

ENGINE <4G1-GDI>

GENERAL INFORMATION

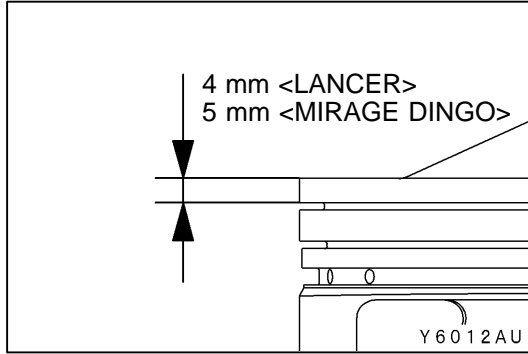
The 4G15-GDI engine is adopted for Hong Kong. This engine is basically the same as the 4G15-GDI engine, which is mounted on Mirage Dingo for Hong Kong, but the components below have been changed:

- Piston
- Exhaust manifold

MAJOR SPECIFICATIONS

Items		4G15-GDI <LANCER>	4G15-GDI <MIRAGE DINGO>
Total displacement mL		1,468	1,468
Bore × stroke mm		75.5 × 82.0	75.5 × 82.0
Compression ratio		11.0	10.6
Combustion chamber		Pentroof type + curved top piston	Pentroof type + curved top piston
Camshaft arrangement		DOHC	DOHC
Valve timing	Intake Opening	BTDC 12°	BTDC 12°
	Intake Closing	ABDC 44°	ABDC 44°
	Exhaust Opening	BBDC 48°	BBDC 48°
	Exhaust Closing	ATDC 12°	ATDC 12°
Maximum output kW/rpm		74/6,000	77/6,000
Maximum torque Nm/rpm		137/3,500	140/3,500
Fuel system		Electronically controlled multi-point fuel injection/Gasoline direct injection	Electronically controlled multi-point fuel injection/Gasoline direct injection
Rocker arm		Roller type	Roller type
Auto-lash adjuster		Equipped	Equipped
Engine oil	Engine oil API classification	SG or higher	SG or higher
	Engine oil quantity L	3.0 (Includes oil filter capacity 0.3)	3.0 (Includes oil filter capacity 0.3)

BASE ENGINE



PISTON

The top land height has been reduced from 5 mm to 4 mm to reduce the exhaust HC.

COOLING SYSTEM

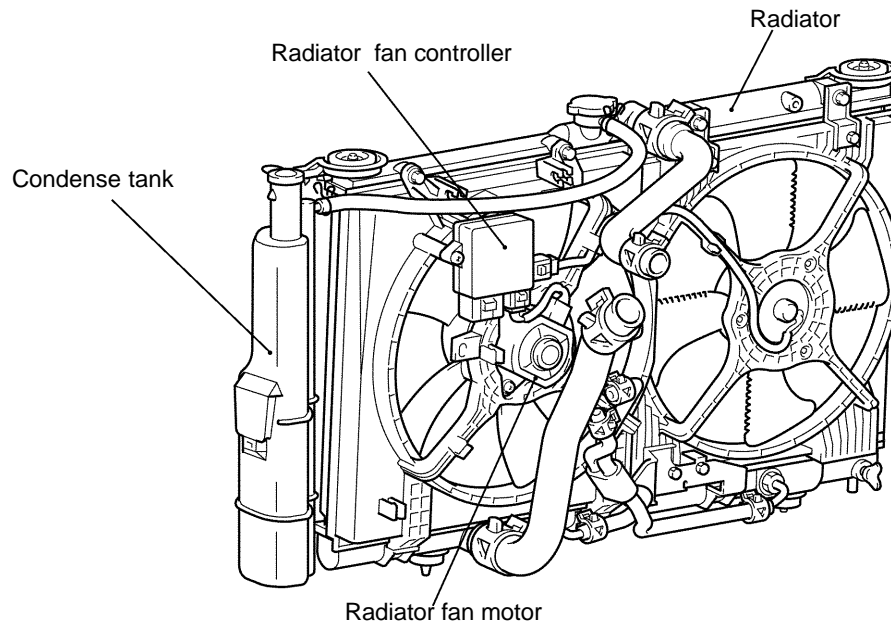
The cooling system is a water-cooled pressurized, forced circulation type which offers the following features.

- To stabilize the engine coolant temperature, the thermostat is located at the coolant inlet port from radiator side to the engine.
- To improve the engine cooling performance and save weight, a plastic tank and an aluminium radiator fins have been introduced.
- The speed of electric cooling fan is optimally controlled by a fan controller and the engine-ECU according to driving conditions so that the fan operating noise is minimized and the fuel efficiency is improved. ([Refer Also.](#))

SPECIFICATIONS

Items		4G15-GDI<LANCER>	4G15-GDI<MIRAGE DINGO>
Cooling method		Water-cooled pressurized, forced circulation with electrical fan	Water-cooled pressurized, forced circulation with electrical fan
Radiator	Type	Pressurized corrugate type	Pressurized corrugate type
	Performance kJ/h	137,736	150,698
Water pump	Type	Impeller of centrifugal type	Impeller of centrifugal type
	Drive method	Drive belt	Drive belt
Thermostat	Type	Wax pellet type with jiggle valve	Wax pellet type with jiggle valve
	Valve open temperature	82	82
A/T oil cooler	Performance kJ/h	5,651	6,405

CONSTRUCTION DIAGRAM



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INTAKE AND EXHAUST

AIR INTAKE SYSTEM

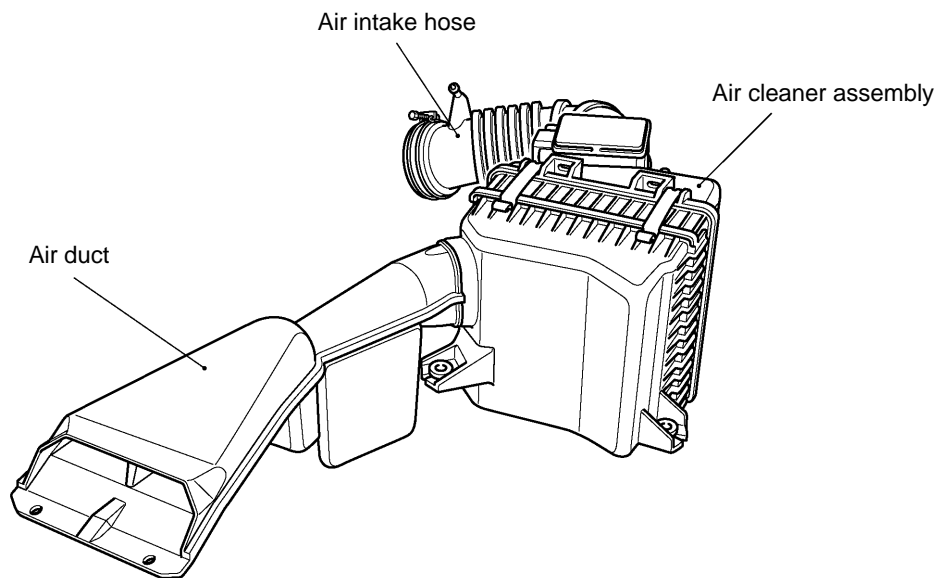
AIR DUCT, AIR CLEANER

- By introducing fresh cool air from the top of the radiator efficiently, the engine performance has been enhanced and intake air noise has been reduced.
- Burnable used paper mixed with plastic materials have been adopted in consideration for reduction of industrial wastes and protection of global environment.

AIR INTAKE HOSE

Unleaded rubber materials have been adopted for air intake hose in consideration for protection of global environment.

CONSTRUCTION DIAGRAM



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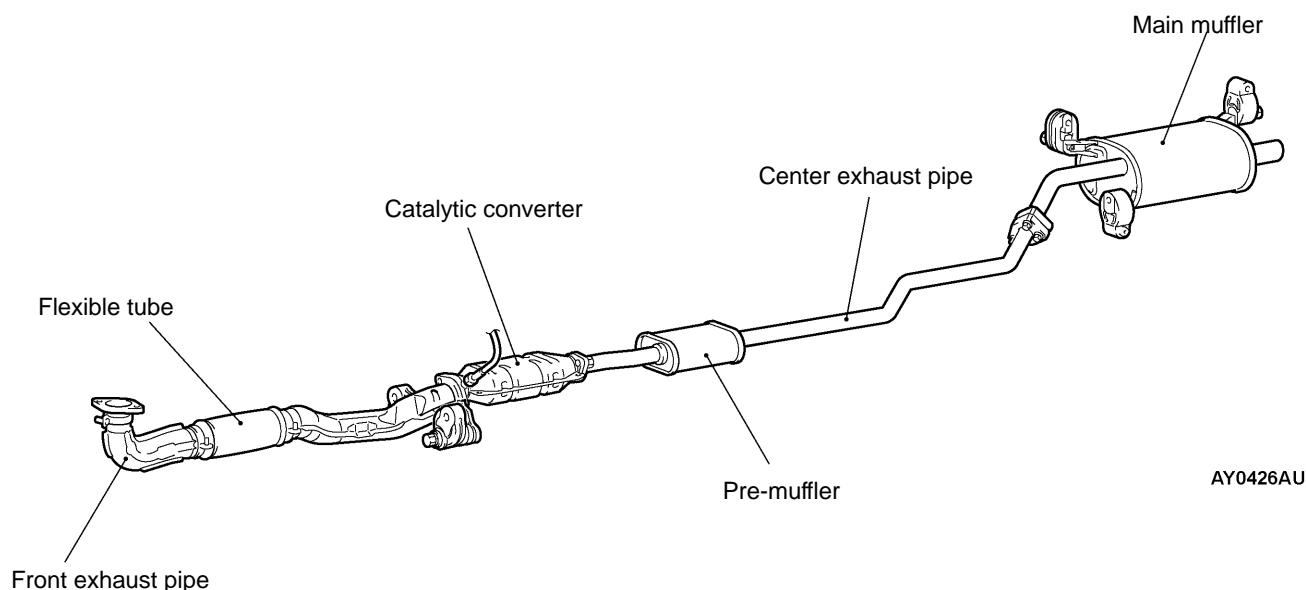
EXHAUST SYSTEM

EXHAUST PIPE

Exhaust pipe consisting of 3 separation system: front exhaust pipe, center exhaust pipe, and exhaust main muffler, has the following features:

- Use of large pre-muffler has reduced exhaust noise.
- Straight layout of exhaust piping has reduced vibration and exhaust pressure in exhaust system.
- Installation of flexible tube on the front pipe has reduced vibration at idle.
- The adoption of hanger rubber with lower spring constant and the decreased number of hangers have reduced vibration in exhaust piping.
- The adoption of all stainless exhaust piping has enhanced resistance to corrosion and heat.
- Installation of thermal insulating cover and materials on front pipe has improved emission control performance.

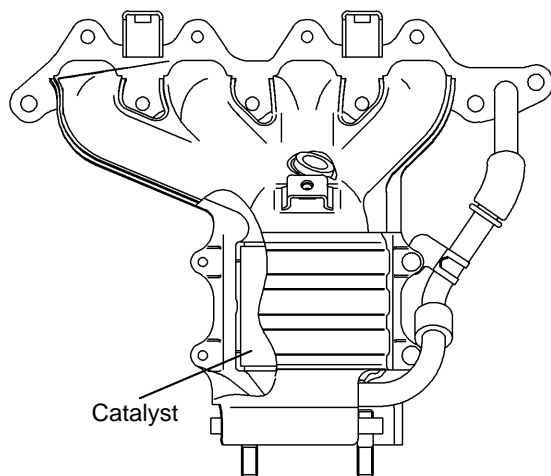
CONSTRUCTION DIAGRAM



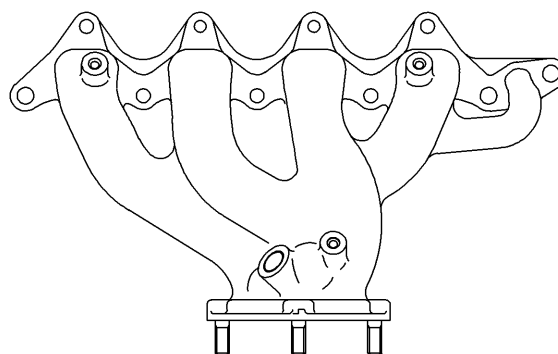
EXHAUST MANIFOLD

A clam-shell type exhaust manifold integrated with catalyst is adopted. This has reduced the catalyst activation time at cold engine start.

<LANCER>



<MIRAGE DINGO>



FUEL SYSTEM

The fuel system consists of components such as solenoid type fuel injectors, a delivery pipe, fuel pump (high pressure) assembly [incorporating fuel pressure regulator (high pressure)], injector driver, fuel pressure regulator (high pressure), fuel pump module, fuel gauge unit and fuel tank. This system has the following features.

- A compact and lightweight fuel pump (high pressure) assembly, which integrates the fuel pump (high pressure) and fuel pressure regulator (high pressure), has been adopted.
- The fuel line has been simplified by integrating the fuel pump (high pressure) and fuel pressure regulator (high pressure).
- In order to reduce weight, the fuel pump (low pressure), fuel filter and fuel pressure regulator (low pressure) have been integrated into a single fuel pump module.
- The adoption of a fuel pump module makes it possible to place the fuel filter and the fuel pressure regulator (low pressure) inside the fuel tank, improving safety in the event of an impact.

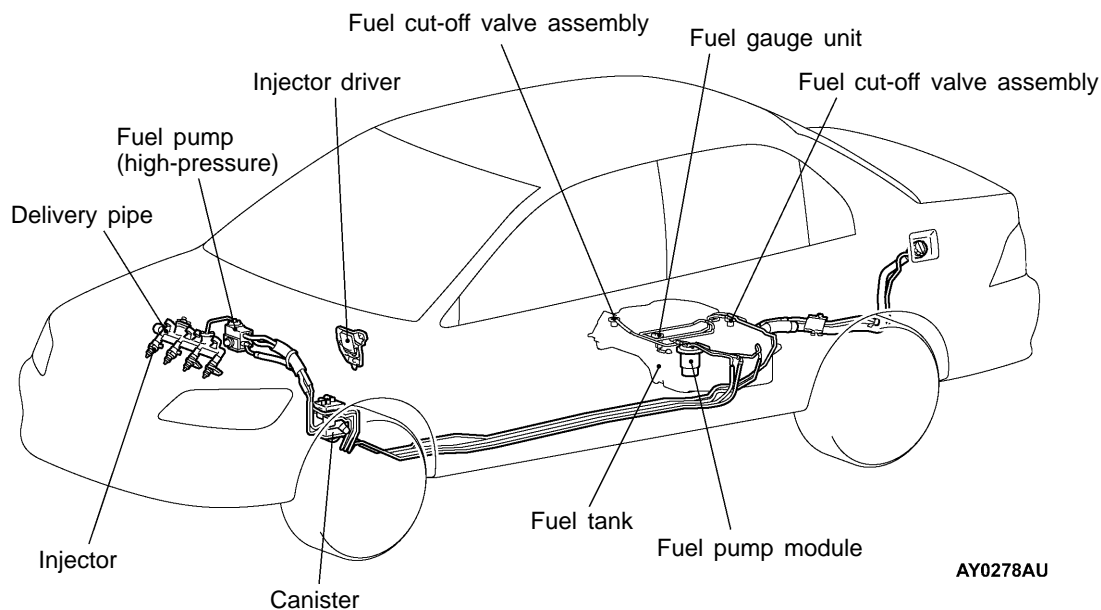
SPECIFICATIONS

Items		4G15-GDI <LANCER>	4G15-GDI <MIRAGE DINGO>
Fuel tank capacity L		50	50
Fuel pump (high pressure) type		Mechanical type	Mechanical type
Fuel pump (low pressure) type		Electric type	Electric type
Fuel filter type		Double mesh filter type (incorporates fuel pump module)	Double mesh filter type (incorporates fuel pump module)
Fuel return system		Fuel pressure regulator return	Fuel pressure regulator return
Fuel pressure regulator (high-pressure) control pressure MPa		5.0	5.0
Fuel pressure regulator (low-pressure) control pressure kPa		323	323
Injectors	Type	Electromagnetic type	Electromagnetic type
	Quantity	4	4
Evaporative emission control system		Canister type	Canister type

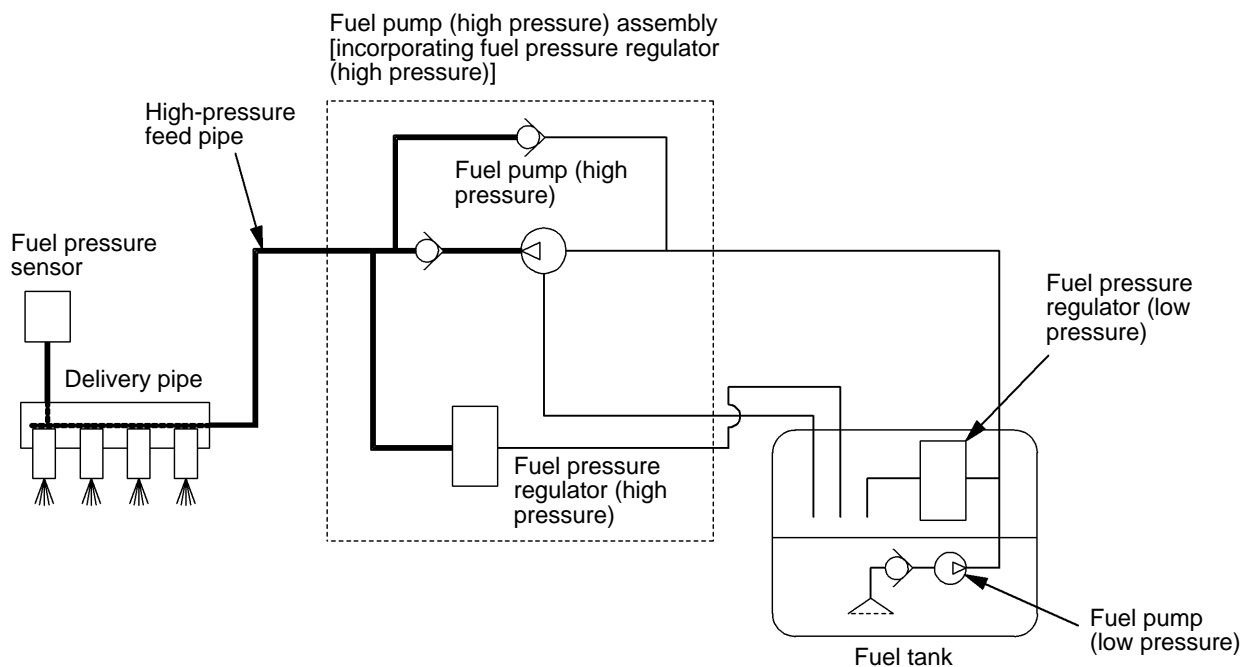
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FUEL ROUTE



FUEL INJECTION PARTS

Structural diagram

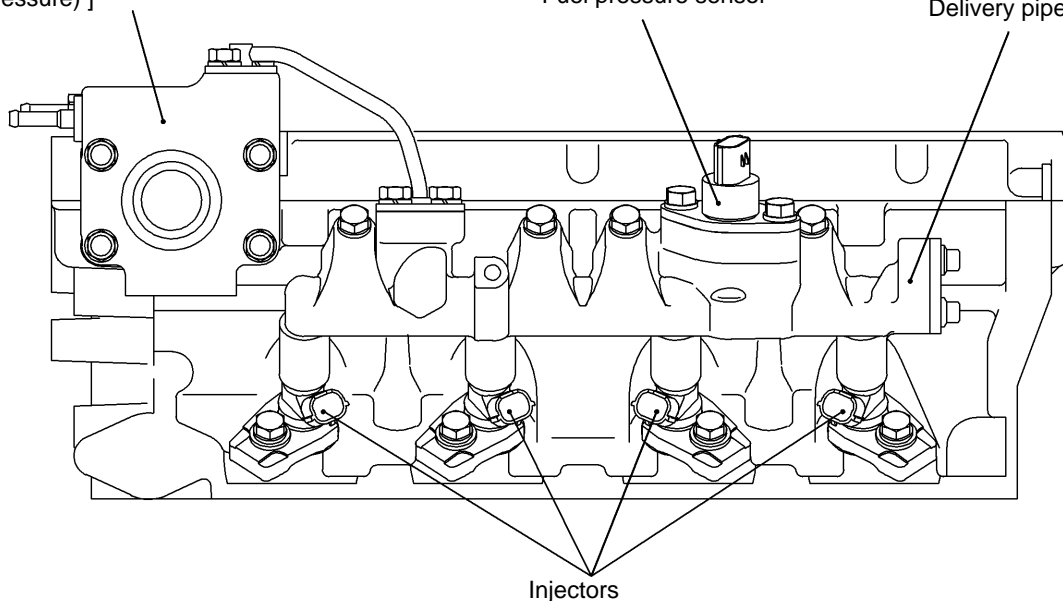
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Fuel pump (high pressure) assembly
[incorporating fuel pressure regulator
(high pressure)]

Fuel pressure sensor

Delivery pipe



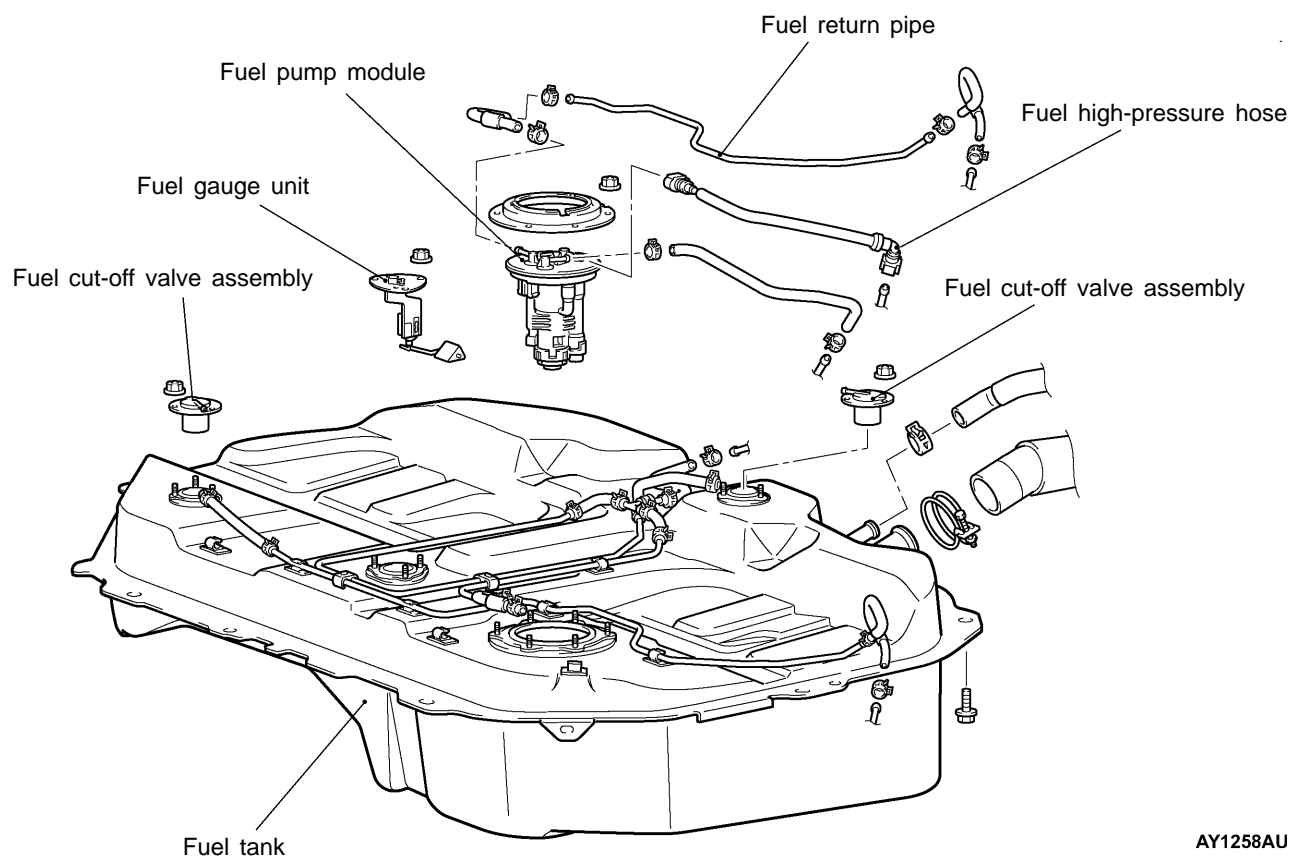
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FUEL TANK

A steel fuel tank is located under the floor of the rear seats to provide increased safety and increase the amount of luggage compartment space.

- In order to reduce, the fuel pump (low pressure), fuel filter and fuel pressure regulator (low pressure) have been integrated into a single fuel pump module.
- The adoption of a fuel pump module makes it possible to place the fuel filter and the fuel pressure regulator (low pressure) inside the fuel tank, improving safety in the event of an impact.
- The fuel tank has been equipped with a fuel cut-off valve assembly which incorporates a fuel-off valve to prevent fuel from leaking out in the event of a collision for adjusting the pressure inside the fuel tank.

CONSTRUCTION DIAGRAM



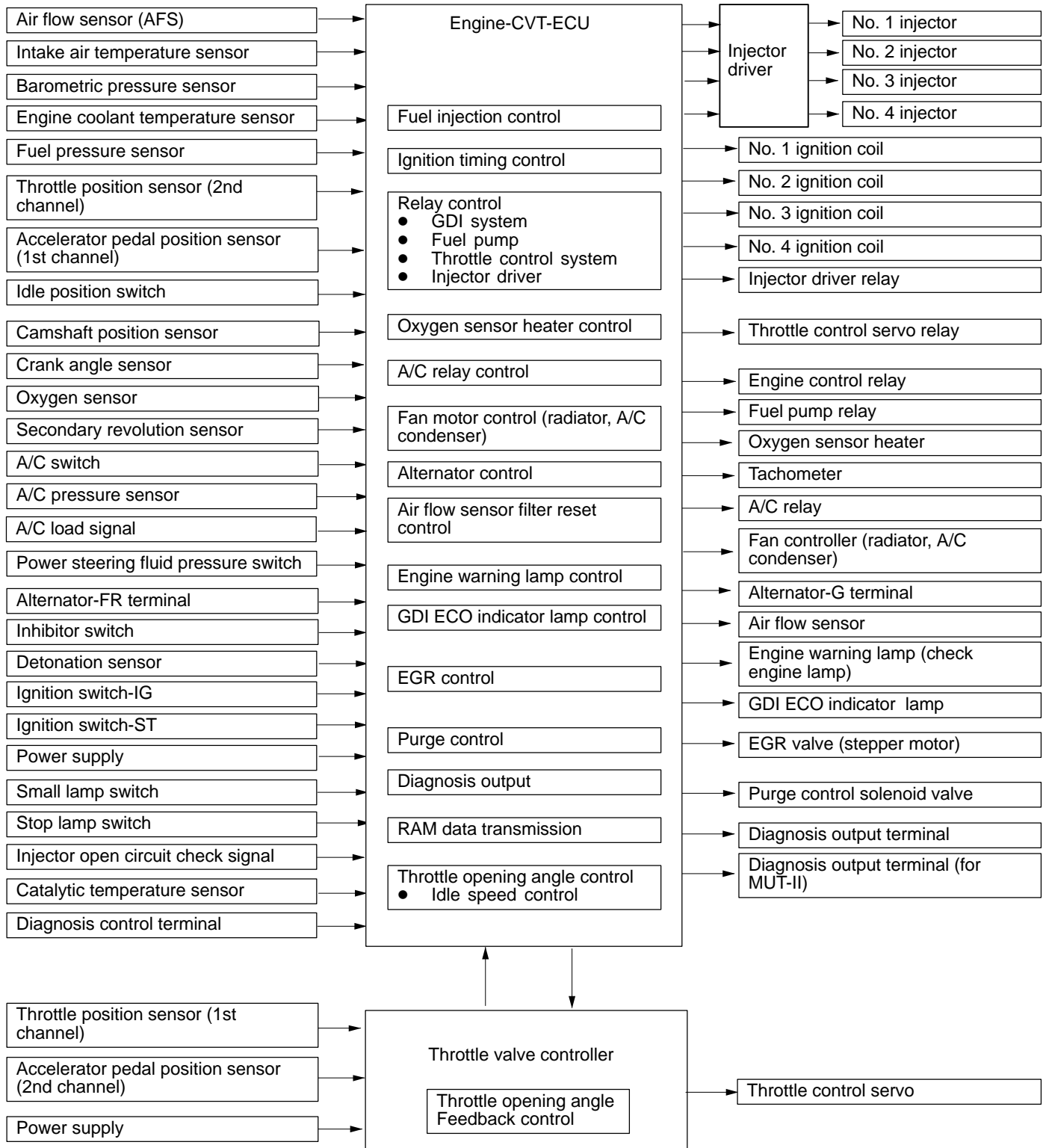
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CONTROL SYSTEM

The control system is based on the system for the 4G9-GDI engine installed in the PAJERO io, with the following improvements added.

Improvements/Additions	Remarks
Adoption of a 32bit integrated ECU integrating CPUs for engine control and transmission control.	<ul style="list-style-type: none">• Engine control performance has been improved by high calculation speed.• High speed engine and transmission integrated control.

