SECTION EC

EMISSION CONTROL SYSTEM

CONTENTS

EMISSION CONTROL DEVICES

Engine model		L28E					
		S130					
Car model		California models		Non-California models			
				For U.S.A.		For Canada	
Transmission		M/T	A/T	M/T	A/T	M/T	A/T
Air inlet system	Fresh air duct	X	X	X	X	X	X
Air/Fuel system	Air flow meter	X	X	X	X	X	X
	Throttle chamber (1 barrel)	X	X	X	X	X	X
	Cold start valve	X	X	X	X	X	X
	Throttle valve switch	X	X	X	X	X	X
	Air regulator	X	X	X	X	X	X
	Cylinder head temperature sensor	X	X	X	X	–	–
	Water temperature sensor	–	–	–	–	X	X
	B.C.D.D. (with altitude corrector)	X	X	X	X	X	X
	Mixture ratio feedback system	X	X	–	–	–	–
Ignition system	Pick-up coil type IC ignition unit	X	X	X	X	X	X
	Idle advance system	–	–	X	X	–	–
	Thermal vacuum valve	X	X	X	X	X	X
	Vacuum delay valve	–	–	X	–	–	–
A.I.S.	Exhaust air induction system	–	–	X	X	–	–
E.G.R. system	E.G.R. system with B.P.T. valve	–	–	X	X	–	–
	E.G.R. system without B.P.T valve	–	–	–	–	X	X
	Thermal vacuum valve	–	–	X	X	X	X
Catalyzer	Oxidation catalytic converter	–	–	X	X	X	X
	3 way catalytic converter	X	X	–	–	–	–
Evaporator system	Canister	X	X	X	X	X	X
Crankcase ventilation system	Positive crankcase ventilation (P.C.V.) valve	X	X	X	X	X	X

Remarks: X: Available
–: Not available

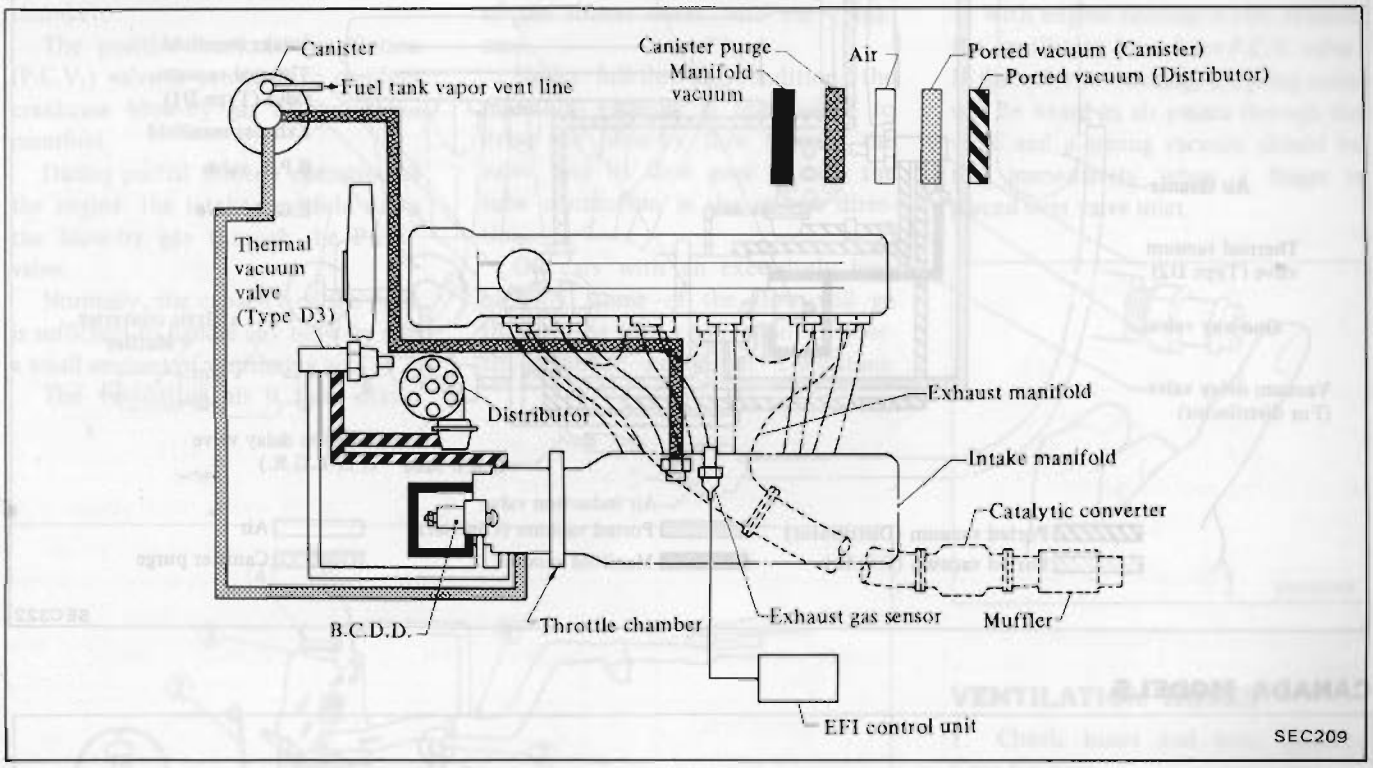
GENERAL DESCRIPTION

There are three types of emission control system. These are:

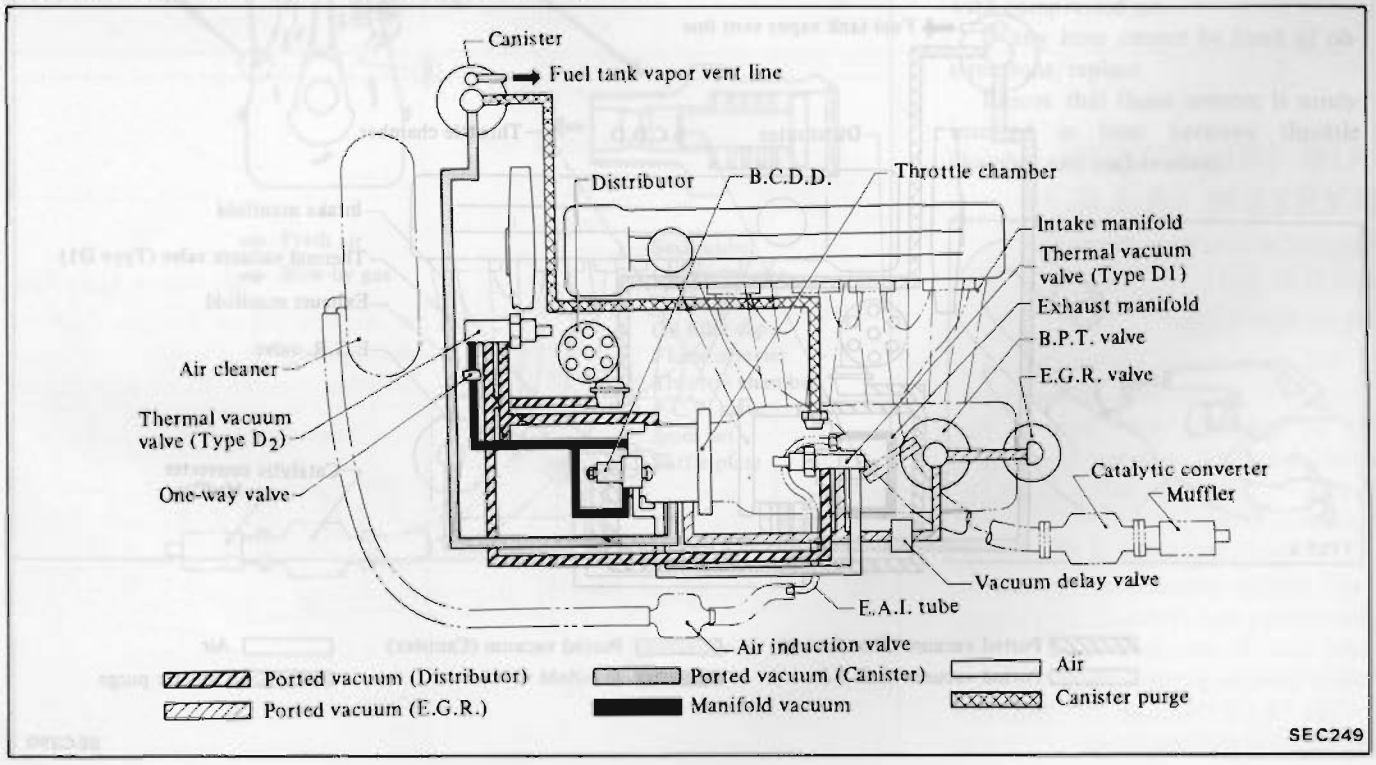
1. Closed type crankcase emission control system.
2. Exhaust emission control system.
3. Evaporative emission control system.

Periodic inspection and required servicing of these systems should be carried out to reduce harmful emissions to a minimum.

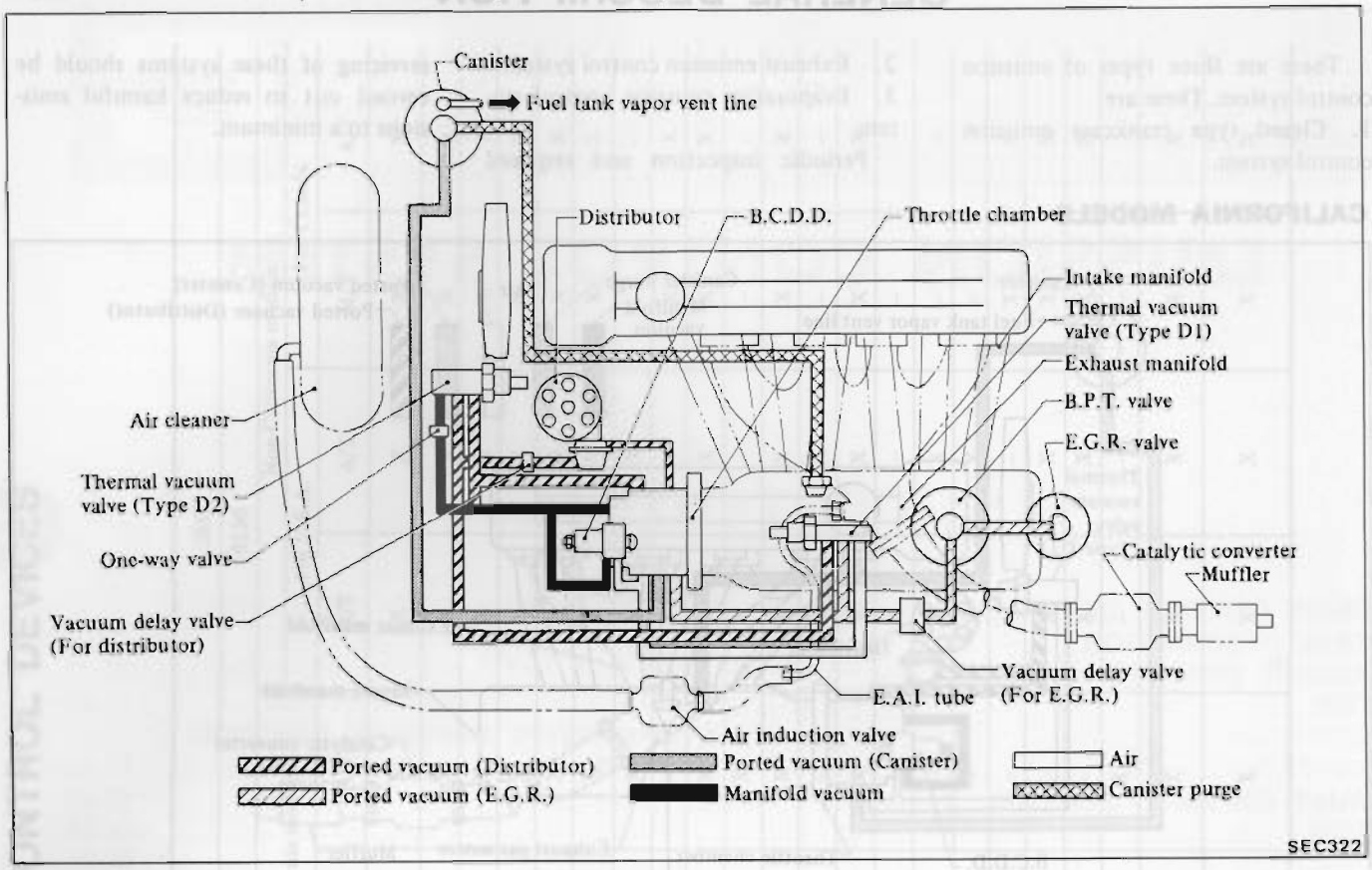
CALIFORNIA MODELS



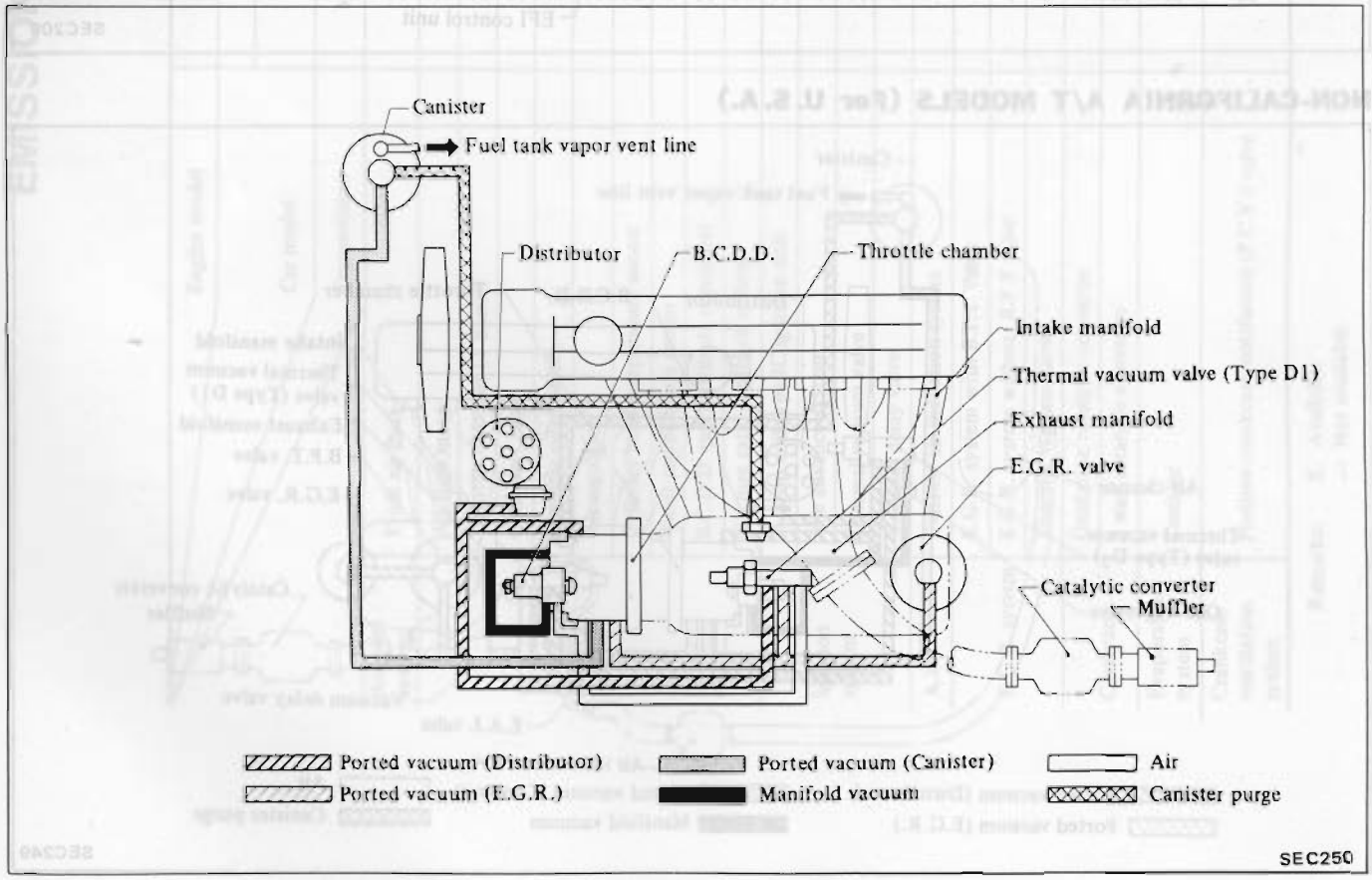
NON-CALIFORNIA A/T MODELS (For U.S.A.)



