EMISSION CONTROL SYSTEMS

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	EG R	Reduces NOx
Three–way catalytic converter	TWC	Reduces C0, HC and NOx
*Multiport fuel injection/Sequential multiport fuel injection	MFI/SFI	Regulates all engine conditions for reduction of exhaust emissions.

" For inspection and repair of the MFI/SFI system, refer to MFI/SFI Section.

PREPARATION

SST (SPECIAL SERVICE TOOLS)

	09843–18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

	09082–00050 TOYOTA Electrical Tester Set	

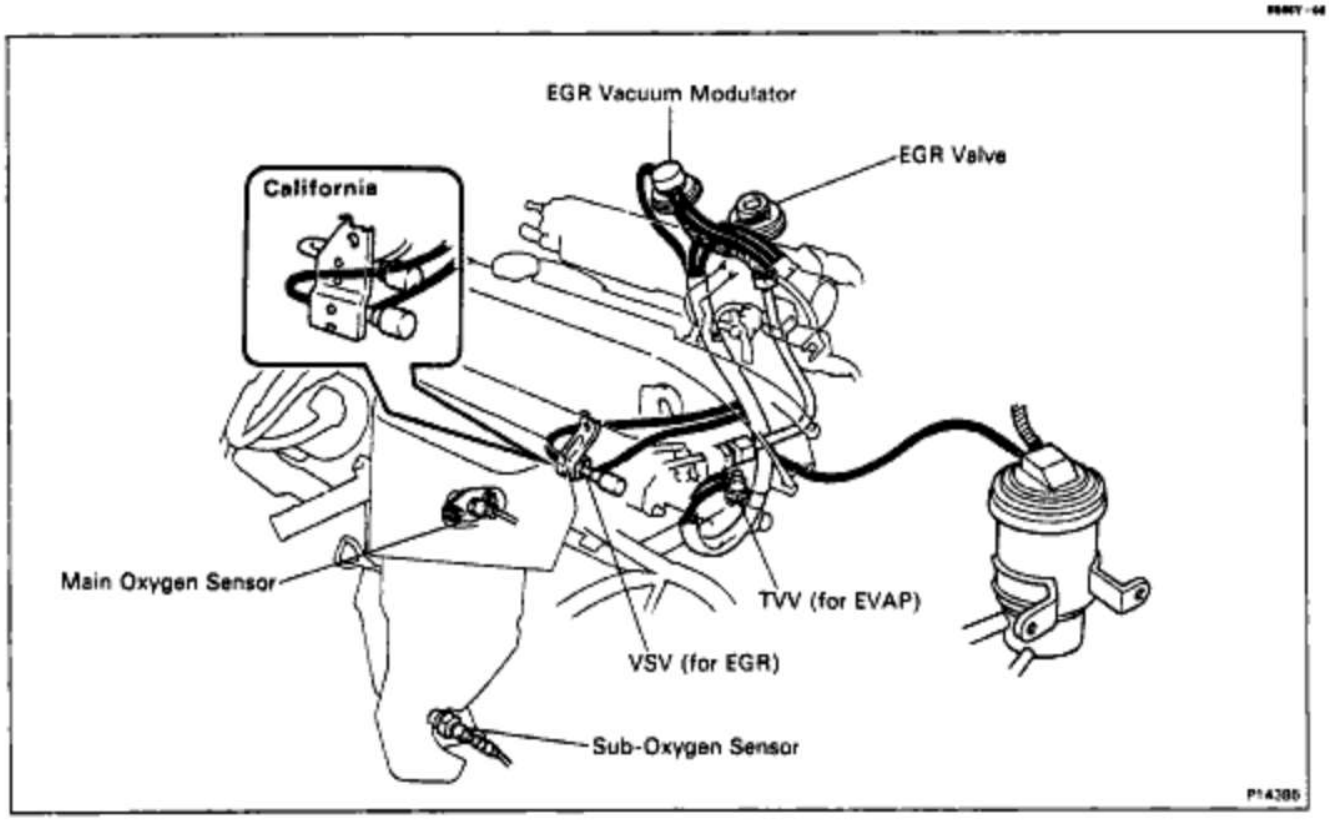
EQUIPMENT

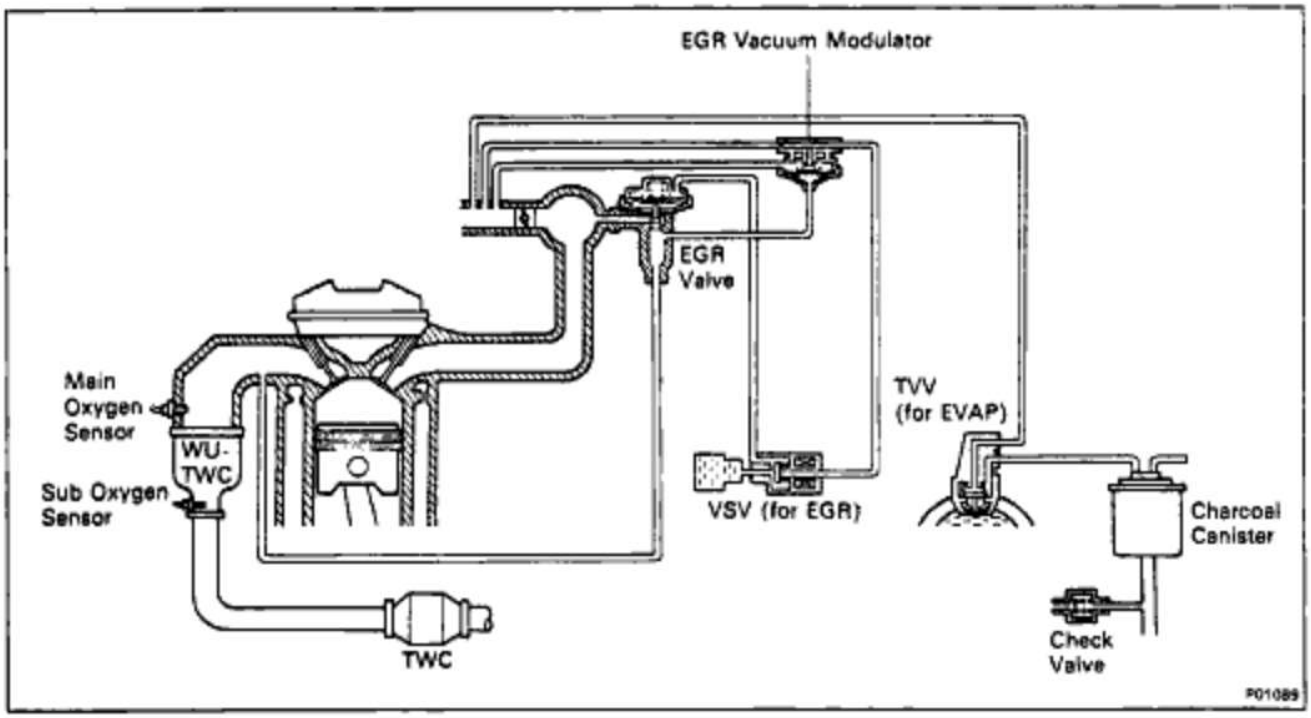
Heater	TVV
Thermometer	TVV
Tachometer	
Torque wrench	
Vacuum gauge	

SSM (SPECIAL SERVICE MATERIALS)

