

GROUP 17c

EMISSION CONTROL

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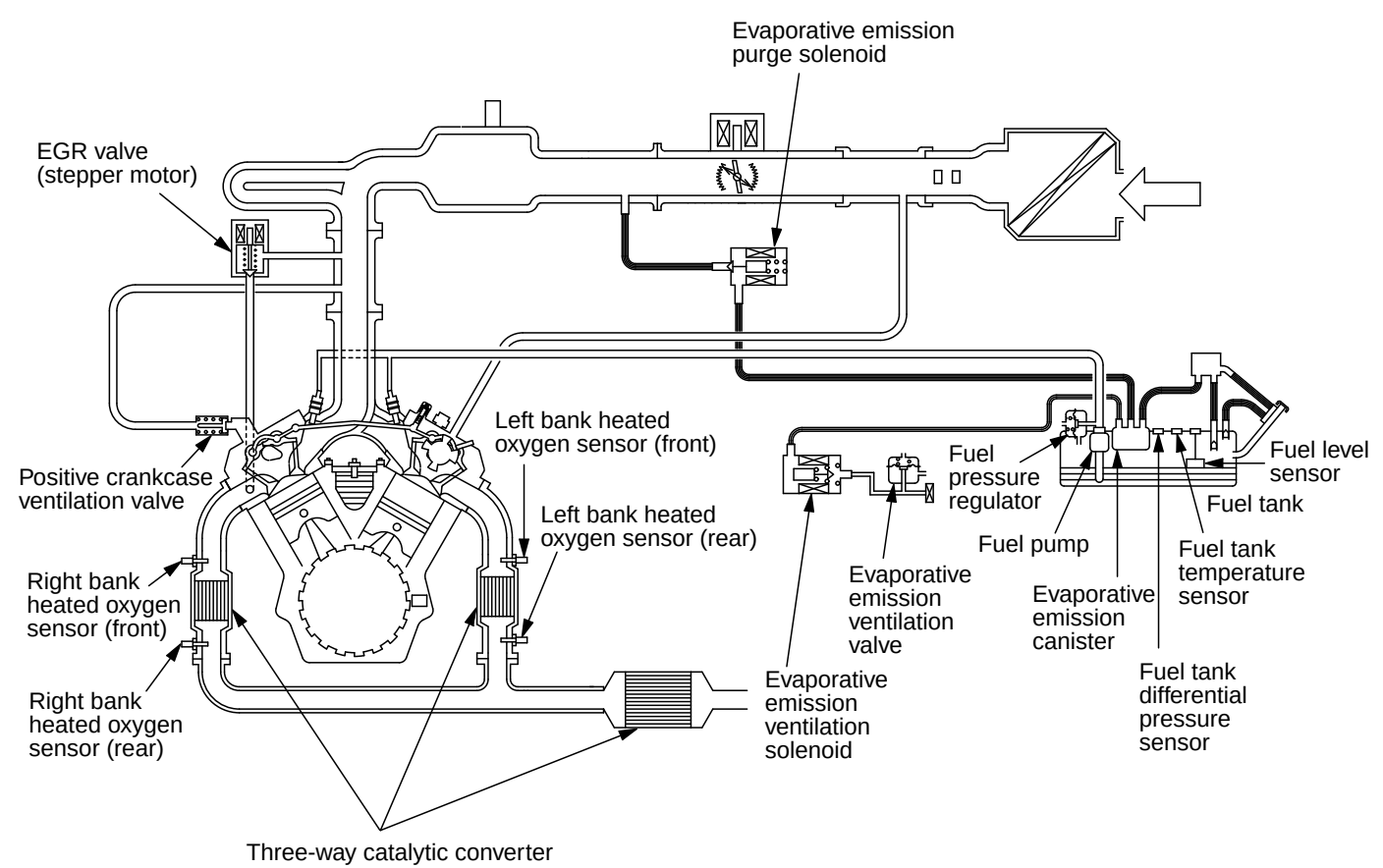
GENERAL INFORMATION