NON-CALIFORNIA M/T MODELS (For U.S.A.)



CANADA MODELS



CRANKCASE EMISSION CONTROL SYSTEM

DESCRIPTION

This system returns blow-by gas to both the intake manifold and throttle chamber.

The positive crankcase ventilation (P.C.V.) valve is provided to conduct crankcase blow-by gas to the intake manifold.

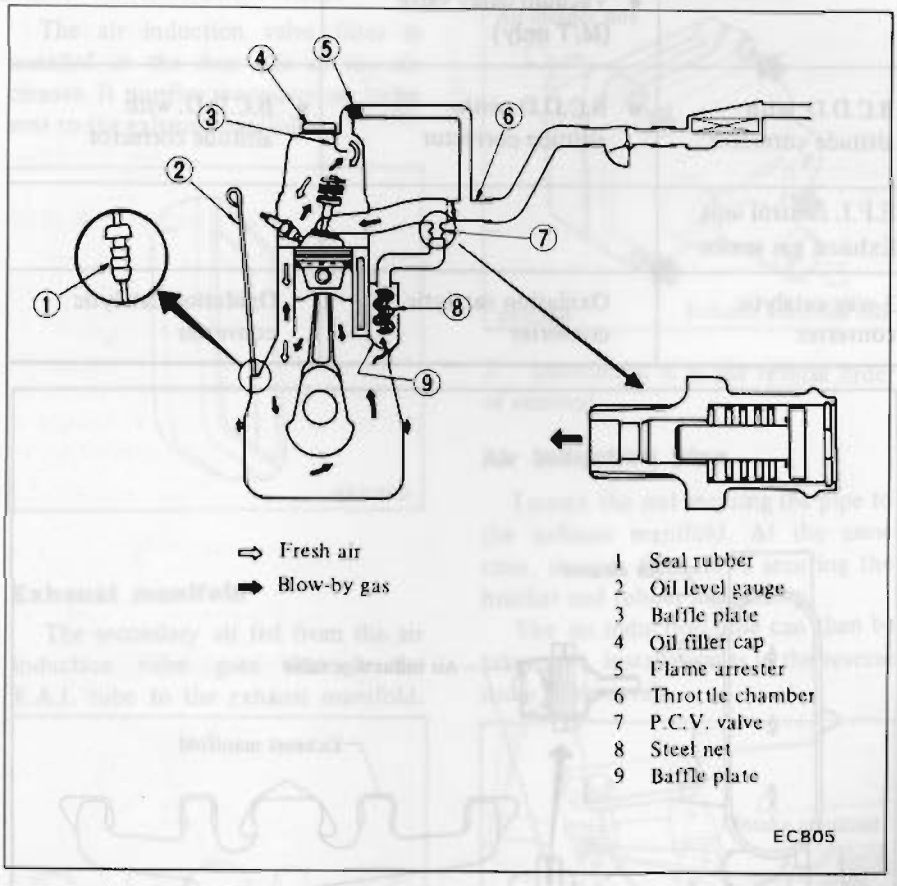
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. valve.

Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.

The ventilating air is then drawn from the throttle chamber, through the tube connecting throttle chamber to the rocker cover, into the crankcase.

Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve, and its flow goes through the tube connection in the reverse direction.

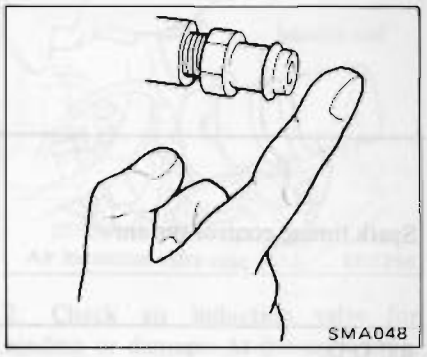
On cars with an excessively high blow-by, some of the flow will go through the tube connection to throttle chamber under all conditions.



INSPECTION

P.C.V. VALVE

With engine running at idle, remove the ventilation hose from P.C.V. valve. If the valve is working, a hissing noise will be heard as air passes through the valve and a strong vacuum should be felt immediately when a finger is placed over valve inlet.

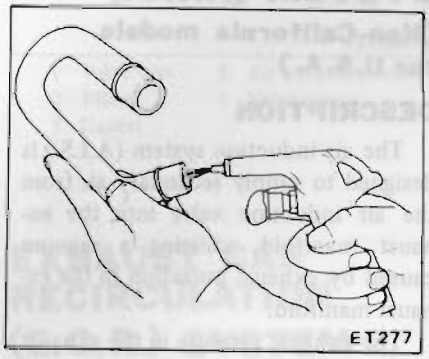


VENTILATION HOSES

1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air.

If any hose cannot be freed of obstructions, replace.

Ensure that flame arrester is surely inserted in hose between throttle chamber and rocker cover.



EXHAUST EMISSION CONTROL SYSTEM

DESCRIPTION

The exhaust emission control system is made up of the following:

Emission control system	California models	Non-California models for U.S.A.	Canada models
Air induction system	–	• Air induction valve • E.A.I. tube	–
E.G.R. system	–	• E.G.R. control valve • B.P.T. valve • Vacuum delay valve (V.D.V.) • Thermal vacuum valve (T.V.V.) (3-port type - Type-D1)	• E.G.R. control valve • Thermal vacuum valve (T.V.V.) (3-port type - Type-D1)
Spark timing control system	T.V.V. (2-port type - Type-D3)	• T.V.V. (3-port type - Type-D1, D2) • One way valve • Vacuum delay valve (M/T only)	• T.V.V. (3 port type - Type-D1)
B.C.D.D. (Boost Controlled Deceleration Device)	• B.C.D.D. with altitude corrector	• B.C.D.D. with altitude corrector	• B.C.D.D. with altitude corrector
Mixture ratio feedback system	• E.F.I. control unit • Exhaust gas sensor	–	–
Catalytic converter	3-way catalytic converter	Oxidation catalytic converter	Oxidation catalytic converter

AIR INDUCTION SYSTEM (A.I.S.)

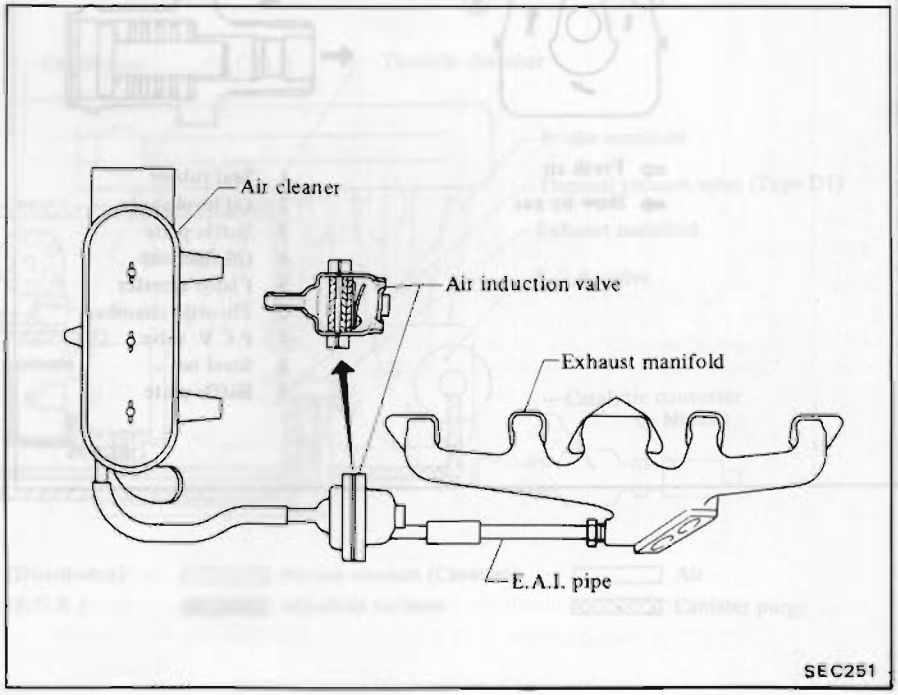
(Non-California models for U.S.A.)

DESCRIPTION

The air induction system (A.I.S.) is designed to supply secondary air from the air induction valve into the exhaust manifold, utilizing a vacuum caused by exhaust pulsation in the exhaust manifold.

The exhaust pressure in the exhaust tube usually pulsates in response to the opening and closing of the exhaust valve and it decreases below atmospheric pressure periodically.

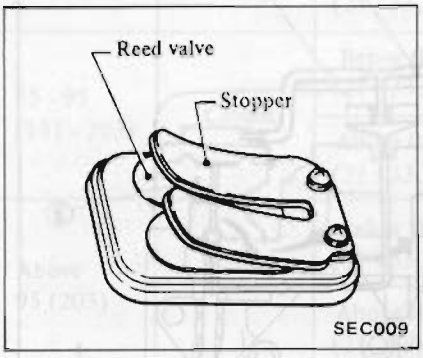
The A.I.S. reduces HC and CO emissions in the exhaust gas.



Air induction valve

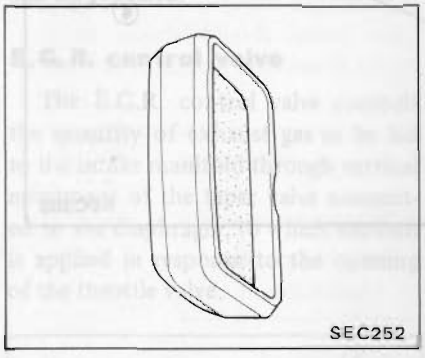
Two reed valves are installed in the air induction valve case. When the exhaust pressure is below atmospheric pressure (negative pressure), secondary air is sent to the exhaust manifold.

When the exhaust pressure is above atmospheric pressure, the reed valves prevent secondary air from being sent back to the air cleaner.



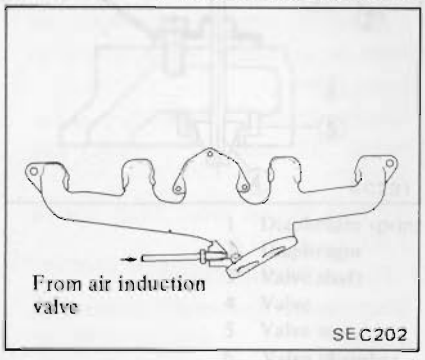
Air induction valve filter

The air induction valve filter is installed at the dust side of the air cleaner. It purifies secondary air to be sent to the exhaust manifold.



Exhaust manifold

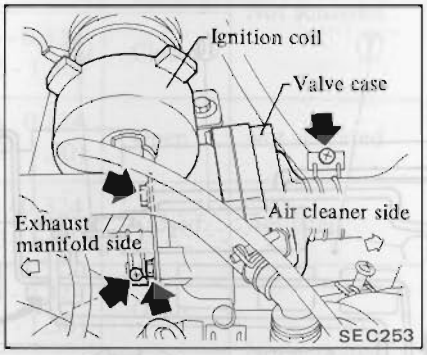
The secondary air fed from the air induction valve goes through the E.A.I. tube to the exhaust manifold.



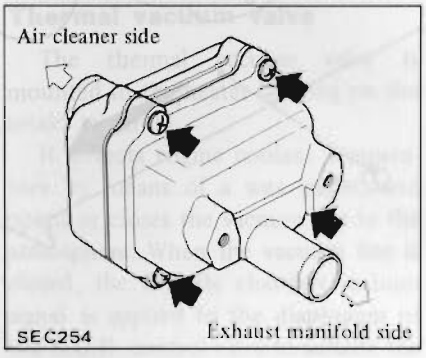
REMOVAL AND INSTALLATION

Air induction valve and filter

1. Remove bolts securing air induction valve case to bracket and disconnect hose clamp. Hose can now be removed from air induction valve case.



2. Remove screws securing front and rear of air induction valve case. Valve and filter can then be removed easily.

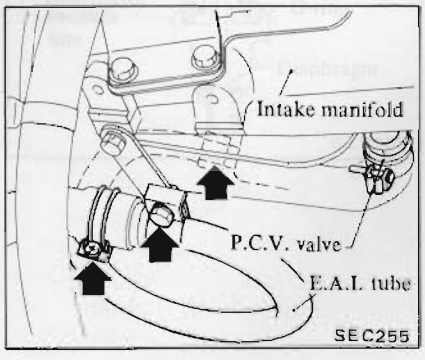


3. Installation is in the reverse order of removal.

Air induction pipe

Loosen the nut securing the pipe to the exhaust manifold. At the same time, remove the screws securing the bracket and rubber hose clamp.

