■ENGINE CONTROL SYSTEM

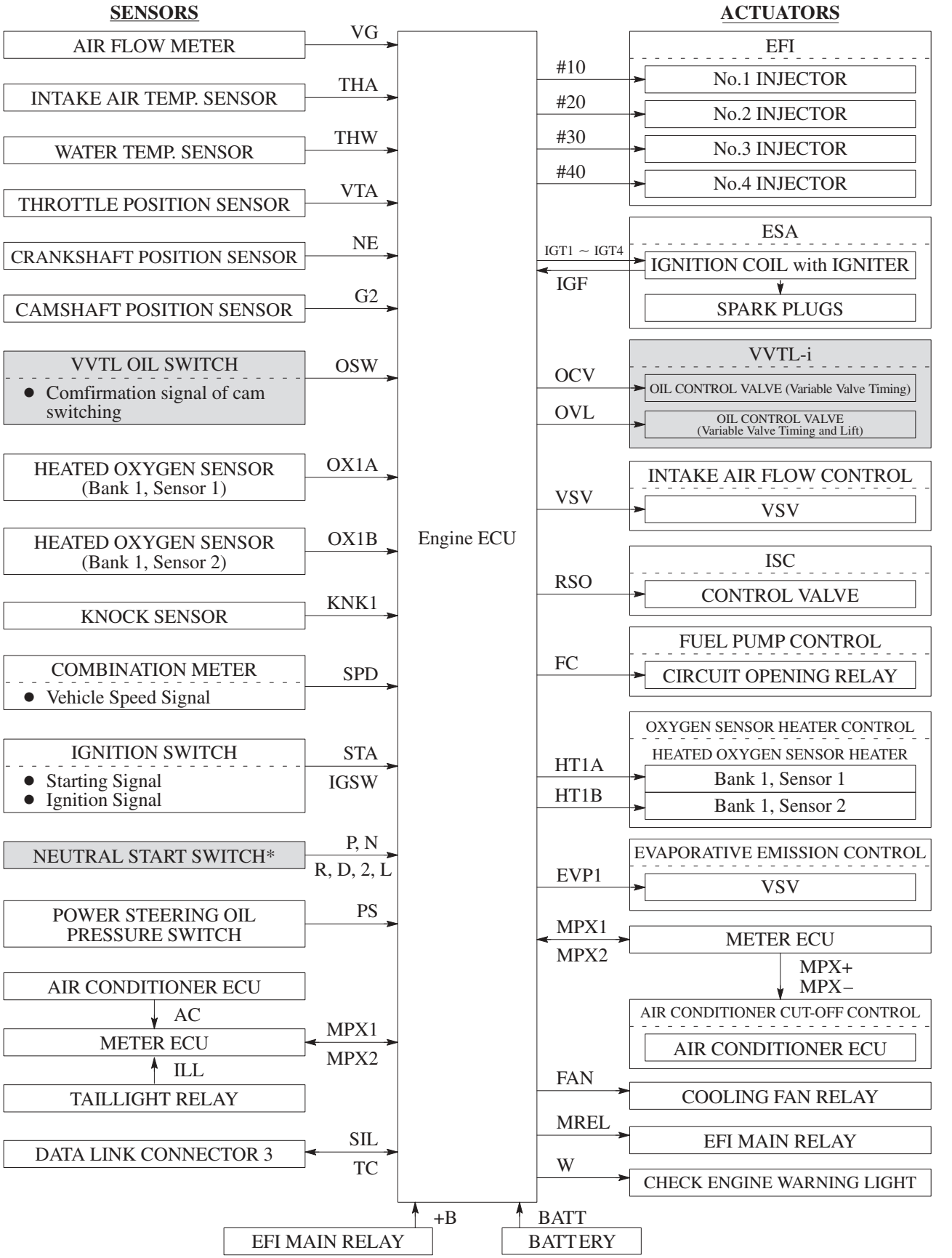
1. General

The engine control system for the 2ZZ-GE engine have following system.

