Emissions Control System

GENERAL

EEHA0010

SPECIFICATIONS

Components	Function	Remarks
Crankcase Emission System Positive crankcase ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System EVAP Canister EVAP Canister Purge Solenoid Valve	HC reduction	Duty control solenoid valve
Exhaust Emission System MFI system (air-fuel mixture control device) Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor feedback type Monolithic type

EVAP : Evaporative Emission

SERVICE STANDARD

EVAP Canister Purge Solenoid Valve Coil current	0.45A or below (at 12V)

TIGHTENING TORQUE

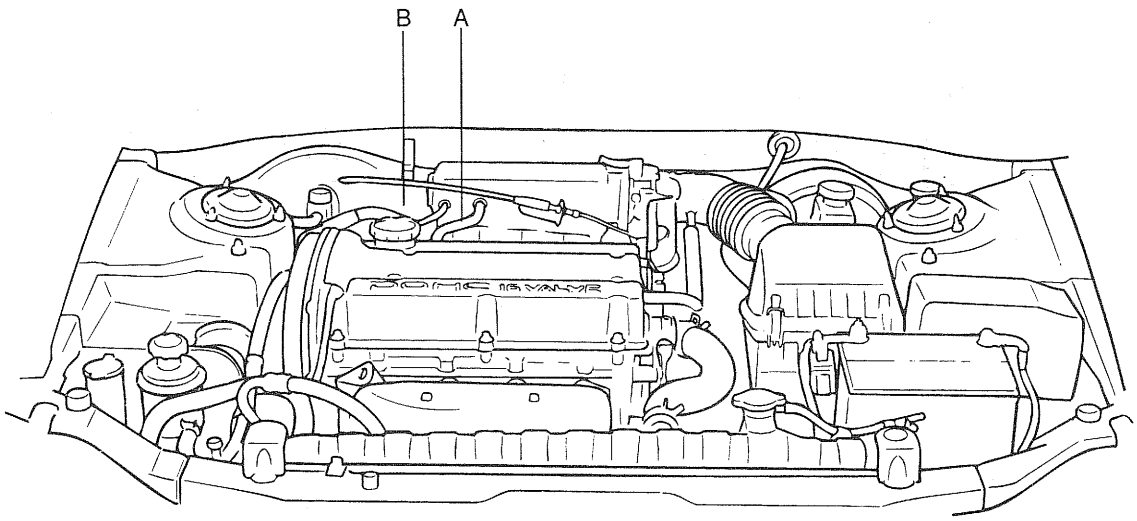
Item	Nm	kg·cm	lb·ft
Positive crankcase ventilation valve	8-12	80-120	6-9

TROUBLESHOOTING

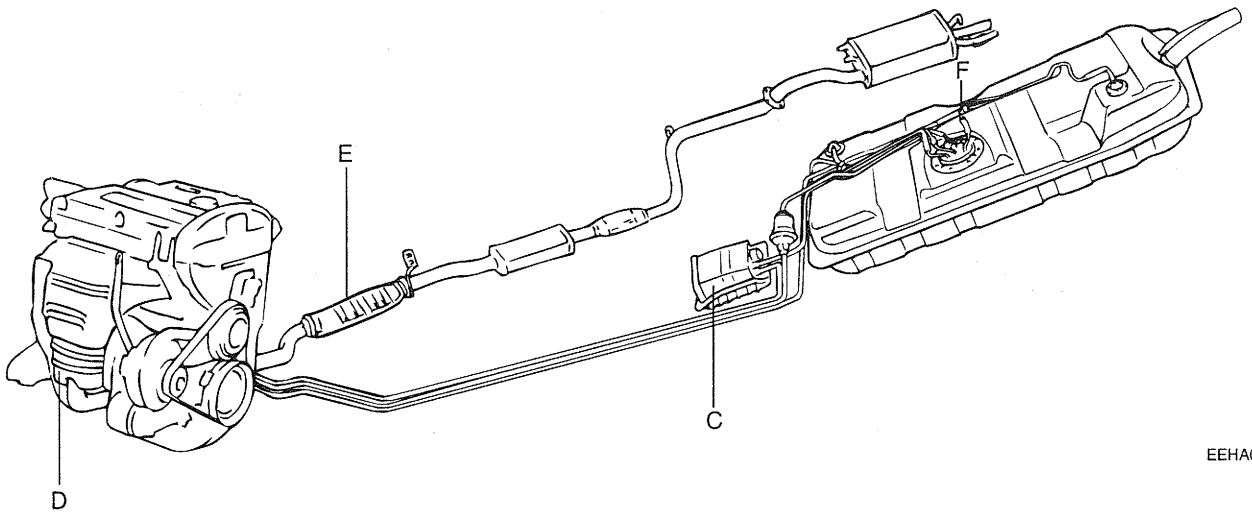
Symptom	Probable cause	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged EGR valve is not closed Malfunction of the EVAP Canister Purge Solenoid Valve	Repair or replace Repair or replace Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged EGR valve is not closed Malfunction of the PCV valve Malfunction of the EVAP Canister Purge System	Repair or replace Repair or replace Replace Check the system; if there is a problem, check its component parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system
Poor fuel mileage	Malfunction of the exhaust gas recirculation	Check the system; if there is a problem, check its component parts

EMISSION CONTROLS LOCATION EEHA0050

[2.0 I4]



EEA9005A

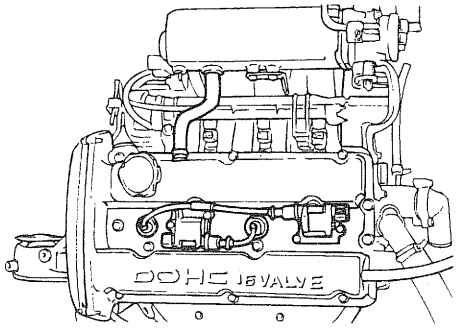


EEHA005B

A. PCV Valve
B. EVAP Canister Purge Solenoid Valve
C. EVAP Canister
D. Catalytic converter (MCC) ..... OBD-II area.
E. Catalytic converter (UCC) ..... OBD-II and General area.
F. Two-way valve