The air induction pipe can then be taken out. Installation is in the reverse order of removal.



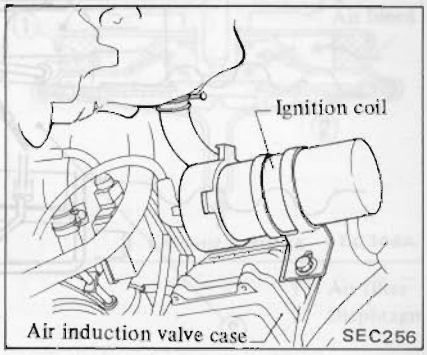
INSPECTION

Preliminary inspection

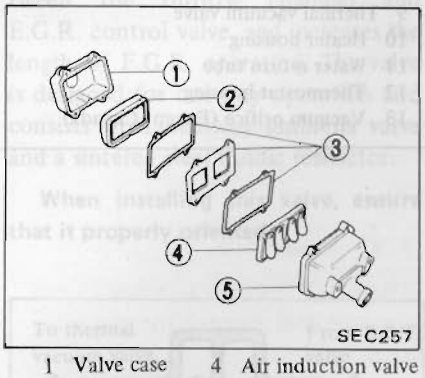
Check hose for looseness, flatting, damage or faulty connections, and each part for proper installation. If necessary, replace.

Air induction valve and filter

1. Disconnect air induction hose at air induction pipe side. Suck or blow hose to make sure that air flows only on the air induction pipe side.



2. Check air induction valve for binding or damage. At the same time, check filter for damage or plugging. If necessary, replace. Filter should be replaced periodically in accordance with Maintenance Schedule.



1 Valve case
2 Filter
3 Gasket
4 Air induction valve
5 Valve case

EXHAUST GAS RECIRCULATION (E.G.R.) SYSTEM

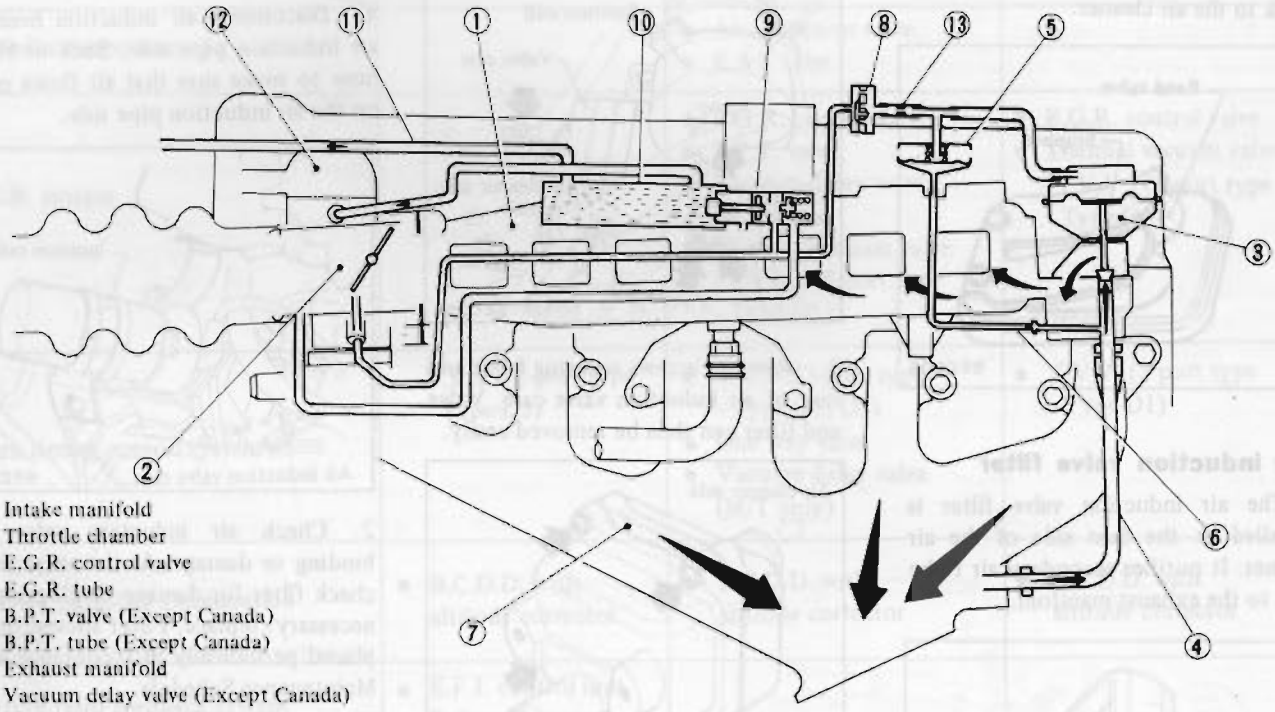
OPERATION

In the exhaust gas recirculation system, some of the exhaust gas is returned to the combustion chamber to

lower the spark flame temperature during combustion. This results in a reduction of the nitrogen oxide content in the exhaust gas.

When the E.G.R. control valve is open, some of the exhaust gas is led from the exhaust manifold to the E.G.R. chamber.

The exhaust gas is then regulated by E.G.R. valve, and is introduced into the intake manifold.



1 Intake manifold
2 Throttle chamber
3 E.G.R. control valve
4 E.G.R. tube
5 B.P.T. valve (Except Canada)
6 B.P.T. tube (Except Canada)
7 Exhaust manifold
8 Vacuum delay valve (Except Canada)
9 Thermal vacuum valve
10 Heater housing
11 Water return tube
12 Thermostat housing
13 Vacuum orifice (Except Canada)

SEC308

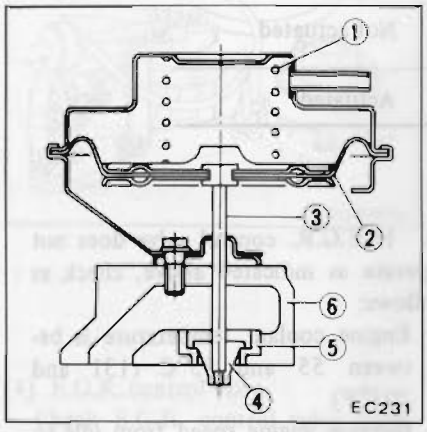
OPERATION

Water temperature °C (°F)	Thermal vacuum valve	B.P.T. valve		E.G.R. control system
		Exhaust gas pressure kPa (mmH_2O, inH_2O)	Operation	
Below 55 (131)	Open	Below 0.206 - 0.324 (21 - 33, 0.83 - 1.30)	Open	Not actuated
		Above 0.206 - 0.324 (21 - 33, 0.83 - 1.30)	Closed	
55 - 95 (131 - 203)	Closed	Below 0.206 - 0.324 (21 - 33, 0.83 - 1.30)	Open	Not actuated
		Above 0.206 - 0.324 (21 - 33, 0.83 - 1.30)	Closed	Actuated
Above 95 (203)	Open	Below 0.206 - 0.324 (21 - 33, 0.83 - 1.30)	Open	Not actuated
		Above 0.206 - 0.324 (21 - 33, 0.83 - 1.30)	Closed	

With the engine at idle or at full throttle, the E.G.R. control valve closes to deactivate the E.G.R. system regardless of water temperature (operation of the thermal vacuum valve) and B.P.T. valve.

E.G.R. control valve

The E.G.R. control valve controls the quantity of exhaust gas to be led to the intake manifold through vertical movement of the taper valve connected to the diaphragm, to which vacuum is applied in response to the opening of the throttle valve.



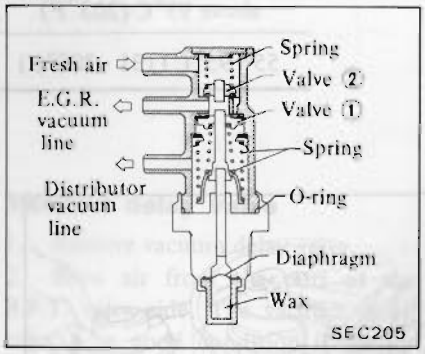
1 Diaphragm spring
2 Diaphragm
3 Valve shaft
4 Valve
5 Valve seat
6 Valve chamber

Thermal vacuum valve

The thermal vacuum valve is mounted in the heater housing on the intake manifold.

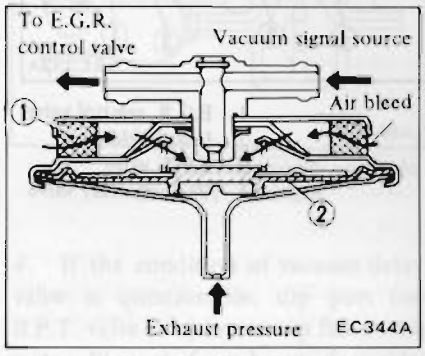
It detects engine coolant temperature by means of a wax pellet, and opens or closes the vacuum line to the atmosphere. When the vacuum line is closed, the throttle chamber vacuum signal is applied to the diaphragm of the E.G.R. control valve to actuate the taper valve connected to the diaphragm.

Type-D1



B.P.T. valve

The B.P.T. valve monitors exhaust pressure to activate the diaphragm, controlling throttle chamber vacuum applied to the E.G.R. control valve. In other words, recirculated exhaust gas is controlled in response to positioning of the E.G.R. control valve or to engine operation.

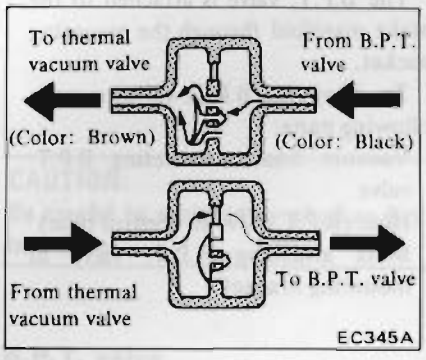


1 Air filter
2 Diaphragm

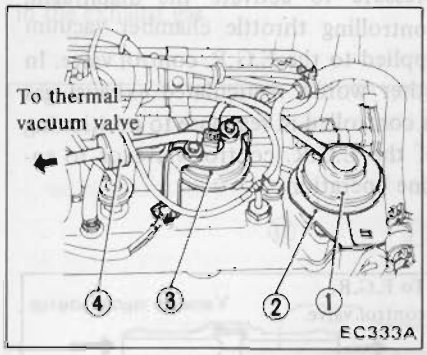
Vacuum delay valve

During rapid acceleration the vacuum delay valve prevents an abrupt escape of vacuum from the line between the throttle chamber and E.G.R. control valve, and increases the length of E.G.R. operation. The valve is designed for one-way operation and consists of a one-way umbrella valve and a sintered steel fluidic restrictor.

When installing this valve, ensure that it properly oriented.



REMOVAL AND INSTALLATION



1 E.G.R. control valve
2 Heat shield plate
3 B.P.T. valve
4 Vacuum delay valve

E.G.R. Control valve

E.G.R. control valve is installed on intake manifold through a gasket. To dismount E.G.R. control valve, remove the following parts:

- Vacuum hose connecting E.G.R. control valve.
- Heat shield plate for E.G.R. control valve (if so equipped).
- Nuts attaching E.G.R. control valve to intake manifold.

To remove vacuum hose, flatten clip connecting vacuum hose to E.G.R. control valve and remove hose by hand.

B.P.T. valve

The B.P.T. valve is attached to the intake manifold through the mounting bracket.

To dismount B.P.T. valve, remove following parts:

- Vacuum hoses connecting B.P.T. valve
- Hose (B.P.T. valve to control tube)
- Bolts attaching B.P.T. valve to mounting bracket

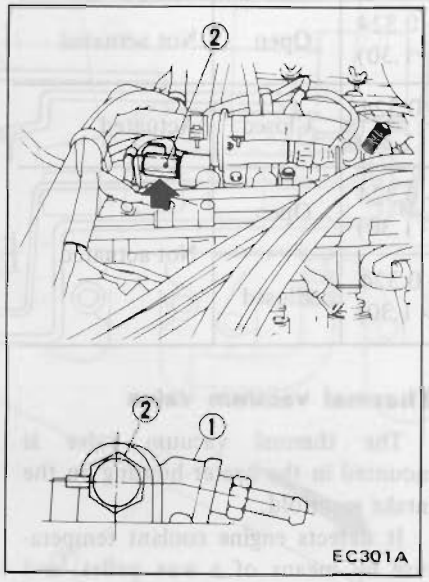
Thermal vacuum valve

After removing following parts and loosening heater housing fixing bolts, thermal vacuum valve can be dismounted.

- Vacuum hoses (Vacuum gellery to thermal vacuum valve)
- Vacuum hose (Thermal vacuum valve to vacuum delay valve).

a. Drain engine coolant, about one liter, before dismounting thermal vacuum valve.

b. Tighten thermal vacuum valve to 22 N-m (2.2 kg-m, 16 ft-lb) max. Make sure that valve is water-tight after installation.



1 Heater housing
2 Thermal vacuum valve

To install E.G.R. control system components, reverse the order of removal.

When connecting vacuum hoses, ensure that they are properly positioned.

INSPECTION

Entire system

1. Make a thorough visual check of E.G.R. control system. If necessary, wipe away oil to facilitate inspection.

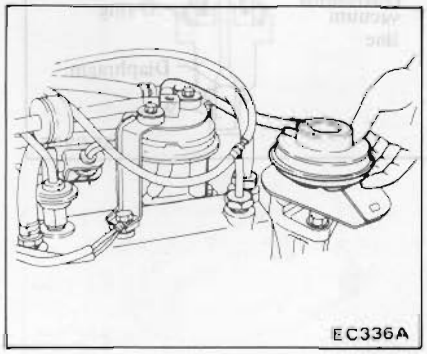
If any hoses are cracked or broken, replace.

2. With engine stopped, inspect E.G.R. control valve for any indication of binding or sticking by moving diaphragm of control valve upwards with finger.

3. With engine running, inspect E.G.R. control valve. Place a finger on the diaphragm of E.G.R. control valve to check for valve operation.

Check operation of E.G.R. valve, using the following chart as a guide. Engine speed should always be increased from idle to 3,000 to 3,500 rpm.

