

GROUP 00

GENERAL

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VEHICLE IDENTIFICATION

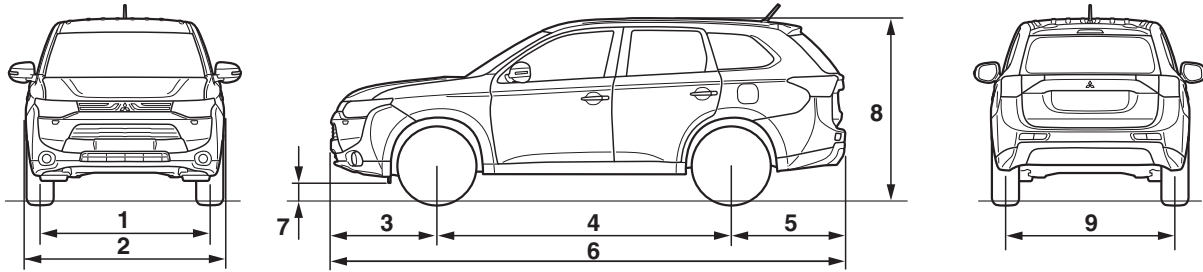
MODELS

M2000001101581

Model code		Seating capacity	Engine model	Transmission model	Fuel supply system
GF4W	XLHYZLAZ	5-persons	6B31 (2,998 mL) SOHC MIVEC petrol engine	W6AJA (Electronic control 4WD, INVECS-II 6A/T with sport mode)	MPI

MAJOR SPECIFICATIONS

M2000030003331



ACB04339AB

Item			GF4W
			XLHYZLAZ
Vehicle dimension mm	Front track	1	1,540
	Overall width	2	1,800
	Front overhang	3	955
	Wheelbase	4	2,670
	Rear overhang	5	1,030
	Overall length	6	4,655
	Ground clearance (unladen)	7	215
	Overall height (unladen)	8	1,680
	Rear track	9	1,540
Vehicle weight kg	Kerb weight	Without full optional parts	1,570
		With full optional parts	1,620
	Gross vehicle weight		2,270
	Gross axle weight rating-front		1,150
	Gross axle weight rating-rear		1,250
	Gross combination weight		3,950
Seating capacity			5
Engine	Model No.		6B31
	Type		SOHC MIVEC petrol engine
	Total displacement mL		2,998
	Max. output <EEC> kW/rpm		164/6,250
	Max. torque <EEC> N·m/rpm		284/3,750
Fuel system	Fuel supply system		MPI
Transmission	Model code		W6AJA
	Type		Electronic control 4WD, INVECS-II 6A/T with sport mode
Turning radius m	Body		5.73
	Wheel		5.3

NOTES

GROUP 11B

**ENGINE
MECHANICAL**

CONTENTS

GENERAL INFORMATION	11B-2	BASE ENGINE	11B-3
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GENERAL INFORMATION

M2112000102507

This vehicle is equipped with the newly developed 6B31 engine, a 3.0L V6 Single Over Head Camshaft (SOHC) 24-valve engine.

The features of this engine are as follows:

- The 3.0L engine employs the Mitsubishi Innovative Valve timing and lift Electronic Control system (MIVEC).
- An aluminium alloy cylinder block is used to be lightweight and compact.

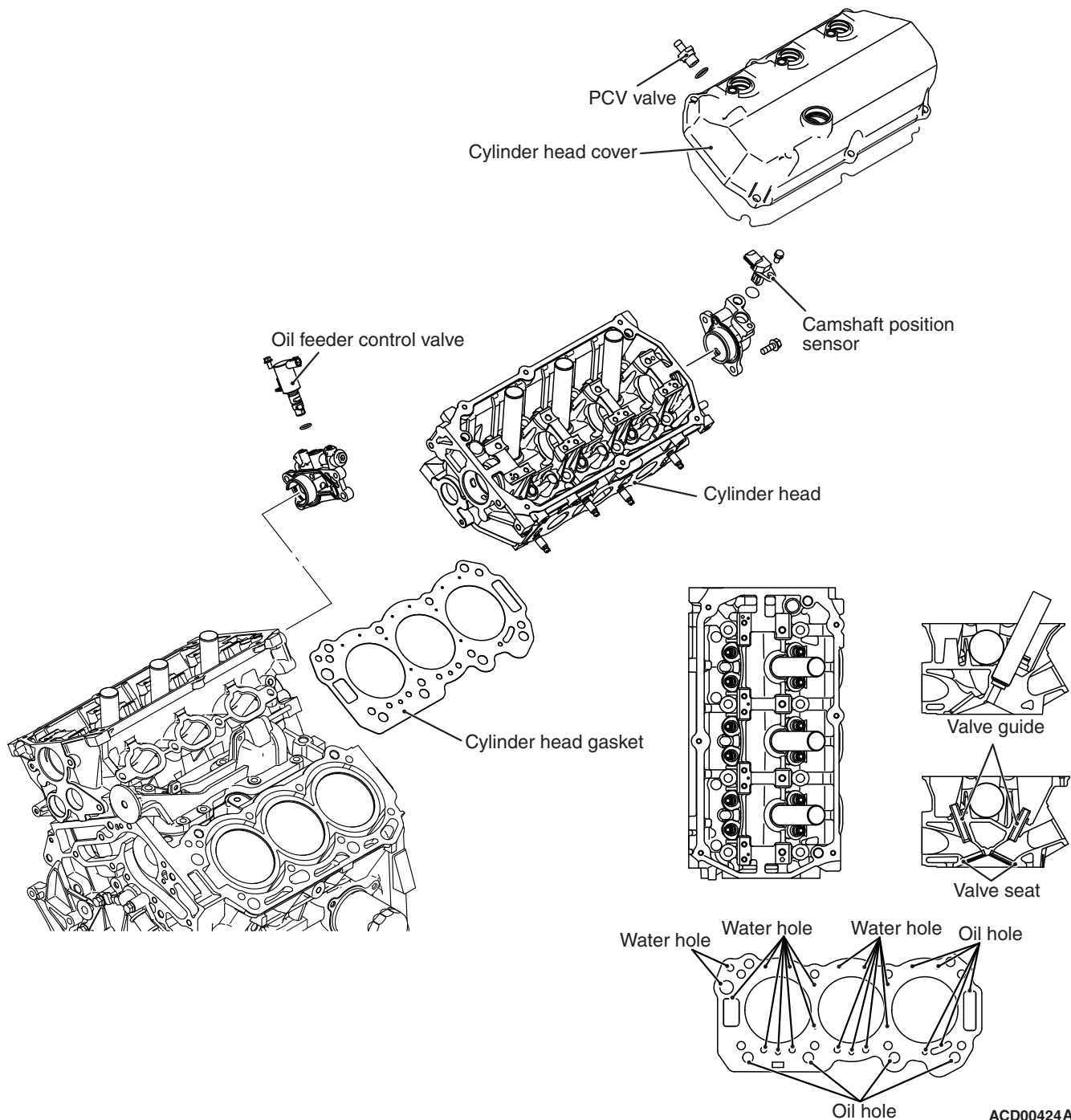
MAJOR SPECIFICATIONS

Item	Specifications
Engine model	6B31
Type	In-line OHV, SOHC
Number of cylinder	6
Combustion chamber shape	Pent roof
Total displacement mL	2,998
Cylinder bore mm	87.6
Piston stroke mm	82.9
Compression ratio	10.5
Lash adjuster	Exhaust side only
Fuel injection system	Electronic-controlled MPI
Ignition system	Electronic-controlled 6-coil

BASE ENGINE

M2112001002235

CYLINDER HEAD RELATION



ACD00424AB

1. ROCKER COVER

- A lightweight resin material is used for the cylinder gasket cover.

2. PCV valve

3. OIL FEEDER CONTROL VALVE

4. CAMSHAFT POSITION SENSOR

5. CYLINDER HEAD

- A cylinder head made of an aluminium alloy, which is lightweight and offers a high level of cooling efficiency, has been adopted. A pent roof combustion chamber with a centre spark plug has been adopted. It has a small valve compound angle to create a compact chamber. Cross-flow type inlet and exhaust ports have been adopted. Two inlet ports and two exhaust ports are provided independently on the right and left sides. Four camshaft bearings are provided at the inlet and exhaust sides, respectively. The No. 4 bearing sustains the thrust load of the camshaft.

6. CYLINDER HEAD GASKET

- A 2.5-layer metal gasket with good sealability and heat resistance is used for the cylinder head gasket.

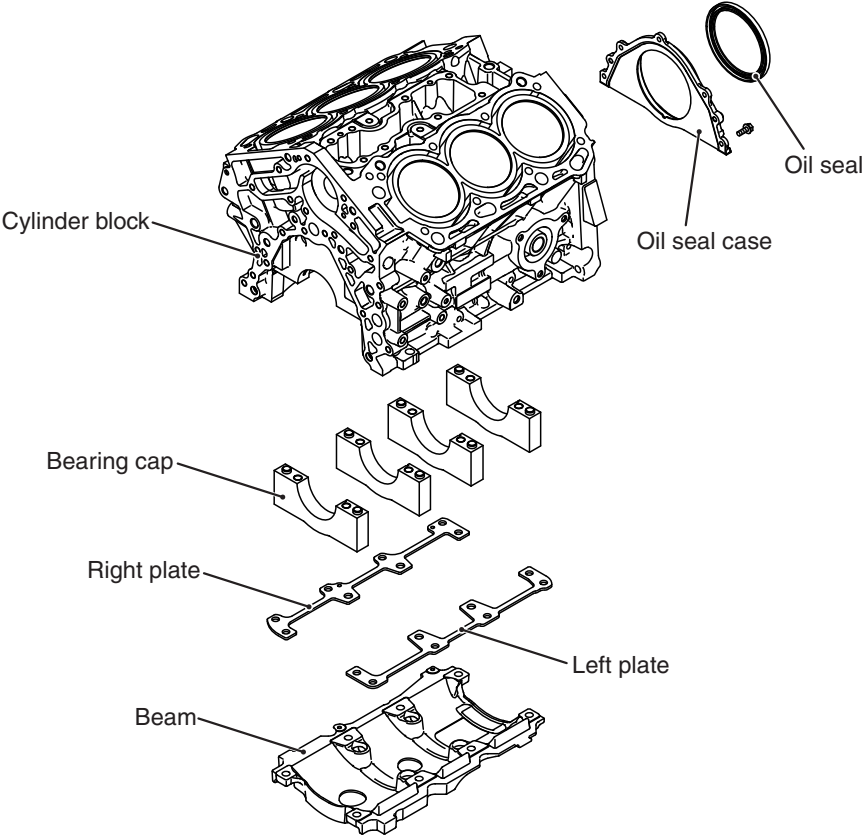
7. VALVE GUIDE

- A sintered alloy material is used for the valve guides.

8. VALVE SEAT

- Sintered alloy valve seats have been adopted.

CYLINDER BLOCK RELATION



ACD00425 AB

1. CYLINDER BLOCK

- The crankshaft journal has 4 bearings. The No.3 bearing carries the thrust load of the crankshaft. The cylinder block is made of lightweight aluminium alloy. The water jacket is of a full-seamless design.

Items	Specifications	Items
Bore mm	87.6	Bore mm
Bore pitch mm	98	Bore pitch mm
Stroke mm	82.9	Stroke mm

2. CRANKSHAFT BEARING CAP

- The crankshaft journal is supported by four bearings.

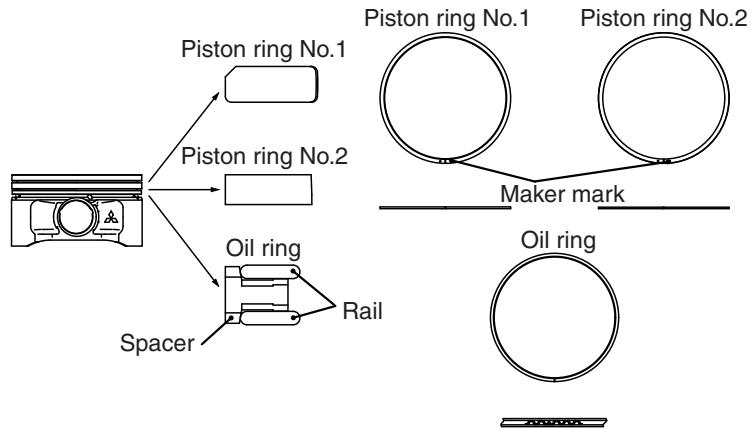
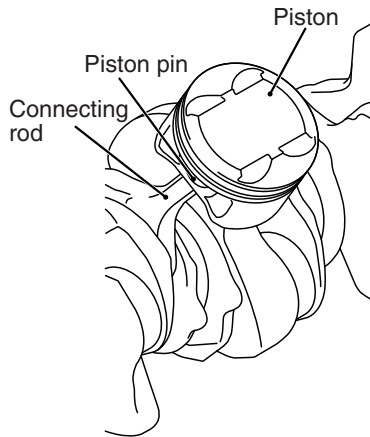
3. RIGHT PLATE, LEFT PLATE

4. BEAM

5. OIL SEAL CASE

6. OIL SEAL

PISTON RELATION



ACD00426 AB

1. PISTON

- Special aluminium alloy is adopted to improve heat efficiency and achieve lower weight. That contributes to higher engine performance and better fuel economy. Piston pinhole centre is offset by 0.5 mm from piston centre towards the thrust side.
- Out side surface of piston skirt has striation-like finishing better oil holding ability (and superior durability against scuffing.)

2. PISTON PIN

- The piston pin is of a semi-floating type, press-fitted into the connecting rod small end while capable of floating relative to the piston.

3. CONNECTING ROD

- High strength carbon steel (forging) material is adopted.
- Rod has "H" shaped cross section.
- Big-end is lubricated through crankshaft oil passage between main journal and pin.

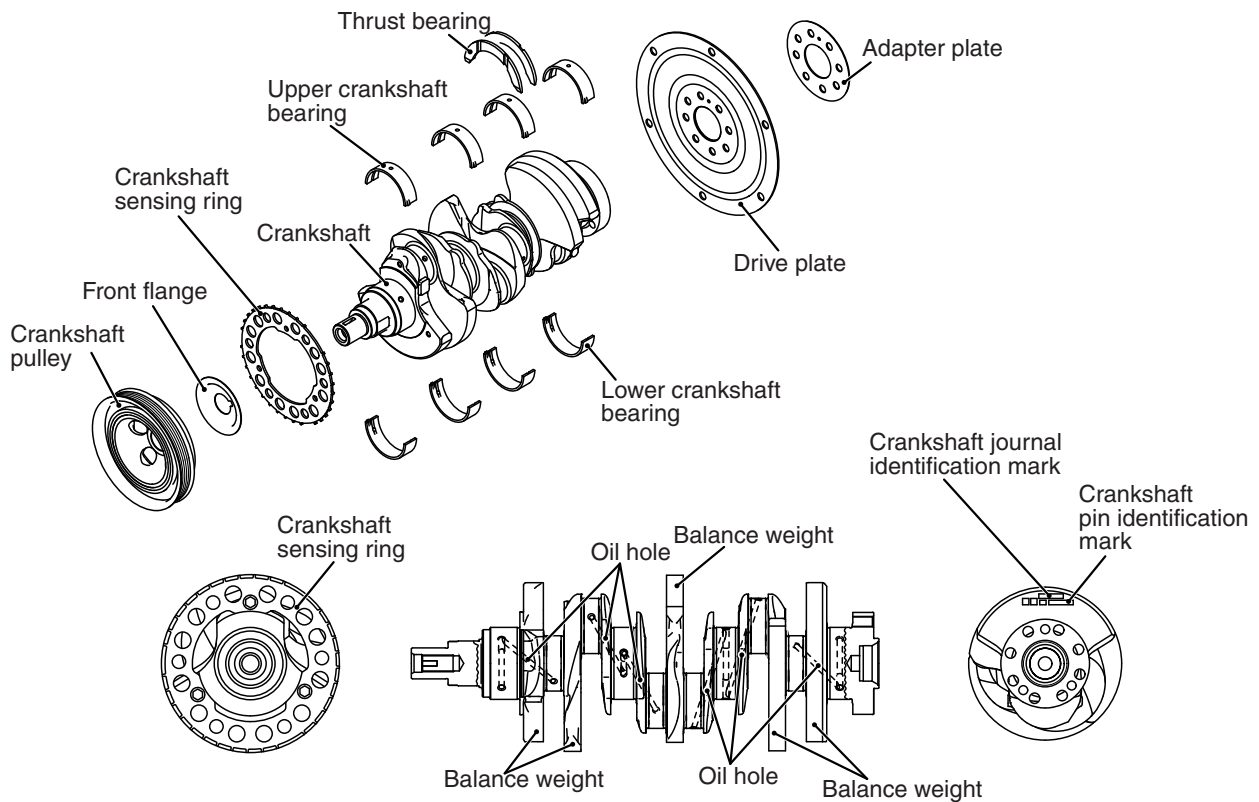
4. PISTON RING

- Each piston is provided with No. 1 and No. 2 compression rings and an oil ring.

5. CONNECTING ROD BEARING

- Upper and lower bearings are same parts. This part consists of overlay (surface), copper alloy plate (middle) and steel plate (back side). The connecting rod bearing is narrower than the bearing cap, this is to minimize wear.

CRANKSHAFT RELATION



ACD00427AB

1. CRANK SHAFT

- A casted crankshaft is used for the crankshaft. The crankshaft consists of four main bearings and five balance weights. The crankshaft pins are arranged at 120° intervals. The oil hole supplies lubrication oil from the journal to the crank pin. A crankshaft sprocket and an oil pump drive gear shaft are shrink-fitted onto the front of the crankshaft.

2. CRANKSHAFT BEARING

- The upper crankshaft bearing (with oil groove) is located on the cylinder block side while the lower bearing (without oil groove) is held by the bearing cap. The crankshaft bearing is equipped with back metal. While the bearing itself is made of aluminum alloy, the back metal is made of steel sheet.

3. THRUST BEARING

- A thrust bearing is installed on both sides of the No. 3 crankshaft bearing.

4. CRANKSHAFT PULLEY

- The outer ring has 6-rib for alternator and air-compressor drive belt. Timing mark notch is applied at the flange of 4-rib side.

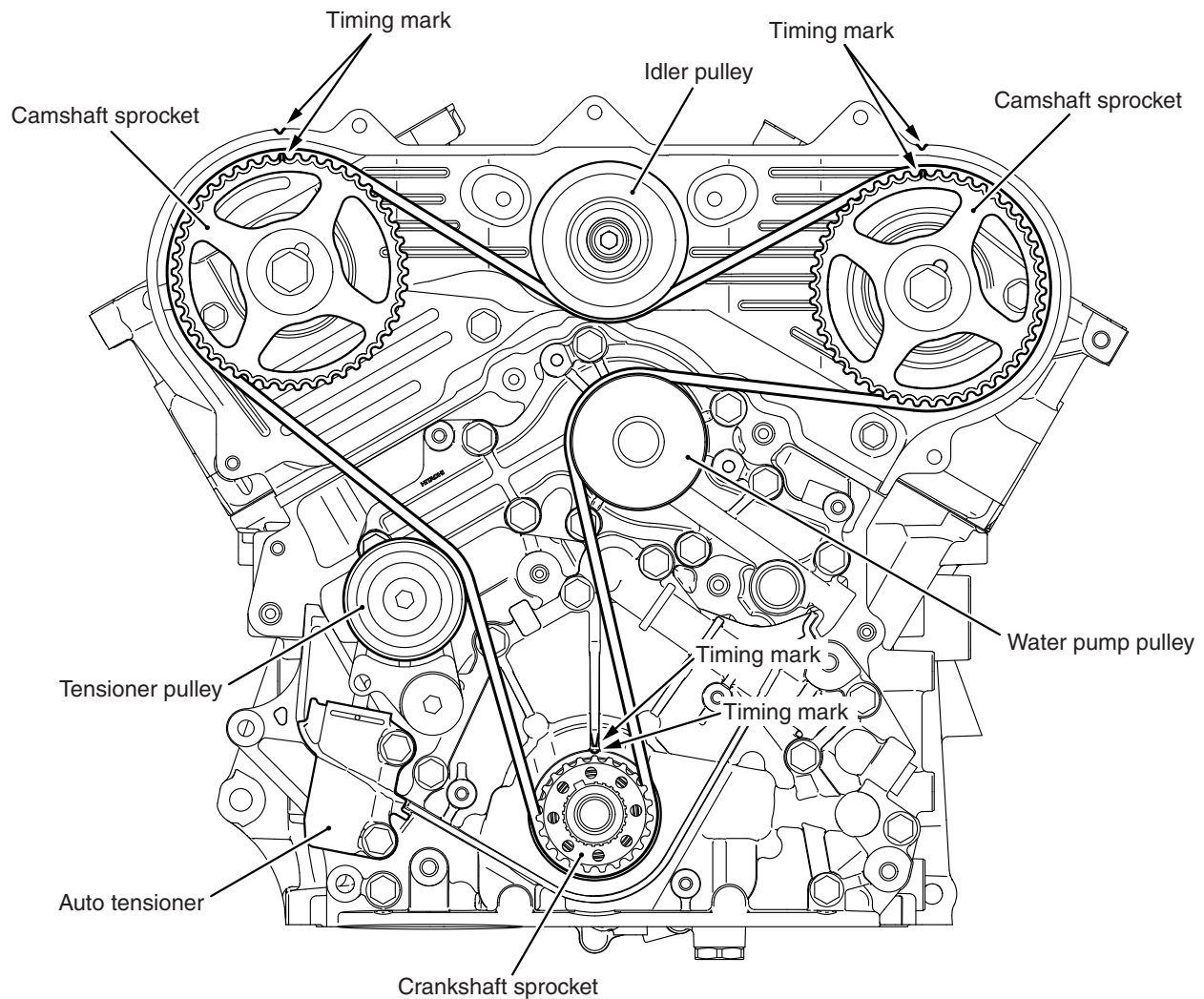
5. CRANKSHAFT SENSING RING

The crankshaft is also fitted with a crankshaft sensing ring.

6. DRIVE PLATE

- The drive plate is made of sheet metal. The drive plate is mounted with 8 bolts.

TIMING BELT RELATION



AK601743AB

1. TIMING BELT

- By using the highly strengthened timing belt, the belt is narrow and long-lasting.

2. CRANKSHAFT SPROCKET

3. CAMSHAFT SPROCKET

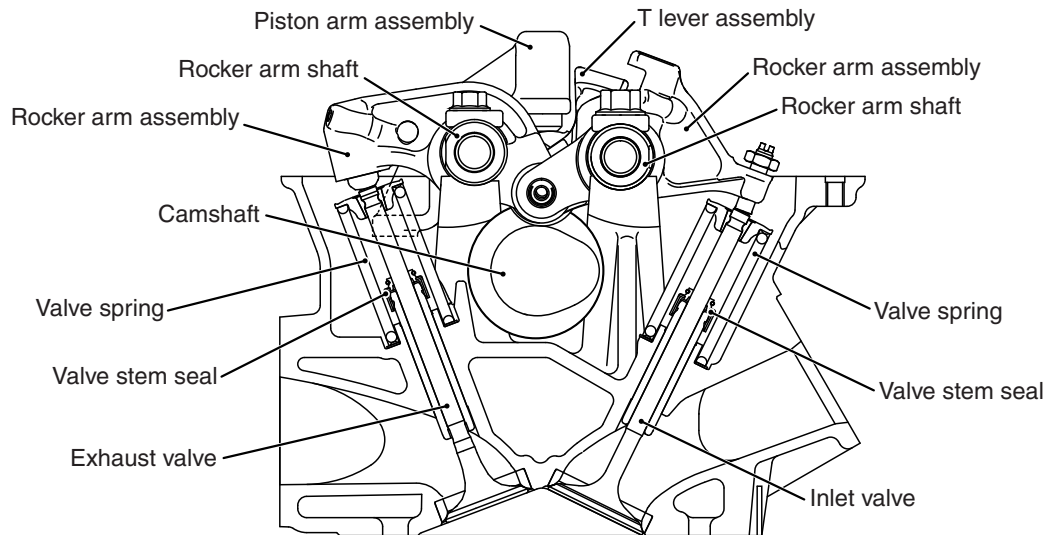
4. TENSIONER PULLEY

5. IDLER PULLEY ASSEMBLY

6. AUTO TENSIONER

- By abolishing a traditional eccentric pulley, the tensioner is designed to be lightweight.

VALVE RELATION



AK602545AE

The valve mechanism was taken as the SOHC system in order to make miniaturization and a weight saving attain. Each cylinder has two intake valves and two exhaust valves, arranged in a V-shape pattern. Arranging rocker arm between camshaft and a valve, thereby, the valve is carrying out the opening-and-closing operation.

1. CAMSHAFT

- By using the highly strengthen timing belt, the belt is narrow and long-lasting.

2. ROCKER ARM

3. ROCKER ARM SHAFT

4. VALVE

- The valve is made of heat resistant steel and has nitride processing on its entire surface.

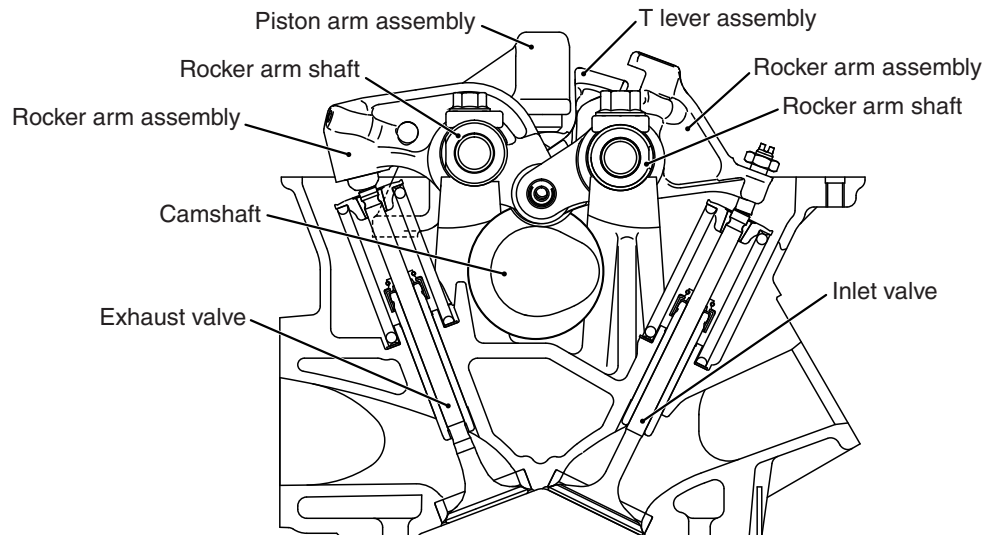
5. VALVE SPRING

- To prevent surging during high speed, variable pitch springs are used.

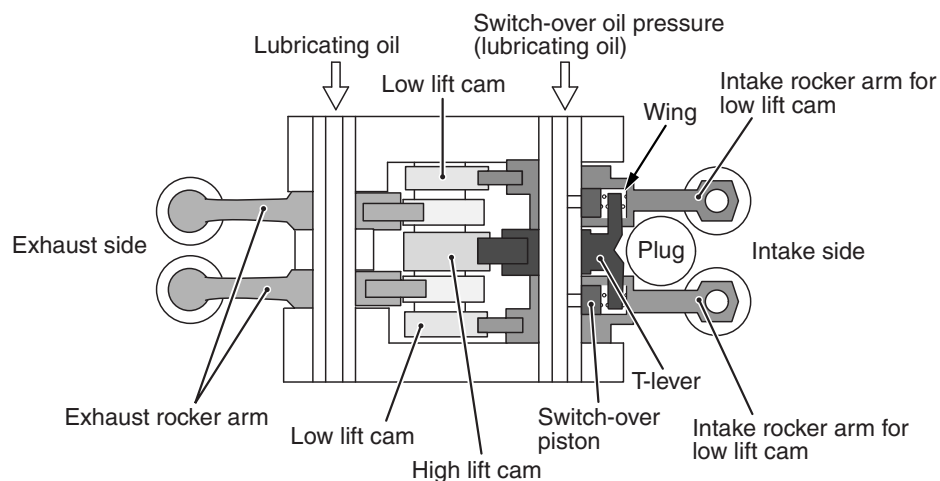
6. VALVE STEM SEAL

- Oil is prevented from seeping down by using a good sealing spring on the valve stem seal.

MITSUBISHI INNOVATIVE VALVE TIMING AND LIFTING ELECTRONIC CONTROL SYSTEM (MIVEC)



AK602545 AD



AK602546 AB

MIVEC has an additional switching system on the two intake valves in the conventional SOHC 4 valve engine. This switching system has two cams for the low mode and for the high mode keeping both valve lifts high.