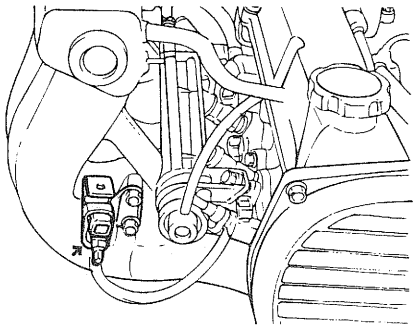
EEHA005A

A. PCV valve



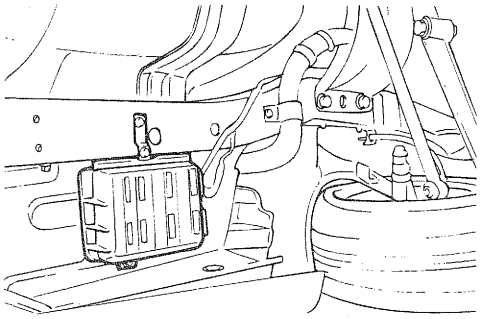
EEA9005C

B. EVAP Canister Purge Solenoid Valve



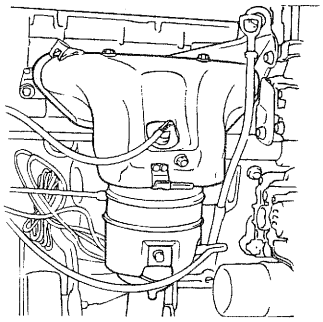
EEA9005D

C. EVAP. Canister



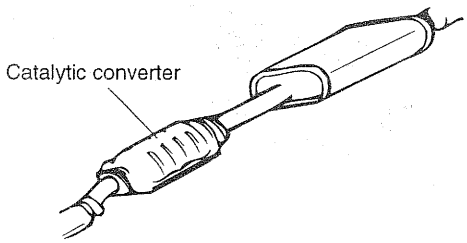
EEA9005E

D. Catalytic Converter (MCC)



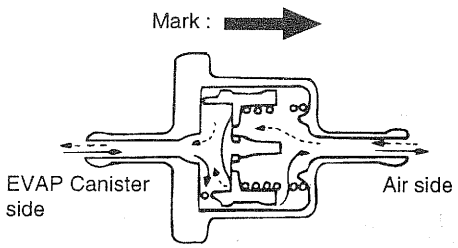
EEA9005G

E. Catalytic Converter (UCC)



EEA9005F

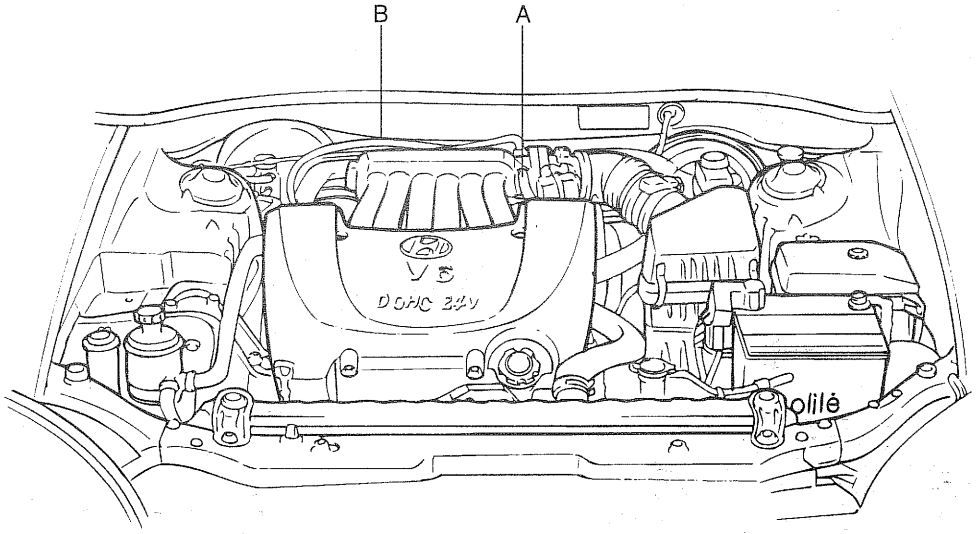
F. Two-way Valve



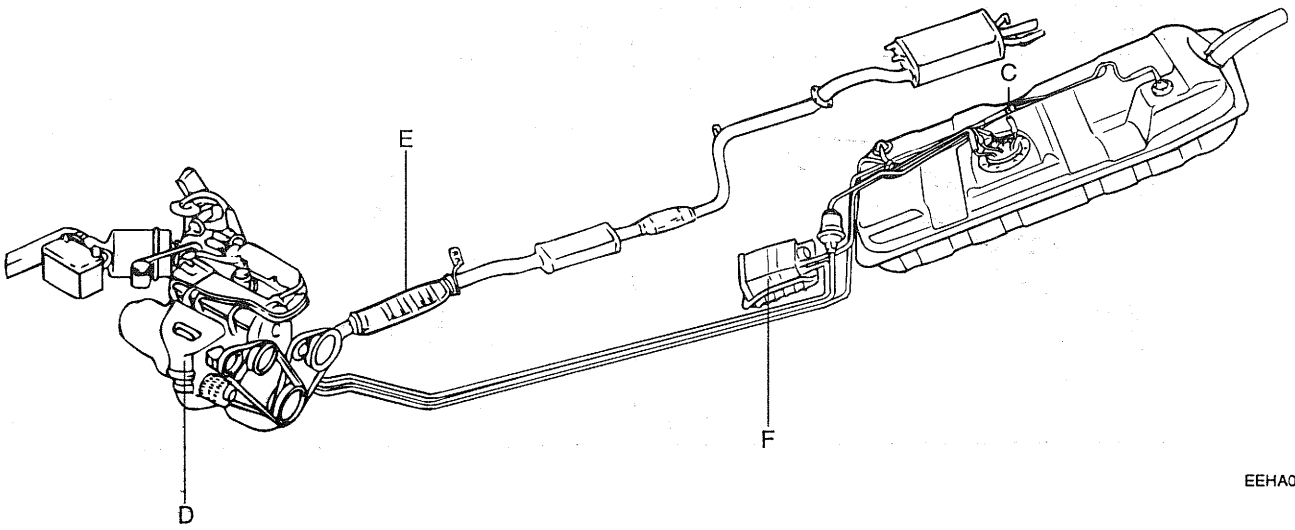
V5EC201D

EMISSION CONTROLS LOCATION EEHA0060

[2.7 V6]



EEA9006A

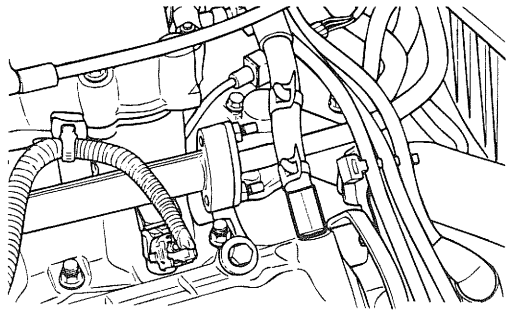


EEHA006A

A. PCV Valve
B. EVAP Canister Purge Solenoid Valve
C. Two-way valve
D. Catalytic converter (MCC) ..... OBD-II area.
E. Catalytic converter (UCC) ..... OBD-II and General area.
F. EVAP Canister

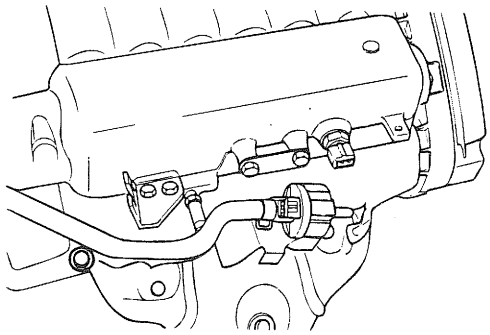
EEHA006A

A. PCV valve



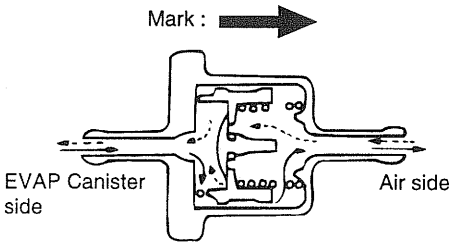
KFW4002A

B. EVAP Canister Purge Solenoid Valve



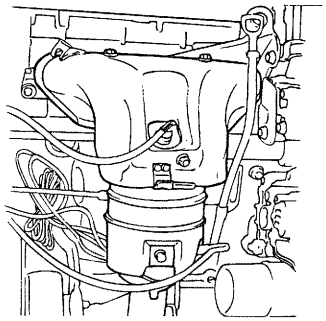
KFW5011A

C. Two-way Valve



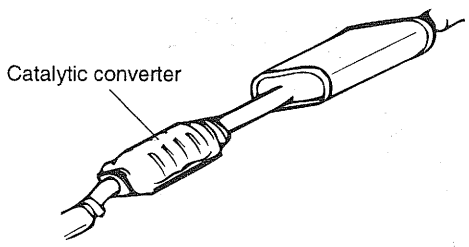
V5EC201D

D. Catalytic Converter (MCC)



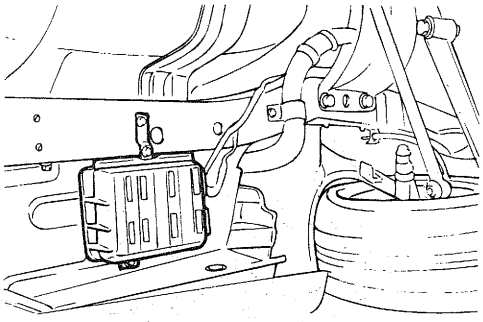
EEA9005G

E. Catalytic Converter (UCC)



EEA9005F

F. Evap. Canister

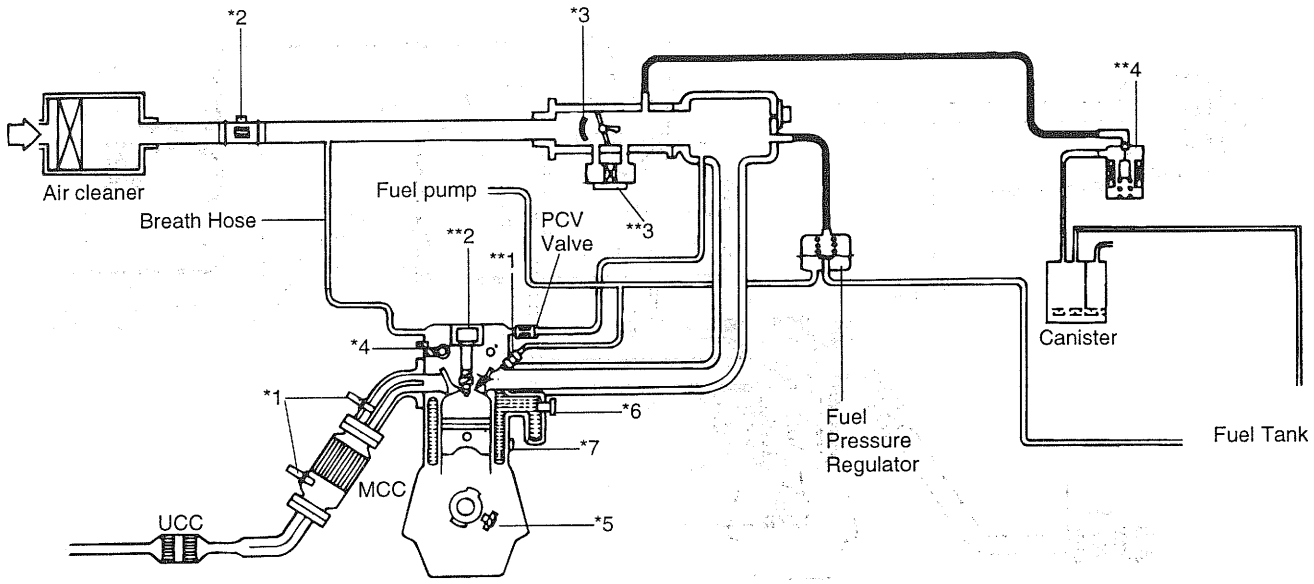


EEA9005E

SCHEMATIC DRAWING (2.0 I4, OBD-II) EEHA0071

[UNLEADED, OBD-II]

*1. HEATER OXYGEN SENSOR (HO2S) *2. HOT FILM SENSOR *3. THROTTLE POSITION SENSOR (With Idle Switch) *4. CAMSHAFT POSITION SENSOR (CMP SENSOR) *5. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *6. ENGINE COOLANT TEMP. SENSOR (ECT Sensor) *7. KNOCK SENSOR	o IGNITION SWITCH o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o POWER STEERING SWITCH o IGNITION DETECT SIGNAL o BATTERY VOLTAGE	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



