GROUP 17

ENGINE AND EMISSION CONTROL

CONTENTS

ENGINE CONTROL

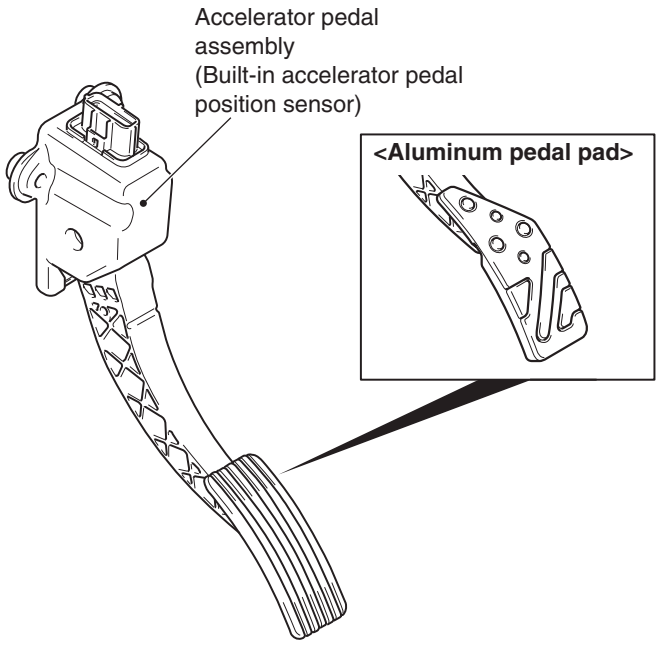
GENERAL INFORMATION

M2170001001458

For the accelerator system, an electronic throttle valve control system has been adopted, disposing of an accelerator cable. This system detects the accelerator pedal travel by using the accelerator pedal position sensor in the accelerator pedal assembly for electronic control of the throttle valve angle.

To the arm of accelerator pedal assembly, a resin arm is employed in order to reduce weight.
Also, the aluminum pedal pad has been adopted to enhance the sporty image <2.0L ENGINE.>

CONSTRUCTION DIAGRAM



AC803239AD

CRUISE CONTROL SYSTEM

GENERAL INFORMATION

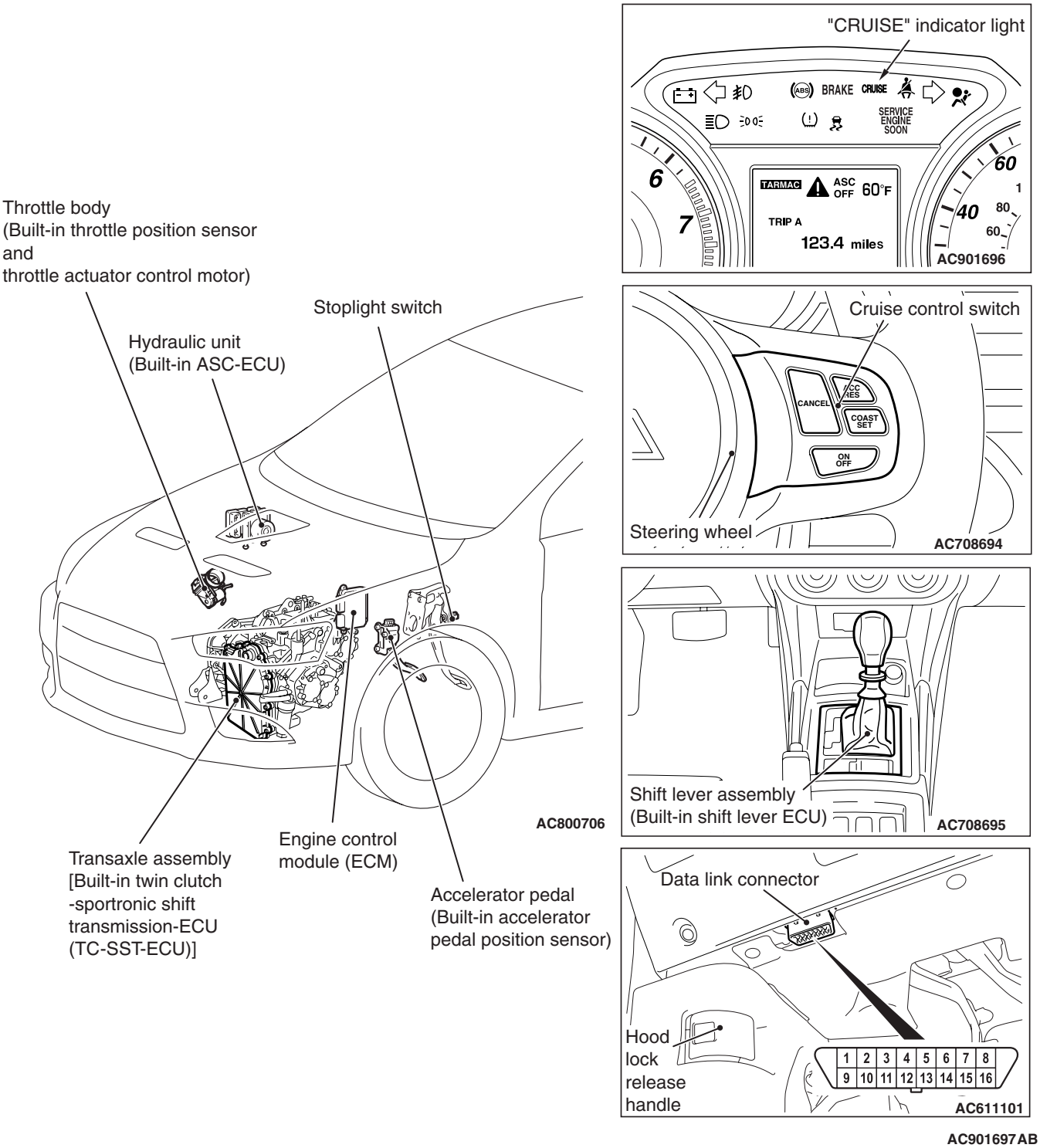
M2170001001469

By using the cruise control system, the driver can drive at preferred speeds in a range of approximately 40 to 200 km/h (25 to 125 mph) without depressing the accelerator pedal.

For this cruise control system, in conjunction with the electronic throttle valve control system, the engine control module (ECM) electronically controls the throttle valve.

