

EMISSION CONTROL SYSTEMS

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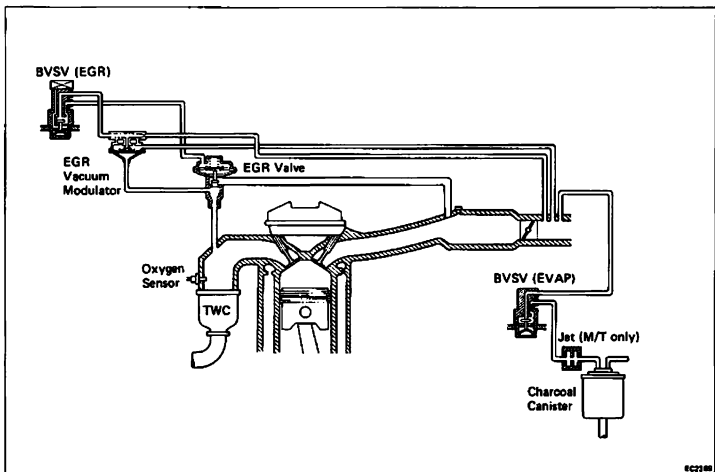
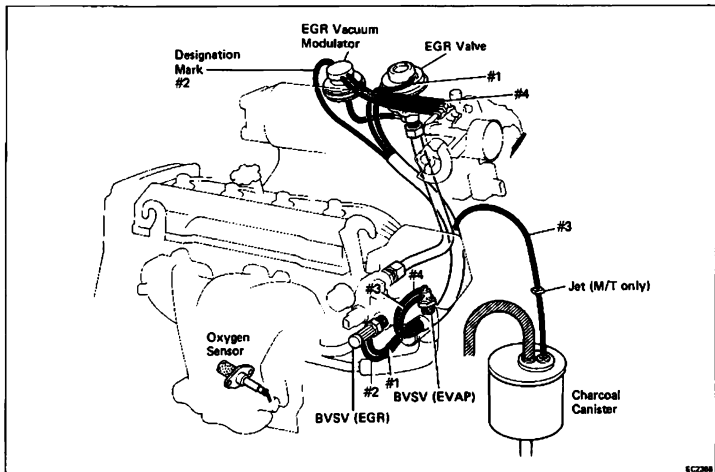
NOTE: TROUBLESHOOTING
See page EM-6

SYSTEM PURPOSE

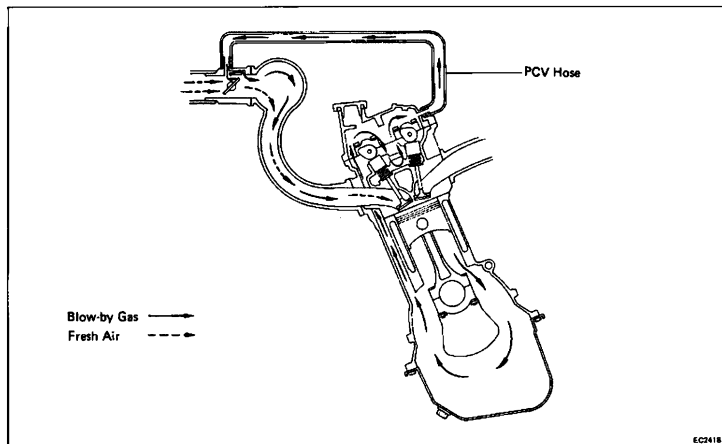
System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduced blow-by gas (HC)
Fuel evaporative emission control	EVAP	Reduced evaporative HC
Exhaust gas recirculation	EGR	Reduces NO _x
Three-way catalyst	TWC	Reduces HC, CO and NO _x
Electronic fuel injection*	EFI	Regulates all engine conditions for reduction of exhaust emissions.

Remarks * For inspection and repair of the EFI system, refer to the EFI section of this manual.

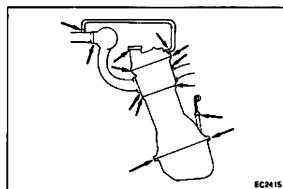
COMPONENT LAYOUT AND SCHEMATIC DRAWING



POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



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

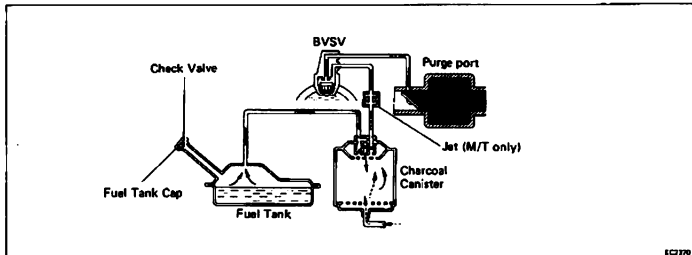


INSPECTION OF PCV HOSE AND CONNECTIONS

VISUALLY INSPECT HOSE AND CONNECTION

Check for cracks, leaks or damage.