Engine coolant Temperature	*E.G.R. control valve* operation
Below 55°C (131°F) or above 95°C (203°F)	Not actuated
55 - 95°C (131 - 203°F)	Actuated



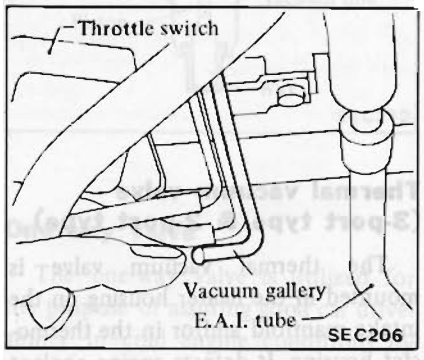
4. If E.G.R. control valve does not operate as indicated above, check as follows:

- Engine coolant temperature is between 55 and 95°C (131 and 203°F)
- Increase engine speed from idle to 3,000 to 3,500 rpm.

(1) Thermal vacuum valve.

- Disconnect one end of vacuum gallery.

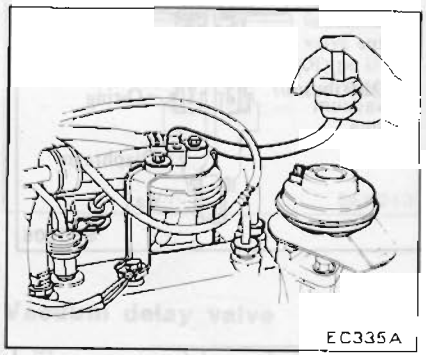
- Make sure that thermal vacuum valve is closed, and that throttle chamber vacuum is not present at end of vacuum tube.
- If vacuum is present, check thermal vacuum valve itself.



(2) Vacuum Delay Valve.
Check vacuum delay valve itself.

(3) B.P.T. valve.

- Disconnect one end (E.G.R. control valve side) of vacuum hose.
- Make sure that B.P.T. valve is operating, and that throttle chamber vacuum is present at end of vacuum hose.
- If vacuum is not present at all, check B.P.T. valve itself.



(4) E.G.R. control valve.
Check E.G.R. control valve itself.

Thermal vacuum valve

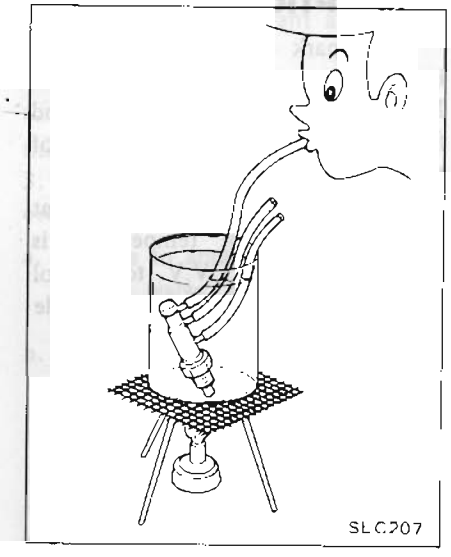
Dismount thermal vacuum valve from heater housing.

Check to be sure that thermal vacuum valve opens or closes in response to water temperature as specified.

If test results satisfy the following, thermal vacuum valve is properly functioning:

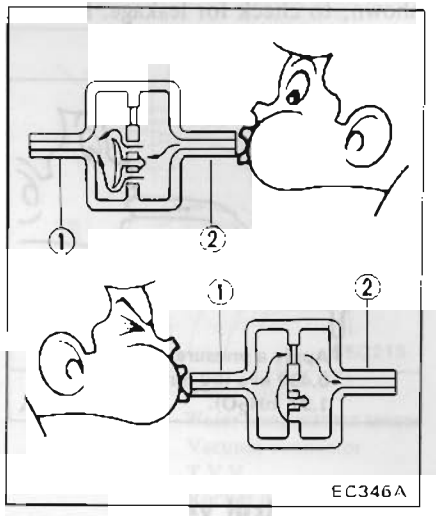
Coolant temperature	Vacuum line
Below 55°C (131°F)	Open
55 - 95°C (131 - 203°F)	Closed
Above 95°C (203°F)	Open

CAUTION:
Do not allow water to get inside the thermal vacuum valve.



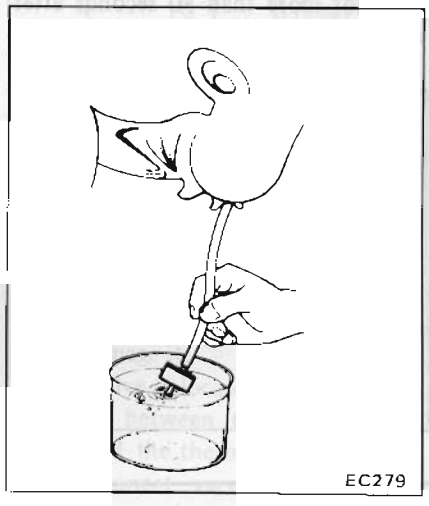
Vacuum delay valve

1. Remove vacuum delay valve.
2. Blow air from the port of the B.P.T. valve side. The vacuum delay valve is in good condition if the air flows through the valve.
3. Try again from the opposite side (Brown face side) of the valve. The valve is in good condition if the air flow resistance is greater than with step 2 above.



1 Thermal vacuum valve side
2 B.P.T. valve side

4. If the condition of vacuum delay valve is questionable, dip port (on B.P.T. valve side) into a cup filled with water. Blow air from brown face side. Small air bubbles should appear.



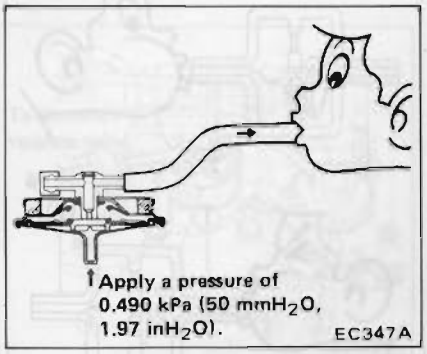
CAUTION:
Be careful to avoid entry of oil or dirt into valve.

B.P.T. valve

Disconnect B.P.T. valve from engine.

Apply a pressure above 0.490 kPa (50 mmH_2O, 1.97 inH_2O) to B.P.T. valve and orally suck port back, as

shown, to check for leakage. If a leak is noted, replace valve.



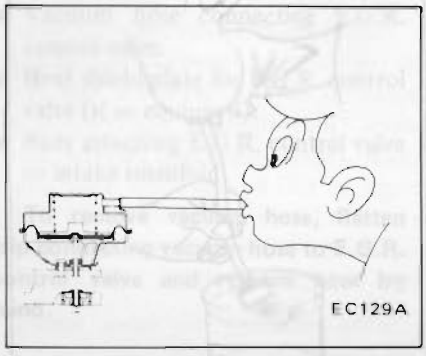
E.G.R. control valve

Dismount E.G.R. control valve from engine.

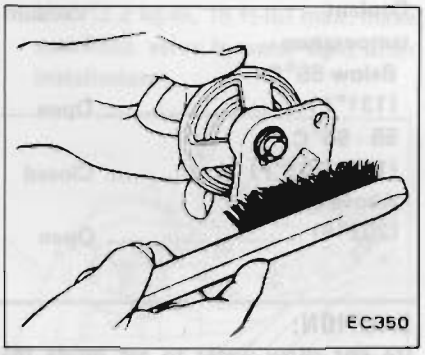
1. Apply vacuum to E.G.R. control valve, referring to the following figure. If the valve moves to full position, it is normal.

Plug hose with vacuum applied.

E.G.R. control valve will remain open for more than 30 seconds after vacuum has cut off.



2. Visually check E.G.R. control valve for damage, wrinkle or deformation.
3. Clean the seating surface of E.G.R. control valve with a brush and compressed air, and remove foreign matter from around the valve and port.



SPARK TIMING CONTROL SYSTEM

DESCRIPTION

The spark timing is controlled in three stages, COLD, WARM-UP and NORMAL DRIVING to obtain good fuel economy and quick warm-up of the catalyst.

This system is designed so that the engine coolant temperature is monitored by the T.V.V. to control the distributor vacuum and provide correct advance timing.

OPERATION

These systems are controlled as follows:

		Cold	Warm-up	Normal driving
Non-California for U.S.A. and Canada models	Water temperature °C (°F)	Below 35 (95)	35 - 55 (95 - 131)	Above 55 (131)
	Spark timing control system	Actuated	Not actuated	Actuated
California models	Water temperature °C (°F)	Below 15 (59)	15 - 60 (59 - 140)	Above 60 (140)
	Spark timing control system	Actuated	Not actuated	Actuated

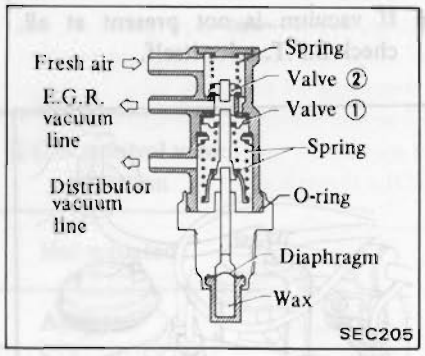
On non-California models for U.S.A., when the coolant reaches the normal temperature, the normal vacuum line is connected. At idle, the manifold vacuum is regulated by the appropriate orifices to a certain value and the vacuum advance unit advances the spark timing half-way.

Thermal vacuum valve (3-port type & 2-port type)

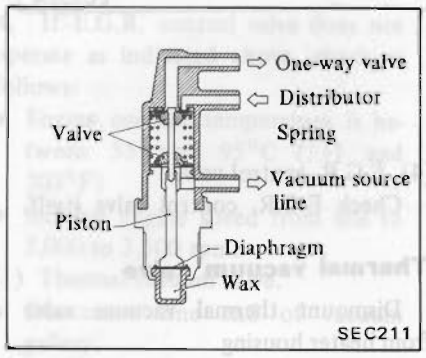
The thermal vacuum valve is mounted in the heater housing on the intake manifold and/or in the thermostat housing. It detects engine coolant temperature by means of a wax pellet, and opens or closes the vacuum line to the atmosphere.

The thermal vacuum valve opens and closes to either permit or obstruct external air passing to the distributor vacuum line. When the valve opens, the vacuum signal line will allow external air to enter, thereby stopping the distributor vacuum from advancing.

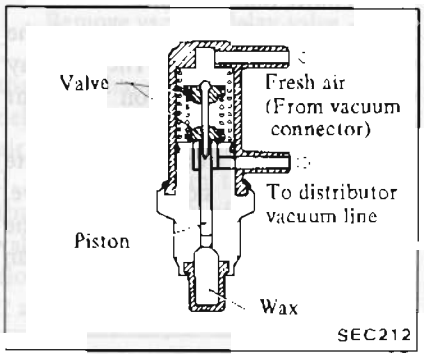
Type D-1

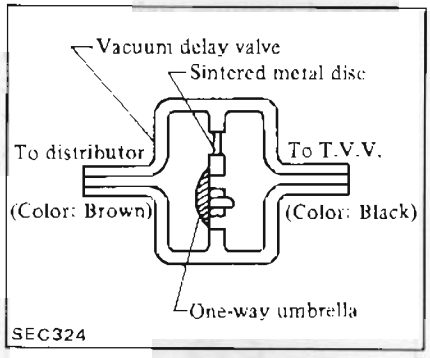


Type D-2



Type D-3

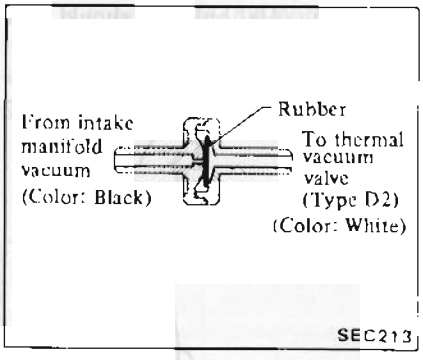




One-way valve

The one-way valve is utilized for the purpose of assuring good car driveability in cold engine conditions by applying manifold vacuum to the distributor vacuum advance unit.

This valve, installed in the vacuum control line to the vacuum advance unit, accumulates the vacuum in the line and advances the spark timing. When the coolant reaches a certain temperature, the thermal vacuum valve (Type-D2) disconnects the vacuum line and normal ported vacuum is applied to the distributor vacuum advance unit.



Vacuum delay valve

The vacuum delay valve is utilized to reduce Nox emissions during rapid acceleration by delaying throttle vacuum applied to the distributor vacuum controller. It also cuts off the vacuum spark advance immediately upon deceleration.

This valve is designed for one-way operation and consists of a one-way umbrella valve and sintered steel fluidic restrictor.

REMOVAL AND INSTALLATION

Thermal vacuum valve

The thermal vacuum valve is made of plastic. Consequently pay attention not to damage it.

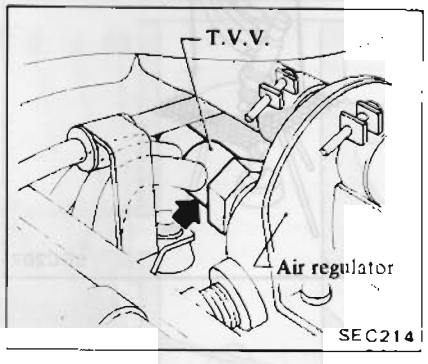
This valve is located on the thermostat housing and/or in the heater housing on the intake manifold.

1. Drain engine coolant about one liter.
2. Disconnect vacuum hoses and unscrew the thermal vacuum valve. Then the valve can be taken out.
3. Installation is in the reverse order of removal.

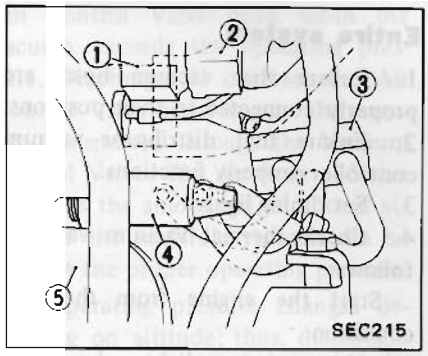
a. Be sure to apply sealer to threads of the valve prior to installing new valve.

b. When installing new thermal vacuum valve, make sure of the color and of the figure.

Type D-1

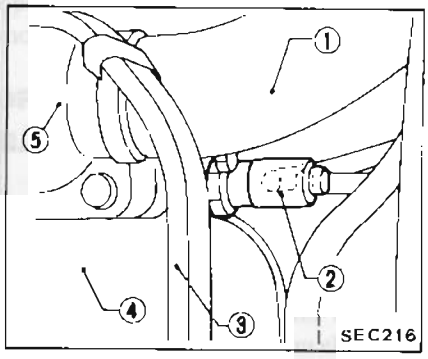


Type D-2



1 Water outlet
2 Water temperature sensor
3 Vacuum connector
4 T.V.V.
5 Rocker cover

Type D-3



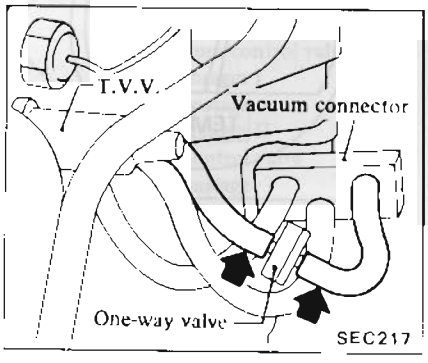
1 Radiator hose
2 T.V.V.
3 Fuel pipe
4 Rocker cover
5 Thermostat housing

One-way valve

The one-way valve is made of plastic. Consequently pay attention not to damage it.