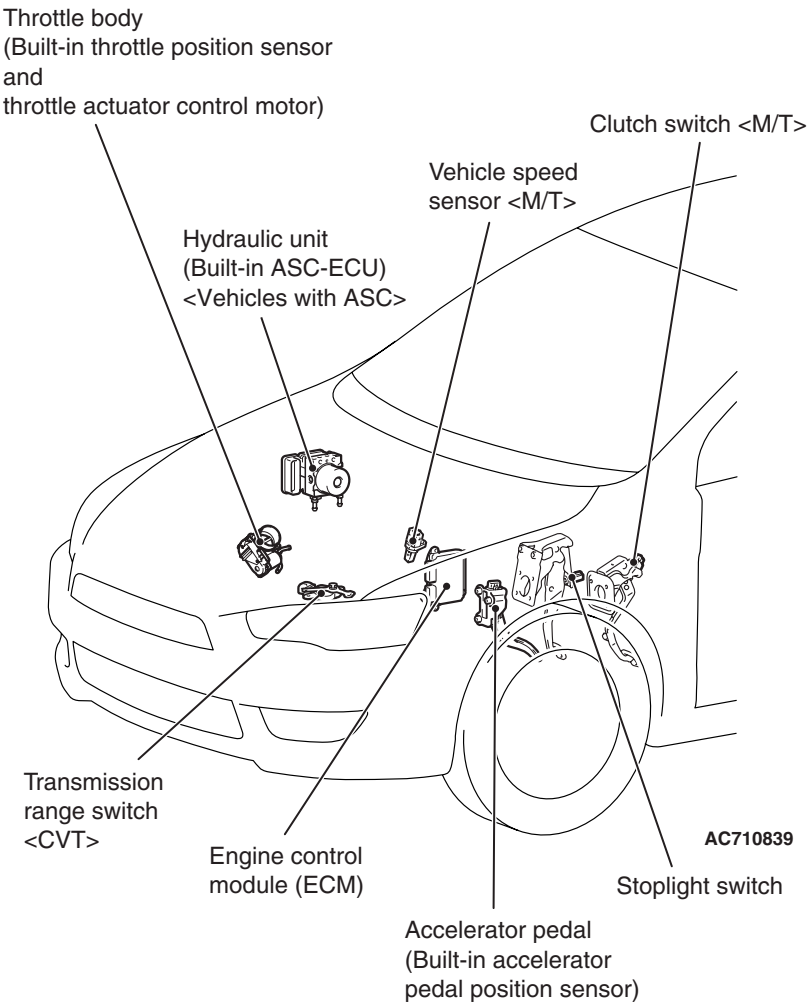
CONSTRUCTION DIAGRAM

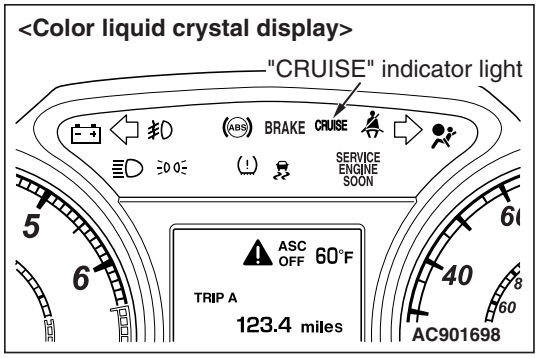
<2.0L ENGINE>

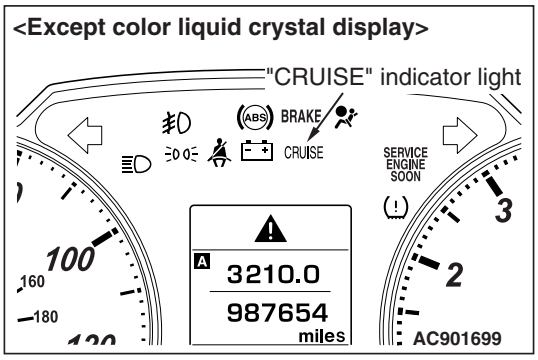


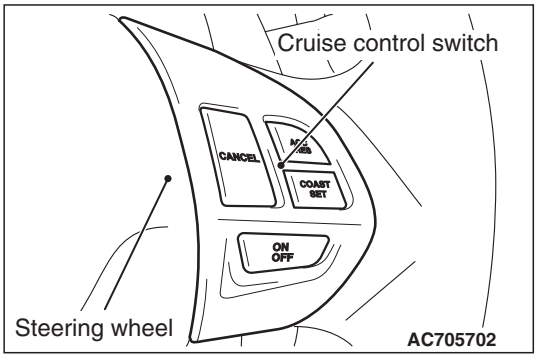
AC901697AB

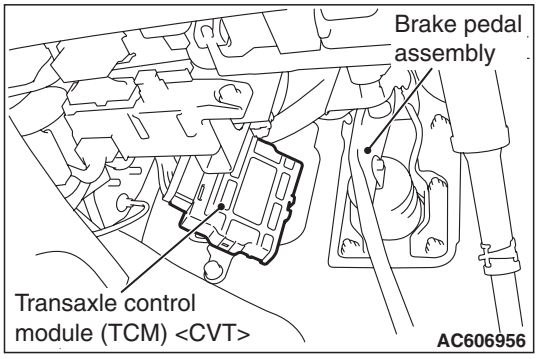
<2.4L ENGINE>

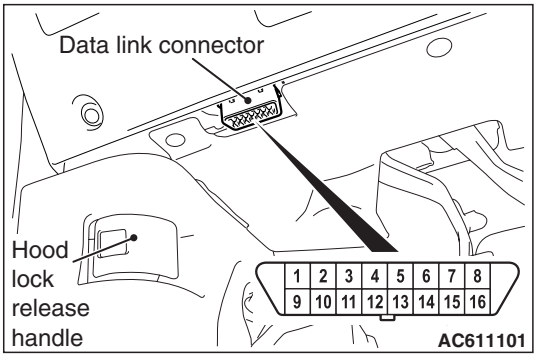












AC901700AB

COMPONENTS AND FUNCTIONS

Component		Function
Accelerator pedal position sensor		Informs the ECM of the accelerator pedal depression.
ASC-ECU <Vehicles with ASC>		• Outputs the cruise control cancel signal to the ECM. • The vehicle speed signal is sent to the ECM <2.0L ENGINE.>
Clutch switch <M/T>		Because the constant speed driving is cancelled by the clutch operation, the clutch pedal status is detected.
Cruise control switch	"ON/OFF" switch	Power switch for cruise control system.
	"ACC/RES" switch	Vehicle speed is set with the "ACC/RES" switch and "COAST/SET" switch.
	"COAST/SET" switch	
	"CANCEL" switch	Cancels the cruise speed setting.
"CRUISE" indicator light		• The light is included in the combination meter and illuminates when the "ON/OFF" switch is pressed (cruise control system: ON). • With the flashing of indicator light, read the diagnostic trouble code for the cruise control system.
Data link connector		If the M.U.T.-III scan tool is connected, the data list from the ECM can be read.

Component	Function
Engine control module (ECM)	• Based on the input signal from each sensors and switches, it outputs the throttle opening angle indication signal to the throttle actuator control motor. • Based on the input signal from each sensors and switches, it outputs the transaxle control signal to the TCM <CVT.> • Based on the input signal from each sensors and switches, it outputs the shift control signal to the TC-SST-ECU <TC-SS.T> • Based on the vehicle speed signal from the vehicle speed sensor, it calculates the vehicle speed <M/T.> • Based on the secondary pulley speed sensor signal from the TCM, it calculates the vehicle speed <CVT.> • Based on the vehicle speed signal from the ASC-ECU, it calculates the vehicle speed <TC-SST.> • Based on the selector lever "N" position signal of the transmission range switch from the ECM, it cancels constant speed driving <CVT.> • Based on the shift lever "N" position signal of the shift lever ECU from the TC-SST-ECU, it cancels constant speed driving <TC-SST.> • Outputs the ON/OFF signals of "CRUISE" indicator light and cruise control system. • The diagnostic trouble code signal is sent to the "CRUISE" indicator light. • The data list signal is sent to the data link connector.
Shift lever ECU <TC-SST>	Because the constant speed driving is cancelled by the shift lever operation, it detects the "N" position.
Stoplight switch	• Because the constant speed driving is canceled by the brake operation, it detects the brake pedal status. • As for the stoplight switch, two built-in switches, the stoplight switch which is also used for the stoplight illumination and the brake switch which is used exclusively for the auto-cruise control, are integrated, and thus the reliability is enhanced.
Throttle actuator control motor	The throttle valve opens and closes in response to the throttle angle signal from the ECM.
Throttle position sensor	Informs the ECM of the throttle valve opening angle.
Transaxle control module (TCM) <CVT>	• Based on the transaxle control signal from the ECM, it controls the transaxle. • Outputs the signal from the secondary pulley speed sensor to the ECM. • Transmits the selector lever "N" position signal from the transmission range switch to the ECM.

Component	Function
Transmission range switch <CVT>	Because the constant speed driving is cancelled by the selector lever operation, it detects the "N" position.
Twin clutch-sport shift transmission-ECU (TC-SST-ECU) <TC-SST>	• Based on the transaxle control signal from the ECM, it controls the transaxle. • Transmits the shift lever "N" position signal from the shift lever ECU sent to the ECM. • TC-SST drive mode signal from the shift lever ECU sent to the ECM.
Vehicle speed sensor <M/T>	Transmits the vehicle speed signal proportional to the vehicle speed to the ECM.

CONSTRUCTION AND OPERATION

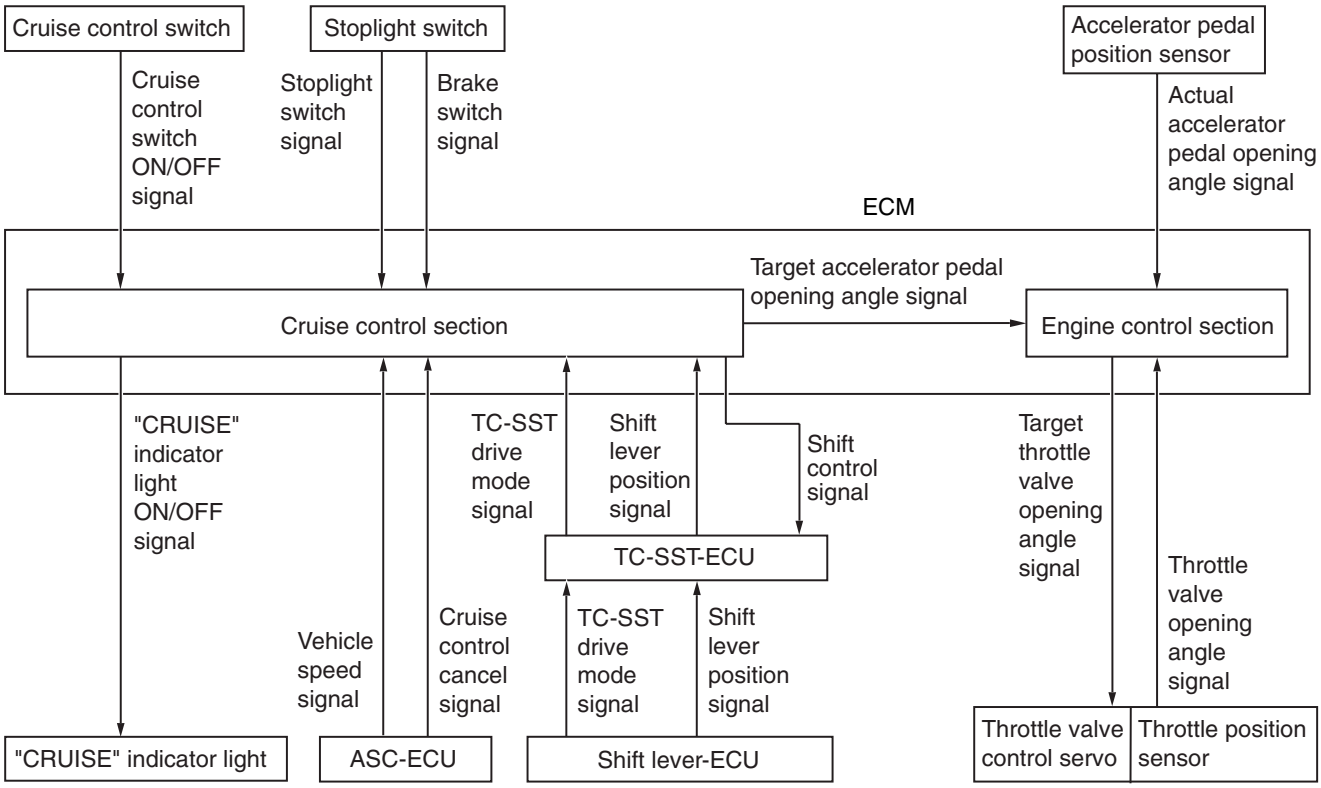
M2170002000856

SYSTEM OUTLINE <2.0L ENGINE>

The cruise control section in ECM calculates the cruise control system operation status based on the signals sent from switches and sensors. Based on the calculation, the cruise control section outputs the target accelerator pedal opening angle signal to the engine control section, and shift control signal to TC-SST-ECU, and "CRUISE" indicator light ON/OFF signal to the combination meter.