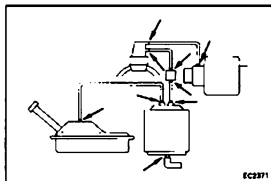
FUEL EVAPORATIVE EMISSION CONTROL (EVAP) SYSTEM



EC270

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

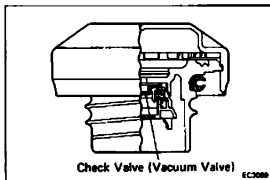
Coolant Temp.	BVSV	Throttle Valve Opening	Canister Check Valve			Check Valve in Cap	Evaporated Fuel (HC)
			(1)	(2)	(3)		
Below 35°C (95°F)	CLOSED	-	-	-	-	-	HC from tank is absorbed into the canister.
Above 54°C (129°F)	OPEN	Positioned below purge port	CLOSED	-	-	-	HC from canister is led into air intake chamber.
		Positioned above purge port	OPEN	-	-	-	
High pressure in tank	-	-	-	OPEN	CLOSED	CLOSED	HC from tank is absorbed into the canister.
High vacuum in tank	-	-	-	CLOSED	OPEN	OPEN	Air is led into the fuel tank.



EC2371

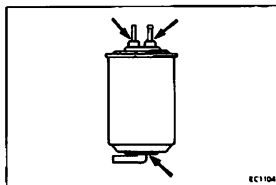
INSPECTION OF FUEL VAPOR LINES, FUEL TANK AND TANK CAP

- 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 TANK CAP**
Check if the cap and/or gasket are deformed or damaged.
If necessary, repair or replace the cap.



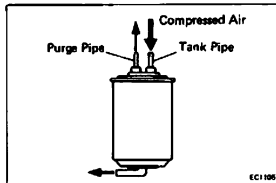
Check Valve (Vacuum Valve)

EC2088



INSPECTION OF CHARCOAL CANISTER

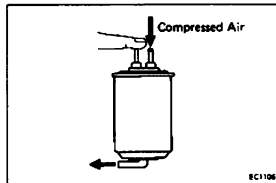
1. REMOVE CHARCOAL CANISTER
2. VISUALLY INSPECT CHARCOAL CANISTER CASE
Look for cracks or damage.



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.



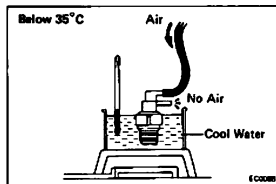
4. CLEAN FILTER IN CANISTER

Clean the filter by blowing 3kg/cm² (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.

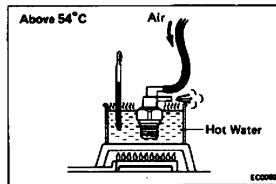
5. INSTALL CHARCOAL CANISTER



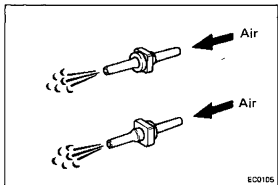
INSPECTION OF BVSV

CHECK BVSV BY BLOWING AIR INTO PIPE

- (a) Drain the coolant from the radiator into a suitable container.
- (b) Remove the BVSV.
- (c) Cool the BVSV to below 35°C (95°F) with cool water.
- (d) Blow air into a pipe and check that the BVSV is closed.



- (e) Heat the BVSV to above 54°C (129°F) with hot water.
 - (f) Blow air into a pipe and check that the BVSV is open.
- If a problem is found, replace the BVSV.
- (g) Apply liquid sealer to the threads of the BVSV and reinstall.
 - (h) Fill the radiator with coolant.