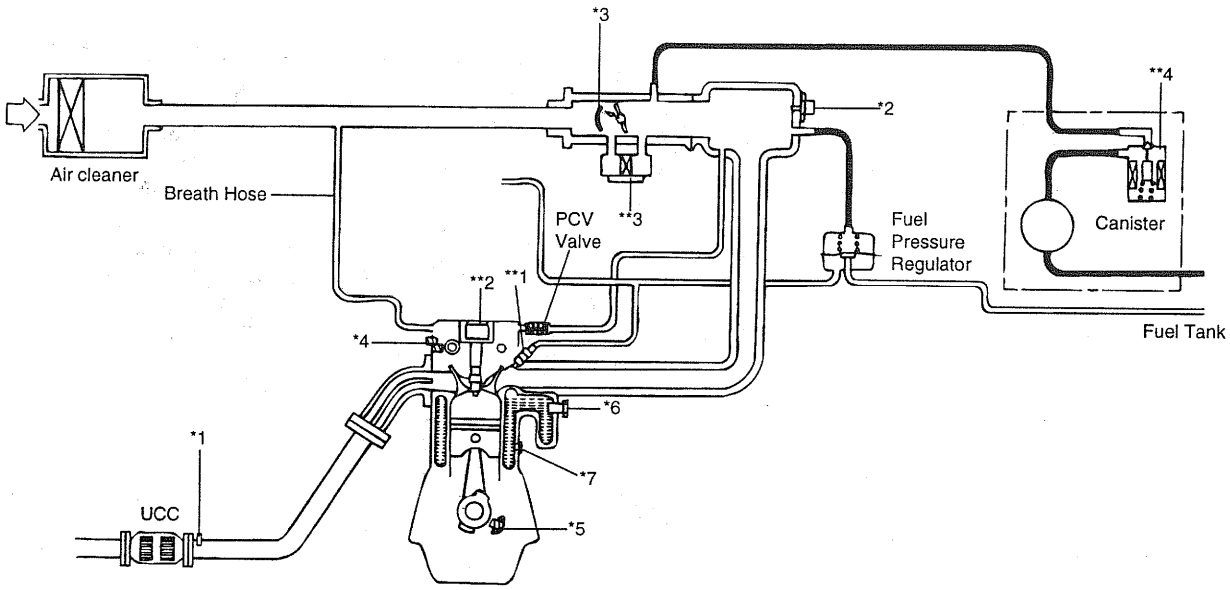
ECM : Engine Control Module
EVAP : Evaporative Emission
MCC : Manifold Catalytic Converter
UCC : Under floor Catalytic Converter

EEHA007A

SCHEMATIC DRAWING (2.0 I4) EEHA0070

[UNLEADED]

*1. HEATER OXYGEN SENSOR (HO2S) *2. MAP & IAT SENSOR *3. THROTTLE POSITION SENSOR (With Idle Switch) *4. CAMSHAFT POSITION SENSOR (CMP SENSOR) *5. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *6. ENGINE COOLANT TEMP. SENSOR (ECT Sensor) *7. KNOCK SENSOR	o IGNITION SWITCH o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o POWER STEERING SWITCH o IGNITION DETECT SIGNAL o BATTERY VOLTAGE	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



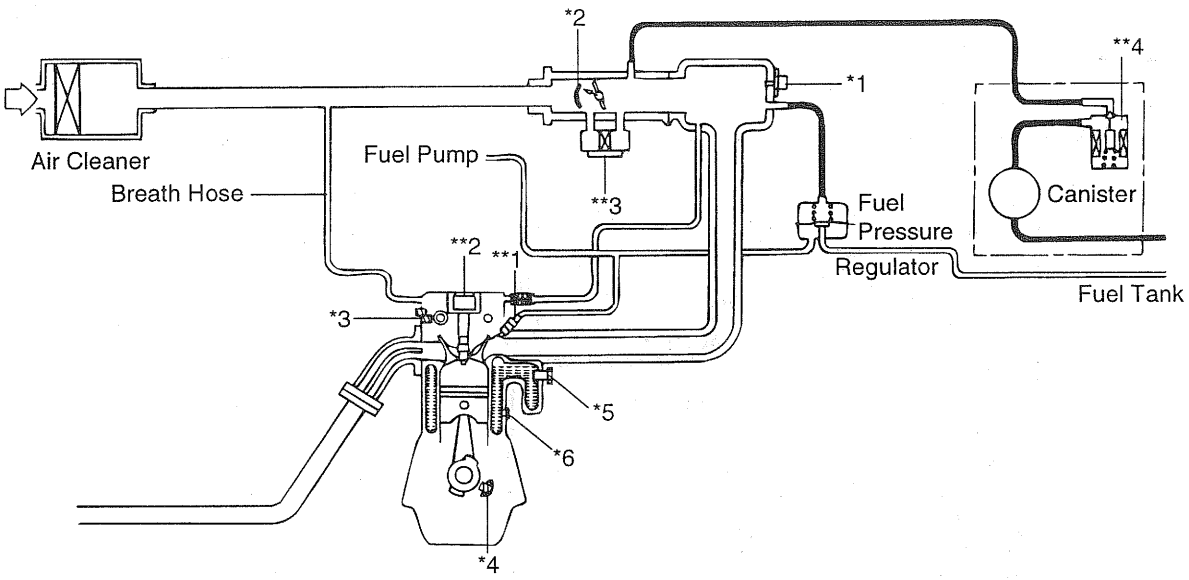
ECM : Engine Control Module
EVAP : Evaporative Emission
UCC : Under floor Catalytic Converter

EEHA007B

SCHEMATIC DRAWING (2.0 I4) EEHA0080

[LEADED]

*1. MAP & IAT SENSOR *2. THROTTLE POSITION SENSOR (With Idle Switch) *3. CAMSHAFT POSITION SENSOR (CMP SENSOR) *4. CAMSHAFT POSITION SENSOR (CKP SENSOR) *5. ENGINE COOLANT TEMP. SENSOR (ECT SENSOR) *6. KNOCK SENSOR	o IGNITION SWITCH o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o POWER STEERING SWITCH o IGNITION DETECT SIGNAL o BATTERY VOLTAGE o VARIABLE REGISTER	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



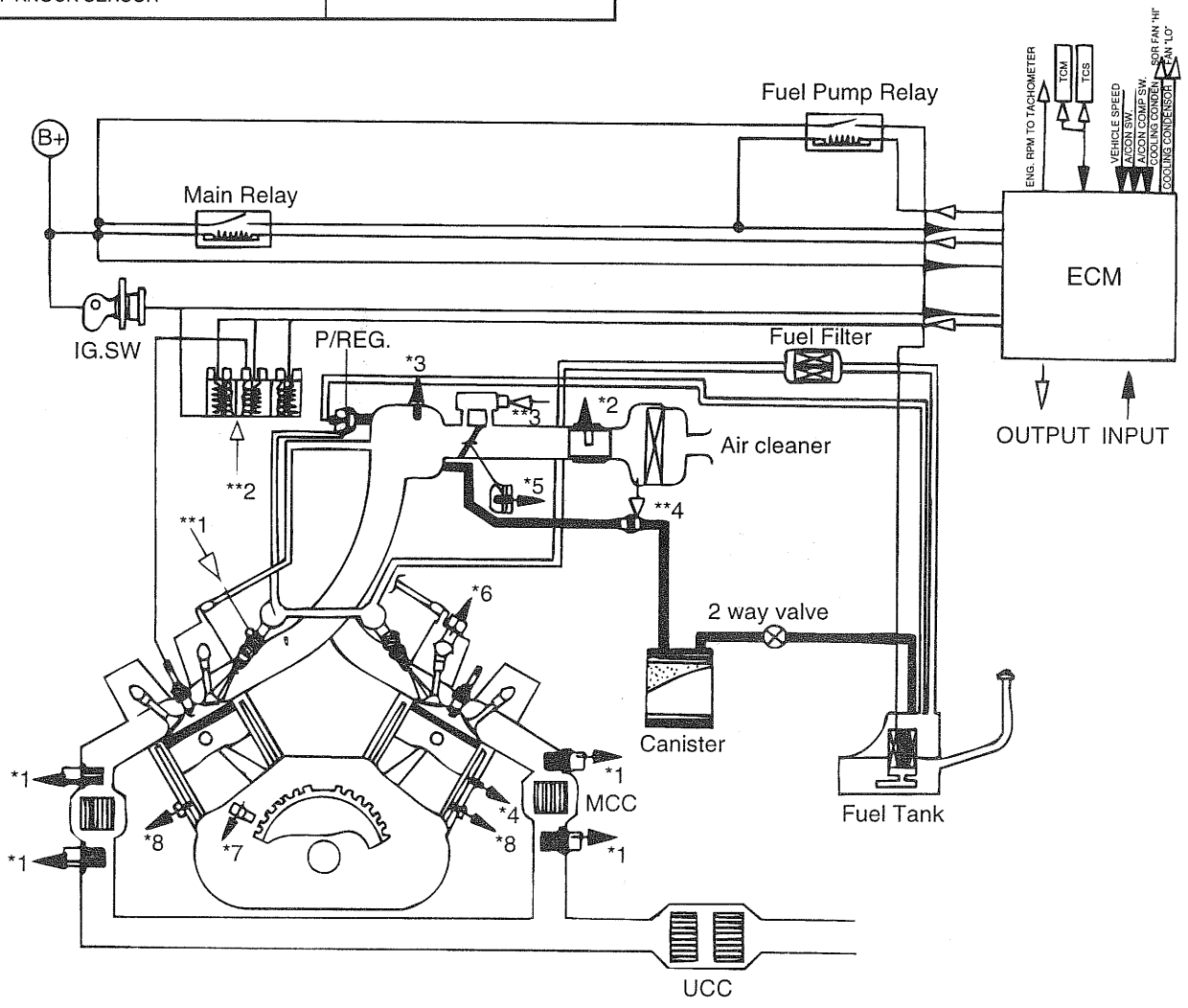
ECM : Engine Control Module
EVAP : Evaporative Emission

