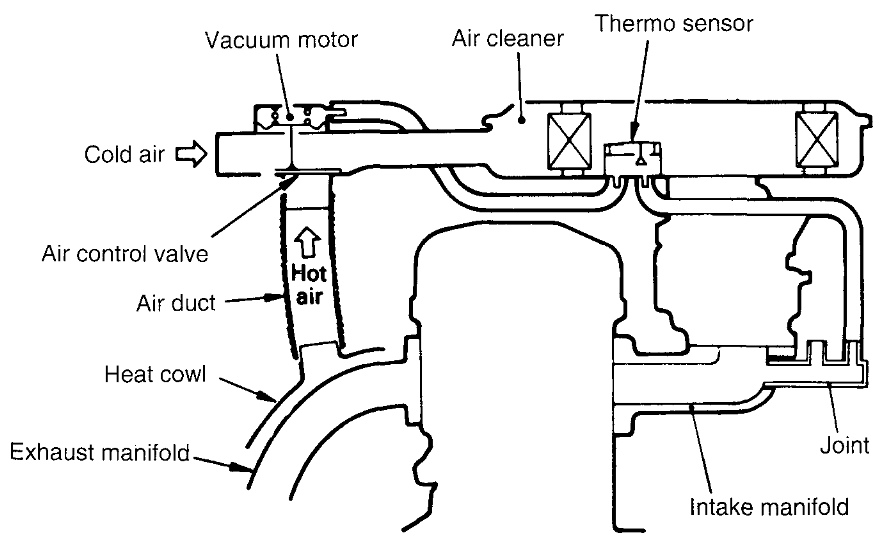
Engine state	Normal condition
Stopped	Vacuum leaks
3,500 rpm	Vacuum holds



29Z120

HEATED AIR INTAKE (HAI) SYSTEM

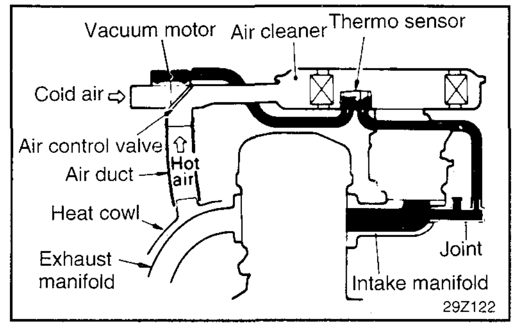
All vehicles are equipped with a temperature regulated air cleaner, as shown in illustration. This allows the carburetor to be calibrated leaner to reduce CO and HC emissions and improved engine warm-up characteristics and minimized carburetor icing. The air cleaner is provided with an air control valve, inside the snorkel, to modulate temperature of carburetor intake air which flows through two routes. The air control valve is operated by a bimetal which responds to the temperature valve combination system which responds to the intake manifold vacuum and temperature inside the air cleaner.



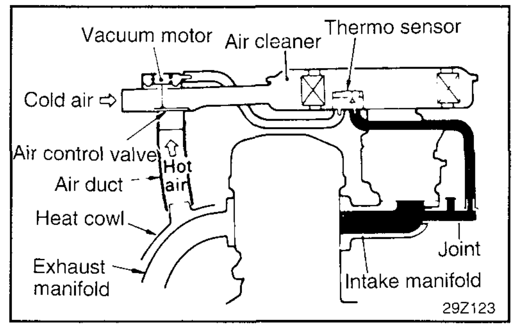
Temperature in air cleaner	Thermo valve	Air control valve	Intake air
Cold Below 30°C (80°F)	Atmospheric port is CLOSED	Heated air passage OPEN	HOT
Hot Above 45°C (113°F)	Atmospheric port is OPEN	Cooled air passage OPEN	COOL

Operating Principle

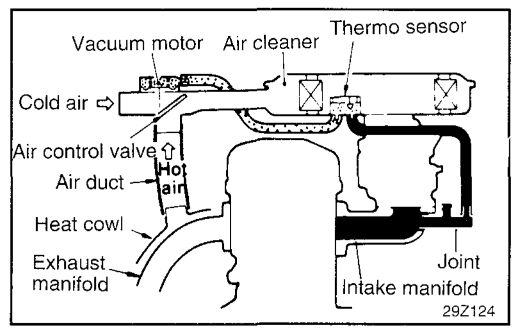
1. When the bimetal senses the temperature inside air cleaner of below about 30°C (86°F) the air bleed valve of temperature sensor remains closed.
   Then, the intake manifold vacuum is applied to the diaphragm of vacuum motor, which in turn, opens the air control valve so as to let the pre-heated intake airflow through the heat cowl and air duct into the air cleaner.



