EMISSION CONTROL SYSTEMS

DESCRIPTION

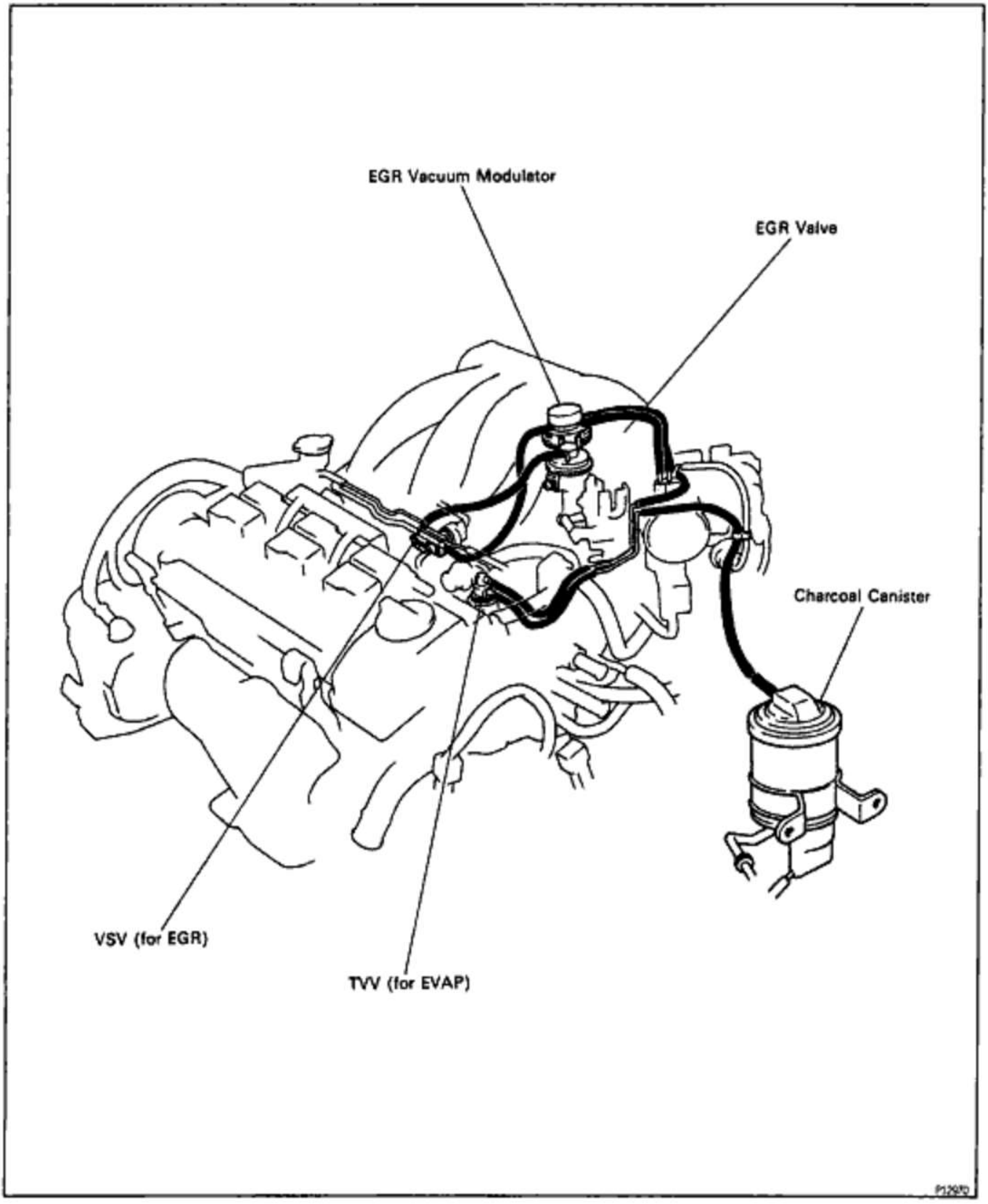
The emission control systems are installed to reduce the amount of HC, CO and NOx emitted from the engine, and to also prevent release of evaporated fuel from the gasoline tank and prevent atmospheric release of blow–by gas.
The system consists of the PCV, EVAP, EGR and TWC.
The function of each system is shown in the following table.

System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow–by gas
Evaporative emission control	EVAP	Reduces evaporative HC
Exhaust gas recirculation	EGR	Reduces NOx
Three–way catalytic converter	TWC	Reduces C0, HC and NOx
Sequential multiport fuel injection*	SFI	Regulates all engine conditions for reduction of exhaust emissions.

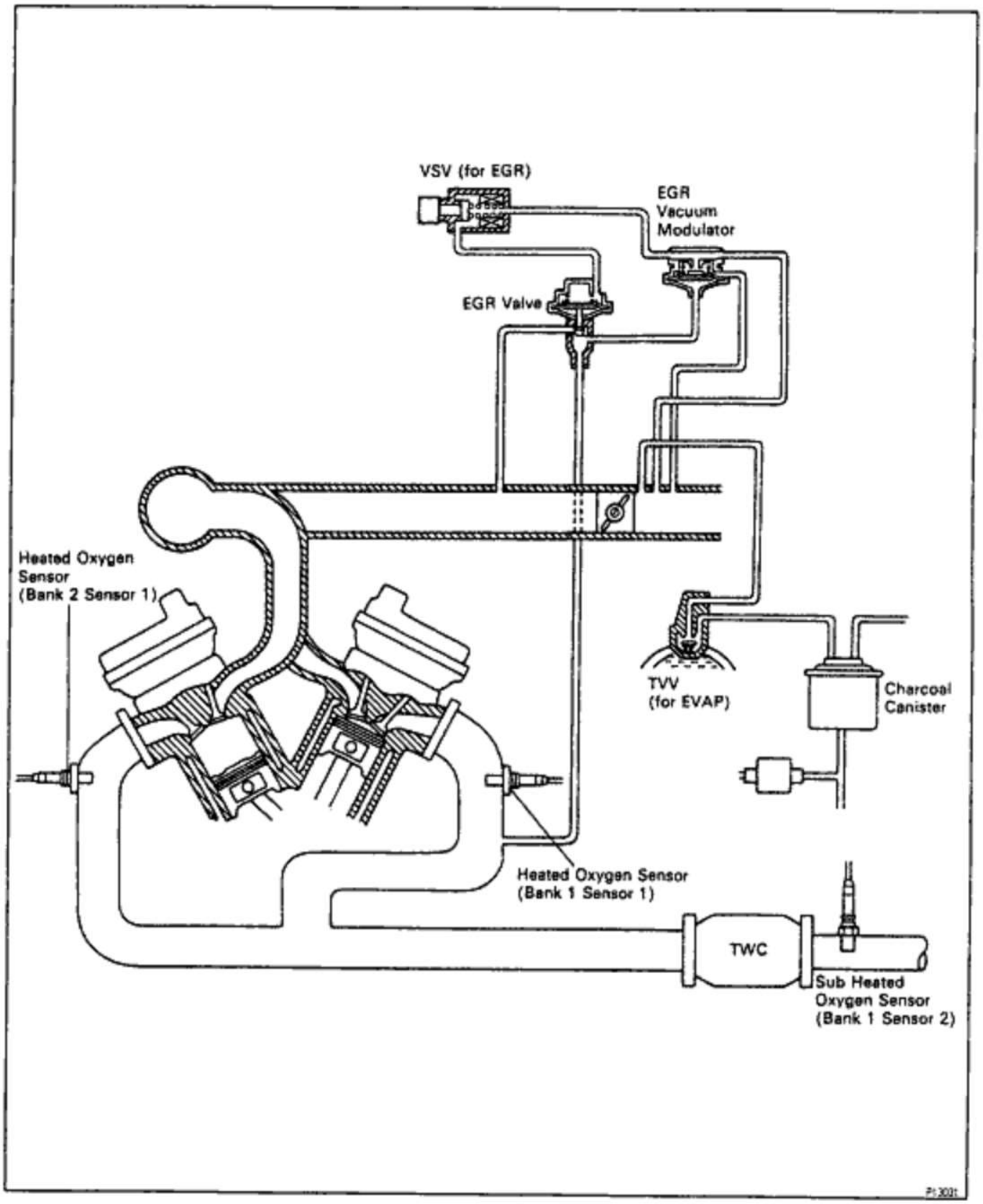
*For inspection and repair of the SFI system, refer to the SFI section.

