B9 EMISSION CONTROL SYSTEM

1KR
1 OUTLINE
1-1 DESCRIPTION

1.The 1KR− FE type engine conforms to 1999/102-/EC (emission control, Step IV) specifications for EU, and to 1999/102-/EC (emission control, step Ⅲ) specifications for Australia and general destinations, by combining following equipment.
(1) Electronically controlled fuel injection system (EFI)
(2) Electronic spark advance system (ESA)
(3) Variable valve-timing control system
(4) Evaporative emission control system with electronically controlled purging system
(5) Electronically controlled exhaust gas recirculation system

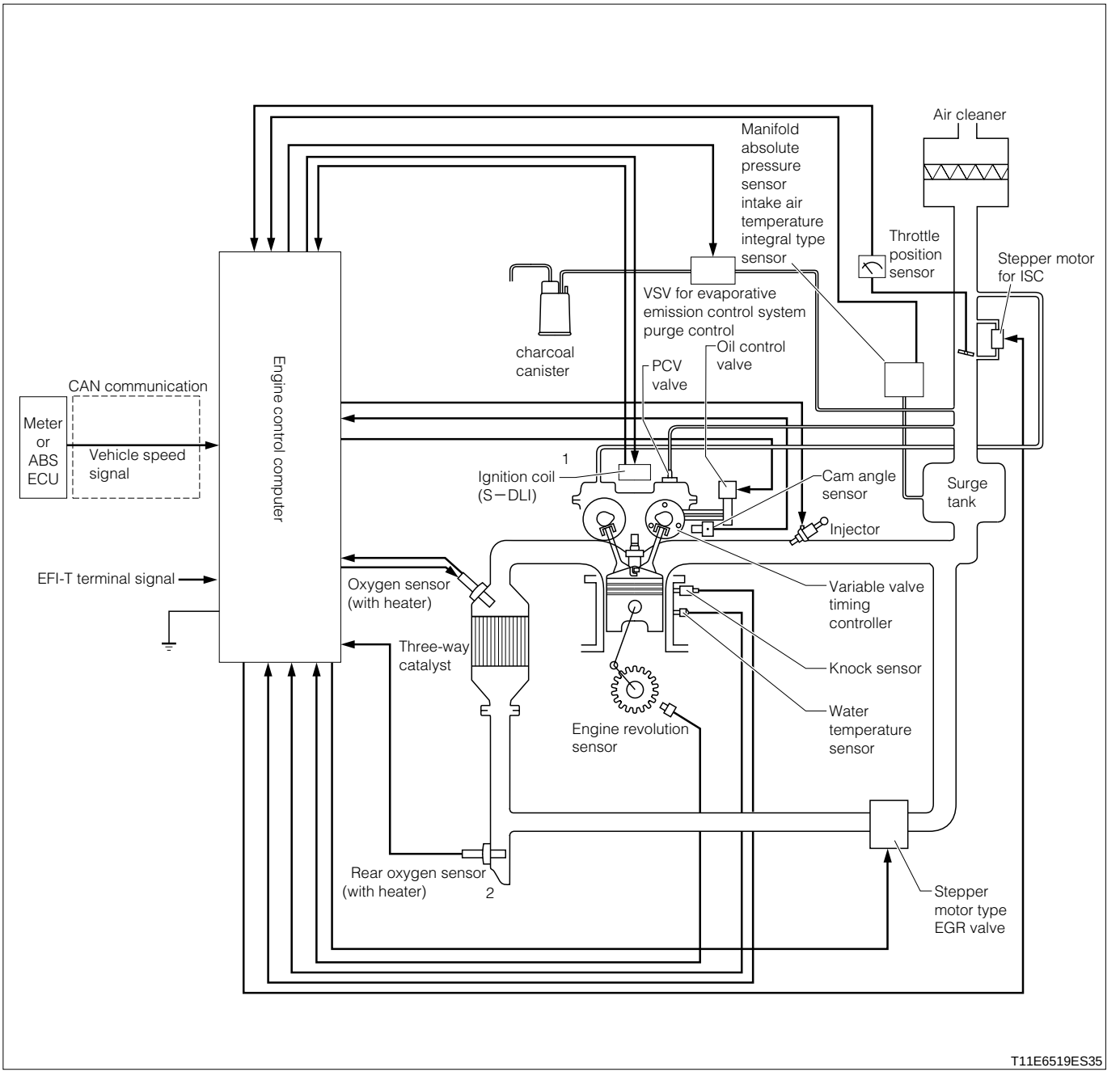
1-2 LIST OF EMISSION CONTROL DEVICES

Name of device	System of device	COMPONENTS	Purpose/function
Catalyst device	Three-way catalyst system	(1)Monolithic catalyst 0.849ℓ	·Reduction of CO, HC and NO_x
Air-fuel ratio control device	Electronic controlled fuel injection system	(1)Injector (2) Oxygen sensor (with heater) (3)Rear oxygen sensor (with heater)*1 (4)Computer for control (5)Operation control device Throttle position sensor, intake pipe pressure/intake air temperature integrated sensor, water temperature sensor, engine revolution sensor, atmospheric pressure sensor*1, stepper motor for ISC	·Reduction of CO, HC and NO_x (The air-fuel ratio of the mixture taken in the combustion chamber will be controlled approximately to the stoichiometric air-fuel ratio, thus enabling the three-way catalyst to fully exercise the purification performance.)
Ignition timing control device (For EU specifications)	Electronic controlled system	(1)Ignition coil (Ion current detection device built-in) (2)Computer for control (3)Operation control device Intake pipe pressure/intake air temperature integrated sensor, water temperature sensor, throttle position sensor, engine revolution sensor, cam angle sensor, knock sensor, injector	·Reduction of HC ·Reduction of NO_x (An appropriate ignition timing control is performed according to the operating conditions.)
Ignition timing control device (For General specifications)	Electronic controlled system	(1)Ignition coil (2)Computer for control (3)Operation control device Intake pipe pressure/intake air temperature integrated sensor, water temperature sensor, throttle position sensor, engine revolution sensor, cam angle sensor, knock sensor, injector	·Reduction of NO_x (An appropriate ignition timing control is performed according to the operating conditions.)
Deceleration control device		(1)Injector (2)Computer for control (3)Operation control device Throttle position sensor	·Reduction of CO and HC during deceleration ·Improvement of fuel consumption ·Prevention of catalyst heating (Fuel cut is carried out during deceleration by the control device.)
Evaporative emission control device	Canister type	(1)Charcoal canister 0.36 ℓ (2)VSV for evaporative emission control system purge control (3)Computer for control	·Emission control of fuel evaporative emission