In the engine control section, the target accelerator pedal opening angle value is calculated based on the target accelerator pedal opening angle signal from the cruise control section, actual accelerator pedal opening angle signal from the accelerator pedal position sensor, and the throttle valve opening angle signal from the throttle position sensor, and the vehicle speed is controlled by the driving of throttle valve control servo.

BLOCK DIAGRAM



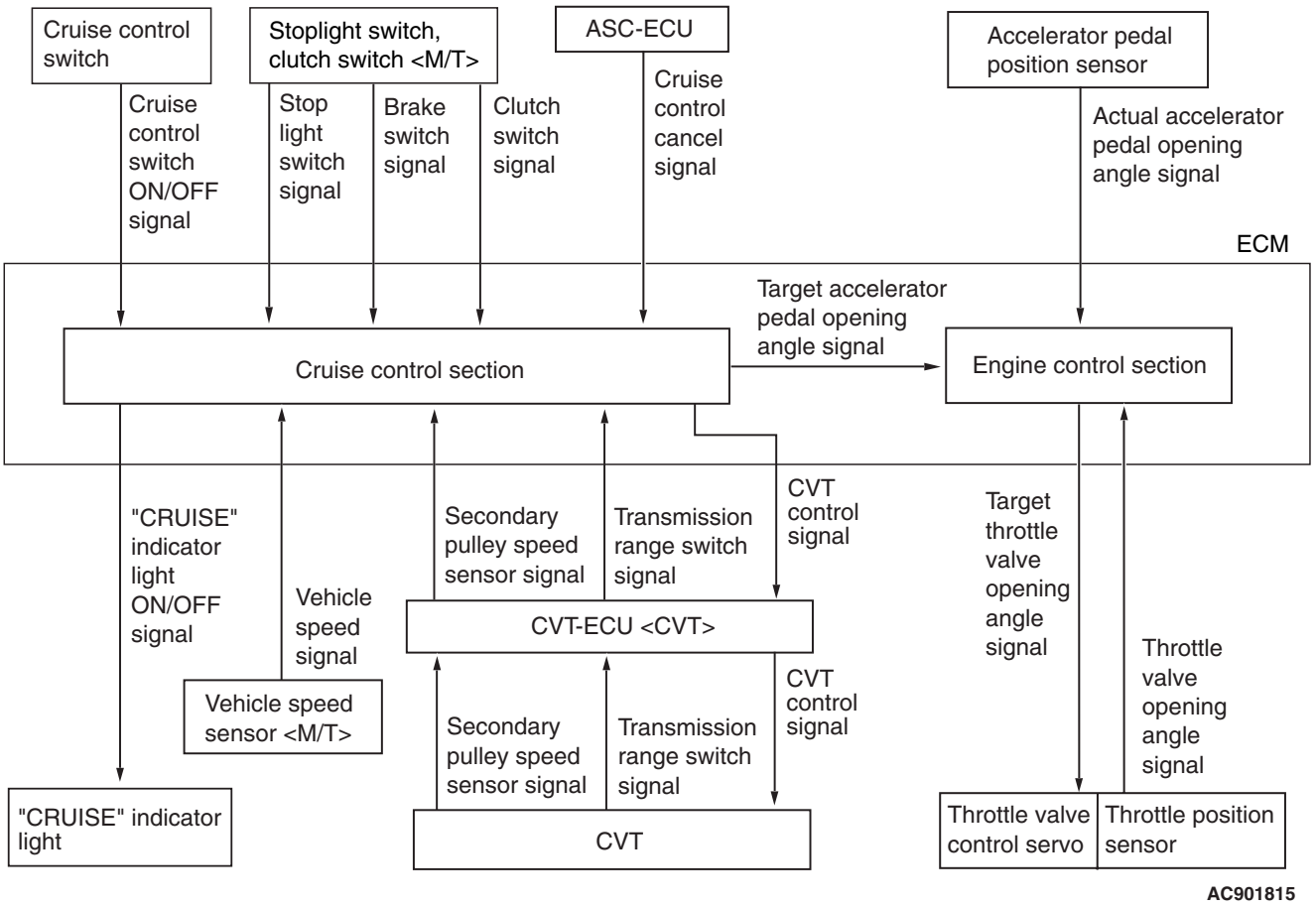
AC807627

SYSTEM OUTLINE <2.4L ENGINE>

The cruise control section in ECM calculates the cruise control system operation status based on the signals sent from switches and sensors. Based on the calculation, the cruise control section outputs the target accelerator pedal opening angle signal to the engine control section, and CVT control signal to CVT-ECU, and "CRUISE" indicator light ON/OFF signal to the combination meter.

In the engine control section, the target accelerator pedal opening angle value is calculated based on the target accelerator pedal opening angle signal from the cruise control section, actual accelerator pedal opening angle signal from the accelerator pedal position sensor, and the throttle valve opening angle signal from the throttle position sensor, and the vehicle speed is controlled by the driving of throttle valve control servo.

BLOCK DIAGRAM



SYSTEM FUNCTIONS

SET FUNCTION

1. During driving with the vehicle speed range from approximately 40 to 200 km/h (25 to 125 mph), press and release the "COAST/SET" switch.
2. The vehicle speed when the "COAST/SET" switch is released is memorized. Thereafter, the constant speed driving is performed at that vehicle speed.
3. When the "COAST/SET" switch is operated during the driving with the vehicle speed of high speed limit [approximately 200 km/h (125 mph)] or more, the constant speed driving will not be performed.

DECELERATION FUNCTION

1. When the "COAST/SET" switch is continuously pressed for approximately 0.5 second or longer during constant speed driving, the throttle valve becomes fully closed while the switch is pressed, and the vehicle is decelerated.
2. When the "COAST/SET" switch is released, the vehicle speed at that time is now memorized. Thereafter, the constant speed driving is performed at that vehicle speed.

3. Also when the "COAST/SET" switch is pressed for less than approximately 0.5 second, the vehicle is decelerated approximately 1.6 km/h (1 mph) from the vehicle speed of constant speed driving, and the decelerated vehicle speed is now memorized. Thereafter, the constant speed driving is performed at that vehicle speed.
4. When the "COAST/SET" switch is continuously pressed and the vehicle speed is decelerated to low speed limit [approximately 40 km/h (25 mph)] or less, the set function and coast function are cancelled, and the constant speed driving is cancelled.

RESUME FUNCTION

1. When the "CANCEL" switch is pressed or the brake pedal is depressed during the constant speed driving, it cancels the constant speed driving.
2. Subsequently, when the "ACC/RES" switch is pressed during driving with the vehicle speed of low speed limit [approximately 40 km/h (25 mph)] or more, the constant speed driving is performed with the vehicle speed memorized at the last cancellation of constant speed driving.

ACCELERATION FUNCTION

1. When the "ACC/RES" switch is continuously pressed for approximately 0.5 second or more during constant driving, it accelerates the vehicle with specified acceleration while the switch is pressed.
2. Then, when the "ACC/RES" switch is released, the vehicle speed at that time is now memorized. Thereafter, the constant speed driving is performed at that vehicle speed.
3. Also, when the "ACC/RES" switch is pressed for less than approximately 0.5 second, the vehicle is accelerated approximately 1.6 km/h (1 mph) from the vehicle speed of constant speed driving, and the accelerated vehicle speed is now memorized. Thereafter, the constant speed driving is performed at that vehicle speed.
4. It is possible to keep pressing the "ACC/RES" switch until the vehicle speed is accelerated to high speed limit [approximately 200 km/h (125 mph)] or above. However, after the "ACC/RES" switch is released, the vehicle speed of high speed limit [approximately 200 km/h (125 mph)] becomes the newly memorized vehicle speed. Thereafter, the constant speed driving is performed at that speed.

CANCEL FUNCTION

When any of the following conditions are satisfied, the constant speed driving will be cancelled.

- The cruise control system is stopped by the pressing the "ON/OFF" switch.
- The "CANCEL" switch is pressed.
- The brake pedal is depressed.
- The clutch pedal is depressed <M/T.>
- The selector lever is shifted to the "N" position <CVT.>
- The shift lever is shifted to the "N" position <TC-SST.>
- TC-SST drive mode is set to the "SPORT" mode <TC-SST.>
- The vehicle speed becomes low speed limit [approximately 40 km/h (25 mph)] or less.
- The vehicle speed is reduced approximately 15 km/h (9 mph) or more from the speed at which the constant speed driving was started.
- The ASC is operated.
- The engine speed rises and approaches the tachometer's red zone.

