TOYOTA model
New Car Features
Supplement
Jul. 2000

COROLLA
MR2
AVENSIS
LAND CRUISER/
LAND CRUISER
PRADO

For More Effective Sales and Service Activities

TOYOTA

FOREWORD

To assist you in your sales and service activities, this manual explains the main characteristics of the new COROLLA, MR2, AVENSIS and LAND CRUISER/LAND CRUISER PRADO, in particular providing a technical explanation of the construction and operation of new mechanisms and new technology used.

CAUTION, NOTICE, *REFERENCE* and **NOTE** are used in the following ways:

CAUTION	A potentially hazardous situation which could result in injury to people may occur if instructions on what to do or not do are ignored.
NOTICE	Damage to the vehicle or components may occur if instructions on what to do or not do are ignored.
REFERENCE	Explains the theory behind mechanisms and techniques.
NOTE	Notes or comments not included under the above 3 titles.

All information contained herein is the most up-to-date at the time of publication. We reserve the right to make changes without prior notice.

TOYOTA MOTOR CORPORATION

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TABLE OF CONTENTS

1 COROLLA

OUTLINE OF NEW FEATURES 2
MODEL CODE 3
MODEL LILNE-UP 3
NEW FEATURES
1CD-FTV Engine
General 4
Features of 1CD-FTV Engine 6
Engine Proper 7
Valve Mechanism 9
Lubrication System 10
Cooling System 11
Intake and Exhaust System 12
Fuel System 15
Engine Control System 20
Clutch 30
E351 Manual Transaxle
General 31
Transmission Gear 32
Shift and Select Mechanism 32
Power Heater System
General 33
Electrical Type Power Heater 33
Combustion Type Power Heater 35
MAJOR TECHNICAL SPECIFICATIONS 40

2 MR2

OUTLINE OF NEW FEATURES 44
MODEL CODE 45
MODEL LINE-UP 45
NEW FEATURES
Engine (Model with Sequential Manual Transmission)
General 46
Intake System 46
Engine Control System 46
Transaxle (Model with Sequential Manual Transmission)
General 49
Sequential Manual Transmission 49
MAJOR TECHNICAL SPECIFICATIONS 66

3 AVENSIS

OUTLINE OF NEW FEATURES 70
MODEL CODE 73
MODEL LINE-UP 74
NEW FEATURES
1ZZ-FE and 3ZZ-FE Engines
General 75
Features of 1ZZ-FE and 3ZZ-FE Engines 77
Engine Proper 78
Valve Mechanism 83
Lubrication System 85
Cooling System 86
Intake and Exhaust System 87
Fuel System 88
Ignition System 89
Serpentine Belt Drive System 90
Engine Control System 91
1AZ-FSE Engine
General 104
Features of 1AZ-FSE Engine 107
Engine Proper 108
Valve Mechanism 113
Lubrication System 115
Cooling System 117
Intake and Exhaust System 119
Direct Injection System 120
Ignition System 127
Serpentine Belt Drive System 128
Engine Control System 129
Clutch
General 148
Clutch Cover 149
Manual Transaxle
General 150
Transmission Gear 152
Shift and Select Mechanism 153
A246E Automatic Transaxle
General 154
Line Pressure Optimal Control 155
U240E Automatic Transaxle
General 156
Planetary Gear Unit 157
Hydraulic Control System 161
Electronic Control System 162
Automatic Transaxle Control System 166
Fail Safe Function 172
Shift Lock System
General 173
Layout of Components 173
Function of Components 173
Key Interlock Device 173
Shift Lock Mechanism 173
Brake
General 174
Brake Booster 174
ABS with EBD 175
ABS with EBD & Brake Assist & TRC & VSC System 177

Combination Meter **194**
Heater Control System **195**
Door Lock Control System
General **196**
Double Locking System **196**
Audio
General **198**
Steering Pad Switch **199**
MAJOR TECHNICAL SPECIFICATIONS **200**

4 LAND CRUISER / LAND CRUISER PRADO

OUTLINE OF NEW FEATURES **214**
MODEL CODE **215**
MODEL LINE-UP **215**
NEW FEATURES
1KD-FTV Engine
General **216**
Features of 1KD-FTV Engine **218**
Engine Proper **219**
Valve Mechanism **223**
Lubrication System **225**
Cooling System **226**
Intake and Exhaust System **228**
Turbocharger **232**
Fuel System **233**
Serpentine Belt Drive System **238**
Engine Control System **239**
Clutch **254**
A343F Automatic Transmission
General **255**
Torque Converter and Planetary Gear Unit **256**
VF3B Transfer
General **257**
Function **258**
Construction and Operation **258**
Air Conditioner
General **260**
Heater Control Panel **263**
Power Heater **263**
A/C Compressor **263**
MAJOR TECHNICAL SPECIFICATIONS **264**

COROLLA

COROLLA

OUTLINE OF NEW FEATURES

1. Model Line-Up

The 1CD-FTV engine model for Europe has been added.

2. 1CD-FTV Engine

- The 1CD-FTV TOYOTA D-4D (Direct injection 4 stroke common-rail Diesel engine) is added for Europe.
- The hydraulic engine mount has been adopted to the right side engine mount. Thus, the noise and vibration reductions and driving comfortability have been improved.

3. Clutch

- In accordance with the adoption of 1CD-FTV engine, the specification of a clutch is optimized.
- On the 1CD-FTV engine model, the clutch pedal has a turn-over mechanism to reduce clutch pedal effort.

4. E351 Manual Transaxle

The E351 manual transaxle is used for the 1CD-FTV engine model.

5. Drive Shaft

The tripod type CVJ (Constant Velocity Universal Joint) is used on the transaxle side, and Rzeppa type CVJ is used on the wheel side for the 1CD-FTV engine model. Furthermore a right-hand drive shaft has a dynamic damper to decrease noise and vibration.

6. Power Heater System

On the 1CD-FTV engine model, an electrical type power heater is provided as standard equipment. Furthermore, a combustion type power heater is available as optional equipment for certain destination models.

MODEL CODE

CDE110 L – A E M N Y W

1 2 3 4 5 6 7 8

1	BASIC MODEL CODE
	CDE110 : With 1CD-FTV Engine

2	STEERING WHEEL POSITION
	L : Left-Hand Drive R : Right-Hand Drive

3	MODEL NAME
	A : Corolla

4	BODY TYPE
	E : 4-Door Sedan G : 3-Door Hatchback L : 5-Door Liftback W : 5-Door Wagon

5	GEARSHIFT TYPE
	M : 5-Speed Manual, Floor

6	GRADE
	D : LINEA TERRA N : LINEA SOL

7	ENGINE SPECIFICATION
	Y : Common-Rail Diesel

8	DESTINATION
	W : Europe

MODEL LINE-UP

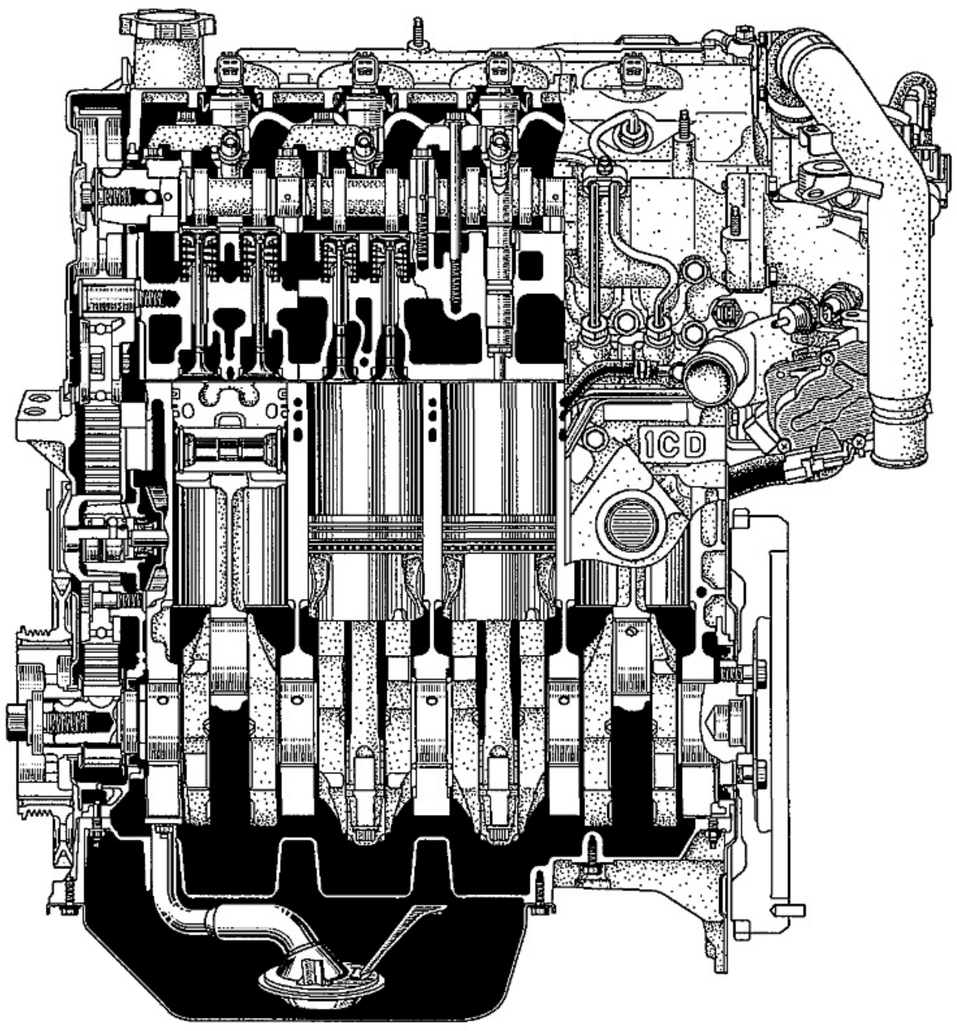
DESTINATION	ENGINE	BODY TYPE	GRADE	Manual 5-Speed E351
Europe	1CD-FTV	4-Door Sedan	LINEA TERRA	CDE110R-AEMDYW
			LINEA SOL	CDE110L-AEMNYW
		3-Door Hatchback	LINEA TERRA	CDE110 R/L -AGMDYW
			LINEA SOL	CDE110L-AGMNYW
		5-Door Liftback	LINEA TERRA	CDE110 R/L -ALMDYW
			LINEA SOL	CDE110 R/L -ALMNYW
		5-Door Wagon	LINEA TERRA	CDE110 R/L -AWMDYW
			LINER SOL	CDE110L-AWMNYW

NEW FEATURES

■1CD-FTV ENGINE

1. General

The 1CD-FTV TOYOTA D-4D (Direct injection 4 stroke common-rail Diesel engine) is in-line 4-cylinder, 2.0-liter, 16-valve DOHC turbocharged diesel engine.
This engine is based on the 1CD-FTV engine on the Avensis and adopted direct injection system and common-rail system to realize high performance, clean emission, low noise and low vibration.



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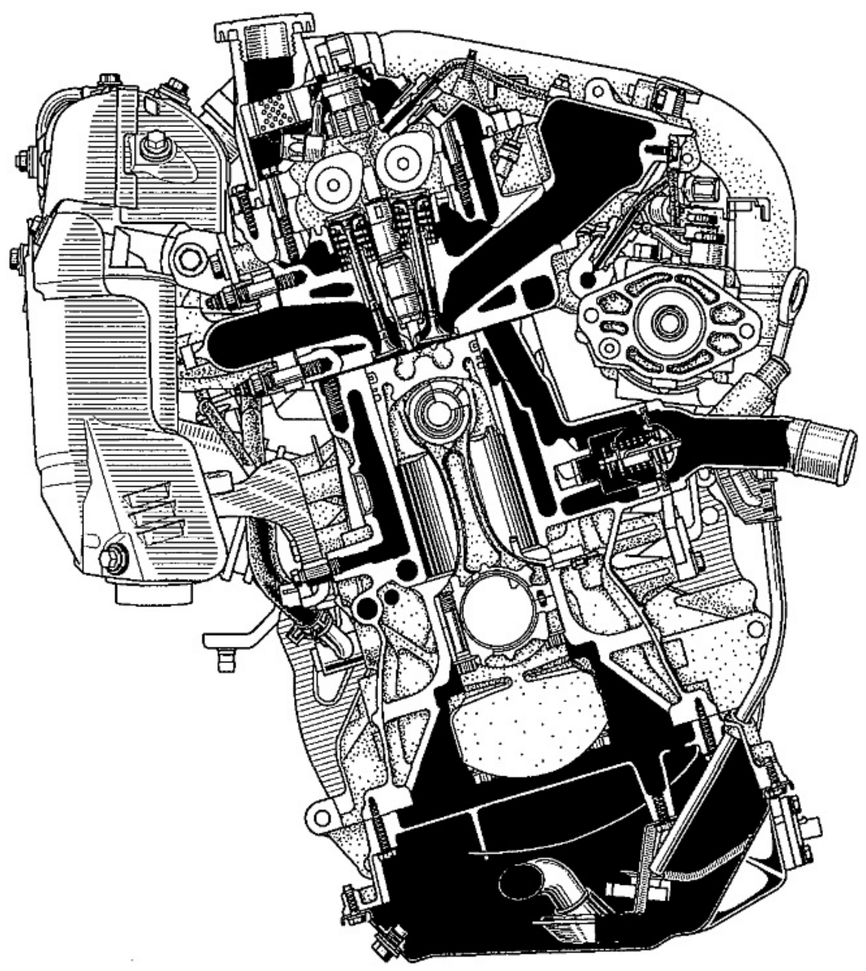
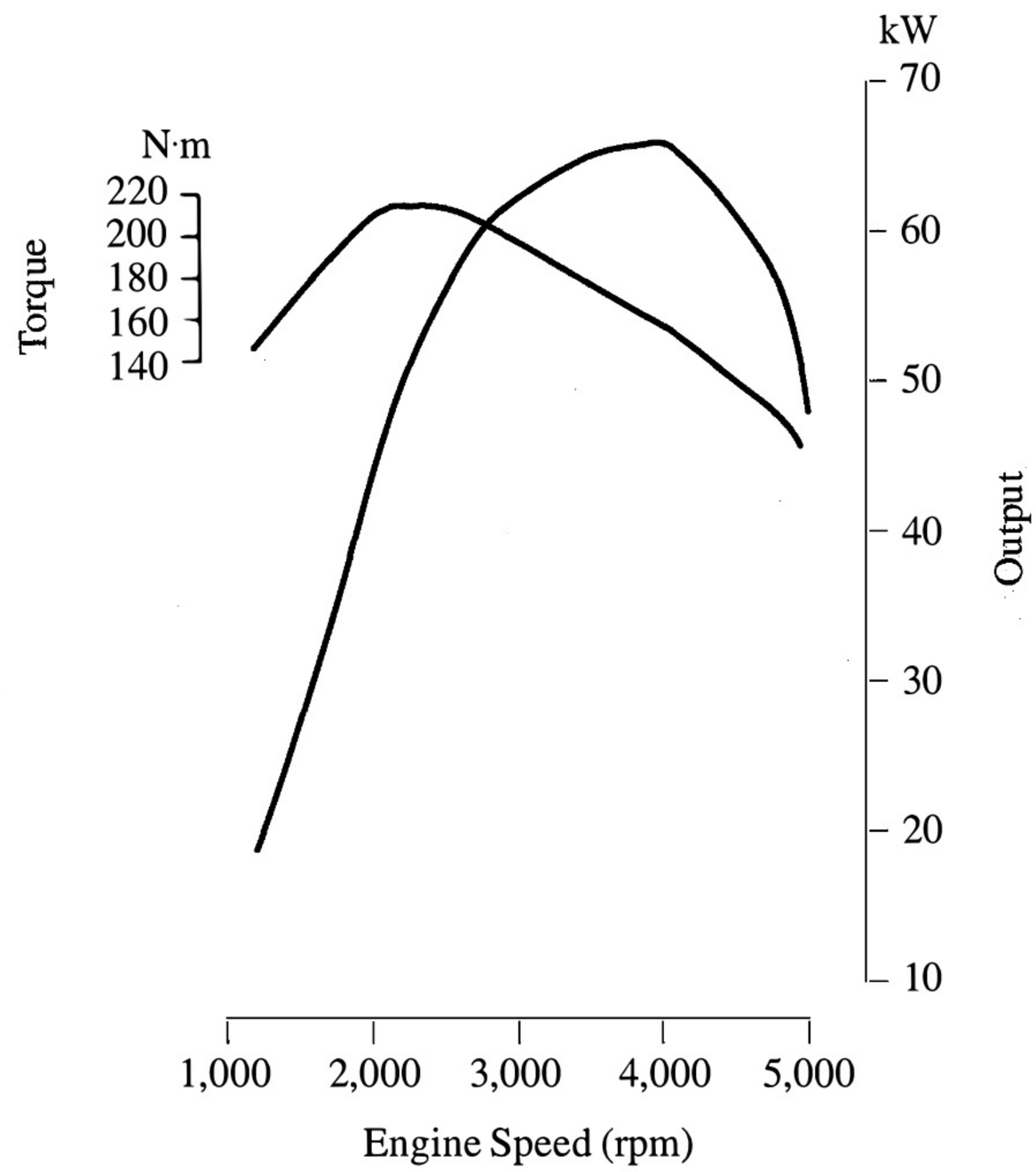


195EG95

▶ Engine Specifications ◀

Engine Type			1CD-FTV
No. of Cyls. & Arrangement			4-Cylinder, In-Line
Valve Mechanism			16-Valve, DOHC, Belt Drive
Combustion Chamber			Direct Injection Type
Manifolds			Cross-Flow
Fuel System			Common-Rail Type
Displacement cm^3 (cu. in.)			1995 (121.7)
Bore x Stroke mm (in.)			82.2 x 94.0 (3.24 x 3.7)
Compression Ratio			18.6 : 1
Max. Output [EEC]			66 kW @ 4000 rpm
Max. Torque [EEC]			215 N·m @ 2200 ~ 2400 rpm
Valve Timing	Intake	Open	2° BTDC
		Close	31° ABDC
	Exhaust	Open	51° BBDC
		Close	0° ATDC
Fuel Cetan Number			52 or more
Oil Grade			CF-4 10W-30

▶ Performance Curve ◀



195EG100

2. Features of 1CD-FTV Engine

The 1CD-FTV engine has been able to achieve the following performance through the adoption of the items listed below.

(1) High performance and fuel economy

(2) Low noise and vibration

(3) Light weight and compact design

(4) Good serviceability

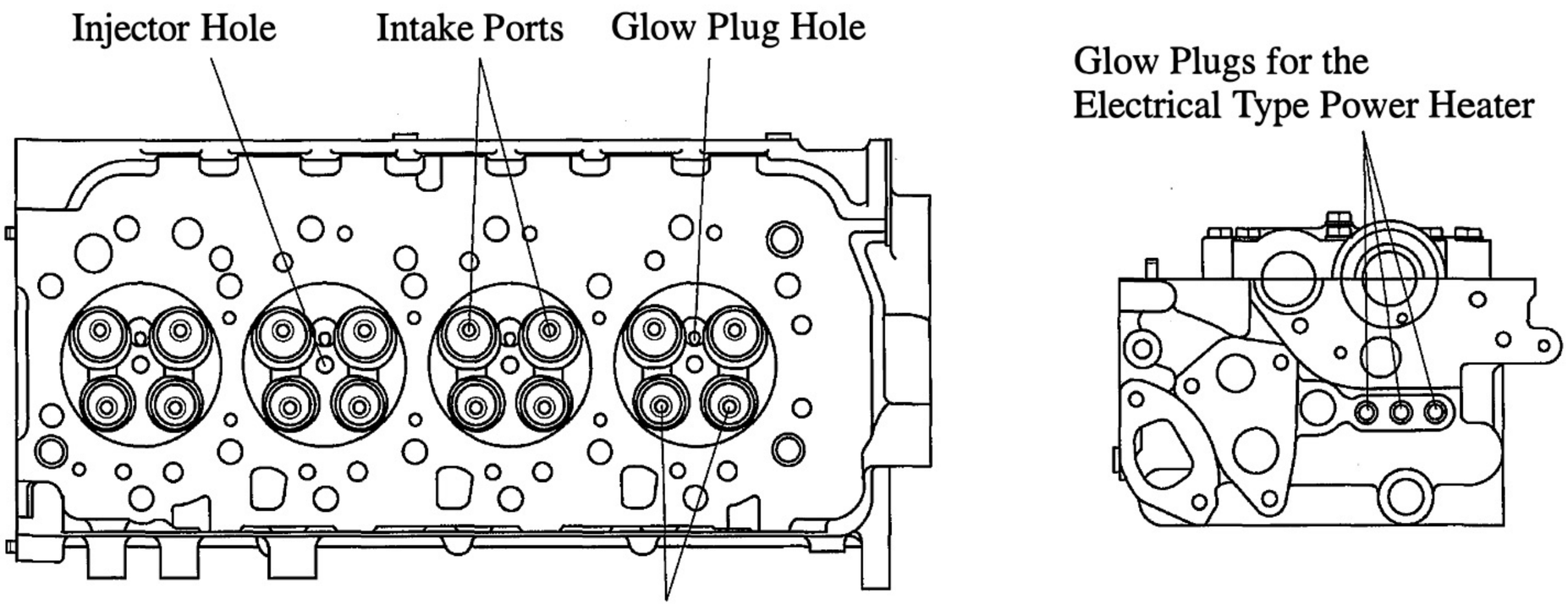
(5) Clean emission

Item	(1)	(2)	(3)	(4)	(5)
Cylinder head cover and cylinder head are made of aluminum.			○		
Cylinder block inner and outer walls have been optimally reinforced.		○	○		
Crankshaft strength and precision have been improved.	○	○	○		○
Crankshaft pulley has adopted a torsional damper.		○			
Oil pan is made of aluminum. No.2 oil pan is made of anti-rust and vibration-damping steel plate.		○			
A common-rail type fuel injection system is used.	○	○			○
A pilot injection control system is used.	○	○			○
Injector is provided in the bore center to improve its air utilization rate.	○				○
Piston provided with combustion chamber has been adopted in conjunction with the adoption of direct injection.	○				○
A compact turbocharger is used.	○		○		○
A camshaft is driven by a timing belt and gear.		○	○		
Engine mount shape and characteristic have been optimized.		○			
Diesel throttle and air flow meter are used.	○	○			○
An automatic tensioner is provided for the timing belt.				○	
An oil level sensor is used.				○	
An EGR and a manifold converter are used.					○
Engine coolant drain cock has been provided in the cylinder block.				○	
A catch plate has been provided for recovering the oil that drips during oil filter replacement.				○	

3. Engine Proper

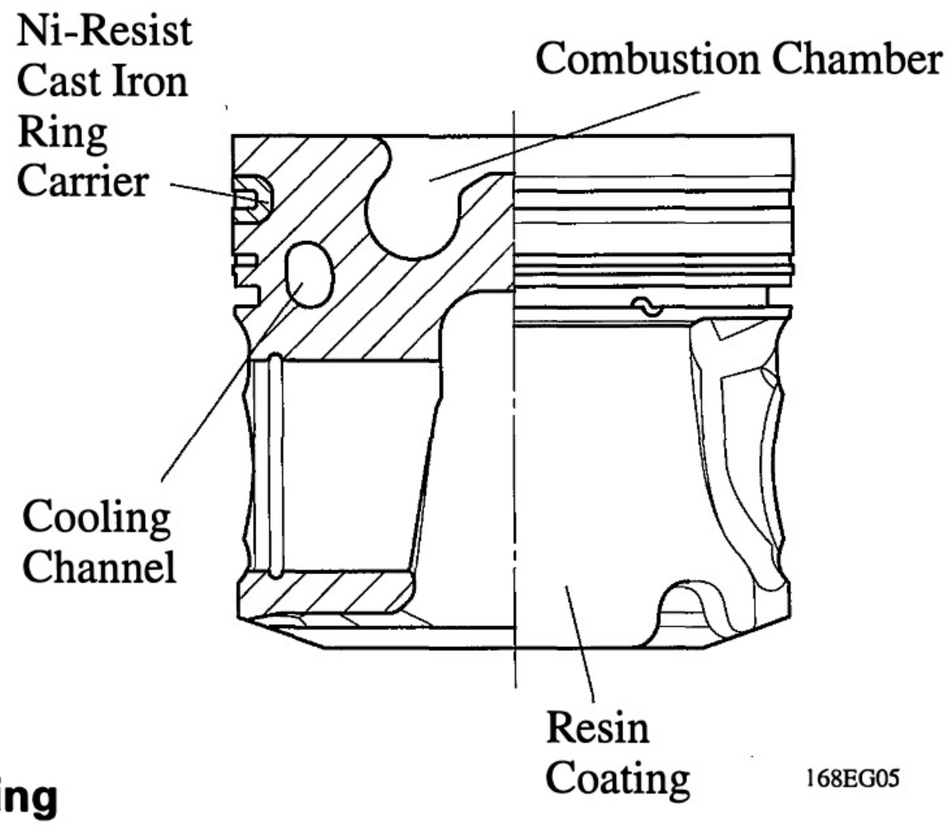
Cylinder Head

- The cylinder head is made of aluminum.
  The injector has been located in the center of the combusion chamber in order to improve engine performance and clean emission.
- A glow plug is placed between the intake ports of each cylinder to ensure startability.
- Glow plugs for the electrical type power heater system have been installed on the back end of the cylinder head.



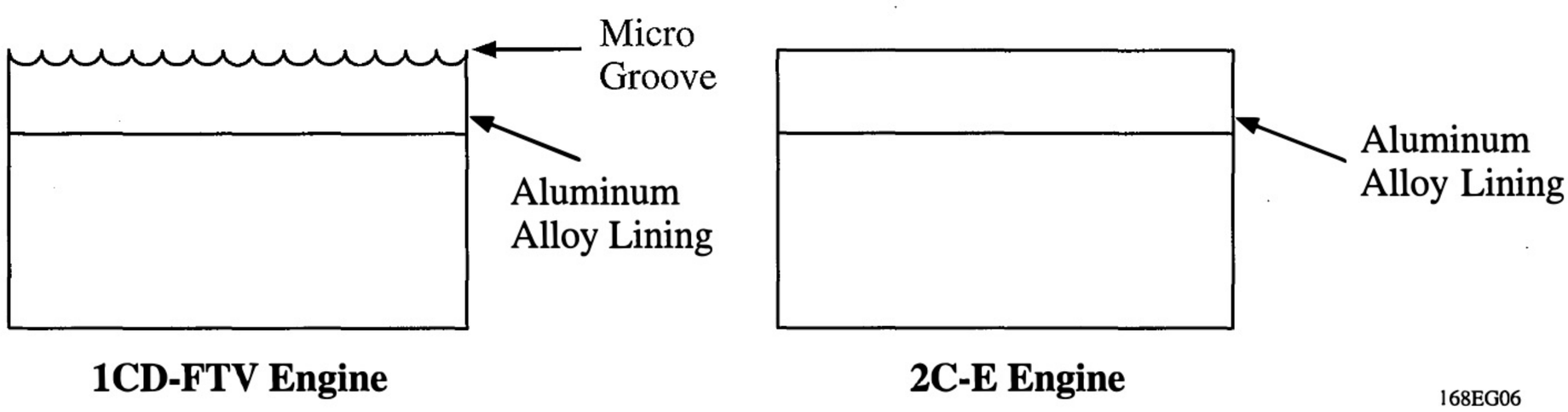
Piston

- In conjunction with the adoption of direct injection, piston provided with combustion chamber has been adopted.
- The piston is made of aluminum alloy.
- A cooling channel has been provided to reduce the piston temperature.
- To improve the wear resistance of the top ring groove, a Ni-resist cast iron ring carrier has been adopted.
- Along with the improved engine performance, the piston skirt has been applied with resin coating to reduce friction loss.



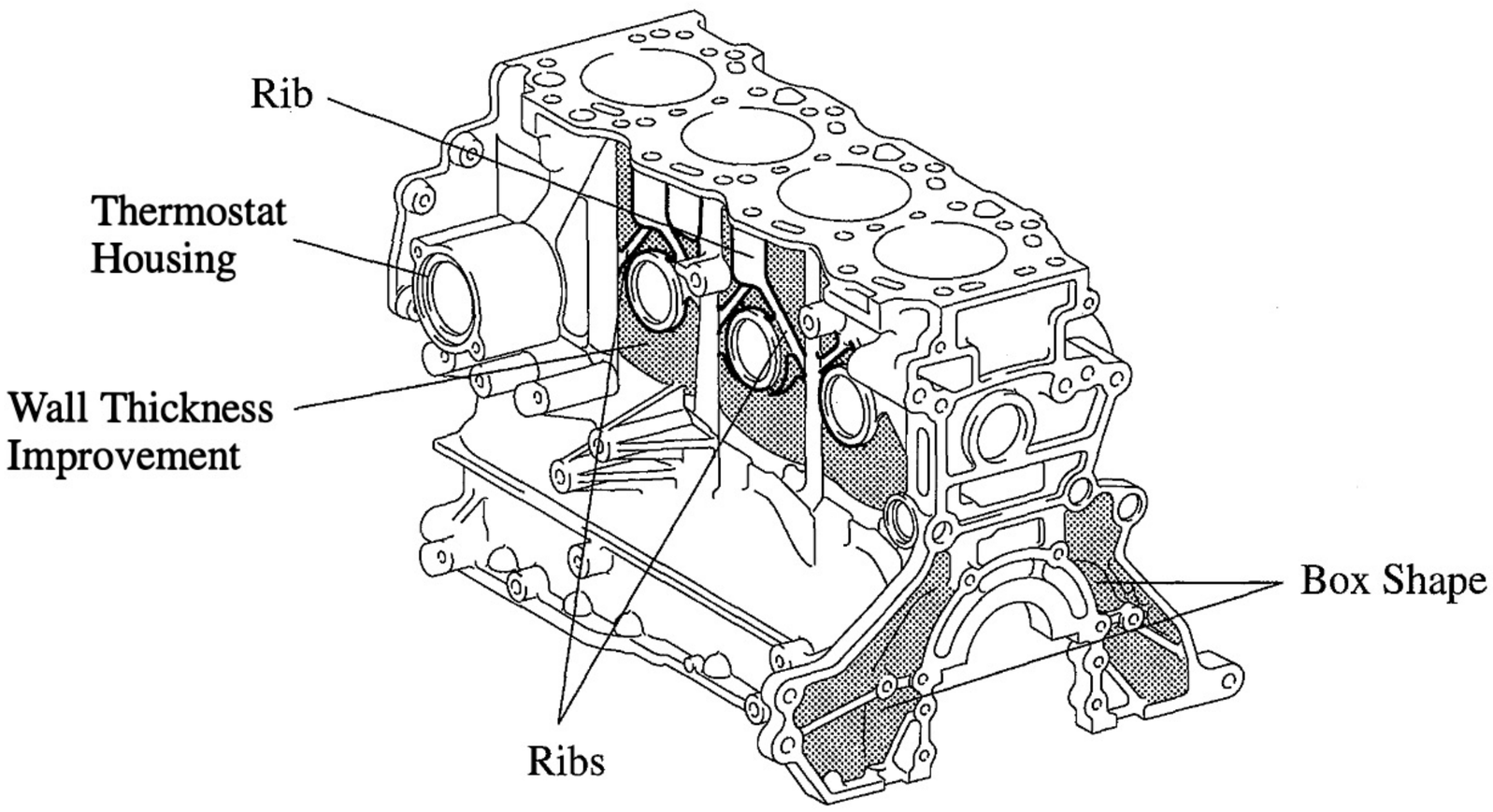
Connecting Rod Bearing & Crankshaft Bearing

To improve the conformance with the shaft and the retention of engine oil, microgroove bearings that have fine grooves on the bearing surface have been adopted.