2. When the bimetal senses the temperature inside air cleaner of above 45°C (113°F) the air bleed valve is fully opened. As a result, the intake air to the carburetor comes directly through the fresh air duct, since the air control valve is positioned as shown in illustration regardless of the intake manifold vacuum.



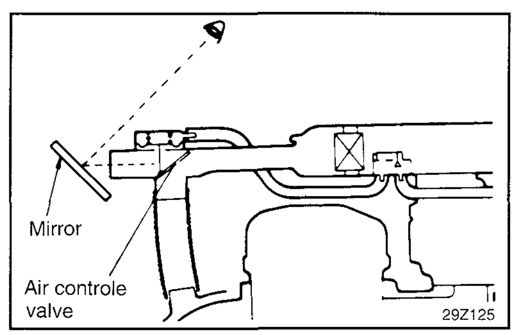
3. At intermediate temperatures, the air entering the carburetor is a blend of fresh air and pre-heated air as regulated by the thermostatically actuated air control valve.



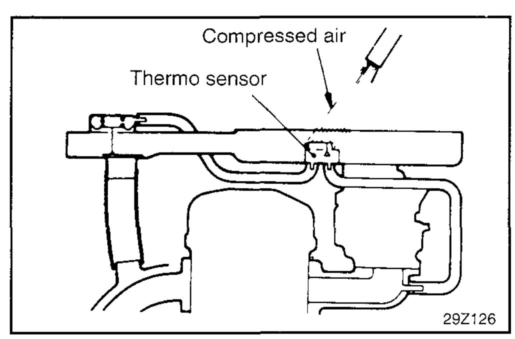
Inspection

1. HAI system
   1) Remove the air cleaner cover and air duct.
   2) Run the engine at idle and check air control valve condition.

Temperature in air cleaner	Normal condition
Below 30°C (86°F)	Cold air side inlet closed
Above 45°C (113°F)	Cold air side inlet opens



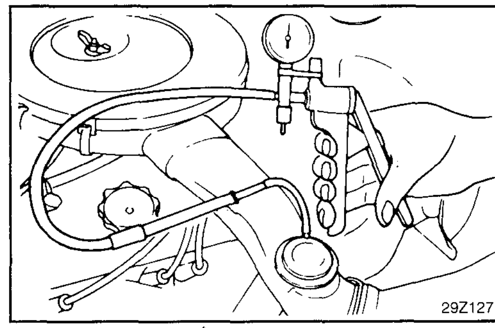
NOTE
If necessary, apply compressed air to cool or apply hot air using a hair dryer, etc. to heat.



2. Air Control Valve
   1) Remove the air cleaner.
   2) Disconnect the vacuum hose from the air control valve and connect a hand vacuum pump to the valve nipple.
   3) Apply a vacuum and check air control valve operation.

Applied vacuum	Normal condition
Under 90 mmHg (9.3 kPa, 1.4 psi)	Cold air side inlet fully opens
Over 190 mmHg (25 kPa, 3.7 psi)	Cold air side inlet fully closed

   4) Connect the disconnected vacuum hose to the original position.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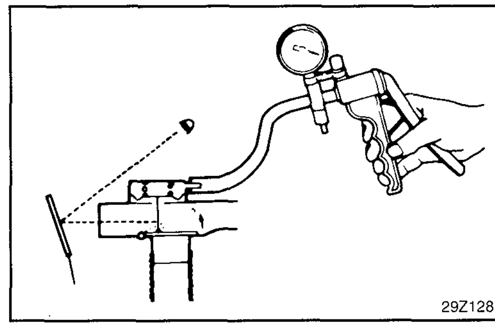
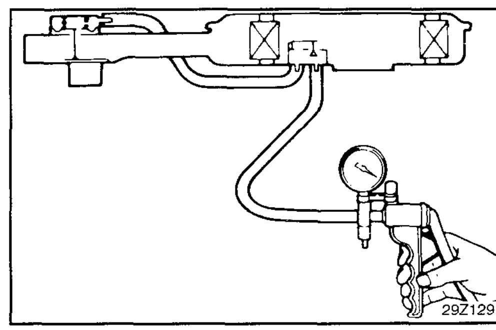

29Z128

3. Thermo Valve
   1) Connect a hand vacuum pump to the thermo valve nipple and apply vacuum.
   2) Check the thermo valve operation.

