

# EMISSION CONTROL SYSTEMS

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**EC**

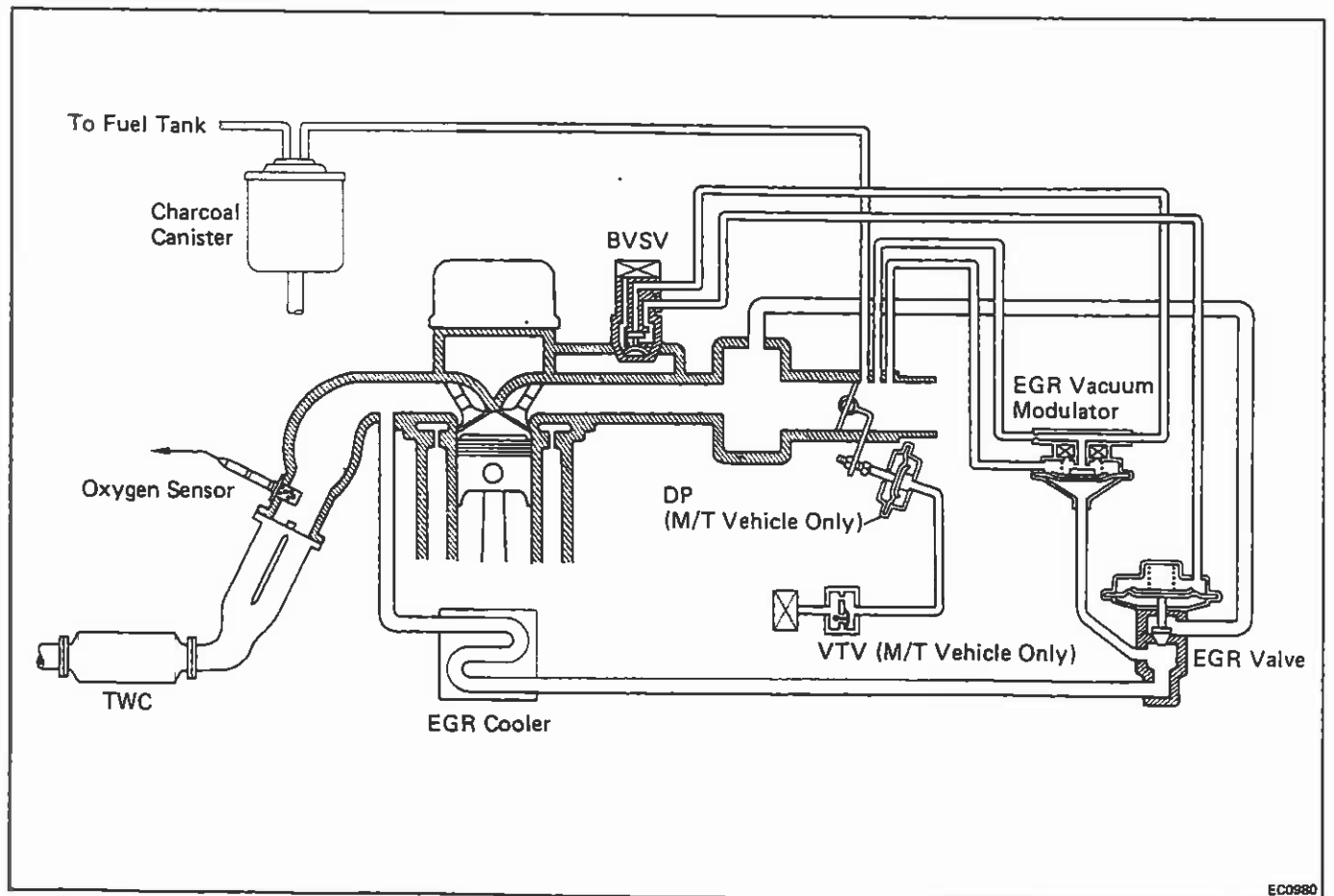
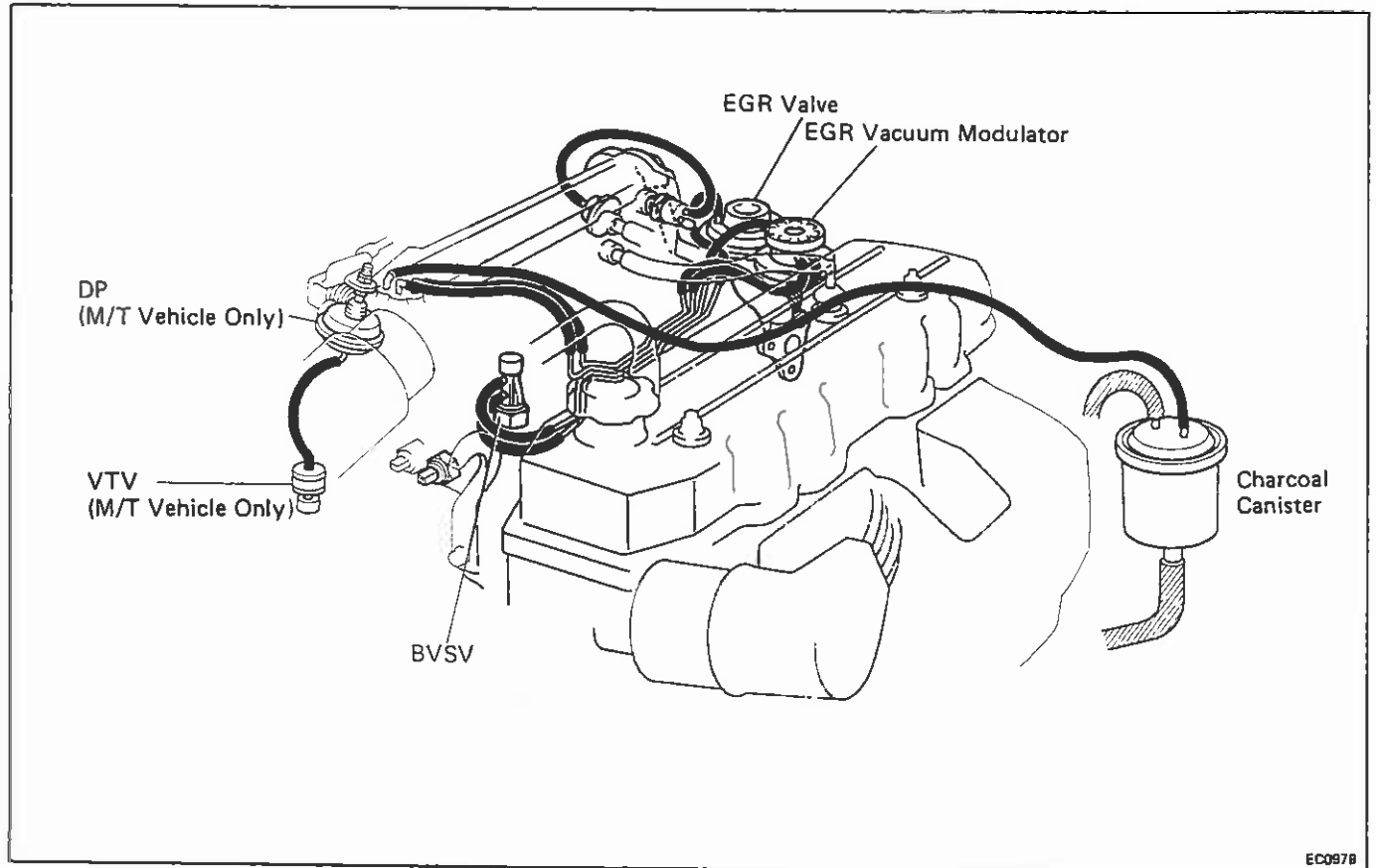
NOTE: TROUBLESHOOTING  
See page EM-2