V02937

COMPONENT LAYOUT



SCHEMATIC DRAWING



PREPARATION

SST (SPECIAL SERVICE TOOL)

	09843–18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

	09082–00050 TOYOTA Electrical Tester Set	

EQUIPMENT

Tachometer	
Torque wrench	
Vacuum gauge	

SSM (SPECIAL SERVICE MATERIALS)

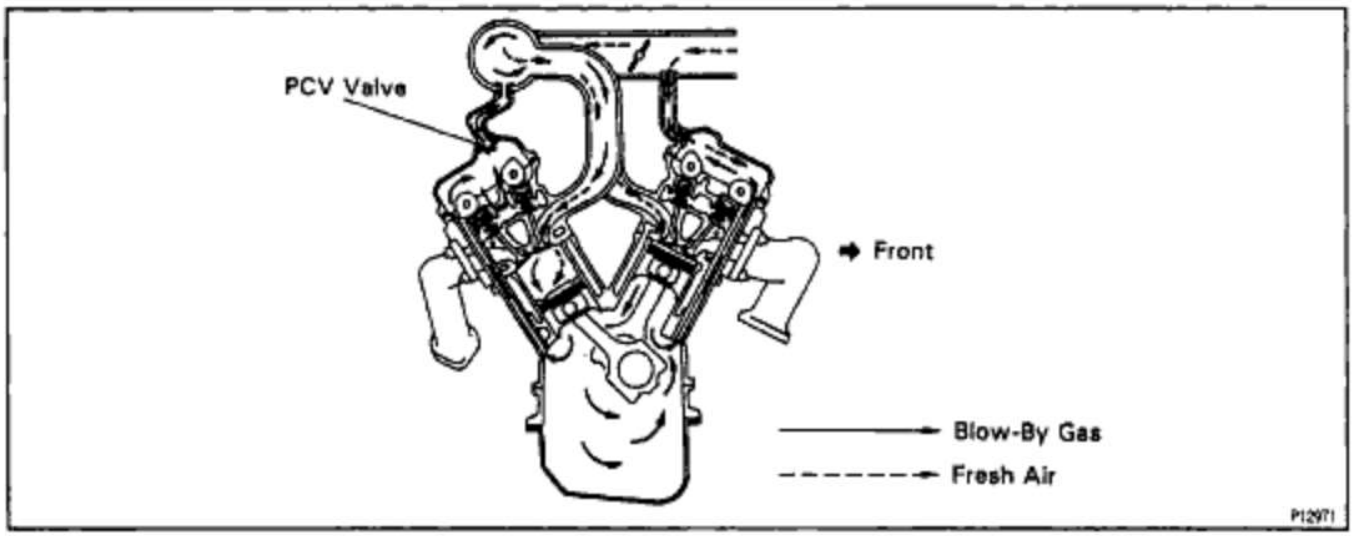
08833–00070 Adhesive 1311, THREE BOND 1311 or equivalent	TVV

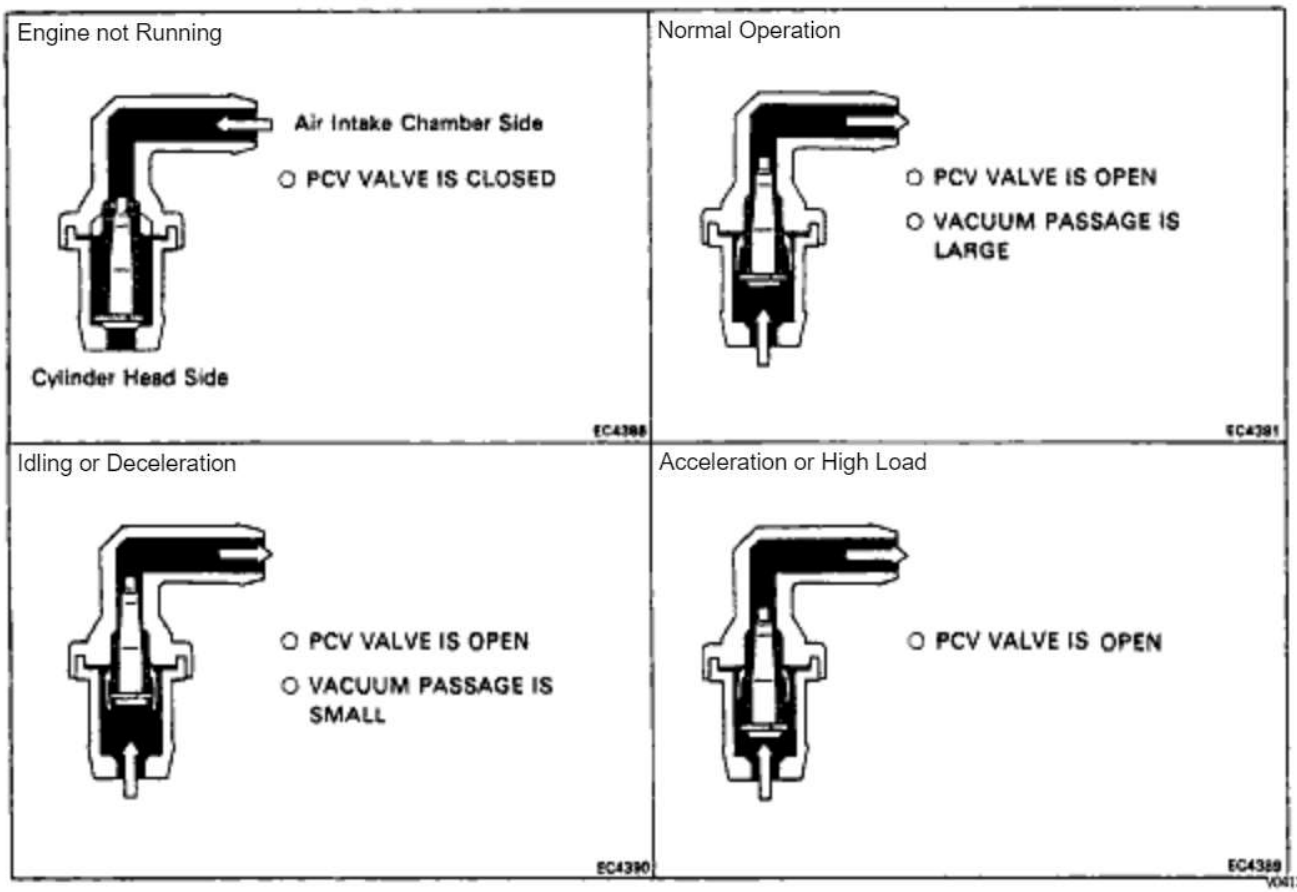
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

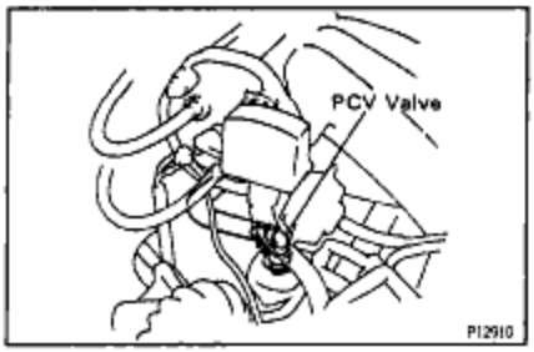
DESCRIPTION

To reduce HC emission, crankcase blow–by gas is routed through the PCV valve to the air intake chamber for combustion in the cylinders.

OPERATION

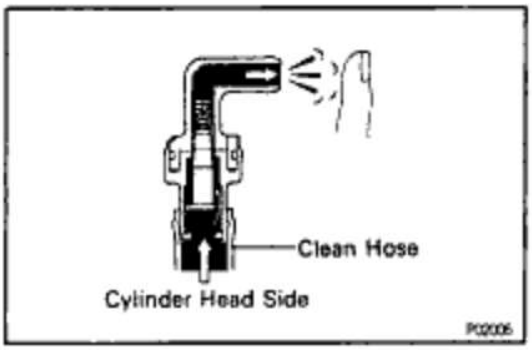




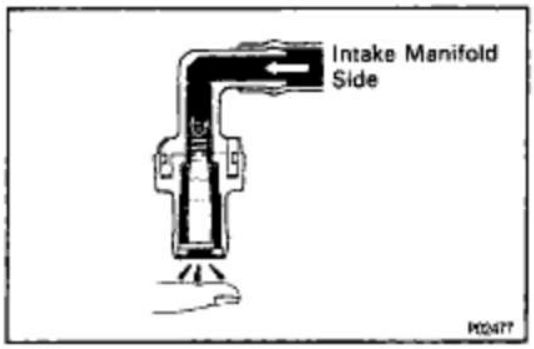


PCV VALVE INSPECTION

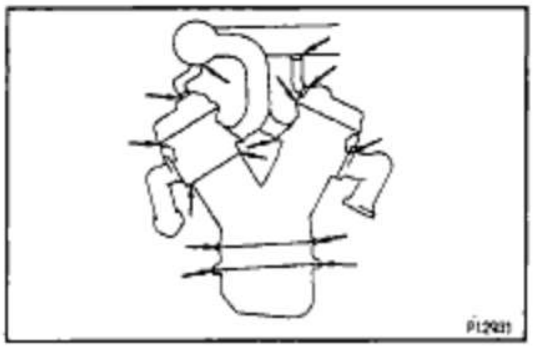
1. REMOVE PCV VALVE
(a) Disconnect the PCV hose from the PCV valve.
(b) Remove the PCV valve.



2. INSTALL CLEAN HOSE TO PCV VALVE
3. INSPECT PCV VALVE OPERATION
(a) Blow air into the cylinder head side, and check that air passes through easily.
CAUTION: Do not suck sir through the valve. Petroleum substances inside the valve are harmful.