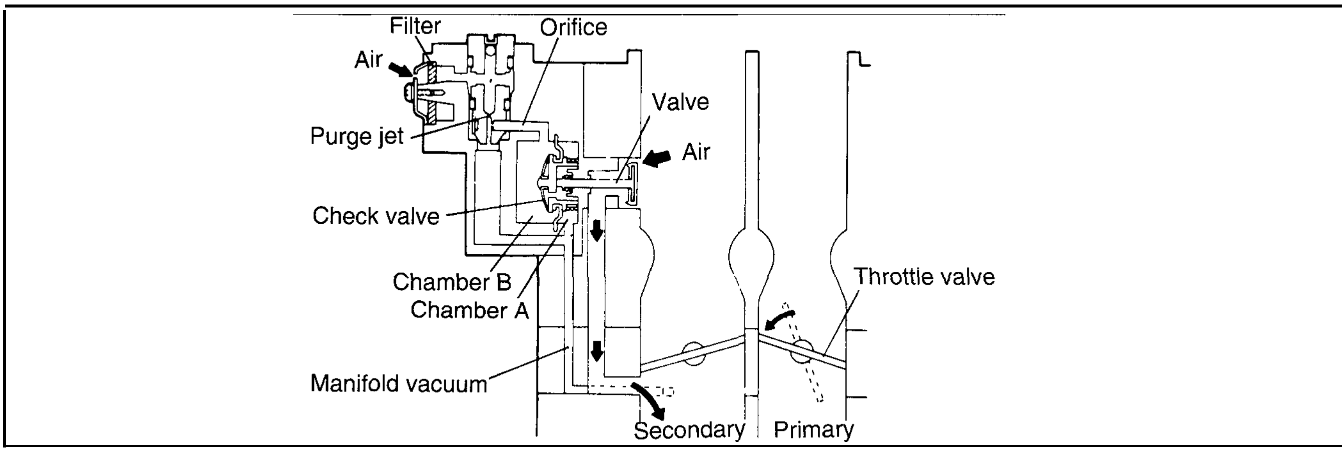
Temperature in air cleaner	Normal condition
Below 30°C (86°F)	Vacuum holds
Above 45°C (113°F)	Vacuum leaks


29Z129

MIXTURE CONTROL VALVE (MCV)

When the throttle is closed suddenly during deceleration of shifting, the fuel remaining in the intake manifold causes an over-rich mixture temporarily.

In order to prevent this, air is supplied temporarily from another passage to correct air-fuel ratio and reduce HC emission.



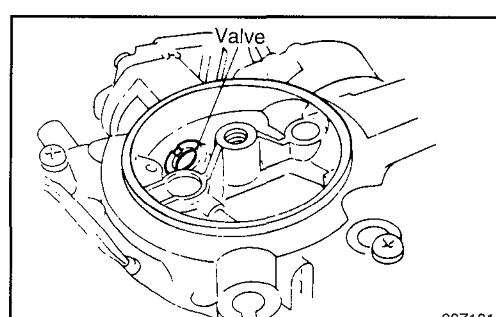
Operating Principle

When the throttle is closed suddenly, the manifold vacuum increases sharply. This increased manifold vacuum acts on the chamber A of the MCV to open the valve so that air is supplied to the intake manifold. The vacuum is also supplied to chamber B but with some delay due to an orifice. when the vacuum is supplied to both chambers B and A, the spring causes the valve to close, stopping supply of air. The check valve located at the diaphragm prevents high vacuum from remaining the chamber B during acceleration or deceleration. (If a high vacuum remains in chamber B, the valve may fail to operate when vacuum acts on chamber A).

Inspection

1. Remove the air cleaner.
2. After warming up the engine, open and close the throttle valve quickly to check MCV valve operation and air suction noise.