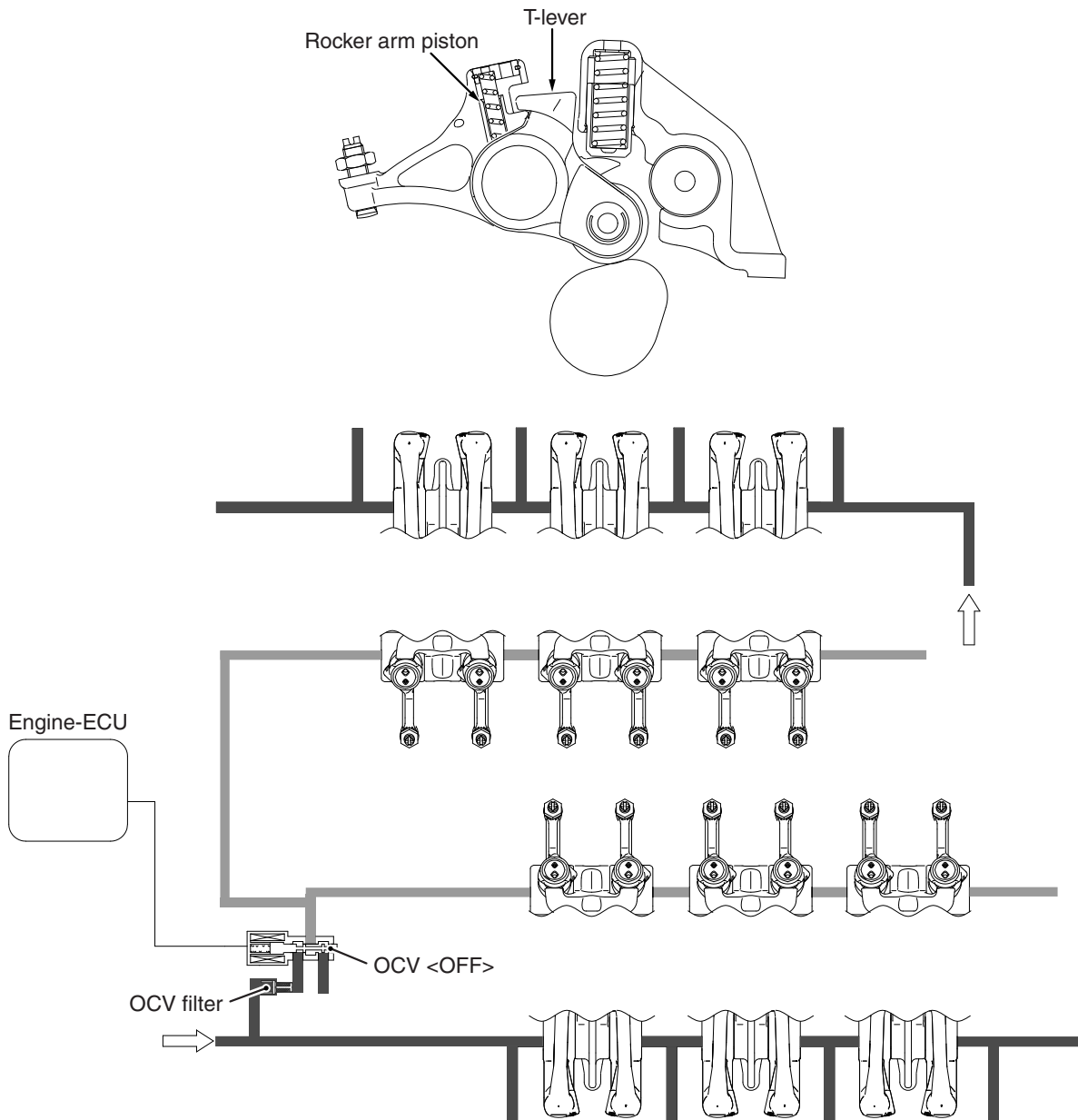
In the range of the low engine speed, the flow within the valves is enhanced by the difference between the valve-lifts. Also, the stabilization of the combustion is designed for low fuel economy, low exhaust gas and high torque. At high engine speeds, the high output due to the increment in the intake air amount is reached by increasing the open valve period and the lift.

A T-lever moves following the high lift cams and is arranged between the high lift cam and two rocker arms, in addition to the low lift cams and two rocker arms that drive the two intake valves respectively.

In the range of the low engine speed, the low lift cam drive each valve respectively because the wing of the T-lever moves freely. At high engine speeds, the oil pressure moves the switch-over piston within the rocker arm. The T-lever reaches the rocker arm and pushes it, and then the high lift cam lifts both valves. The cam switching is carried out when the torque produced in the low speed mode and the one produced in the high-speed mode crosses each other at an engine speed.

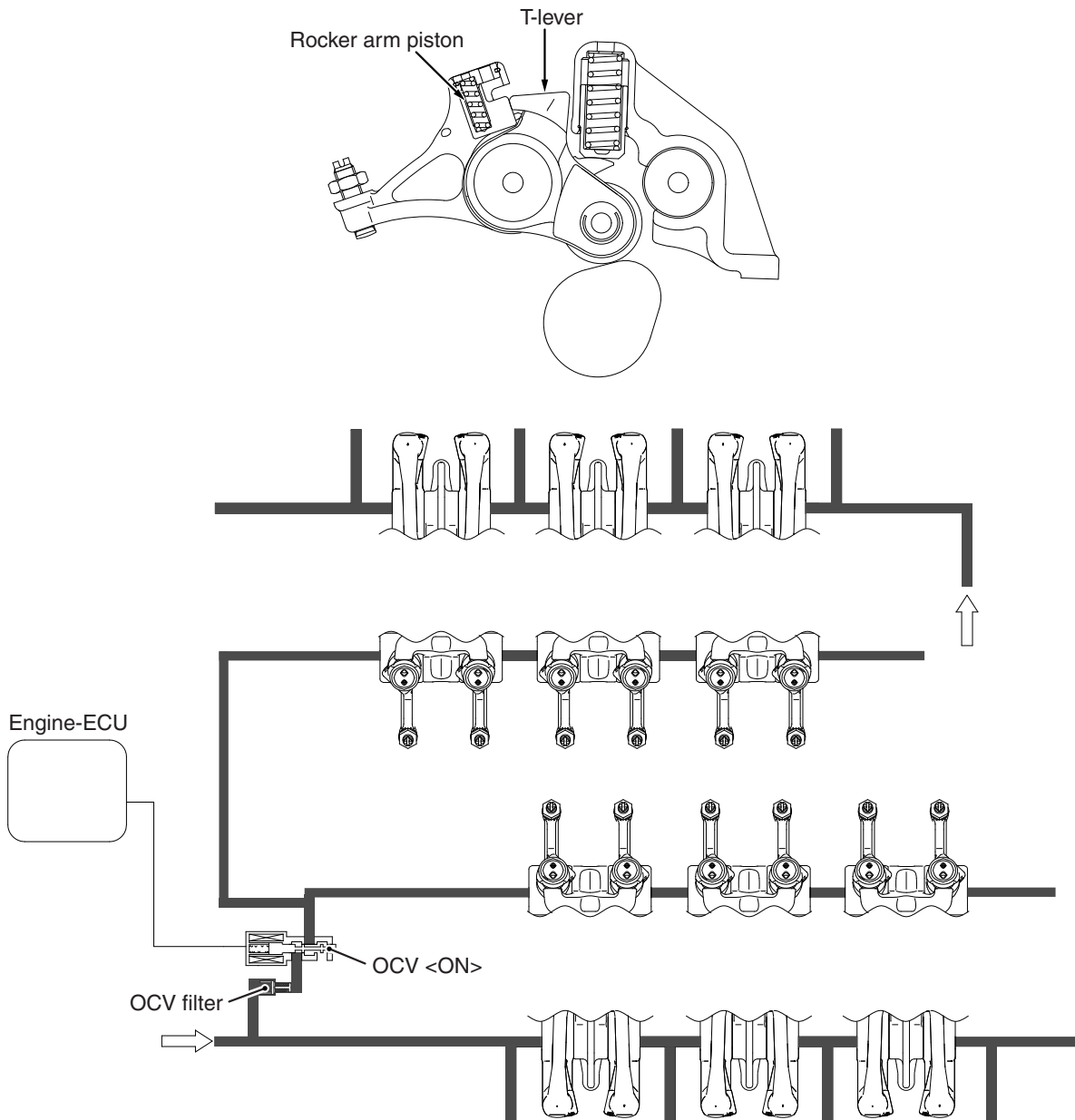
The oil passage is divided into two, one for the intake rocker shaft and the other for the exhaust rocker shaft, just in front of the oil feeder control valve (OCV). Oil is always supplied to the exhaust rocker shaft.

Oil supply to the intake rocker shaft is controlled by ON/OFF of the oil feeder control valve (OCV) and carries out the switching for the low and high lift cams.



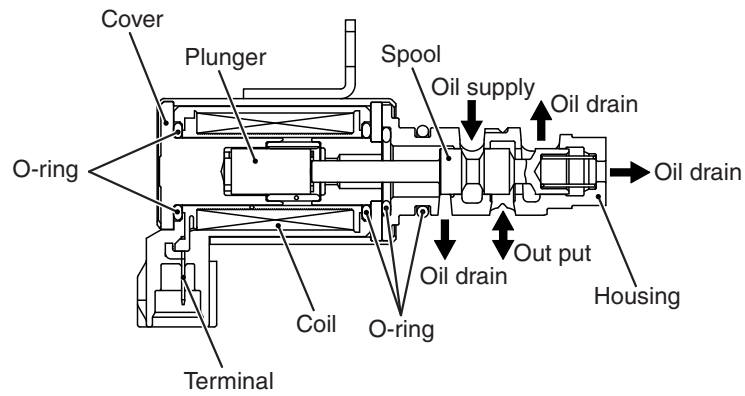
AK602547AC

When the OCV is in the OFF position, the switch-over piston does not operate because the switch-over oil pressure within the intake rocker shaft is below the specified pressure, and so the wing of the T-lever does not reach the switch-over piston. Accordingly, the intake valve is driven by the rocker arm for low lift cam.



AK602548AC

When the OCV is in the ON position, the switch-over piston is pushed by the oil pressure because the switch-over oil pressure within the intake rocker shaft is above the specified pressure, and so the wing of the T-lever reaches the switch-over piston. Accordingly, the intake valve is driven by the T-lever.

OIL FEEDER CONTROL VALVE

AK602549AB

The oil feeder control valve uses electromagnetic valve mechanism to change oil pressure to rocker arm and rocker shaft that drive MIVEC.

GROUP 12

ENGINE
LUBRICATION

CONTENTS

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OIL PUMP	12-3		

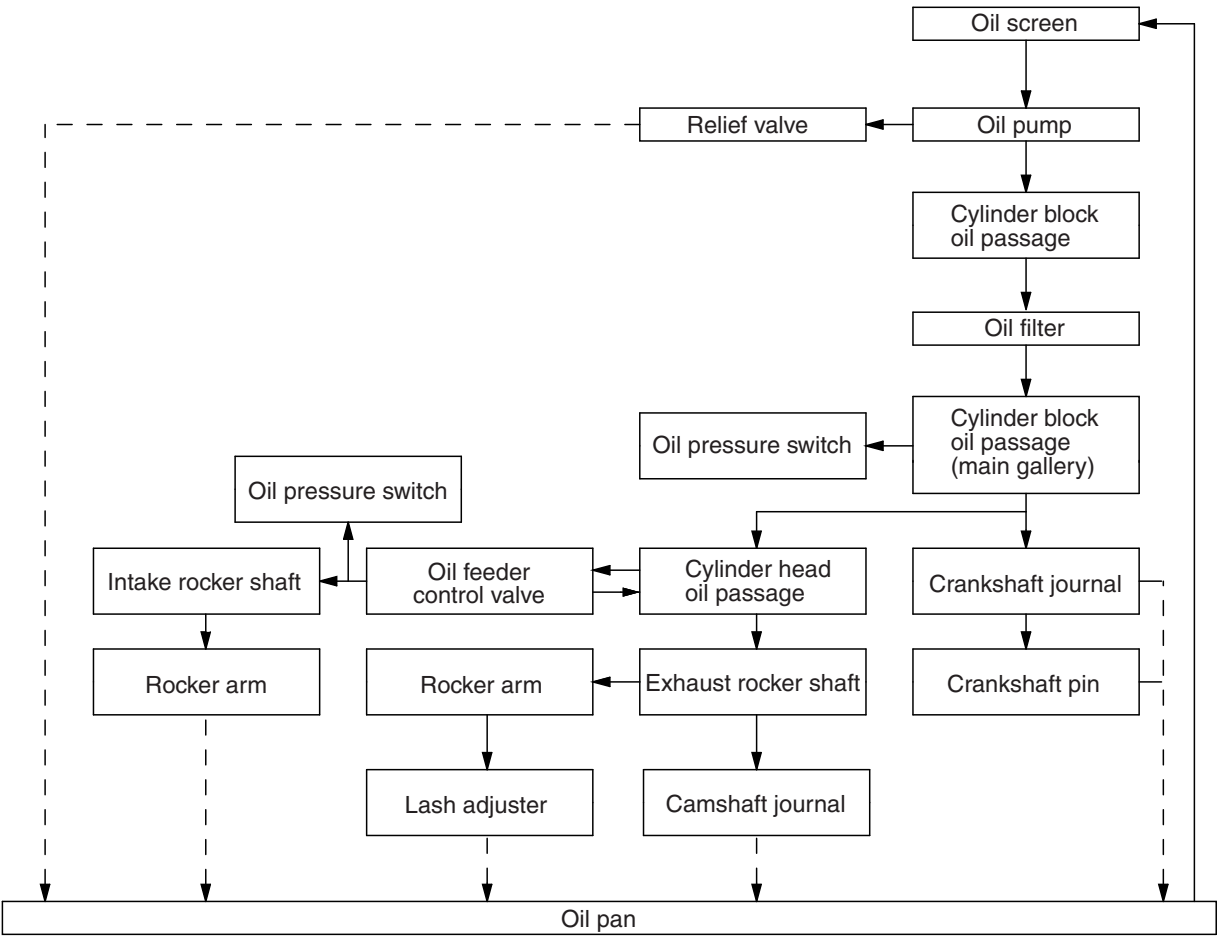
GENERAL INFORMATION

The descriptions for vehicles with 6B3 engine have been added.

M2120000100506

OIL PASSAGE

M2120000200785



OIL PUMP

M2120002000334

The oil pump is a trochoid type, directly driven by the crankshaft.

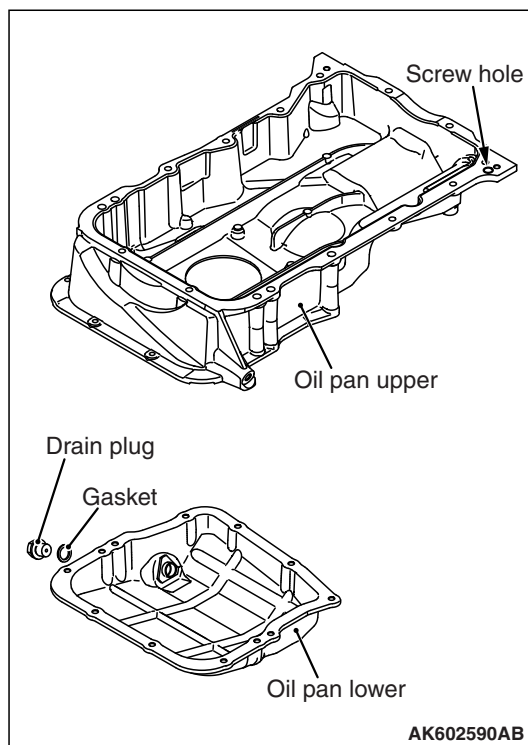
On cycloid oil pump, as the inner rotor is rotated by the crankshaft, the outer rotor also rotates. The resultant change in spatial volumes between the rotors generates pumping action.

Specifically, oil is sucked into the expanding space and is pushed out from the shrinking space.

Item	Specifications
Discharge pressure kPa (6,000 r/min.)	340
Discharge amount L/min (6,000 r/min.)	63

OIL PAN

M2120006000541

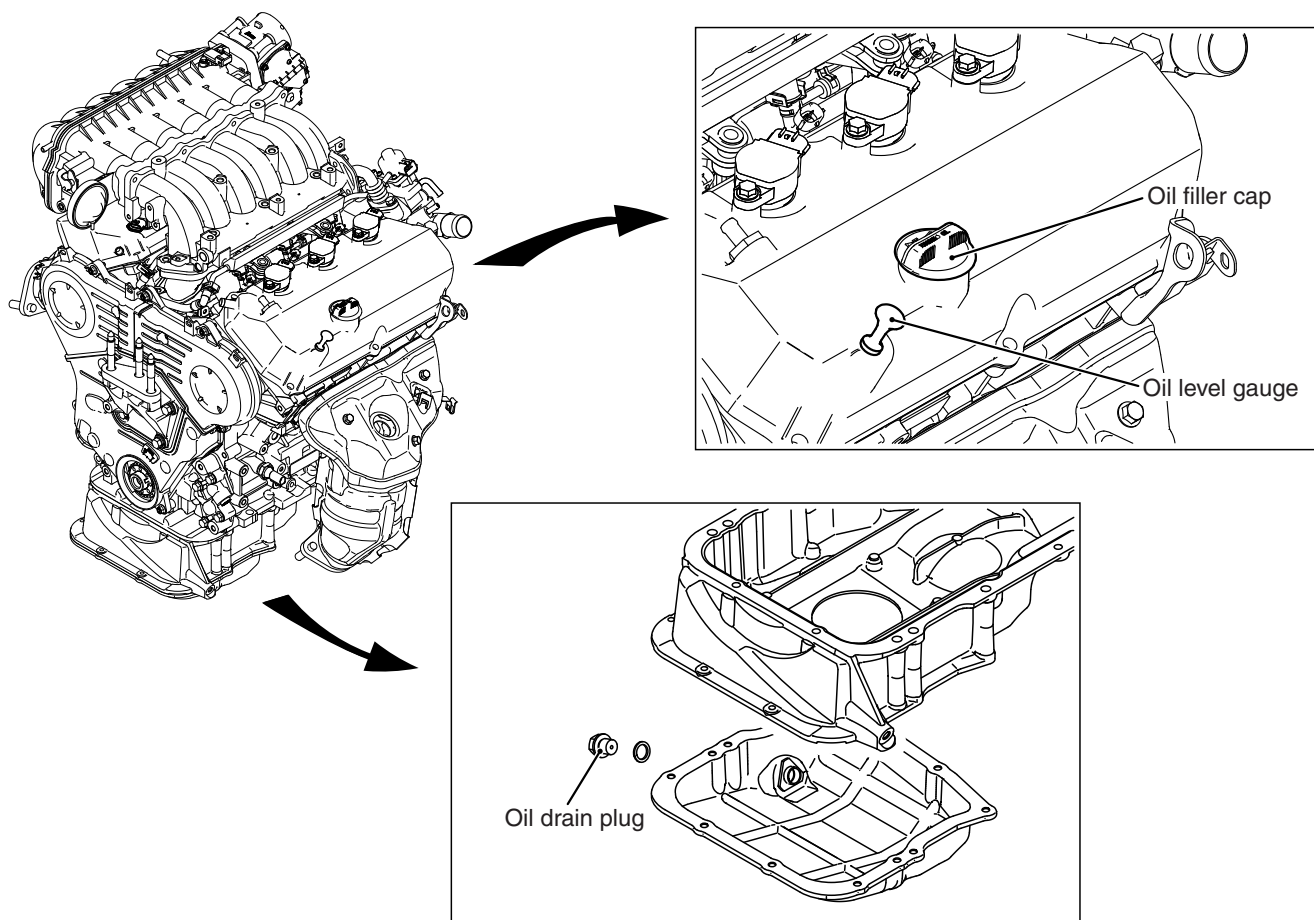


The oil pan consists of the upper and the lower oil pans. The upper oil pan is made of aluminium and the lower one is made of high damping steel.

The screw holes for removing and installing the upper oil pan are designed to make its removal and installation easy.

OIL LEVEL GAUGE, OIL FILLER CAP, OIL DRAIN PLUG

M2120007000373



AK602939AB

GROUP 13

FUEL

CONTENTS

FUEL SUPPLY 13B

MULTIPOINT FUEL INJECTION (MPI) <6B3>..... 13F

NOTES

GROUP 13B

FUEL SUPPLY

CONTENTS

GENERAL INFORMATION 13B-2 FUEL TANK 13B-3

GENERAL INFORMATION

M2134000101706

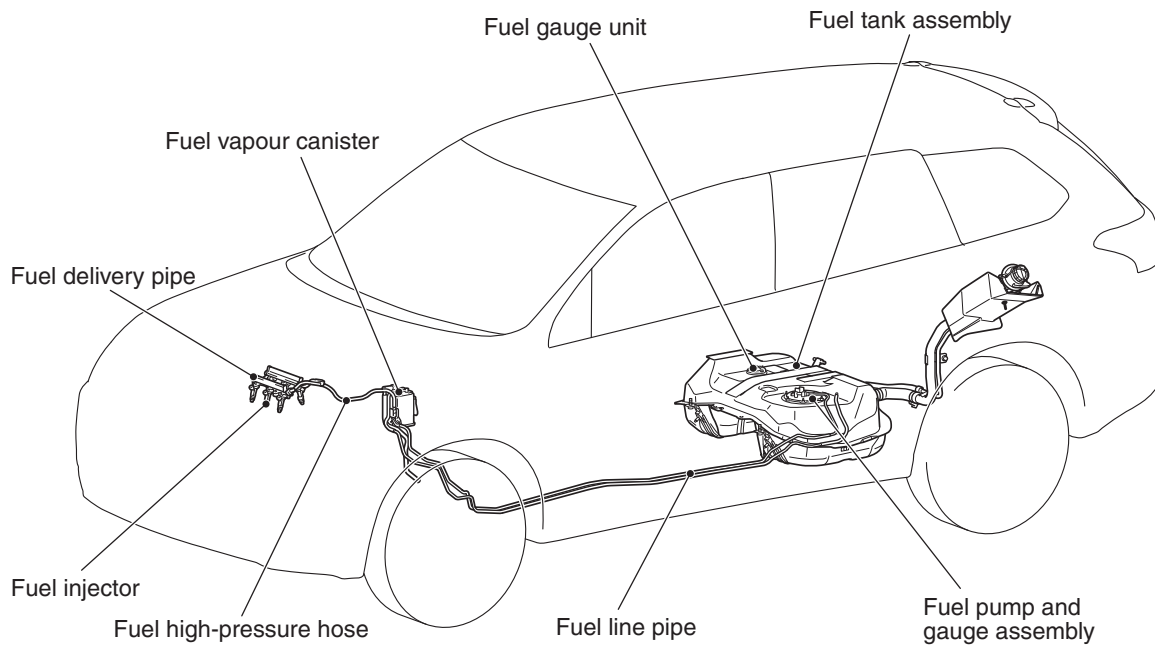
The fuel system consists of the following components:

- Fuel injector
- Fuel delivery pipe
- Fuel vapour canister
- Fuel high-pressure hose
- Fuel line pipe
- Fuel tank assembly
- Fuel pump and gauge assembly
- Fuel gauge unit

SPECIFICATIONS

Item		Specification
Fuel tank capacity L		60
Fuel pump type		Electric (incorporates tank pump and gauge assembly)
Fuel filter type		Cartridge (incorporates tank pump and gauge assembly)
Fuel return system		Return less
Fuel injector	Type	Elector-magnetic
	Quantity	6
Evaporative emission control system		Fuel vapour canister

CONSTRUCTION DIAGRAM



ACD00304AB

This fuel system is designed with consideration for global environment protection to ensure safety at a collision, reduce weight, and improve reliability and quality. This system has the following features:

- A quick-joint connector of a plastic tube is used for the fuel high-pressure hose in the engine compartment to reduce the permeation of fuel evaporative emission.
- The surface of under floor fuel line pipes is coated with 1-mm thickness of resin to improve resistance to corrosion and chipping.
- A return less fuel system eliminates returned fuel from the engine. The heat that fuel receives from the engine is reduced, minimising fuel temperature in the fuel tank and controlling the amount of evaporated gas.
- The activated charcoal of fuel vapour canister is modified for downsizing, weight saving and better performance.

FUEL TANK

The same as for conventional 4WD.

M2134001001702

NOTES

GROUP 13F

MULTIPOINT FUEL INJECTION (MPI) <6B3>

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MIVEC (Mitsubishi Innovative Valve Electronic Control System)	13F-21	CONTROLLER AREA NETWORK (CAN)	13F-24
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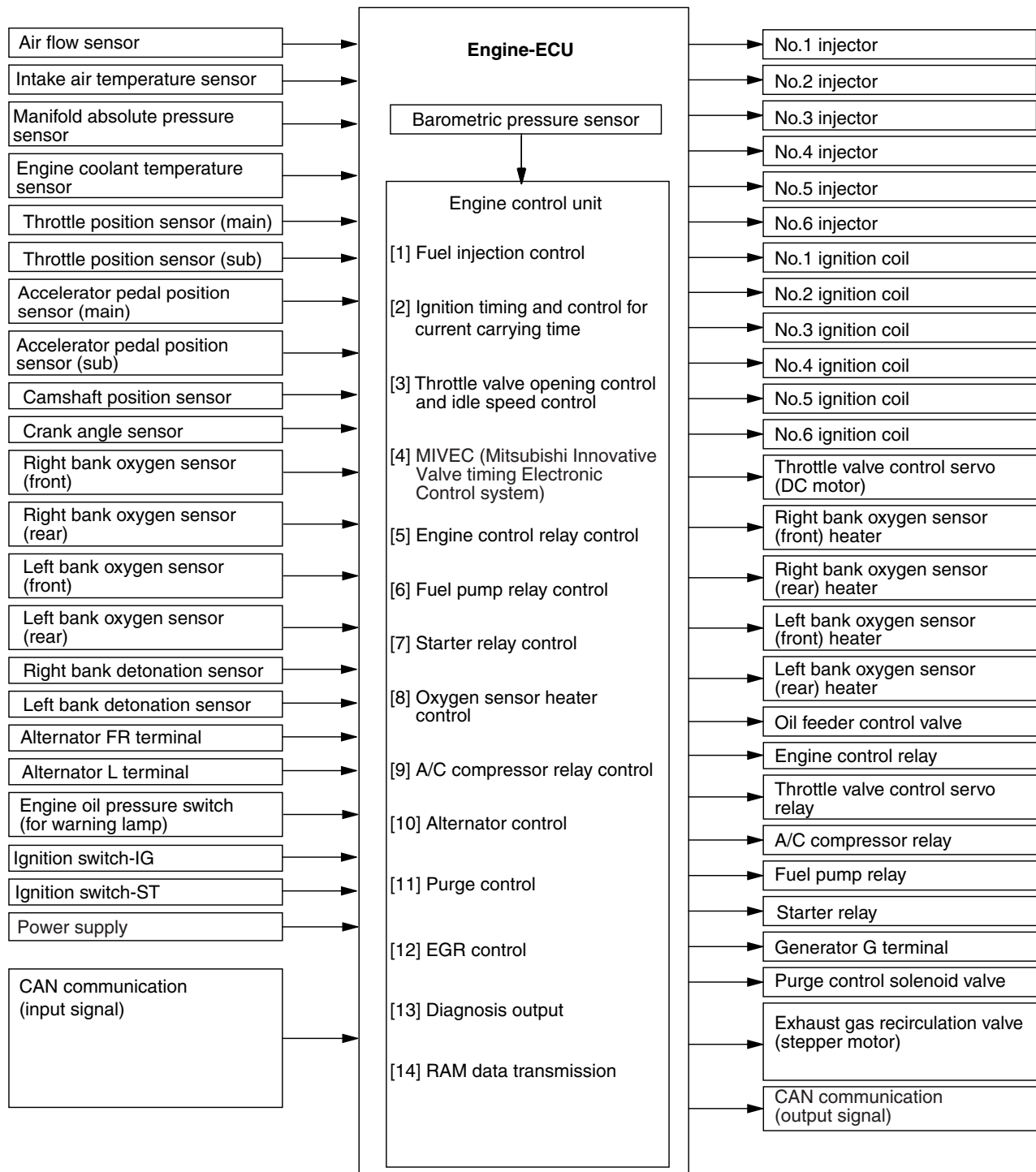
GENERAL INFORMATION