System	Outline	2ZZ-GE Engine	1ZZ-FE Engine
EFI (Electronic Fuel Injection)	● An L-type EFI system directly detects the intake air volume with a hot-wire type flow meter. ● The fuel injection system is a sequential multiport fuel injection system.	○	○
ESA (Electronic Spark Advance)	Ignition timing is determined by the engine ECU based on signals from various sensors. The engine ECU corrects ignition timing in response to engine knocking.	○	○
ISC (Idle Speed Control)	A rotary solenoid type ISC valve controls the fast idle and idle speeds.	○	○
Intake Air Flow Control	The intake air duct is divided into two areas, and the engine ECU controls the variable intake valve and the actuator that are provided in one of the areas to reduce the amount of engine noise.	○	○
VVT-i (Variable Valve Timing-intelligent)	Controls the intake camshaft to an optimal valve timing in accordance with the engine condition.	–	○
VVTL-i (Variable Valve Timing and Lift-intelligent)	Controls the intake camshafts and the cam changeover mechanism to realize an optimal valve timing and valve lift in accordance with the engine conditions.	○	–
Fuel Pump Control	● Fuel pump operation is controlled by signal from the engine ECU. ● To stop the fuel pump during operation of the SRS airbag.	○	○
Oxygen Sensor Heater Control	Maintains the temperature of the oxygen sensors at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	○	○
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.	○	○
Air Conditioner Cut-off Control	By turning the air conditioner compressor ON or OFF in accordance with the engine condition, drivability is maintained.	○	○
Engine Immobiliser	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.	○	○
Diagnosis	When the engine ECU detects a malfunction, the engine ECU diagnoses and memorizes the failed section.	○	○
Fail-Safe	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in memory.	○	○

2. Construction

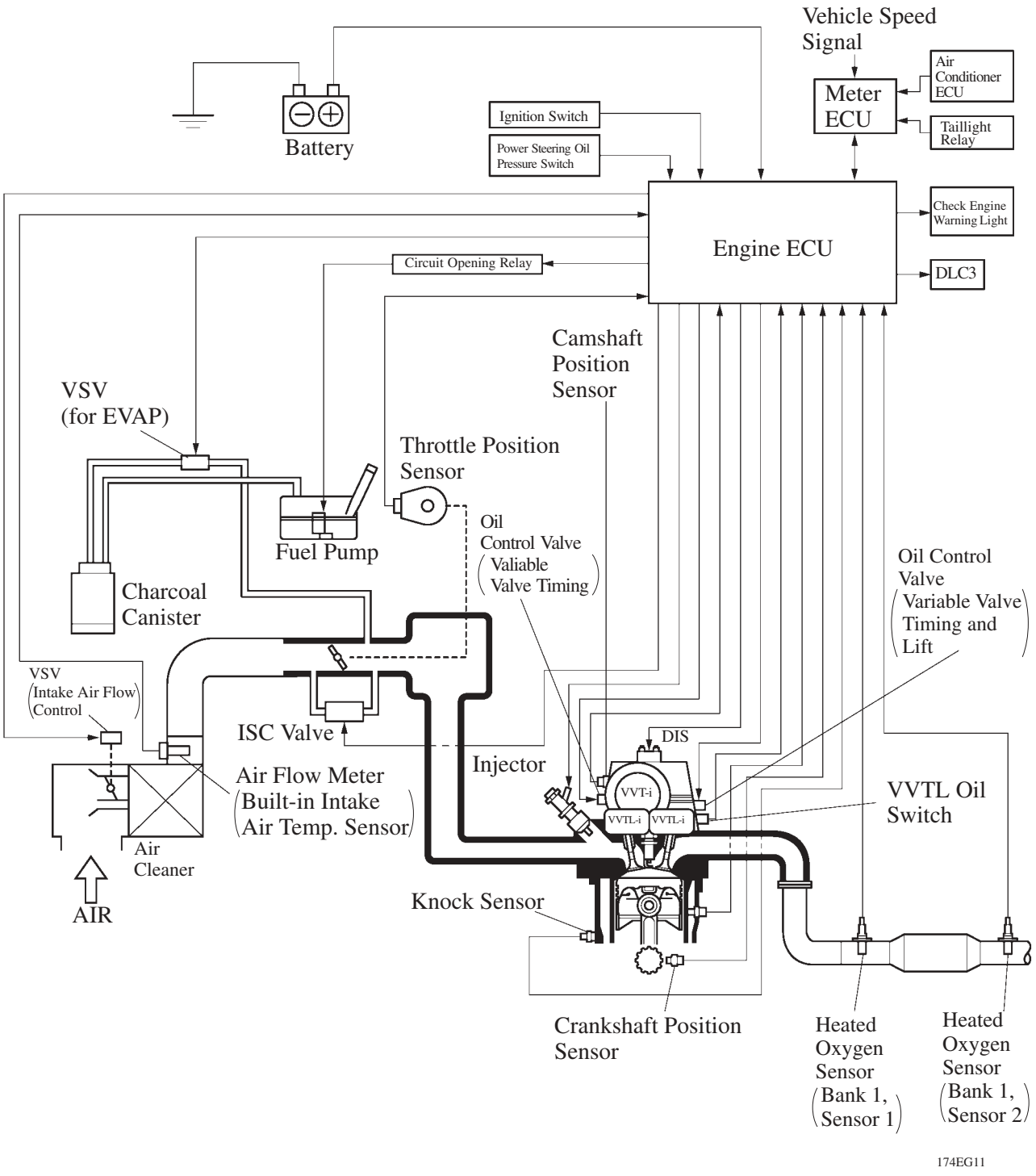
The configuration of the engine control system in the 2ZZ-GE engine in the new CELICA is as shown in the following chart. Shaded portions differ from the 1ZZ-FE engine.