This valve is located in the vacuum hose line between the vacuum connector and the thermal vacuum vlave.

1. Disconnect vacuum hoses from the one way valve. The one-way valve can then be taken out.



2. Installation is in the reverse order of removal.

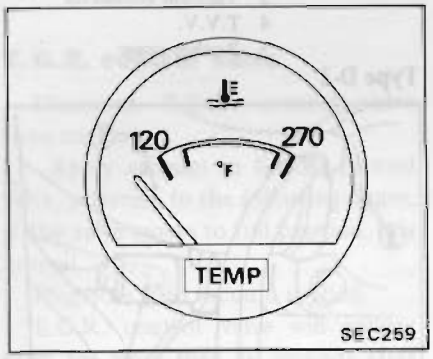
INSPECTION

Entire system

1. Ensure that vacuum hoses are properly connected to their positions.
2. Ensure that distributor vacuum controller properly functions.
3. Set timing light.
4. Check thermal vacuum valve as follows:

Start the engine from the cold condition.

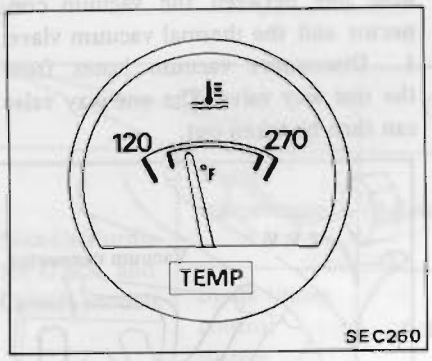
(1) Using timing light, check the spark timing when the engine is cold.



(2) Using timing light, ensure that the spark timing retards from the former condition when the temperature gauge changes from the former condition to the middle position.

(3) Warm up the engine to the middle position of temperature gauge.

Ensure that the spark timing advances from the former condition.



If the spark timing does not change, replace thermal vacuum valve.

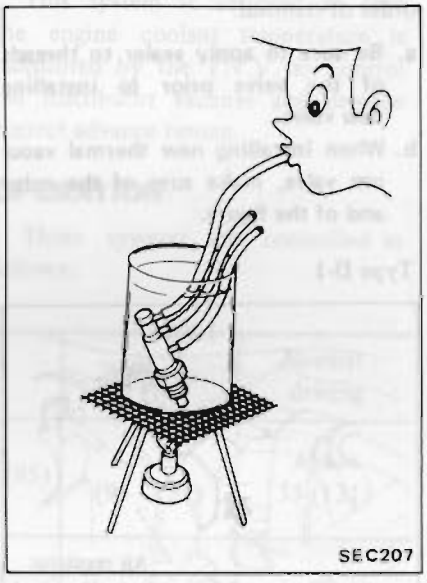
Check proper operation of thermal vacuum valve as follows:

Thermal vacuum valve

Remove thermal vacuum valve from engine. Inhale air from port of spark timing control system and check to be sure that thermal vacuum valve opens or closes in response to its temperature.

Thermal vacuum valve operating temperature:

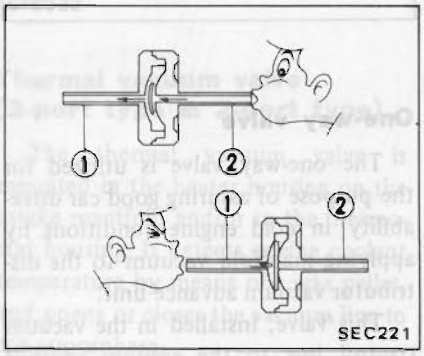
Type	Operating temperature °C (°F)	
	Open	Close
Type D-1	35 - 55 (95 - 131)	Below 35 (95) Above 55 (131)
Type D-2	Below 40 (104)	Above 40 (104)
Type D-3	15 - 60 (59 - 140)	Below 15 (59) Above 60 (140)



CAUTION:
Do not allow water to get inside the thermal vacuum valve.

One-way valve

1. Remove one-way valve.
2. Blow air from the port of the vacuum connector side. The one way valve is in good condition if the air flows through the valve.
3. Try again from the opposite side (White face side) of the valve. The valve is in good condition if the air flow resistance is greater than with step 2 above.



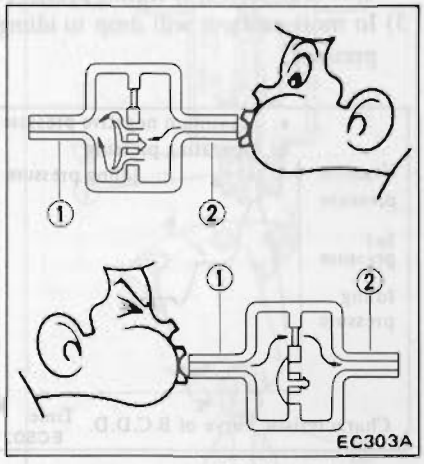
1 Thermal vacuum valve side
2 Vacuum connector side

4. If the condition of the one-way valve is questionable, dip port (On vacuum connector side) into a cup filled with water. Blow air from white face side. Air bubbles should not appear.

CAUTION:
Be careful to avoid entry of oil or dirt into valve.

Vacuum delay valve

1. Remove vacuum delay valve.
2. Blow air from the port of the throttle chamber side. The vacuum delay valve is in good condition if the air flows through the valve.
3. Try again from the opposite side (brown face side) of the valve. The valve is in good condition if the air flow resistance is greater than the step 2 above.



1 Distributor side
2 Throttle chamber side

4. If the condition of vacuum delay valve is questionable, dip port (on distributor side) into a cup filled with water. Blow air from brown face side. Small air bubbles should appear.

CAUTION:
Be careful to avoid entry of oil or dirt into valve.

BOOST CONTROLLED DECELERATION DEVICE (B.C.D.D.)

DESCRIPTION

The Boost Controlled Deceleration Device (B.C.D.D.) is employed to reduce HC emissions emitted during coasting. The B.C.D.D., installed under the throttle chamber as a part of it, supplies additional air to the intake manifold during coasting to maintain the manifold vacuum at the proper operating pressure.

There are two diaphragms in the device unit. Diaphragm I detects the manifold vacuum and makes the Vacuum Control Valve open when the vacuum exceeds the operating pressure. Diaphragm II operates the Air Control Valve according to the vacuum transmitted through the Vacuum Control Valve. The Air Control Valve regulates the amount of additional air so that the manifold vacuum can be kept at the proper operating pressure. The operating pressure changes depending on altitude; thus, diaphragm II and control valve operations are adjusted automatically in coincidence with the altitude at which the vehicle is driven. The graph shown in Figure is driven. The table indicates change in operating pressure for changes in atmospheric pressure and altitude.

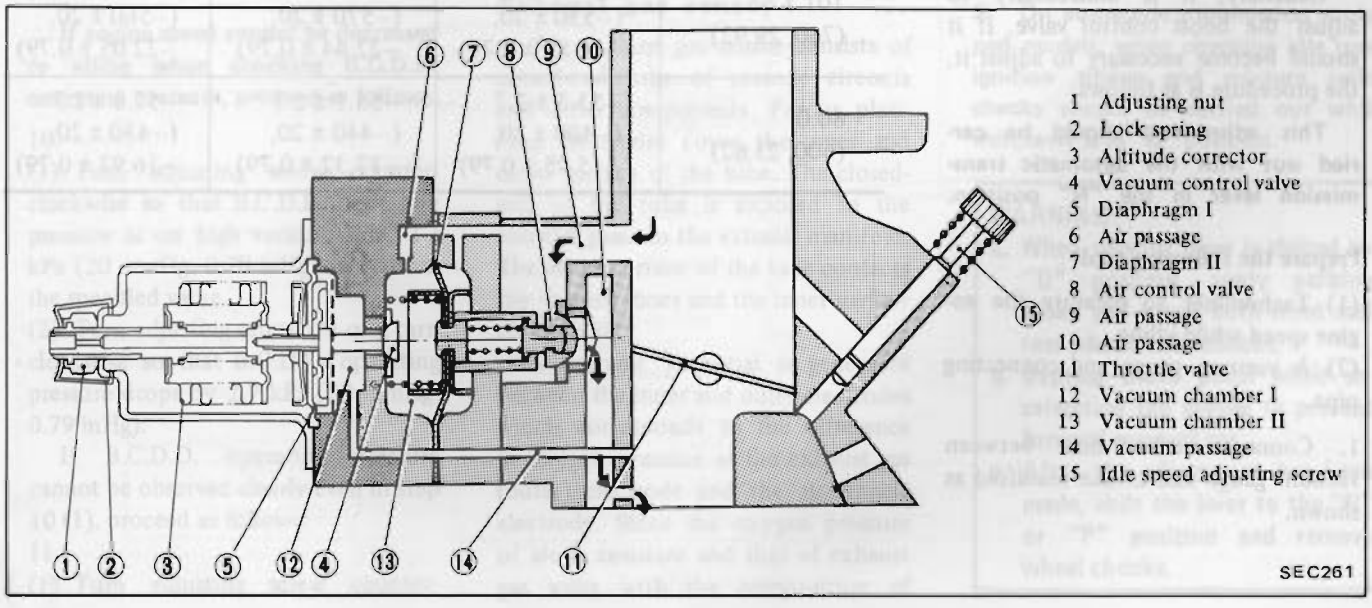
OPERATION

B. C. D. D.

Diaphragm I ⑤ monitors the manifold vacuum; when the vacuum exceeds a pre-determined value, it acts so as to open the vacuum control valve ④. This causes the manifold vacuum to be introduced into vacuum chamber II ⑬ and actuates diaphragm II ⑦.

When diaphragm II operates, the air control valve ⑧ opens the air passage and introduces the additional air into the manifold.

The amount of air is controlled by the servo-action of the air control valve ⑧ and vacuum control valve ④ so that the manifold vacuum may be kept at the pre-determined value.



1 Adjusting nut
2 Lock spring
3 Altitude corrector
4 Vacuum control valve
5 Diaphragm I
6 Air passage
7 Diaphragm II
8 Air control valve
9 Air passage
10 Air passage
11 Throttle valve
12 Vacuum chamber I
13 Vacuum chamber II
14 Vacuum passage
15 Idle speed adjusting screw

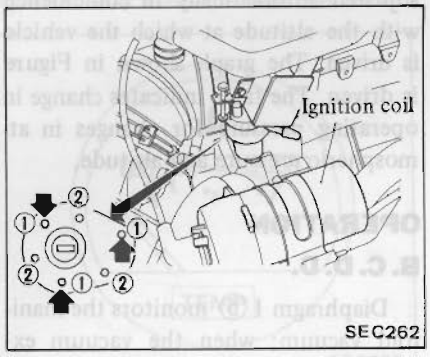
REMOVAL AND INSTALLATION

B. C. D. D.

The B.C.D.D. cannot be disassembled. If it is found to be functioning unsatisfactorily, it must be replaced as an assembly.

1. Remove the B.C.D.D. by unscrewing the three securing screw ①.

Do not unscrew the four B.C.D.D. assembly screws ②.



2. To install, reverse the removal procedure.

Ⓣ : **2.0 - 3.9 N·m (20 - 40 kg-cm, 17 - 35 in-lb)**

INSPECTION

Entire system

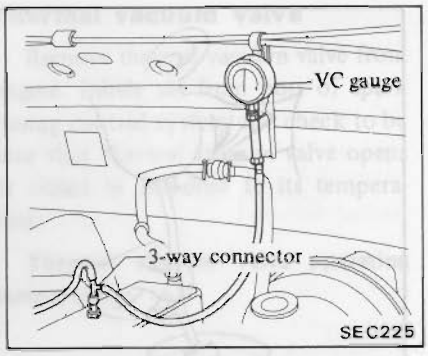
Generally, it is unnecessary to adjust the boost control valve. If it should become necessary to adjust it, the procedure is as follows:

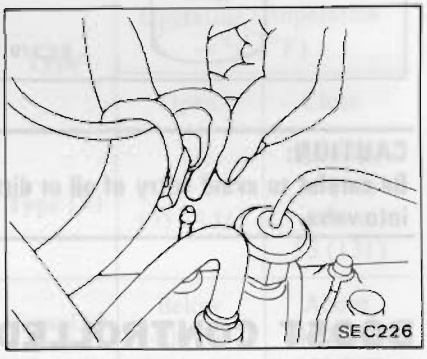
This adjustment should be carried out with the automatic transmission lever in the "N" position.

Prepare the following tools

(1) Tachometer to measure the engine speed while idling.
(2) A vacuum gauge and connecting pipe.

1. Connect rubber hose between vacuum gauge and intake manifold as shown.



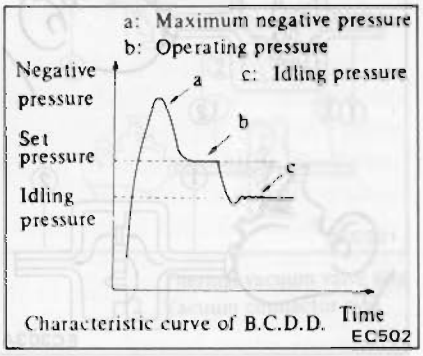


2. Warm up the engine until it is heated to operating temperature.

Then adjust the engine at normal idle setting. (Refer to the item "Idle Adjustment").

3. Run the engine under no load. Increase engine speed to 3,000 to 3,500 rpm, then quickly close throttle valve.

4. At that time, the manifold vacuum pressure will change as follows:
1) It will abruptly rise up to −80.0 kPa (−600 mmHg, −23.62 inHg) or above.
2) It will decrease gradually to a certain level and stay there for a while. This is so called operating pressure.
3) In most cases, it will drop to idling pressure.



Characteristic curve of B.C.D.D.