**SYSTEM PURPOSE**

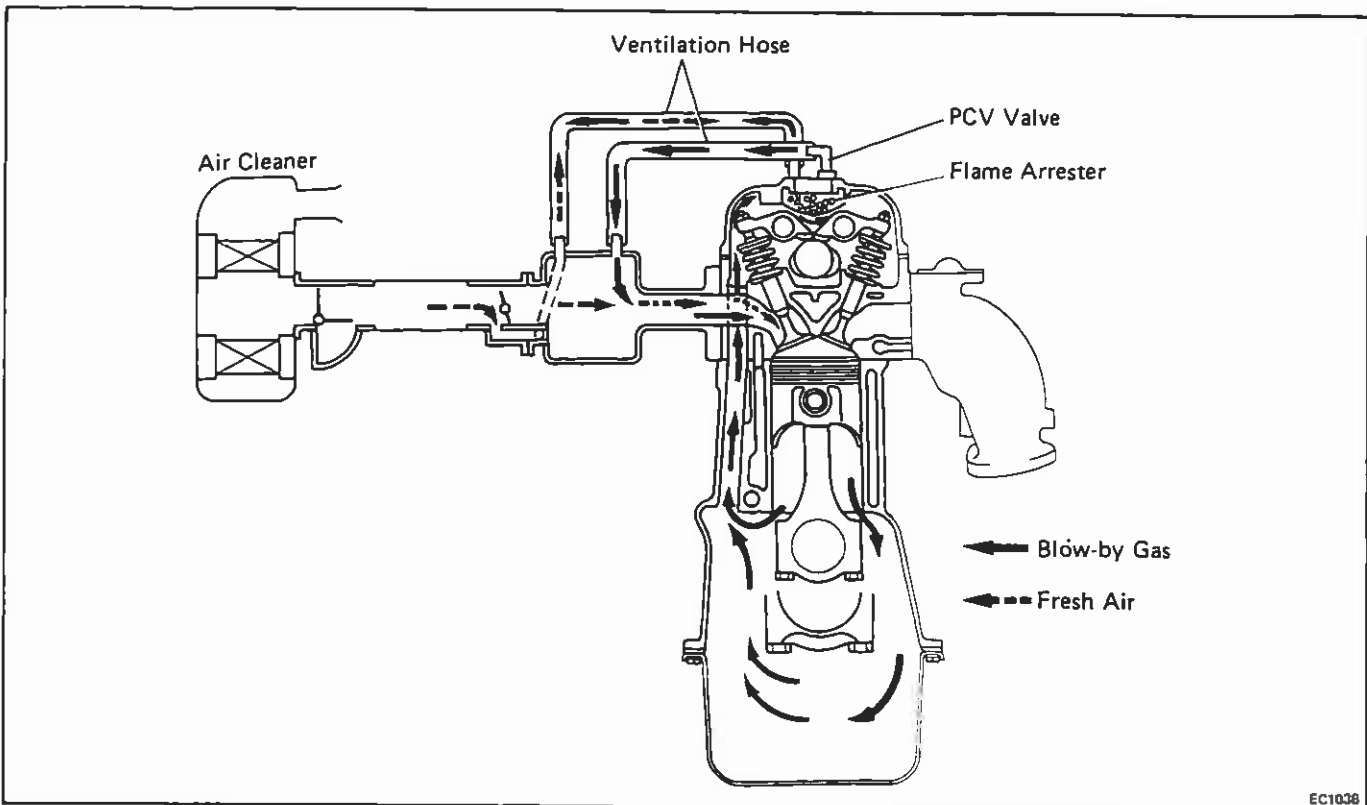
System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow-by gas (HC)
Fuel evaporative emission control	EVAP	Reduces evaporative HC
Dash pot *	DP	Reduces HC and CO performance at idle
Exhaust gas recirculation	EGR	Reduces NOx
Three-way catalyst	TWC	Reduces HC, CO and NOx
Electronic fuel injection **	EFI	Regulates all engine conditions for reduction of exhaust emissions.

Remark \* M/T Vehicles Only

\*\* For inspection and repair of the EFI system, refer to EFI section.

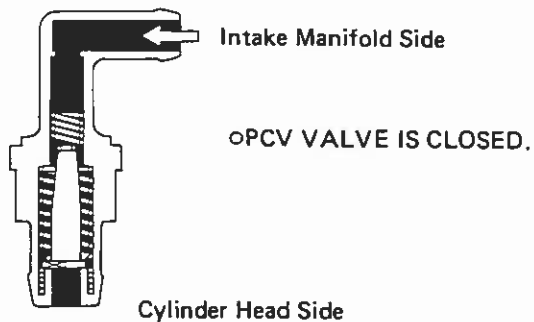
**COMPONENT LAYOUT AND SCHEMATIC DRAWING**

## POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

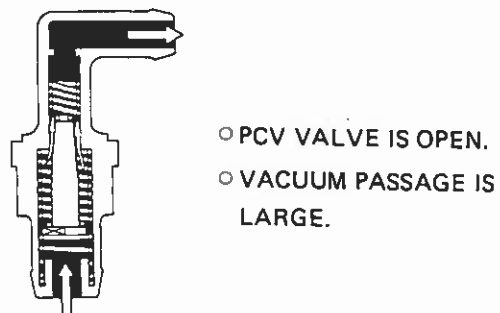


To reduce HC emissions, crankcase blow-by gas (HC) is routed through the PCV valve to the intake manifold for combustion in the cylinders.