*: Only for the Automatic Transaxle Model

3. Engine Control System Diagram

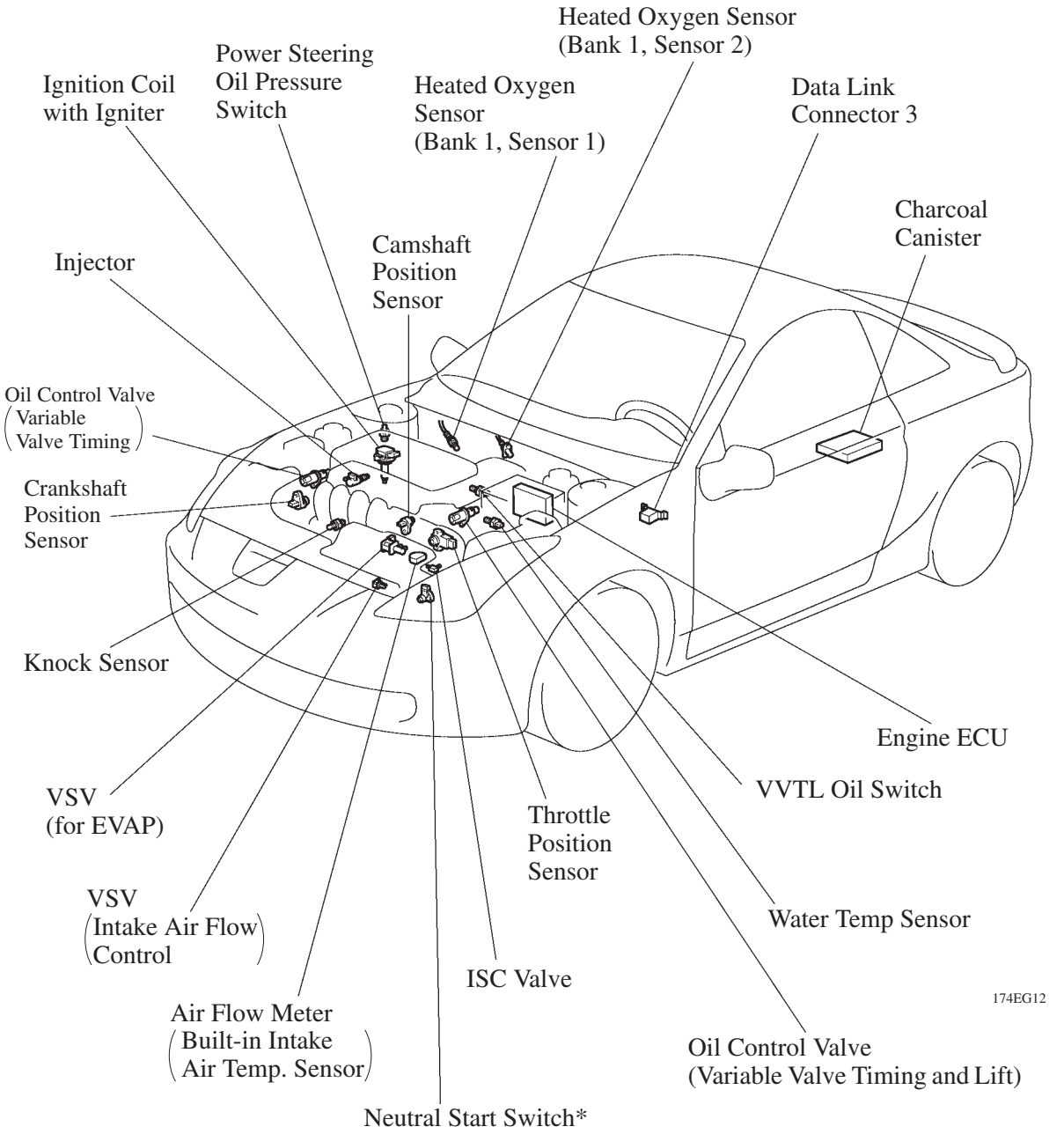
In contrast to the 1ZZ-FE engine, the 2ZZ-GE engine has adopted an oil control valve (for variable valve lift) in conjunction with the adoption of the VVTL-i system.