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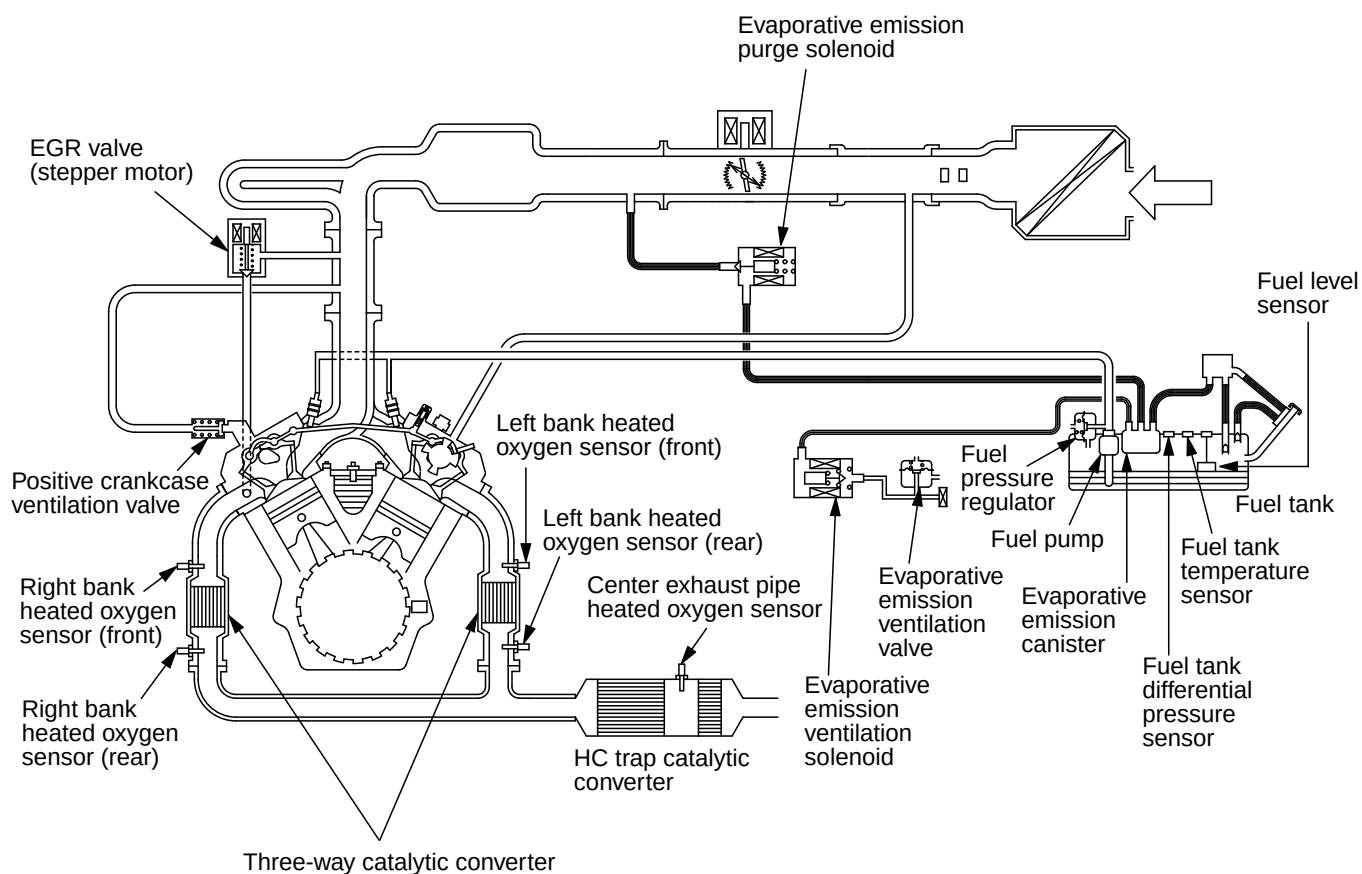
The following changes have been made to the controls of the 3.8L engine provided on the OUTLANDER.