5. Check that the B.C.D.D. operating pressure is within the specified range.

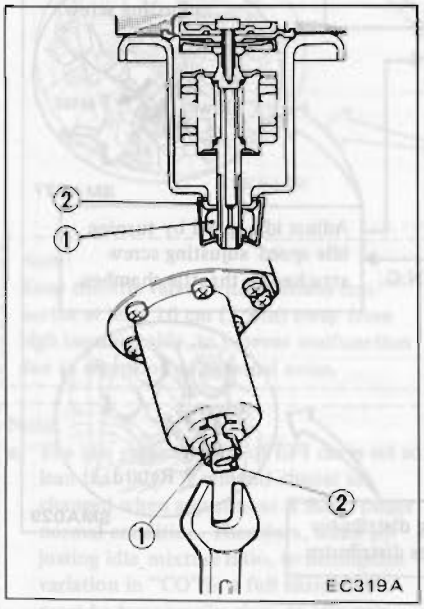
Operating pressure:

Unit: kPa (mmHg, inHg)

At atmospheric pressure	California	Non-California for U.S.A.	Canada
101.3 (760, 29.92)	−70.6 ± 2.7 (−530 ± 20, −20.87 ± 0.79)	−76.0 ± 2.7 (−570 ± 20, −22.44 ± 0.79)	−74.6 ± 2.7 (−560 ± 20, −22.05 ± 0.79)
80.0 (600, 23.62)	−53.3 ± 2.7 (−400 ± 20, −15.75 ± 0.79)	−58.7 ± 2.7 (−440 ± 20, −17.32 ± 0.79)	−57.3 ± 2.7 (−430 ± 20, −16.93 ± 0.79)

6. If it is lower or higher than the specified level, turn the adjusting screw in the following direction until correct adjustment is made.

Adjusting screw:
Lower condition
Counterclockwise
Higher condition
Clockwise



1 Adjusting nut
2 Lock spring

7. Race the engine and check for adjustment.
8. If it is lower than the set level, turn the adjusting screw until correct adjustment is made.
9. Race the engine and check for adjustment.

If engine speed cannot be decreased to idling when checking B.C.D.D. operating pressure, proceed as follows.

10.
(1) Turn adjusting screw counterclockwise so that B.C.D.D. operating pressure is on high vacuum side, 2.7 kPa (20 mmHg, 0.79 inHg) away from the specified value.
(2) Turn adjusting screw 1/4 of a turn clockwise so that B.C.D.D. operating pressure drops by 2.7 kPa (20 mmHg, 0.79 inHg).

If B.C.D.D. operating pressure cannot be observed clearly even in step 10 (1), proceed as follows:

11.
(1) Turn adjusting screw counterclockwise so that B.C.D.D. operating pressure is on the high vacuum side 6.7 kPa (50 mmHg, 1.97 inHg) away from the specified value.
(2) Turn the adjusting screw 1/2 of a turn clockwise.

The B.C.D.D. operating pressure should be correctly set within the specified range after the above adjustments, even if the engine speed cannot be decreased to idling.

MIXTURE RATIO FEEDBACK SYSTEM

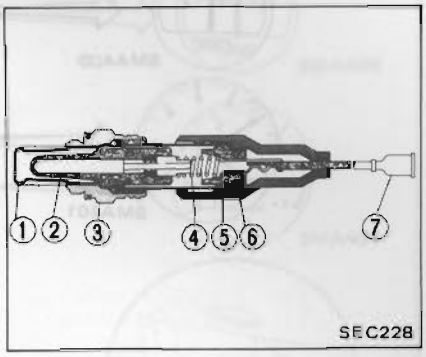
DESCRIPTION

This system is designed to control the mixture ratio precisely to the stoichiometric point so that the three-way catalyst can minimize CO, HC and NOx emissions simultaneously. The system uses the oxygen sensor located in the exhaust manifold to give an indication of whether the inlet mixture ratio is richer or leaner than the stoichiometric point. The sensor transmits a nonlinear voltage to the electronic control unit. The control unit adjusts the injection pulse width according to the sensor voltage so the mixture ratio will be within the narrow window of the three-way catalyst. During engine warm-up period, however, this system becomes open until the sensor reaches the operating temperature.

Exhaust gas sensor

The exhaust gas sensor consists of closed-end tube of ceramic zirconia and other components. Porous platinum electrodes cover the inner and outer surface of the tube. The closed-end of the tube is exposed to the exhaust gases in the exhaust manifold. The outer surface of the tube contacts the exhaust gases and the inner surface contacts air.

A galvanic potential is generated between the inner and outer electrodes which corresponds to the difference in oxygen pressure at the exhaust gas (outer) electrode and the air (inner) electrode. Since the oxygen pressure of air is constant and that of exhaust gas vaies with the composition of exhaust gases, the galvanic potential can be utilized as an indicator of mixture ratio.



1 Louver
2 Zirconia tube
3 Holder
4 Spring
5 Terminal support
6 Boots
7 Connector

ENTIRE SYSTEM INSPECTION

Preparation

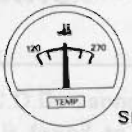
1. Make sure that the following parts are in good order.
- **Battery**
- **Ignition system**
- **Engine oil and coolant levels**
- **Fuses**
- **EFI harness connectors**
- **Vacuum hoses**
- **Air intake system (oil filler cap, oil level gauge etc.)**
- **Valve clearance, engine compression**

2. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".

3. On automatic transmission equipped models, when checking idle rpm, ignition timing and mixture ratio, checks should be carried out while shift lever is in "D" position.

WARNING:
a. When selector lever is shifted to "D" position, apply parking brake and block both front and rear wheels with chocks.
b. Depress brake pedal while accelerating the engine to prevent forward surge of car.
c. After the adjustment has been made, shift the lever to the "N" or "P" position and remove wheel chocks.

Inspection procedure

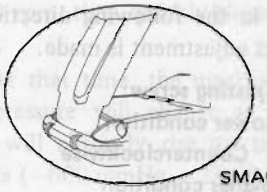

SMA400


SMA401

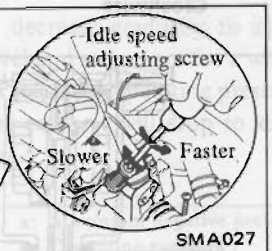
START

Start engine and warm up engine until water temperature indicator points to the middle of gauge.

- Open engine hood.
- Run engine at about 2,000 rpm for about 5 minutes under no-load.


SMA080

Race engine two or three times under no-load, then run engine at idle speed.



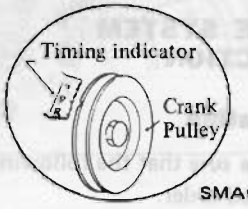
SMA027

Check idle speed.

IDLE SPEED:
Manual Transmission Models
700 ± 100 rpm
Automatic Transmission Models
700 ± 100 rpm (in "D" position)

N.G. → Adjust idle speed by turning idle speed adjusting screw attached to throttle chamber.

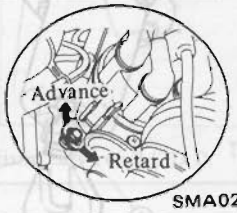
O.K.



SMA028

Check ignition timing with timing light.

Ignition timing
10 ± 2° B.T.D.C.



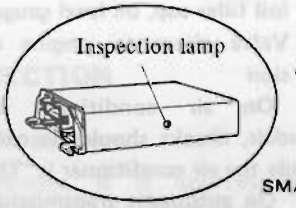
SMA029

O.K. → Run engine at about 2,000 rpm under no-load.

N.G. → Adjust ignition timing by turning distributor after loosening bolt which secures distributor.


SMA401

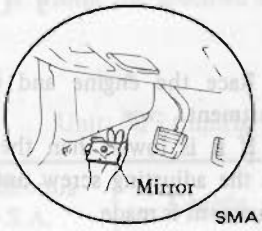
Make sure that inspection lamp on control unit goes on and off more than 5 times during 10 seconds.



SMA032

O.K. → END

N.G. →

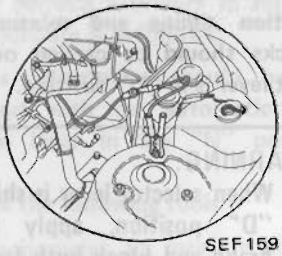


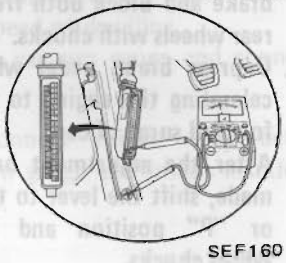
SMA165

Check exhaust gas sensor harness:

1) Turn off engine and disconnect battery ground cable.
2) Disconnect EFI 35-pin connector from control unit.
3) Disconnect exhaust gas sensor harness connector and connect terminal for exhaust gas sensor to ground with a jumper wire.
4) Check for continuity between terminal No. 31 of EFI 35-pin connector and ground metal on car body.

Continuity exists ..... O.K.
Continuity does not exist ..... N.G.


SEF159

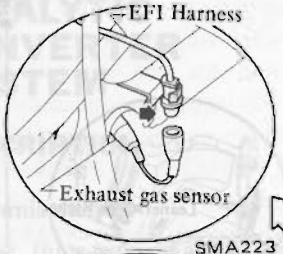

SEF160

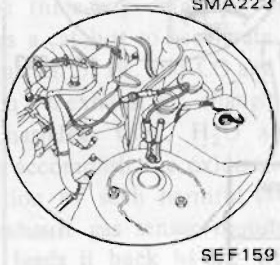
O.K. → Connect EFI 35-pin connector to control unit and connect battery ground cable.

N.G. → Correct or replace EFI harness.

Ⓐ

Ⓑ





Note:
Keep throttle valve switch harness connector at least 10 cm (3.9 in) away from high tension cable, to prevent malfunction due to reception of external noise.

Note:
a. The idle mixture ratio of EFI car is set so lean that "CO"% remains almost unchanged when adjustment is made under normal condition. Therefore, when adjusting idle mixture ratio, to distinguish variation in "CO"%, a full enrichment must be temporarily given to idle mixture setting to make it richer.
b. Make lead wire as follows:
Use flat plate terminals 3 mm (0.12 in) wide, 0.8 mm (0.031 in) thick as male terminals. Place flat plate terminals parallel with each other and keep distance between inside faces 2 mm (0.08 in). Solder lead wire to each terminal and wrap insulation tape around soldered portion.

Note:
a. When measuring "CO"%, insert probe into tail pipe more than 0.4 m (16 in).
b. Use "CO"-meter after it is fully warmed up.

Note:
a. The air by-pass screw which has been preset at the factory should be adjusted to lower exhaust emission as directed by official inspections.
The steel plug which seals air by-pass screw should not be removed during routine maintenance.
Adjusting mixture using other than the following method may violate Federal or other State and Provincial laws.

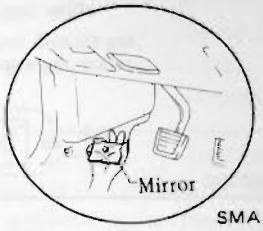
Note:
After drilling, be sure to remove shavings and dust.

Ⓐ

Check EFI Control Unit:
1) Start engine and warm up engine until water temperature indicator points to the middle of gauge.
2) Run engine at about 2,000 rpm under no-load.
3) Check inspection lamp on control unit as following conditions.

Harness connector of exhaust gas sensor	Inspection lamp
① Disconnected	Does not glow
② Grounded	Glows

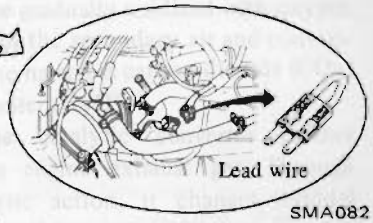
4) Turn off engine.



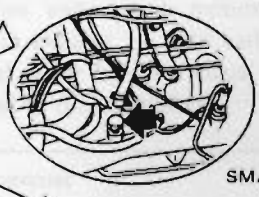
O.K.

N.G. → Replace control unit. → Ⓑ

Disconnect throttle valve switch harness connector and connect a lead wire between terminals No. 24 and No. 30 of throttle valve switch harness connector.



Disconnect canister purge hose from intake manifold, and install proper cap on connector.



Start engine and warm up engine until water temperature indicator points to the middle of gauge.

Race engine two or three times under no-load, then run engine at idle speed.

Check "CO"% with "CO"-meter

Idle "CO"%
(With full enrichment and exhaust gas sensor harness connector disconnected)
Less than 5%

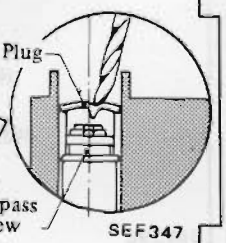
O.K.

Does engine run smoothly?

Yes. → Ⓒ

No. → Turn off engine and remove air flow meter from car.

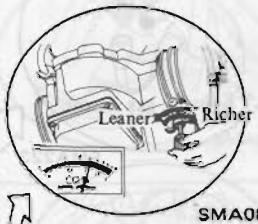
Drill a hole in steel plug which seals air by-pass screw and remove steel plug. → Ⓓ



N.G. → Ⓔ Ⓑ

Ⓒ Ⓓ Ⓔ Ⓑ

Install air flow meter on car. Start engine and warm up engine until water temperature indicator points to the middle of gauge.



SMA083

Race engine two or three times under no-load, then run engine at idling speed.

N.G.

Adjust "CO"% by turning air by-pass screw on air flow meter.

Idle "CO"%
With full enrichment and exhaust gas sensor harness connector disconnected
1.0 ±0.8%

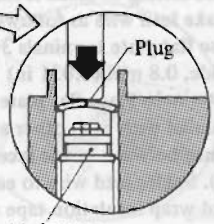
Not adjustable

O.K.

Correct or replace air flow meter or other malfunctioned parts of EFI components.

Turn off engine and remove air flow meter from car.

Insert new steel plug (furnished as a service part) with its convex side up into air by-pass screw. Tap steel plug with suitable bar, thereby installing steel plug on air flow meter.



SEF348

Install air flow meter on car.

Replace exhaust gas sensor.