EEA9008A

SCHEMATIC DRAWING (2.7 V6, OBD-II) EEHA0091

[UNLEADED, OBD-II]

*1. HEATED OXYGEN SENSOR (H02S) *2. HOT FILM SENSOR *3. INTAKE AIR TEMP. SENSOR (IAT SENSOR) *4. ENGINE COOLANT TEMP. SENSOR (ECT SENSOR) *5. THROTTLE POSITION SENSOR (TP SENSOR) *6. CAMSHAFT POSITION SENSOR (CMP SENSOR) *7. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *8. KNOCK SENSOR	o IGNITION SWITCH o BATTERY VOLTAGE o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o FUEL PUMP RELAY SIGNAL	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



ECM : Engine Control Module
EVAP : Evaporative Emission
UCC : Under floor Catalytic Converter
MCC : Manifold Catalytic Converter

EEHA009A

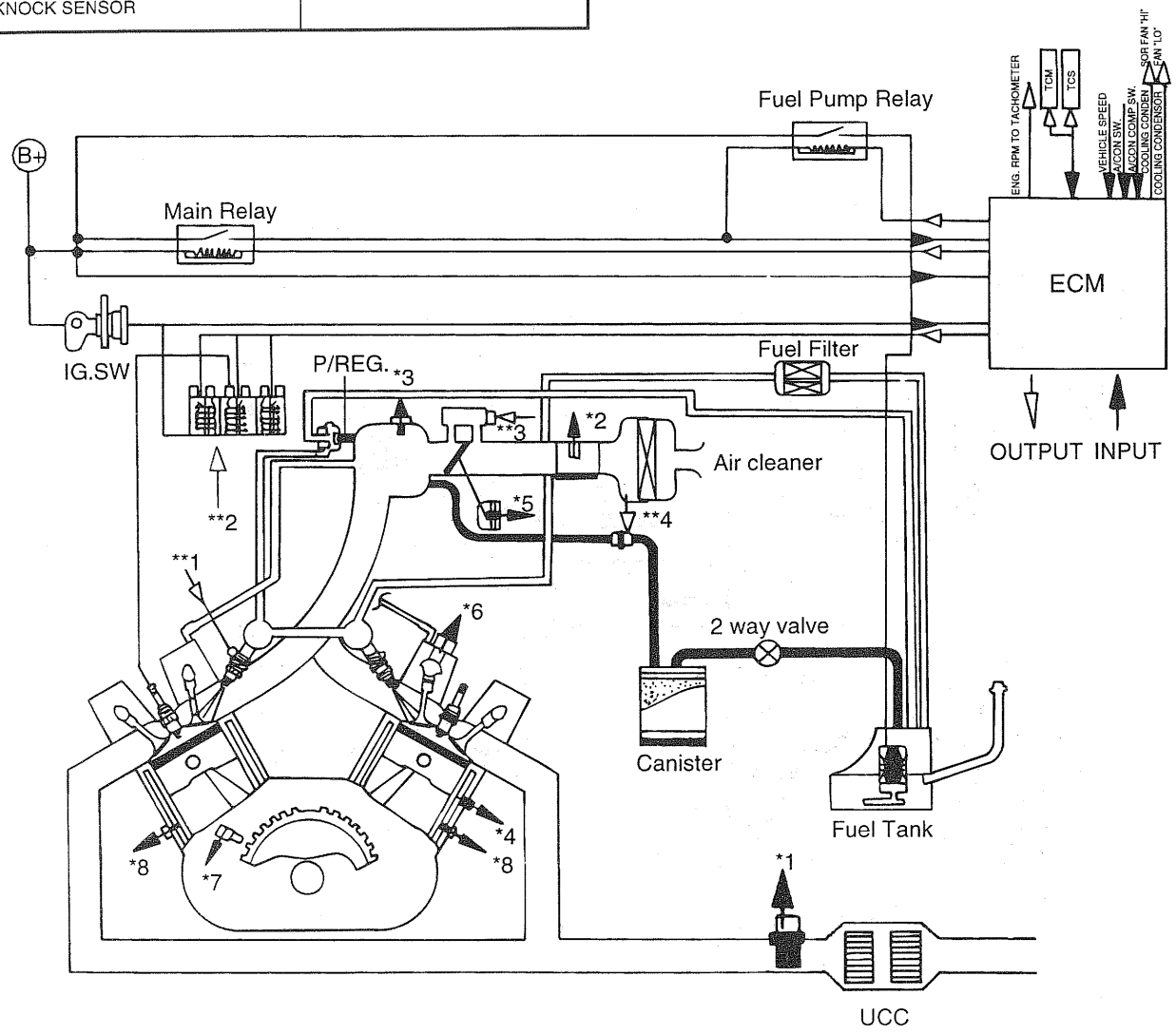
SCHEMATIC DRAWING (2.7 V6) EEHA0090

[UNLEADED]

*1. HEATED OXYGEN SENSOR (H02S) *2. HOT FILM SENSOR *3. INTAKE AIR TEMP. SENSOR (IAT SENSOR) *4. ENGINE COOLANT TEMP. SENSOR (ECT SENSOR) *5. THROTTLE POSITION SENSOR (TP SENSOR) *6. CAMSHAFT POSITION SENSOR (CMP SENSOR) *7. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *8. KNOCK SENSOR	o IGNITION SWITCH o BATTERY VOLTAGE o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o FUEL PUMP RELAY SIGNAL

INPUT → ECM → OUTPUT

**1. FUEL INJECTOR
**2. IGNITION COIL
**3. ISC MOTOR (Linear Solenoid Type)
**4. EVAP Canister Purge Solenoid Valve
o FUEL PUMP CONTROL
o MFI CONTROL RELAY
o COOLER RELAY
o IGNITION TIMING CONTROL
o DIAGNOSIS



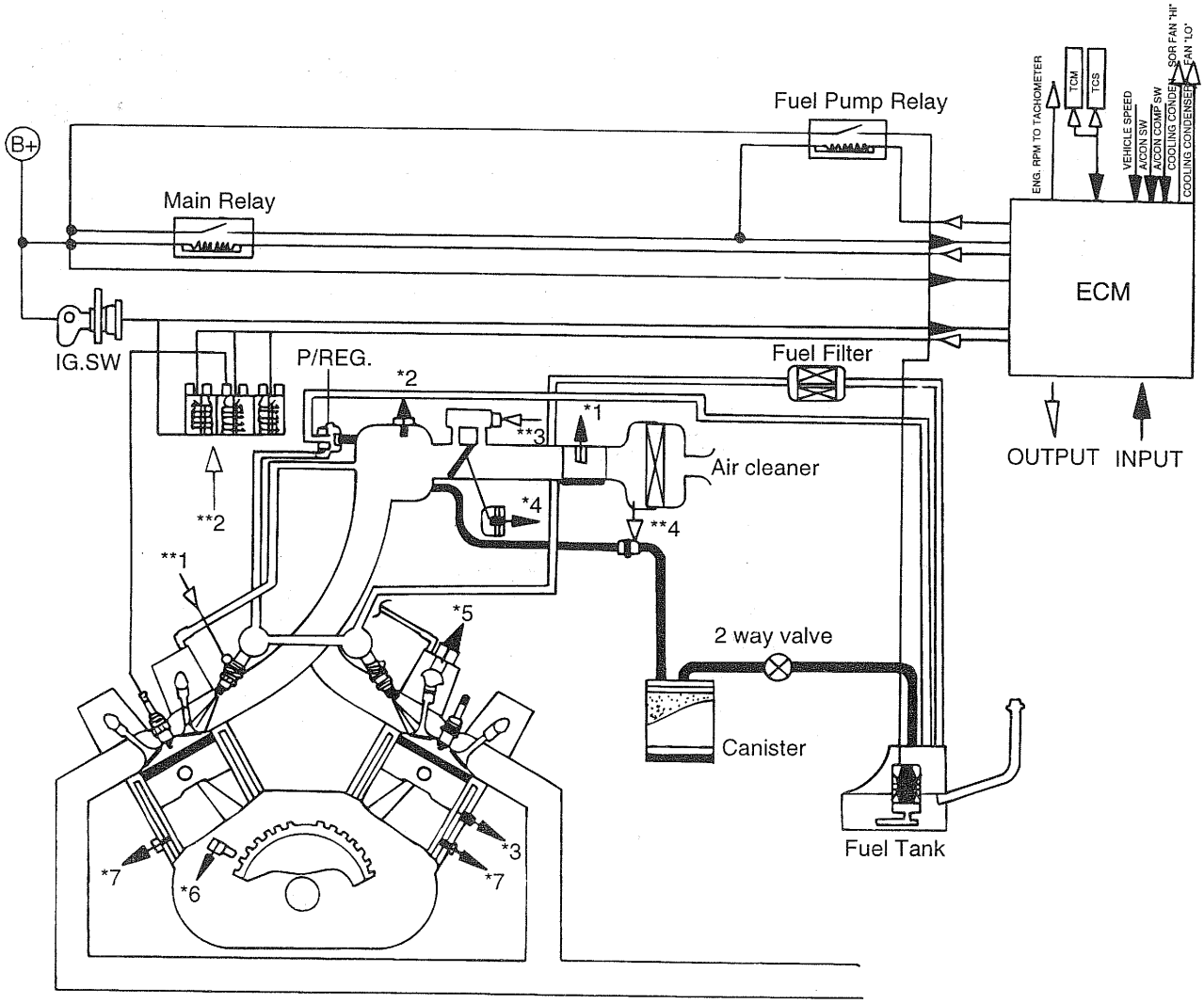
ECM : Engine Control Module
EVAP : Evaporative Emission
UCC : Under floor catalytic converter