EG

4. Layout of Components

In contrast to the 1ZZ-FE engine, an oil control valve (for variable valve lift) has been installed on the back of the cylinder head of the 2ZZ-GE engine in conjunction with the adoption of the VVTL-i system.



*: Only for the Automatic Transaxle Model

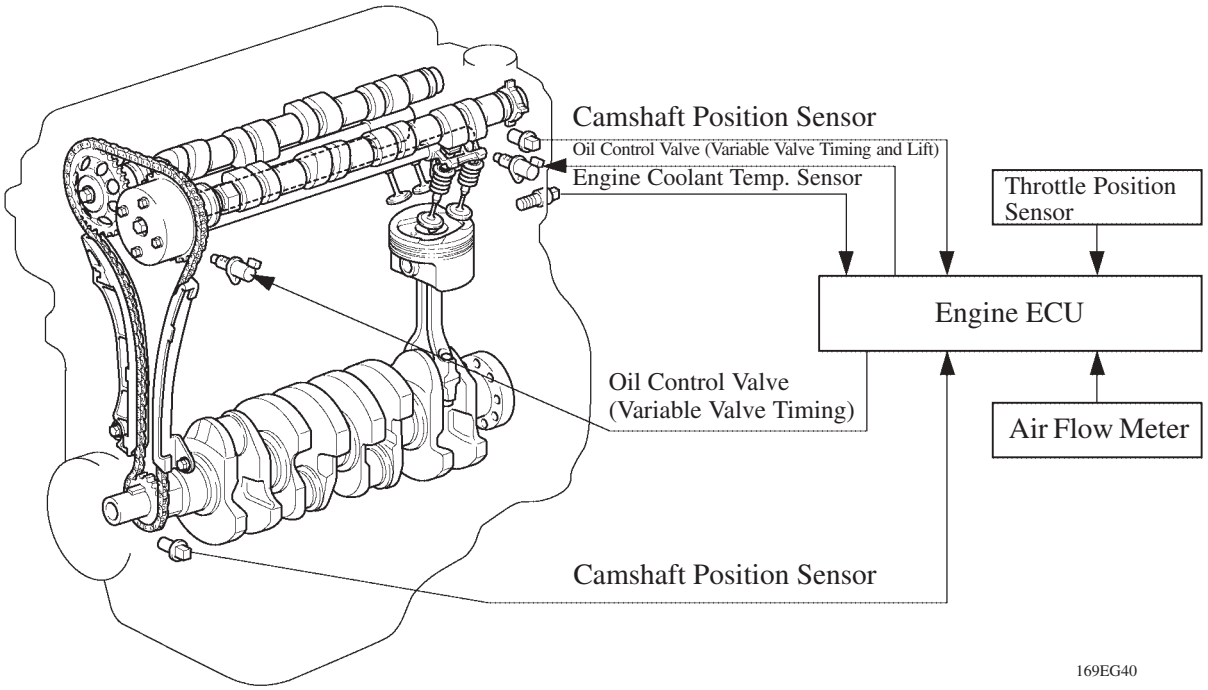
5. VVTL-i (Variable Valve Timing and Lift-intelligent) System