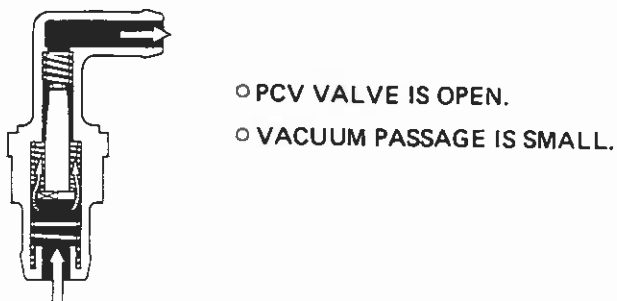
### Engine not Running or Backfiring



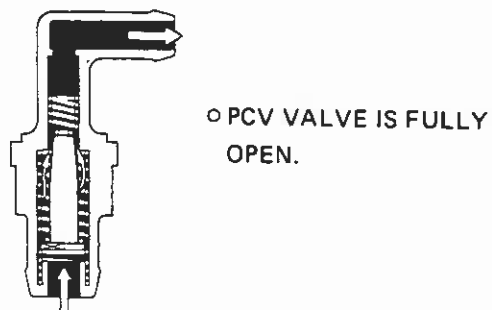
### Normal Operation

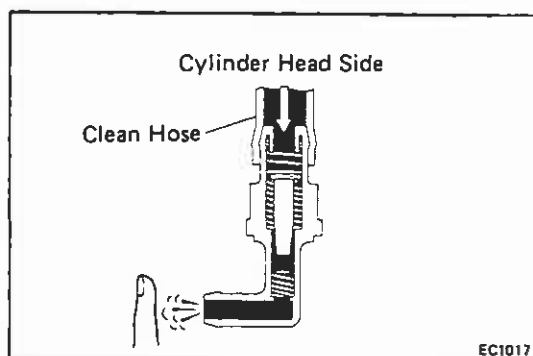


### Idling or Decelerating



### Acceleration or Heavy Load



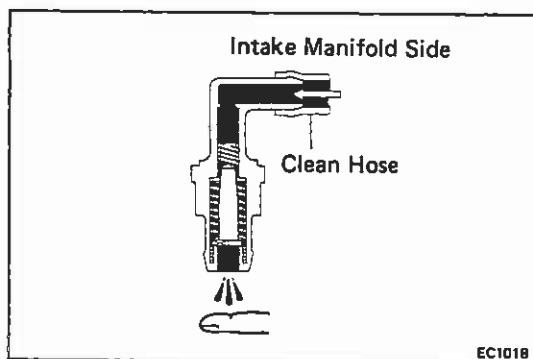


## INSPECTION OF PCV VALVE

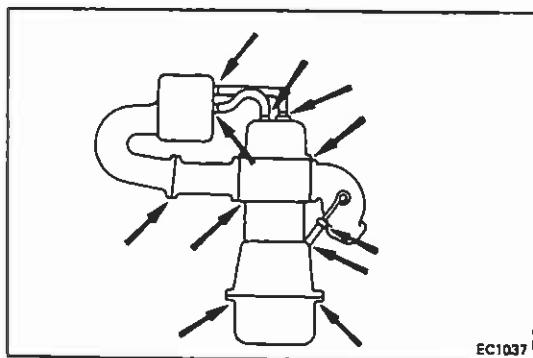
1. REMOVE PCV VALVE
2. ATTACH CLEAN HOSE TO PCV VALVE
3. BLOW FROM CYLINDER HEAD SIDE

Check that air passes through easily.

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



4. BLOW FROM INTAKE MANIFOLD SIDE
- Check that air passes through with difficulty. If the PCV valve fails either check, replace it.
5. REINSTALL PCV VALVE

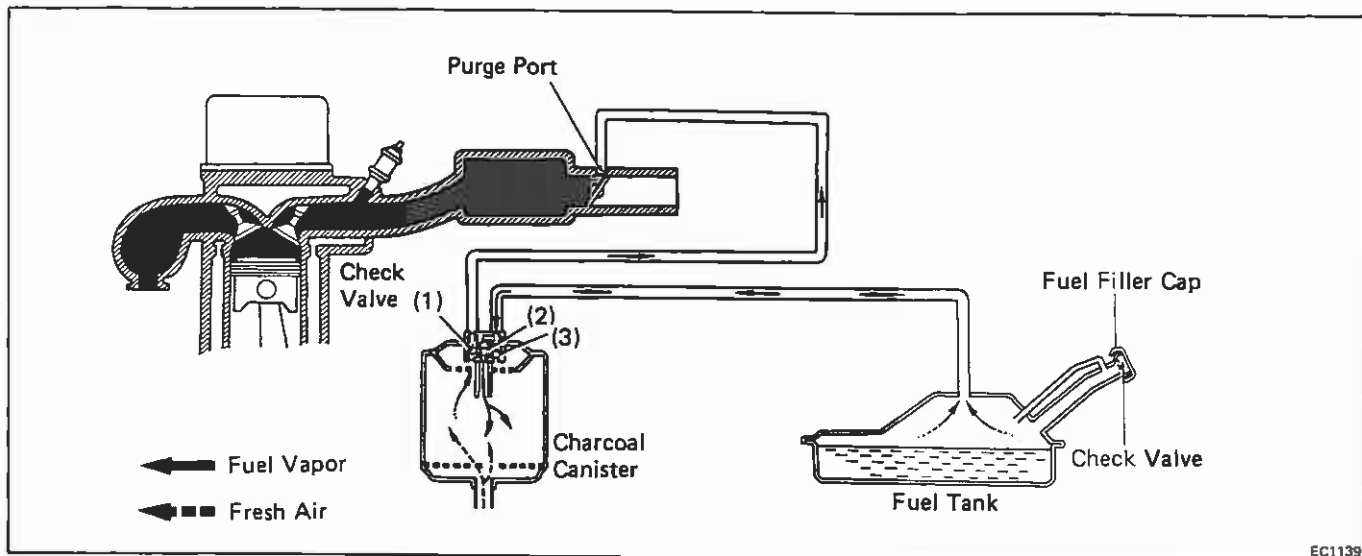


## INSPECTION OF PCV HOSES AND CONNECTIONS

**VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS**

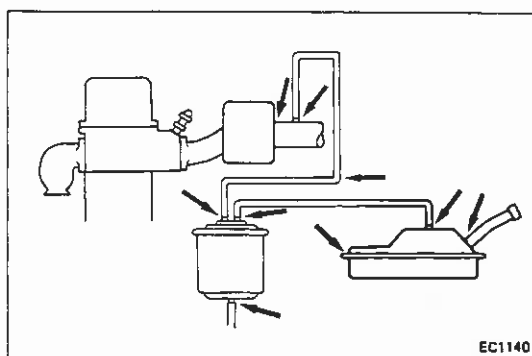
Check for cracks, leaks or damage.

## FUEL EVAPORATIVE EMISSION CONTROL (EVAP) SYSTEM



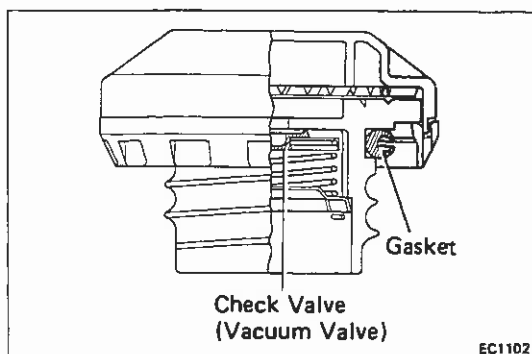
To reduce HC emission, evaporated fuel from the fuel tank is routed through the charcoal canister to the throttle body for combustion in the cylinders.