EEHA009B

SCHEMATIC DRAWING (2.7 V6) EEHA0100

[LEADED]

*1. HOT FILM SENSOR *2. INTAKE AIR TEMP. SENSOR (IAT SENSOR) *3. ENGINE COOLANT TEMP. SENSOR (ECT SENSOR) *4. THROTTLE POSITION SENSOR (TP SENSOR) *5. CAMSHAFT POSITION SENSOR (CMP SENSOR) *6. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *7. KNOCK SENSOR	o IGNITION SWITCH o BATTERY VOLTAGE o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o FUEL PUMP RELAY SIGNAL o VARIABLE REGISTER	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS

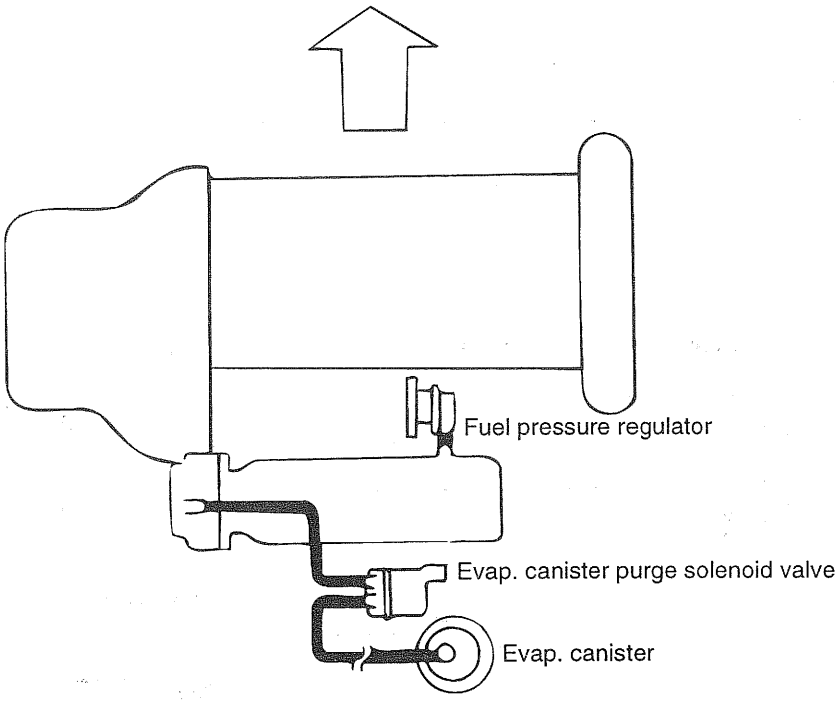


ECM : Engine Control Module
EVAP : Evaporative Emission

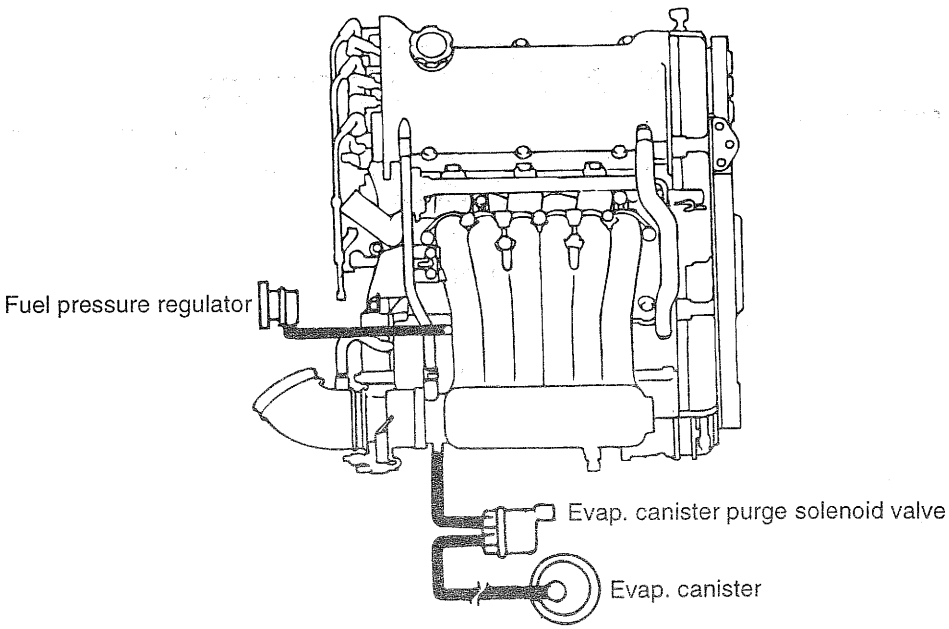
EEA9009B

VACUUM HOSES LAYOUT EEHA0110

[2.0 I4]



[2.7 V6]