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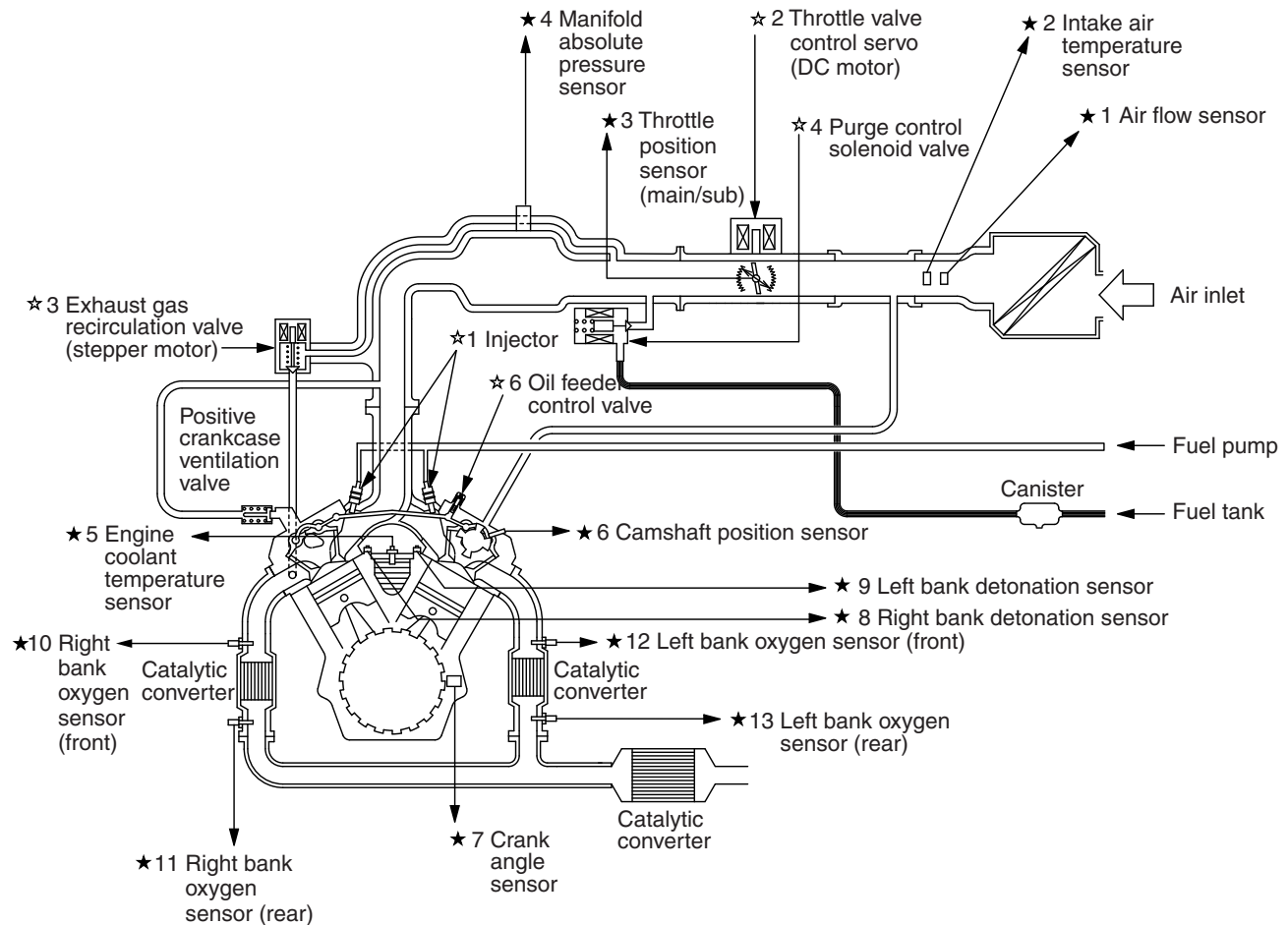
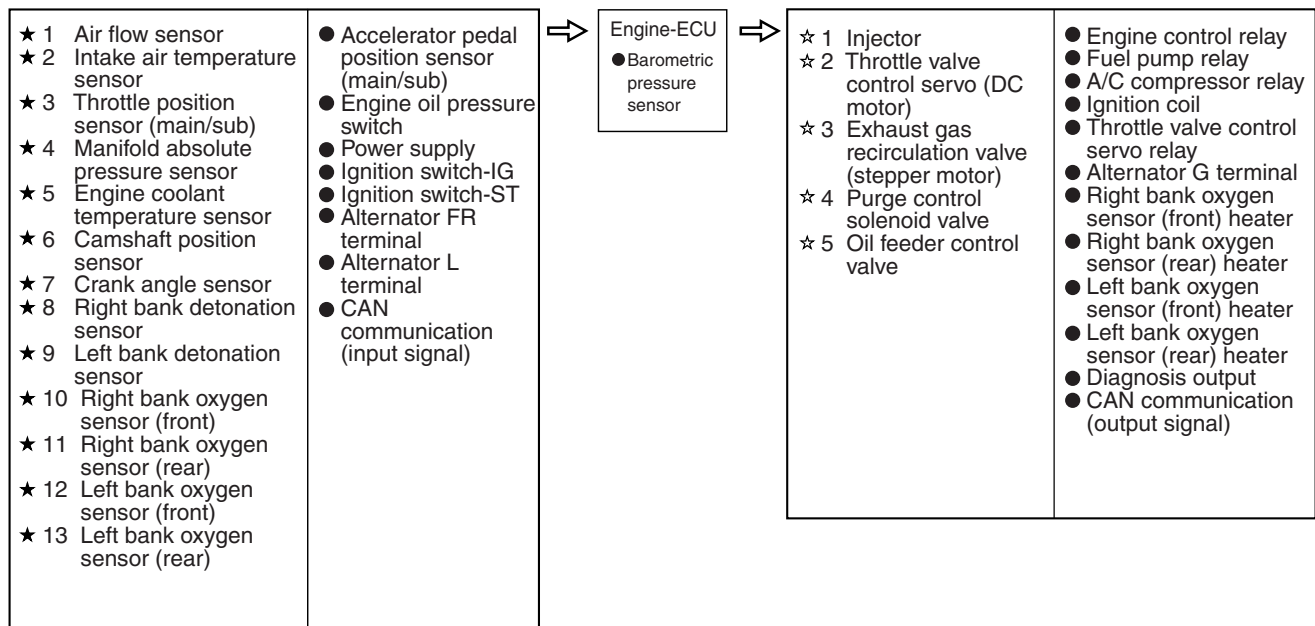
Based on the controls of the 6B31 engine equipped on the conventional OUTLANDER (CW6W), the following change has been made.

Improvement / Additions	Remark
An exhaust gas recirculation (EGR) system is used.	Reduce NOx generation.
The air flow sensor has been changed.	• The engine-ECU delivers a sensor reference voltage to the air flow sensor. • This system is the same as that for 4B1 engine.
An electric power steering has been adopted.	Due to this, the power steering fluid pressure switch terminal has been deleted from the engine-ECU.

SYSTEM BLOCK DIAGRAM



CONTROL SYSTEM DIAGRAM



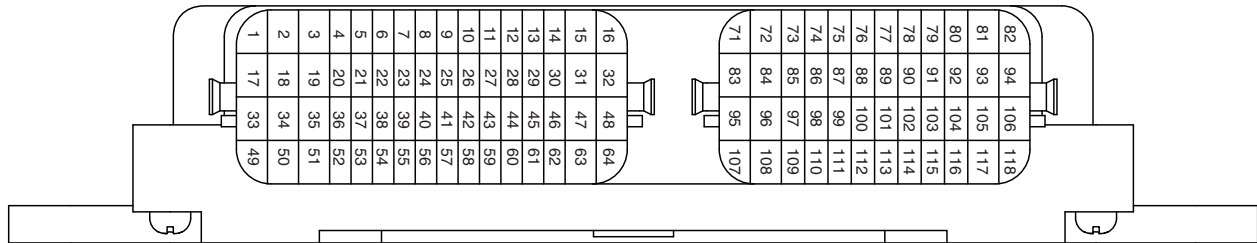
CONTROL UNIT

M2132021501093

ENGINE-ECU

The structure and operation is basically the same as that of the 4B1 engine. Refer to GROUP 13A – CONTROL UNIT.

ENGINE-ECU CONNECTOR INPUT/OUTPUT PIN ARRANGEMENT



AK800012AB

Terminal No.	Terminal code	Terminal name	Terminal No.	Terminal code	Terminal name
1	OCV	Oil feeder control valve	2	INJ1	No. 1 injector
3	INJ2	No. 2 injector	4	CIL1	Ignition coil No. 1
5	CIL2	Ignition coil No. 2	6	NTSW	Starter active signal
7	OFRE	Right bank oxygen sensor (front) offset voltage	8	SGT	Crank angle sensor
9	5V	Sensor supplied voltage	10	TPSM	Throttle position sensor (main)
11	TPSS	Throttle position sensor (sub)	12	TPS5	Power supply voltage applied to throttle position sensor
13	TPSE	Throttle position sensor earth	14	SGC	Camshaft position sensor
15	ETV+	Throttle valve control servo (+)	16	ETV-	Throttle valve control servo (-)
18	INJ3	No. 3 ignition coil	19	INJ4	No. 4 ignition coil
20	CIL3	Ignition coil No. 3	21	CIL4	Ignition coil No. 4
22	O2FR	Right bank oxygen sensor (front)	24	SGTE	Crank angle sensor earth
25	K/S	Left bank detonation sensor (+)	26	WTS	Engine coolant temperature sensor
27	WTSE	Engine coolant temperature sensor earth	28	K/S2	Right bank detonation sensor (+)
29	KS2E	Right bank detonation sensor (-)	30	CPIE	Camshaft position sensor earth
31	EGRA	Exhaust gas recirculation valve (A)	32	EGRB	Exhaust gas recirculation valve (B)

Terminal No.	Terminal code	Terminal name	Terminal No.	Terminal code	Terminal name
33	OHFR	Right bank oxygen sensor (front) heater	34	OHFL	Left bank oxygen sensor (front) heater
35	OHRL	Left bank oxygen sensor (rear) heater	36	OPSW	Engine oil pressure switch
37	PURG	Purge control solenoid valve	40	O2RL	Left bank oxygen sensor (rear)
41	ORLE	Left bank oxygen sensor (rear) offset voltage	42	K/SE	Left bank detonation sensor (–)
44	MAP5	Power supply voltage applied to manifold absolute pressure sensor	45	MAP	Manifold absolute pressure sensor
46	MAPE	Manifold absolute pressure sensor earth	47	EGRC	Exhaust gas recirculation valve (C)
48	EGRD	Exhaust gas recirculation valve (D)	49	OHRR	Right bank oxygen sensor (rear) heater
50	INJ5	No. 5 injector	51	INJ6	No. 6 injector
52	CIL5	Ignition coil No. 5	53	CIL6	Ignition coil No. 6
54	O2RR	Right bank oxygen sensor (rear)	55	ORRE	Right bank oxygen sensor (rear) offset voltage
57	O2FL	Left bank oxygen sensor (front)	58	OFLE	Left bank oxygen sensor (front) offset voltage
60	ALTG	Alternator G terminal	61	ALTF	Alternator FR terminal
62	ALTL	Alternator L terminal	71	RSG	Throttle valve control servo earth
72	RSB	Throttle valve control servo power supply	73	C/R	Engine control relay
74	APSM	Accelerator pedal position sensor (main)	75	APS5	Power supply voltage applied to accelerator pedal position sensor (main)
76	APSE	Accelerator pedal position sensor (main) earth	77	APSS	Accelerator pedal position sensor (sub)
78	5VV	Power supply voltage applied to accelerator pedal position sensor (sub)	79	EV	Accelerator pedal position sensor (sub) earth
81	GNDE	Sensor earth	82	BAT1	Power supply
83	RSH	Throttle valve control servo earth	84	C/RL	Throttle valve control servo relay
87	AFS	Air flow sensor	88	AFSE	Air flow sensor earth
89	ATS	Intake air temperature sensor	90	CANH	CAN interface (high)
91	CANL	CAN interface (low)	92	IGN	Ignition switch-IG
93	GNDE	Sensor earth	96	FP/R	Fuel pump relay

Terminal No.	Terminal code	Terminal name	Terminal No.	Terminal code	Terminal name
97	AFS5	Air flow sensor reference voltage	102	AC/R	A/C compressor relay
103	FMB	Flash EP-ROM power supply	104	BACK	Backup power supply
105	ST	Ignition switch-ST	106	STRL	Starter relay

SENSOR

M2132001001609

AIR FLOW SENSOR

The structure and operation is basically the same as that of the 4B1 engine.

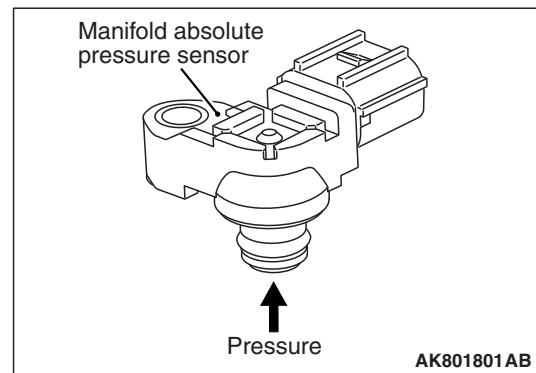
Refer to GROUP 13A – Sensor.

INTAKE AIR TEMPERATURE SENSOR

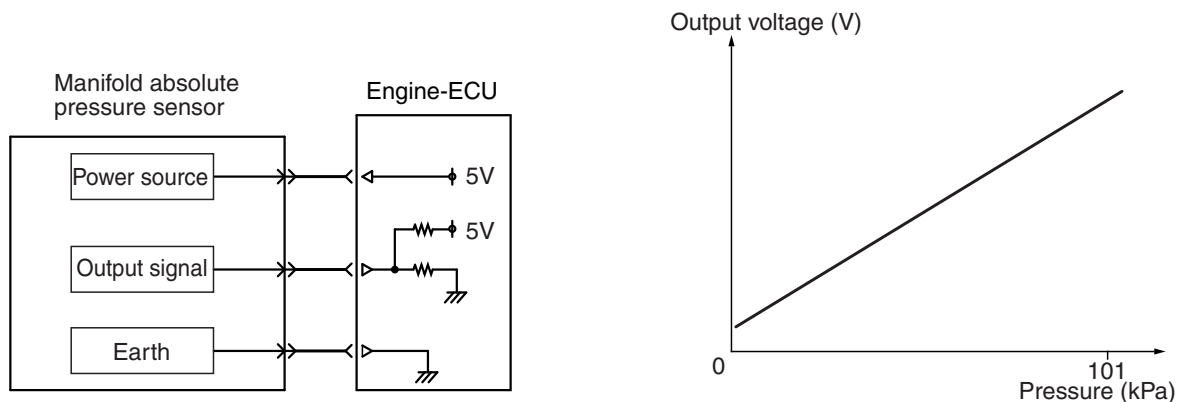
The structure and operation is basically the same as that of the 4B1 engine.

Refer to GROUP 13A – Sensor.

MANIFOLD ABSOLUTE PRESSURE SENSOR



The manifold absolute pressure sensor is installed in the inlet manifold. Manifold absolute pressure sensor uses a piezo resistive semiconductor to output the voltage according to manifold absolute pressure to engine-ECU. Engine-ECU uses this output voltage to compensate fuel injection volume according to manifold absolute pressure. Sensor properties are as shown in the figure.



AK602206AF

**ENGINE COOLANT TEMPERATURE
SENSOR**

The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

THROTTLE POSITION SENSOR

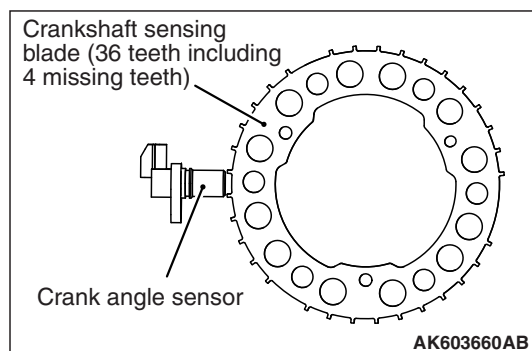
The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

**ACCELERATOR PEDAL POSITION
SENSOR**

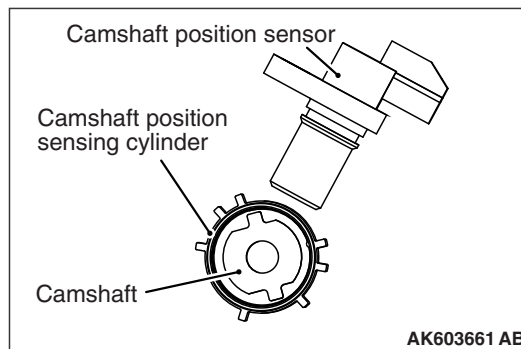
The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

OXYGEN SENSOR

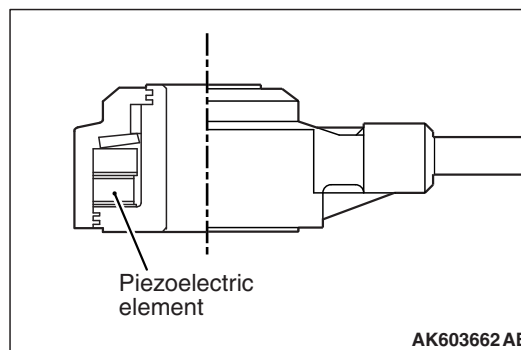
Oxygen sensors are installed in 2 positions (front, rear) on both the right bank manifold catalytic converter and left bank manifold catalytic converter.
The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

CRANK ANGLE SENSOR

A crank angle sensor is installed to the right bank side on the cylinder block. The crank angle sensor monitors rotation of crankshaft sensing blade (36 teeth including 4 missing teeth) installed on the crankshaft and converts to voltage (pulse signal) that is output to engine-ECU. Engine-ECU uses crank angle sensor's output pulse to detect crankshaft position.
The structure is basically the same as that of the 4B12-MPI-MIVEC engine.
Refer to GROUP 13A – Sensor.

CAMSHAFT POSITION SENSOR

A camshaft position sensor is installed on the camshaft position sensor support on left bank side. The camshaft position sensor monitors rotation of the camshaft position-sensing cylinder (7 teeth) and converts to voltage (pulse signal) that is output to Engine-ECU. Engine-ECU uses a combination of the camshaft position sensor output pulse signal and crankshaft position sensor output pulse signal to identify cylinders in the compression process.
The structure is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

DETONATION SENSOR

A detonation sensor is installed on the cylinder block (both right bank side and left bank side).
The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

BAROMETRIC PRESSURE SENSOR

The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

ENGINE OIL PRESSURE SWITCH

The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

ALTERNATOR L TERMINAL

The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

ALTERNATOR FR TERMINAL

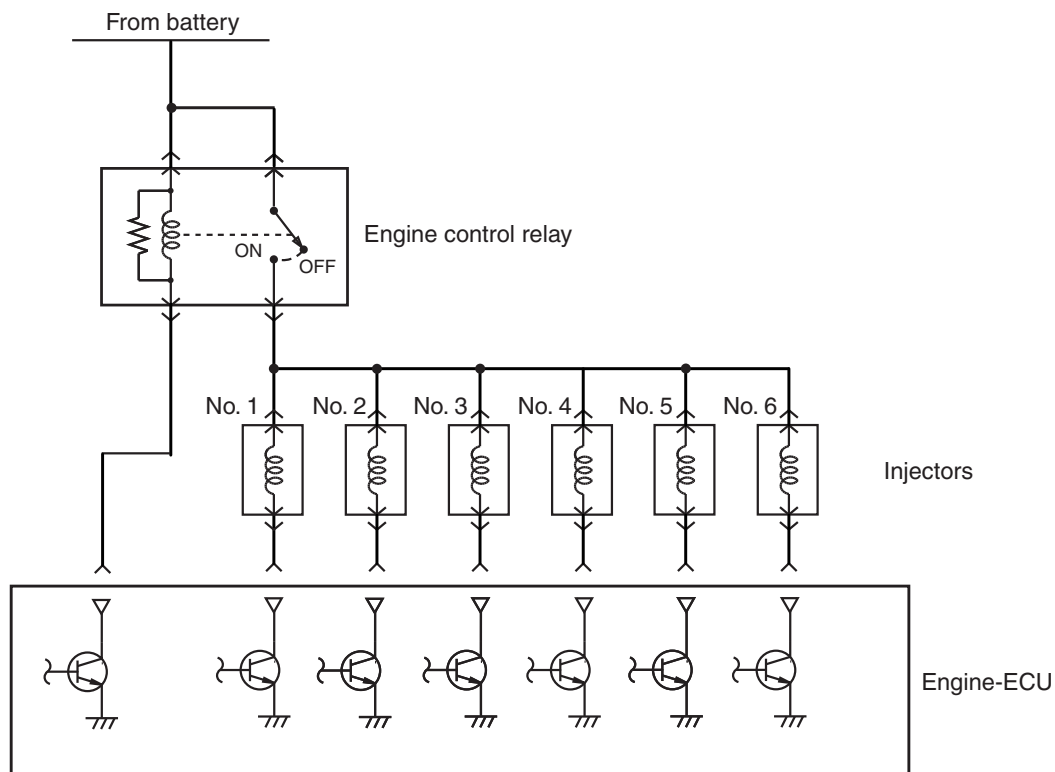
The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Sensor.

ACTUATOR

M2132002001248

INJECTOR

The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Actuator.



ACD01120AB

Voltage from the battery gets applied from the engine control relay to the injector and up to the engine-ECU. Engine-ECU turns ON its power transistor and prepares the injector's earth circuit. Thus, current flows through the injector while power transistor is ON and the injector injects fuel.

THROTTLE VALVE CONTROL SERVO

The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Actuator.

IGNITION COIL

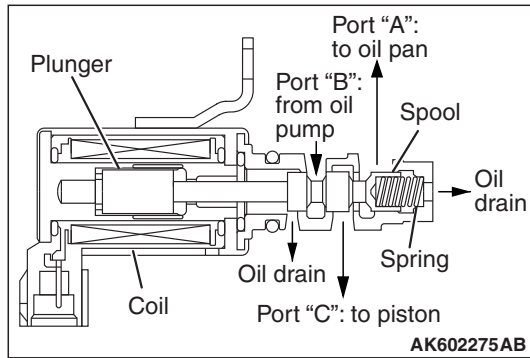
Refer to GROUP 16 – Ignition Coil.

EXHAUST GAS RECIRCULATION (EGR) VALVE

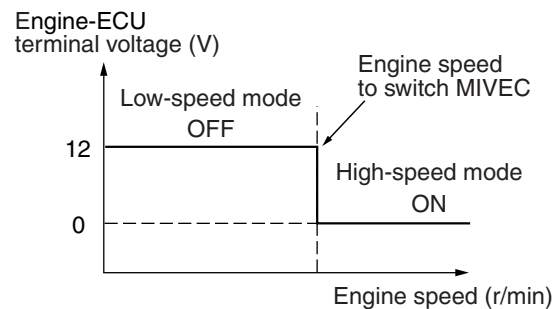
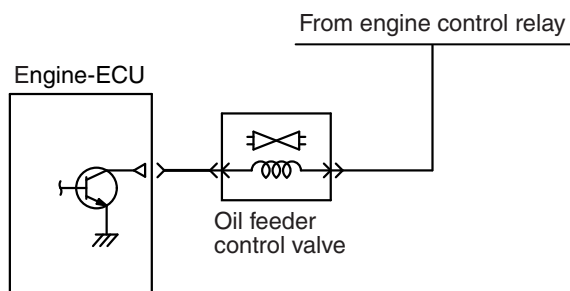
Refer to GROUP 17 – Emission Control – Exhaust Gas Recirculation (EGR) System [P.17-6](#).

EVAPORATIVE EMISSION PURGE SOLENOID

Refer to GROUP 17 – Emission Control – Evaporative Emission Control System [P.17-5](#).

ENGINE OIL FEEDER CONTROL VALVE

An engine oil feeder control valve is installed on the cylinder head. The engine oil feeder control valve is a duty control type solenoid valve and is used in oil pressure control for cam change. When no current is passing through the engine oil control valve's coil (duty: 0 %), port B gets closed and the oil pressure path between port A and port C connects. Oil that had been acting on the cam change control piston is expelled from port C via port A. Thus, the low speed cam drives the inlet valve. When current is passed through the coil (duty: 100 %) and the spool moves, port A gets closed and port B and port C get connected. At this time the oil pressure-fed from the oil pump passes from port B via port C and acts on the cam change control piston. Thus, high-speed cam drives the inlet valve.



AK602214AD

ALTERNATOR G TERMINAL

The structure and operation is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Actuator.

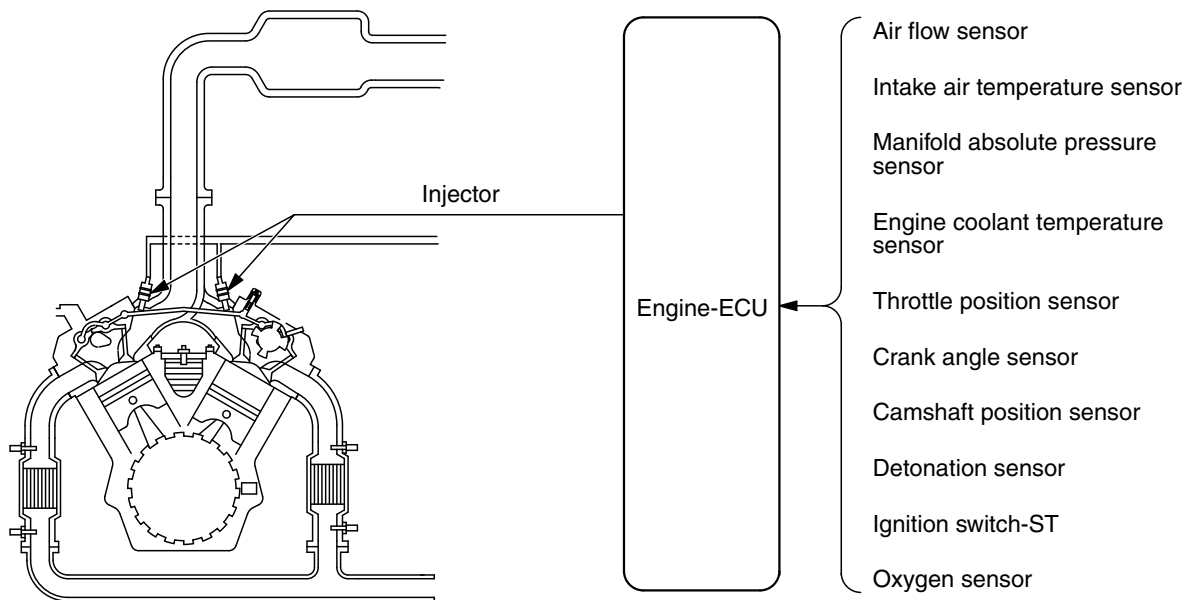
FUEL INJECTION CONTROL

M2132003001995

Fuel injection volume is regulated to obtain the optimum air-fuel ratio in accordance with the constant minute changes in engine driving conditions. Fuel injection volume is controlled by injector drive time (injection time). There is a prescribed basic drive time that varies according to the engine speed and

intake air volume. Engine-ECU adds prescribed compensations to this basic drive time according to conditions such as the intake air temperature and engine coolant temperature to decide injection time. Fuel injection is done separately for each cylinder and is done once in two engine rotations.

System Configuration Diagram

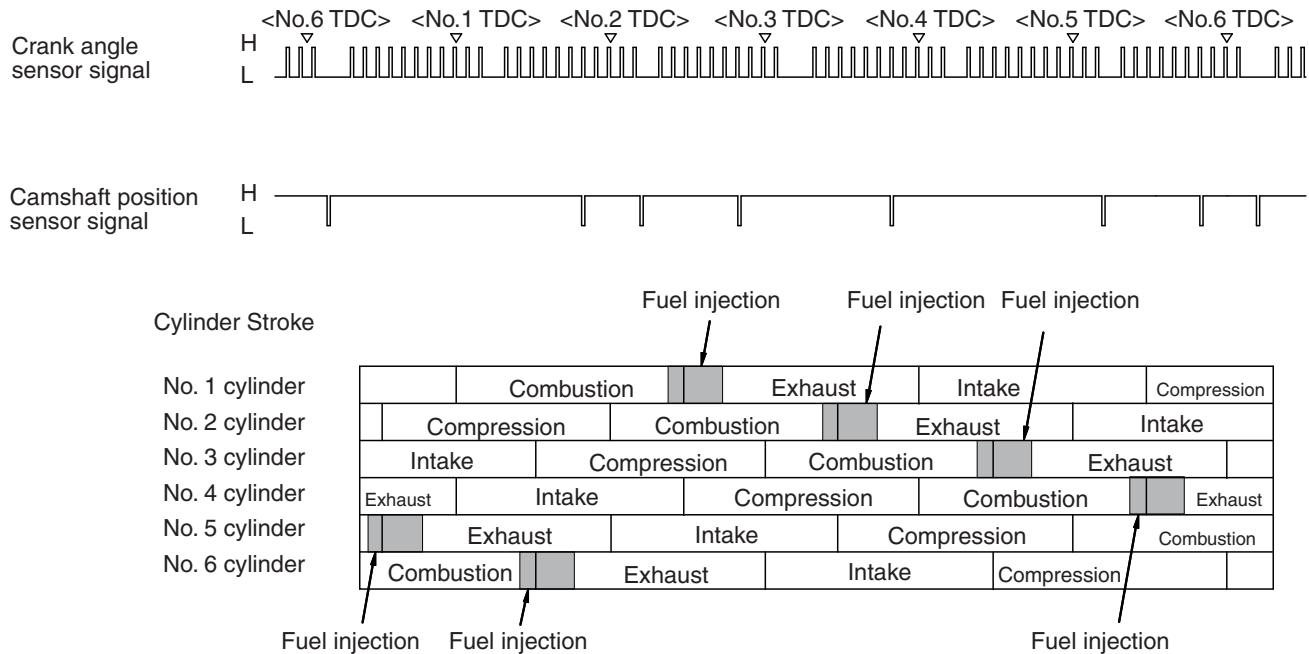


AK900207 AB

1. INJECTOR ACTUATION (FUEL INJECTION) TIMING

Injector drive time in case of multipoint fuel injection (MPI) is controlled as follows according to driving conditions.