Cylinder Block

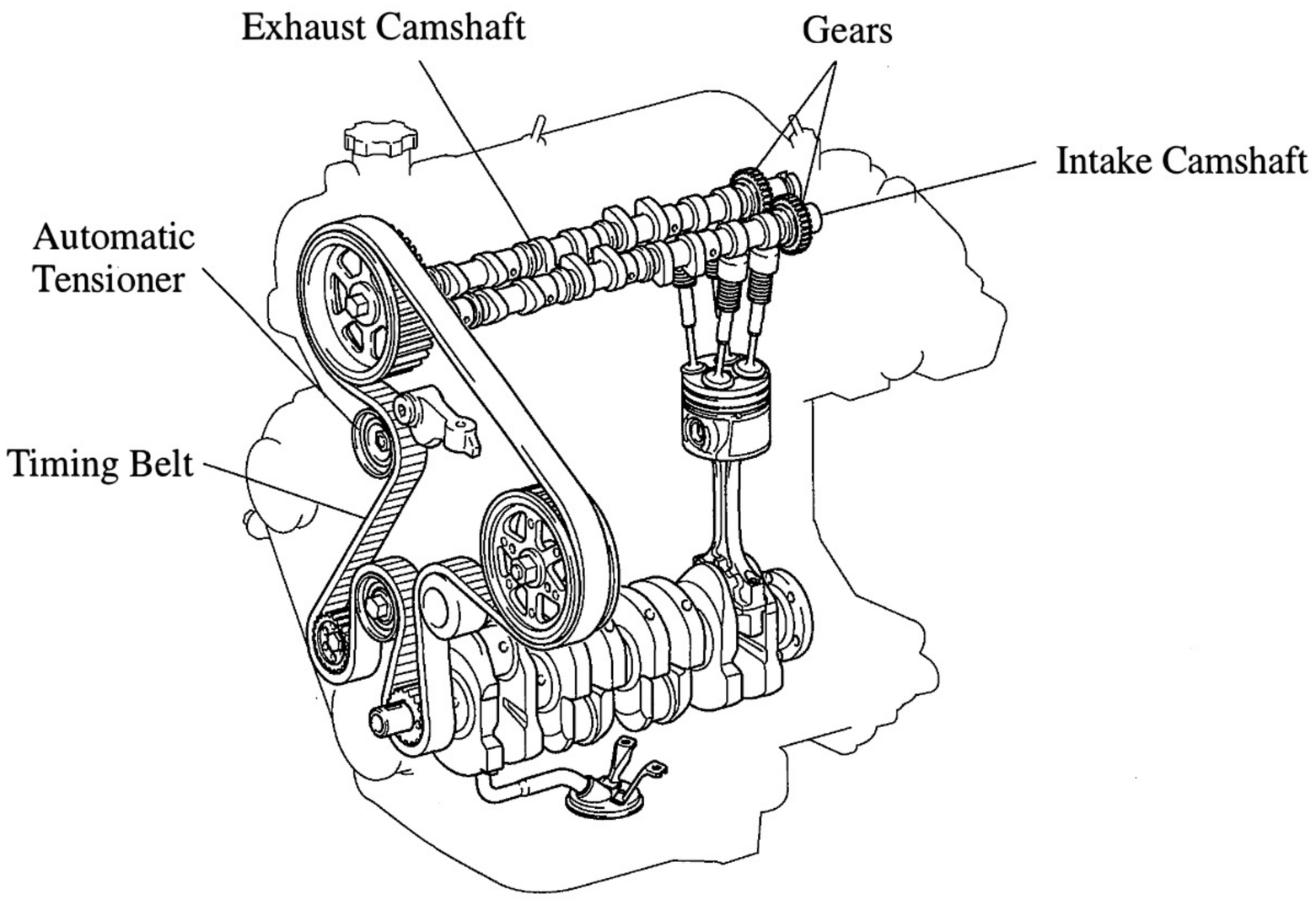
- By the adoption of the rib and implementation of the wall thickness improvement for the cylinder block, optimal strength is secured.
- By making the rear surface of the cylinder block in a box shape, thus aimed to improve low vibration, high rigidity and light weight.
- In order to deal with the increase of timing belt tension, a bushing is pressed in to the oil pump housing, and thus improved the reliability by setting the bearings of the oil pump rotor at two positions of the front and rear.
- By expanding the thermostat housing and reducing the water flow resistance, thus improved the cooling performance.



195EG73

4. Valve Mechanism

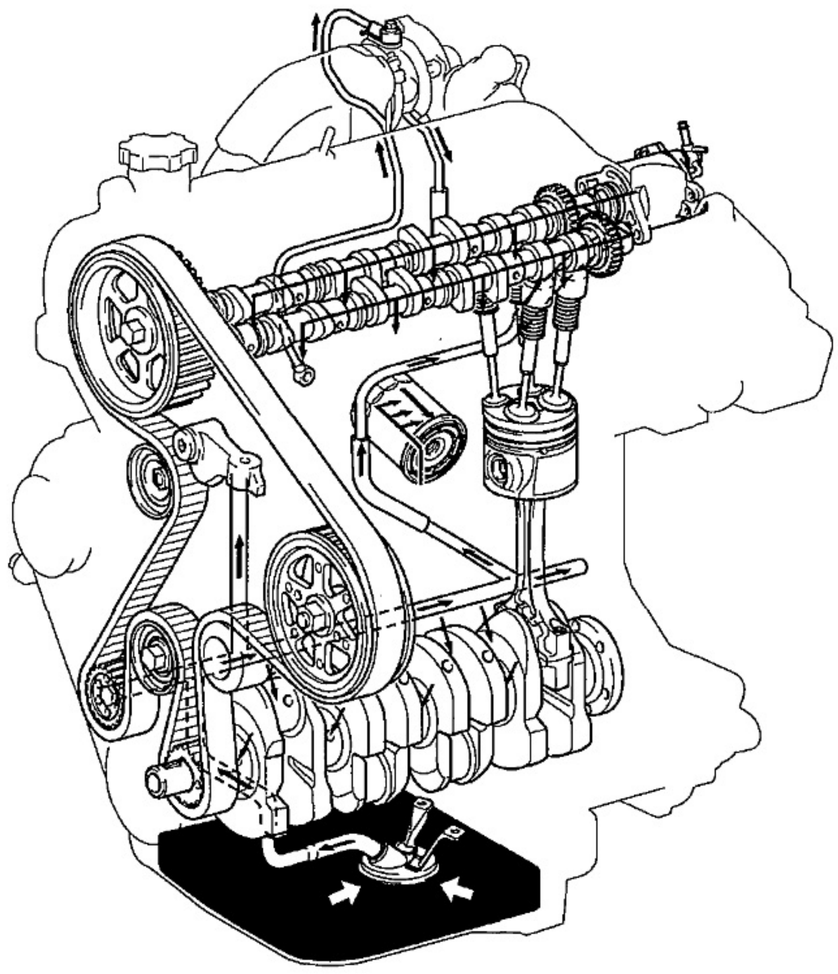
- Each cylinder has 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency is increased by means of the larger total port areas.
- The valves are directly opened and closed by 2 camshafts.
- The exhaust camshaft is driven by a timing belt, while the intake camshaft is driven through gear on the exhaust camshaft.
- Small-diameter, and flat-teeth gears are used for driving the intake camshaft in order to reduce gear noise.



168EG08

5. Lubrication System

- The lubrication circuit is fully pressurized and all oil passes through an oil filter.
- A trochoid gear type oil pump is driven by timing belt.
- The water-cooled type engine oil cooler is used to lower the oil temperature.
- To extend the oil maintenance intervals, an oil filter with a larger capacity and containing twin filter elements has been adopted.
- A catch plate has been provided for recovering the oil that drips during oil filter replacement.



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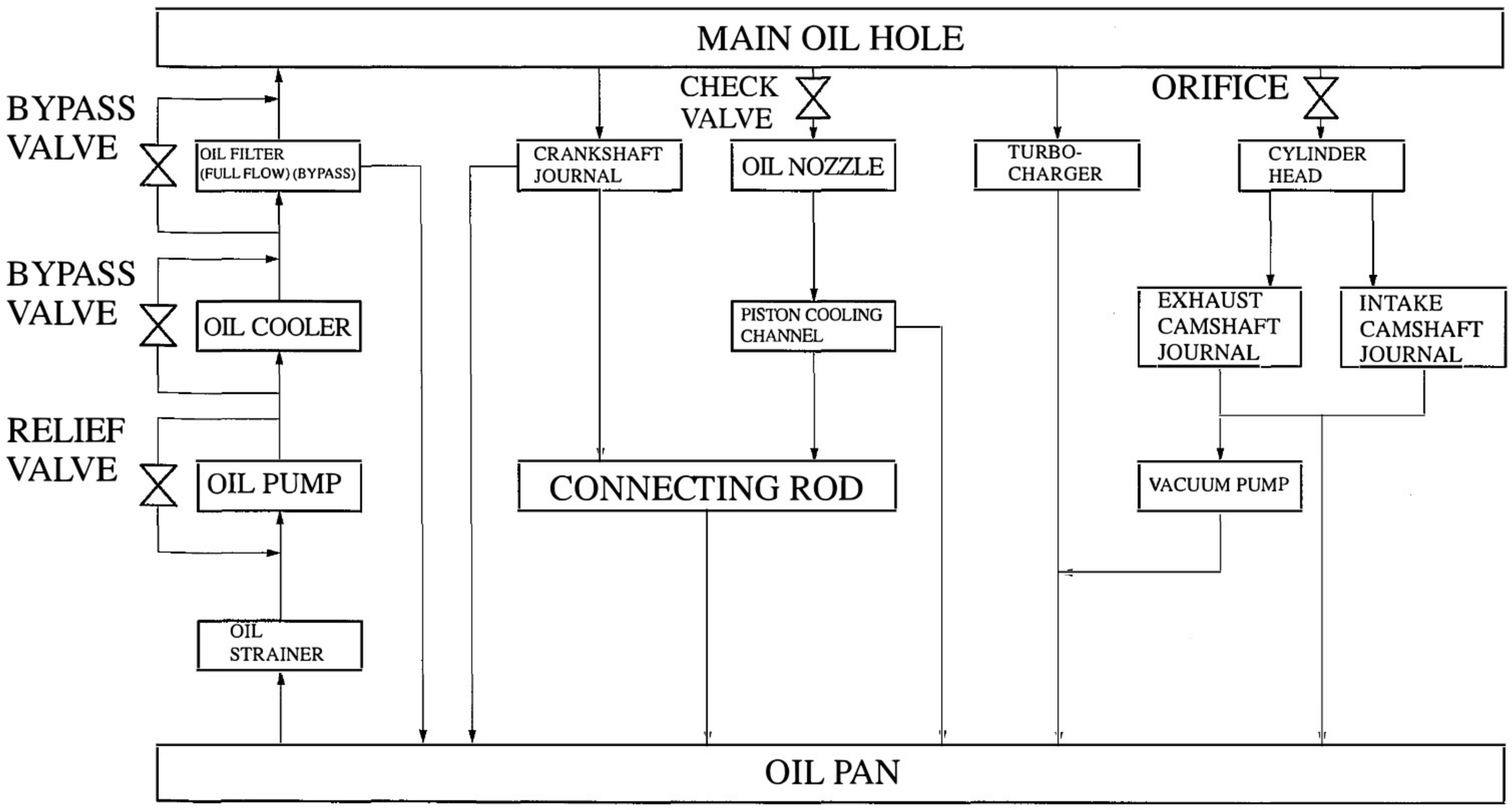
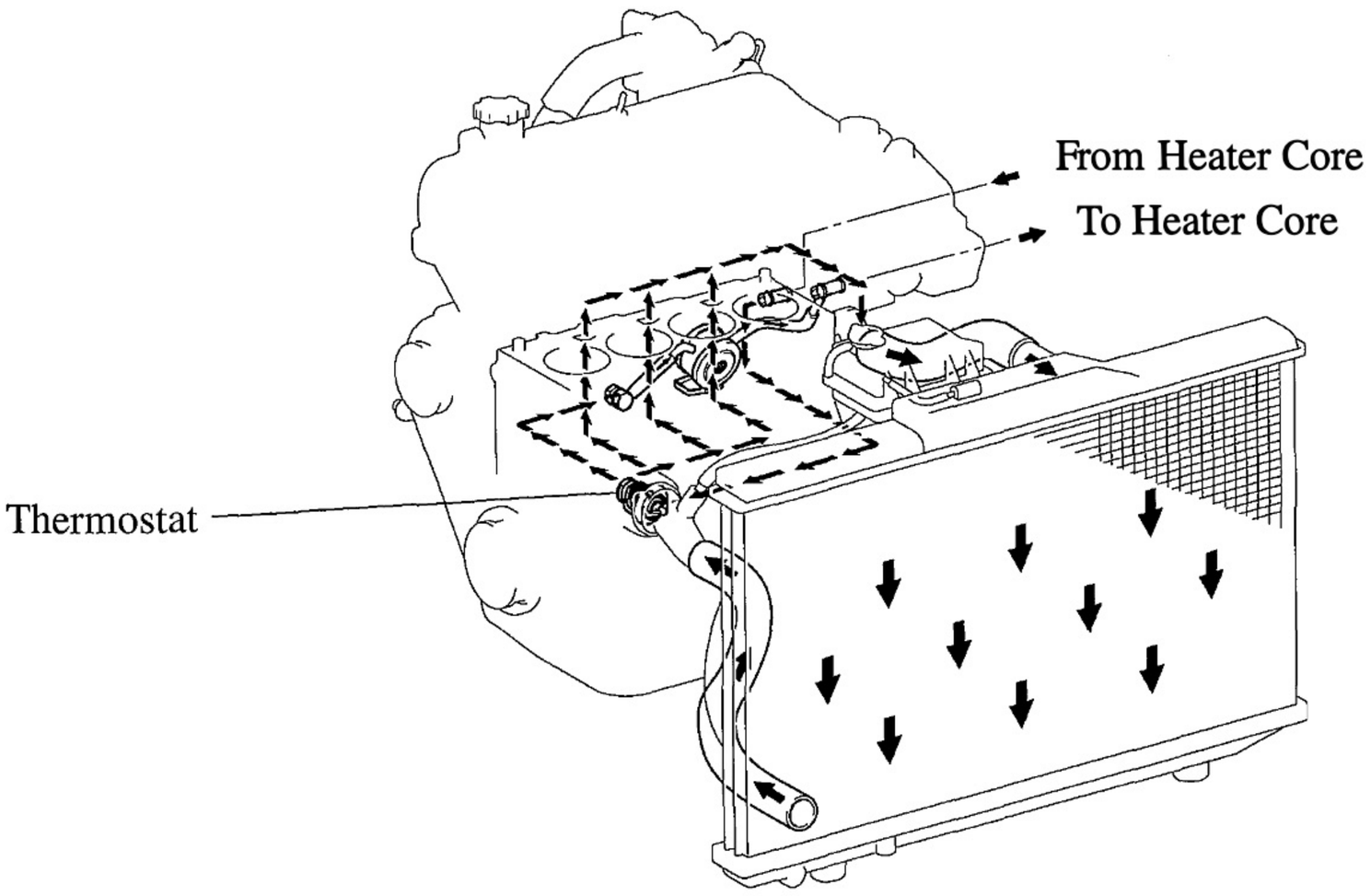


168EG10

6. Cooling System

- The cooling system is a pressurized, forced-circulation type.
- A pressurized reservoir tank has been adopted to prevent the engine coolant from deteriorating upon contact with external air.
- An aluminum radiator core is used for weight reduction.



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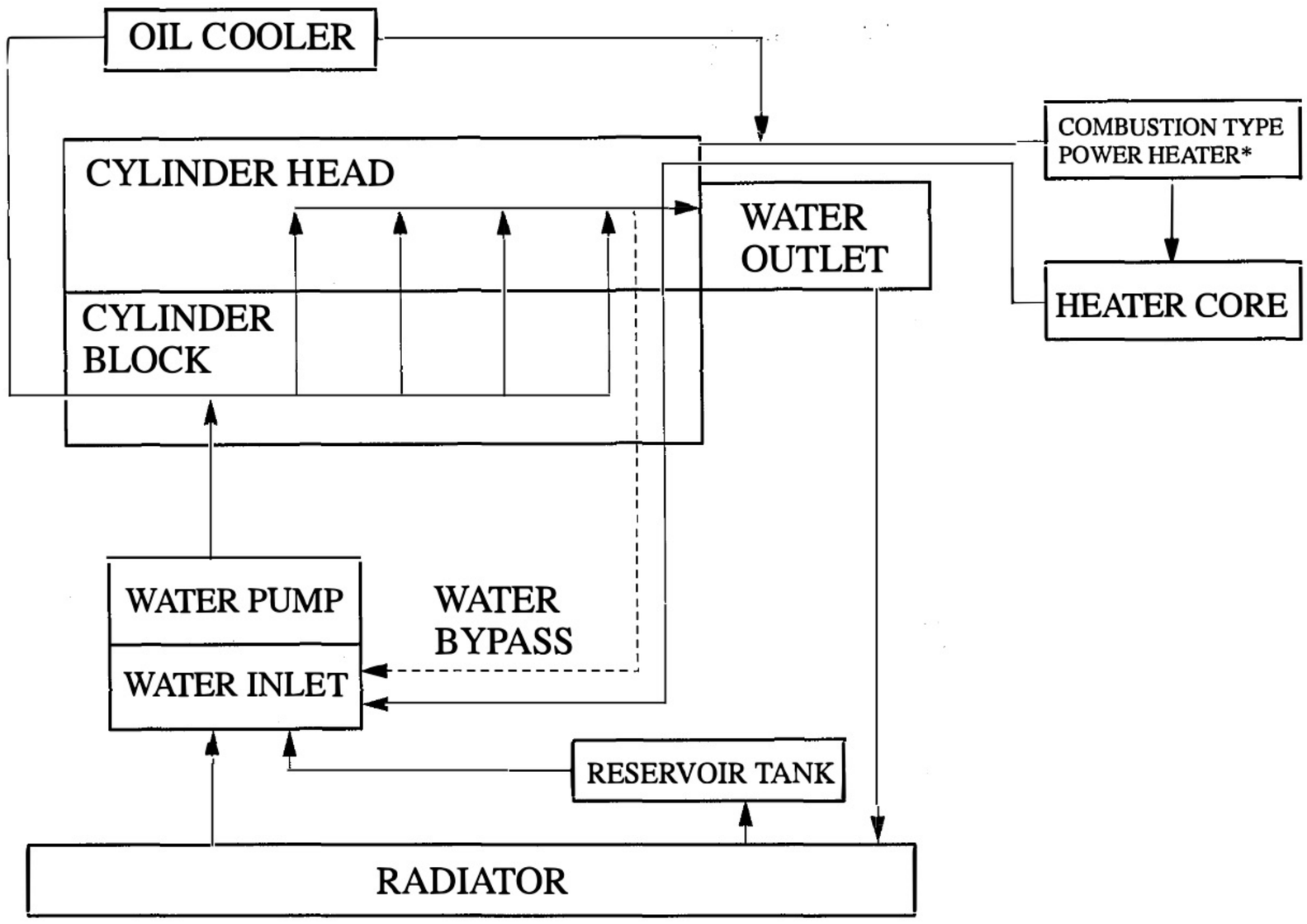


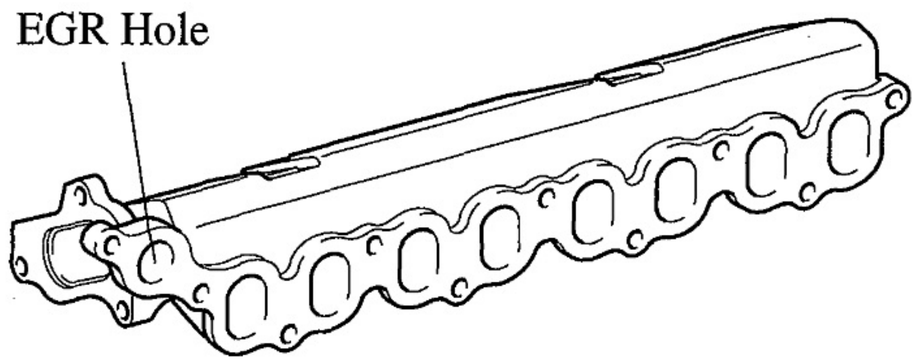
195EG97

*: With Combustion Type Power Heater

7. Intake and Exhaust System

Intake Manifold

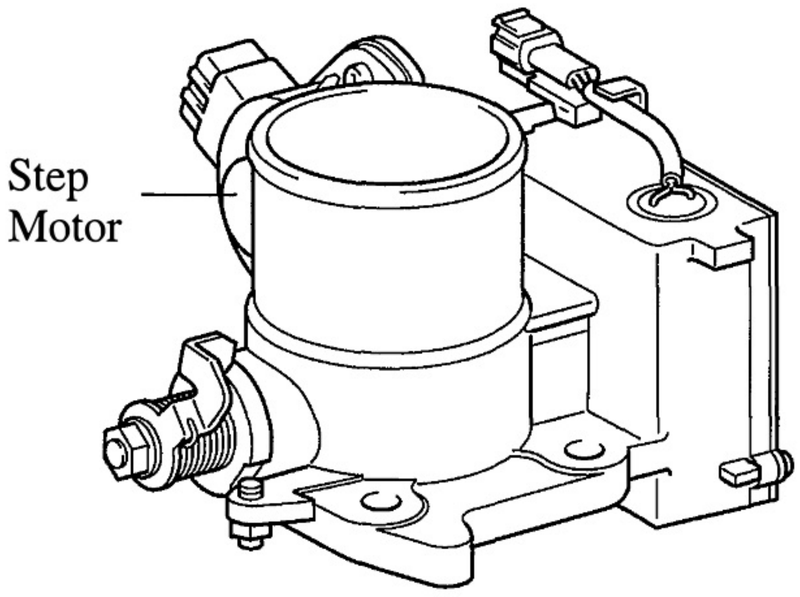
- In conjunction with the adoption of the direct injection system, an intake manifold provided with an air intake chamber has been adopted in order to reduce the swirl variances between the cylinders.
- A hole for introducing the EGR gas has been adopted in the air intake chamber.



168EG13

Diesel Throttle

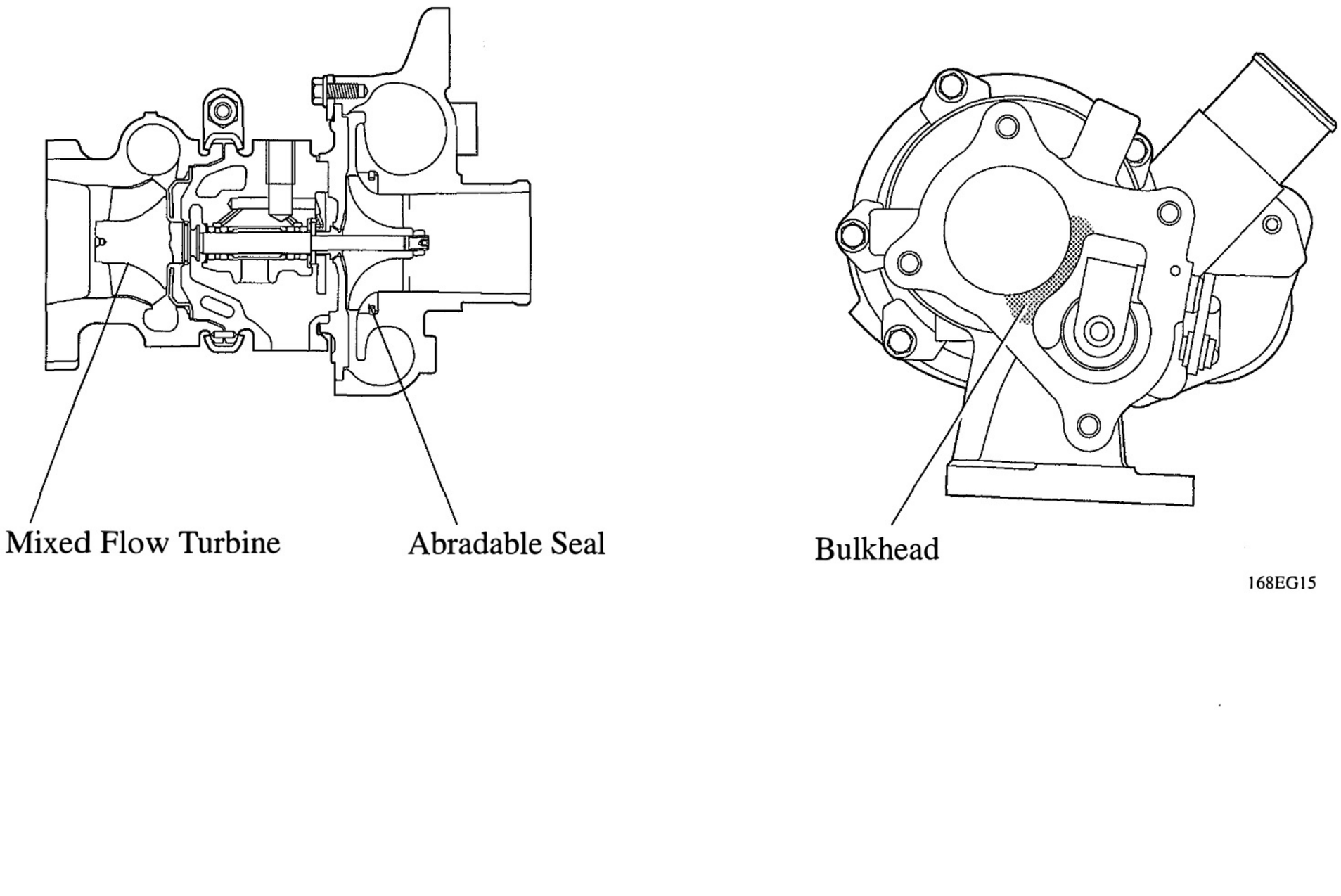
A step motor type throttle has been adopted to improve EGR performance and to reduce the vibration when stopping the engine.



168EG14

Turbocharger

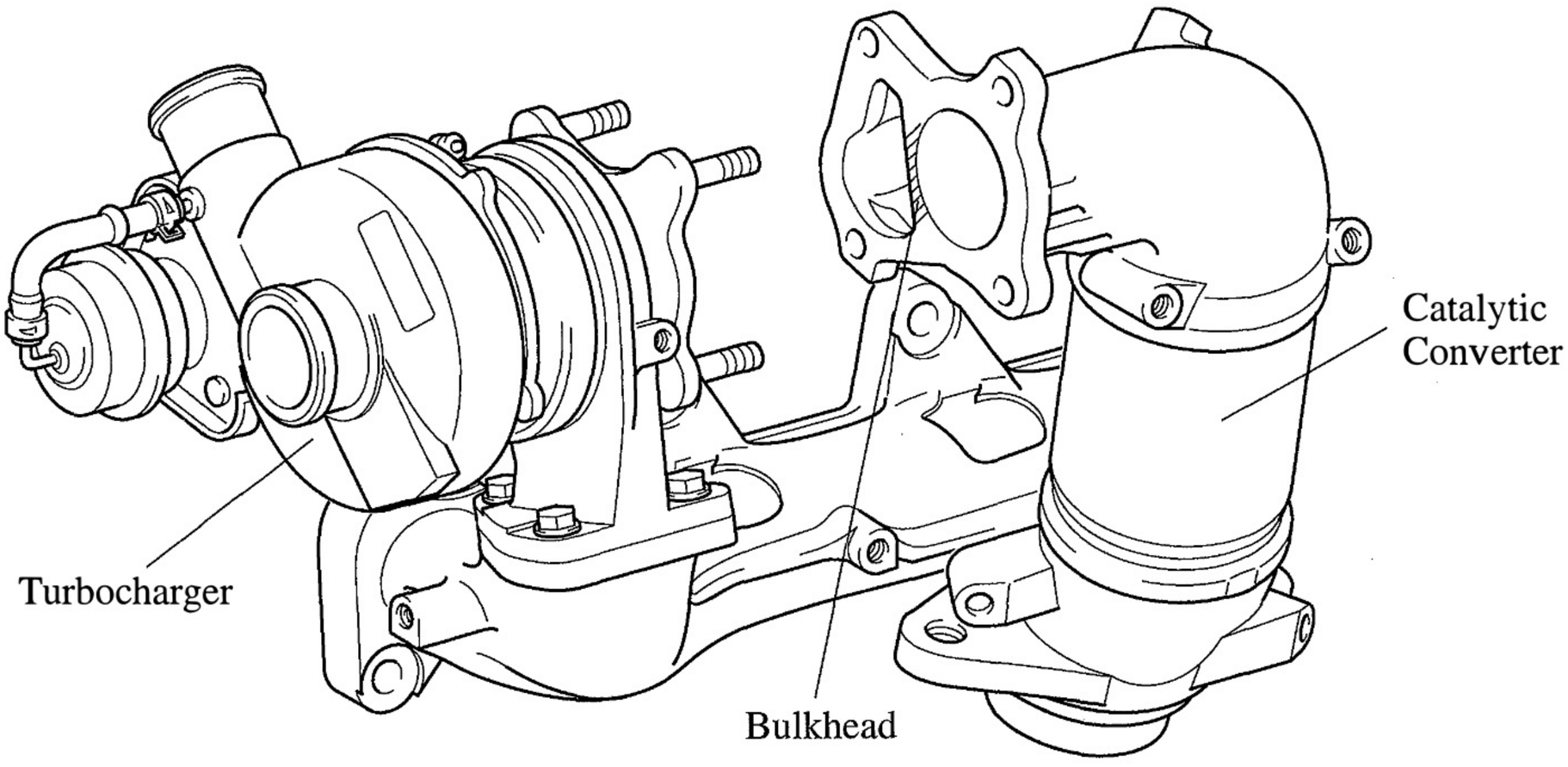
- An insert type abradable seal has been adopted in the compressor housing in order to improve turbocharging efficiency.
- A mixed flow turbine has been adopted to accommodate the high boost pressure despite its compact size.
- A bulkhead has been provided at the outlet of the turbine housing to prevent exhaust gas interference.



168EG15

Catalytic Converter

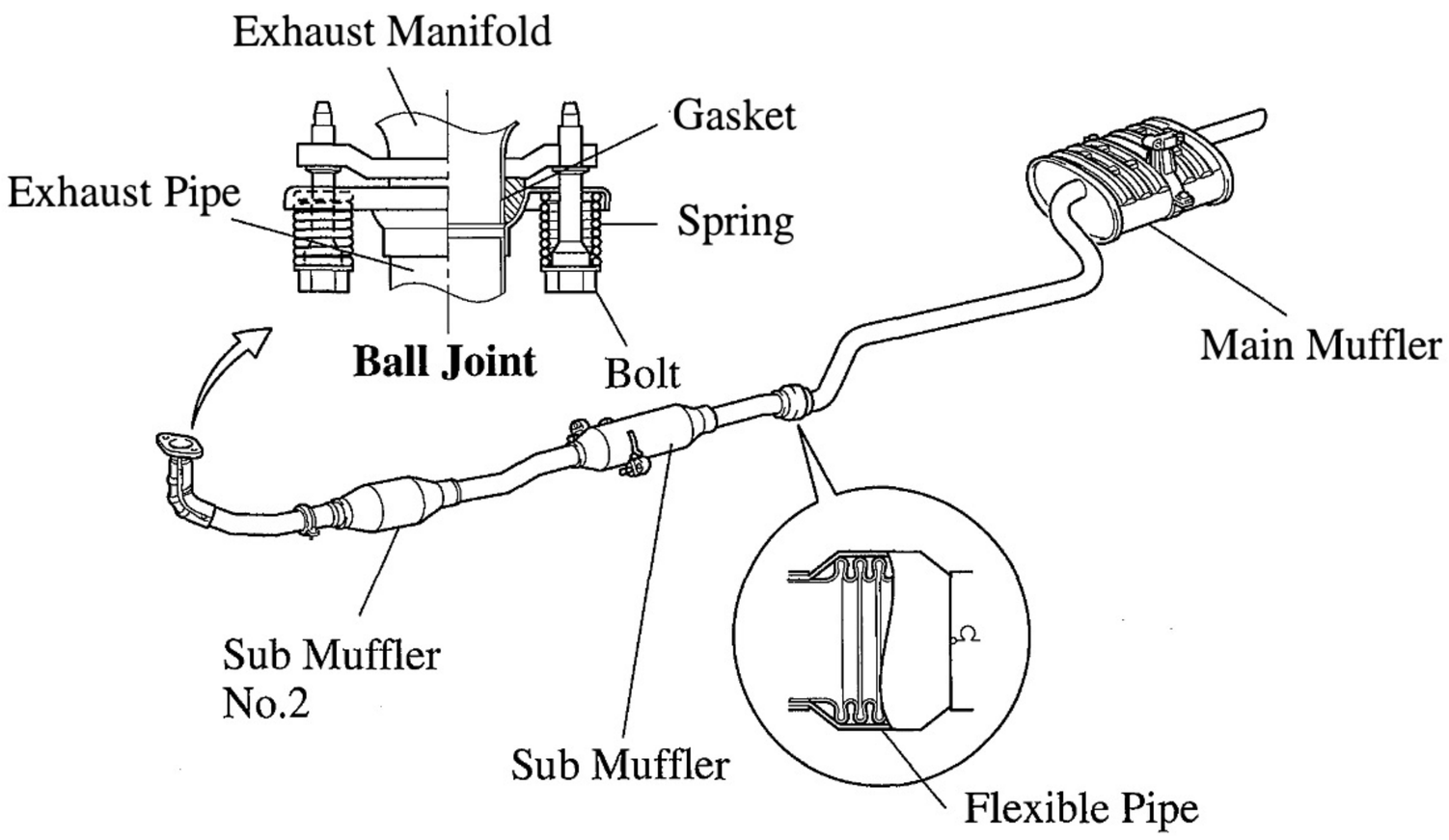
- The bulkhead of the turbine housing has been extended to the inside of the catalytic converter in order to prevent exhaust gas interference and reduce exhaust pressure.
- The catalytic converter has been placed immediately after the turbocharger to reduce CO and HC.