Blow-by gas recirculation device	Closed type	(1)Ventilation hose (2)PCV valve	·Reduction of CO and HC (The blow-by gas will be burned again to prevent emission of CO and HC.)
Variable valve timing device		(1)Oil control valve Variable valve timing controller (3)Computer for control (4)Operation control device Engine revolution sensor, cam angle sensor, intake pipe pressure/intake air temperature integrated sensor, water temperature sensor, injector	·Reduction of NO_x (The NO_x is reduced by controlling the opening and closing of the intake valve to the appropriate timing according to the operating conditions.)

Exhaust gas recirculation device	Electronic controlled system	(1)Stepper motor type EGR valve (2)Computer for control (3)Operation control device Engine revolution sensor, water temperature sensor, intake pipe pressure/intake air temperature integrated sensor, throttle position sensor	·Reduction of NO_x (The NO_x in the exhaust gas is reduced by the external EGR effect.) ·Improvement of fuel consumption
On-board diagnosis device		Engine control computer, throttle position sensor, intake pipe pressure/intake air temperature integrated sensor, water temperature sensor, engine revolution sensor, cam angle sensor, oxygen sensor, oxygen sensor heater circuit, rear oxygen sensor*1, rear oxygen sensor heater circuit*1, oil control valve, atmospheric pressure sensor*1, ignition coil (ion current detection device built-in*1), fuel supply system, exhaust gas recirculation system, warning lamp	·Detection of failure of the emission control device

*1: For only EU specifications

1-3 SCHEMATIC DIAGRAM OF EXHAUST EMISSION PURIFICATION DEVICE



1: Ion current detection device built-in for only EU specifications
2: For only EU specifications

2 CONSTRUCTION AND OPERATION

2-1 CATALYST DEVICE

2-1-1 DESCRIPTION

The catalyst, made of ceramic, has gas passages called monolith which has grid cross-section with its surface covered with noble metal. This catalyst is mounted in the exhaust manifold so that harmful components of the exhaust gas can be removed as the exhaust gas passes through the passages.
The O_2 sensor is mounted downstream of the catalyst for EU specification vehicles to monitor degradation of the O_2 sensor mounted upstream of the catalyst, to prevent exhaust gas from deterioration.

2-2 AIR-TO-FUEL RATIO CONTROL DEVICE

2-2-1 DESCRIPTION

The air-to-fuel ratio is controlled by the electronically controlled fuel injection system so that the air to fuel ratio which is fit to the engine's operating conditions can be obtained and that high purification performance can be obtained in the catalyst device.

2-3 IGNITION TIMING CONTROL DEVICE

2-3-1 DESCRIPTION

The ignition timing is controlled by the electronic spark advance system so that the ignition timing may become fit to the engine operating conditions and that harmful emissions in the exhaust gas can be reduced.