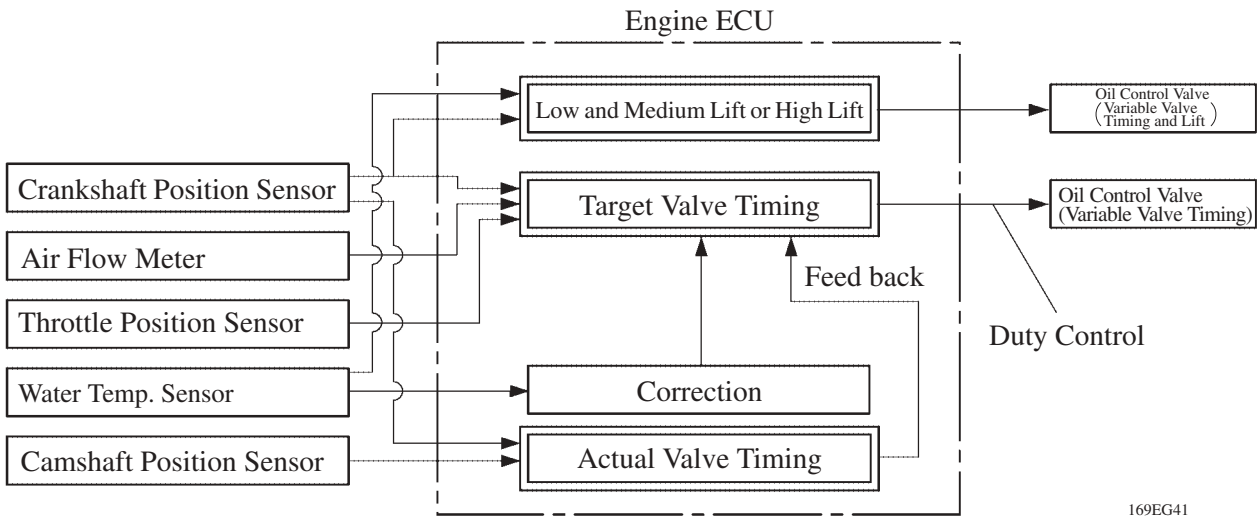
General

Based on the VVT-i system, the VVTL-i system has adopted a cam changeover mechanism that varies the amount of lift of the intake and exhaust valves while the engine is operating at high speeds. In addition to achieving higher engine speeds and higher outputs, this system enables the valve timing to be optimally set, resulting in improved fuel economy.

When the engine is operating in the low-to mid-speed range, the low-and medium-speed cams of the camshafts operate to move the two valves via the rocker arms. Then, when the engine is operating in the high-speed range, the signals from the sensors cause the engine ECU to change the hydraulic passage of the oil control valve (for the variable valve timing and lift), thus changing to the operation of the high-speed cams. Thus, the lift of the intake and exhaust valves increases, allowing the introduction of a greater volume of air-fuel mixture, and the discharge of a greater volume of exhaust gases. As a result, the engine operates at higher speeds and higher outputs.

The construction and the operation of the valve timing control are basically the same as in the VVT-i system.