Improvement / Additions	Remark
Addition of HC trap catalytic converter <California>	HC decrease

SYSTEM CONFIGURATION DIAGRAM
<Except for California>



<California>



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Exhaust gas cleaning devices list

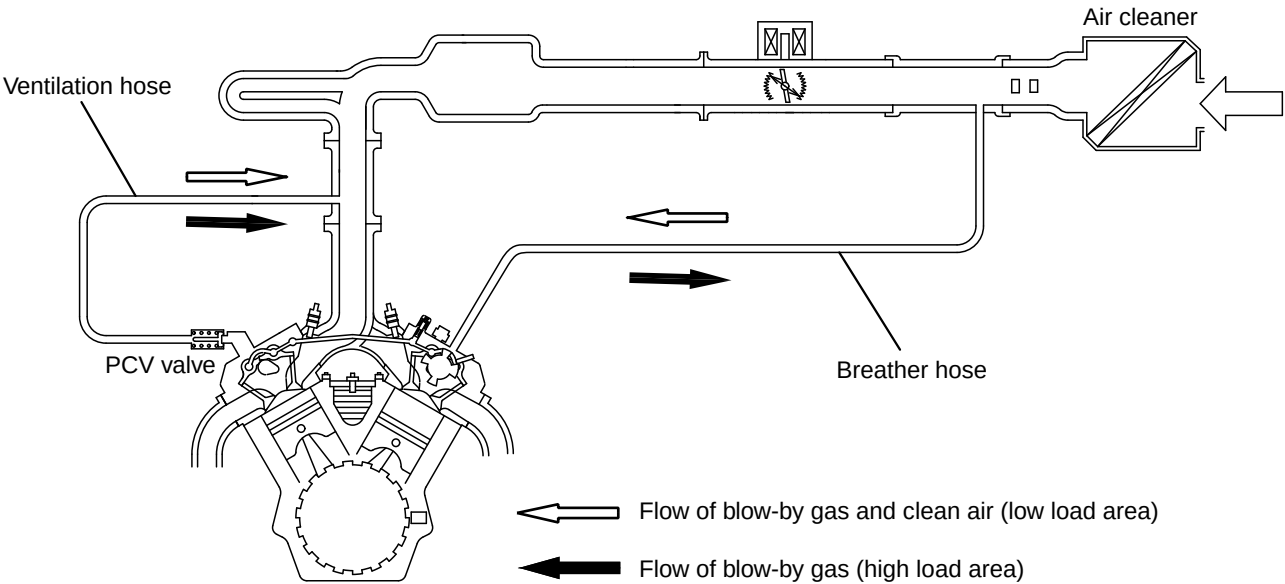
System		Objective / Function	Composition parts
Crankcase ventilation system		HC decrease Re-combustion of blow-by gas.	Positive crankcase ventilation valve
Evaporative emission control system		HC decrease Re-combustion of fuel vapor gas.	▪ Canister ▪ Evaporative emission purge solenoid
Exhaust gas recirculation (EGR) system		NOx decrease Reduce NOx generation by controlling EGR volume according to engine warm-up condition and driving conditions.	EGR valve
Emission reduction systems	Air-fuel feedback control	Decrease of CO, HC and NOx	▪ ECM ▪ Mass airflow sensor ▪ Injector ▪ Heated oxygen sensor ▪ Crankshaft position sensor etc.

EMISSION CONTROL CRANKCASE VENTILATION SYSTEM

System		Objective / Function	Composition parts
		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.	
	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 <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

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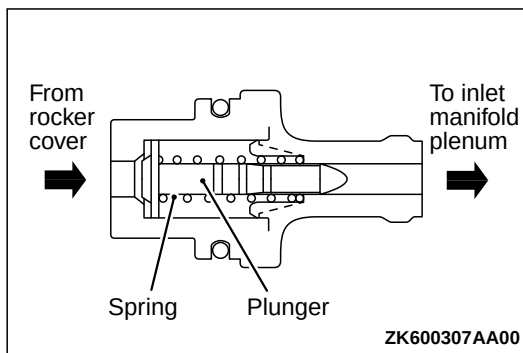


A blow-by gas reduction device prevents blow-by gas from being expelled into the atmosphere and is of closed type. A positive crankcase ventilation (PCV) valve is provided in the ventilation hose from the rocker cover to the intake manifold plenum. During low load driving, clean air is supplied to the 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 plenum through the rocker cover and PCV valve. During high load driving, blow-by gas in the crankcase is induced to the intake manifold plenum 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.