2-4 CONTROL DEVICE DURING DECELERATION

2-4-1 DESCRIPTION

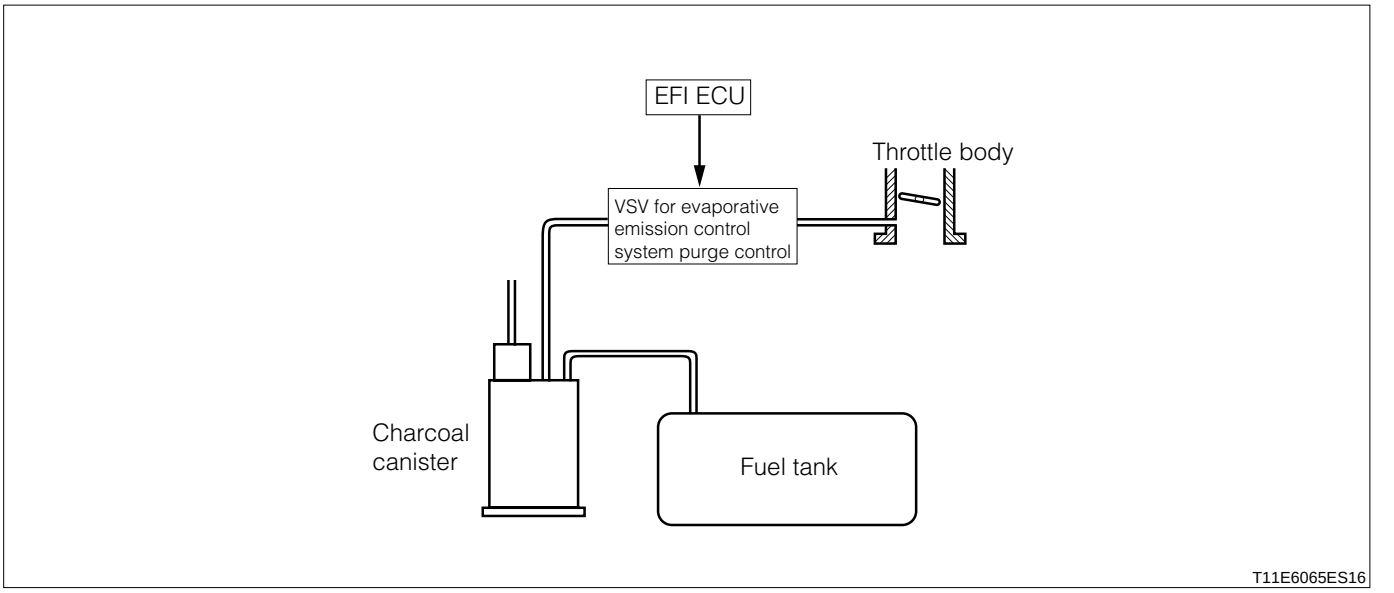
Deceleration fuel cut occurs when the throttle valve opening degree and engine speed fall into the fuel cut range in order to reduce unburnt components discharged when the throttle valve is closed during deceleration.

2-5 FUEL EVAPORATIVE EMISSION CONTROL DEVICE

2-5-1 CANISTER METHOD

(1) Description

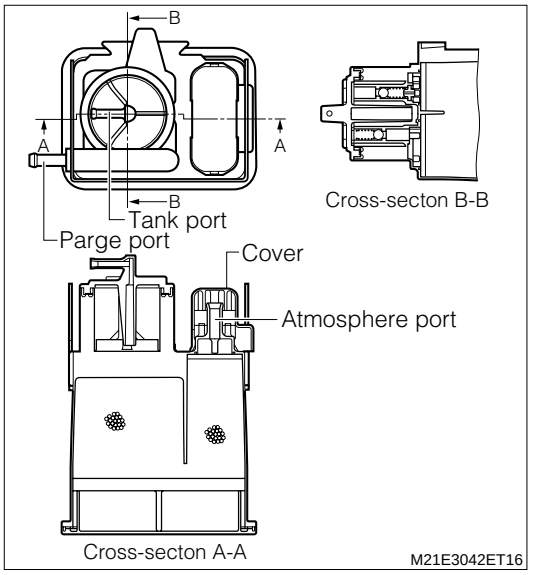
Fuel evaporative emissions generated inside the fuel tank are absorbed in the charcoal canister.
The adsorbed fuel evaporative emissions are sucked into the intake manifold and burned during engine operation.



(2) Components

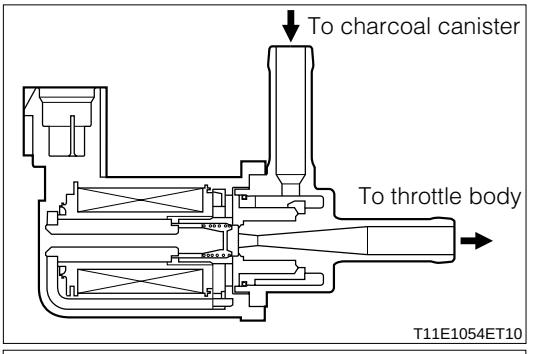
① Charcoal canister

The charcoal canister (capacity : 0.36 ℓ) is mounted on the vehicle left side dash in the engine compartment.



② Evaporator purge VSV

The purge amount of the evaporative emission gas to the intake manifold is controlled by the signal (duty ratio) sent from the engine control computer, which is calculated based on operation conditions of the engine, fuel evaporative emission concentration, etc.