Condition	Check Valve in Charcoal Canister			Check Valve in Fuel Filler Cap	Evaporated Fuel (HC)
	(1)	(2)	(3)		
Parking, idling and low speed	CLOSED	—	—	—	HC from tank is absorbed in the canister.
Medium and high speed	OPEN	—	—	—	HC from canister is led into throttle body.
High pressure in tank	—	OPEN	CLOSED	CLOSED	HC from tank is absorbed in the canister.
High vacuum in tank	—	CLOSED	OPEN	OPEN	(Air is led into the tank.)

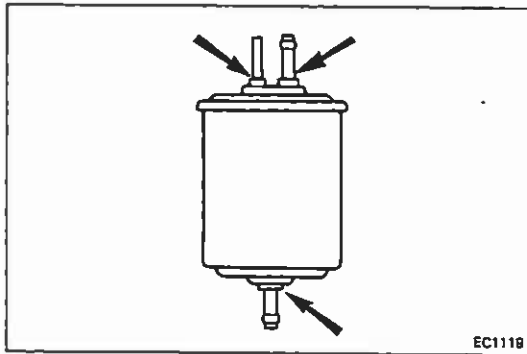


### INSPECTION OF FUEL VAPOR LINES, FUEL TANK AND FILLER CAP

- VISUALLY INSPECT LINES AND CONNECTIONS**  
Look for loose connections, sharp bends or damage.
- VISUALLY INSPECT FUEL TANK**  
Look for deformation, cracks or fuel leakage.



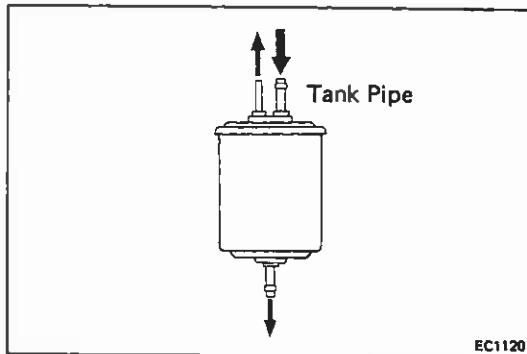
- VISUALLY INSPECT FUEL FILLER CAP**  
Look for a damaged or deformed gasket and cap.  
If necessary, repair or replace the cap.



## INSPECTION OF CHARCOAL CANISTER

1. REMOVE CHARCOAL CANISTER
2. VISUALLY INSPECT CHARCOAL CANISTER CASE

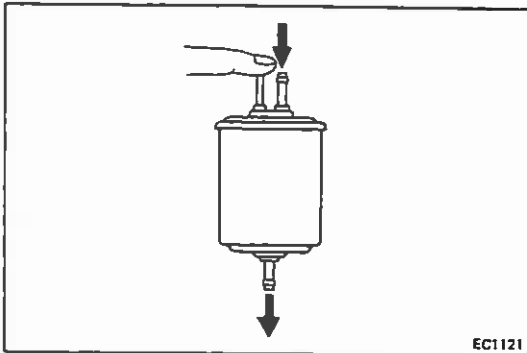
Look for cracks or damage.



3. CHECK FOR CLOGGED FILTER AND STUCK CHECK VALVE

- (a) Using low pressure compressed air, blow into the tank pipe and check that the air flows without resistance from the other pipes.
- (b) Blow into the purge pipe and check that the air does not flow from the other pipes.

If a problem is found, replace the charcoal canister.



4. CLEAN CANISTER FILTER

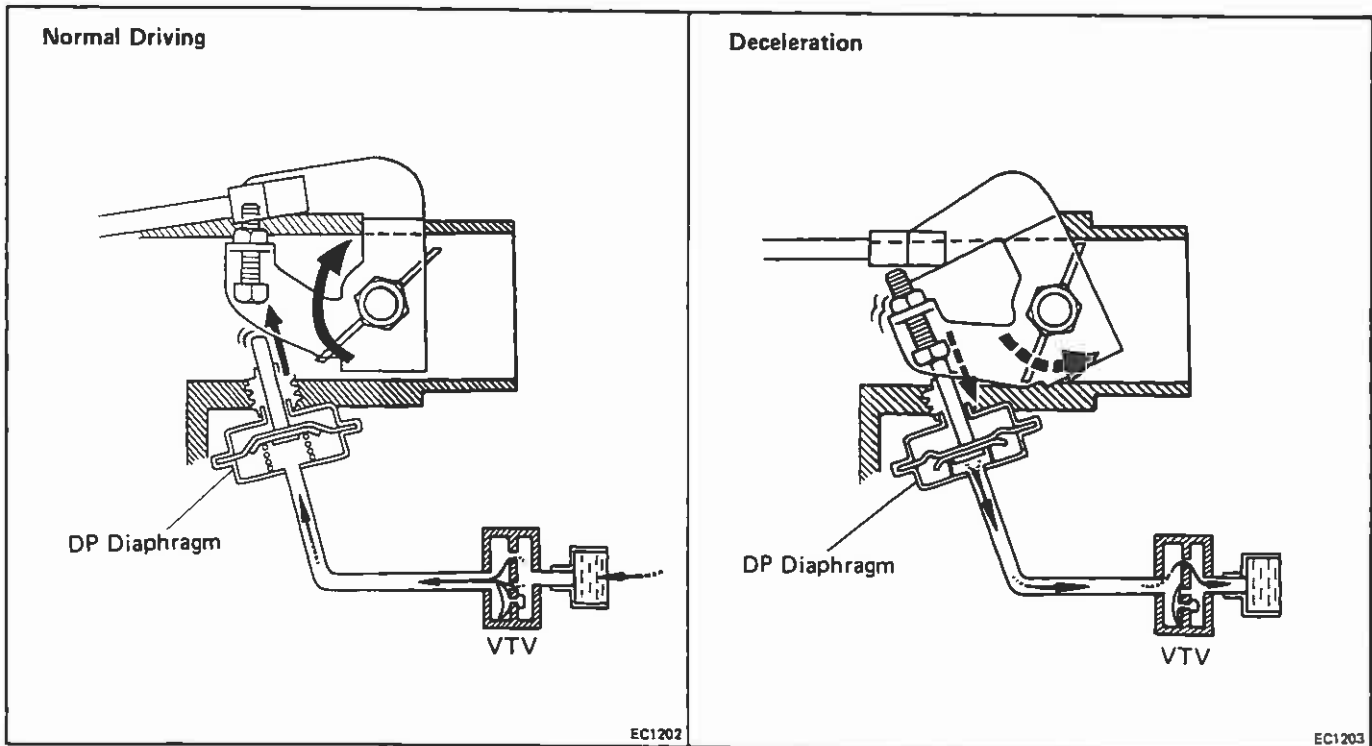
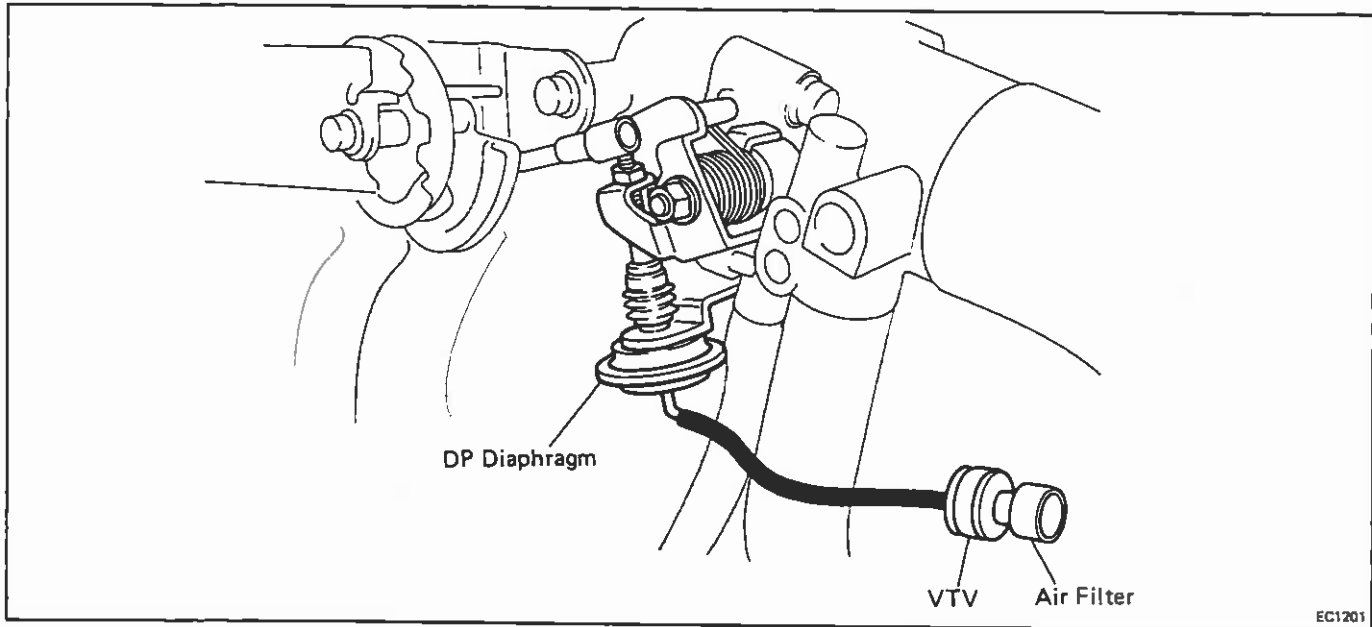
Clean the filter by blowing 3 kg/cm<sup>2</sup> (43 psi, 294 kPa) of compressed air into the tank pipe, while holding the other upper canister pipe closed.