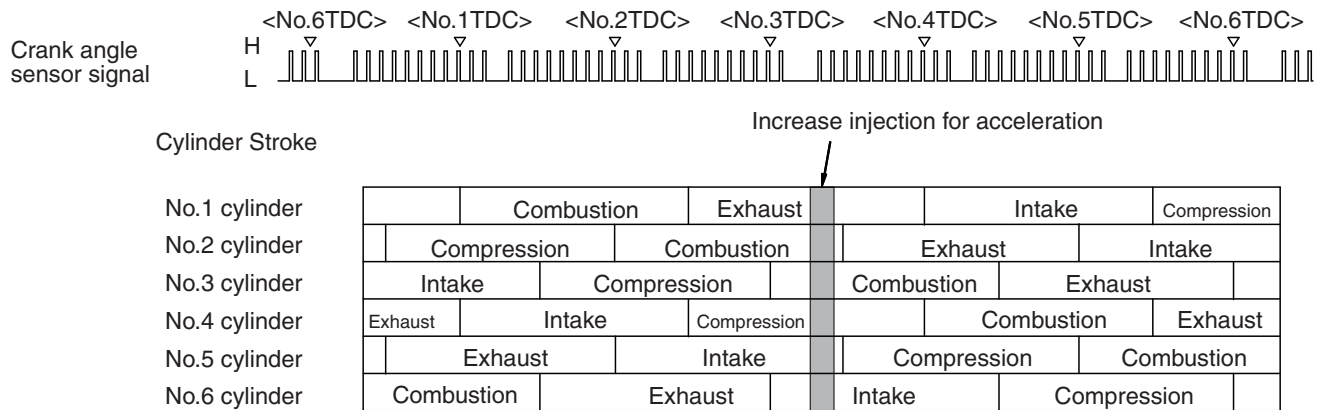
Fuel Injection During Cranking and Normal Operation



AK603568AB

Fuel injection to each cylinder is done by driving the injector at optimum timing while it is in exhaust process based on the crank angle sensor signal. Engine-ECU compares the crank angle sensor output pulse signal and camshaft position sensor output pulse signal to identify the cylinder. Using this as a base, it performs sequential injection in the sequence of cylinders 1, 2, 3, 4, 5, 6.

Additional Fuel Injection During Acceleration



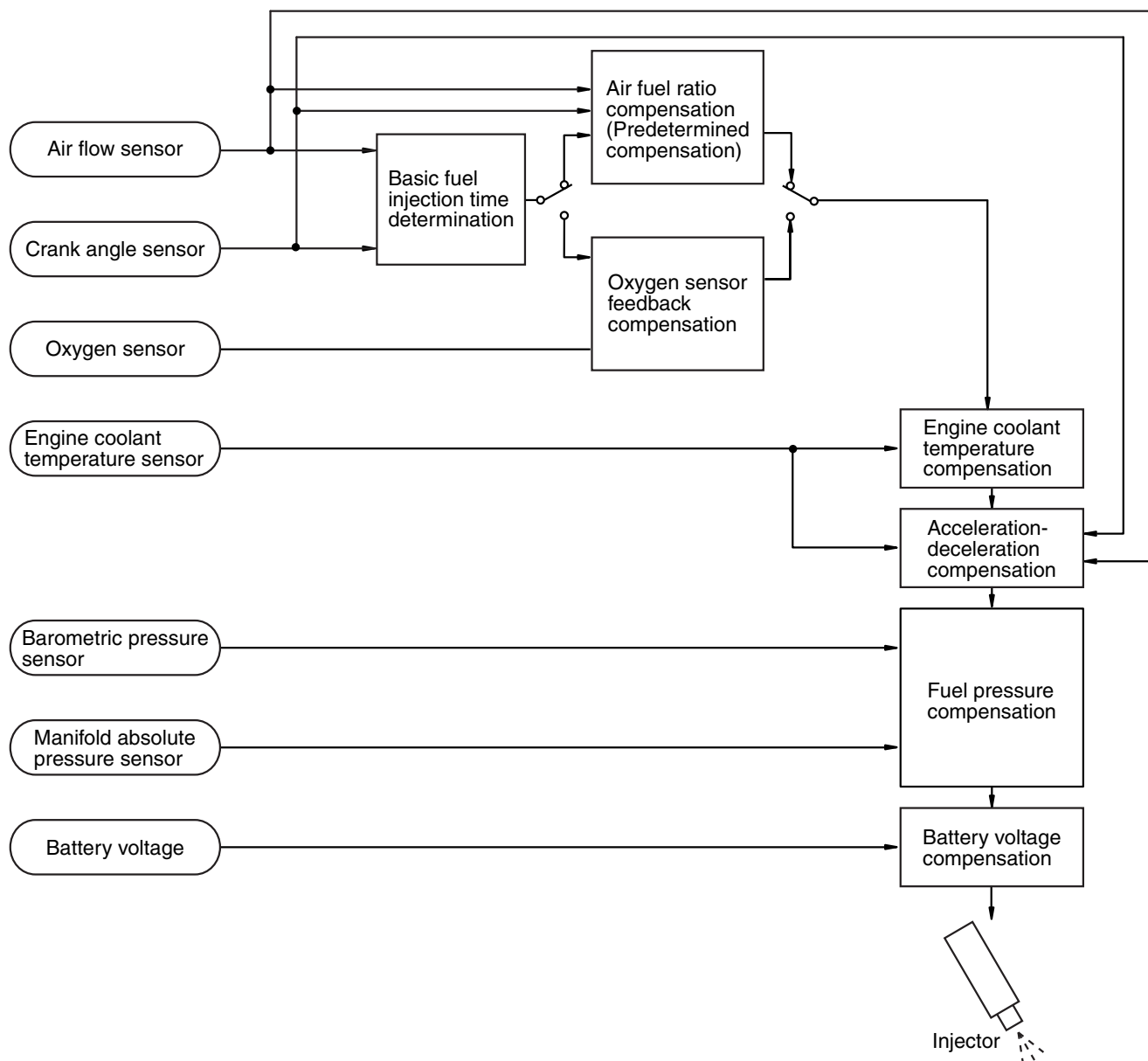
AK602277AB

In addition to the synchronizing fuel injection with crank angle sensor signal during acceleration, the volume of fuel is injected according to the extent of the acceleration.

2. Fuel injection volume (injector drive time) control

The figure is the calculation flowchart that describes the injector driving time for the fuel injection under the normal operating conditions. Basic drive time is decided based on the air flow sensor signal (intake air volume signal) and crank angle sensor signal (engine rotation signal). This basic drive time is compensated according to signals from various sensors and optimum injector drive time (fuel injection volume) is calculated according to driving conditions.

Fuel Injection Volume Control Block Diagram (Fuel injection under normal operating conditions)



[Injector basic drive time]

Fuel injection is performed once per cycle for each cylinder. Basic drive time refers to fuel injection volume (injector drive time) to achieve theoretical air-fuel ratio for the intake air volume of 1 cycle of 1 cylinder. Fuel injection volume changes according to

the pressure difference (injected fuel pressure) between manifold pressure and fuel pressure (constant). So, injected fuel pressure compensation is made to injector drive time for theoretical air-fuel ratio to arrive at basic drive time.

$$\text{Basic fuel injection time} \propto \frac{\text{Intake air amount per cycle per cylinder}}{\text{Theoretical air-fuel ratio}} \times \text{Fuel injection pressure compensation}$$

AK602279AB

Intake air volume of each cycle of 1 cylinder is calculated by engine-ECU based on the air flow sensor signal and crank angle sensor signal. Also, during engine start, the map value prescribed by the coolant temperature sensor signal is used as basic drive time.

[Injector drive time compensation]

After calculating the injector basic drive time, the engine-ECU makes the following compensations to control the optimum fuel injection volume according to driving conditions.

List of main compensations for fuel injection control

Compensations	Content
Oxygen sensor feedback compensation	The oxygen sensor signal is used for making the compensation to get air-fuel ratio with best cleaning efficiency of the 3-way catalytic converter. This compensation might not be made sometimes in order to improve drivability, depending on driving conditions. (Air-fuel ratio compensation is made.) The engine-ECU compensates the output signal of the oxygen sensor (front) using the output signal of the oxygen sensor (rear). This allows the deviation of the output signal, caused by the deterioration of the oxygen sensor (front), to be solved, then the highly accurate exhaust gas control is performed.
Air-fuel ratio compensation	Under driving conditions where oxygen sensor feedback compensation is not performed, compensation is made based on pre-set map values that vary according to engine speed and intake air volume.
Engine coolant temperature compensation	Compensation is made according to the engine coolant temperature. The lower the engine coolant temperature, the greater the fuel injection volume.
Acceleration/ Deceleration compensation	Compensation is made according to change in intake air volume. During acceleration, fuel injection volume is increased. Also, during deceleration, fuel injection volume is decreased.
Fuel injection compensation	Compensation is made according to the pressure difference between atmospheric pressure and manifold absolute pressure. The greater the difference in pressure, the shorter the injector drive time.
Battery voltage compensation	Compensation is made depending on battery voltage. The lower the battery voltage, the greater the injector drive signal time.
Learning value for fuel compensation	Compensation amount is learned to compensate feedback of oxygen sensor. This allows system to compensate in accordance with engine characteristics.

[Fuel limit control during deceleration]

Engine-ECU limits fuel when decelerating downhill to prevent excessive rise of catalytic converter temperature and to improve fuel efficiency.

[Fuel-cut control when over-run]

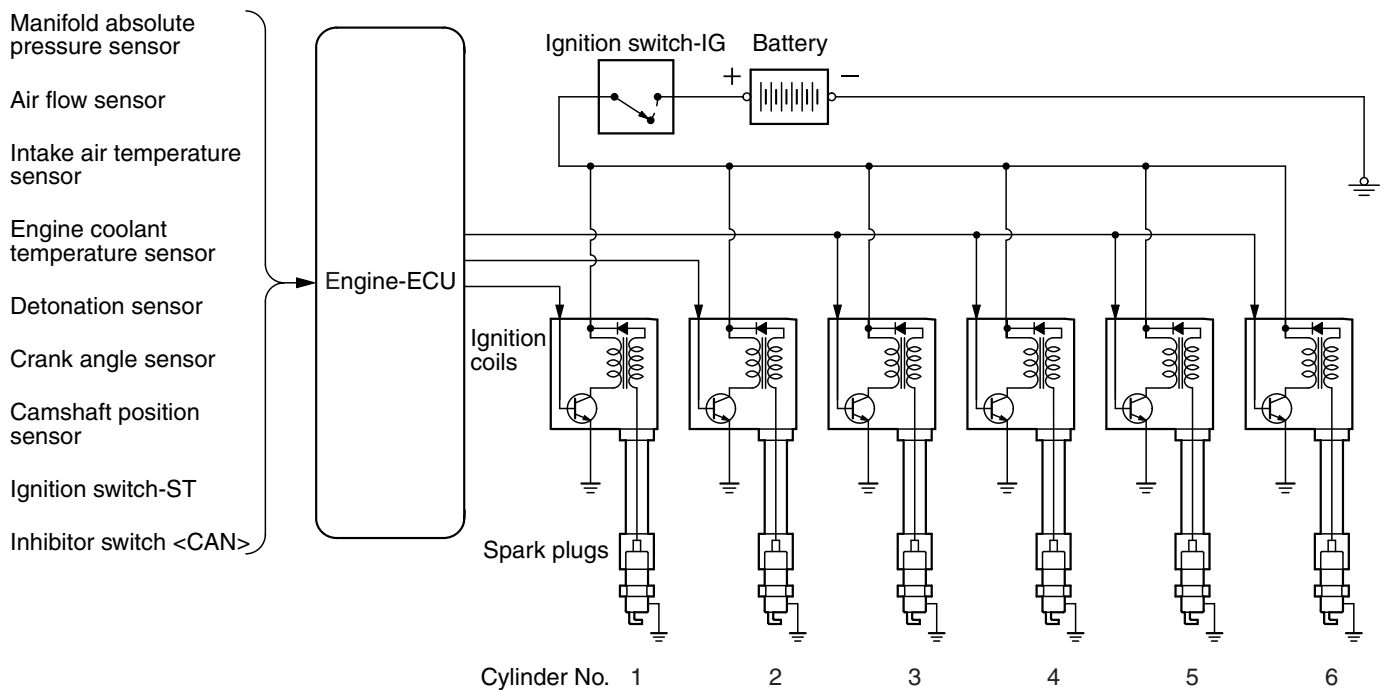
When engine speed exceeds a prescribed limit (7,500 r/min), engine-ECU cuts fuel supply to prevent overrunning and thus protect the engine.

IGNITION TIMING AND CONTROL FOR CURRENT CARRYING TIME

M2132027100647

Ignition timing is pre-set according to engine driving conditions. Compensations are made according to pre-set values depending on conditions such as engine coolant temperature, battery voltage etc. to decide optimum ignition timing. Primary current connect/disconnect signal is sent to the power transistor to control ignition timing. Ignition is done in sequence of cylinders 1, 2, 3, 4, 5, 6.

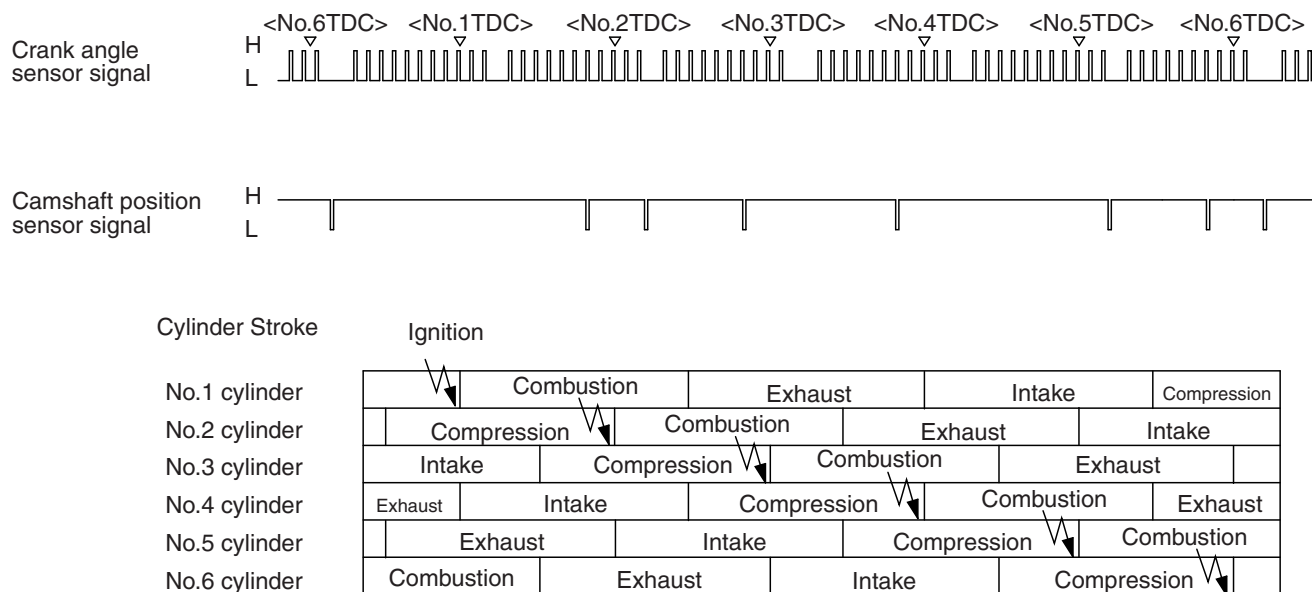
System Configuration Diagram



AK602235AC

1. Ignition power control

Based on the crank angle sensor signal and camshaft position sensor signal, engine-ECU decides the ignition cylinder, calculates the ignition timing and sends the ignition coil primary current connect/disconnect signal to the power transistor of each cylinder in the ignition sequence.



AK602280AB

2. Spark-advance control and current carrying time control

[During start]

Engine-ECU initiates ignition at fixed ignition timing (5° BTDC) synchronized with the crank angle sensor signal.

[During normal operation]

After determining the basic spark-advance based on the intake air volume and engine speed, engine-ECU makes compensations based on input from various sensors to control the optimum spark-advance and current carrying time.

List of main compensations for spark-advance control and current carrying time control

Compensations	Content
Intake air temperature compensation	Compensation is made according to intake air temperature. The higher the intake air temperature the greater the delay in ignition timing.
Engine coolant temperature compensation	Compensation is made according to engine coolant temperature. The lower the engine coolant temperature the greater the advance in ignition timing.
Knocking compensation	Compensation is made according to generation of knocking. The greater the knocking the greater the delay in ignition timing.
Stable idle compensation	Compensation is made according to change in idle speed. In case engine speed becomes lower than target speed, ignition timing is advanced.

Compensations	Content
Delay compensation when changing shift	During change of shift, sparking is delayed compared to normal ignition timing to reduce engine output torque and absorb the shock of the shift change.
Battery voltage compensation	Compensation is made depending on battery voltage. The lower the battery voltage the greater the current carrying time and when battery voltage is high current carrying time is shortened.

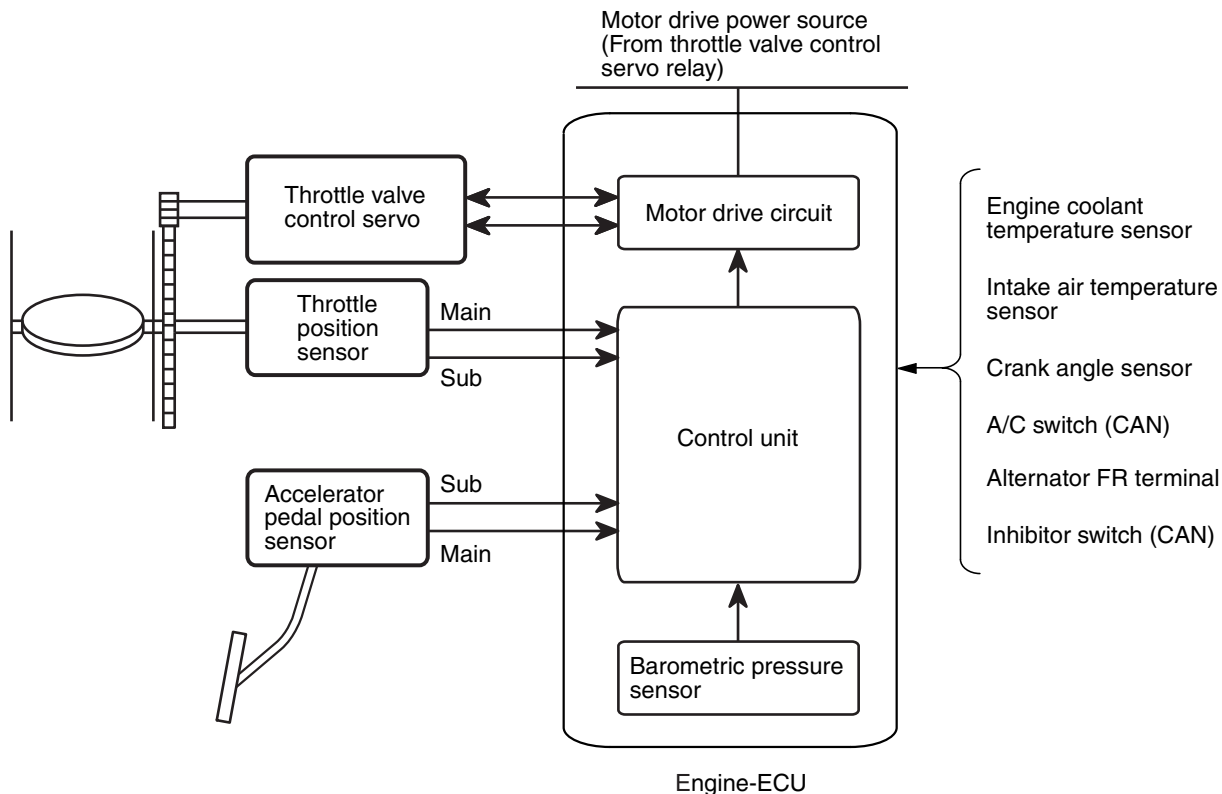
[Control for checking ignition timing]

During basic ignition timing set mode for M.U.T.-III actuator test function, sparking is done with fixed ignition timing (5° BTDC) synchronized with crank angle sensor signal.

THROTTLE VALVE OPENING ANGLE CONTROL AND IDLE SPEED CONTROL

M2132003501149

Engine-ECU detects the amount of accelerator pedal depression (as per operator's intention) through the accelerator pedal position sensor. Based on pre-set basic target opening angles it adds various compensations and controls the throttle valve opening angle according to the target opening angle.



While starting

Engine-ECU adds various compensations to the target opening angle that are set based on the engine coolant temperature, so that the air volume is optimum for starting.

While driving

Compensations are made to the target opening angle set according to the accelerator pedal opening angle and engine speed to control the throttle valve opening angle.

While idling

Engine-ECU controls the throttle valve to achieve the target opening angle that are set based on the engine coolant temperature. In this way best idle operation is achieved when engine is cold and when it is hot. Also, the following compensations ensure optimum control.

List of main compensations for throttle valve opening angle and idle speed control

Compensations	Content
Stable idle compensation (immediately after start)	In order to stabilize idle speed immediately after start, target opening angle is kept big and then gradually reduced. Compensation values are set based on the engine coolant temperature.
Rotation speed feedback compensation (while idling)	In case there is a difference between the target idle speed and actual engine speed, engine-ECU compensates the throttle valve opening angle based on that difference.
Atmospheric pressure compensation	At high altitudes atmospheric pressure is less and the intake air density is low. So, the target opening angle is compensated based on atmospheric pressure.
Engine coolant temperature compensation	Compensation is made according to the engine coolant temperature. The lower the engine coolant temperature the greater the throttle valve opening angle.
Electric load compensation	Throttle opening angle is compensated according to electric load. The greater the electric load, the greater the throttle valve opening angle.
Compensation when shift is in D range	When transmission is changed from P or N range to some other range, throttle valve opening angle is increased to prevent reduction in engine speed.
Compensation when A/C is functioning	Throttle opening angle is compensated according to functioning of A/C compressor. While A/C compressor is being driven, the throttle valve opening angle is increased.

Initialize control

After ignition switch turns OFF, engine-ECU drives the throttle valve from fully closed position to fully open position and records the fully closed/open studied value of the throttle position sensor (main and sub) output signals. The recorded studied values are used as studied value compensation for compensating basic target opening angle when the engine is started next.

Engine protection control

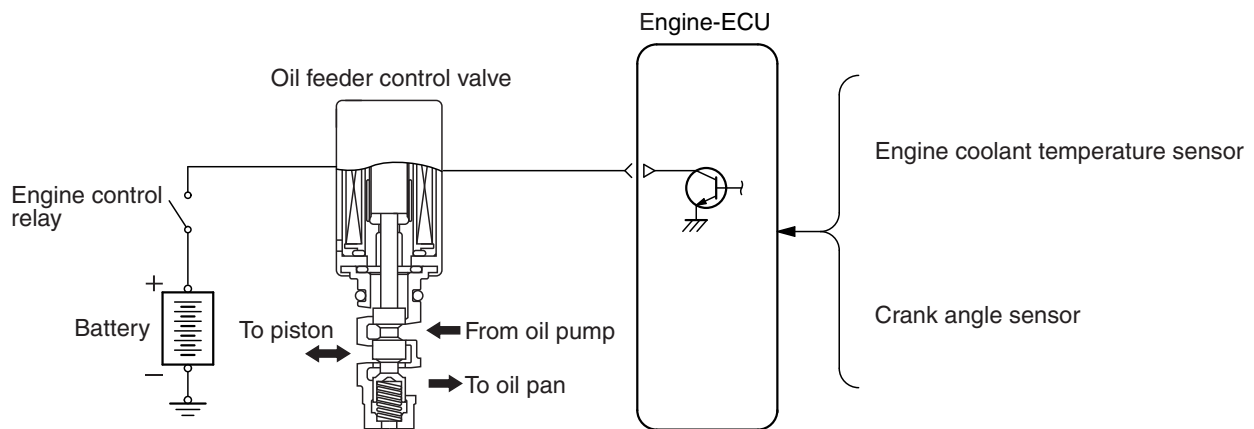
When the racing is continued during the vehicle stopped period (no-load period) for more than the specified time, the engine-ECU closes the throttle valve and restricts the engine speed to protect the engine.

MIVEC (Mitsubishi Innovative Valve Electronic Control System)

M2132023501022

Engine-ECU turns the engine oil control valve ON/OFF according to engine speed in order to control oil pressure acting on the piston in the rocker arm. Thus, change is done between low-speed cam and high-speed cam.

System Configuration Diagram

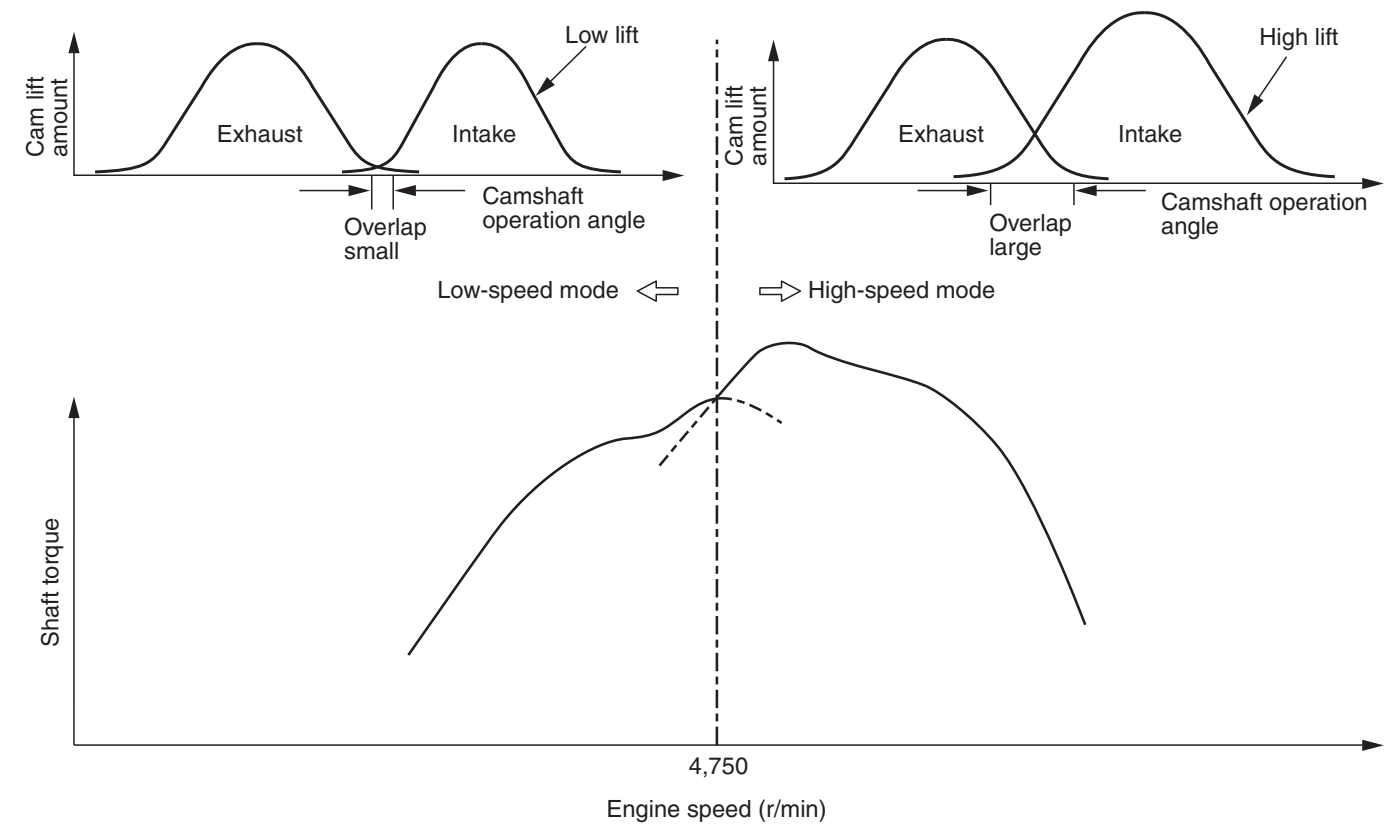


AK602237AG

Engine-ECU turns OFF (Duty: 0 %) the engine oil control valve at low engine speed (4,750 r/min or less). As a result, oil pressure does not act on the piston in the rocker arm and inlet valve is driven by the low speed cam. Engine-ECU turns ON (Duty: For 2 seconds after change 100 %; after 2 seconds 60 %) the engine oil control valve at high engine speed

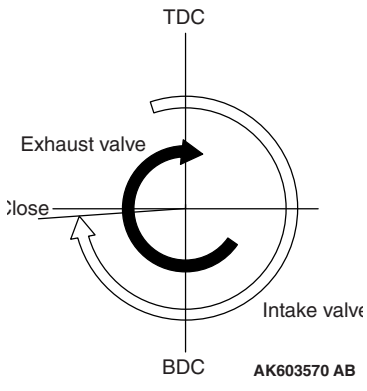
(4,750 r/min or more). As a result, oil pressure acts on the piston in the rocker arm and inlet valve is driven by the high speed cam. It will be continually driven by the low speed cam under following conditions.

- Engine coolant temperature is less than 20°C.
- For 10 seconds after engine is fully started.



AK602281 AC

Driving condition	Valve timing	Action	Benefit
Low engine speed	AK603569 AB	Valve opening time is shortened to limit spit back volume by intake air.	Improvement of low speed torque

Driving condition	Valve timing	Action	Benefit
High engine speed		Valve opening time is increased to increase input air volume.	Improve output power

ALTERNATOR CONTROL

M2132025000882

Alternator control is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Alternator Control.

A/C COMPRESSOR RELAY CONTROL

M2132034500807

A/C compressor relay control is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – A/C Compressor Relay Control.