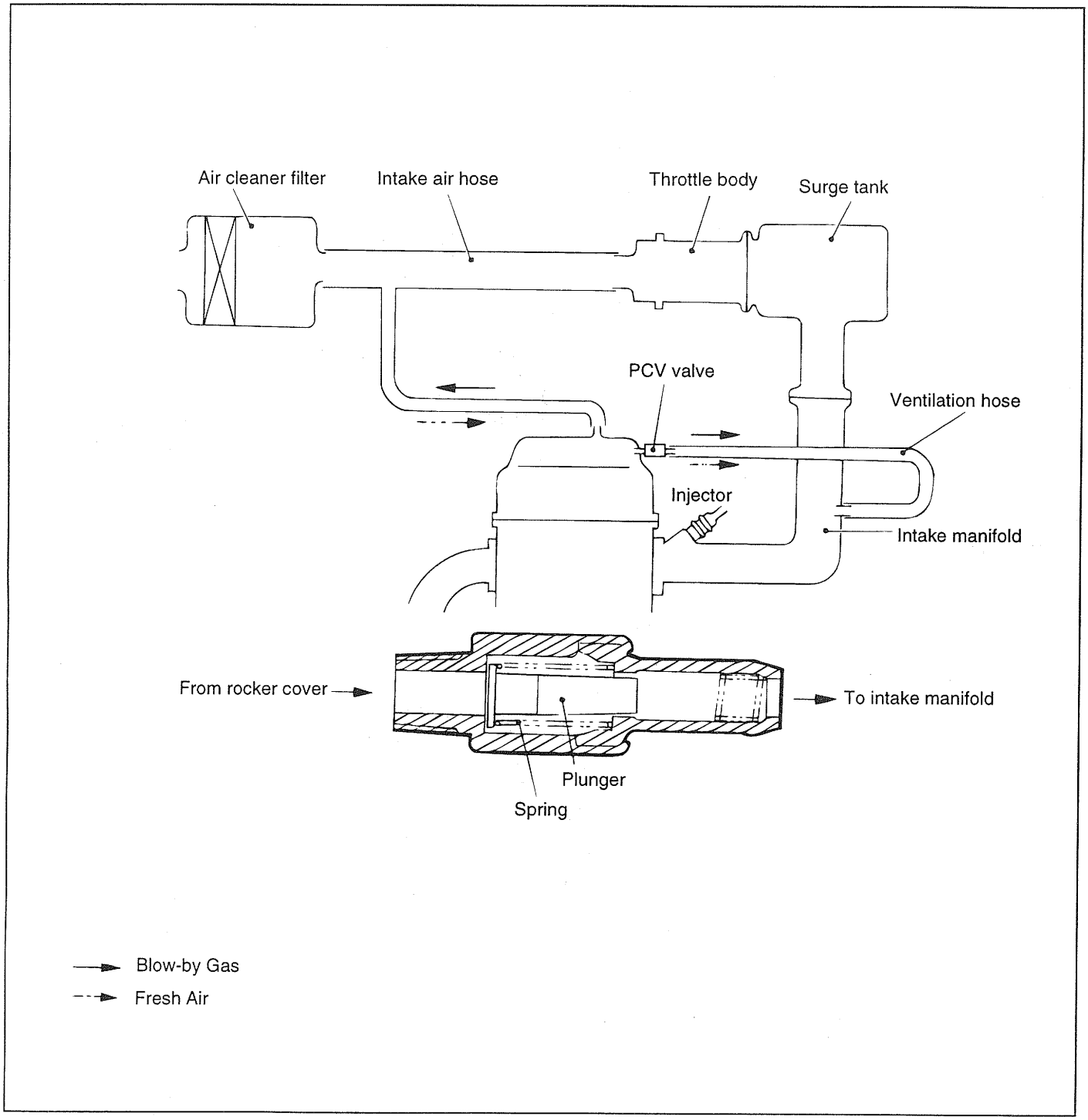


EEHA011A

CRANKCASE EMISSION CONTROL SYSTEM

POSITIVE CRANKCASE VENTILATION (PCV) VALVE EEA90120

COMPONENTS

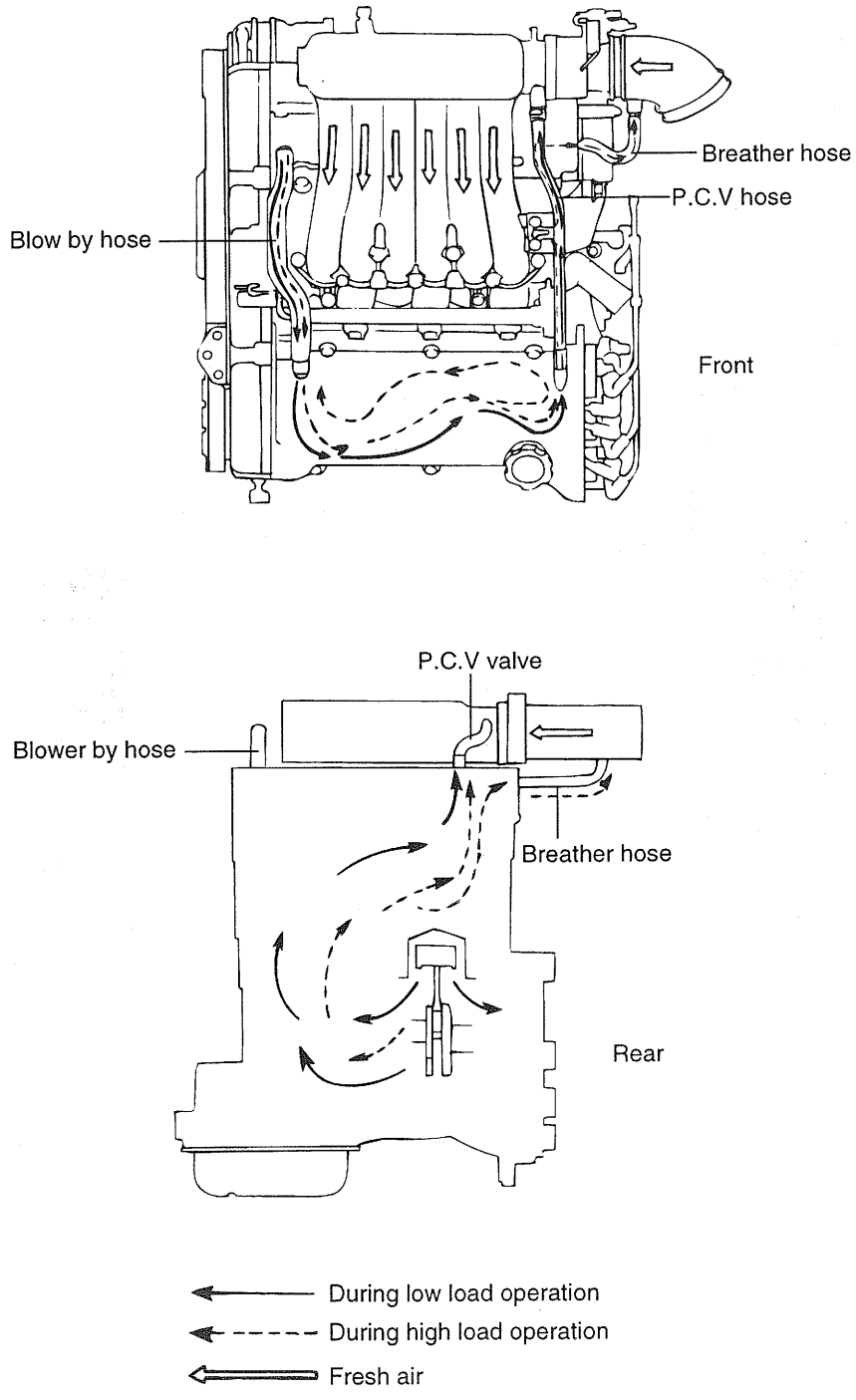


EEA9012A

POSITIVE CRANKCASE VENTILATION (PCV) VALVE EEHA0130

COMPONENTS

[2.7 V6]

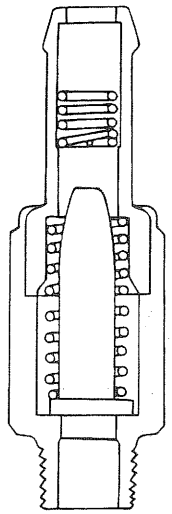


EEHA013A

PCV VALVE OPERATING

EEA90140

Intake manifold side (No vacuum)

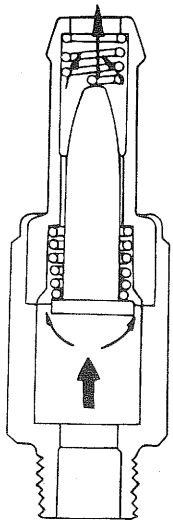


EEA9014A

Rocker cover side

Engine condition	Not running
PCV valve	Not operating
Vacuum passage	Restricted

Intake manifold side (High vacuum)

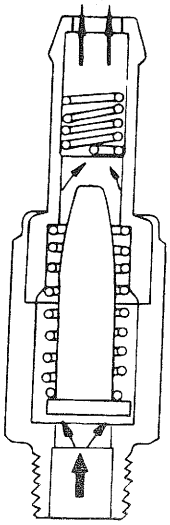


EEA9014B

Rocker cover side

Engine condition	Idling or decelerating
PCV valve	Fully operating
Vacuum passage	Small

Intake manifold side (Moderate vacuum)

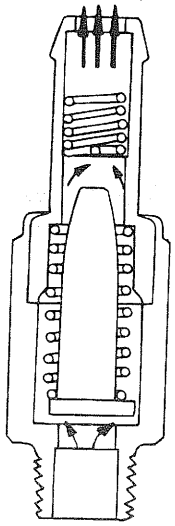


EEA9014C

Rocker cover side

Engine condition	Normal operation
PCV valve	Properly operating
Vacuum passage	Large

Intake manifold side (Low vacuum)



EEA9014D

Rocker cover side

Engine condition	Accelerating and high load
PCV valve	Slightly operating
Vacuum passage	Much large

DISASSEMBLY EEA90150

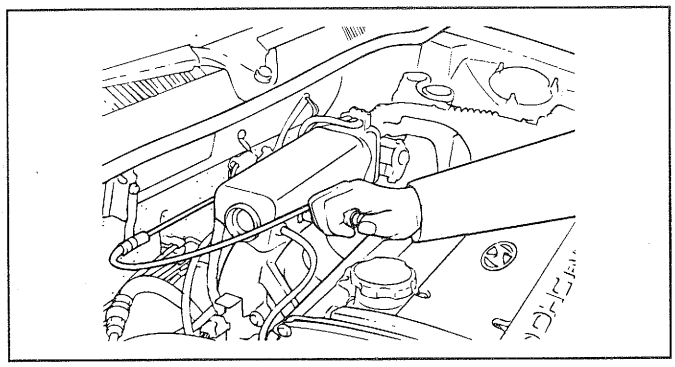
1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.

2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum is felt.

NOTE

The plunger inside the PCV valve will move back and forth.

3. If vacuum is not felt, clean the PCV valve and ventilation hose in cleaning solvent, or replace if necessary.



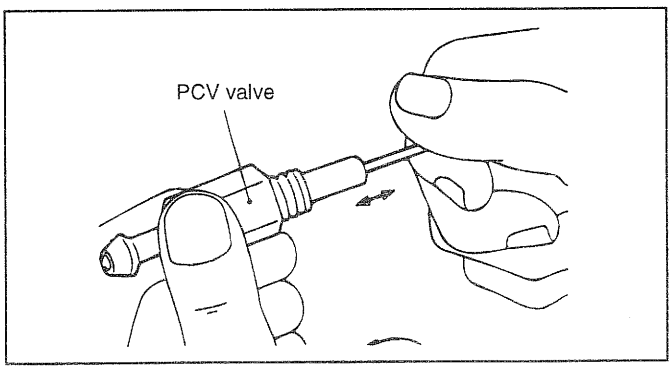
EEA9015A

INSPECTION

1. Remove the positive crankcase ventilation valve.

2. Insert a thin stick into the positive crankcase ventilation valve from the threaded side to check that the plunger moves.