### NOTE:

- Do not attempt to wash the canister.
- No activated carbon should come out.

5. INSTALL CHARCOAL CANISTER

## DASH POT (DP) SYSTEM (M/T Vehicles Only)



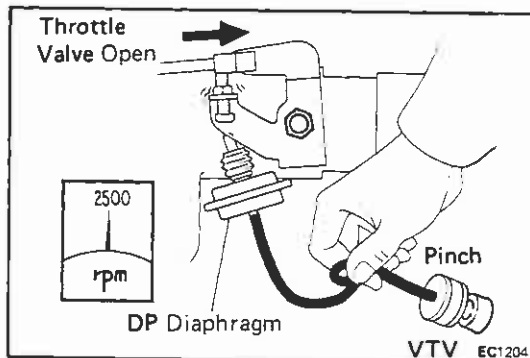
To reduce HC and CO emissions, when decelerating the dash pot opens the throttle valve slightly more than at idle. This causes the air-fuel mixture to burn completely.

Condition	DP Diaphragm	VTV	Throttle Valve
Idling	Pushed in by return force of throttle valve	CLOSED	Idle speed position
Normal driving	Pushed out by diaphragm spring	OPEN	High speed position
Deceleration	Pushed in by return force of throttle valve	CLOSED	Slightly opens and then slowly closes to idle position

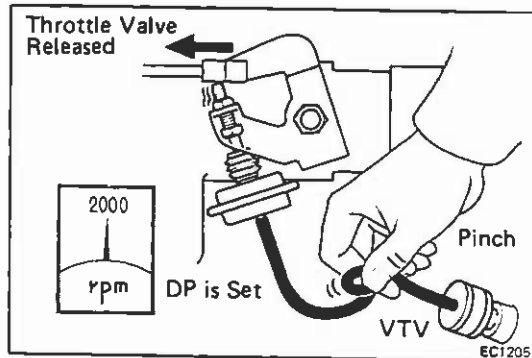


**INSPECTION OF DP SYSTEM**

1. WARM UP ENGINE
2. CHECK IDLE SPEED AND ADJUST, IF NECESSARY

**3. CHECK DP SETTING SPEED**

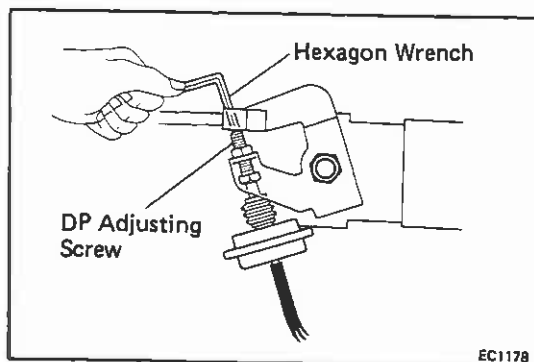
- (a) Maintain the engine at 2,500 rpm.
- (b) Pinch the vacuum hose between the DP and VTV.



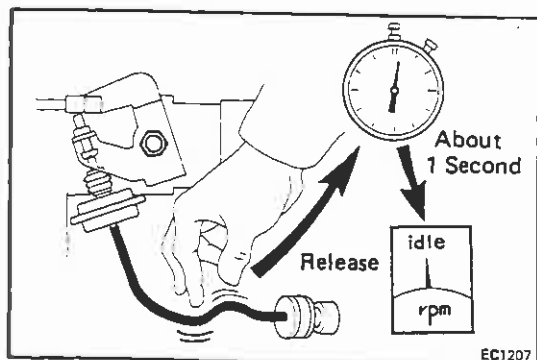
- (c) Release the throttle valve.

- (d) Check that the DP is set.

DP setting speed: 2,000 rpm

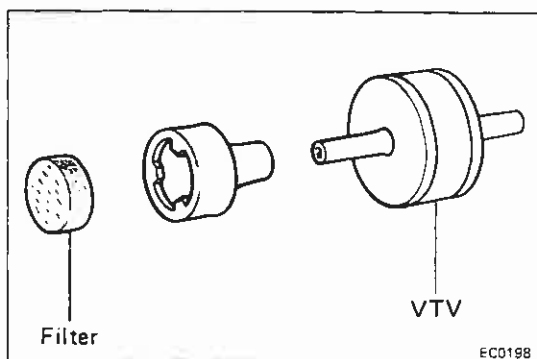


If not at specified speed, adjust with the DP adjusting screw.

**4. CHECK OPERATION OF VTV**

- (a) Set the DP speed in the same procedure as above; 3. (a) to (c).
- (b) Release the pinched hose and check that the engine returns to idle speed in about 1 second.