OXYGEN SENSOR HEATER CONTROL

M2132007000808

Oxygen sensor heater control is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Oxygen Sensor Heater Control.

STARTER RELAY CONTROL

M2132025500779

Starter relay control is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Starter Relay Control.

FUEL PUMP RELAY CONTROL

M2132006500877

Fuel pump relay control is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Fuel Pump Relay Control.

ENGINE CONTROL RELAY CONTROL

M2132006000838

Engine control relay control is basically the same as that of the 4B1 engine.
Refer to GROUP 13A – Relay Control.

EVAPORATIVE EMISSION PURGE CONTROL

M2132012000536

Refer to GROUP 17 – Emission Control – Evaporative Emission Control System [P.17-5](#).

EXHAUST GAS RECIRCULATION CONTROL

M2132016000419

Refer to GROUP 17 – Emission Control – Exhaust Gas Recirculation System [P.17-6](#).

CONTROLLER AREA NETWORK (CAN)

M2132019001057

CAN communication is established to ensure the reliable transmission of information. Refer to GROUP 54C – General Information.

DIAGNOSIS SYSTEM

M2132009002190

Engine-ECU has been provided with the following functions for easier system inspection. Refer to the workshop manual for the details about each item.

- Freeze-frame data function
- Diagnosis code function
- Data list function
- Actuator test function

GROUP 14

ENGINE COOLING

CONTENTS

GENERAL INFORMATION	14-2	WATER PUMP	14-2
WATER PASSAGE	14-2		

GENERAL INFORMATION

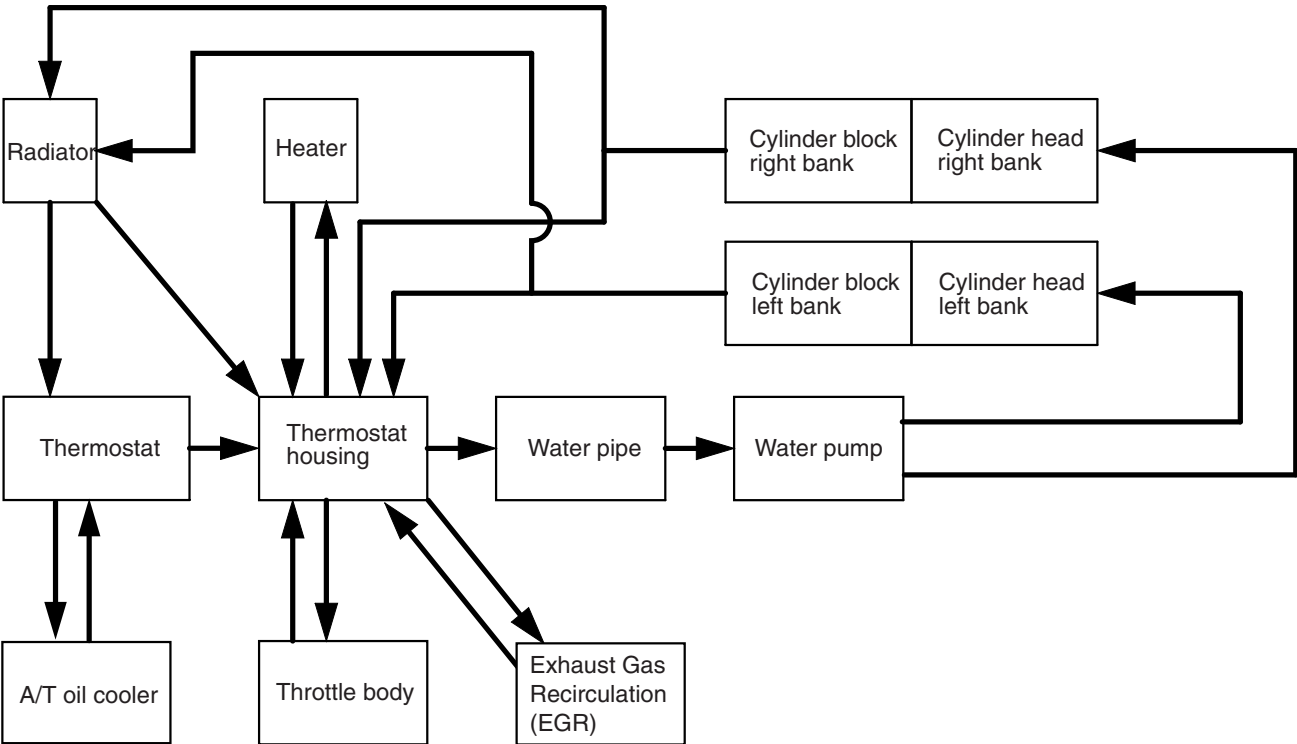
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The contents below have been added due to the introduction of 6B3 engine.

- Cooling circuit
- Water pump for 6B3 engine

WATER PASSAGE

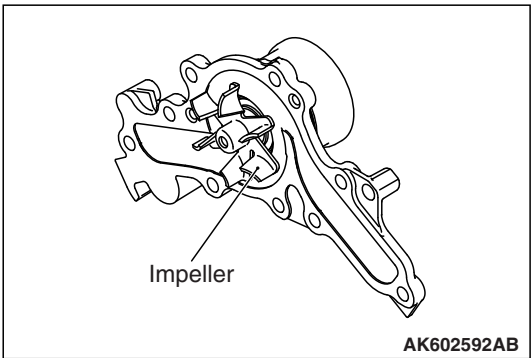
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ACD00159AB

WATER PUMP

M2140003000522



Item	Specifications
Discharge volume L/rpm	70/3 000, 140/6 000
Impeller diameter mm	64

The water pump is installed in the front of the cylinder block and driven by the timing belt.

GROUP 15

INTAKE AND
EXHAUST

CONTENTS

GENERAL INFORMATION	15-2	EXHAUST SYSTEM	15-3
AIR INTAKE SYSTEM	15-2	EXHAUST MANIFOLD	15-3
AIR DUCT AND AIR CLEANER	15-2	EXHAUST PIPE AND MUFFLER	15-3
INTAKE MANIFOLD	15-2		

GENERAL INFORMATION

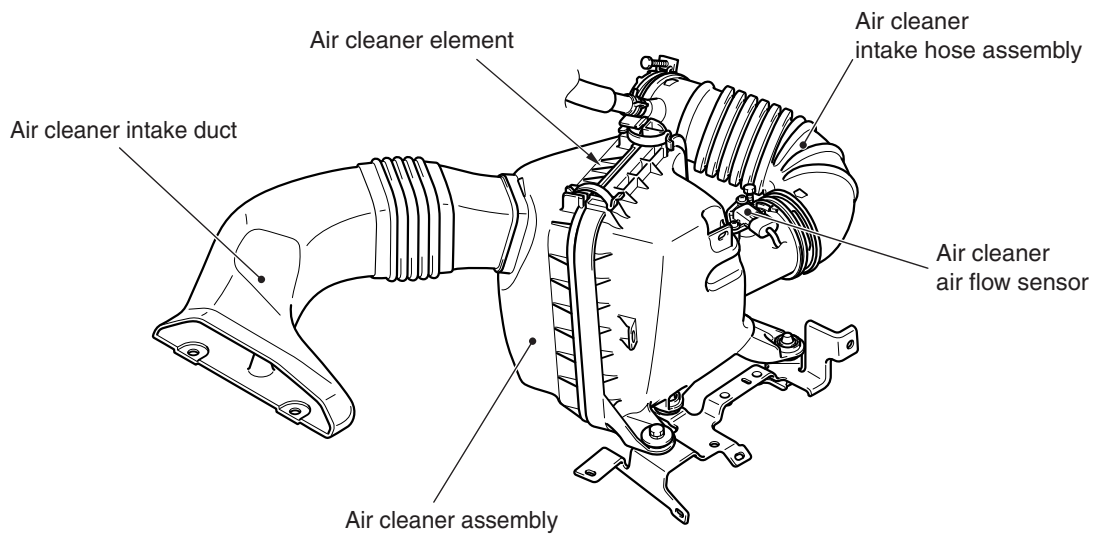
M2150002000092

The intake and exhaust system components for vehicles with 6B3 engine have been added.

AIR INTAKE SYSTEM

AIR DUCT AND AIR CLEANER

M2150004001422



ACD00128 AB

INTAKE MANIFOLD

M2150010000699

The inlet manifold consists of the upper inlet manifold and the lower inlet manifold.

The upper inlet manifold and the lower one are made of an aluminium cast to be lightweight.

EXHAUST SYSTEM

EXHAUST MANIFOLD

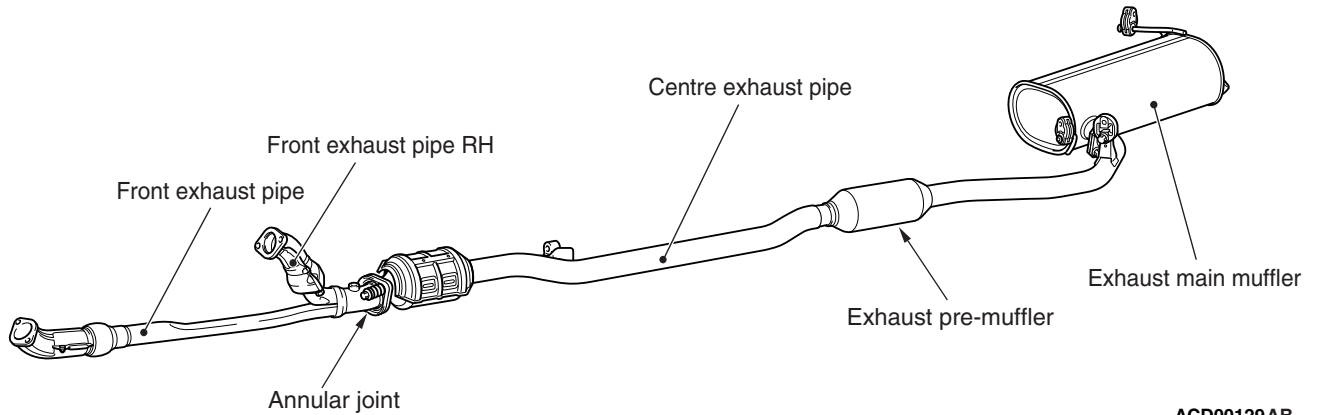
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The exhaust manifold clam-shell design reduces heat capacity and improves exhaust gas performance.

It advances the early warm-up of the catalyst and improves the exhaust gas performance especially right after the engine start by installing the manifold catalytic converter just under the exhaust manifold.

EXHAUST PIPE AND MUFFLER

M2150003001816



ACD00129AB

A four-piece type of exhaust pipe and muffler which consists of the front exhaust pipe, front exhaust pipe RH, centre exhaust pipe, and exhaust main muffler has been adopted.

NOTES

GROUP 17

ENGINE AND EMISSION CONTROL <6B3>

CONTENTS

CRUISE CONTROL SYSTEM	17-2	CRANKCASE VENTILATION SYSTEM . . .	17-4
GENERAL INFORMATION.	17-2	EVAPORATIVE EMISSION CONTROL SYSTEM	17-5
EMISSION CONTROL MPI.	17-2	EXHAUST GAS RECIRCULATION SYSTEM	17-6
GENERAL INFORMATION.	17-2	EMISSION REDUCTION SYSTEMS.	17-8

CRUISE CONTROL SYSTEM

GENERAL INFORMATION

M2170001001630

The cruise control system is basically the same as for vehicles with 4B1 engine. Note that you should replace the component names as below when you refer to the service publications for vehicles with 4B1 engine.

- CVT → A/T
- Secondary pulley speed sensor → Output shaft speed sensor

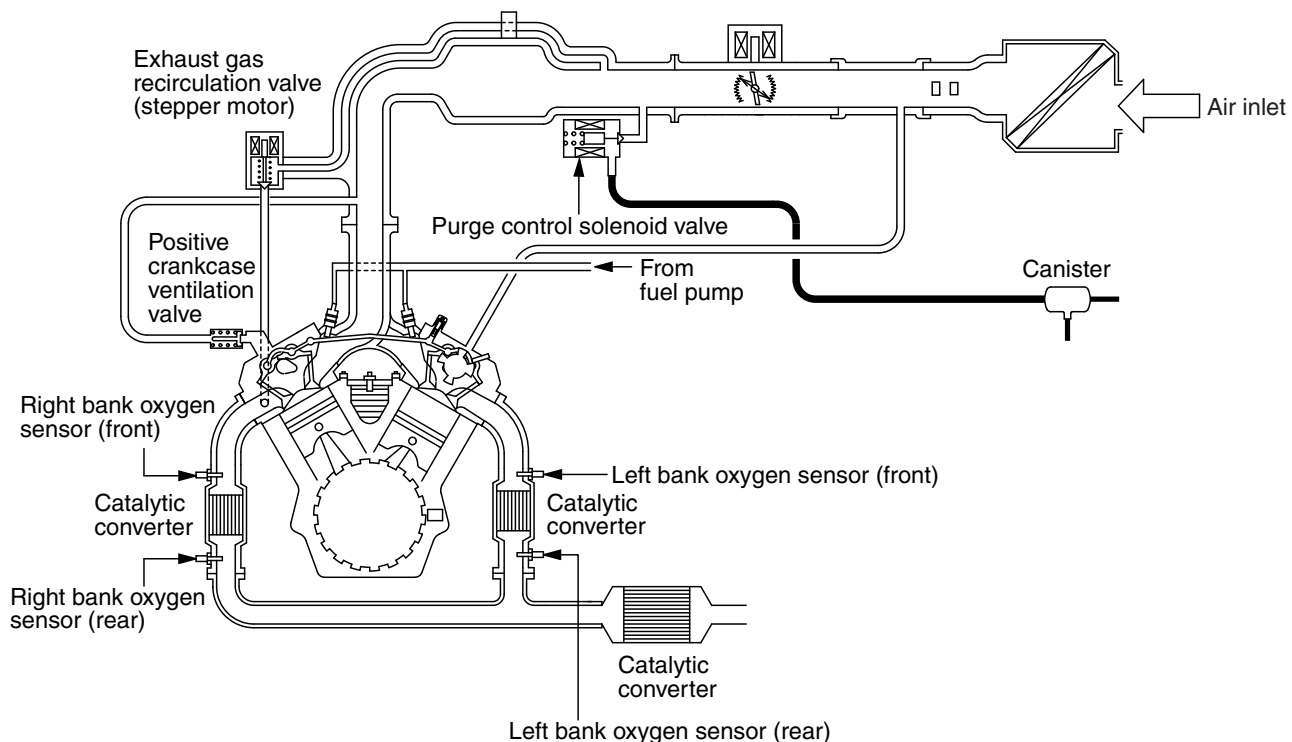
EMISSION CONTROL<MPI>

GENERAL INFORMATION

M2171000101864

Based on the controls of the 6B31 engine equipped on the conventional OUTLANDER (CW6W), the following change has been made.

Improvement / Addition	Remark
An exhaust gas recirculation (EGR) system is used.	Reduce NOx generation.

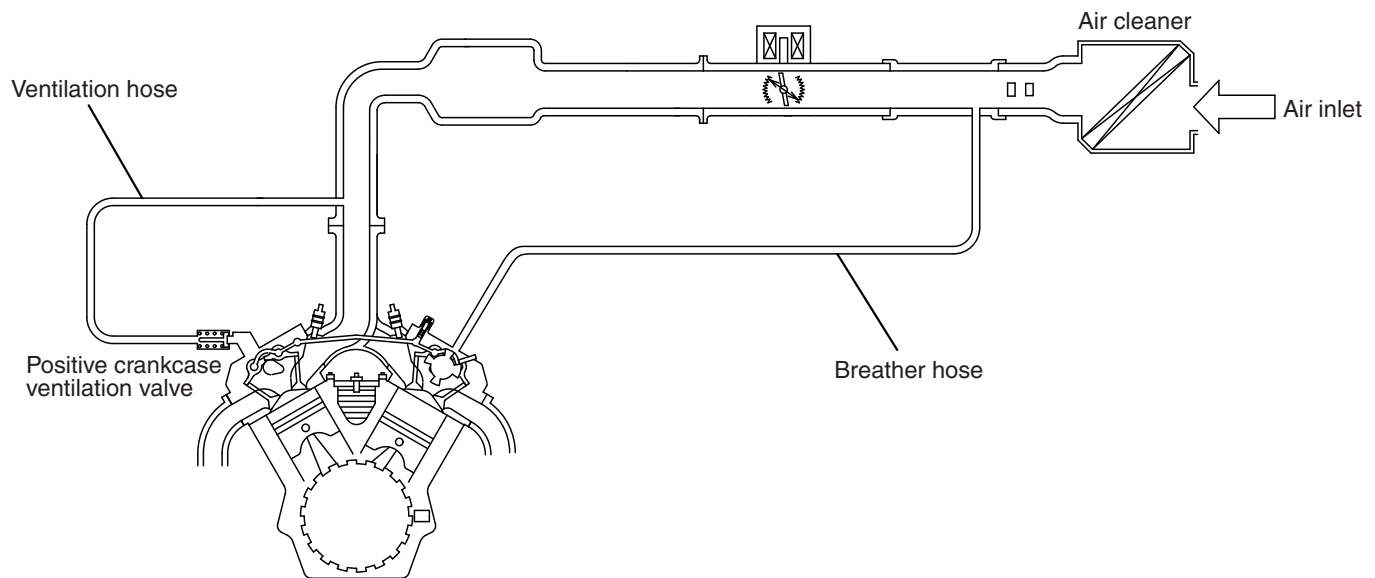


Exhaust gas cleaning devices list

System		Objective / Function	Composition parts
Crankcase ventilation system		HC decrease Re-combustion of blow-by gas.	Positive crankcase ventilation (PCV) valve
Evaporative emission control system		HC decrease Re-combustion of blow-by gas.	• Canister • Purge control solenoid valve
Exhaust gas recirculation system		NOx decrease Reduce NOx generation by controlling EGR volume according to engine warm-up condition and driving conditions.	Exhaust gas recirculation valve
Emission reduction systems	Air-fuel ratio feedback control	Decrease of CO, HC and NOx Controls air-fuel ratio of air-fuel mixture to become theoretical air-fuel ratio (about 14.7), which is when the 3-way catalytic converter's cleaning performance is best. It also controls optimum fuel supply based on coolant temperature, driving conditions etc.	• Engine-ECU • Air flow sensor • Injector • Oxygen sensor • Crank angle sensor etc.
	Catalytic converter	Decrease of CO, HC and NOx It facilitates oxidation of CO and HC and reduction of NOx so that all 3 component gases are cleaned simultaneously.	Monolith catalyst

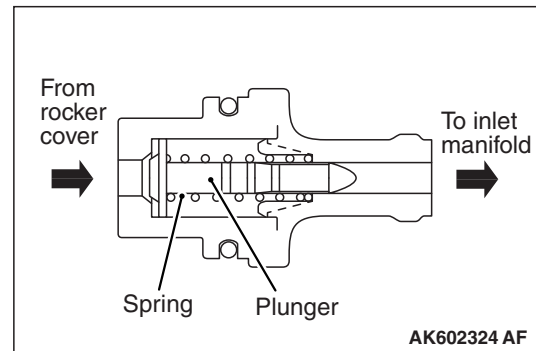
CRANKCASE VENTILATION SYSTEM

M2171000400691



AK900120AB

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

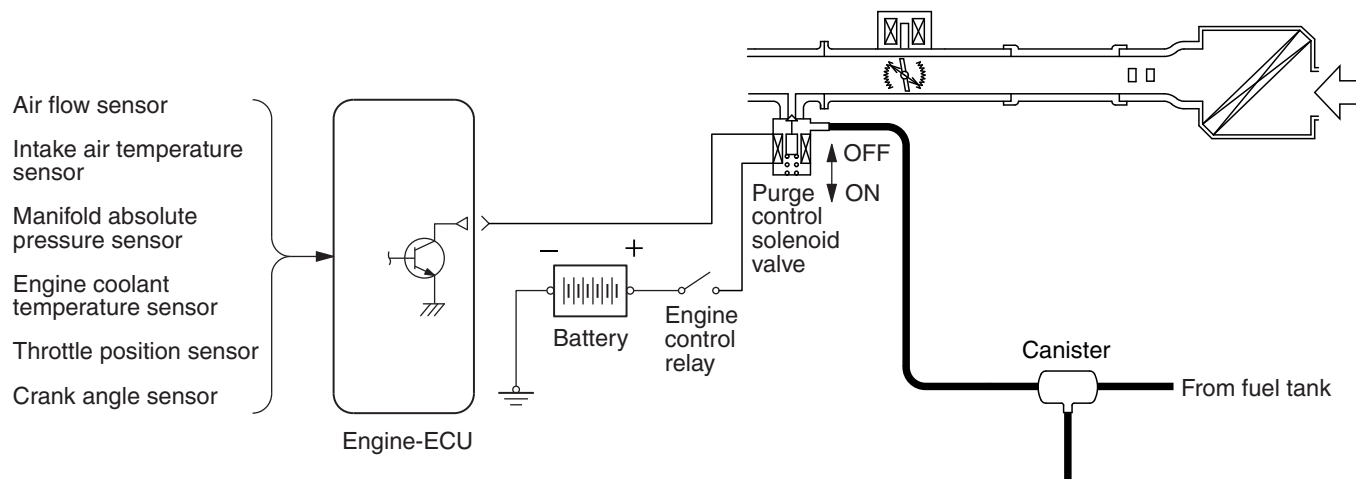
POSITIVE CRANKCASE VENTILATION (PCV) VALVE

AK602324 AF

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

EVAPORATIVE EMISSION CONTROL SYSTEM

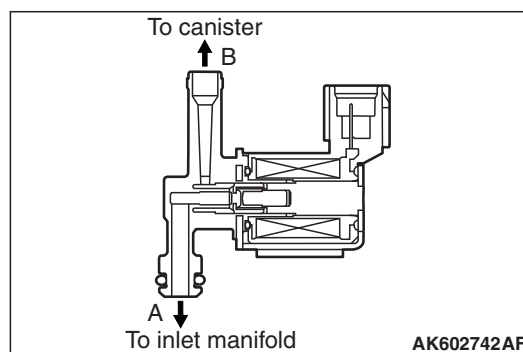
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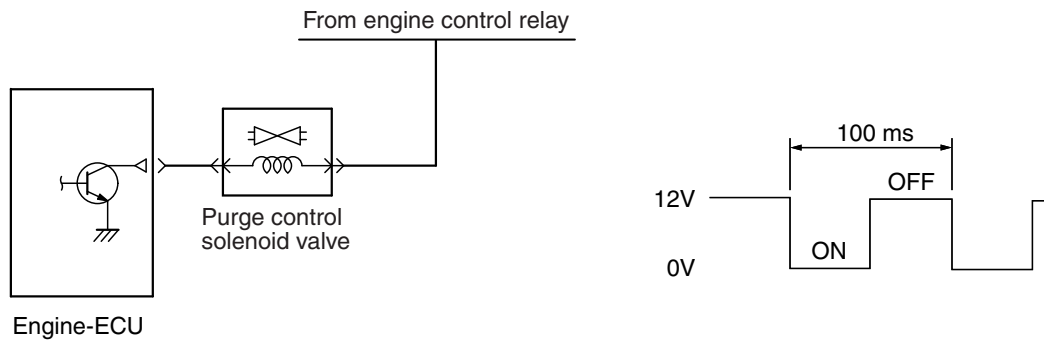
HC (hydrocarbon) generated in the fuel tank are adsorbed by the active carbon in the canister and stored. HC stored in the canister is introduced to the inlet manifold when engine is in operation where it is mixed with intake air and combusted. Engine-ECU introduces optimum HC amount according to driving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

PURGE CONTROL SOLENOID VALVE



AK602742AF

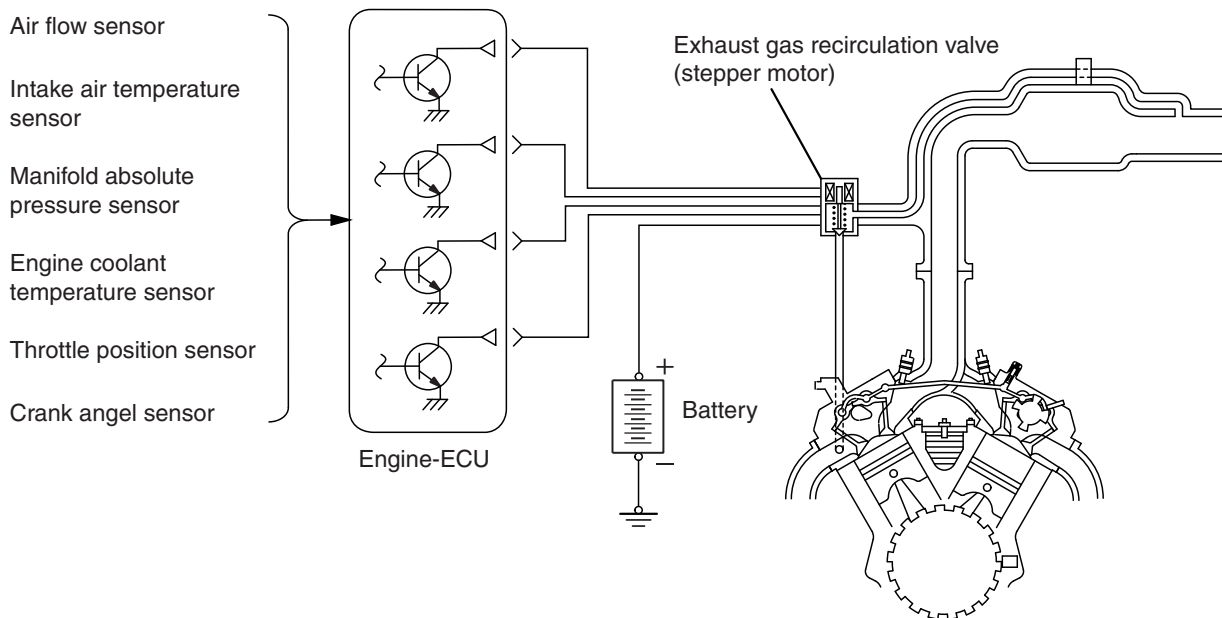
A purge control solenoid valve is installed in the inlet manifold. The purge control solenoid valve controls the intake volume of fuel vapour gas from the canister. The purge control solenoid valve is a duty control type solenoid valve. When current is not passing through the coil, nipple A is kept airtight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



AK602245AC

EXHAUST GAS RECIRCULATION SYSTEM

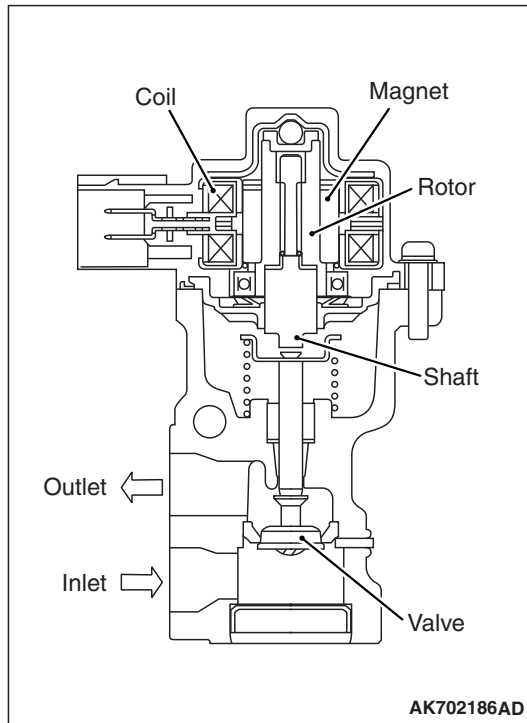
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AK900125AB

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

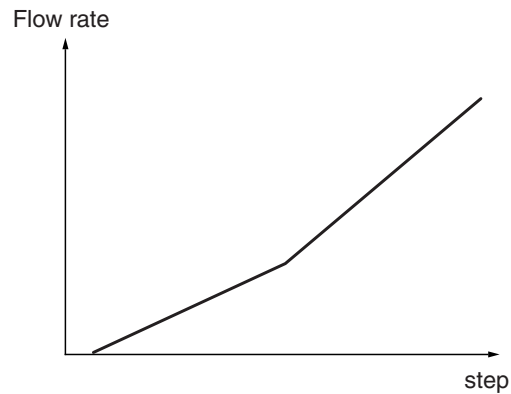
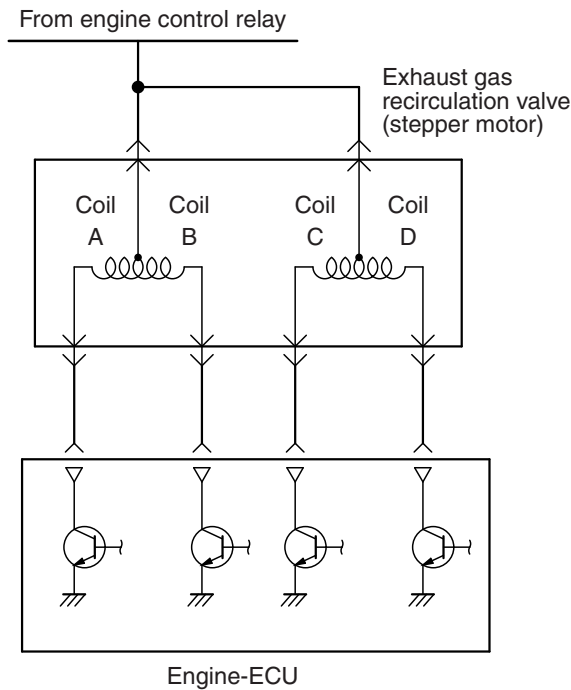
temperature and reduce the volume of NO_x generated. Engine-ECU calculates the exhaust gas recirculation introduction volume according to engine operating conditions and controls the exhaust gas recirculation valve opening angle at optimum. Also, immediately after the ignition switch ON signal is input, it drives fully closed stepper motor and performs initialization.