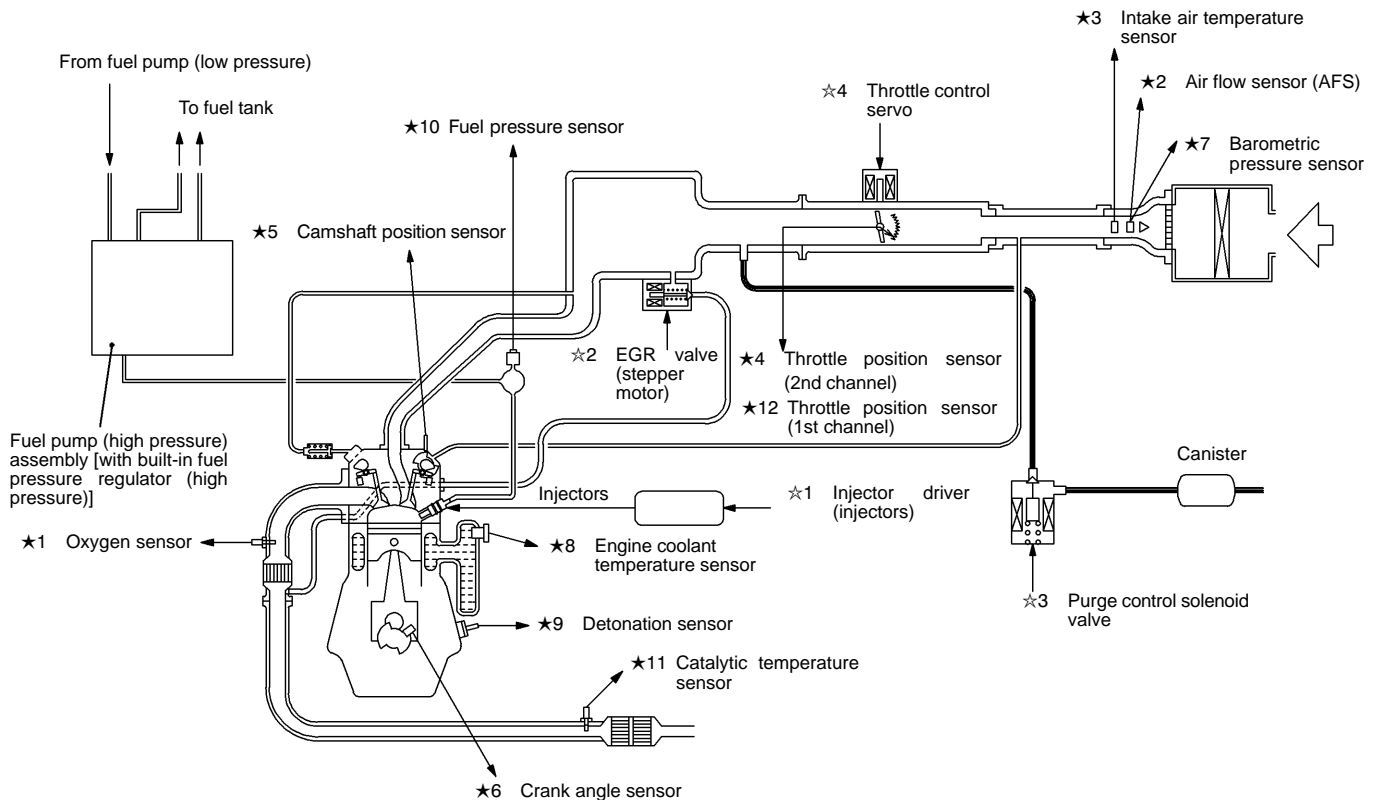
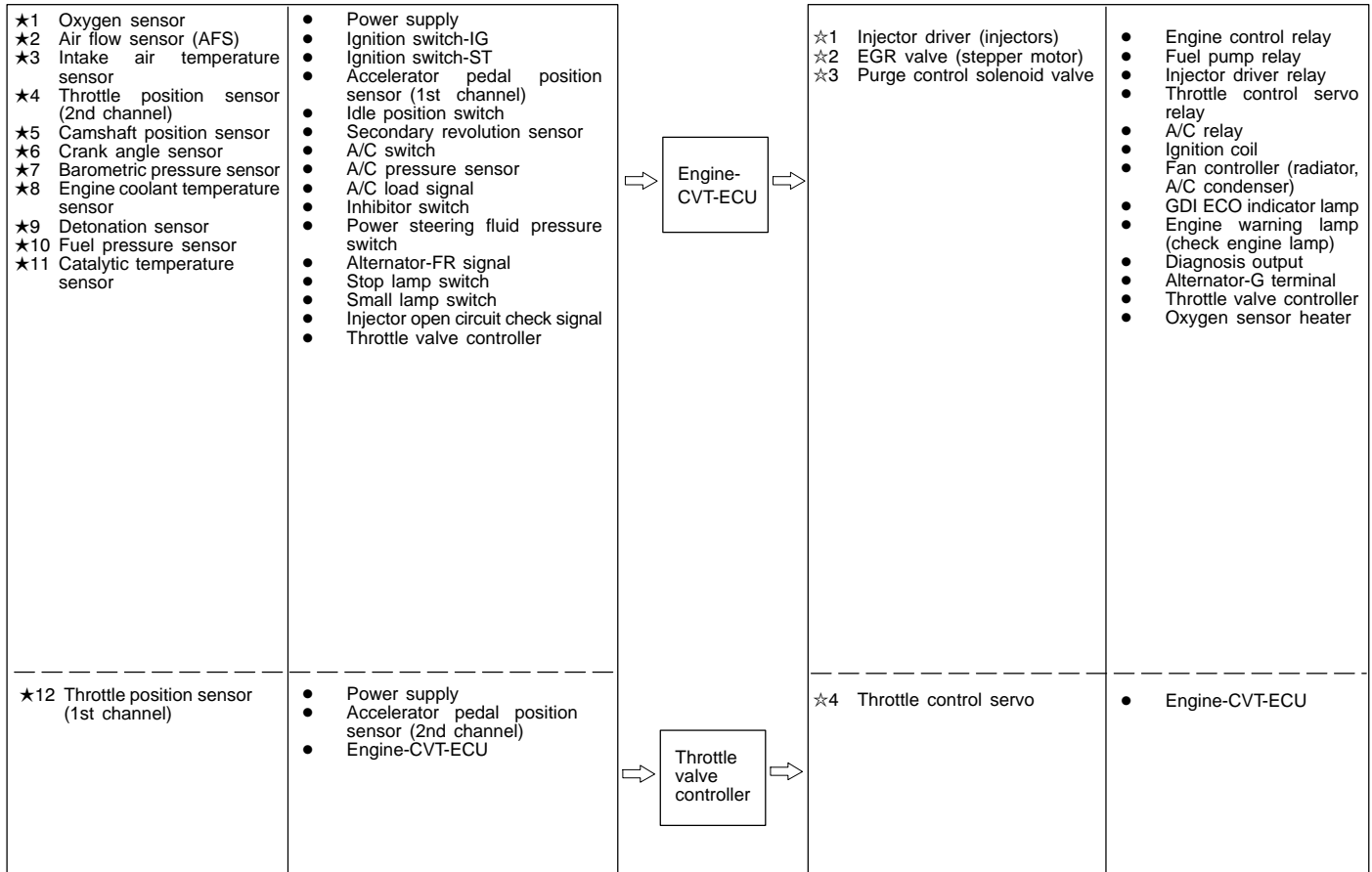
SYSTEM BLOCK DIAGRAM



CONTROL SYSTEM DIAGRAM

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LIST OF COMPONENT FUNCTIONS

Name		Function
ECU	Engine-CVT-ECU	Uses the signals input from the various sensors to control operation of actuators in accordance with the driving conditions.
	Throttle valve controller	Uses the target throttle valve opening angle input from the engine-CVT-ECU to control the throttle valve opening angle.
Sensors	Ignition switch-IG	Detects the ON/OFF position of the ignition switch. When this signal is input to the engine-CVT-ECU, power is supplied to components such as the injector driver, air flow sensor, throttle valve control servo and crank angle sensor.
	Ignition switch-ST	Detects whether the engine is cranking. The engine-CVT-ECU controls the fuel injection, throttle valve opening angle and ignition timing to the appropriate settings based on this signal.
	Air flow sensor (AFS)	Detects the amount of intake air (volumetric capacity) by means of a Karman vortex meter. The engine-CVT-ECU controls the basic injector drive time based on this signal and on the engine speed.
	Barometric pressure sensor	Detects the barometric pressure by means of a semiconductor diffusion-type pressure sensor. The engine-CVT-ECU detects the vehicle's altitude based on this signal, and uses this to correct the fuel injection amount so that the optimum air/fuel mixture ratio is obtained for that altitude.
	Oxygen sensor	Detects the concentration of oxygen in the exhaust gas by means of zirconia and platinum electrodes. The engine-CVT-ECU judges whether the air/fuel mixture ratio is at the optimum theoretical ratio based on this concentration.
	Intake air temperature sensor	Detects the temperature of the intake air by means of a thermistor. The engine-CVT-ECU corrects the fuel injection amount to the correct amount corresponding to the intake air temperature based on the voltage output from this sensor.
	Engine coolant temperature sensor	Detects the temperature of the engine coolant by means of a thermistor. The engine-CVT-ECU detects how warm the engine is based on the signal from this sensor, and uses this to control the fuel injection amount, idle speed and ignition timing.
	Throttle position sensor (1st channel)	Detects the throttle valve opening angle by means of a potentiometer. The throttle valve controller carries out drive control of the throttle valve using this sensor signals.
	Throttle position sensor (2nd channel)	Detects the throttle valve opening angle by means of a potentiometer. The engine-CVT-ECU checks the driving state of the throttle valve using this sensor signal. The output characteristic of the throttle position sensor (2nd channel) is the opposite of the output characteristic of the throttle position sensor (1st channel).
	Accelerator pedal position sensor (1st channel)	Detects the accelerator pedal angle by means of a potentiometer. The engine-CVT-ECU carries out appropriate fuel injection and control of the throttle valve opening angle according to the accelerator opening angle (driver's intension) using this sensor signal.
	Accelerator pedal position sensor (2nd channel)	Detects the accelerator pedal open angle by means of a potentiometer. The throttle valve controller checks the accelerator opening angle using this sensor signal.
	Idle position switch	This is a movable contact switch which is built into the accelerator pedal position sensor. It is used to detect when the accelerator pedal is fully open.
	Secondary revolution sensor*	Converts the secondary revolution sensor signal to the vehicle speed signal.

*: Refer to "Transmission" section.

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Name		Function
Sensors	Camshaft position sensor	Detects the No. 1 cylinder compression top dead centre position by means of a magnetic rheostatic element.
	Detonation sensor	Detects the vibration of the cylinder block when knocking occurs by means of a pressure transducer. The engine-CVT-ECU detects whether this vibration is only due to knocking, and controls the retardation of ignition timing in accordance with the strength of the knocking.
	Crank angle sensor	Detects the crank angle by means of a Hall element. The engine-CVT-ECU controls the injectors based on the signal from this sensor.
	Alternator-FR terminal	Detects the energising duty ratio of the alternator field coil.
	Inhibitor switch*	Detects the Park and Neutral positions of the A/T selector lever.
	Power steering fluid pressure switch	Detects whether there is a power steering load present by means of a contact switch.
	Fuel pressure sensor	Detects the fuel pressure applied to the fuel pump (high pressure) by means of a metallic membrane type pressure sensor. The engine-CVT-ECU corrects the fuel injection amount based on this fuel pressure.
	Stop lamp switch*	Detects the depression amount for the brake pedal by means of a contact switch.
	Small lamp switch	Inputs electrical load information to the engine-CVT-ECU.
	A/C switch	Detects the ON/OFF condition of the A/C.
	A/C load signal	Inputs the compressor drive state (low load/high load) to the engine-CVT-ECU. The engine-CVT-ECU controls the A/C idle-up revolution speed using this signal.
	A/C pressure sensor	Detects the A/C refrigerant pressure, and inputs the A/C compressor drive state to the engine-CVT-ECU. The engine-CVT-ECU uses this signal for controlling the fuel injection mode.
	Catalytic temperature sensor	Detects the catalytic temperature using a thermistor.
	Injector open circuit check signal	The engine-CVT-ECU detects open circuits in the injectors by means of this signal.
	Diagnosis control terminal	If diagnosis codes have been stored in memory, they can be displayed through the flashing of the engine warning lamp by connecting this terminal to the vehicle earth.

*: Refer to “Transmission” section.

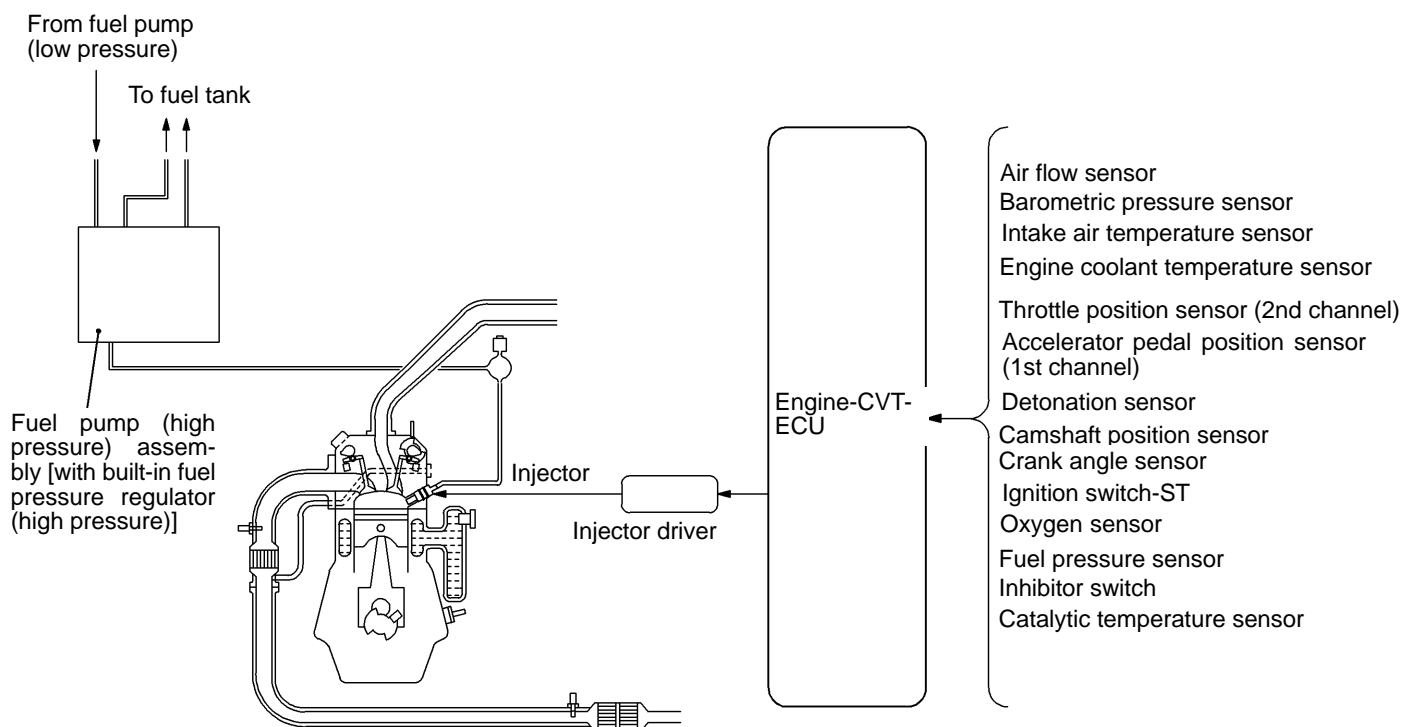
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Name		Function
Actuators	Engine control relay	Turns the engine-CVT-ECU power circuit on and off.
	Throttle control servo relay	Turns the throttle valve controller power supply circuit on and off.
	Injector driver	Drives the injectors by means of drive signals from the engine-CVT-ECU.
	Injector driver relay	Turns the injector driver power supply circuit on and off.
	Injectors	Injects the fuel according to the drive signals from the injector driver.
	Ignition coil (with built-in power transistor)	Interrupts the ignition coil primary current in accordance with the ignition signals from the engine-CVT-ECU, in order to generate a high voltage for ignition.
	Throttle control servo	Controls the throttle valve opening angle by means of signals from the throttle valve controller.
	EGR valve (stepper motor)	Controls the EGR flow volume by means of signals from the engine-CVT-ECU.
	Fuel pump relay	Controls the supply of power to the fuel pump (low pressure).
	Fan controller (radiator, A/C condenser)	Controls the radiator and condenser fan speeds smoothly by means of signals from the engine-CVT-ECU.
	Purge control solenoid valve	Controls the amount of purge air introduced to the air intake plenum by means of signals from the engine-CVT-ECU.
	Alternator-G terminal	Controls the amount of power generated by the alternator by means of signals from the engine-CVT-ECU.
	Tachometer	Displays the engine speed on the tachometer inside the speedometer.
	A/C relay	Controls the operation of the A/C compressor.
	GDI ECO lamp	Illuminates when low fuel consumption driving mode is active to notify the driver.
	Engine warning lamp (check engine lamp)	Illuminates to notify the driver of any abnormalities when a problem occurs with any of the sensors. Also flashes in order to output diagnosis codes.

FUEL INJECTION CONTROL



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FUEL INJECTION MODES

The fuel injection modes for the GDI engine are classified into two modes in accordance with the injection timing and air/fuel mixture ratios as shown in the table below.

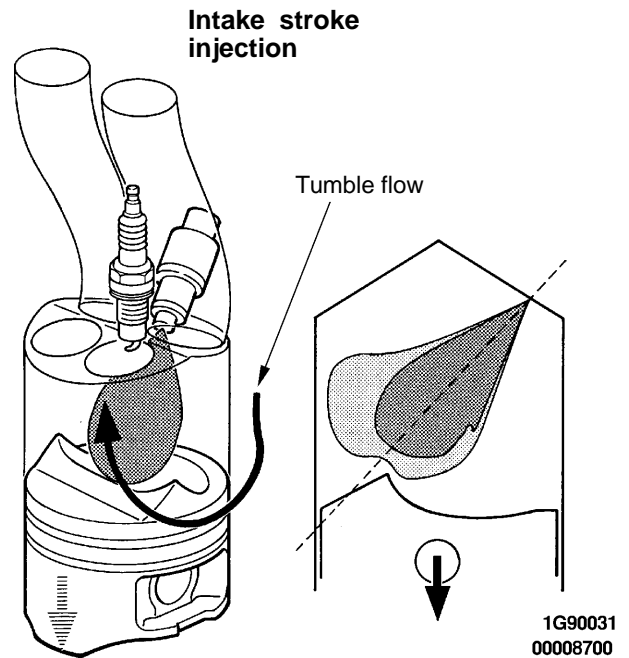
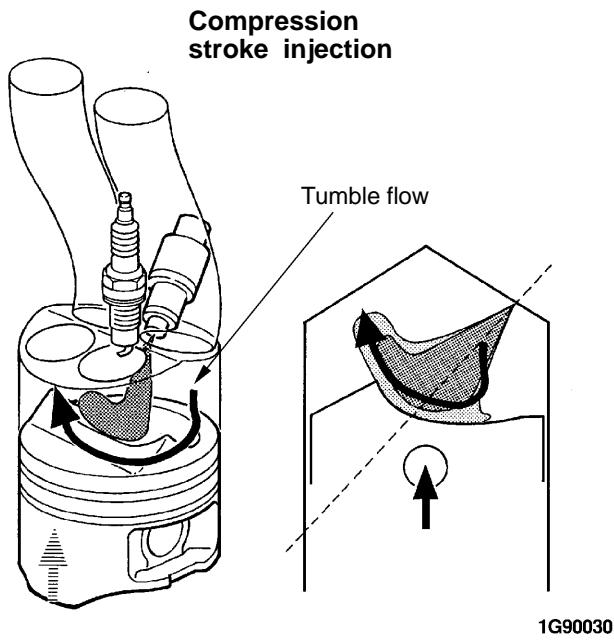
Fuel injection mode	Compression stroke fuel injection/ lean A/F *1	Air/fuel mixture ratio feedback *2 or open loop
Fuel injection timing	Compression stroke	Intake stroke
Air/fuel mixture ratio	30 – 40	Stoichiometric*2 or rich
Condition of air in mixture	Layered mixture	Uniform mixture
Driving conditions	Low-load driving	Medium or high-load driving
Air/fuel mixture ratio feedback control	No	Yes *2 or no
EGR control	Yes	Yes
Throttle valve opening angle control	Yes	Yes

NOTE

*1: The fuel injection mode during low-load driving uses layered combustion with an ultra-lean air/fuel mixture to improve fuel consumption and to reduce CO₂.

*2: The fuel injection mode during medium or high-load driving uses feedback control by means of an oxygen sensor to maintain driveability.

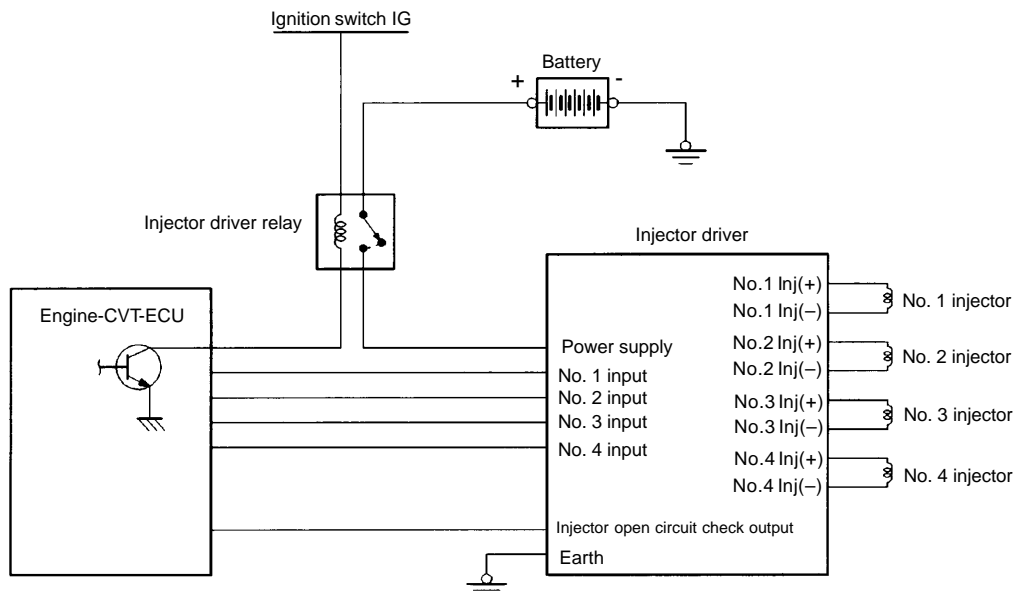
*3: Stoichiometric air/fuel ratio



INJECTOR DRIVER CONTROL

- The injector driver applies a high voltage and large current to the injectors in accordance with the drive signals from the engine-CVT-ECU. In addition, current control using the value for the current is used as the injector drive control.
- When the injector driver detects a surge voltage when the injectors are fully closed, it outputs an injector wire open circuit signal to the engine-CVT-ECU. The engine-CVT-ECU checks the injectors for open circuits based on this signal.

SYSTEM CONFIGURATION DIAGRAM



FUEL INJECTION AMOUNT CONTROL

- Fuel injection is basically synchronised with the engine speed, and the injector drive time corresponds to the intake air amount.
- The fuel injection time (injector drive time) equals the basic injector drive time determined by the intake air amount and the engine speed, plus correction values for each fuel injection mode.

Fuel injection mode	Compression stroke fuel injection/lean A/F *1	Air/fuel mixture ratio feedback *2
Basic injector drive time	Determined by the number of air flow sensor output pulses (corresponding to the intake air amount for a single engine stroke) in between each crank angle sensor output signal.	
Intake air temperature correction		
Barometric pressure correction		
Engine warm-up correction		
Correction immediately after starting		
Air/fuel mixture ratio correction		-
Air/fuel mixture ratio feedback correction	-	
Air/fuel mixture ratio learning correction		
Idle correction		-
Air fuel ratio rich compensation		-
Increased acceleration/decreased deceleration correction		
Waste time correction		

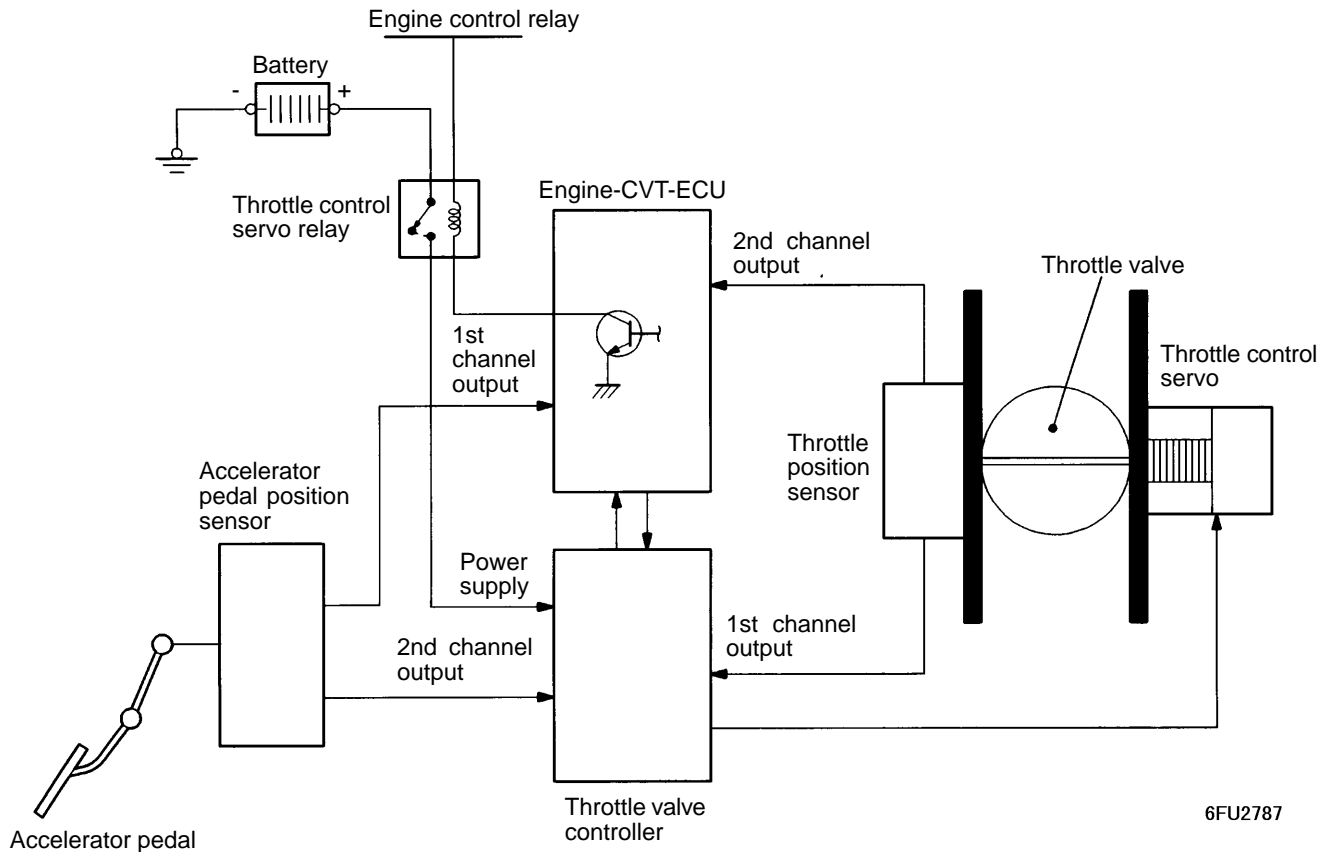
NOTE

- *1: The fuel injection mode during low-load driving uses layered combustion with an ultra-lean air/fuel mixture to improve fuel consumption and to reduce CO₂.
- *2: The fuel injection mode during medium or high-load driving uses feedback control by means of an oxygen sensor to maintain driveability.

THROTTLE OPENING ANGLE CONTROL

- The accelerator pedal depression amount is detected by the accelerator pedal position sensor (APS), and the engine-CVT-ECU uses this amount to transmit a target throttle valve opening angle which has been preset in accordance with the current driving conditions to the throttle valve controller. The throttle valve controller receives this signal and uses it to vary the direction and magnitude of the current flowing to the throttle valve control servo which is installed to the throttle body, in order to control the throttle valve to the target opening angle.

SYSTEM CONFIGURATION DIAGRAM



CONTROL WHILE DRIVING

- The throttle valve is controlled to the target throttle valve opening angle which is determined from factors such as the accelerator opening angle and driving conditions.

IDLE SPEED CONTROL (ISC)

- Several methods of ISC control are used. In engine speed feedback control, the actual idle speed is constantly calculated by the engine-CVT-ECU, and if there is a difference between it and the target idle speed, the throttle valve is driven to correct the actual idle speed until it equals the target idle speed. In throttle valve position control, the throttle valve is driven until it is at the target opening angle in response to fluctuations in engine load caused by items such as the air conditioner.

Engine Speed Feedback Control

When the engine is idling, the throttle valve is driven to control the volume of air passing through the throttle valve in order to maintain the engine speed at the target idle speed.

The target idle speed is set to the optimum speed for different engine operating conditions (such as if the A/C switch is on or off). Furthermore, this engine speed feedback control is only carried out when specified idle speed conditions are fulfilled. At other times, throttle valve position control is carried out.

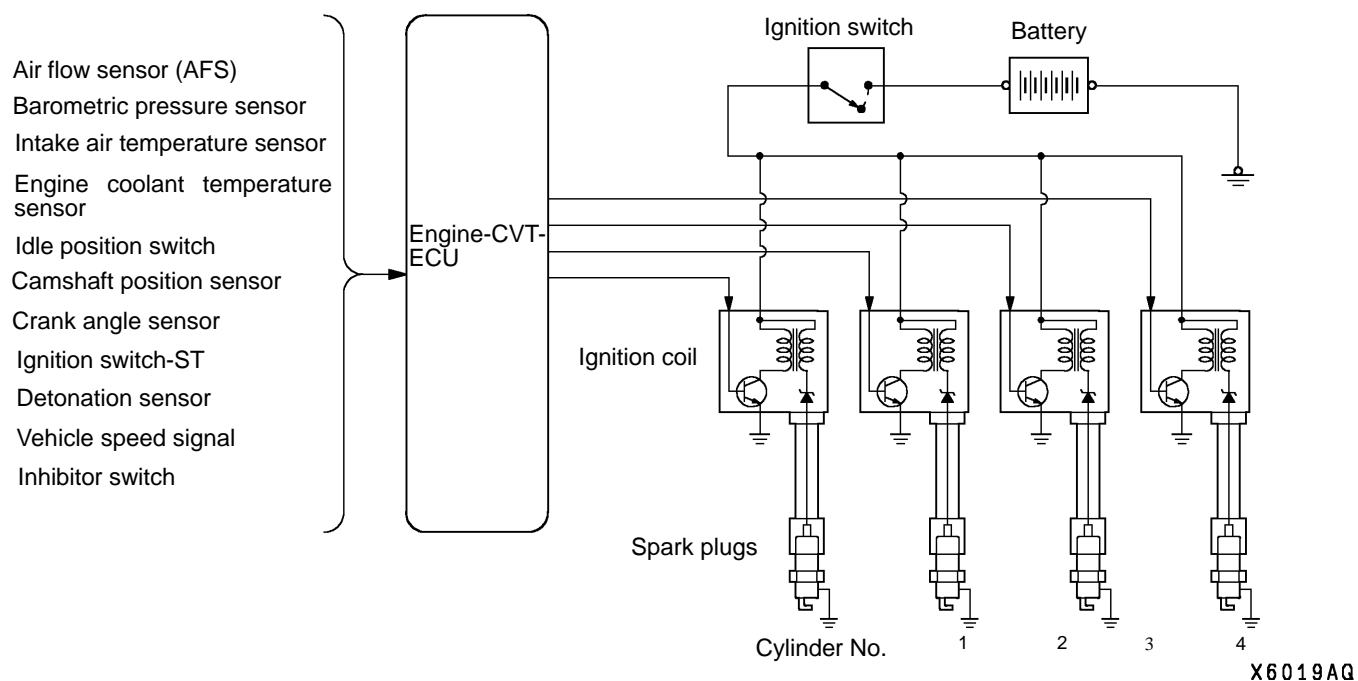
Throttle Valve Position Control

If any operations such as turning the steering wheel, operating the A/C switch or shifting the transmission range are carried out while the engine is idling, the load on the engine changes and thus the idle speed changes rapidly. Immediately after the changed signal is detected, the throttle valve is driven to the target position. This controls the volume of air passing through the throttle valve in order to suppress fluctuations in the idle speed.