195EG98

Exhaust Pipe

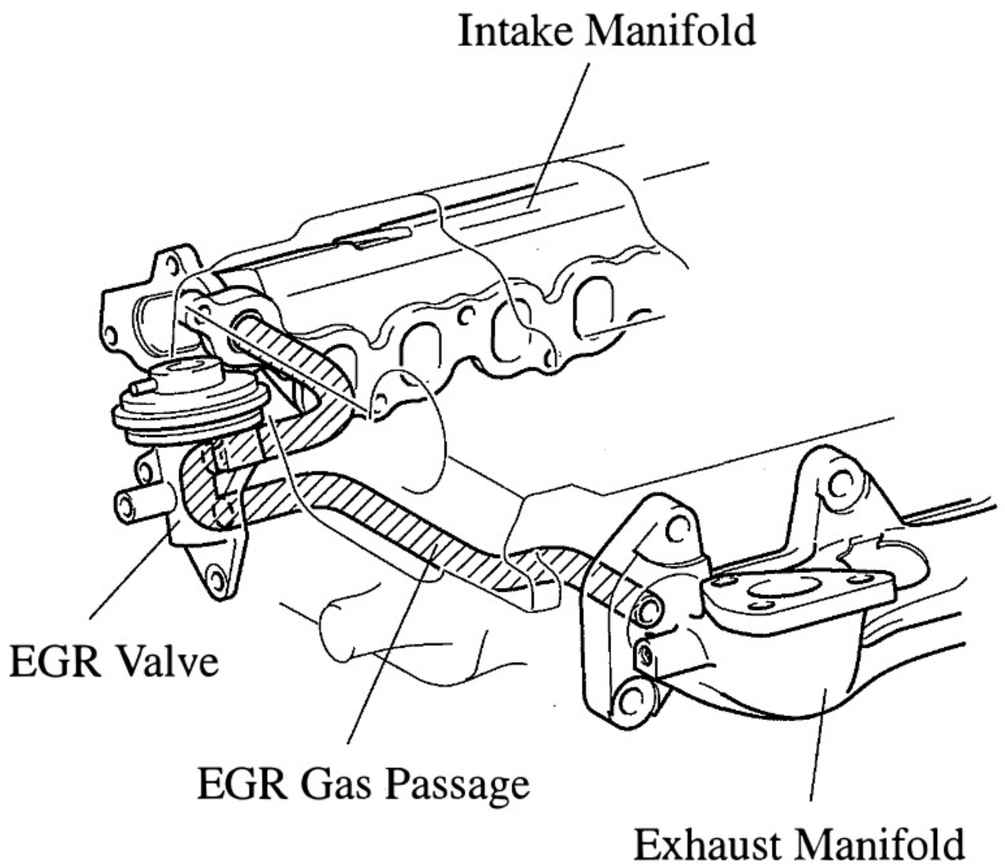
- The exhaust manifold is connected to the exhaust pipe by a ball-joint, making the exhaust pipe configuration simpler and lighter.
- Flexible pipe is adopted between the sub muffler and the main muffler, thus the reduction of noise and vibration and the improvement of the strength have been realized.



195EG78

EGR

By cooling the exhaust gas with the EGR gas passage created inside the cylinder head, EGR performance has been improved and the purging of exhaust gas has been realized.



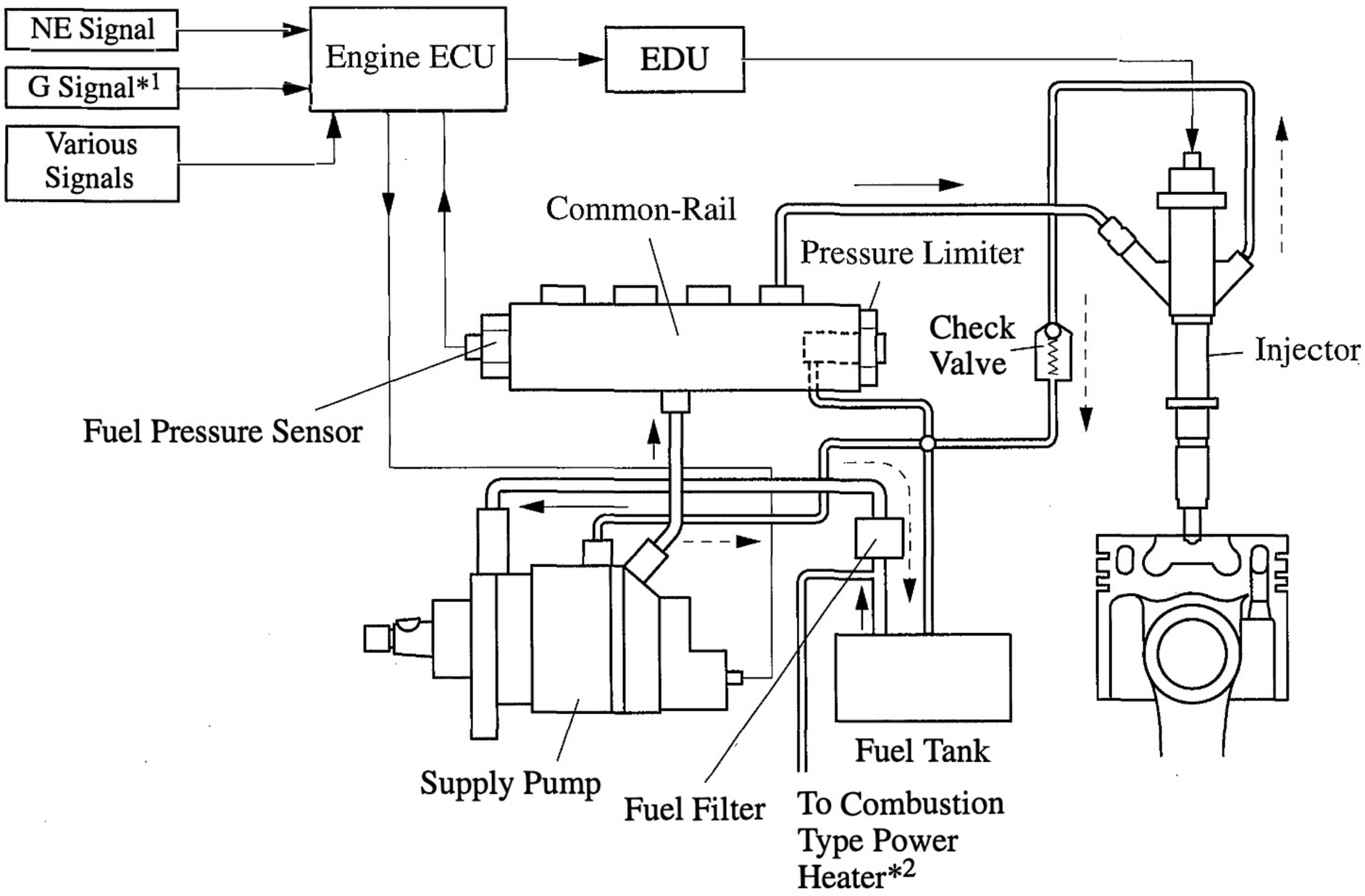
168EG17

8. Fuel System

General

- A common-rail type fuel injection system has been adopted in the fuel system of the 1CD-FTV engine.
- Consisting of a supply pump, common-rail, electric control injector, and fuel pipe, this system effects optimal control for combustion by controlling the fuel pressure, injection volume, and the injection timing via the engine ECU and EDU (Electronic Driver Unit).

▶ System Diagram ◀

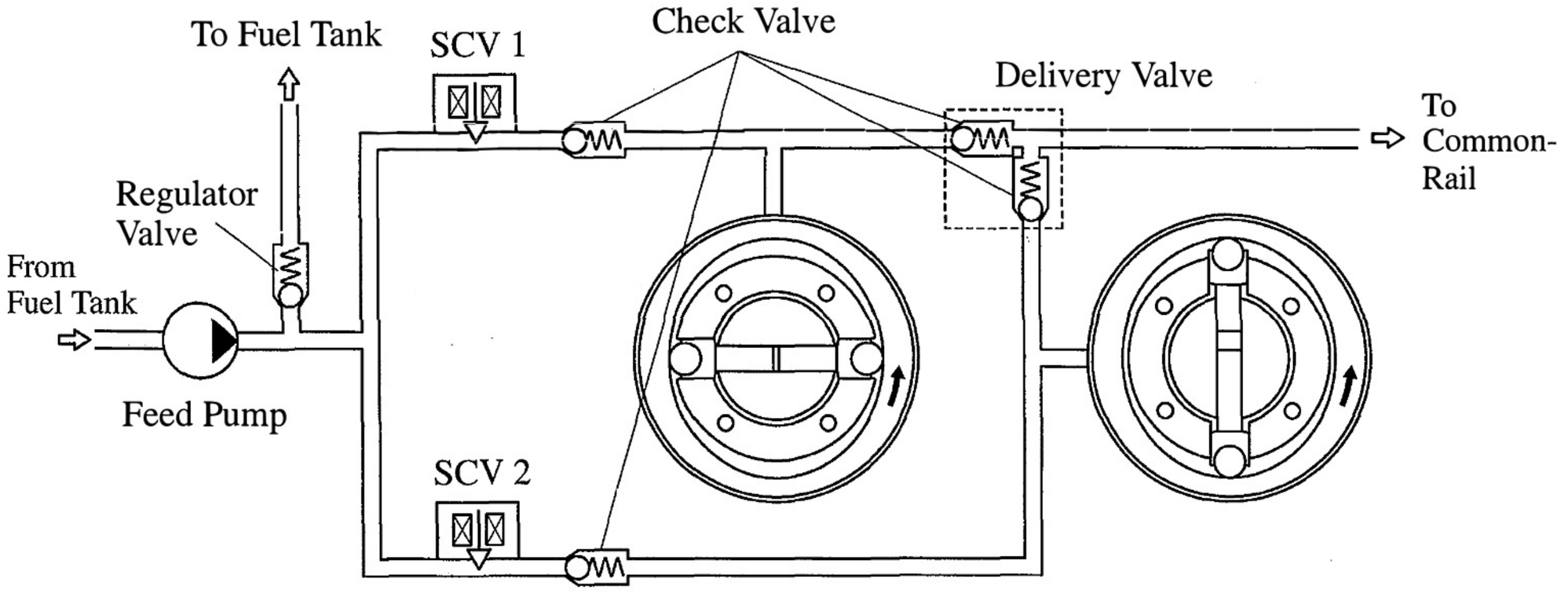


*1: Camshaft Angle Signal
*2: With Combustion Type Power Heater

Supply Pump

1) General

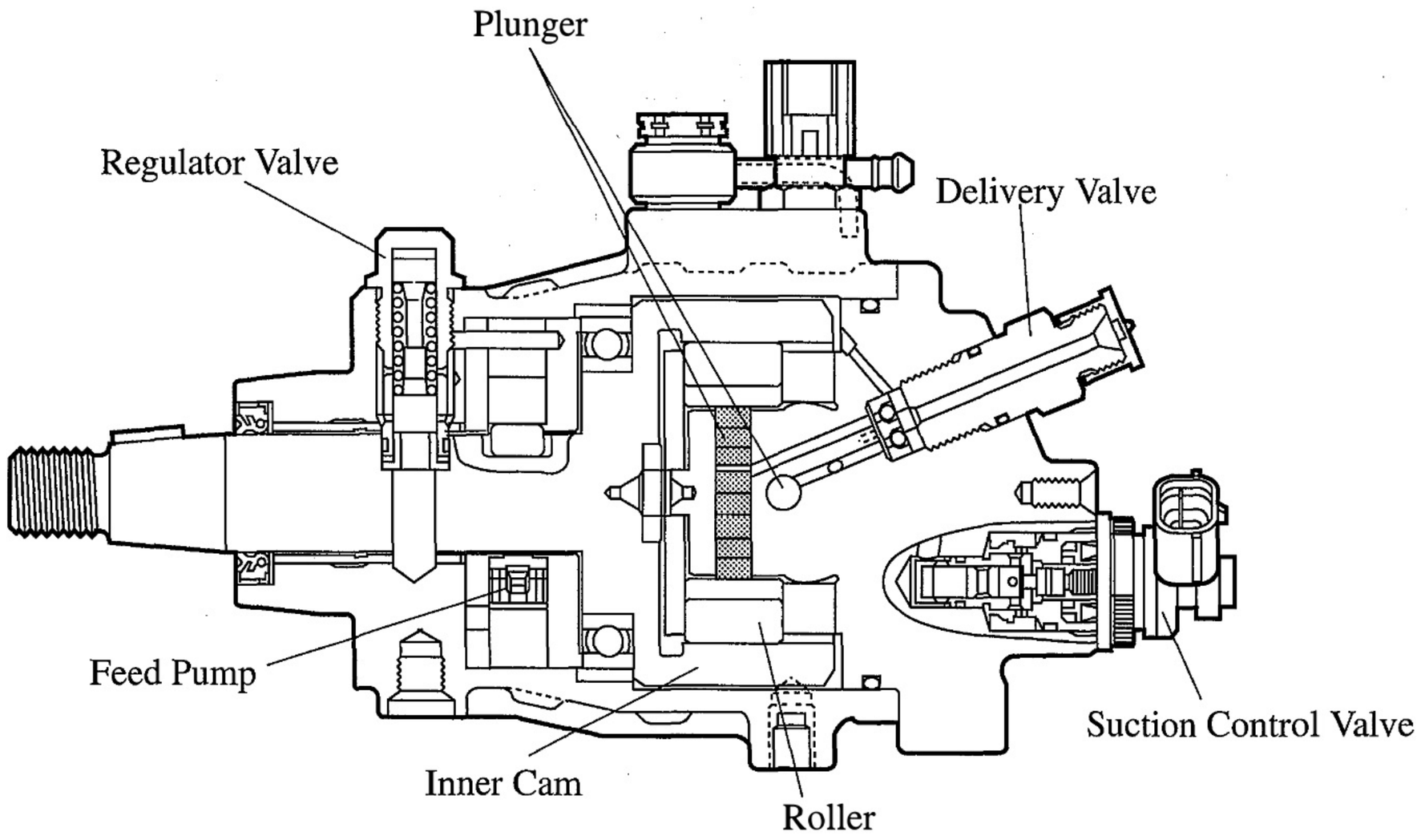
- An electric control type supply pump has been adopted for the common-rail system.
- The supply pump is a tandem type that have two functions of fuel suction and fuel delivery. This pump achieves both the high-pressure pumping of fuel and the reduction of driving torque fluctuation.
- An SCV (Suction Control Valve) that controls the amount of fuel drawn in supply pump during the suction stroke has been adopted.



168EG19

2) Construction

The supply pump consists of an inner cam, roller, and plunger.



195EG103

3) Operation

In its oval-shaped inner cam, this pump contains two systems of plungers, each repeating its respective suction and pumping function.

As shown in Fig.1 below, plunger A becomes positioned at the shorter diameter of the inner cam. The suction stroke starts as plunger A expands with the fuel pressure created by the feed pump. Meanwhile, plunger B becomes positioned at the longer diameter of the inner cam. The pumping stroke starts as plunger B is pushed by the inner cam.

As the inner cam rotates further, and assumes the position shown in Fig.2 below, plunger A becomes positioned at the longer diameter of the inner cam. The pumping stroke starts as plunger A is pushed by the inner cam. Meanwhile, plunger B becomes positioned at the shorter diameter of the inner cam. The suction stroke starts as plunger B expands with the fuel pressure created by the feed pump.

The suction and pumping of fuel is effected by repeating these strokes.

However, because the volume of fuel drawn in by the plunger is regulated by the engine ECU via SCV, the plunger stops upon having drawn in the regulated amount of fuel. Thereafter, the inner cam resumes pumping. To regulate the volume of fuel drawn in by the plunger, the engine ECU calculates the target common-rail pressure in accordance with the vehicle driving conditions and controls the SCV (Suction Control Valve) so that the target fuel pressure is achieved by the output of the fuel pressure sensor.

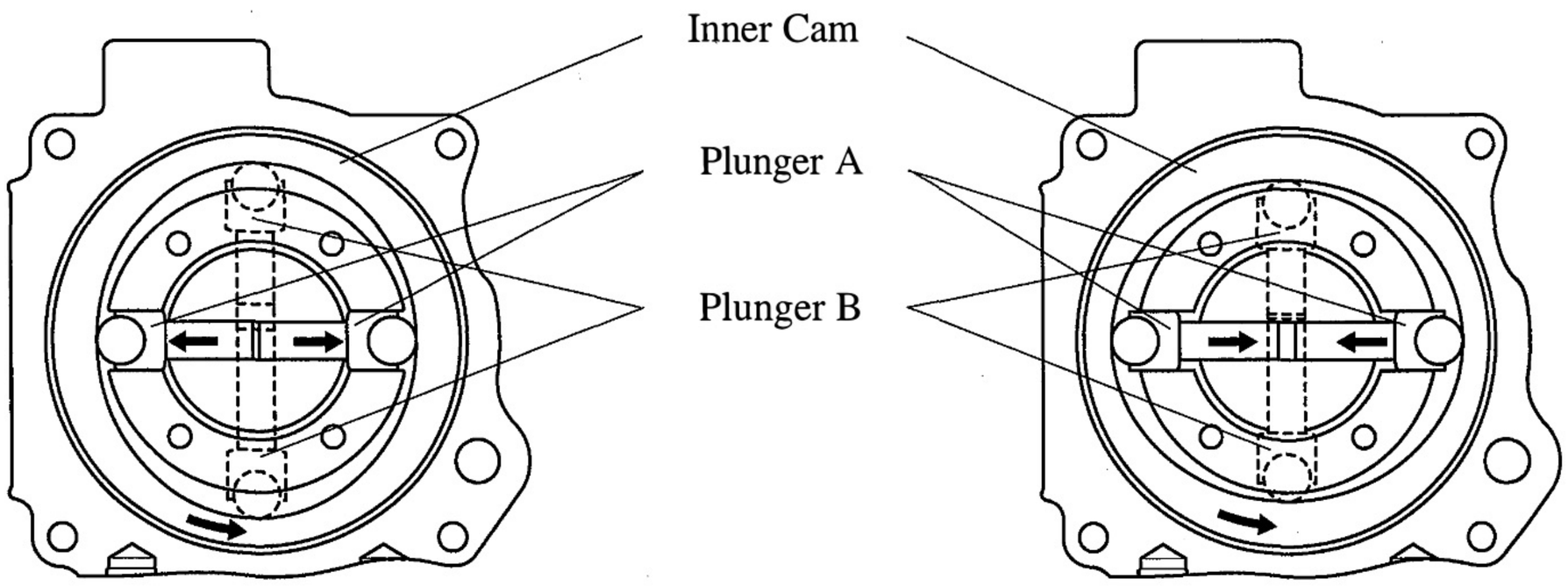


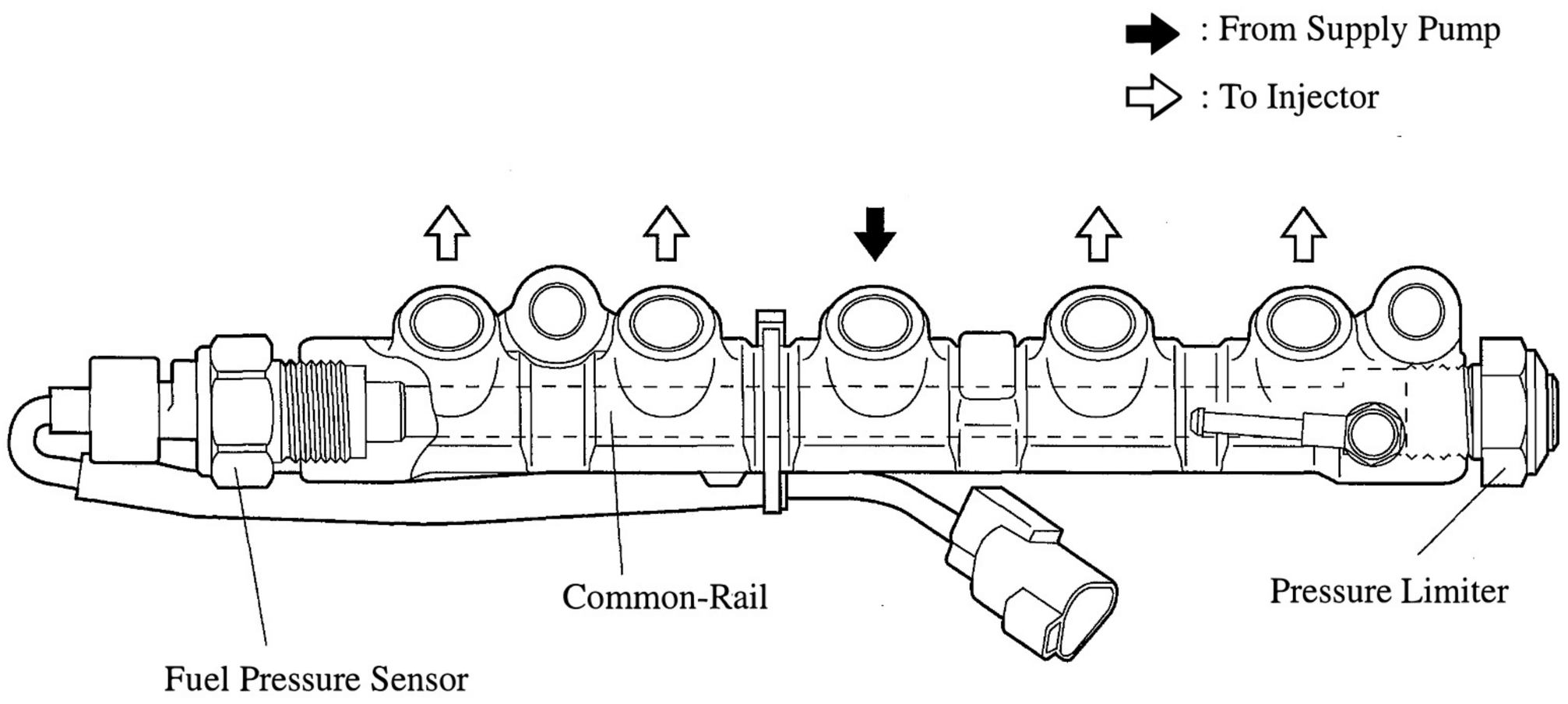
Fig.1. Starting Suction

Fig.2. Starting Pumping

168EG21

Common-Rail

- By storing fuel at a high pressure (20 to 135 MPa), the peak torque during the pumping of fuel under high load conditions has been restrained, thus reducing the vibration and noise of the fuel injection system.
- The fuel pressure sensor senses the fuel pressure and outputs the resultant signal to the engine ECU.
- When the pressure in the common-rail is abnormally high, the pressure limiter leaks the fuel to the fuel tank to reduce pressure.



168EG22

Service Tip

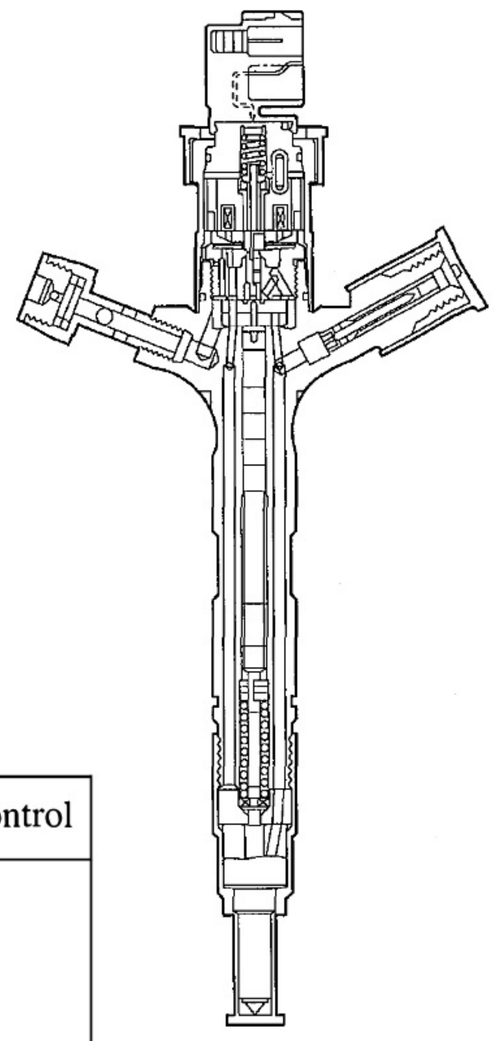
- Fuel pressure sensor has its sealing portion (plastic-deformed) in order to keep sealing performance, so do not reuse it after disassembling.
- Do not disassemble the pressure limiter because its operating pressure has been adjusted after assembly.
- If parts that affect the alignment has been changed, make sure to replace the pipe with a new one as well. The parts that require the replacement of a pipe are listed below.

  Injection Pipe: Injector, Common-Rail, Cylinder Head
  Fuel Inlet Pipe: Supply Pump, Common-Rail, Cylinder Block, Water Pump, Cylinder Head
- Refer to the 1CD-FTV Engine Repair Manual Supplement (Pub. No. RM800E)

Injector

1) General

- Compact and saving electricity injectors are used.
- The injectors are actuated by the EDU (Electronic Driver Unit).
- Pilot injection control has been adopted in the injection system. By injecting a small amount of fuel in advance as pilot injection, it helps shorten the fuel ignition lag during main injection.
  As a result, the sudden rise in cylinder pressure has been restrained and low noise operation has been realized.



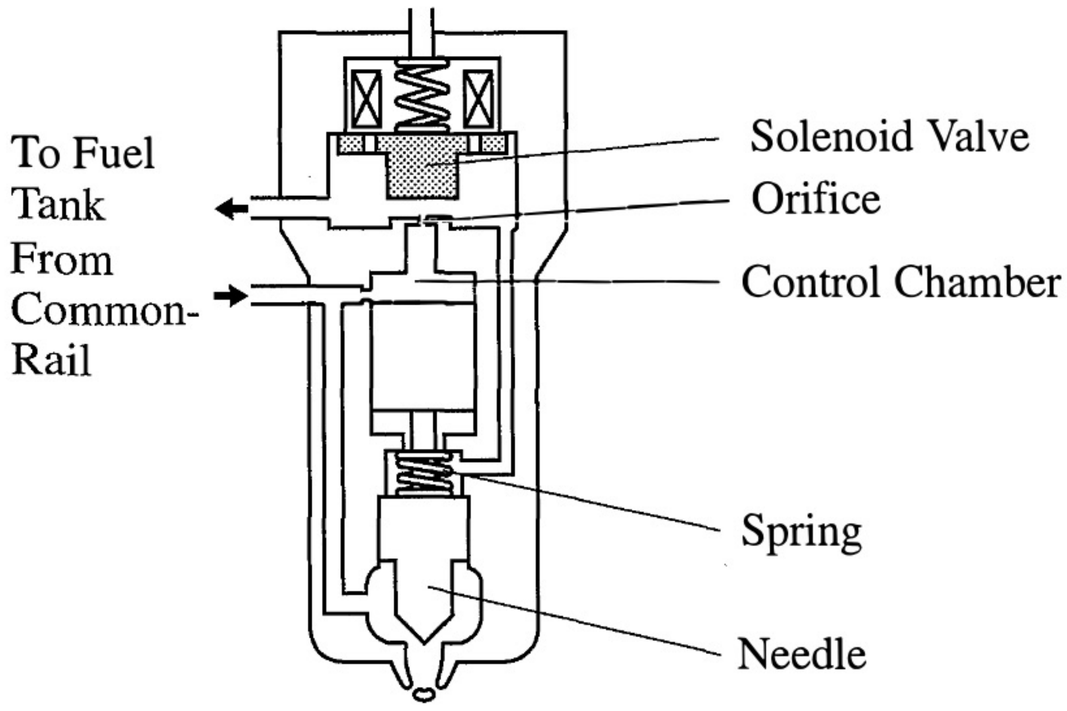
168EG24

	Pilot Injection Control	Conventional Injection Control
Nozzle Lift	Pilot Injection, Main Injection	
Cylinder Pressure		

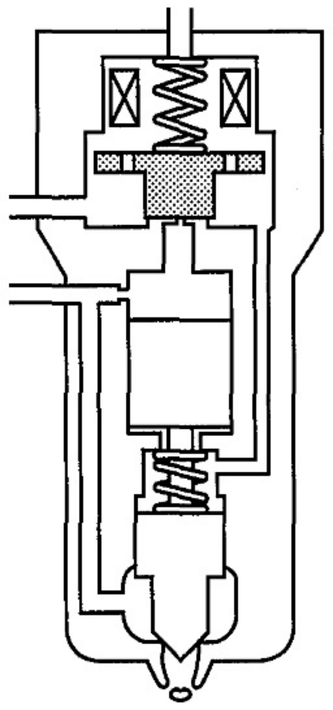
195EG90

2) Operation

As the solenoid valve opens in accordance with the signal from the EDU, the control chamber pressure decreases, causing the needle valve to open and allowing the fuel to be injected.
As the solenoid valve turns OFF and closes orifice in accordance with the signal from the EDU, the control chamber pressure increases, causing the needle valve to close and ending the injection.
The solenoid valve turns ON/OFF in accordance with the signal from the ECU to effect the control of the injection timing, injection volume, and pilot injection.



Injection
(Solenoid Valve "ON")



No Injection
(Solenoid Valve "OFF")

195EG92

9. Engine Control System

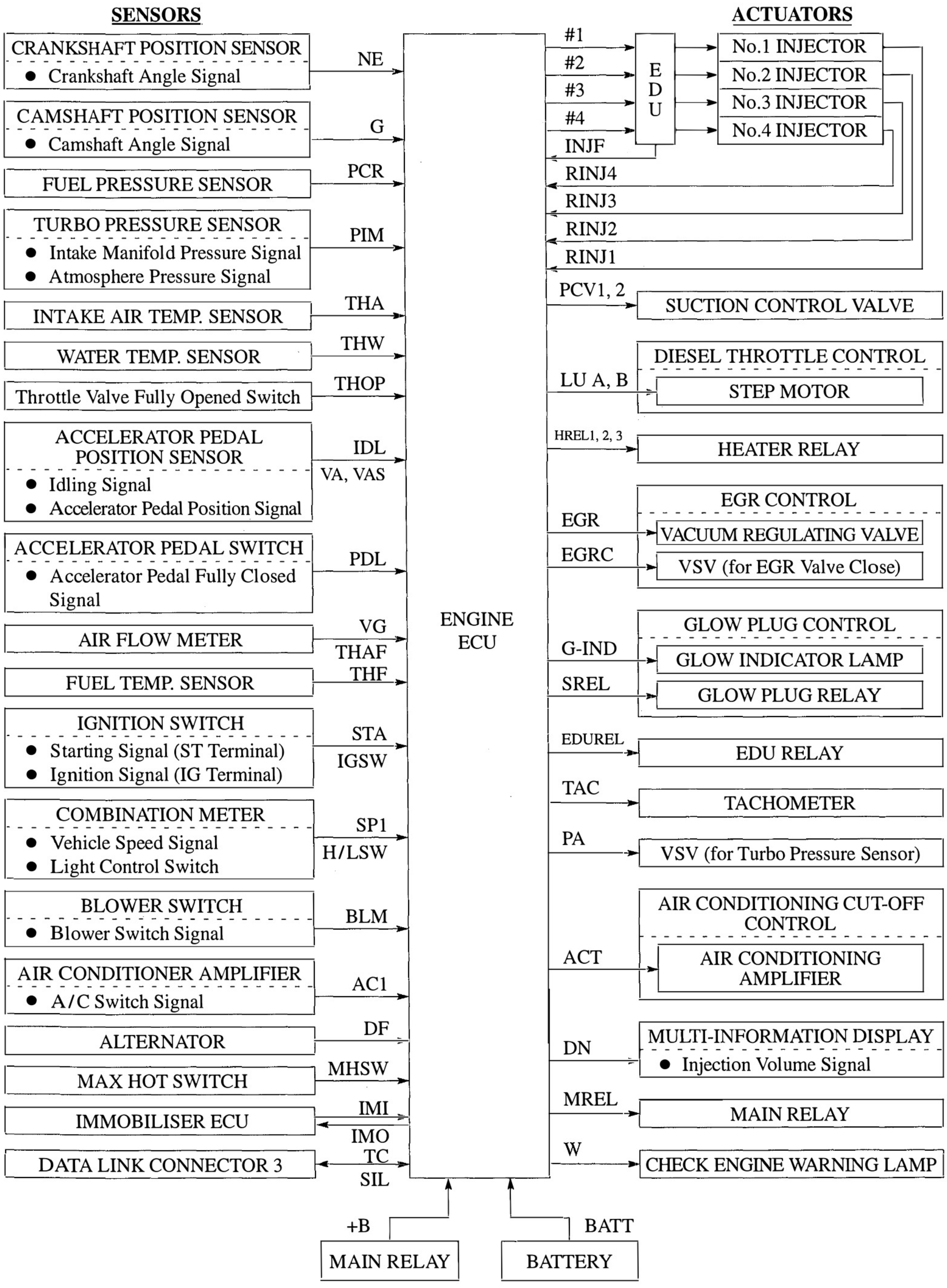
General

The engine control system for the 1CD-FTV engine has following system.

