MODEL CODE

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UZJ100 L - G N A E K A

1 2 3 4 5 6 7 8

	BASIC MODEL CODE
1	UZJ100: With 2UZ-FE Engine

	STEERING WHEEL POSITION
2	L: Left-Hand Drive

	BODY TYPE
3	G: Station Wagon

	BACK DOOR TYPE
4	N: Lift-Up

	GEAR SHIFT TYPE
5	A: 5-Speed Automatic, Floor

	GRADE
6	E: VX

	ENGINE SPECIFICATION
7	K: DOHC and SFI

	DESTINATION
8	A: U.S.A.

MODEL LINE-UP

DESTINATION	ENGINE	BACK DOOR TYPE	GRADE	TRANSMISSION
				A750F 5-Speed Automatic
U.S.A.	2UZ-FE	Lift-Up	VX	UZJ100L-GNAEKA

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LAND CRUISER

OUTLINE OF NEW FEATURES

The following changes are made for 2006 model year.

1. Exterior

- The design of the headlights and radiator grille has been changed.
- The design of the rear combination lights has been changed.
- The rear spoiler has been made newly available as optional equipment.
- The following exterior colors are provided:

Color No.	Color Name	Note
056	White	Carryover
1F7	Silver Metallic	New
1D2	Gray Metallic	Carryover
1E9	Dark Gray Mica Metallic	Carryover
202	Black	Carryover
3Q2	Dark Red Mica	Carryover
4R3	Beige Mica Metallic	Carryover
8R3	Grayish Blue Metallic	New

2. 2UZ-FE Engine

The VVT-i (Variable Valve Timing-intelligent), ACIS (Acoustic Control Induction System), and AI (Air Injection) system are added to the 2UZ-FE engine to achieve high performance and reduce exhaust emissions. For details, see the major difference on page 10.

3. A750F Automatic Transmission

Along with the use of the VVT-i system on the 2UZ-FE engine, the number of clutch discs has been changed.

4. Active Height Control Suspension and Skyhook TEMS

The AHC (Active Height Control) Suspension and skyhook TEMS (Toyota Electronic Modulated Suspension) is newly provided as optional equipment.

5. Brake Control System (ABS with EBD, Brake Assist, A-TRAC and VSC System)

- CAN (Controller Area Network) communication is used in a portion between the skid control ECU and ECM.
- Along with the use of CAN communication, the DTCs (Diagnostic Trouble Codes) have been changed.

6. Tire Pressure Warning System

The direct-sensing type tire pressure warning system is standard equipment.

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7. Multiplex Communication

CAN (Controller Area Network) communication is used in a portion of the multiplex communication system between the ECM, skid control ECU, and combination meter. For details, refer to New Features (on page 88) of the ’06 Land Cruiser.

8. Lighting

The taillight and stop light bulbs have been changed to LEDs (Light-Emitting Diodes).

9. Combination Meter

- The red zone indication on the tachometer has been changed from 5200 - 7000 rpm to 5600 - 7000 rpm.
- Along with the use of the tire pressure warning system, a low tire pressure warning light has been provided in the combination meter.

10. Wireless Door Lock Remote Control System

The assembly method inside the transmitter has been changed from the adhesion type to a snap-fit type.

11. Cruise Control System

The cruise control system has been changed to keep the set vehicle speed in its memory even if the vehicle speed has dropped below the low-speed limit.

12. Inner Rear View Mirror

The design of the automatic glare-resistant EC (Electrochromic) mirror, which is available as optional equipment, has been changed.

NEW FEATURES

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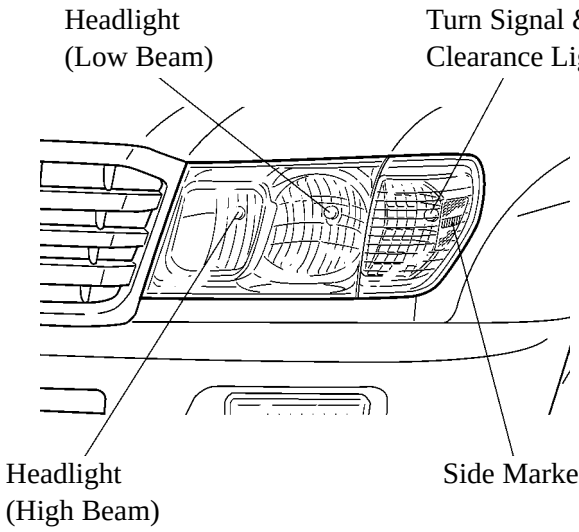
■EXTERIOR

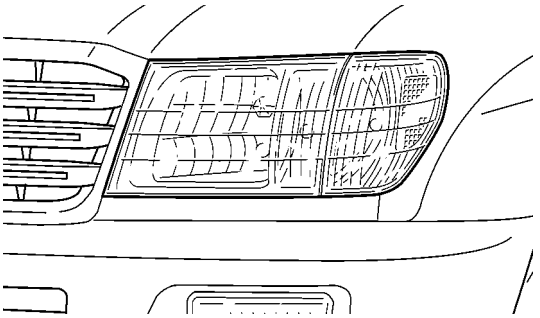
1. Headlight

The high beams extend continuously from the radiator grille and the turn signal lights are integrated with the headlights to achieve a headlight design that gives a wide look and a sense of presence.



001LC02Y

’06 Land Cruiser

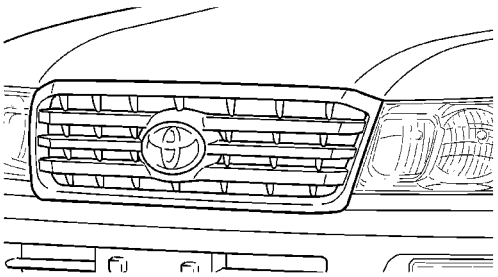


001LC03Y

’05 Land Cruiser

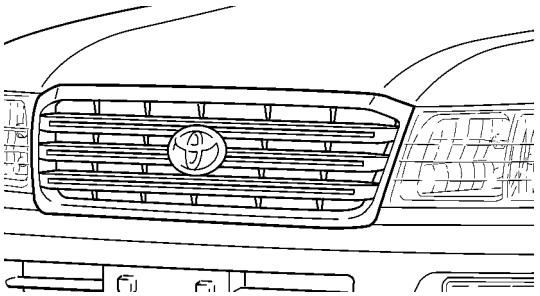
2. Radiator Grille

Shaped to emphasize the symbol mark and containing 3 horizontal bars, the radiator grille has been designed to express powerfulness.



001LC04Y

’06 Land Cruiser



001LC05Y

’05 Land Cruiser

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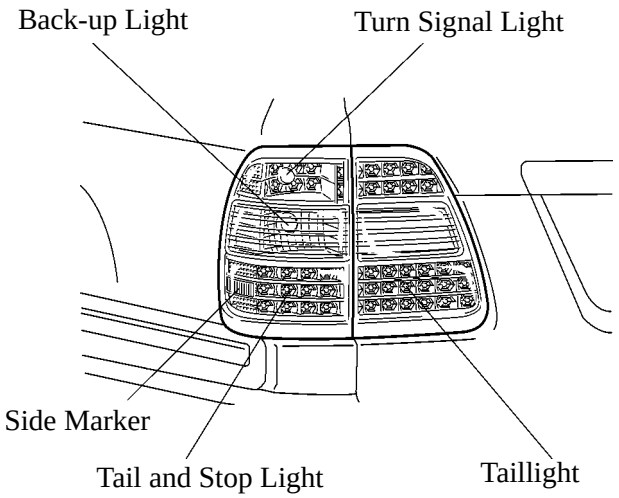
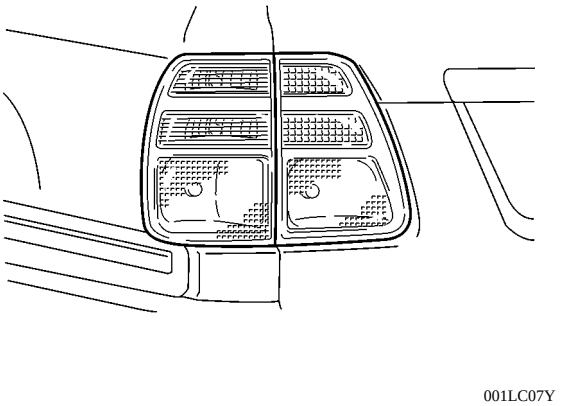
3. Rear Combination Light

The taillight and stop light bulbs in the rear combination lights have been changed to LEDs (Light-Emitting Diodes) to achieve a high quality design.



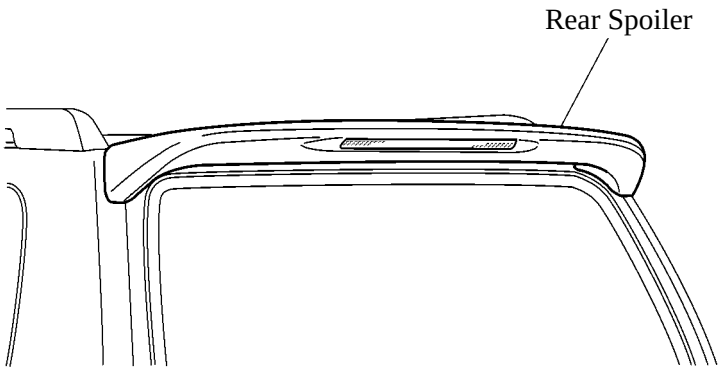
’06 Land Cruiser



’05 Land Cruiser

4. Rear Spoiler

The rear spoiler has been made newly available as optional equipment.



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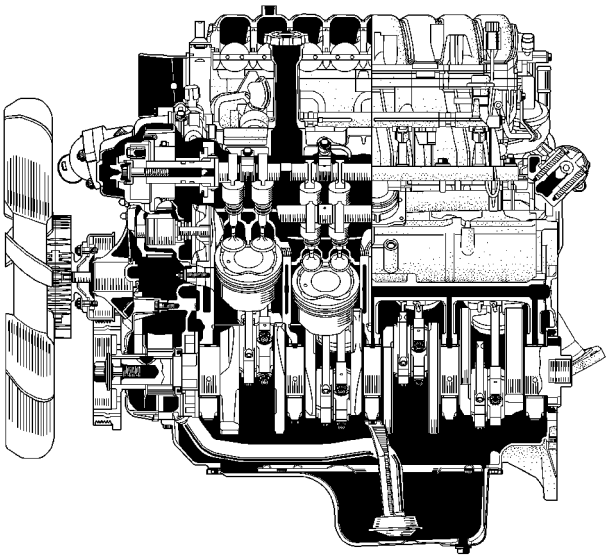
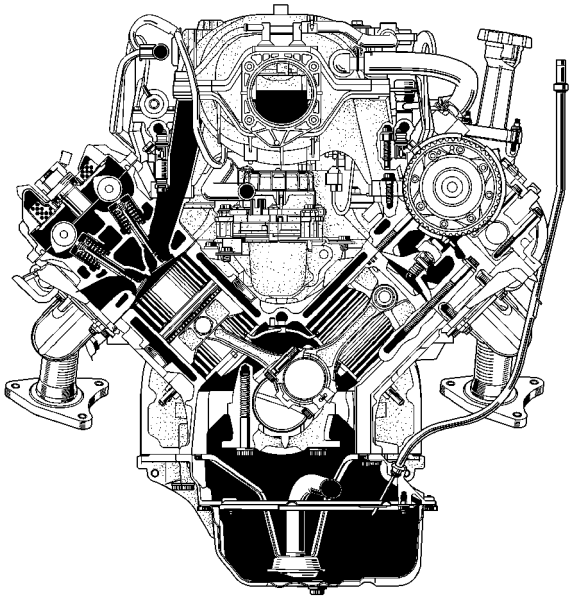
■2UZ-FE ENGINE

1. General

The 2UZ-FE engine is a V8, 4.7-liter, 32-valve DOHC engine. This engine is added the VVT-i (Variable Valve Timing-intelligent), ACIS (Acoustic Control Induction System), and AI (Air Injection) system to achieve high performance and reduce exhaust emissions. For details, see the major difference on page 10.



001LC19Y



001LC20Y

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▶ Engine Specification ◀

Model			’06 Land Cruiser	’05 Land Cruiser
Engine Type			2UZ-FE	←
No. of Cyls. & Arrangement			8-Cylinder, V Type	←
Valve Mechanism			32-Valve DOHC, Belt & Gear Drive (with VVT-i)	32-Valve DOHC, Belt & Gear Drive (without VVT-i)
Combination Chamber			Pentroof Type	←
Manifolds			Cross-Flow	←
Fuel System			SFI	←
Displacement	cm^3 (cu.in.)		4664 (284.5)	←
Bore x Stroke	mm (in.)		94.0 x 84.0 (3.70 x 3.31)	←
Compression Ratio			10.0 : 1	9.6 : 1
Max. Output*1			205 kW @ 5400 rpm (275 HP @ 5400 rpm)	175 kW @ 4800 rpm (235 HP @ 4800 rpm)
Max. Torque*1			450 N·m @ 3400 rpm (332 ft·lbf @ 3400 rpm)	434 N·m @ 3400 rpm (320 ft·lbf @ 3400 rpm)
Valve Timing	Intake	Open	15° ATDC to 30° BTDC	3° BTDC
		Close	14° to 59° ABDC	36° ABDC
	Exhaust	Open	46° BBDC	←
		Close	3° ATDC	←
Firing Order			1 - 8 - 4 - 3 - 6 - 5 - 7 - 2	←
Research Octane Number			91 or higher*2	←
Octane Rating			87 or higher*3	←
Engine Service Mass*4 (Reference)	kg (lb)		245 (540)	240 (529)
Oil Grade			API SL, EC or ILSAC	←
Tailpipe Emission Regulation		California	LEVII-ULEV, SFTP	ULEV, SFTP
		Except California	Tier2-Bin8, SFTP	
Evaporative Emission Regulation			LEV-II, ORVR	←

*1: Data was acquired using Premium fuel.
*2: 96 or higher recommended
*3: 91 or higher recommended
*4: Weight shows the figure with the oil and engine coolant fully filled.

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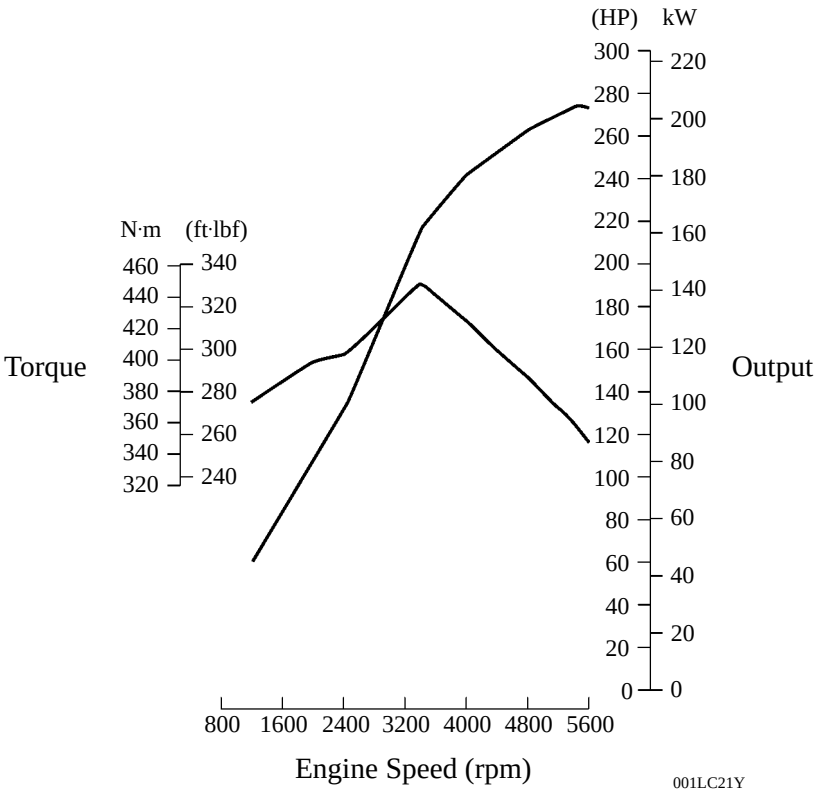
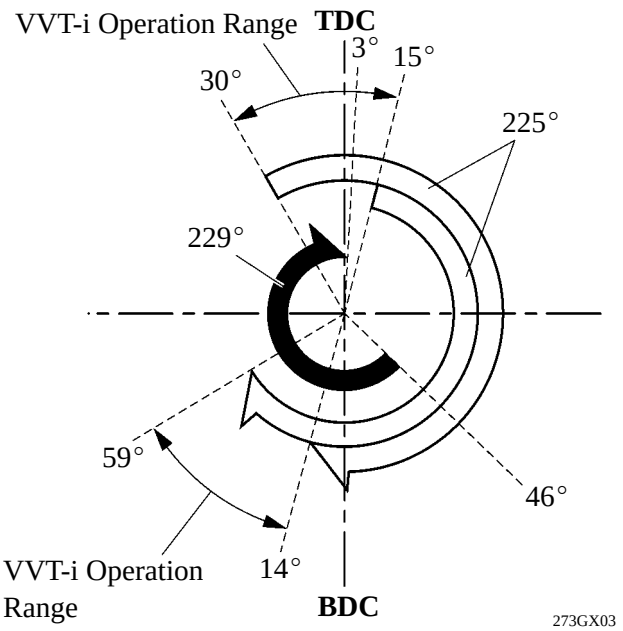
▶ Performance Curve ◀

Data was acquired using Premium fuel.



▶ Valve Timing ◀

: Intake Valve Opening Angle
: Exhaust Valve Opening Angle



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2. Major Difference

The major differences between the new 2UZ-FE engine on the ’06 Land Cruiser and the 2UZ-FE engine on the ’05 Land Cruiser are the following:

System		Features
Engine Specification		According to various changes, the following specifications are changed. ● Valve Mechanism ● Compression Ratio ● Intake Valve Timing ● Max. Output and Torque ● Engine Service Mass
Engine Proper	Cylinder Head	● A lead-free valve seat is used. ● The passage for the air injection is added.
	Cylinder Block	● A lead-free crankshaft bearing is used. ● Oil jet for piston is added.
	Piston	Piston shape is changed.
	Connecting Rod	A lead-free connecting rod bearing is used.
Valve Mechanism		Intake camshaft for the VVT-i (Variable Valve Timing-intelligent) is used.
Lubrication System		Oil passage for the VVT-i and oil jet for the piston are added.
Intake and Exhaust System		● A charcoal filter is used in the air cleaner cap. ● The throttle body shape is changed. ● The material of the intake manifold is changed from aluminum to plastic. ● The air injection pipe is provided on the exhaust manifold. ● The capacity of the TWC (Three-Way Catalytic Converter) has been changed.
Fuel System		● An injector, based on the injector of the ’05 Land Cruiser, with moving parts that are lightweight and an optimized magnetic circuit performance, is used. ● The fuel filler pipe has been changed from steel to stainless steel.
Engine Control System		● Mass air flow meter is changed from the plug-in type to the slot-in type. ● Camshaft position sensor is changed from the pick-up type to the magnetic resistance element type. ● Two VVT-i sensors are added. ● Accelerator pedal position sensor is changed from the non-contact type to the linear (contact) type, which is the same type as on the ’03 Land Cruiser. ● Knock sensor is changed from the resonant type to the non-resonant type. ● Two air-fuel ratio sensors are used. ● VVT-i control is added. ● ACIS (Acoustic Control Induction System) control is added. ● Air injection control is added. ● The construction of the evaporative emission control system is changed.
Diagnosis		Some DTCs (Diagnostic Trouble Codes) have been added and discontinued.

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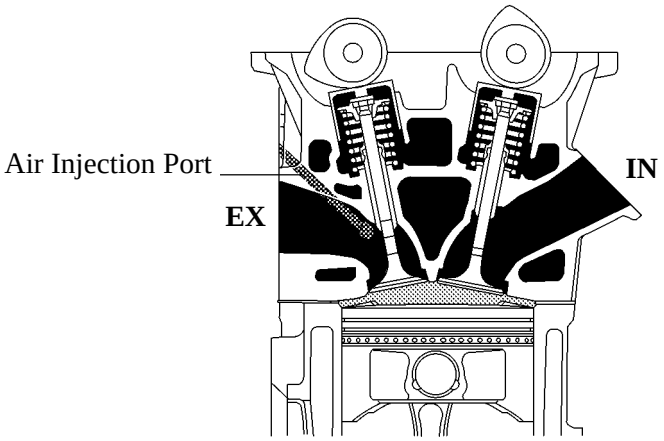
3. Engine Proper

Cylinder Head

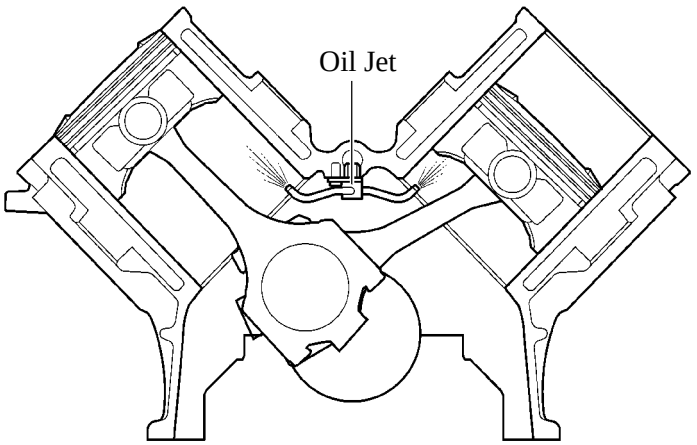
- A lead-free valve seat is used for environmental purposes.
- The air injection port is provided for the air injection system. For details, see page 36.

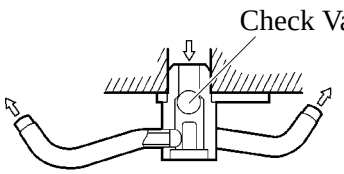


273GX76

Cylinder Block

- A lead-free crankshaft bearing is used for environmental purposes.
- Four oil jets for each piston are added. A check valve is built into an oil jet to stop oil injection when engine oil pressure is low, preventing engine oil pressure drop.





Check Valve Opening Pressure:
2.1 to 2.5 kgf/cm^2 (210 to 250 kPa)

273GX04

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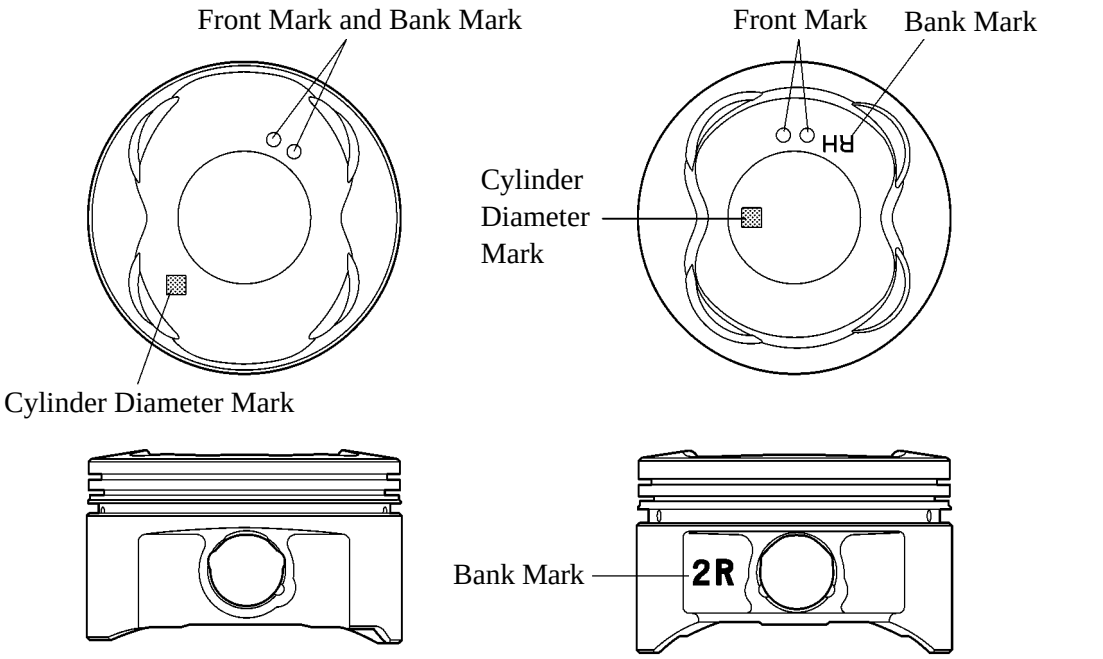
Piston

According to the compression ratio change, the piston shape is changed.

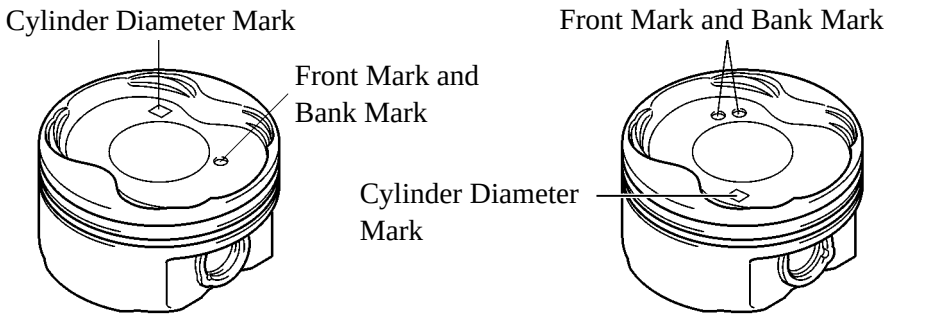


'06 Land Cruiser **'05 Land Cruiser** 273GX61

Service Tip

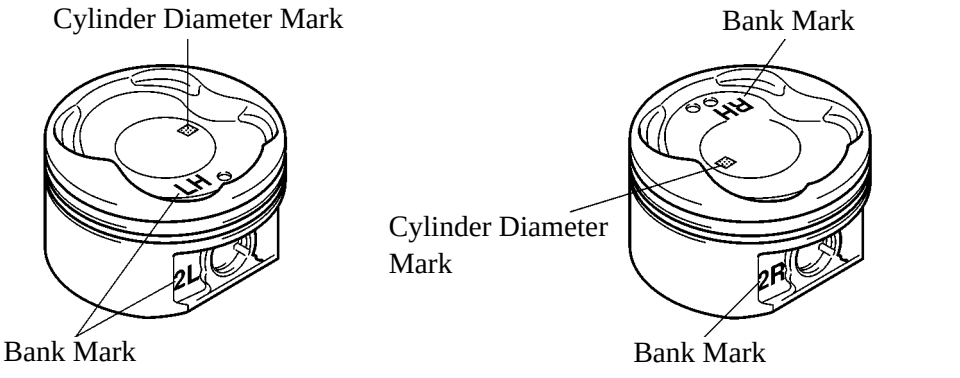
Cylinder diameter mark and bank mark are changed.

▶ '06 Land Cruiser ◀



LH Piston **RH Piston** 273GX62

▶ '05 Land Cruiser ◀



LH Piston **RH Piston** 273GX63

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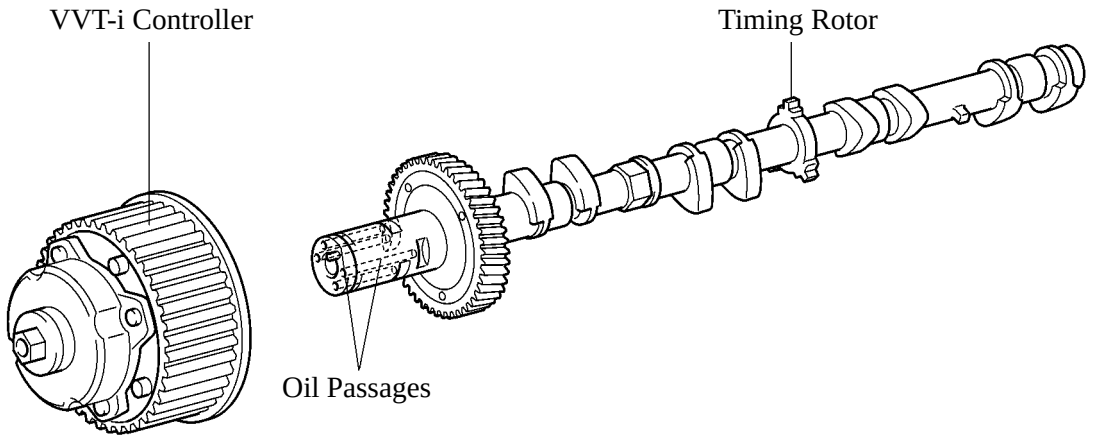
4. Valve Mechanism

According to the addition of the VVT-i system, the intake camshaft is changed as follows.

- A VVT-i controller is installed on the front of the intake camshaft to vary the intake valve timing.
- A timing rotor for the VVT-i sensor is provided on the intake camshaft.
- An oil passage is provided in the intake camshaft in order to supply engine oil to the VVT-i controller.



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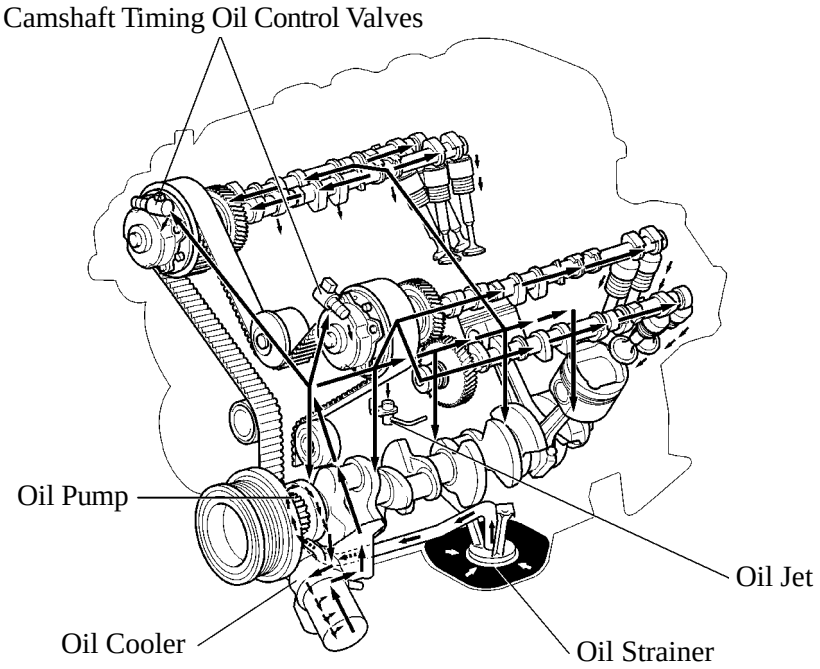
5. Lubrication System

According to the addition of the VVT-i system and four oil jets, the oil circuit is changed as follows.



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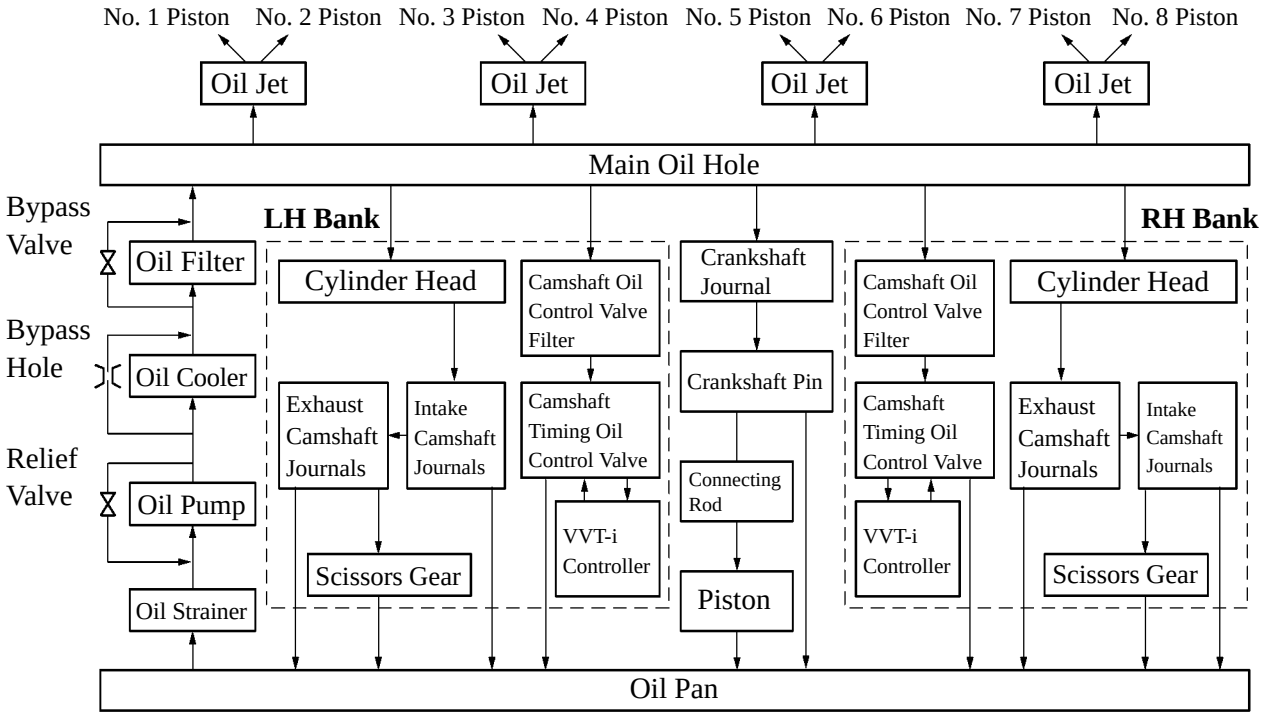
▶ Oil Circuit ◀



273GX06

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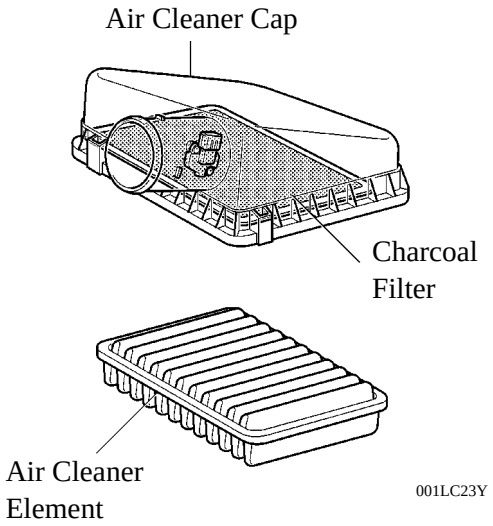
6. Intake and Exhaust System

Air Cleaner

A charcoal filter, which adsorbs the HC that accumulates in the intake system when the engine is stopped, has been added in the air cleaner cap in order to reduce evaporative emissions.

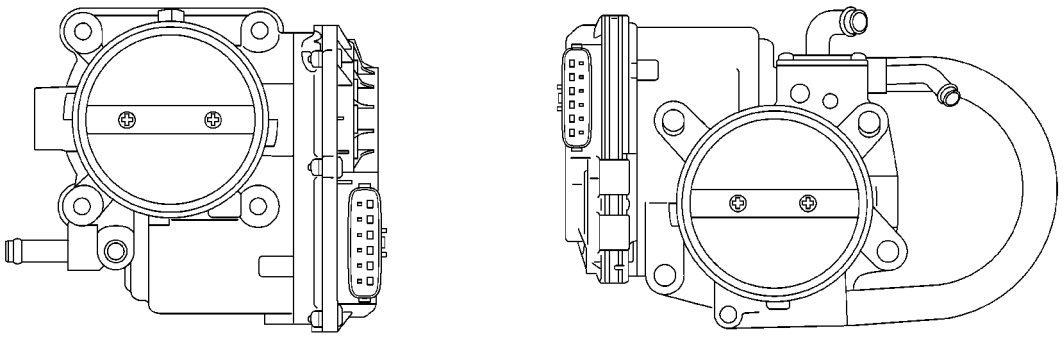


Service Tip

The charcoal filter, which is maintenance-free, cannot be removed from the air cleaner cap.

Throttle Body

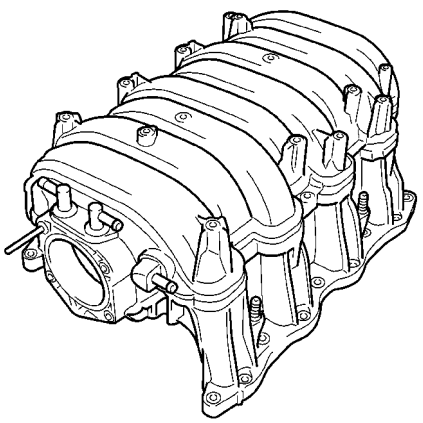
A lightweight and compact throttle body is used.