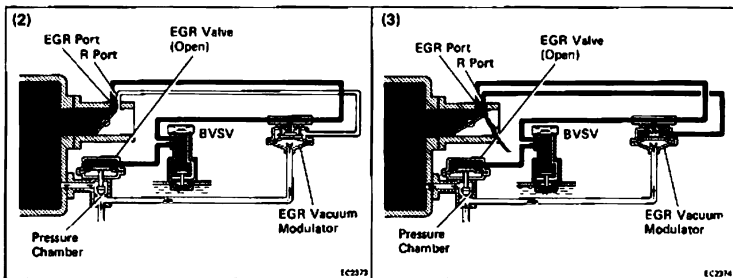
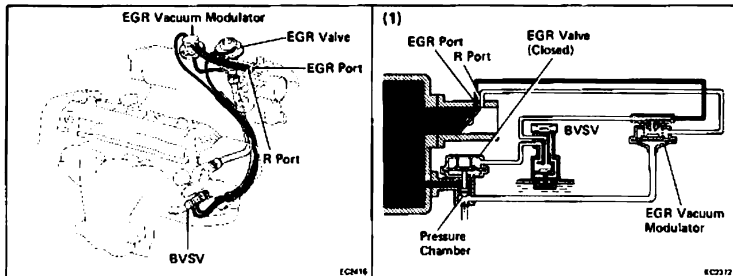


INSPECTION OF JET (M/T only)

CHECK JET BY BLOWING AIR FROM EACH SIDE

Check for stoppage.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

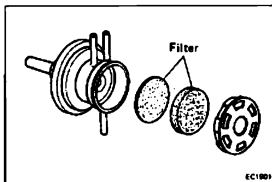


To reduce NO_x emission, part of the exhaust gases are recirculated through the EGR valve to the intake manifold to lower the maximum combustion temperature.

Coolant Temp.	BVSV	Throttle Valve Opening Angle	Pressure in the EGR Valve Pressure Chamber	EGR Vacuum Modulator	EGR Valve	Exhaust Gas	
Below 45°C (113°F)	CLOSED	—	—	—	CLOSED	Not recirculated	
Above 66°C (151°F)	OPEN	Positioned below EGR port	—	—	CLOSED	Not recirculated	
		Positioned between EGR port and R port	(1) LOW	*Pressure constantly alternating between low and high	OPENS passage to atmosphere	CLOSED	Not recirculated
			(2) HIGH	**	CLOSES passage at 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 ←

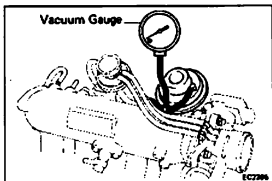
**When the throttle valve is positioned above the R port, the EGR vacuum modulator will close the atmosphere passage and open the EGR valve to increase the EGR gas, even if the exhaust pressure is insufficiently low.



INSPECTION OF EGR SYSTEM

1. CHECK AND CLEAN FILTERS IN EGR VACUUM MODULATOR

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

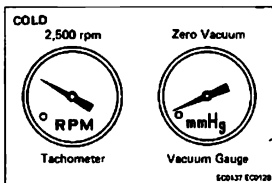


2. PREPARATION

Using a 3-way connector, connect a vacuum gauge to the hose between the EGR valve and vacuum pipe.

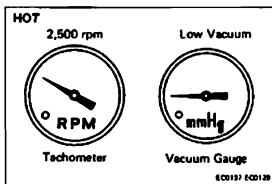
3. CHECK SEATING OF EGR VALVE

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



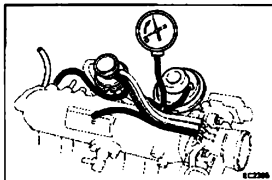
4. CHECK BVSV WITH COLD ENGINE

- The coolant temperature should be below 45°C (113°F).
- Check that the vacuum gauge indicates zero at 2,500 rpm.



5. CHECK BVSV AND EGR VACUUM MODULATOR WITH HOT ENGINE

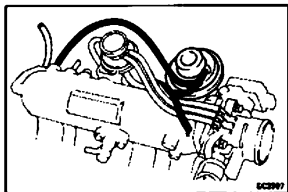
- Warm up the engine.
- Check that the vacuum gauge indicates low vacuum at 2,500 rpm.



- Disconnect the vacuum hose from port R of the EGR vacuum modulator and connect port R directly to the intake manifold with another hose.
- Check that the vacuum gauge indicates high vacuum at 2,500 rpm.

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

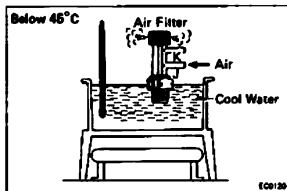
- Disconnect the vacuum gauge and reconnect the vacuum hoses to the proper locations.



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 the proper location.