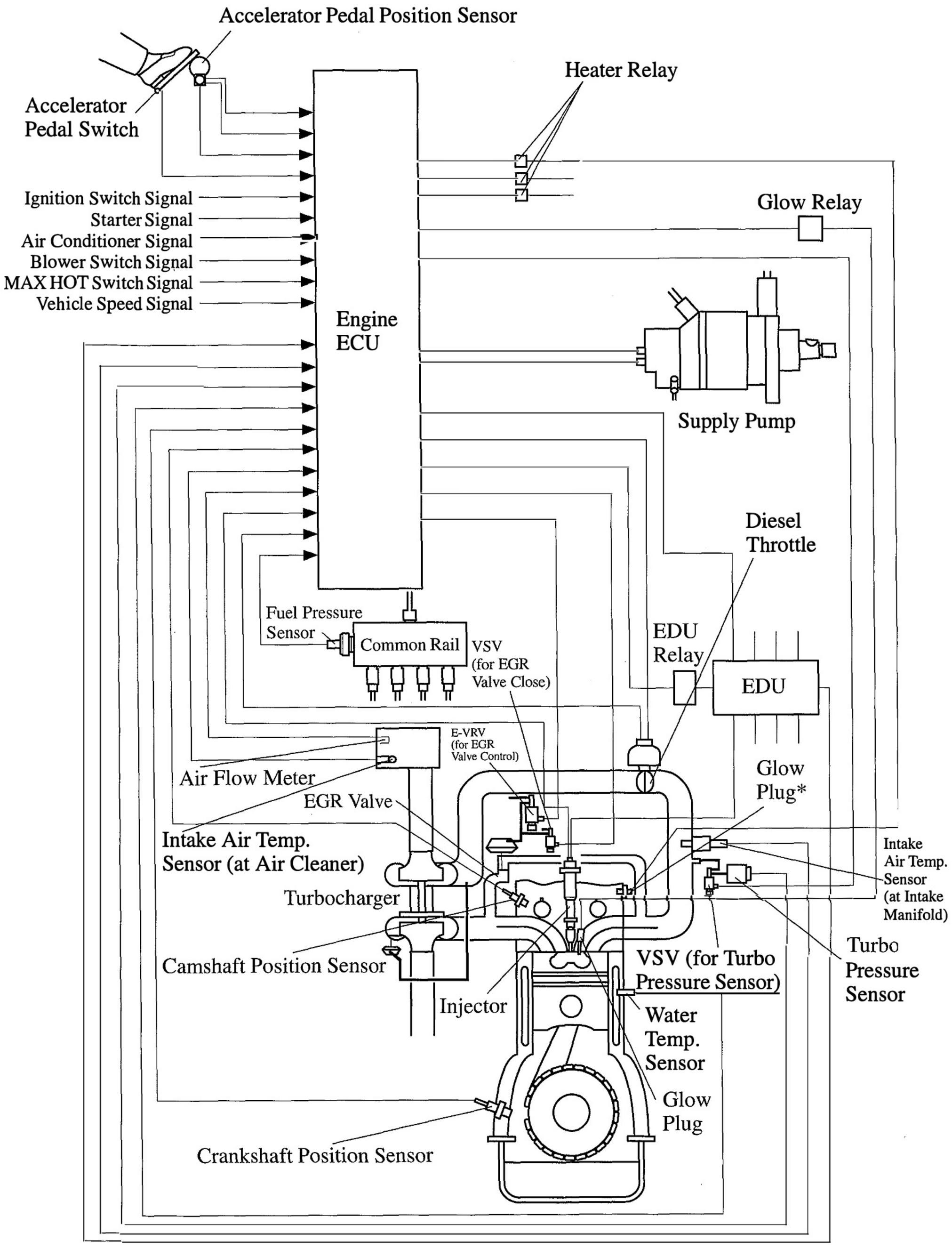
System	Outline
Fuel Injection Volume Control	Based on the signals received from the sensors, the engine ECU determines the fuel injection volume in accordance with the engine condition.
Fuel Injection Timing Control	Based on the signals received from the sensors, the engine ECU determines the fuel injection timing in accordance with the engine condition.
Fuel Pressure Control	Based on the signals received from the sensors, the engine ECU determines the fuel pressure in accordance with the engine condition.
Pilot Injection Control	Controls the fuel injection. For details, see page 19 in the fuel section.
Idle Speed Control	The engine ECU determines the idle speed in accordance with the engine condition, and controls the fuel injection volume in order to maintain the target idle speed.
Glow Plug Control	Controls the length of time when the current in applied to the glow plugs, in accordance with the coolant temperature.
Electrical Type Power Heater Control	Controls the glow plugs for the electrical type power heater. For details, see page 33 in the power heater section.
Diesel Throttle Control	● Controls the throttle valve opening angle in accordance with the engine condition. ● Fully close the throttle in order to reduce the vibration when the engine in stopped.
EGR Control	Controls the EGR volume via EGR valve in accordance with the engine condition.
Air Conditioning Cut-Off Control	By controlling the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Engine Immobiliser	Prohibits fuel injection 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 the memory.

Construction

The configuration of the engine control system in the 1CD-FTV engine is shown in the following chart.



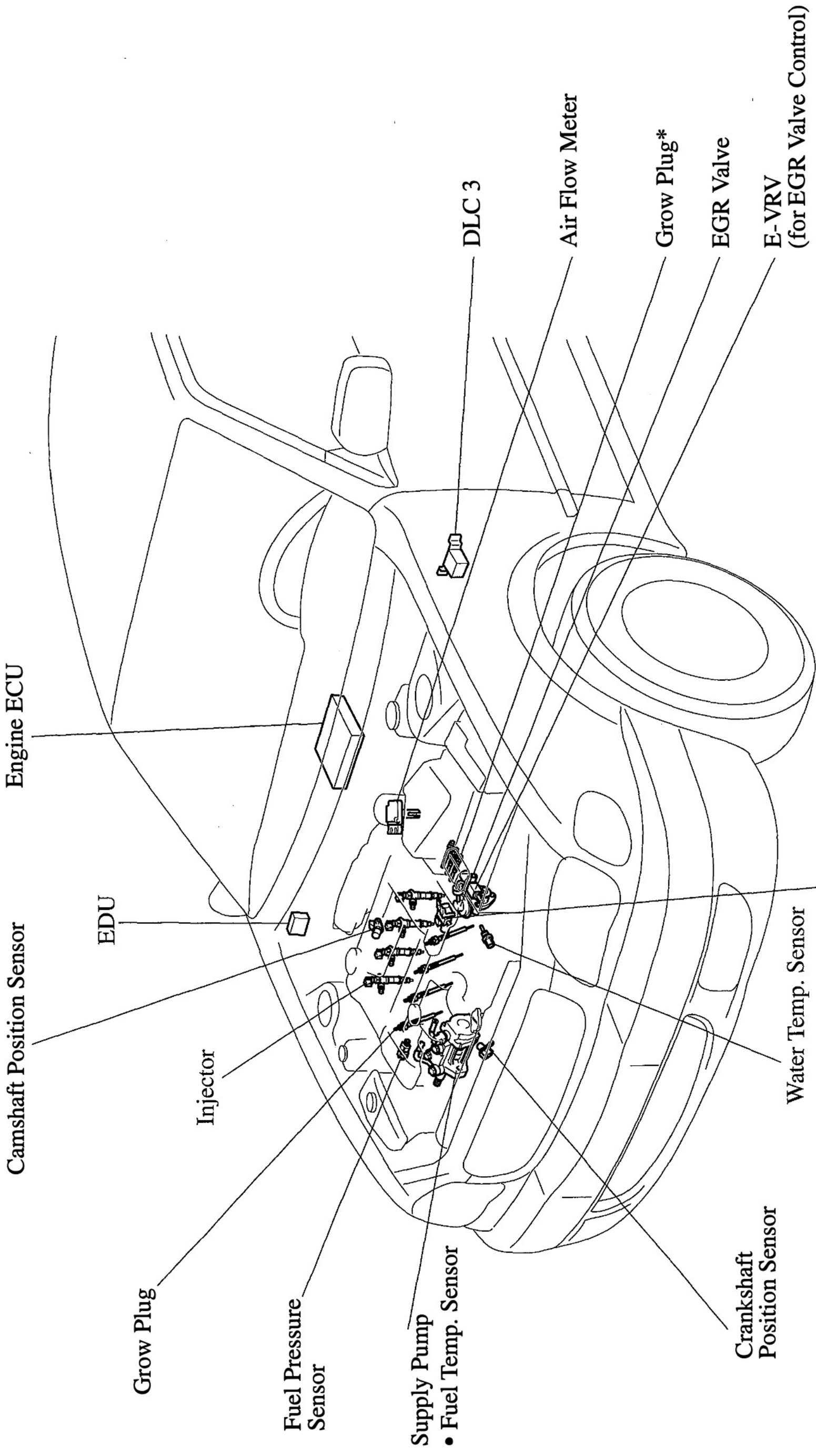
Engine Control System Diagram



195EG93

*: With Electrical Type Power Heater

Layout of Main Components

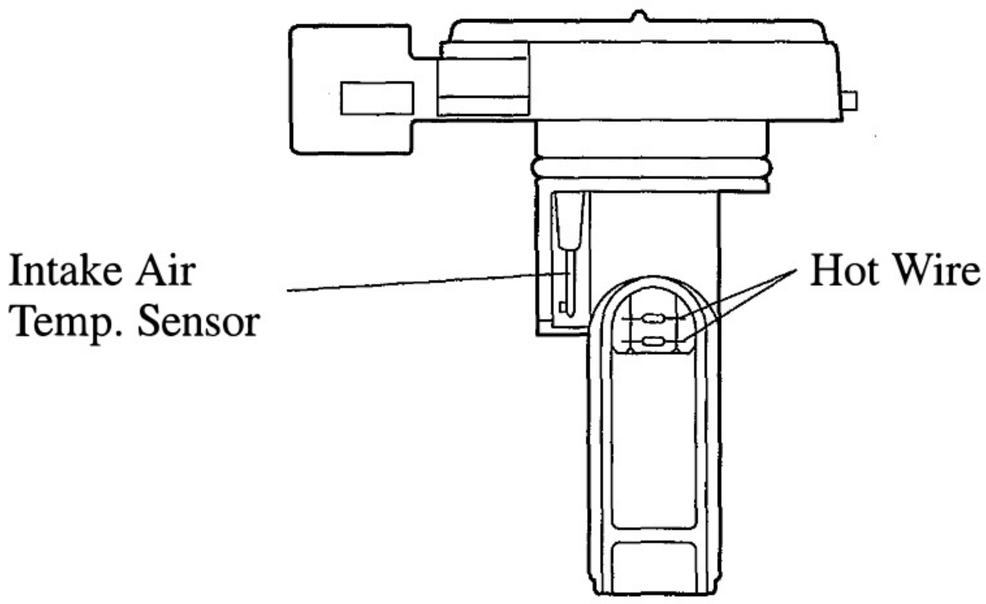


*: With Electrical Type Power Heater

Main Components of Engine Control System

1) Air Flow Meter

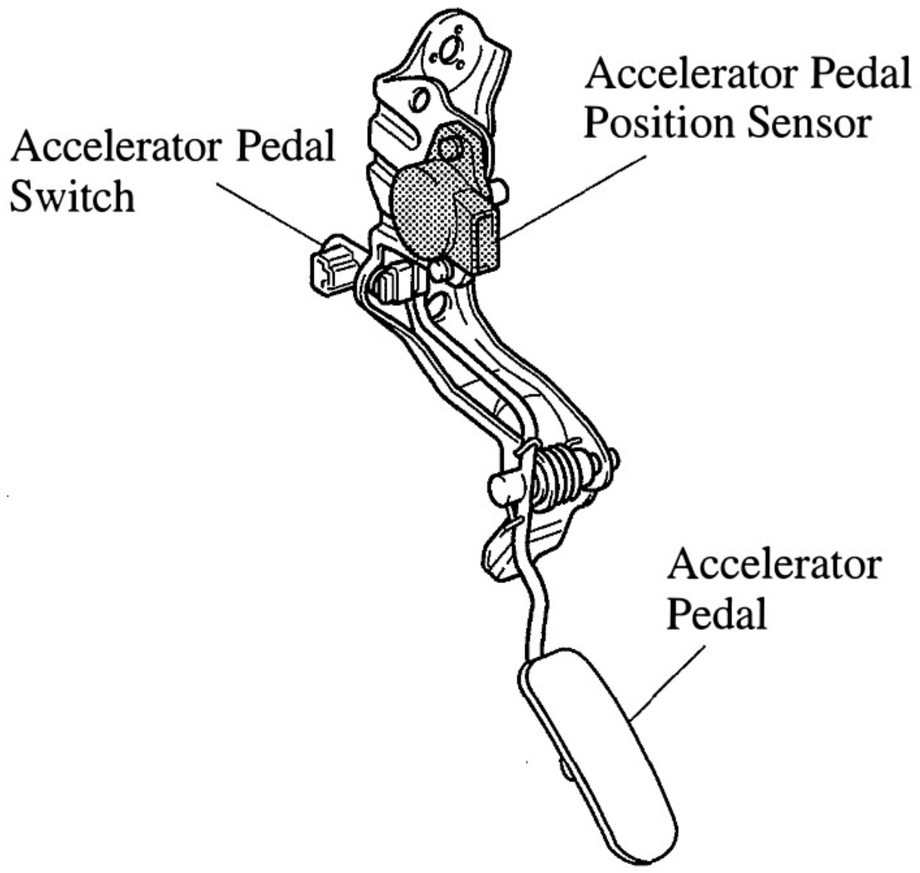
The 1CD-FTV engine adopts the hot-wire type air flow meter designed for direct electrical measurement of the intake air mass flow.



168EG32

2) Accelerator Pedal Position Sensor

- The accelerator pedal position sensor uses a hall element that outputs voltage that changes linearly in relation to the amount of pedal effort that is applied to the accelerator pedal.
  The accelerator pedal position sensor uses a duplex system to ensure its reliability.
- An idle switch that detects the fully closed condition of the accelerator pedal is enclosed in the accelerator pedal position sensor.



145EG50

3) Accelerator Pedal Switch

Detects the fully closed condition of the accelerator pedal.

4) EDU (Electronic Driver Unit)

- The EDU has been adopted to drive the injector at high speeds. The EDU has realized high-speed driving under high fuel pressure conditions through the use of a DC/DC converter that provides a high-voltage, quick-charging system.
- The engine ECU constantly monitors the EDU and stops the engine in case an abnormal condition is detected.

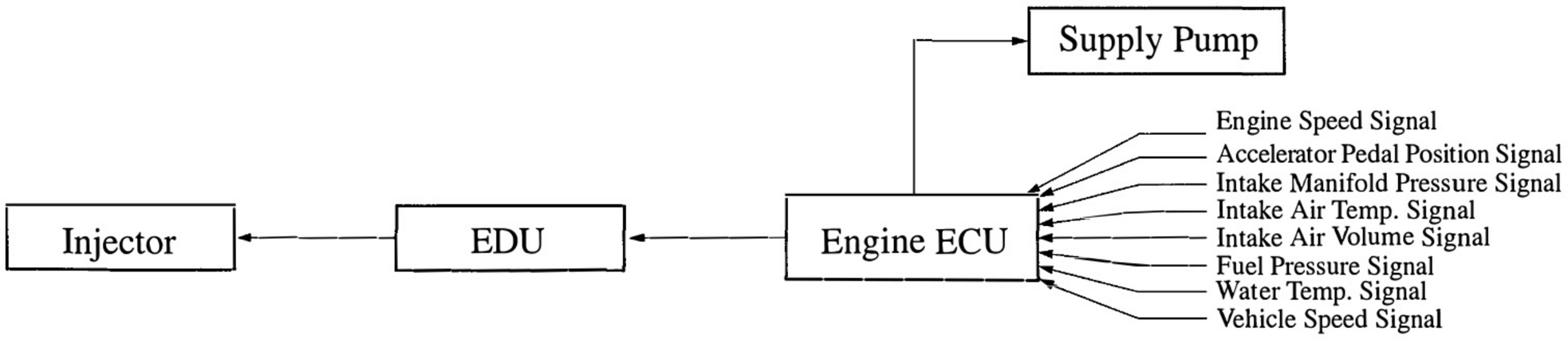
5) Turbo Pressure Sensor

The turbo pressure sensor consists of a semiconductor which utilizes the characteristic of a silicon chip that changes its electrical resistance when pressure is applied to it. The sensor converts the intake air pressure into an electrical signal, and sends it to the engine ECU in an amplified frow.
In addition, the atmospheric pressure can be detected by switching the piping passage through the operation of the VSV.

Fuel Injection Volume Control

1) General

Based on sensor signals, the engine ECU calculates and controls the fuel injection volume that is appropriate for the engine condition.



168EG28

2) Function of Engine ECU

The engine ECU calculates the basic injection volume based on the accelerator pedal position and engine speed, and the maximum injection volume for the engine condition. The two injection volumes are then compared, and the lesser of the two is selected. A correction value, which is obtained via the correction resistors, is added to that injection volume, thus determining the final injection volume.

a. Basic Injection Volume

Determined in accordance with the accelerator pedal position and the engine speed.

b. Maximum Injection Volume

Based on the signals received from the sensors, correction values are added to the theoretically required injection volume (basic maximum injection volume) to determine the maximum injection volume during engine operation.

Basic Maximum Injection Volume

Determined in accordance with the engine speed.

Intake Manifold Pressure Correction

Corrects the basic maximum injection volume in accordance with the intake manifold pressure. The higher the intake manifold pressure becomes, the larger the injection volume becomes.

Intake Air Temperature Correction

Corrects the variance in the air-fuel ratio that is created by the difference in the density of the intake air in accordance with the intake air temperature. The higher the intake air temperature becomes, the smaller the injection volume becomes.

Fuel Pressure Correction

In case that the fuel pressure inside the common-rail than the target value, it reduces the injection volume and revises the follow-up delay.

Water Temperature Correction

The lower the engine coolant temperature, the greater the injection volume becomes in order to ensure drivability immediately following cold-starting.

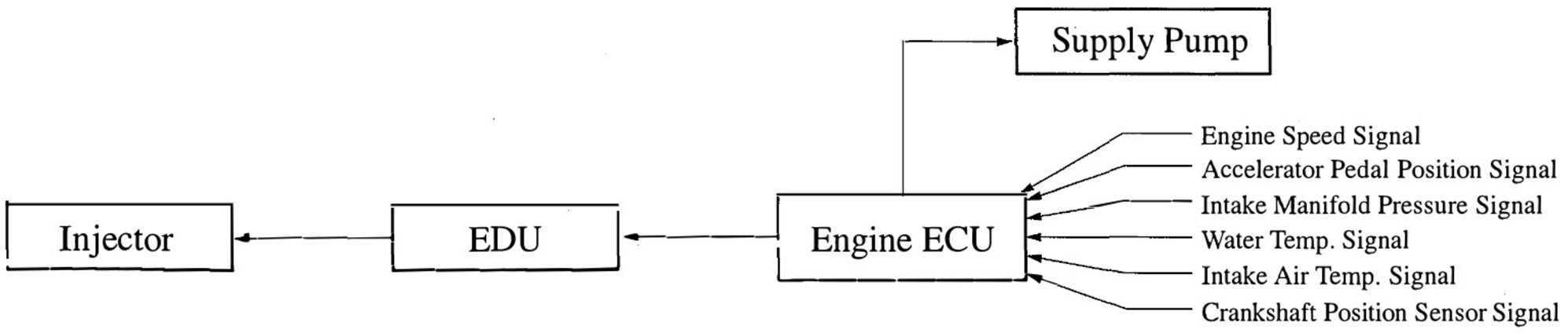
c. Starting Injection Volume Control

Determines the fuel injection volume during starting in accordance with the starting signal and the water temperature signal. When the engine is cold, the lower the coolant temperature becomes, the larger the injection volume becomes.

Fuel Injection Timing Control

1) General

Based on the signals received from the sensors, the engine ECU calculates and controls the fuel injection timing to be optimal for the engine condition.



168EG29

2) Function of Engine ECU

The engine ECU adds the corrections from the sensor signals to the basic fuel injection timing to calculate the fuel injection timing that is optimal for the engine condition.

a. Basic Injection Timing

The basic injection timing is determined in accordance with the accelerator pedal position and the engine speed.

b. Injection Timing Correction

Intake Manifold Pressure Correction

Corrects the basic fuel injection timing in accordance with the intake air pressure. The injection timing is advanced when the intake air pressure is low in such the case as of high altitude areas.

Water Temperature Correction

Corrects the basic fuel injection timing in accordance with the water temperature. The injection timing is advanced when the water temperature is low.

Intake Air Temperature Correction

Corrects the basic fuel injection timing in accordance with the intake air temperature. The injection timing is advanced when the intake air temperature is low.

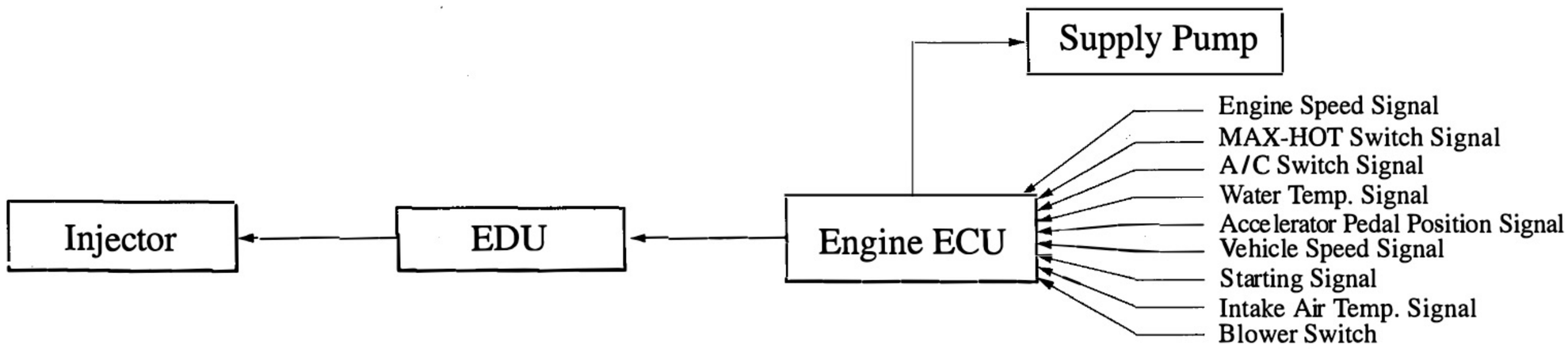
c. Starting Injection Timing Control

The starting injection timing is determined in accordance with the starting signal, water temperature signal, and engine speed. The injection timing is advanced when the engine speed is high.

Idle Speed Control

1) General

- In this system, the engine ECU calculates the target engine speed in accordance with the engine condition, and determines the fuel injection volume, thus controlling the idle speed rpm.
- During cold operation, the idle is increased by turning ON the blower switch and MAX-HOT switch, thus improving the heating performance of the heater.



168EG30

2) Function of Engine ECU

a. Feedback Control

During idling, injection volume is controlled to maintain the target idle speed, if there is a difference between the target idle speed calculated by the engine ECU and the actual idle speed.

b. Warm-Up Control

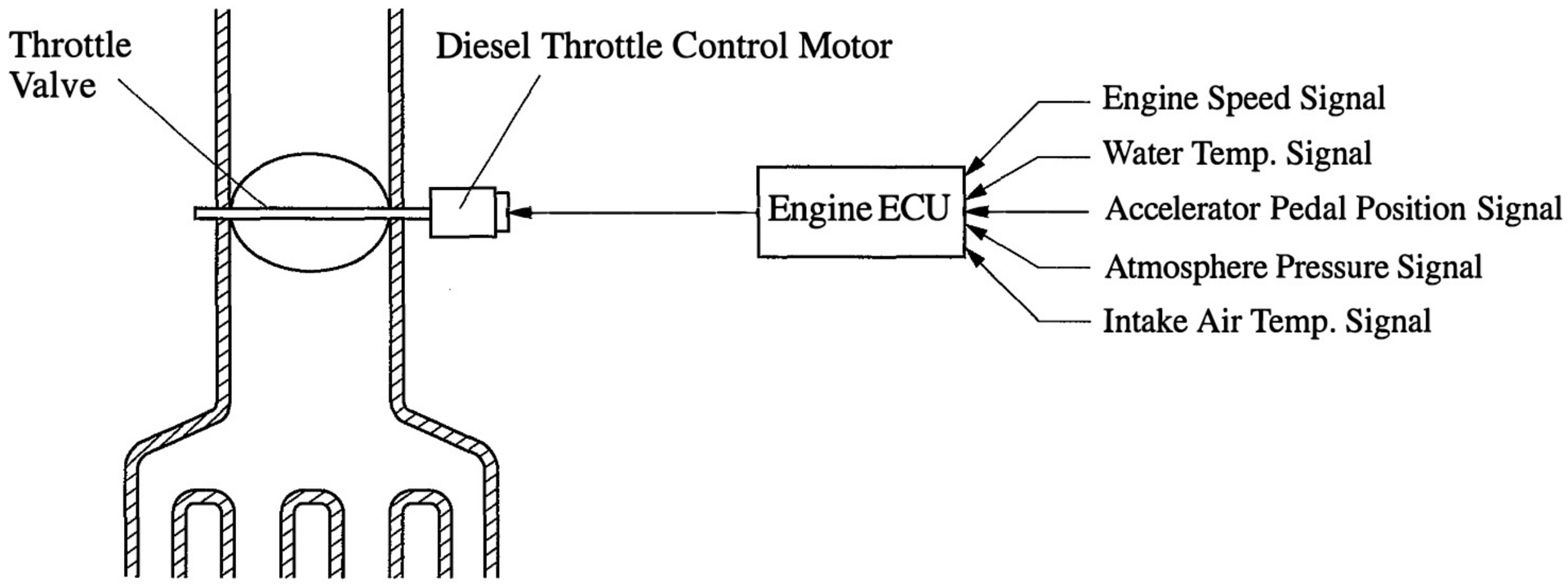
Controls the injection volume during warm-up to achieve an optimal fast idle speed in accordance with water temperature and intake air temp.

c. Engine Speed Change Estimate Control

Immediately after the air conditioning switch is engaged, the idle speed can be affected by the change in the load that is applied to the engine. To prevent this symptom, the control engine speed-change estimate injection volume before the idle speed changes.

Diesel Throttle Control

The opening of the throttle valve that is installed on the intake manifold is controlled by the engine ECU in accordance with the engine condition.
As a result, the noise that is generated during idling and deceleration, as well as the noise and vibration that are generated when the engine is stopped, have been reduced and this control makes it possible to re-circulate the exhaust gas in accordance with the driving condition.



195EG91

Engine Immobiliser System

The engine immobiliser system has been designed to prevent the vehicle from being stolen. This system uses a transponder key computer that stores the ID code of the authorized ignition key. If an attempt is made to start the engine using an unauthorized key, the transponder key computer emits a signal to the engine ECU to prohibit both the supply pump and the injector operation in order to disable the engine.

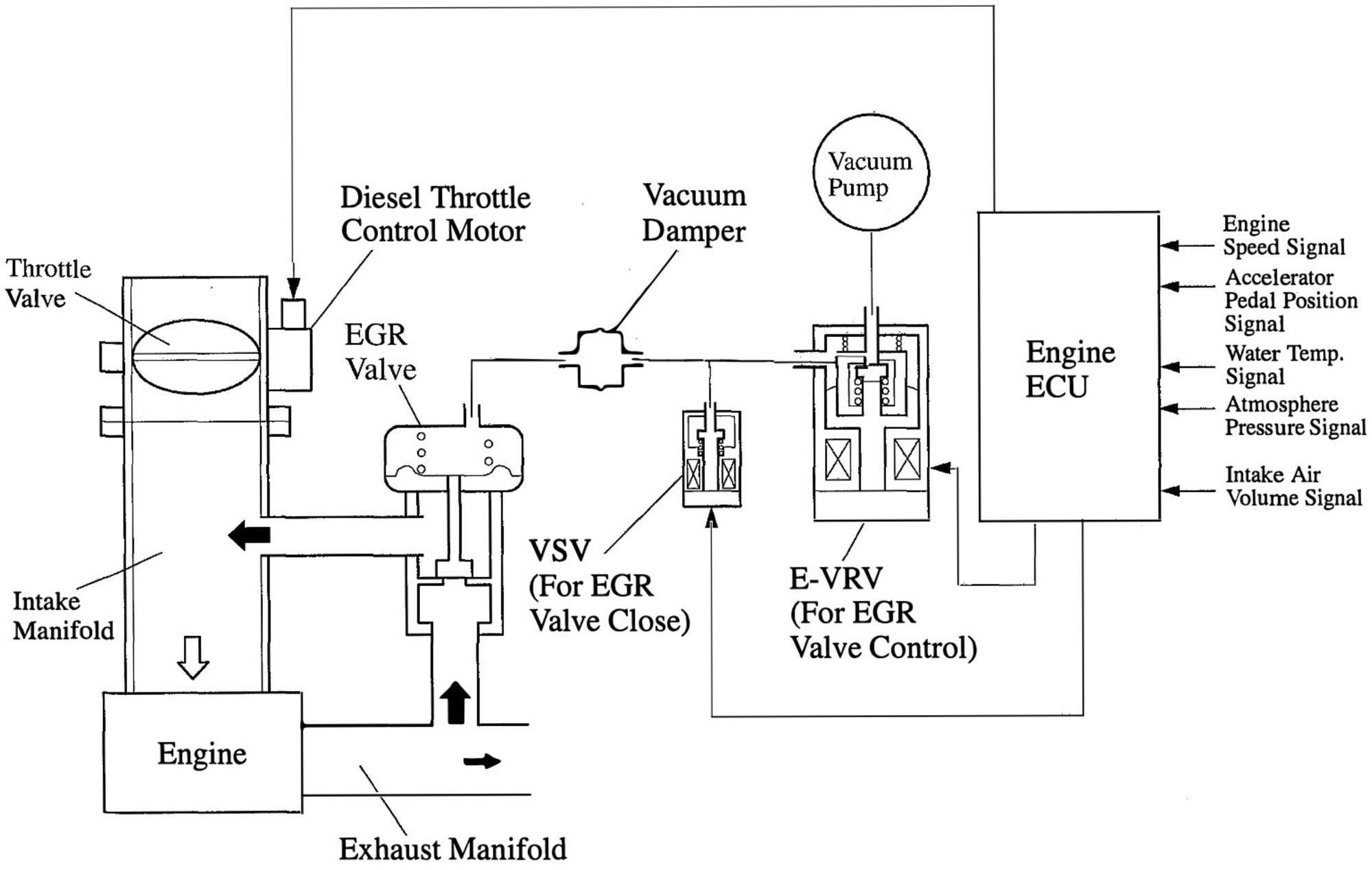
Diagnosis

- If the engine ECU detects any problem with a sensor or an electrical circuit, it turns on the check engine warning lamp in the combination meter to inform the driver. In addition, the malfunction code will be stored in memory.
- An M-OBD (Multiplex On-Board Diagnostic) System has been adopted to improve serviceability.

EGR Control System

This system is designed to reduce and control NOx formation due to a slight reduction of peak temperature in the engine combustion chamber, which is accomplished by introducing a small amount of inert gas into intake manifold.

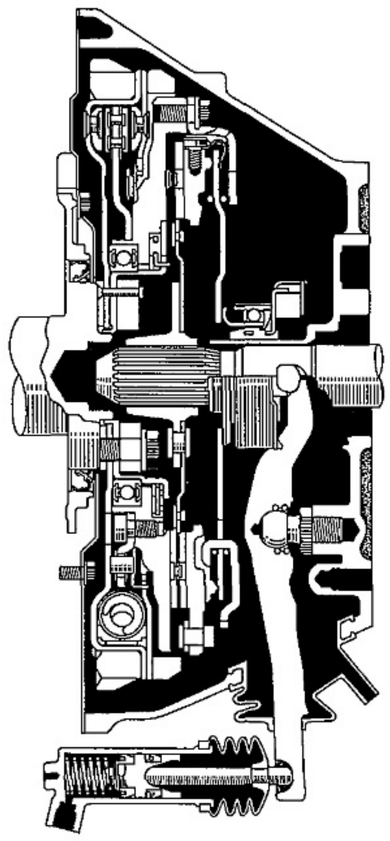
By sensing the engine driving conditions, the control unit electrically operates both the E-VRV (for EGR valve control) and VSV (for EGR valve close), which controls the magnitude of vacuum introduced into diaphragm of EGR valve and throttle opening position with stepping motor and the amount of recirculating exhaust gas is regulated. EGR valve opening lift is controlled by modulated negative pressure.