'06 Land Cruiser **'05 Land Cruiser**

Intake Manifold

A plastic intake manifold is used for weight reduction.



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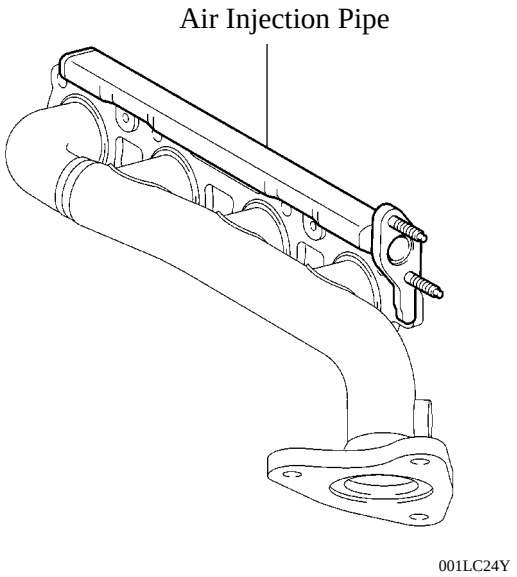
Exhaust Manifold

According to the addition of the air injection system, the air injection pipe is provided on the exhaust manifold.



For LH Bank

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7. Engine Control System

General

The engine control system of the 2UZ-FE engine on the '06 Land Cruiser has the following systems.

System	Outline	Model	
		'06 Land Cruiser	'05 Land Cruiser
SFI Sequential Multiport Fuel Injection	An L-type SFI system directly detects the intake air mass with a hot wire type mass air flow meter.	○	○
ESA Electronic Spark Advance	Ignition timing is determined by the ECM based on the signals from various sensors. The ECM corrects ignition timing in response to engine knocking.	○	○
ETCS-i Electronic Throttle Control System-intelligent	Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the conditions of the engine and the vehicle.	○	○
VVT-i Variable Valve Timing-intelligent [See page 30]	Controls the intake camshaft to ensure optimal valve timing in accordance with the engine condition.	○	—
ACIS Acoustic Control Induction System [See page 34]	The intake air passages are switched according to the engine speed and throttle valve opening angle to provide high performance in all speed ranges.	○	—
Air Injection [See page 36]	The ECM controls the air injection time based on the signals from the crankshaft position sensor, engine coolant temp. sensor, mass air flow meter and air pressure sensor.	○	—
Fuel Pump Control	● The fuel pump speed is controlled by the signal from the ECM. ● The fuel pump is stopped when the SRS airbag is deployed in front, side or rear side collision.	○	○
Oxygen Sensor Heater Control	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	—	○
Air-Fuel Ratio Sensor and Oxygen Sensor Heater Control	Maintains the temperature of the air-fuel ratio sensor or oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	○	—
Evaporative Emission Control [See page 41]	The ECM controls the purge flow of evaporative emission (HC) in the canister in accordance with engine conditions.	○	○
	Using two VSVs and a canister pressure sensor, the ECM detects any evaporative emission leakage occurring between the fuel tank and the canister through the changes in the tank pressure.	—	○
	Approximately five hours after the ignition switch has been turned OFF, the ECM operates the leak detection pump to detect any evaporative emission leakage occurring evaporative emission control system through changes in the reference orifice pressure.	○	—

(Continued)

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System	Outline	Model	
		’06 Land Cruiser	’05 Land Cruiser
Air Conditioning Cut-off Control	By turning the A/C compressor ON or OFF in accordance with the engine condition, drivability is maintained.	○	○
Engine Immobilizer	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.	○	○
Diagnosis [See page 53]	When the ECM detects a malfunction, the ECM diagnoses and memorizes the failed section.	○	○
Fail-safe	When the ECM detects a malfunction, the ECM stops or controls the engine according to the data already stored in the memory.	○	○

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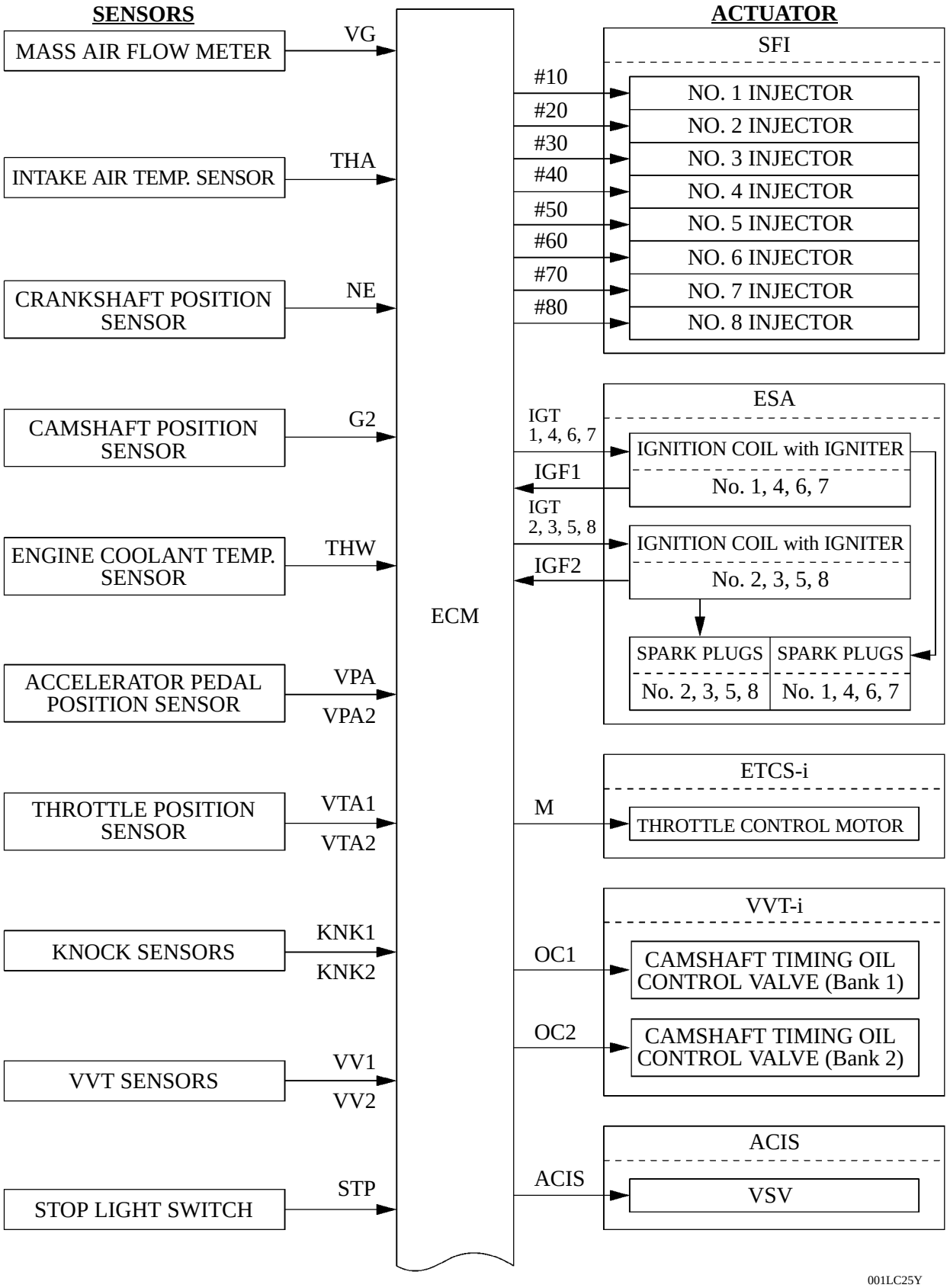
Construction

The configuration of the engine control system in the 2UZ-FE engine is shown in the following chart.



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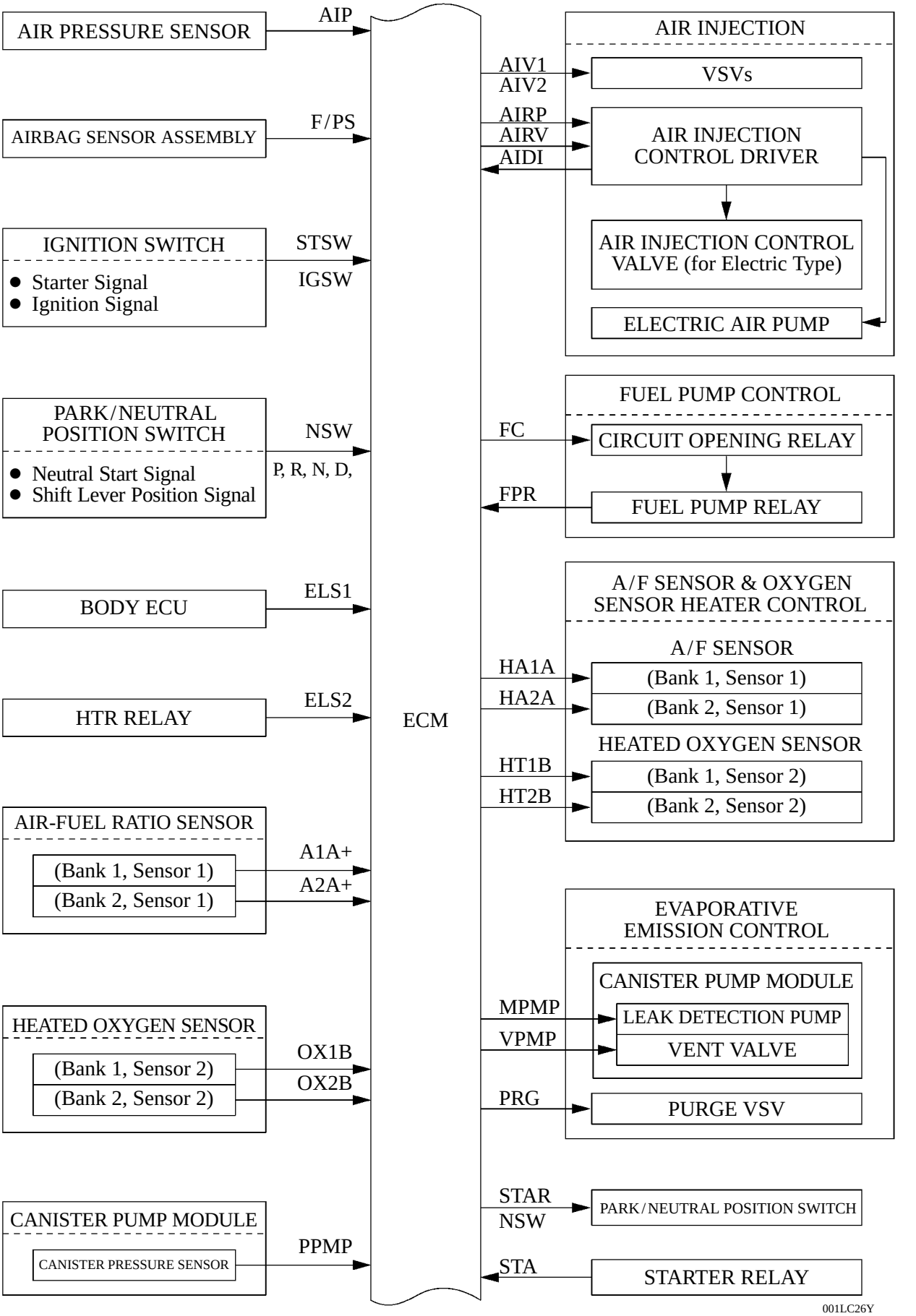

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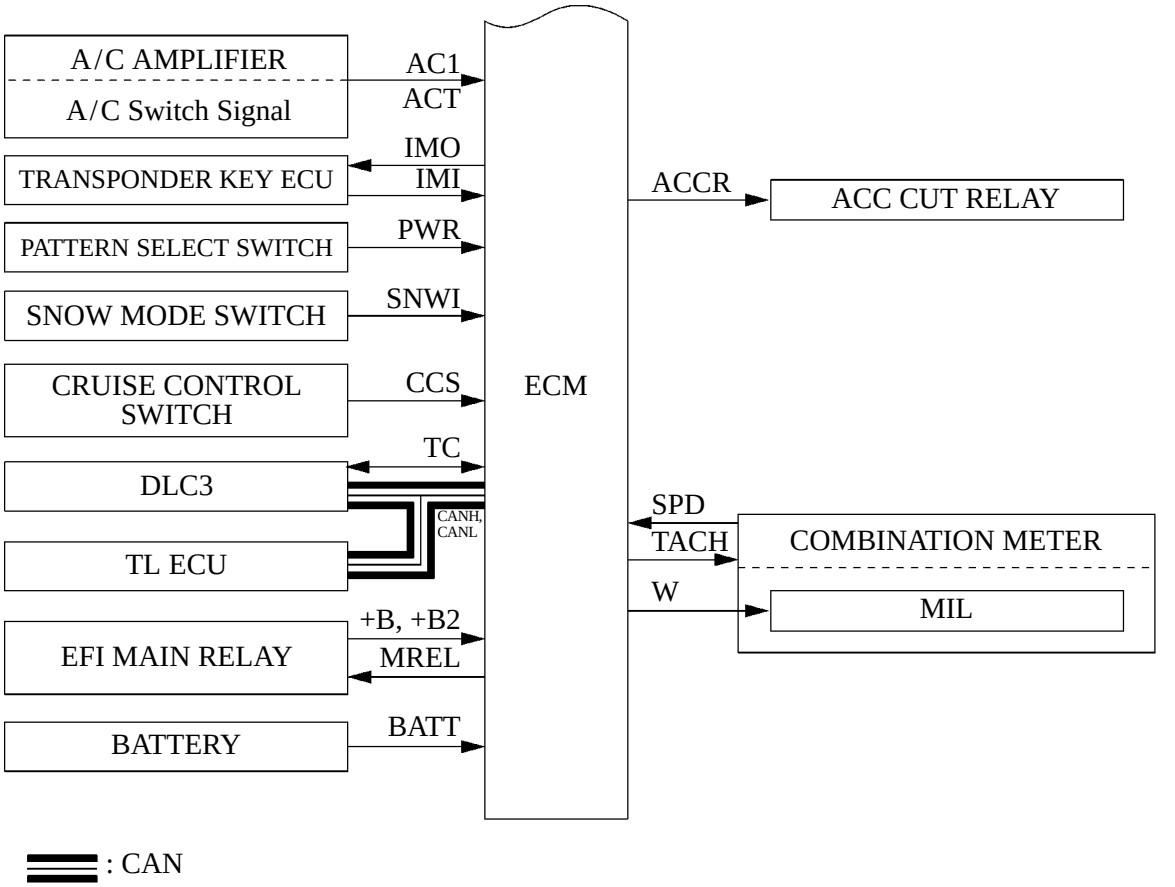

001LC27Y

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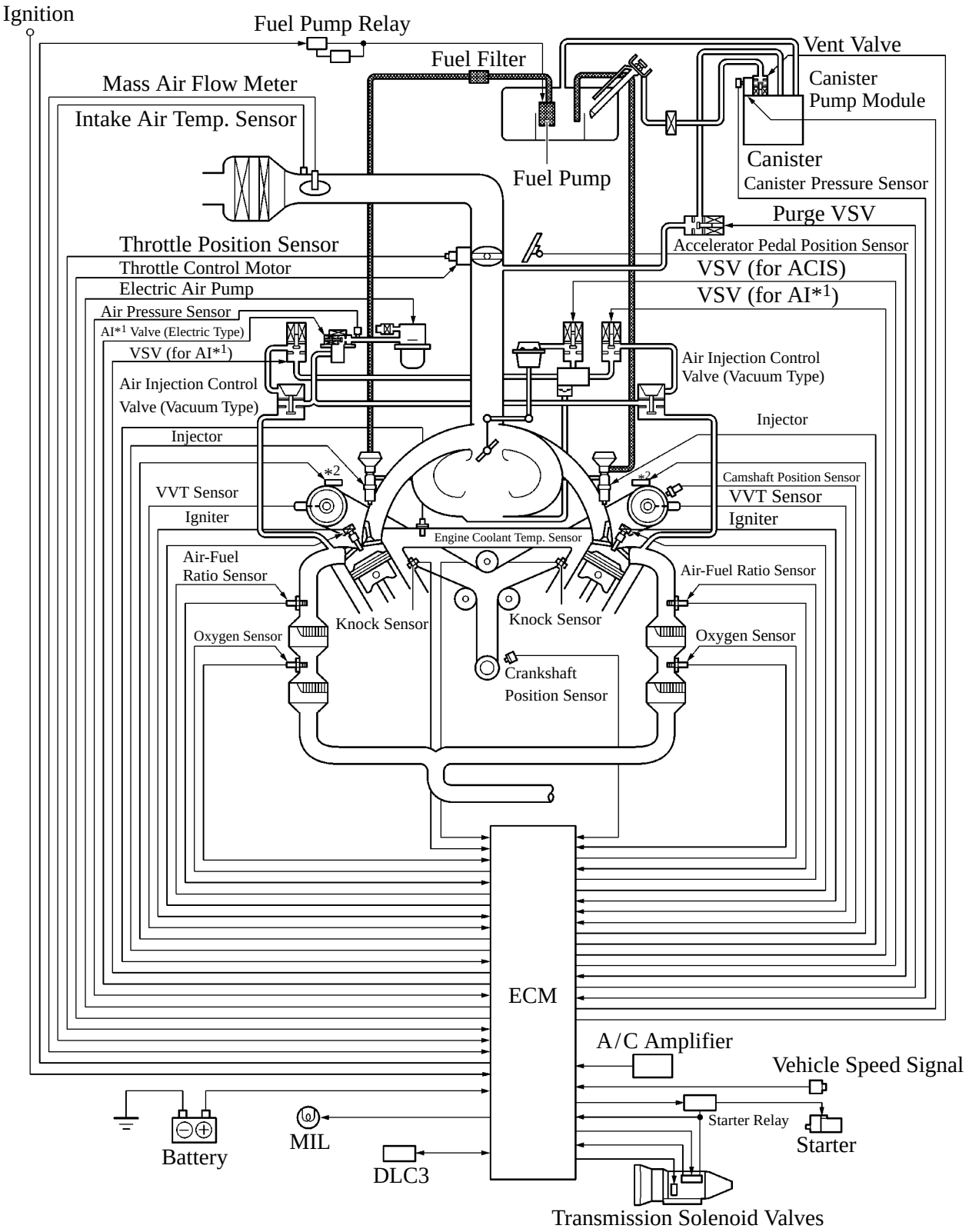
Engine Control System Diagram



*1: AI: Air Injection

*2: Camshaft Timing Oil Control Valve

275TU83

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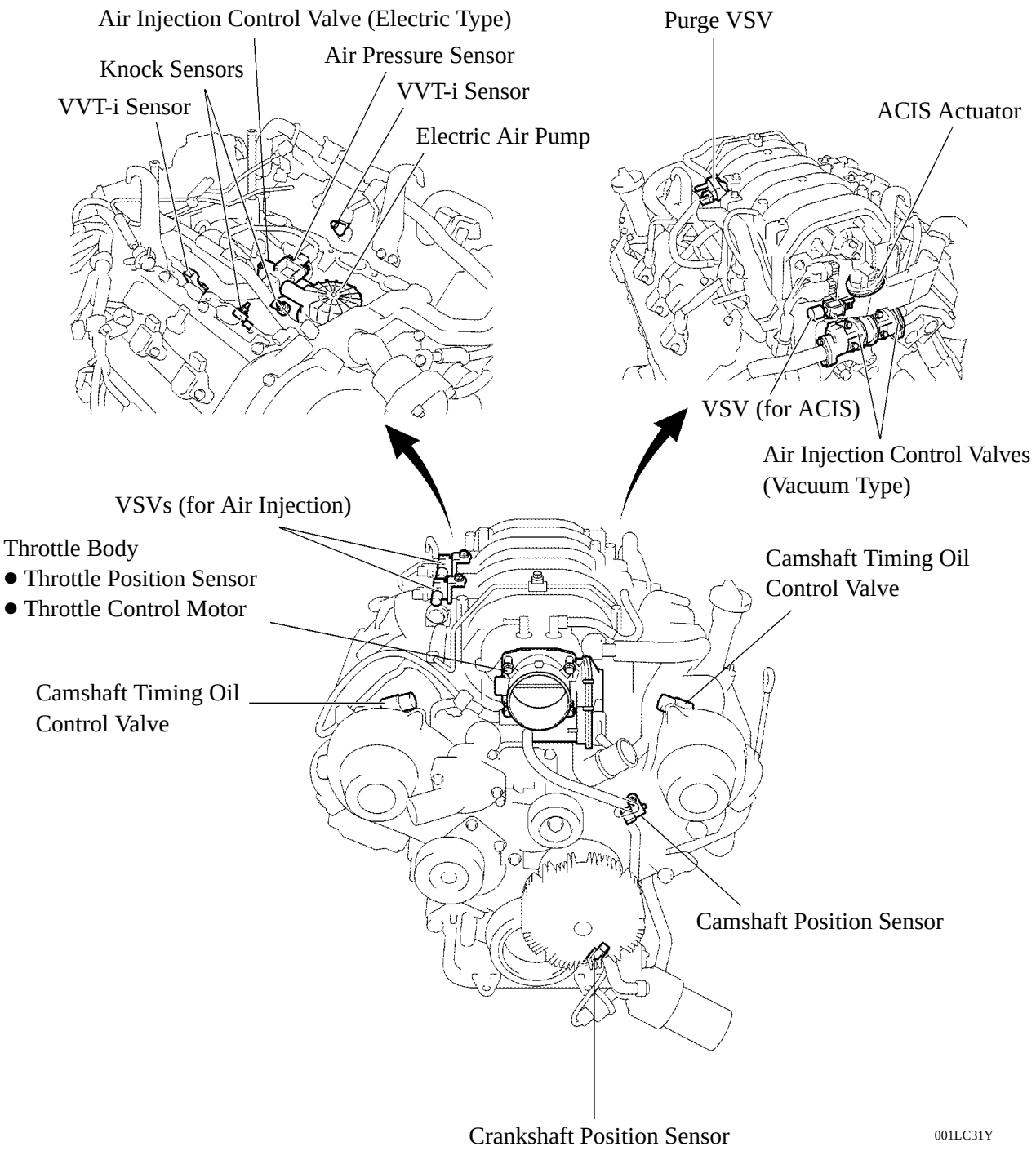
Layout of Main Components



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Main Components of Engine Control System

1) General

The main components of the 2UZ-FE engine control system are as follows:

Components		'06 Land Cruiser		'05 Land Cruiser	
		Outline	Quantity	Outline	Quantity
ECM		32-bit CPU	1	←	
Mass Air Flow Meter		Hot-wire Type (Slot-in)	1	Hot-wire Type (Plug-in)	1
Crankshaft Position Sensor (Rotor Teeth)		Pick-up Coil Type (36-2)	1	←	
Camshaft Position Sensor (Rotor Teeth)		Magnetic Resistance Element Type (3)	1	Pick-up Coil Type (1)	1
VVT Sensor LH, RH (Rotor Teeth)		Pick-up Coil Type (3)	1	—	
Accelerator Pedal Position Sensor		Linear (Contact) Type (Mounted on Accelerator Pedal)	1	Non-contact Type (Mounted on Accelerator Pedal)	1
Throttle Position Sensor		Non-contact Type	1	←	
Knock Sensor 1, 2		Built-in Piezoelectric Type (Non-resonant Type/ Flat Type)	2	Built-in Piezoelectric Type (Resonant Type)	2
Air-Fuel Ratio Sensor (Bank 1, Sensor 1) (Bank 2, Sensor 1)		with Heater Type (Planar Type)	2	—	
Oxygen Sensor	(Bank 1, Sensor 1) (Bank 2, Sensor 1)	—		with Heater Type	2
	(Bank 1, Sensor 2) (Bank 2, Sensor 2)	with Heater Type	2	←	
Injector		4-Hole Type	8	←	

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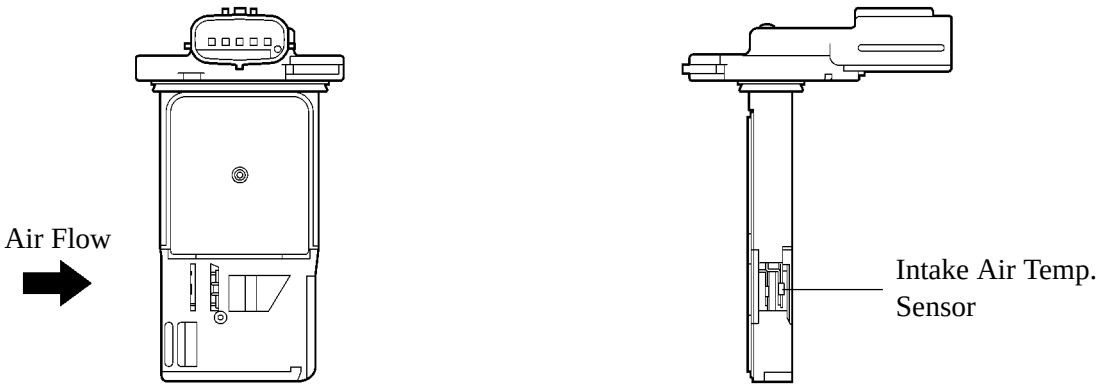
2) Mass Air Flow Meter

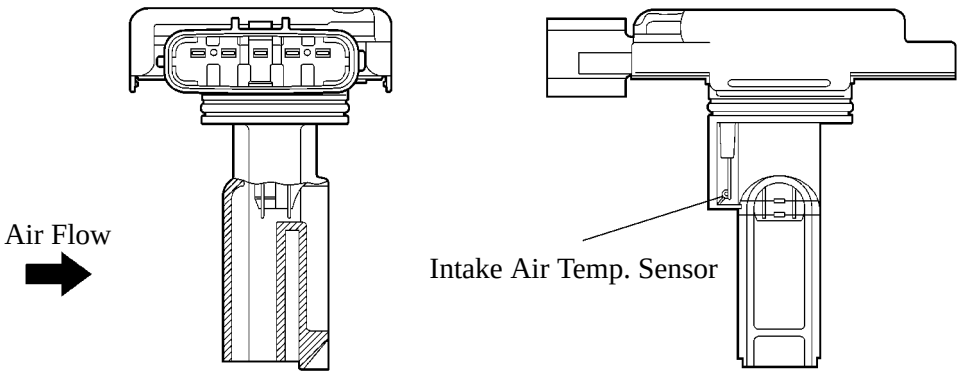
The mass air flow meter, which is a slot-in, allows a portion of the intake air to flow through the detection area. By directly measuring the mass and the flow rate of the intake air, the detection precision is ensured and the intake air resistance is reduced.

- This mass air flow meter has a built-in intake air temperature sensor.



'06 Land Cruiser

273GX15



'05 Land Cruiser

273GX16

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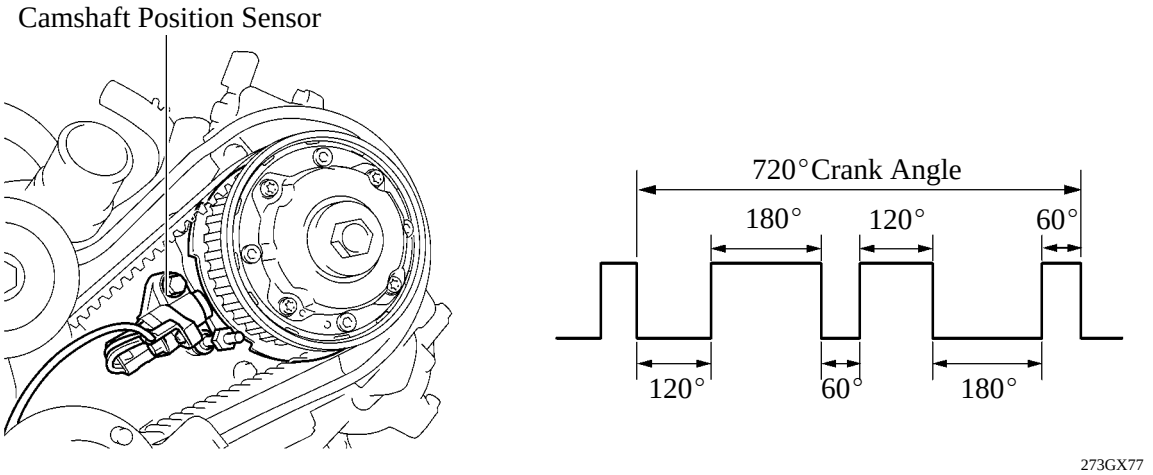
3) Camshaft Position Sensor

The MRE (Magnetic Resistance Element) type camshaft position sensor converts changes in the magnetic field due to timing rotor rotation into internal circuit voltage. Unlike the pick-up type, an ON-OFF signal is output so that the sensor is not easily influenced by noise. This signal generates 3 pulses for every 2 revolutions of the crankshaft.

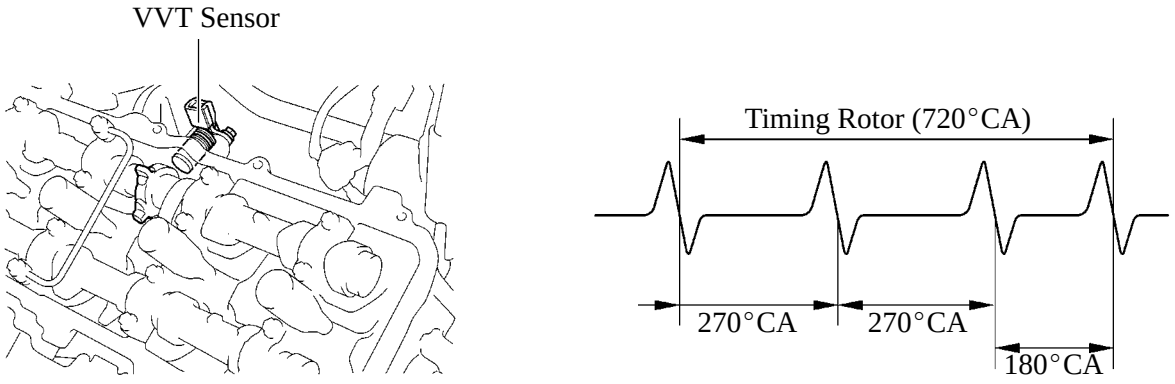


Service Tip

The inspection method differs from the pick-up type because this sensor uses the MRE type. For details, refer to the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

4) VVT Sensor

A VVT sensor is mounted on the intake side of each cylinder head. To detect the camshaft position, a timing rotor that is provided on the intake camshaft is used to generate 3 pulses for every 2 revolutions of the crankshaft.



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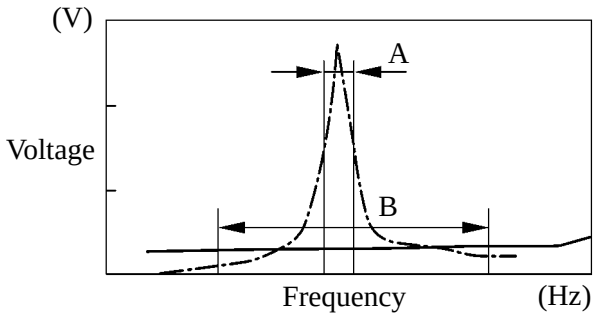
5) Knock Sensor (Flat Type)

a. General

In the conventional type knock sensor (resonant type), a vibration plate, which has the same resonance point as the knocking frequency of the engine, is built in and can detect the vibration in this frequency band.
On the other hand, a flat type knock sensor (non-resonant type) has the ability to detect vibration in a wider frequency band from about 6 kHz to 15 kHz, and has the following feature:

- The engine knocking frequency will change a bit depending on the engine speed. The flat type knock sensor can detect vibration even when the engine knocking frequency is changed. Thus, the vibration detection ability is increased compared to the conventional type knock sensor, and a more precise ignition timing control is possible.

———— : Resonance Characteristic of Conventional
— - — - : Resonance Characteristic of Flat Type

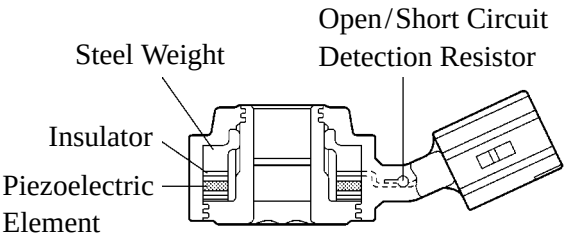


A: Detection Band of Conventional Type
B: Detection Band of Flat Type

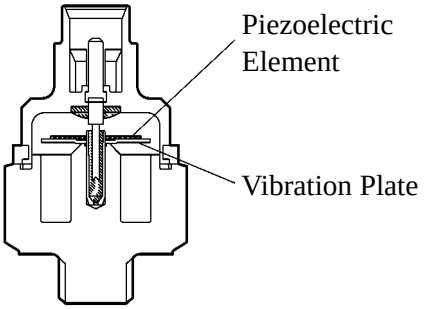
Characteristic of Knock Sensor 214CE04

b. Construction

- The flat type knock sensor is installed on the engine through the stud bolt installed on the cylinder block. For this reason, a hole for the stud bolt is running through in the center of the sensor.
- Inside of the sensor, a steel weight is located on the upper portion and a piezoelectric element is located under the weight through the insulator.
- The open/short circuit detection resistor is integrated.



Flat Type Knock Sensor (Non-Resonant Type) 214CE01



Conventional Type Knock Sensor (Resonant Type) 214CE02

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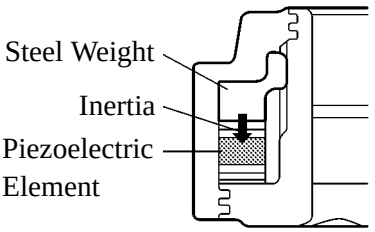
c. Operation

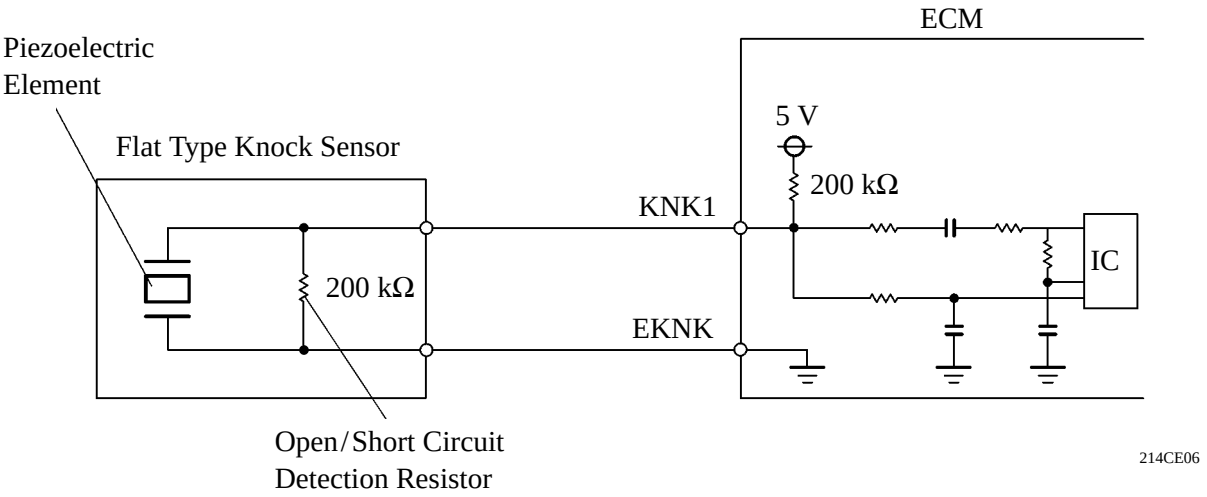
The knocking vibration is transmitted to the steel weight and its inertia and they apply pressure to the piezoelectric element. The action generates electromotive force.



214CE08

d. Open/Short Circuit Detection Resistor

During the ignition is ON, the open/short circuit detection resistor in the knock sensor and the resistor in the ECM keep the voltage at the terminal KNK1 of the engine constantly.
An IC (Integrated Circuit) in the ECM is always monitoring the voltage of the terminal KNK1. If the open/short circuit occurs between the knock sensor and the ECM, the voltage of the terminal KNK1 will change and the ECM detects the open/short circuit and stores DTC (Diagnostic Trouble Code).