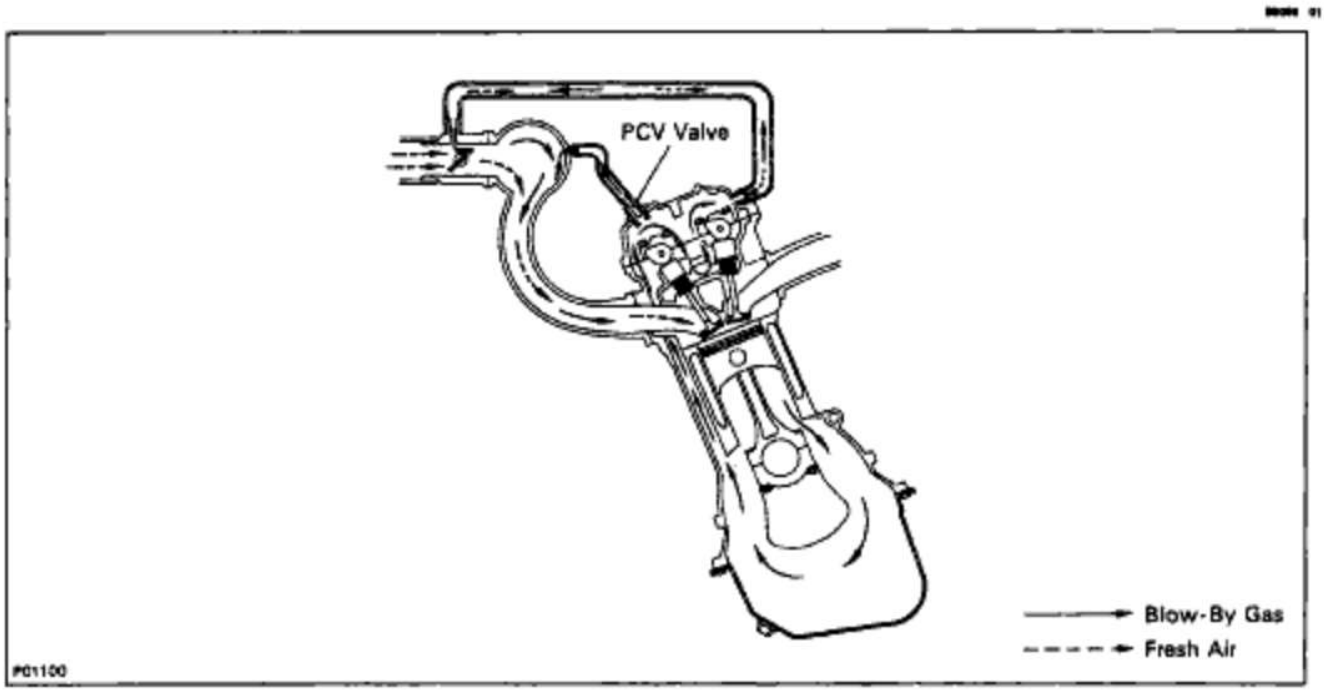
08833–00070 Adhesive 1311, THREE BOND 1311 or equivalent	¿¿V

LAYOUT AND SCHEMATIC DRAWING





POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



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

Engine not Running

- PCV VALVE IS CLOSED.

Normal Operation

- PCV VALVE IS OPEN.
- VACUUM PASSAGE IS LARGE.

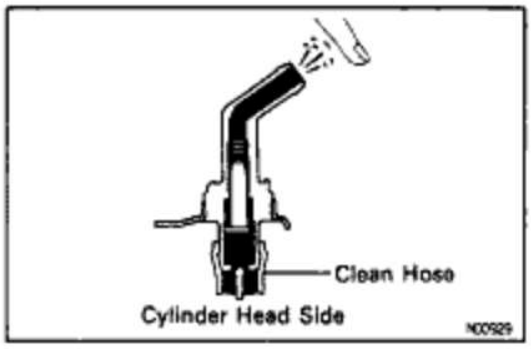
Idling or Deceleration

- PCV VALVE IS OPEN.
- VACUUM PASSAGE IS SMALL.

Acceleration or High Load

- PCV VALVE IS FULLY OPEN.

V04800



PCV VALVE INSPECTION

1. REMOVE PCV VALVE

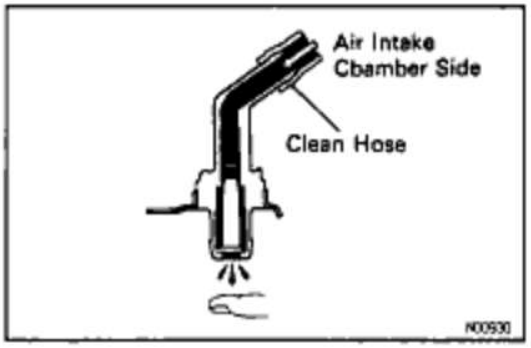
2. INSTALL CLEAN HOSE TO PCV VALVE

3. BLOW AIR FROM CYLINDER HEAD SIDE

Check that air passes through easily.

NOTICE: Do not suck air through the valve.

Petroleum substances inside the valve are harmful.



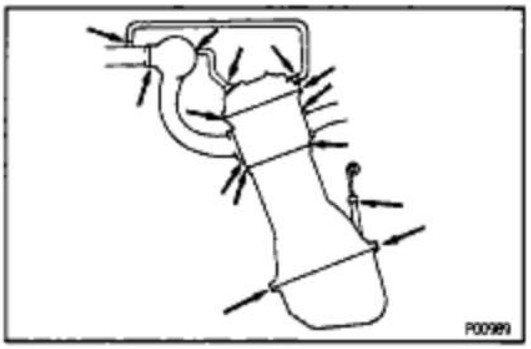
4. BLOW AIR FROM AIR INTAKE CHAMBER SIDE

Check that air passes through with difficulty.

If the PCV valve fails either of the checks, replace it.