FAILSAFE CONTROL

- If the engine-CVT-ECU or the throttle valve controller detects a system abnormality, the engine warning lamp illuminates and the engine output is reduced by limiting the throttle valve opening angle and cutting the amount of fuel supplied. Alternatively, the throttle valve control servo relay is turned off and power to the throttle valve control servo is interrupted.
- When the power supply to the throttle valve control servo is interrupted, the throttle valve is designed to open to a specific opening angle (the angle at which sufficient air can be supplied in order to allow a minimum level of driving). This ensures that a minimum level of driving is still possible even if a problem occurs in the throttle valve control system.

IGNITION TIMING AND ENERGISATION TIME CONTROL SYSTEM CONFIGURATION DIAGRAM



IGNITION TIMING CONTROL

- The ignition timing includes a function where corrections are added to the basic spark advance.

Driving mode	During normal driving	When starting
Basic spark advance	The optimum spark advances for the intake air amount per cylinder during each cycle (engine load) and the engine speed are recorded inside the engine-CVT-ECU. These settings are used as basic spark advances to control ignition timing.	-
Fixed advance (5° BTDC)	-	-
Engine coolant temperature correction	-	-
Barometric pressure correction	-	-
Intake air temperature correction	-	-

RELAY CONTROL (ENGINE CONTROL, FUEL PUMP, THROTTLE CONTROL SYSTEM, INJECTOR DRIVER), OXYGEN SENSOR HEATER CONTROL, A/C RELAY CONTROL, AIR FLOW SENSOR FILTER RESET CONTROL, FAN MOTOR CONTROL, ALTERNATOR CONTROL, ENGINE/TRANSMISSION TOTAL CONTROL, GDI ECO INDICATION LAMP CONTROL

The control methods used are basically the same as those used for the 4G9-GDI engine installed in the PAJERO iO.

DIAGNOSIS SYSTEM

- The on-vehicle system (OBD [On-Board Diagnostics] System) is adopted.
- A freeze-frame data function has been added
- In addition, the engine-CVT-ECU is provided with the following functions to make system inspection easier.

Diagnosis Code and Engine Warning Lamp (Check Engine Lamp) Items

The diagnosis items and engine warning lamp illumination items are shown in the following table.

Code No.	Diagnosis items	Main diagnosis contents	Engine warning lamp
P0100	Air flow sensor system	Open circuit or short-circuit in sensor related circuits	ON
P0105	Barometric pressure sensor system	Open circuit or short-circuit in sensor related circuits	ON
P0110	Intake air temperature sensor system	Open circuit or short-circuit in sensor related circuits	ON
P0115	Engine coolant temperature sensor system	<ul style="list-style-type: none"> • Open circuit or short-circuit in sensor related circuits • Excessive connector contact resistance 	ON
P0120	Throttle position sensor (1st channel) system	Open circuit or short-circuit in sensor related circuits	ON* ²
P0130	Oxygen sensor (front) system	Open circuit or short-circuit in sensor related circuits	ON
P0135	Oxygen sensor heater (front) system	Open circuit or short-circuit in sensor related circuits	ON
P0170	Abnormal fuel system	Leanness or richness problem	ON
P0190* ¹	Fuel pressure abnormality system	Leanness or richness problem	ON
P0201	No.1 injector system	Open circuit in injector related circuits	ON
P0202	No.2 injector system	Open circuit in injector related circuits	ON
P0203	No.3 injector system	Open circuit in injector related circuits	ON
P0204	No.4 injector system	Open circuit in injector related circuits	ON
P0220	Accelerator pedal position sensor (1st channel)	Open circuit or short-circuit in sensor related circuits	ON* ³
P0225	Throttle position sensor (2nd channel) system	Open circuit or short-circuit in sensor related circuits	ON* ²
P0300	Random cylinder misfire detected	Misfiring	ON
P0301	No.1 cylinder misfire detected	Misfiring	ON
P0302	No.2 cylinder misfire detected	Misfiring	ON
P0303	No.3 cylinder misfire detected	Misfiring	ON
P0304	No.4 cylinder misfire detected	Misfiring	ON
P0325	Detonation sensor system	Abnormal sensor output	–

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Code No.	Diagnosis items	Main diagnosis contents	Engine warning lamp
P0335	Crank angle sensor system	Abnormal sensor output	ON
P0340	Camshaft position sensor system	Abnormal sensor output	ON
P0403	EGR valve system	Open circuit or short-circuit in EGR valve related circuits	ON
P0425	Catalyst temperature sensor system	Abnormal exhaust gas purification performance of catalyst	ON
P0443	Purge control solenoid valve system	Open circuit or short-circuit in solenoid valve related circuits	ON
P0500	Vehicle speed signal system	Abnormal signal input	–
P1200	Injector driver system	Open circuit or short-circuit in injector driver related circuits	ON
P1220	Electronic-controlled throttle valve system	Abnormal throttle valve opening angle	Flash- ing
P1221	Throttle valve position feedback system	<ul style="list-style-type: none"> Motor problem Abnormal throttle valve opening angle 	Flash- ing
P1223	Throttle valve controller communication line system	Communication error between engine-CVT-ECU and throttle valve controller	Flash- ing
P1224	Throttle valve control servo motor (motor 1st phase malfunction) system	Open circuit or short-circuit in motor related circuits	Flash- ing
P1225	Accelerator pedal position sensor (2nd channel) system	Open circuit or short-circuit in sensor related circuits	ON* ³
P1228	Throttle valve control servo motor (motor 2nd phase malfunction) system	Open circuit or short-circuit in motor related circuits	Flash- ing
P1500	Alternator FR terminal system	Open circuit or short-circuit in system related circuits	–
P1515	Brake vacuum sensor system	Open circuit or short-circuit in sensor related circuits	ON
–	Engine-CVT-ECU	Abnormality in engine-CVT-ECU	ON

NOTE

*¹: Code No. P0190 can also be set when air gets into the high-pressure fuel line as a result of the vehicle running dry of fuel.

*²: If there is a problem in both channels of the throttle position sensor at the same time, the engine warning lamp flashes.

*³: If there is a problem in both channels of the accelerator pedal position sensor at the same time, the engine warning lamp flashes.

Data List Output

The service data output items are shown in the following table.

Item No.	Data list items	Units
11	Oxygen sensor	mV
12	Air flow sensor	Hz
13	Intake air temperature sensor	°C
14	Throttle position sensor (2nd channel)	mV
16	Battery voltage	mV
18	Cranking signal (ignition switch–ST)	ON – OFF
21	Engine coolant temperature sensor	°C

ENGINE <4G1-GDI> – Control System

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Item No.	Data list items	Units
22	Crank angle sensor	r/min
24	Vehicle speed signal	km/h
25	Barometric pressure sensor	kPa
26	Idle position switch	ON – OFF
27	Power steering fluid pressure switch	ON – OFF
28	A/C switch	ON – OFF
31	Small lamp switch	ON – OFF
34	Air flow sensor filter reset signal	ON – OFF
37	Volumetric efficiency	%
38	Crank angle sensor	r/min
41	Injector	ms
44	Ignition advance	BTDC
49	A/C relay	ON – OFF
66	Brake vacuum sensor	kPa
68	EGR valve	STEP
74	Fuel pressure sensor	MPa
77	Accelerator pedal position sensor (2nd channel)	mV
78	Accelerator pedal position sensor (1st channel)	mV
79	Throttle position sensor (1st channel)	mV
81*	Long-term fuel compensation	%
82*	Short-term fuel compensation	%
87*	Calculation load value <General Export and China>	%
99	Fuel injection mode	Lean compression – Stoichiometric feed-back – Open loop
A1*	Oxygen sensor	V
3A*	A/C pressure sensor	mV
8A*	Throttle position sensor (1st channel) (throttle valve opening angle)	%

NOTE

*: These items are not displayed when the check mode data list is selected.

Actuator Tests

The actuator test items are shown in the following table.

Item No.	Actuator test items
01	No.1 injector: OFF
02	No.2 injector: OFF
03	No.3 injector: OFF
04	No.4 injector: OFF
07	Fuel pump (low pressure): ON
08	Purge control solenoid valve: ON
17*	Basic ignition timing: 5° BTDC
21	Fan controller: Radiator fan and A/C condenser fan operate at high speed.
34	Electronic-controlled throttle valve system: Throttle valve is opened slightly

NOTE

*: Continues for 27 minutes. Can be released by pressing the CLEAR key.

OBD SYSTEM

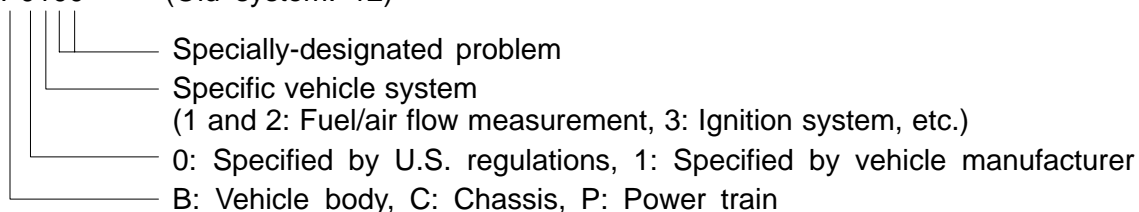
This is a vehicle diagnosis system which is based on international standards with the aim of standardising vehicle problem diagnosis.

A full range of diagnosis items has been adopted, and changes have been made to the diagnosis code assignment system to correspond to the adoption of the OBD system. The assignment system used is as follows.

- A U.S. (American) format is used for communication between the MUT-II and the engine-CVT-ECU, and as a result of this, the diagnosis code number display has been changed from a 2-digit display to a "P" plus four digits (U.S. format).
- DTC output by means of the flashing of the MIL has been abolished in line with standardisation of the self-diagnosis functions.

Example: For the air flow sensor system

New system: P0100 (Old system: 12)



FREEZE-FRAME DATA

When the engine-CVT-ECU detects a problem and stores the resulting diagnosis code, the engine condition at that time is also memorised. The MUT-II can then be used to analyze this data in order to increase the effectiveness of troubleshooting. The freeze-frame data display items are shown in the following table.

Item No.	Data items	Unit or condition
21	Engine coolant temperature sensor	°C
22	Crank angle sensor	r/min
24	Vehicle speed	km/h
81	Long-term fuel compensation (long-term fuel trim)	%
82	Short-term fuel compensation (short-term fuel trim)	%
87	Calculation load value	%

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Item No.	Data items	Unit or condition
88	Fuel control condition (B1)	<ul style="list-style-type: none">• CL (Closed loop)*¹• OL (Open loop)*²• OL–DRV (Open loop – drive condition)*³• OL–SYS (Open loop – system failure)*⁴
89* ⁵	Fuel control condition (B2)	–

NOTE

- *1: Fuel control is in process by sending an oxygen sensor signal to the engine-CVT-ECU.
- *2: Fuel control is in process by not sending an oxygen sensor signal to the engine-CVT-ECU as conditions for proceeding to closed loop control are not satisfied.
- *3: Being in open loop mode due to accelerating or decelerating.
- *4: Being in open loop mode due to system failure.
- *5: This data item is displayed, but applicable only for V-shaped engine left bank. Therefore, in-line 4-cylinder engine is not applicable, and “–” is displayed.

EMISSION CONTROL SYSTEM

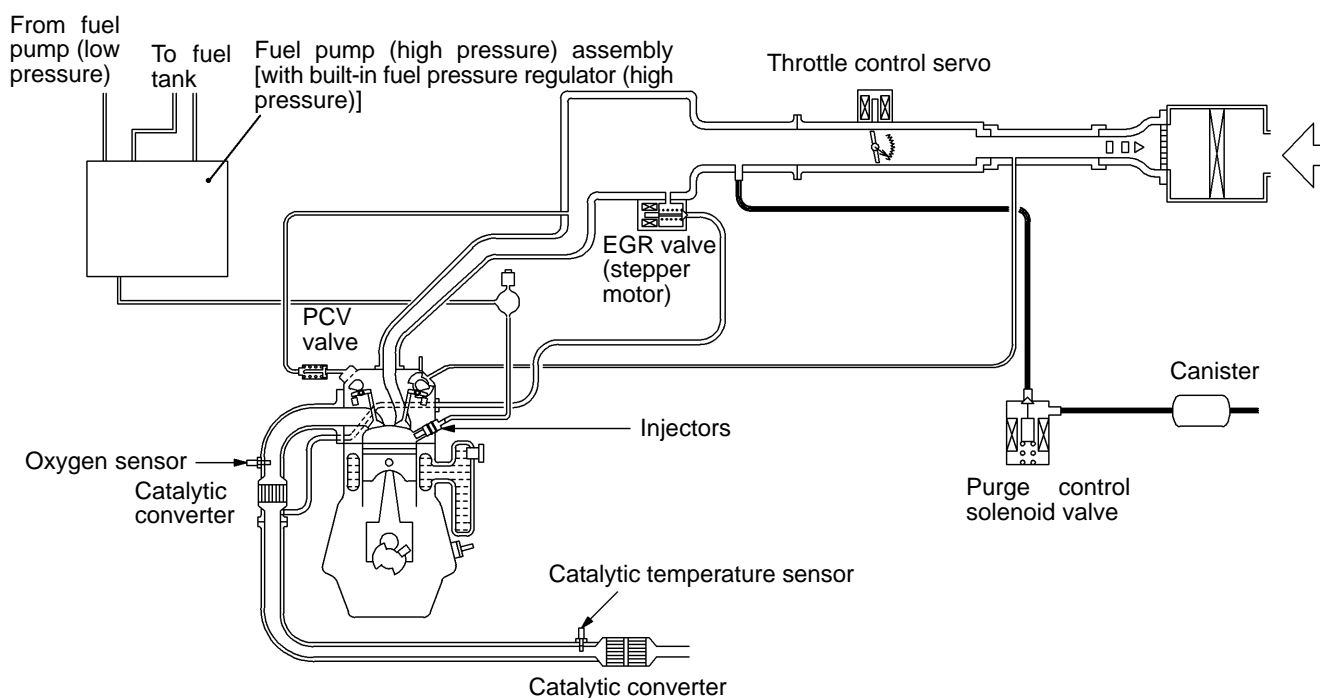
EGR CONTROL

- When compression stroke injection is being carried out in the ultra-lean combustion driving range, the volume of NO_x emissions is lower than when driving at the theoretical air/fuel mixture ratio, but sometimes it is not possible for the three-way catalyst to maintain reduced levels of NO_x. EGR control has been provided to ensure further reductions in NO_x levels.
- The GDI engine has an extremely fast combustion speed, so that stable combustion can be maintained with no deterioration in combustion performance even if EGR is used at ultra-lean combustion ratios. By utilising this characteristic, large EGR volumes which were not possible with previous engines can be introduced at ultra-lean combustion ratios. This has allowed the levels of NO_x immediately after discharge from the engine to be reduced by approximately 90% from the level for the theoretical air/fuel mixture ratio in previous engines. This degree of performance is about the same as for vehicles which are equipped with a three-way catalytic converter. In addition, even when driving at the theoretical air/fuel mixture ratio in the high-output zone, introducing EGR results in a reduction in pump losses due to an increase in air pressure inside the air intake pipe, which reduces combustion.

PURGE CONTROL

- Evaporated fuel gases which have collected inside the canister pass through the purge control solenoid valve and into the air intake plenum due to the negative pressure inside the intake manifold, and are then sent to the combustion chamber.
- Furthermore, when the engine coolant temperature is low (65°C or less) and when the intake air volume is small (such as when idling), the engine-CVT-ECU turns off the purge control solenoid valve so that the evaporated fuel gases are no longer sent to the air intake plenum. This improves driveability and stabilises exhaust gas levels when the engine is cold and when engine loads are small.

EMISSION CONTROL SYSTEM DIAGRAM



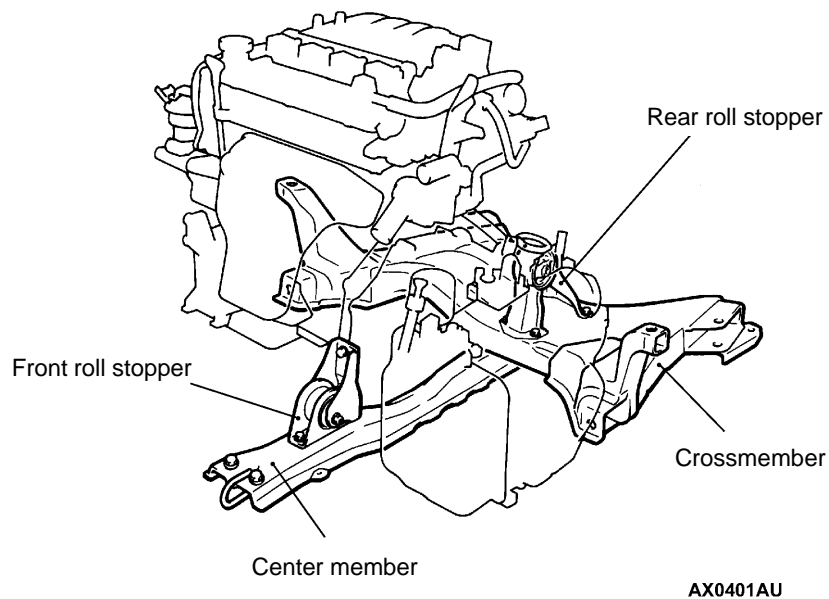
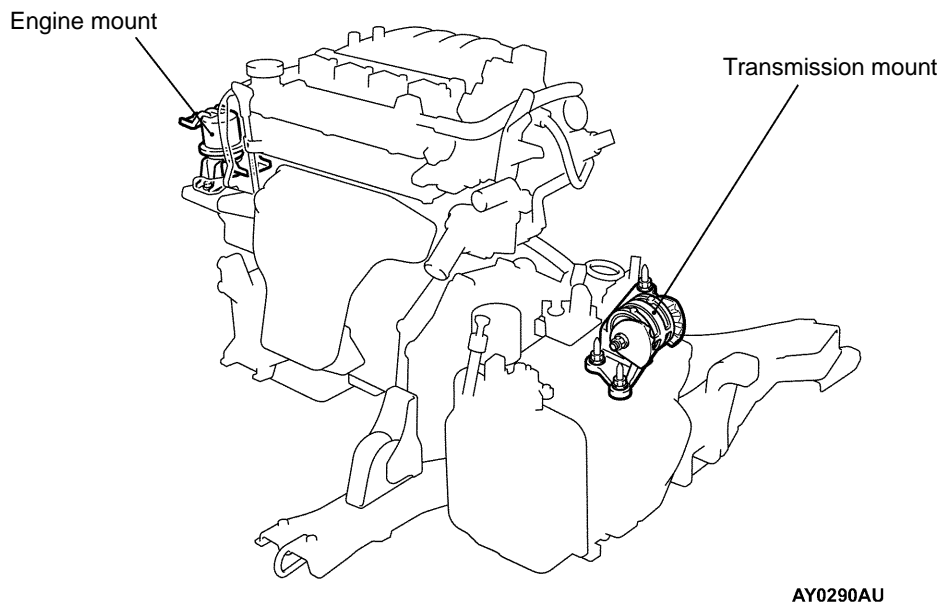
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MOUNT

The inertia axial system based on the past achievements in COLT/LANCER has been adopted for the engine mount system.

- Longitudinal installation type of cylindrical liquid-filled engine mount has been adopted for reduction of idle vibration and improvement of ride feeling.
- The liquid-filled mount system has been adopted for transmission mount to improve ride feeling by optimizing the insulator.
- Installation of roll mount in the upper area has reduced engine rolling. Furthermore, enlargement of insulator diameter has reduced idle vibration.

CONSTRUCTION DIAGRAM



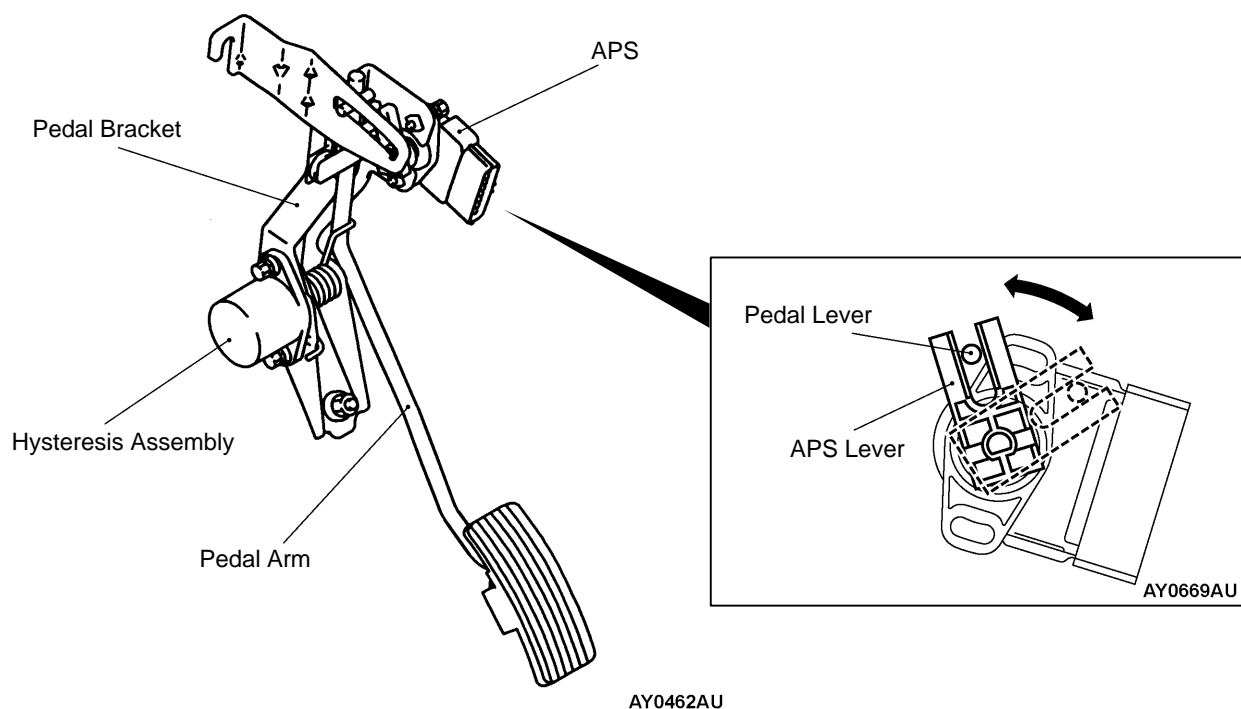
ACCELERATOR SYSTEM

Instead of a conventional accelerator cable, the electronic throttle valve system has been adopted for the accelerator.

When accelerator pedal stroke is detected by the accelerator pedal position sensor (APS) installed on the pedal bracket, throttle valve angle is electrically controlled.

In addition, hysteresis generating mechanism newly designed for the pedal bracket has enhanced a feeling of maneuvering the accelerator pedal.

CONSTRUCTION DIAGRAM



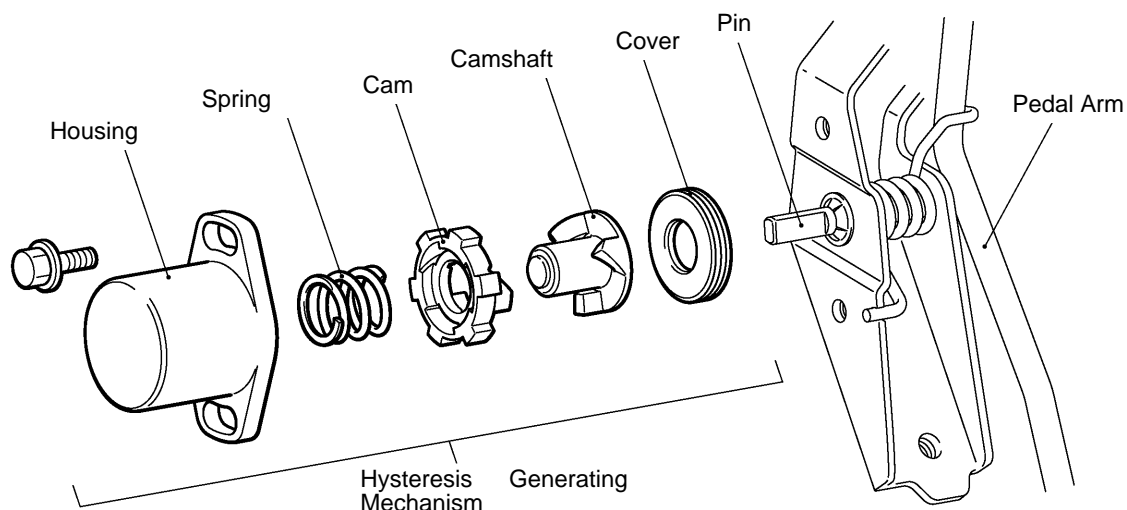
HYSTERESIS GENERATING MECHANISM

Description of Structure and Operations

Hysteresis generating mechanism consists of spring generating reaction force in pedal operation, cam generating friction force, camshaft, housing, and cover.

Because the pedal arm pin and the camshaft are engaged, the camshaft rotates as the pedal is operated. As the contact surface of the camshaft and the cam is diagonally cut, the cam moves laterally according to the camshaft rotation.

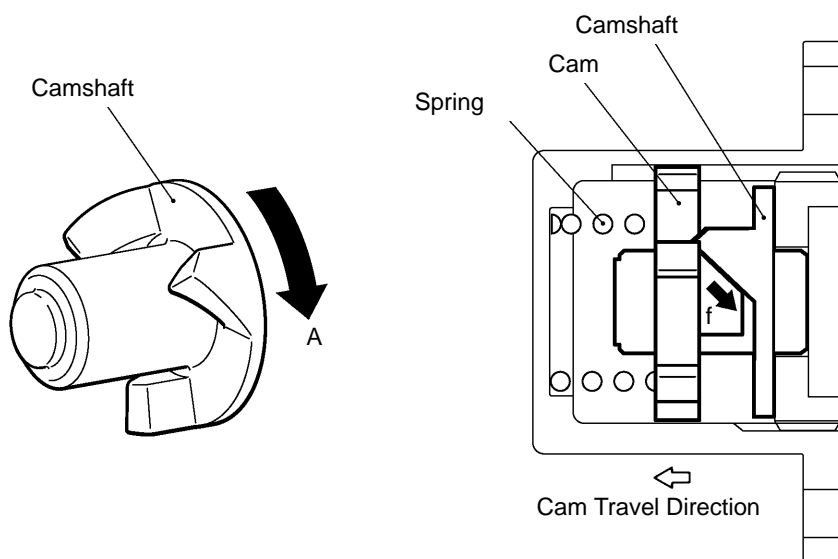
As the direction of friction force generated at this time changes, difference of the force between in depression and release of the pedal (hysteresis) is generated resulting in lighter pedal force in release than depression of the pedal.



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When Accelerator Pedal is Depressed:

When the accelerator pedal is depressed, the camshaft rotates in direction A, and the cam is compressing the spring against spring force to move to the left shown in the illustration. At this time, friction force (f) occurs on the contact surface of camshaft and cam, resulting in heavier pedal force.

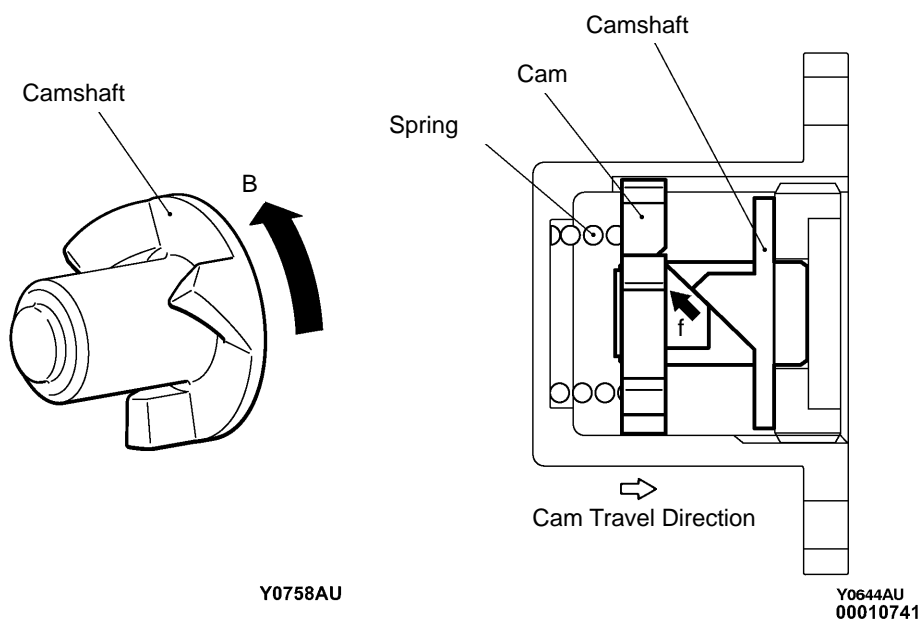


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When Accelerator Pedal is Released:

When the accelerator pedal is released, the camshaft rotates in direction B, spring reaction force moves the cam to the right shown in the illustration. At this time, friction force (f) is applied to the opposite direction of pedal depressing operation, i.e. the direction to reduce the pedal force.



ENGINE <4G9-GDI>

GENERAL INFORMATION

The 4G93-GDI engine for Hong Kong is adopted.

Basically it is the same as the 4G93-GDI engine installed in the PAJERO io, but the following changes have been made.