214CE06

Service Tip

In accordance with the adoption of an open/short circuit detection resistor, the inspection method for the sensor has been changed. For details, refer to the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

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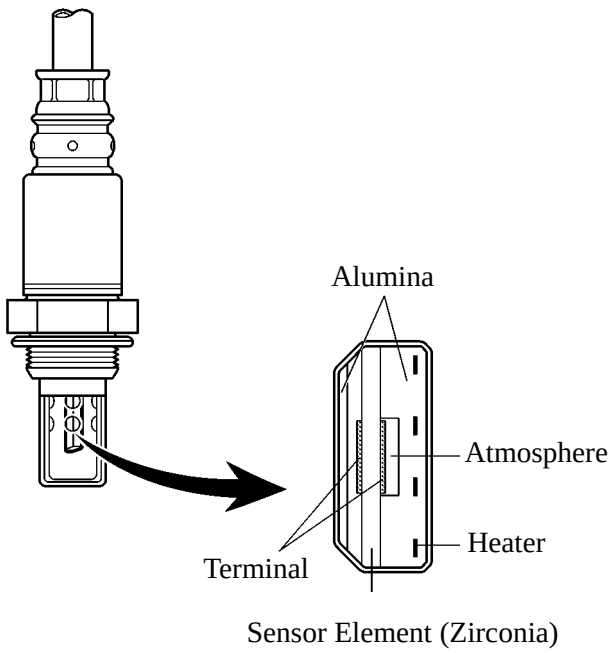
6) Air-Fuel Ratio Sensor

a. General

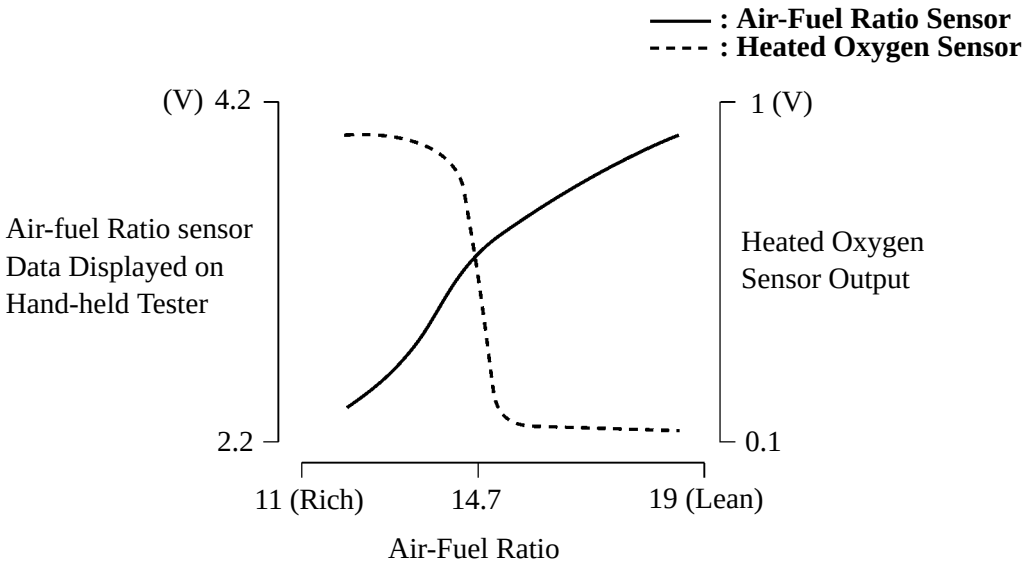
The planar type air-fuel ratio sensor uses alumina, which excels in heat conductivity and insulation, to integrate a sensor element with a heater, thus improving the warm-up performance (warm-up time: approx. 10 seconds) of the sensor.



D13N12

b. Characteristic

As illustrated below, the conventional heated oxygen sensor is characterized by a sudden change in its output voltage at the threshold of the stoichiometric air-fuel ratio (14.7:1). In contrast, the air-fuel ratio sensor data is approximately proportionate to the existing air-fuel ratio. The air-fuel ratio sensor converts the oxygen density to the current and sends it to the ECM. As a result, the detection precision of the air-fuel ratio has been improved. The air-fuel ratio sensor data is read out by a hand-held tester.



D13N11

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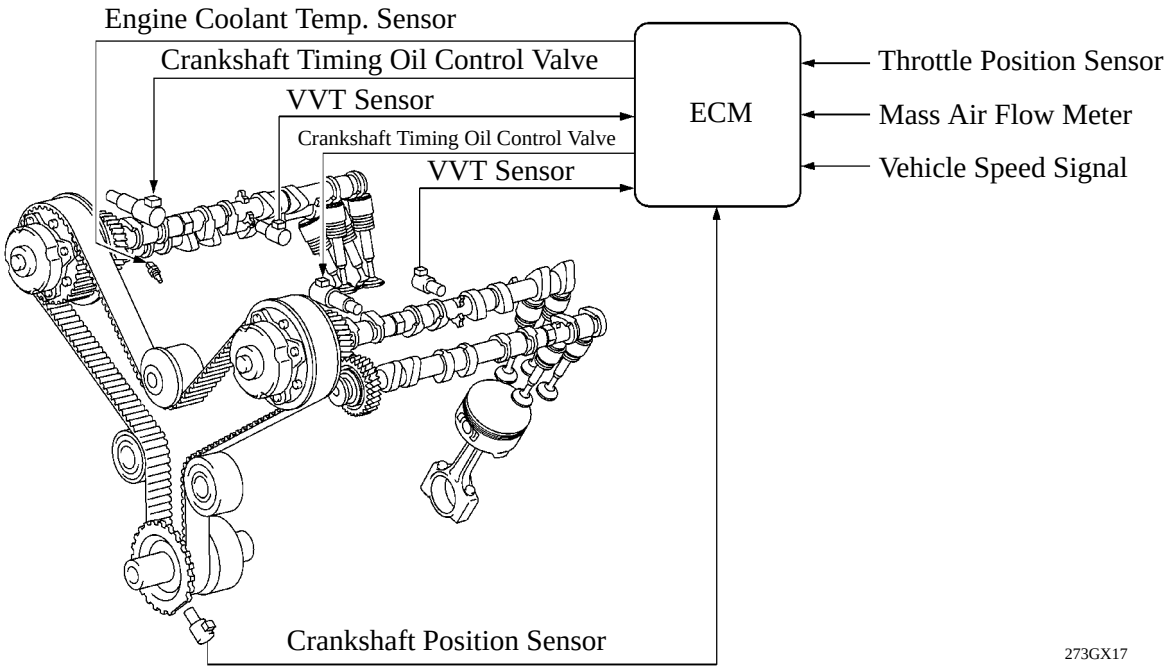
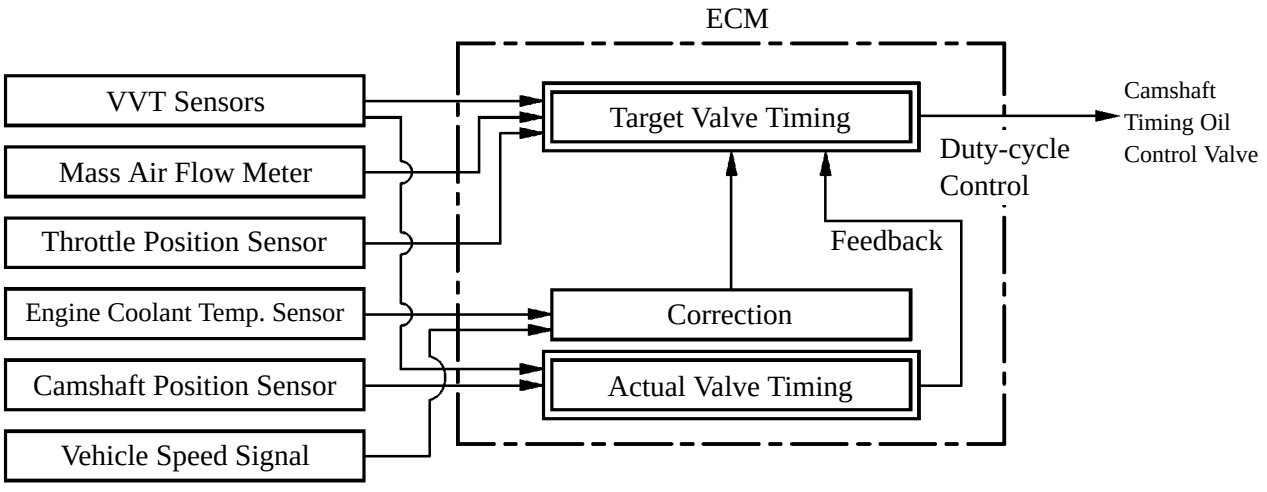
VVT-i (Variable Valve Timing-intelligent) System

1) General

- The VVT-i system is designed to control the intake camshaft within a range of 45° (of Crankshaft Angle) to provide valve timing that is optimally suited to the engine condition. This improves torque in all the speed ranges as well as increasing fuel economy, and reducing exhaust emissions.



- By using the engine speed, intake air mass, throttle position and engine coolant temperature, the ECM calculates optimal valve timing for each driving condition and controls the camshaft timing oil control valve. In addition, the ECM uses signals from the two VVT sensors and the crankshaft position sensor to detect the actual valve timing, thus providing feedback control to achieve the target valve timing.



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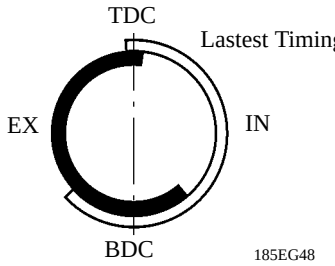
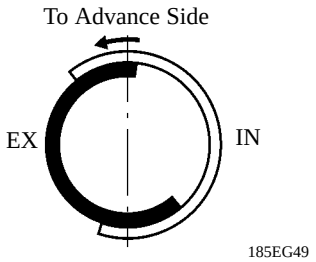
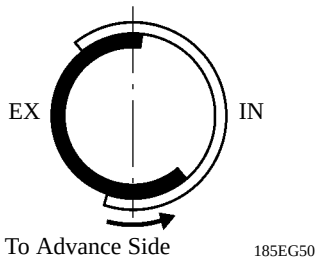
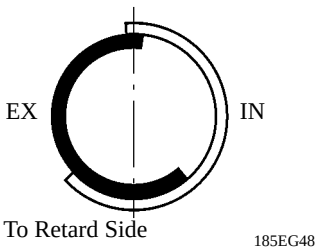
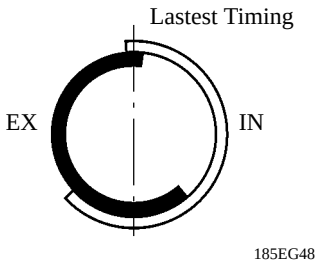
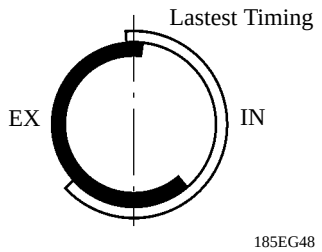
2) Effectiveness of the VVT-i System

Operation State	Objective	Effect
● During Idling ● At Light Load	 Minimizing overlap to reduce blowback to the intake side	● Stabilized idling rpm ● Better fuel economy
At Medium Load	 Increasing overlap increases internal EGR, reducing pumping loss	● Better fuel economy ● Improved emission control
In Low to Medium Speed Range with Heavy Load	 Advancing the intake valve close timing for volumetric efficiency improvement	Improved torque in low to medium speed range
In High Speed Range with Heavy Load	 Retarding the intake valve close timing for volumetric efficiency improvement	Improved output
At Low Temp.	 Minimizing overlap to prevent blowback to the intake side leads to the lean burning condition, and stabilizes the idling speed at fast idle	● Stabilized fast idle rpm ● Better fuel economy
● Upon Starting ● Stopping the Engine	 Minimizing overlap to minimize blowback to the intake side	Improved startability

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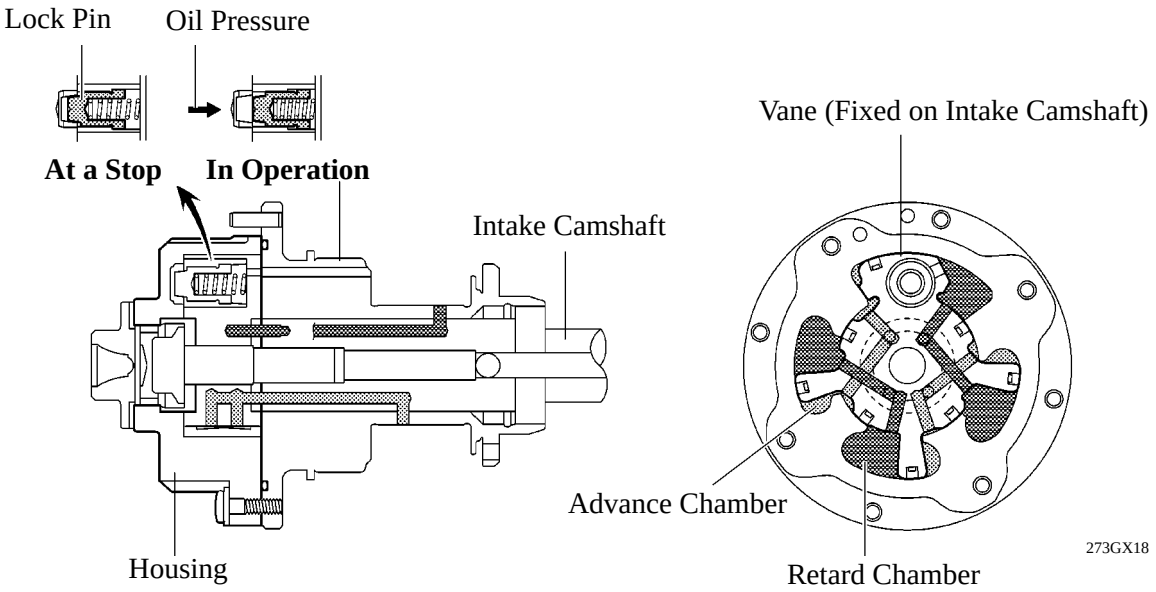
3) Construction

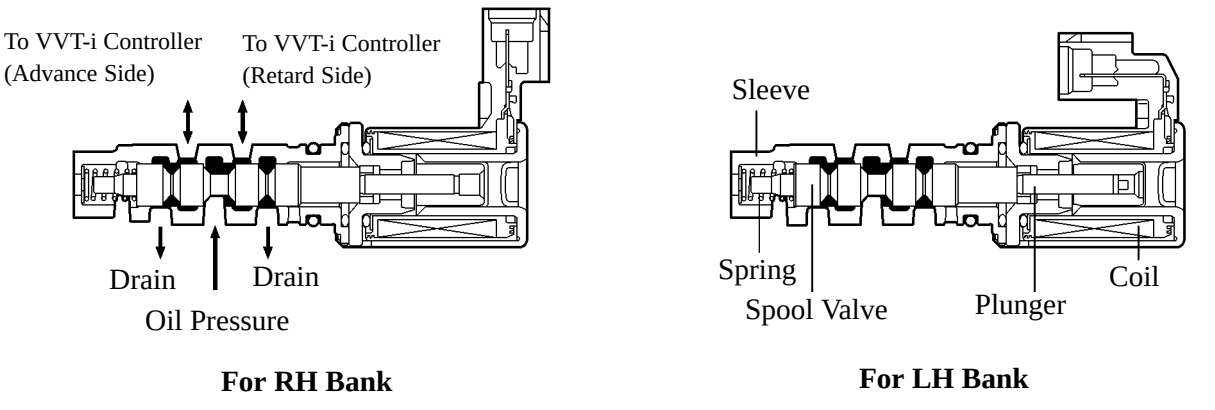
a. VVT-i Controller

VVT-i controller consists of the housing, four vanes, and lock pin. The oil pressure sent from the advance or retard side path at the intake camshaft causes rotation in the VVT-i controller vane circumferential direction to vary the intake valve timing continuously.
When the engine is stopped, the intake camshaft will be in the most retarded state to ensure startability. When oil pressure is not applied to the VVT-i controller immediately after the engine has been started, the lock pin locks the movement of the VVT-i controller to prevent a knocking noise.



b. Camshaft Timing Oil Control Valve

The camshaft timing oil control valve controls the spool valve position in accordance with the duty control from the ECM, thus allocating the hydraulic pressure that is applied to the VVT-i controller to the advance and the retard side. When the engine is stopped, the camshaft timing oil control valve is in the most retarded state.



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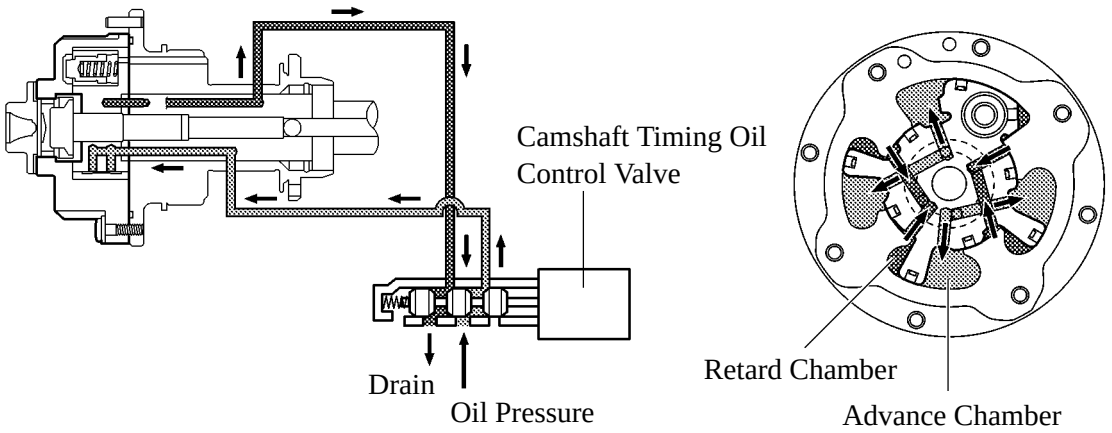
4) Operation

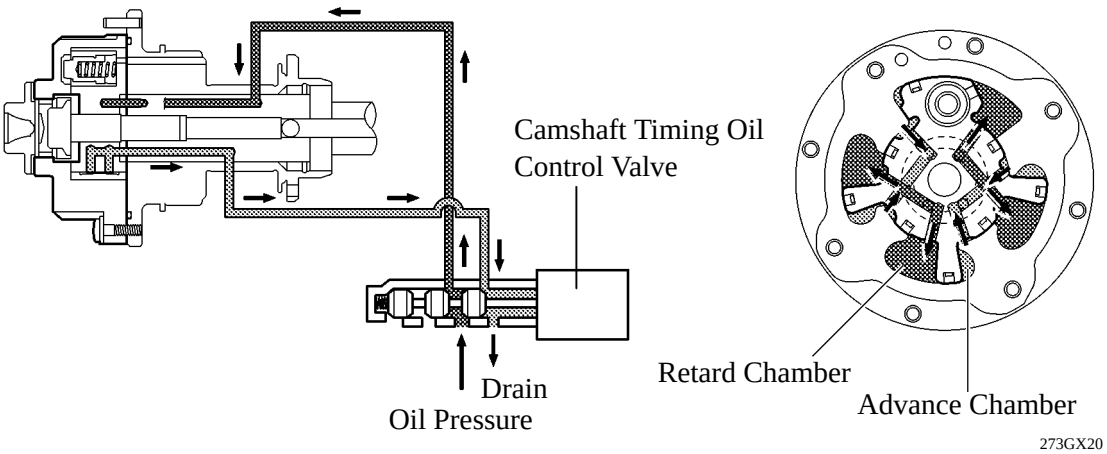
a. Advance

When the camshaft timing oil control valve is positioned as illustrated below by the advance signal from the ECM, the resultant oil pressure is applied to the timing advance side vane chamber to rotate the camshaft in the timing advance direction.



b. Retard

When the camshaft timing oil control valve is positioned as illustrated below by the retard signal from the ECM, the resultant oil pressure is applied to the timing retard side vane chamber to rotate the camshaft in the timing retard direction.



c. Hold

After reaching the target timing, the valve timing is held by keeping the camshaft timing oil control valve in the neutral position unless the traveling state changes.
This adjusts the valve timing at the desired target position and prevents the engine oil from running out when it is unnecessary.

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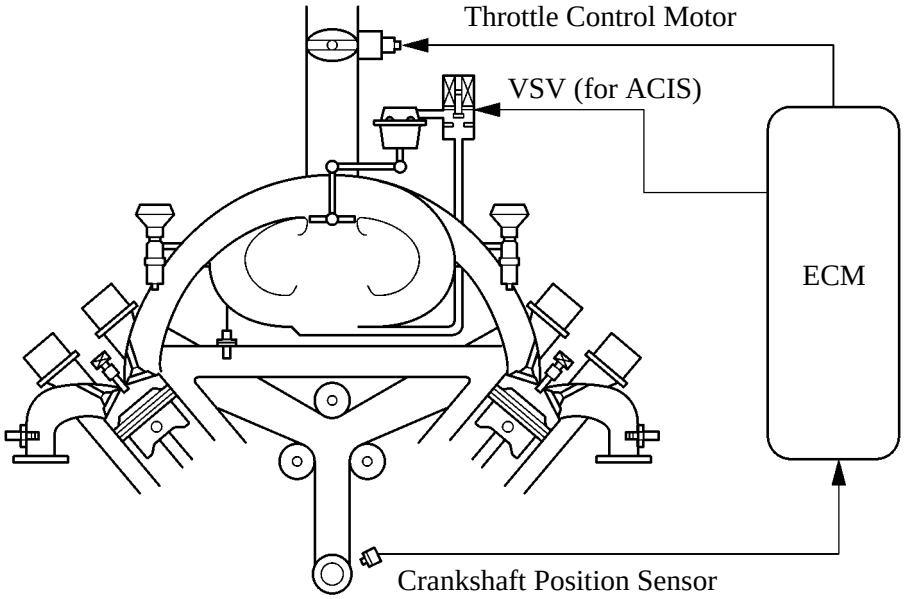
ACIS (Acoustic Control Induction System)

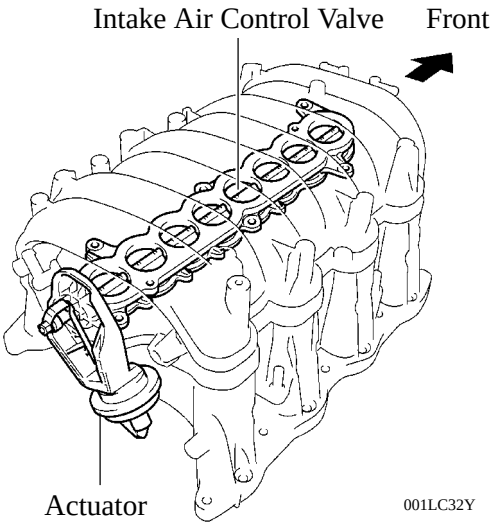
1) General

The ACIS is realized by using a bulkhead to divide the intake manifold into two stages, with an intake air control valve in the bulkhead being opened and closed to vary the effective length of the intake manifold in accordance with the engine speed and throttle valve opening angle. This increases the power output in all ranges from low to high speed.



2) Intake Air Control Valve and Actuator

The intake air control valve and actuator are integrated with the intake manifold. This valve opens and closes to change the effective length of the intake manifold in two stages.



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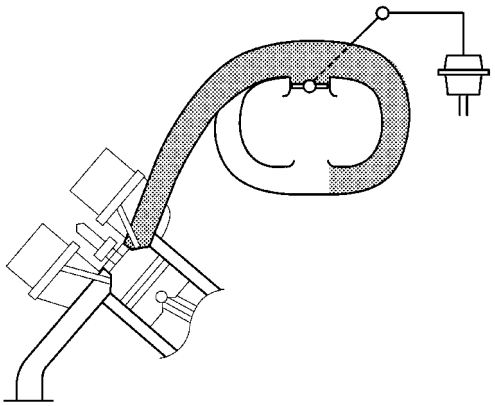
3) Operation

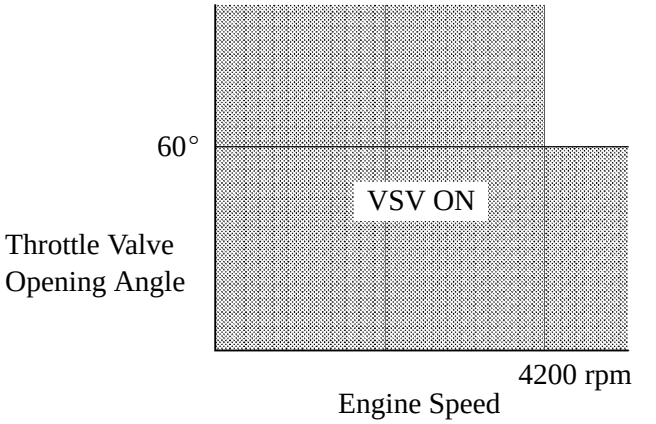
a. When the Intake Air Control Valve Closes (VSV ON)

The ECM activates the VSV to match the longer pulsation cycle so that the negative pressure acts on the diaphragm chamber of the actuator. This closes the control valve. As a result, the effective length of the intake manifold is lengthened and the intake efficiency in the low-to-medium speed range is improved due to the dynamic effect of the intake air, thereby increasing the power output.

: Effective Intake Manifold Length



273GX23

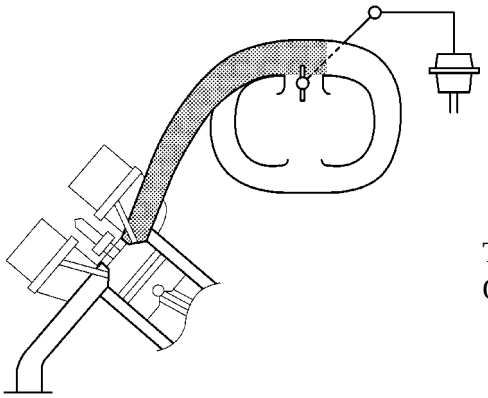


189EG22

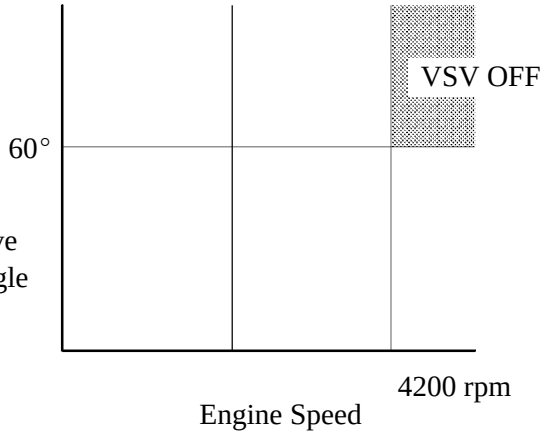
b. When the Intake Air Control Valve Opens (VSV OFF)

The ECM deactivates the VSV to match the shorter pulsation cycle so that atmospheric air is led into the diaphragm chamber of the actuator and opens the control valve. When the control valve is open, the effective length of the intake air chamber is shortened and the peak intake efficiency is shifted to the high engine speed range, thus providing greater output at high engine speeds.

: Effective Intake Manifold Length



273GX24



189EG23

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Air Injection System

1) General

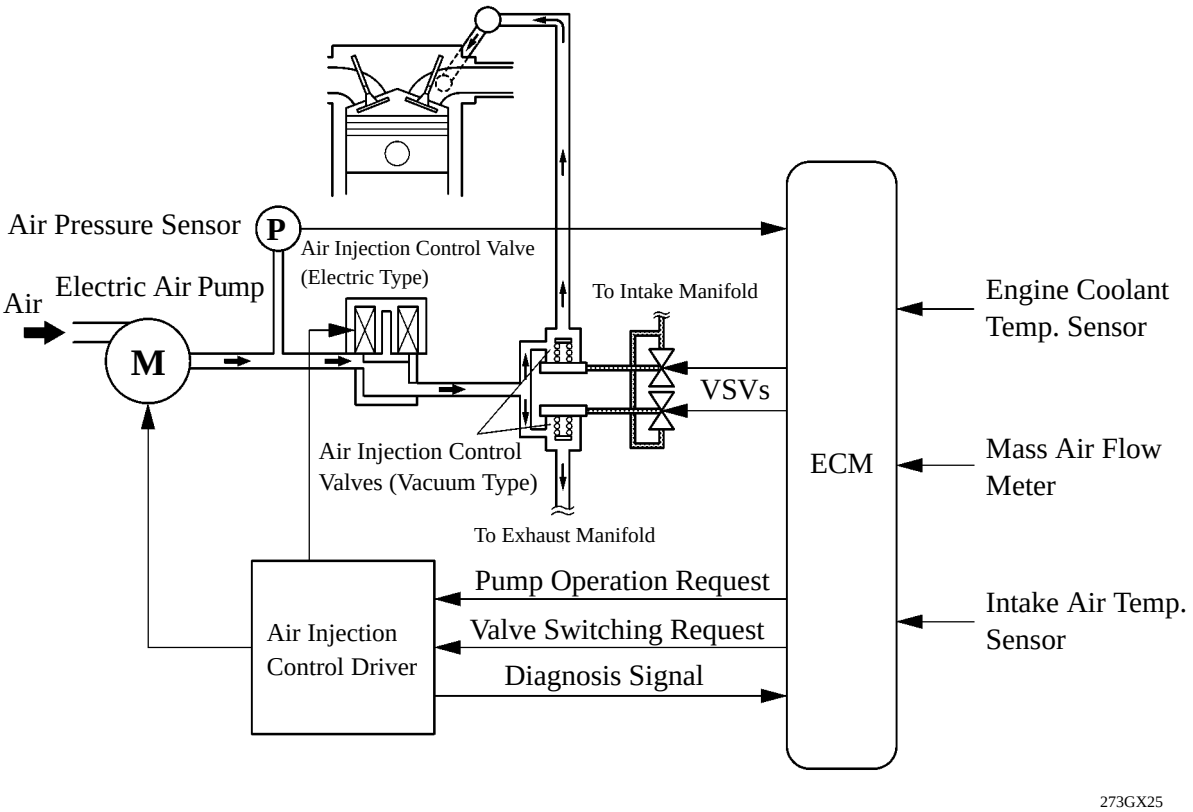
To ensure the proper warm-up performance of the TWC (Three-Way catalytic Converter) when starting a cold engine is started, an air injection system is used.

- This system consists of an electric air pump, an air injection control driver, two air injection control valves (vacuum type), an air injection control valve (electric type), and two VSVs.
- The ECM estimates the amount of the air injected to the TWC based on the signals from the mass air flow meter in order to regulate the air injection time.
- The air injection operates under the following operation conditions.

▶ Operation Condition ◀

Engine Coolant Temp.	5 to 45°C (41 to 113°F)
Intake Air Temp.	5°C (41°F) or more

▶ System Diagram ◀



273GX25

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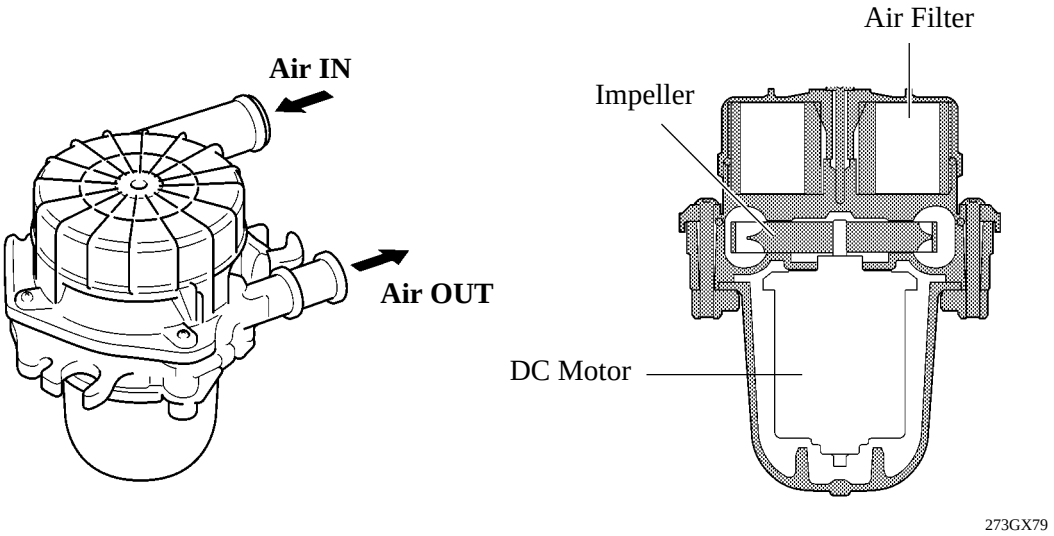
2) Construction and Function of Main Components

a. Electric Air Pump

An electric air pump consists of a DC motor, an impeller and an air filter.

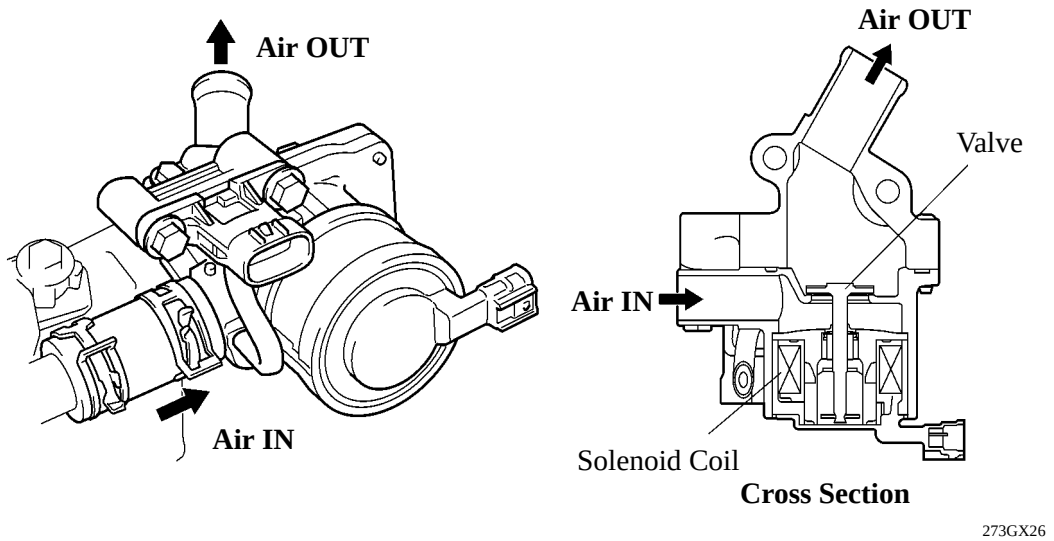
- The pump supplies air into an air injection control valve (electric type) through the impeller.
- The air filter is maintenance-free.



Cross Section

b. Air Injection Control Valve (Electric Type)

The air injection control valve (electric type) is operated by a solenoid coil to control air injection and prevent back-flow of exhaust gas. Opening timing of the valve is synchronized with operation timing of the electric air pump.



Cross Section

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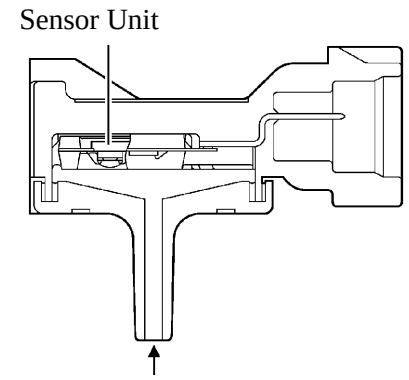
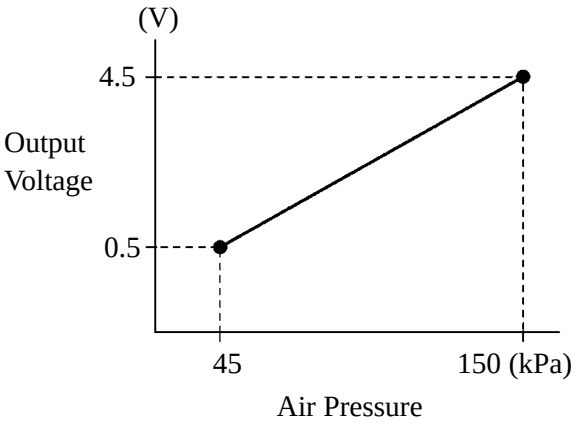
c. Air Pressure Sensor

The air pressure sensor consists of a semiconductor, which utilizes the characteristics of silicon chip that changes its electrical resistance when pressure is applied to it. The sensor converts the pressure into an electrical signal, and sends it to the ECM in an amplified form.