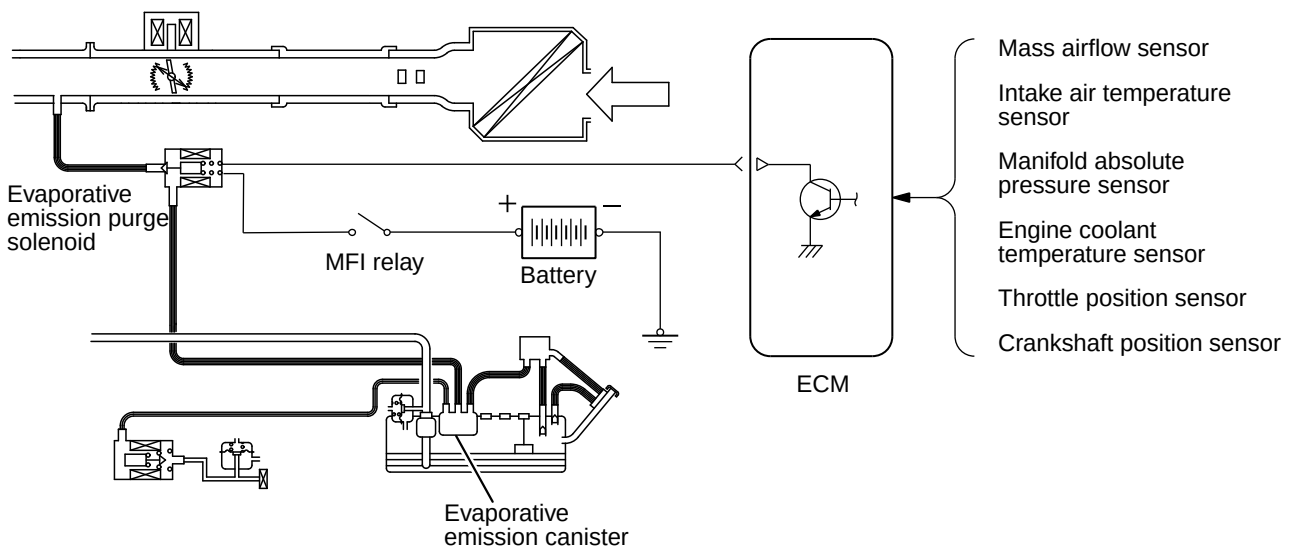
POSITIVE CRANKCASE VENTILATION (PCV) VALVE

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



EVAPORATIVE EMISSION CONTROL SYSTEM

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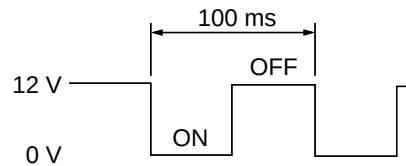
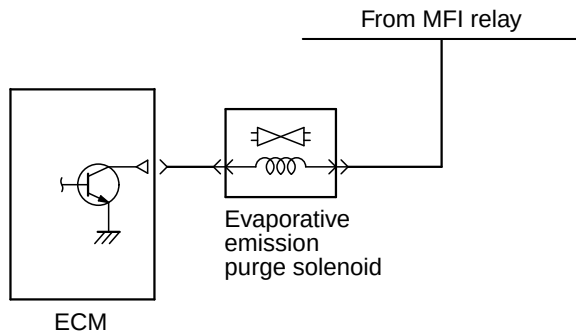
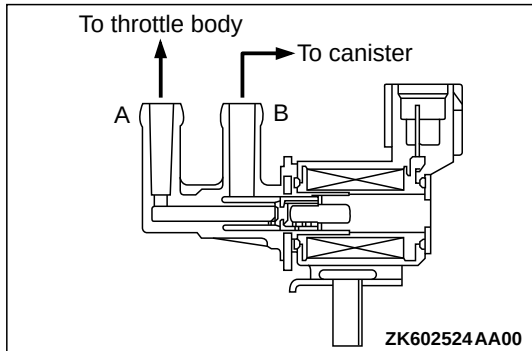
HC (hydrocarbon) generated in the fuel tank are adsorbed by the active carbon in the canister and stored. HC stored in the canister is introduced to the intake manifold when engine is in operation where it