(b) Blow air into the intake manifold side, and check that air passes through with difficulty.
If operation is not as specified, replace the PCV valve.
4. REMOVE CLEAN HOSE FROM PCV VALVE
5. REINSTALL PCV VALVE



PCV HOSES AND CONNECTORS INSPECTION

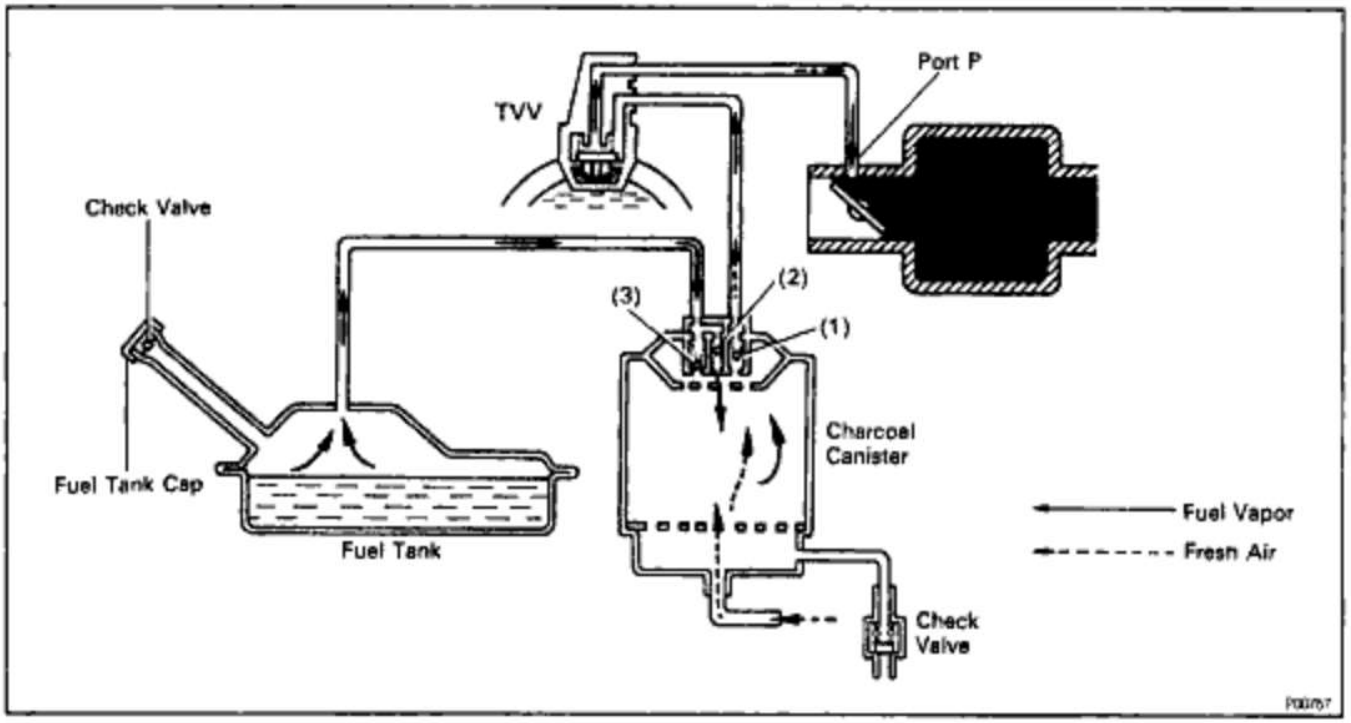
VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS
Check for cracks, leaks or damage.

EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

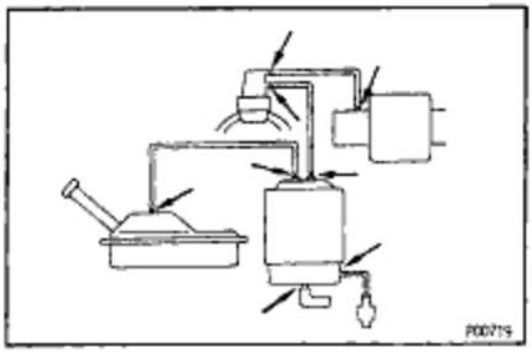
DESCRIPTION

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.

OPERATION



Engine Coolant Temp.	TVV	Throttle Valve Position	Canister Check Valve			Check Valve in Tank Cap	Evaporated Fuel (HC)
			(1)	(2)	(3)		
Below 40₂C (104₂F)	CLOSED	–	–	–	–	–	HC from tank is absorbed into the canister.
Above 59₂C (138₂F)	OPEN	Positioned below port P	CLOSED	–	–	–	
		Positioned above port P	OPEN	–	–	–	HC from canister is led into air intake chamber.
Nigh pressure in tank	–	–	–	OPEN	CLOSED	CLOSED	HC from tank is absorbed into the canister.
High vacuum in take	–	–	–	CLOSED	OPEN	OPEN	Air is led into the fuel tank



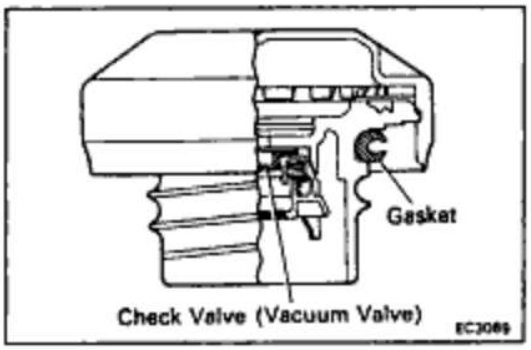
FUEL VAPOR LINES, FUEL TANK AND TANK CAP INSPECTION

1. VISUALLY INSPECT LINES AND CONNECTIONS

Look for loose connections, sharp bends or damage.

2. VISUALLY INSPECT FUEL TANK

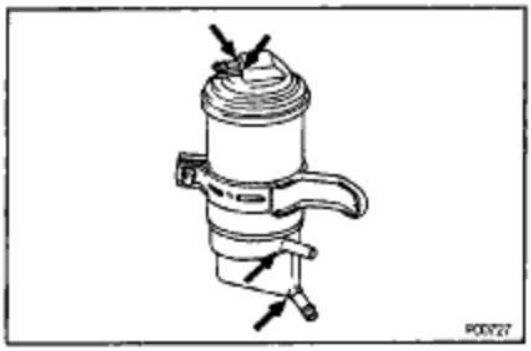
Look for deformation, cracks or fuel leakage.



3. VISUALLY INSPECT FUEL TANK CAP

Check if the cap and/or gasket are deformed or damaged.

If necessary, repair or replace the cap.

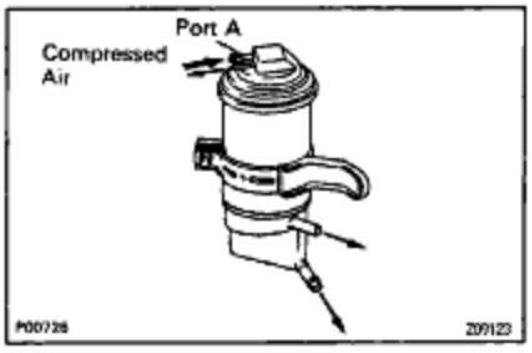


CHARCOAL CANISTER INSPECTION

1. REMOVE CHARCOAL CANISTER

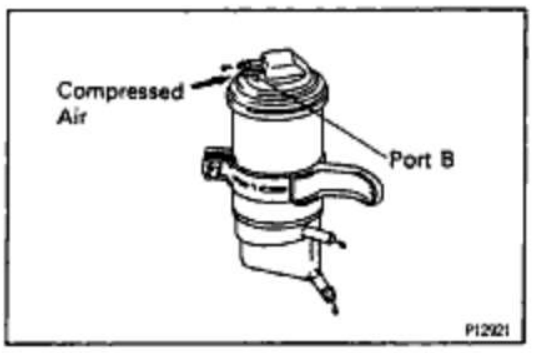
2. VISUALLY INSPECT CHARCOAL CANISTER

Look for cracks or damage.



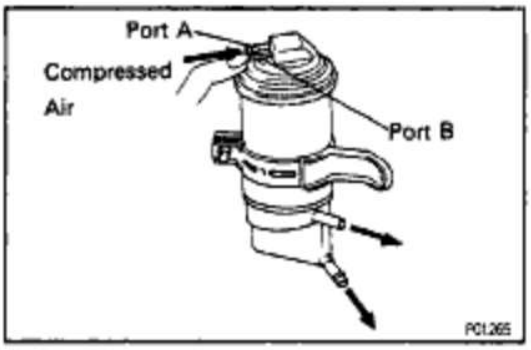
3. CHECK FOR CLOGGED FILTER AND STUCK CHECK VALVE

(a) Blow low pressure compressed air (4.71 kPa, 48 gf/cm^2. 0.68 psi) into port A and check that air flows without resistance from the other ports.



(b) Blow low pressure compressed air (4.71 kPa, 48 gf/cm^2, 0.68 psi) into port B and check that air does not flow from the other ports.

If a problem is found, replace the charcoal canister.



4. CLEAN FILTER IN CANISTER

Clean the filter by blowing 294 kPa (3 kgf/cm^2, 43 psi) of compressed air into port A while holding port B closed.