257MA21

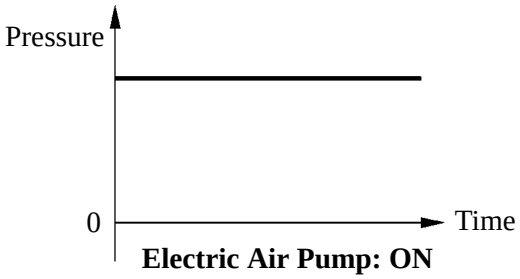


257MA22

The ECM detects operation condition of the air injection system based on the signals from the air pressure sensor as follows:

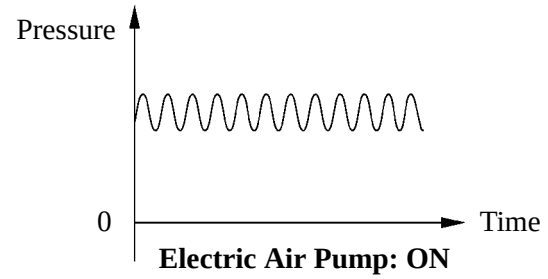
1) When the electric air pump is ON and the VSVs are OFF, the pressure is constant.
2) When the VSVs are turned ON with the electric air pump ON and all air injection control valves open, the pressure drops slightly and becomes unstable because of exhaust-pulse.
3) When the electric air pump is OFF and the VSVs are OFF, the pressure remains 0.
4) When the VSVs are turned ON with the electric air pump OFF and all air injection control valves open, the pressure drops below 0 and becomes unstable because of exhaust-pulse.

Example: 1



Electric Air Pump: ON
VSVs: OFF

Example: 2

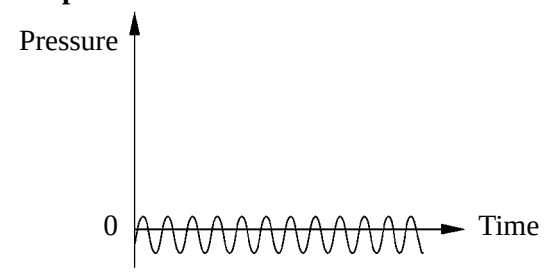


Electric Air Pump: ON
VSVs: ON

Example: 3

Electric Air Pump: OFF
VSVs: OFF

Example: 4



Electric Air Pump: OFF
VSVs: ON

273GX81

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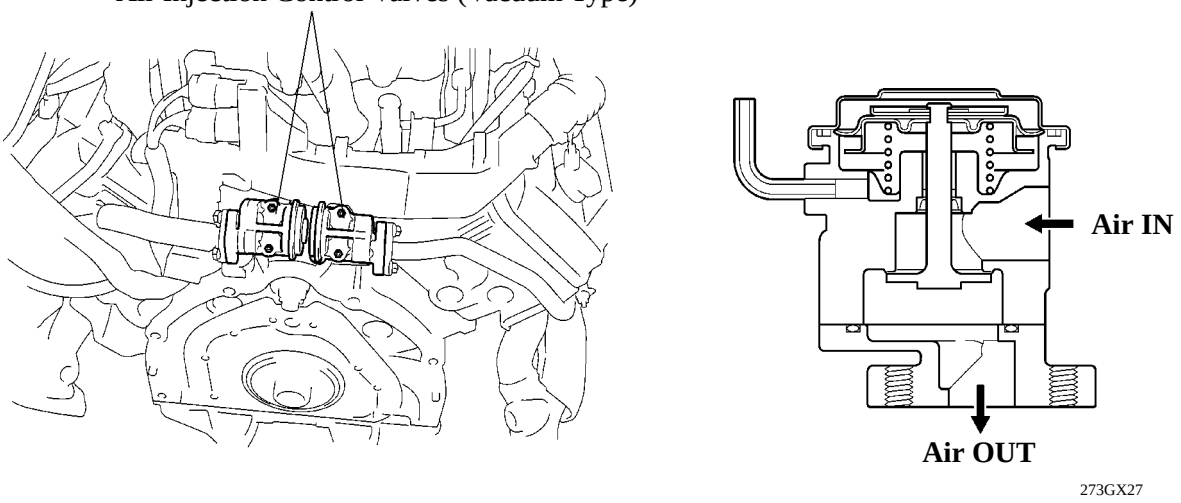
d. Air Injection Control Valve (Vacuum Type)

The air injection control valve (vacuum type) switches according to the vacuum pressure introduced by VSV.

Air Injection Control Valves (Vacuum Type)



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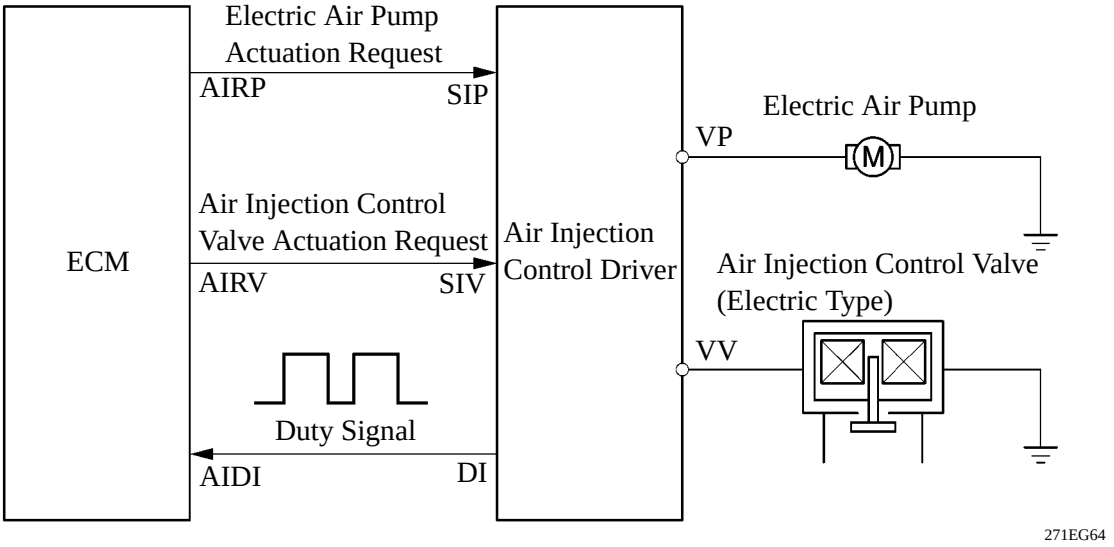
e. Air Injection Control Driver

- The air injection control driver uses semiconductor. Activated by the ECM, this driver actuates the electric air pump and the air injection control valve.
- The air injection control driver also detects failures in the input and output circuits at the air injection driver and transmits the failure status to the ECM via duty cycle signals.



▶ DI Terminal Output ◀

Condition	AIRP*1	AIRV*2	Output (Duty Signal)
Open circuit in line between AIDI and DI terminals.	—	—	GND 273GX28
Failure in line between ECM terminals and air injection control driver.	ON	ON	GND 273GX29
Output failure at air injection control driver. (Failure in electric air pump actuation circuit)	—	—	20 ms GND 273GX30
Output failure at air injection control driver. (Failure in air injection control valve actuation circuit)	—	—	GND 273GX31
Overheat failure of air injection control driver.	—	—	GND 273GX32
Normal	ON	ON	GND 273GX33
	OFF	OFF	GND 273GX29
	ON	OFF	
	OFF	ON	

*1: Electric air pump actuation request
*2: Air injection control valve actuation request

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Evaporative Emission Control System

1) General

The evaporative emission control system prevents the vapor gas that is created in the fuel tank from being released directly into the atmosphere.

- The canister stores the vapor gas that has been created in the fuel tank.
- The ECM controls the purge VSV in accordance with the driving conditions in order to direct the vapor gas into the engine, where it is burned.
- In this system, the ECM checks the evaporative emission leak and outputs DTCs (Diagnostic Trouble Codes) in the event of a malfunction. An evaporative emission leak check consists of an application of a vacuum pressure to the system and monitoring the changes in the system pressure in order to detect a leakage.
- This system consists of an purge VSV, canister, refueling valve, canister pump module, and ECM.
- An ORVR (Onboard Refueling Vapor Recovery) function is provided in the refueling valve.
- The canister pressure sensor has been included in the canister pump module.
- A canister filter has been provided on the fresh air line. This canister filter is maintenance-free.
- The following are the typical conditions for enabling an evaporative emission leak check:

Typical Enabling Condition	● Five hours have elapsed after the engine has been turned OFF.* ● Altitude: Below 2400 m (8000 feet) ● Battery Voltage: 10.5 V or more ● Ignition Switch: OFF ● Engine Coolant Temperature: 4.4 to 35°C (35 to 95°F) ● Intake Air Temperature: 4.4 to 35°C (35 to 95°F)

*: If engine coolant temperature does not drop below 35°C (95°F), this time should be extended to 7 hours. Even after that, if the temperature is not less than 35°C (95°F), the time should be extended to 9.5 hours.

Service Tip

The canister pump module performs the fuel evaporative emission leak check. This check is done approximately five hours after engine is turned off. So you may hear sound coming from underneath the luggage compartment for several minutes. It does not indicate a malfunction.

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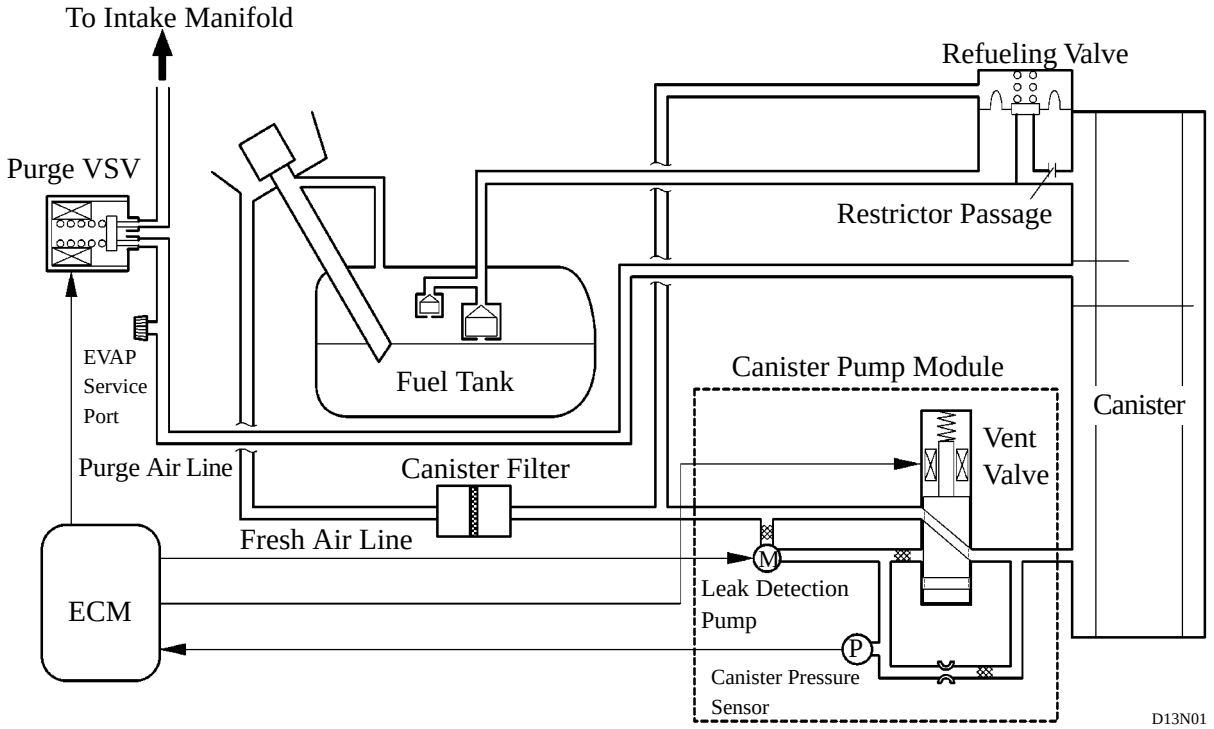
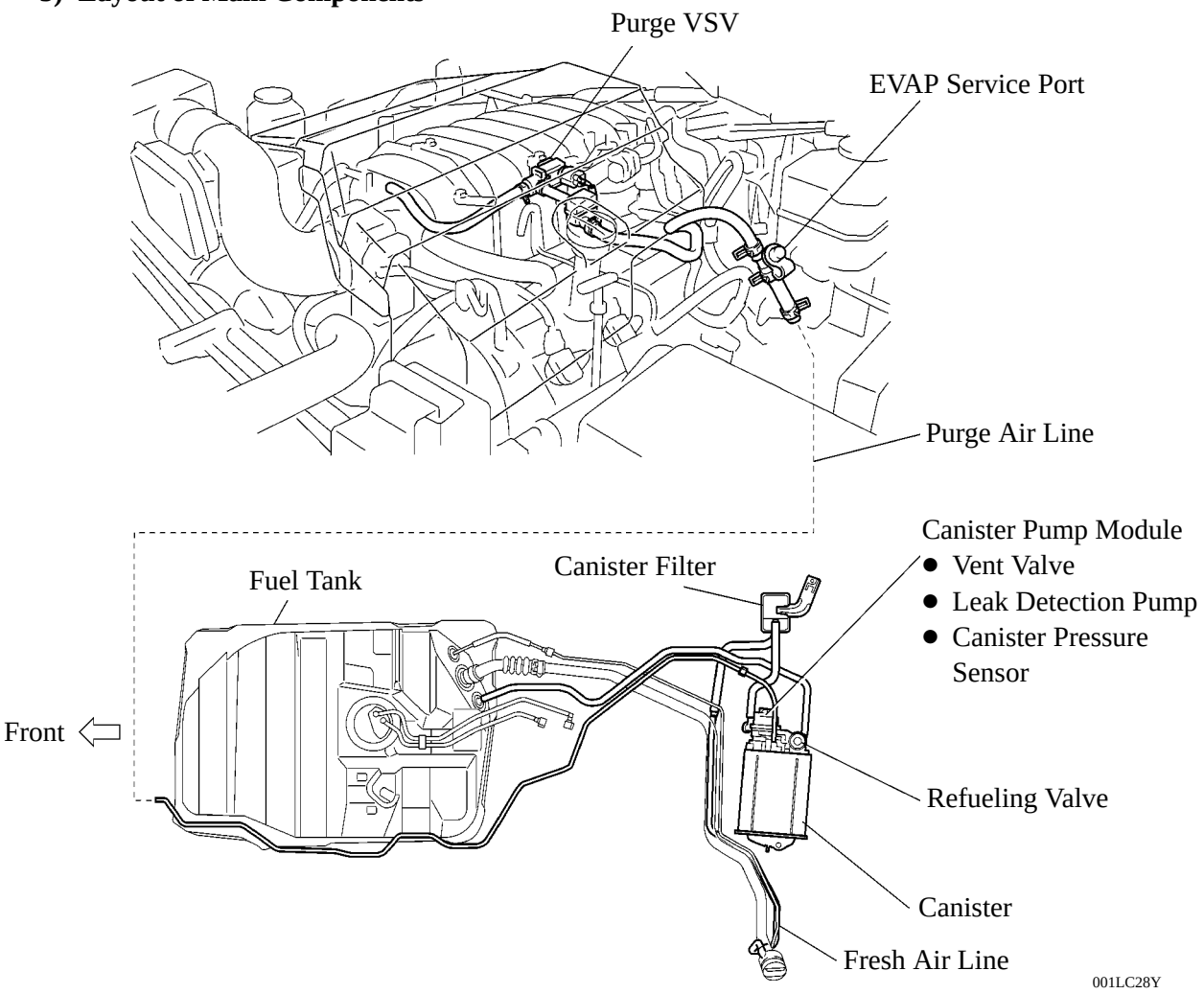
2) System Diagram



3) Layout of Main Components



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4) Function of Main Components

Component		Function
Canister		Contains activated charcoal to absorb the vapor gas that is crated in the fuel tank.
Refueling Valve		Controls the flow rate of the vapor gas from the fuel tank to the canister when the system is purging or during refueling.
	Restrictor Passage	Prevents the large amount of vacuum during purge operation or system monitoring operation from affecting the pressure in the fuel tank.
Fresh Air Inlet		Fresh air goes into the canister and the cleaned drain air goes out into the atmosphere.
Canister Pump Module	Vent Valve	Opens and closes the fresh air line in accordance with the signals from the ECM.
	Leak Detection Pump	Applies vacuum pressure in the evaporative emission system in accordance with the signals from the ECM.
	Canister Pressure Sensor	Detects the pressure in the evaporative emission system and sends the signals to the ECM.
Purge VSV		Opens in accordance with the signals from the ECM when the system is purging, in order to send the vapor gas that was absorbed by the canister into the intake manifold. During the system monitoring mode, this valve controls the introduction of the vacuum into the fuel tank.
Canister Filter		Prevents dust and debris in the fresh air from entering the system.
EVAP Service Port		This port is used for connecting a vacuum gauge for inspecting the system.
ECM		Controls the canister pump module and the purge VSV in accordance with the signals from various sensors, in order to achieve a purge volume that suits the driving conditions. In addition, the ECM monitors the system for any leakage and outputs a DTC if a malfunction is found.

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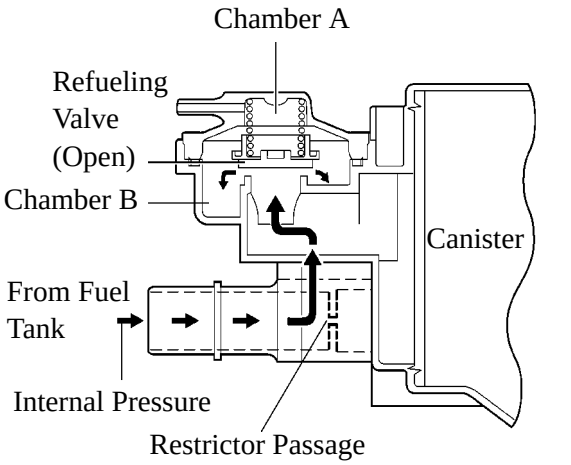
5) Construction and Operation

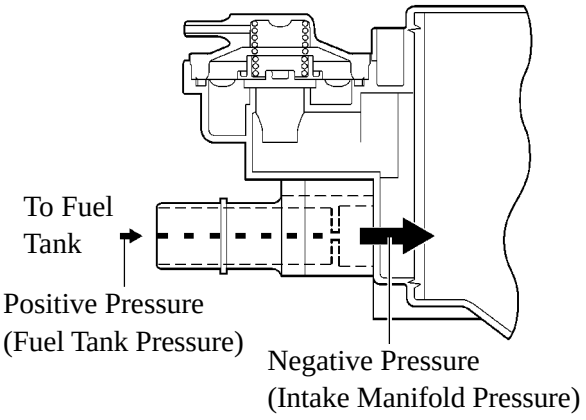
a. Refueling Valve

The refueling valve consists of the chamber A, chamber B, and restrictor passage. A constant atmospheric pressure is applied to chamber A.

- During refueling, the internal pressure of the fuel tank increases. This pressure causes the refueling valve to lift up, allowing the fuel vapors to enter the canister.
- The restrictor passage prevents the large amount of vacuum that is created during purge operation or system monitoring operation from entering the fuel tank, and limits the flow of the vapor gas from the fuel tank to the canister. If a large volume of vapor gas recirculates into the intake manifold, it will affect the air-fuel ratio control of the engine. Therefore, the role of the restrictor passage is to help prevent this from occurring.



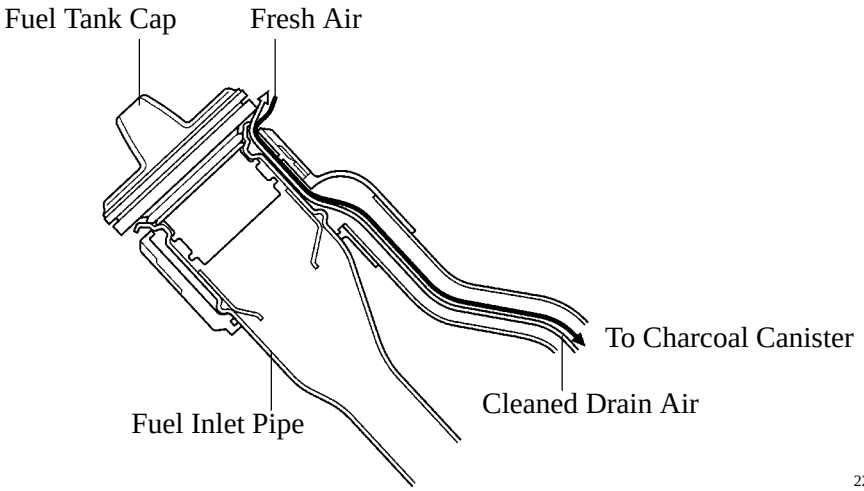
During Refueling



During Purge Operation or System Monitoring Operation

b. Fuel Inlet (Fresh Air Inlet)

In accordance with the change of structure of the evaporative emission control system, the location of a fresh air line inlet has been changed from the air cleaner section to near fuel inlet. The flesh air from the atmosphere and drain air cleaned by the charcoal canister will go in and out to the system through the passage shown below.



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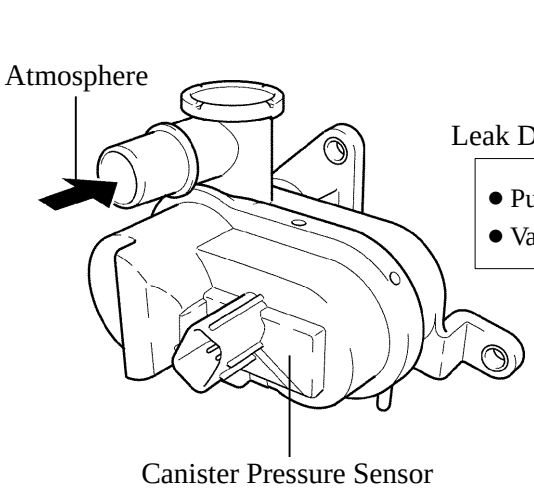
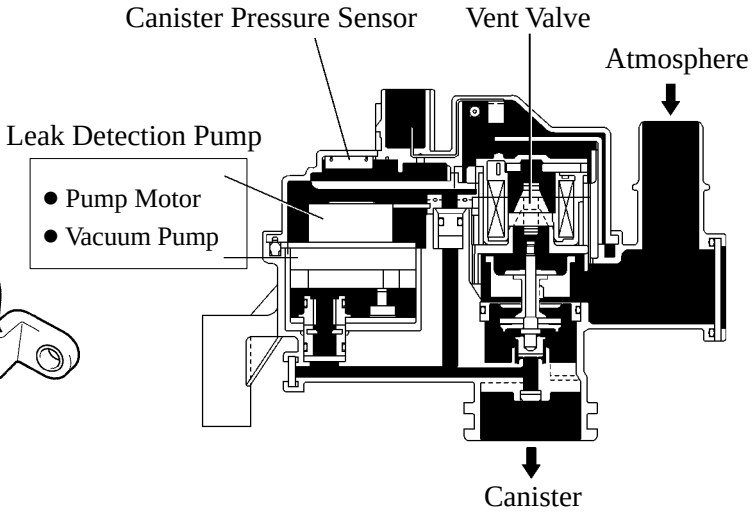
c. Canister Pump Module

Canister pump module consists of the vent valve, canister pressure sensor, leak detection pump.

- The vent valve switches the passages in accordance with the signals received from the ECM.
- A DC type brush-less motor is used for the pump motor.
- A vane type vacuum pump is used.

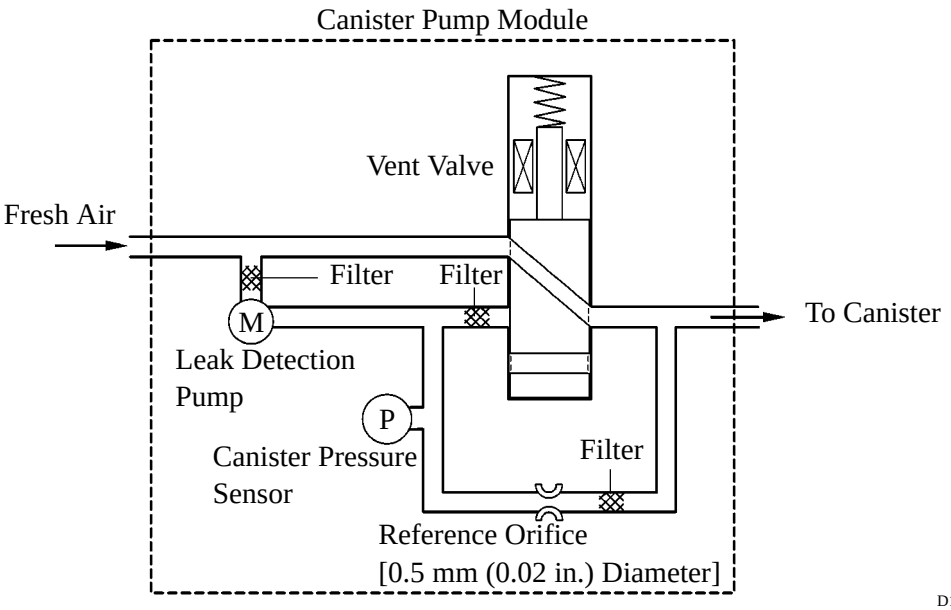


D13N15



D13N16

▶ Simple Diagram ◀



D13N17

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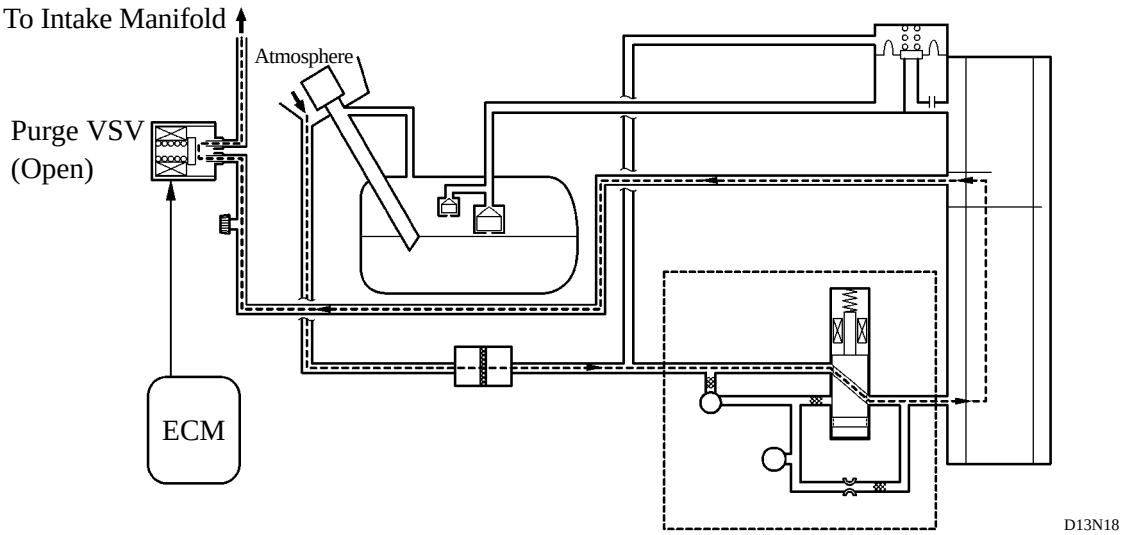
6) System Operation

a. Purge Flow Control

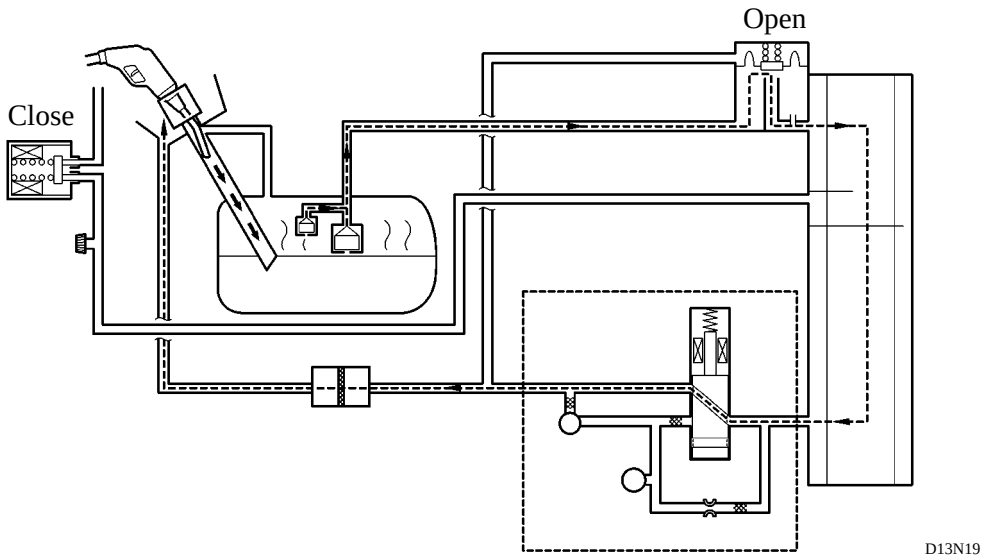
When the engine has reached predetermined parameters (closed loop, engine coolant temp. above 74°C (165°F), etc), stored fuel vapors are purged from the canister whenever the purge VSV is opened by the ECM.

The ECM will change the duty ratio cycle of the purge VSV, thus controlling purge flow volume. Purge flow volume is determined by intake manifold pressure and the duty ratio cycle of the purge VSV. Atmospheric pressure is allowed into the canister to ensure that purge flow is constantly maintained whenever purge vacuum is applied to the canister.



b. ORVR (On-Board Refueling Vapor Recovery)

When the internal pressure of the fuel tank increases during refueling, this pressure causes the diaphragm in the refueling valve to lift up, allowing the fuel vapors to enter the canister. Because the vent valve is always open (even when the engine is stopped) when the system is in a mode other than the monitoring mode, the air that has been cleaned through the canister is discharged outside of the vehicle via the fresh air line. If the vehicle is refueled during the system monitoring mode, the ECM will recognize the refueling by way of the canister pressure sensor, which detects the sudden pressure increase in the fuel tank, and will open the vent valve.



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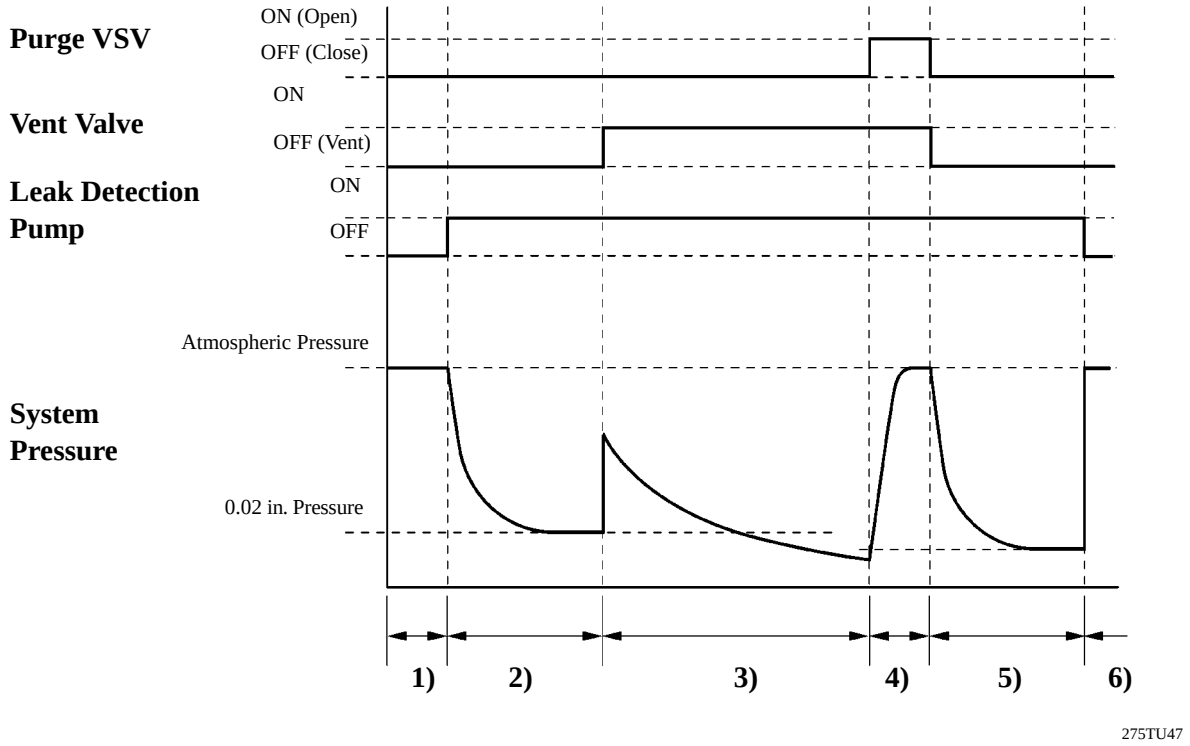
c. EVAP Leak Check

i) General

The EVAP leak check operates in accordance with the following timing chart:

▶ Timing Chart ◀



Order	Operation	Description	Time
1)	Atmospheric Pressure Measurement	ECM turns vent valve OFF (vent) and measures EVAP system pressure to memorize atmospheric pressure.	10 sec.
2)	0.02 in. Leak Pressure Measurement	Leak detection pump creates negative pressure (vacuum) through 0.02 in. orifice and pressure is measured. ECM determines this as 0.02 in. leak pressure.	60 sec.
3)	EVAP Leak Check	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. If stabilized pressure is larger than 0.02 in. leak pressure, ECM determines EVAP system has leak. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP monitor.	Within 15 min.
4)	Purge VSV Monitor	ECM opens purge VSV and measure EVAP pressure increase. If increase is large, ECM interprets this as normal.	10 sec.
5)	Repeat 0.02 in. Leak Pressure Measurement	Leak detection pump creates negative pressure (vacuum) through 0.02 in. orifice and pressure is measured. ECM determines this as 0.02 in. leak pressure.	60 sec.
6)	Final Check	ECM measures atmospheric pressure and records monitor result.	—

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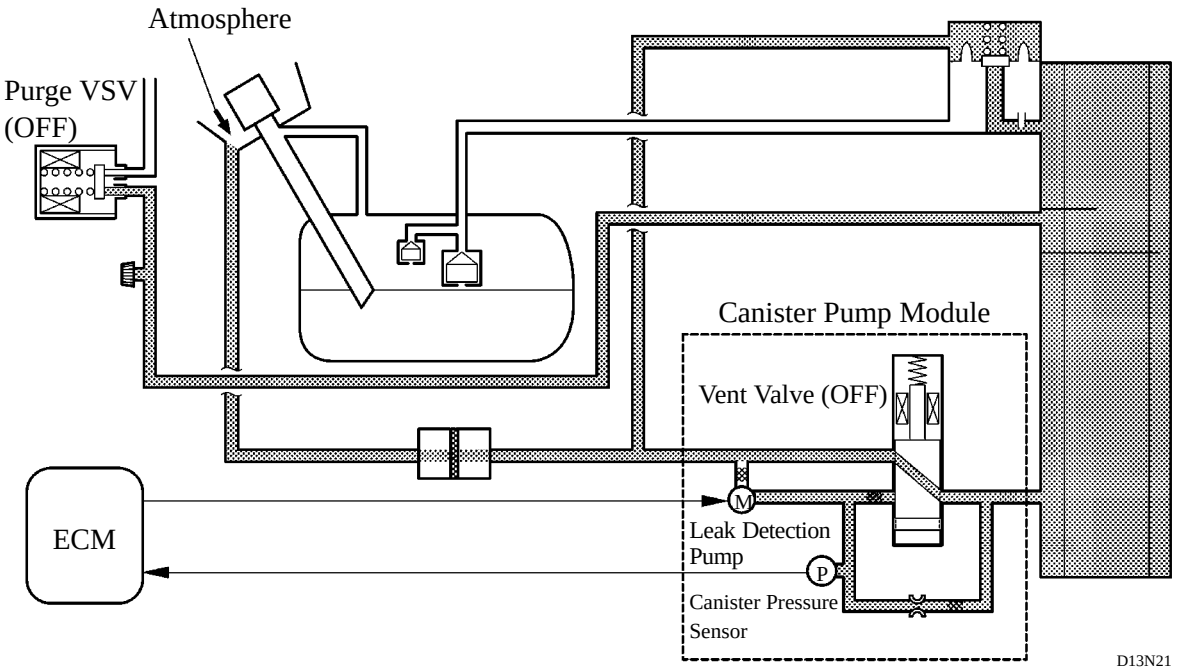
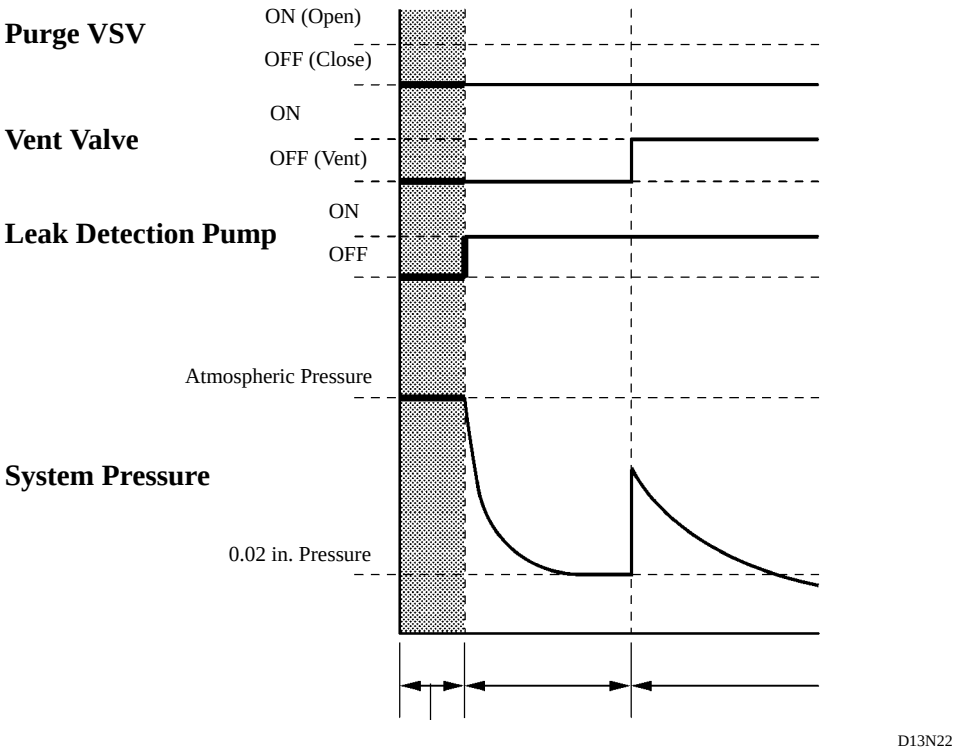
ii) Atmospheric Pressure Measurement

1) When the ignition switch is turned OFF, the purge VSV and the vent valve are turned OFF. Therefore, the atmospheric pressure is introduced into the canister.
2) The ECM measures the atmospheric pressure through the signals provided by the canister pressure sensor.
3) If the measurement value is out of standards, the ECM actuates the leak detection pump in order to monitor the changes in the pressure.