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

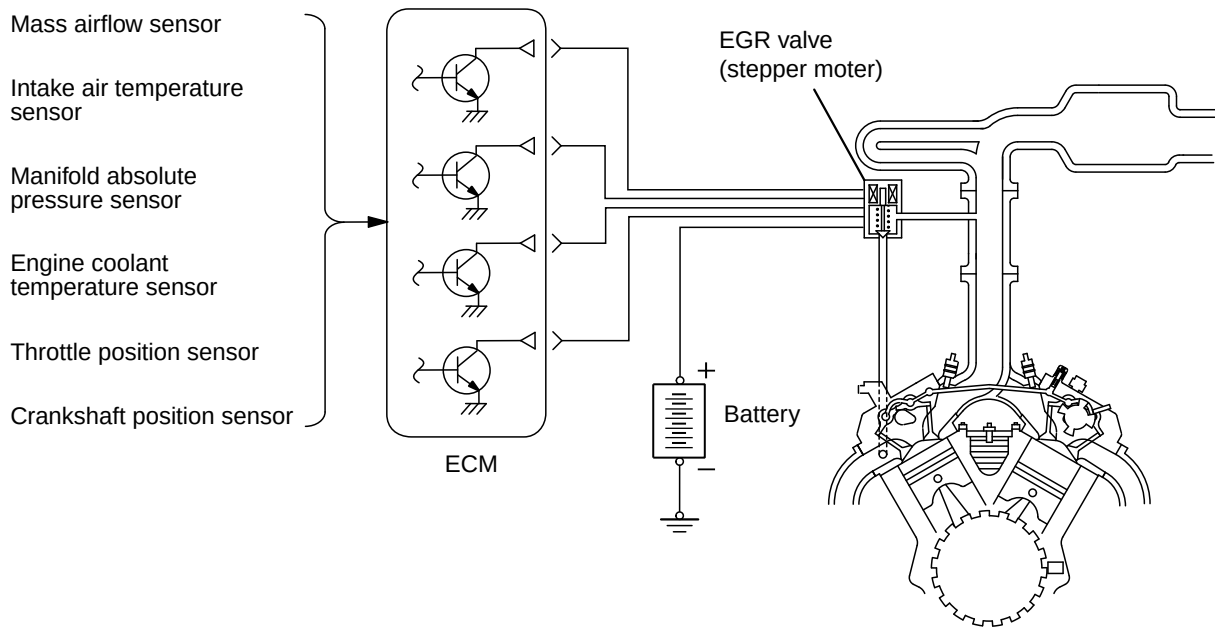
An evaporative emission purge solenoid is installed in the intake manifold. The evaporative emission purge solenoid controls the intake volume of fuel vapor gas from the canister. The evaporative emission purge solenoid is a duty control type solenoid valve. When current is not passing through the coil, 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.



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EXHAUST GAS RECIRCULATION (EGR) SYSTEM

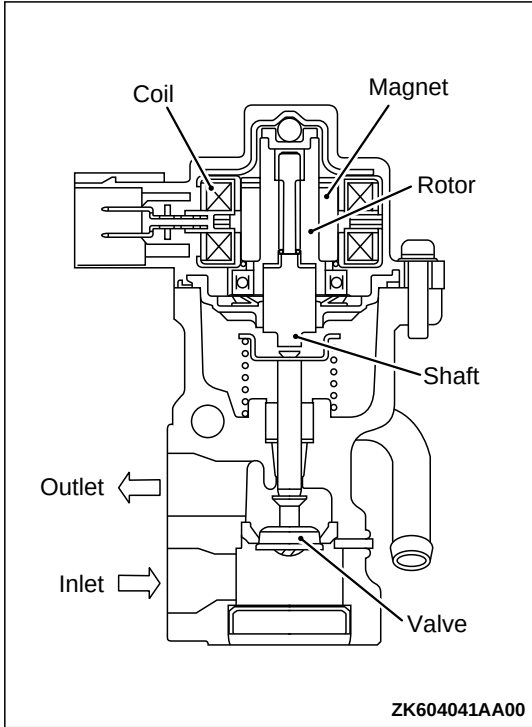
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When the combustion gas temperature becomes high, generation of the environment polluting NOx (nitrogen oxides) increases rapidly. EGR system is used to decrease the volume of NOx generated. EGR system re-circulates exhaust gas inside the intake manifold. It increases specific heat of the combustion gases and reduces combustion speed to lower the