NOTICE:

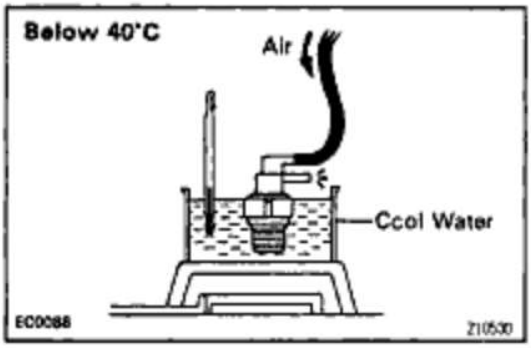
- **Do not attempt to wash the canister.**
- **No activated carbon should come out.**

5. REINSTALL CHARCOAL CANISTER

TVV INSPECTION

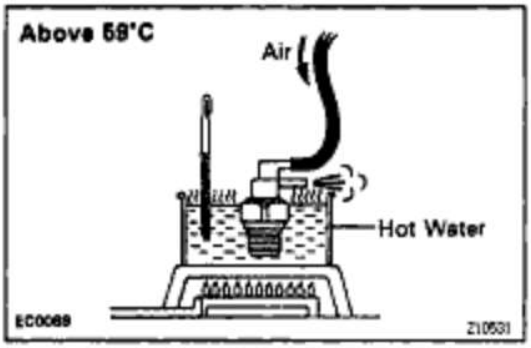
1. DRAIN ENGINE COOLANT

2. REMOVE TVV FROM INTAKE MANIFOLD



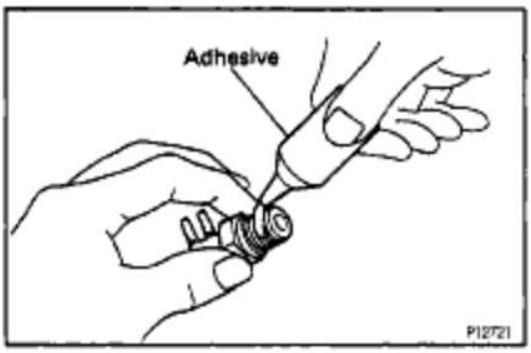
3. INSPECT TVV OPERATION

(a) Cool the TVV to below 40$_2$C (104$_2$F) with cool water.
(b) Check that air does not flow from the upper port to lower port.



(c) Heat the TVV to above 59$_2$C (138$_2$F) with hot water.
(d) Check that air flows from the upper port to lower port.

If operation is not as specified, replace the TVV.



4. REINSTALL TVV

Apply adhesive to 2 or 3 threads of the TVV, and install it.

Adhesive:

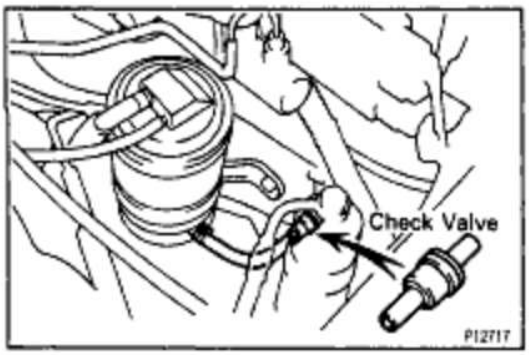
Part No. 08833–00070, THREE BOND 1324 or equivalent

Torque: 30 N–m (305 kgf–cm, 22 ft–lbf)

5. REFILL WITH ENGINE COOLANT

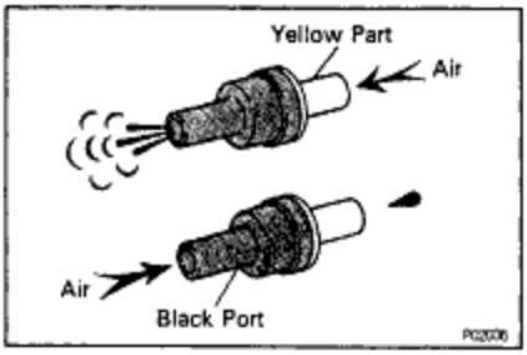
CHECK VALVE INSPECTION

1. REMOVE CHECK VALVE



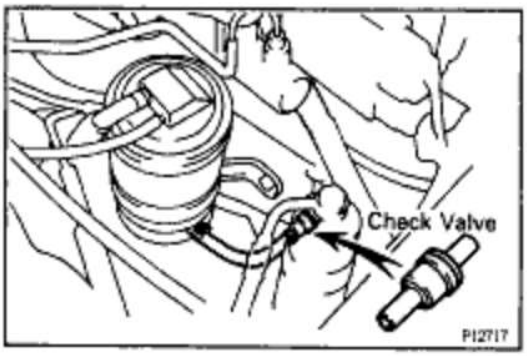
2. INSPECT CHECK VALVE

(a) Check that air flows from the yellow port to the black port.
(b) Check that air does not flow from the black port to the yellow port.
If operation is not as specified, replace check valve.



3. REINSTALL CHECK VALVE

HINT: Reinstall the check valve with the black port facing the purge port side.

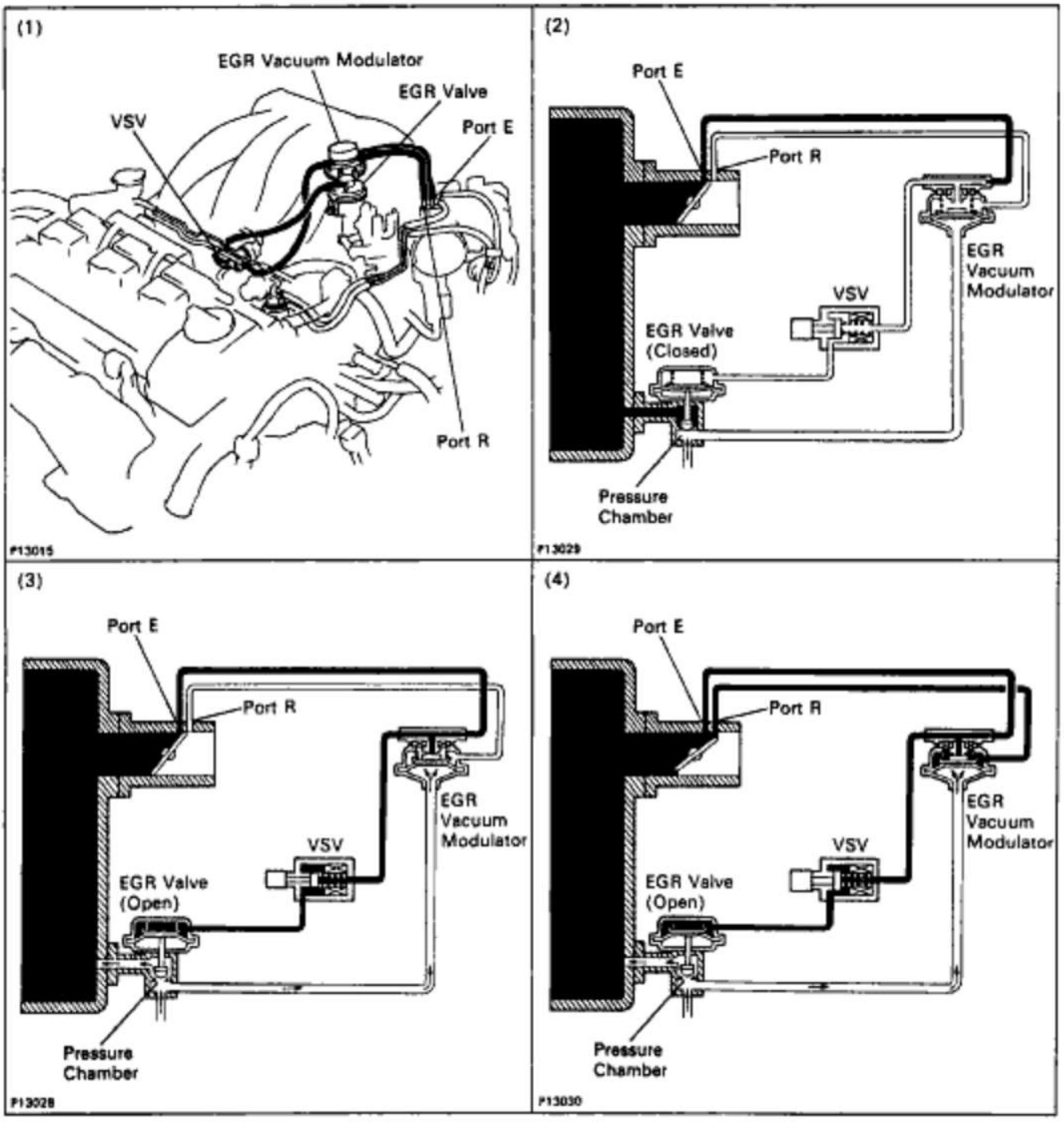


EXHAUST GAS RECIRCULATION (EGR) SYSTEM

DESCRIPTION

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

OPERATION



Engine Coolant Temp.	VSV	Throttle Valve Position	Pressure in the EGR Valve Pressure Chamber		EG R Vacuum Modulator	EG R Valve	Exhaust Gas
Below 55°C (131°F)	ON OPENS passage to atmosphere	–	–		–	CLOSED	Not recirculated
Above 60°C (140°F)	OFF CLOSED passage to atmosphere	Positioned below port E	–		–	CLOSED	Not recirculated
		Positioned between port E and port R	(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 port R	(3) HIGH	**	CLOSES passage to atmosphere	OPEN	Recirculated (increase)

* Pressure increase → Modulator closes → EGR valve opens → Pressure drops
EGR valve closes ← Modulator opens
** When the throttle valve is positioned above port R, 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.