Atmospheric Pressure Measurement

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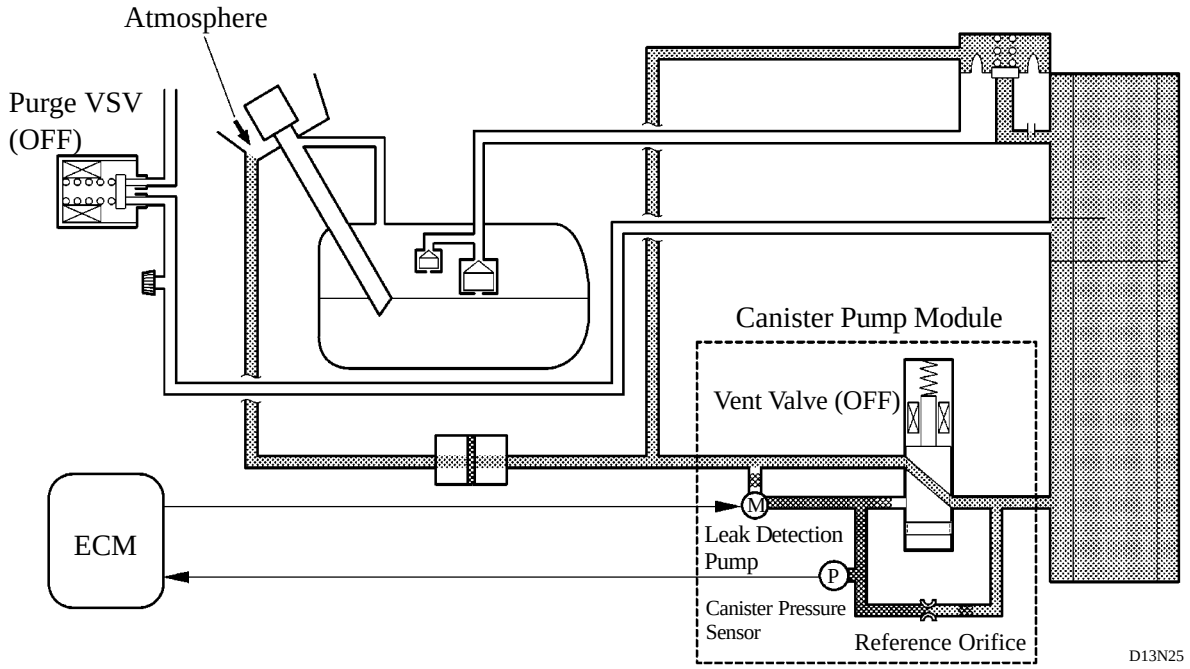
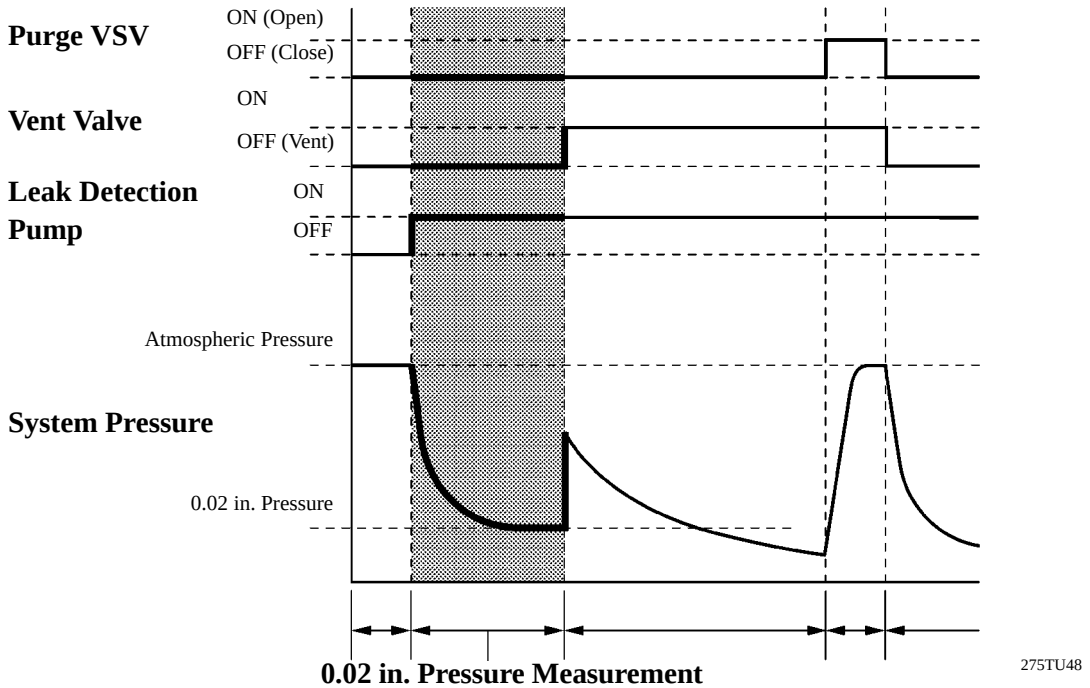
iii) 0.02 in. Leak Pressure Measurement

1) The ECM turns OFF the vent valve, introduces atmospheric pressure into the canister, and actuates the leak detection pump, in order to create a negative pressure.
2) At this time, the pressure will not decrease beyond a predetermined level due to the atmospheric pressure that enters through a 0.02 in. diameter orifice.
3) The ECM compares the logic value to this pressure, and stores it as a 0.02 in. leak pressure in its memory.
4) If the measurement value is below the standard, the ECM will determine that the reference orifice is clogged. When the ignition switch is turned ON, the ECM will illuminate the MIL and store DTC (Diagnostic Trouble Code) P043E in its memory.
5) If the measurement value is above the standard, the ECM will determine that a high flow rate of pressure is passing through the reference orifice. When the ignition switch is turned ON, the ECM will illuminate the MIL and store DTCs P043F, P2401 and P2402 in its memory.





0.02 in. Pressure Measurement

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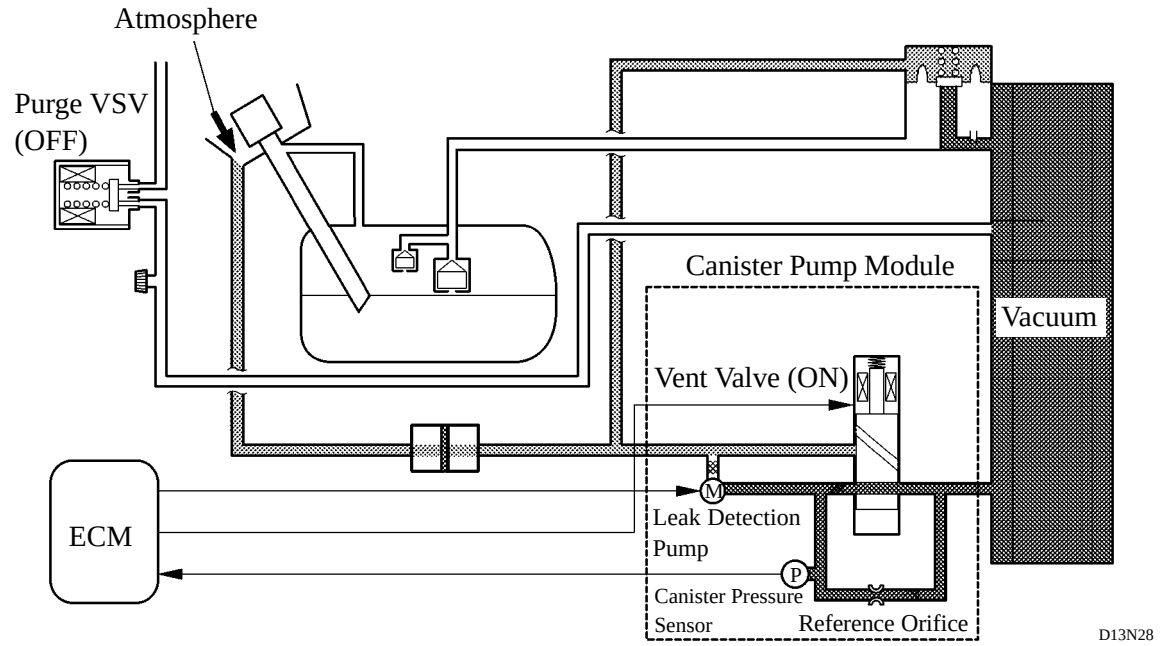
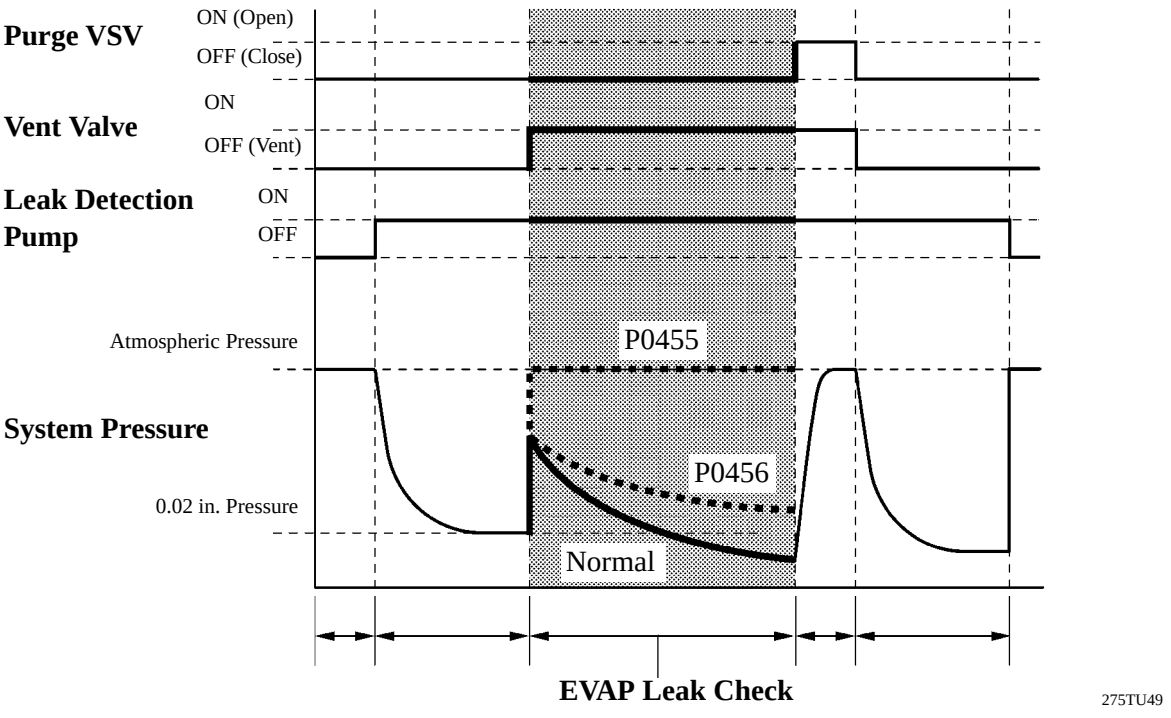
iv) EVAP Leak Check

1) While the leak detection pump is actuated, the ECM turns ON the vent valve in order to introduce a vacuum into the canister.
2) When the pressure in the system stabilizes, the ECM compares this pressure to the 0.02 in. pressure in order to check for a leakage.
3) If the detection value is below the 0.02 in. pressure, the ECM determines that there is no leakage.
4) If the detection value is above the 0.02 in. pressure and near atmospheric pressure, the ECM determines that there is a gross leakage (large hole), illuminates the MIL, and stores DTC P0455 in its memory.
5) If the detection value is above the 0.02 in. pressure, the ECM determines that there is a small leakage, illuminates the MIL, and stores DTC P0456 in its memory.





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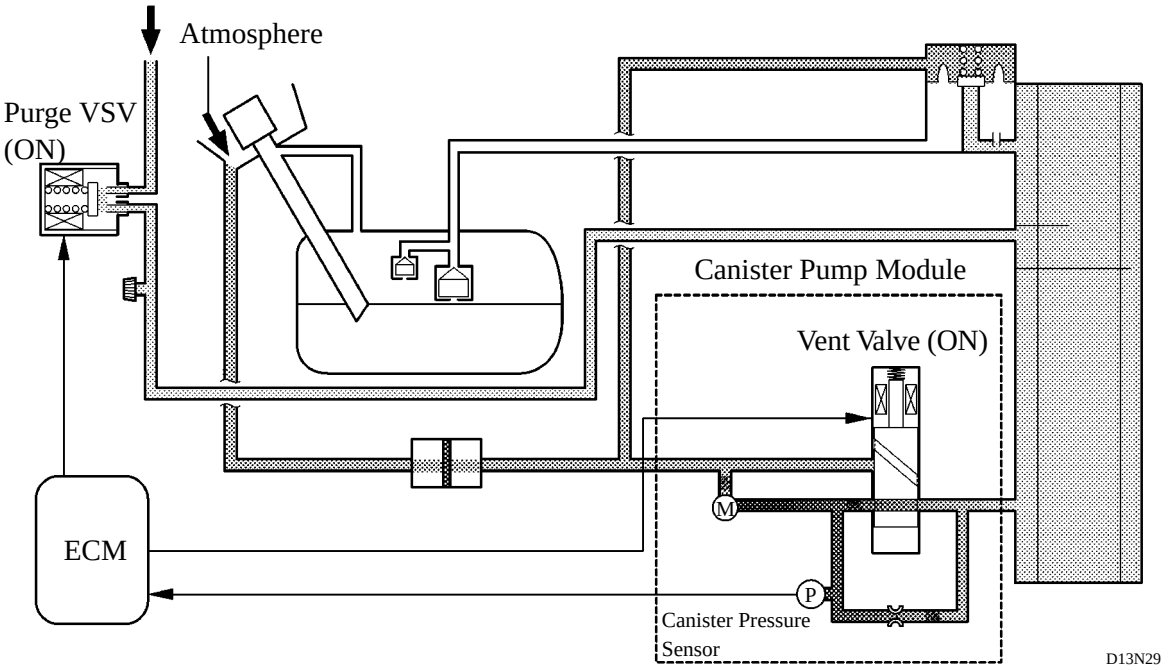
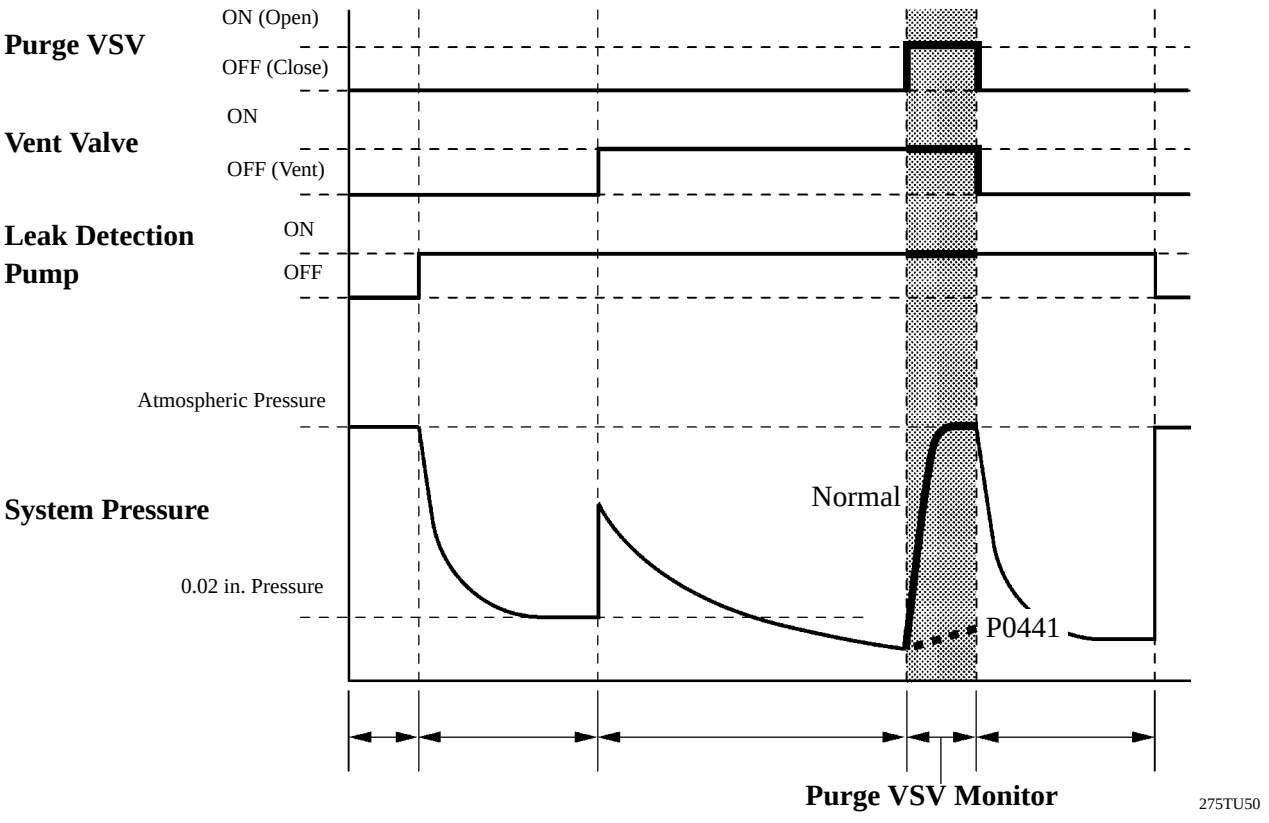
v) Purge VSV Monitor

1) After an EVAP leak check is completed, the ECM turns ON (open) the purge VSV with the leak detection pump actuated, and introduces the atmospheric pressure in the intake manifold.
2) If the pressure change at this time is within the normal range, the ECM determines the condition to be normal.
3) If the pressure is out of the normal range, the ECM will stop the purge VSV monitor. When the ignition switch is turned ON, the ECM will illuminate the MIL and store DTC P0441 in its memory.





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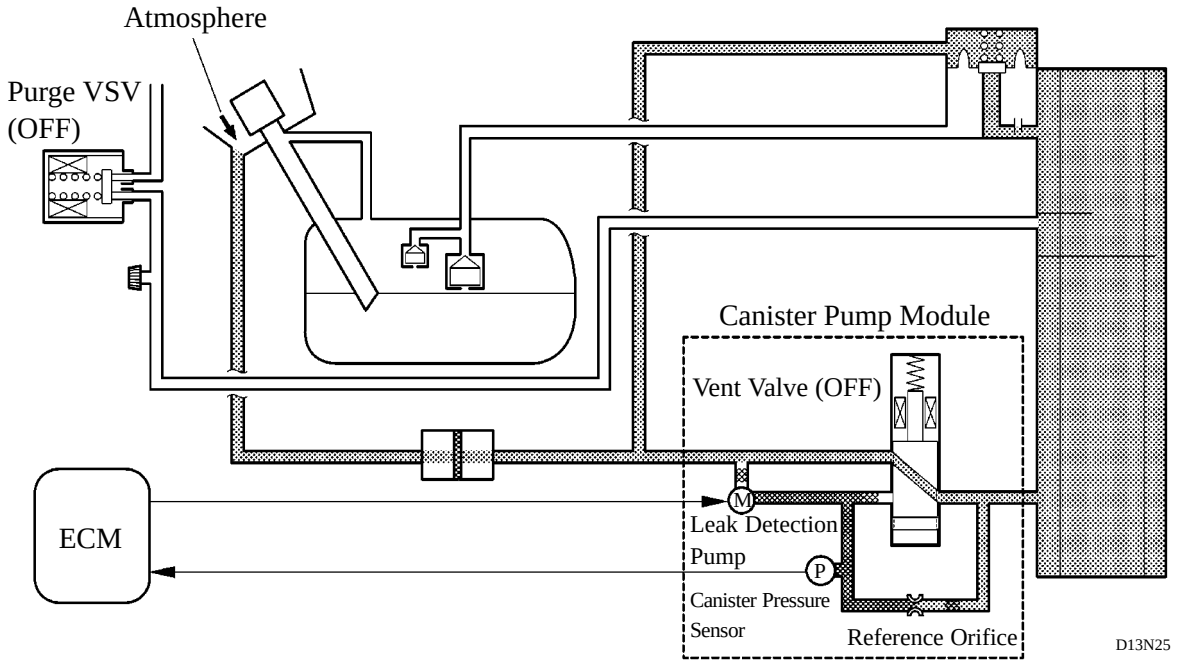
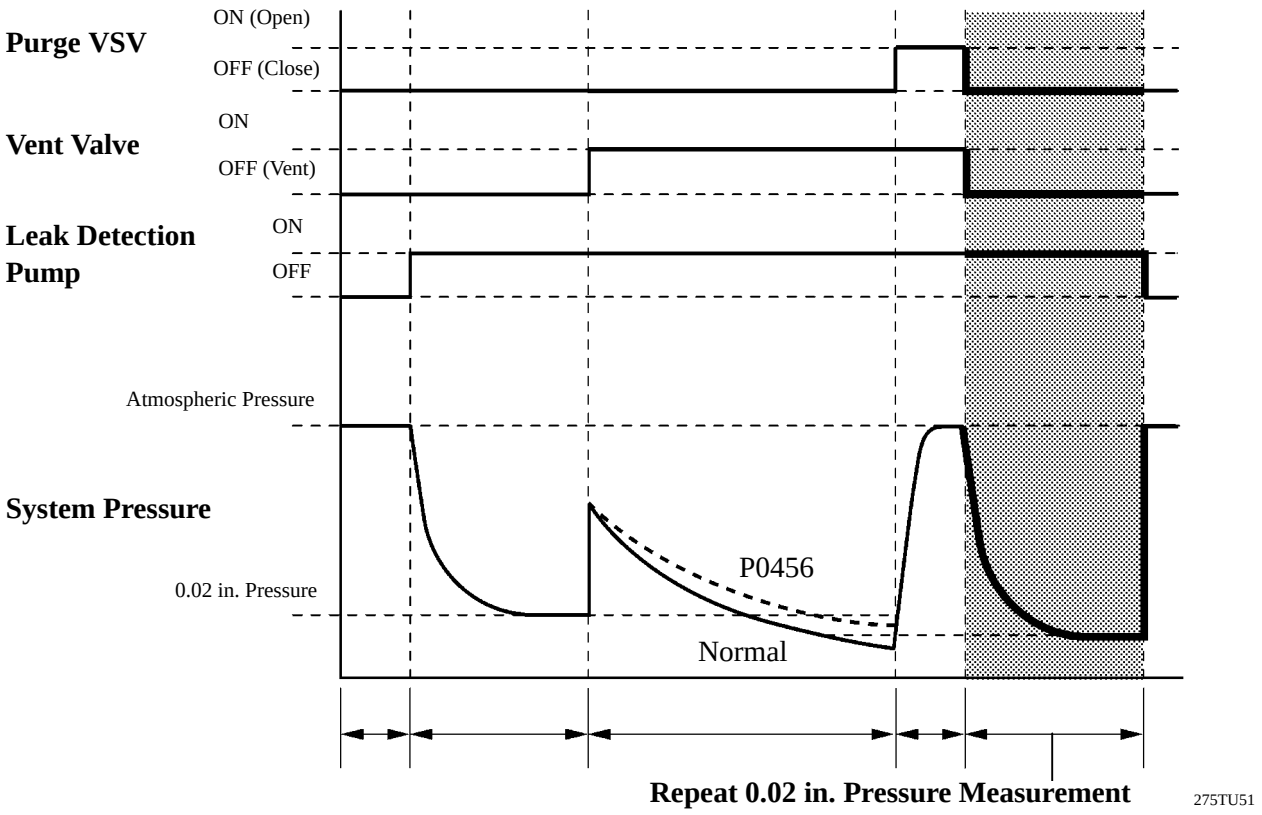
vi) Repeat 0.02 in. Leak Pressure Measurement

1) While the ECM operates the vacuum pump, the purge VSV and vent valve turn off and a repeat 0.02 in. leak pressure measurement is performed.
2) The ECM compares the measured pressure with the pressure during EVAP leak check.
3) If the pressure during the EVAP leak check is below the measured value, the ECM determines that there is no leakage.
4) If the pressure during the EVAP leak check is above the measured value, the ECM determines that there is a small leakage, illuminates the MIL, and stores DTC P0456 in its memory.





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Diagnosis

The following DTCs (Diagnostic Trouble Codes) are added and discontinued.

▶ Added DTC Chart ◀

DTC	Detection Item	DTC	Detection Item
P0010	Camshaft Position “A” Actuator Circuit (Bank 1)	P0412	Secondary Air Injection System Air Switching Valve Malfunction
P0011	Camshaft Position “A” - Timing Over-Advanced or System Performance (Bank 1)	P0418	Secondary Air Injection System Air Pump Malfunction
P0012	Camshaft Position “A” - Timing Over-Retarded (Bank 1)	P043E	Evaporative Emission Control System Reference Orifice Clog Up
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)	P043F	Evaporative Emission Control System Reference Orifice High Flow
P0018	Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor A)	P0450	Evaporative Emission Control System Pressure Sensor/Switch
P0020	Camshaft Position “A” Actuator Circuit (Bank 2)	P0491	Secondary Air Injection System (Bank 1)
P0021	Camshaft Position “A” - Timing Over-Advanced or System Performance (Bank 2)	P1340	Igniter Circuit Malfunction
P0022	Camshaft Position “A” - Timing Over-Retarded (Bank 2)	P1341	Camshaft Position Sensor “A” (Bank 1 Sensor 2)
P0137	Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2)	P1440	Secondary Air Injection System VSV Malfunction
P0138	Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)	P1441	Secondary Air Injection System Switching Valve Stuck Open
P0157	Oxygen Sensor Circuit Low Voltage (Bank 2 Sensor 2)	P1442	Secondary Air Injection System Switching Valve Stuck Closed
P0158	Oxygen Sensor Circuit High Voltage (Bank 2 Sensor 2)	P1443	Secondary Air Injection System VSV Malfunction
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	P1444	Secondary Air Injection System Switching Valve Stuck Open
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	P1445	Secondary Air Injection System Switching Valve Stuck Closed
P0332	Knock Sensor 2 Circuit Low Input (Bank 2)	P1613	Secondary Air Injection System Air Injection Driver
P0333	Knock Sensor 2 Circuit High Input (Bank 2)	P2237	A/F Sensor Pumping Current Circuit/Open (for A/F sensor) (Bank 1 Sensor 1)
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	P2238	A/F Sensor Pumping Current Circuit Low (for A/F sensor) (Bank 1 Sensor 1)
P0346	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 2)	P2239	A/F Sensor Pumping Current Circuit High (for A/F sensor) (Bank 1 Sensor 1)

(Continued)

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DTC	Detection Item	DTC	Detection Item
P2240	A/F Sensor Pumping Current Circuit/Open (for A/F sensor) (Bank 2 Sensor 1)	P2420	Evaporate Emission System Switching Valve Control Circuit High
P2241	A/F Sensor Pumping Current Circuit Low (for A/F sensor) (Bank 2 Sensor 1)	P2430	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Bank1
P2242	A/F Sensor Pumping Current Circuit High (for A/F sensor) (Bank 2 Sensor 1)	P2431	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/Performance Bank1
P2251	A/F Sensor Reference Ground Circuit/Open (for A/F sensor) (Bank 1 Sensor 1)	P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low Bank1
P2252	A/F Sensor Reference Ground Circuit Low (for A/F sensor) (Bank 1 Sensor 1)	P2433	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High Bank1
P2253	A/F Sensor Reference Ground Circuit High (for A/F sensor) (Bank 1 Sensor 1)	P2440	Secondary Air Injection System Switching Valve Stuck Open
P2254	A/F Sensor Reference Ground Circuit/Open (for A/F sensor) (Bank 2 Sensor 1)	P2441	Secondary Air Injection System Switching Valve Stuck Closed
P2255	A/F Sensor Reference Ground Circuit Low (for A/F sensor) (Bank 2 Sensor 1)	P2444	Secondary Air Injection System Pump Stuck On Bank1
P2256	A/F Sensor Reference Ground Circuit High (for A/F sensor) (Bank 2 Sensor 1)	P2445	Secondary Air Injection System Pump Stuck Off Bank1
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	P2610	ECM/PCM Internal Engine Off Timer Performance
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	P2A00	A/F Sensor Circuit Slow Response (Bank 1 Sensor 1)
P2419	Evaporate Emission System Switching Valve Control Circuit Low	P2A03	A/F Sensor Circuit Slow Response (Bank 2 Sensor 2)

▶ Discontinued DTC Chart ◀

DTC	Detection Item	DTC	Detection Item
P0130	Oxygen Sensor Circuit (Bank 1 Sensor 1)	P0154	Oxygen Sensor Circuit No Activity Detected (Bank 2 Sensor 1)
P0133	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	P0442	Evaporative Emission Control System Leak Detected (Small Leak)
P0134	Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	P0446	Evaporative Emission Control System Vent Control Circuit
P0150	Oxygen Sensor Circuit (Bank 2 Sensor 1)	P2418	Evaporative Emission System Valve Control Circuit/Open
P0153	Oxygen Sensor Circuit Slow Response (Bank 2 Sensor 1)		

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■A750F AUTOMATIC TRANSMISSION

To accommodate the increased engine torque of the 2UZ-FE engine through the use of the VVT-i system, the number of clutch discs has been changed as indicated below.

▶ Planetary Gear Unit Specification ◀

Model				’06 Land Cruiser	’05 Land Cruiser
C_1	No. 1 Clutch	The No. of Discs		7	6
C_2	No. 2 Clutch			6	5
C_3	No. 3 Clutch			5	←
B_1	No. 1 Brake			4	3
B_2	No. 2 Brake			3	←
B_3	No. 3 Brake			4	←
B_4	No. 4 Brake			8	←
F_1	No. 1 One-Way Clutch	The No. of Sprags		18	←
F_2	No. 2 One-Way Clutch			25	←
F_3	No. 3 One-Way Clutch			26	←
Front Planetary Gear		The No. of Sun Gear Teeth		40	←
		The No. of Pinion Gear Teeth	Inner	22	←
			Outer	21	←
		The No. of Ring Gear Teeth		91	←
Center Planetary Gear		The No. of Sun Gear Teeth		31	←
		The No. of Pinion Gear Teeth		23	←
		The No. of Ring Gear Teeth		77	←
Rear Planetary Gear		The No. of Sun Gear Teeth		25	←
		The No. of Pinion Gear Teeth		19	←
		The No. of Ring Gear Teeth		63	←

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■ACTIVE HEIGHT CONTROL SUSPENSION AND SKYHOOK TEMS

1. General

- The active height control suspension and skyhook TEMS (Toyota Electronic Modulated Suspension) is a suspension system in which comfort and convenience have been significantly improved through the integration of a vehicle height adjustment system and a damping force control system.
- The vehicle height adjustment system improves the occupants' in-and-out access by quickly lowering the vehicle height at the touch of a switch. Furthermore, by raising the vehicle height, the occurrence of road interference can be minimized on unpaved roads. Also, by maintaining a constant vehicle height regardless of the load conditions such as the number of occupants or the weight of the cargo, under the prescribed loading condition the suspension stroke can be utilized effectively to ensure constantly stable riding comfort.
- Based on the skyhook theory, the damping force control system controls the suspension to achieve an optimal damping force in accordance with the bumpiness of the road surface. Furthermore, through the use of the various types of sensors, this system detects the vehicle's operating condition to obtain an optimal damping force to provide excellent riding comfort, stability, and controllability.

2. System Function

Vehicle Height Control Function

1) Vehicle Height Selection Function

The following three types of vehicle heights can be selected by operating the switch: normal vehicle height (N), low vehicle height (LO), and high vehicle height (HI).

Selected Height Position		LO	N	HI
Vehicle Height	Front	Approximately - 50 mm (-2.0 in.)	Standard Vehicle Height	Approximately +40 mm (+1.6 in.)
	Rear	Approximately - 40 mm (-1.6 in.)	Standard Vehicle Height	Approximately +50 mm (+2.0 in.)
Vehicle Height Adjustment Speed	Up	LO to N or N to HI Approximately 10 to 15 seconds (Main accumulator in the stored state)		
	Down	HI to N or N to LO Approximately 3 to 8 seconds		

2) Automatic Leveling Function

This function maintains the vehicle height constant regardless of the load conditions such as the number of occupants or the weight of the cargo under the prescribed loading condition. It effects constant control so that the vehicle height is maintained at a prescribed value when the normal vehicle height is selected.

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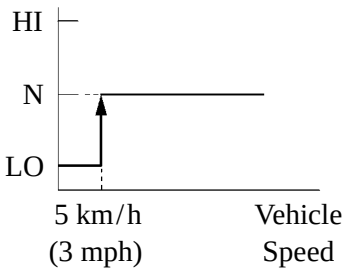
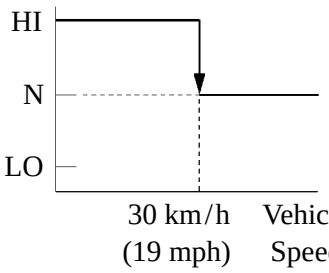
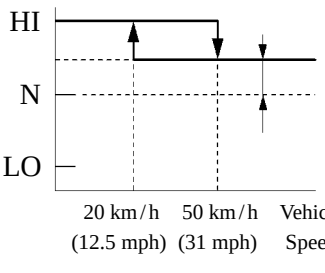
3) Vehicle Speed Sensing Function

This function automatically adjusts the vehicle height in accordance with the vehicle speed in order to ensure stability and riding comfort while driving.

During LO Position	During HI Position	During HI Position*
 155CH19	 155CH20	 155CH21
When the vehicle speed becomes higher than approximately 5 km/h (3 mph), the vehicle height switches to normal. The normal vehicle height is maintained even if the vehicle speed becomes lower than 5 km/h (3 mph).	When the vehicle speed becomes higher than approximately 30 km/h (19 mph), the vehicle height switches to normal. The normal vehicle height is maintained even if the vehicle speed becomes lower than 30 km/h (19 mph).	When the vehicle speed becomes higher than approximately 50 km/h (31 mph), the vehicle height switches to a height that is approximately 25 mm (1 in.) higher than the normal vehicle height. When the vehicle speed becomes lower than approximately 20 km/h (12.5 mph), it returns to the high vehicle height.

*: Transfer shifted in the low.

4) Extra High Mode

While driving on an unpaved road with the transfer shifted in the low range and the vehicle height set to high, if one of the wheels freewheels, the vehicle height raises automatically by approximately 30 mm (1.2 in.) at the front and approximately 20 mm (0.8 in.) at the rear.