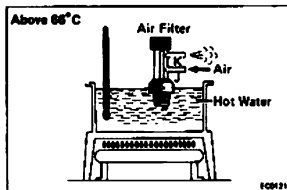
IF NO PROBLEM IS FOUND WITH THIS INSPECTION, THE SYSTEM IS OKAY; OTHERWISE INSPECT EACH PART



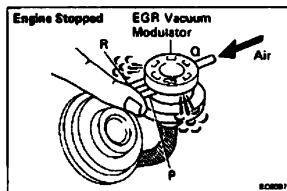
INSPECTION OF BVSV

CHECK BVSV BY BLOWING AIR INTO PIPE

- Drain the coolant from the radiator into a suitable container.
- Remove the BVSV from the water outlet.
- Cool the BVSV to below 45°C (113°F) with cool water.
- Check that air flows from pipe J to the air filter.



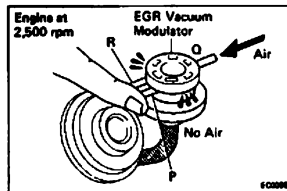
- Heat the BVSV to above 66°C (151°F) with hot water.
 - Check that air flows from pipe J to pipe K.
- If a problem is found, replace the BVSV.
- Apply liquid sealer to the threads of the BVSV and install.
 - Fill the radiator with coolant.



INSPECTION OF EGR VACUUM MODULATOR

CHECK EGR VACUUM MODULATOR OPERATION

- Disconnect the vacuum hoses from ports P, Q and R of the EGR vacuum modulator.
- Block ports 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 speed at 2,500 rpm.
- Repeat the above test. Check that there is a strong resistance to air flow.
- Reconnect the vacuum hoses to the proper locations.

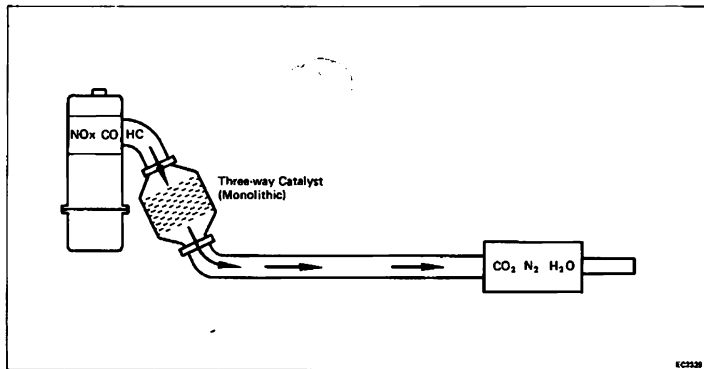


INSPECTION OF EGR VALVE

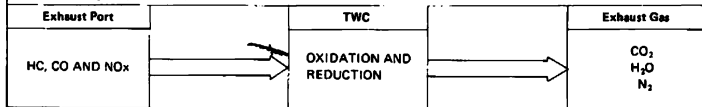
1. REMOVE EGR VALVE

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

2. REINSTALL EGR VALVE WITH NEW GASKET

THREE-WAY CATALYST(TWC) SYSTEM

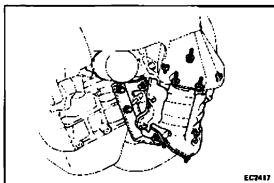
To reduce HC, CO and NO_x emissions, they are oxidized, reduced and converted to nitrogen (N₂), carbon dioxide (CO₂) and water (H₂O) by the catalyst.

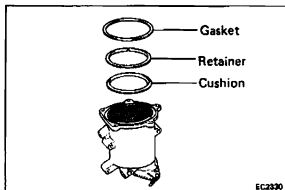
**INSPECTION OF EXHAUST PIPE ASSEMBLY**

CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE

REPLACEMENT OF CATALYTIC CONVERTER**1. REMOVE CONVERTER**

- (a) Jack up the vehicle.
- (b) Check that the converter is cool.
- (c) Disconnect the exhaust pipe from the converter.
 - Loosen the bolt, and disconnect the clamp from the exhaust pipe bracket.
 - Remove the three nuts, and disconnect the exhaust pipe. Remove the gasket.
- (d) Remove the two bolts, two nuts and converter stay.
- (e) Remove the three bolts, two nuts, gasket, retainer, cushion and converter.
- (f) Remove the eight bolts and two heat insulators from the converter.





2. INSTALL CONVERTER

- (a) Install the two heat insulators to the converter with the eight bolts.
- (b) Place new cushion, retainer and gasket on the converter.
- (c) Install the converter with the three bolts and two nuts. Torque the bolts and nuts.

Torque: 300 kg-cm (21 ft-lb, 29 N·m)

- (d) Install the converter stay with the two bolts and two nuts.