FAIL-SAFE FUNCTION

When any of the following conditions are satisfied, the cruise control system function is stopped until the system returns to normal. Also, when any of the conditions are satisfied during the constant speed driving, the constant speed driving is cancelled immediately.

- An abnormality occurs to the cruise control switch.
- An abnormality occurs to the stoplight switch.
- The engine coolant temperature becomes abnormally high <2.0L ENGINE>.

When any of the following conditions are satisfied, stop the vehicle once and turn the ignition switch to "LOCK" (OFF). Otherwise, even when the system returns to normal, the cruise control system function will continue to be stopped. Also, when any of the conditions are satisfied during the constant speed driving, the constant speed driving is cancelled immediately.

- ECM abnormality
- TCM abnormality <CVT>
- TC-SST-ECU abnormality <TC-SST>
- CAN communication system abnormality
- Vehicle speed signal abnormality
- Throttle position sensor abnormality.
- Accelerator pedal position sensor abnormality.

DIAGNOSIS FUNCTION

- The diagnostic trouble code check is possible with the "CRUISE" indicator light.
- To facilitate the system check, check the service data output with the scan tool.

NOTE: For diagnostic items, service data output items, and check method, refer to the Service Manual.

EMISSION CONTROL

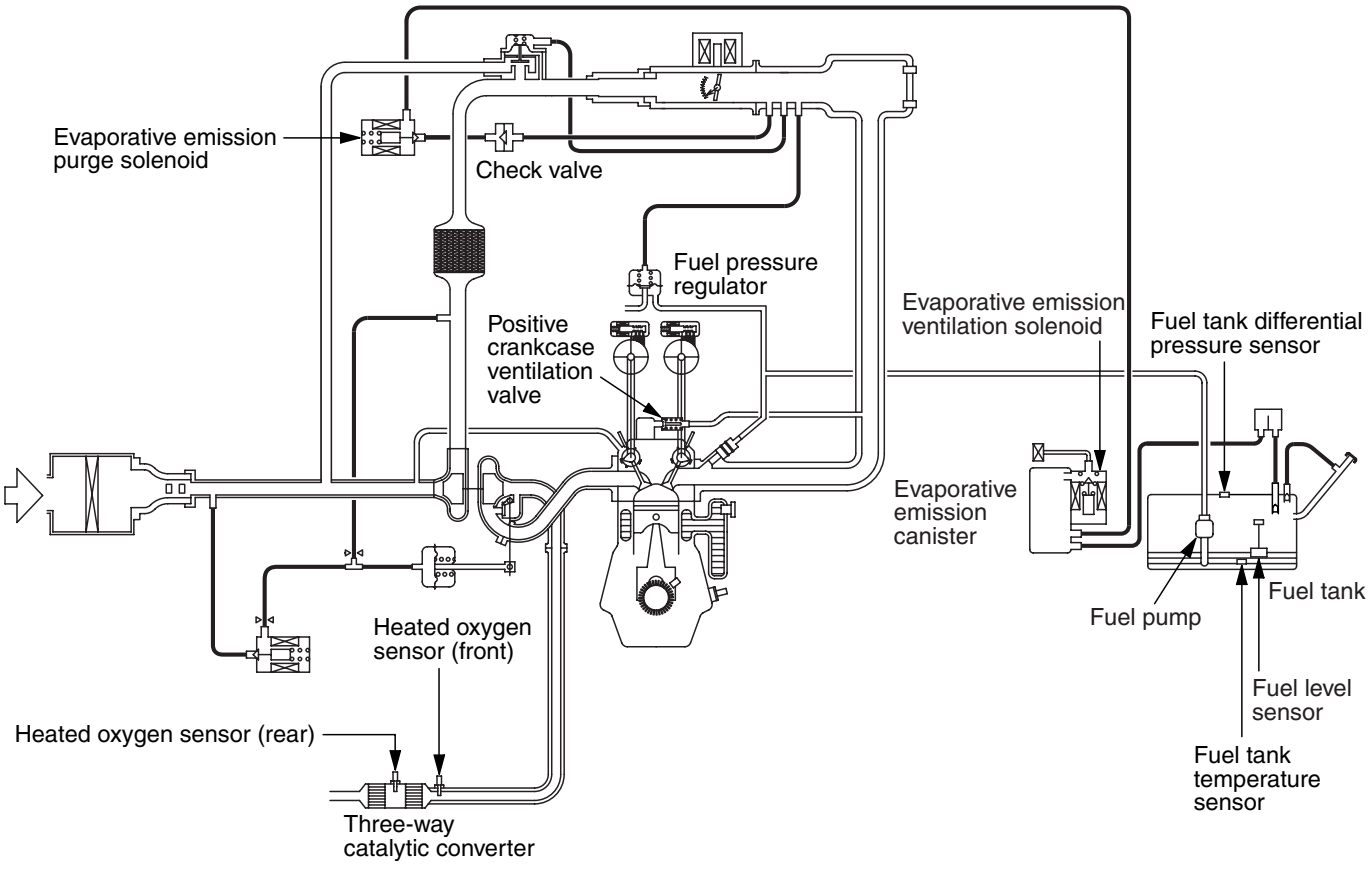
GENERAL DESCRIPTION

M2171000101693

The emission control system of the 2.0L turbo-charged engine and 2.4L engine mounted on the 2010 LANCER SPORTBACK have the following structure. The emission control system is the same as that of the conventional LANCER.