195EG99

■CLUTCH

- A dry, single-plate clutch operated by hydraulic pressure is also used on the 1CD-FTV engine model.
- On the 1CD-FTV engine model, the clutch pedal has a turn-over mechanism to reduce clutch pedal effort.
- A clevis damper has been adopted in the clutch master cylinder on the 1CD-FTV engine model to reduce the vibration that is transmitted to the clutch pedal.



1CD-FTV Engine Model

168CL01

▶ Specifications ◀

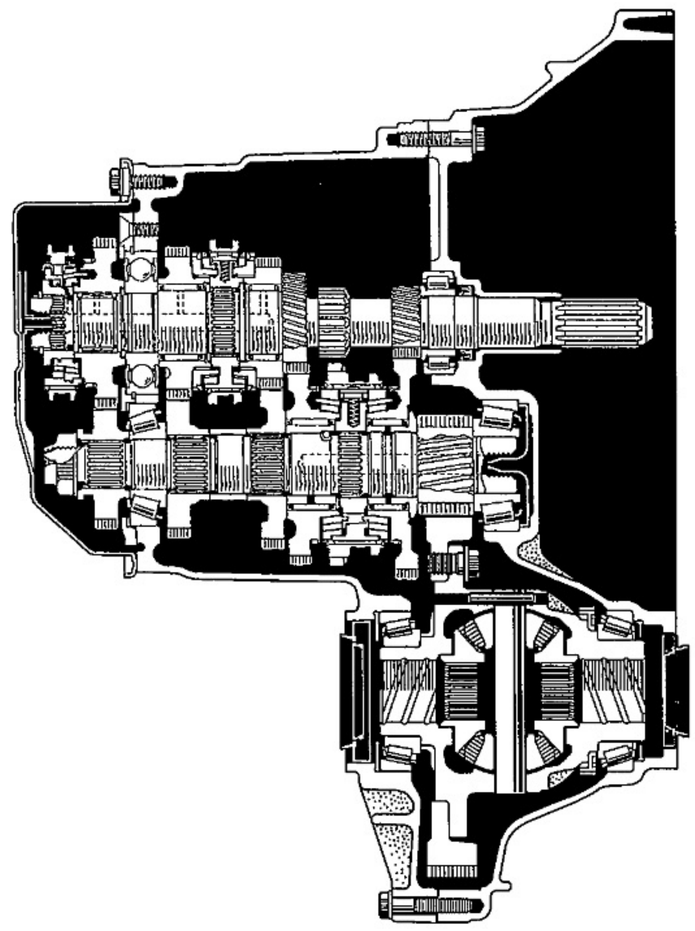
Engine Type			1CD-FTV
Clutch	Type		Dry Type Single Plate Clutch Diaphragm Spring
	Operation		Hydraulic
Clutch Cover	Type		DST*1
	Size	mm (in.)	236 (9.29)
	Installed Load	N	5884
Clutch Disc	Facing Size*2	mm (in.)	236 x 150 x 3.5 (9.29 x 5.91 x 0.14)
	Facing Area	cm^2 (in^2)	260 (40.2)
Master Cylinder	Type		Conventional
	Cylinder Diameter	mm (in.)	15.87 (0.62)
Release Cylinder	Type		Non-Adjustable
	Cylinder Diameter	mm (in.)	20.64 (0.81)

*1: DST (Diaphragm Spring Turnover)
*2: Outer Diameter x Inner Diameter x Thickness

■ E351 MANUAL TRANSAXLE

1. General

- On the 1CD-FTV engine model, based on the usual E55F manual transaxle, E351 manual transaxle with the improved performance has been adopted.
- As compared with E55F manual transaxle, E351 manual transaxle is made to reduce oil flow by discontinuing the oil pump. Also, its light-weight is realized by changing the differential gear from 4 pinion type to 2 pinion type.



E351 Manual Transaxle

195CH27

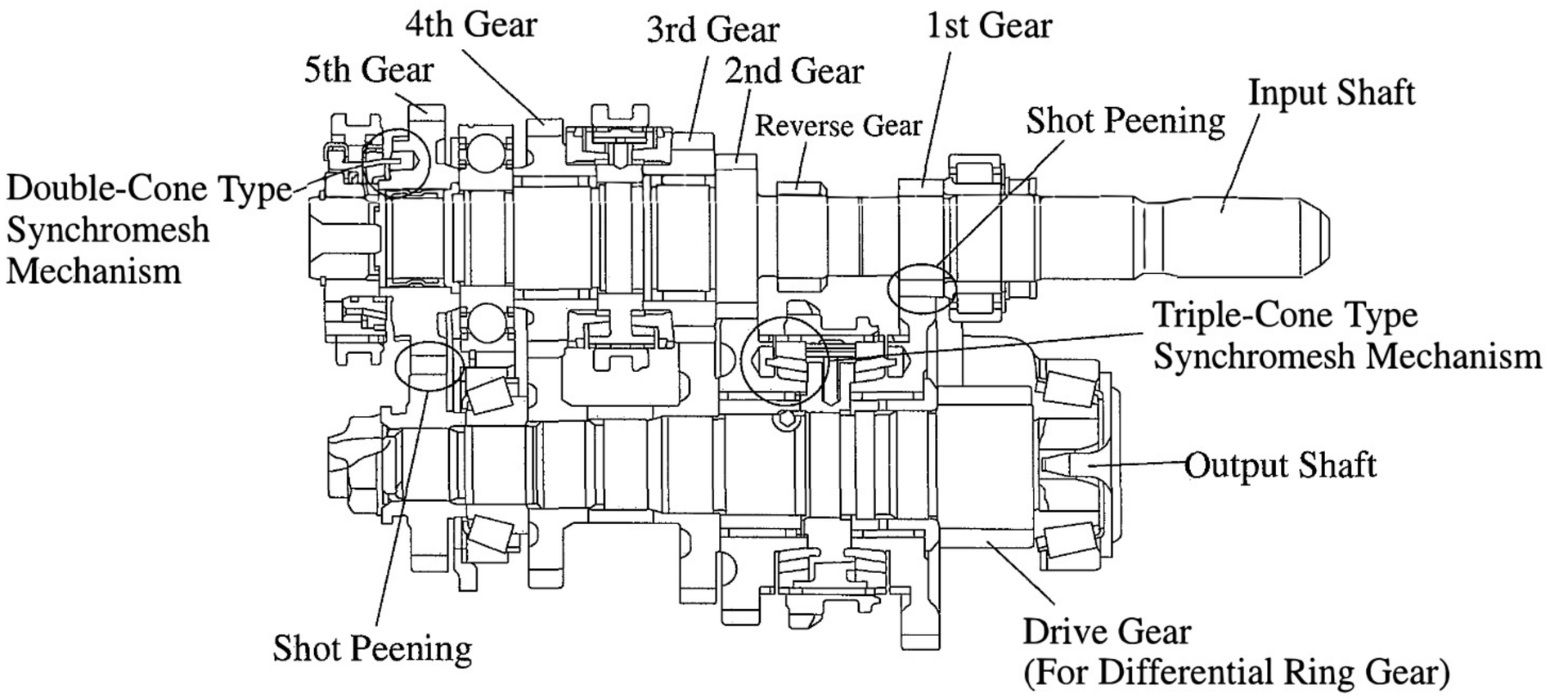
▶ Specifications ◀

Engine Type		1CD-FTV
Transaxle Type		E351
Gear Ratio	1st	3.538
	2nd	2.045
	3rd	1.333
	4th	0.972
	5th	0.731
	Reverse	3.583
Differential Gear Ratio		3.684
Oil Capacity Liters (US qts, Imp. qts)		2.5 (2.6, 2.2)
Oil Viscosity		SAE 75W-90
Oil Grade		API GL-4 or GL-5

2. Transmission Gear

As compared with the usual E55F manual transaxle, the following modifications are implemented.

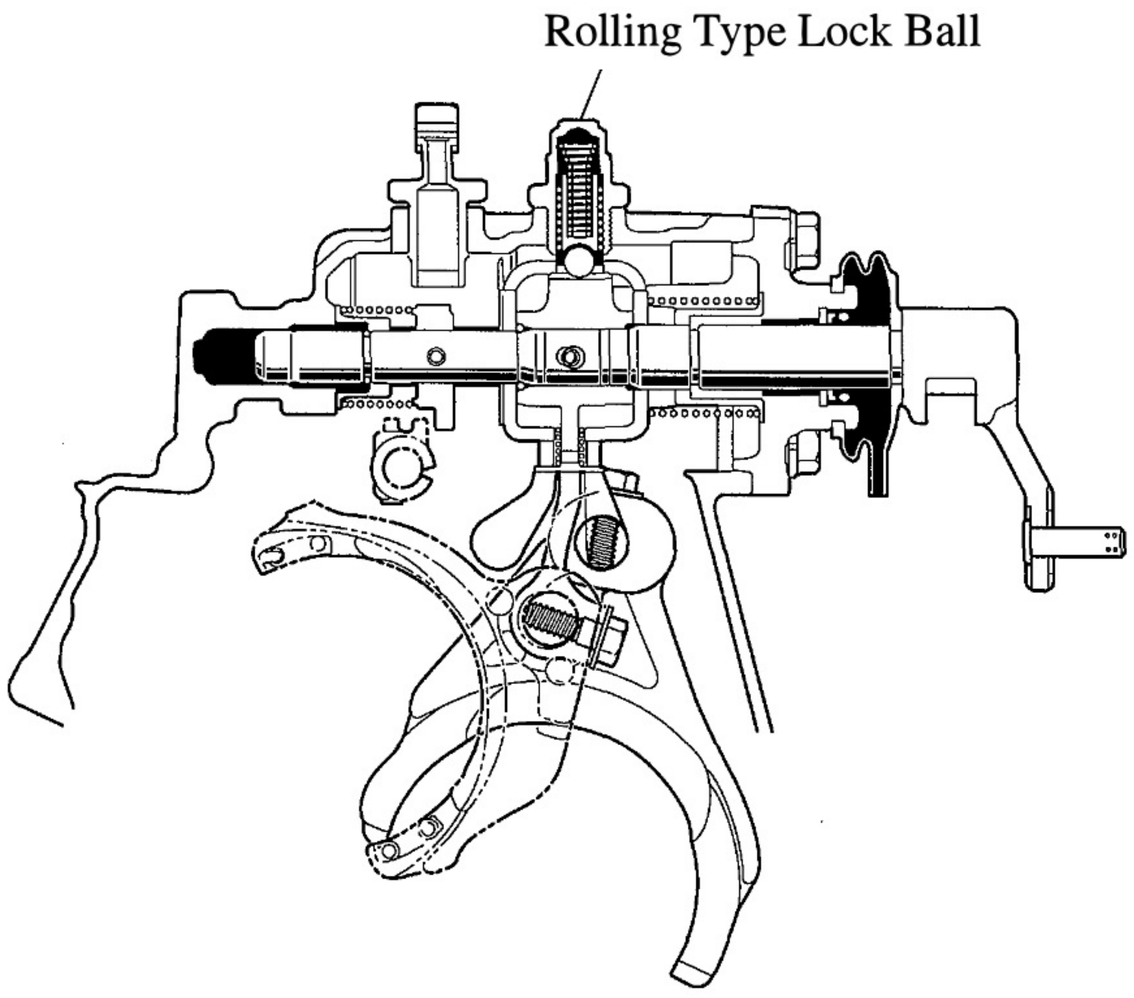
- The adoption of a shot peening on the 1st gear and 5th gear, thus obtaining the optimum gear strength.
- A triple-cone type synchromesh mechanism is used for the 1st gear and 2nd gear to increase the synchronizer capacity. This helps to reduce the shifting effort and provide smoother shifting.
- A double-cone type synchromesh mechanism is used in the 5th gear to suppress gear engagement noise.



195CH02

3. Shift and Select Mechanism

The shift feel has been improved through the adoption of the rolling type lock ball.



195CH04

■POWER HEATER SYSTEM

1. General

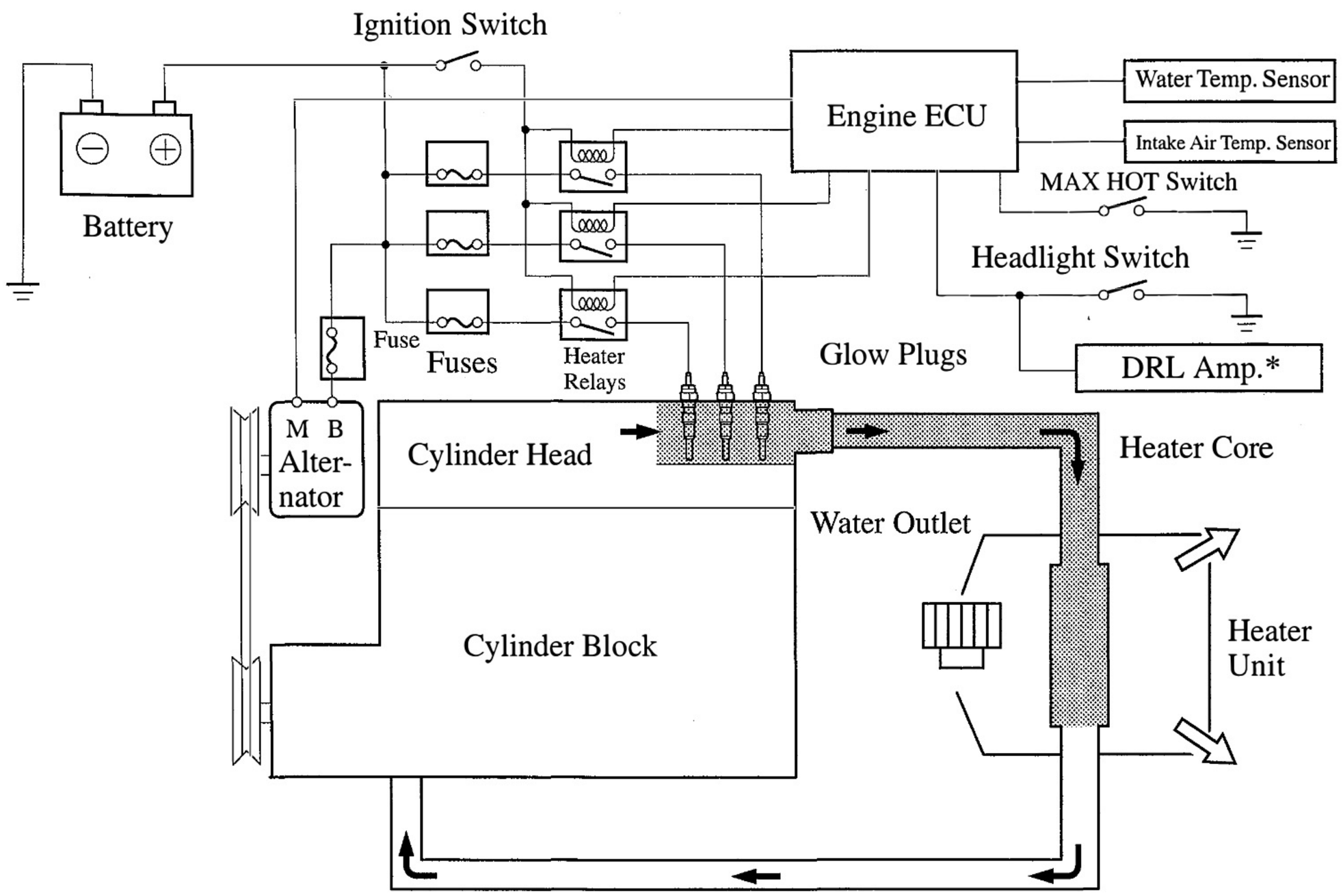
While the 1CD-FTV engine offers excellent combustion efficiency, it generates less heat. Therefore, depending on the operating condition, the coolant temperature remains low, making it difficult to ensure the proper heating effect. Thus, in order to provide an adequate heating effect, an electrical type power heater is provided as standard equipment. Furthermore, on certain destination models, a combustion type power heater is available as optional equipment.

2. Electrical Type Power Heater

General

To heat the engine coolant, this heater system provides three glow plugs in the water outlet of the cylinder head. By directly heating the engine coolant in this manner, the rise in water temperature is accelerated, thus enhancing the heating effect.

The engine ECU controls the number (0 to 3) of glow plugs to be activated in accordance with the water temperature, outside air temperature (intake air temperature), alternator power ratio and electrical load.



*: With Daytime Running Light System

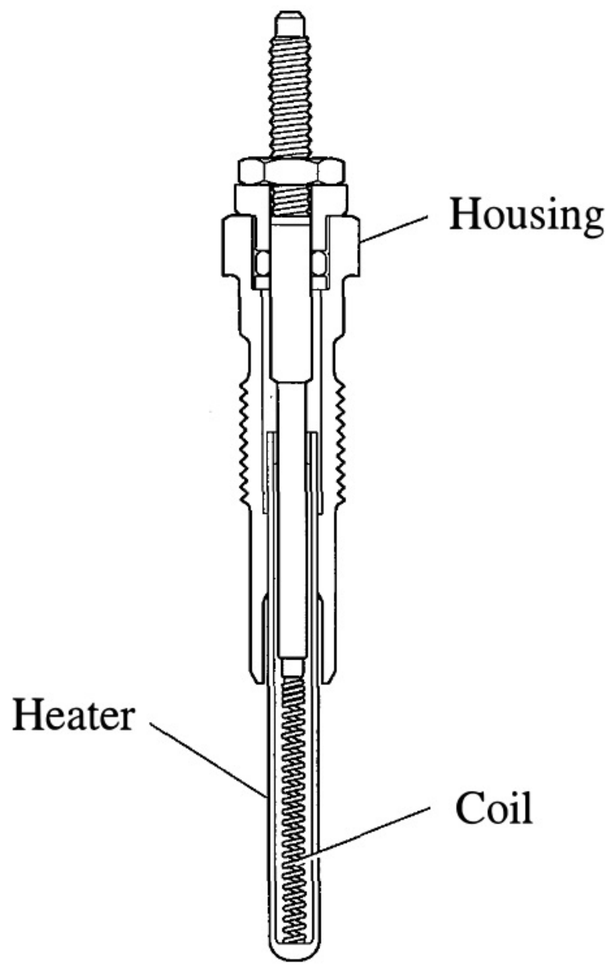
168AC01

Glow Plug

The glow plugs are the same as the glow plugs used in the ignition of the ordinary diesel engine in terms of both material and construction.
This system uses three glow plugs, each of which is controlled by the engine ECU via a fuse and a heater relay.

Number of Plugs Used	Wattage Consumption	Amount of Heat Generated*
1	330 W	230 W
2	660 W	460 W
3	1000 W	700 W

*: Amount of heat transferred by the glow plugs to the engine coolant.



168AC02

Operation

1) Ordinary Control

In this control, the system activates when all the conditions given below have been met. Furthermore, the engine ECU controls the number of glow plugs to be activated (0 to 3) in accordance with the water temperature, outside air temperature (intake air temperature), alternator power ratio, etc.

- Water temperature below 80°C
- Outside air temperature (intake air temperature) below 15°C
- MAX HOT switch turned ON
- Alternater power ratio below 95%
- Engine operating

2) Engine Starting Control

The purpose of this control is to quickly stablize the engine by accelerating the rise in the water temperature during warm-up. The activation of the glow plugs is regulated in steps during a certain length of time as calculated by the engine ECU in accordance with the conditions such as the water temperature, outside air temperature (intake air temperature), alternator power ratio and electrical load.

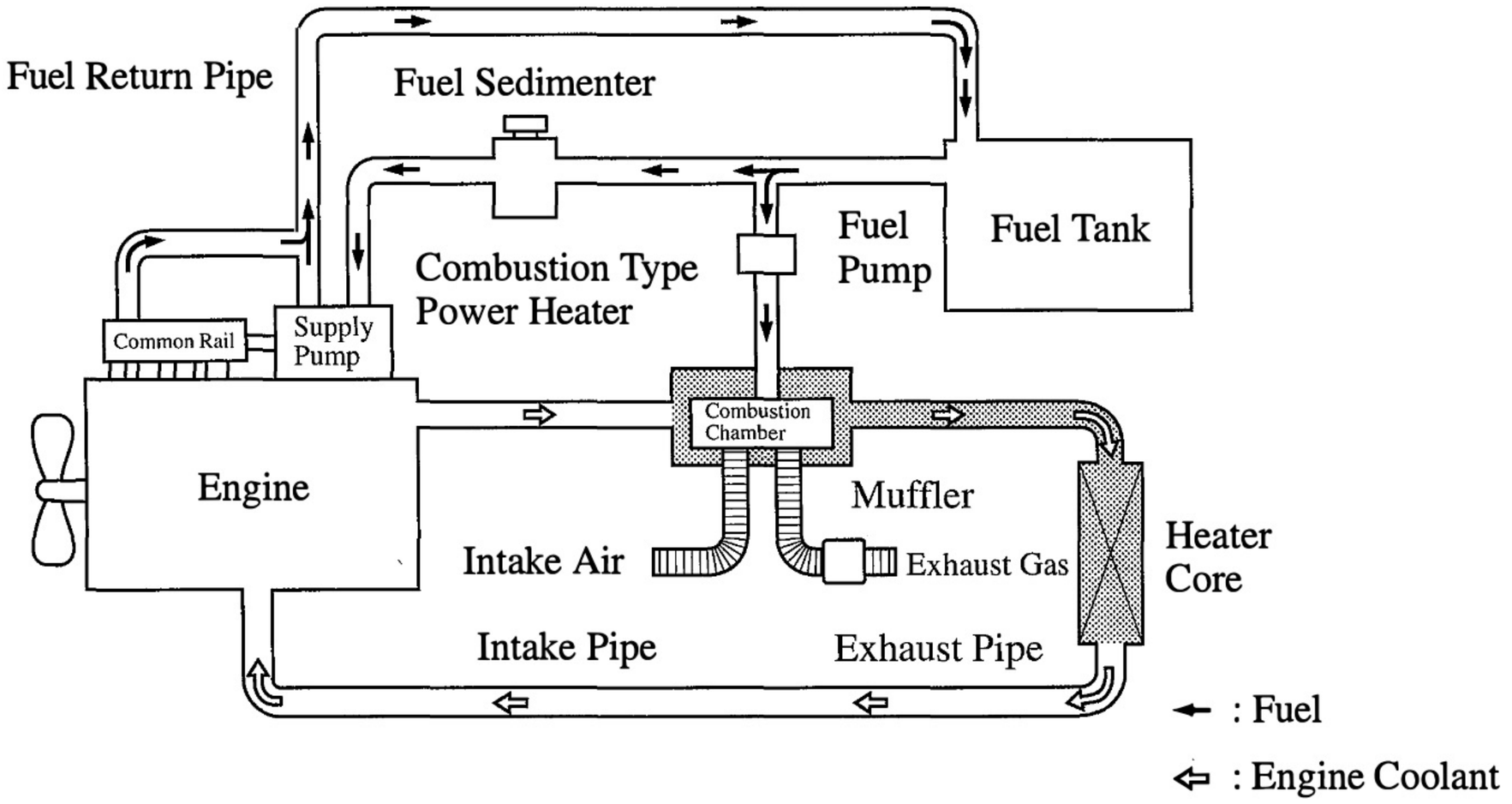
3) Headlight Dimming Countermeasure Control

When the system is activated and the engine rpm is low, this control activates one fewer glow plug if the headlights are turned ON.

3. Combustion Type Power Heater

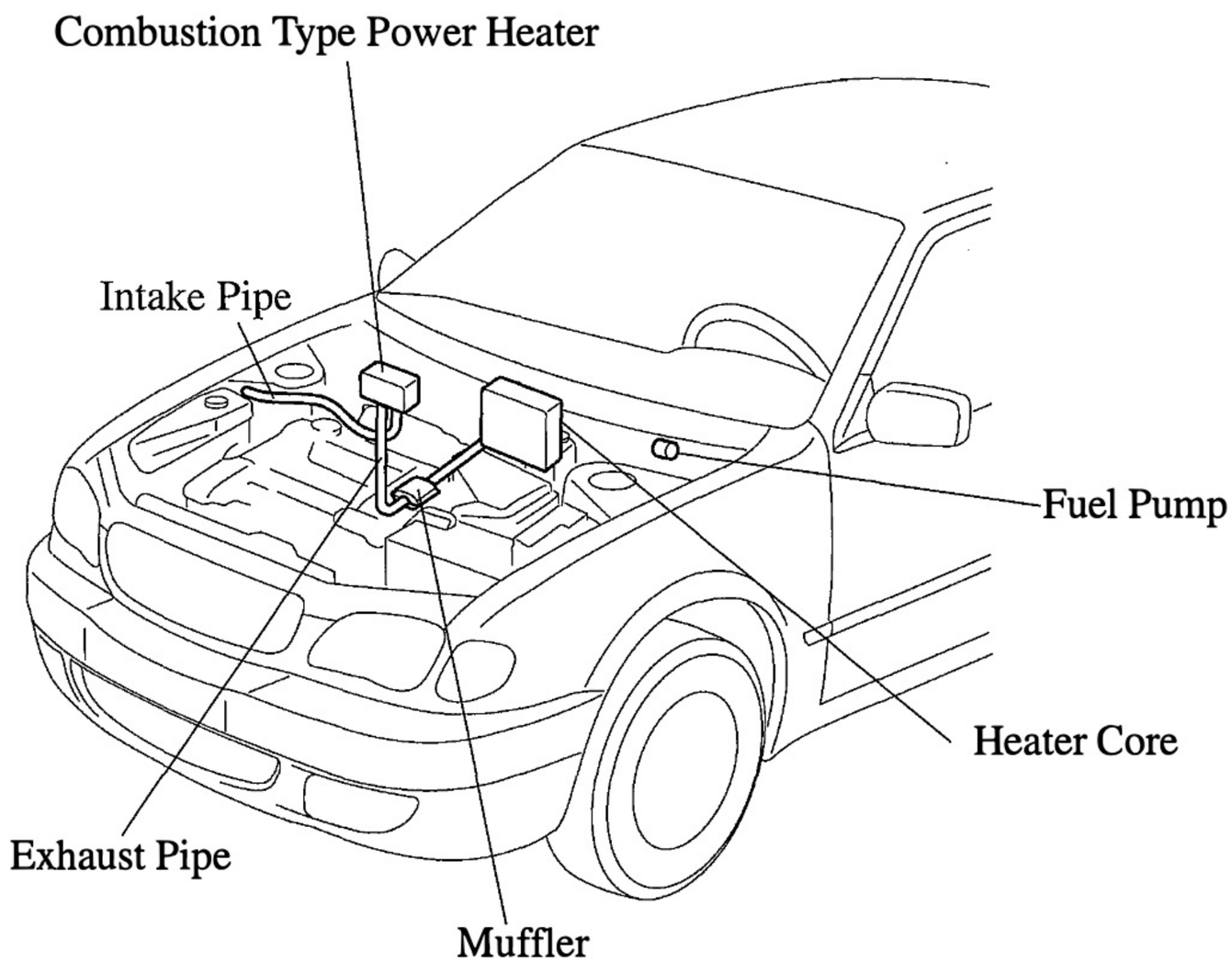
General

This heater system provides a combustion type power heater between the engine and the heater core. Air and fuel are introduced into the heater's combustion chamber, and a glow plug is used to ignite this mixture. By heating the engine coolant that flows around the combustion chamber, this system enhances the heating effect. The system can be activated or deactivated by turning the power heater switch provided on the instrument panel ON/OFF.



168AC03

Layout of Main Components

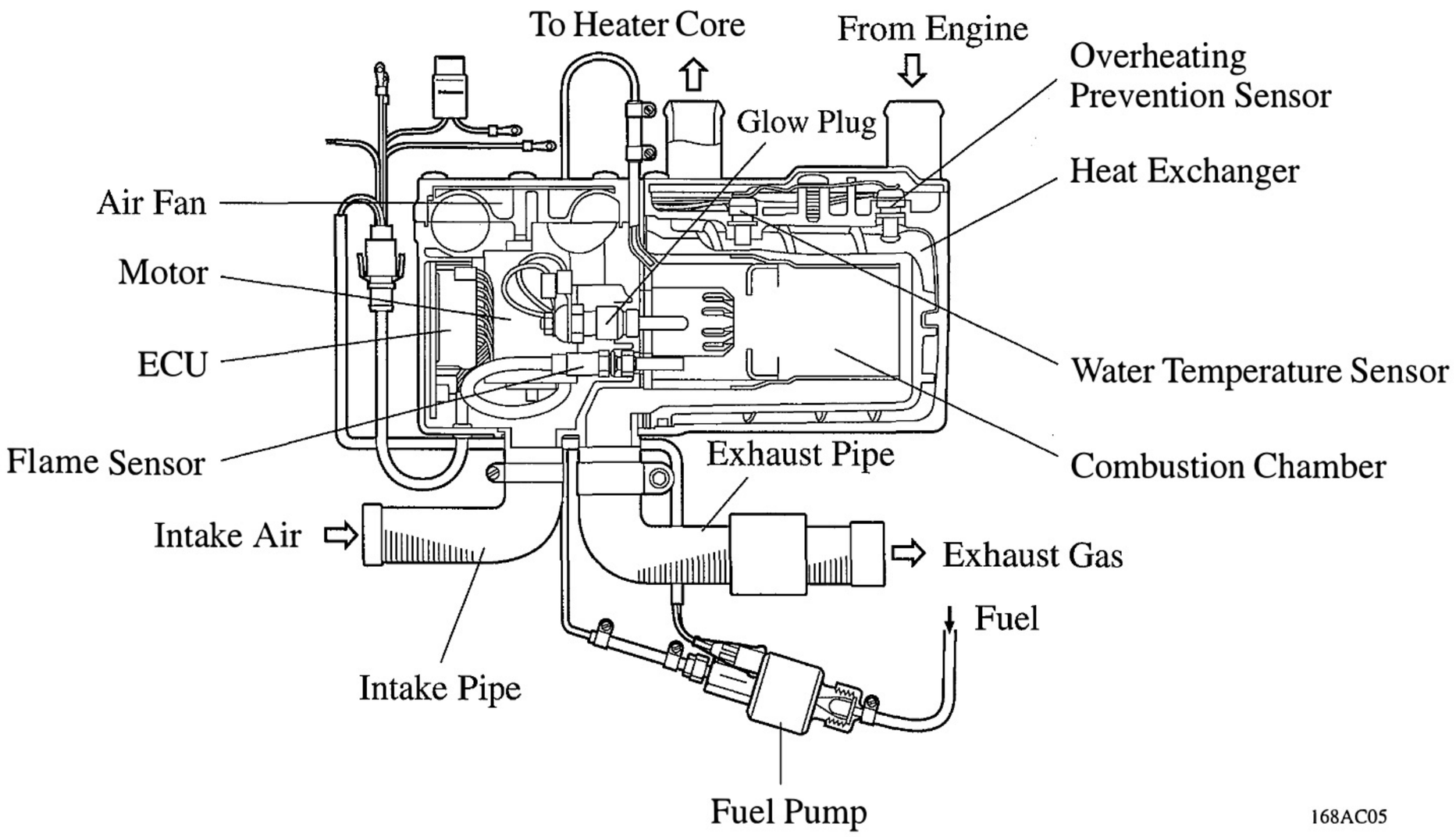


195EG80

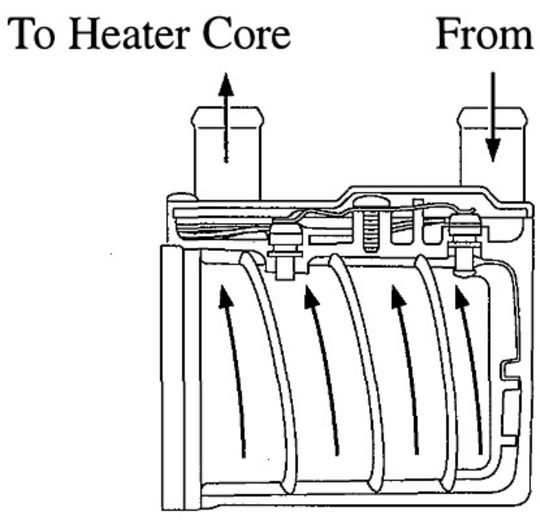
Combustion Type Power Heater Assembly

1) General

The combustion type power heater assembly consists mainly of a heat exchanger, glow plug, motor, air fan, ECU, water temperature sensor, overheating prevention sensor, flame sensor, intake pipe, exhaust pipe and fuel pump.
This heater is installed between the engine and the heater core. The coolant from the engine flows through the spiral passage around the heat exchanger and flows into the heater core. At this time, the glow plug ignites the air and fuel in the combustion chamber of the heat exchanger, and the resultant heat of combustion heats the engine coolant.