Torque: 425 kg-cm (31 ft-lb, 42 N·m)

- (e) Connect the exhaust pipe to the converter.
 - Place a new gasket on the exhaust pipe.
 - Connect the exhaust pipe with the three nuts.

Torque: 630 kg-cm (46 ft-lb, 62 N·m)

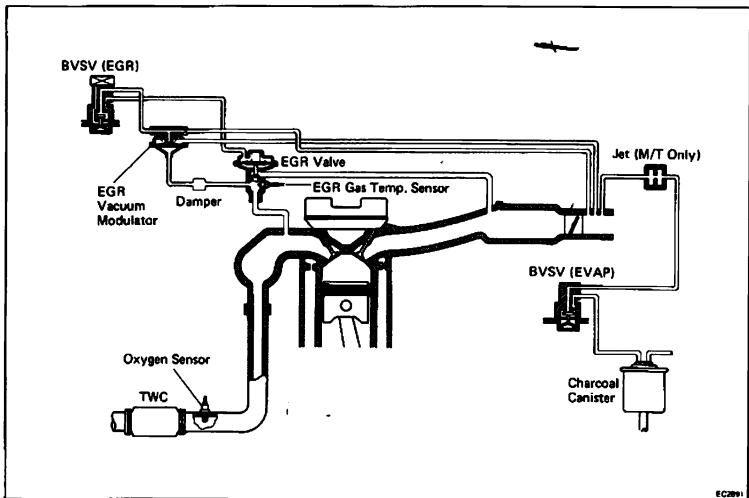
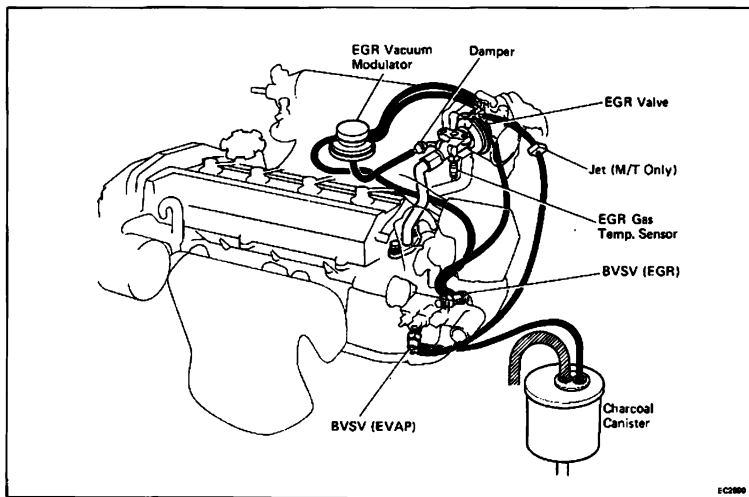
- Install the exhaust pipe clamp with the bolt.

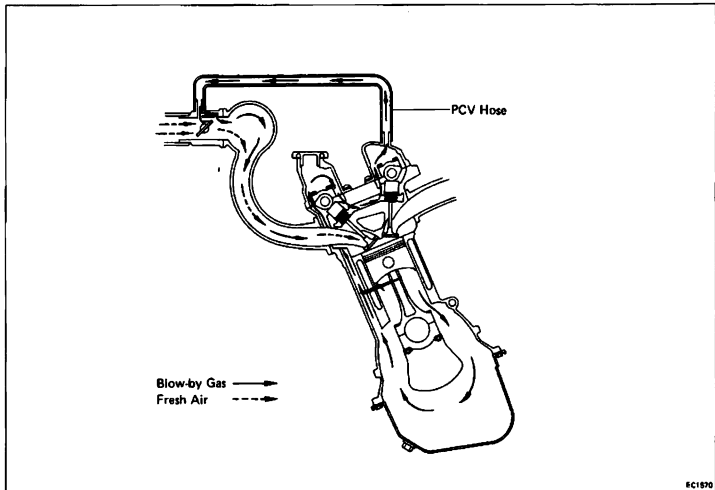
SYSTEM PURPOSE

System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow-by gas (HC)
Fuel evaporative emission control	EVAP	Reduces evaporative HC
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

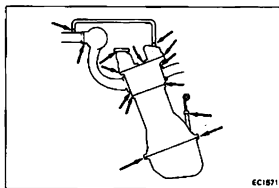
Remarks *For inspection and repair of the EFI system, refer to EFI section of this manual.