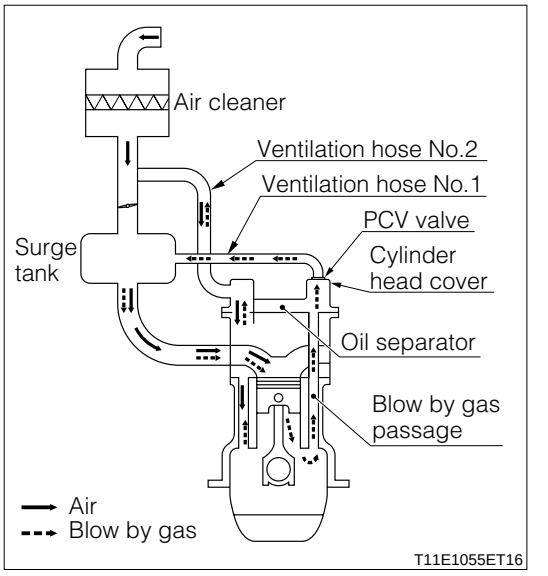


2-6 BLOW-BY GAS RECIRCULATION DEVICE

2-6-1 DESCRIPTION

The crank case ventilation system is employed, in which the blow-by gas inside the crank case flows through the blow-by gas passage of the cylinder block into the cylinder head cover side.

The oil separator is provided in the cylinder head cover and the cylinder block so that the blow-by gas is separated and enters into the combustion chamber for afterburning .



2-7 DYNAMIC VARIABLE TIMING DEVICE

2-7-1 DESCRIPTION

The open/close timing of the intake air valve is controlled to provide the intake air amount and internal EGR amount, etc. that are fit to the operating conditions, thereby reducing the exhaust emissions.

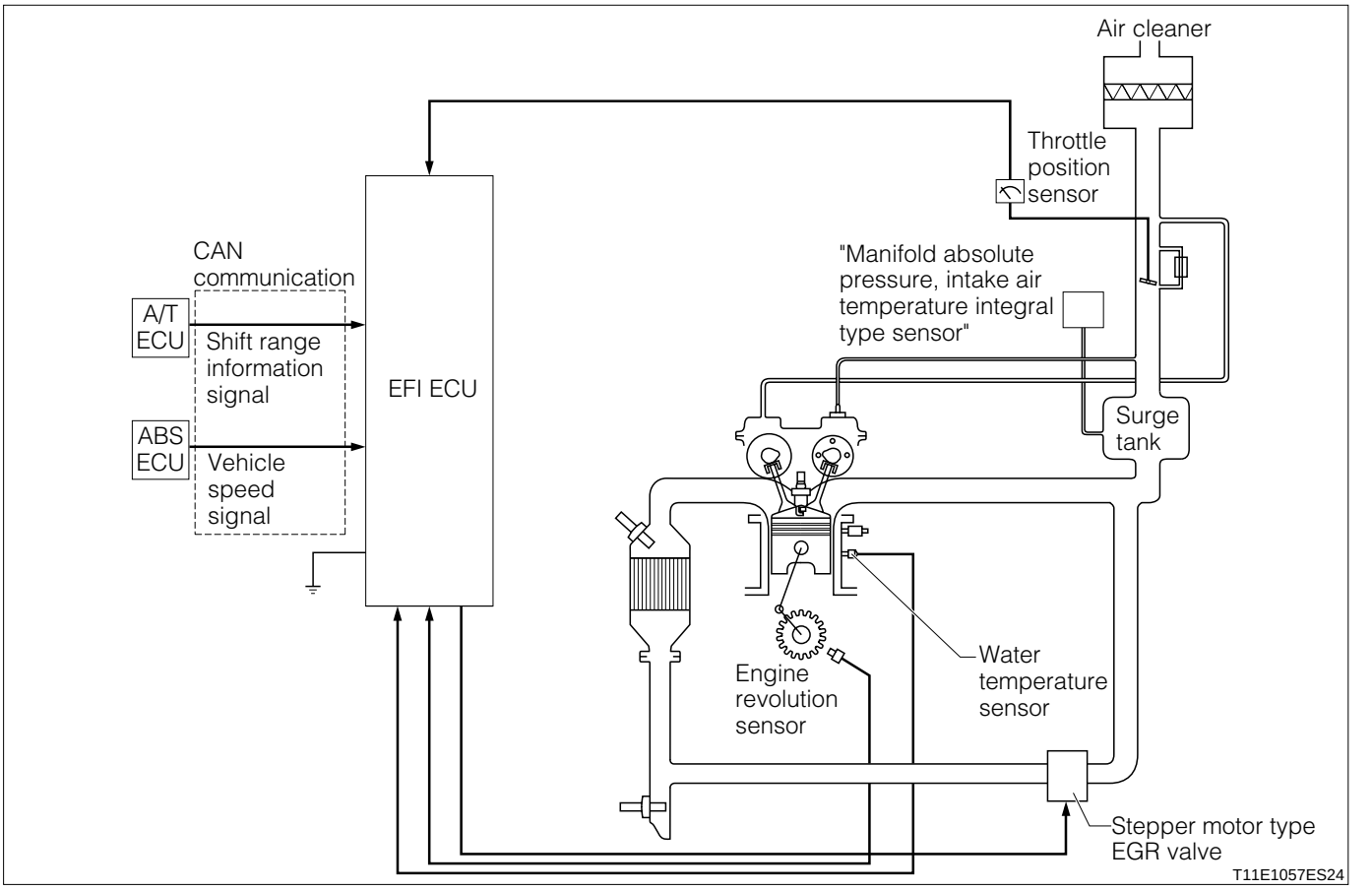
2-8

2-8-1 DESCRIPTION

The electronically controlled exhaust gas recirculation system is employed so that an optimum amount of the exhaust emissions that are adjusted according to the operating conditions can be circulated into the combustion chamber, thereby lowering the combustion temperature and reducing NO_X.