5. REMOVE CLEAN HOSE FROM PCV VALVE

6. REINSTALL PCV VALVE



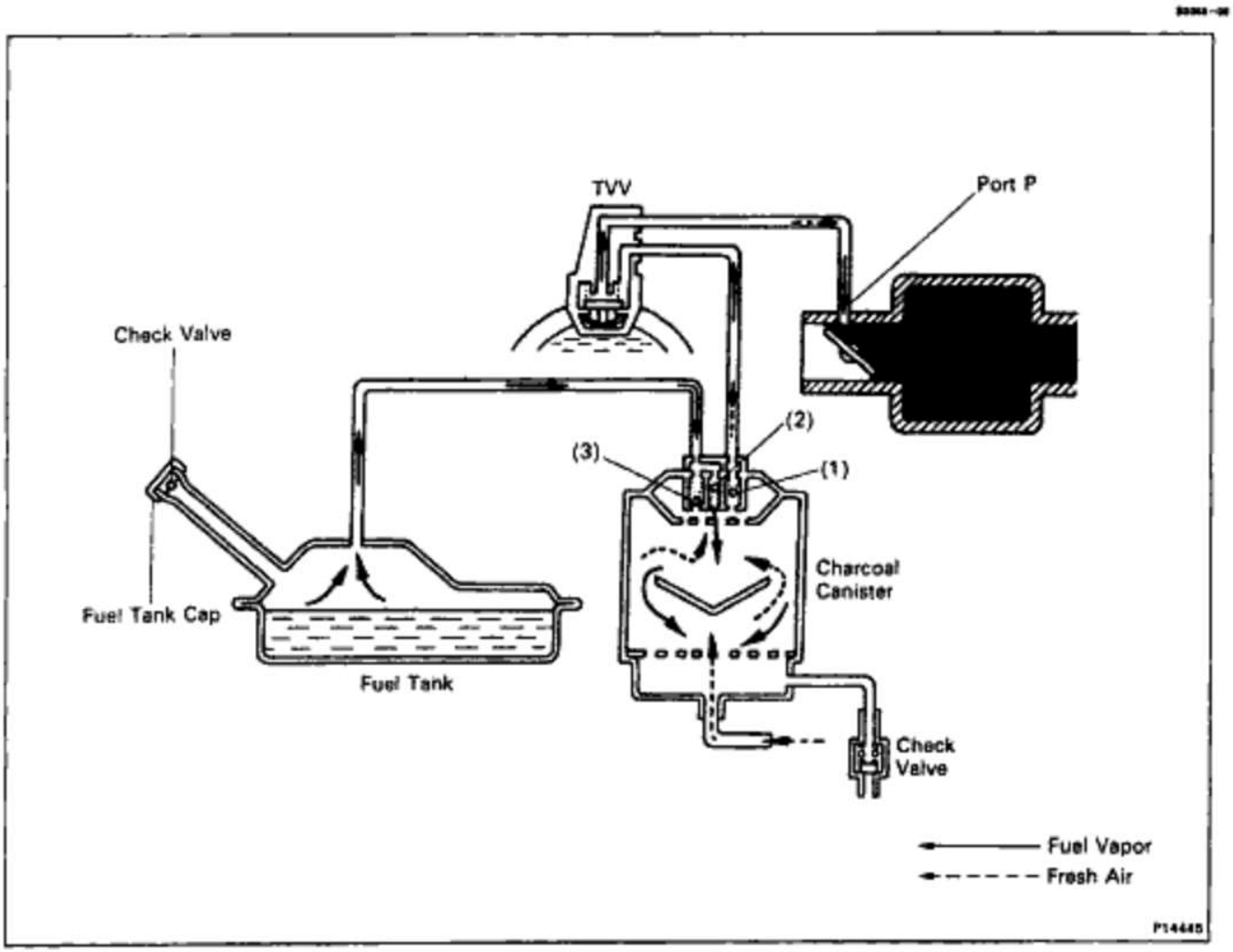
PCV HOSES AND CONNECTIONS

INSPECTION

VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS

Check for cracks, leaks or damage.

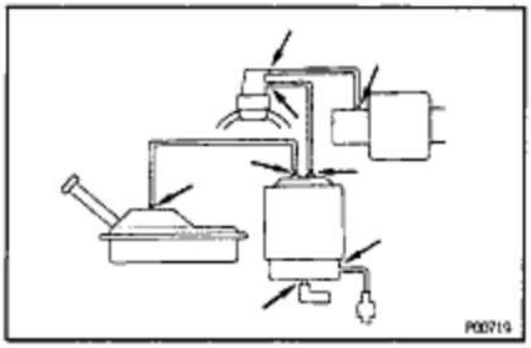
EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM



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

Engine Coolant Temp.	TVV	Throttle Valve Opening	Canister Check Valve			Check Valve In Cap	Evaporated Fuel (HC)
			(1)	(2)	(3)		
Below 35 C (95 F)	CLOSED	-	-	-	-	-	NC from tank is absorbed into the canister
Above 54 C (129 F)	OPEN	Positioned below port P	CLOSED	-	-	-	
		Positioned above port P	OPEN	-	-	-	HC from canister is led into air intake chamber.
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.

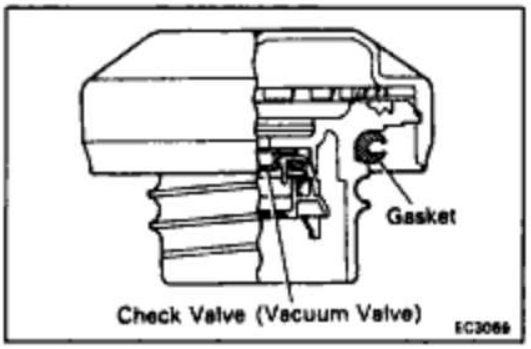
V04477



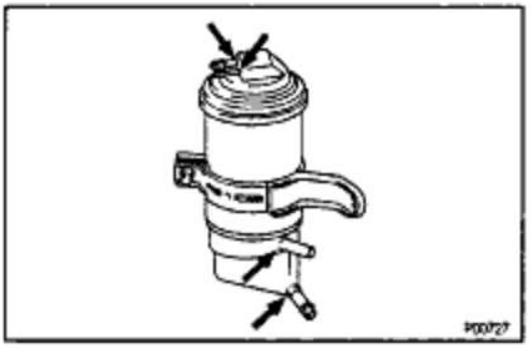
FUEL VAPOR LINES. FUEL TANK AND TANK CAP INSPECTION

1. VISUALLY INSPECT LINES AND CONNECTIONS
Look for loosen connections, sharp bends or damage.
2. VISUALLY INSPECT FUEL TANK

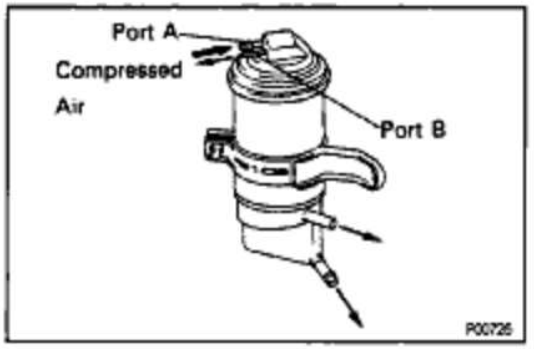
Look for deformation, cracks or fuel leakage.



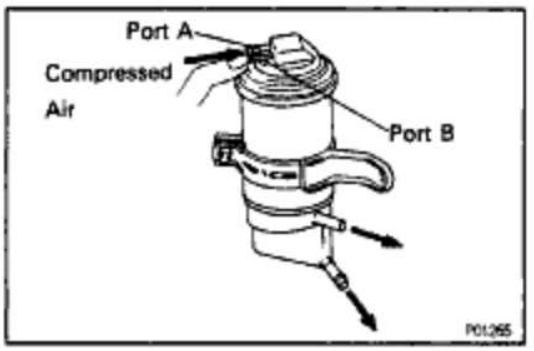
3. VISUALLY INSPECT FUEL TANK CAP
Check if the cap and/or gasket are deformed or dam–aged.
If necessary, repair or replace the cap.



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) Using low pressure compressed air (4.71 kPa, 48 gf/cm^2, 0.68 psi), blow into port A and check that air flows without resistance from the other ports.
(b) Blow air (4.71 kPa, 48 gf/cm1, 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.

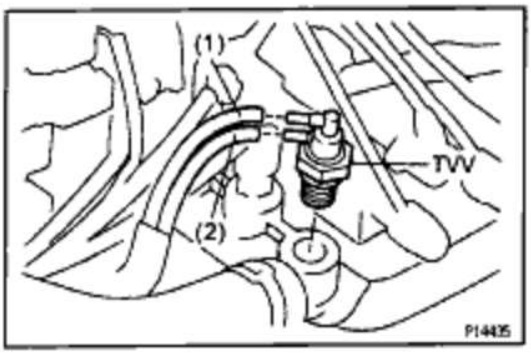


4. CLEAN FILTER IN CANISTER
Clean the filter by blowing 294 kPa (3 kgf/cm1, 43 psi) of compressed air into port A while holding port B closed.

NOTICE:

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

5. REINSTALL CHARCOAL CANISTER



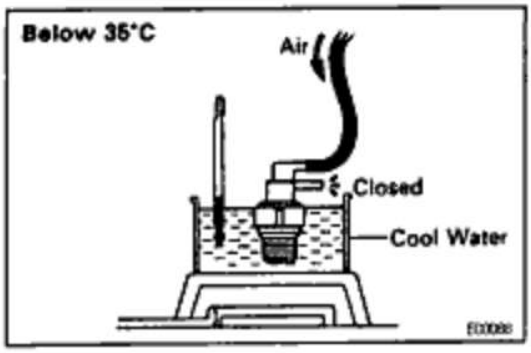
TVV INSPECTION

1. DRAIN ENGINE COOLANT

2. REMOVE TVV FROM WATER INLET HOUSING

(a) Disconnect the following hoses:
(1) Vacuum hose (from throttle body)
(2) Vacuum hose (from charcoal canister)

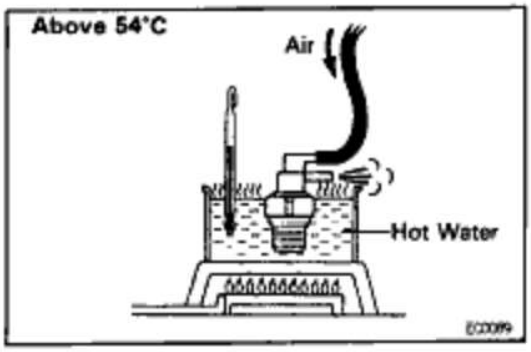
(b) Remove the TVV.