Bring back following parts to its original positions.
- Throttle valve switch harness connector
- Canister purge hose
- Exhaust gas sensor harness connector

CATALYTIC CONVERTER SYSTEM

DESCRIPTION

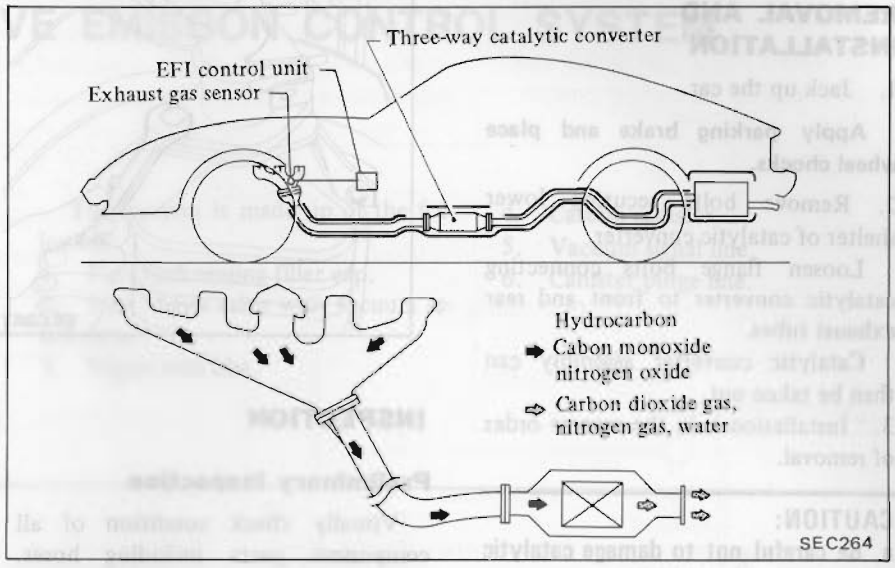
California models

The three-way catalytic converter utilizes a catalyst to accelerate the recombustion of HC and CO and reduce NOx in the exhaust gas, changing them into harmless CO_2, H_2O and N_2.

To accomplish the oxidization and reduction of such harmful contents, the exhaust gas sensor monitors O_2 level, feeds it back to the EFI control unit and maintains the mixture ratio to the stoichiometric point at all times.

Non-California models

The catalytic converter accelerates the chemical reaction of hydrocarbons (HC) and carbon monoxide (CO) in the exhaust gas, and changes them into harmless carbon dioxide (CO_2) and water (H_2O). This chemical reaction process requires the proper amount of air, which is induced by the air induction valve (Refer to the item "A.I.S."). This air is called "secondary air".



Non-California models

Exhaust gas emitted from the engine contains some harmful substances due to incomplete combustion in the combustion chamber. The air induction system is designed to reduce the content of such substances in the exhaust gas. In this system, the secondary air is led from the air induction valve and injected into the exhaust manifold. With this injection of the secondary air, hydrocarbons (HC) and carbon monoxide (CO) in the exhaust gas are gradually oxidized with oxygen (O_2) in the secondary air and converted into harmless carbon dioxide (CO_2) and water (H_2O).

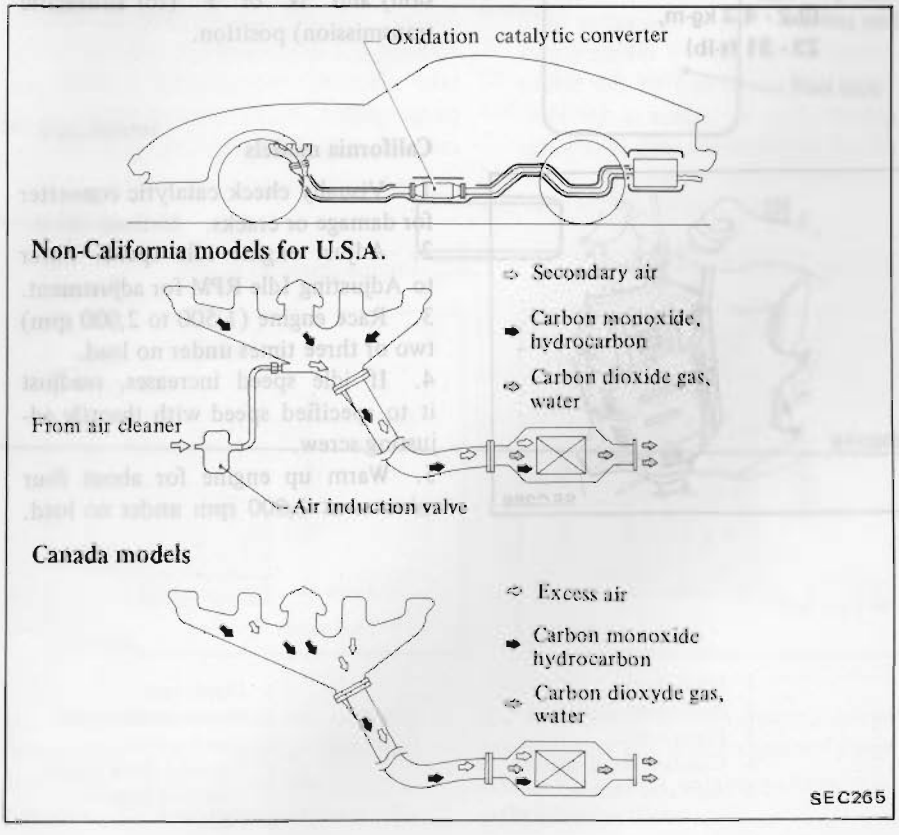
The catalytic converter further cleans engine exhaust gas. Through catalytic action, it changes residual hydrocarbons and carbon monoxide contained in exhaust gas into carbon dioxide and water before exhaust gas is discharged to the atmosphere.

OPERATION

California models

The exhaust gas from the engine contains unburned, harmful components. The mixture ratio feedback system reduces such harmful components in the exhaust gas. In this system, an exhaust gas sensor monitors the contents of O_2 density to determine the combustion condition and maintains the mixture ratio to the stoichiometric point.

While the mixture ratio is so maintained, the three-way catalytic converter activates to change the harmful components (HC, CO, and NOx) into harmless CO_2, H_2O and N_2. In this way, the catalytic converter cleans the exhaust gas and discharges H_2O, CO_2 and N_2 into the atmosphere.



REMOVAL AND INSTALLATION

1. Jack up the car.

Apply parking brake and place wheel chocks.

2. Remove bolts securing lower shelter of catalytic converter.

Loosen flange bolts connecting catalytic converter to front and rear exhaust tubes.

Catalytic converter assembly can then be taken out.

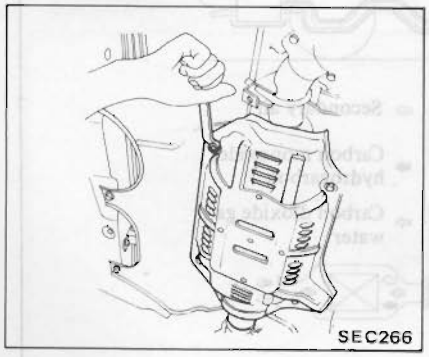
3. Installation is in the reverse order of removal.

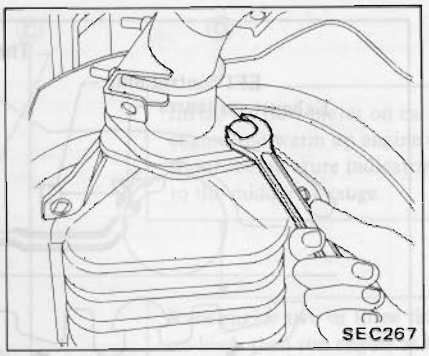
CAUTION:

a. Be careful not to damage catalytic converter when handling.

b. Never wet catalyzer with water, oil, etc.

(T) : Converter lower shelter bolt
6.3 - 8.3 N·m
(0.64 - 0.85 kg-m,
4.6 - 6.1 ft-lb)
Catalytic converter bolt
31 - 42 N·m
(3.2 - 4.3 kg-m,
23 - 31 ft-lb)


SEC266


SEC267

INSPECTION

Preliminary inspection

Visually check condition of all component parts including hoses, tubes, and wires, replace if necessary. Refer to Air Induction System or Mixture Ratio Feedback System for inspection.

Catalytic converter

Check whether catalytic converter is normal or not by observing variation in CO percentage. The checking procedure is as follows:

Apply parking brake. Shift gears into "Neutral" (for manual transmission) and "N" or "P" (for automatic transmission) position.

California models

1. Visually check catalytic converter for damage or cracks.
2. Adjust engine idle speed. Refer to Adjusting Idle RPM for adjustment.
3. Race engine (1,500 to 2,000 rpm) two or three times under no load.
4. If idle speed increases, readjust it to specified speed with throttle adjusting screw.
5. Warm up engine for about four minutes at 2,000 rpm under no load.
6. Measure CO percentage at idle speed. After step 5 has been completed, wait for one minute before making CO percentage measurement.
7. If CO percentage measured in step 6 is less than 0.3%, the catalytic converter is normal.
8. If CO percentage measured in step 6 is over 0.3%, check mixture ratio feedback system to see if it is functioning properly. Then, perform inspection steps 5 and 6.
9. If CO percentage is still over 0.3% in step 8, catalytic converter is malfunctioning. Replace catalytic converter.

Non-California models

1. Adjust engine idle speed and CO percentage. Refer to Adjusting Idle RPM and Mixture Ratio for adjustment.
2. Race engine (1,500 to 2,000 rpm) two or three times under no load and make sure that specified CO percentage is obtained.
3. Remove cap and connect air hose to air induction valve.

If idle speed increases, readjust it to specified speed with throttle adjusting screw.

4. Warm up engine for about four minutes at 2,000 rpm under no load.
5. Measure CO percentage at idle speed. After step 4 has been completed, wait for one minute before making CO percentage measurement.
6. If CO percentage measured in step 5 is less than 0.3%, the catalytic converter is normal.
7. If CO percentage measured in step 5 is over 0.3%, recheck A.I.S. and replace air induction valve. Then, perform inspection steps 4 and 5.
8. If CO percentage is still over 0.3% in step 7, catalytic converter is malfunctioning. Replace catalytic converter.

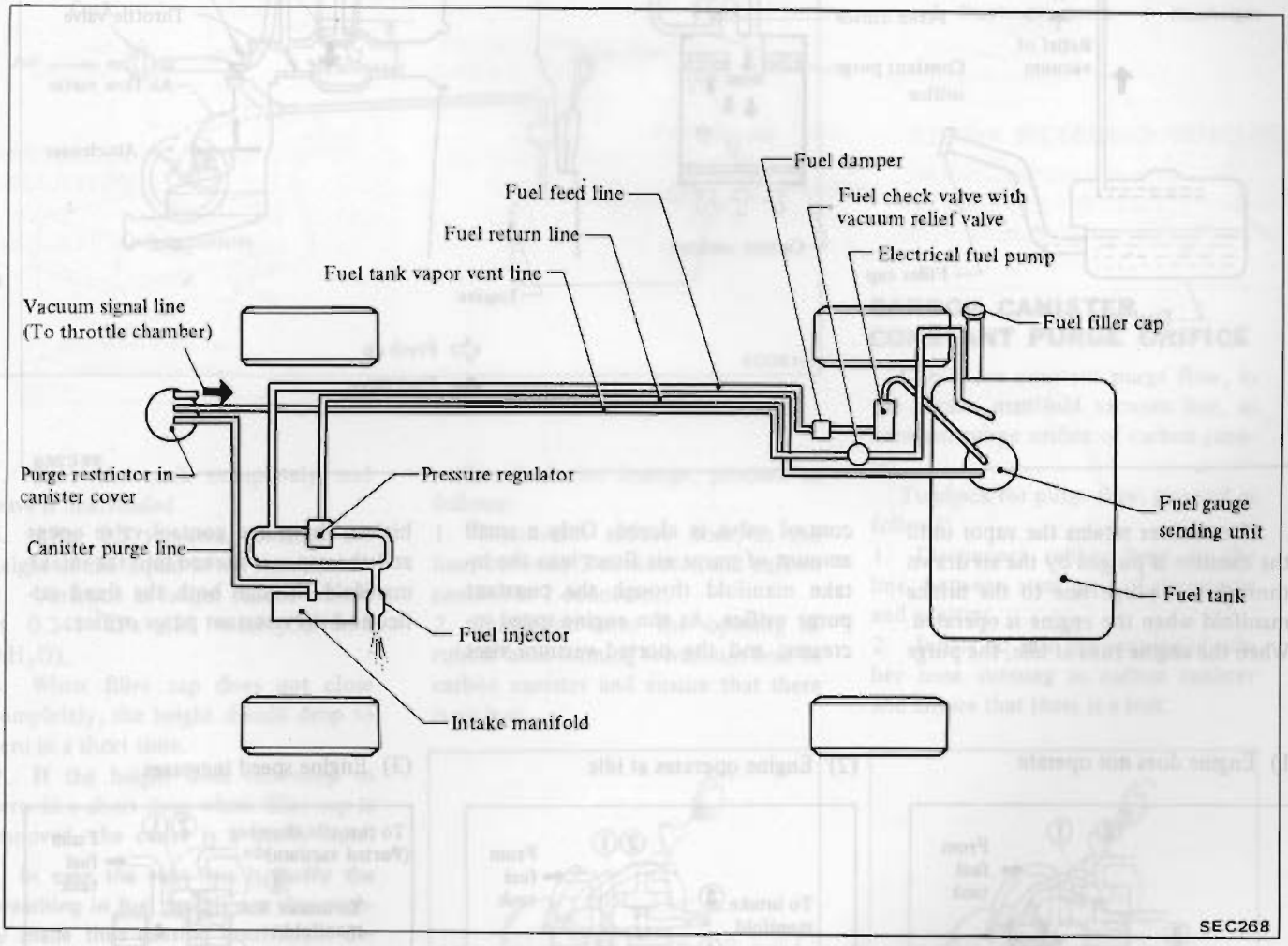
EVAPORATIVE EMISSON CONTROL SYSTEM

DESCRIPTION

The evaporative emission control system is used to reduce hydrocarbons emitted to the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the carbon canister.