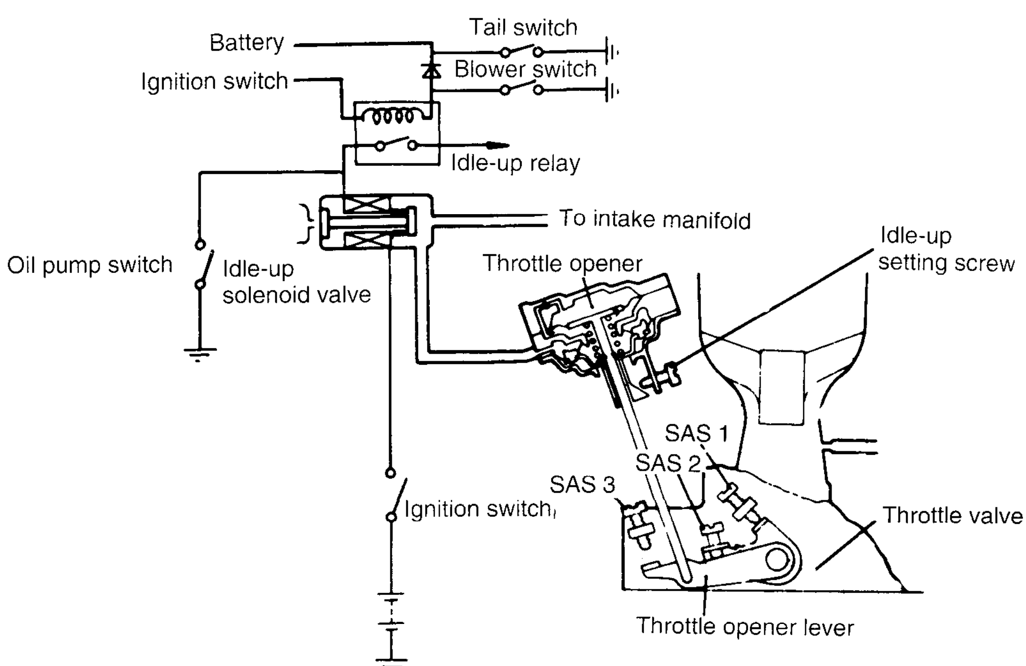
Engine condition	Normal condition	
	MCV valve	Air suction noise
Throttle lever open and close	Open	Heard
Idling condition	Closed	Not heard



IDLE-UP SYSTEM

This system consists of a dash pot assembly, a solenoid valve, a blower motor, a tail switch and the oil pump switch of the power steering.

When the blower motor or the tail switch or oil pump switch is turned on at the idle speed, the solenoid valve is opened. the intake manifold vacuum acting on the dash pot opens the throttle valve via the idle up lever which is freely movable on the throttle valve shaft. Consequently, engine speed is increased whenever power steering or electrical loads are high. when the above load is turned off, the idle-up system stops working, and the engine return to the original idle speed.



HIGH-ALTITUDE COMPENSATION SYSTEM (FOR FEDERAL VEHICLES)

In order to meet the Federal requirements at all altitudes, all carburetor vehicles are equipped with high altitude compensation system in addition to feedback carburetor system. High altitude compensation system consists of a high altitude compensator (HAC), a vacuum switching valve and a distributor equipped with high altitude advance system.

Air/fuel ratio at high altitude is controlled by the HAC to approximately the same value as the one at sea level, by supplying additional bleed air into the primary and secondary main wells through HAC and vacuum switching valve controlled by the HAC.

At low altitude, vacuum signal to a vacuum switching valve is relieved to atmosphere via the HAC.