- Rocker cover
- Piston
- Intake manifold
- Exhaust manifold

MAJOR SPECIFICATIONS

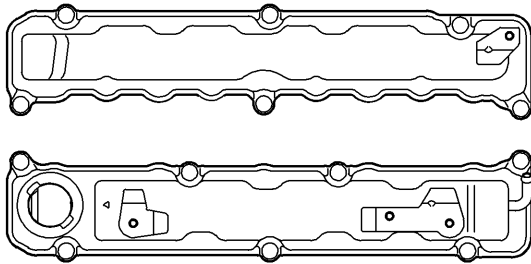
Items		4G93-GDI <LANCER>	4G93-GDI <PAJERO io>
Total displacement mL		1,834	1,834
Bore × stroke mm		81.0 × 89.0	81.0 × 89.0
Compression ratio		12.0	11.6
Combustion chamber		Pentroof type + curbed top piston	Pentroof type + curbed top piston
Camshaft arrangement		DOHC	DOHC
Valve timing	Intake Opening	BTDC 15°	BTDC 15°
	Intake Closing	ABDC 56°	ABDC 56°
	Exhaust Opening	BBDC 55°	BBDC 55°
	Exhaust Closing	ATDC 15°	ATDC 15°
Maximum output kW/rpm		96/6,000	93/5,500
Maximum torque Nm/rpm		177/3,750	173/3,500
Fuel system		Electronically controlled multi-point fuel injection/Gasoline direct injection	Electronically controlled multi-point fuel injection/Gasoline direct injection
Rocker arm		Roller type	Roller type
Auto-lash adjust		Equipped	Equipped
Engine oil	Engine oil API classification	SG or higher	SG or higher
	Engine oil quantity L	3.5 (Includes oil filter capacity 0.3)	3.5 (Includes oil filter capacity 0.3)

BASE ENGINE

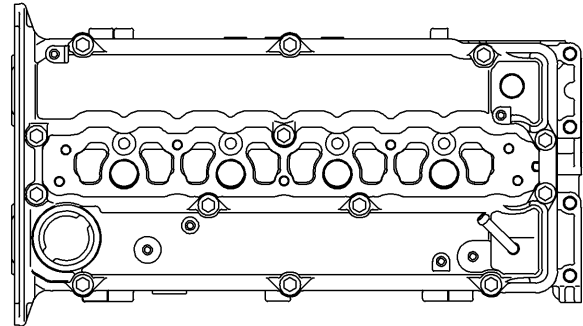
ROCKER COVER

A partitioned rocker cover is adopted.

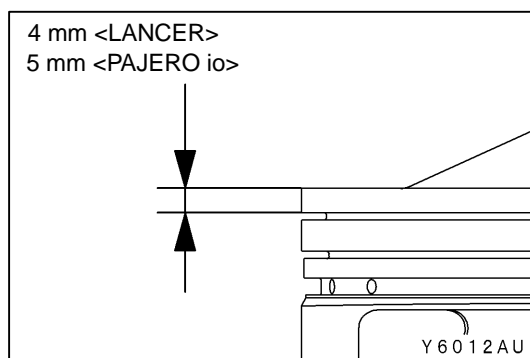
<LANCER>



<PAJERO io>



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PISTON

The top land height has been decreased from 5mm to 4 mm in order to reduce the HC in the exhaust.

COOLING SYSTEM

This system is basically the same as for 4G1-GDI engine ([Refer Also](#)).

SPECIFICATIONS

Items		4G93–GDI<LANCER>	4G93–GDI<PAJERO io>
Cooling method		Water-cooled pressurized, forced circulation with electrical fan	Water-cooled pressurized, forced circulation with electrical fan
Radiator	Type	Pressurized corrugate type	Pressurized corrugate type
	Performance kJ/h	151,216	152,791* ¹ , 169,535* ²
Water pump	Type	Impeller of centrifugal type	Impeller of centrifugal type
	Drive method	Drive belt	Timing belt
Thermostat	Type	Wax pellet type with jiggle valve	Wax pellet type with jiggle valve
	Valve open temperature	85	85
A/T oil cooler	Performance kJ/h	5,651	5,652

NOTE

*1: M/T

*2: A/T

INTAKE AND EXHAUST

AIR INTAKE SYSTEM

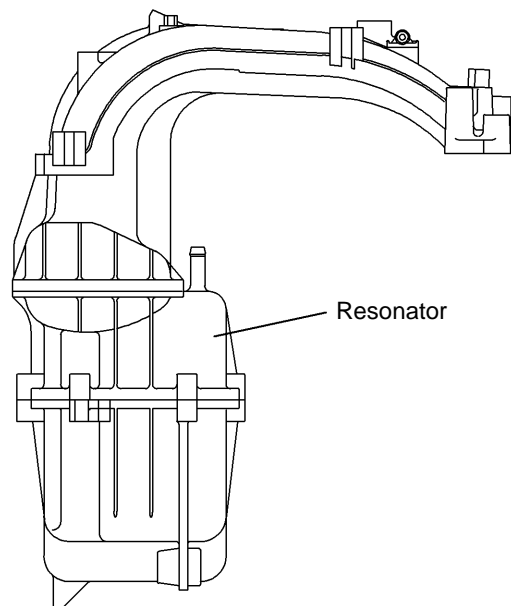
AIR DUCT, AIR CLEANER AND AIR INTAKE HOSE

These components are the same as for 4G1-GDI engine ([Refer Also](#)).

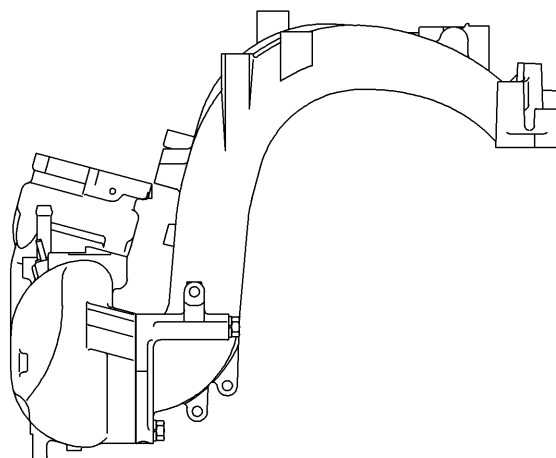
INTAKE MANIFOLD

A resonator integrated resin intake manifold is used.
This has led to the sharp decrease in the weight.

<LANCER>



<PAJERO io>



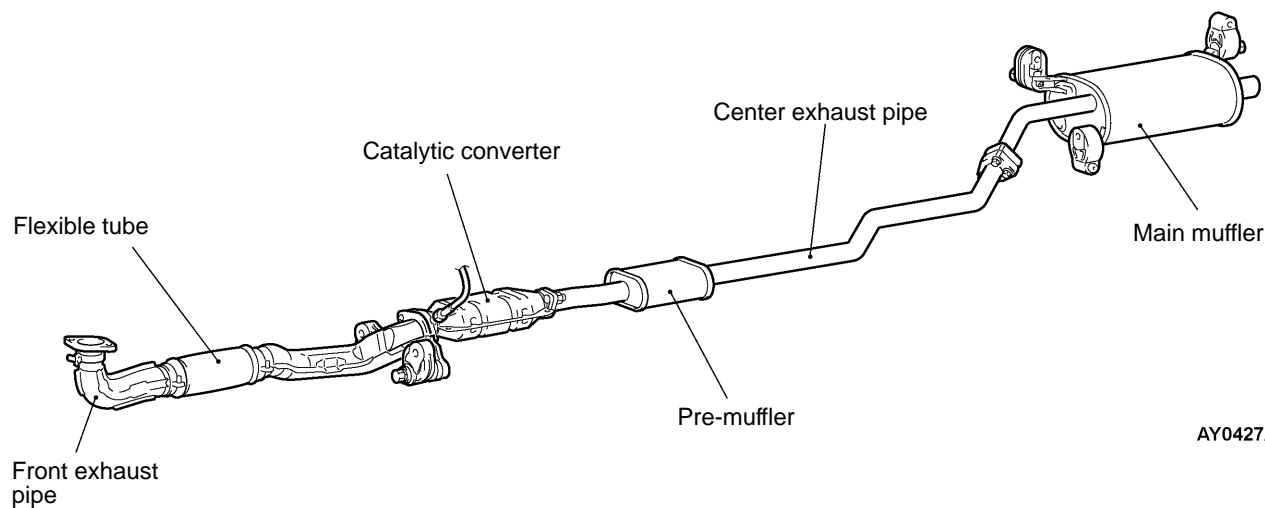
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EXHAUST SYSTEM

EXHAUST PIPE

This component is the same as for 4G1-GDI engine ([Refer Also](#)).

CONSTRUCTION DIAGRAM

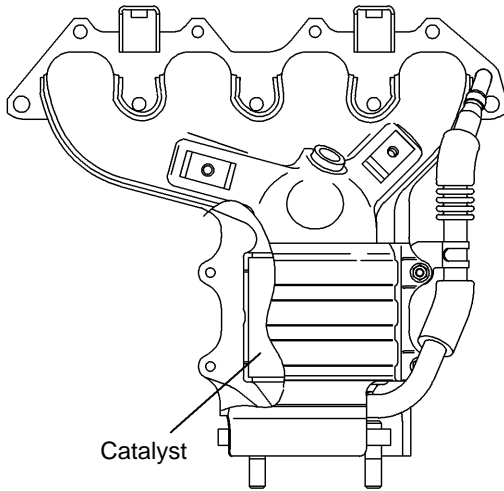


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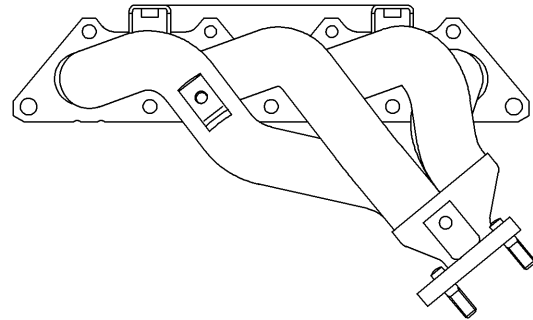
EXHAUST MANIFOLD

A clam-shell type exhaust manifold integrated with catalyst is adopted.
This has contributed to the reduction of the catalyst activation time at cold engine start.

<LANCER>



<PAJERO io>



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FUEL SYSTEM

The fuel system consists of components such as solenoid-type fuel injectors, a delivery pipe, fuel pump (high pressure) assembly [incorporating fuel pressure regulator (high pressure)], injector driver, fuel pressure regulator (high pressure), fuel pump module, fuel gauge unit and fuel tank. This system has the following features.

- A compact and lightweight fuel pump (high pressure) assembly integrating the fuel pump (high pressure) and fuel pressure regulator (high pressure) is adopted.
- The fuel line has been simplified by integrating the fuel pump (high pressure) and fuel pressure regulator (high pressure).
- In order to reduce weight, the fuel pump (low pressure), fuel filter and fuel pressure regulator (low pressure) have been integrated into a single fuel pump module.
- The adoption of a fuel pump module makes it possible to place the fuel filter and the fuel pressure regulator (low pressure) inside the fuel tank, improving safety in the event of an impact.

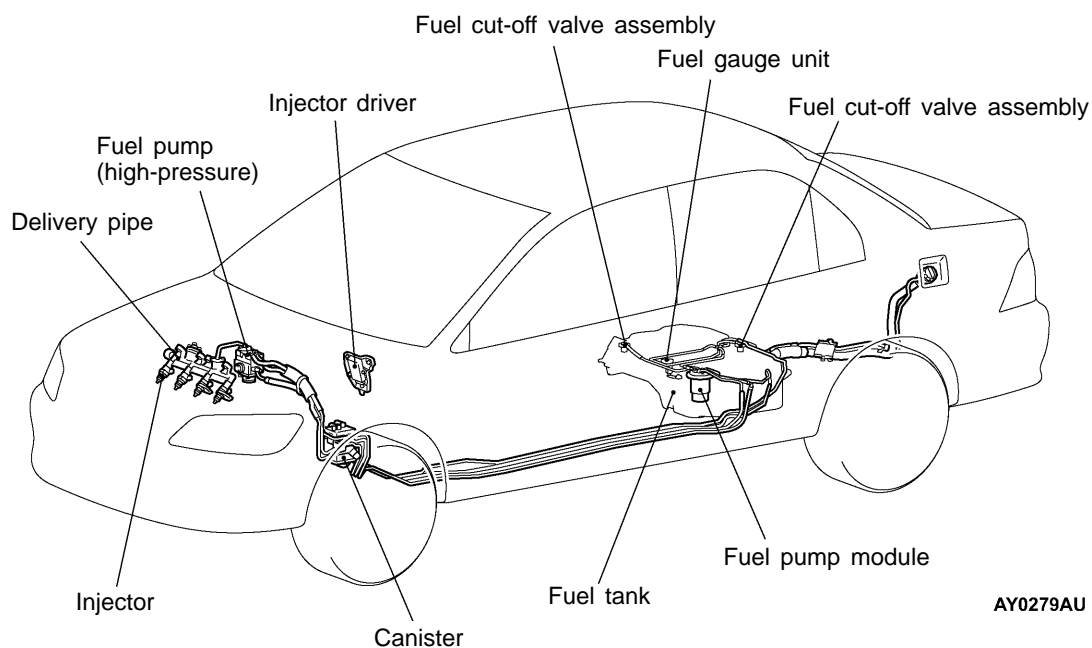
SPECIFICATIONS

Items		4G93-GDI <LANCER>	4G93-GDI <PAJERO io>
Fuel tank capacity L		53	53
Fuel pump (high pressure) type		Mechanical type	Mechanical type
Fuel pump (low pressure) type		Electric type	Electric type
Fuel filter type		Double mesh filter type (incorporates fuel pump module)	Double mesh filter type (incorporates fuel pump module)
Fuel return system		Fuel pressure regulator return	Fuel pressure regulator return
Fuel pressure regulator (high-pressure) control pressure MPa		5.0	5.0
Fuel pressure regulator (low-pressure) control pressure kPa		323	323
Injectors	Type	Electromagnetic type	Electromagnetic type
	Quantity	4	4
Evaporative emission control system		Canister type	Canister type

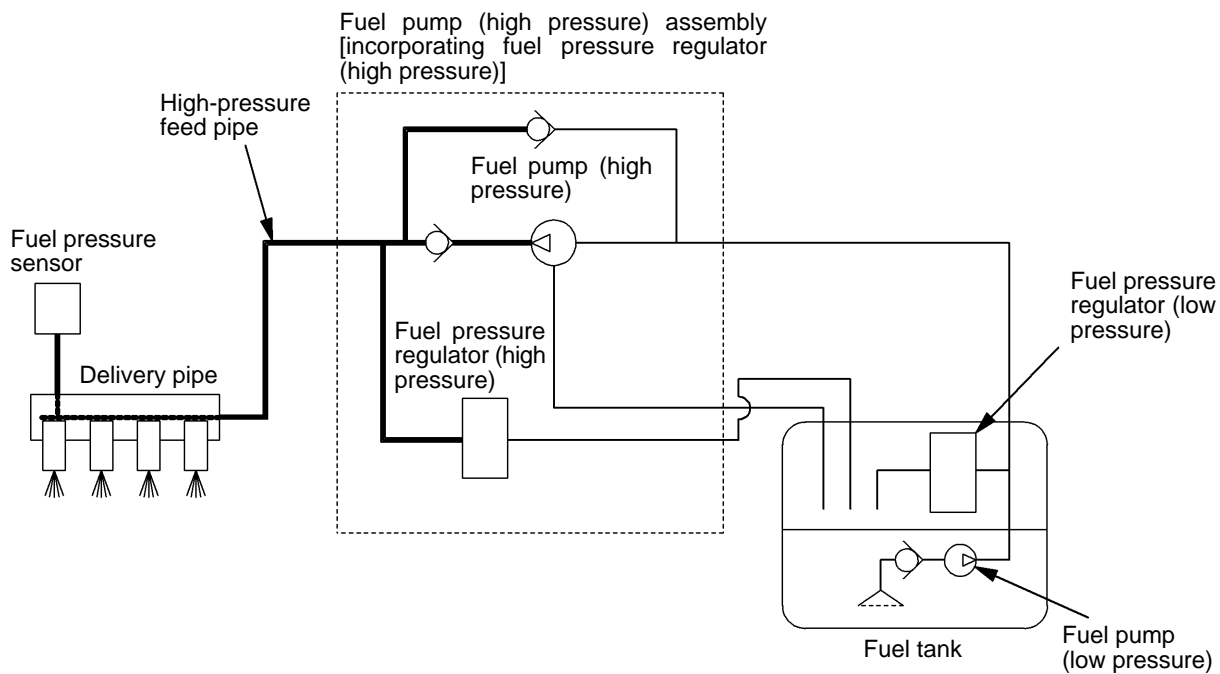
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FUEL ROUTE



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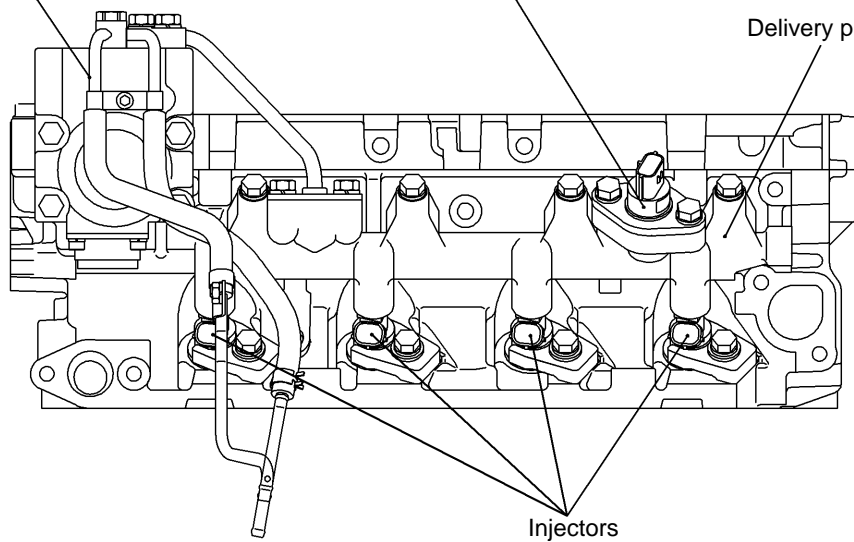
FUEL INJECTION PARTS

Structural diagram

Fuel pump (high pressure) assembly
[incorporating fuel pressure regulator
(high pressure)]

Fuel pressure sensor

Delivery pipe



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FUEL TANK

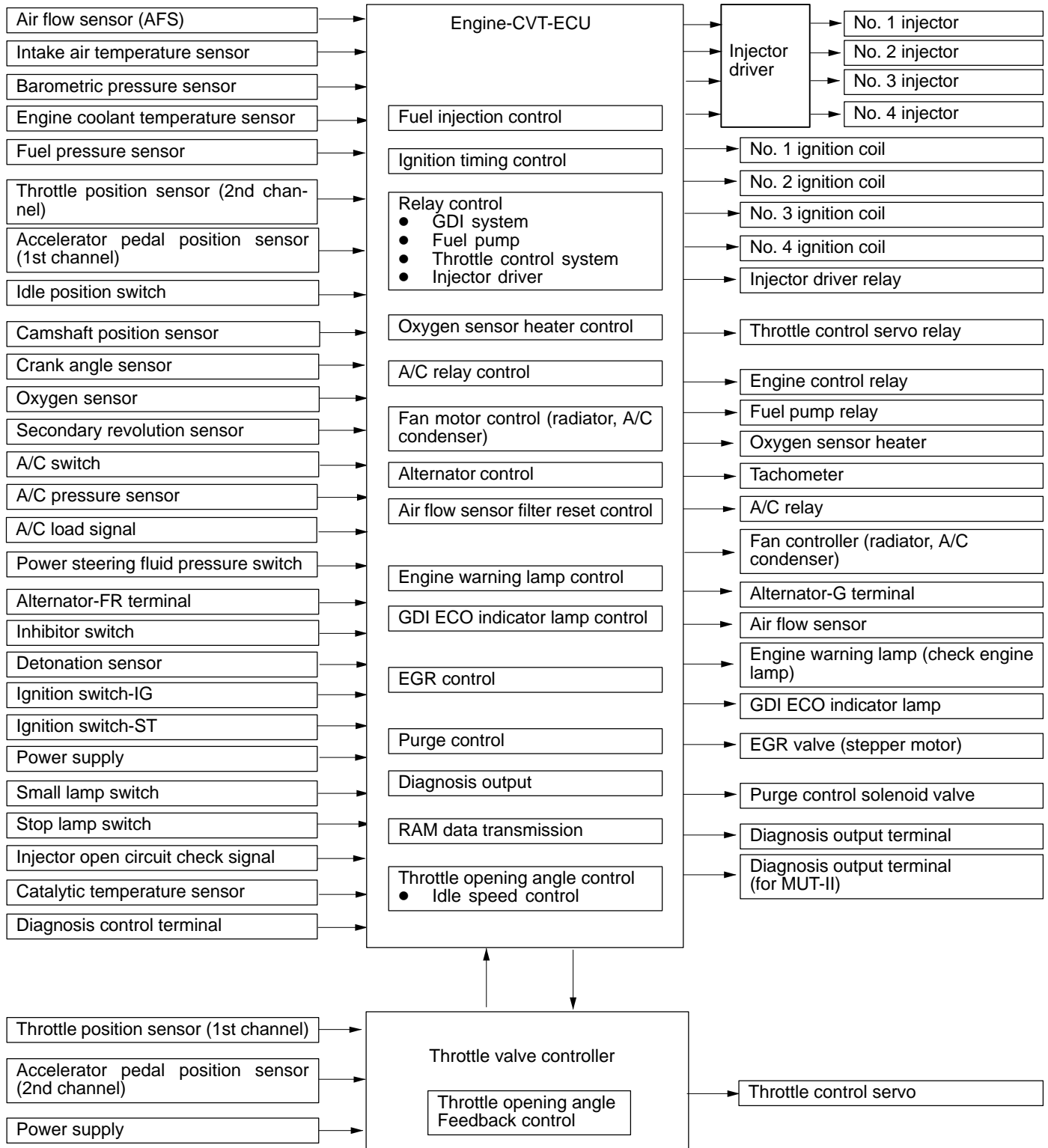
The basic construction and parts configuration of the fuel tank are the same as in the 4G1-GDI engine.
([Refer Also](#))

CONTROL SYSTEM

The control system is based on the system for the 4G9-GDI engine installed in the PAJERO io, with the following improvements added.

Improvements/Additions	Remarks
Adoption of a 32bit integrated ECU integrating CPUs for engine control and transmission control	<ul style="list-style-type: none">• Engine control performance has been improved by high calculation speed.• High speed engine and transmission integrated control.

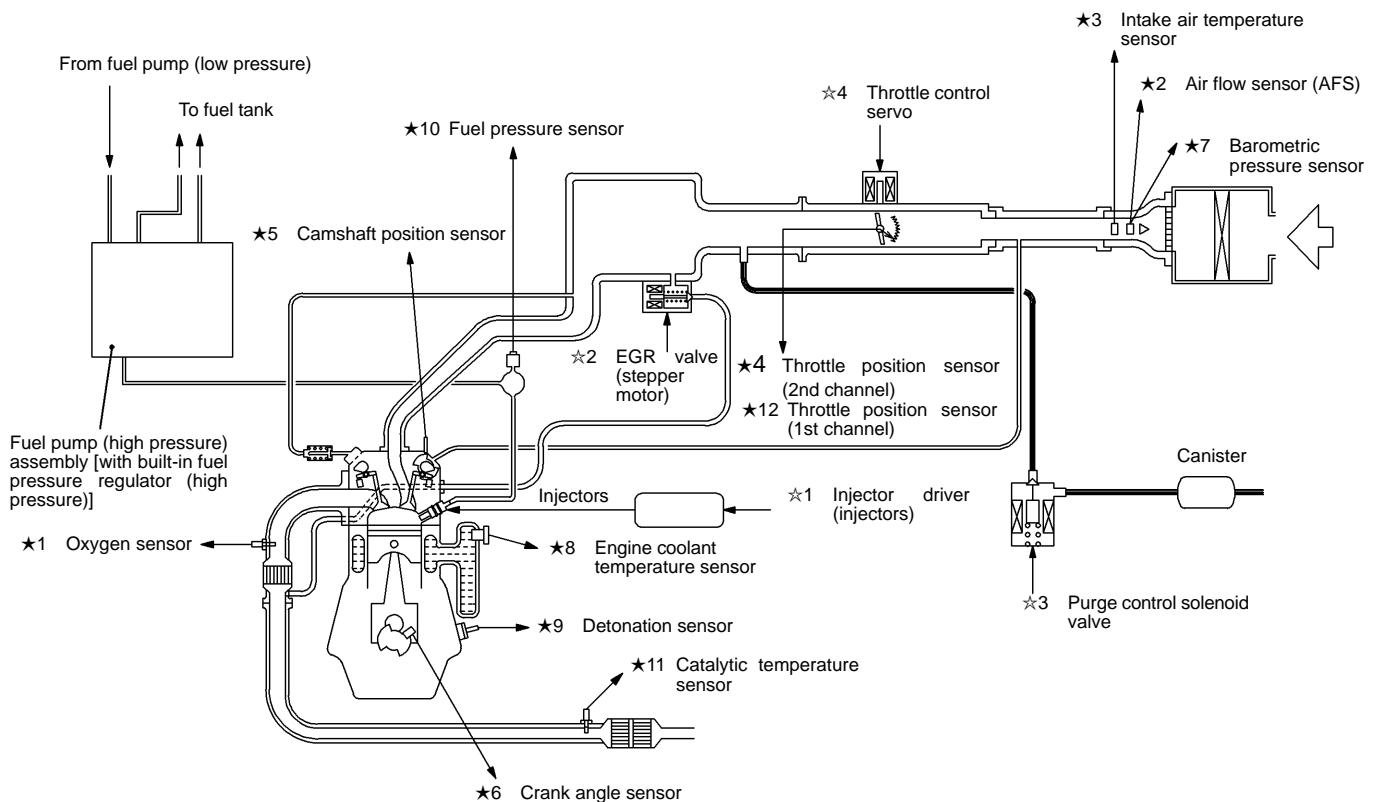
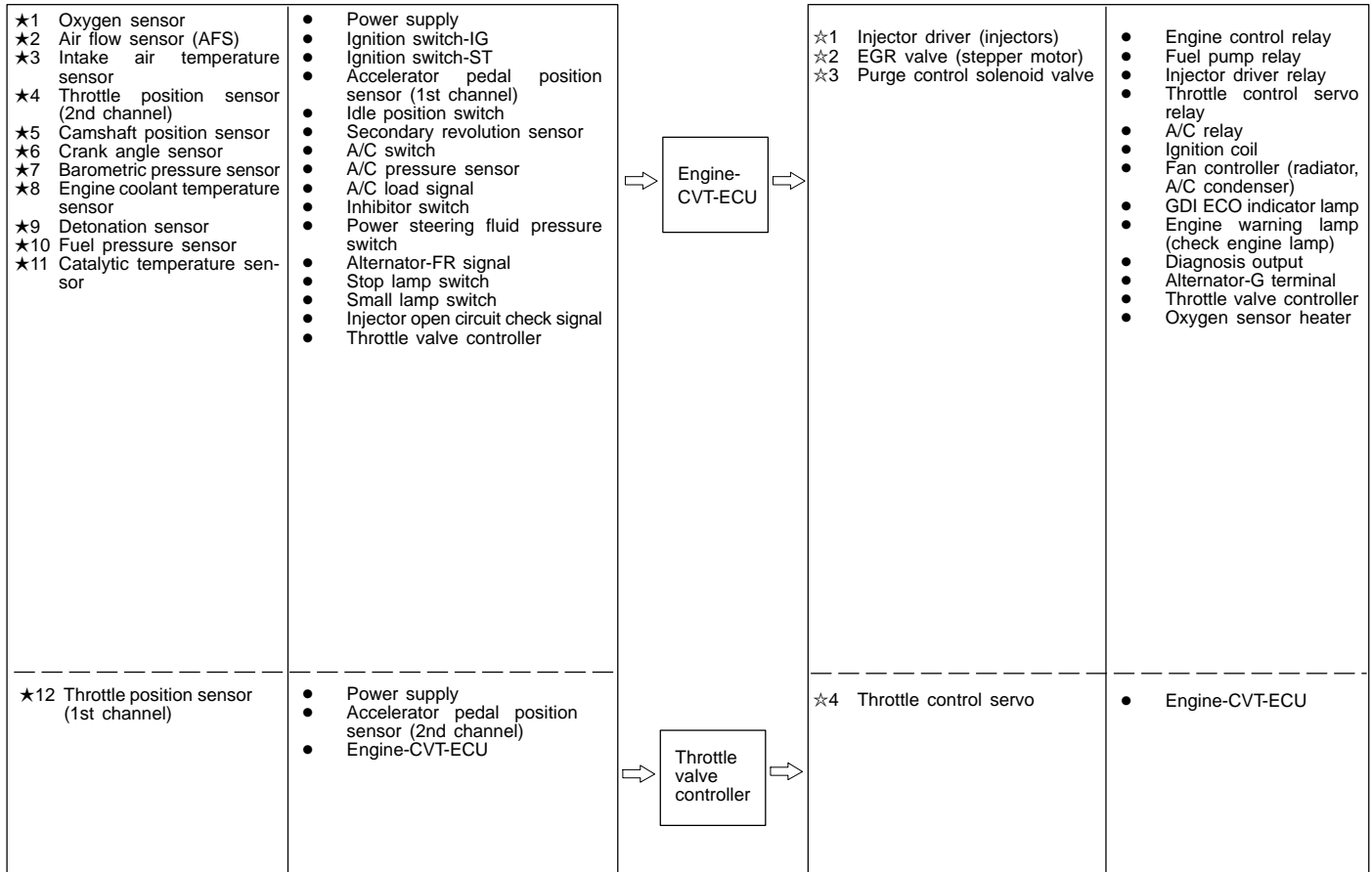
SYSTEM BLOCK DIAGRAM



CONTROL SYSTEM DIAGRAM

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LIST OF COMPONENT FUNCTIONS

Name		Function
ECU	Engine-CVT-ECU	Uses the signals input from the various sensors to control operation of actuators in accordance with the driving conditions.
	Throttle valve controller	Uses the target throttle valve opening angle input from the engine-CVT-ECU to control the throttle valve opening angle.
Sensors	Ignition switch-IG	Detects the ON/OFF position of the ignition switch. When this signal is input to the engine-CVT-ECU, power is supplied to components such as the injector driver, air flow sensor, throttle valve control servo and crank angle sensor.
	Ignition switch-ST	Detects whether the engine is cranking. The engine-CVT-ECU controls the fuel injection, throttle valve opening angle and ignition timing to the appropriate settings based on this signal.
	Air flow sensor (AFS)	Detects the amount of intake air (volumetric capacity) by means of a Karman vortex meter. The engine-CVT-ECU controls the basic injector drive time based on this signal and on the engine speed.
	Barometric pressure sensor	Detects the barometric pressure by means of a semiconductor diffusion-type pressure sensor. The engine-CVT-ECU detects the vehicle's altitude based on this signal, and uses this to correct the fuel injection amount so that the optimum air/fuel mixture ratio is obtained for that altitude.
	Oxygen sensor	Detects the concentration of oxygen in the exhaust gas by means of zirconia and platinum electrodes. The engine-CVT-ECU judges whether the air/fuel mixture ratio is at the optimum theoretical ratio based on this concentration.
	Intake air temperature sensor	Detects the temperature of the intake air by means of a thermistor. The engine-CVT-ECU corrects the fuel injection amount to the correct amount corresponding to the intake air temperature based on the voltage output from this sensor.
	Engine coolant temperature sensor	Detects the temperature of the engine coolant by means of a thermistor. The engine-CVT-ECU detects how warm the engine is based on the signal from this sensor, and uses this to control the fuel injection amount, idle speed and ignition timing.
	Throttle position sensor (1st channel)	Detects the throttle valve opening angle by means of a potentiometer. Throttle valve controller carries out drive control of the throttle valve using this signal.
	Throttle position sensor (2nd channel)	Detects the throttle valve opening angle by means of a potentiometer. The engine-CVT-ECU checks the drive state of the throttle valve using this sensor signal. The output characteristic of the throttle position sensor (2nd channel) is the opposite of the output characteristic of the throttle position sensor (1st channel).
	Accelerator pedal position sensor (1st channel)	Detects the accelerator pedal angle by means of a potentiometer. The engine-CVT-ECU carries out appropriate fuel injection and control of the throttle valve opening angle according to the accelerator opening angle (driver's intention) using this sensor signal.
	Accelerator pedal position sensor (2nd channel)	Detects the accelerator pedal angle by means of a potentiometer. The throttle valve controller checks the accelerator opening angle using this sensor signal.
	Idle position switch	This is a movable contact switch which is built into the accelerator pedal position sensor. It is used to detect when the accelerator pedal is fully open.
	Secondary revolution sensor*	Converts the secondary revolution sensor signal to the vehicle speed signal, and uses it for engine control.