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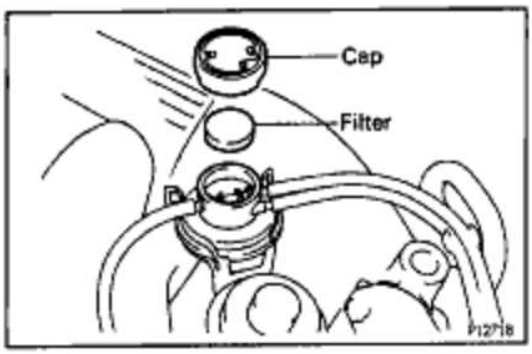
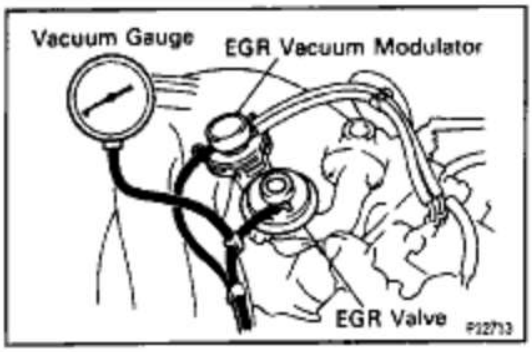
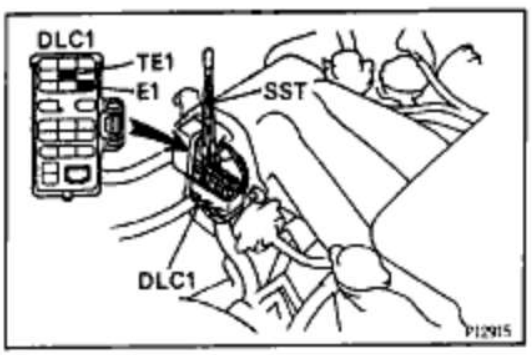






EGR SYSTEM INSPECTION

1. CHECK AND CLEAN FILTER IN EGR VACUUM MODULATOR

(a) Remove the cap and filter.
(b) Check the filter for contamination or damage.
(c) Using compressed air, clean the filter.
(d) Reinstall the filter and cap.
HINT: Install the filter with the coarser surface facing out to the atmospheric side.

2. INSTALL VACUUM GAUGE

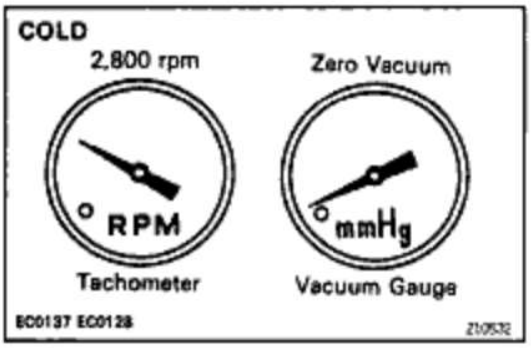
Using a 3–way connector, connect a vacuum gauge to the hose between the EGR valve and EGR VSV.

3. INSPECT SEATING OF EGR VALVE

Check that the engine starts and runs at idle.

4. CONNECT TERMINALS TE1 AND E1

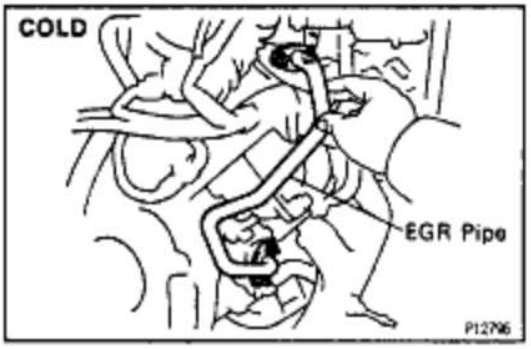
Using SST, connect terminal TE1 and E1 of the data link connector 1.
SST 09843–18020



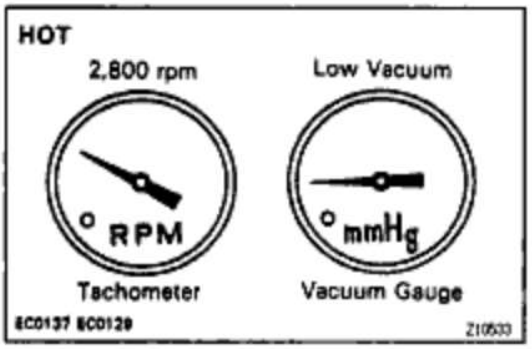
5. INSPECT VSV OPERATION WITH COLD ENGINE

(a) The engine coolant temperature should be below 55_2 C (1131_2F).

(b) Check that the vacuum gauge indicates zero at 2,800 rpm.



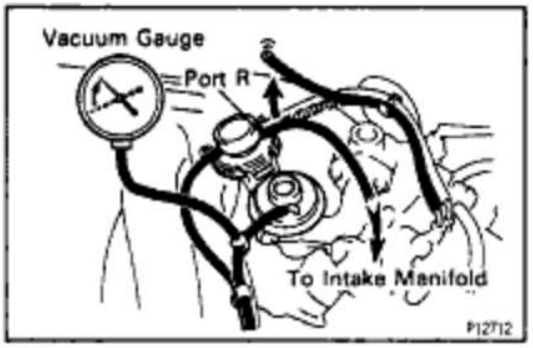
(c) Check that the EGR pipe is not hot.



6. INSPECT OPERATION OF VSV AND EGR VACUUM MODULATOR WITH HOT ENGINE

(a) Warm up the engine to above 80_2C (176° F).

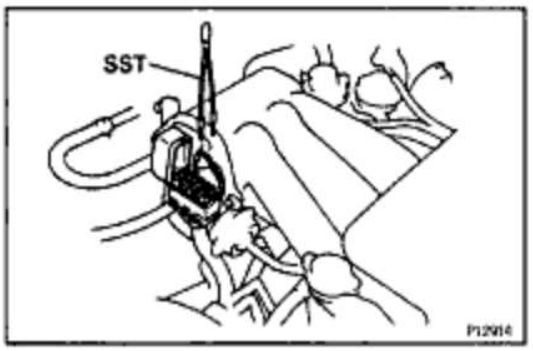
(b) Check that the vacuum gauge indicates low vacuum at 2,800 rpm.



(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 3,500 rpm.

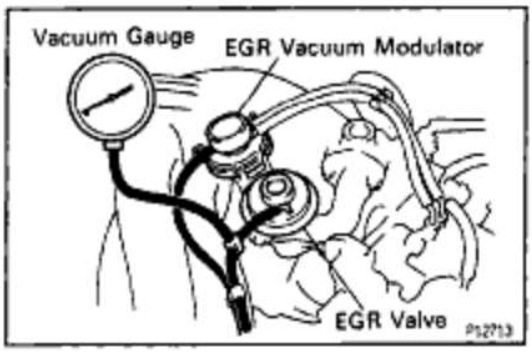
HINT: As exhaust gas is increasingly recirculated, the engine will start to misfire.



7. DISCONNECT TERMINALS TE1 AND E1

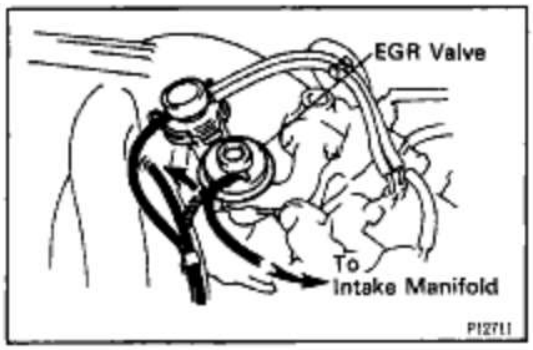
Remove the SST from the data link connector 1.

SST 09843–18020



8. REMOVE VACUUM GAUGE

Remove the vacuum gauge, and reconnect the vacuum hoses to their proper locations.



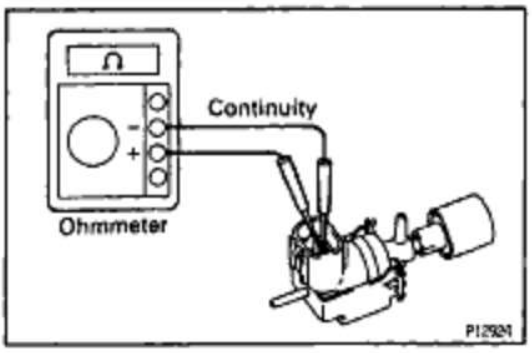
9. INSPECT EGR VALVE

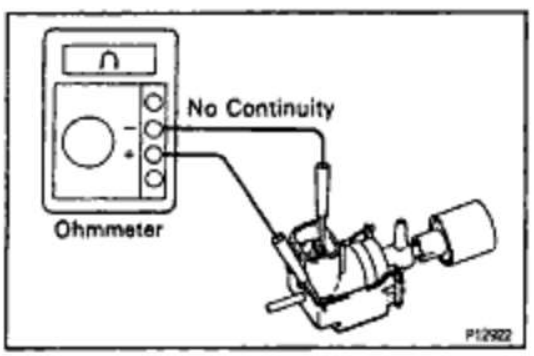
(a) Apply vacuum directly to the EGR valve with the engine idle.

(b) Check that the engine runs rough or dies.

(c) Reconnect the vacuum hoses to their proper loca–tions.