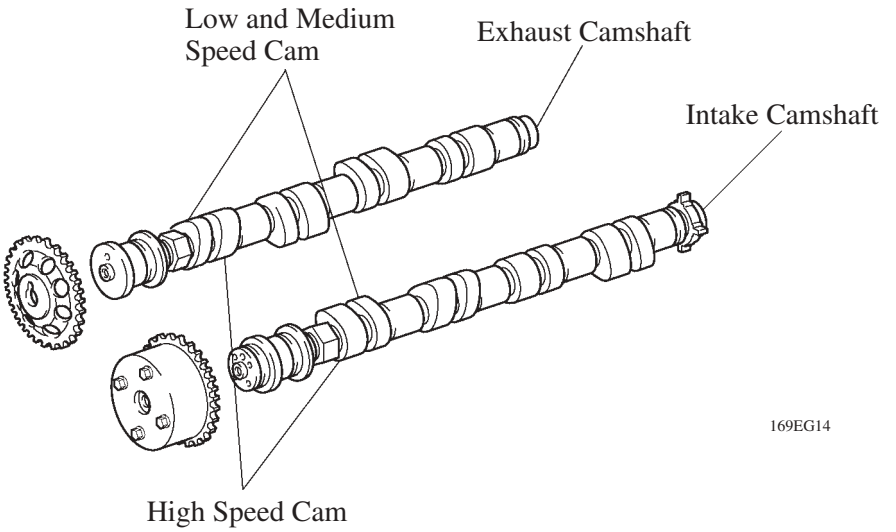


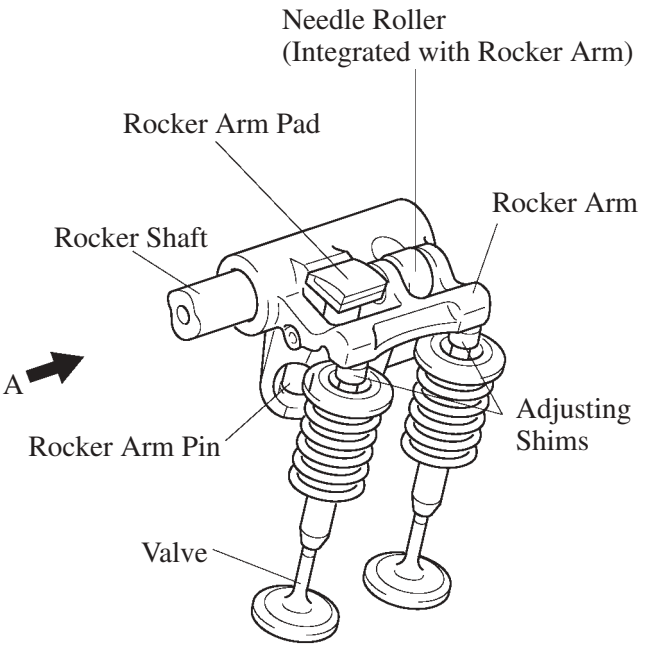
Construction and Operation

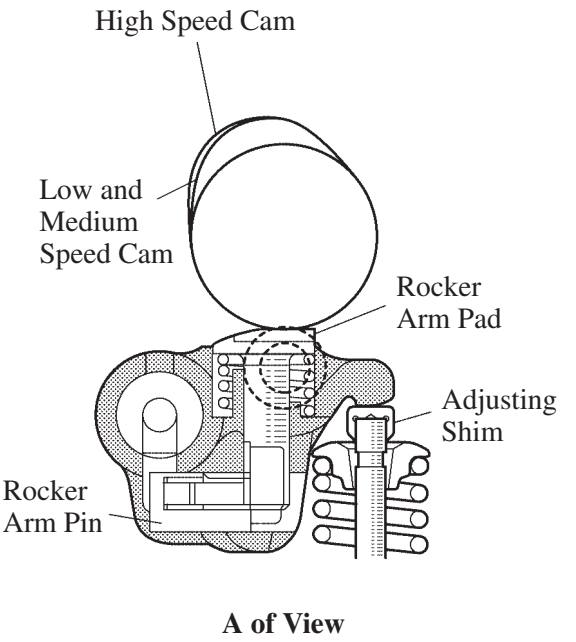
1) Cam Changeover Mechanism (Rocker Arm Type)

a. Construction

- A rocker arm type cam changeover mechanism has been adopted. The main components of the rocker arm type are the rocker arm, rocker arm pad, rocker arm pin, and the rocker shaft.
  This mechanism is provided for both the intake and exhaust camshafts, with each connected to its respective rocker arm shaft.
- Both the intake and exhaust camshafts contain low-and medium-speed cams and high-speed cams.