EXHAUST GAS RECIRCULATION VALVE

Depending on the vehicle, the installation location of the exhaust gas recirculation valve is as follows. Exhaust gas recirculation valve is installed in EGR valve support.

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

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



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EMISSION REDUCTION SYSTEMS

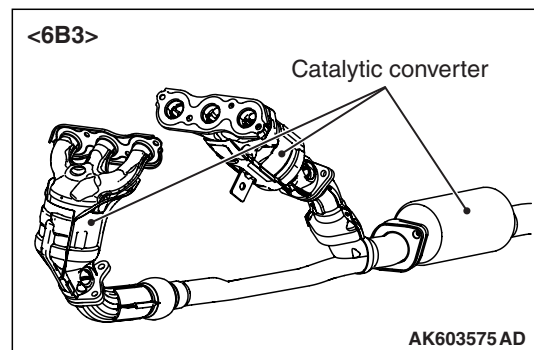
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These decrease CO, HC and NOx in the exhaust gases and consist of air-fuel ratio feedback control and catalytic converter.

1. AIR-FUEL RATIO FEEDBACK CONTROL

Refer to GROUP 13F <6B3> – Fuel Injection Control P.13F-11.

2. CATALYTIC CONVERTER



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

GROUP 23B

AUTOMATIC TRANSMISSION

CONTENTS

GENERAL INFORMATION	23B-2	LIST OF CONTROL ITEMS AND INPUT/OUTPUT SIGNALS	23B-20
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OIL PUMP	23B-6	A/T FLUID WARMER	23B-28
CLUTCH AND BRAKE	23B-6	TRANSFER	23B-28
VALVE BODY ASSY	23B-8	GENERAL INFORMATION	23B-28
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GENERAL INFORMATION

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This automatic transmission is a high torque capacity FF 6-speed A/T. By making the shift range into a multi step, a more effective engine torque transfer results.

CHARACTERISTICS

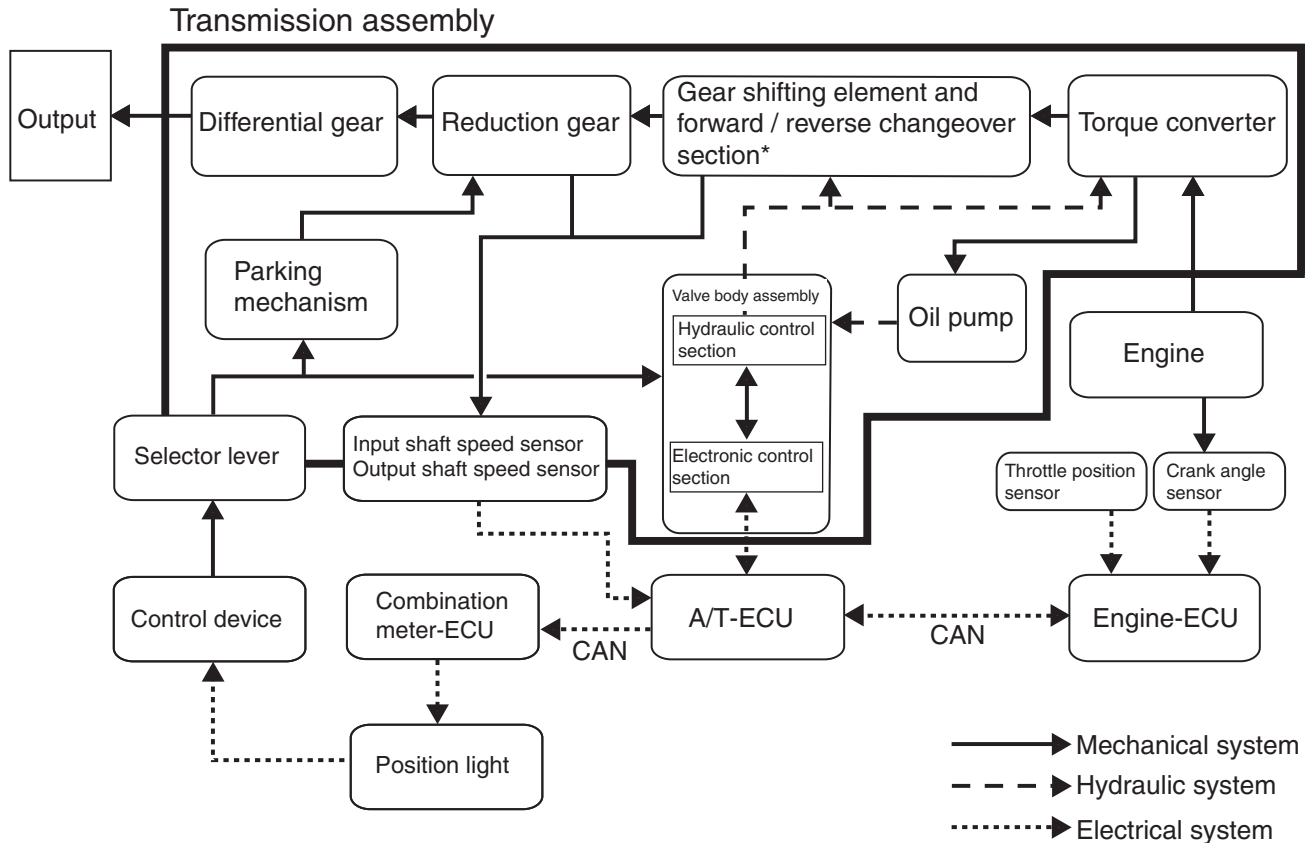
Item	Contents
Power/fuel consumption performance	The gear ratio range (1st to 6th) of up to 6.1 has been adopted to combine the fuel consumption and power performance.
Shift control	The A/T-ECU accommodating the controls of slip lock-up*¹, INVECS-II*², and manual shift control*² has been adopted. *¹: Mechanism that controls the slip amount inside the torque converter *²: Control which selects the optimum gear that matches the driving style or driving environment

SPECIFICATIONS

Transmission model		W6AJA
Drive type		4WD
Torque converter	Model	3-element, 1-stage, 2-phase
	Stall torque ratio	1.96
	Lock-up	Present
Shift position		P-R-N-D-L
Transmission type		Forward 6-speed, reverse 1-stage
Front and rear switching		Single pinion x 2 (front, rear) Double pinion x 1 (reduction) <Based on lepelletier system>
Clutch and brake		Clutch x 3 (low clutch, 3-5 reverse clutch, high clutch) Brake x 2 (2-6 brake, low and reverse brake)
Oil pump		Trochoid type
Maximum hydraulic pressure		2.0 MPa
Torque capacity		320 N·m
Solenoid valve		Linear x 6 pieces ON/OFF x 2 pieces
Transmission ratio	1st	4.199
	2nd	2.405
	3rd	1.583
	4th	1.161
	5th	0.855
	6th	0.685
	Reverse	3.457

Primary reduction ratio: A		1.071
Final reduction ratio: B		3.136
A × B		3.360
Weight (including A/T fluid)		Approximately 103 kg
A/T fluid	Brand name	MITSUBISHI MOTORS GENUINE ATF - J3
	Capacity (L)	8.2

SYSTEM CONFIGURATION



* : Low clutch, 3-5 reverse clutch, High clutch, Low-reverse brake, 2-6 brake, Input shaft, front/rear/reduction planetary gear

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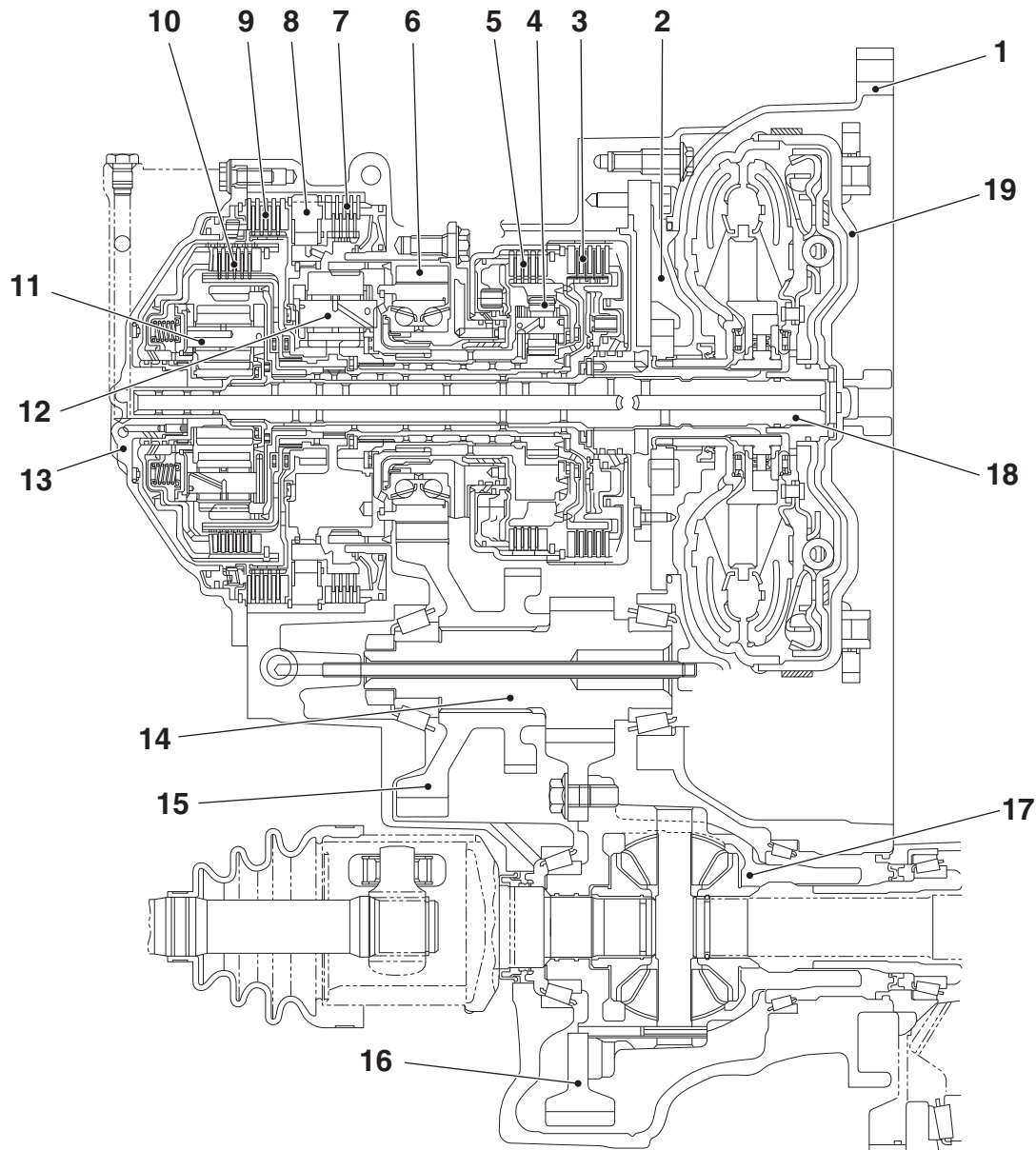
Parts name	Function
Torque converter	Composed of the cover converter, turbine assembly, stator, pump impeller assembly, and others. It increases the engine torque, and transfers the power to transmission.
Oil pump	Composed of the gear, housing, cover, and others. It generates the oil pressure necessary for the A/T fluid circulation, and for the operations of clutch and brake.
Low clutch	Composed of the clutch drum, piston, spring retainer assembly, drive plate, driven plate, and others. It links the plates by the hydraulic operation of piston, and transfers the power to the front internal gear.

3-5 reverse clutch	The components are the same as for the low clutch. It links the plates by the hydraulic operation of piston, and transfers the power to the front sun gear.
High clutch	The components are the same as for the low clutch. It links the plates by the hydraulic operation of piston, and transfers the power to the rear carrier.
Low and reverse brake	Composed of the piston, spring retainer assembly, drive plate, driven plate, and others. It links the plates by the hydraulic operation of piston, and fixes the rear carrier.
2-6 brake	The components are the same as for the low and reverse brake. It links the plates by the hydraulic operation of piston, and fixes the rear sun gear.
Input shaft	It is spline-engaged with the reduction carrier. It transfers the power from the torque converter. For the shaft inner hole, there are the lubricant supply hole for the each sliding area inside the unit and the hydraulic pressure distribution hole for the lock-up ON-OFF.
Front planetary gear	Composed of the carrier, sun gear, and internal gear. It increases or decreases the output rotation in relation to the input by fixing or releasing the carrier, sun gear, and internal gear.
Rear planetary gear	The components are the same as for the front planetary gear. By fixing or releasing the carrier, sun gear, and internal gear, it increases or decreases the output rotation in relation to the input, and switches the rotation direction between normal and reverse.
Reduction planetary gear	The components are the same as for the front planetary gear. By fixing or releasing the carrier, sun gear, and internal gear, it increases or decreases the output rotation in relation to the input.
4-point gear	The power is transferred from the rear internal gear to the output gear → idler gear → reduction pinion gear → final gear.
Valve body assembly	Controls the original pressure from the oil pump to the suitable hydraulic pressure for the line pressure control system, shift control system, lock-up control system, and lubrication system.

CONSTRUCTION AND OPERATION

SECTIONAL VIEW

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- | | |
|--------------------------|------------------------------|
| 1. Converter housing | 11. Reduction planetary gear |
| 2. Oil pump | 12. Rear planetary gear |
| 3. 3-5 reverse clutch | 13. Side cover |
| 4. Front planetary gear | 14. Reduction pinion gear |
| 5. Low clutch | 15. Idler gear |
| 6. Output gear | 16. Final gear |
| 7. Low and reverse brake | 17. Differential case |
| 8. One-way clutch | 18. Input shaft |
| 9. 2-6 brake | 19. Torque converter |
| 10. High clutch | |

TORQUE CONVERTER

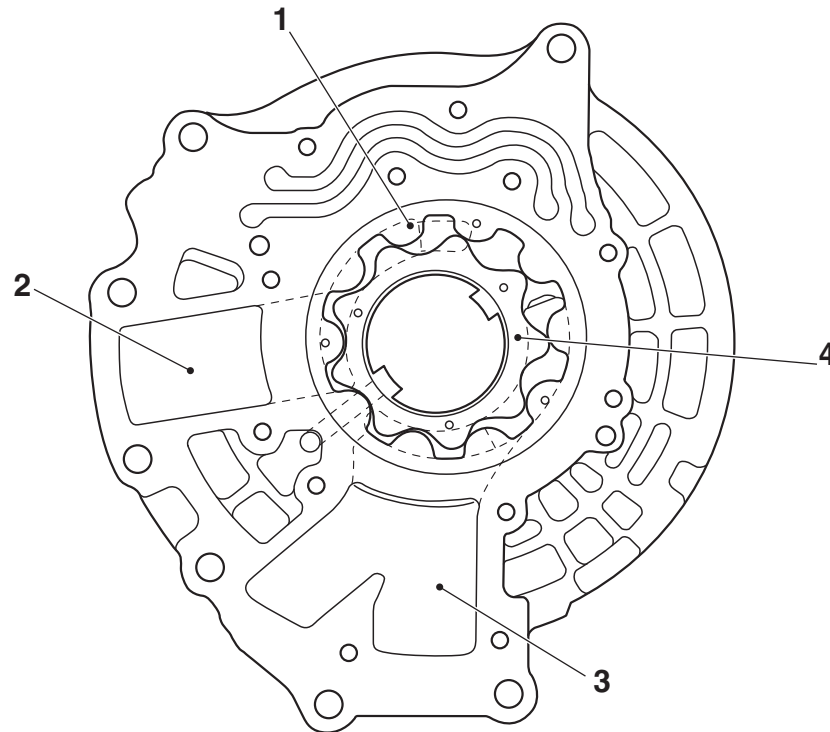
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The torque converter with the "3-element, 1-stage, 2-phase" lock-up mechanism has been adopted.

OIL PUMP

M2230001600074

The oil pump of "internal trochoid gear pump" has been adopted.



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1. Outer gear
2. Discharge port
3. Inlet port
4. Inner gear

CLUTCH AND BRAKE

M2230002900034

DISH PLATE AND HIGH-LOAD WAVE PLATE

In order to reduce the shock at the engagement, the "dish plate" with elastic effect has been adopted to the high clutch and low clutch. Also, the "high-load wave plate" with the similar effect has been adopted to the 2-6 brake and 3-5 reverse clutch.

CENTRIFUGAL CANCEL CHAMBER

With this A/T, a "centrifugal cancel chamber" that faces all the clutch chambers is used. To the "centrifugal cancel chamber," the A/T fluid is always charged via the special oil passage of oil pump.

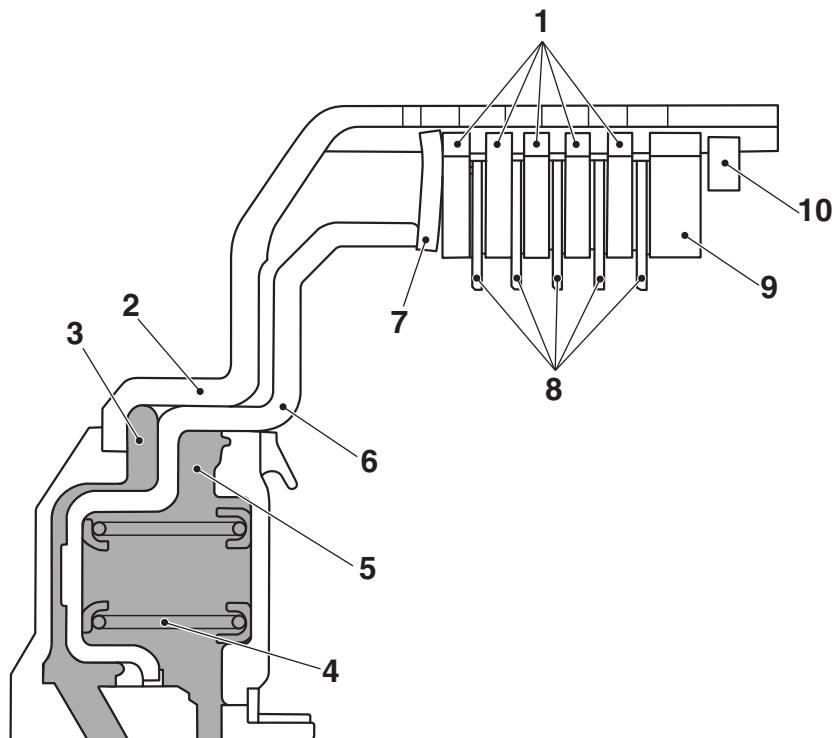
Operation and function

- Clutch pressure not in operation

When the clutch drum is rotated, the centrifugal force works on the remaining A/T fluid in clutch chamber, and the force pushes the clutch piston. However, because the centrifugal force also works on the A/T fluid charged in the centrifugal cancel chamber, the clutch piston is pushed back. Therefore, the clutch piston does not move because both forces are cancelled by each other, preventing the clutch drag.

- Clutch pressure in operation

When the clutch pressure works on the cylinder chamber, the pressure overcomes the facing centrifugal cancel chamber's hydraulic pressure and the spring force. Consequently, the clutch piston is pushed, and the clutch is engaged. At this time, the centrifugal force that works on the clutch pressure of cylinder chamber is cancelled out by the centrifugal force that works on the centrifugal cancel chamber. Therefore, the effects from centrifugal force generated by the clutch drum rotation will be eliminated. For this reason, the constant clutch piston pushing force is obtained with all rotations, and smooth shifting has been achieved.



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1. Clutch plate
2. Clutch drum
3. Cylinder chamber
4. Return spring
5. Centrifugal cancel chamber
6. Clutch piston
7. Dish plate
8. Clutch disc
9. Retaining plate
10. Snap ring

ONE-WAY CLUTCH

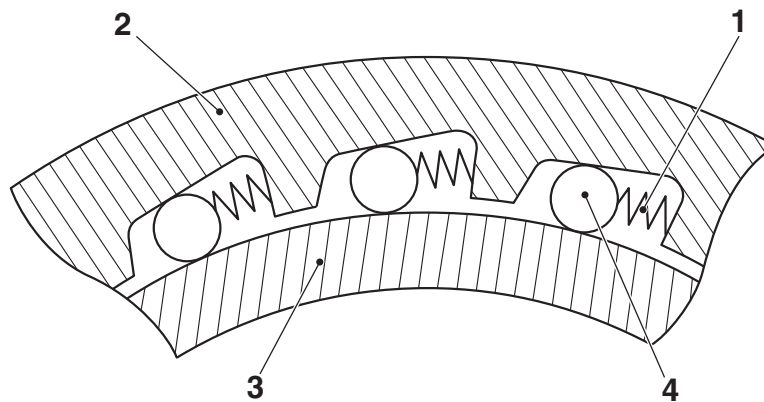
The type of one-way clutch adopted with this A/T is called as "roller type." Depending on the direction of torque application, the clutch engages by itself and transfers the torque. It rotates freely to the opposite direction, and does not transfer the torque.

STRUCTURE

With "roller type," the roller and spring are inserted between the inner race of cylindrical surface and the outer race with a number of tilted cam surfaces. This type is composed of four parts.

OPERATION

- When the one-way clutch is operating
When the one-way clutch rotates toward the torque transmission direction, the rollers move toward the narrow side of the roller chamber, which is composed of the inner race and the outer race. Since the narrow side of the roller chamber is smaller than the roller diameter, the rollers are engaged between the cam surfaces of the outer race and the cylindrical surface of the inner race, and the inner race and the outer race rotate together.
- When the one-way clutch is not operating
When the one-way clutch rotates toward the direction opposite to the torque transmission, the rollers move toward the wide side of the roller chamber, which is composed of the inner race and the outer race. Since the wide side of the roller chamber is larger than the roller diameter, a clearance is created between the roller chamber and the rollers. Therefore, the inner race and the outer race are released.



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1. Spring
2. Outer race

3. Inner race
4. Roller

VALVE BODY ASSY

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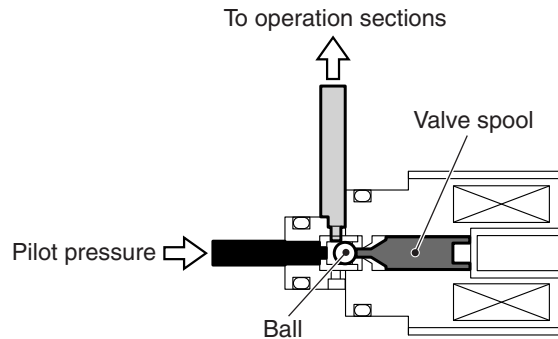
The valve body assembly plays its role as the core of the A/T which performs "shift control", "hydraulic pressure control", and "fluid distribution to lubrication line". The components are the "body lower", "body upper", "body inter", "separate plate", "solenoid valve", "valve spool", "spring", and "check ball", and all these parts require considerable precision.

Solenoid valve

There are two types of the solenoid valve adopted to this A/T, "ON-OFF solenoid valve" and "linear solenoid valve".

- ON-OFF solenoid valve
The valve spool installed inside the coil only operates so as to press or not to press the ball, which seals the hydraulic pressure supply section, against the sheet surface. With this A/T, the normal low type is used. When the voltage is not

applied to the coil, the ball is pressed against the sheet surface by the force of built-in spring, stopping the pilot pressure. When the voltage is applied to the coil, the valve is drawn to the right, and the hydraulic pressure seal by the ball is released, supplying the pilot pressure to the operation sections.



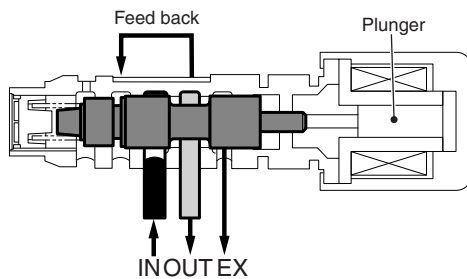
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- Linear solenoid valve

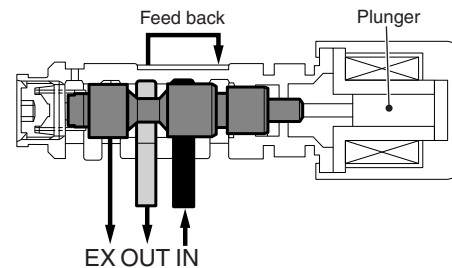
There are two types to this solenoid valve, the normal low type with which the control hydraulic pressure is not generated when the voltage is not applied to the coil, and the normal high type which has an opposite characteristics. The principle of solenoid valve is the phenomenon that the pushing force against the valve spool installed inside the coil increases approximately in proportion to the electric current. By using this pushing force, it can generate the hydraulic pressure proportionate to the force.

ple of solenoid valve is the phenomenon that the pushing force against the valve spool installed inside the coil increases approximately in proportion to the electric current. By using this pushing force, it can generate the hydraulic pressure proportionate to the force.

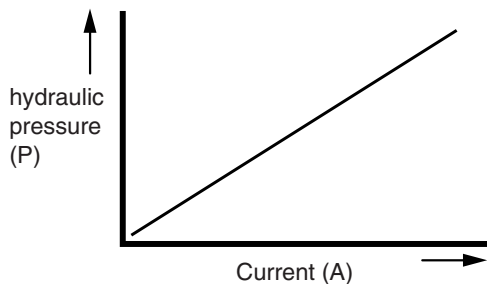
Normal low type



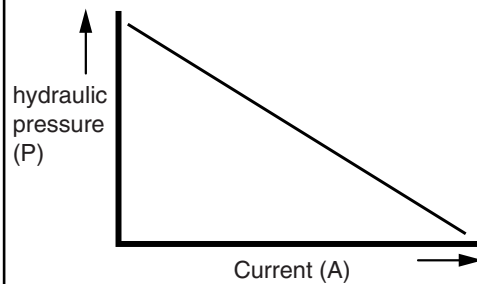
Normal high type



Characteristics diagram of normal low type



Characteristics diagram of normal high type



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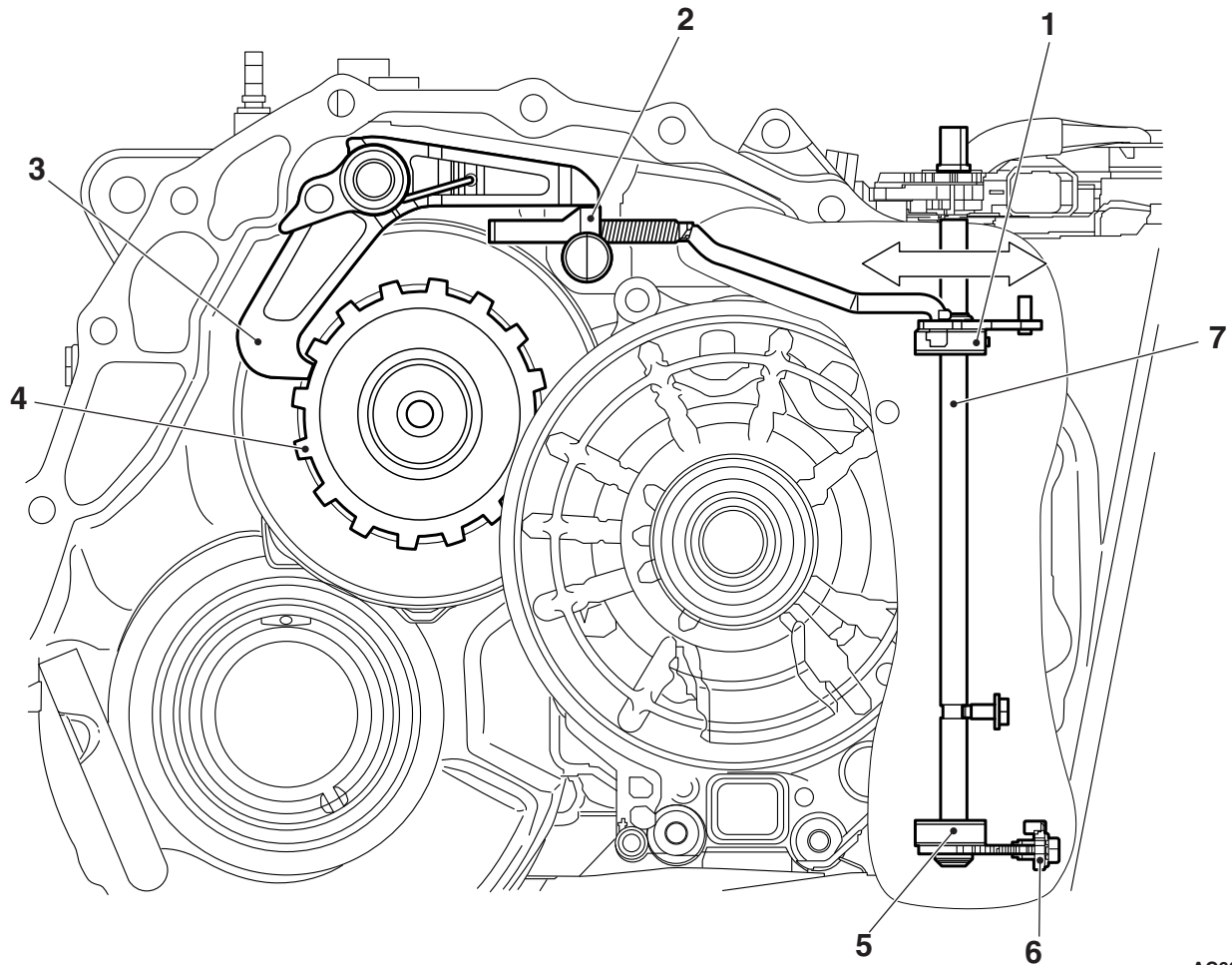
PARKING MECHANISM

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The parking mechanism immobilizes the vehicle in combination with the side brake while the vehicle is parked. This is interlocked with the vehicle's selector lever, and it mechanically locks the parked vehicle so that the vehicle does not move. Its components includes the manual shaft, manual plate, rod plate, parking rod, detent spring, parking pawl, and parking gear.