COMPONENT LAYOUT AND SCHEMATIC DRAWING



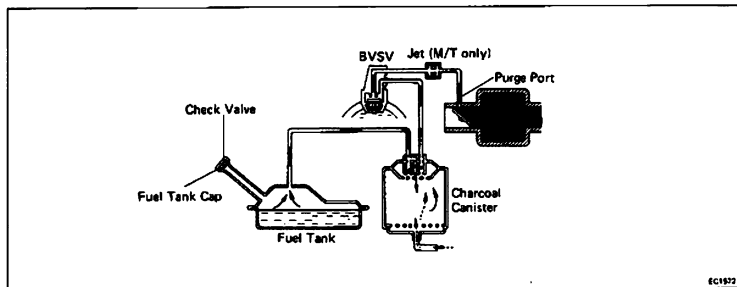
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

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

**INSPECTION OF PCV HOSE AND CONNECTIONS****VISUALLY INSPECT HOSE AND CONNECTION**

Check for cracks, leaks or damage.

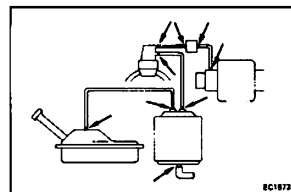
FUEL EVAPORATIVE EMISSION CONTROL (EVAP) SYSTEM



EC1872

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

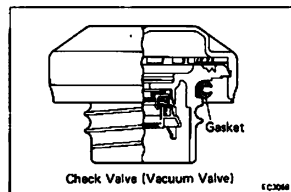
Coolant Temp.	BVS	Throttle Valve Opening	Canister Check Valve			Check Valve in Cap	Evaporated Fuel (HC)
			(1)	(2)	(3)		
Below 35°C (95°F)	CLOSED	—	—	—	—	—	HC from tank is absorbed into the canister.
Above 54°C (129°F)	OPEN	Positioned below purge port	CLOSED	—	—	—	HC from canister is led into air intake chamber.
		Positioned above purge port	OPEN	—	—	—	
High pressure in tank	—	—	—	OPEN	CLOSED	CLOSED	HC from tank is absorbed into the canister.
High vacuum in tank	—	—	—	CLOSED	OPEN	OPEN	Air is led into the fuel tank.



EC1873

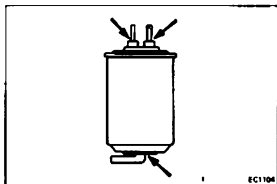
INSPECTION OF FUEL VAPOR LINES, FUEL TANK AND TANK CAP

- 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 TANK CAP**
Check if the cap and/or gasket are deformed or damaged.
If necessary, repair or replace the cap.



Check Valve (Vacuum Valve)

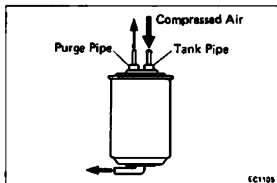
EC2088



EC1104

INSPECTION OF CHARCOAL CANISTER

1. REMOVE CHARCOAL CANISTER
2. VISUALLY INSPECT CHARCOAL CANISTER CASE
Look for cracks or damage.

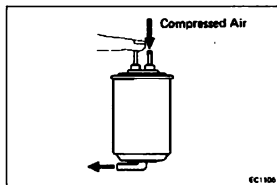


EC1105

3. CHECK FOR CLOGGED FILTER AND STUCK CHECK VALVE

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

If a problem is found, replace the charcoal canister.



EC1106

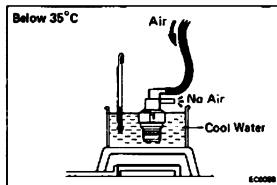
4. CLEAN FILTER IN CANISTER

Clean the filter by blowing 3 kg/cm² (43 psi, 294 kPa) of compressed air into the tank pipe while holding the other canister pipe closed.

NOTE:

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

5. INSTALL CHARCOAL CANISTER

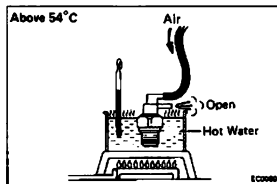


EC0088

INSPECTION OF BVSV

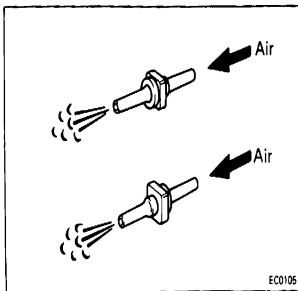
CHECK BVSV BLOWING AIR INTO PIPE

- (a) Drain the coolant from the radiator into a suitable container.
- (b) Remove the BVSV.
- (c) Cool the BVSV to below 35°C (95°F) with cool water.
- (d) Blow air into a pipe and check that the BVSV is closed.