*: Refer to "Transmission" section.

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Name		Function
Sensors	Camshaft position sensor	Detects the No. 1 cylinder compression top dead centre position by means of a magnetic rheostatic element.
	Detonation sensor	Detects the vibration of the cylinder block when knocking occurs by means of a pressure transducer. The engine-CVT-ECU detects whether this vibration is only due to knocking, and controls the retardation of ignition timing in accordance with the strength of the knocking.
	Crank angle sensor	Detects the crank angle by means of a Hall element. The engine-CVT-ECU controls the injectors based on the signal from this sensor.
	Alternator-FR terminal	Detects the energising duty ratio of the alternator field coil.
	Inhibitor switch*	Detects the Park and Neutral positions of the A/T selector lever.
	Power steering fluid pressure switch	Detects whether there is a power steering load present by means of a contact switch.
	Fuel pressure sensor	Detects the fuel pressure applied to the fuel pump (high pressure) by means of a metallic membrane-type pressure sensor. The engine-CVT-ECU corrects the fuel injection amount based on this fuel pressure.
	Stop lamp switch*	Detects the depression amount for the brake pedal by means of a contact switch.
	Small lamp switch	Inputs electrical load information to the engine-CVT-ECU.
	A/C switch	Detects the ON/OFF condition of the A/C.
	A/C load signal	Inputs the A/C compressor drive state (low load/high load) to the engine-CVT-ECU. The engine-CVT-ECU controls the A/C idle-up revolution speed using this signal.
	A/C pressure sensor	Detects the A/C refrigerator pressure, and inputs the A/C compressor drive state to the engine-CVT-ECU. The engine-CVT-ECU uses this signal for controlling the fuel injection mode.
	Catalytic temperature sensor	Detects the catalytic temperature using a thermistor.
	Injector open circuit check signal	The engine-CVT-ECU detects open circuits in the injectors by means of this signal.
	Diagnosis control terminal	If diagnosis codes have been stored in memory, they can be displayed through the flashing of the engine warning lamp by connecting this terminal to the vehicle earth.

*: Refer to “Transmission” section.

ENGINE <4G9-GDI> – Control System

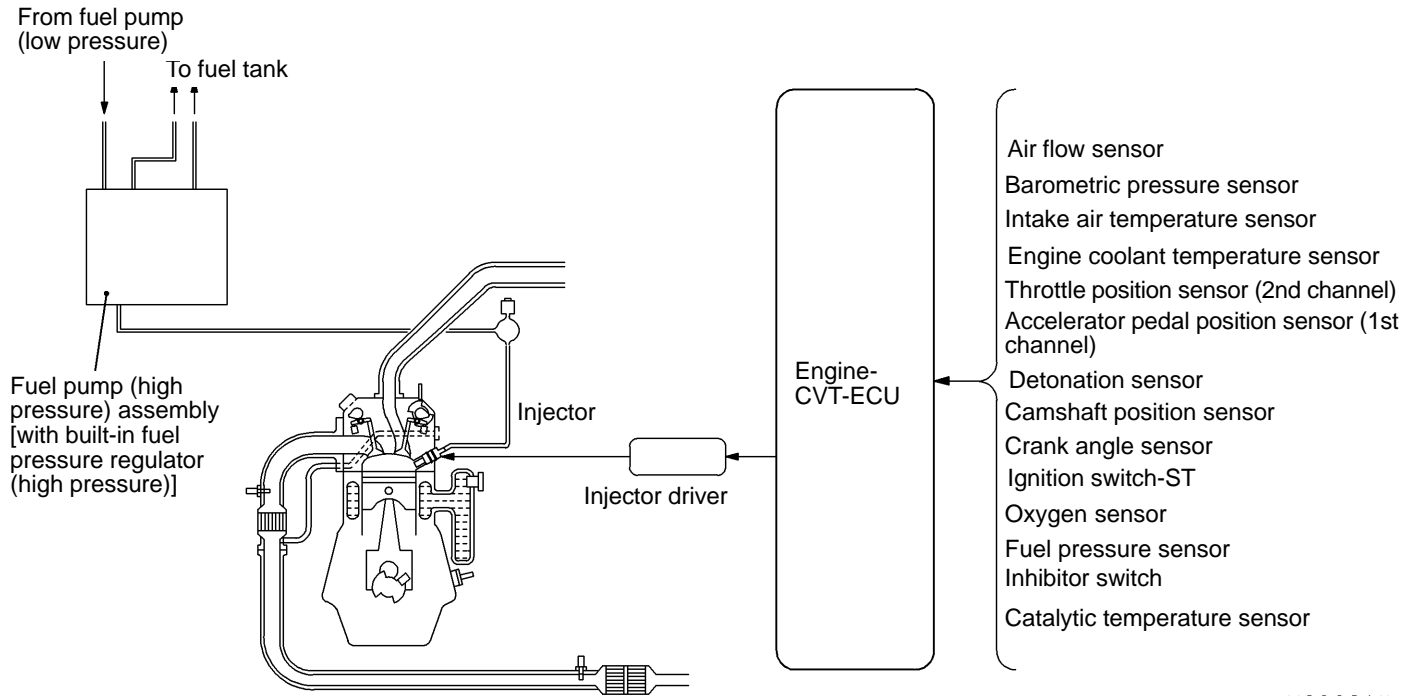
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Name		Function
Actuators	Engine control relay	Turns the engine-CVT-ECU power circuit on and off.
	Throttle control servo relay	Turns the throttle valve controller power supply circuit on and off.
	Injector driver	Drives the injectors by means of drive signals from the engine-CVT-ECU.
	Injector driver relay	Turns the injector driver power supply circuit on and off.
	Injectors	Injects the fuel according to the drive signals from the injector driver.
	Ignition coil (with built-in power transistor)	Interrupts the ignition coil primary current in accordance with the ignition signals from the engine-CVT-ECU, in order to generate a high voltage for ignition.
	Throttle control servo	Controls the throttle valve opening angle by means of signals from the throttle valve controller.
	EGR valve (stepper motor)	Controls the EGR flow volume by means of signals from the engine-CVT-ECU.
	Fuel pump relay	Controls the supply of power to the fuel pump (low pressure).
	Fan controller (radiator, A/C condenser)	Controls the radiator and condenser fan speeds smoothly by means of signals from the engine-CVT-ECU.
	Purge control solenoid valve	Controls the amount of purge air introduced to the air intake plenum by means of signals from the engine-CVT-ECU.
	Alternator-G terminal	Controls the amount of power generated by the alternator by means of signals from the engine-CVT-ECU.
	Tachometer	Displays the engine speed on the tachometer inside the speedometer.
	A/C relay	Controls the operation of the A/C compressor.
	GDI ECO indicator lamp	Illuminates when low fuel consumption driving mode is active to notify the driver.
	Engine warning lamp (check engine lamp)	Illuminates to notify the driver of any abnormalities when a problem occurs with any of the sensors. Also flashes in order to output diagnosis codes.

FUEL INJECTION CONTROL

The fuel injection control is basically the same as the control method of the 4G1-GDI. [Refer Also.](#)

SYSTEM CONFIGURATION DIAGRAM

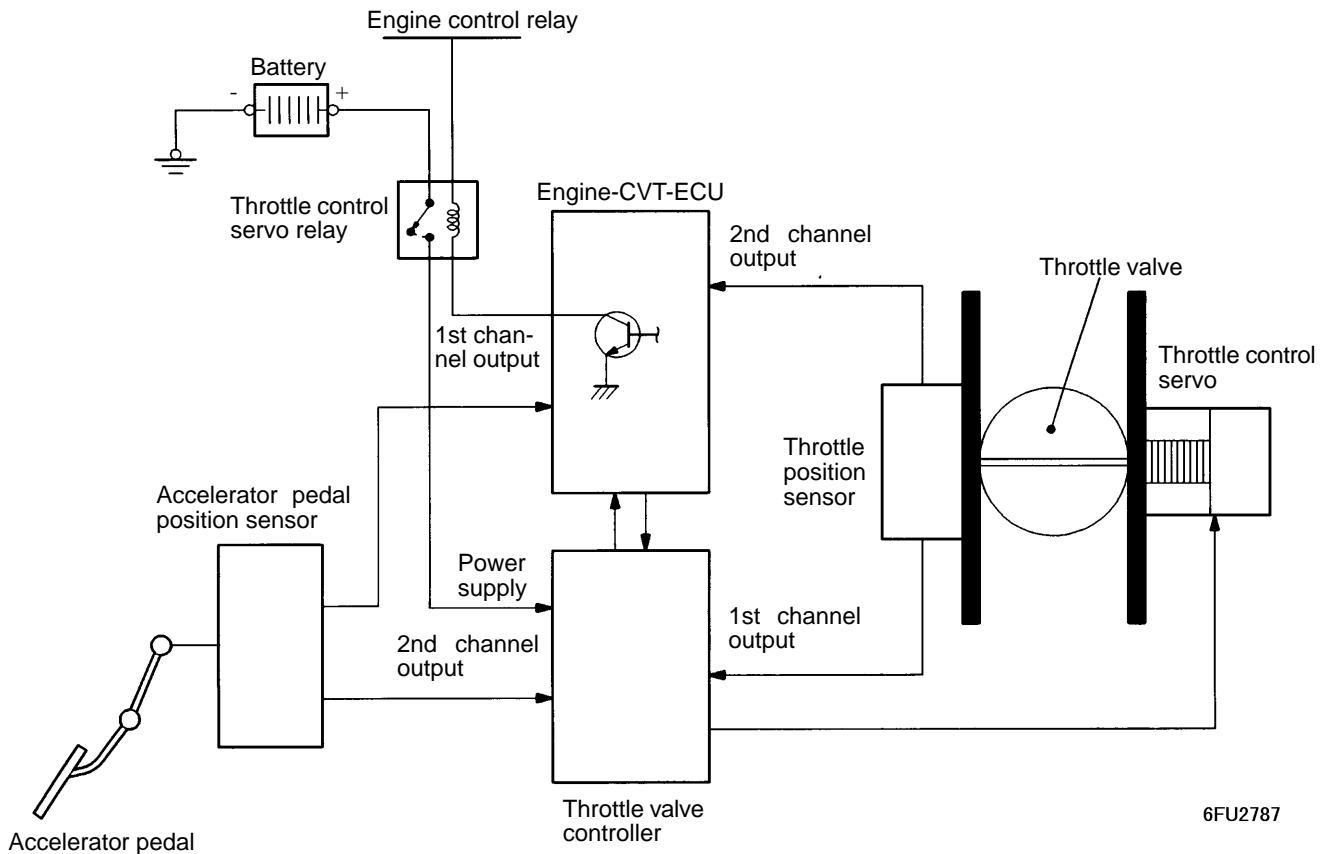


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THROTTLE OPENING ANGLE CONTROL

The throttle opening angle control is basically as the same as the control method of the 4G1-GDI. [Refer Also.](#)

SYSTEM CONFIGURATION DIAGRAM

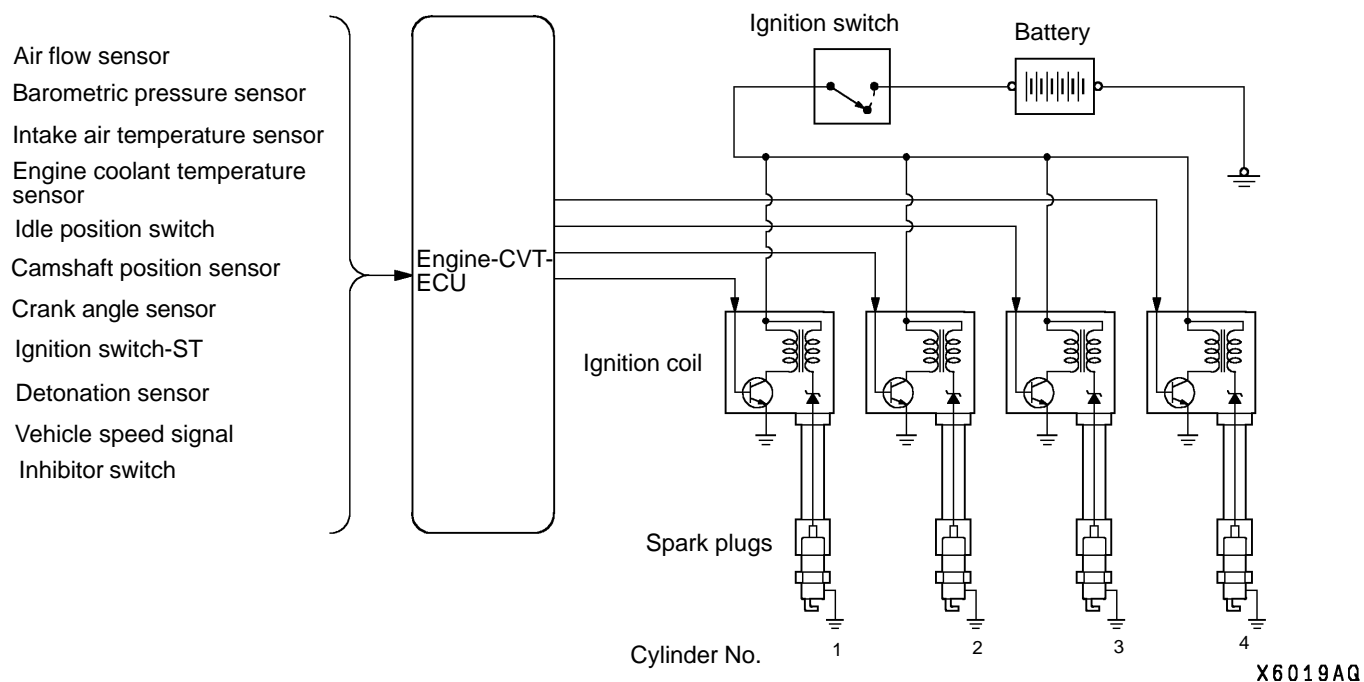


6FU2787

IGNITION TIMING AND ENERGISATION TIME CONTROL

The ignition timing and energisation time control are basically the same as for the 4G1-GDI. [Refer Also.](#)

SYSTEM CONFIGURATION DIAGRAM



RELAY CONTROL (ENGINE CONTROL, FUEL PUMP, THROTTLE CONTROL SYSTEM, INJECTOR DRIVER), OXYGEN SENSOR HEATER CONTROL, A/C RELAY CONTROL, AIR FLOW SENSOR FILTER RESET CONTROL, FAN MOTOR CONTROL, ALTERNATOR CONTROL, ENGINE/TRANSMISSION TOTAL CONTROL, GDI ECO INDICATION LAMP CONTROL

The control methods used are basically the same as those used for the 4G9-GDI engine installed in the PAJERO io.

DIAGNOSIS SYSTEM

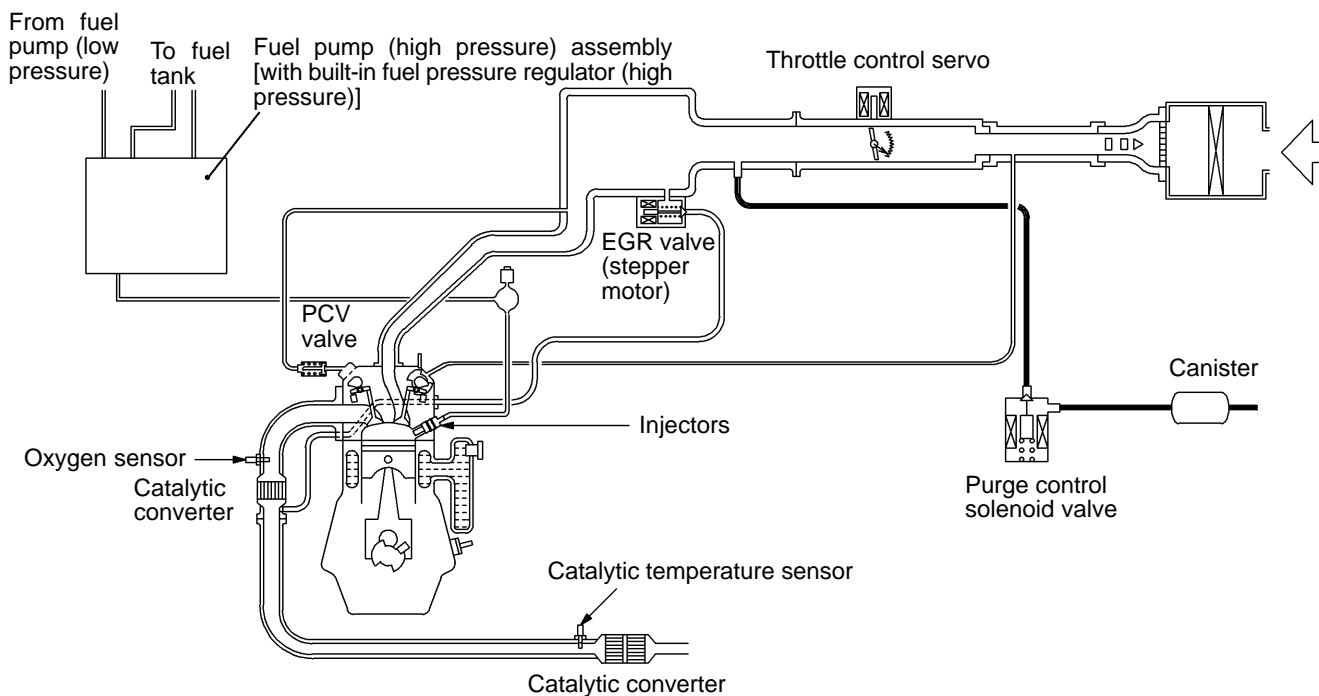
- The on-vehicle system (OBD [On-Board Diagnostics] System) is adopted.
- A freeze-frame data function has been added.
- In addition, the engine-CVT-ECU is provided with the following functions to make system inspection easier.

[Refer Also.](#)

EMISSION CONTROL SYSTEM

The emission control system basically adopts the same control method as 4G1-GDI. [Refer Also.](#)

EMISSION CONTROL SYSTEM DIAGRAM



Y 6 0 0 2 A U

MOUNT

This component is the same as for 4G1-GDI engine ([Refer Also](#)).

ACCELERATOR SYSTEM

This system is the same as for vehicles with 4G1-GDI engine ([Refer Also](#)).

ENGINE <4G1-CARBURETTOR, MPI>

GENERAL INFORMATION

The 4G13 and 4G18 engines are the engines which modified from the conventional SOHC-12 valve engine to the SOHC-16 valve. The 4G18 engine is the 4G13 engine with increased displacement. Both the 4G13 and 4G18 engines are basically the same as the 4G13 engine installed in the LANCER, but the following changes have been made.

<4G13 Engine>

- Changed the piston.
- Changed the camshaft.
- Changed the intake manifold.
- Changed the exhaust manifold.
- Changed the ignition distribution method from distributor method to the distributorless 2-coil method.<MPI only>
- Added a cam position sensor for detecting with the sensing cylinder installed at the back of the camshaft.<MPI only>
- Added a crank angle sensor for detecting with the sensing plate installed to the crankshaft.<MPI only>

<4G18 Engine>

- Changed the piston
- Changed the crankshaft
- Changed the camshaft (Same as 4G13 engine)
- Changed the intake manifold (The 4G18 carburettor is the same as 4G13 carburettor).
- Changed the exhaust manifold (Same as the 4G13 engine)
- Changed the ignition distribution method from distributor method to the distributorless 2-coil method. (Same as the 4G13 engine)
- Added a cam position sensor for detecting with the sensing cylinder installed at the back of the camshaft. (Same as the 4G13 engine)
- Added a crank angle sensor for detecting with the sensing plate installed to the crankshaft. (Same as the 4G13 engine)

ENGINE <4G1-CARBURETTOR, MPI> – General Information

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[Group TOC](#)

MAJOR SPECIFICATIONS

Items		4G13 16-valve carburettor	4G18 16-valve carburettor	4G13 12-valve carburettor
Total displacement mL		1,299	1,584	1,299
Bore × stroke mm		71.0 × 82.0	76.0 × 87.3	71.0 × 82.0
Compression ratio		9.5	9.5	9.5
Combustion chamber		Pentroof type	Pentroof type	Sem-spherical type
Camshaft arrangement		SOHC	SOHC	SOHC
Valve timing	Intake Opening	BTDC 12°	BTDC 12°	BTDC 14°
	Intake Closing	ABDC 48°	ABDC 48°	ABDC 46°
	Exhaust Opening	BBDC 48°	BBDC 48°	BBDC 52°
	Exhaust Closing	ATDC 12°	ATDC 12°	ATDC 14°
Maximum output kW/rpm		60/6,000	70/6,000	58/6,500 (79 HP/6,500 rpm: GCC)
Maximum torque Nm/rpm		108/4,000	132/3,500	103/4,000 (10.5 kgf·m/4,000 rpm: GCC)
Fuel system		Carburettor	Carburettor	Carburettor
Rocker arm		Roller type	Roller type	Roller type
Auto-lash adjuster		Not equipped	Not equipped	Not equipped
Engine oil	Engine oil API classification	SG or higher	SG or higher	SG or higher
	Engine oil quantity L	3.0 (Includes oil filter capacity 0.3)	3.0 (Includes oil filter capacity 0.3)	3.0 (Includes oil filter capacity 0.3)

ENGINE <4G1-CARBURETTOR, MPI> – General Information

Items		4G13 16-valve MPI	4G18 16-valve MPI	4G13 12-valve MPI
Total displacement mL		1,299	1,584	1,299
Bore × stroke mm		71.0 × 82.0	76.0 × 87.3	71.0 × 82.0
Compression ratio		9.5	9.5 (10.0: GCC)	9.5
Combustion chamber		Pentroof type	Pentroof type	Sem-spherical type
Camshaft arrangement		SOHC	SOHC	SOHC
Valve timing	Intake Opening	BTDC 17°	BTDC 17°	BTDC 14°
	Intake Closing	ABDC 43°	ABDC 43°	ABDC 46°
	Exhaust Opening	BBDC 53°	BBDC 53°	BBDC 52°
	Exhaust Closing	ATDC 7°	ATDC 7°	ATDC 14°
Maximum output kW/rpm		65/6,000 (90 HP/6,000 rpm: GCC)	77/6,000 (122 HP/6,000 rpm: GCC)	57/6,000
Maximum torque Nm/rpm		112/4,500 (11.6 kgf·m/4,500 rpm: GCC)	138/4,500 (15.6 kgf·m/4,500 rpm: GCC)	109/3,000
Fuel system		Electronically controlled multipoint fuel injection	Electronically controlled multipoint fuel injection	Electronically controlled multipoint fuel injection
Rocker arm		Roller type	Roller type	Roller type
Auto-lash adjuster		Not equipped	Not equipped	Not equipped
Engine oil	Engine oil API classification	SG or higher	SG or higher	SG or higher
	Engine oil quantity L	3.0 (Includes oil filter capacity 0.3)	3.0 (Includes oil filter capacity 0.3)	3.0 (Includes oil filter capacity 0.3)

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BASE ENGINE

PISTON

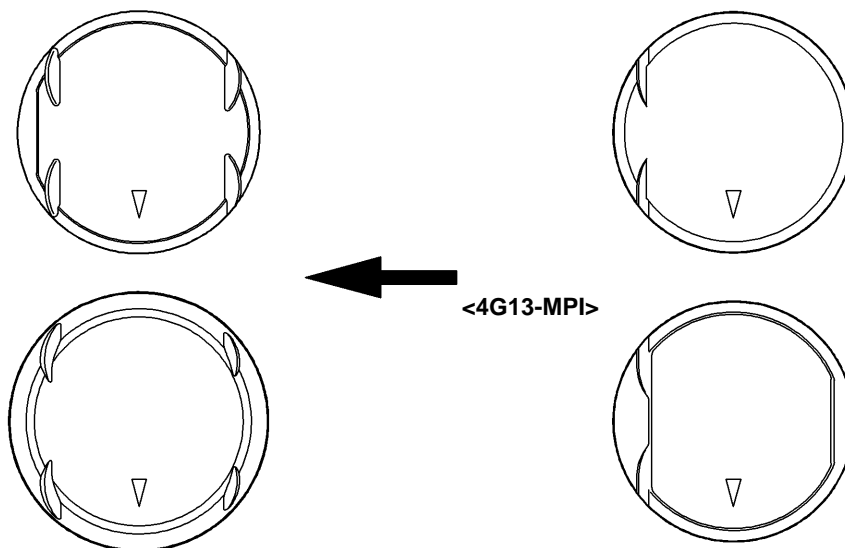
The piston curved shape has been changed due to the modification into 16-valve engine.

<4G13>

<4G13-Carburettor>

<4G18>

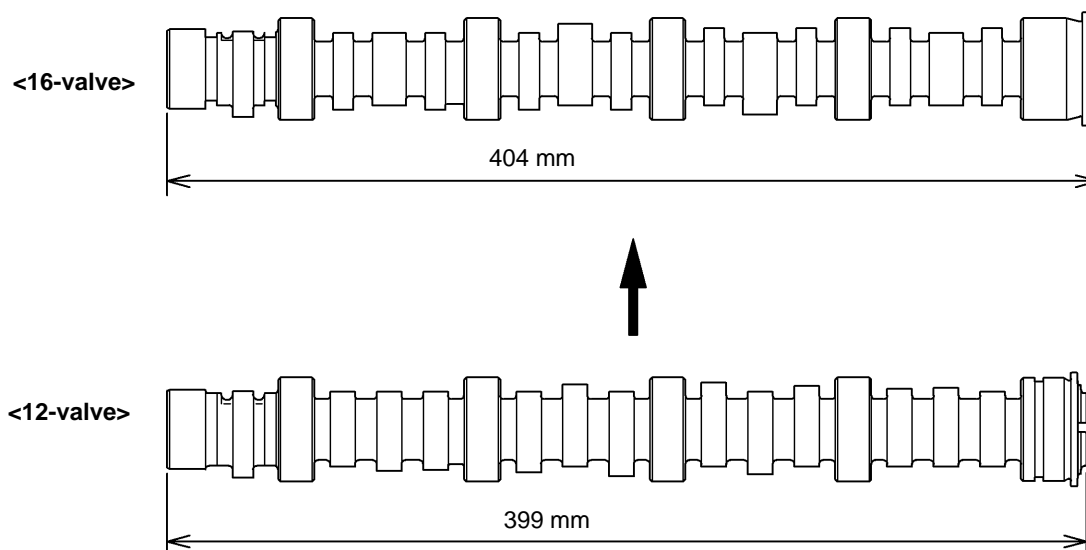
<4G13-MPI>



Y 6 1 0 2 A U

CAMSHAFT

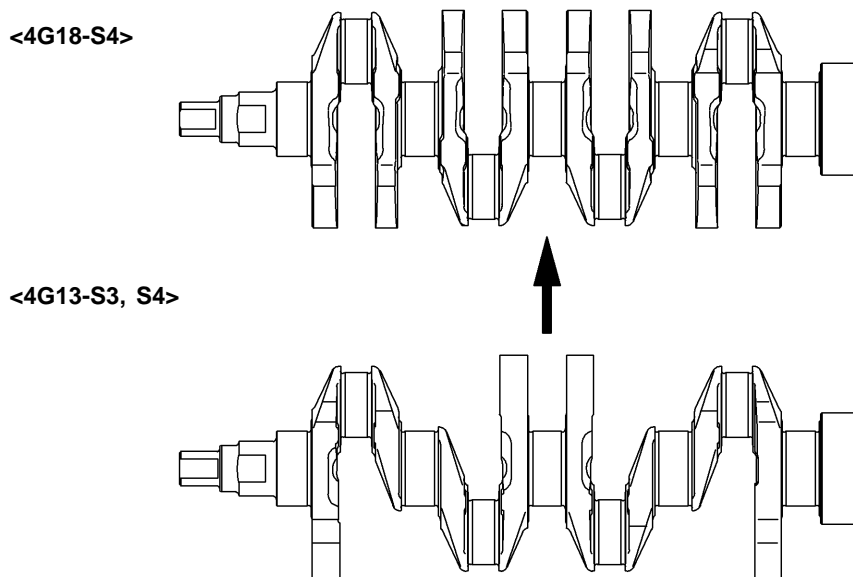
The camshaft has been reshaped due to the modification into 16-valve engine.



Y 6 1 0 3 A U

CRANKSHAFT <4G18>

The crankshaft has been reshaped.

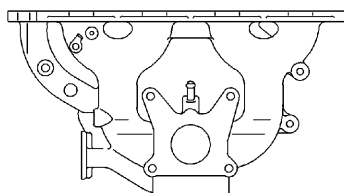


Y 6104AU

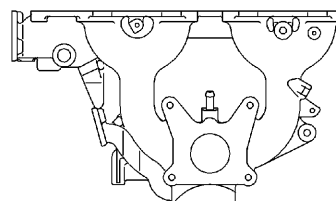
INTAKE MANIFOLD

The intake manifold has been reshaped.