168AC05



Engine Coolant Flow

168AC06

2) Sensors

The table below shows the functions of the sensors.

Sensor	Function
Water Temperature Sensor	Detects the temperature of the engine coolant in the heater.
Overheating Prevention Sensor	Detects the temperature of the wall surface of the combustion chamber.
Flame Sensor	Detects the temperature of the exhaust gas.

Operation

1) General

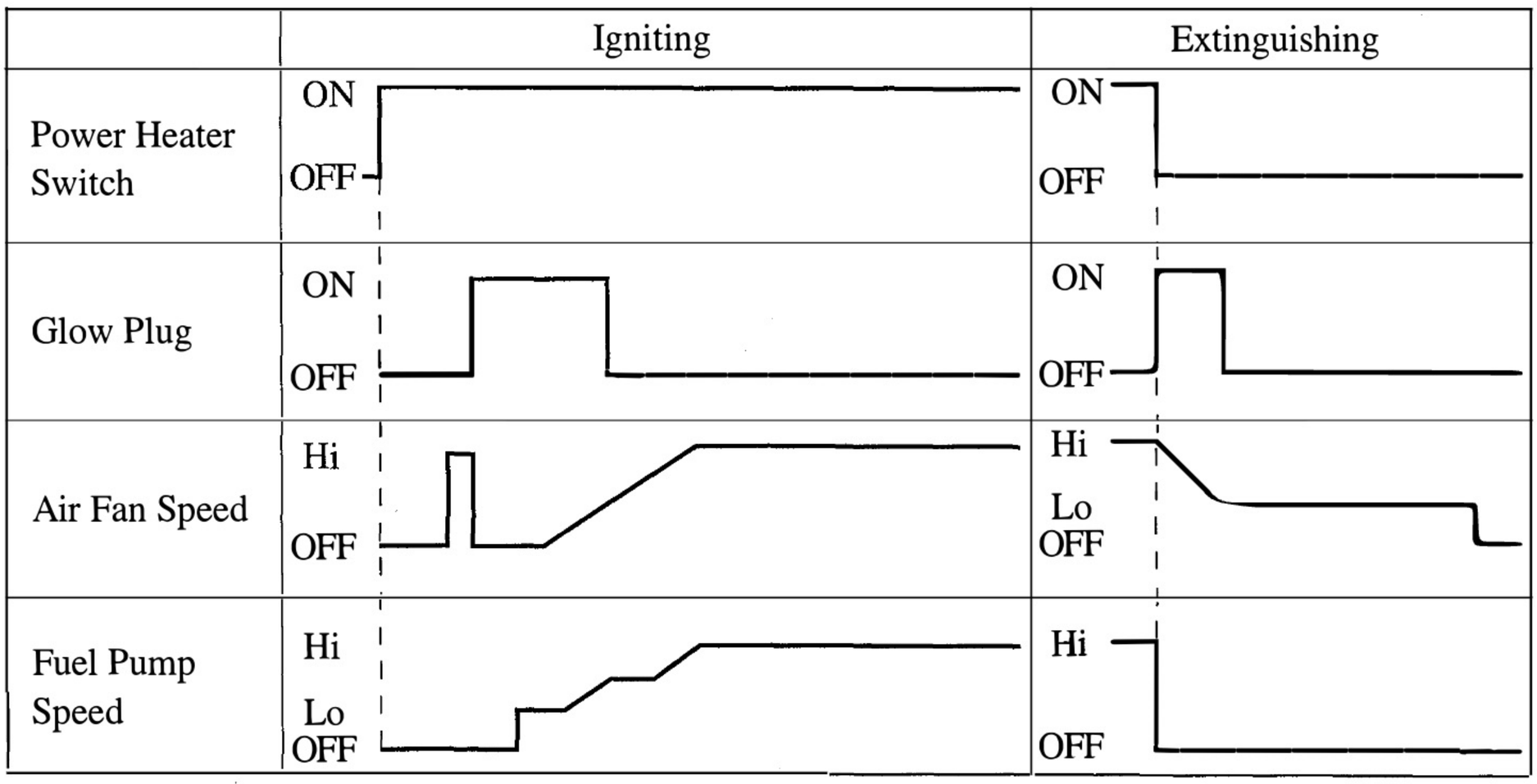
a. Igniting

When the engine is operating, turning the power heater switch on causes the air fan to operate for several seconds for verification purposes. Then, the glow plug starts to preheat the combustion chamber. After that, the fuel pump and the air fan turn on in due order to start Lo combustion. The fuel pump speed is then increased in steps, and this is accompanied by a gradual increase in the speed of the air fan, thus leading to Hi combustion.

b. Extinguishing

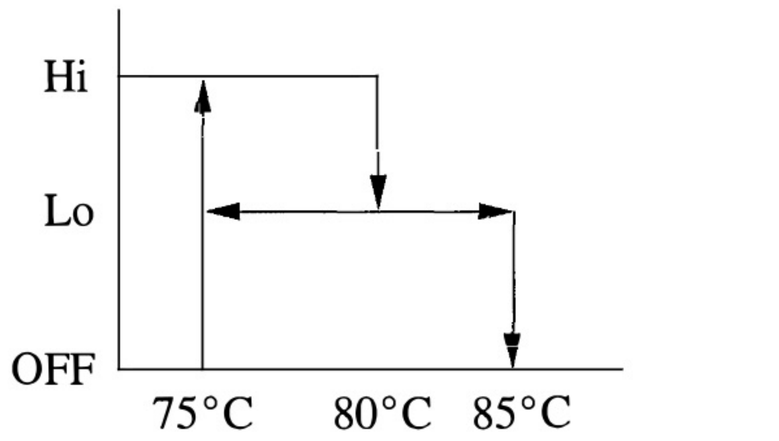
When the ignition switch is turned off or the power heater switch is turned off, the fuel pump stops, causing the combustion to stop. For the purpose of after-purge, current is applied again to the glow plug, and the air fan is activated for several seconds. Then, the entire system comes to a stop.

▶ Timing Chart ◀



c. Operating

While the system is in operation, it controls the fuel pump speed and switches Hi combustion and Lo combustion, and always keeps the water temperature between 75°C and 85°C. If the water temperature exceeds 85°C, the fuel pump stops automatically to stop the combustion. Thereafter, when the water temperature reaches 75°C or below, ignition occurs again. The operation of the glow plug, the air fan, and the fuel pump during extinguishing and re-igniting is the same as when these are operated by the switch as mentioned previously.



Water Temperature Control

2) Protective Control

For self-protection, this system stops if an abnormal condition is detected. A description of the control is indicated below.

Function	Control
Dry run prevention	If the temperature detected by the water temperature sensor or the overheating prevention sensor exceeds 125°C, the ECU determines that the heater is operating without engine coolant and automatically stops the system.
Overheating prevention	If the difference in temperature detected by the water temperature sensor and the overheating prevention sensor exceeds 15°C, the ECU determines that the flow volume of the engine coolant is insufficient and automatically stops the system.
Non-ignition or misfiring detection	If the temperature of the exhaust gas as detected by the flame sensor is low, the ECU determines that a non-ignition or a misfiring condition exists and automatically stops the system.
Open or short circuit detection	If an open or short circuit exists in the sensors or actuators, the ECU automatically stops the system.
Air fan seizure detection	If the air fan becomes seized, the ECU automatically stops the system.

3) Diagnosis

If a malfunction occurs in the system, it is possible to access the diagnostic trouble code by using a SST (Special Service Tools) that has been designed exclusively for the combustion type power heater. For details on the diagnostic trouble codes, etc., described above, refer to the COROLLA Chassis and Body Repair Manual Supplement (Pub. No. RM798E)

NOTES:
- When the power heater is turned on or off, some white smoke and a slight odor may be emitted from the exhaust located under the floor. If the power heater is being used under extremely cold conditions, vapor may be visible from the exhaust. This is normal.
- We recommend not to restart the power heater for 10 minutes after you turn it off. Otherwise, a noise may be heard as the heater ignites.
- Do not turn the power heater on and off repeatedly within 5 minute intervals as this can shorten the life of the heater components. If the engine is to be turned on and off repeatedly within short intervals (such as when being used for delivery purposes), turn the power heater switch off.

– MEMO –

MAJOR TECHNICAL SPECIFICATIONS

Item \ Area				Europe			
Body Type				4-Door Sedan		3-Door Hatchback	
Vehicle Grade				LINEA TERRA	LINEA SOL	LINEA TERRA	
Model Code				CDE110R-AEMDYW	CDE110L-AEMNYW	CDE110R-AGMDYW	CDE110L-AGMDYW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4315 (169.9)	←	4120 (162.2)	←
		Width	mm (in.)	1690 (66.5)	←	←	←
		Height	mm (in.)	1385 (54.5), 1405 (55.3)*1	←	←	←
	Wheel Base		mm (in.)	2465 (97.0)	←	←	←
	Tread	Front	mm (in.)	1460 (57.5)	←	←	←
		Rear	mm (in.)	1440 (56.7)	←	←	←
	Room	Length	mm (in.)	1830 (72.0)	←	1810 (71.3)	←
		Width	mm (in.)	1425 (56.1)	←	←	←
		Height	mm (in.)	1165 (45.9)	←	←	←
	Overhang	Front	mm (in.)	850 (33.5)	←	850 (33.5)	←
		Rear	mm (in.)	1000 (39.4)	←	805 (31.7)	←
	Min. Running Ground Clearance		mm (in.)	137 (5.4)	←	←	←
	Angle of Approach		degrees	18.6°	←	←	←
	Angle of Departure		degrees	17.2°	←	20.6°	←
	Curb Weight	Front	kg (lb)	750 ~ 810 (1653 ~ 1786)	755 ~ 815 (1664 ~ 1797)	←	←
		Rear	kg (lb)	430 ~ 455 (948 ~ 1003)	←	435 ~ 460 (959 ~ 1014)	←
		Total	kg (lb)	1180 ~ 1265 (2601 ~ 2789)	1185 ~ 1270 (2612 ~ 2800)	1190 ~ 1275 (2623 ~ 2811)	←
	Gross Vehicle Weight	Front	kg (lb)	920 (2028)	←	←	←
		Rear	kg (lb)	785 (1731)	←	←	←
		Total	kg (lb)	1705 (3759)	←	←	←
	Fuel Tank Capacity		ℓ (Imp.gal)	50 (11.0)	←	←	←
	Luggage Compartment Capacity		m³ (cu.ft.)	0.390 (13.8)	←	0.281 (9.9)	←
Performance	Max. Speed		km/h (mph)	180 (112)	←	←	←
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Acceleration	0 to 100 km/h	sec.	12.9	←	←	←
		0 to 400 m	sec.	18.8	←	←	←
	Max. Permissible Speed	1st Gear	km/h (mph)	41 (26)	←	←	←
		2nd Gear	km/h (mph)	71 (44)	←	←	←
		3rd Gear	km/h (mph)	109 (68)	←	←	←
		4th Gear	km/h (mph)	150 (93)	←	←	←
	Min. Turning Radius	Tire	m (ft.)	4.8 (15.7)	←	←	←
		Body	m (ft.)	5.2 (17.1)	←	←	←
Engine	Engine Type			1CD-FTV	←	←	←
	Valve Mechanism			16-Valve, DOHC	←	←	←
	Bore x Stroke		mm (in.)	82.2 x 94.0 (3.24 x 3.7)	←	←	←
	Displacement		cm³ (cu.in.)	1995 (121.7)	←	←	←
	Compression Ratio			18.6 : 1	←	←	←
	Carburetor Type or Injection Pump Type (Diesel)			Common-Rail Type	←	←	←
	Research Octane No. or Cetane No. (Diesel)			52 or More	←	←	←
	Max. Output (EEC)		kW/rpm	66/4000	←	←	←
	Max. Torque (EEC)		N·m/rpm	215/2200 ~ 2400	←	←	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	—	—	—	—
	Alternator Output		Watts	—	—	—	—
	Starter Output		kW	—	—	—	—
Chassis	Clutch Type			Dry, Single	←	←	←
	Transaxle Type			E351	←	←	←
	Transmission Gear Ratio	In First		3.538	←	←	←
		In Second		2.045	←	←	←
		In Third		1.333	←	←	←
		In Fourth		0.972	←	←	←
		In Fifth		0.731	←	←	←
		In Sixth		—	—	—	—
		In Reverse		3.583	←	←	←
	Counter Gear Ratio			—	—	—	—
	Differential Gear Ratio (Final)			3.684	←	←	←
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Disc	←	←	←
	Parking Brake Type			Drum	←	←	←
	Brake Booster Type and Size		in.	Single, 9"	←	←	←
	Proportioning Valve Type			Dual-P Valve	←	←	←
	Suspension Type	Front		MacPherson Strut	←	←	←
		Rear		MacPherson Strut	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack and Pinion	←	←	←
	Steering Gear Ratio (Overall)			18.1	←	←	←
	Power Steering Type			Integral Type	←	←	←

*1: For Rough Road Package
*1: With 175/65 R14 Tire
*3: Option

	Europe					
	3-Door Hatchback	5-Door Liftback				5-Door Wagon
	LINEA SOL	LINEA TERRA		LINEA SOL		LINEA TERRA
	CDE110L-AGMNYW	CDE110R-ALMDYW	CDE110L-ALMDYW	CDE110R-ALMNYW	CDE110L-ALMNYW	CDE110R-AWMDYW
5	←	4290 (168.9)	←	←	←	4340 (170.9)
	←	←	←	←	←	←
	←	←	←	←	←	1445 (56.9)
	←	←	←	←	←	←
	←	←	←	←	←	←
10	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	1200 (47.2)
	←	←	←	←	←	←
15	←	975 (38.4)	←	←	←	1025 (40.4)
	←	←	←	←	←	←
	←	←	←	←	←	15.8°
	←	17.2°	←	←	←	18.5°
	760 ~ 820 (1675 ~ 1808)	755 ~ 815 (1664 ~ 1797)	←	760 ~ 820 (1675 ~ 1808)	←	745 ~ 810 (1642 ~ 1786)
20	←	470 ~ 495 (1036 ~ 1091)	←	←	←	480 ~ 505 (1058 ~ 1113)
	1195 ~ 1280 (2634 ~ 2822)	1225 ~ 1310 (2701 ~ 2888)	←	1230 ~ 1315 (2712 ~ 2899)	←	1225 ~ 1315 (2701 ~ 2899)
	←	←	←	←	←	←
	←	825 (1819)	←	←	←	←
	←	1745 (3847)	←	←	←	←
25	←	←	←	←	←	←
	←	0.372 (13.1)	←	←	←	0.308 (10.9)
	←	←	←	←	←	←
	—	—	—	—	←	—
	←	←	←	←	←	←
30	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
35	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
40	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
45	←	←	←	←	←	←
	—	—	—	—	—	—
	—	—	—	—	—	—
	—	—	—	—	—	—
	←	←	←	←	←	←
50	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
55	←	←	←	←	←	←
	—	—	—	—	—	—
	←	←	←	←	←	←
	—	—	—	—	—	—
	←	←	←	←	←	←
60	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
65	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
70	←	←	←	←	←	←
	←	←	←	←	←	←

*1: For Rough Road Package
*2: With 175 / 65 R14 Tire
*3: Option

Item / Area				Europe	
Body Type				5-Door Wagon	
Vehicle Grade				LINEA TERRA	LINEA SOL
Model Code				CDE110L-AWMDYW	CDE110L-AWMNYW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4340 (170.9)	←
		Width	mm (in.)	1690 (66.5)	←
		Height	mm (in.)	1445 (56.9)	←
	Wheel Base		mm (in.)	2465 (97.0)	←
	Tread	Front	mm (in.)	1460 (57.5)	←
		Rear	mm (in.)	1440 (56.7)	←
	Room	Length	mm (in.)	1810 (71.3)	←
		Width	mm (in.)	1425 (56.1)	←
		Height	mm (in.)	1200 (47.2)	←
	Overhang	Front	mm (in.)	850 (33.5)	←
		Rear	mm (in.)	1025 (40.4)	←
	Min. Running Ground Clearance		mm (in.)	137 (5.1)	←
	Angle of Approach		degrees	15.8°	←
	Angle of Departure		degrees	18.5°	←
	Curb Weight	Front	kg (lb)	745 ~ 810 (1642 ~ 1786)	750 ~ 815 (1653 ~ 1797)
		Rear	kg (lb)	480 ~ 505 (1058 ~ 1113)	←
		Total	kg (lb)	1225 ~ 1315 (2701 ~ 2899)	1230 ~ 1320 (2712 ~ 2910)
	Gross Vehicle Weight	Front	kg (lb)	920 (2028)	←
		Rear	kg (lb)	825 (1819)	←
		Total	kg (lb)	1745 (3847)	←
	Fuel Tank Capacity		ℓ (Imp.gal)	50 (11.0)	←
	Luggage Compartment Capacity		m³ (cu.ft.)	0.308 (10.9)	←
Performance	Max. Speed		km/h (mph)	180 (112)	←
	Max. Cruising Speed		km/h (mph)	—	—
	Acceleration	0 to 100 km/h	sec.	12.9	←
		0 to 400 m	sec.	18.8	←
	Max. Permissible Speed	1st Gear	km/h (mph)	41 (26)	←
		2nd Gear	km/h (mph)	71 (44)	←
		3rd Gear	km/h (mph)	109 (68)	←
		4th Gear	km/h (mph)	150 (93)	←
	Min. Turning Radius	Tire	m (ft.)	4.8 (15.7)	←
		Body	m (ft.)	5.2 (17.1)	←
Engine	Engine Type			1CD-FTV	←
	Valve Mechanism			16-Valve, DOHC	←
	Bore x Stroke		mm (in.)	82.2 x 94.0 (3.24 x 3.7)	←
	Displacement		cm³ (cu.in.)	1995 (121.7)	←
	Compression Ratio			18.6 : 1	←
	Carburetor Type or Injection Pump Type (Diesel)			Common-Rail Type	←
	Research Octane No. or Cetane No. (Diesel)			52 or More	←
	Max. Output (EEC)		kW/rpm	66/4000	←
	Max. Torque (EEC)		N·m/rpm	215/2200 ~ 2400	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	—	—
	Alternator Output		Watts	—	—
	Starter Output		kW	—	—
Chassis	Clutch Type			Dry, Single	←
	Transaxle Type			E351	←
	Transmission Gear Ratio	In First		3.538	←
		In Second		2.045	←
		In Third		1.333	←
		In Fourth		0.972	←
		In Fifth		0.731	←
		In Sixth		—	—
		In Reverse		3583	←
	Counter Gear Ratio			—	—
	Differential Gear Ratio (Final)			3.684	←
	Brake Type	Front		Ventilated Disc	←
		Rear		Disc	←
	Parking Brake Type			Drum	←
	Brake Booster Type and Size		in.	Single, 9"	←
	Proportioning Valve Type			Dual-P Valve	←
	Suspension Type	Front		MacPherson Strut	←
		Rear		MacPherson Strut	←
	Stabilizer Bar	Front		STD	←
		Rear		STD	←
	Steering Gear Type			Rack and Pinion	←
	Steering Gear Ratio (Overall)			18.1	←
	Power Steering Type			Integral Type	←

*1: For Rough Road Package
*2: With 175/65 R14 Tire
*3: Option

MR2

MR2

OUTLINE OF NEW FEATURES

1. Model Line-Up

The models with sequential manual transmission (ZZW30R-AKGQHW, ZZW30L-AKGQHW and ZZW30R-AKGQHQ) have been added.

2. Engine (Model with Sequential Manual Transmission)

- The ETCS-i (Electronic Throttle Control System-intelligent) has been adopted to realize excellent throttle control.
- Along with the adoption of the sequential manual transmission, the brake start control function, which operates the starter only when the brake is ON and the gear is shifted to the N range, has been added to the engine ECU.
- To inform the driver of the gear position when the vehicle is parked, a function that controls the shift display on the combination meter, the warning light, and the buzzer when the ignition switch is turned OFF, has been added to the engine ECU.

3. Clutch (Model with Sequential Manual Transmission)

- The clutch pedal has been discontinued to realize an automatic clutch operation.
- In contrast to the clutch that is used on a conventional transaxle, no master cylinder or release cylinder is provided.

4. Transaxle (Model with Sequential Manual Transmission)

- In addition to the automatic clutch operation, a sequential manual transmission, which enables the driver to operate the shift lever forward or rearward to effect up-shift or down-shift during gear changes, has been adopted.
- The transmission shift switches are provided as optional equipment. The transmission shift switches are located on the steering wheel and they allow the driver to shift the gears.

5. Seat

Genuine leather seats are optional equipment on all models.

MODEL CODE

ZZW30 L – A K G Q H W

1 2 3 4 5 6 7 8

2

1	BASIC MODEL CODE
	ZZW30 : With 1ZZ-FE Engine

2	STEERING WHEEL POSITION
	L : Left-Hand Drive R : Right-Hand Drive

3	MODEL NAME
	A : MR2

4	BODY TYPE
	K : Convertible

5	GEAR SHIFT TYPE
	M : 5-Speed Manual, Floor G : 5-Speed Sequential, Floor

6	GRADE
	Q : G

7	ENGINE SPECIFICATION
	H : DOHC and EFI

8	DESTINATION
	W : Europe Q : Australia

MODEL LINE-UP

DESTINATION	ENGINE	BODY TYPE	GRADE	TRANSAXLE		
				C52 5-Speed Manual		C56 5-Speed Manual
				Conventional Shift	Sequential Shift	Sequential Shift
Europe	1ZZ-FE	Convertible	G	ZZW30 R/L -AKMQHW	ZZW30 R/L -AKGQHW	–
Australia				–	–	ZZW30R-AKGQHQ

NEW FEATURES

■ENGINE (MODEL WITH SEQUENTIAL MANUAL TRANSMISSION)

1. General

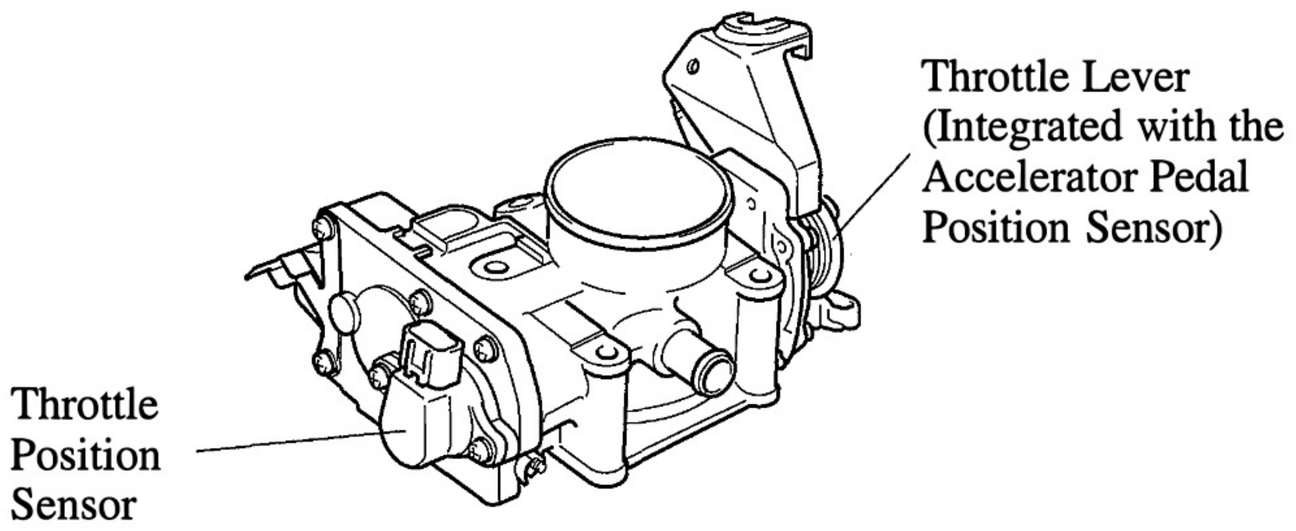
The following items have been changed.

- The ETCS-i (Electronic Throttle Control System-intelligent) has been adopted to realize excellent throttle control.
- The following functions have been added to the engine control system.
  - ETCS-i
  - Brake Start Control Function
  - Indicator, Warning and Buzzer Control

2. Intake System

Throttle Body

- The adoption of the ETCS-i has realized excellent throttle control.
- The ETCS-i drives the throttle valve through a DC motor that is controlled by the engine ECU.
- The ISC system is controlled comprehensively by the ETCS-i.



I91MR27

3. Engine Control System

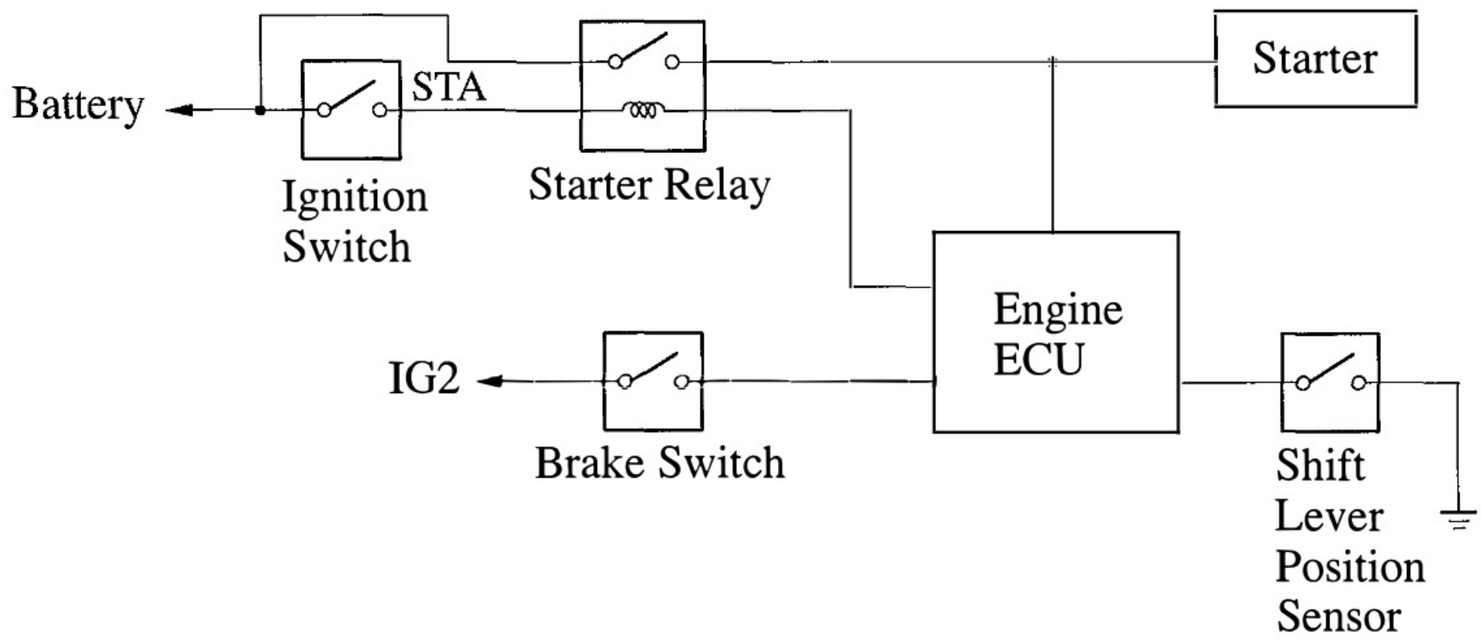
ETCS-i (Electronic Throttle Control System-intelligent)

- The ETCS-i, which realizes excellent throttle control in all the operating ranges, has been adopted.
- In the conventional throttle body, the throttle valve opening is determined invariably by the amount of the accelerator pedal effort. In contrast, the ETCS-i used the engine ECU to calculate the optimal throttle valve opening that is appropriate for the respective driving condition and uses a throttle control motor to control the opening.
- The ETCS-i controls the ISC (Idle Speed Control) system and the cruise control system.

The basic construction and operation are the same as in the 2UZ-FE engine model of Land Cruiser. For details, see the Land Cruiser New Car Features (Pub. No. NCF147E).

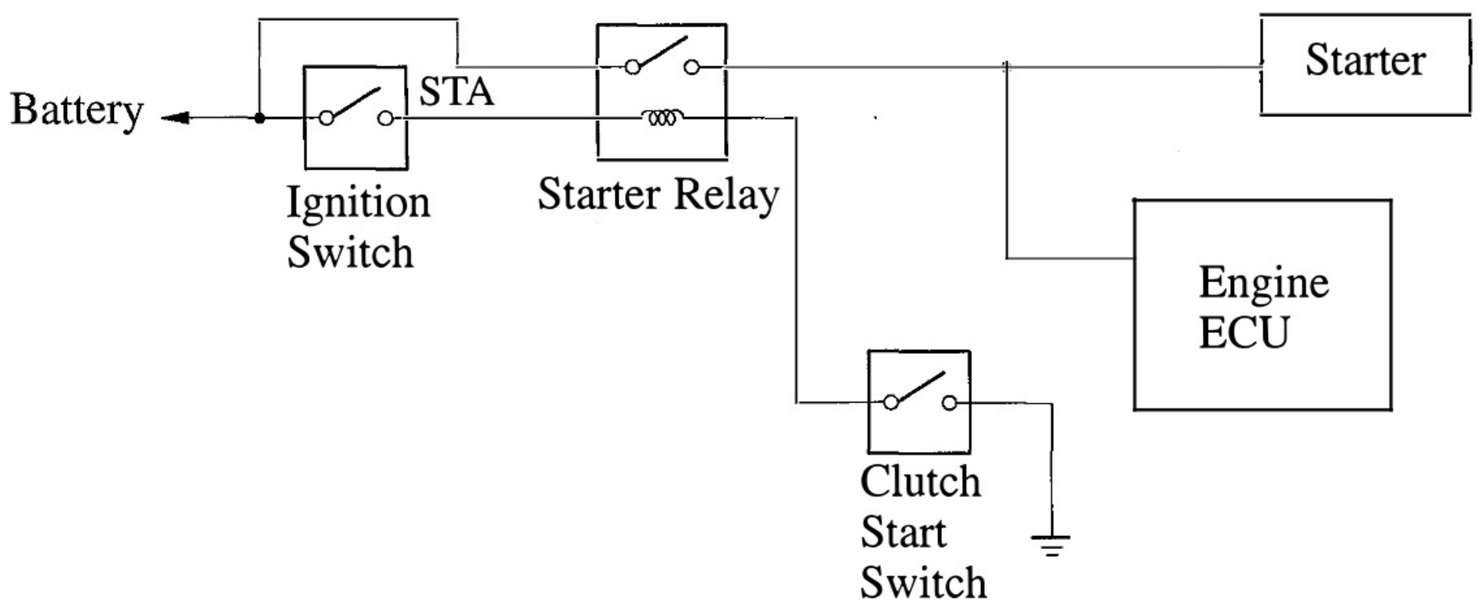
Brake Start Control System

On the models with the conventional transaxle, the ST signal of the ignition switch and the ON signal of the clutch start switch operated the starter, thus causing the engine to start. However, on the models with the sequential manual transmission, when the ON signal from the brake switch, the N position signal from the shift lever position signal sensor, and the ST signal from the ignition switch are input into the engine ECU, the engine ECU operates the starter to start the engine.



191MR02

Model with Sequential Manual Transmission

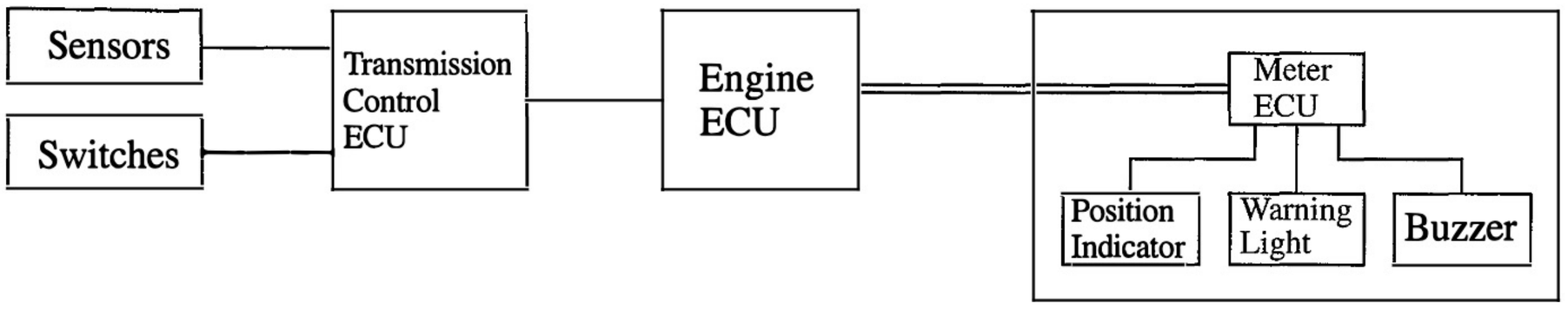


191MR03

Model with Conventional Transaxle

Indicator, Warning and Buzzer Control

To inform the driver of the position at which the gear is shifted when the vehicle is parked, the engine ECU effects the control of the gear position indicator, system warning light, and warning buzzer in the combination meter through the meter ECU even after the ignition switch has been turned OFF. This control is effected under the instructions from the transmission control ECU, and is stopped approximately 5 seconds after the ignition switch is turned OFF.