EC0089

- (e) Heat the BVSV to above 54°C (129°F) with hot water.
 - (f) Blow air into a pipe and check that the BVSV is open.
- If a problem is found, replace the BVSV.
- (g) Apply liquid sealer to the threads of the BVSV and reinstall.
 - (h) Fill the radiator with coolant.

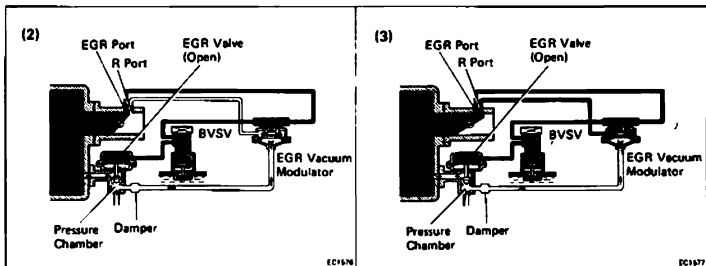
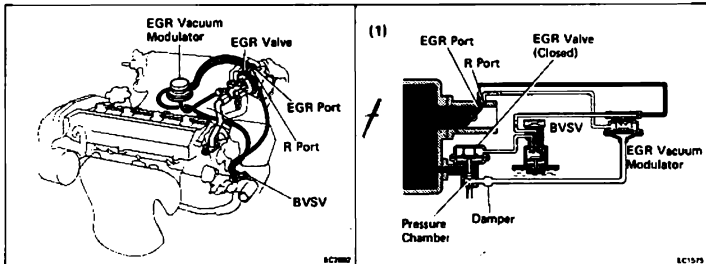


INSPECTION OF JET (M/T only)

CHECK JET BY BLOWING AIR FROM EACH SIDE

Check for stoppage.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

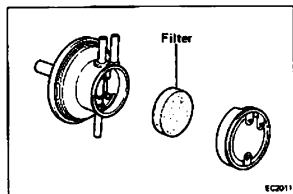


To reduce NO_x emission, part of the exhaust gases are recirculated through the EGR valve to the intake manifold to lower the maximum combustion temperature.

Coolant Temp.	BVSV	Throttle Valve Opening Angle	Pressure in the EGR Valve Pressure Chamber		EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 45°C (113°F)	CLOSED	–	–		–	CLOSED	Not recirculated
Above 66°C (151°F)	OPEN	Positioned below EGR port	–		–	CLOSED	Not recirculated
		Positioned between EGR port and 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

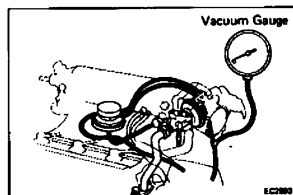
** When the throttle valve is positioned above the R port, the EGR vacuum modulator will close the atmosphere passage and open the EGR valve to increase the EGR gas, even if the exhaust pressure is insufficiently low.



INSPECTION OF EGR SYSTEM

1. CHECK AND CLEAN FILTER IN EGR VACUUM MODULATOR

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

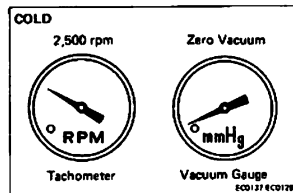


2. PREPARATION

Using a 3-way connector, connect a vacuum gauge to the EGR valve.

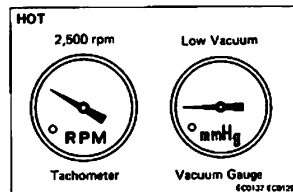
3. CHECK SEATING OF EGR VALVE

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



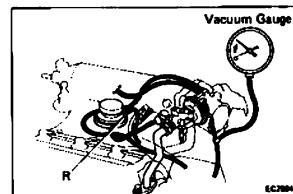
4. CHECK BVSV WITH COLD ENGINE

- (a) The coolant temperature should be below 45°C (113°F).
- (b) Check that the vacuum gauge indicates zero at 2,500 rpm.



5. CHECK BVSV AND EGR VACUUM MODULATOR WITH HOT ENGINE

- (a) Warm up the engine.
- (b) Check that the vacuum gauge indicates low vacuum at 2,500 rpm.

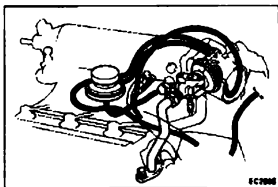


- (c) Disconnect the vacuum hose from port R of the EGR vacuum modulator and connect port R directly to the intake manifold with another hose.