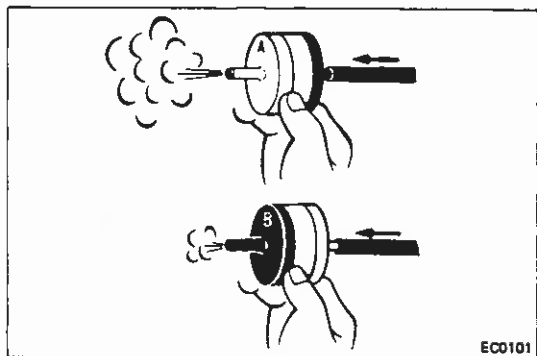
IF NO PROBLEM IS FOUND WITH THIS INSPECTION, THE SYSTEM IS OKAY; OTHERWISE INSPECT EACH PART



### INSPECTION OF VTV

#### 1. CHECK AND CLEAN FILTER ON VTV

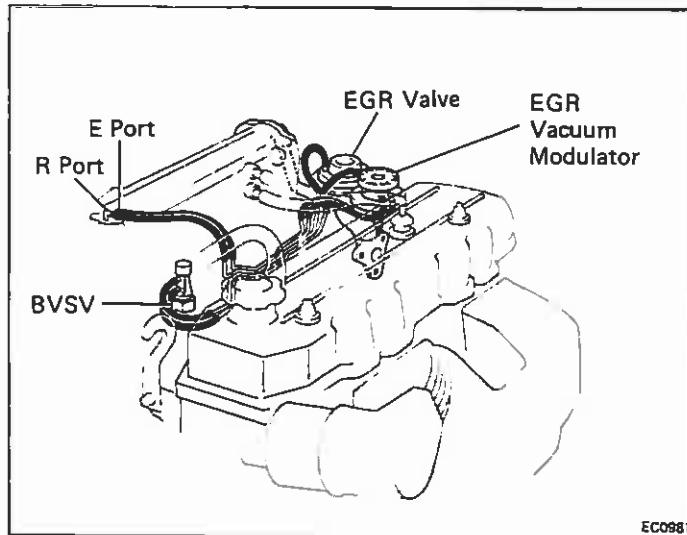
- (a) Check the filter for contamination or damage.
- (b) Using compressed air, clean the filter.



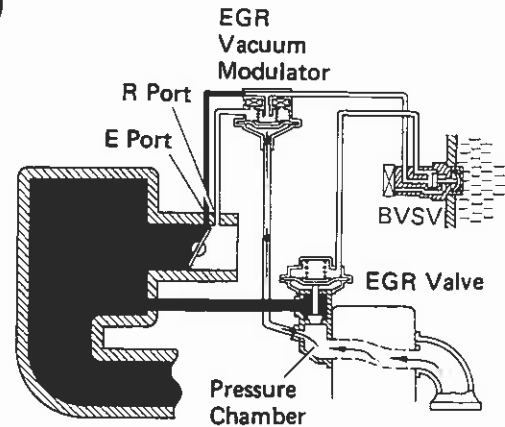
#### 2. CHECK VTV BY BLOWING AIR INTO EACH SIDE

- (a) Check that air flows without resistance from B to A.
- (b) Check that air flows with difficulty from A to B.

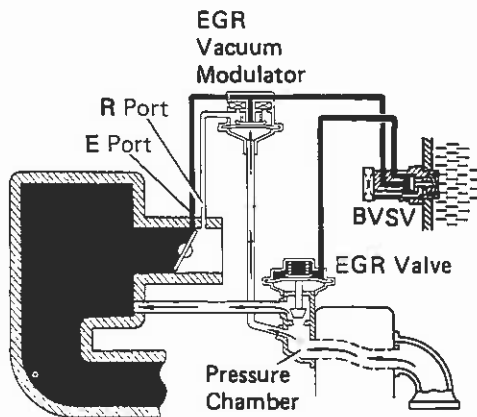
# EXHAUST GAS RECIRCULATION (EGR) SYSTEM



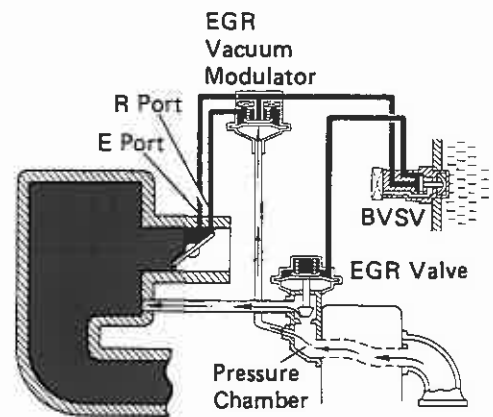
(1)



(2)



(3)

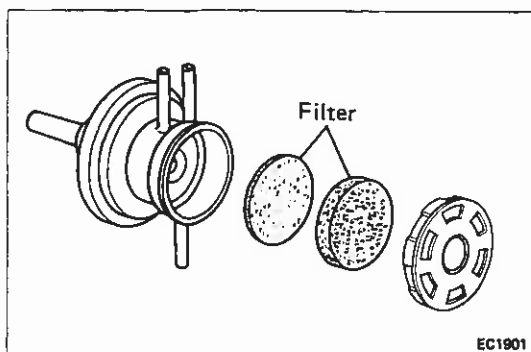


To reduce NO<sub>x</sub> emission, part of the exhaust gases are recirculated through the EGR valve to the intake manifold to lower the maximum combustion temperature.

Coolant Temp.	BVSV	Throttle Valve Opening Angle	Pressure in the EGR Valve Pressure Chamber		EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 30°C (86°F)	CLOSED	—	—		—	CLOSED	Not recirculated
Above 44°C (111°F)	OPEN	Positioned below E port	—		—	CLOSED	Not recirculated
		Positioned between E port & R port	(1) LOW	*Pressure constantly alternating between low and high	OPENS passage to atmosphere	CLOSED	Not recirculated
			(2) HIGH		CLOSES passage to atmosphere	OPEN	Recirculated
		Positioned above R port	(3) HIGH	**	CLOSES passage to atmosphere	OPEN	Recirculated (increase)

Remarks: \*Pressure increase → Modulator closes → EGR valve opens → Pressure drops  
 ← EGR valve closes ← Modulator opens ←

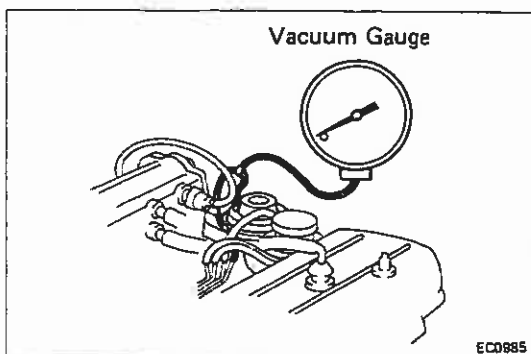
\*\*When the throttle valve is positioned above the R port, the EGR vacuum modulator will close the atmosphere passage and open the EGR valve to increase the EGR gas, even if the exhaust pressure is insufficiently low.