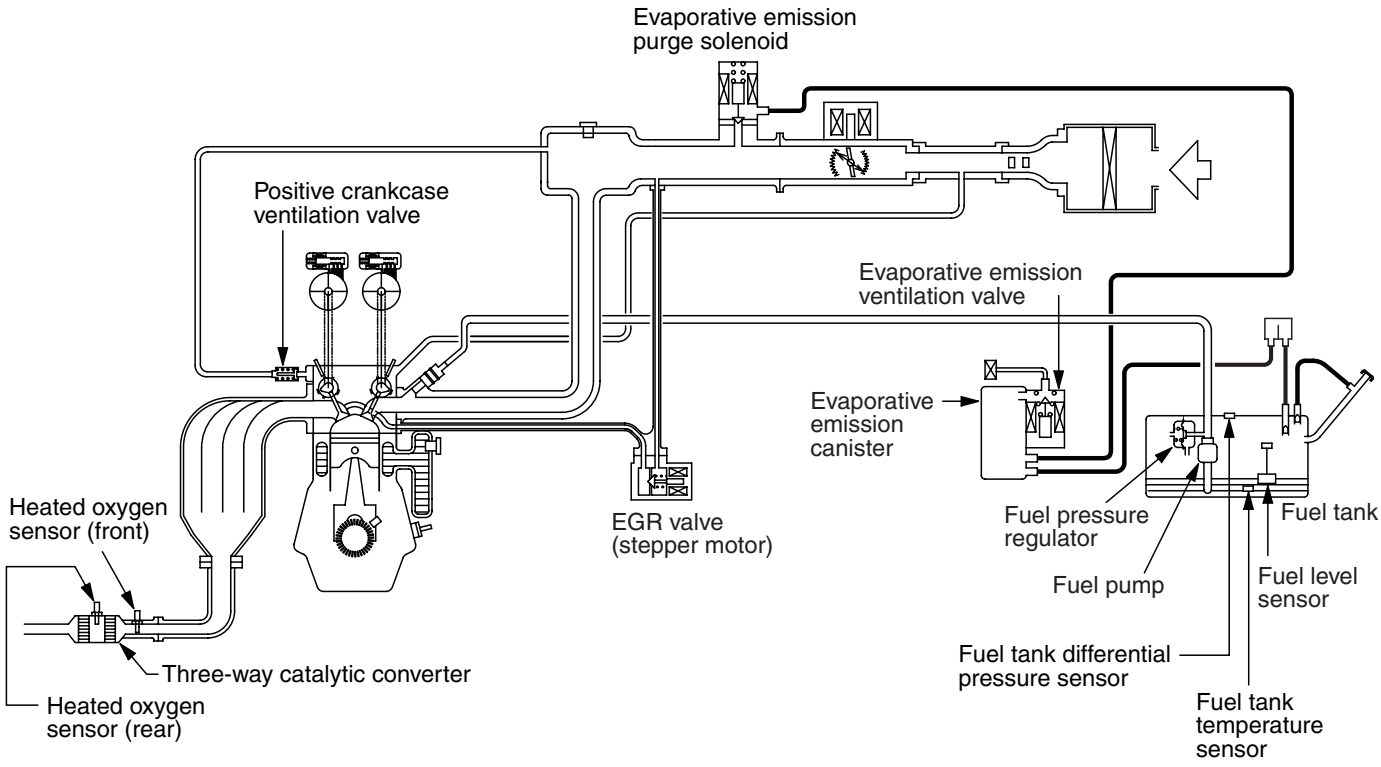
SYSTEM CONFIGURATION DIAGRAM

<2.0L ENGINE>



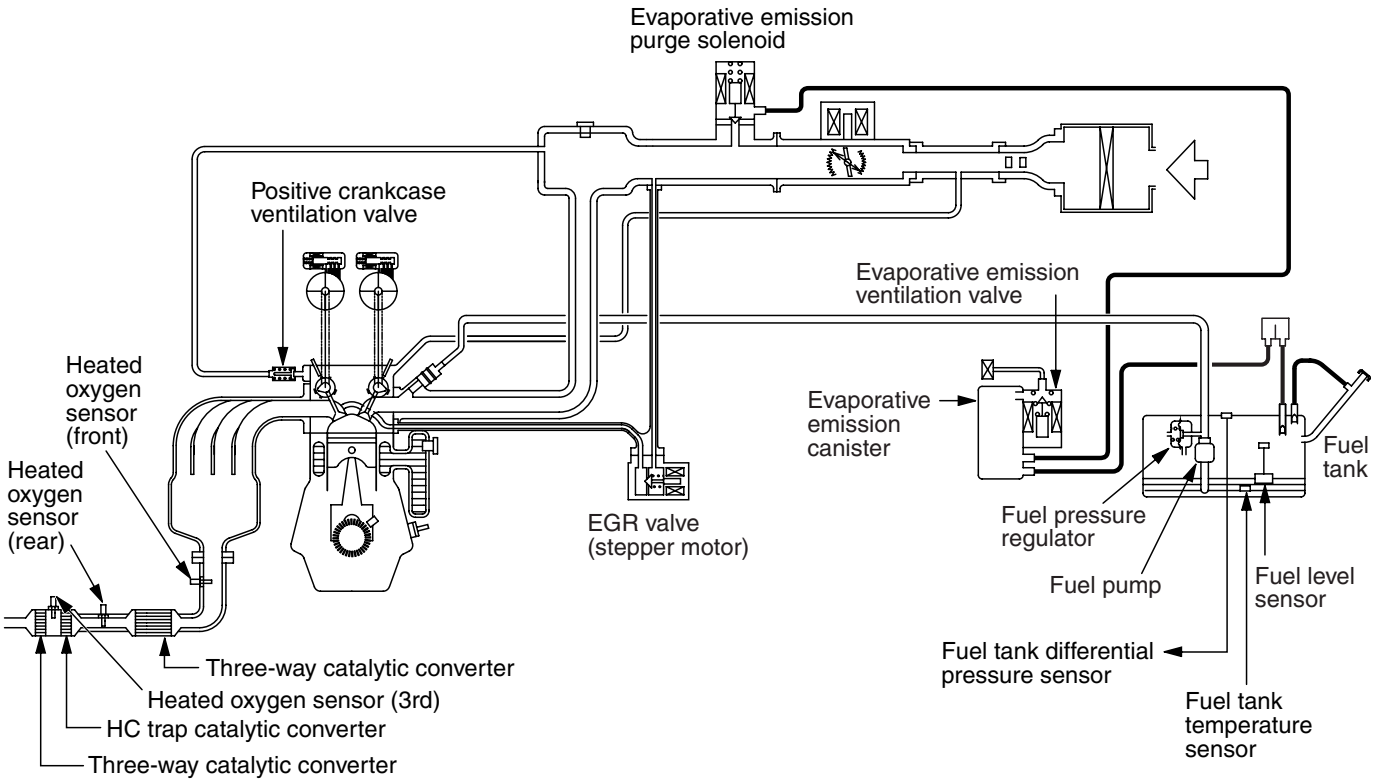
AK900474 AB

<2.4L ENGINE –except vehicles for California>



AK900475AB

<2.4L ENGINE –vehicles for California>



AK900476AB

Exhaust gas cleaning devices list

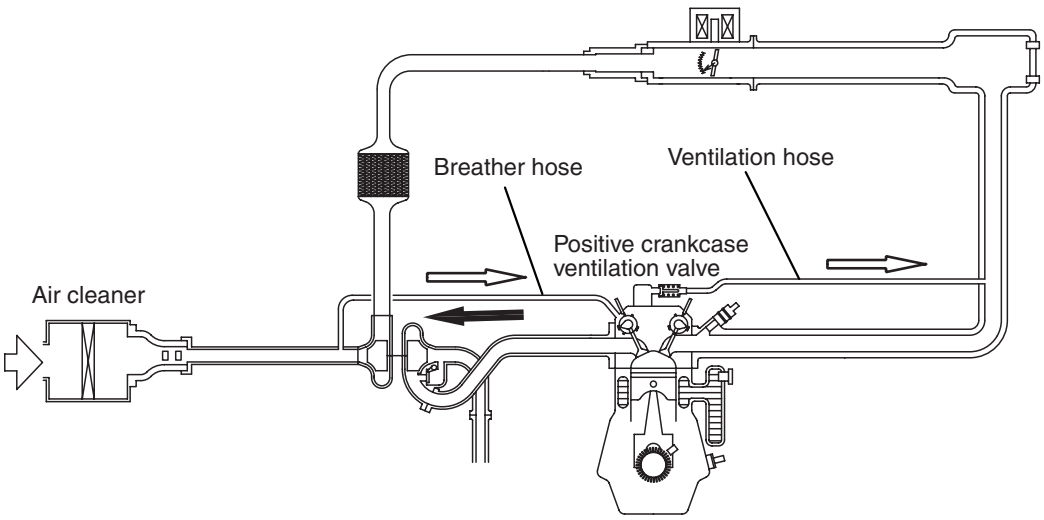
System	Objective / Function	Composition parts
Crankcase ventilation system	HC decrease Re-combustion of blow-by gas.	Positive crankcase ventilation (PCV) valve
Evaporative emission control system	HC decrease Re-combustion of fuel vapor gas.	• Canister • Evaporative emission purge solenoid
Exhaust gas recirculation (EGR) system <2.4L ENGINE>	NOx decrease Reduce NOx generation by controlling EGR volume according to engine warm-up condition and driving conditions.	EGR valve

System		Objective / Function	Composition parts
Emission reduction systems	Air-fuel ratio feedback control	Decrease of CO, HC and NOx Controls air-fuel ratio of air-fuel mixture to become theoretical air-fuel ratio (about 14.7), which is when the 3-way catalytic converter's cleaning performance is best. It also controls optimum fuel supply based on coolant temperature, driving conditions etc.	• ECM • Mass airflow sensor • Injectors • Heated oxygen sensor • Crankshaft position sensor etc.
	Catalytic converter	Decrease of CO, HC and NOx It facilitates oxidation of CO and HC and reduction of NOx so that all 3 component gases are cleaned simultaneously.	Monolith catalyst
	HC trap catalytic converter <2.4L ENGINE - vehicles for California>	HC decrease During cold operation of engine, exhaust HC is temporarily absorbed. And then Exhaust HC is released when temperature reaches to level at which catalyst is activated. This allows HC to be reduced.	Monolith catalyst

CRANKCASE VENTILATION SYSTEM

M2171000400505

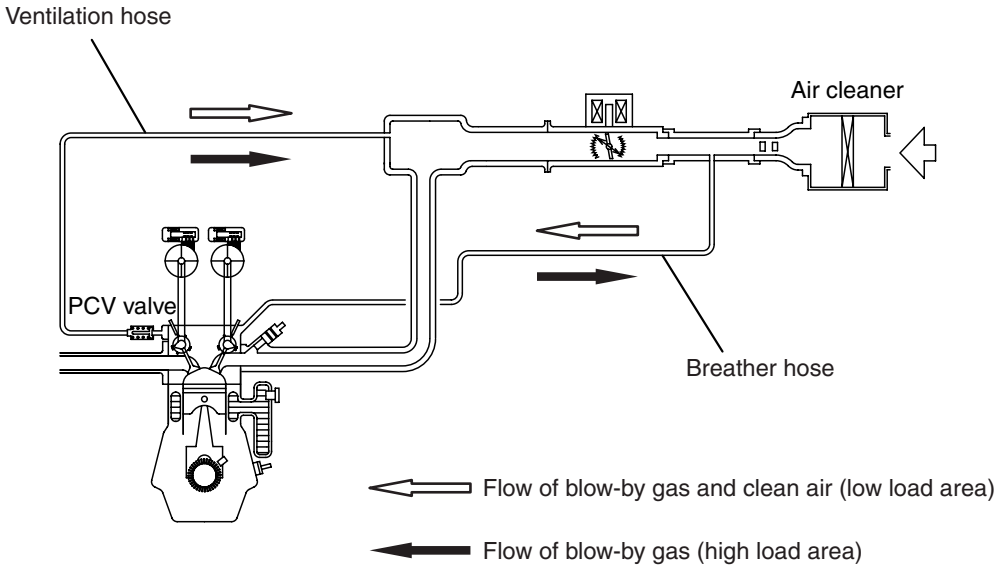
<2.0L ENGINE>



AK800122 AB

A blow-by gas reduction device prevents blow-by gas from being expelled into the atmosphere and is of closed type. A positive crankcase ventilation (PCV) valve is provided in the ventilation hose from the rocker cover to the intake manifold. During low load driving, clean air is supplied to the crankcase by the air intake hose via the breather hose and rocker cover, and it mixes with the blow-by gas in the crankcase. The blow-by gas in the crankcase is induced to the intake manifold through the rocker cover and PCV valve. During high load driving, blow-by gas in the crankcase is induced to the intake manifold through the air intake hose and throttle body via the breather hose due to negative pressure in the air cleaner.