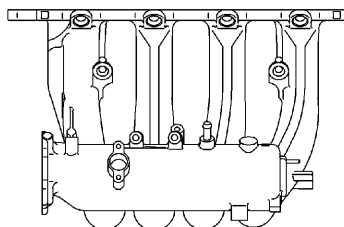
<4G13-S4-Carburettor>
<4G18-S4-Carburettor>



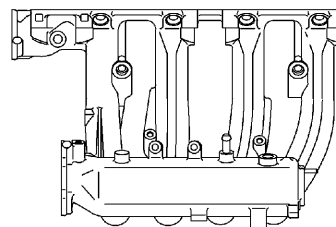
<4G13-S3-Carburettor>



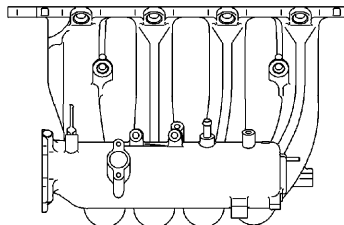
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<4G13-S3-MPI>



<4G18-S4-MPI>

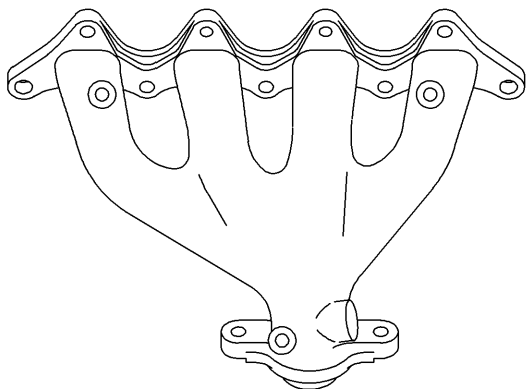


Y 6105AU

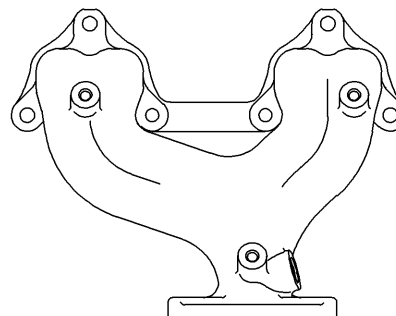
EXHAUST MANIFOLD

The exhaust manifold has been reshaped.

<16-valve>



<12-valve>



Y6106AU

COOLING SYSTEM

This system is basically the same as for 4G1-GDI engine ([Refer Also](#)).

SPECIFICATIONS

Items			2001 MY	2000 MY
Cooling method			Water-cooled pressurized, forced circulation with electrical fan	Water-cooled pressurized, forced circulation with electrical fan
Radiator	Type		Pressurized corrugate type	Pressurized corrugate type
	Performance kJ/h	General Export 4G13-5M/T	137,736	132,700* ¹ , 172,000* ² , 149,400* ³
		General Export 4G13-4A/T, 4G18, Egypt 5M/T GCC 4G13-5M/T	151,216	
		Egypt 4A/T, GCC 4G18	164,930	
Water pump	Type		Impeller of centrifugal type	Impeller of centrifugal type
	Drive method		Drive belt	Drive belt
Thermostat	Type		Wax pellet type with jiggle valve	Wax pellet type with jiggle valve
	Valve open temperature	Carburettor	90	90
		MPI	95	95
A/T oil cooler	Performance kJ/h		5,651	5,651

NOTE

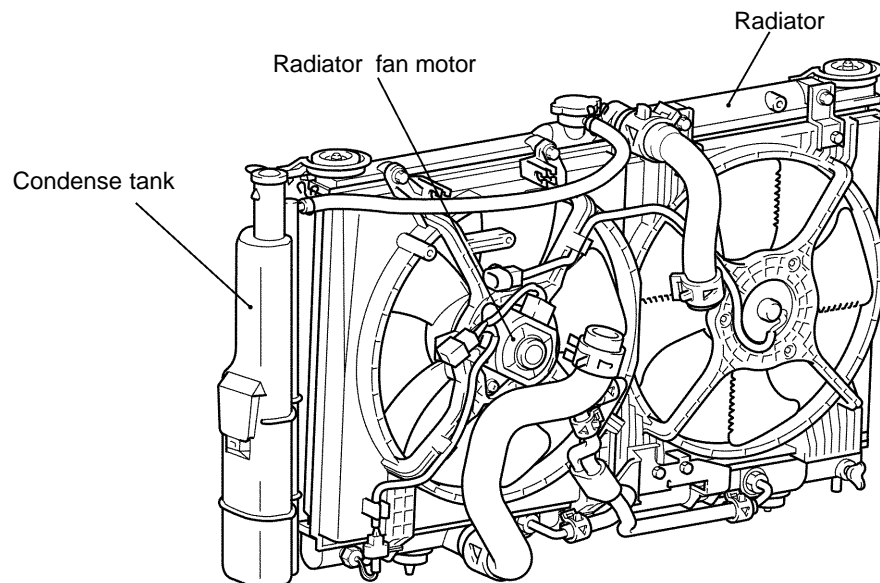
*1: M/T

*2: A/T <Vehicles for General Export>

*3: A/T <Vehicles for GCC>

CONSTRUCTION DIAGRAM

<Carburettor>



AY1366AU

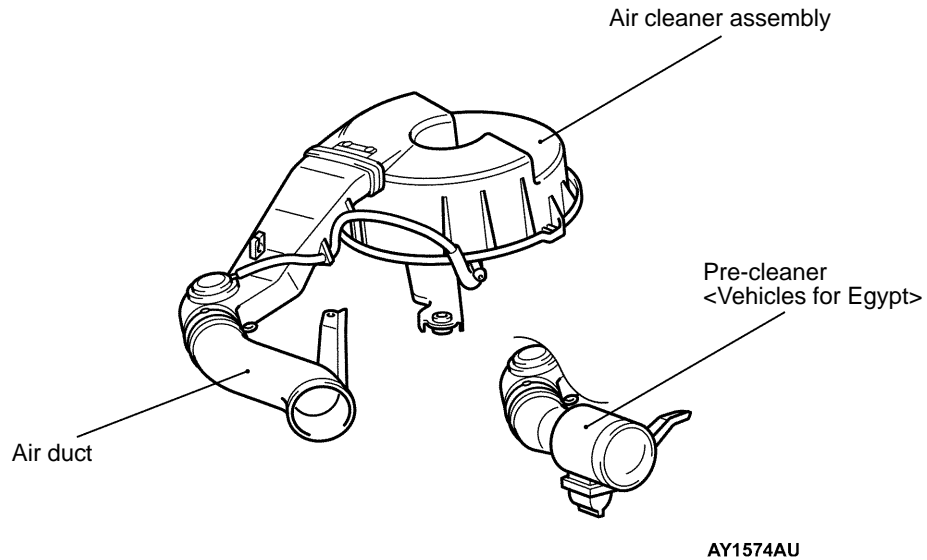
INTAKE AND EXHAUST

AIR INTAKE SYSTEM<CARBURETTOR>

AIR CLEANER

The air cleaner element uses a conventional screening paper.

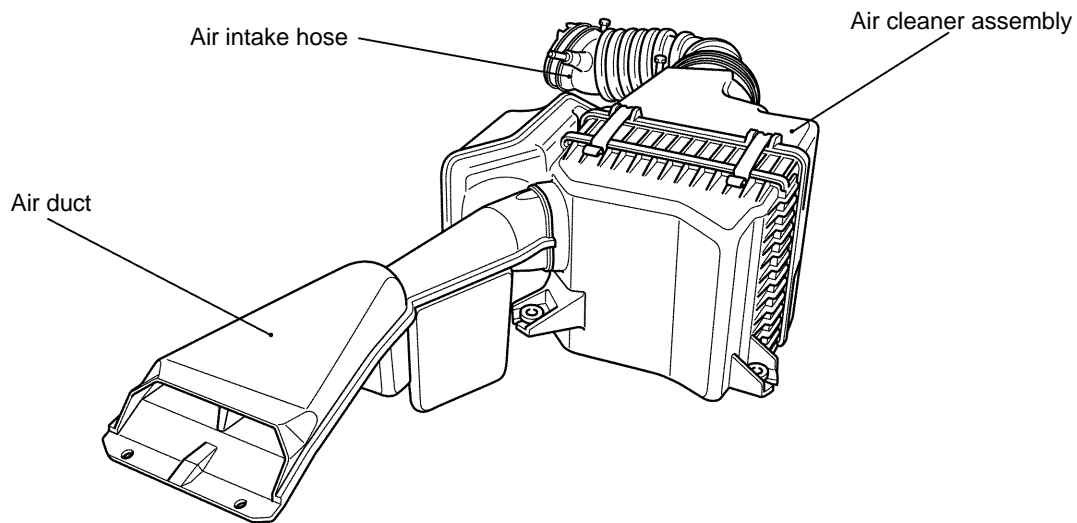
CONSTRUCTION DIAGRAM



AIR INTAKE SYSTEM<MPI>

AIR DUCT, AIR CLEANER AND AIR INTAKE HOSE

These components are basically the same as for 4G1-GDI engine ([Refer Also](#)).

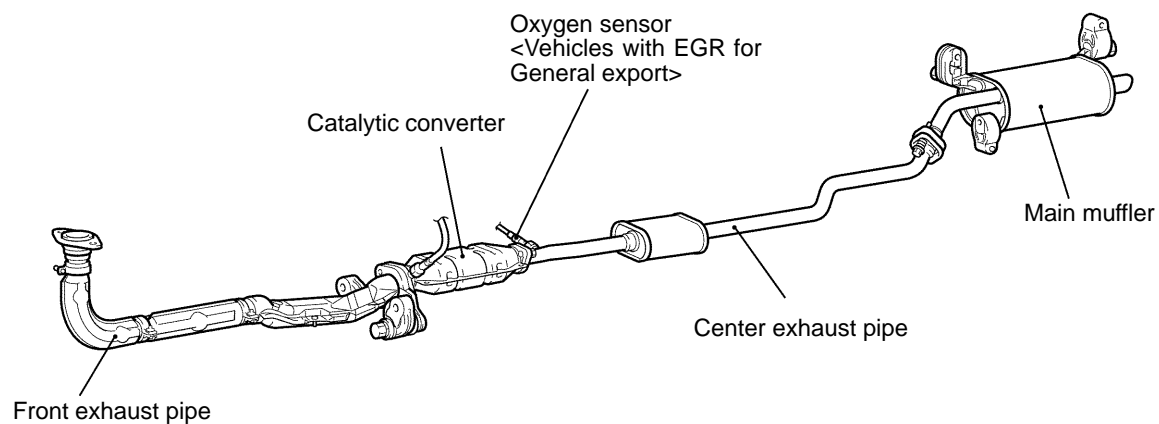


EXHAUST SYSTEM

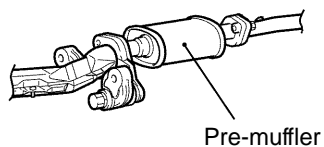
EXHAUST PIPE

This component is basically the same as for 4G1-GDI engine ([Refer Also](#)).

CONSTRUCTION DIAGRAM



<Vehicles without catalytic converter>



FUEL SYSTEM <CARBURETTOR>

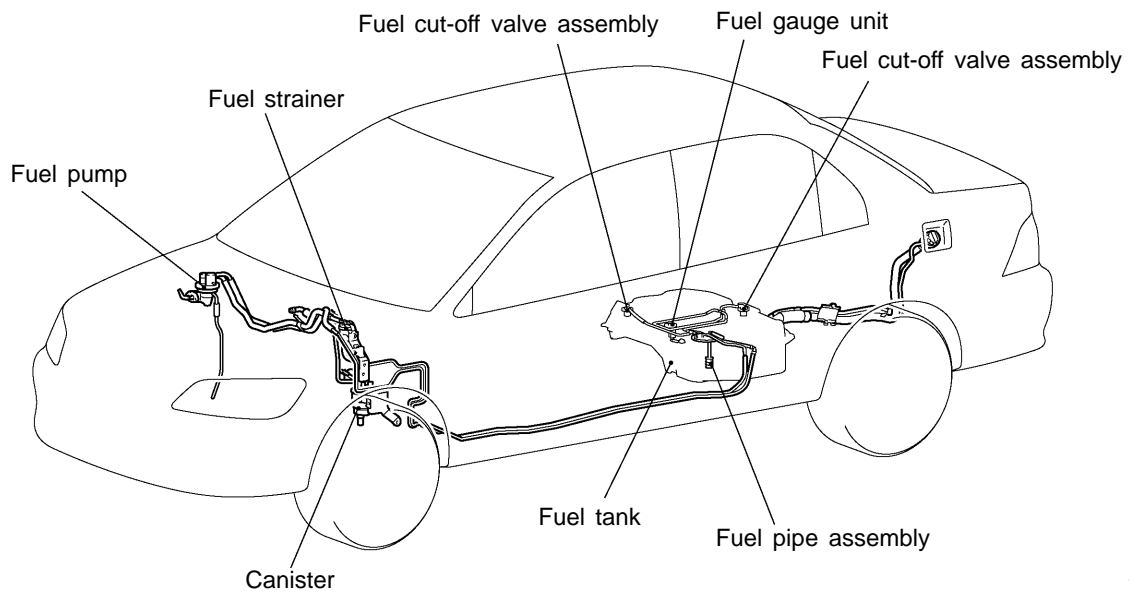
The fuel system is composed of the variable venturi type carburettor, mechanical fuel pump (diaphragm type), fuel hose and pipe, fuel filter and a fuel tank, etc.

The carburettor is essentially the same as that for conventional 4G1 engines.

SPECIFICATIONS

Items	2001 MY	2000 MY
Fuel tank capacity	50	50
Fuel filter type	Cartridge (filter-paper type)	Cartridge (filter-paper type)
Fuel filter type (in tank)	Provided	Provided
Fuel pump type	Mechanical diaphragm	Mechanical diaphragm

CONSTRUCTION DIAGRAM



AY1257AU

CARBURETTOR SPECIFICATIONS

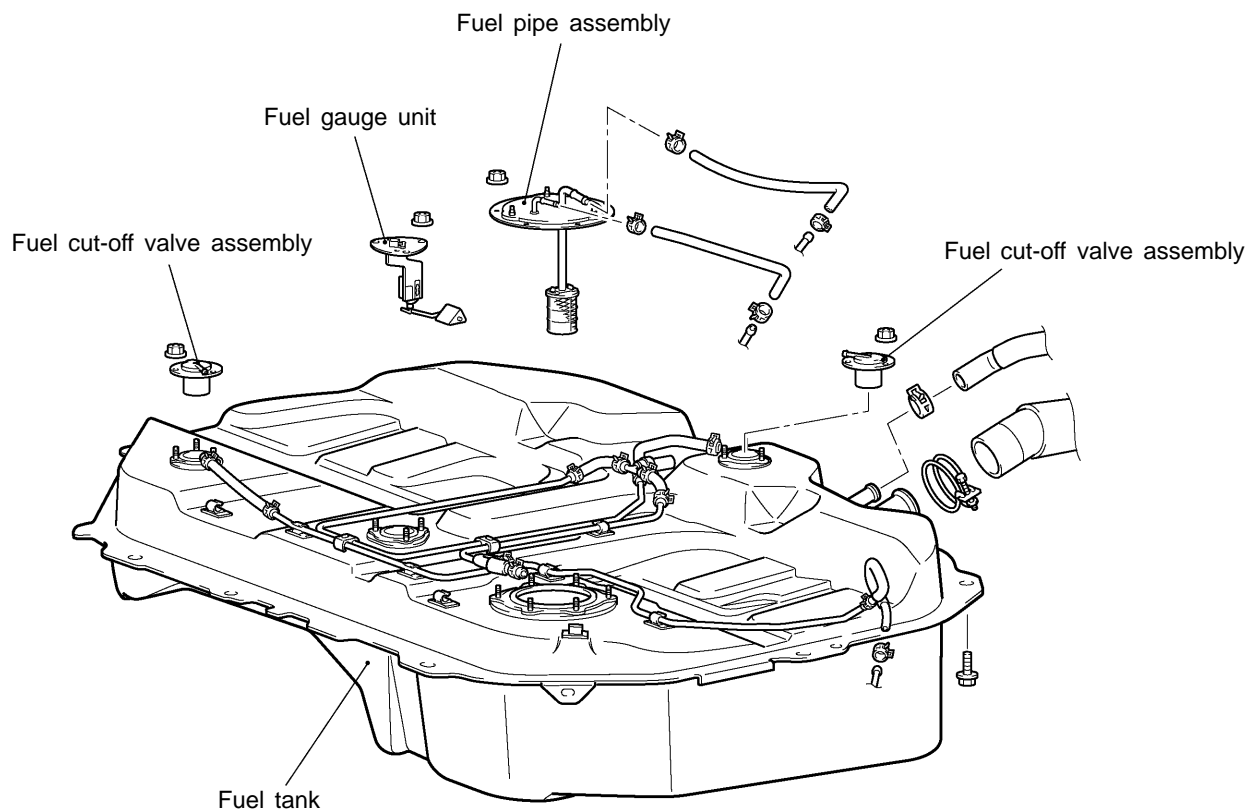
Items		2001 MY	2000 MY
Carburettor type		Variable venturi	Variable venturi
Throttle bore diameter mm		42	42
Main jet diameter mm		3	3
Chock mechanism	Type	Automatic (wax type, without chock valve)	Automatic (wax type, without chock valve)
	Breaker valve	Provided	Provided
	Fast idle	Provided	Provided
Devices	Unloader	Provided	Provided
	Fuel cut solenoid valve	Provided	Provided
	Dash pot	Provided <A/T only>	Provided <A/T only>
Cold mixture heater		Not provided	Not provided
Cold advance angle control		Not provided	Not provided
Idle advance angle control		Provided	Not provided
Deceleration advance angle control		Provided	Provided

FUEL TANK

A steel fuel tank is located under the floor of the rear seats to provide increased safety and increase the amount of luggage compartment space.

The fuel tank has been equipped with a valve assembly which incorporates a fuel cut-off valve to prevent fuel from leaking out in the event of a collision for adjusting the pressure inside the fuel tank.

CONSTRUCTION DIAGRAM



AY1259AU

FUEL SYSTEM <MPI>

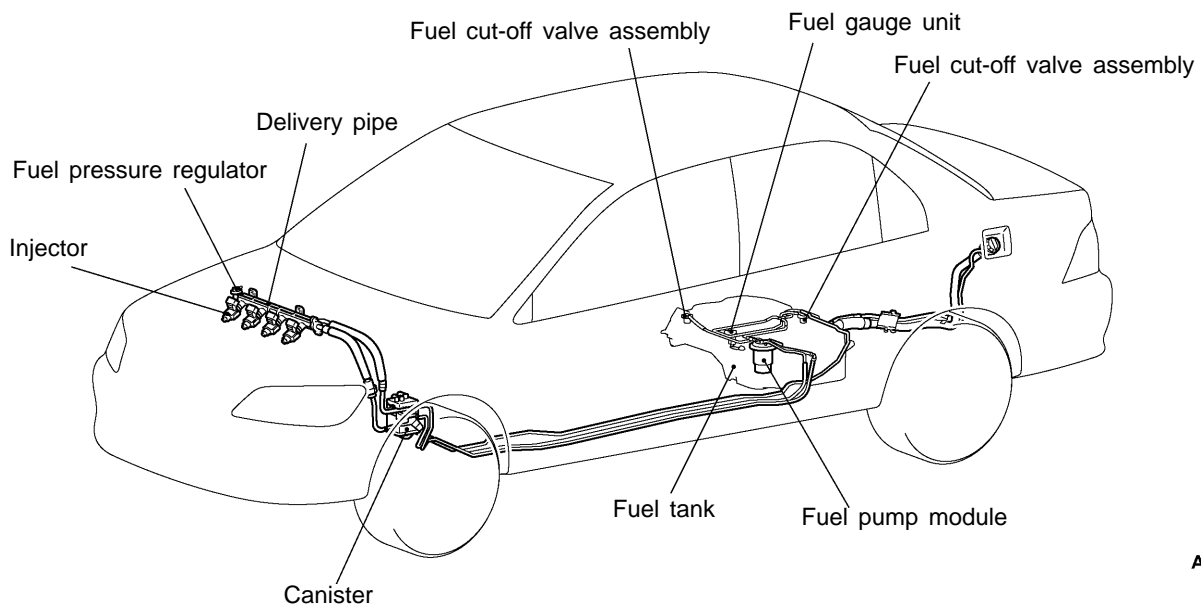
The fuel system is composed of the fuel injector, delivery pipe, fuel pressure regulator, electric fuel pump, fuel hose and pipe, fuel filter and a fuel tank, etc.

The system is essentially the same as that for conventional 4G1 engines.

SPECIFICATIONS

Items	2001 MY	2000 MY
Fuel tank capacity	50	50
Fuel filter type	Cartridge (filter-paper type)	Cartridge (filter-paper type)
Fuel pump type	Electric	Electric

CONSTRUCTION DIAGRAM



AY1256AU

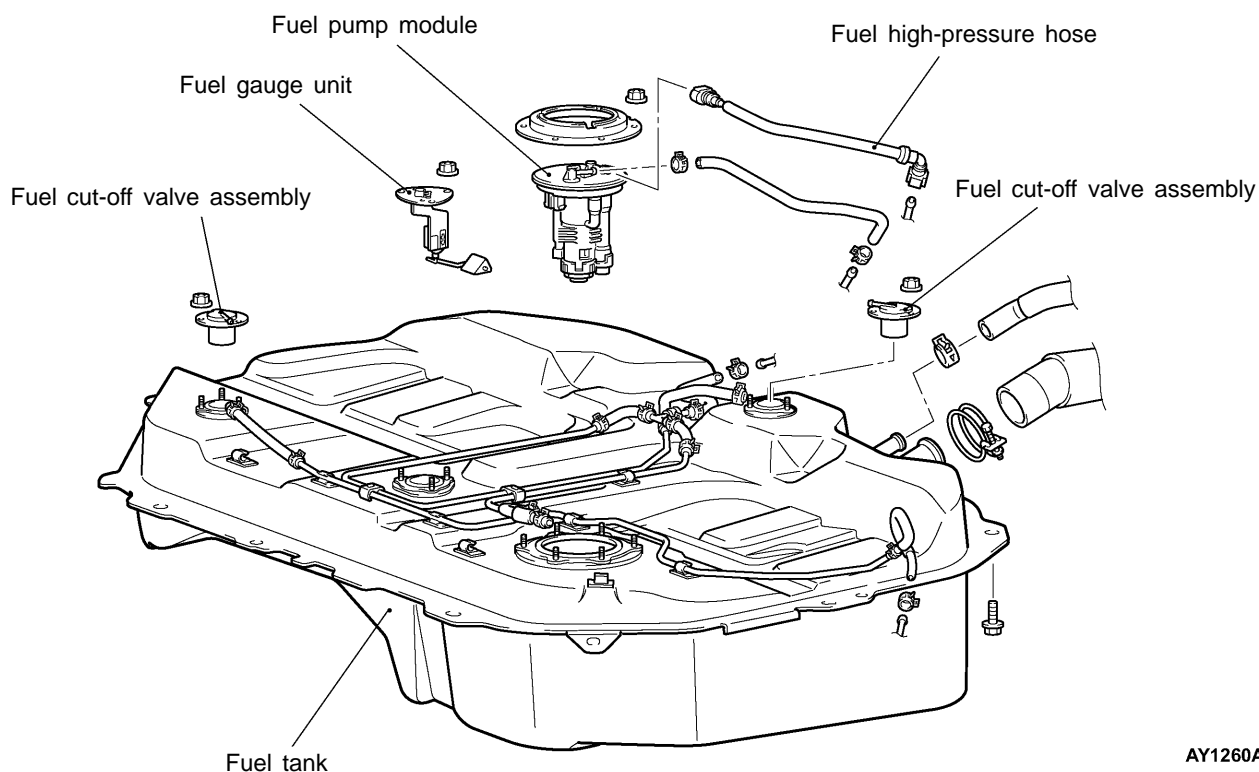
FUEL TANK

A steel fuel tank is located under the floor of the rear seats to provide increased safety and increase the amount of luggage compartment space.

- The fuel tank has been equipped with a valve assembly which incorporates a fuel cut-off valve to prevent fuel from leaking out in the event of a collision for adjusting the pressure inside the fuel tank.

- For better serviceability, the fuel tank has been coupled with the main line by a one-touch joint method, not the conventional double flare nut method.

CONSTRUCTION DIAGRAM



AY1260AU

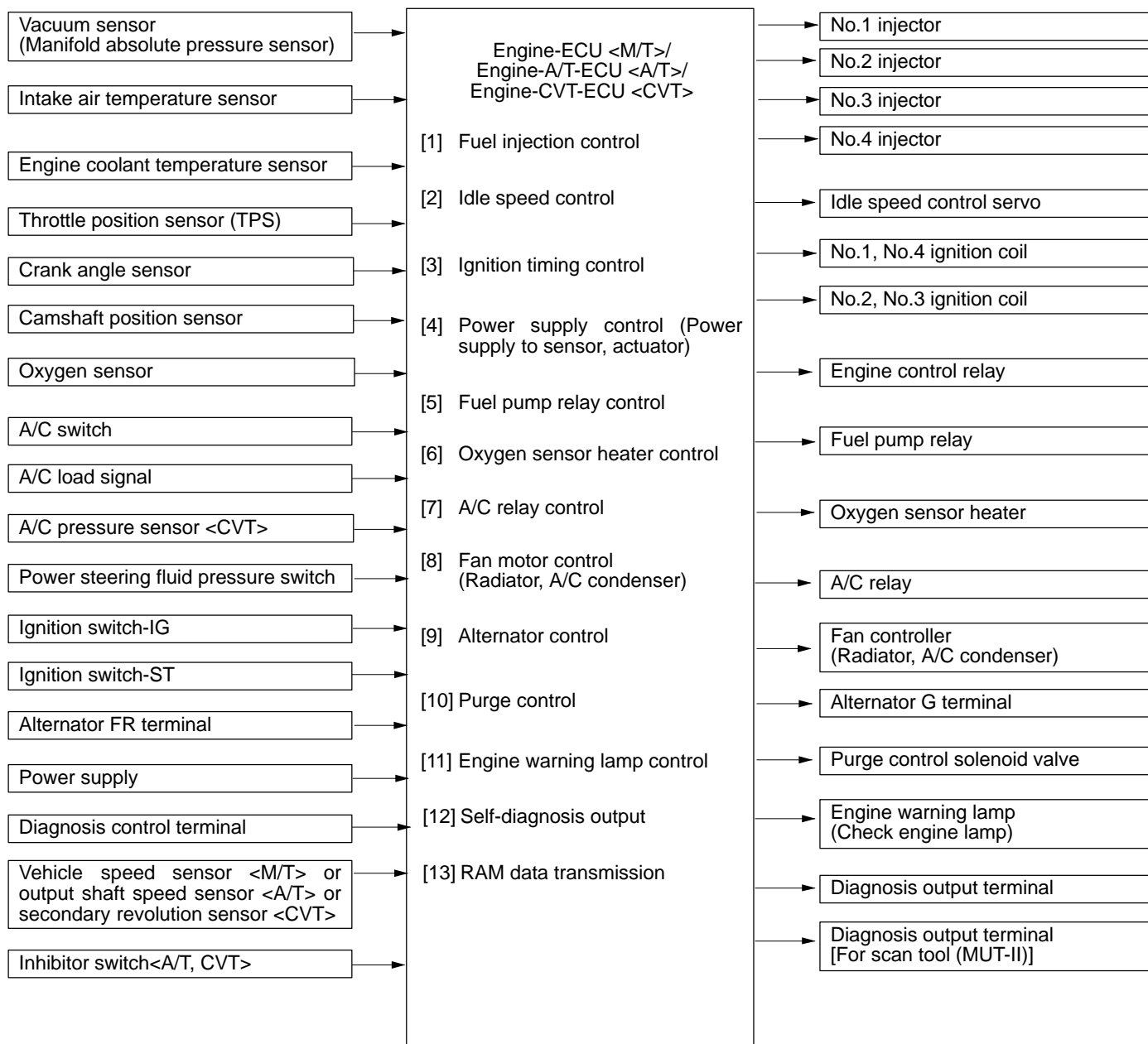
CONTROL SYSTEM <MPI>

The control system is based on the system for the 4G1-MPI engine installed in the COLT/LANCER, with the following improvements added.

Improvements/Additions	Remarks
Adoption of direct installation-type crank angle sensor and camshaft position sensor	<ul style="list-style-type: none"> Improved detection precision Basically the same as that used in the PAJERO io
Adoption of compact throttle position sensor	<ul style="list-style-type: none"> Smaller size and lighter weight Higher resistance to vibration Basically the same as that used in the PAJERO io
Adoption of compact stepper motor for idle speed control servo	<ul style="list-style-type: none"> Smaller size and lighter weight Basically the same as that used in the PAJERO io
Adoption of plug top-type ignition coils	<ul style="list-style-type: none"> Improved ignition performance Basically the same as that used in the PAJERO io
Adoption of PWM (pulse width modulation) method of fan motor control	<ul style="list-style-type: none"> Reduced fuel consumption Reduced fan noise Basically the same as that used in the PAJERO io
Vacuum sensor (manifold absolute pressure sensor) has been mounted on the intake manifold directly. In addition, the intake air temperature sensor has been integrated in this vacuum sensor.	<ul style="list-style-type: none"> Simplified system components. Basically the same as that used in the PAJERO io
Adoption of 32bit integrated ECU integrating CPUs for engine control and transmission control<A/T, CVT>	<ul style="list-style-type: none"> Engine control performance has been improved by high calculation speed. High speed engine and transmission integrated control.