5) Vehicle Height Adjustment Prohibition Control

When the vehicle is raised on a jack or is being towed, the vehicle adjustment can be prohibited by operating the height control switch. However, the prohibition control cancels automatically when the vehicle speed becomes higher than approximately 80 km/h (50 mph) at the normal vehicle height, or higher than approximately 30 km/h (19 mph) at the high or low vehicle height.

NOTE:
Occasionally, the set vehicle height may not be maintained when the vehicle is carrying a load that is heavier than a prescribed amount. At times, it might not be possible to raise the vehicle height even by operating the switch.

- Up to 4 occupants* plus about 300 kg (661 lb.) in the normal mode
- Up to 4 occupants* plus about 170 kg (375 lb.) in the high mode

*: About 68 kg (150 lb.) for a person

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Damping Force Control Function

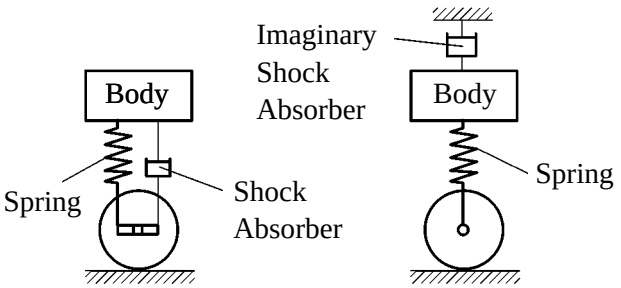
The actuator uses a 16-step step motor to generate a continually variable damping force. This provides a wide selection of damping force and enables a smooth transition of the damping force.
As a result, a minutely controlled damping force that accommodates types of driving conditions has been made possible.

1) Float and Pitch Control (Skyhook Control)

Based on the skyhook theory to take semi-active control of the damping force, this function effects independent front/rear control of the damping force in order to achieve an optimal damping force in accordance with the bumpiness of the road surface.
The suspension control ECU calculates the relative speed between the body and the wheels based on the signals received from the height control sensor and controls the actuators to maintain a flat and stable vehicle posture in various road conditions.

a. Skyhook Theory

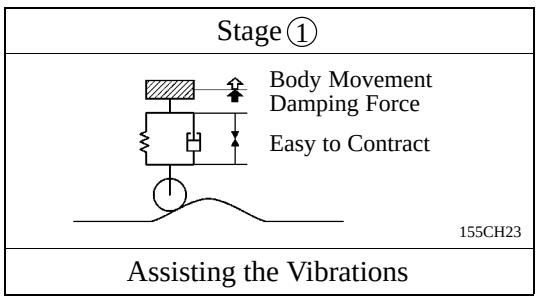
This theory proposes an imaginary shock absorber suspended in the air. This imaginary shock absorber is inactive against any force that is applied from the ground, but effectively activates a damping force against body vibrations.

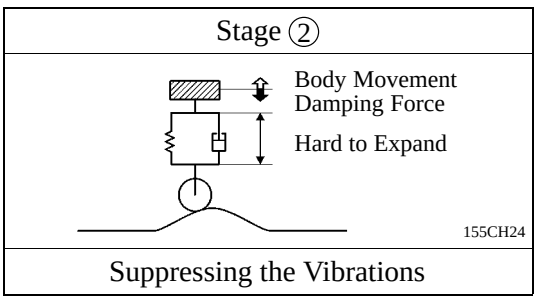


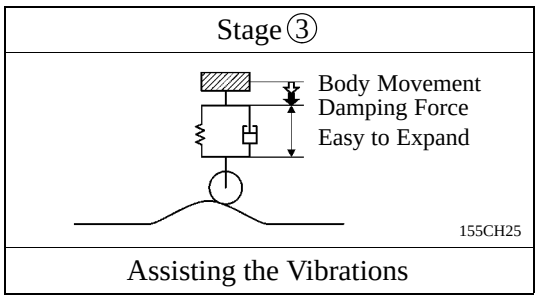
b. Semi-Active Control

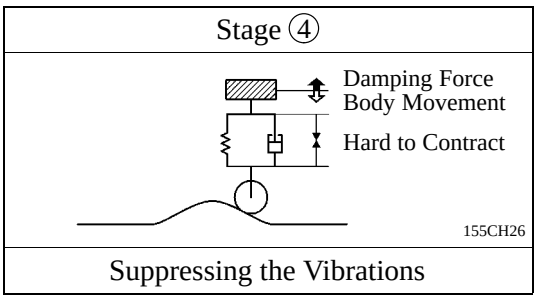
The conditions in which the vehicle goes over mild bumps are demonstrated through the model the following four conditions:

① The shock absorber contracts and the body moves upward.
② The body keeps moving upward causing the shock absorber to elongate gradually.
③ The shock absorber keeps elongating and body starts moving downward.
④ The body keeps moving downward causing the shock absorber to contract gradually.









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Thus, during stages ① and ③ the shock absorbers assist the vibration to create a softer damping force, and during stages ② and ④ the shock absorber suppress the vibration to create a hard damping force, the shock absorbers are minutely controlled to suppress the vibration to restrain the movement of the body.
The above processes are performed independently between the front and rear wheels in order to stabilize the vehicle to a flat posture.

2) Thumping Sensitive Control

While the vehicle is running on rough road, this function controls the damping force lower, thus ensuring flatness and soft ride.

3) Unsprung Vibration Control

If unsprung resonance is detected, this function controls so that the damping force will not decrease below a certain level, in order to reduce the unsprung resonance.
As a result, excellent road-holding performance has been ensured without affecting riding comfort.

4) Speed Sensitive Control

To optimally balance the vehicle's riding comfort and road-holding performance, the damping force is increased along with the increase in vehicle speed, in order to ensure stability during high-speed driving.

5) Anti-Roll Control

During cornering, this function makes the damping force firmer, thus restraining the body roll speed in order to provide excellent stability and controllability.

6) Anti-Dive Control

This function detects the body dive based on the signals received from the stop light switch and speed sensor, and makes the damper force firmer to provide excellent stability and controllability.

7) Anti-Squat Control

During acceleration and deceleration, this function makes the damping force firmer to minimize the changes in the vehicle body posture to provide excellent stability and controllability.

Right-Left Wheel Communicating Function

Normally, an oil passage remains open between the shock absorbers for the right and left wheels. This enables the suspension to contract and elongate smoothly when the right and left wheels move gradually at opposite phases and provides excellent road-holding performance while driving on a winding road. When the driver operates the steering wheel, the oil passage between the right and left shock absorbers closes according to that condition. This restrains the increase of the vehicle body roll during cornering, thus ensuring the vehicle's stability and controllability.

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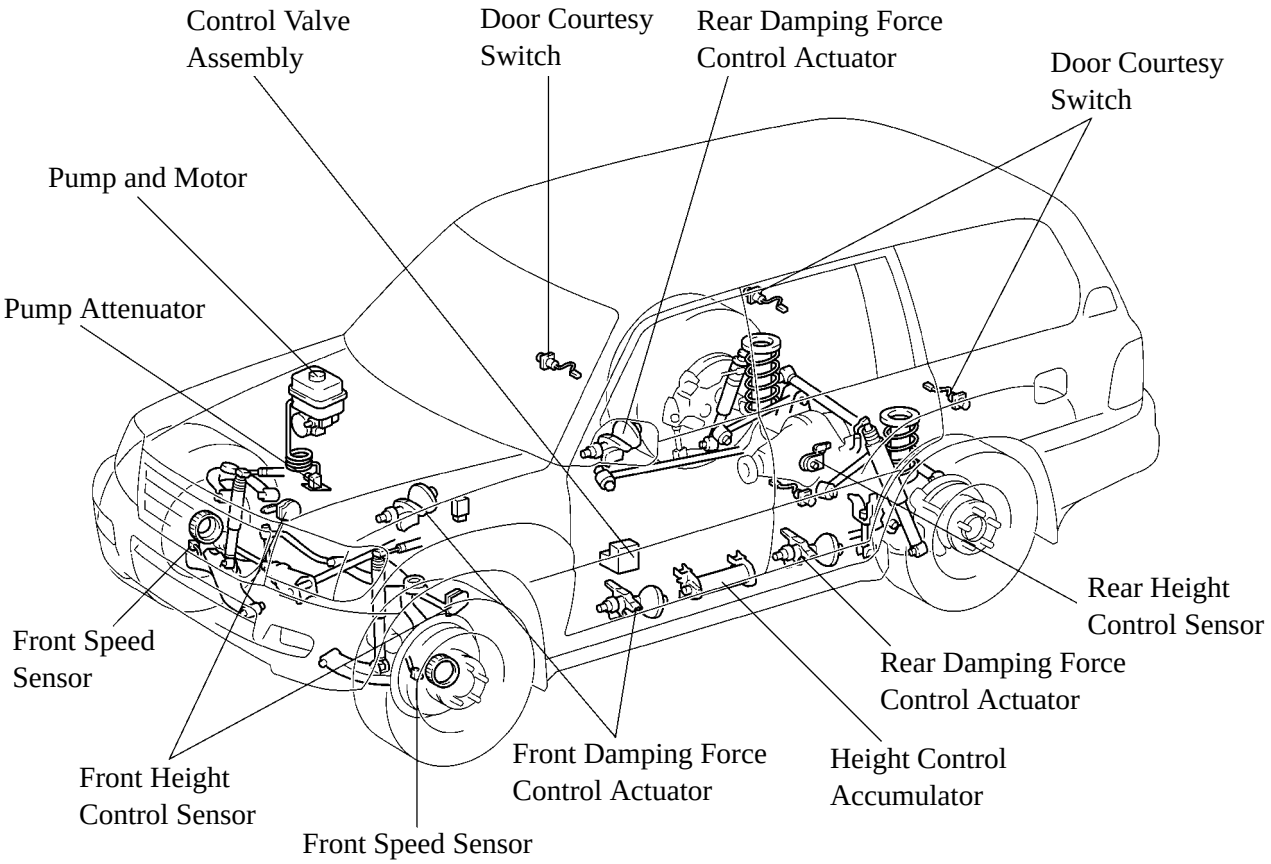
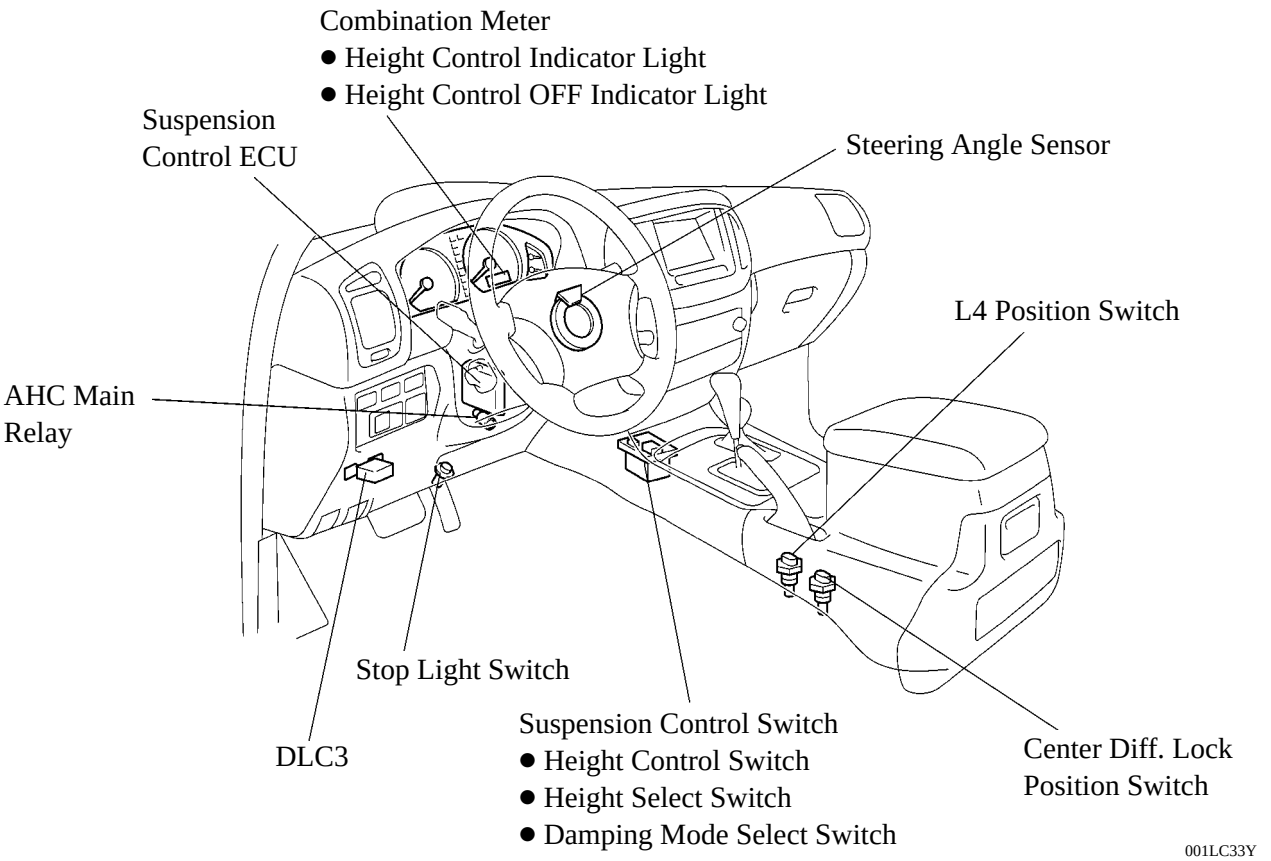
3. Layout of Main Components





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4. Function of Main Components

Component		Function
Height Control Indicator Light		Indicates the present vehicle height condition.
Height Control OFF Indicator Light		● Lights to inform the driver when the active height control system is turned OFF by the height control OFF switch. ● Blinks to alert the driver when the ECU detects the malfunction in the active height control suspension and skyhook TEMS. ● Indicates the diagnostic code.
Height Select Switch		Selects the target vehicle height.
Height Control Switch		Prohibits the adjustment of the vehicle height.
Damping Mode Select Switch		Selects a damping force control mode.
Front Speed Sensors		Detect the wheel speed.
Height Control Sensors		Detect the vehicle height.
Steering Angle Sensor		Detects the steering direction and angle.
Pump and Motor		Generates the high hydraulic pressure that is necessary for raising the vehicle height.
	Reservoir Tank	Maintains the amount of fluid that is returned during the low vehicle height and the amount of fluid that is discharged during the high vehicle height.
	Return Valve	Opens and closes the oil passage between the control valve assembly and the reservoir tank.
	Pressure Sensor	Detects the pump's discharge pressure.
	Temperature Sensor	Detects the fluid temperature.
Pump Attenuator		Dampens the hydraulic pulsation of the fluid that is discharged by the pump.
Height Control Accumulator		Stores the hydraulic pressure to accelerate the speed in which the vehicle height is raised.
Control Valve Assembly	Leveling Valve	Opens and closes the oil passage between the pump and the gas chambers of the wheels.
	Gate Valves	Open and close the oil passage between the right and left shock absorbers.
Gas Chambers		Perform the same functions as those of the gas chamber of the conventional shock absorber.
Damping Force Control Actuators		Switch the damping force.
Shock Absorbers		Generate a damping force similar to the conventional shock absorber.
High Pressure Hose		Serves as the oil passage that links the gas chamber and the shock absorbers.
Suspension Control ECU		Controls the entire system by performing the calculations for height control and damping force control based on the signals received from the sensors and switches.
Center Diff. Lock Position Switch		Detects that the center differential is locked.
L4 Position Switch		Detects the transfer shifted in the low.
Stop Light Switch		Detects the brake signal.
Door Courtesy Switches		Detects the open and closed condition of the doors.
Generator L terminal		Detects that the engine is operating.
AHC Main Relay		Supplies power to the suspension system.
AHC Motor Relay		Supplies power to the pump motor.

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5. Construction and Operation of Main Components

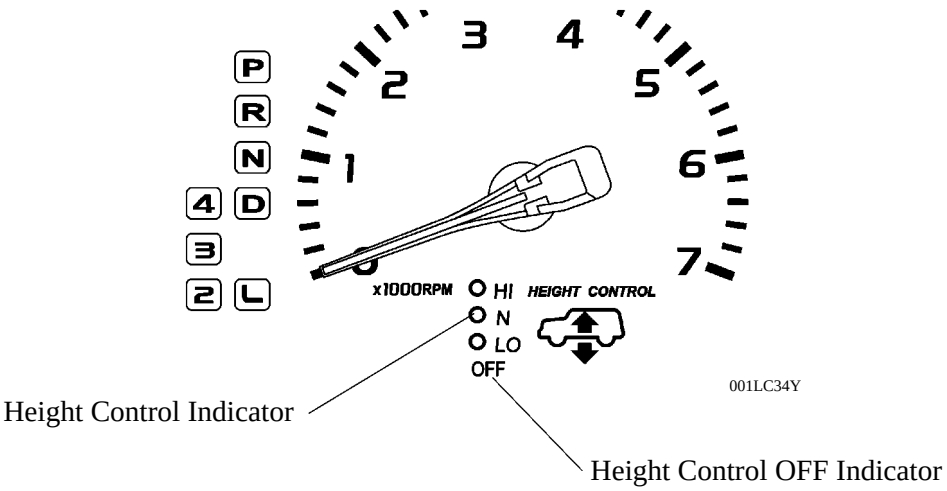
Indicator Lights

1) Height Control Indicator Light

The height control indicator light has been provided below tachometer in the combination meter. It informs the driver by illuminating the indicator light for the present vehicle height position.
When the height select switch is pressed to effect height control, the indicator for the present height position turns OFF and the indicator light for the target height position blinks. After height control is completed, the indicator light for the height position that has been attained illuminates.

2) Height Control OFF Indicator Light

The height control OFF indicator light is located under the height control indicator light.
This indicator light lights up to inform the driver when the active height control system is turned off by the height control switch.
This indicator light blinks to alert the driver when the ECU detects the malfunction in the system.
By effecting the DTC (Diagnostic Trouble Code) check mode, the DTCs can be obtained from this indicator light. For details, see the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).



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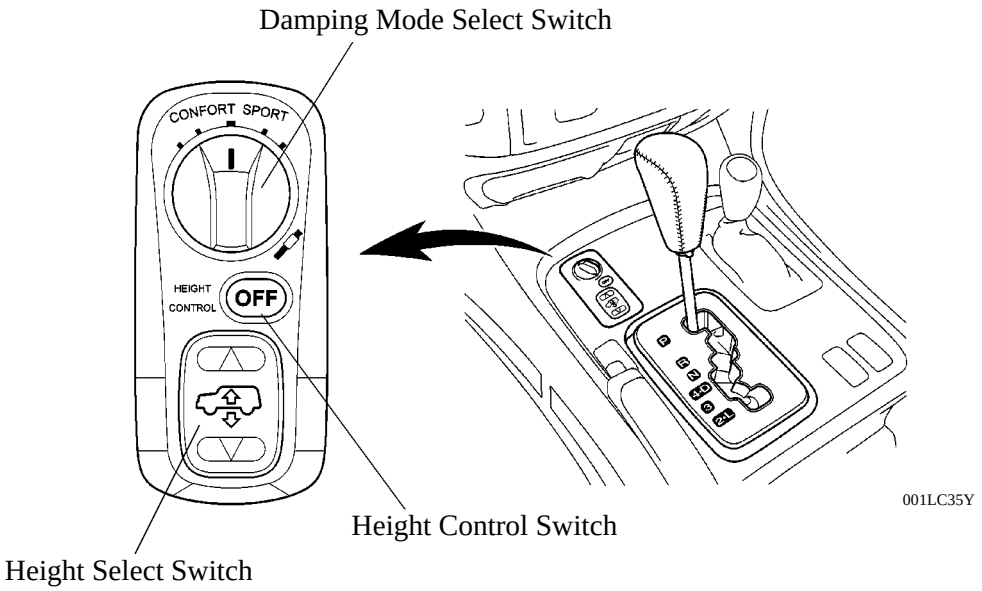
Control Switches

The height select switch, the height control switch and the damping mode select switch are located in front of the shift lever.



1) Height Select Switch

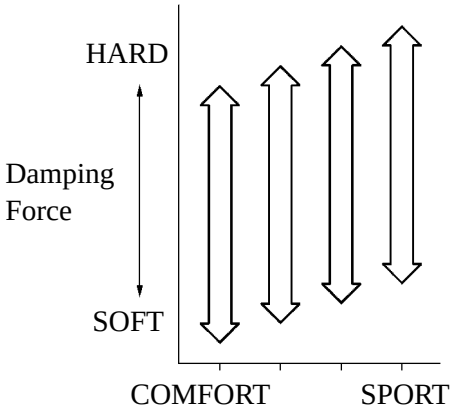
A seesaw type momentary switch has been used for the height select switch that is used for selecting a desired height. Pressing the ▲ (up) side of the switch once raises the vehicle height, and pressing the ▼ (down) side once lowers the vehicle height.

2) Height Control Switch

Pressing this switch prohibits the height control function. Pressing it again cancels the prohibition.
The prohibition cancels automatically when the vehicle speed becomes higher than 80 km/h (50 mph) at the normal vehicle height, or higher than 30 km/h (19 mph) at any other vehicle height.
The state of height control prohibition is stored in memory even after the ignition switch has been turned OFF.

3) Damping Mode Select Switch

As shown on the right, this control switch enables the driver to select a desired damping force from the 4 modes.



Select Switch Position

155CH27

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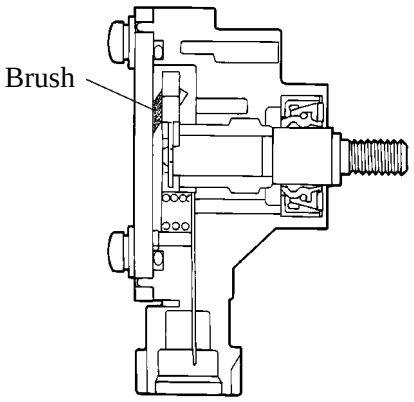
Front Speed Sensors

The sensors detect the individual speeds of the front wheels. The wheel speed signals are then input into the suspension control ECU via the skid control ECU.

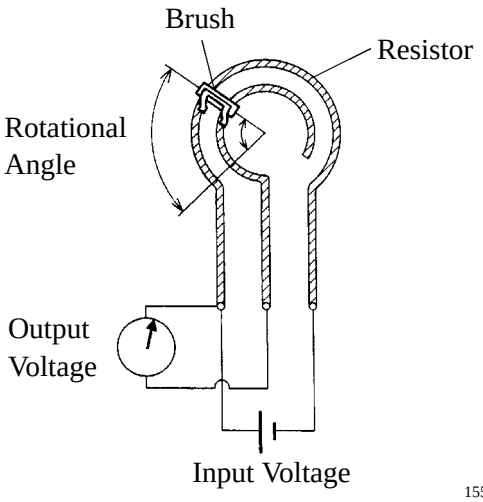
Height Control Sensors

A total of 3 sliding resistance type height control sensors are provided: 1 in each of the right and left front wheel housings and 1 in the center of the cross member located above the rear axle.
The sensor consists of a brush that is integrated with a shaft, which slides on the resistor that is formed on a substrate. Because the resistance value between the brush and the resistor terminal varies in proportion to the shaft's rotational angle, a prescribed amount of voltage is applied to the resistor so that a change in the rotational angle can be detected in the form of a voltage change.



155CH71

Cross Section

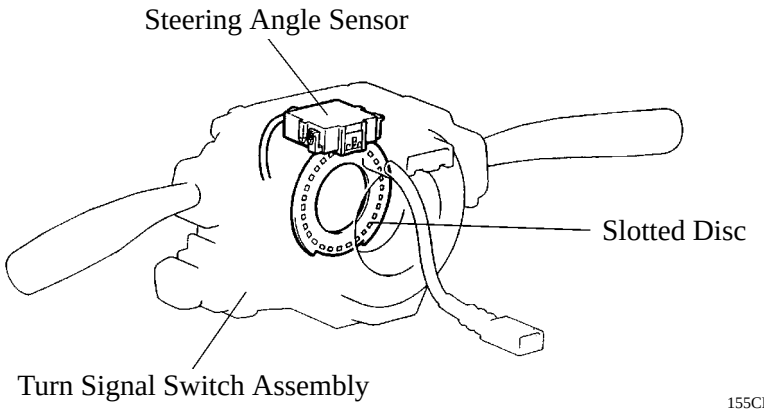


155CH41

Diagram of the Principle

Steering Angle Sensor

The steering angle sensor is fitted to the turn signal switch assembly and detects the steering direction and angle.
The sensor contains 2 photo interrupters with phases, and a slotted disc interrupts the light to turn the photo transistor ON and OFF to detect the steering direction and angle.



155CH42

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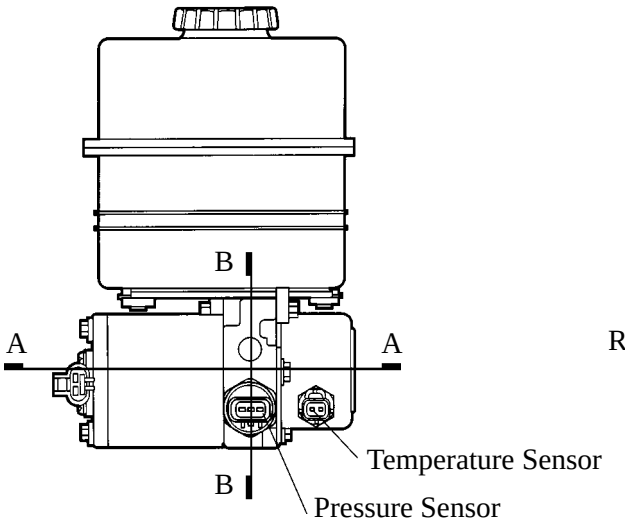
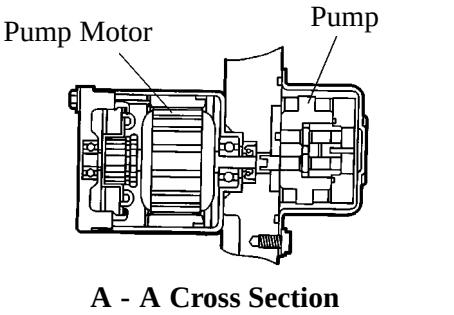
Pump and Motor

A system in which the pump, pump motor, reservoir tank, return valve, pressure sensor, and temperature sensor are integrated is used.

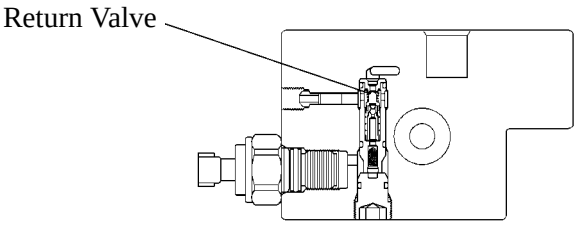


155CH72



A - A Cross Section

155CH73

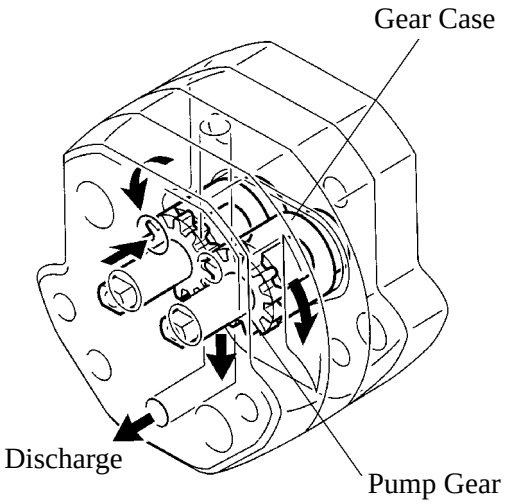


B - B Cross Section

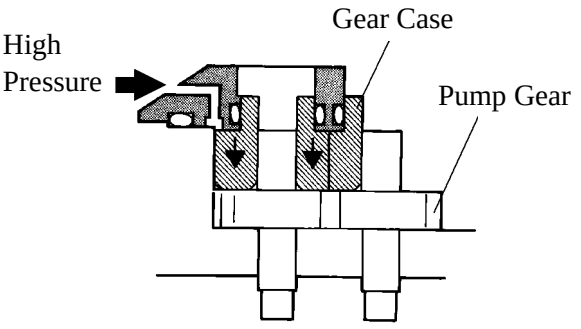
155CH28

1) Pump

An external gear pump that contains less parts and excels in durability is used. Also, the pump is a pressure-loading type in which the discharge pressure of the pump itself is utilized and routed via the gear case to push on the side of the pump gear in order to reduce the internal leakage, thus making high-pressure discharge possible.



155CH74



155CH75

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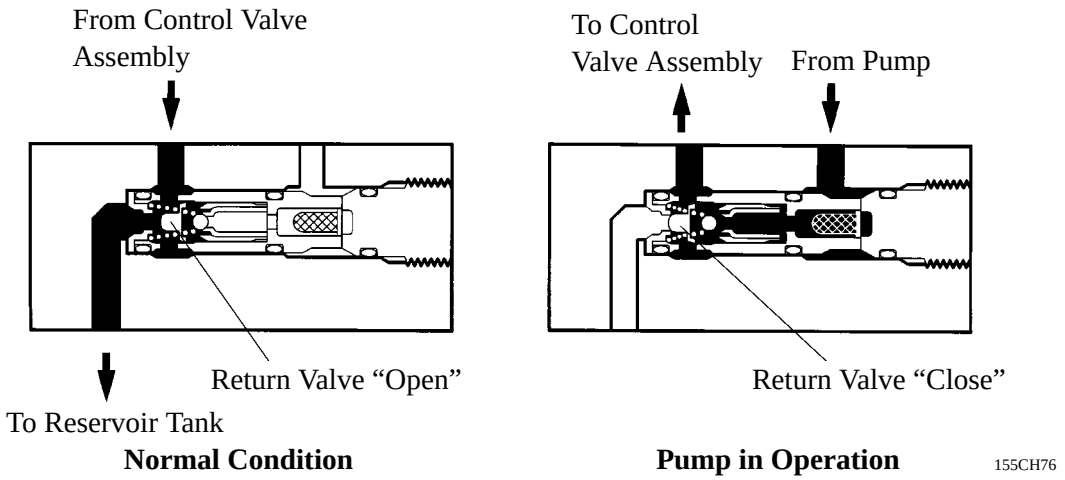
2) Motor

A DC motor with 4-pole brushes is used to realize excellent durability and high torque.

3) Return Valve

The return valve opens and closes the oil passage between the control valve assembly and the reservoir tank. The return valve has been simplified by adopting a construction in which the valve is closed by the flow of the discharged fluid.
Normally, a spring force is applied to the return valve to maintain the oil passage between the control valve assembly and the reservoir tank open.
When the pump operates in order to raise the vehicle height, the pressure of the fluid that is discharged by the pump causes the return valve to move to the left of the diagram as illustrated.
Accordingly, the oil passage between the control valve assembly and the reservoir tank closes, and the fluid that is discharged from the pump flows towards the control valve assembly.



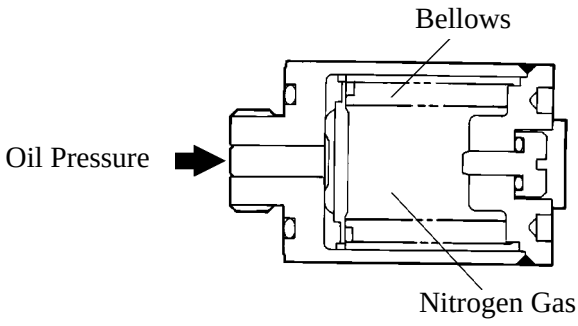
Normal Condition **Pump in Operation** 155CH76

Pump Attenuator

The pump attenuator dampens the hydraulic pulsation of the fluid that is discharged by the pump.
A bellows type accumulator that is made of stainless steel, which offers excellent gas penetration resistance and good pulsation absorption performance, is used.

▶ Specification ◀

Sealed Gas		Nitrogen Gas
Gas Chamber Volume	cc (cu in.)	2 (0.12)
Sealed Gas Pressure	MPa (kgf/cm^2, psi)	1.96 (20, 284)



155CH77

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Height Control Accumulator

A free piston type accumulator, which provides a large gas chamber capacity, is used for the height control accumulator.

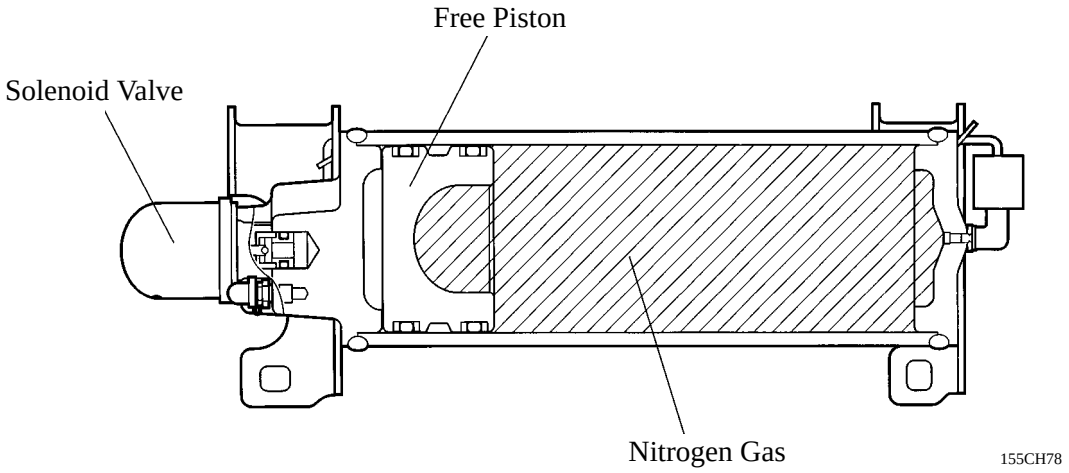
The height control accumulator consists of a cylinder, free piston, and solenoid valve. When raising the vehicle height, the accumulator discharges the stored fluid to accelerate the raising speed.

Normally, the solenoid valve remains closed.

When the vehicle height is being raised or the fluid is being stored in the main accumulator, the solenoid valve opens in accordance with the signal received from the suspension control ECU.

▶ Specification ◀

Sealed Gas		Nitrogen Gas
Gas Chamber Volume	cc (cu in.)	945 (57.5)
Sealed Gas Pressure	MPa (kgf/cm^2, psi)	5.9 (60, 853)



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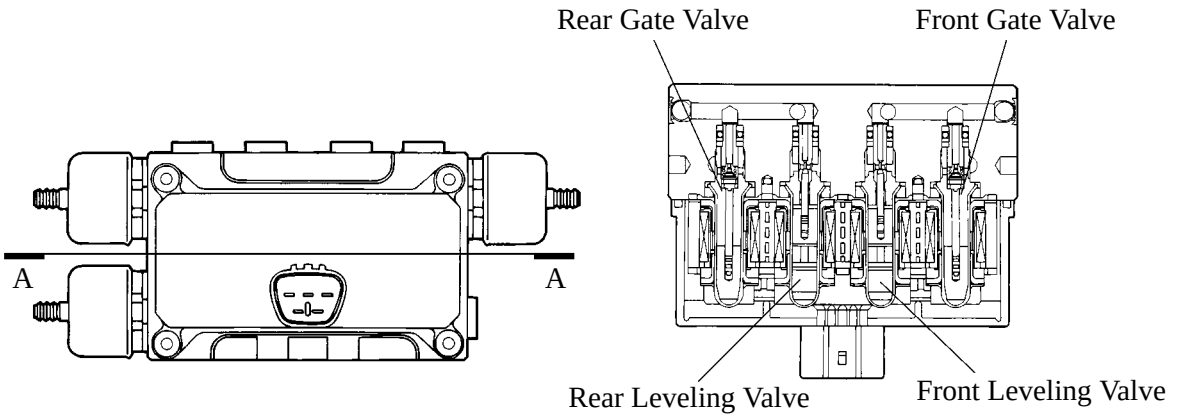
Control Valve Assembly

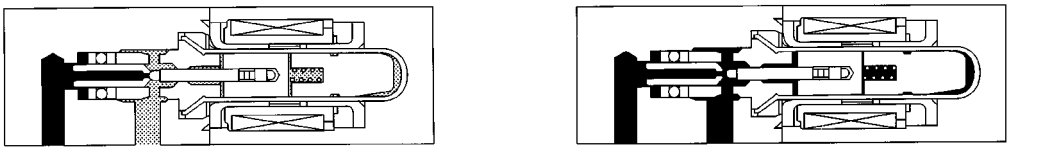
The control valve assembly consists of the leveling valves for adjusting the vehicle height and the gate valves for controlling the right-left wheel communicating function. There are 4 valves each for the front and rear.