<2.4L ENGINE>

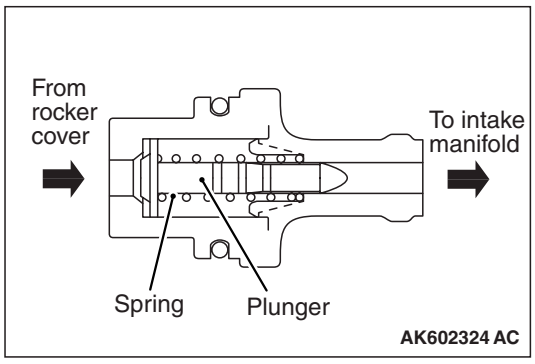


AK802254AB

A blow-by gas reduction device prevents blow-by gas from being expelled into the atmosphere and is of closed type. A positive crankcase ventilation (PCV) valve is provided in the ventilation hose from the rocker cover to the intake manifold. During low load driving, clean air is supplied to the crankcase by the air intake hose via the breather hose and rocker cover, and it mixes with the blow-by gas in the crankcase. The blow-by gas in the crankcase is induced to the intake manifold through the rocker cover and PCV valve. During high load driving, blow-by gas in the crankcase is induced to the intake manifold through the rocker cover and PCV valve and at the same time also via the air intake hose and throttle body due to negative pressure in the air cleaner.

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

PCV valve lifts the plunger according to negative pressure in the intake manifold to create appropriate ventilation for the crankcase.