The circulated exhaust emissions are controlled by the stepper motor type EGR valve, and pass through the three-way catalyst. Then the emissions flow in the sequence of the cylinder head, EGR valve, and intake manifold insulator and enter the combustion chamber.

System diagram



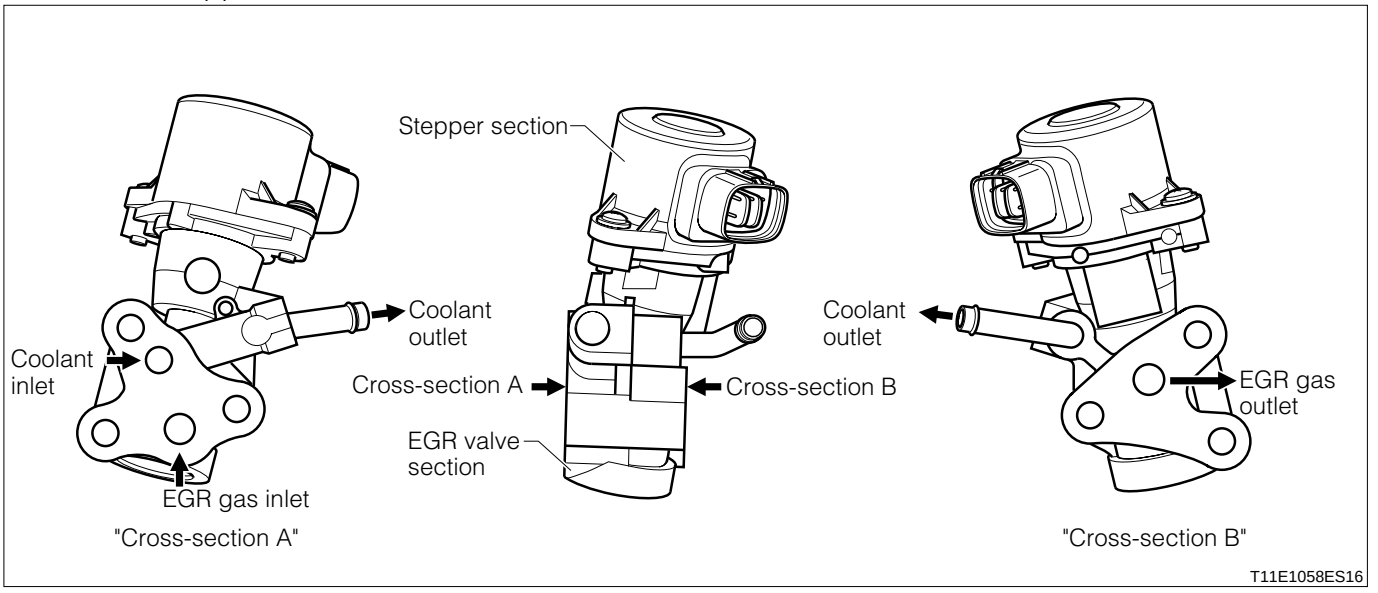
2-8-2 COMPONENTS

(1) Stepper motor type EGR valve

The stepper motor type EGR valve consists of the stepper motor and the EGR valve.

The EGR stepper motor controlled by the engine control computer drives the EGR valve and regulates the EGR valve opening degree. In this way, the exhaust emission amount mixed into the intake air can be controlled.

The coolant circulates through the stepper motor type EGR valve in order to cool the valve's sliding portion and the stepper motor.



K3
1 OUTLINE
1-1 DESCRIPTION

1.The K3−VE type engine has attained the 75% reduction level of the 2005 exhaustemission standard for gasoline-fueled passenger vehicles, bycombining the following equipment.
(1) Electronically controlled fuel injection system (EFI)
(2) Electronic spark advance system (ESA)
(3) Variable valve-timing control system
(4) Evaporative emission control system with electronically controlled purging system
(5) Intelligent catalyst (three-way catalyst) (EU specification vehicles only)