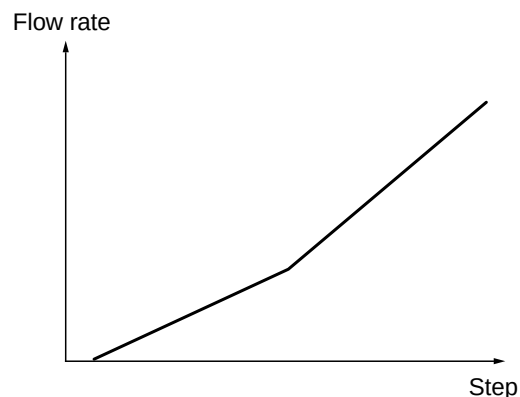
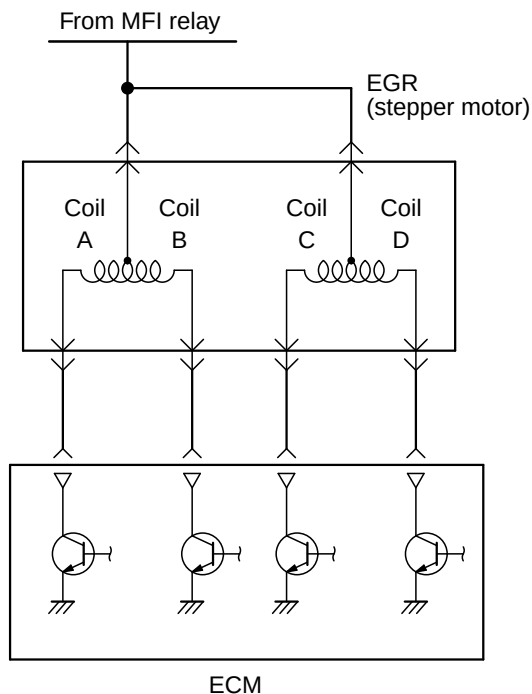
combustion temperature and reduce the volume of NOx generated. ECM calculates the EGR introduction volume according to engine operating conditions and controls the EGR valve opening angle at optimum. Also, immediately after the ignition switch ON signal is input, it drives fully closed stepper motor and performs initialization.



EXHAUST GAS RECIRCULATION (EGR) VALVE

An EGR valve is installed in the inlet manifold plenum. The EGR valve controls EGR flow volume using the stepper motor method and reduces exhaust gas (NO_x) 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



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EMISSION REDUCTION SYSTEMS

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

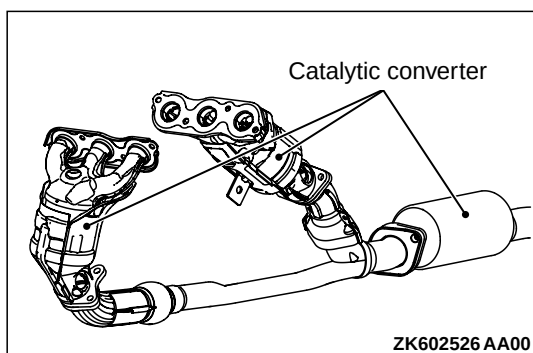
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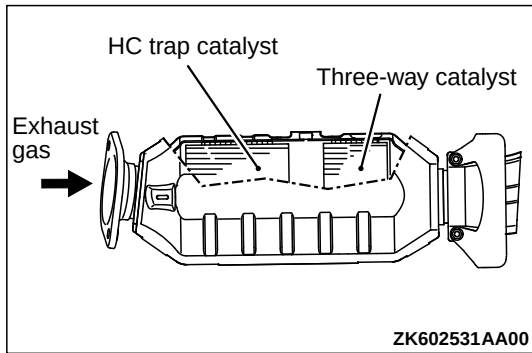
1. AIR-FUEL RATIO FEEDBACK CONTROL

Refer to GROUP 13A - Fuel Injection Control P.13A-31.