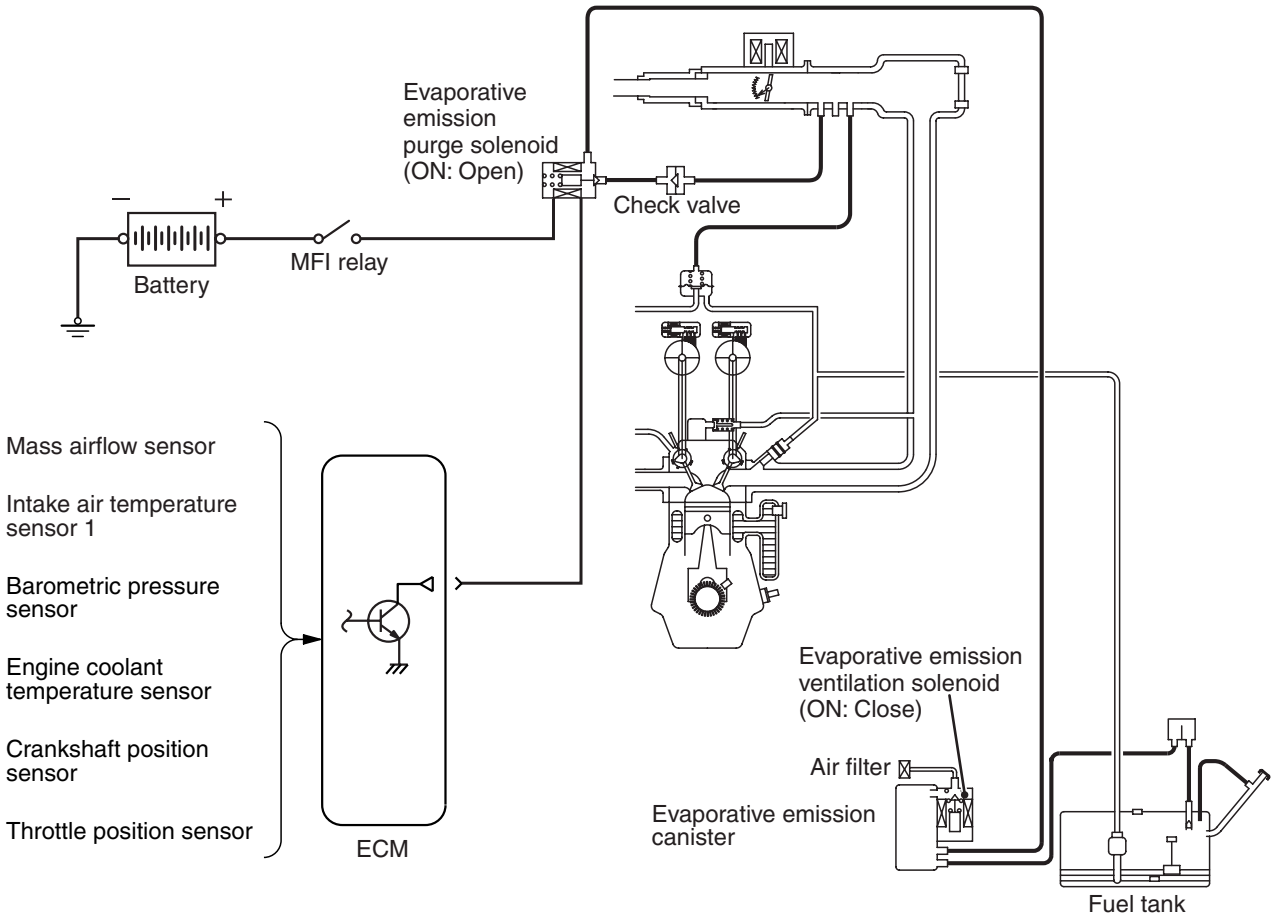


AK602324AC

EVAPORATIVE EMISSION CONTROL SYSTEM

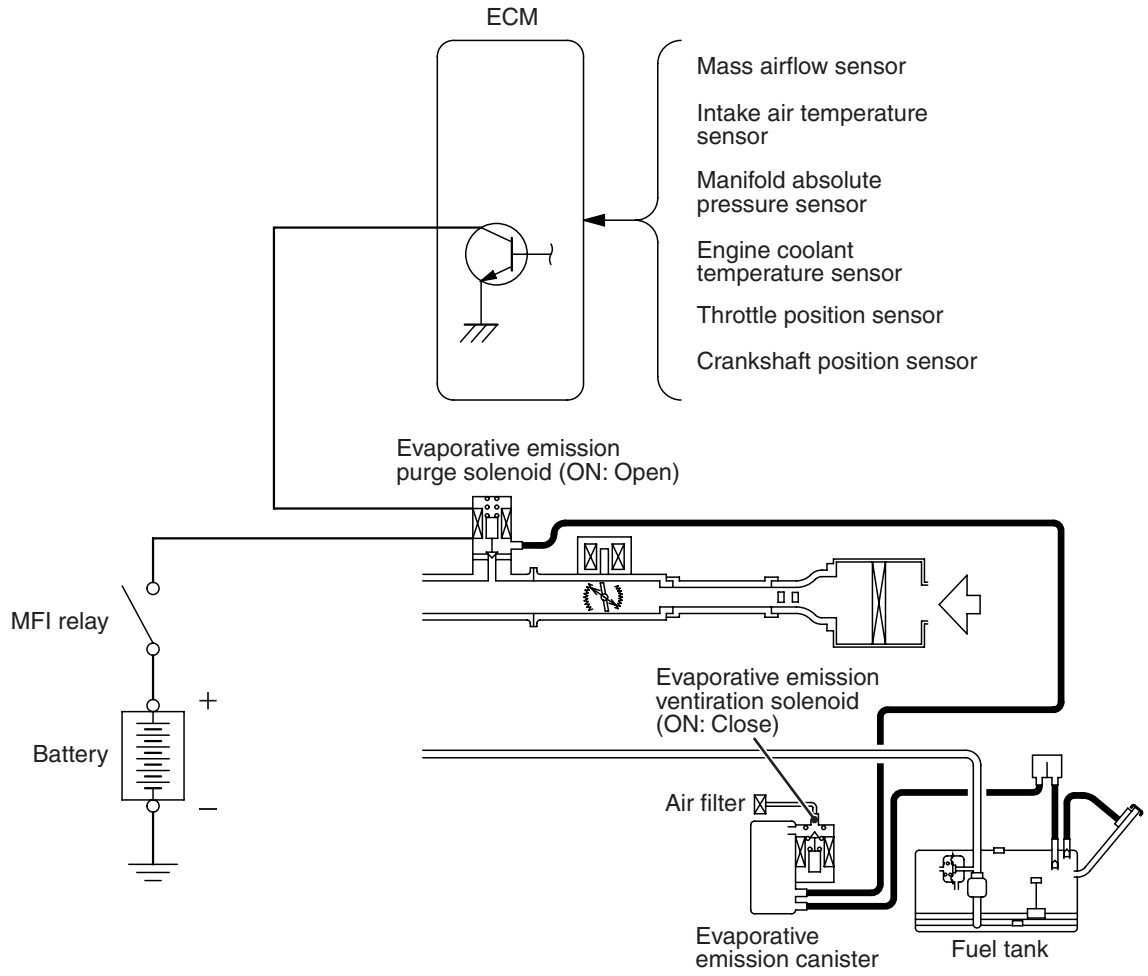
M2171000200556

<2.0L ENGINE>



AK900411AB

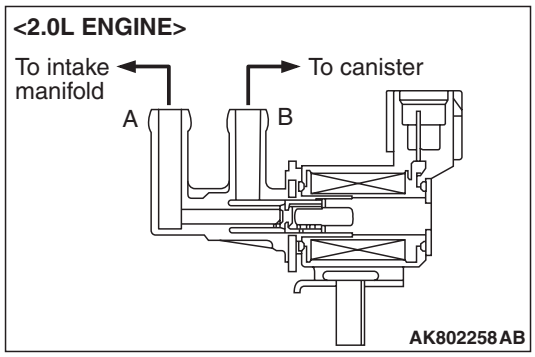
<2.4L ENGINE>

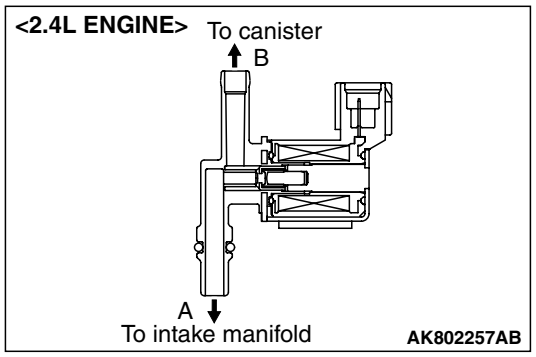


AK900407 AB

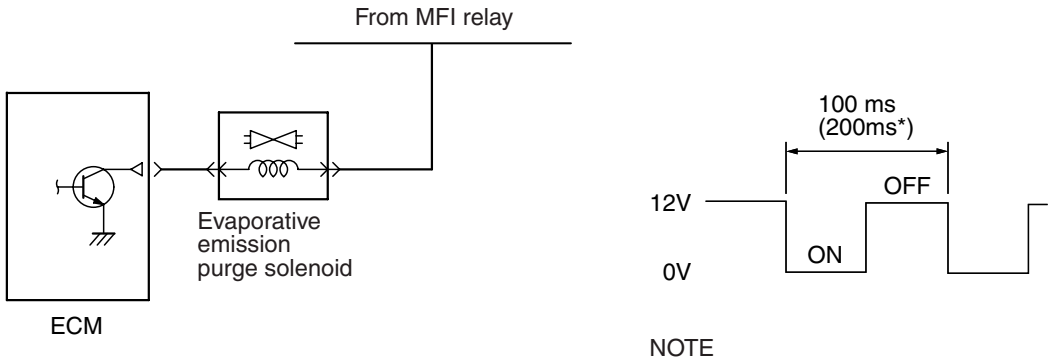
HC (hydrocarbon) generated in the fuel tank are adsorbed by the active carbon in the canister and stored. HC stored in the canister is introduced to the intake manifold when engine is in operation where it is mixed with intake air and combusted. ECM introduces optimum HC amount according to driving conditions and so performs duty control on the evaporative emission purge solenoid. Also, the evaporative emission purge solenoid is closed during deceleration or immediately after engine start to restrict change in air-fuel ratio and prevent engine from stalling.

EVAPORATIVE EMISSION PURGE SOLENOID



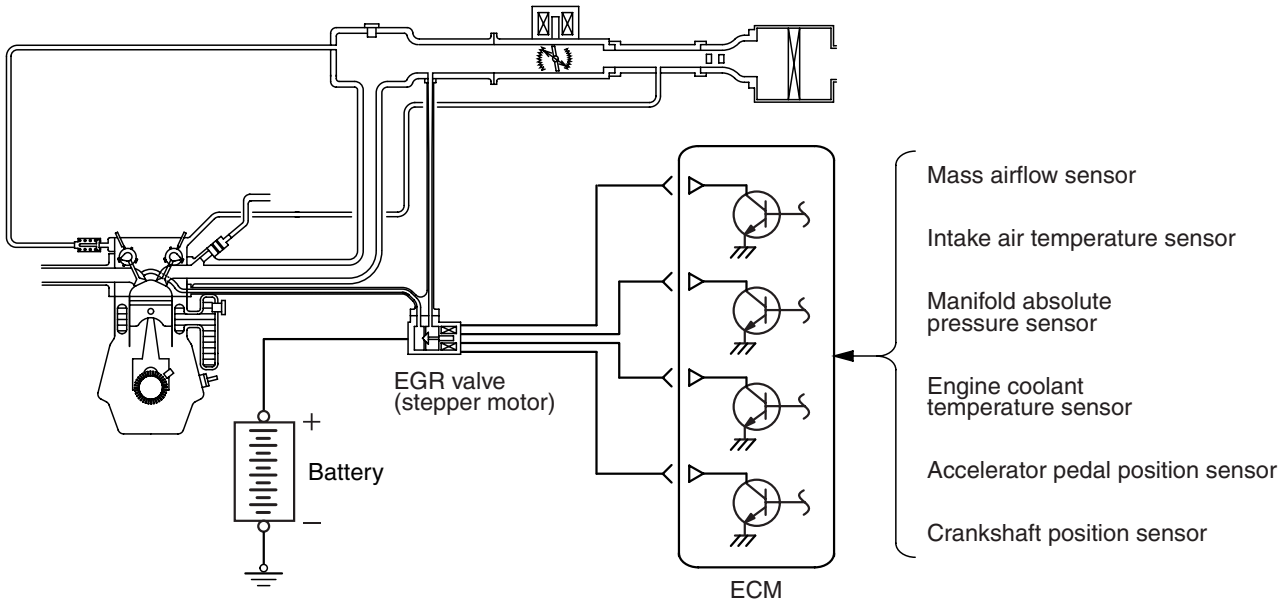


An evaporative emission purge solenoid is installed in the intake manifold.The evaporative emission purge solenoid controls the intake volume of fuel vapor gas from the canister. The evaporative emission purge solenoid is a duty control type solenoid valve. When current is not passing through the coil, nipple A is kept airtight and fuel vapor gas cannot be sucked in. When current passes through the coil, air can pass between nipple A and B and fuel vapor gas is sucked in. ECM changes the ON duty ratio according to engine's operating condition to control the intake volume of fuel vapor gas.



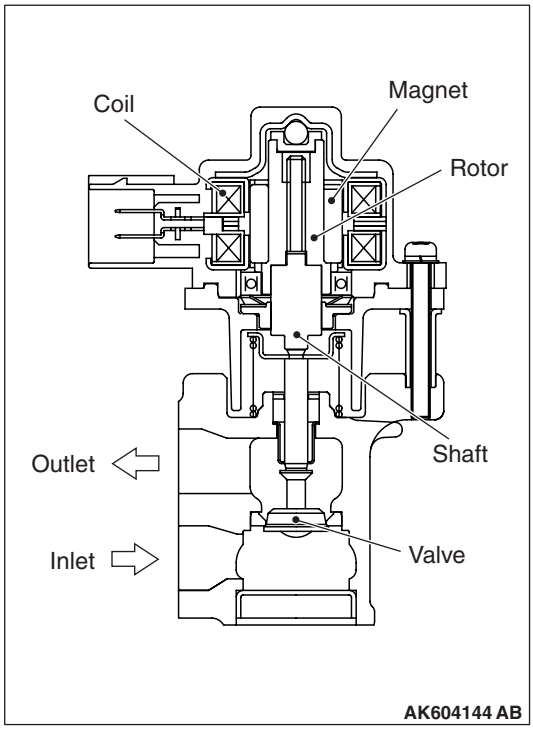
EXHAUST GAS RECIRCULATION (EGR) SYSTEM <2.4L ENGINE>

M2171000300412



AK802259AB

When the combustion gas temperature becomes high, generation of the environment polluting NOx (nitrogen oxides) increases rapidly. EGR system is used to decrease the volume of NOx generated. EGR system re-circulates exhaust gas inside the intake manifold. It increases specific heat of the combustion gases and reduces combustion speed to lower the combustion temperature and reduce the volume of NOx generated. ECM calculates the EGR introduction volume according to engine operating conditions and controls the EGR valve opening angle at optimum. Also, immediately after the ignition switch ON signal is input, it drives fully closed stepper motor and performs initialization.