IF NO PROBLEM IS FOUND DURING THIS INSPECTION, SYSTEM IS NORMAL; OTHERWISE INSPECT EACH PART





VSV INSPECTION

1. REMOVE VSV

2. INSPECT VSV

A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance:

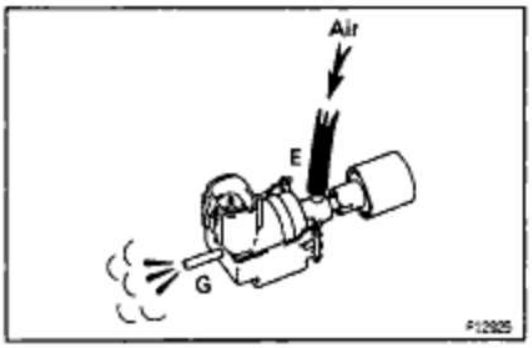
33 – 39 Ω at 20$_2$C (68$_2$F)

If there is no continuity, replace the VSV.

B. Inspect VSV for ground

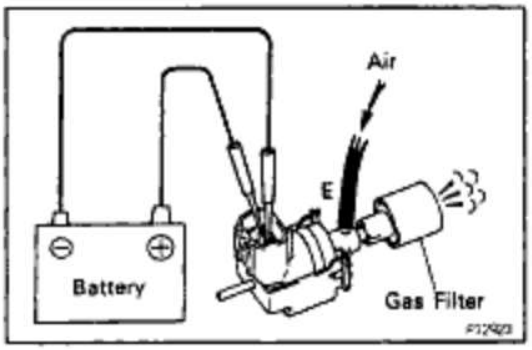
Using an ohmmeter, check that there is no continuity between each terminal and the body.

!f there is continuity, replace the VSV.



C. Inspect VSV operation

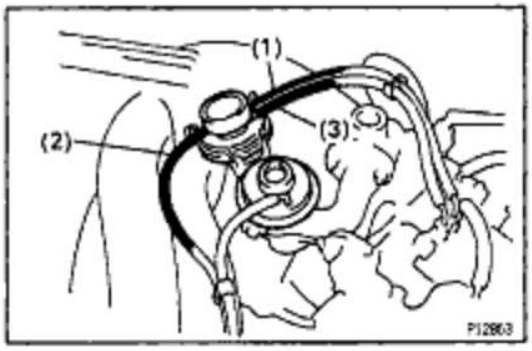
(a) Check that the air flows from ports E to G.



(b) Apply battery voltage across the terminals.
(c) Check that the air flows from port E to the gas filter.
If operation is not as specified, replace the VSV.

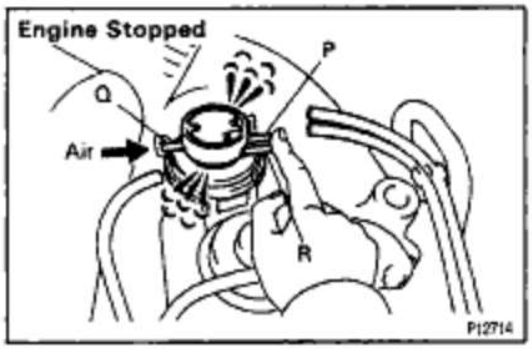
3. REINSTALL VSV

EGR VACUUM MODULATOR INSPECTION



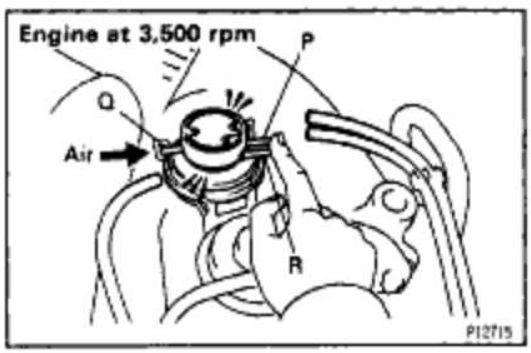
1. DISCONNECT VACUUM HOSES FROM EGR VACUUM MODULATOR

Disconnect the following vacuum hoses:
(1) Vacuum hose from P port
(2) Vacuum hose from Q port
(3) Vacuum hose from R port

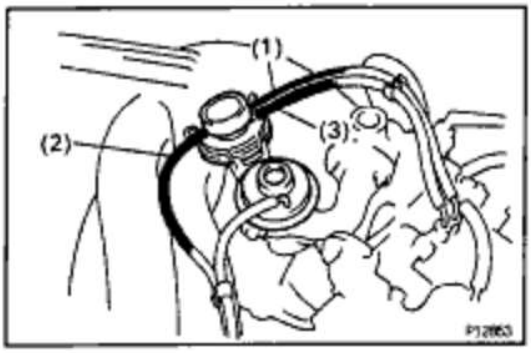


2. INSPECT EGR VACUUM MODULATOR OPERATION

(a) Block ports P and R with your finger.
(b) Blow air into port Q, and check that the air passes through to the air filter side freely.

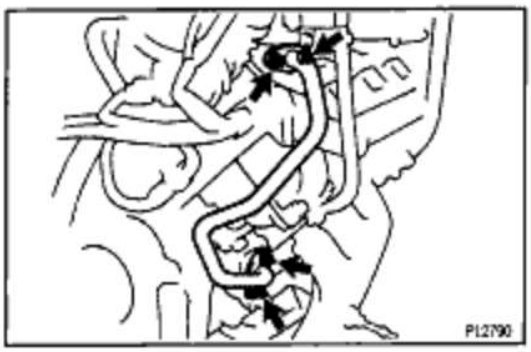


(c) Start the engine, and maintain speed at 3,500 rpm.
(d) Repeat the above test. Check that there is a strong resistance to air flow.



3. RECONNECT VACUUM HOSES TO EGR VACUUM MODULATOR

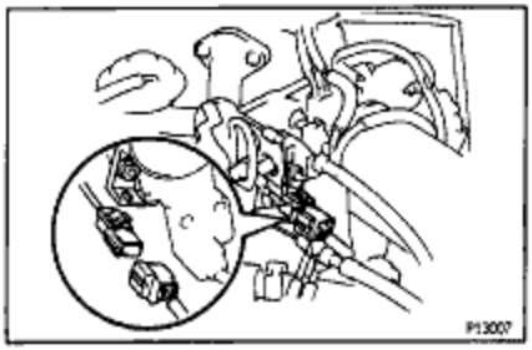
Connect the following vacuum hoses:
(1) Vacuum hose to P port
(2) Vacuum hose to Q port
(3) Vacuum hose to R port



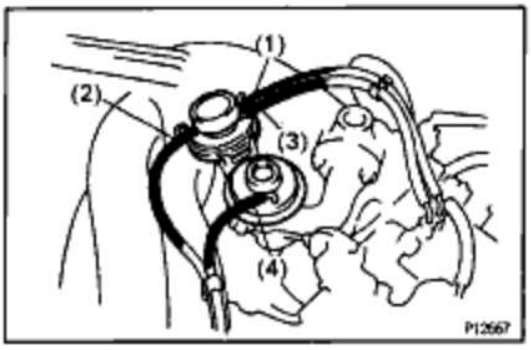
EGR VALVE INSPECTION

1. REMOVE EGR PIPE

Remove the 4 nuts, EGR pipe and 2 gaskets.