3. INSPECT TVV OPERATION

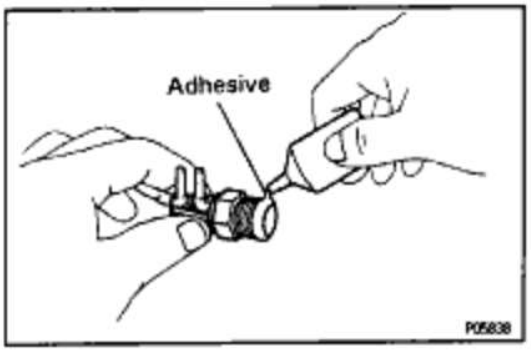
(a) Cool the TVV to below 35 C (95 F) with cool water.

(b) Check that air does not flow from the upper port to lower port.



(c) Heat the TVV to above 54 C (129 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.

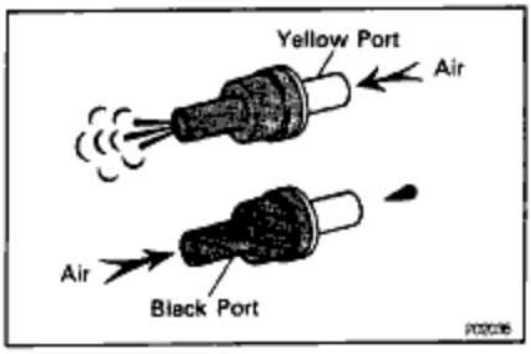


4. REINSTALL TVV

(a) Apply adhesive to 2 or 3 threads of the TVV, and install it.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent
Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)

(b) Reconnect 2 vacuum hoses.

5. REFILL WITH ENGINE COOLANT



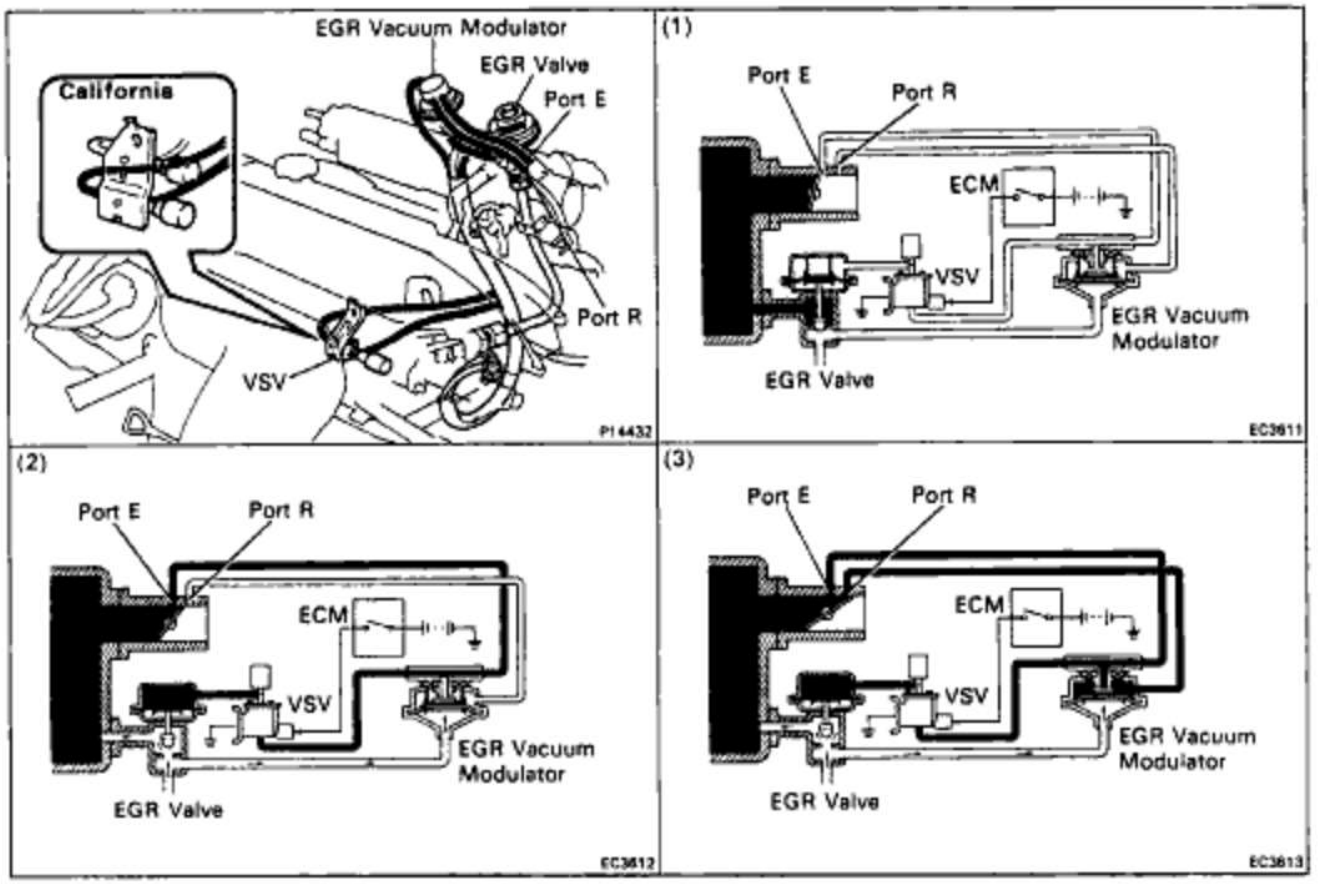
CHECK VALVE INSPECTION

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 the check valve.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM



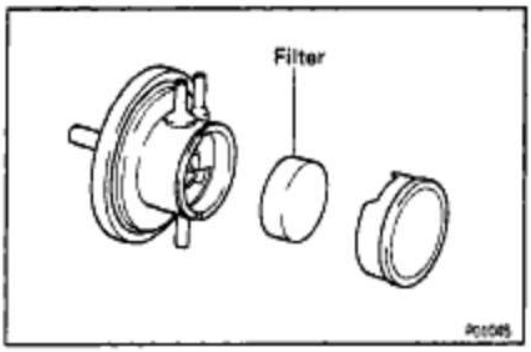
ECT	RPM	PIM (ECM)	VSV	Throttle Valve Opening Angle	Pressure the EGR Valve Pressure Chamber		EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 55°C (131°F)	-	-	CLOSED	-	-		-	CLOSED	Not recirculated
Above 60°C (140°F)	Below 4,000 rpm	OFF	CLOSED	Position below port E	-		-	CLOSED	Not recirculated
			CLOSED	Position below port E	(1)	-	-	CLOSED	Not recirculated
		*** ON	OPEN	Positioned between port E and port R	(2) HIGH	*	CLOSES passage to atmosphere	OPEN	Recirculated
				Position above port R	(3) HIGH	**	CLOSES passage to atmosphere	OPEN	Recirculated (increase)
	Above 4,000 rpm	OFF	CLOSED	-	-		-	CLOSED	Not Recirculated

* Pressure increases → Modulator closes → EGR valve opens → Pressure drops → EGR valve closes → Modulator opens → Pressure increases

** 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 exhaust gas, even if the exhaust pressure is insufficiently low.