A - A Cross Section 155CH79

1) Leveling Valve

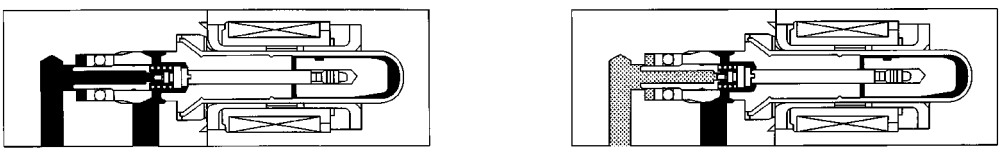
This valve opens and closes the oil passage between the pump and the gas chamber located at each wheel. Normally, the oil passage remains closed, and during vehicle height control, the oil passage opens in accordance with the signal received from the suspension control ECU.



Close **Open** 155CH80

2) Gate Valve

This valve opens and closes the oil passage between the right and left shock absorbers. Normally, the oil passage remains open, connecting the right and left shock absorbers. When the suspension control ECU determines that the oil passage between the right and left shock absorbers must be closed, the gate valve activates to close the oil passage.



Open **Close** 155CH81

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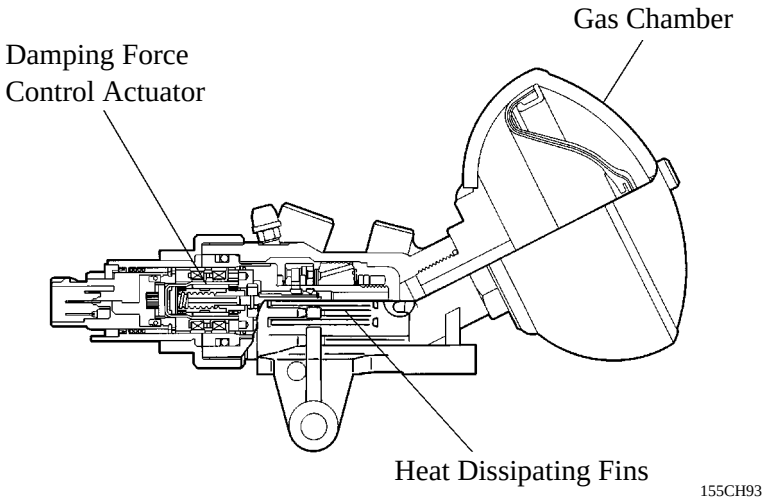
Gas Chamber and Damping Force Control Actuator

A gas chamber (a substitute for the gas chamber in the conventional shock absorber) and actuator to switch the damping force have been integrated.
The housing is provided with heat dissipating fins to improve the dissipation of the heat that is generated by the actuator.

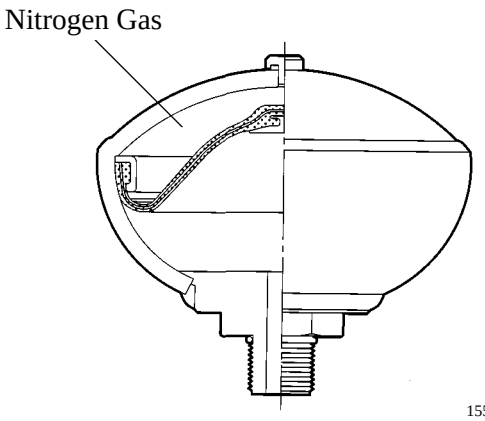


1) Gas Chamber

The gas chamber uses the bladder type hydro-pneumatic accumulator.
A resin membrane is sandwiched between rubber layers to realize excellent gas penetration resistance.
The internal pressure of the gas chamber is varied by allowing the fluid to flow in and out of this gas chamber in order to raise or lower the vehicle height.

▶ Specification ◀

	Front	Rear
Sealed Gas	Nitrogen Gas	←
Gas Chamber Volume cc (cu in.)	400 (24.4)	500 (30.5)
Sealed Gas Pressure MPa (kgf/cm^2, psi)	2.26 (23, 327)	2.65 (27, 384)



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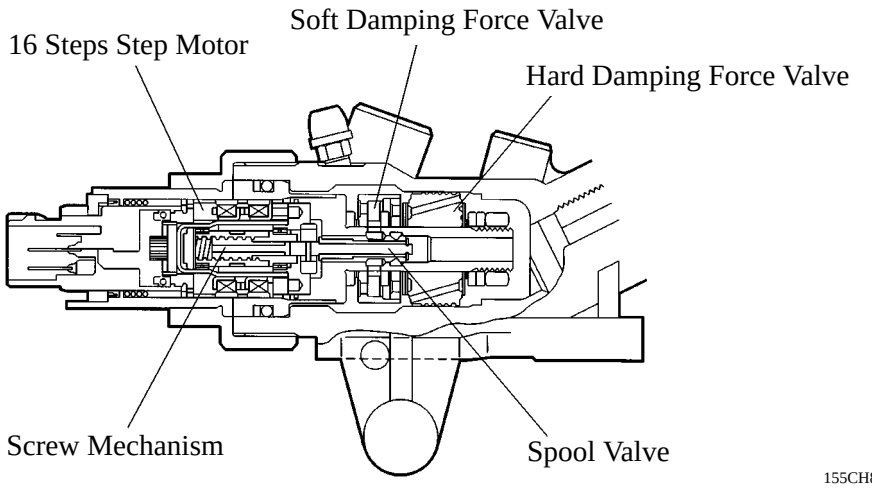
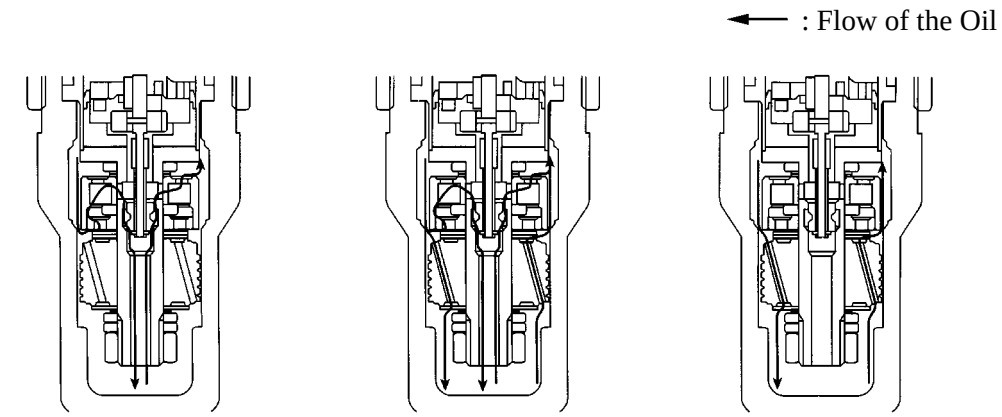
2) Damping Force Control Actuator

This actuator consists of the 16 steps step motor, a screw mechanism (which converts the rotational movement to a linear movement), a spool valve, a soft damping force valve and hard damping force valve.

Signals from the suspension control ECU activate the actuator causing the spool valve to switch the oil passage. Thus, the volume of oil that passes through each valve is varied in order to control the damping force in 16 steps.



155CH83



155CH84

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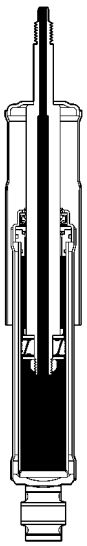
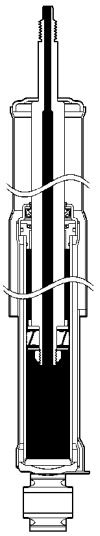
Shock Absorber

The shock absorber has adopted a dual construction using a high-pressure main seal made of fluoroethylene resin and a high-pressure oil seal made of nitrile rubber and provided with a backup ring in order to ensure sealing performance and reduce friction.



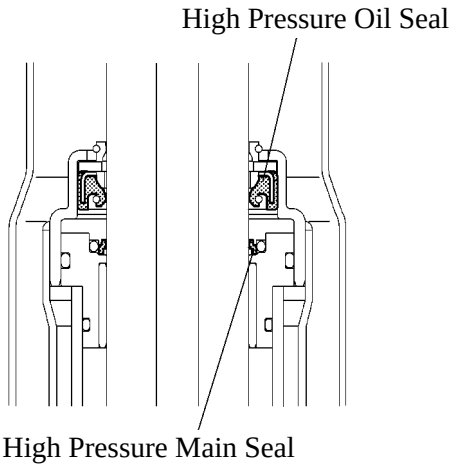
155CH29

Front Shock Absorber



155CH30

Rear Shock Absorber



155CH14

Seals

Fluid

This system uses a fluid called the “Active Suspension Fluid AHC”.

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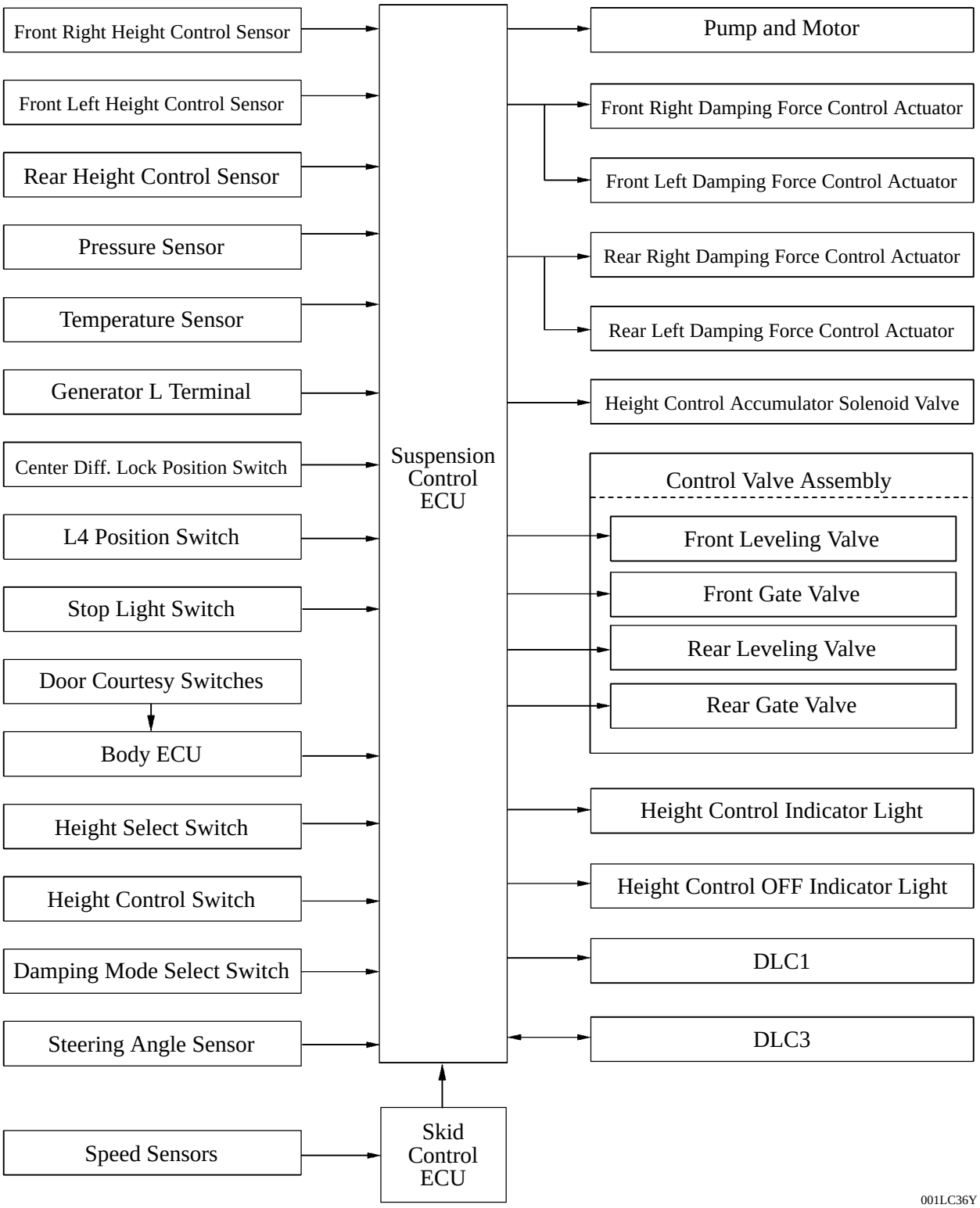
Suspension Control ECU

1) General

The suspension control ECU is located in the driver's side instrument panel.
Based on the signals received from the sensors and switches, the suspension control ECU detects the vehicle height and vehicle conditions and outputs the control signals to the actuators and the pump.



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2) Self-Diagnosis

If the suspension control ECU detects a malfunction in this system, it blinks the height control OFF indicator light to alert the driver of the malfunction. The ECU will also store the codes of the malfunctions.
The diagnostic trouble codes (DTCs) can be accessed through the blinking of the height control OFF indicator light or the use of a hand-held tester. For details, see the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

3) Test Mode

The operation of the sensor and the switches can be inspected in the test mode. For details, see the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

4) Active Test

Hand-held tester can be used to activate the actuators for inspecting their operation. For details, see the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

5) Fail-Safe

If a malfunction occurs in any of sensors or actuator, the ECU prohibits the vehicle height control and the damping force control.

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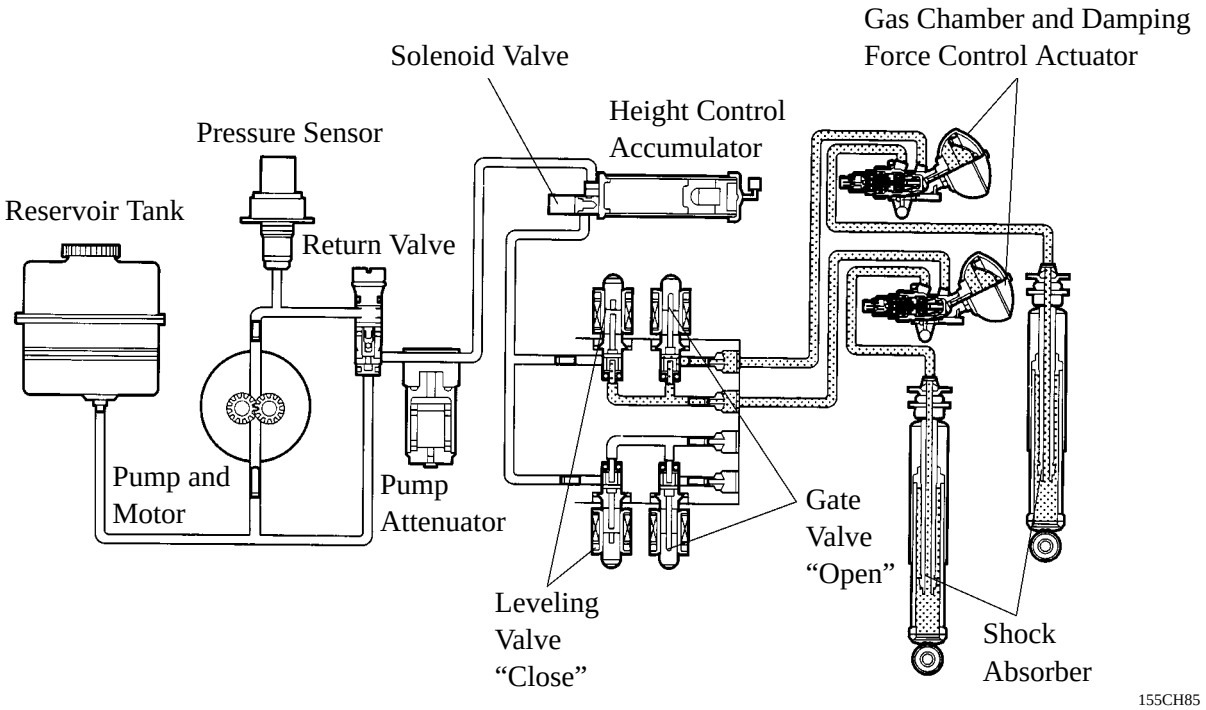
6. System Operation

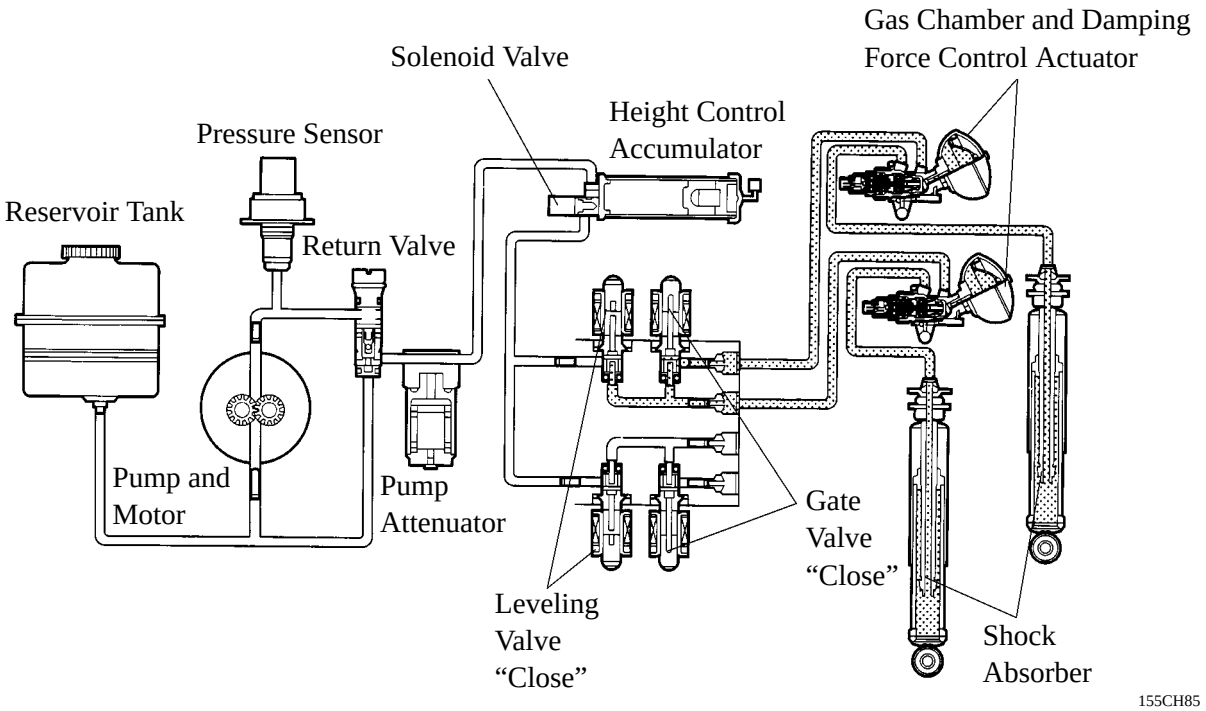
Normal Driving (Straightline Driving)

The high pressure in the gas chamber and the shock absorber is shut off with the leveling valve. The gate valve remains open, and the right and left shock absorbers remain connected. The damping force is controlled in accordance with road surface conditions.



Cornering

The high pressure in the gas chamber and the shock absorber is shut off with the leveling valve. The gate valve is closed, and the right and left shock absorbers are shut off from each other. The damping force is controlled in accordance with road surface conditions and the operating condition of the steering wheel.



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Raising the Vehicle Height

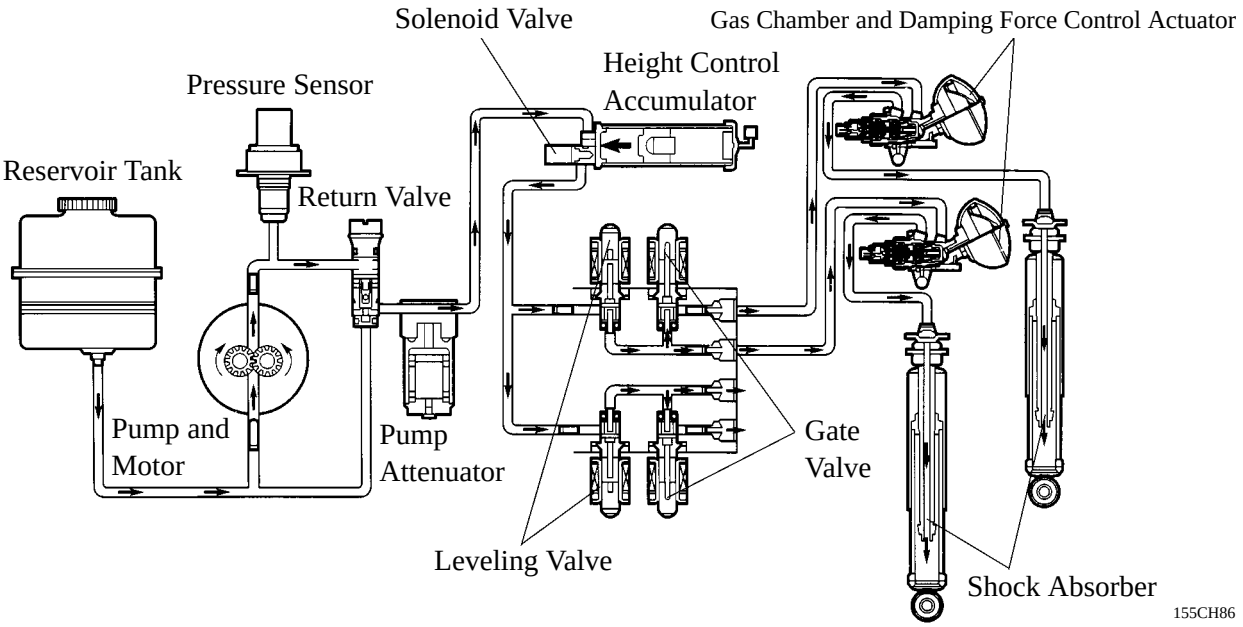
Operating the height select switch to raise the vehicle height activates the pump motor, which rotates the pump. The fluid that is discharged by the pump is sent to the gas chambers and shock absorbers in order to raise the vehicle height.

1) Vehicle Stopped

The solenoid valve of the height control accumulator is opened in order to use the fluid that is stored in the height control accumulator, which accelerates the raising speed of the vehicle height.
To use the fluid that is stored in the accumulator, the front and rear leveling valves are opened simultaneously to raise all 4 wheels at the same time.
When the stored fluid has been depleted, the front and rear leveling valves are opened alternately to raise the suspension of the front wheels and the rear wheels alternately.

2) Vehicle in Motion

When the vehicle speed is less than approximately 25 km/h (16 mph), the fluid that is stored in the height control accumulator is used in the same way as when the vehicle is stopped.
When the vehicle speed is higher than approximately 25 km/h (16 mph), the vehicle height is raised using only the fluid that is discharged by the pump, without using the height control accumulator. At this time, the front and rear leveling valves are opened alternately to raise the suspension of the front wheels and rear wheels alternately.
When the vehicle height is at low, it is automatically raised to normal when the vehicle speed becomes higher than approximately 5 km/h (3 mph). At this time, the fluid that is stored in the height control accumulator is also used.



Condition			Vehicle Stopped		Vehicle in Motion	
			Use Height Control Accumulator	Not Use Height Control Accumulator	25 km/h (16 mph) or less and at the time of using the height control accumulator	Except the left mentioned condition
Control Valve Assembly	Front	Leveling Valve	Open	Open and Close	Open	Open and Close
		Gate Valve	Open	Open	Open	Open
	Rear	Leveling Valve	Open	Open and Close	Open	Open and Close
		Gate Valve	Open	Open	Open	Open
Height Control Accumulator Solenoid Valve			Open	Close	Open	Close
Pump and Motor			Operation	Operation	Operation	Operation

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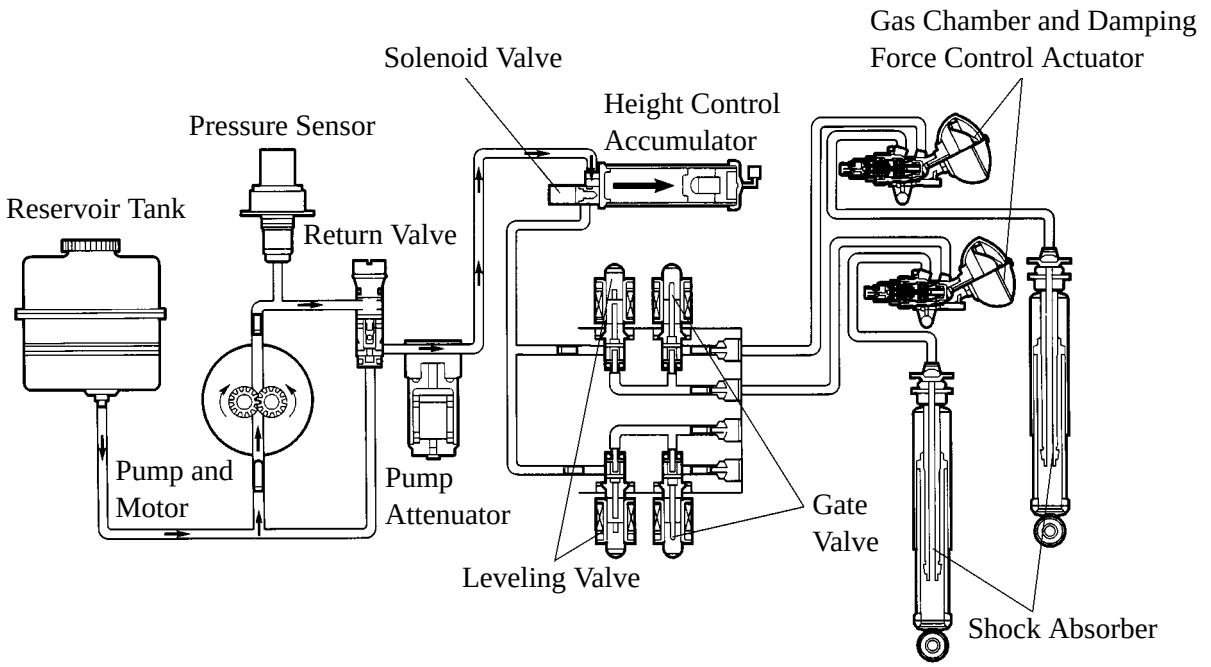
Fluid Stored in Height Control Accumulator

Normally, the height control accumulator stores only the amount of fluid that is equivalent that used in raising the vehicle height once. Therefore, after the vehicle has been raised from low to normal, or from normal to high, it is necessary to replenish the fluid in the height control accumulator.
At this time, the pump motor is operated to rotate the pump, the leveling valves are closed, the solenoid valve of the height control accumulator is opened, and the fluid is stored in the height control accumulator.
When the vehicle height is raised while the fluid that is stored in the height control accumulator has not reached a prescribed pressure, only the fluid that is discharged by the pump is used for raising the vehicle height, without using the fluid in the height control accumulator.



Control Valve Assembly	Front	Leveling Valve	Close
		Gate Valve	Open
	Rear	Leveling Valve	Close
		Gate Valve	Open
Height Control Accumulator Solenoid Valve			Open
Pump and Motor			Operation

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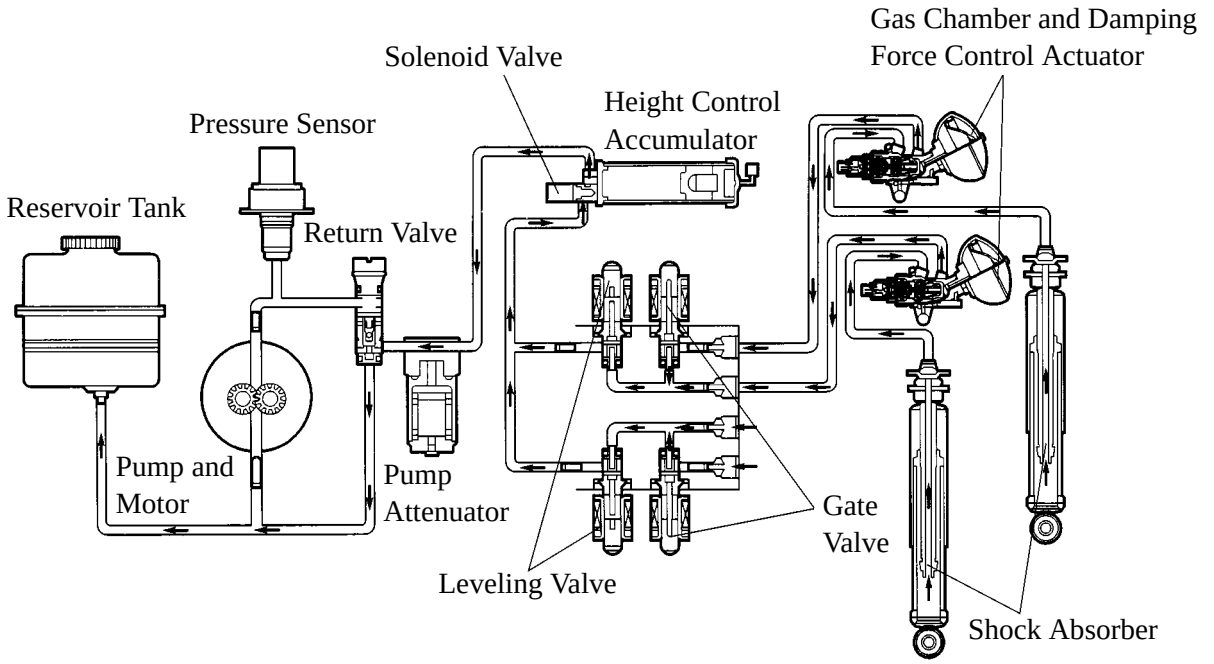
Lowering the Vehicle Height

1) Vehicle Speed Under 5 km/h (3 mph)

When the height select switch is operated to lower the vehicle height from high to normal, or from normal to low, the front and rear leveling valves are opened simultaneously to allow the fluid in the gas chambers and the shock absorbers at the 4 wheels to return to the reservoir tank, causing the height of the suspension at all 4 wheels to become lowered at the same time.
However, if the rear side is expected to become lower more quickly due to the load condition, and the difference between the lowering of the front side and the rear side becomes greater than a prescribed value, the rear leveling valve closes once, allowing only the vehicle height to become lowered at the front side. This feature prevents the headlights from being aimed upward.

2) Vehicle Speed Over 5 km/h (3 mph)

When the height select switch is operated to lower the vehicle height from high to normal, the front and rear leveling valves are opened alternately to lower the suspension of the front wheels and rear wheels alternately.
When the vehicle speed is higher than approximately 5 km/h (3 mph), the vehicle height will not be lowered from normal to low.



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Condition			Under 5 km/h (3 mph)		Over 5 km/h (3 mph)
			When lowering the 4 wheels simultaneously	Except lowering the 4 wheels simultaneously	
Control Valve Assembly	Front	Leveling Valve	Open	Open or Close	Open or Close
		Gate Valve	Open	Open	Open
	Rear	Leveling Valve	Open	Open or Close	Open or Close
		Gate Valve	Open	Open	Open
Height Control Accumulator Solenoid Valve			Close	Close	Close
Pump and Motor			Stop	Stop	Stop

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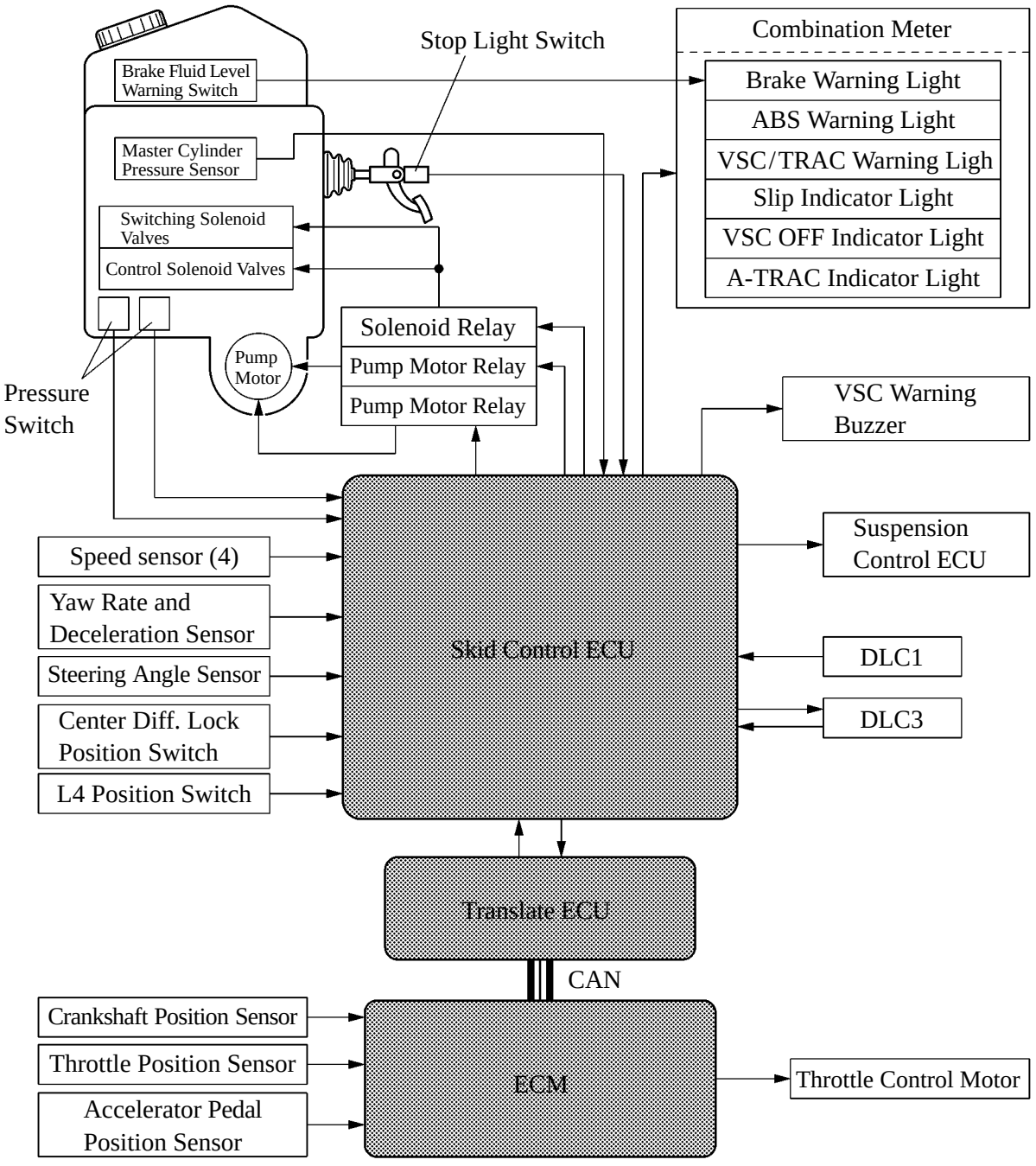
■BRAKE CONTROL SYSTEM (ABS with EBD, Brake Assist, A-TRAC and VSC System)

1. General

- The communication circuit between the skid control ECU and ECM has been changed. A translate ECU has been newly provided. It maintains serial communication with the skid control ECU and CAN communication with the ECM, in order to transmit data between each other.
- Along with the change in the communication circuit, the DTCs (Diagnostic Trouble Codes) have been changed.

2. System Diagram



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3. Self-Diagnosis

- The DTCs (Diagnostic Trouble Codes) have been added as indicated below.
  For details, see the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

▶ DTC Chart (blinking VSC warning light) ◀ : NEW

DTC No.		Detection Item
2-digit	5-digit	
26	C1369	Translate ECU malfunction
31	C1335	Malfunction in steering angle sensor
32	C1232	Malfunction in deceleration sensor
33	C1233	Open or short in yaw rate sensor circuit
34	C1234	Malfunction in yaw rate sensor
35	C1231	Open or short in steering angle sensor circuit
36	C1210	Zero point calibration of yaw rate sensor undone
39	C1336	Zero point calibration of deceleration sensor undone
42	U0073	Control module communication bus off
43	C1223	Malfunction in ABS control system
47	C1340	Open circuit in center differential lock signal
51	C1201	ECM system malfunction
53	C1203	Malfunction in CAN1 communication
65	U0100	Lost communication with ECM/PCM “A”
66	C1290	Zero point calibration of steering sensor undone

- The following DTCs have been deleted.