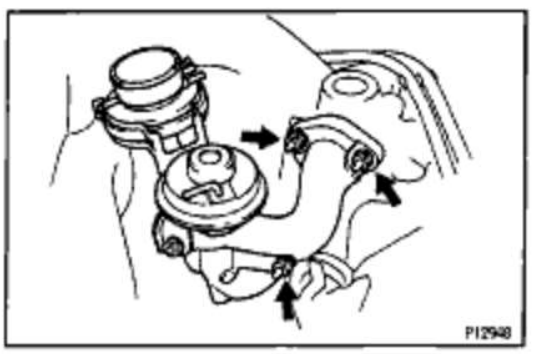
2. DISCONNECT EGR GAS TEMPERATURE SENSOR CONNECTOR AND CLAMP

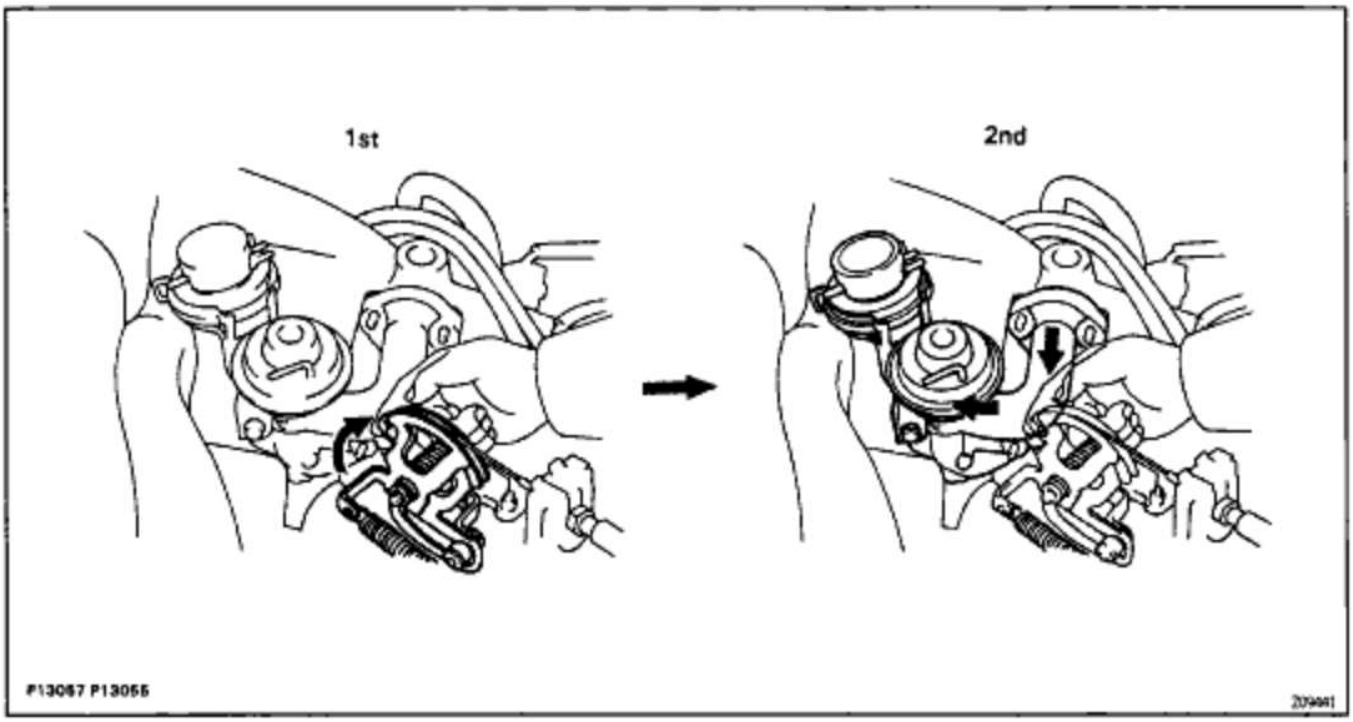


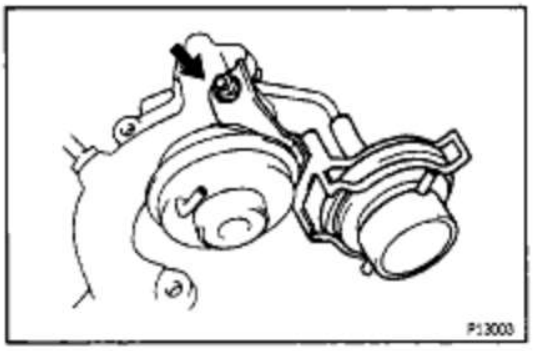
3. REMOVE EGR VALVE AND VACUUM MODULATOR ASSEMBLY

(a) Disconnect the following hoses: .
(1) Vacuum hose from P port of EGR vacuum modulator
(2) Vacuum hose from Q port of EGR vacuum modulator
(3) Vacuum hose from R port of EGR vacuum modulator
(4) Vacuum hose from EGR valve

(b) Remove the 3 nuts, EGR valve and vacuum modulator assembly and gasket.



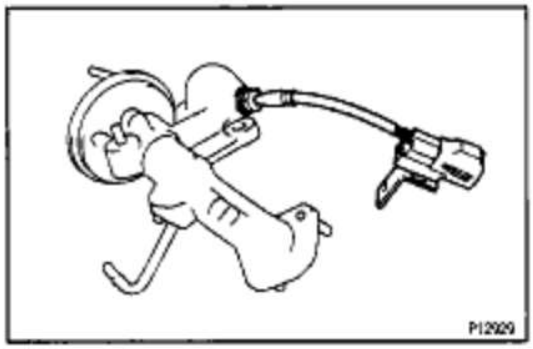




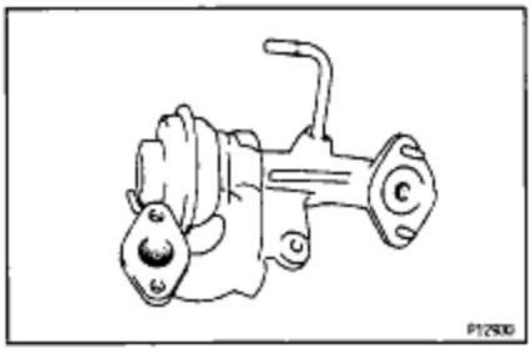
4. SEPARATE EGR VALVE AND VACUUM MODULATOR

(a) Remove the nut and disconnect the EGR vacuum modulator.

(b) Disconnect the pressure hose from the EGR valve and remove the EGR vacuum modulator.



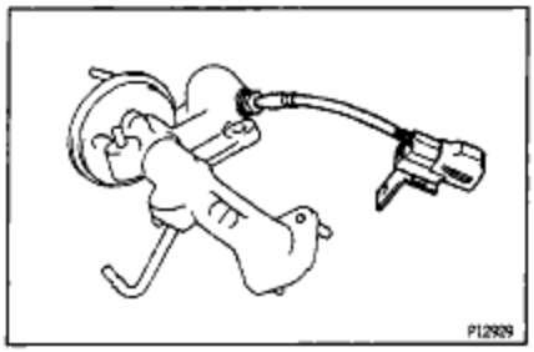
5. REMOVE EGR GAS TEMPERATURE SENSOR



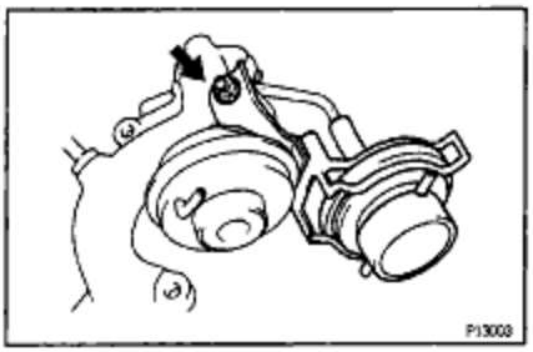
6. INSPECT EGR VALVE

Check for sticking and heavy carbon deposits.

If a problem is found, replace the EGR valve.

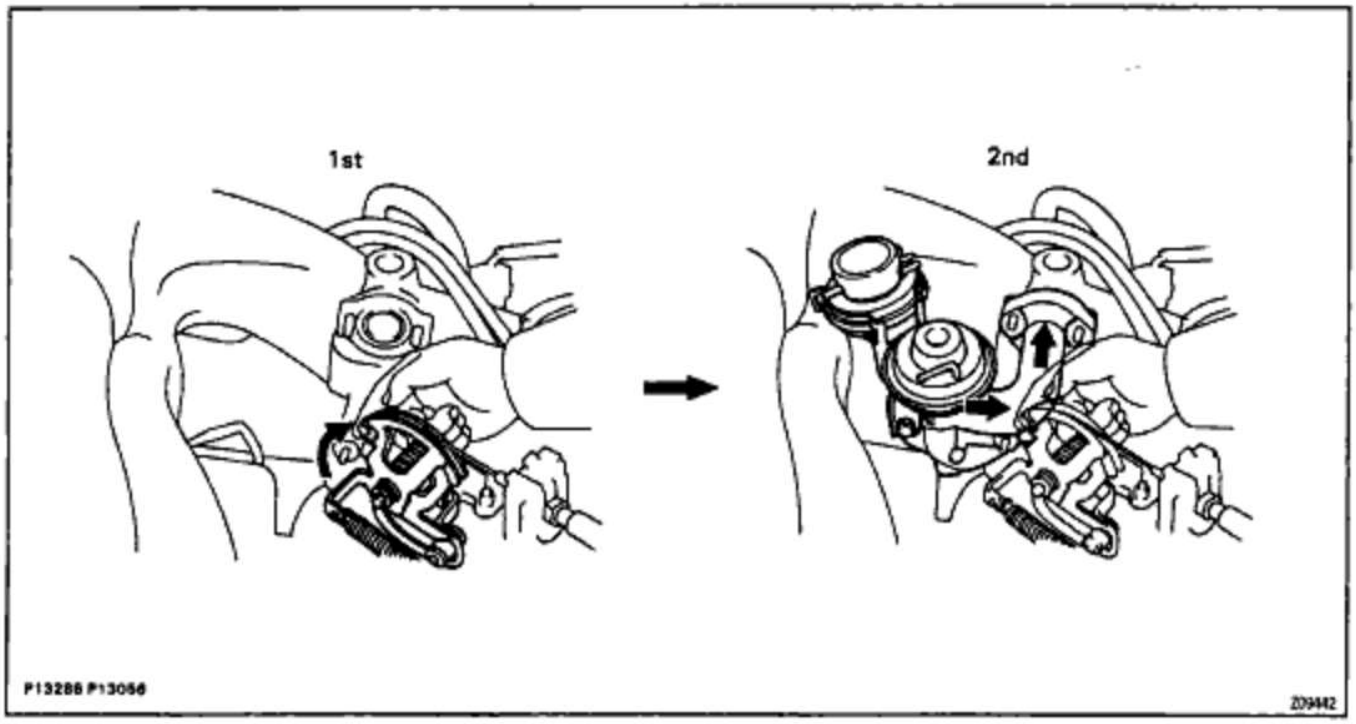


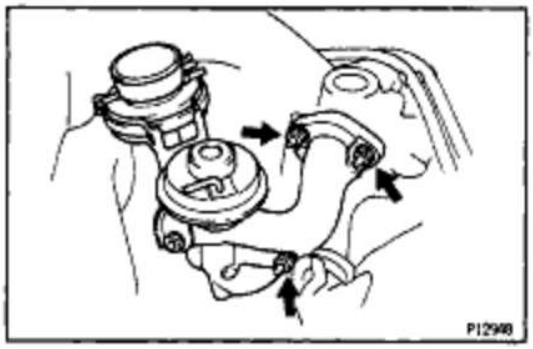
7. REINSTALL EGR GAS TEMPERATURE SENSOR
Torque: 20 N–m (200 kgf–cm, 14 ft–lbf)



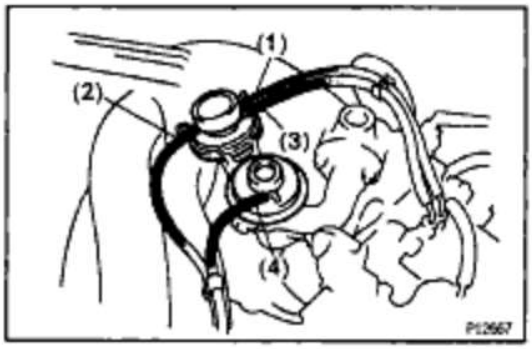
8. REASSEMBLE EGR VALVE AND VACUUM MODULATOR
(a) Connect the pressure hose to the EGR valve.
(b) Install the EGR vacuum modulator with the nut.
Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)

9. REINSTALL EGR VALVE AND VACUUM MODULATOR ASSEMBLY
(a) Install the EGR valve and vacuum modulator assembly to the air intake chamber.