## INSPECTION OF EGR SYSTEM

### 1. CHECK AND CLEAN FILTER IN EGR VACUUM MODULATOR

- Check the filter for contamination or damage.
- Using compressed air, clean the filter.

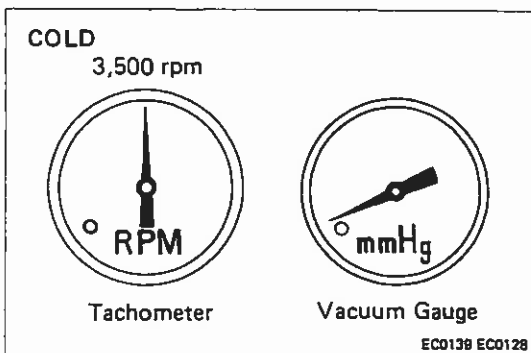


### 2. PREPARATION

Disconnect the vacuum hose from the EGR valve and, using a three way union, connect a vacuum gauge to it.

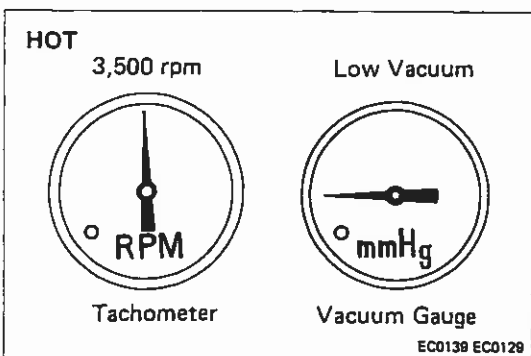
### 3. CHECK SEATING OF EGR VALVE

Start the engine and check that the engine starts and runs at idle.



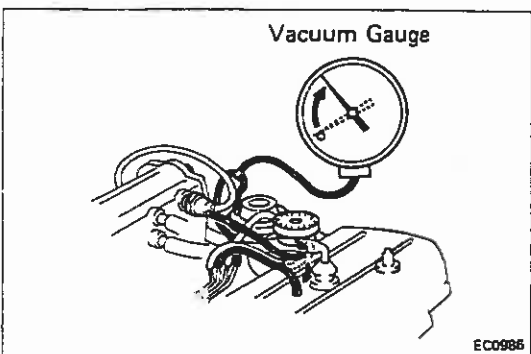
### 4. CHECK BVSV WITH COLD ENGINE

- The coolant temperature should be below 30°C (86°F).
- Check that the vacuum gauge indicates zero at 3,500 rpm.



### 5. CHECK BVSV AND EGR VACUUM MODULATOR WITH HOT ENGINE

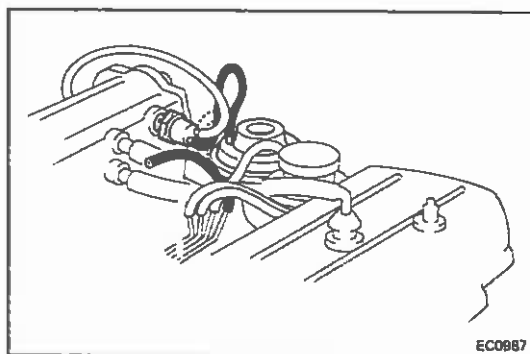
- Warm up the engine.
- Check that the vacuum gauge indicates low vacuum at 3,500 rpm.



- Disconnect the vacuum hose from R port of the EGR vacuum modulator and connect the R port directly to the intake manifold with another hose.
- Check that the vacuum gauge indicates high vacuum at 3,500 rpm.

NOTE: As a large amount of EGR gas enters, the engine will misfire slightly.

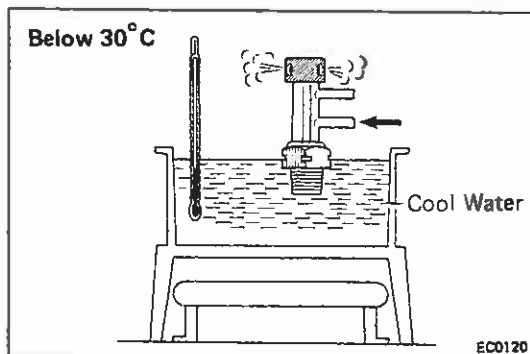
- Disconnect the vacuum gauge and reconnect the vacuum hoses to their proper locations.



## 6. CHECK EGR VALVE

- Apply vacuum directly to the EGR valve with the engine idling.
- Check that the engine runs rough or dies.
- Reconnect the vacuum hoses to their proper location.

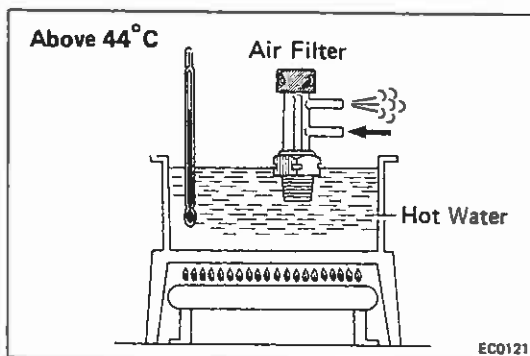
IF NO PROBLEM IS FOUND WITH THIS INSPECTION, THE SYSTEM IS OKAY; OTHERWISE INSPECT EACH PART



## INSPECTION OF BVS

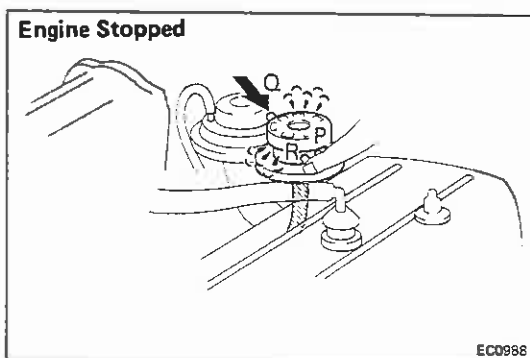
### CHECK BVS BY BLOWING AIR INTO PIPE

- Drain the coolant from the radiator into a suitable container.
- Remove the BVS.
- Cool the BVS to below 30°C (86°F).
- Check that air flows from pipe J to the air filter.



- Heat the BVS to above 44°C (111°F).
- Check that air flows from pipe J to pipe K.
- Apply liquid sealer to the threads of the BVS and reinstall.
- Fill the radiator with coolant.

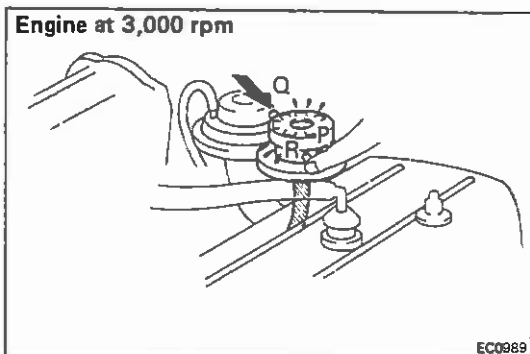
If a problem is found, replace the BVS.