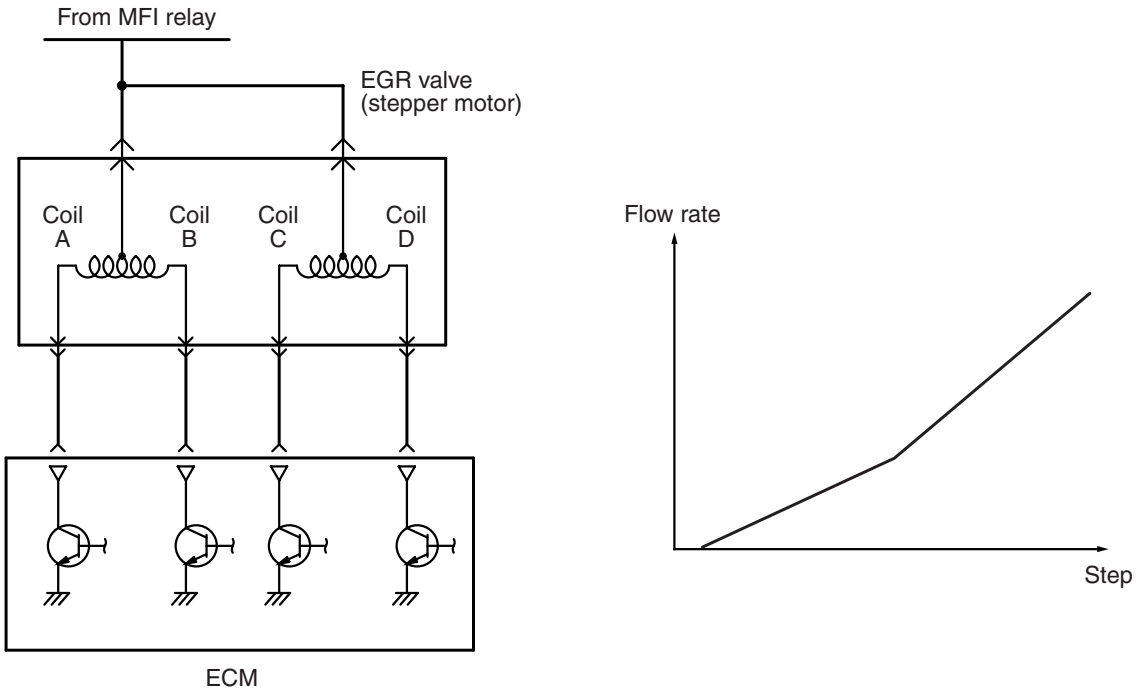


AK604144 AB

EXHAUST GAS RECIRCULATION (EGR) VALVE

An EGR valve is installed in the EGR valve support.The EGR valve controls EGR flow volume using the stepper motor method and reduces exhaust gas (NOx) and fuel consumption. The EGR valve drives the stepper motor based on the signal from ECM. When stepper motor rotor turns in clockwise or anti-clockwise direction, the shaft fitted with a rotor and a screw expands and contracts and the movement of the shaft causes the valve to go up and down. Thus, EGR path gap is controlled minutely. The stepper motor turns 15° per step. The stepper motor turns forward or back only up to the angle dictated by the number of pulse signals (number of steps) from the ECM. In other words, increase and decrease of the EGR flow volume depends on the number of signals (number of steps) from ECM. ECM changes current flow to the 4 coils (A, B, C, D) in the stepper motor in sequence according to the phase pattern in the following chart in order to turn the stepper motor rotor. Open valve changes phase in order of 0 →1 →2 →3 →0. Close valve changes phase in order of 3 →2 →1 →0 →3.

Phase number	Stepper motor coil			
	Coil A	Coil B	Coil C	Coil D
0	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON



AK604145 AB

EMISSION REDUCTION SYSTEMS

M2171000800332

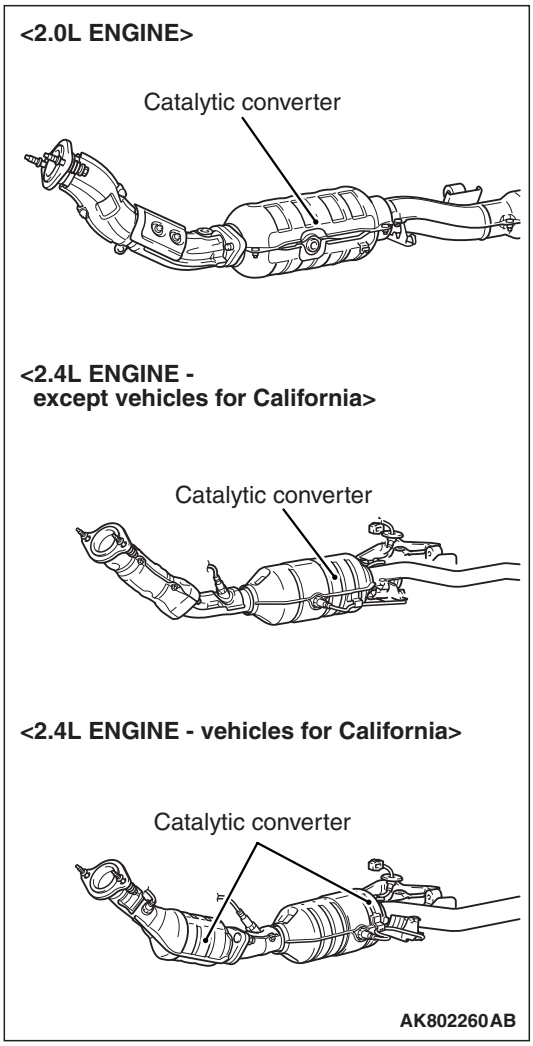
These decrease CO, HC and NOx in the exhaust gases and consist of air-fuel ratio feedback control and catalytic converter.

1. AIR-FUEL RATIO FEEDBACK CONTROL

Refer to GROUP 13A <2.0L ENGINE> –Fuel Injection Control P.13A-29.
Refer to GROUP 13B <2.4L ENGINE> –Fuel Injection Control P.13B-31.

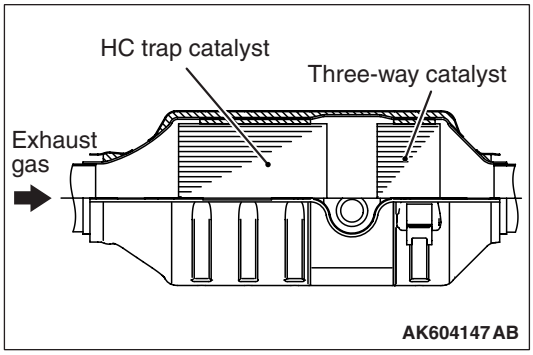
2. CATALYTIC CONVERTER

Catalytic converter is installed in the exhaust pipe below the floor and in the front of exhaust pipe <2.4L ENGINE –vehicles for California>. Based on appropriate air-fuel ratio feedback from oxygen sensor, CO and HC are oxidized and NOx is reduced.

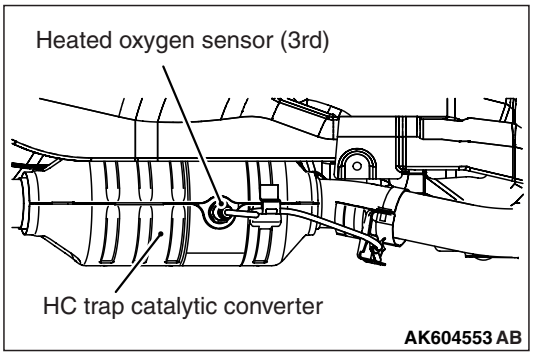


3. HC TRAP CATALYTIC CONVERTER <2.4L ENGINE –vehicles for California>

The HC trap catalytic converter is installed in the exhaust pipe below the floor. The HC trap catalytic converter consists of the HC trap catalyst and the three-way catalysts. The HC trap catalyst temporarily absorbs the exhaust HC from the engine within the temperature range in which the three-way catalyst is not activated, and prevents the exhaust HC from releasing outside the vehicle. After that, the HC trap catalyst temperature rises and releases the absorbed HC. The released HC is burnt out in the downstream three-way catalyst.

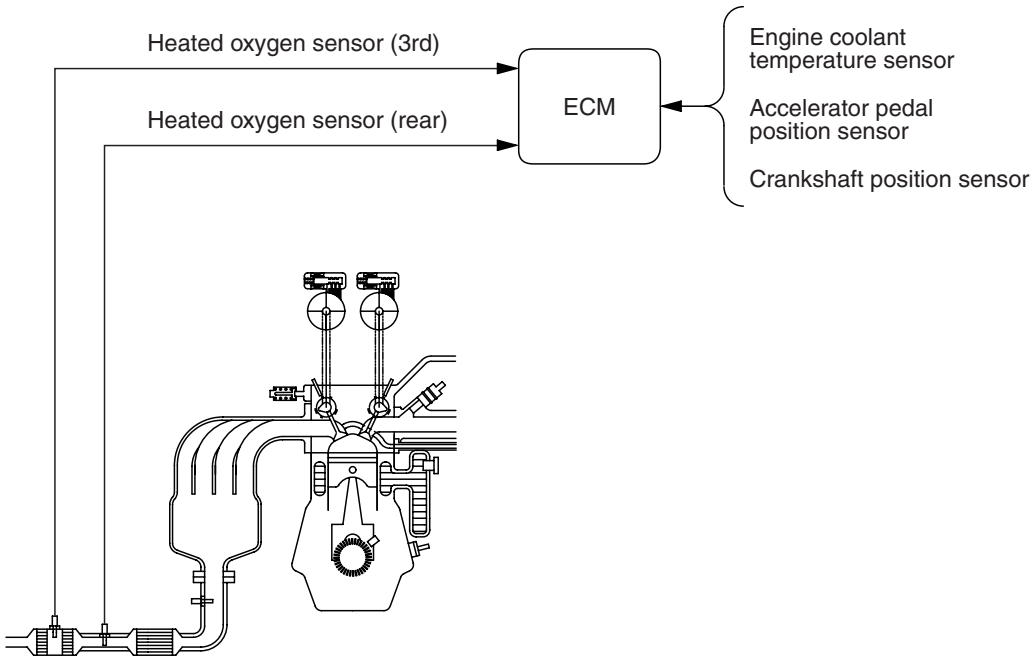


HEATED OXYGEN SENSOR (3RD)



The heated oxygen sensor (3rd) is installed to the HC trap catalytic converter. The heated oxygen sensor (3rd) detects the oxygen density of the exhaust gas and outputs the voltage to the ECM in accordance with the oxygen density.
The ECM uses this output voltage to detect the deterioration of the HC trap catalytic converter. The structure of the heated oxygen sensor (3rd) is the same as that of the heated oxygen sensor (rear) installed in the exhaust pipe.

HC TRAP CATALYTIC CONVERTER DETERIORATION MONITOR



The ECM detects the deterioration of the HC trap catalytic converter.
When reaching the certain operating range, the ECM begins monitoring the difference in the feedback time between the heated oxygen sensor (rear) on the upstream of the HC trap catalyst and the heated oxygen sensor (3rd) on the downstream of the HC trap catalyst. This monitoring allows the ECM to detect the deterioration of the HC trap catalytic converter.

NOTES