3. If the plunger does not move, the positive crankcase ventilation valve is clogged. Clean or replace it.



EEA9015B

INSTALLATION

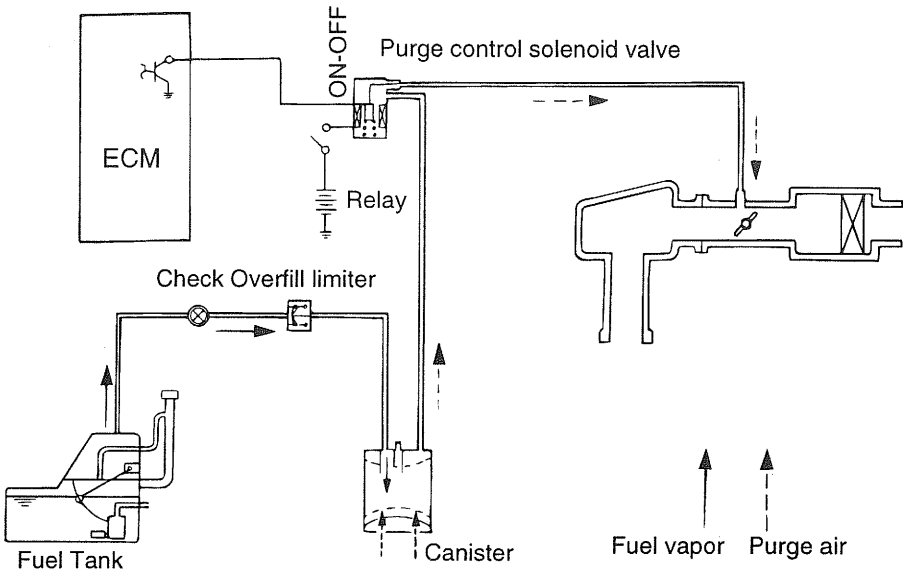
Install the positive crankcase ventilation valve and tighten to the specified torque.

Tightening torque PCV valve : 8-12 Nm(80-120 kg.cm, 6-8 lb.ft)

EVAPORATIVE EMISSION CONTROL SYSTEM

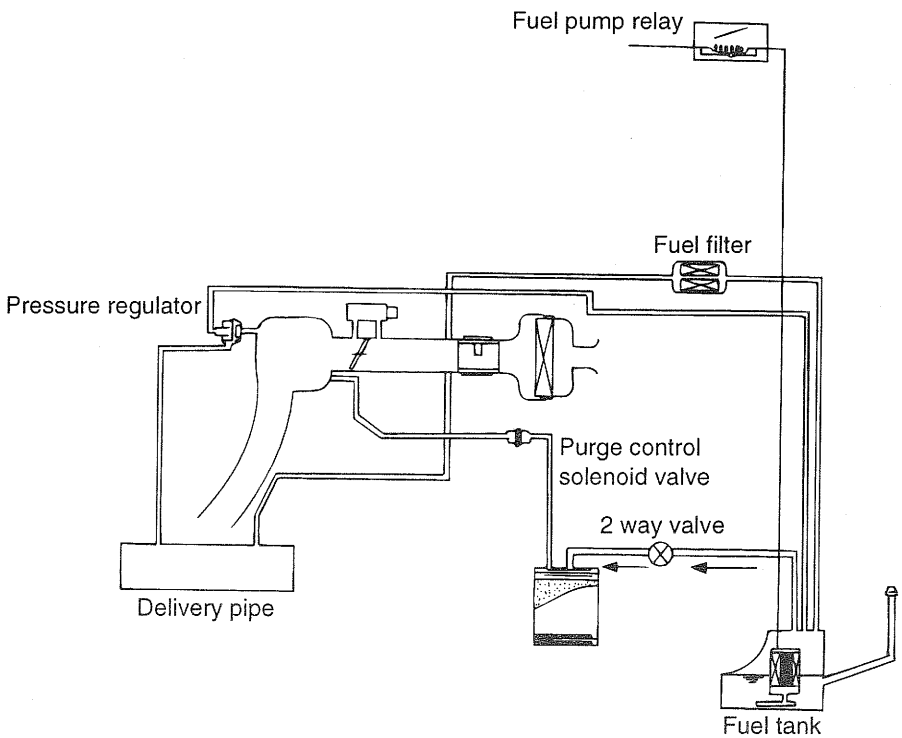
COMPONENTS EEHA0180

[2.0 I4]



EEA9016A

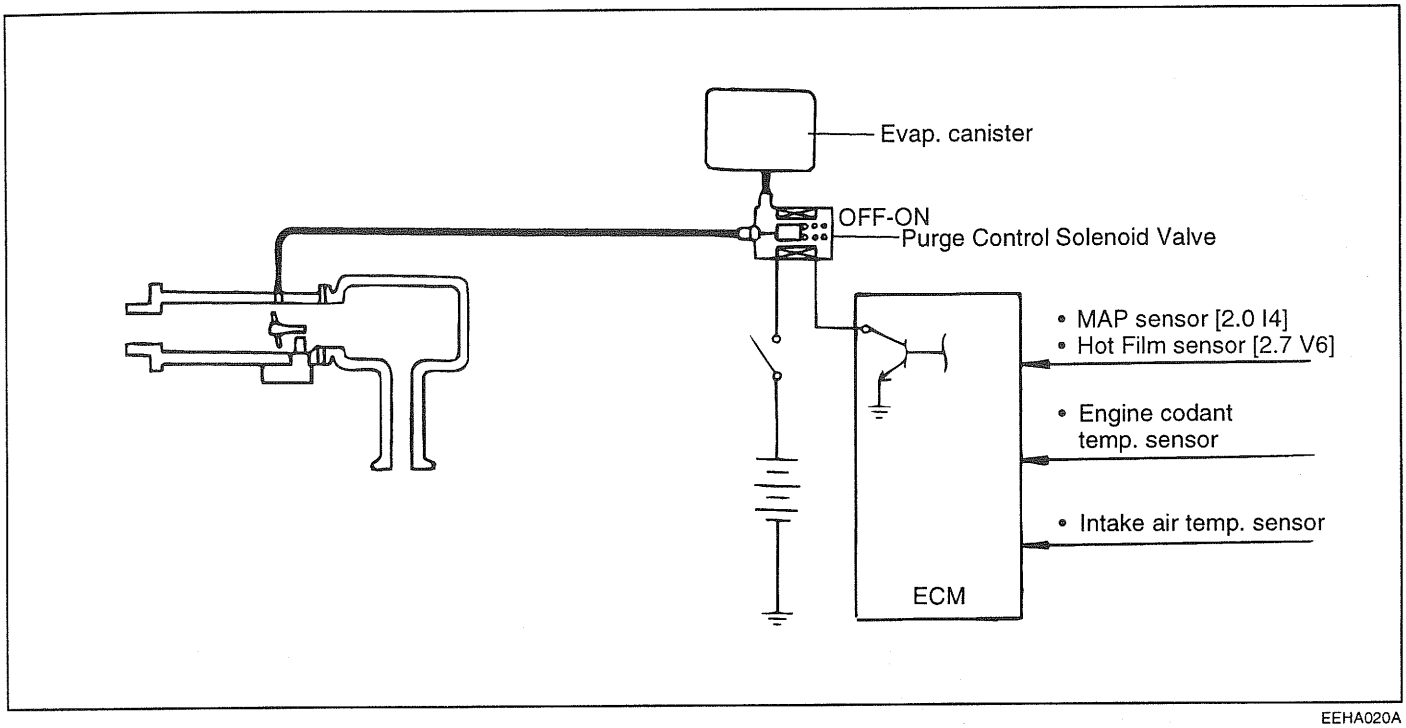
[2.7 V6]



EEA9016B

EEHA018A

EVAPORATIVE (EVAP) CANISTER PURGE SOLENOID VALVE EEHA0200

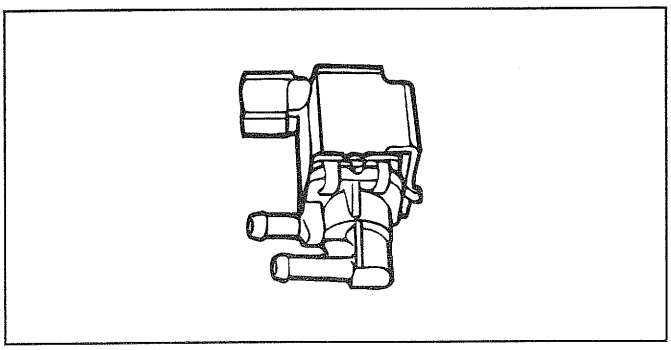


EEHA020A

EVAP CANISTER PURGE SOLENOID VALVE

NOTE

The EVAP Canister Purge Solenoid Valve is controlled by the ECM; when the engine coolant temperature is low, and also during idling, the valve closes so that evaporated fuel is not drawn into the surge tank. After the warm-up of the engine during ordinary driving, valve opens to let the stored vapors flow into the surge tank.

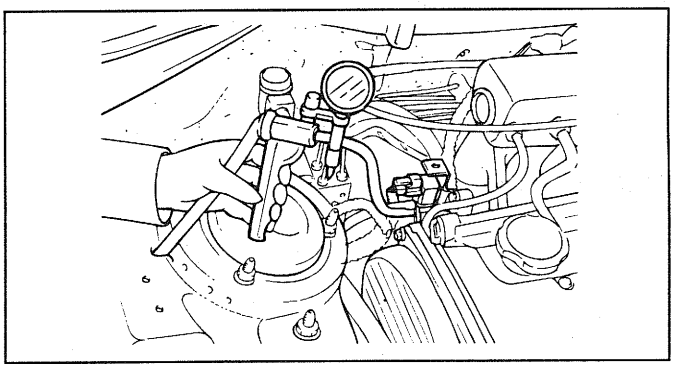


EEAA024A

INSPECTION

NOTE

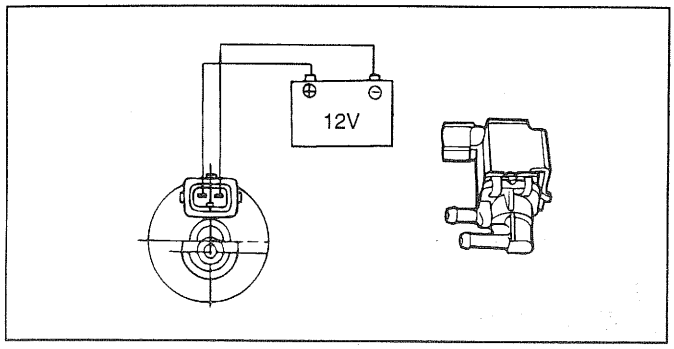
When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.