*** If terminals TE1 and E1 of data link connector 1 are connected, the VSV switches ON.

V04478

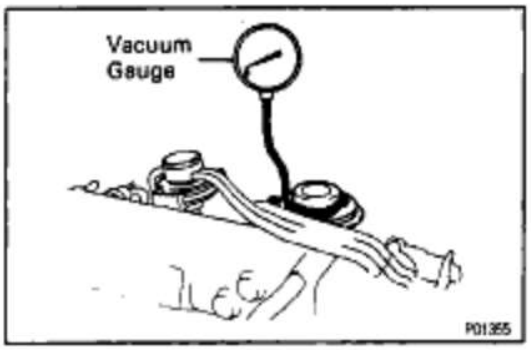


EGR SYSTEM INSPECTION

1. CHECK AND CLEAN FILTER IN EGR VACUUM MODULATOR

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

HINT: Install the filter with the coarser surface facing the atmospheric side (outward).

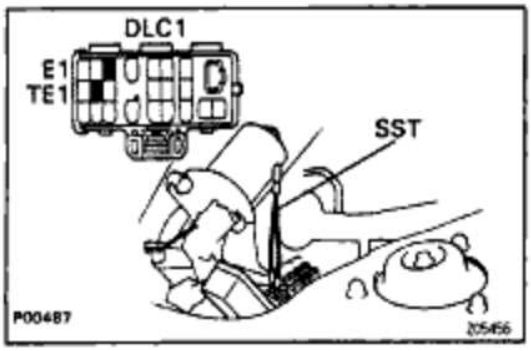


2. PREPARATION

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

3. CHECK SEATING OF EGR VALVE

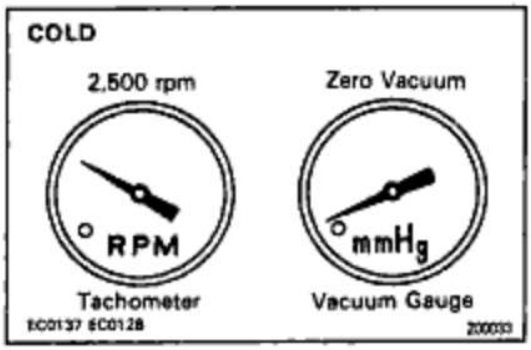
Start the engine and check that the engine starts and runs at idle.



4. CONNECT TERMINALS TE1 AND E1

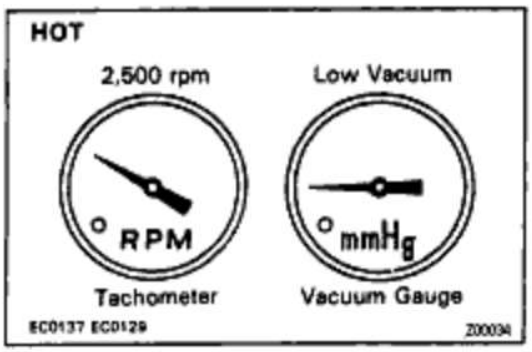
Using SST, connect terminals TE 1 and E 1 of the data link connector 1.

SST 09843–18020



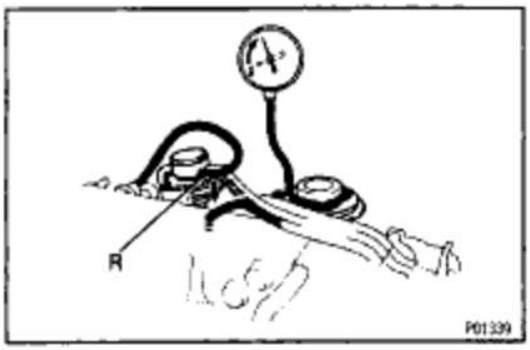
5. CHECK VSV

(a) The engine coolant temperature should be below 60°C (140°F) (A/T) or 55°C (131 °F) (M/T).
(b) Check that the vacuum gauge indicates zero at 2.500 rpm.



6. CHECK VSV AND EGR VACUUM MODULATOR WITH HOT ENGINE

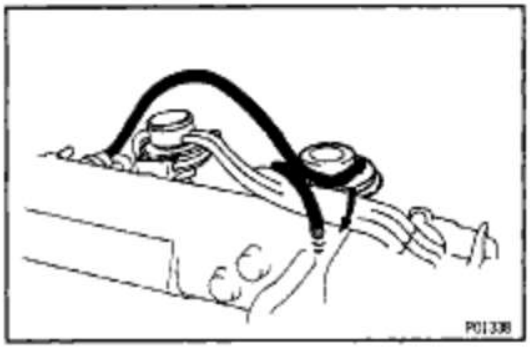
(a) Warm up the engine.
(b) Check that the vacuum gauge indicates low vacuum at 2,500 rpm.



(c) Disconnect the vacuum hose 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.

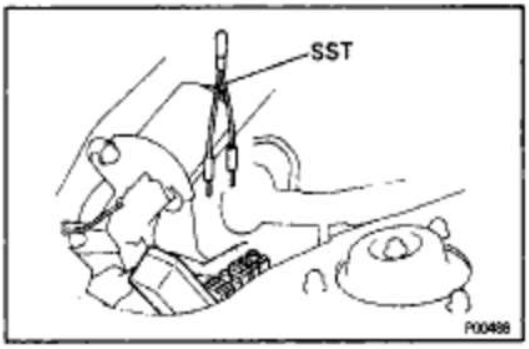
HINT: As a large amount of exhaust gas enters, the engine will misfire slightly.

(e) Remove the vacuum gauge, and reconnect the vacuum hoses to the proper locations.



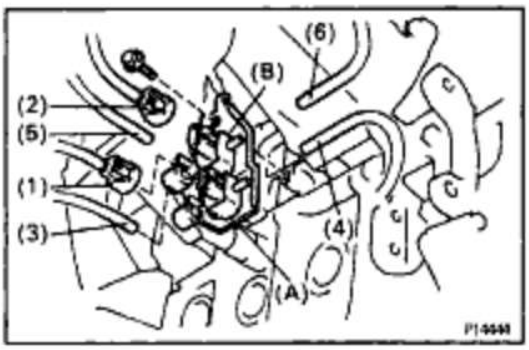
7. CHECK EGR VALVE

(a) Apply vacuum directly to the EGR valve with the engine idling.
(b) Check that the engine runs rough or dies.
(c) Reconnect the vacuum hoses to the proper locations.



8. DISCONNECT TERMINALS TE1 AND E1

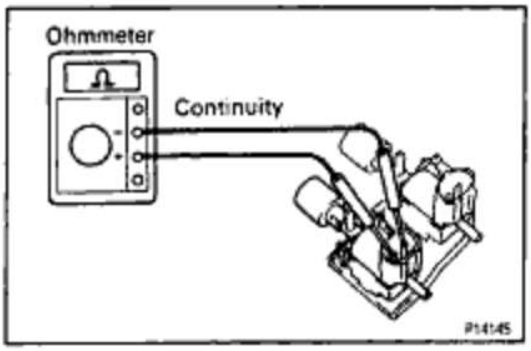
Remove the SST.
SST 09843–18020
IF NO PROBLEM IS FOUND WITH THIS INSPECTION, SYSTEM IS NORMAL; OTHERWISE INSPECT EACH PART



VSV INSPECTION (California)

1. REMOVE VSV

(a) Disconnect the following connectors and hoses:
(1) VSV for EGR
(A) connector
(2) VSV for fuel pressure control
(B) connector
(3) Vacuum hose (from EGR valve) from port E of VSV (A)
(4) Vacuum hose (from port “a” of EGR vacuum modulator) from port G of VSV (A)
(5) Vacuum hose (from fuel pressure regulator) from port E of VSV (B)
(6) Vacuum hose (from air intake chamber) from port G of VSV (B)
(b) Remove the bolt and VSV assembly.