▶ DTC (blinking ABS warning light) ◀

DTC No.		Detection Item
2-digit	5-digit	
37	C1237	Size of some tires is different from the other tires

▶ DTC (blinking VSC warning light) ◀

DTC No.		Detection Item
2-digit	5-digit	
44	C1224	Open or short in NE signal circuit

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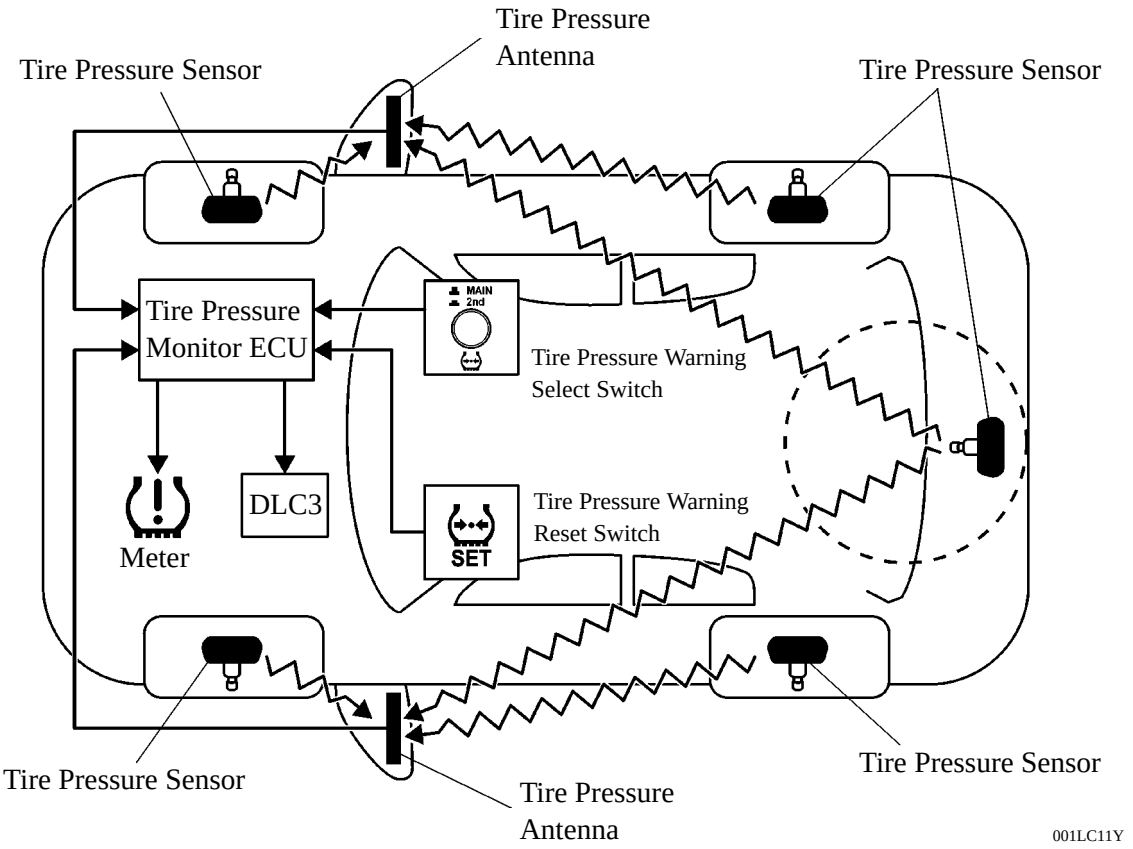
■TIRE PRESSURE WARNING SYSTEM

1. General

- A direct-sensing type tire pressure warning system is standard equipment on all models.
- A tire pressure sensor that detects the air pressure of the tire has been installed directly on all wheels. To receive their signals, tire pressure antennas are provided inside both the right and left outside rearview mirrors.
- If the vehicle continues to be driven with one or more of five tires (which includes the spare tire) inflated to a low air pressure that could cause problems in driving, this system will illuminate the tire pressure warning light to inform the driver of the low air pressure.

2. System Diagram



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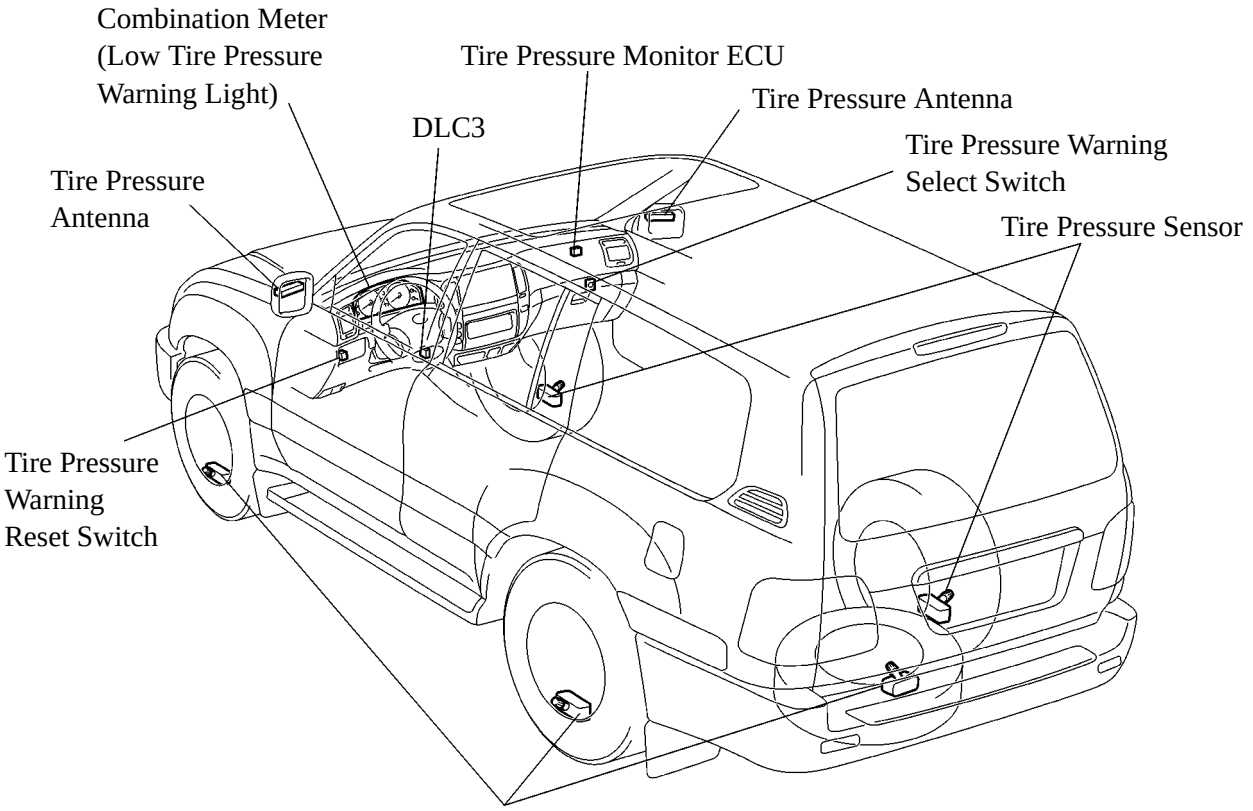
3. Layout of Main Components



4. Function of Main Components

Components	Function
Tire Pressure Sensor	Integrated in the air valve of the disc wheel, this sensor detects the pressure and the temperature in the tire. Then, it transmits the detected values and the recognition ID to the tire pressure antenna.
Tire Pressure Antenna	Located in an outside rear view mirror, this antenna receives the signals from the tire pressure sensors and transmits the signals that are required by the tire pressure monitor ECU.
Tire Pressure Monitor ECU	Has a built-in receiver. The receiver portion receives the signals from the tire pressure antenna and recognizes whether the signals are coming from the vehicle's own wheels. If the measured values fall below the specified value, this ECU transmits a signal to illuminate the pressure warning light in the combination meter.
Tire Pressure Warning Select Switch	Selects either of the 2 sets of ID codes that are registered in the tire pressure monitor ECU.
Tire Pressure Warning Reset Switch	When the driver keeps this switch pressed for 3 seconds while the ignition switch is turned ON, the system accepts initialization.
Low Tire Pressure Warning Light	Located in the combination meter, this light informs the driver of a low tire pressure or a system failure.

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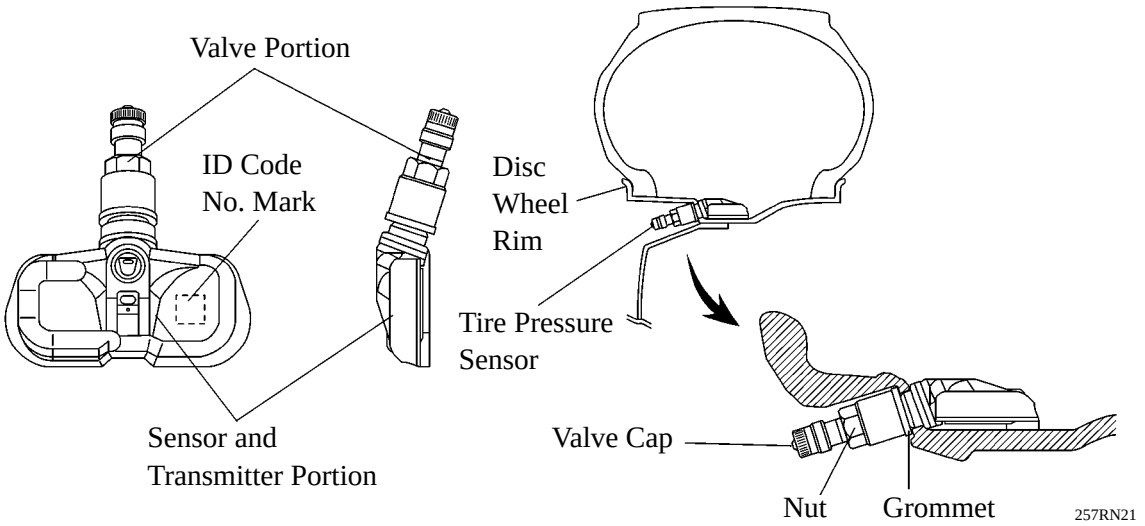
5. Construction and Operation of Main Components

Tire Pressure Sensor

- The tire pressure sensor is integrated in the air valve of a disc wheel. It measures the pressure and the temperature of the air in the tire and transmits the measured values and recognition ID to the tire pressure antenna.
- If the battery voltage drops, the tire pressure sensor assembly must be replaced. Furthermore, if the battery voltage drops, the sensor will be unable to transmit signals, which causes a DTC to be output.
- Each sensor has a built-in semi-conductor to directly measure the inflation pressure of the tire.
- Frequency of the sensor is 314.98MHz.



NOTICE

- Ensure the proper direction of the sensor by adhering to the prescribed procedure for installing a tire pressure sensor on a wheel. Failure to do so could result in an incorrect measurement of the tire air inflation pressure.
- Make sure to replace the tires in accordance with the prescribed procedure. To prevent the sensor from damage, drop the sensor into the wheel before removing the tire. Failure to do so could damage the tire pressure sensor.

For further details regarding the above, refer to the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

Service Tip

- If the lithium battery is depleted, replace the entire tire pressure sensor assembly.
- After a sensor has been replaced, the ID of the sensor must be registered in the ECU. To register an ID, use a hand-held tester to enter the ID code that is indicated on the sensor.
- When the tire pressure sensors are replaced, all the separate ID codes of the five sensors must be registered. Even if only one sensor is replaced, the ID codes of all five sensors must be registered again.
- A new tire pressure sensor that is available as a service part is in the sleep mode in its initial state to prevent the battery from depleting. After the sensor and the tire are correctly mounted on the disc wheel, inflating the tire to the specified pressure causes the sleep mode to cancel.

For further details regarding the above, refer to the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

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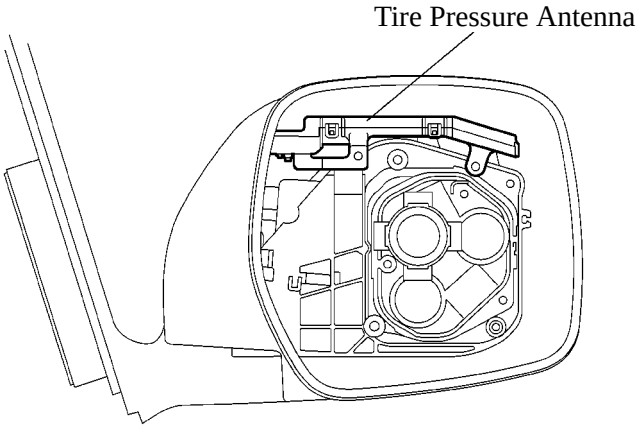
Tire Pressure Antenna

- Antennas are provided inside both the right and left outside rear view mirrors.
- The antennas receive signals from the tire pressure sensors and transmit them to the tire pressure monitor ECU.



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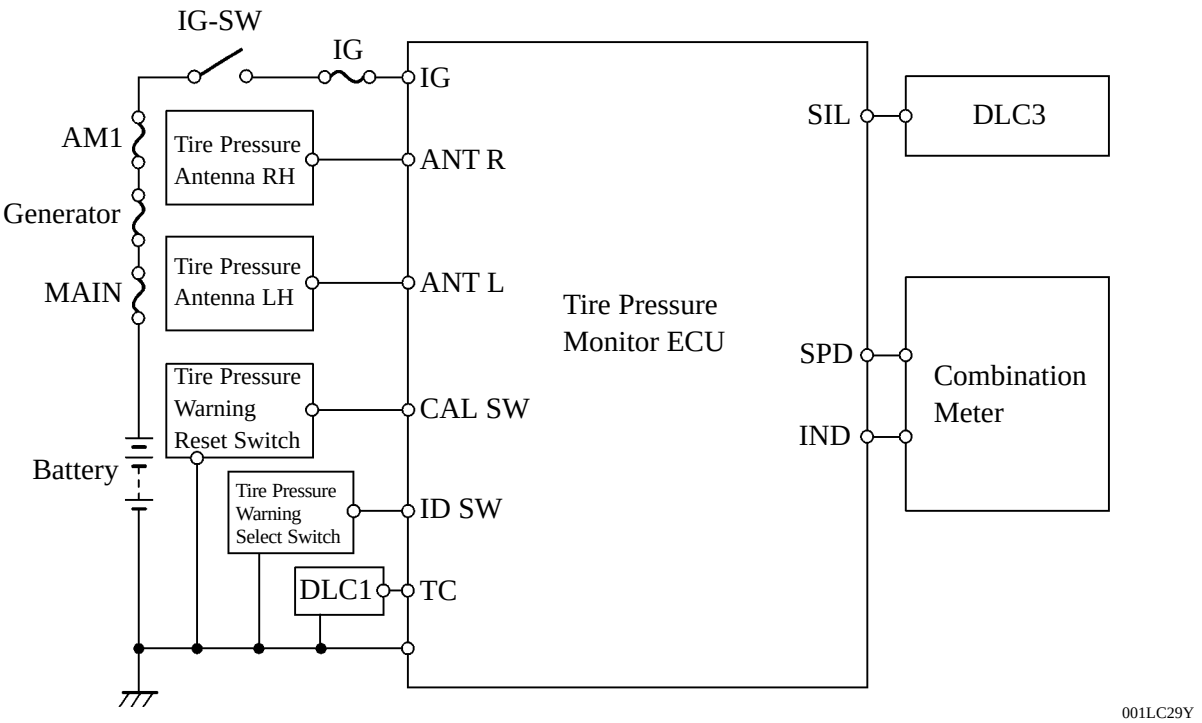
Tire Pressure Monitor ECU

- Has a built-in receiver.
- The receiver portion receives the signals from the tire pressure antenna and determines whether the signals are coming from the vehicle's own wheels.
- If the measured values fall below the specified value, this ECU transmits signal to illuminate the pressure warning light in the combination meter.
- The tire pressure sensor ID codes of 2 sets (5 x 2) of wheels can be registered through the use of a hand-held tester. For details, refer to the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

▶ Wiring Diagram ◀



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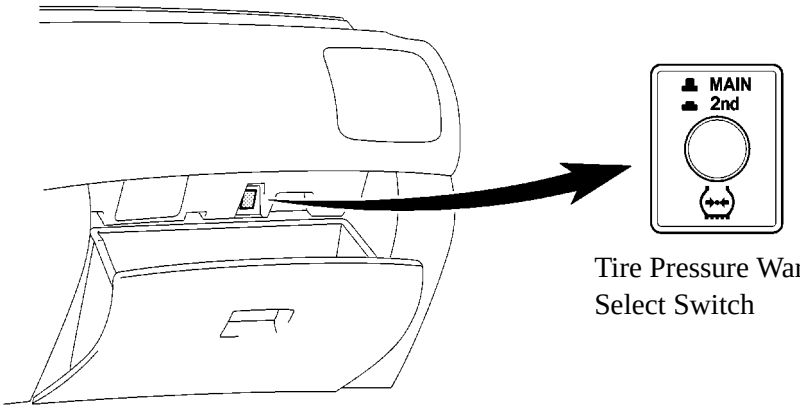
Tire Pressure Warning Select Switch

- This switch is located in the lower area of the instrument panel on the passenger side.
- The transmitter IDs for two sets of tires can be registered in the tire pressure monitor ECU. The driver can operate the tire pressure warning select switch to select one of the sets. Therefore, it is unnecessary to register the IDs each time tires are replaced.



Tire Pressure Warning
Select Switch

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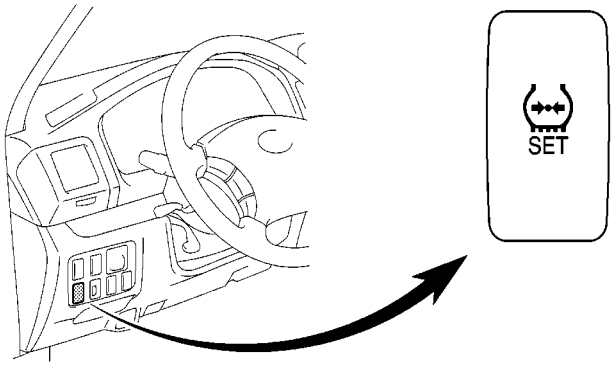
Tire Pressure Warning Reset Switch

- The pressure warning reset switch is located in the lower area of the instrument panel on the driver side.
- After adjusting the tire pressure to a set value, press the pressure warning reset switch for more than 3 seconds. This will enable the system to issue a warning at a pressure in accordance with the set pressure.



Tire Pressure Warning
Reset Switch

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Service Tip

- The system must be initialized under the following condition:
  1) New vehicle delivery
  2) Air pressure sensor replacement
  3) Replacement with tires of different size
  4) Tire pressure monitor ECU replacement
- Before operating the tire pressure warning reset switch, make sure to adjust the air pressure of the 5 tires to the specified value.

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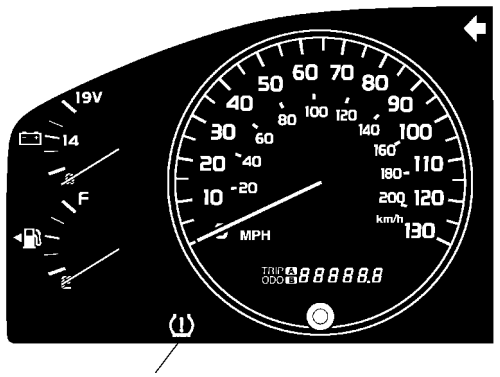
Low Tire Pressure Warning Light

- The low tire pressure warning light is located in the combination meter.
- This warning light illuminates or blinks in accordance with signals from the tire pressure sensor if the vehicles own tires are inflated with low pressure or if malfunction occurs in the system.



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▶ Light Illumination Pattern ◀

Condition	Illumination Pattern
Ignition switch turned ON (System Check)	After illuminating 3 seconds, it turns OFF (when system is normal)
Low tire pressure detected	Illumination
Tire pressure warning system malfunction	Blinking*

*: Illuminates when there is an open circuit between the meter ECU and the low tire pressure warning light.

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Self-Diagnosis

- If the tire pressure monitor ECU detects a malfunction, the tire pressure monitor ECU makes a diagnosis and memorizes the failed section. Furthermore, the low tire pressure warning light in the combination meter illuminates or blinks to inform the driver.
- The DTC (Diagnosis Trouble Code) can be read by connecting the SST (09843-18040) between the Tc and E1 terminals DLC1 or Tc and CG terminals DLC3, and observing the blinking of the low tire pressure warning light or connecting a hand-held tester.

For details, refer to the 2006 Land Cruiser Repair Manual (Pub. No. RM0010U).

▶ DTC chart (blinking low tire pressure warning light) ◀

DTC No.	Detection Item	DTC Deletion Condition
C2111/11	Tire pressure sensor ID1 operate stop	When data is received from a transmitter with an ID code that is registered in the ECU, or the ID code of the tire pressure sensor is newly registered in the ECU.
C2112/12	Tire pressure sensor ID2 operate stop	
C2113/13	Tire pressure sensor ID3 operate stop	
C2114/14	Tire pressure sensor ID4 operate stop	
C2115/15	Tire pressure sensor ID5 operate stop	
C2121/21	Tire pressure sensor ID1 not received (Main)	When a DTC deletion operation is implemented or the ID code of the tire pressure sensor is newly registered in the ECU.
C2122/22	Tire pressure sensor ID2 not received (Main)	
C2123/23	Tire pressure sensor ID3 not received (Main)	
C2124/24	Tire pressure sensor ID4 not received (Main)	
C2125/25	Tire pressure sensor ID5 not received (Main)	
C2131/31	Tire pressure sensor ID1 not received (2nd)	
C2132/32	Tire pressure sensor ID2 not received (2nd)	
C2133/33	Tire pressure sensor ID3 not received (2nd)	
C2134/34	Tire pressure sensor ID4 not received (2nd)	
C2135/35	Tire pressure sensor ID5 not received (2nd)	
C2141/41	Tire pressure sensor ID1 error	
C2142/42	Tire pressure sensor ID2 error	
C2143/43	Tire pressure sensor ID3 error	
C2144/44	Tire pressure sensor ID4 error	
C2145/45	Tire pressure sensor ID5 error	
C2165/65	Abnormal temperature inside ID1 tire	
C2166/66	Abnormal temperature inside ID2 tire	
C2167/67	Abnormal temperature inside ID3 tire	
C2168/68	Abnormal temperature inside ID4 tire	
C2169/69	Abnormal temperature inside ID5 tire	
C2171/71	Tire pressure sensor ID not registered (Main)	
C2172/72	Tire pressure sensor ID not registered (2nd)	
C2176/76	Receiver error	
C2177/77	Initialization not completed	

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C2181/81	Tire pressure sensor ID1 not received	When deletion conditions of the ID codes have been established or departing from the test mode.
C2182/82	Tire pressure sensor ID2 not received	
C2183/83	Tire pressure sensor ID3 not received	
C2184/84	Tire pressure sensor ID4 not received	
C2185/85	Tire pressure sensor ID5 not received	
C2191/91	Vehicle speed signal error	
C2192/92	Malfunction in tire pressure warning select switch	
C2195/95	Open circuit at receiving antenna	

Fail-Safe

If a system failure occurs, the tire pressure warning light in the combination meter illuminates to inform the driver of the failure.

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■MULTIPLEX COMMUNICATION

1. General

- CAN (Controller Area Network) communication is used on the ’06 Land Cruiser.
- CAN is a type of on-vehicle multiplex communication system that performs excellent data communication and error detection between ECUs and sensors.
- CAN uses twisted-pair wires, consisting of two wires, CAN-H and CAN-L, which have different voltages to establish communication.

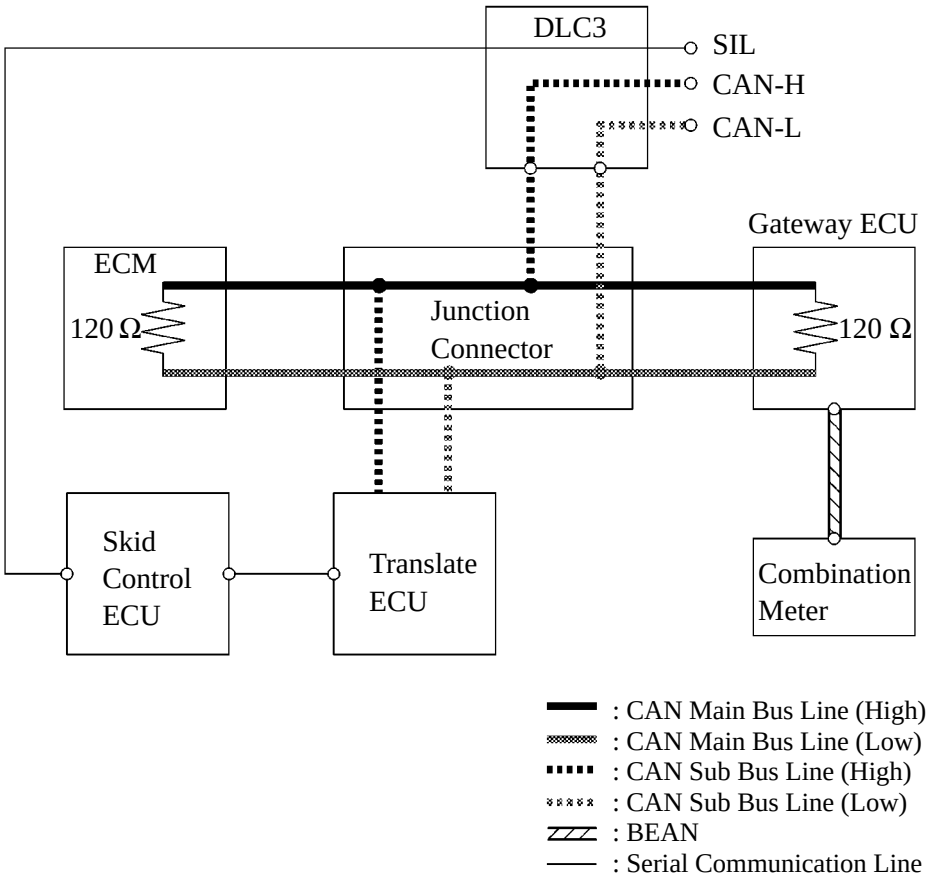
▶ Characteristic ◀

- Through the use of twisted-pair wires, the wiring harness routing is simplified.
- Its communication speed is faster than BEAN (Body Electronics Area Network) used on other models.

Communication Type	CAN	BEAN
Communication Speed	500 Kbps	MAX: 10 Kbps

- The CAN used on the ’06 Land Cruiser connects the translate ECU, gateway ECU, ECM, and DLC3 (Data Link Connector) as indicated below. Serial communication is maintained between the translate ECU and the skid control ECU. The gateway ECU and the combination meter are connected by BEAN. However, the diagnosis information from the skid control ECU is output from the SIL line.

▶ System Diagram ◀



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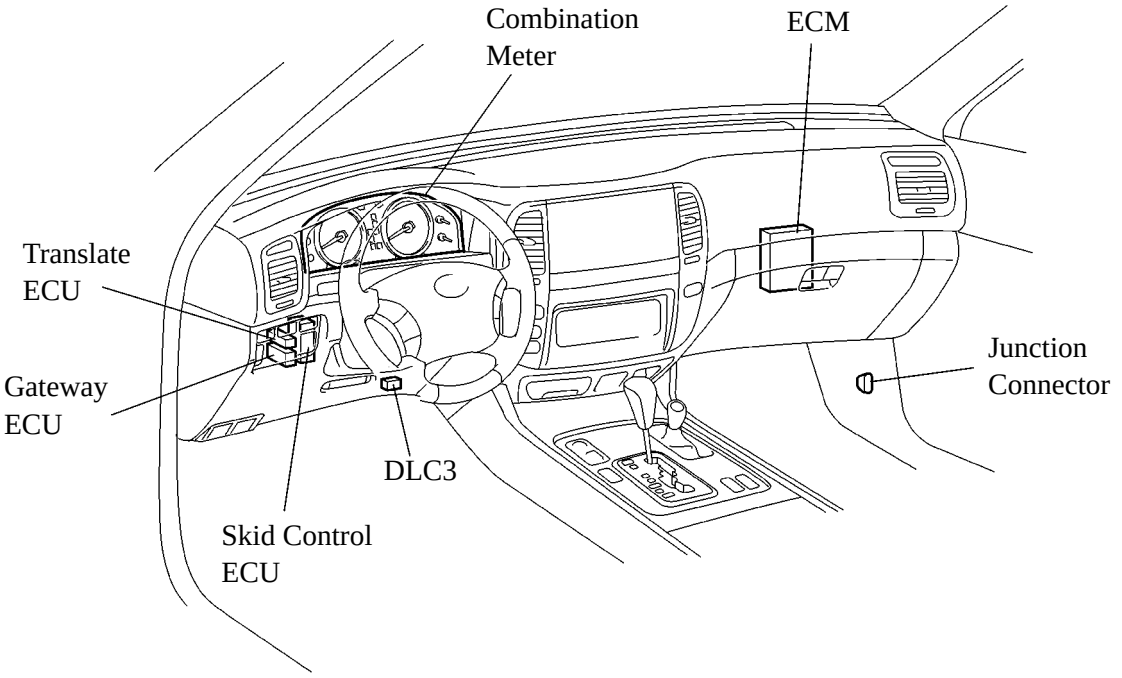
2. Layout of Main Components



3. Diagnosis

- If the CAN has a communication error at ECU or sensor, DTCs (Diagnostic Trouble Codes) are output simultaneously to indicate the malfunction location.
- The DTCs for CAN communication concerning the brake control system can be read by connecting SST 09843-18040 to Tc and CG terminals of DLC3 connector, and observing the blinking of the ABS and VSC warning lights (2-digit code) or by connecting a hand-held tester (5-digit code). For details, see the 2006 Land Cruiser Repair Manual (Pub No. RM0010U).

▶ DTC Combination Chart ◀

DTC Code Output (from Skid Control ECU)	Mode
C1203/53, C1223/43 U0073/42, U0100/65	Translate ECU (Skid Control ECU) communication stop mode
U0073/42, U0100/65	ECM communication stop mode
—	Gateway ECU (Combination Meter) communication stop mode

▶ DTC Chart ◀

DTC	Detection Item
C1203/53	Malfunction in CAN1 communication
C1223/43	Malfunction in ABS control system
U0073/42	Control module communication bus off
U0100/65	Lost communication with ECM/PCM “A”

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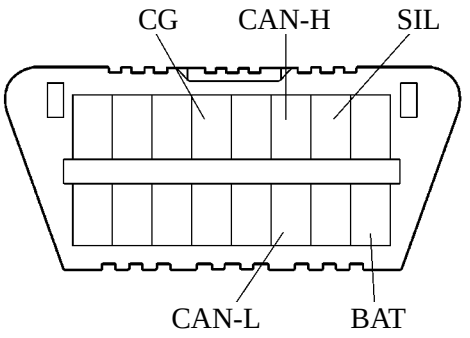
- DLC3 is equipped with CAN-H and CAN-L terminals for CAN diagnosis. It is possible to determine if there is an open or short on the main bus line by measuring the resistance value between these terminals. It is possible to determine if there is a short between the bus line-power supply/ground by measuring the resistance value between terminal CAN-H or CAN-L, and the BAT or CG terminal.

▶ CAN-H - CAN-L Inspection ◀

Resistance Value	Bus Line Status
Less than 54 Ω	Short between lines
	Short between bus line and power or ground (DTC is output)
54 Ω - 67 Ω	Normal
	Sub bus line open (DTC is output)
	Short between bus line and power or ground (DTC is output)
More than 67 Ω	Sub bus line open
	Main bus line open



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DLC3

▶ Inspection for short between bus line-power supply/ground ◀

Inspection Item	Resistance Value	Bus Line Status
CAN-H - BAT	More than 1 kΩ	Bus line is OK if no DTC is output
	Less than 1 kΩ	Short between bus line and power or ground
CAN-L - BAT	More than 1 kΩ	Bus line is OK if no DTC is output
	Less than 1 kΩ	Short between bus line and power or ground
CAN-H - CG	More than 3 kΩ	Bus line is OK if no DTC is output
	Less than 3 kΩ	Short between bus line and power or ground
CAN-L - CG	More than 3 kΩ	Bus line is OK if no DTC is output
	Less than 3 kΩ	Short between bus line and power or ground

- If a communication malfunction occurs between the skid control ECU and the ECM or the translate ECU, the skid control ECU stops control of the VSC (Vehicle Stability Control).
- For details of the CAN diagnosis system, see the 2006 Land Cruiser Repair Manual (Pub No. RM0010U).

4. Fail-Safe

The fail-safe system provided for each system will operate if a failure occurs in the communication wire such as a short or an open circuit.

- On the ’06 Land Cruiser, the following fail-safe functions will operate if CAN communication is unavailable.

Location of Disabled Communication	Fail-Safe
Skid Control ECU, ECM and Translate ECU	● Stops VSC/ABS functions ● Illuminates VSC indicator light and ABS indicator light ● Detects DTCs
Gateway ECU	—

MAJOR TECHNICAL SPECIFICATIONS

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Item \ Area				U.S.A.
Body Type				Wagon
Vehicle Grade				VX
Model Code				UZJ100L-GNAEKA
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4890 (192.5)
		Width	mm (in.)	1940 (76.4)
		Height*1	mm (in.)	1875 (73.8), 1850 (72.8)*2
	Wheel Base		mm (in.)	2850 (112.2)
	Tread	Front	mm (in.)	1620 (63.8)
		Rear	mm (in.)	1615 (63.6)
	Effective Head Room	Front	mm (in.)	993 (39.1)
		Rear	mm (in.)	987 (39.9), 979 (38.5)*3
	Effective Leg Room	Front	mm (in.)	1074 (42.3)
		Rear	mm (in.)	870 (34.3), 752 (29.6)*3
	Shoulder Room	Front	mm (in.)	1558 (61.3)
		Rear	mm (in.)	1552 (61.1)
	Cargo Space	Length	mm (in.)	1009 (39.7)
		Width	mm (in.)	1081 (42.6)
		Height	mm (in.)	1005 (39.6)
	Overhang	Front	mm (in.)	895 (35.2)
		Rear	mm (in.)	1145 (45.1)
	Min. Running Ground Clearance		mm (in.)	250 (9.8)
	Angle of Approach		degrees	31°, 30°*2
	Angle of Departure		degrees	24°, 23°*2
	Curb Mass.	Front	kg (lb)	1275 (2811), 1295 (2849)*2
		Rear	kg (lb)	1185 (2612), 1195 (2629)*2
		Total	kg (lb)	2460 (5423), 2490 (5478)*2
	Gross Vehicle Mass.	Front	kg (lb)	—
		Rear	kg (lb)	—
		Total	kg (lb)	3140 (6923), 3170 (6974)*2
	Fuel Tank Capacity		L (US.gal., Imp.gal.)	96 (25.4, 21.1)
	Luggage Compartment Capacity		m^3 (cu.ft.)	—
Performance	Max. Speed		km / h (mph)	180 (112)
	Max. Cruising Speed		km / h (mph)	144 (89.5)
	Max. Permissible Speed	1st Gear	km / h (mph)	20 (12)*4, 51 (32)*5
		2nd Gear	km / h (mph)	36 (22)*4, 87 (54)*5
		3rd Gear	km / h (mph)	52 (32)*4, 127 (79)*5
		4th Gear	km / h (mph)	72 (45)*4, 178 (111)*5
	Turning Diameter (Outside Front)	Wall to Wall	m (ft.)	12.7 (41.7)
		Curb to Curb	m (ft.)	12.1 (39.7)
Engine	Engine Type			2UZ-FE
	Valve Mechanism			32-Valve, DOHC
	Bore x Stroke		mm (in.)	94.0 x 84.0 (3.70 x 3.31)
	Displacement		cm^3 (cu.in.)	4664 (284.5)
	Compression Ratio			10.0 : 1
	Fuel System			SFI
	Octane Rating			87 or higher*6
	Max. Output		kW / rpm (HP@rpm)	205 / 5400 (275@5400)
	Max. Torque		N·m / rpm (lb-ft@rpm)	450 / 3400 (332@3400)
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12 - 64
	Alternator Output		Watts	1560
	Starter Output		kW	2.0
Chassis	Clutch Type			—
	Transmission Type			A750F
	Transmission Gear Ratio*7	In First		3.520
		In Second		2.042
		In Third		1.400
		In Fourth		1.000
		In Fifth		0.716
		In Reverse		3.224
	Transfer Gear Ratio H4 / L4			1.000 / 2.488
	Differential Gear Ratio (Front / Rear)			4.100 / 4.100
	Differential Gear Size (Front / Rear)		in.	8" / 9.5"
	Brake Type	Front		Ventilated Disc
		Rear		Ventilated Disc
	Parking Brake Type			Duo Servo Drum
	Brake Booster Type and Size		in.	Hydraulic
	Proportioning Valve Type			—
	Suspension Type	Front		Double Wishbone
		Rear		4-Link with Lateral Rod
	Stabilizer Bar	Front		Standard
		Rear		Standard
	Steering Gear Type			Rack and Pinion
	Steering Gear Ratio (Overall)			19.8
	Power Steering Type			Hydrauric

*1: Unladen Vehicle
*2: With AHC
*3: Center Seat
*4: Transfer in Low
*5: Transfer in High
*6: 91 or higher recomened
*7: Counter Gear Ratio Included

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