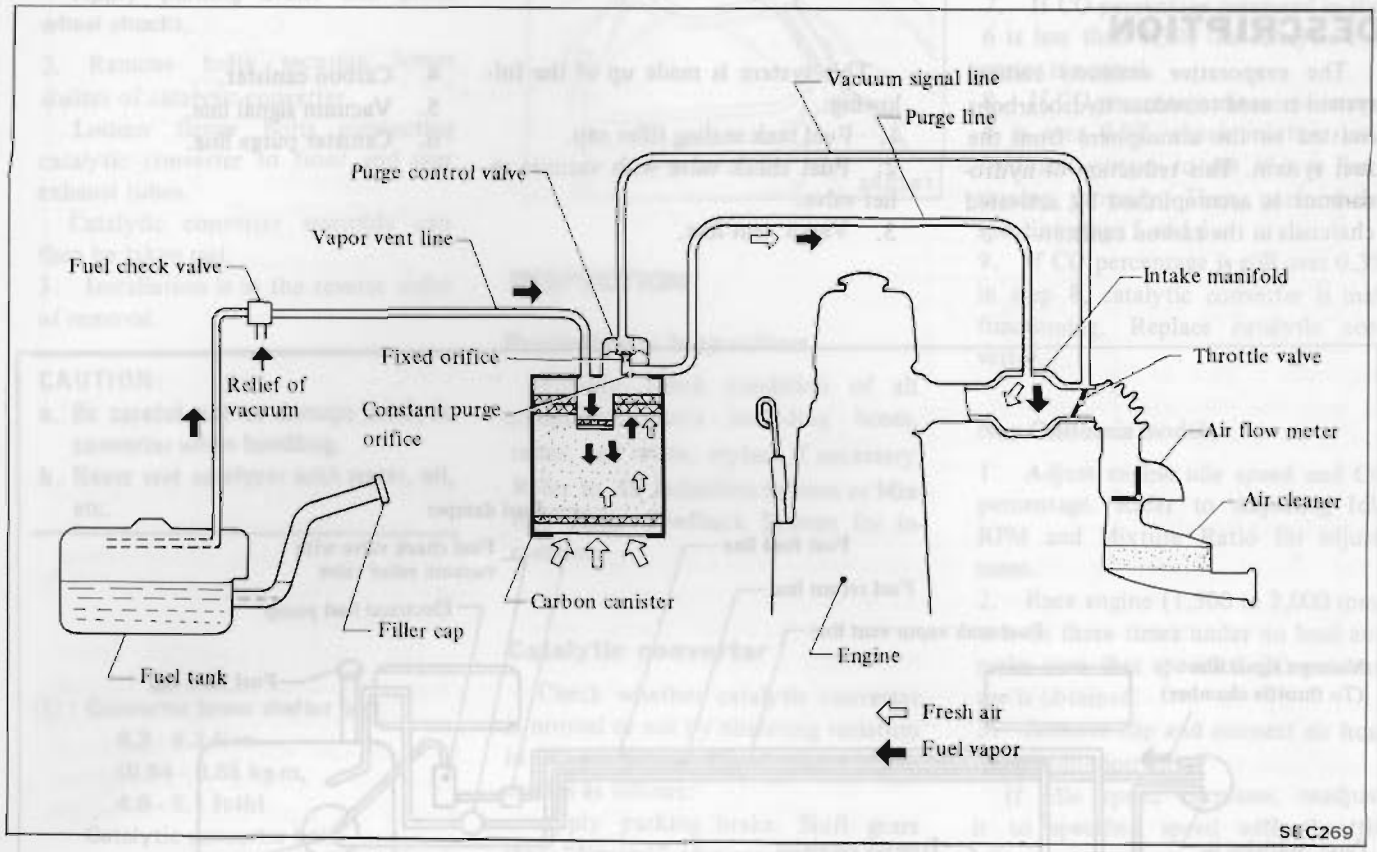
This system is made up of the following:

1. Fuel tank sealing filler cap.
2. Fuel check valve with vacuum relief valve.
3. Vapor vent line.
4. Carbon canister.
5. Vacuum signal line.
6. Canister purge line.



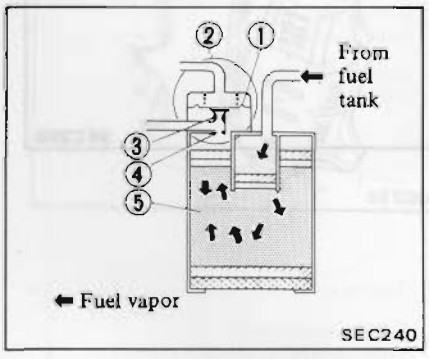
OPERATION

Fuel vapors from the sealed fuel tank are led into the carbon canister, which is filled with activated charcoals, and stored there when the engine is not running.



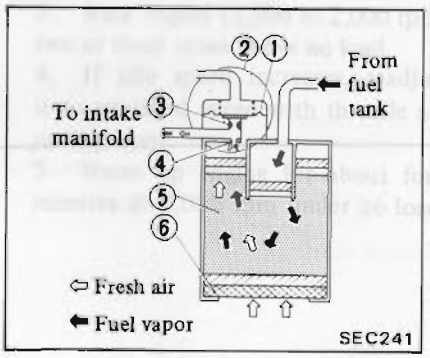
The canister retains the vapor until the canister is purged by the air drawn through the purge line to the intake manifold when the engine is operated. When the engine runs at idle, the purge control valve is closed. Only a small amount of purge air flows into the intake manifold through the constant purge orifice. As the engine speed increases, and the ported vacuum rises higher, the purge control valve opens and the vapor is sucked into the intake manifold through both the fixed orifice and the constant purge orifice.

(1) Engine does not operate



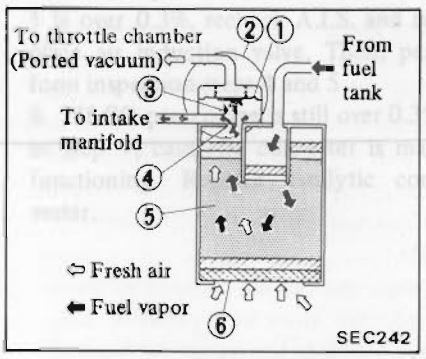
1 Diaphragm
2 Purge control valve
3 Fixed orifice
4 Constant fixed orifice
5 Activated carbon

(2) Engine operates at idle



1 Diaphragm
2 Purge control valve
3 Fixed orifice
4 Constant fixed orifice
5 Activated carbon
6 Filter

(3) Engine speed increases

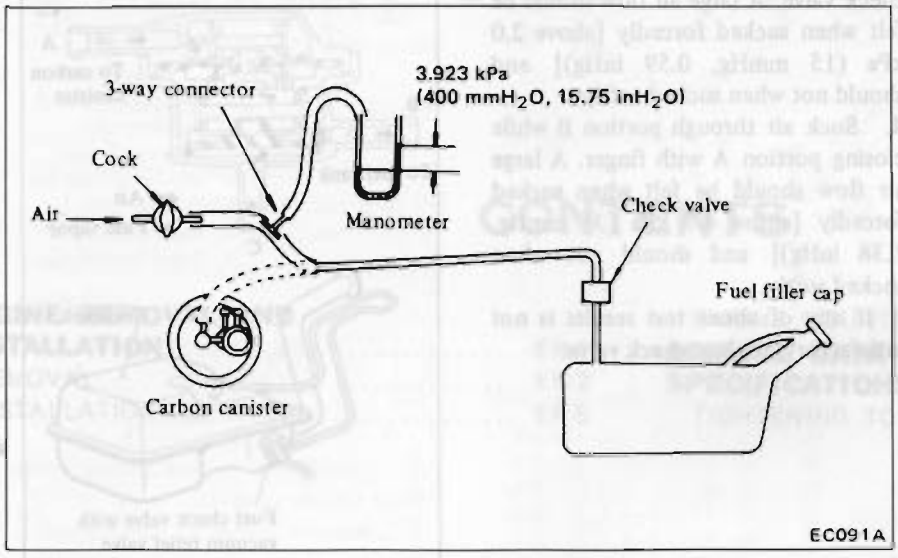


1 Diaphragm
2 Purge control valve
3 Fixed orifice
4 Constant fixed orifice
5 Activated carbon
6 Filter

INSPECTION

FUEL TANK AND VAPOR VENT LINE

1. Check all hoses and fuel tank filler cap.
2. Disconnect the vapor vent line connecting carbon canister to fuel tank.
3. Connect a 3-way connector, a manometer and a cock (or an equivalent 3-way charge cock) to the end of the vent line.
4. Supply fresh air into the vapor vent line through the cock little by little until pressure becomes 3.923 kPa (400 mmH_2O, 15.75 inH_2O).



5. Shut the cock completely and leave it unattended.
6. After 2.5 minutes, measure the height of the liquid in the manometer.
7. Variation in height should remain at 0.245 kPa (25 mmH_2O, 0.98 inH_2O).
8. When filler cap does not close completely, the height should drop to zero in a short time.
9. If the height does not drop to zero in a short time when filler cap is removed, the cause is a stuffy hose.

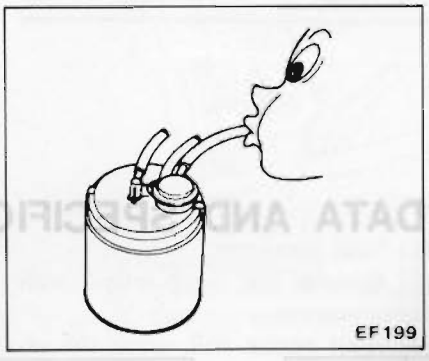
In case the vent line is stuffy the breathing in fuel tank is not thoroughly made thus causing insufficient deliver of fuel to engine or vapor lock. It must, therefore, be repaired or replaced.

CARBON CANISTER PURGE CONTROL VALVE

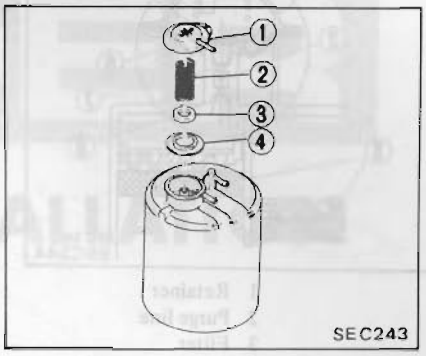
Check for fuel vapor leakage, in the distributor vacuum line, at diaphragm of carbon canister purge control valve.

To check for leakage, proceed as follows:

1. Disconnect rubber hose, in the line, between T-connector and carbon canister at T-connector.
2. Inhale air into the opening of rubber hose running to vacuum hole in carbon canister and ensure that there is no leak.



3. If there is a leak, remove top cover from purge control valve and check for dislocated or cracked diaphragm. If necessary, replace diaphragm kit (which is made up of a retainer, diaphragm and spring).



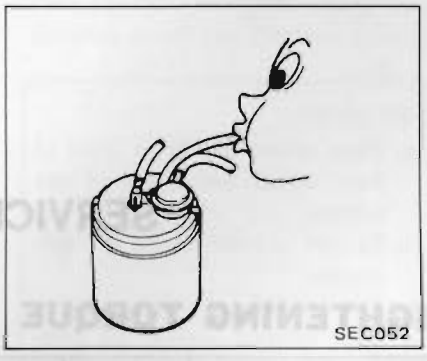
1 Cover
2 Diaphragm spring
3 Retainer
4 Diaphragm

CARBON CANISTER CONSTANT PURGE ORIFICE

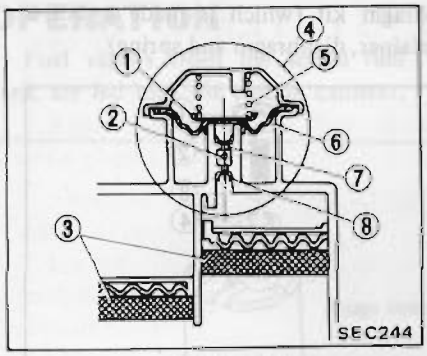
Check for constant purge flow, in the intake manifold vacuum line, at constant purge orifice of carbon canister.

To check for purge flow, proceed as follows:

1. Disconnect rubber hose, in the line, between steel pipe of the engine and canister.
2. Inhale air into the opening of rubber hose running to carbon canister and ensure that there is a leak.



3. If there is no leak, remove purge control valve and check constant purge orifice for leak. If necessary, blow constant purge orifice.

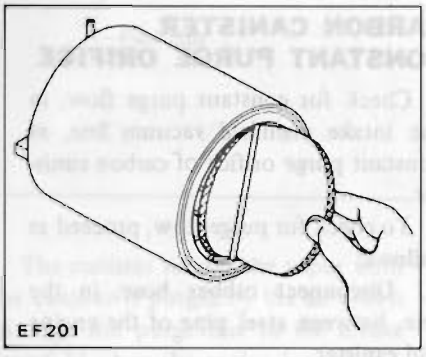


1 Retainer
2 Purge line
3 Filter
4 Purge control valve
5 Spring
6 Diaphragm
7 Purge orifice
8 Constant purge orifice

CARBON CANISTER FILTER

Check for a contaminated element.

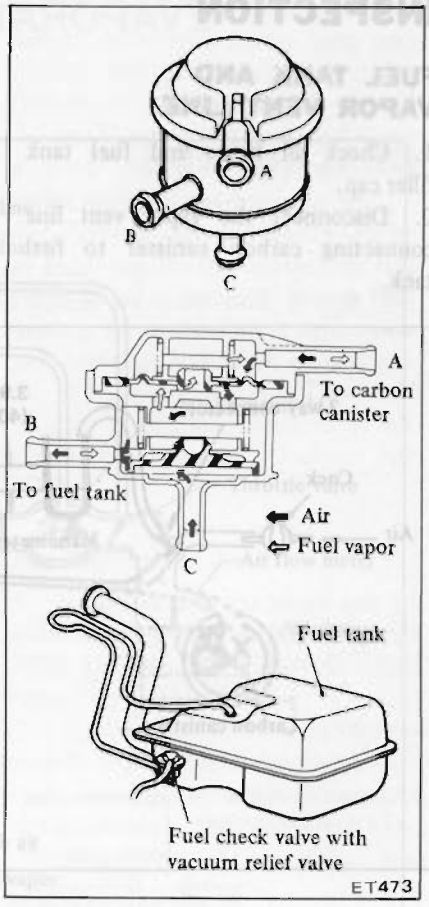
Element can be removed at the bottom of canister installed on car body.



FUEL CHECK VALVE WITH VACUUM RELIEF VALVE

1. Remove check valve from car.
2. Suck air through portion A of check valve. A large air flow should be felt when sucked forcedly [above 4.9 kPa (37 mmHg, 1.46 inHg)] and should not when sucked softly.
3. Suck air through portion B of check valve. A large air flow should be felt when sucked forcedly [above 2.0 kPa (15 mmHg, 0.59 inHg)] and should not when sucked softly.
4. Suck air through portion B while closing portion A with finger. A large air flow should be felt when sucked forcedly [above 4.7 kPa (35 mmHg, 1.38 inHg)] and should not when sucked softly.

If any of above test results is not satisfactory, replace check valve.



SERVICE DATA AND SPECIFICATIONS

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
E.G.R. tube securing nut	34 - 44	3.5 - 4.5	25 - 33
E.A.I. tube securing nut	34 - 44	3.5 - 4.5	25 - 33
Thermal vacuum valve	Less than 22	Less than 2.2	Less than 16

Unit	N·m	kg-m	ft-lb
B.P.T. valve mounting screw	3.7 - 5.0	0.38 - 0.51	2.7 - 3.7
Catalytic converter bolt	31 - 42	3.2 - 4.3	23 - 31
Exhaust gas sensor	39 - 49	4.0 - 5.0	29 - 36