EEA9020B

1. Disconnect the vacuum hose (black with red stripe) from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-striped vacuum hose was connected.
4. Apply vacuum and check when voltage is applied to the EVAP Canister Purge Solenoid Valve and when the voltage is discontinued.

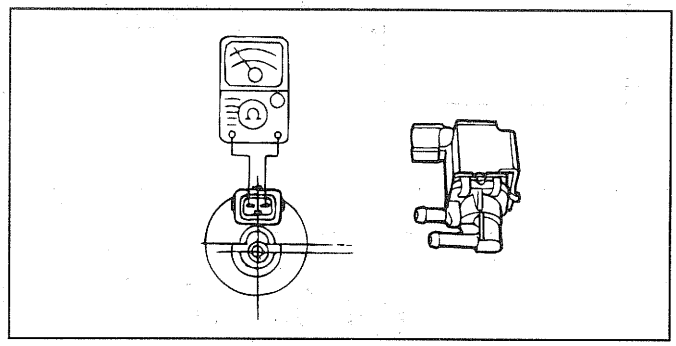
Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained



EEAA020C

5. Measure the current between the terminals of the solenoid valve.

EVAP Canister Purge Solenoid Valve:
Coil at 20°C (68°F) : 0.45A or below (at 12V)
Coil resistance : 26Ω [at 20°C (68°F)]

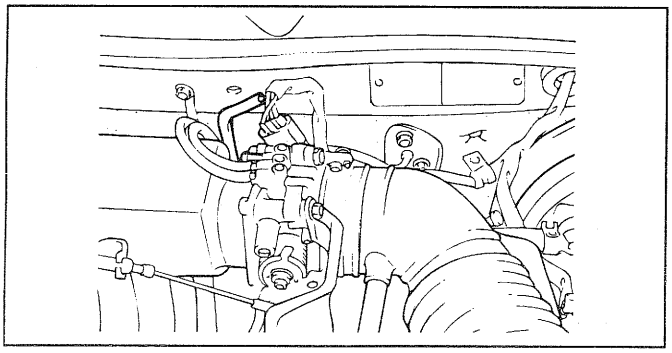


EEAA020D

VACUUM HOSE

Engine coolant temperature : 80-95°C (176-205°F)

1. Disconnect the vacuum hose from the intake manifold purge hose nipple and connect a hand vacuum pump to the nipple.

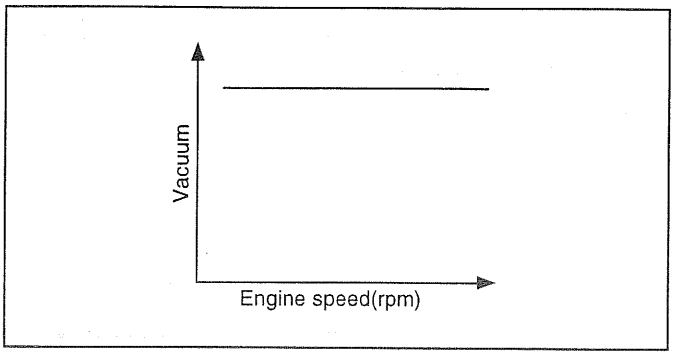


EEA9023A

2. Start the engine and check that, after raising the engine speed by racing the engine, vacuum remains fairly constant.

NOTE

If there is no vacuum created, the intake manifold port may be clogged and require cleaning.



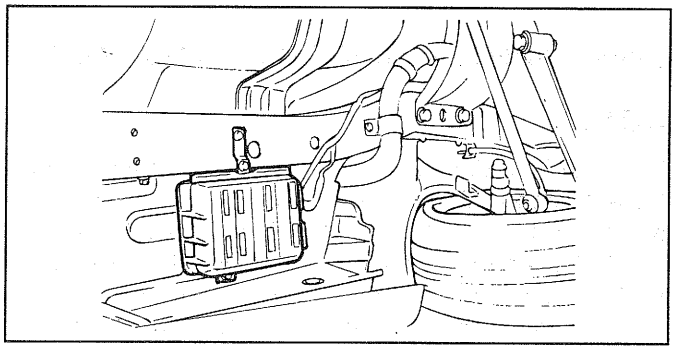
EEA9023B

EVAPORATIVE (EVAP) CANISTER EEHA0240

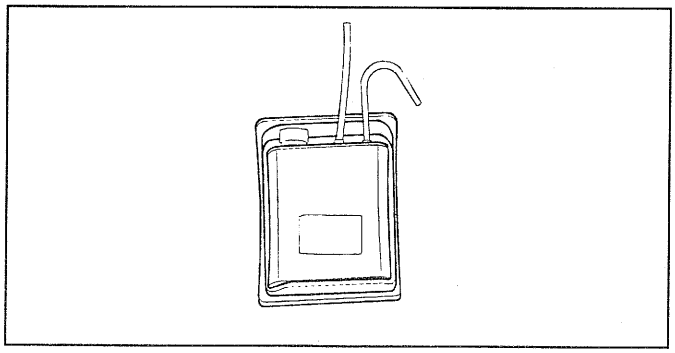
CANISTER

For monitoring, a CCV and an air filter exists as in the illustration.

1. Look for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel leakage.
3. After removing the EVAP Canister, inspect for cracks or damage.



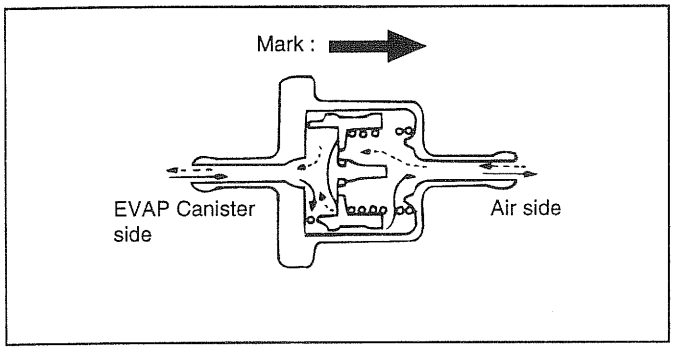
EEA9005E



EEHA005E

TWO-WAY VALVE

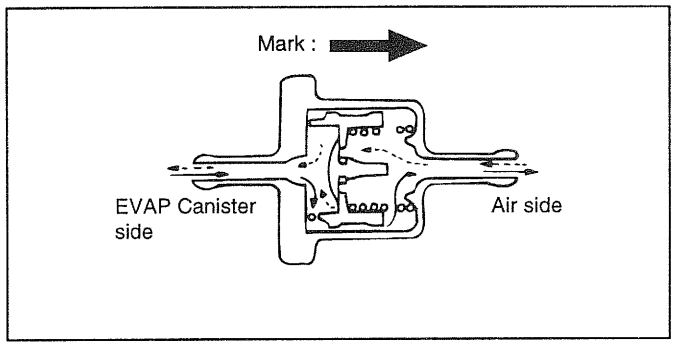
1. Inspect that air flows as shown.
2. Check to connect correctly such as the arrow mark on the valve.



V5EC201D

OVERFILL LIMITER (TWO WAY VALVE) EEAA0250

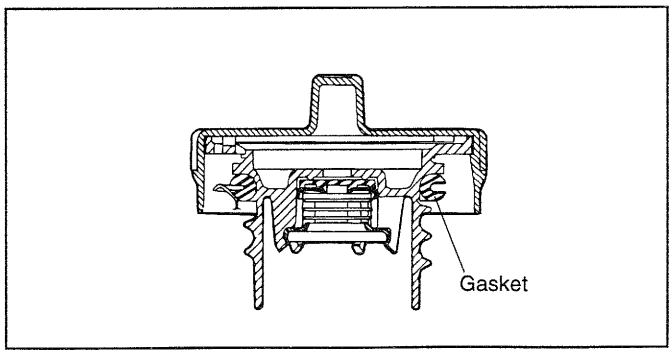
To inspect the overfill limiter (two-way valve), refer to Fuel tank.



V5EC201D

FUEL FILER CAP EEAA0260

Check the gasket of the fuel filler cap, and the filler cap itself, for damage or deformation. Replace the cap if necessary.



V5EC205A

EXHAUST EMISSION CONTROL SYSTEM

VEHICLES WITH CATALYTIC CONVERTER EEA90270

Exhaust emissions (CO, HC, NOx) are controlled by a combination of engine modifications and the addition of special control components.

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system. Additional control devices include a catalytic converter.

These systems have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

AIR/FUEL MIXTURE RATIO CONTROL SYSTEM [MULTIPORT FUEL INJECTION (MFI) SYSTEM] EEA90280

The MFI system employs the signals from the heated oxygen sensor to activate and control the injector installed in the manifold for each cylinder, precisely regulating the air/ fuel mixture ratio and reducing emissions.

This allows the engine to produce exhaust gases of the proper composition to permit the use of a three-way catalyst. The three-way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. The two operating modes in the MFI system are as follows:

1. Open loop-air/fuel ratio is controlled by information programmed into the ECM during the manufacturing process.
2. Closed loop-air/fuel ratio varies by the ECM based on information supplied by the heated oxygen sensor.