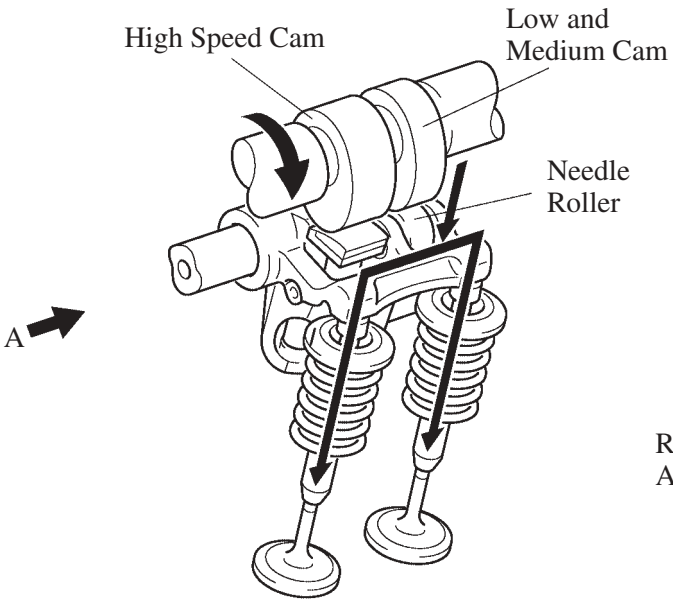


A of View

b. Operation

- When the engine coolant temperature is higher than 60°C and the engine speed is higher than 6000 rpm, this system changes the operation of the low-and medium-speed cams on the camshafts to the high-speed cams.
  When the engine is operating in the low-to mid-speed range (below 6000 rpm), the low-and medium-speed cam pushes the needle roller of the rocker arm down to operate the two valves. At this time, the high-speed cam is also pushing down on the rocker arm pad, but because the rocker arm pad moves freely, this movement does not cause the rocker arm and the valves to move. Thereafter, when the engine reaches a high speed (over 6000 rpm), the hydraulic pressure pushes the rocker arm pin out to lock the bottom of the rocker arm pad. Because the high-speed cam has a greater cam lift than the low-and medium-speed cam, this time, the high-speed cam operates the two valves via the rocker arm pad and the rocker arm.

▶ Low and Medium Speed ◀



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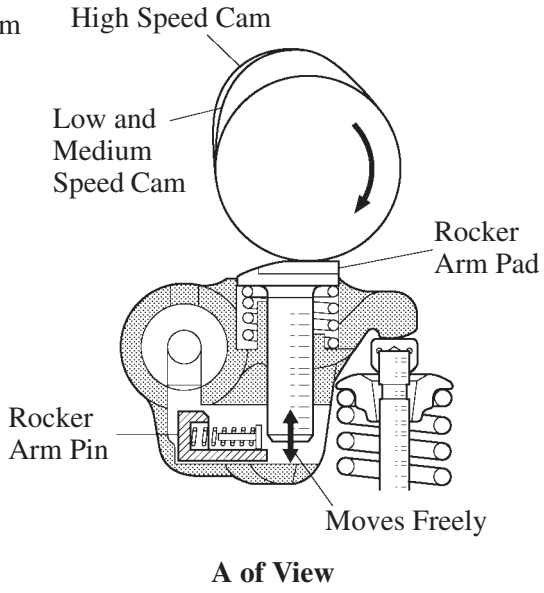

A of View

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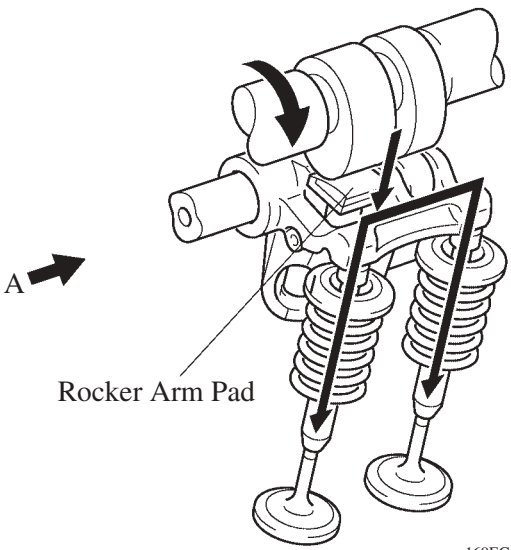
▶ High Speed ◀



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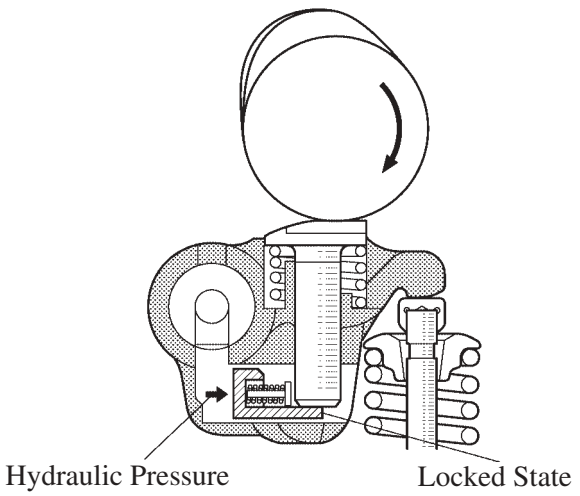

A of View

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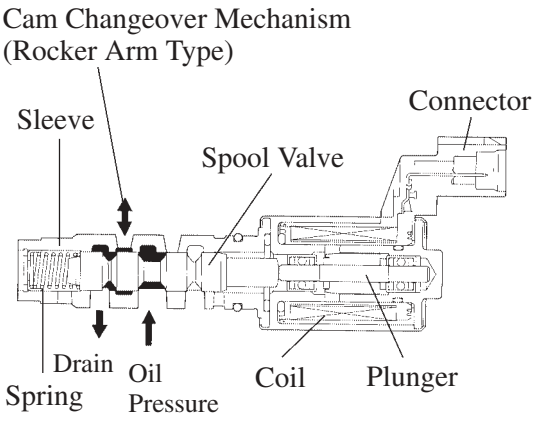
2) Oil Control Valve (Variable Valve Timing and Lift)

The oil control valve (for the variable valve timing and lift) controls the spool valve position in accordance with the duty control from the engine ECU, thus allocating the hydraulic pressure that is applied to the high-speed cam side of the cam changeover mechanism.