## INSPECTION OF EGR VACUUM MODULATOR

### CHECK EGR VACUUM MODULATOR OPERATION

- Disconnect the vacuum hoses from port P, Q and R of the EGR vacuum modulator.
- Plug port P and R with your finger.
- Blow air into port Q. Check that the air passes through to the air filter side freely.
- Start the engine and maintain the speed at 3,000 rpm.
- Repeat the above test. Check that there is a strong resistance to air flow.
- Reconnect the vacuum hoses to the proper locations.



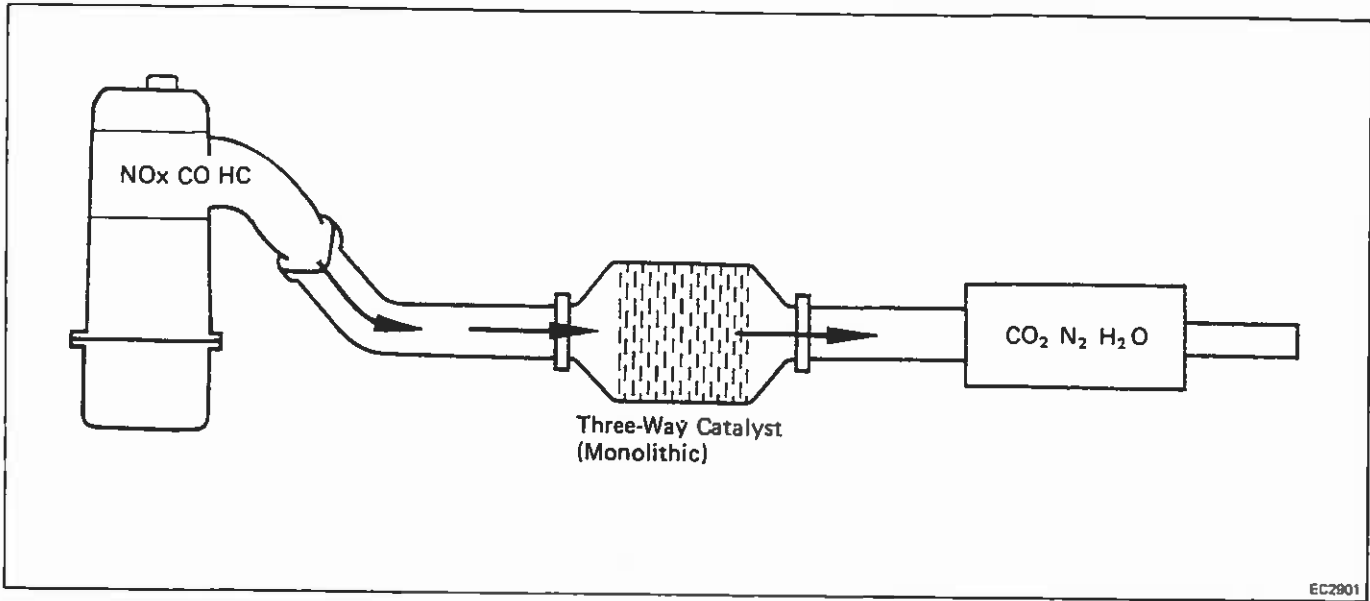
## INSPECTION OF EGR VALVE

### 1. REMOVE EGR VALVE

Check the valve for sticking and heavy carbon deposits. If a problem is found, replace it.

### 2. INSTALL EGR VALVE WITH A NEW GASKET

## THREE-WAY CATALYST (TWC) SYSTEM

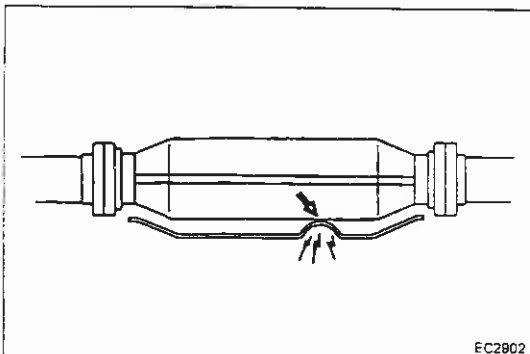


To reduce HC, CO and NO<sub>x</sub> emissions, they are oxidized, reduced and converted to nitrogen ( $\text{N}_2$ ), carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ) by the catalyst.

Exhaust Port		TWC		Exhaust Gas
HC, CO and NO <sub>x</sub>	→	Oxidation and reduction	→	$\text{CO}_2$ $\text{H}_2\text{O}$ $\text{N}_2$

### INSPECTION OF EXHAUST PIPE ASSEMBLY

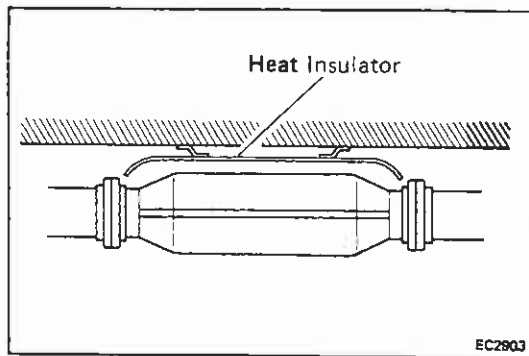
1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE
2. CHECK CLAMPS FOR WEAKNESS, CRACKS OR DAMAGE



### INSPECTION OF CATALYTIC CONVERTER

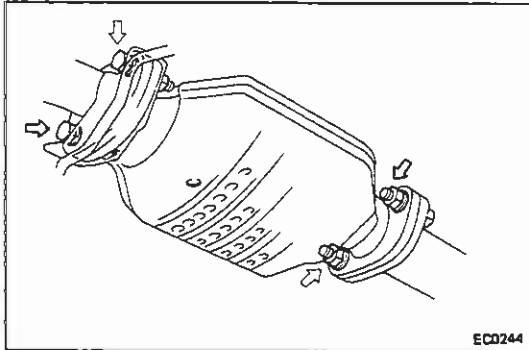
#### CHECK FOR DENTS OR DAMAGE

If any part of the protector is damaged or dented to the extent that it contacts the catalyst, repair or replace it.



## INSPECTION OF HEAT INSULATOR

1. CHECK HEAT INSULATOR FOR DAMAGE
2. CHECK FOR ADEQUATE CLEARANCE BETWEEN CATALYTIC CONVERTER AND HEAT INSULATOR



## REPLACEMENT OF CATALYTIC CONVERTER

1. REMOVE CONVERTER
  - (a) Jack up the vehicle.
  - (b) Check that the converter is cool.
  - (c) Remove the bolts at the front and rear of the converter.
  - (d) Remove the converter and gaskets.
2. INSTALL CONVERTER
  - (a) Place new gaskets on the converter front and rear pipes, and connect the converter to the exhaust pipes.
  - (b) Tighten the bolts.

**Torque: Catalyst — Exhaust pipe**  
**440 kg-cm (32 ft-lb, 43 N·m)**

  - (c) Reinstall the bracket bolts and tighten them.