191MR04

■TRANSAXLE (MODEL WITH SEQUENTIAL MANUAL TRANSMISSION)

1. General

- In addition to the conventional manual transaxle, a new sequential manual transmission has been adopted. The sequential manual transmission contains a hydraulic actuator, electronic throttle, dedicated shift lever, transmission control ECU, sensors, etc. in addition to the conventional transaxle. During gear shifting, it automatically operates the clutch and controls the engine, and shifts gears only by operating the lever forward or rearward, resulting in a shift feel of a new dimension.
- The transmission shift switches are provided as optional equipment. The transmission shift switches are located on the steering wheel and they allow the driver to shift the gears.

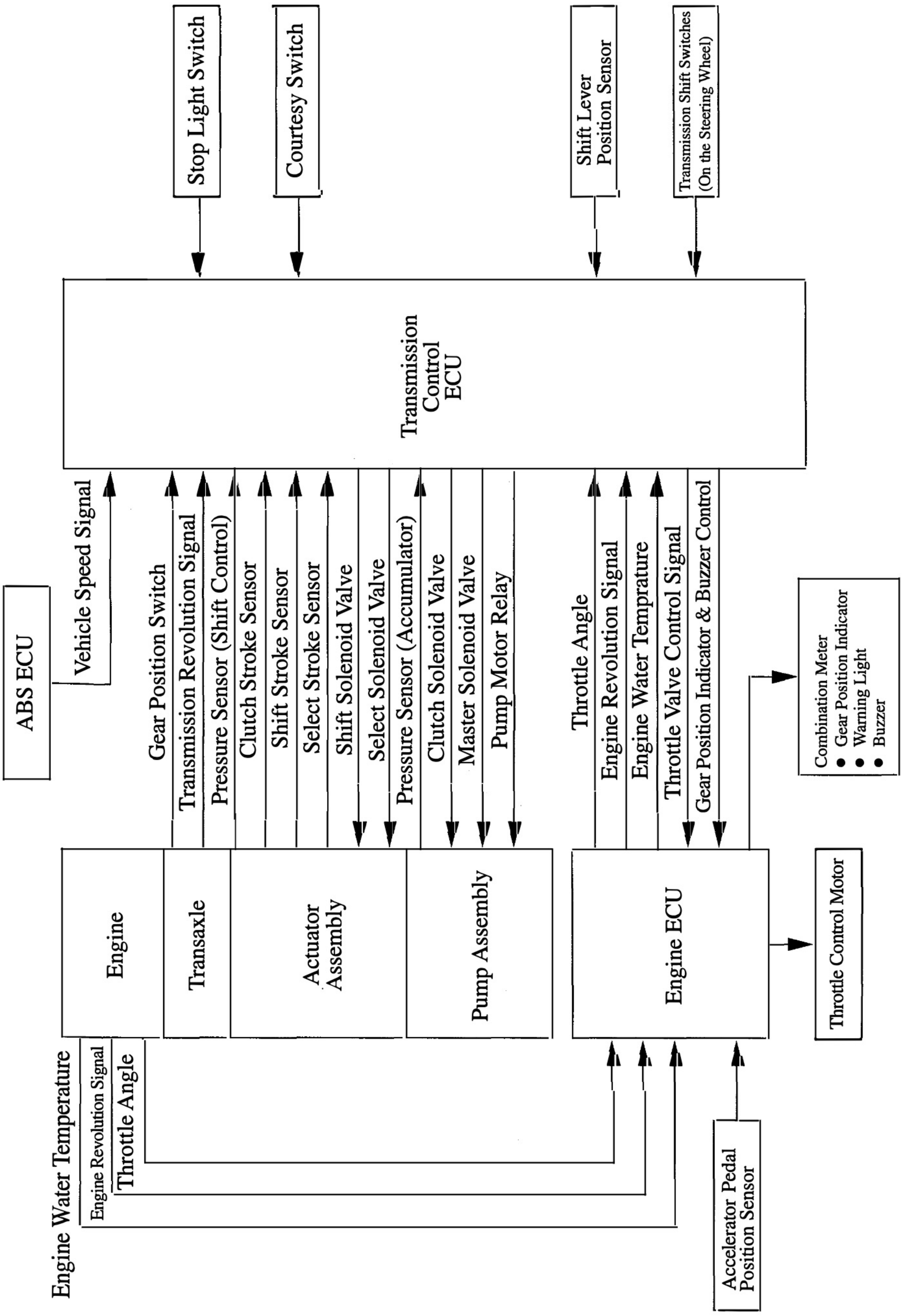
2. Sequential Manual Transmission

Characteristics

The sequential manual transmission has the following characteristics.

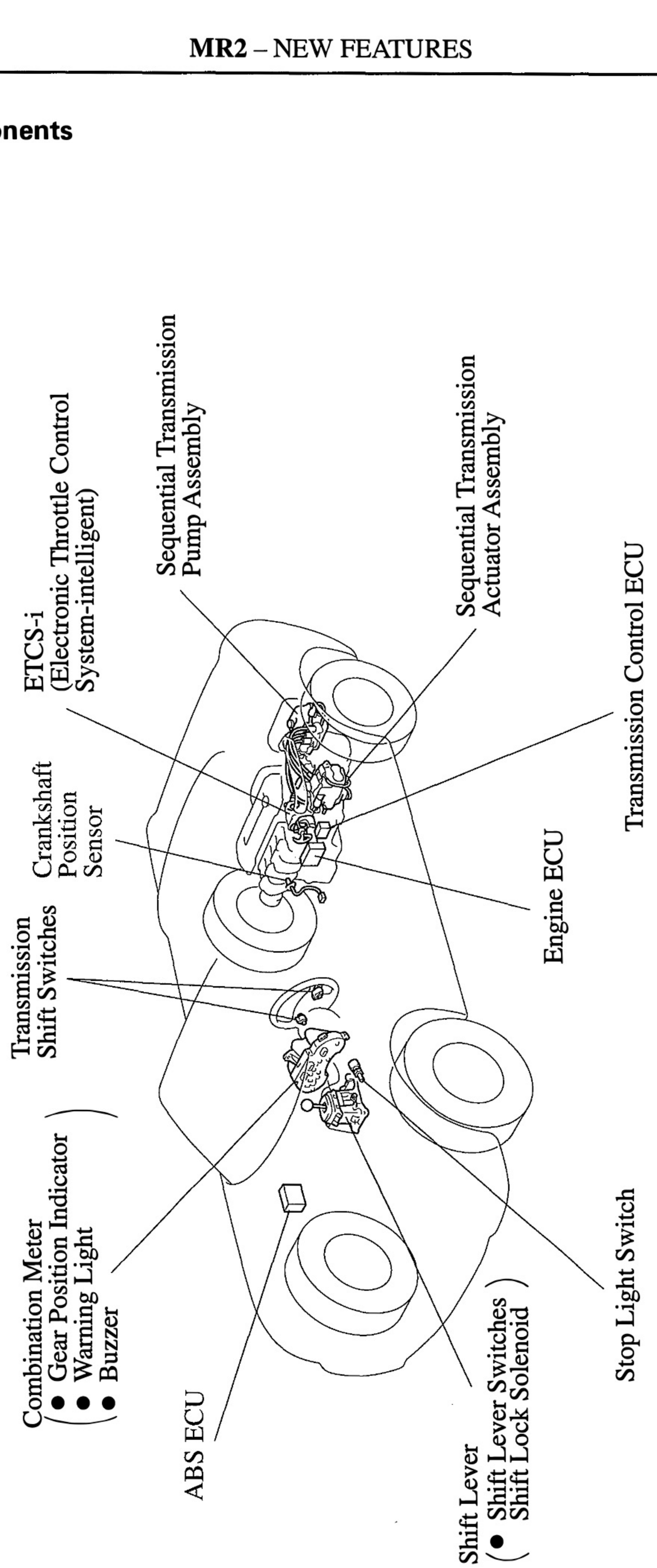
- On behalf of the driver, the transmission control ECU optimally controls the engine, clutch, and the transaxle, and accomplishes precise shifting in a short time.
- Provides a sporty drive feel through the sequential shift lever operation, as well as through the adoption of the optional transmission shift switches.
- Frees the driver from operating the clutch pedal during start off, for ease of driving. When the vehicle comes to a stop, it shifts automatically to the 1st gear, so that it can be started off again without operating the shift lever.
- Provides protection control to help prevent the driver from mis-shifting, and a buzzer and an indicator light to warn the driver.
- Because the clutch is always disengaged whenever the vehicle is stopped, the generation of a rattling noise at idle and a gear noise when shifting into reverse gear is prevented.

System Diagram



191MR05

Layout of Components



Function of Components

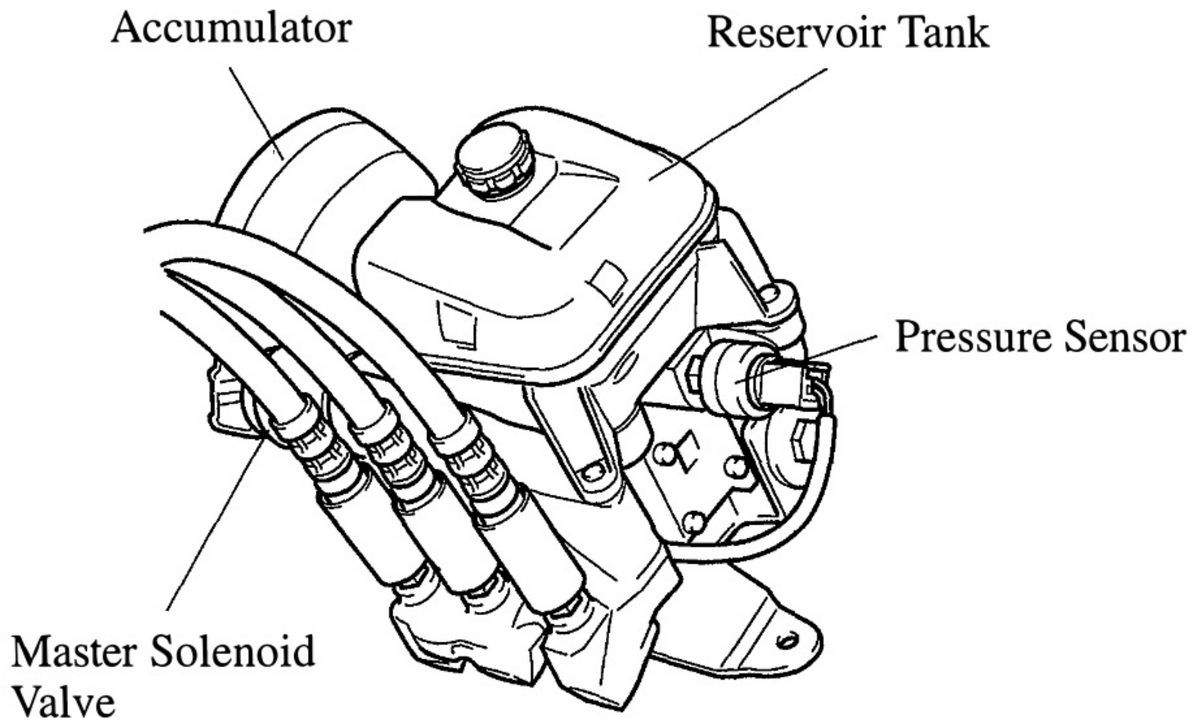
Components	Outline
Sequential Transmission Pump Assembly	● Generates the hydraulic pressure that is required for the system operation. ● Supply the hydraulic pressure to the clutch release cylinder that is integrated with the sequential transmission actuator assembly in accordance with the signals from the transmission control ECU. ● Controls the hydraulic pressure that is applied to the hydraulic circuit of the shift operating system in accordance with the signals from the hydraulic pressure sensor.
Sequential Transmission Actuator Assembly	● Engage or disengage the clutch in accordance with the hydraulic pressure from the pump assembly. ● Shifts gears in accordance with the signals from the transmission control ECU.
Shift Lever Switches	● The shift position and the movement of the shift lever are detected through the combination of the 4 switches that are integrated in the lever. ● The operating conditions of the switches are detected and the signals send to the transmission control ECU.
Transmission Control ECU	● Controls the pump assembly and the actuator assembly to engage or disengage the clutch and shift the gears in accordance with the signals from the ECUs, sensors, switches, etc. ● Controls the transmission and requests the engine ECU to control the ETCS-i during gear changes.
Engine ECU	● Controls the ETCS-i in accordance with the request from the transmission control ECU. ● Controls the operation of the warning light in the combination meter, indicator, and the buzzer.
System Warning Light	Lights up to alert the driver when the transmission control ECU detects the malfunction in the sequential manual transmission.
Gear Position Indicator	● Indicates the gear position of the transmission. ● Causes the indicator to blink if the shift lever position and the gear position become mismatched.
Stop Light Switch	Detects that the brake pedal is pressed.
Shift Lock Solenoid	Locks the movement of the shift lever when the ignition switch is turned ACC or LOCK position and prevents the lever position and the gear position from becoming mismatched.
Transmission Revolution Sensor	Detects the input shaft speed.

Construction and Operation of Main Components

1) Sequential Transmission Pump Assembly

Sequential transmission pump assembly consists of the following components:

Components	Outline
Pump and Pump Motor	● An axial piston type pump is used. ● Draws up the brake fluid from the reservoir tank and provides high hydraulic pressure to the accumulator.
Accumulator	● The accumulator is filled with high-pressure gas. ● Stores a sufficient amount of hydraulic pressure generated by the pump to operate the system.
Pressure Sensor	Detects the accumulator pressure and send the signal to the transmission control ECU.
Clutch Solenoid Valve	● A 3-port linear spool type solenoid valve is used. ● Supply the hydraulic pressure to the clutch release cylinder that is integrated into the sequential transmission actuator assembly in accordance with the signals from the transmission control ECU.
Master Solenoid Valve	● A linear spool type solenoid valve is used. ● Controls the hydraulic pressure that is applied to the hydraulic circuit of the shift operating system in accordance with the signals from the pressure sensor that is provided in the sequential transmission actuator assembly.
Reservoir Tank	Stores the fluid.
Relief Valve	Drains the fluid when the accumulator pressure becomes abnormally high.
Check Valve	Prevents the accumulator pressure from backflowing into the pump.

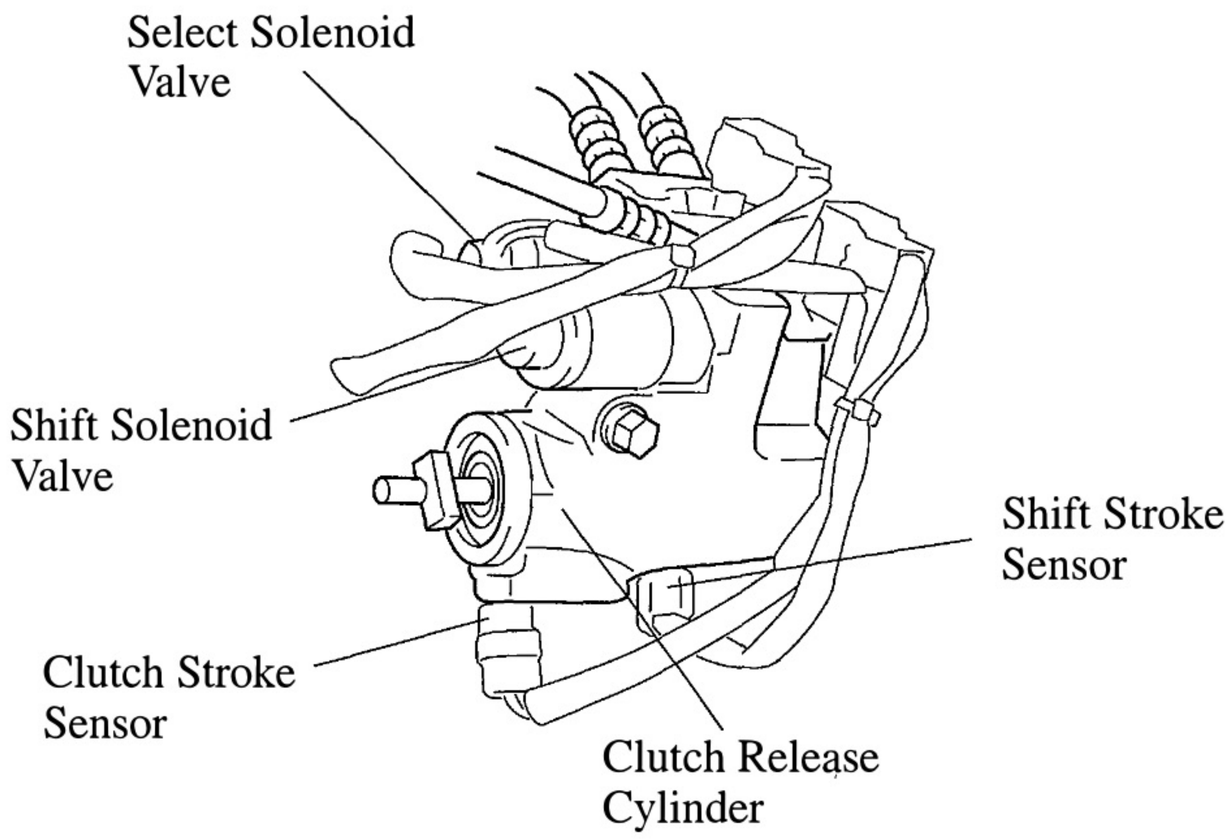


191MR07

2) Sequential Transmission Actuator Assembly

Sequential transmission actuator assembly consists of the following components:

Components	Outline
Clutch Release Cylinder	Actuates the clutch release fork through the hydraulic pressure from the sequential transmission pump assembly in order to engage or disengage the clutch.
Shift Solenoid Valve	● A linear spool type solenoid valve is used. ● Controls the hydraulic pressure that is applied to the shift piston in accordance with the signals from the transmission control ECU.
Select Solenoid Valve	● A linear spool type solenoid valve is used. ● Controls the hydraulic pressure that is applied to the select piston in accordance with the signals from the transmission control ECU.
Pressure Sensor	Detects the hydraulic pressure of the hydraulic circuit in the shift operating system.
Shift Stroke Sensor	Detects the shift stroke.
Select Stroke Sensor	Detects the select stroke.
Clutch Stroke Sensor	Detects the clutch stroke.

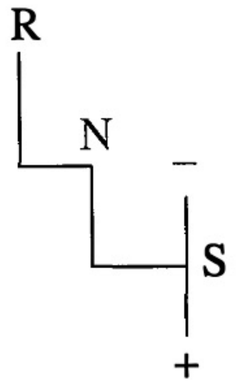


191MR08

3) Shift Lever

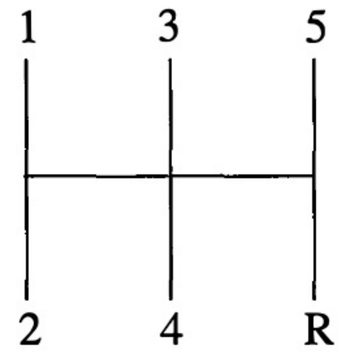
a. General

- A control-by-wiring type shift lever, which detects the movement of the shift lever through the tripping of the switches that are integrated in the lever and effects shifting through electric signals, has been adopted.
- A sequential control type shift pattern, in which gears are shifted only by operating the lever forward or rearward, has been adopted.
- A moderation mechanism has been provided to enable the driver to feel the shift effort.
- A shift lock mechanism that locks the shift lever when the ignition switch is turned ACC or LOCK position is provided.



Sequential Shift Type

191MR09



Conventional Shift Type

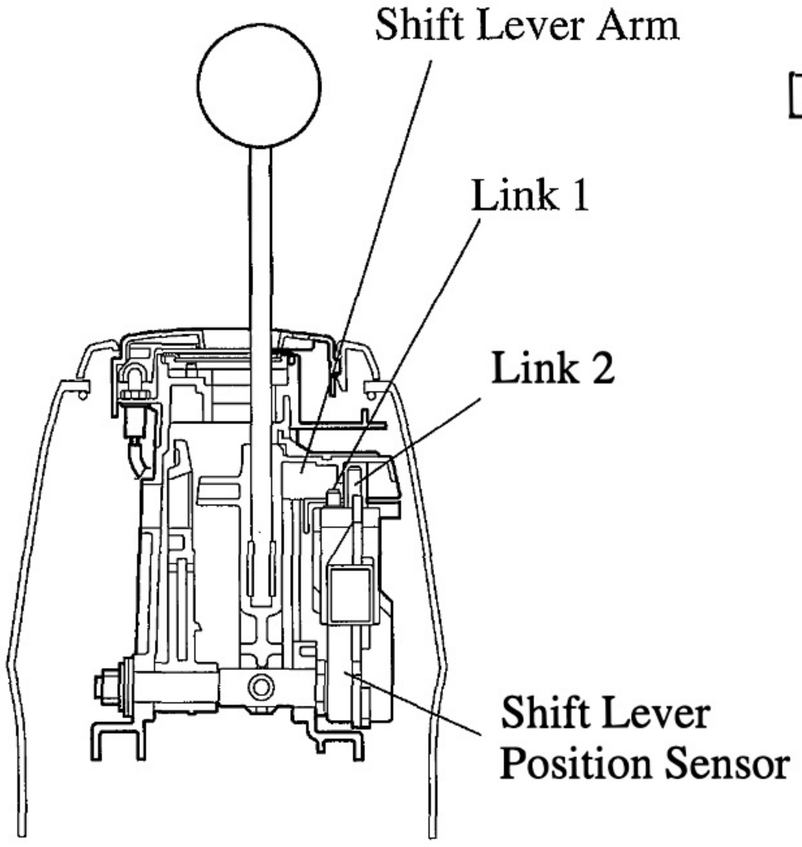
191MR10

Shift Pattern

b. Construction and Operation

i) Shift Position Detection Mechanism

- A shift position detection mechanism that electrically detects the movement of the shift lever has been provided because the shifting of the transaxle is controlled through hydraulic and electric means.
- The shift position detection mechanism consists of cross grooves in the shift lever arm and shift lever position sensors. Furthermore, the shift lever position sensors consist of Link-1 and Link-2 that engage with the cross grooves of the lever arm, and 4 switches that turn ON/OFF in accordance with the movements of the respective links.



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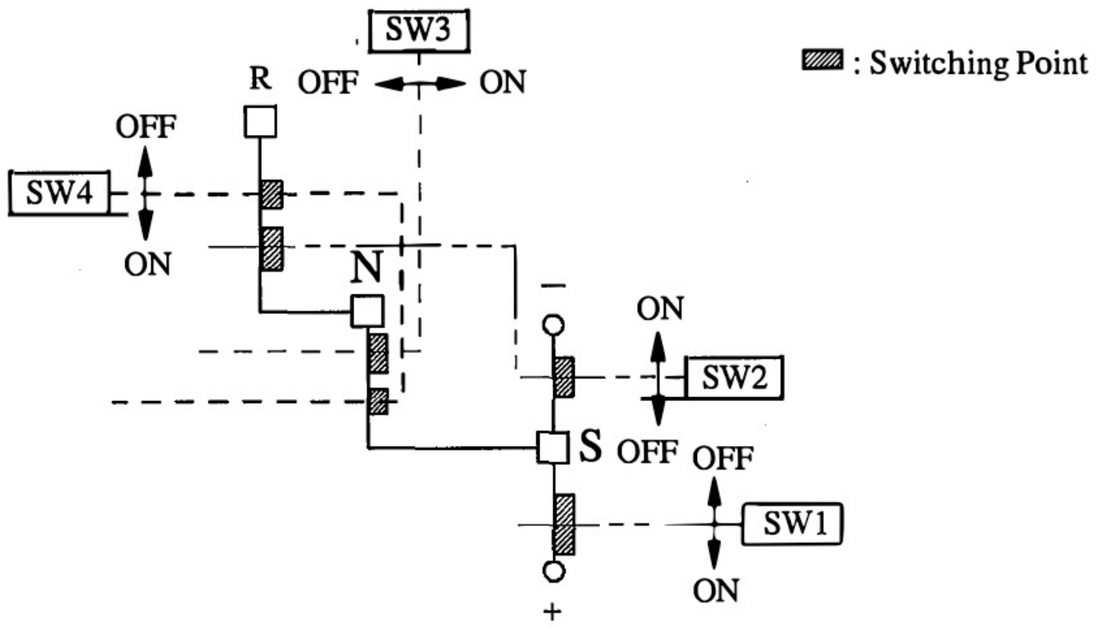
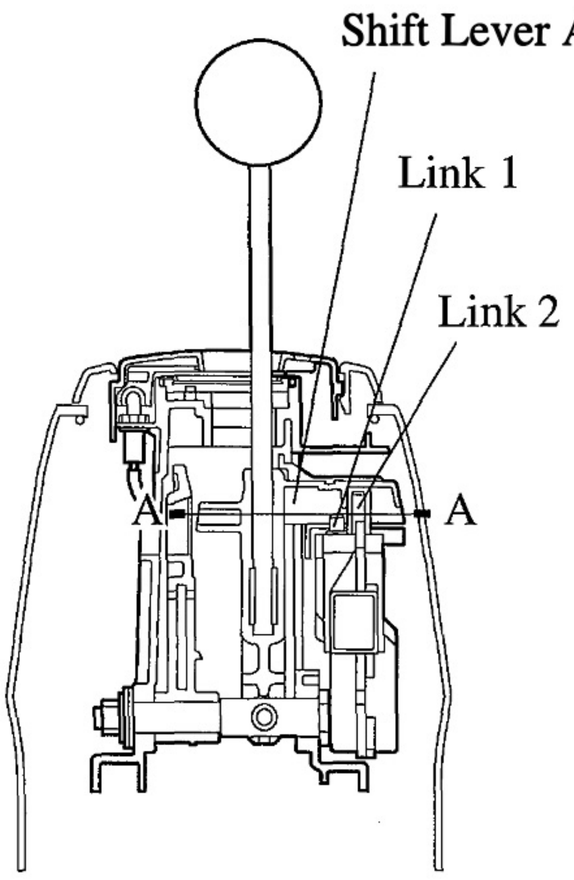


191MR12

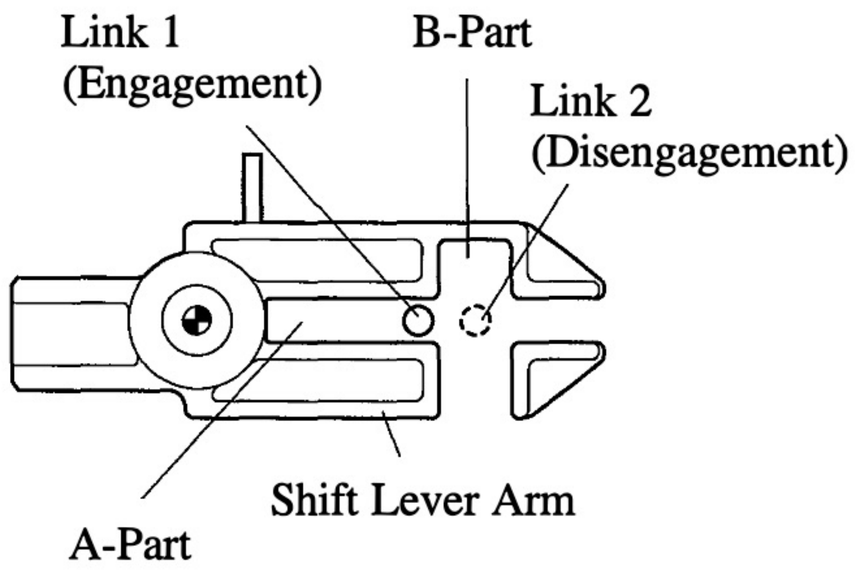
Switch	Detection Range	Link
SW1	+ (Up-Shift)	Link 1
SW2	– (Down-Shift), R	Link 1
SW3	N	Link 2
SW4	S, R	Link 2

- **When the Shift Lever is in the S Range**

When the shift lever is in the S range, Link-1 is engaged with portion A of the cross grooves. If the lever is operated in the up-shift (+) or down-shift (–) direction, Link-1 rotates in the forward or rearward direction in unison with the movement of the shift lever. This causes the 2 switches, SW1 and SW2, that are provided at Link-1 to switch, in order to detect the movement of the lever. At this time, because Link-2 is engaged with portion B of the cross grooves, it remains in this position by the force of the spring provided in the sensor, even if the shift lever is operated.



191MR29

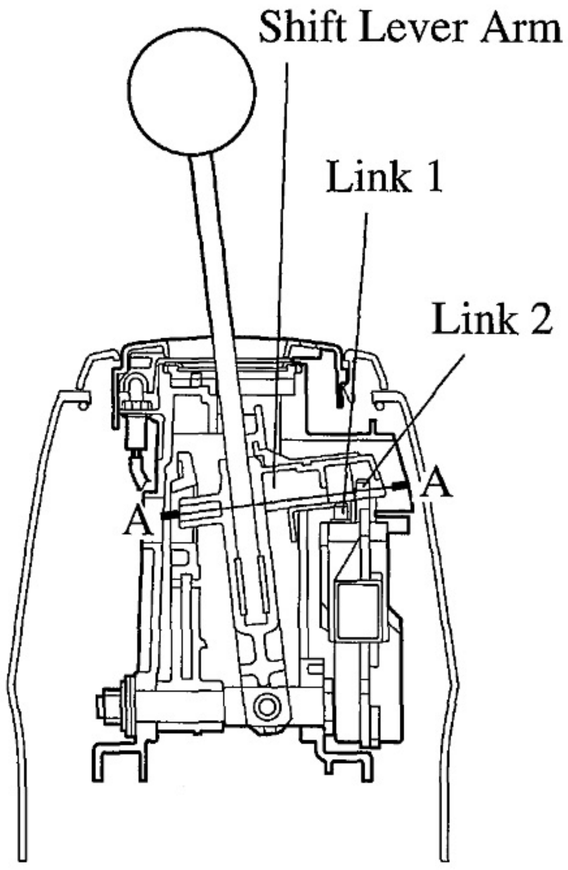


A – A Cross Section

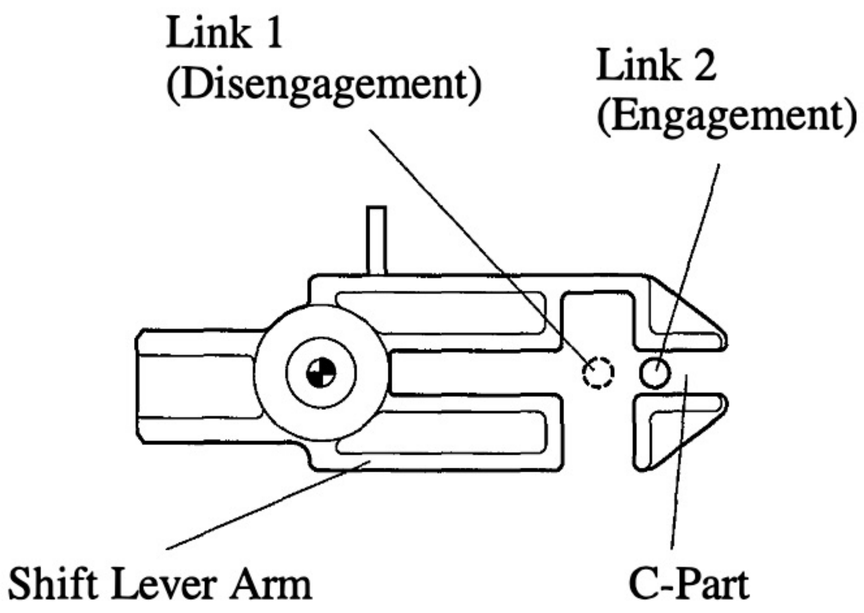
191MR14

- **When the Lever is Shifted from the S to N Range**

When the lever is shifted from the S to N range, Link-1 disengages from the cross grooves due to the lateral rotation of the lever, and Link-2 engages with portion C of the cross grooves. Consequently, Link-2 rotates in unison with the shift lever, causing the 2 switches, SW3 and SW4, that are provided at Link-2 to switch in order to detect the movement of the lever. At this time, because Link-1 is disengaged from the cross grooves, it remains in its position by the force of the spring provided in the sensor, even if the shift lever is operated.