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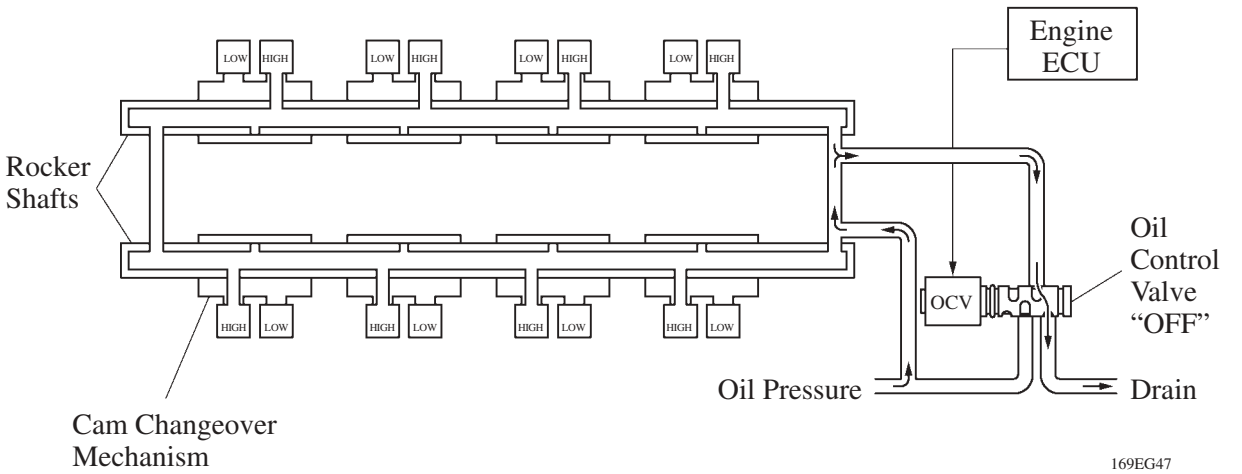
3) Oil Pressure Control

When the engine is operating in the low-to mid-speed range, the oil control valve opens on the drain side so that the oil pressure will not be applied to the cam changeover mechanism. Then, when the engine reaches a high speed, the oil control valve closes on the drain side in order to apply the oil pressure to the high-speed cam of the cam changeover mechanism.

▶ Low and Medium Speed ◀



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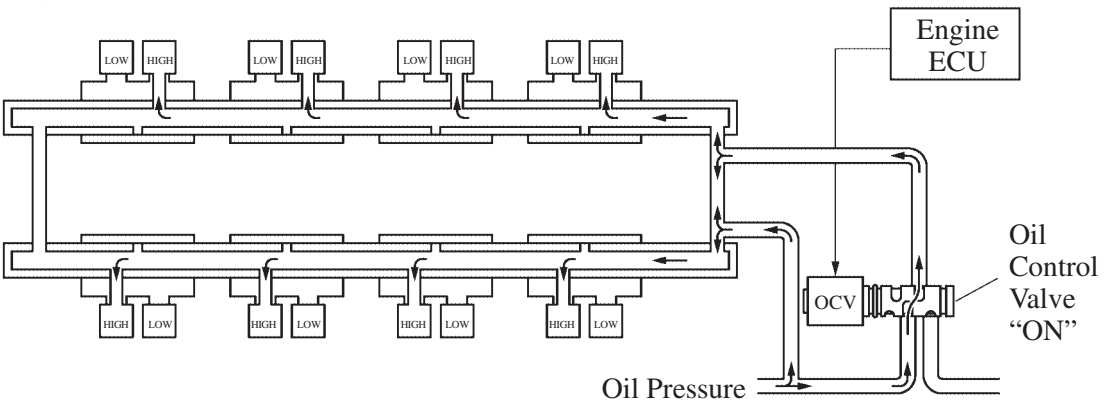
▶ High Speed ◀



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