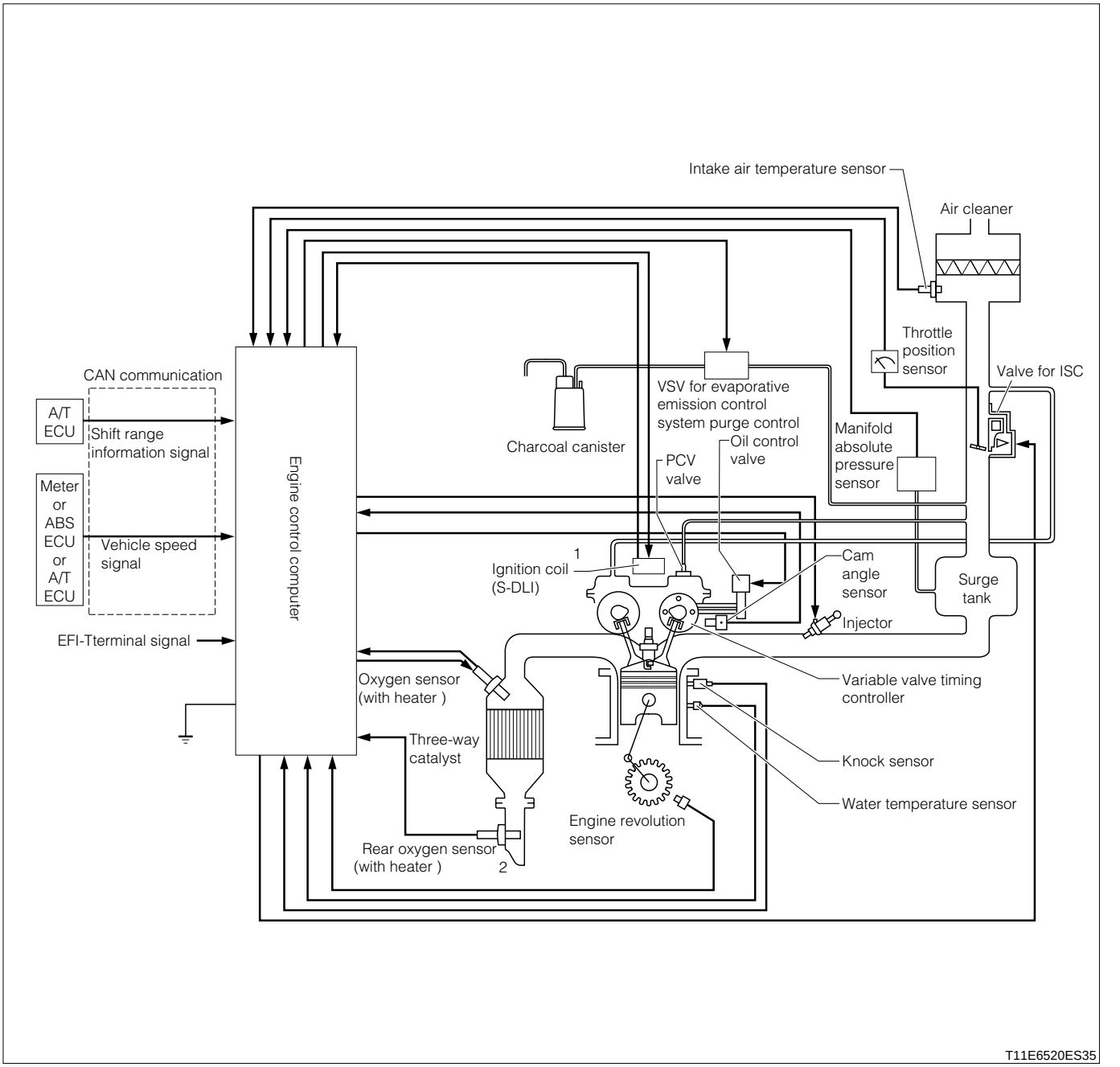
1-2 LIST OF EMISSION CONTROL DEVICES

Name of device	System of device	COMPONENTS	Purpose/function
Catalyst device	Three-way catalyst system	(1)Monolithic catalyst 1.152ℓ	·Reduction of CO, HC and NO_x
Air-fuel ratio control device	Electronic controlled fuel injection system	(1)Injector (2)Oxygen sensor (with heater[*1]) (3)Rear oxygen sensor (with heater)[*1] (4)Computer for control (5)Operation control device Throttle position sensor, intake pipe pressure sensor, water temperature sensor, intake air temperature sensor, engine revolution sensor, atmospheric pressure sensor[*1]	·Reduction of CO, HC and NO_x (The air-fuel ratio of the mixture taken in the combustion chamber will be controlled approximately to the stoichiometric air-fuel ratio, thus enabling the three-way catalyst to fully exercise the purification performance.)
Ignition timing control device (For EU specifications)	Electronic controlled system	(1)Ignition coil (Ion current detection device built-in) (2)Computer for control (3)Operation control device Intake pipe pressure sensor, water temperature sensor, throttle position sensor, engine revolution sensor, cam angle sensor knock sensor	·Reduction of HC ·Reduction of NO_x (An appropriate ignition timing control is performed according to the operating conditions.)
Ignition timing control device (For General specifications)	Electronic controlled system	(1)Ignition coil (2)Computer for control (3)Operation control device Intake pipe pressure sensor, water temperature sensor, throttle position sensor, engine revolution sensor, cam angle sensor knock sensor	·Reduction of NO_x (An appropriate ignition timing control is performed according to the operating conditions.)
Deceleration control device		(1)Injector (2)Computer for control (3)Operation control device Throttle position sensor, engine revolution sensor	·Reduction of CO and HC during deceleration ·Improvement of fuel consumption ·Prevention of catalyst heating (Fuel cut is carried out during deceleration by the control device.)
Evaporative emission control device	Canister type	(1)Charcoal canister 0.36 ℓ (2)VSV for evaporative emission control system purge control (3)Computer for control	·Emission control of fuel evaporative emission
Blow-by gas recirculation device	Closed type	(1)Ventilation hose (2)PCV valve	·Reduction of CO and HC (The blow-by gas will be burned again to prevent emission of CO and HC.)
Variable valve timing device		(1)Oil control valve Variable valve timing controller (3)Computer for control (4)Operation control device Engine revolution sensor, cam angle sensor, intake pipe pressure, water temperature sensor	·Reduction of NO_x (The NO_x is reduced by controlling the opening and closing of the intake valve to the appropriate timing according to the operating conditions.)