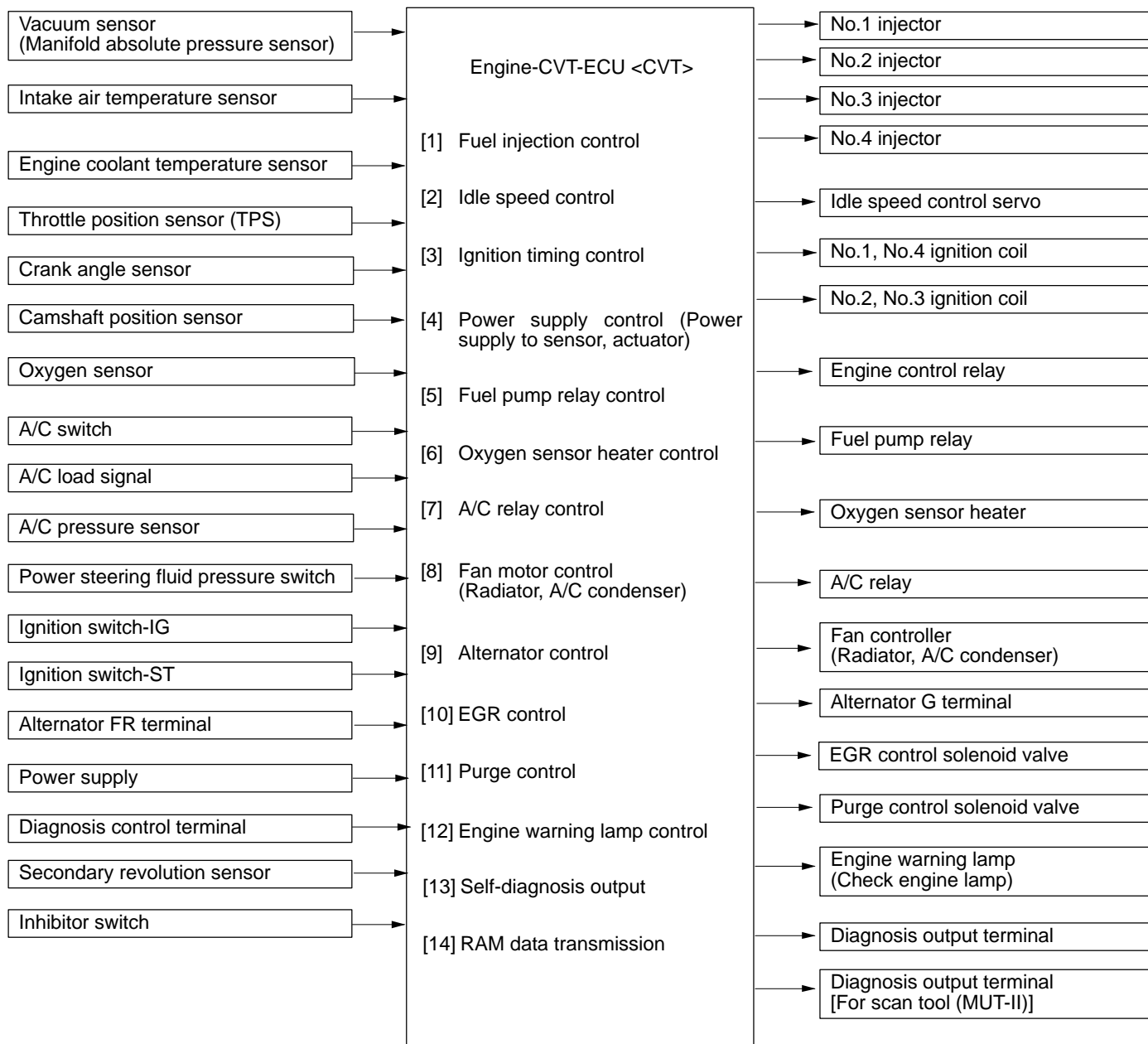
SYSTEM BLOCK DIAGRAM

<General Export – except CS3ASTJEQR>



ENGINE <4G1-CARBURETTOR, MPI> – Control System

<General Export – CS3ASTJEQR and China>

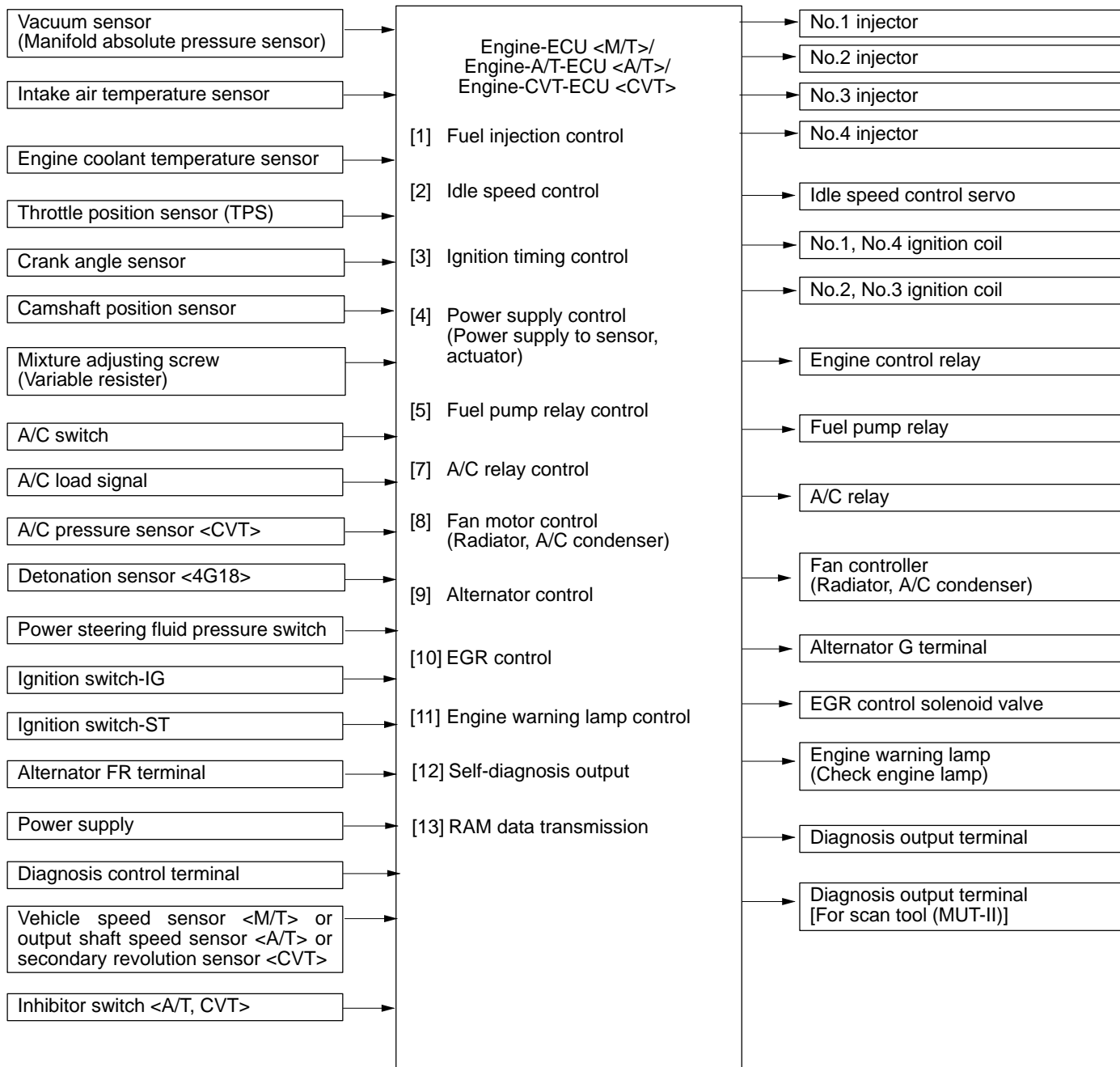


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ENGINE <4G1-CARBURETTOR, MPI> – Control System

<GCC>



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CONTROL SYSTEM DIAGRAM

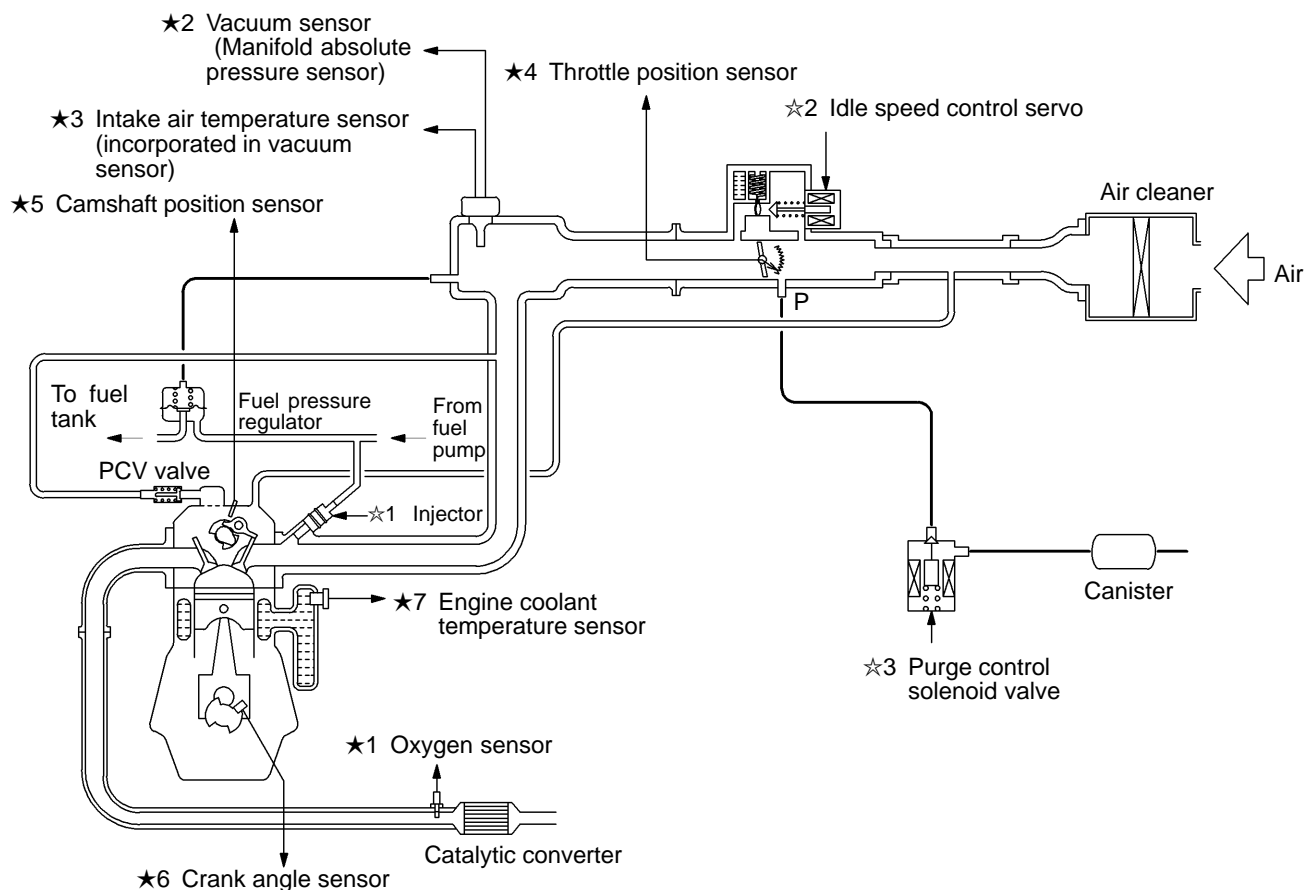
<General Export – except CS3ASTJEQR>

- ★1 Oxygen sensor
 - ★2 Vacuum sensor (Manifold absolute pressure sensor)
 - ★3 Intake air temperature sensor
 - ★4 Throttle position sensor
 - ★5 Camshaft position sensor
 - ★6 Crank angle sensor
 - ★7 Engine coolant temperature sensor
-
- Power supply
 - Ignition switch-IG
 - Ignition switch-ST
 - Vehicle speed sensor
 - A/C switch
 - A/C pressure sensor <CVT>
 - A/C load signal
 - Power steering fluid pressure switch
 - Alternator FR terminal
 - Vehicle speed sensor <M/T> or output shaft speed sensor <A/T> or secondary revolution sensor<CVT>
 - Inhibitor switch <A/T, CVT>

Engine-ECU <M/T>/
Engine-A/T-ECU <A/T>/
Engine-CVT-ECU <CVT>

- ★1 Injector
- ★2 Idle speed control servo
- ★3 Purge control solenoid valve

- Engine control relay
- Fuel pump relay
- A/C relay
- Ignition coil
- Fan controller
- Alternator G terminal
- Engine warning lamp
- Diagnosis output



ENGINE <4G1-CARBURETTOR, MPI> – Control System

<General Export – CS3ASTJEQR and China>

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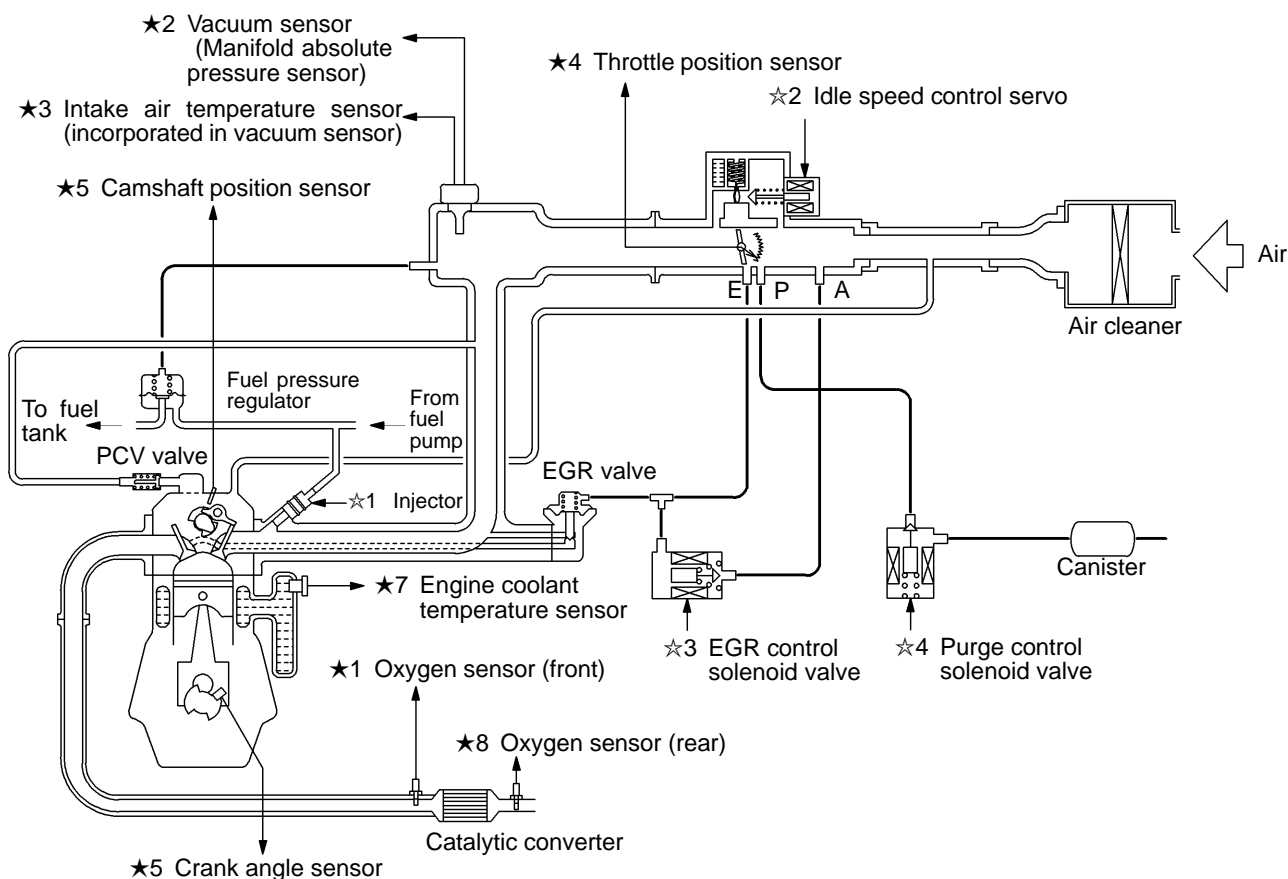
- ★1 Oxygen sensor (front)
- ★2 Vacuum sensor (Manifold absolute pressure sensor)
- ★3 Intake air temperature sensor
- ★4 Throttle position sensor
- ★5 Camshaft position sensor
- ★6 Crank angle sensor
- ★7 Engine coolant temperature sensor
- ★8 Oxygen sensor (rear)

- Power supply
- Ignition switch-IG
- Ignition switch-ST
- A/C switch
- A/C pressure sensor (CVT)
- A/C load signal
- Power steering fluid pressure switch
- Alternator FR terminal
- Secondary revolution sensor
- Inhibitor switch

Engine-CVT-ECU

- ★1 Injector
- ★2 Idle speed control servo
- ★3 EGR control solenoid valve
- ★4 Purge control solenoid valve

- Engine control relay
- Fuel pump relay
- A/C relay
- Ignition coil
- Fan controller
- Alternator G terminal
- Engine warning lamp
- Diagnosis output



VC110011

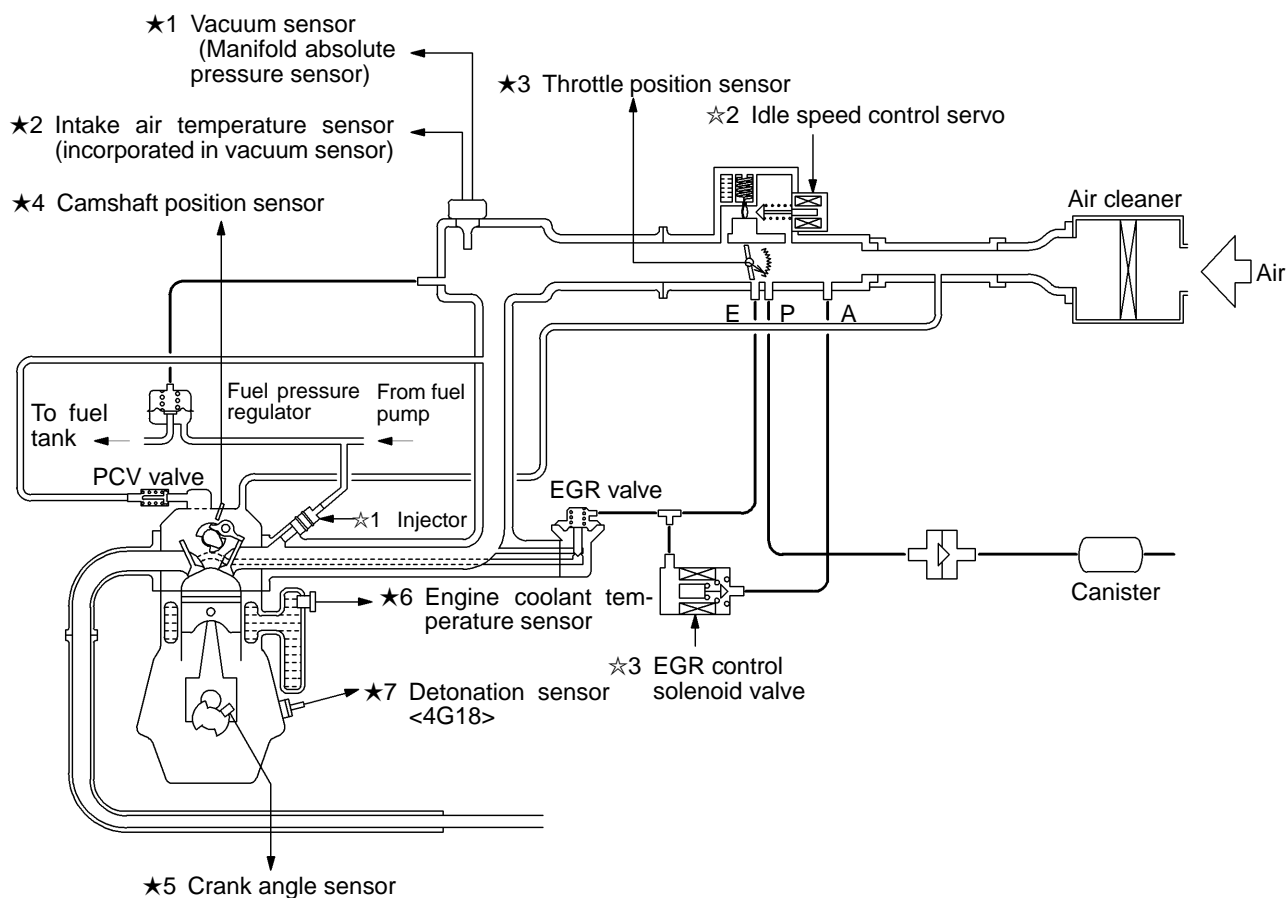
ENGINE <4G1-CARBURETTOR, MPI> – Control System

<GCC>

- ★1 Vacuum sensor (Manifold absolute pressure sensor)
 - ★2 Intake air temperature sensor
 - ★3 Throttle position sensor
 - ★4 Camshaft position sensor
 - ★5 Crank angle sensor
 - ★6 Engine coolant temperature sensor
 - ★7 Detonation sensor <4G18>
-
- Power supply
 - Ignition switch-IG
 - Ignition switch-ST
 - A/C switch
 - A/C pressure sensor <CVT>
 - A/C load signal
 - Mixture adjusting screw (Variable resistor)
 - Power steering fluid pressure switch
 - Alternator FR terminal
 - Vehicle speed sensor <M/T> or output shaft speed sensor <A/T> or secondary revolution sensor <CVT>
 - Inhibitor switch

Engine-ECU <M/T>/
Engine-A/T-ECU <A/T>/
Engine-CVT-ECU <CVT>

- ★1 Injector
 - ★2 Idle speed control servo
 - ★3 EGR control solenoid valve
-
- Engine control relay
 - Fuel pump relay
 - A/C relay
 - Ignition coil
 - Fan controller
 - Alternator G terminal
 - Engine warning lamp
 - Diagnosis output



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LIST OF COMPONENT FUNCTIONS

Name		Function
ECU	Engine-ECU <M/T> Engine-A/T-ECU <A/T> Engine-CVT-ECU <CVT>	Uses the signals input from the various sensors to control operation of actuators in accordance with the driving conditions.
Sensors	Ignition switch-IG	Detects the ON/OFF position of the ignition switch. When this signal is input to the ECU, power is supplied to components such as the injectors, air flow sensor, idle speed control servo and crank angle sensor.
	Ignition switch-ST	Detects whether the engine is cranking. The ECU controls the fuel injection, throttle valve opening angle and ignition timing to the appropriate settings based on this signal.
	Vacuum sensor (Manifold absolute pressure sensor)	Detects the pressure inside the intake manifold by means of a semiconductor-type pressure sensor.
	Oxygen sensor <General Export and China>	Detects the concentration of oxygen in the exhaust gas by means of zirconia and platinum electrodes. The ECU judges whether the air/fuel mixture ratio is at the optimum theoretical ratio based on this concentration.
	Intake air temperature sensor	Detects the temperature of the intake air by means of a thermistor. The ECU corrects the fuel injection amount to the correct amount corresponding to the intake air temperature based on the voltage output from this sensor.
	Engine coolant temperature sensor	Detects the temperature of the engine coolant by means of a thermistor. The ECU detects how warm the engine is based on the signal from this sensor, and uses this to control the fuel injection amount, idle speed and ignition timing.
	Throttle position sensor	Detects the throttle valve opening angle by means of a potentiometer. The ECU controls the throttle valve and also determines the optimum fuel injection for the vehicle's degree of acceleration based on the voltage output from this sensor.
	Vehicle speed sensor <M/T>	Detects the vehicle speed by means of a magnetic rheostatic element.
	Output shaft speed sensor* <A/T>	Converts the output shaft speed sensor signal to the vehicle speed signal, and uses it for engine control.
	Secondary revolution sensor* <CVT>	Converts the secondary revolution sensor signal to the vehicle speed signal, and uses it for engine control.
	Detonation sensor <GCC-4G18>	Detects cylinder block vibration when knocking is generated by the piezoelectric element. The ECU controls retardation of the ignition timing according to the knocking strength.
	Camshaft position sensor	Detects the No. 1 cylinder compression top dead centre position by means of a magnetic rheostat element.
	Crank angle sensor	Detects the crank angle by means of a Hall element. The ECU controls the injectors based on the signal from this sensor.
	Alternator FR terminal	Detects the energising duty ratio of the alternator field coil.

*: Refer to "Transmission" section.

ENGINE <4G1-CARBURETTOR, MPI> – Control System

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Name		Function
Sensors	Power steering fluid pressure switch	Detects whether there is a power steering load present by means of a contact switch.
	A/C switch	Detects the ON/OFF condition of the A/C.
	A/C load signal	A/C Inputs the drive state of the compressor (low load/high load) to the ECU. The ECU controls the A/C idle-up engine speed using this signal.
	A/C pressure sensor <CVT>	A/C Detects the refrigerant pressure and inputs the drive state of the A/C compressor to the ECU.
	Inhibitor switch* <A/T, CVT>	Detects the Park and Neutral positions of the A/T selector lever.
	Diagnosis control terminal	If diagnosis codes have been stored in memory, they can be displayed through the flashing of the engine warning lamp by connecting this terminal to the vehicle earth.
Actuators	Engine control relay	Turns the ECU power circuit on and off.
	Injector	Drives the fuel injection by means of drive signals from the ECU.
	Ignition coil (with power transistor)	Interrupts the ignition coil primary current in accordance with the ignition signals from the ECU, in order to generate a high voltage for ignition.
	Idle speed control (ISC) servo	The throttle valve bypass air amount during idling and deceleration is controlled with the signal from the ECU.
	EGR control solenoid valve <General Export – CS3ASTJEQR and GCC>	Controls the EGR flow volume by means of signals from the ECU.
	Fuel pump relay	Controls the drive condition of the fuel pump.
	Fan controller	Controls the radiator and condenser fan speeds smoothly by means of signals from the ECU.
	Purge control solenoid valve <General Export and China>	Controls the amount of purge air introduced to the air intake plenum by means of signals from the ECU.
	Alternator G terminal	Controls the amount of power generated by the alternator by means of signals from the ECU.
	A/C relay	Controls the operation of the A/C compressor.
	Engine warning lamp	Illuminates to notify the driver of any abnormalities when a problem occurs with any of the sensors. Also flashes in order to output diagnosis codes.

*: Refer to “Transmission” section.

SENSOR

THROTTLE POSITION SENSOR (TPS)

- A lightweight and compact TPS has been adopted for excellent vibration resistance.
- The control logic for the main TPS signal has enabled the idle position switch to be abolished. Furthermore, the ECU detects the idle position from the TPS signal and outputs an idle position switch signal to the necessary systems (such as the A/T).

FUEL INJECTION CONTROL

The fuel injection control system is basically the same as the control system for the 4G1-MPI engine installed in the PAJERO io.

System Configuration Diagram

Vacuum sensor (Manifold absolute pressure sensor)

Intake air temperature sensor

Engine coolant temperature sensor

Throttle position sensor

Crank angle sensor

Camshaft position sensor

Vehicle speed signal

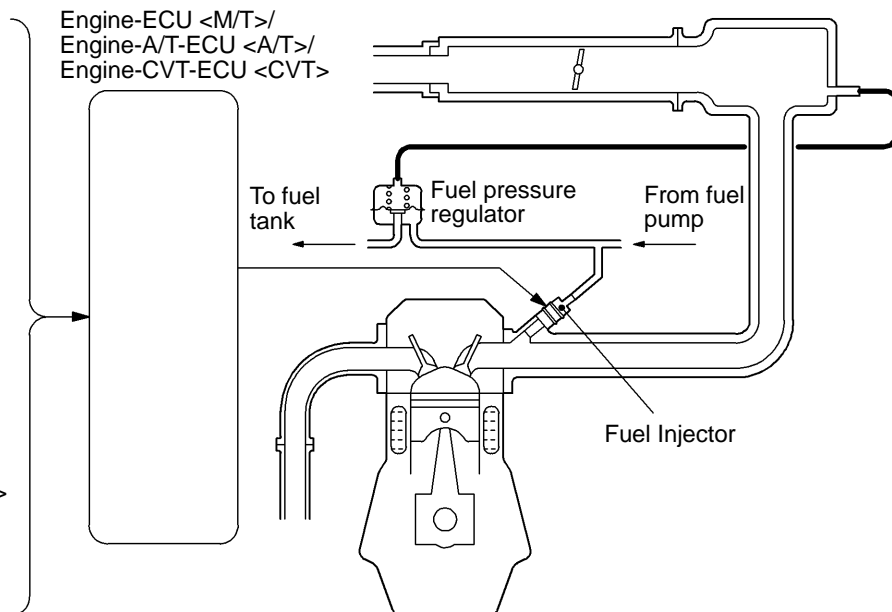
Detonation sensor <GCC-4G18>

Ignition switch-ST

Oxygen sensor <General Export and China>

Mixture adjusting screw (variable resistor) <GCC>

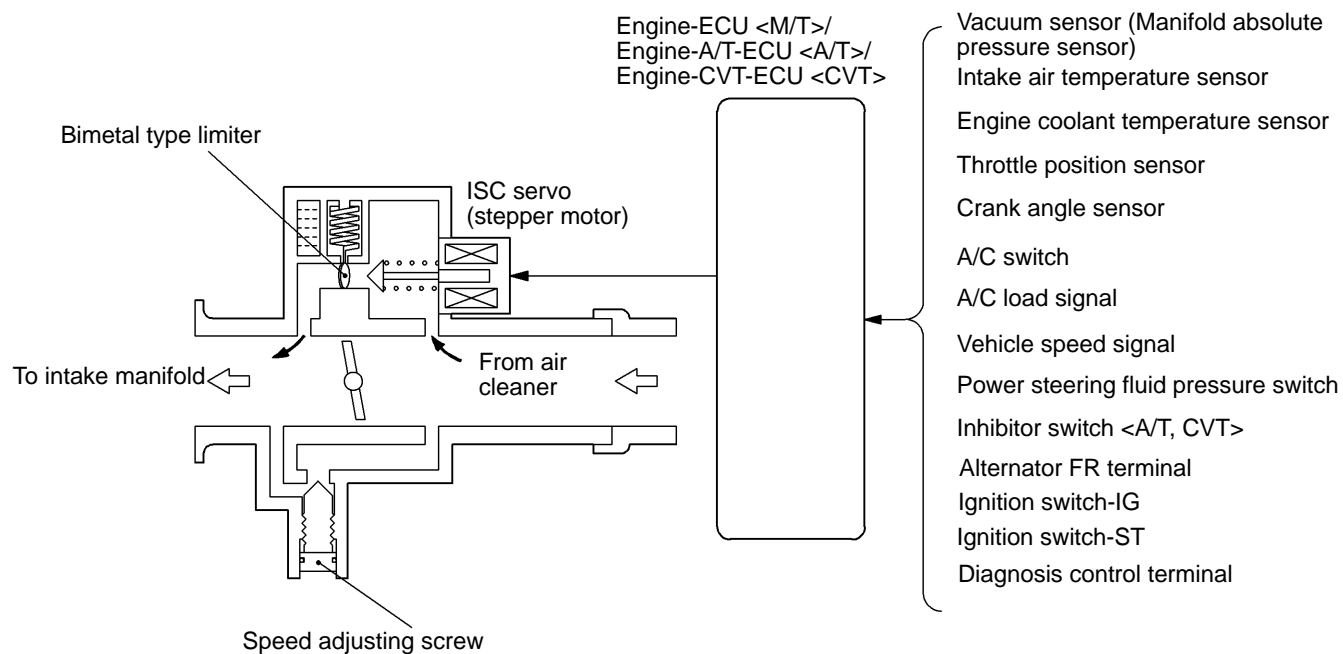
Engine-ECU <M/T>/
Engine-A/T-ECU <A/T>/
Engine-CVT-ECU <CVT>



IDLE SPEED CONTROL (ISC)

The idle speed control system is basically the same as the control system for the 4G1-MPI engine installed in the PAJERO io.