Parking structure

1. Select the parking position with the manual shaft. (The detent feel of each range is determined by the detent spring and the overstriding force over the protrusion and depression of manual plate.)
2. When the rod plate reaches the P position, the parking rod is pressed down, and the rod slides in the support actuator inner hole.
3. At the parking rod cam, a force acts to turn the parking pawl. Then, the pawl section of the parking pawl is engaged with the parking gear.
4. Because the parking gear which is spline-engaged with the reduction gear will be fixed, the output axis will also be fixed.



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- | | |
|-----------------|------------------|
| 1. Rod plate | 5. Manual plate |
| 2. Parking rod | 6. Detent spring |
| 3. Parking pawl | 7. Manual shaft |
| 4. Parking gear | |

SHIFT MECHANISM

M2230003600036

When three elements (sun gear, carrier, internal gear) of planetary gear are selected as input, output, and fixing for each element, the gear ratio and rotation direction are determined. Each clutch and brake perform the input, output, and fixing. The following tables "Clutch and brake, and their actions" and "Clutch and brake, and their operations" indicate the relation of planetary gear with the clutch and brake.

Clutch and brake, and their actions

Parts name	Function
Low clutch	Works with 1st, 2nd, 3rd, and 4th gears, and transfers the input from 3-5 reverse clutch drum to the front internal gear.
3-5 reverse clutch	Works with 3rd, 5th, and reverse gears, and transfers the reduction internal gear input to the front sun gear.
High clutch	Works with 4th, 5th, and 6th gears, and transfers the input shaft input to the rear carrier.
Low and reverse brake	Works with engine brake, 1st and reverse gears, and fixes the rear carrier.
2-6 brake	Works with 2nd and 6th, and fixes the rear sun gear rotation.
One-way clutch	Works when in 1st gear under acceleration status, and fixes the rear carrier.

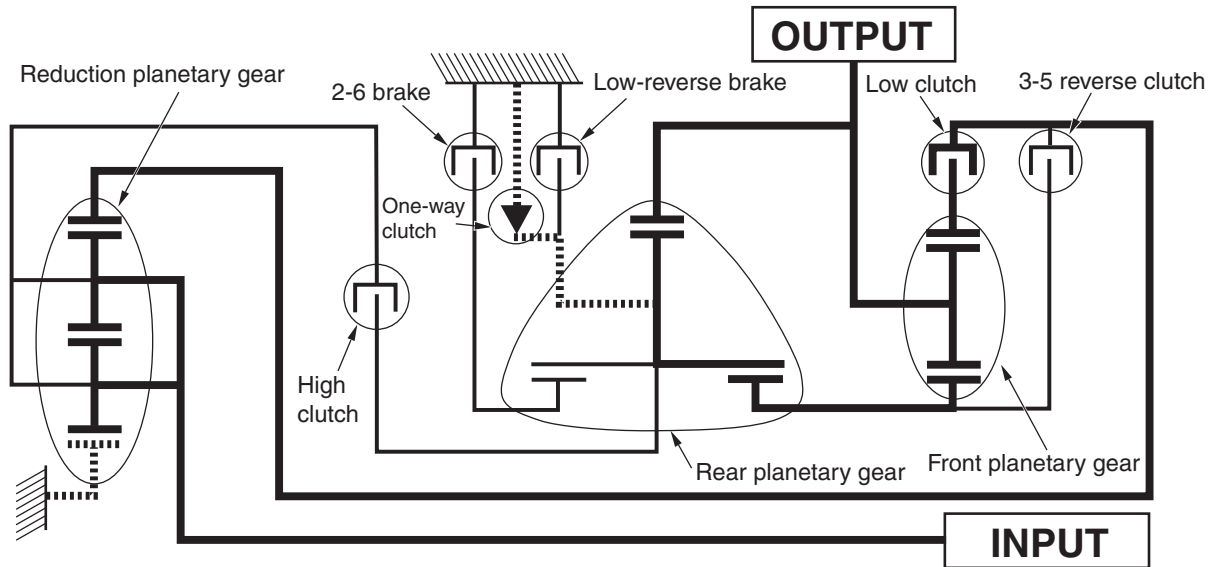
Clutch and brake, and their operations

Selector lever position		Low clutch	3-5 reverse clutch	High clutch	Low and reverse brake	2-6 brake	One-way clutch
P		—	—	—	—	—	—
R		—	×	—	×	—	—
N		—	—	—	—	—	—
D	1st	×	—	—	—	—	×
	1st gear engine brake	×	—	—	×	—	—
	2nd	×	—	—	—	×	—
	3rd	×	×	—	—	—	—
	4th	×	—	×	—	—	—
	5th	—	×	×	—	—	—
	6th	—	—	×	—	×	—

×: Function element —: Not applicable

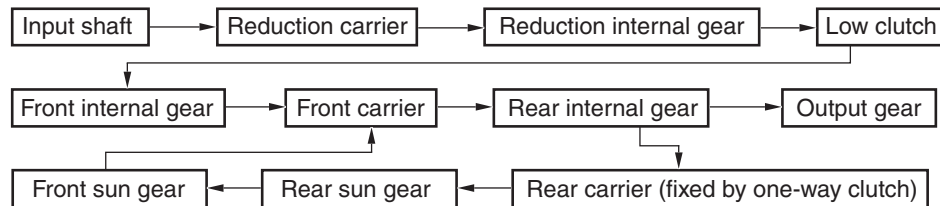
POWER FLOW

The following skeleton diagram (simplified drawing of unit structure used for the locations which indicates the power flow passage) describes at the time of 1st to 6th and reverse.

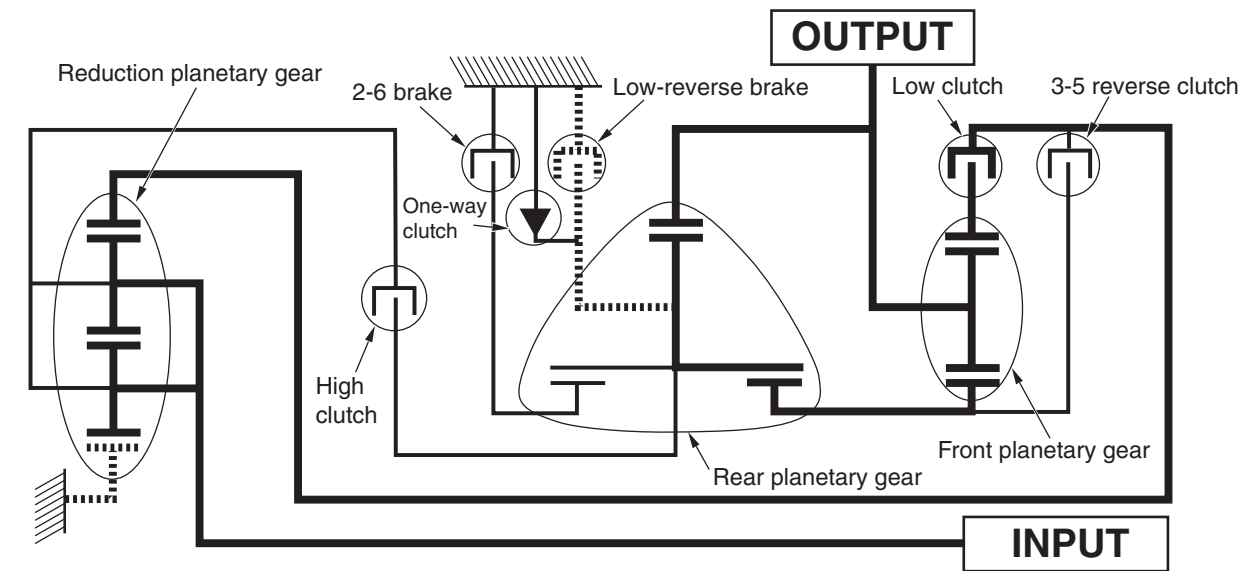
1st

- : Torque-transfer state
 - - - : Free state
 : Fixed state

Based on lepelletier system

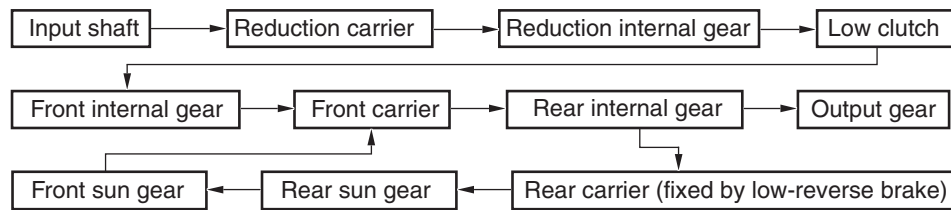


1st gear engine brake

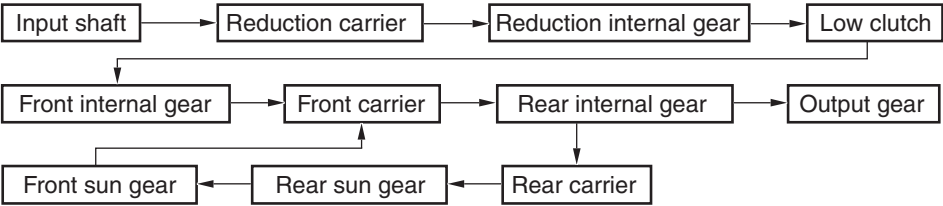
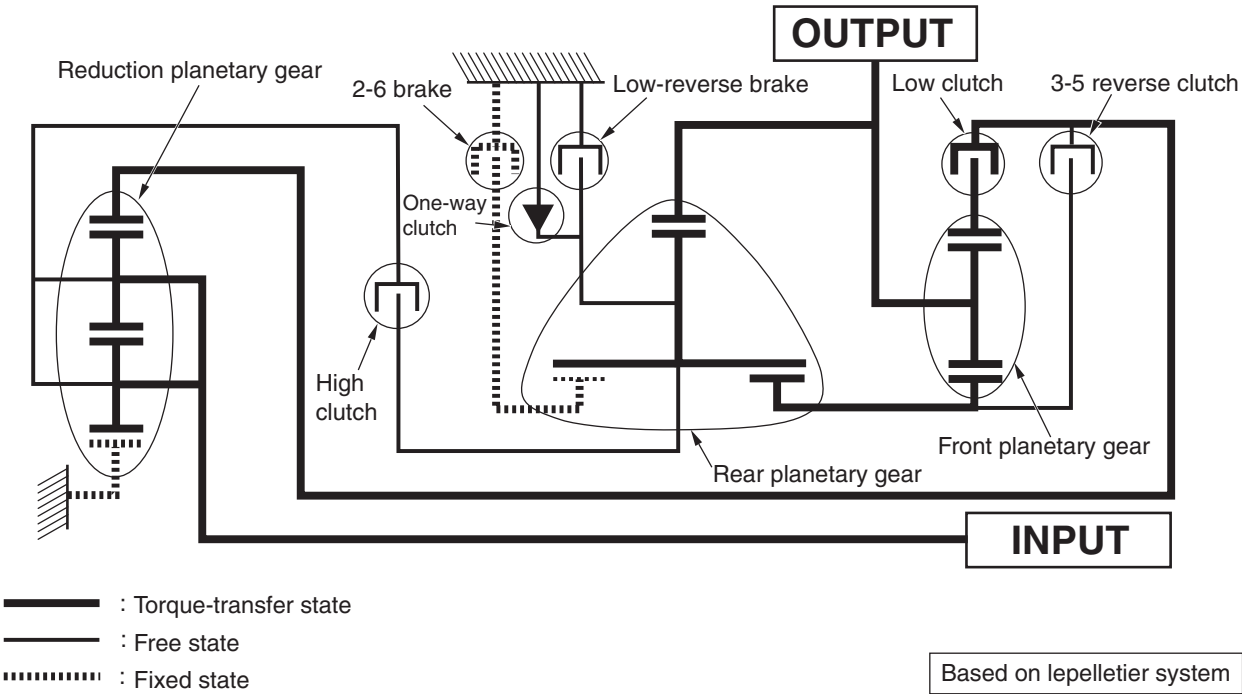


— : Torque-transfer state
 - - - : Free state
 : Fixed state

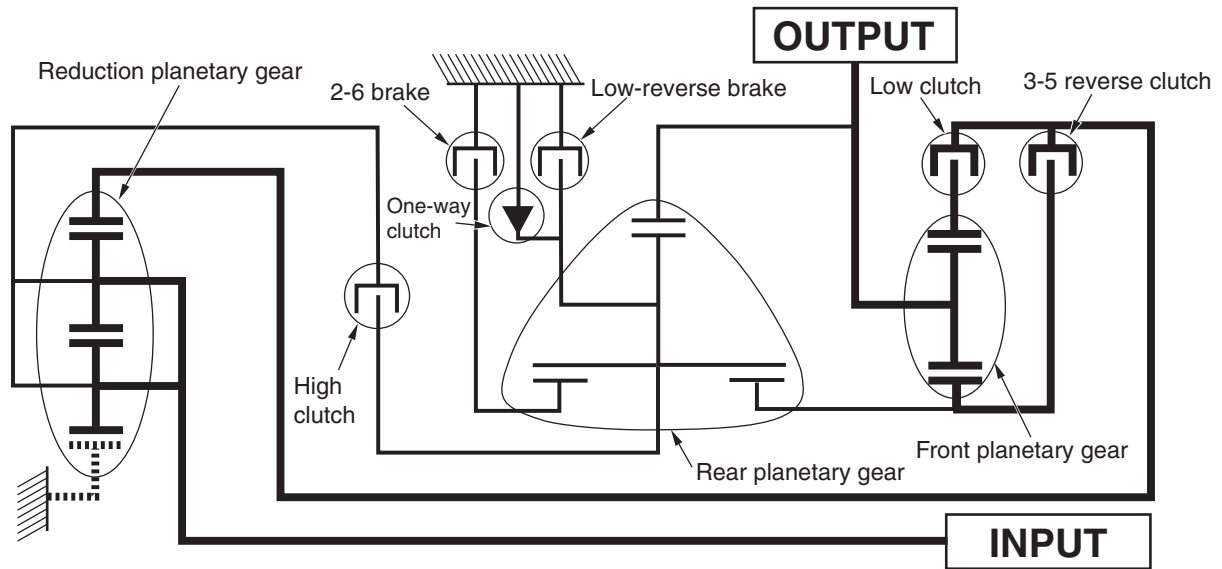
Based on Iepelletier system



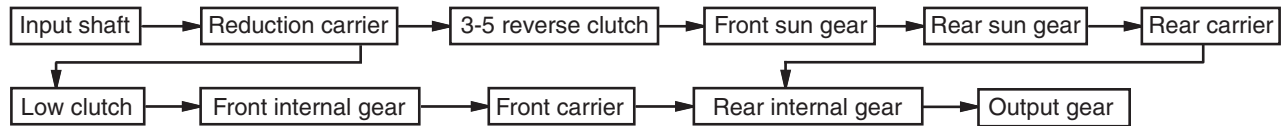
2nd



3rd

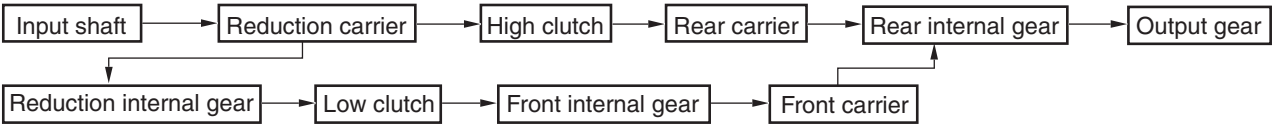
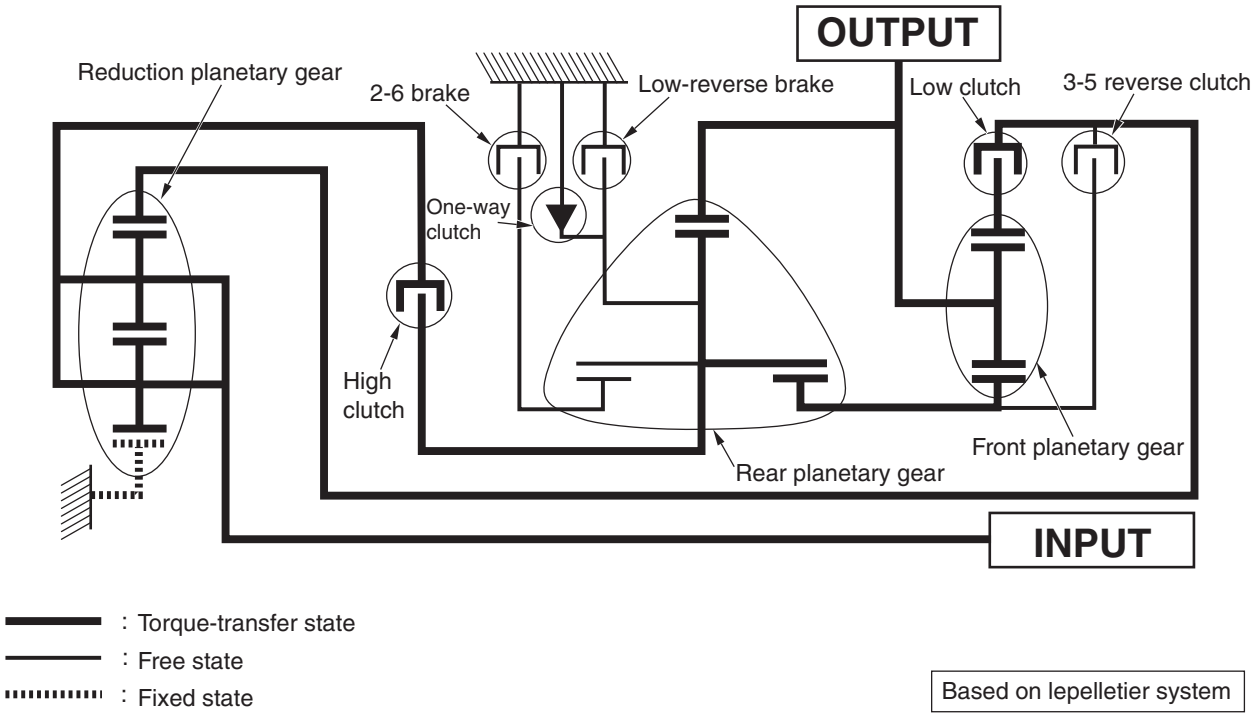


Based on lepelletier system

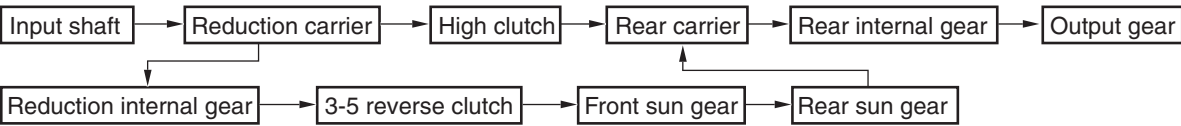
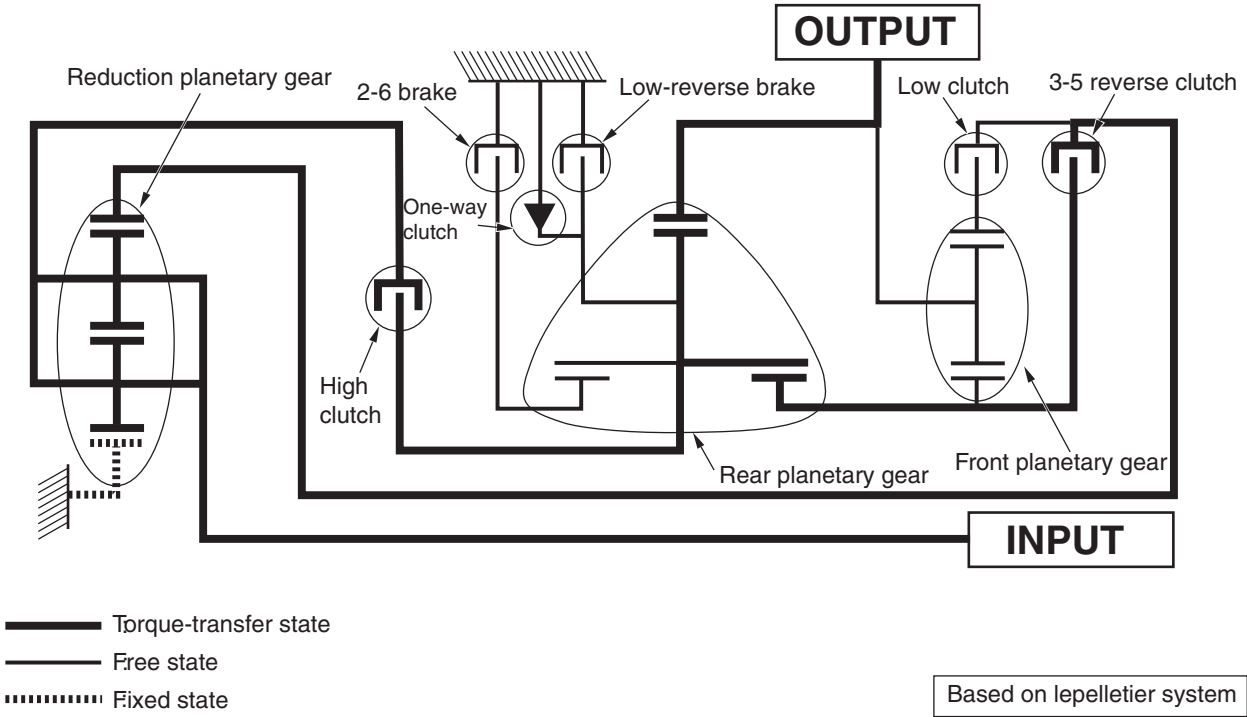


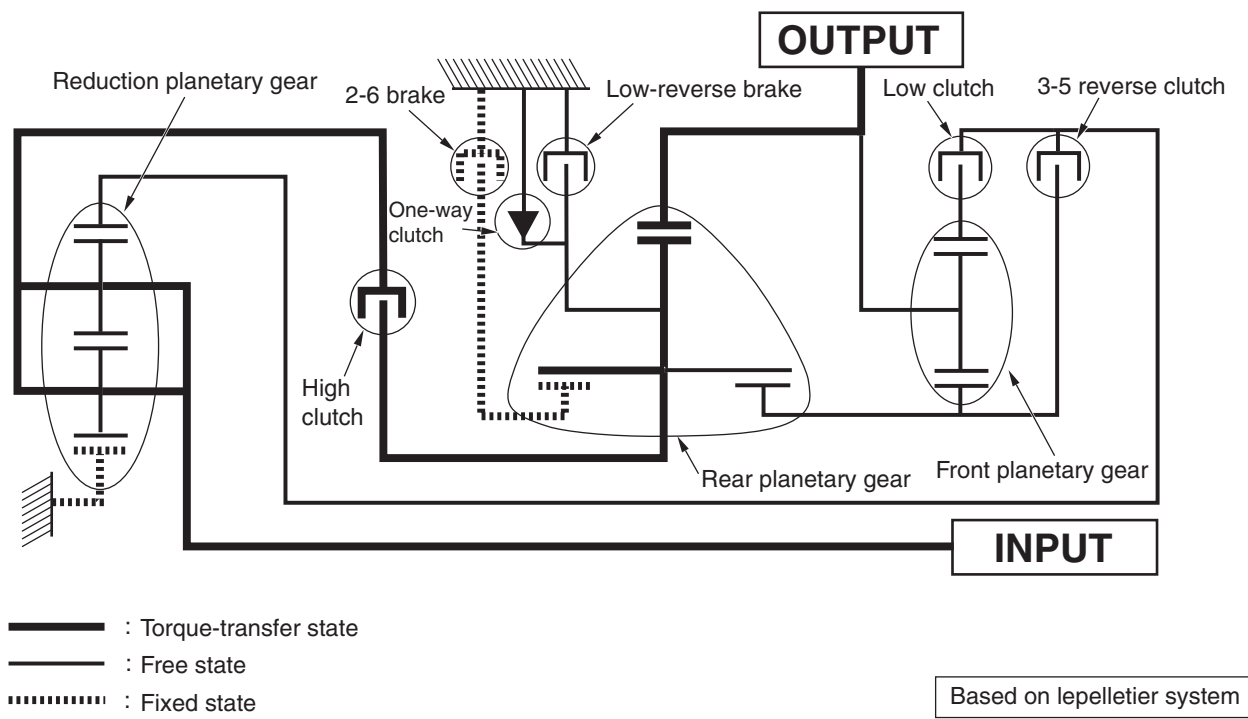
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4th

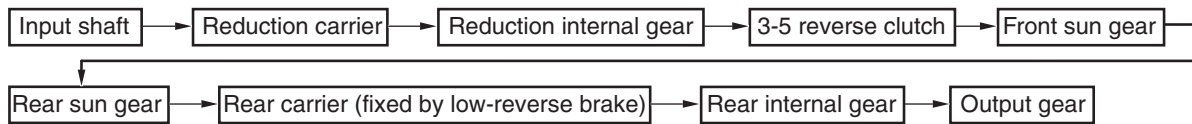
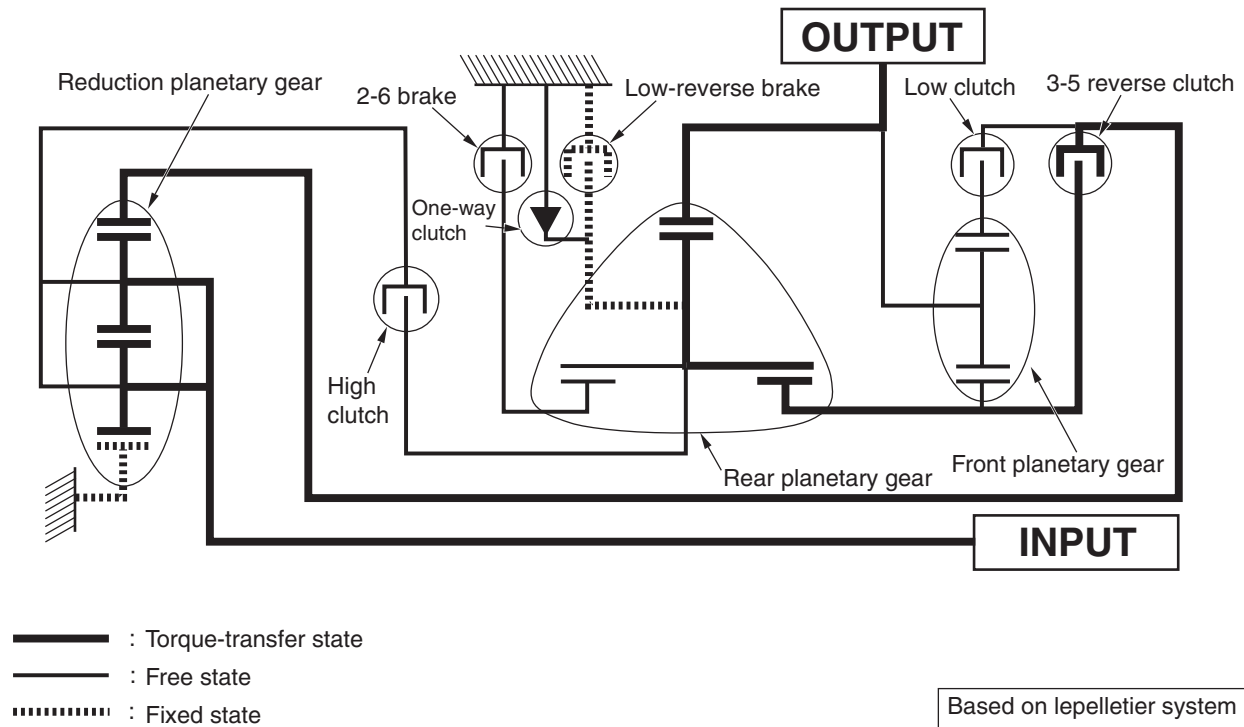