2. CATALYTIC CONVERTER

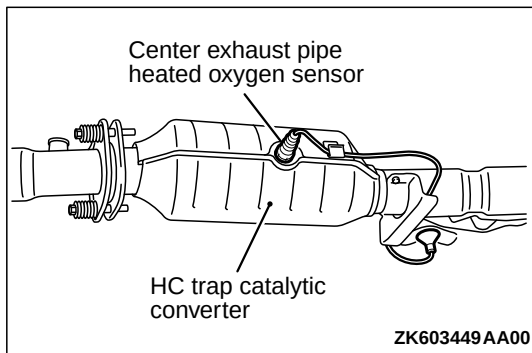
Catalytic converter is installed in the exhaust manifold junction of each bank and in the center of exhaust pipe below the floor. Based on appropriate air-fuel ratio feedback from oxygen sensor, CO and HC are oxidized and NO_x is reduced. Catalytic converter is a monolith with beehive design with catalysts on the unit surface. It is protected by a thermally insulating mat and enclosed in a shell.





3. HC TRAP CATALYTIC CONVERTER <California>

The HC trap catalytic converter is installed to the center of exhaust pipe under the vehicle's floor. The HC trap catalytic converter consists of the HC trap catalyst and the three-way catalysts, which are the monolith type; the catalyst element is attached to the honeycomb catalyst surface. The HC trap catalyst and the three-way catalysts are held by the heat-insulating mat and installed in the shell. 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.

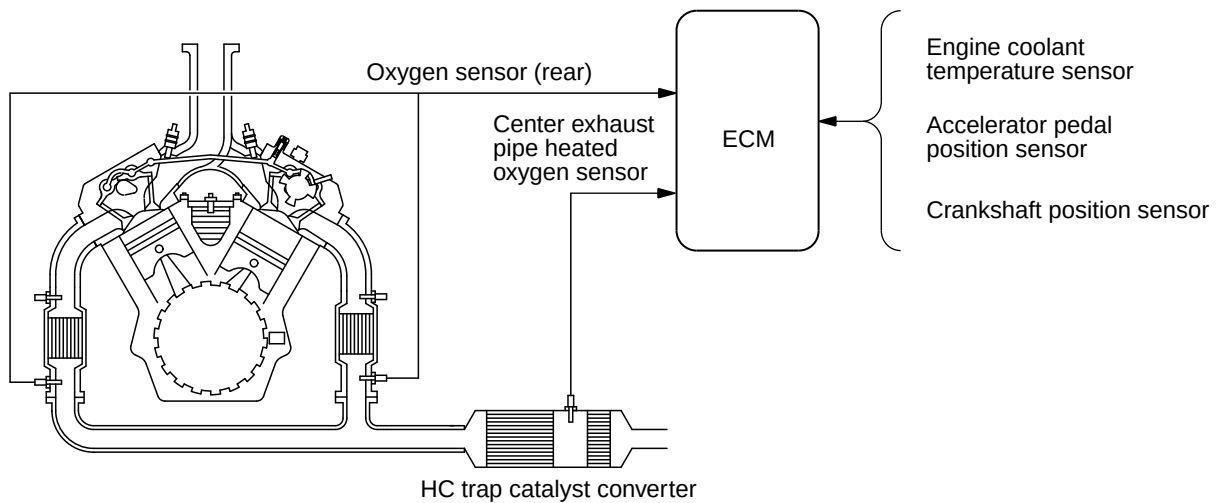


CENTER EXHAUST PIPE HEATED OXYGEN SENSOR

The center exhaust pipe heated oxygen sensor is installed to the HC trap catalytic converter. The center exhaust pipe heated oxygen sensor 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 center exhaust pipe heated oxygen sensor is the same as that of the heated oxygen sensor (rear) installed in the exhaust manifold on the both banks.

HC TRAP CATALYTIC CONVERTER DETERIORATION MONITOR



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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 center exhaust pipe heated oxygen sensor on the downstream of the HC trap catalyst. This monitoring allows the ECM to detect the deterioration of the HC trap catalytic converter.

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