2. INSPECT VSV

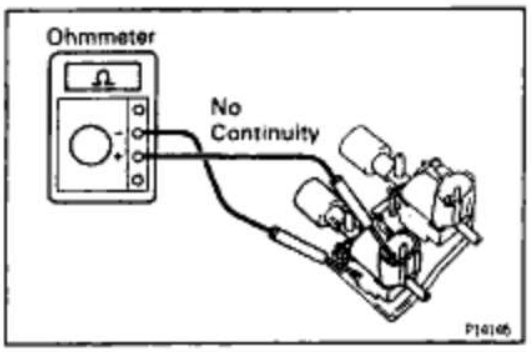
A. Inspect VSV for open circuit

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

Resistance (Cold):

33–39Ω

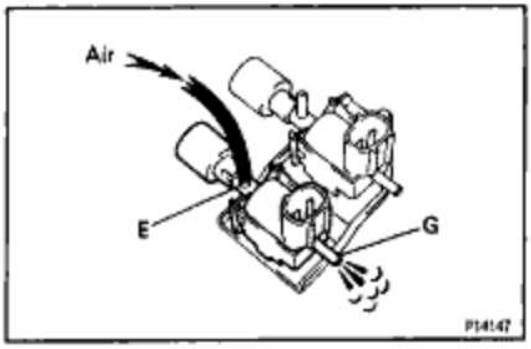
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

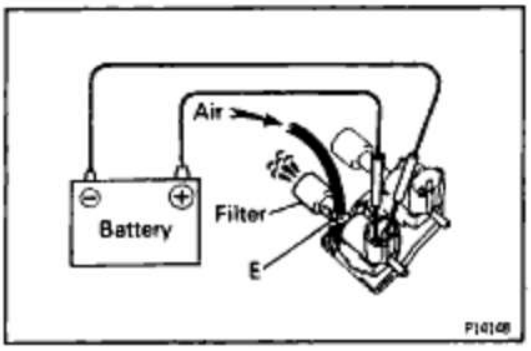
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

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

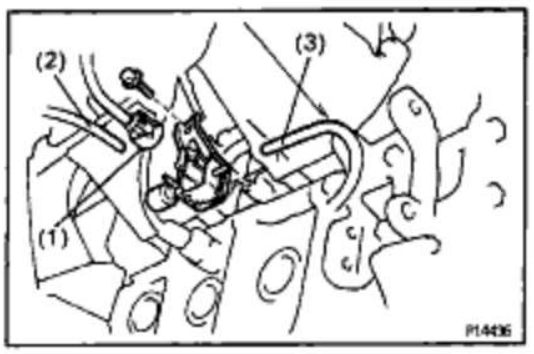


(b) Apply battery voltage across the terminals.

(c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

3. REINSTALL VSV



VSV INSPECTION (Except California)

1. REMOVE VSV

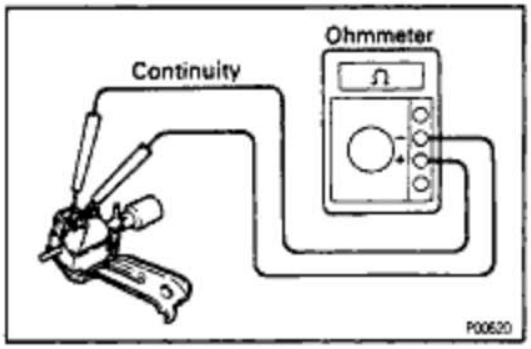
(a) Disconnect the following connector and hoses:

(1) VSV connector

(2) Vacuum hose (from EGR valve) from port E of VSV

(3) Vacuum hose (from port “Q” of EGR vacuum modulator) from port G of VSV

(b) Remove the bolt and VSV.



2. INSPECT VSV

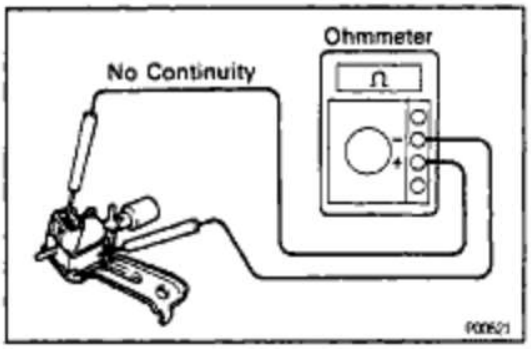
A. Inspect VSV for open circuit

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

Resistance (Cold):

33–39Ω

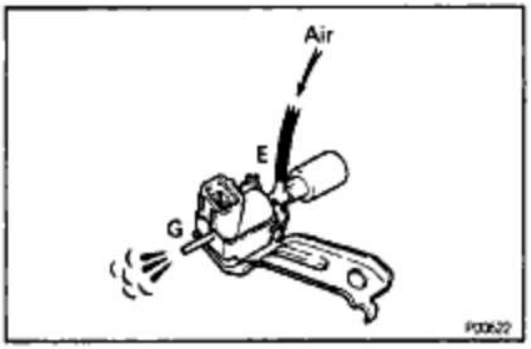
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

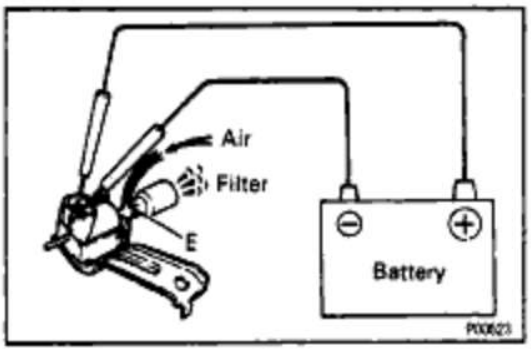
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

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

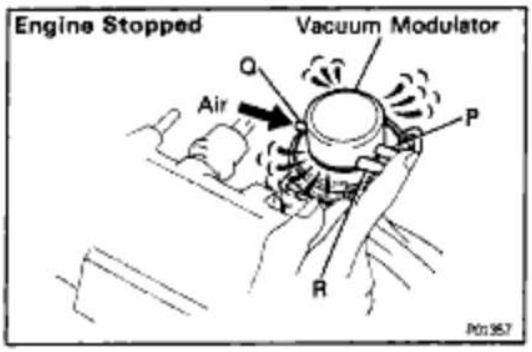


(b) Apply battery voltage across the terminals.

(c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

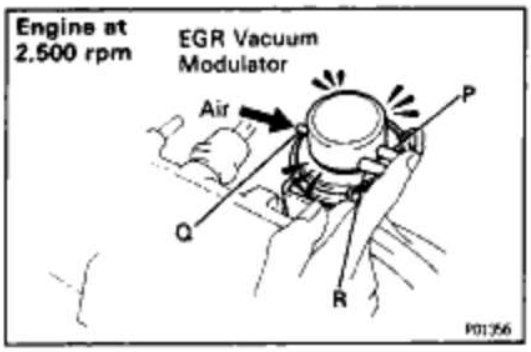
3. REINSTALL VSV



EGR VACUUM MODULATOR INSPECTION

CHECK EGR VACUUM MODULATOR OPERATION

(a) Disconnect the vacuum hoses from ports P, Q and R of the EGR vacuum modulator.
(b) Block ports P and R with your finger.
(c) Blow air into port Q, and check that the air passes through to the air filter side freely.



(d) Start the engine, and maintain speed at 2.500 rpm.
(e) Repeat the above test. Check that there is a strong resistance to air flow.
(f) Reconnect the vacuum hoses to the proper locations.