5th





Reverse



ELECTRONIC CONTROL SYSTEM**LIST OF CONTROL ITEMS AND
INPUT/OUTPUT SIGNALS**

M2230003200094

List of control items and input/output signals

Part name		Gear Change	Pressure Control	Lock up	Torque management	Display	INVECS-II	Manual shift control
Input system	Inhibitor switch	×	×	×	×	×	×	×
	Output shaft speed sensor	×	×	×	×	—	×	—
	Input shaft speed sensor	×	×	×	×	—	×	—
	A/T fluid temperature sensor	×	×	×	—	—	—	—
	Paddle shift switch	—	—	—	—	—	—	×
	2-6 brake pressure switch	×	—	—	—	—	—	—
	High clutch pressure switch	×	—	—	—	—	—	—
	Low-reverse brake pressure switch	×	—	—	—	—	—	—
	C A N	Throttle Signal	×	×	×	×	×	—
		Engine revolution signal	×	×	×	×	×	—
		Engine torque signal	—	×	×	×	×	—
		Gear change forbid	×	—	—	×	×	—
		Engine coolant temperature signal	—	—	—	×	×	—
		Stop lamp signal	×	—	×	×	×	—

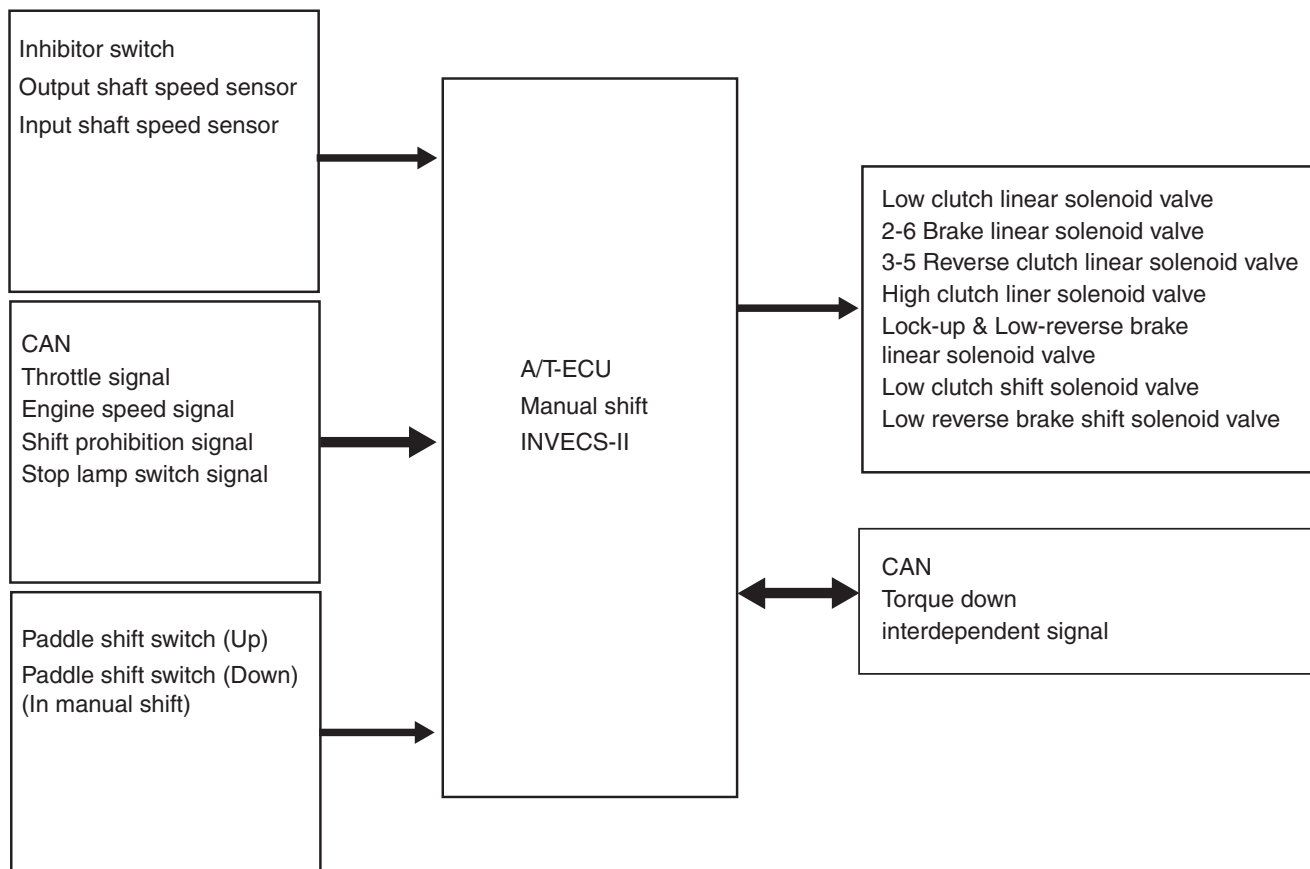
Output system	Low clutch Linear solenoid		×	—	—	—	—	—	×
	2-6 brake Linear solenoid		×	—	—	—	—	—	×
	3-5 reverse clutch Linear solenoid		×	—	—	—	—	—	×
	High clutch Linear solenoid		×	—	—	—	—	—	×
	Lock-up & low-reverse brake Linear solenoid		×	—	×	—	—	—	×
	Low clutch Shift solenoid		×	—	—	—	—	—	×
	Low-reverse brake Shift solenoid		×	—	×	—	—	—	×
	PL liner solenoid		—	×	—	—	—	—	—
	C A N	Fast torque request	—	—	—	×	—	—	—
		Slow torque request	—	—	—	×	—	—	—
		Torque converter state	—	—	—	×	—	—	—
		Lever and A/T position	—	—	—	—	×	—	—
		Failure lamp	—	—	—	—	×	—	—
		MIL lamp	—	—	—	—	×	—	—
		CAN output	—	—	—	×	×	—	—

×: Function element —: Not applicable

CONTROL SCHEMATIC DIAGRAM

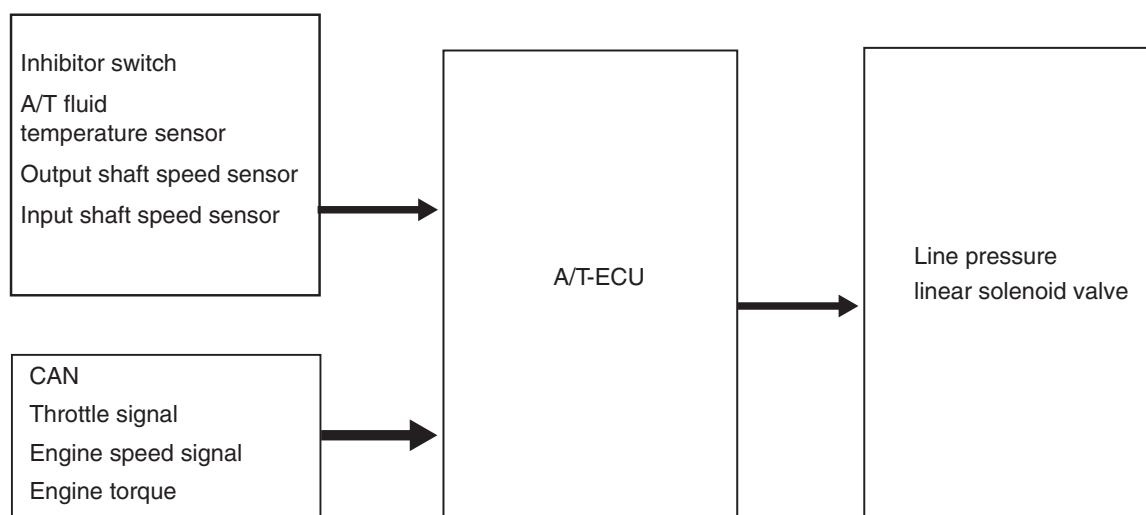
M2230003400076

Shifting control



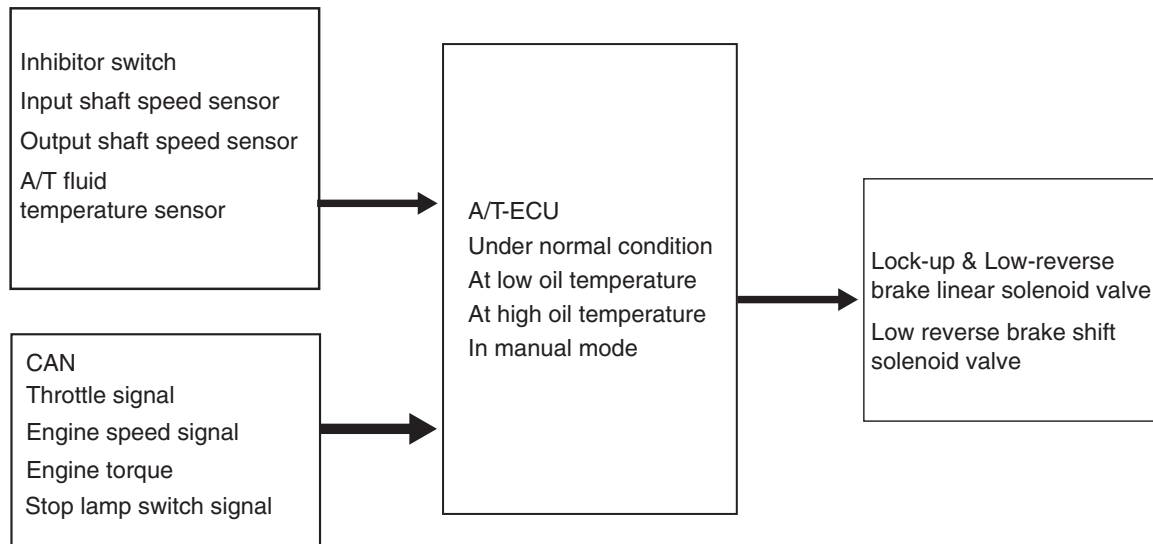
AC607507AC

Hydraulic pressure shifting



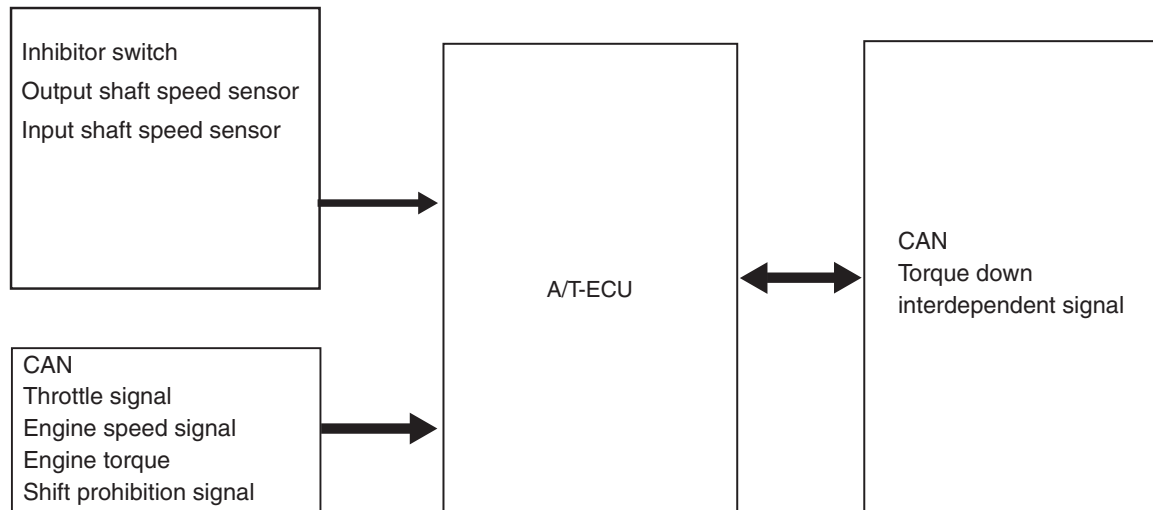
AC607513AB

Lock-up shifting



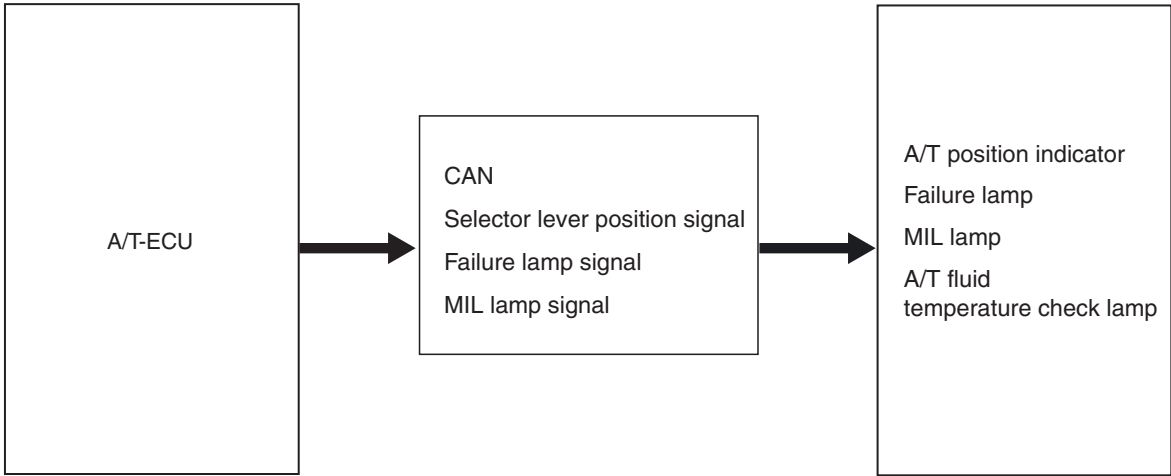
AC607514AB

Torque down shifting



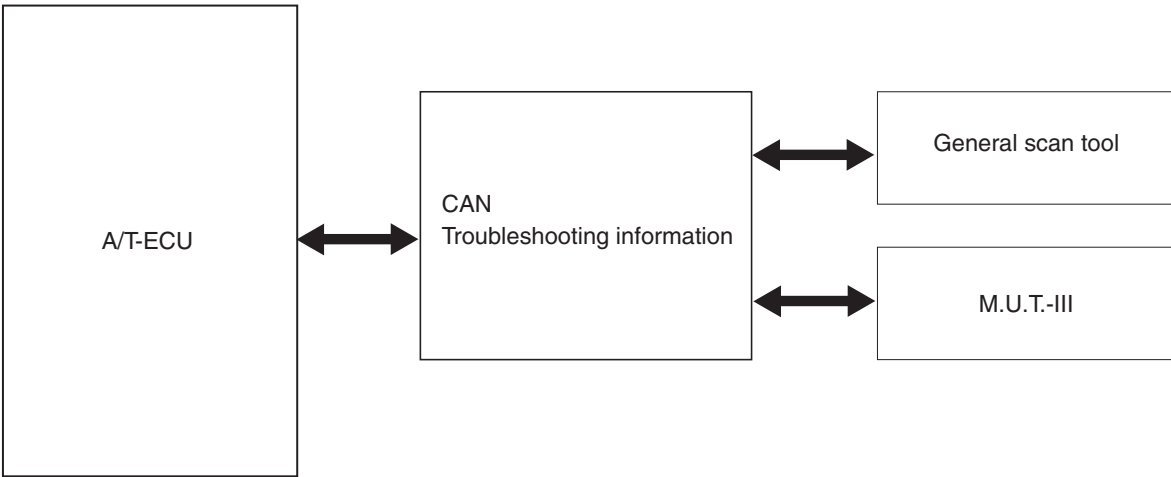
AC607515AB

Monitor



AC607516 AB

Troubleshooting



AC607517 AB

OPERATION REFERENCE TABLE FOR EACH SHIFT RANGE

M2230003300080

	Pressure switch			Linear solenoid					Shift solenoid	
	2-6 brake	High clutch	Low- reverse brake	Low clutch	2-6 brake	3-5 reverse clutch	High clutch	Lock-up & Low- reverse brake	Low clutch	Low- reverse brake
D1	-	-	-	×	-	-	-	-	-	×
D2	×	-	-	×	×	-	-	-	-	-
D3	-	-	-	×	-	×	-	-	-	-
D3 Lock-up	-	-	-	×	-	×	-	×	-	-
D4	-	×	-	×	-	-	×	-	-	-
D4 Lock-up	-	×	-	×	-	-	×	×	-	-
D5	-	×	-	-	-	×	×	-	×	-
D5 Lock-up	-	×	-	-	-	×	×	×	×	-
D6	×	×	-	-	×	-	×	-	×	-
D6 Lock-up	×	×	-	-	×	-	×	×	×	-
P	-	-	-	-	-	-	-	-	-	×
R	-	-	×	-	-	×	-	×	-	×
N	-	-	-	-	-	-	-	-	-	×
1st gear engine brake	-	-	×	×	-	-	-	×	-	×

×: Function element –: Not applicable

DIAGNOSIS CLASSIFICATION TABLE

M2230010000393

The A/T-ECU is equipped with the diagnostic function to monitor the input signals from each sensor and output signals from the actuators. If an abnormality occurs in the signal system, the diagnostic function memorises the abnormal symptoms and outputs a diagnosis code.

FAIL-SAFE FUNCTION

When a malfunction of a main sensor or actuator is detected by the A/T-ECU, the transmission is controlled by pre-set control logic to maintain safe conditions for driving.

The following table shows how the fail-safe/backup function affects vehicle driveability and operation.

Diagnosis code No.	Detection items	Fail-safe
P0705	Inhibitor switch system	• Fixed at the D range. • Manual mode is prohibited. • Lock-up is prohibited.
P0712	A/T fluid temperature sensor system (Short circuit)	Not present.
P0713	A/T fluid temperature sensor system (Open circuit)	Fixed to 5th gear during driving, and to 3rd gear after a vehicle stop.
P0715	Input shaft speed sensor system	• Fixed to the driving gear position during driving, and to 3rd gear after a vehicle stop.
P0720	Output shaft speed sensor system	
P0729	6th gear incorrect ratio	The current shift position is continued, and gear is fixed to 3rd gear after a vehicle stop.
P0731	1st gear incorrect ratio	• At engine run-up detection: Fixed to 5th gear after a vehicle stop. • At gear ratio abnormality detection: Fixed to 2nd, 3rd, 4th gear.
P0732	2nd gear incorrect ratio	The current shift position is continued, and gear is fixed to 5th gear after a vehicle stop.
P0733	3rd gear ratio	The current shift position is continued, and gear is fixed to 6th gear after a vehicle stop.
P0734	4th gear incorrect ratio	The current shift position is continued, and gear is fixed to 5th gear after a vehicle stop.
P0735	5th gear incorrect ratio	The current shift position is continued, and gear is fixed to 2nd gear after a vehicle stop.
P0736	Reverse gear incorrect ratio	Controlled by making the line pressure to maximum.
P0741	Damper clutch system (Stuck off)	Lock-up is prohibited.
P0742	Damper clutch system (Stuck on)	Lock-up is prohibited.
P0815	Paddle shift switch (up) system	The manual mode operation during the driving cycle ^{*1} in question is prohibited.
P0816	Paddle shift switch (down) system	The manual mode operation during the driving cycle ^{*1} in question is prohibited.
P0846	2-6 brake pressure switch system	Control is continued with always switch on.
P0876	High clutch pressure switch system	Control is continued with always switch on.
P0893	Interlock detection	Fixed to a feasible shift position.

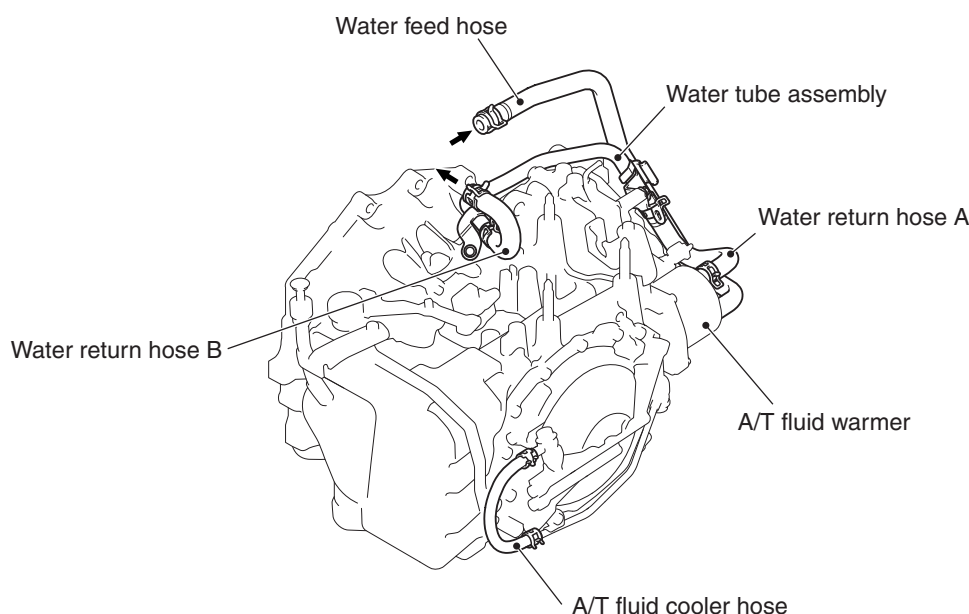
Diagnosis code No.	Detection items	Fail-safe
P0962	Line pressure linear solenoid valve system (Short circuit)	Controlled by making the line pressure to maximum.
P0963	Line pressure linear solenoid valve system (Open circuit)	
P0973	Low clutch linear solenoid valve system (Short circuit)	Fixed to 5th gear.
P0974	Low clutch linear solenoid valve system (Open circuit)	
P0976	2-6 brake linear solenoid valve system (Short circuit)	Fixed to 5th gear during driving, and to 3rd gear after a vehicle stop.
P0977	2-6 brake linear solenoid valve system (Open circuit)	
P0979	3-5 reverse clutch linear solenoid valve system (Short circuit)	Fixed to 5th gear during driving, and to 3rd gear after a vehicle stop.
P0980	3-5 reverse clutch linear solenoid valve system (Open circuit)	
P0982	High clutch linear solenoid valve system (Short circuit)	Fixed to 5th gear.
P0983	High clutch linear solenoid valve system (Open circuit)	
P0988	Low-reverse brake pressure switch system	Control is continued with always switch on.
P0998	Low clutch shift solenoid valve system (Short circuit)	Not present.
P0999	Low clutch shift solenoid valve system (Open circuit)	
P099B	Low-reverse brake shift solenoid valve system (Short circuit)	Fixed to 5th gear during driving, and to 3rd gear after a vehicle stop.
P099C	Low-reverse brake shift solenoid valve system (Open circuit)	
P1637	Memory backup system	Initial value is set to RAM.
P1705	Throttle position sensor information (engine)	• Controlled with the throttle position fixed to 2/8 position. • Lock-up is prohibited.
P1706	Accelerator pedal position information	• Controlled with the throttle position fixed to 2/8 position. • Lock-up is prohibited.
P1773	ABS Information (ASC)	The lock-up during the deceleration and when vehicle speed is 40 km/h or less is prohibited.
P2763	Lock-up and Low-reverse brake linear solenoid valve system (Open circuit)	• Fixed to 5th gear during driving and to 3rd gear after a vehicle stop. • Lock-up is prohibited.
P2764	Lock-up and Low-reverse brake linear solenoid valve system (Short circuit)	
U0001	CAN bus off	Fixed to 5th gear during driving, and to 3rd gear after a vehicle stop.

Diagnosis code No.	Detection items	Fail-safe
U0100	Engine-ECU time out	Fixed to 5th gear during driving, and to 3rd gear after a vehicle stop.
U0121	ASC-ECU time out	No action
U0141	ETACS-ECU time out	Judges as brake ON, and continues control.

*1: Indicates the series of driving cycle "ignition key OFF → ON → drive → OFF."

A/T FLUID WARMER

M2233000300013



ACD00339AB

The A/T fluid warmer, which is cooled by the engine coolant, is used. The A/T fluid warmer makes the best use of the characteristics that engine coolant gets warm more quickly than A/T fluid after the engine starts. The warmer warms the A/T fluid up to

an optimum temperature (70 – 80°C) quickly to avoid loss of the automatic transmission performance. Once the A/T fluid has reached the optimum temperature, the warmer starts cooling down the fluid to stabilize the temperature.

TRANSFER

GENERAL INFORMATION

M2230000101091

The transfer has been adopted, the same as for vehicles with CVT.

TRANSMISSION CONTROL

GENERAL INFORMATION

M2230000101109

The transmission control has been adopted, the same as for vehicles with CVT.

GROUP 26

FRONT AXLE

CONTENTS

GENERAL INFORMATION	26-2
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GENERAL INFORMATION

M2260000101577

SPECIFICATIONS

Item			Specifications
Drive shaft	Shaft length* × shaft diameter (mm)	LH	371.0 × 26.5
		RH	499.5 × 29.0

NOTE: *: Indicates the distance between each joint centre.

CONSTRUCTION DIAGRAM

This model is also equipped with a dynamic damper at left side, just like vehicles with 4N1 engine.

GROUP 42A

BODY

CONTENTS

WINDOW GLASS..... [42A-2](#)

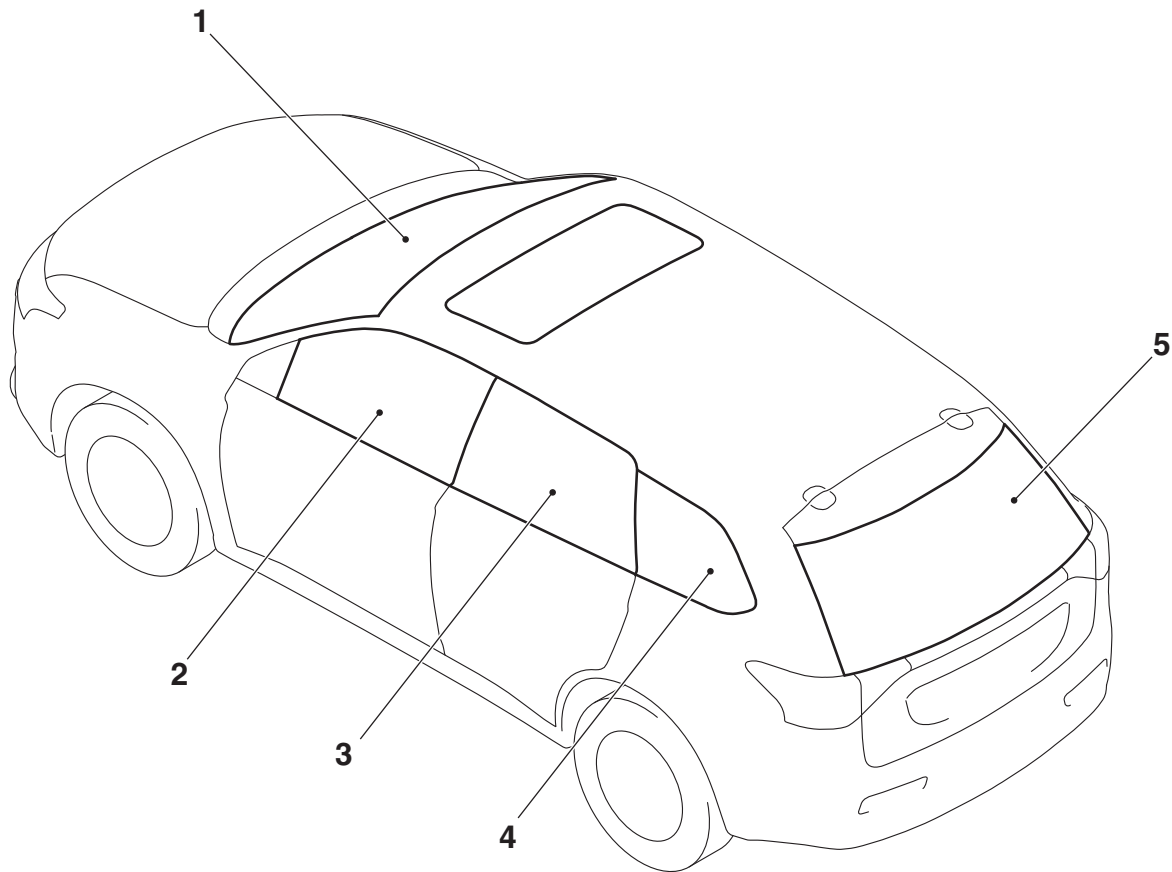
WINDOW GLASS

M2420015001684

GENERAL INFORMATION

The thicknesses of the front door window glasses and the visible light transmission characteristics of all the window glasses have been changed. The other window glasses are of the same thickness as before.

VISIBLE RAY TRANSMISSIVITY RATE
FOR WINDOW GLASS



ACB05026 AC

Number	Name	Type	Thickness (mm)	Colour	Visible ray transmissivity rate (%)
1	Windshield	Laminated glass	4.76	Green	76
2	Front door window glass	Tempered glass	3.5		79
3	Rear door window glass		3.1		81
4	Quarter window glass				
5	Tailgate window glass				

NOTE: The visible ray transmissivity rate (%) is a reference value.

GROUP 51

EXTERIOR

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GENERAL INFORMATION	51-2
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GENERAL INFORMATION

M2510000103234

OUTLINE OF CHANGE

The V6 mark has been added to the fender panel.

GROUP 54A

CHASSIS
ELECTRICAL

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BATTERY.....	54A-2	GENERAL INFORMATION.....	54A-2
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BATTERY

GENERAL INFORMATION

M2544200200918

An battery (80D26L) has been added for the 3000 engine.

Item	80D26L
Voltage V	12
Capacity (5-hour rate) Ah	55
Electrolytic fluid specific gravity (fully charged state at 20°C)	1.220 – 1.290