On-board diagnosis device		Engine control computer, throttle position sensor, intake pipe pressure sensor, intake air temperature sensor, water temperature sensor, engine revolution sensor, cam angle sensor, oxygen sensor, oxygen sensor heater circuit*1, rear oxygen sensor*1, rear oxygen sensor heater circuit*1, oil control valve, , atmospheric pressure sensor*1, ignition coil (Ion current detection device built-in), fuel supplying system, water pump	·Detection of failure of the emission control device

*1: For only EU specifications

1-3 SCHEMATIC DIAGRAM OF EXHAUST EMISSION PURIFICATION DEVICE



1: Ion current detection device built-in for only EU specifications

2: For only EU specifications

2 CONSTRUCTION AND OPERATION

2-1 CATALYST DEVICE

2-1-1 DESCRIPTION

The catalyst, made of ceramic, has gas passages called monolith which has grid cross-section with its surface covered with noble metal. This catalyst is mounted in the exhaust manifold so that harmful components of the exhaust gas can be removed as the exhaust gas passes through the passages.

The intelligent catalyst (three-way catalyst of platinum, rhodium and palladium) is provided to the EU specification vehicles. The rear O_2 sensor is mounted downstream of the catalyst to monitor the degradation of the O_2 sensor mounted upstream of the catalyst, to prevent exhaust gas from deterioration.

2-1-2 INTELLIGENT CATALYST (EU SPECIFICATION VEHICLES ONLY)

The exhaust emission purifying catalyst, which has a self-reproduction function of noble metals, is used to prevent the purification performance from lowering due to increased travel distance.

2-2 AIR-TO-FUEL RATIO CONTROL DEVICE

2-2-1 DESCRIPTION

The air-to-fuel ratio is controlled by the electronically controlled fuel injection system so that the air to fuel ratio which is fit to the engine's operating conditions can be obtained and that high purification performance can be obtained in the catalyst device.

2-3 IGNITION TIMING CONTROL DEVICE

2-3-1 DESCRIPTION

The ignition timing is controlled by the electronic spark advance system so that the ignition timing may become fit to the engine operating conditions and that harmful emissions in the exhaust gas can be reduced.

2-4 CONTROL DEVICE DURING DECELERATION

2-4-1 DESCRIPTION

Deceleration fuel cut occurs when the throttle valve opening degree and engine speed fall into the fuel cut range in order to reduce unburnt components discharged when the throttle valve is closed during deceleration.

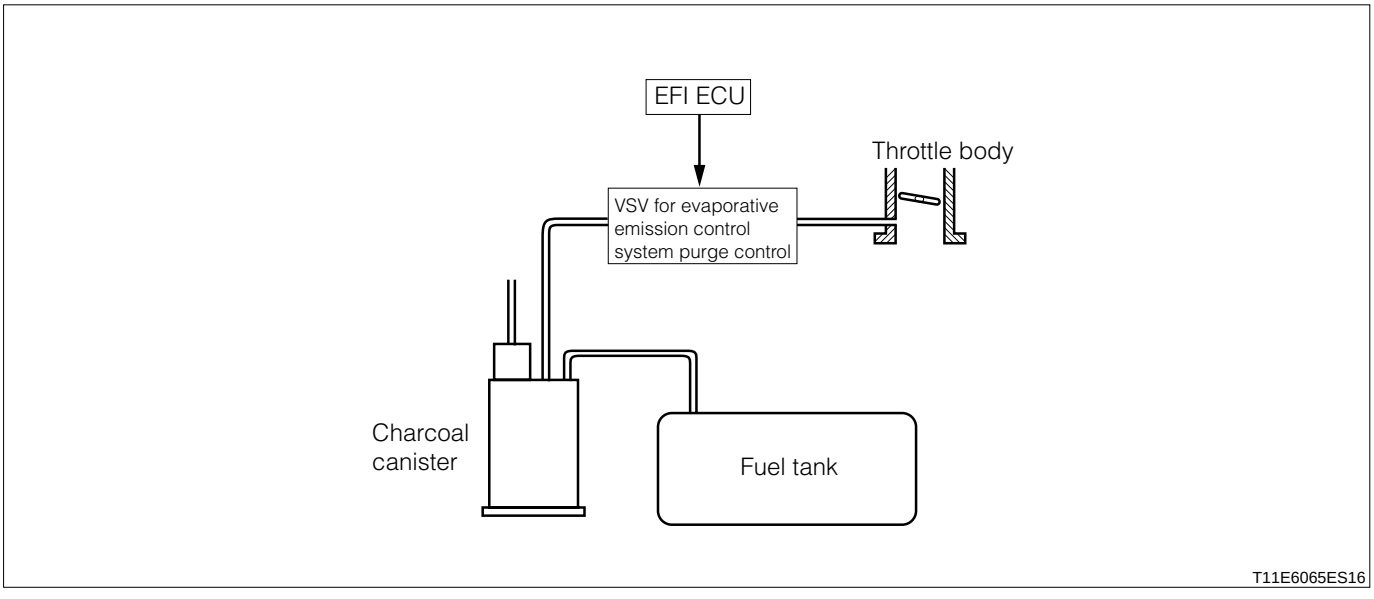
2-5 FUEL EVAPORATIVE EMISSION CONTROL DEVICE