EGR VALVE INSPECTION

1. REMOVE EGR VALVE

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

2. REINSTALL EGR VALVE WITH NEW GASKET

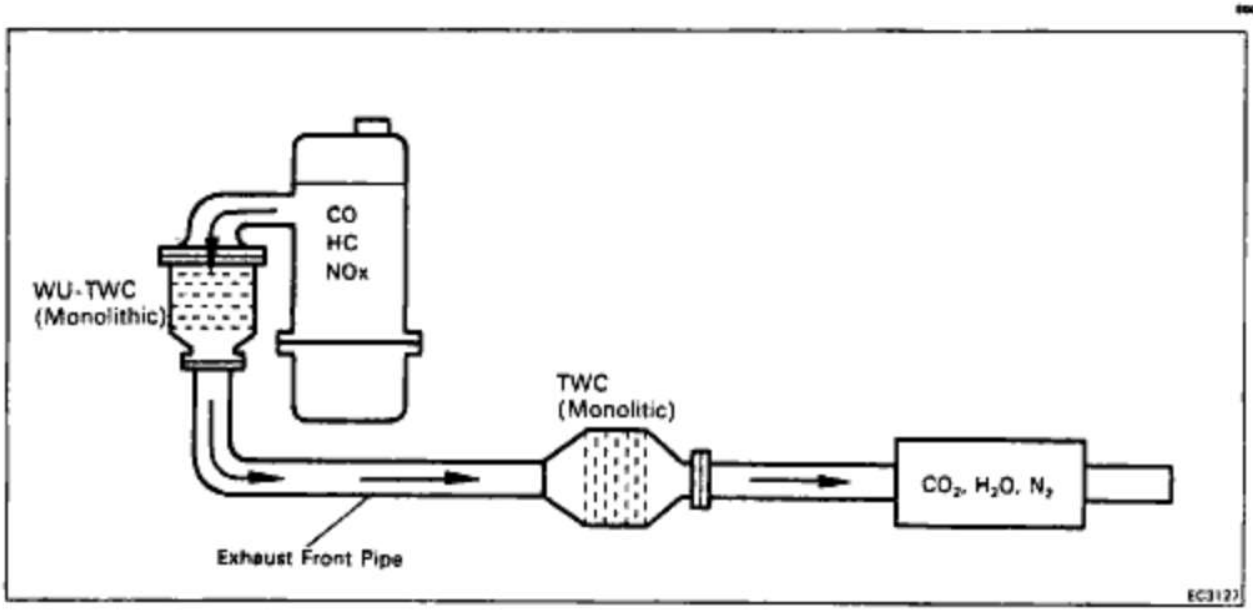
Nut

Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)

Union nut

Torque: 59 N–m (600 kgf–cm, 43 ft–lbf)

THREE–WAY CATALYTIC CONVERTER (TWC) SYSTEM

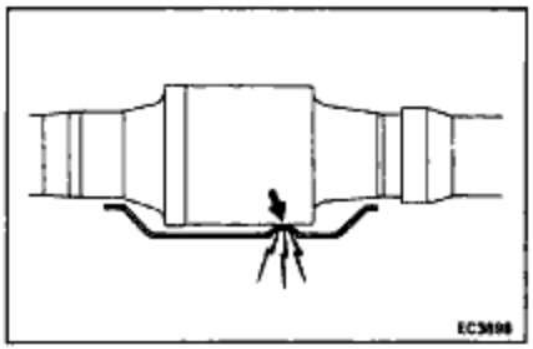


To reduce C0, HC end NOx emissions, they are oxidized, reduced and converted to carbon dioxide (CO_2), water (H_20) and nitrogen (N_2) by the catalyst.

Exhaust Port		WU–TWC		TWC		Exhaust Gas
CO HC NOx	→	OXIDATION AND REDUCTION	→	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

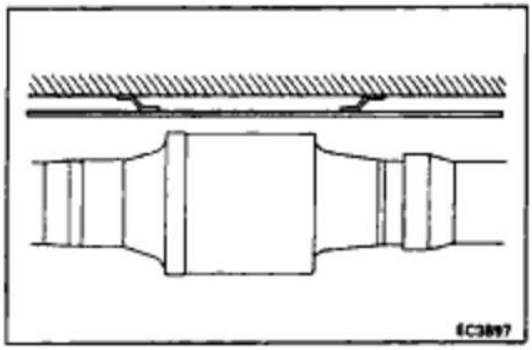


THREE–WAY CATALYTIC CONVERTER INSPECTION

TWC:

CHECK FOR DENTS OR DAMAGE

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

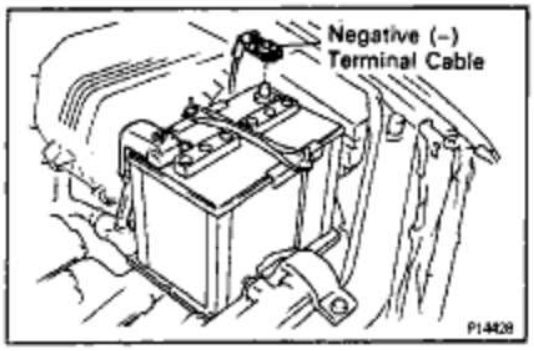


HEAT INSULATOR INSPECTION

TWC:

1. CHECK HEAT INSULATOR FOR DAMAGE

2. CHECK FOR ADEQUATE CLEARANCE BETWEEN THREE – WAY CATALYTIC CONVERTER AND HEAT INSULATOR

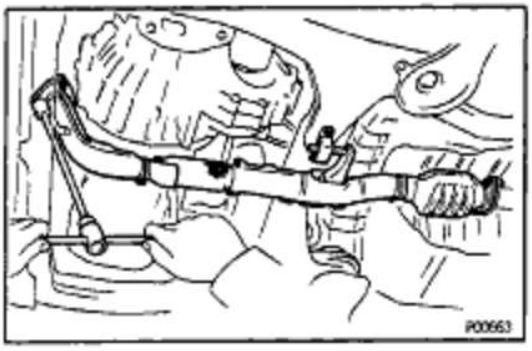


THREE–WAY CATALYTIC CONVERTER REPLACEMENT

WU–TWC:

1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.



2. REMOVE FRONT EXHAUST PIPE

(a) Loosen the 2 bolts, and disconnect the bracket.

(b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.

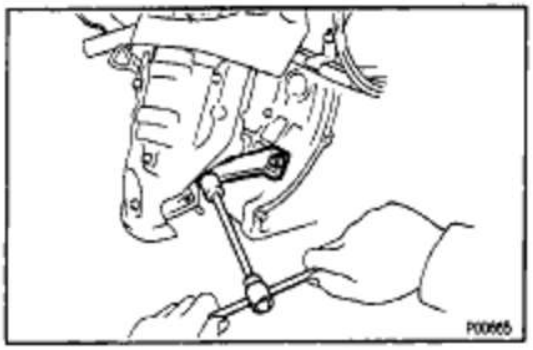
(c) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU–TWC.

(d) Remove the front exhaust pipe and gaskets.

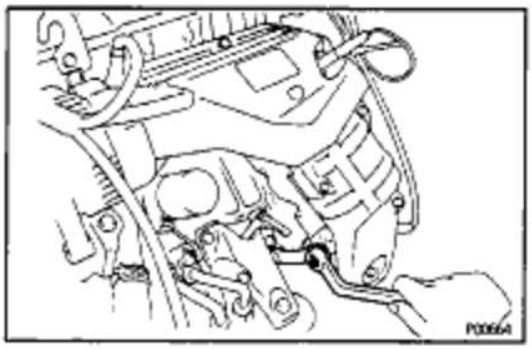
3. REMOVE WARM UP THREE – WAY CATALYTIC CONVERTER

(a) Check that the WU–TWC is cool.