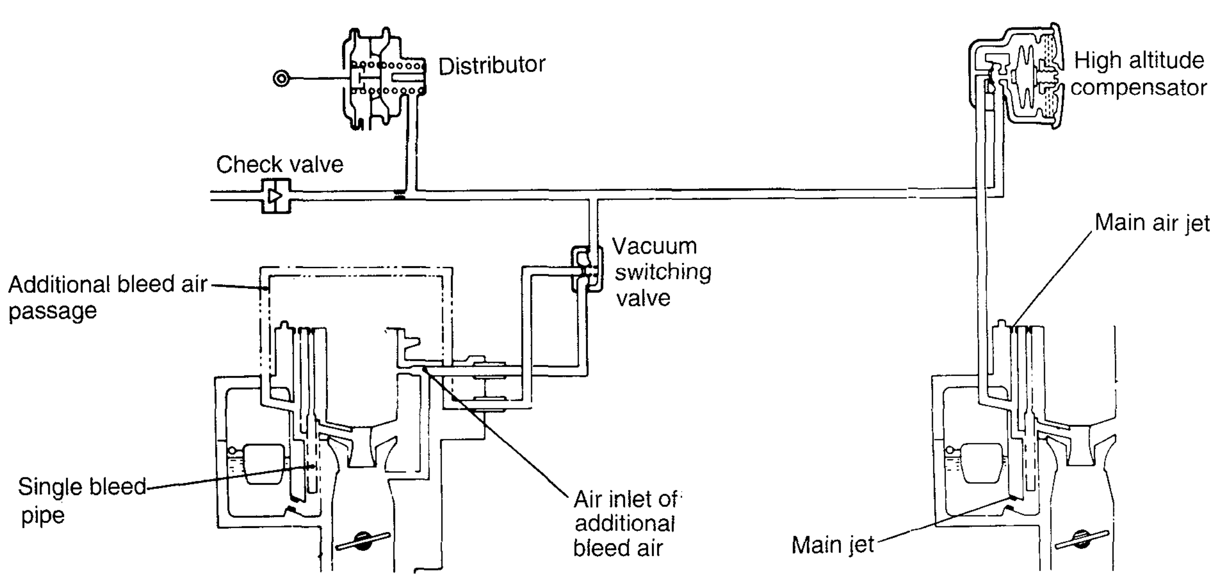
At high altitude, the HAC closes the air-leak line and a vacuum signal is sent to the vacuum switching valve. The vacuum switching valve opens and additional bleed air supplied to the primary emission well.

At high altitude, the HAC also opens the additional air bleed passage in the emission well.

The air/fuel ratio is precisely controlled by feedback carburetor system to comply with the applicable emission standards at all altitudes.

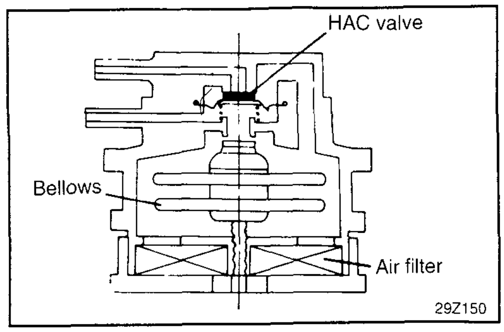
In order to reduce HC and CO emission and to get better driveability at high altitude ignition timing is advanced by specified degrees at high altitude.

Spark advance vacuum signal is sent to the sub-diaphragm chamber of the distributor via the HAC.

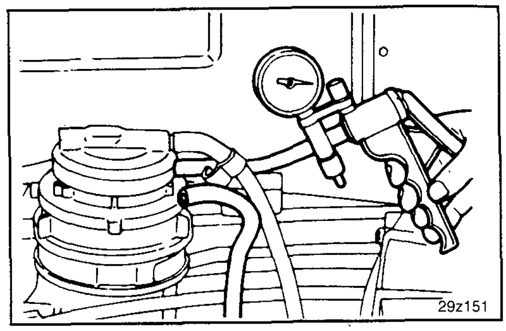


Inspection

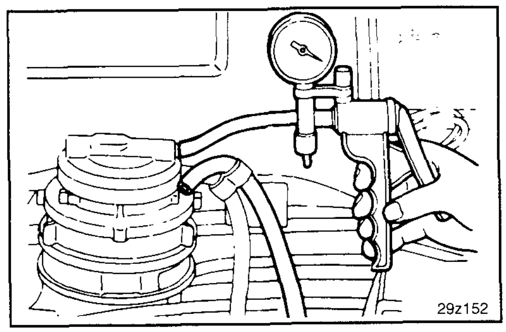
1. HAC valve (For Federal Vehicles)
   (a) Remove the HAC and look for deformation or cracks.
   (b) Clean the air filter in the HAC valve.



   (c) At altitude below 1,200 m (3,900 ft)
   - Disconnect the vacuum hose from the HAC and connect a hand vacuum pump to the HAC lower nipple.
   - Apply vacuum and check that it leaks and does not hold.



   - Disconnect the vacuum hose from the HAC lower nipple and connect a hand vacuum pump to the HAC upper nipple.
   - Check that vacuum holds when applied.



   (d) At altitude above 1,200 m (3,900 ft)
   - Disconnect the vacuum hose from the HAC and connect a hand vacuum pump to the HAC lower to upper nipple.
   - Check that vacuum holds when applied.