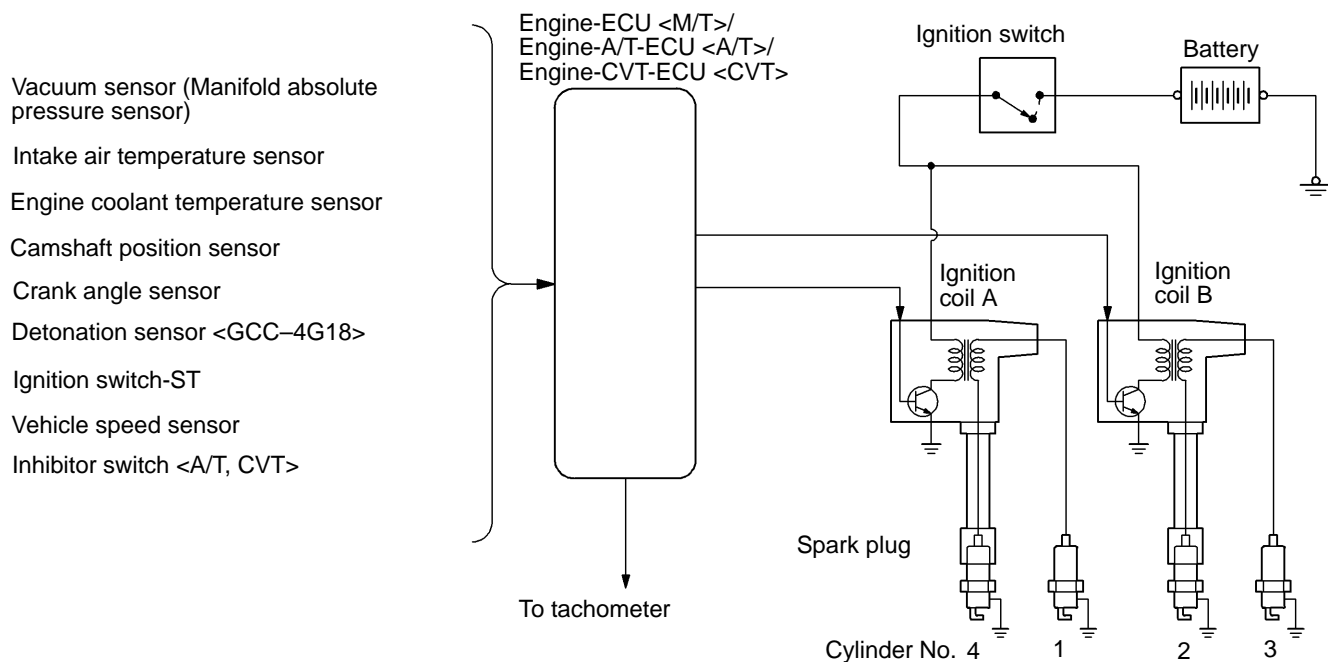
System Configuration Diagram



IGNITION TIMING AND DISTRIBUTION CONTROL

The ignition timing and distribution control system is basically the same as the control system for the 4G1-MPI engine installed in the PAJERO io.

System Configuration Diagram



Y 6 1 2 7 A U

RELAY CONTROL (ENGINE CONTROL, FUEL PUMP), A/C RELAY CONTROL, ALTERNATOR CONTROL, ENGINE/TRANSMISSION TOTAL CONTROL

These control systems are basically the same as the control systems for the 4G1-MPI engine which has been installed in the COLT/LANCER.

OXYGEN SENSOR HEATER CONTROL, FAN MOTOR CONTROL

These control systems are basically the same as the control systems for the 4G1-MPI engine installed in the PAJERO io.

DIAGNOSIS SYSTEM

The engine-ECU <M/T>/engine-A/T-ECU <A/T>/engine-CVT-ECU <CVT> is provided with the following functions to make system inspection easier.

Diagnosis Code and Engine Warning Lamp (Check Engine Lamp) Items

The diagnosis items and engine warning lamp illumination items are shown in the following table.

Code No.	Diagnosis items	Main diagnosis contents	Engine warning lamp
13	Intake air temperature sensor system	Open circuit or short-circuit in sensor related circuits	ON
14	Throttle position sensor system	Open circuit or short-circuit in sensor related circuits	ON
21	Engine coolant temperature sensor system	<ul style="list-style-type: none"> Open circuit or short-circuit in sensor related circuits Excessive connector contact resistance 	ON
22	Crank angle sensor system	Abnormal sensor output	ON
23	Camshaft position sensor system	Abnormal sensor output	ON
24	Vehicle speed sensor system <M/T>	Open circuit or short-circuit in sensor related circuits	-
	Vehicle speed signal system <A/T, CVT>	Abnormal signal input	-
31	Detonation sensor system <GCC-4G18>	Abnormal sensor output	-
32	Vacuum sensor (manifold absolute pressure sensor) system	Open circuit or short-circuit in sensor related circuits	ON
41	Injector system	Open circuit in injector related circuits	ON
44	Ignition coil (power transistor) system	Abnormal ignition system (one of two coils failed)	ON
54	Immobilizer system <GCC>	Open circuit or short-circuit in sensor related circuits	-
64	Alternator FR terminal system	Open circuit or short-circuit in system related circuits	-
-	Engine-ECU <M/T>, or engine-A/T-ECU <A/T> or engine-CVT-ECU <CVT>	Abnormality in engine-ECU <M/T>, or engine-A/T-ECU <A/T> or engine-CVT-ECU <CVT>	ON

Data List Output

The service data output items are shown in the following table.

Item No.	Data list items	Units
11	Oxygen sensor (front) <General Export and China>	mV
13	Intake air temperature sensor	°C
14	Throttle position sensor	mV
16	Battery voltage	mV
18	Cranking signal (ignition switch-ST)	ON – OFF
21	Engine coolant temperature sensor	°C
22	Crank angle sensor	r/min
24	Vehicle speed sensor <M/T> or vehicle speed signal <A/T, CVT>	km/h
27	Power steering fluid pressure switch	ON – OFF
28	A/C switch	ON – OFF
32	Vacuum sensor (manifold absolute pressure sensor)	kPa
41	Injector	ms
44	Ignition advance	BTDC
45	Idle speed control motor position	STEP
49	A/C relay	ON – OFF
59	Oxygen sensor (rear) <General Export – CS3ASTJEQR and China>	mV

Actuator Tests

The actuator test items are shown in the following table.

Item No.	Actuator test items
01	No.1 injector: OFF
02	No.2 injector: OFF
03	No.3 injector: OFF
04	No.4 injector: OFF
07	Fuel pump: ON
08	Purge control solenoid valve <General Export and China>: ON
10	EGR control solenoid valve <General Export – CS3ASTJEQR, China and GCC>: ON
17*	Basic ignition timing: 5° BTDC
21	Fan controller: Radiator fan and A/C condenser fan operate at high speed.
30*	Fix idle speed control servo: Fixed at reference step when SAS adjustment is to be made.

NOTE

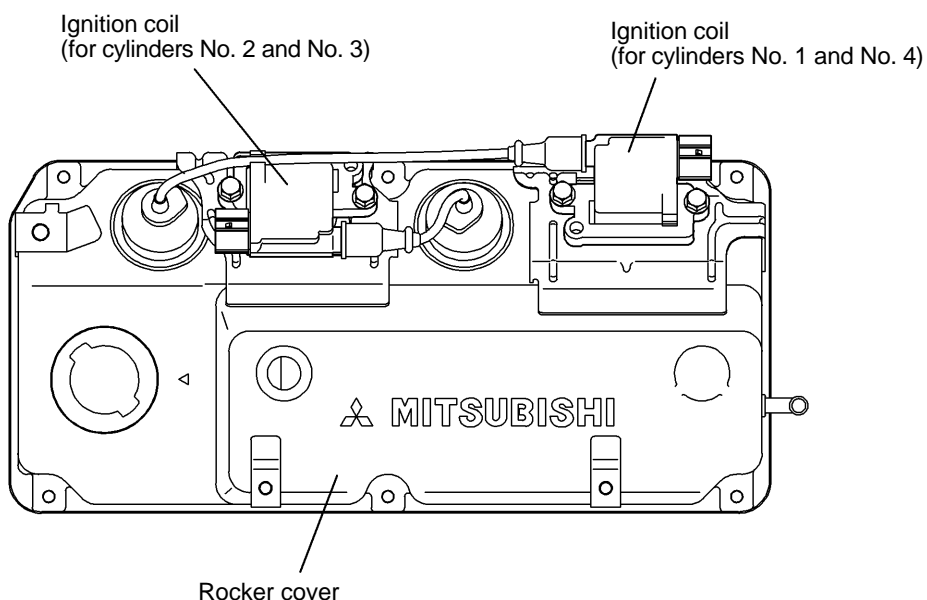
*: Continues for 27 minutes. Can be released by pressing the CLEAR key.

ELECTRIC SYSTEM

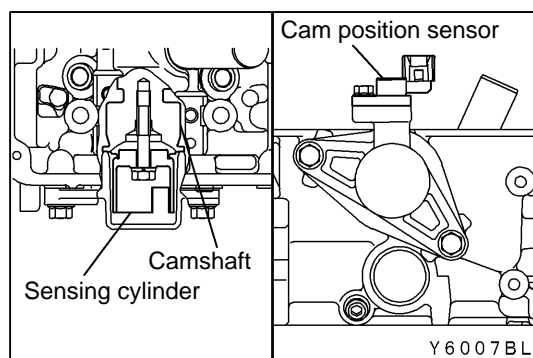
IGNITION COIL <MPI>

The built-in distributor method has been changed to the 2-coil ignition distribution method to improve ignition performance.

The wiring has been simplified and made lighter with the adoption of the plug-on type ignition coil with built-in power transistor.

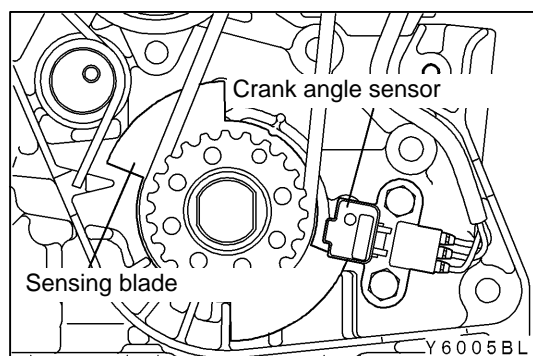


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CAM POSITION SENSOR <MPI>

A method which detects with the sensing cylinder installed at the back of the camshaft has been adopted.



CRANK ANGLE SENSOR <MPI>

The crank angle detection accuracy has been improved for direct detection of the crankshaft position using the sensing plate installed to the crankshaft.

**EMISSION CONTROL SYSTEM <VARIABLE VENTURI
CARBURETTOR>**

The emission control system is essentially the same as the one for the conventional 4G1 engine which has been installed in the MIRAGE/LANCER.

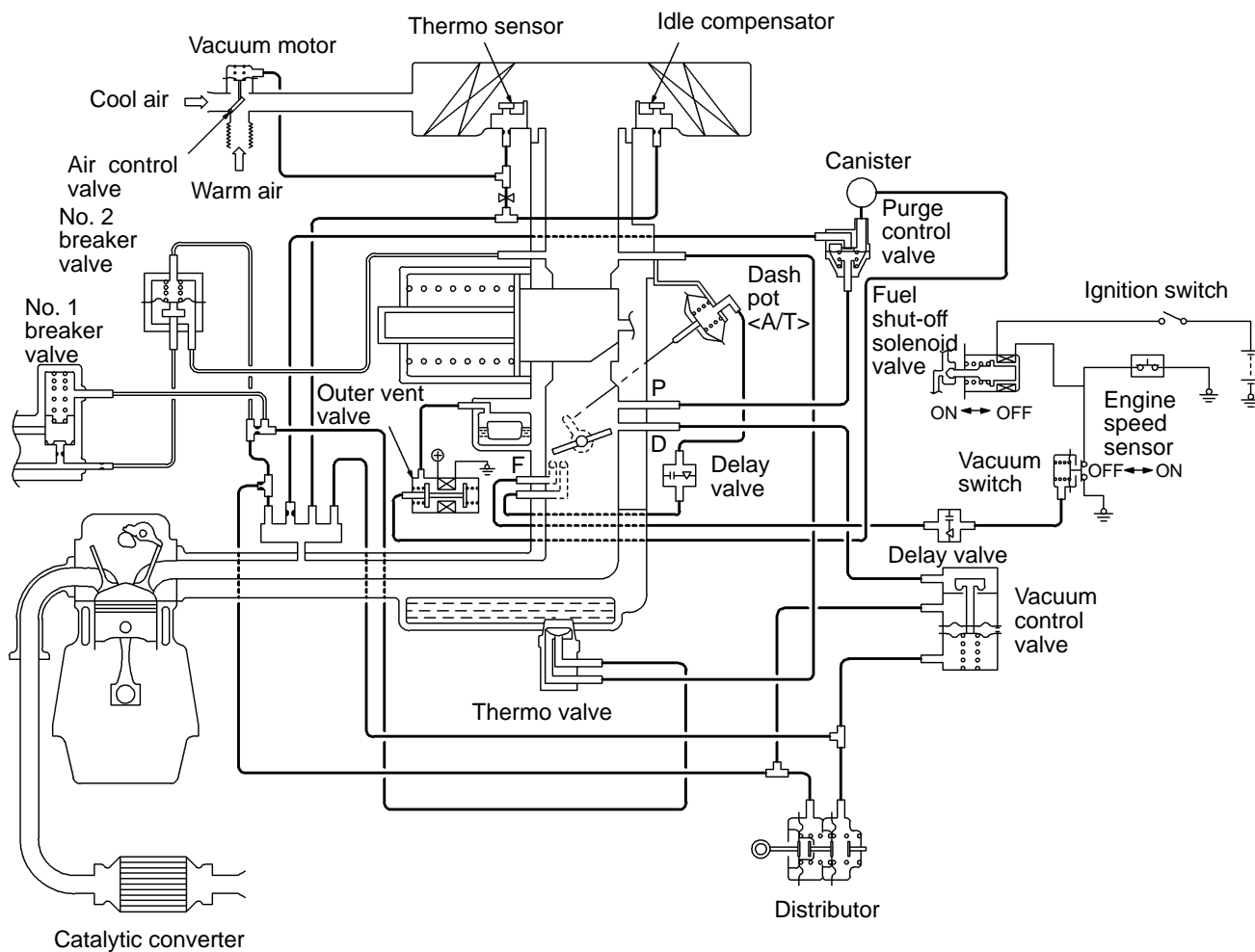
System	Vehicles with catalytic converter	Vehicles without catalytic converter	Remarks
Crankcase ventilation system	×	×	Closed type
Evaporative emission control system	×	×	Carburettor purge port vacuum control type
Intake air temperature control system	×	×	Vacuum control type
Fuel shut-off device at deceleration	×	-	Vacuum switch and engine speed sensor control type
Outer vent valve	×	×	Electronic control type (ON-OFF type solenoid valve with temperature control)
Idle compensator	×	×	Bimetal type
Catalytic converter	×	-	Oxidizing catalyst

EMISSION CONTROL SYSTEM DIAGRAM

<Vehicles with catalytic converter>

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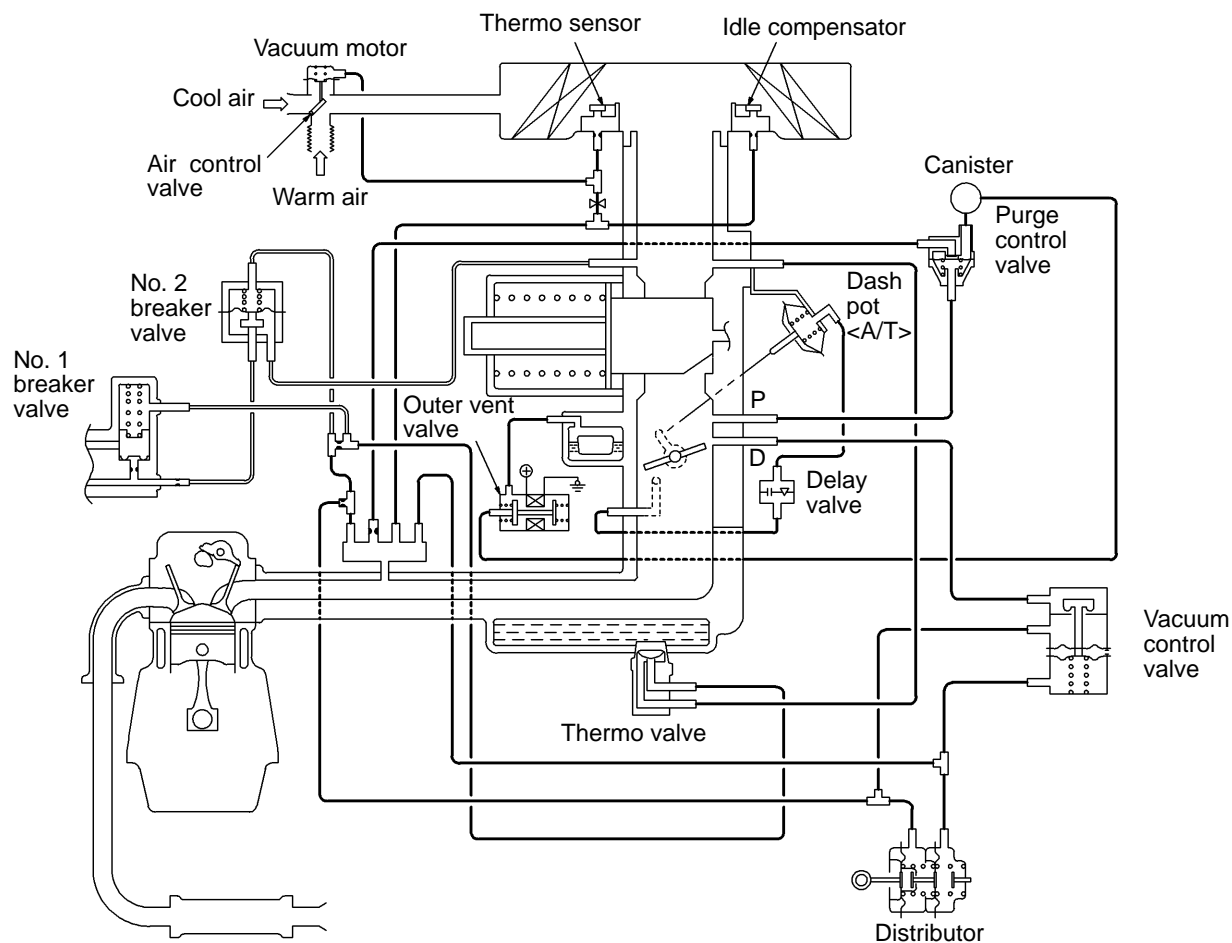


Y6130AU

<Vehicles without catalytic converter>

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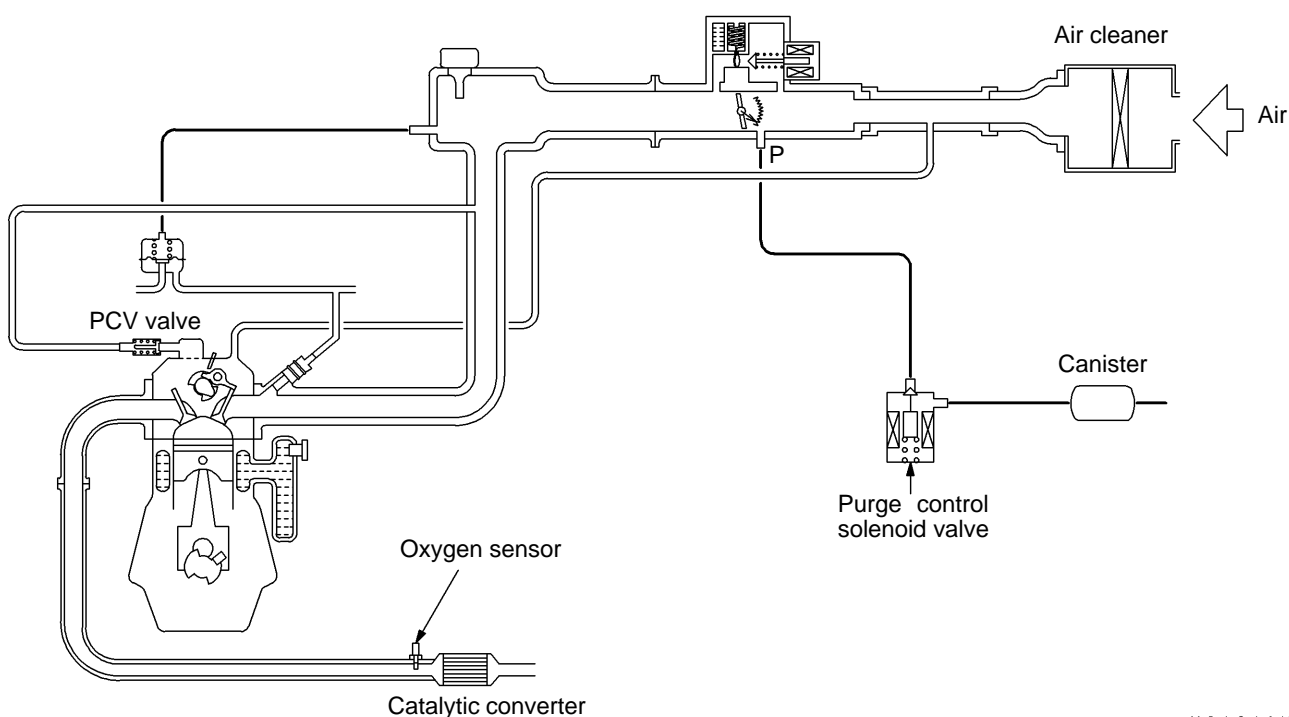
EMISSION CONTROL SYSTEM <MPI>

The emission control system is basically the same as the control system for the 4G1-MPI engine installed in the MIRAGE/LANCER.

System	General Export – except CS3ASTJEQR	General Export – except CS3ASTJEQR	GCC	Remarks
Crankcase ventilation system	×	×	×	Closed type
Evaporative emission control system	×	×	-	Electronic control type (ON-OFF type solenoid valve)
	-	-	×	Vacuum control type
Exhaust gas recirculation (EGR) system	-	×	×	Electronic control type (ON-OFF type solenoid valve)
Air/fuel ratio closed loop control system	×	×	-	Oxygen sensor signal used
Catalytic converter	×	×	-	Three-way catalyst

EMISSION CONTROL SYSTEM DIAGRAM

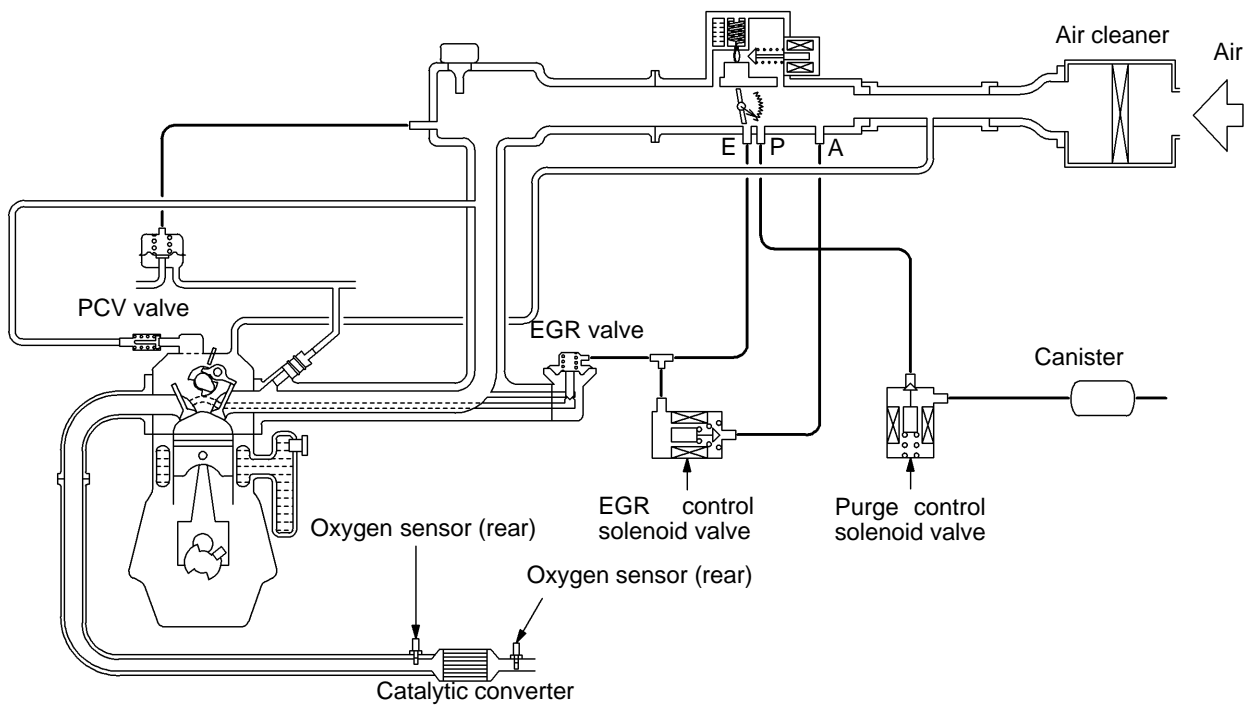
<General Export – except CS3ASTJEQR>



<General Export – CS3ASTJEQR>

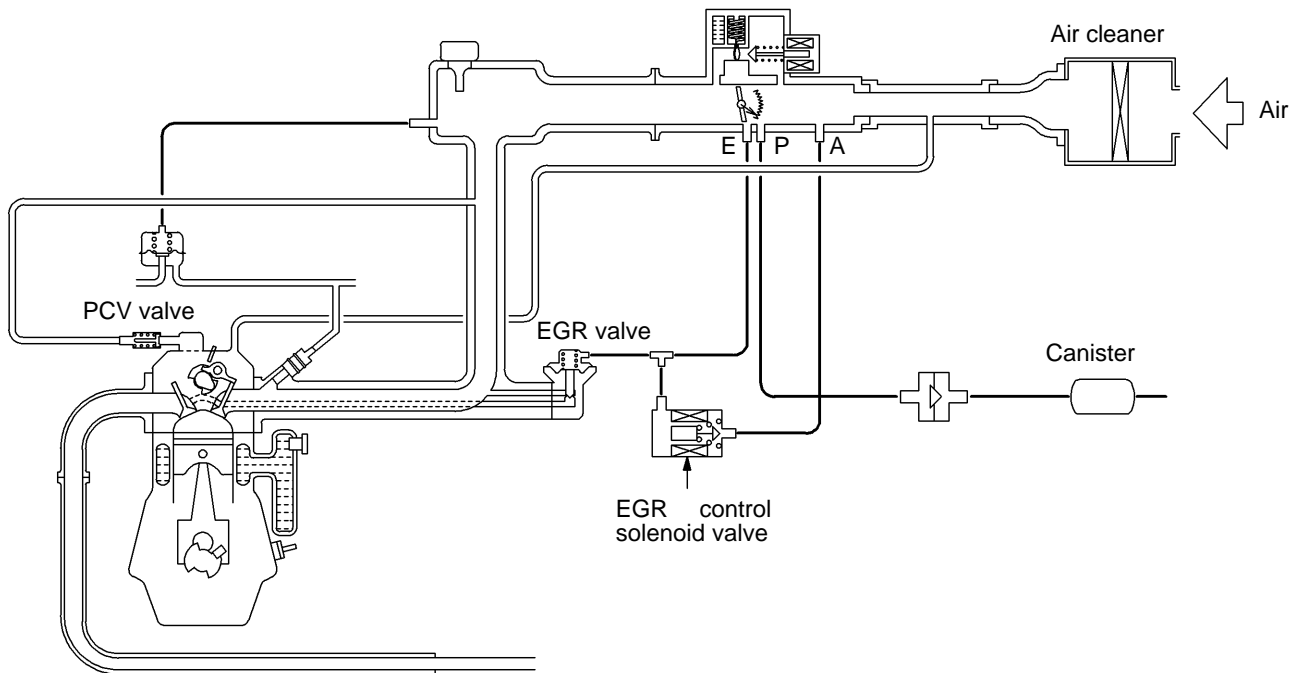
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Y6132AU

<GCC>



Y6133AU

MOUNT

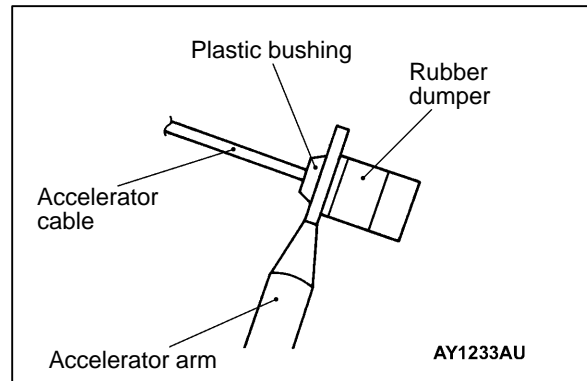
This component is basically the same as for 4G1-GDI engine ([Refer Also](#)).

ACCELERATOR SYSTEM

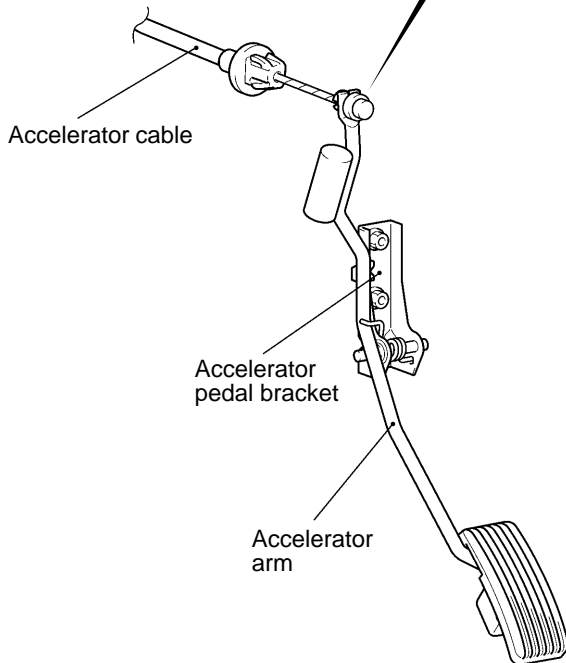
ACCELERATOR PEDAL AND ACCELERATOR CABLE

The accelerator system is a cable and suspended pedal combination. Plastic bushing and rubber dumper have been attached to the end of the accelerator cable, to pre-

vent noise and vibration when the cable and accelerator arm contact.



<L.H. drive vehicles>



<R.H. drive vehicles>