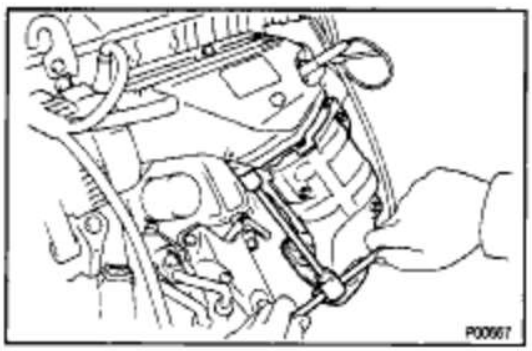
(b) Disconnect the sub oxygen sensor connector.



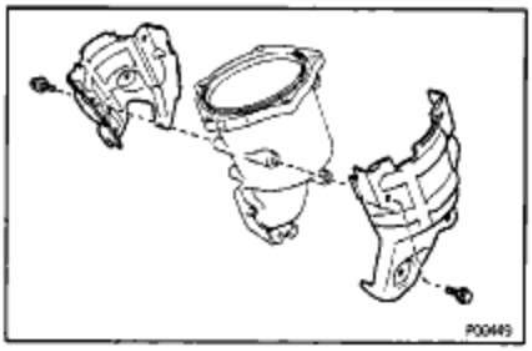
(c) Remove the bolt, nut and No. 1 manifold stay.



(d) Remove the bolt, nut and manifold stay.

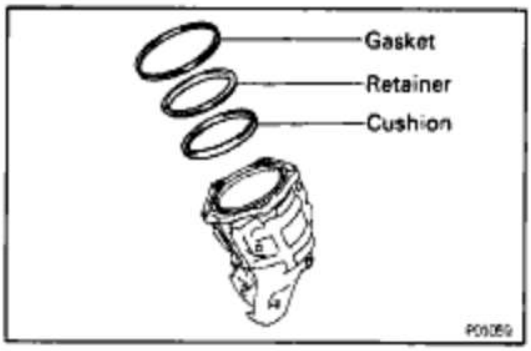


(e) Remove the 3 bolts, 2 nuts, WU –TWC, gasket, retainer and cushion.
(f) Remove the 8 bolts and 2 heat insulators from the WU –TWC.

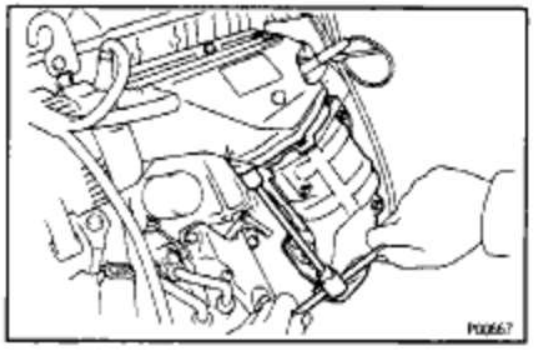


4. REINSTALL WARM–UP THREE–WAY CATALYTIC CONVERTER

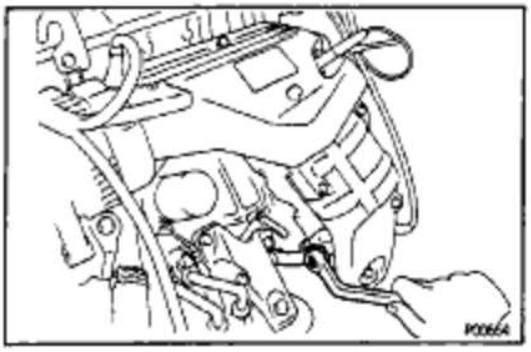
(a) Install the 2 heat insulators to a new WU –TWC with the 8 bolts.



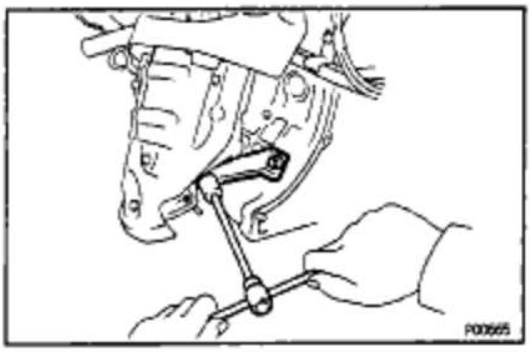
(b) Place new cushion, retainer and gasket on the WU–TWC.



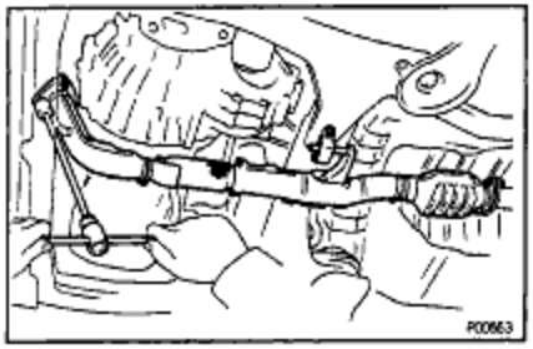
(c) Install the WU–TWC with the 3 bolts and 2 new nuts.
Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)



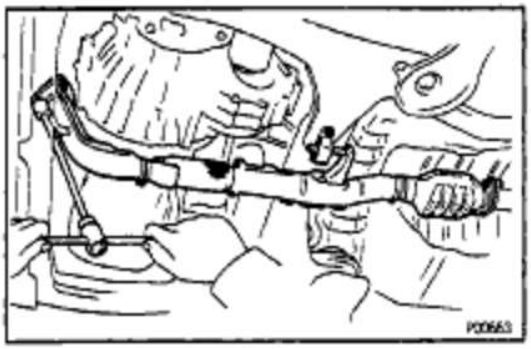
(d) Install the manifold stay with the bolt and nut.
Torque: 42 N–m (425 kgf–cm. 31 ft–lbf)



(e) Install the No. 1 manifold stay with the bolt and nut.
Torque: 42 N–m (425 kgf–cm. 31 ft–lbf)
(f) Connect the sub oxygen sensor connector.



5. REINSTALL FRONT EXHAUST PIPE
(a) Place 2 new gaskets on the front and rear of the front exhaust pipe.
(b) Temporarily install the 2 bolts and 2 new nuts holding the front exhaust pipe to the center exhaust pipe.
(c) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU –TWC.
Torque: 62 N–m (630 kgf–cm, 46 ft–lbf)
(d) Tighten the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
Torque: 58 N–m (570 kgf–cm, 41 ft–lbf)
(e) Install the bracket with the 2 bolts.
6. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY



TWC:

1. REMOVE FRONT EXHAUST PIPE (THREE – WAY CATALYTIC CONVERTER)

(a) Loosen the 2 bolts, and disconnect the bracket.
(b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
(c) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU–TWC.
(d) Remove the front exhaust pipe and gasket.

2. REINSTALL FRONT EXHAUST PIPE (THREE–WAY CATALYTIC CONVERTER)

(a) Place 2 new gaskets on the front and rear of the front exhaust pipe.
(b) Temporarily install the 2 bolts and 2 new nuts holding the front exhaust pipe to the center exhaust pipe.
(c) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU –TWC.
Torque: 412 N–m (630 kgf–cm, 46 ft–lbf)
(d) Tighten the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
Torque: 58 N–m (570 kgf–cm, 41 ft–lbf)
(e) Install the bracket with the 2 bolts.

SERVICE SPECIFICATIONS
SERVICE DATA

VSV (for EGR)	Resistance	at 20°C (68°F)	33 – 39 Ω

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
TVV x Water outlet housing	29	300	22
EGR valve x Intake manifold	13	130	9
EG R valve x EGR pipe	59	600	43
WU–TWC x Exhaust manifold	29	300	22
Exhaust manifold stay x WU–TWC	42	425	31
Exhaust manifold stay x FR engine mounting insulator	42	425	31
No.1 exhaust manifold stay x WU–TWC	42	425	31
No.1 exhaust manifold stay x Cylinder block	42	425	31
Front exhaust pipe x WU–TWC	62	630	46
Front exhaust pipe x Center exhaust pipe	56	570	41