2-5-1 CANISTER METHOD

(1) Description

Fuel evaporative emissions generated inside the fuel tank are absorbed in the charcoal canister.

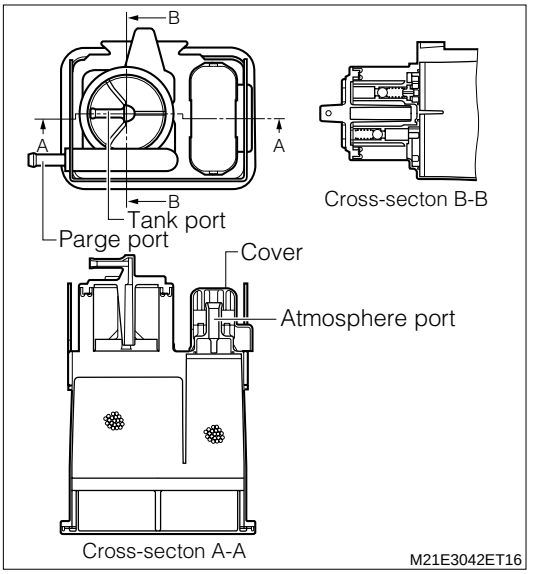
The adsorbed fuel evaporative emissions are sucked into the intake manifold and burned during engine operation.



(2) Components

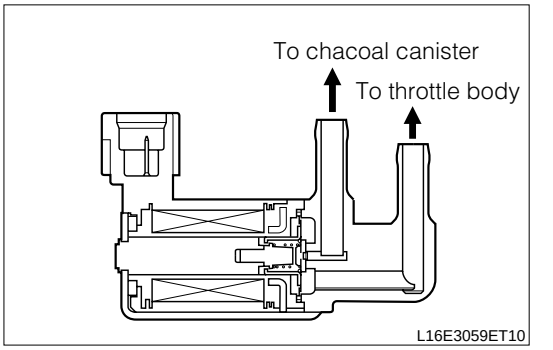
① Charcoal canister

The charcoal canister (capacity : 0.36 ℓ) is mounted on the vehicle left side dash in the engine compartment.



② Evaporator purge VSV

The purge amount of the evaporative emission gas to the intake manifold is controlled by the signal (duty ratio) sent from the engine control computer, which is calculated based on operation conditions of the engine, fuel evaporative emission concentration, etc.

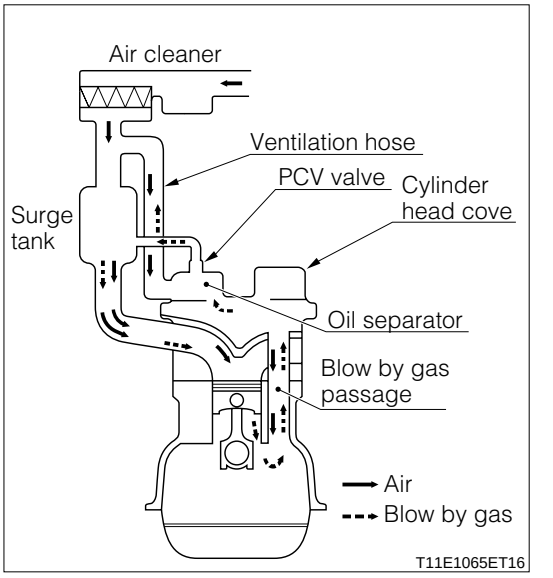


2-6 BLOW-BY GAS RECIRCULATION DEVICE

2-6-1 DESCRIPTION

The crank case ventilation system is employed, in which the blow-by gas inside the crank case flows through the blow-by gas passage of the cylinder block into the cylinder head cover side.

The oil separator chamber is provided in the cylinder head cover. Therefore, after the oil is separated from the blow-by gas, it enters the combustion chamber to be burned again.



2-7 DYNAMIC VARIABLE TIMING DEVICE

2-7-1 DESCRIPTION

The open/close timing of the intake air valve is controlled to provide the intake air amount and internal EGR amount, etc. that are fit to the operating conditions, thereby reducing the exhaust emissions.