- (d) Check that the vacuum gauge indicates high vacuum at 2,500 rpm.

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

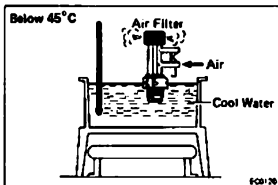
- (e) Disconnect the vacuum gauge and reconnect the vacuum hoses to the proper locations.



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 the proper location.

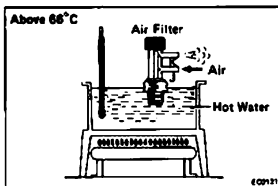
IF NO PROBLEM IS FOUND WITH THIS INSPECTION, THE SYSTEM IS OKAY; OTHERWISE INSPECT EACH PARTS



INSPECTION OF BVSV

CHECK BVSV BY BLOWING AIR INTO PIPE

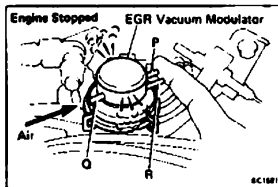
- Drain the coolant from the radiator into a suitable container.
 - Remove the BVSV from the water outlet.
 - Cool the BVSV to below 45°C (113°F) with cool water.
 - Check that air flows from pipe J to the air filter.
 - Heat the BVSV to above 66°C (151°F) with hot water.
 - Check that air flows from pipe J to pipe K.
- If a problem is found, replace the BVSV.
- Apply liquid sealer to the threads of the BVSV and install.
 - Fill the radiator with coolant.



INSPECTION OF EGR VACUUM MODULATOR

CHECK EGR VACUUM MODULATOR OPERATION

- Disconnect the vacuum hoses from ports P, Q and R of the EGR vacuum modulator.
- Block ports 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 speed at 2,500 rpm.
- Repeat the above test. Check that there is a strong resistance to air flow.
- Reconnect the vacuum hoses to the proper locations.

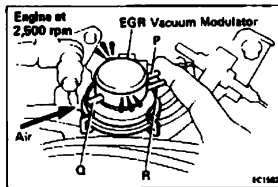


INSPECTION OF EGR VALVE

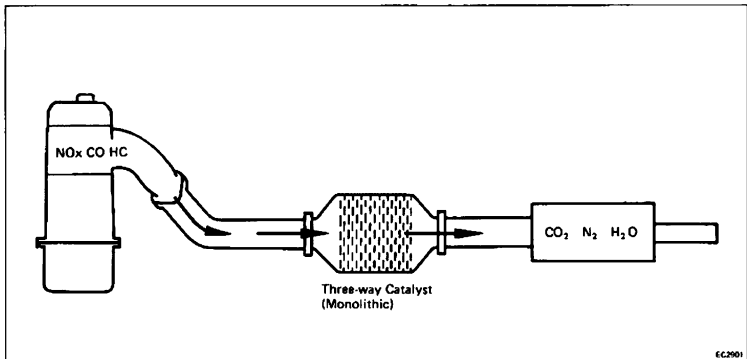
1. REMOVE EGR VALVE

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

2. REINSTALL EGR VALVE WITH NEW GASKET



THREE-WAY CATALYST (TWC) SYSTEM

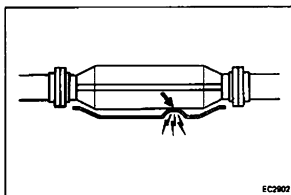


To reduce HC, CO and NO_x emissions, they are oxidized, reduced and converted to nitrogen (N₂), carbon dioxide (CO₂) and water (H₂O) by the catalyst.

Exhaust port		TWC		Exhaust Gas
HC, CO AND NO _x	→	OXIDATION AND REDUCTION	→	CO ₂ H ₂ O N ₂

INSPECTION OF EXHAUST PIPE ASSEMBLY

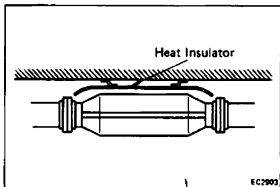
1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE
2. CHECK CLAMPS FOR WEAKNESS, CRACKS OR DAMAGE



INSPECTION OF CATALYTIC CONVERTER

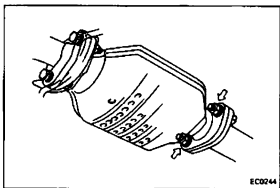
CHECK FOR DENTS OR DAMAGE

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



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 (Converter to exhaust pipe):
440 kg-cm (32 ft-lb, 43 N·m)

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