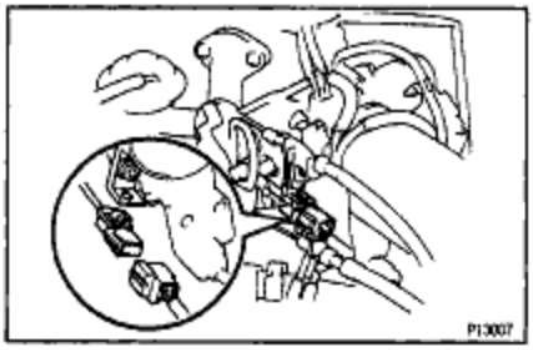




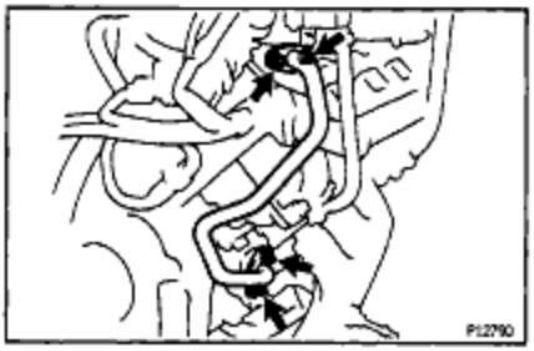
(b) Install and torque the 3 nuts.
Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)



(c) Connect the following vacuum hoses:
(1) Vacuum hose to P port of EGR vacuum modulator
(2) Vacuum hose to a port of EGR vacuum modulator
(3) Vacuum hose to R port of EGR vacuum modulator
(4) Vacuum to EGR valve



10. RECONNECT EGR GAS TEMPERATURE SENSOR CONNECTOR AND CLAMP



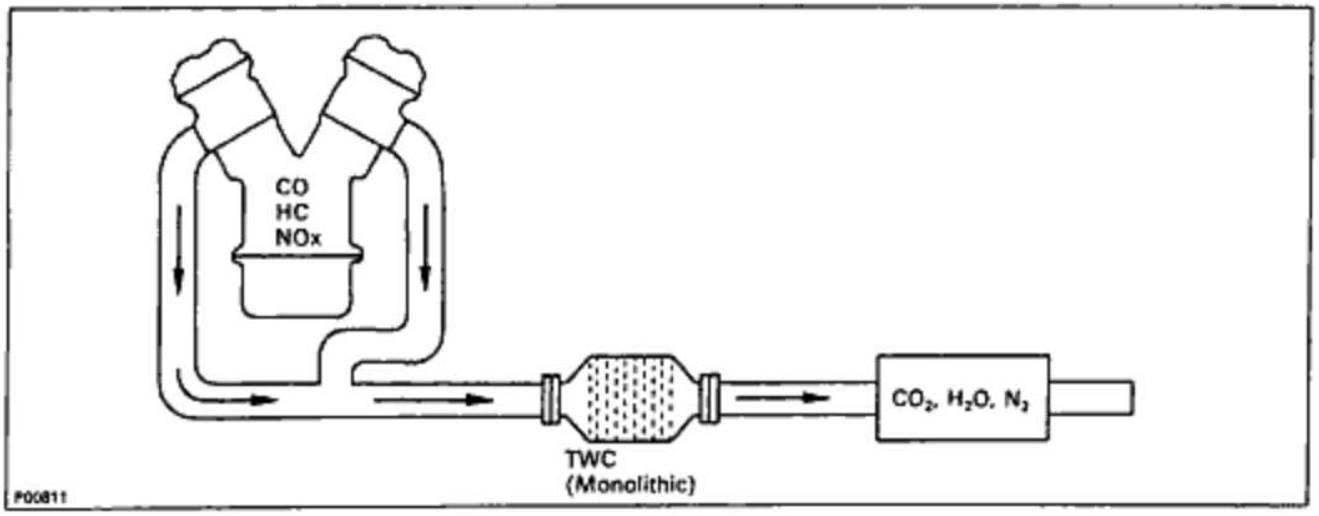
11. REINSTALL EGR PIPE
Install 2 new gaskets and the EGR pipe with the 4 nuts.
Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)

THREE–WAY CATALYTIC CONVERTER (TWC) SYSTEM

DESCRIPTION

To reduce HC. CO and NOx emissions, they are oxidized, reduced and converted to nitrogen (N_2), carbon dioxide ($C0_2$) and water (H_20) by the three–way catalytic converter.

OPERATION

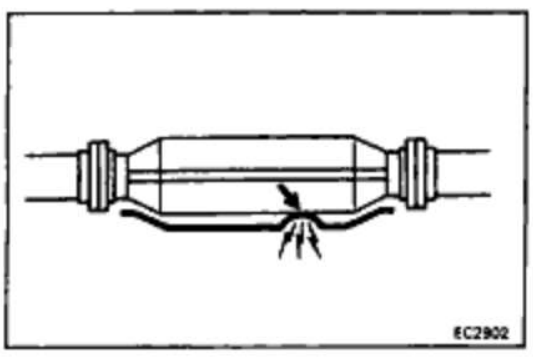


Exhaust port		TWC		Exhaust Gas
HC, CO, AND NOx	→	OXIDATION AND REDUCTION	→	CO_2 H_2O N_2

EXHAUST PIPE ASSEMBLY INSPECTION

1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE

2. CHECK CLAMPS FOR WEAKNESS. CRACKS OR DAMAGE

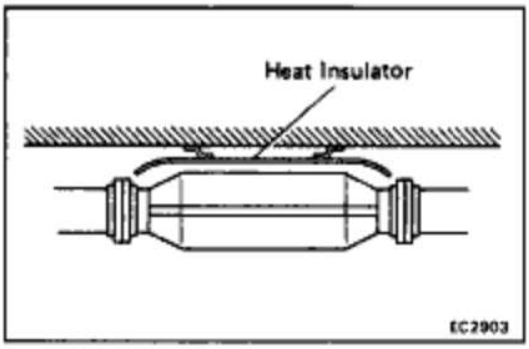


THREE–WAY CATALYTIC CONVERTER

INSPECTION

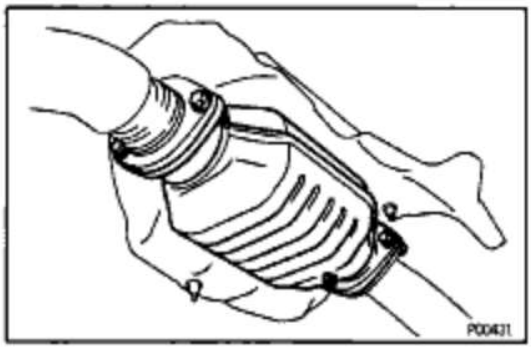
CHECK FOR DENTS OR DAMAGE

If any part of the protector is damaged or dented to the extent that it contacts the three–way catalytic converter, repair or replace it.



HEAT INSULATOR INSPECTION

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



THREE–WAY CATALYTIC CONVERTER REPLACEMENT

1. REMOVE CONVERTER

(a) Jack up the vehicle.
(b) Check that the converter is cool.
(c) Remove the 4 bolts and nuts holding the pipes to the converter.
(d) Remove the converter and 2 gaskets.

2. REINSTALL CONVERTER

(a) Place 2 new gaskets on the front and rear pipes.
(b) Install the converter with the bolts and nuts. Torque the bolts and nuts.
Torque: 43 N–m (440 kgf–cm, 32 ft–lbf)

SERVICE SPECIFICATIONS

SERVICE DATA

VSV for EGR	Resistance	et 20_2 C (68_2 F)	33 –39Ω

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
TVV x Cylinder heed	30	305	22
EGR gas temperature x EGR valve	20	200	14
EGR vacuum modulator x EGR valve	20	200	14
EGR valve x Air intake chamber	12	120	9
EGR pipe x Air intake chamber	12	120	9
EGR pipe x EGR cooler	12	120	9
Three –way catalytic converter x Front exhaust pipe	43	440	32
Three–way catalytic converter x Center exhaust pipe	43	440	32