191MR13

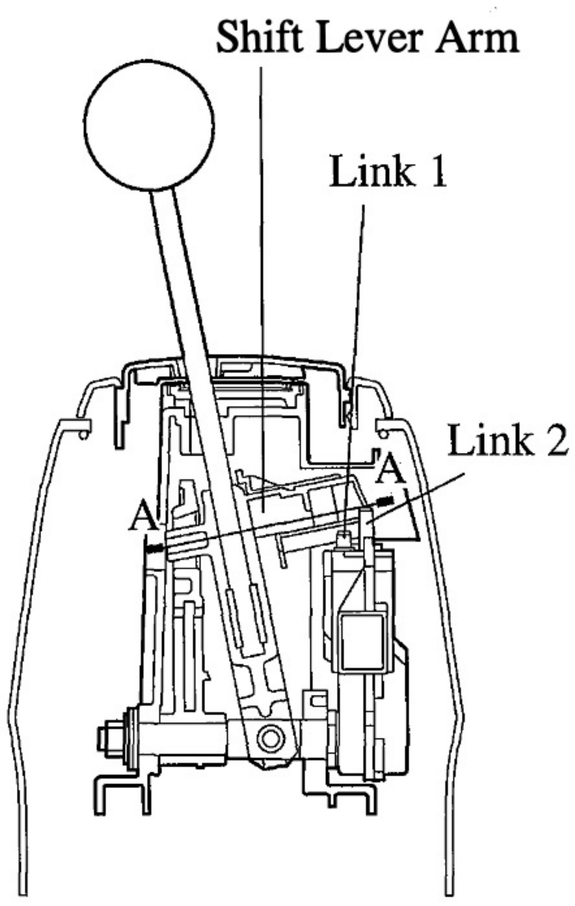


A – A Cross Section

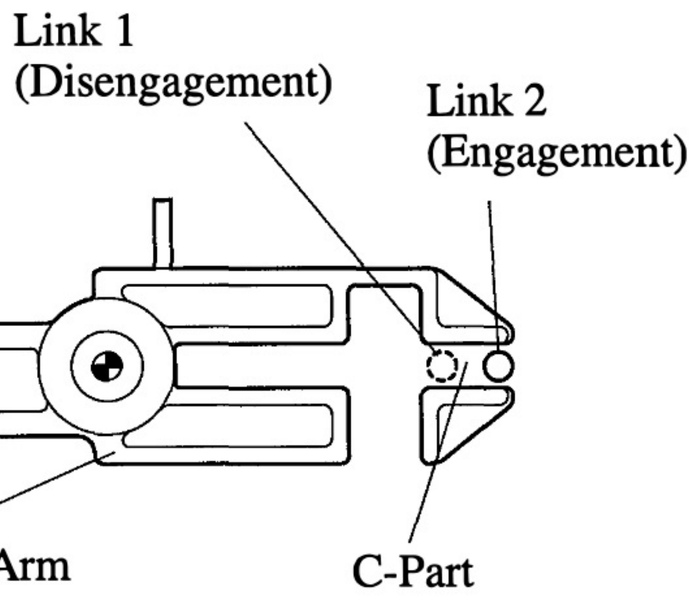
191MR16

- **When the lever is shifted from the N to R range**

When the lever is shifted from the N to R range, the lever rotates further sideways, but Link-2 remains engaged with the cross grooves and Link-1 remains disengaged from the cross grooves. Therefore, Link-2 rotates in unison with the shift lever, but Link-2 and Link-1 come in contact with each other in the midst of this rotation, thus allowing Link-1 to rotate simultaneously with Link-2. Consequently, the 2 switches, SW2 and SW4, that are provided at Link-1 and Link-2, switch in order to detect the movement of the lever.



191MR15

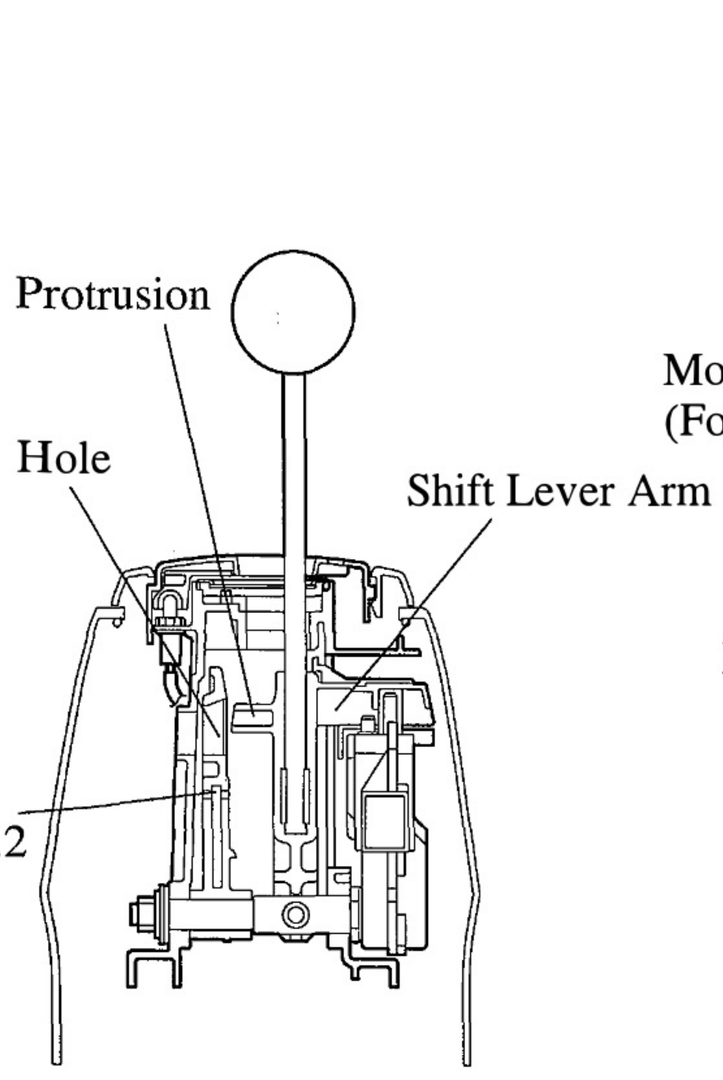


191MR18

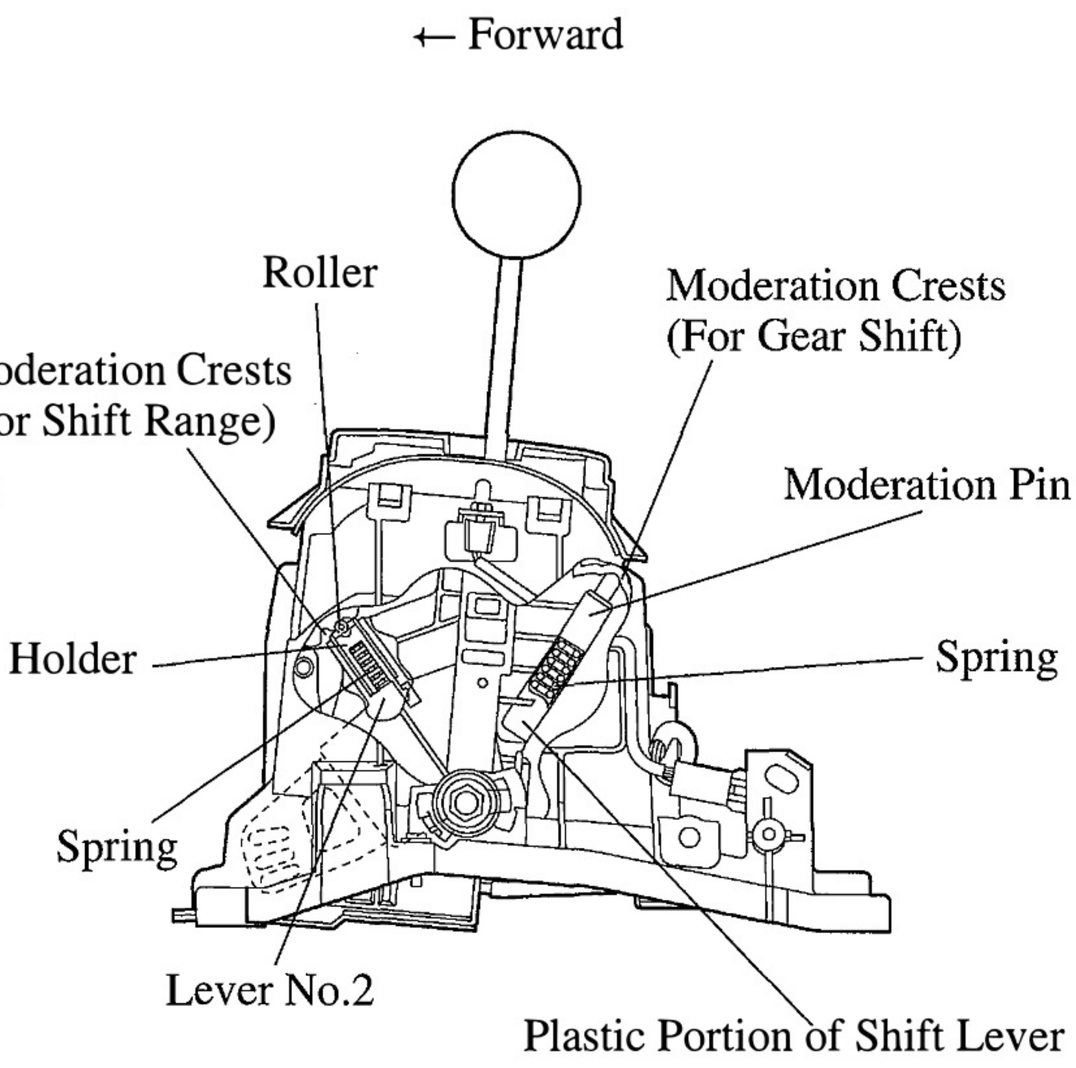
ii) Moderation Mechanism

- The shift lever and the transaxle are not connected to each other through a shift cable due to the adoption of the control-by-wiring type shift lever. For this reason, a moderation mechanism has been adopted to provide a retention force to the shift lever and to generate a shift effort during the operation of the shift lever.
- There are two types of moderation mechanisms: one that generates a shift effort during up-shifting or down-shifting and restrains the lateral movement of the shift lever, and the other that generates a shift effort during shift range changes and restrains the forward/rearward movement of the shift lever.

- The moderation mechanism for up-shift or down-shift consists of a moderation pin and moderation crests that are held in the plastic portion of the shift lever, and springs that push the moderation pin against the moderation crests.
  When the shift lever is in the S range, the moderation pin is in contact with the moderation crests that block the pin's forward/rearward movement, and the shift lever is held in the S range.
  When the shift lever is moved to up-shift or down-shift, the plastic portion of the shift lever, which is integrated with the shift lever, also rotates forward or rearward, causing the moderation pin to overcome the small protrusion that is provided in the midst of the moderation crests. As a result, the shift effort during shifting is generated.
- A lateral force is constantly applied to the shift lever by the moderation pin and moderation crests so that the shift lever is kept in the N or S range. As a result, the shift lever is prevented from stopping in between when shifting between the R and N ranges or from the N to the S range.
- The moderation mechanism for changing the shift ranges consists of a protrusion on the shift arm, moderation crests, lever No.2, and a spring with a roller that is held to lever No.2, which presses the holder and roller to the moderation crests.
  When the lever is shifted between the S and N ranges or between the N and R ranges, the protrusion on the shift arm engages with the hole in lever No.2 due to the lateral movement of the shift lever. Consequently, lever No.2 rotates forward or rearward in unison with the movement of the shift lever, and the roller moves within the groove of the moderation crests of the respective range. As a result, the shift effort for shifting between the ranges is generated and the forward/rearward movement of the shift lever is restrained.



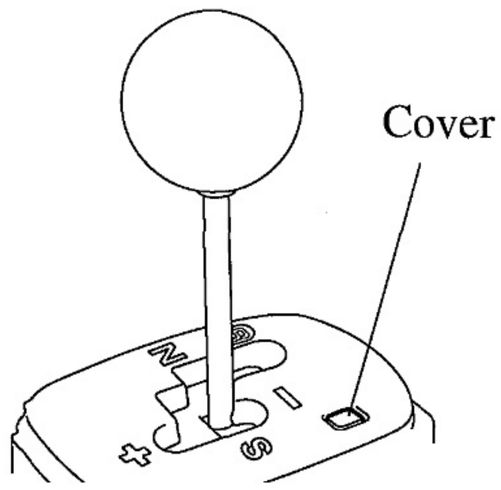
191MR11



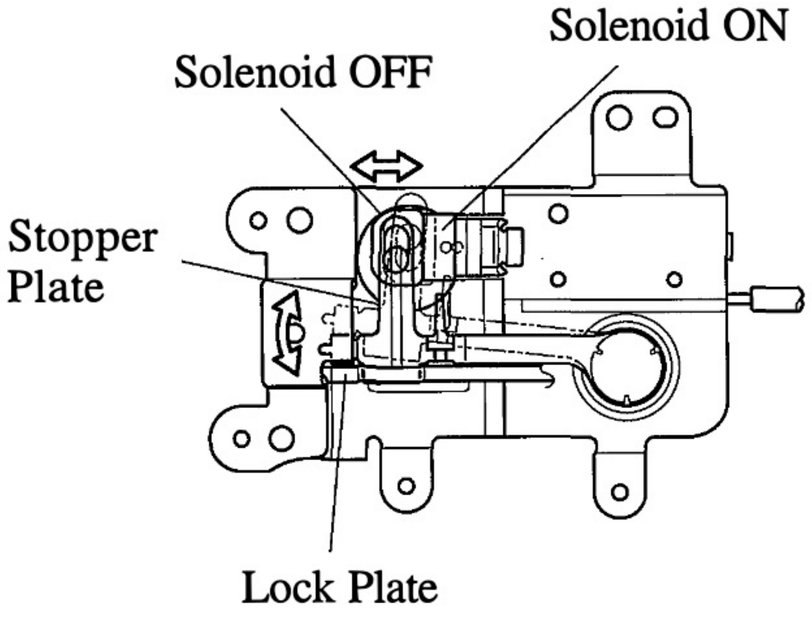
191MR20

iii) Shift Lock Mechanism

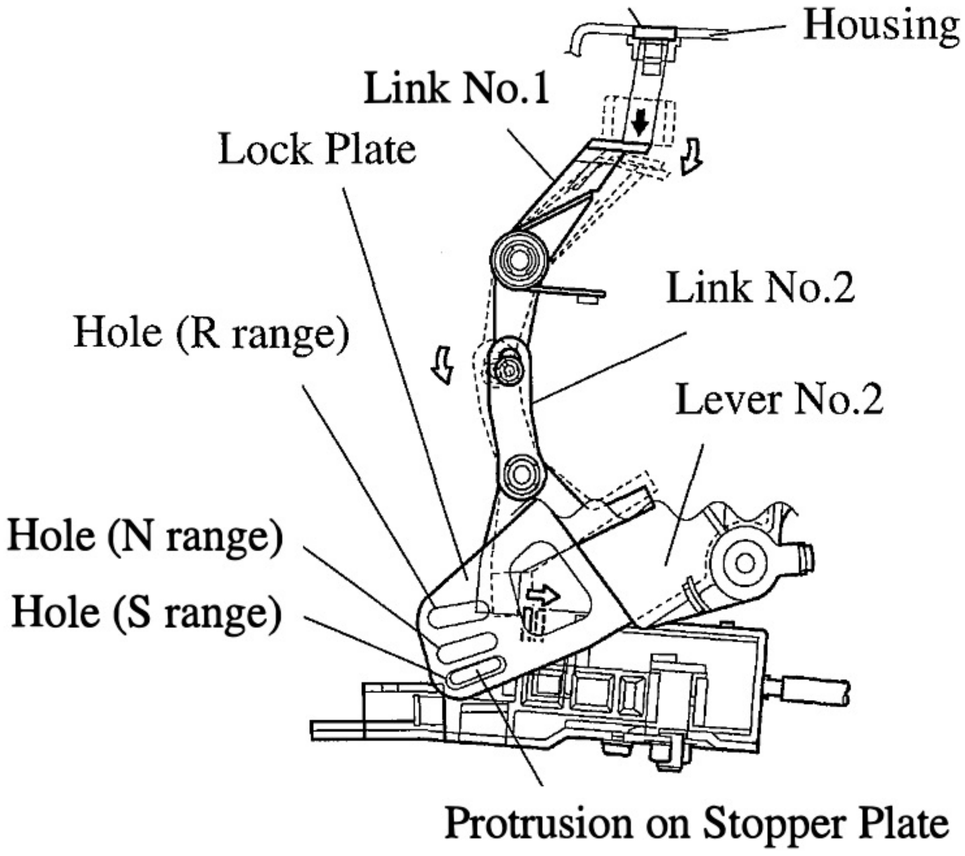
- To lock the shift lever when the ignition switch is turned OFF in order to prevent the shift lever position and the gear position from becoming mismatched, a shift lock mechanism has been provided. Furthermore, a shift lock override button that can manually cancel the shift lock mechanism has been provided.
- The shift lock mechanism consists of a shift lock solenoid, stopper plate, and a lock plate that is integrated with lever No.2.When the ignition switch is turned OFF, the stopper plate rotates due to the movement of the shift lock solenoid, causing the protrusion on the plate to engage with the hole in the lock plate. Because this causes lever No.2, which moves in unison with the shift lever when shifting between ranges, to lock, the shift lever also becomes locked. The lock plate has holes for the R, N, and S ranges respectively, so that the shift lever can be locked in any range. Even when the shift lock mechanism is in operation, the shift lever can be moved laterally, as well as in the up-shift and down-shift directions.
- If the shift lock mechanism cannot be unlocked due to a malfunction in the shift lock solenoid or a drained battery, a flat-blade screwdriver or an equivalent tool may be used to press the shift lock override button, which presses the stopper via a link, which unlocks the lock plate.



191MR28



191MR21

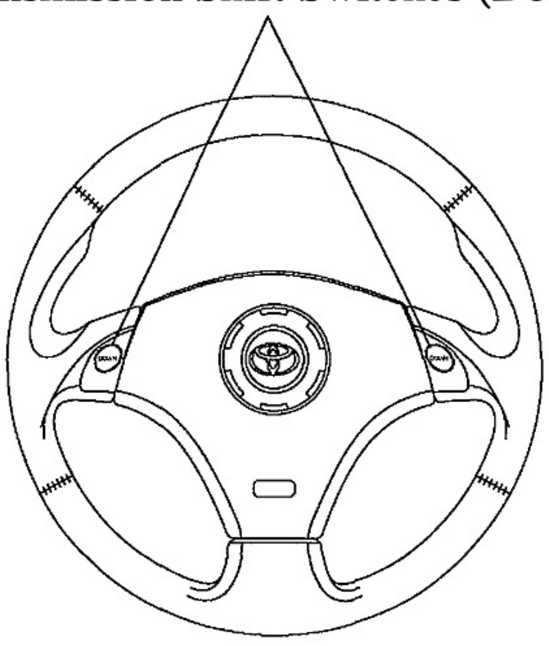


191MR22

4) Transmission Shift Switch

The transmission shift switches are located on the steering wheel and they allow the driver to shift the gears. The transmission shift switch are provided as optional equipment.
The transmission shift switches for down-shift are located on the top side of the steering wheel and the transmission shift switches for up-shift are located on the back side of the steering wheel.

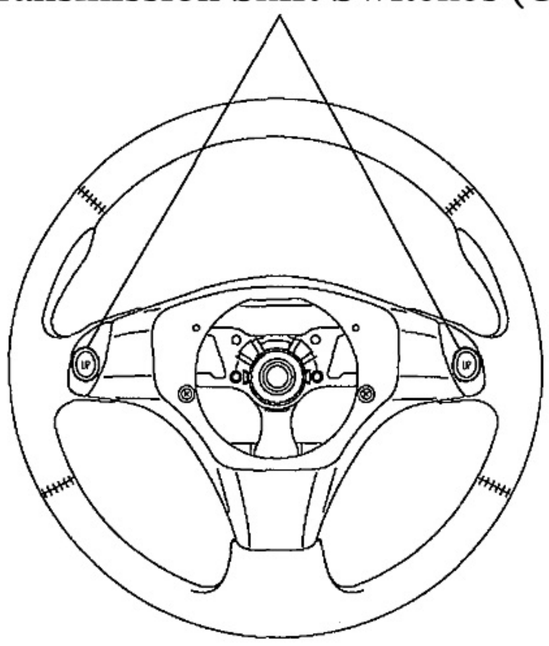
Transmission Shift Switches (Down)



195CH25

Top Side

Transmission Shift Switches (Up)

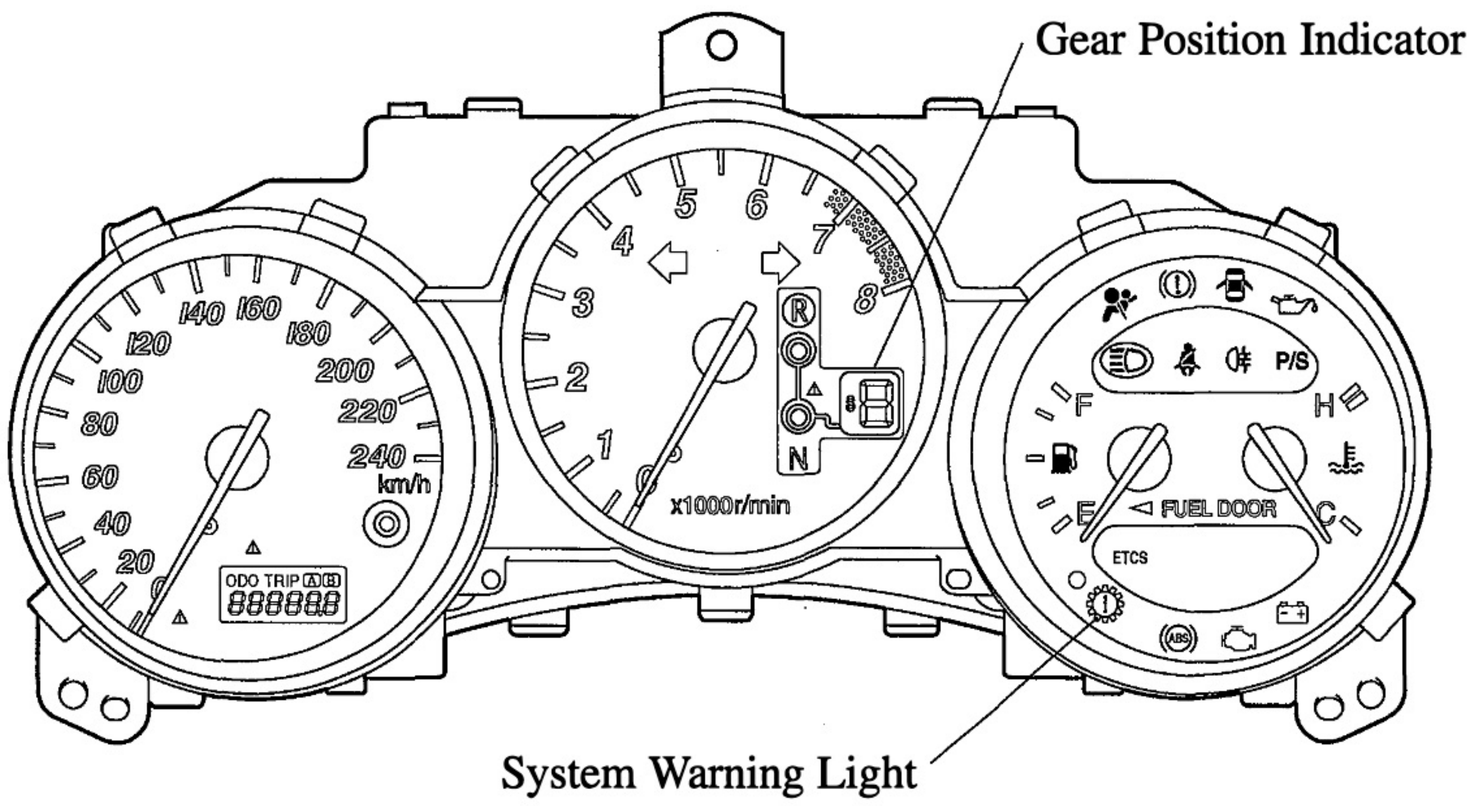


195CH26

Back Side

5) System Warning Light and Gear Position Indicator

Along with the adoption of the sequential manual transmission, the system warning light and gear position indicator are located on the combination meter.



195BE11

a. System Warning Light

The system warning light comes on the alert the driver about the system trouble when a malfunction is detected in self-diagnosis of the transmission control ECU. In normal operating conditions when the ignition switch is turned to the ON position, the light comes on for several seconds and then goes off to check the bulb.

b. Gear Position Indicator

Under normal operating conditions, the gear position indicator indicates the gear position of the transmission. If a mismatch occurs between the shift lever position and the gear position of the transmission, the indication of the gear position blinks.

System Operation

1) Normal Operation

a. Starting the System

When the driver's door is opened, the signal from the courtesy light switch activates the transmission control ECU, causing the pump and the pump motor in the sequential transmission pump assembly to operate. When the brake fluid for system control becomes pressurized to a prescribed pressure by the pump and the pump motor, the system assumes a standby mode. When a prescribed length of time elapses with the system in the standby mode, the transmission control ECU automatically turns OFF the power.

b. Starting the Engine

When the ignition switch is turned ON, the shift lock mechanism unlocks, enabling the driver to operate the shift lever. The engine ECU permits the operation of the starter to start the engine only when the brake pedal is pressed and the shift lever is in the N range.

c. Start Off

When the transmission is shifted to 1st, 2nd, or reverse gear and the accelerator pedal is pressed, the transmission control ECU engages the clutch by controlling the clutch solenoid valve and the clutch release cylinder. As a result, the vehicle starts off.
In addition, the control ECU controls the stroke of the clutch to achieve the target engine speed in accordance with the opening angle of the accelerator pedal.

d. Shifting

- When an up-shift or down-shift signal generated by the operation of the shift lever or the transmission shift switches is input into the transmission control ECU, the control ECU disengages the clutch. When the control ECU determines the disengagement of the clutch through a signal from the clutch stroke sensor, the control ECU shifts gears by controlling the shift solenoid and the select solenoid in the sequential transmission actuator assembly. When the control ECU determines that the shifting of gears has been completed through the signals from the shift stroke sensor and the select stroke sensor, the control ECU engages the clutch while controlling the stroke and the speed of the clutch.
- When shifting with the accelerator pedal pressed, the control ECU sends signals to the engine ECU to close the throttle. This prevents the engine from revving during shifting. Conversely, when shifting with the accelerator pedal released, the throttle opens to match the engine speed.

e. Stopping

- As the moving vehicle comes to a stop, and the input shaft speed decreases below a predetermined rpm, the transmission control ECU disengages the clutch.
- When the shift lever is in the S range, if the vehicle speed decreases below a predetermined level, the control ECU automatically down-shifts the transmission to the 1st gear.

f. Parking

- To park the vehicle, the driver must apply the parking brake, shift the lever to the S or R range, verify on the gear position indicator that the shifting has been properly executed, and turn the ignition switch OFF. When the ignition switch is turned OFF, the shift lock mechanism causes the shift lever to lock. Approximately 1 second later, the control ECU engages the clutch. As a result, the transmission assumes the gear parking mode, with its gears meshed.
- The vehicle can be parked whether the lever is shifted to any range, R, N, or S. However, when the shift lever is in the N range, the gear parking mode described above cannot be effected because the gears are not meshed. Also, the gear parking mode may not be effected if the ignition switch is turned OFF before the shifting to the S or R range is indicated on the indicator.
- For 10 seconds after the ignition switch has been turned OFF, the driver can verify the gear position on the indicator due to the function of the engine ECU.

No.	Item	Vehicle State	Operation	Control	Warning
1	Revving start off	During start off	Shifting the lever to the S or R range with the engine revved to 4000 rpm or higher.	Slow start off control is effected to prevent the vehicle from starting off suddenly (a warning is issued when the engine speed is 4000 rpm or higher).	Warning sound
2	Misshifting	Shifting while driving	Up-shifting causing the engine to under-rev.	The shifting request is canceled (to prevent clutch damage and to ensure dynamic performance).	—
3	Misshifting	Shifting while driving	Down-shifting causing the engine to over-rev.	Shifting request is canceled (to prevent engine or clutch damage).	A reject sound is emitted once.
4	Misshifting	While driving forward	Shifting the lever from S to R range.	Gear changes are prohibited at vehicle speeds of 5 km/h or higher.	N lamp blinks.
5	Misshifting	While coasting forward	Shifting the lever from N to R range.	Gear changes are prohibited at vehicle speeds of 5 km/h or higher.	N lamp blinks.
6	Misshifting	While driving backward	Shifting the lever from R to S range.	Gear changes are prohibited through vehicle speed control.	N lamp blinks and reverse buzzer sounds.
7	Misshifting	While coasting backward	Shifting the lever from N to S range.	Gear changes are prohibited through vehicle speed control.	N lamp blinks.
8	Clutch high-load operation warning	While stopping on a slope or starting off	Stopping the vehicle on a slope by operating only the accelerator pedal. Increasing the load on the clutch due to excess load (increasing the time in which the clutch is partially applied).	During start off, the clutch engagement control is changed to light-load engagement control (shocks could be created during clutch engagement depending on the road surface conditions).	Warning sound
9	Door Open Warning	While the vehicle is stopped	When the lever is shifted to the S range (1st gear), the brake is OFF, and a door is open.	The driver is alerted of the engagement of the gear when the door is opened.	Warning sound
10	The shift lever remains in the S range	While the vehicle is stopped	When the lever is shifted to the S range (1st gear), the brake is OFF, a door is open, and 10 seconds have elapsed.	The gears in the transmission are shifted to neutral.	Warning sound
11	The shift lever remains in the S range	While the vehicle is stopped	When the lever is shifted to the S range (1st gear), the brake is OFF, and 90 seconds have elapsed.	The gears in the transmission are shifted to neutral.	Warning sound

No.	Contents	Item	Operation	Control	Warning (Light)
1	Retry control	While the vehicle is parked with the engine ON.	Shift lever: N range → S or R range Gear position: remains at N (improper gear engagement)	● When parking the vehicle in the R range, after the shift lever is returned to the N range and the clutch has been engaged, the transmission shifts automatically to the R range again. ● When parking the vehicle in the S (1st gear) range, after the shift lever is returned to the N range and the clutch has been engaged, the transmission shifts automatically to the S (1st gear) range again.	N range indicator blinks (during execution).
2	Retry control	While the vehicle is parked with the engine OFF.	Shift lever: N range → S or R range Gear position: remains at N (improper gear engagement)	● When parking the vehicle in the R range, after the lever has been shifted to the R range and 1st gear, the transmission shifts automatically to the R range again. ● When parking the vehicle in the S (1st gear) range, after the lever has been shifted to the 1st gear and 2nd gear, the transmission shifts automatically to the 1st gear again.	N range indicator blinks (during execution).
3	Gear popping measure	While driving	— Unintended mechanical popping out of the gears.	A reinstatement operation is executed in accordance with the shift lever operations listed below. ● Shift lever: S → + (up-shift) or – (down-shift) →+: Shifts to the 1st high range gear prior to the popping out of the gear. –: Shifts to the 1st low ratio gear prior to the popping out of the gear. ● Shift lever: S → N → S →Shifts to an optimal gear that is suited to the vehicle speed. ● Shift lever: R → N → R →Shifts to the R range (provided that the vehicle speed is under 5 km/h).	N range indicator blinks.
4	Shift rejection at ultra-low temperatures	While driving	Shift lever: S (2nd gear driving) → – (down-shift) Gear position: remains in the 2nd gear	—	2nd gear indicator blinks.
5	Reinstatement method after shifting automatically to the N position	Vehicle stopped	— The transmission control ECU automatically shifts the transmission to the N position after the vehicle has remained shifted in a gear for a long time.	A reinstatement operation is executed in accordance with the shift lever operations listed below. ● Brake pedal: ON →If the vehicle was stopped in the 1st gear, it reverts to the 1st gear. If the vehicle was stopped in the 2nd gear, it reverts to the 2nd gear. ● Shift lever: S → + (up-shift) →If the vehicle was stopped in the 1st gear, it reverts to the 2nd gear. If the vehicle was stopped in the 2nd gear, it reverts to the 2nd gear. ● Shift lever: S → – (down-shift) →If the vehicle was stopped in the 1st gear, it reverts to the 1st gear. If the vehicle was stopped in the 2nd gear, it reverts to the 1st gear. ● Shift lever: S → N → S →If the vehicle was stopped in the 1st gear, it reverts to the 1st gear. If the vehicle was stopped in the 2nd gear, it reverts to the 1st gear.	—

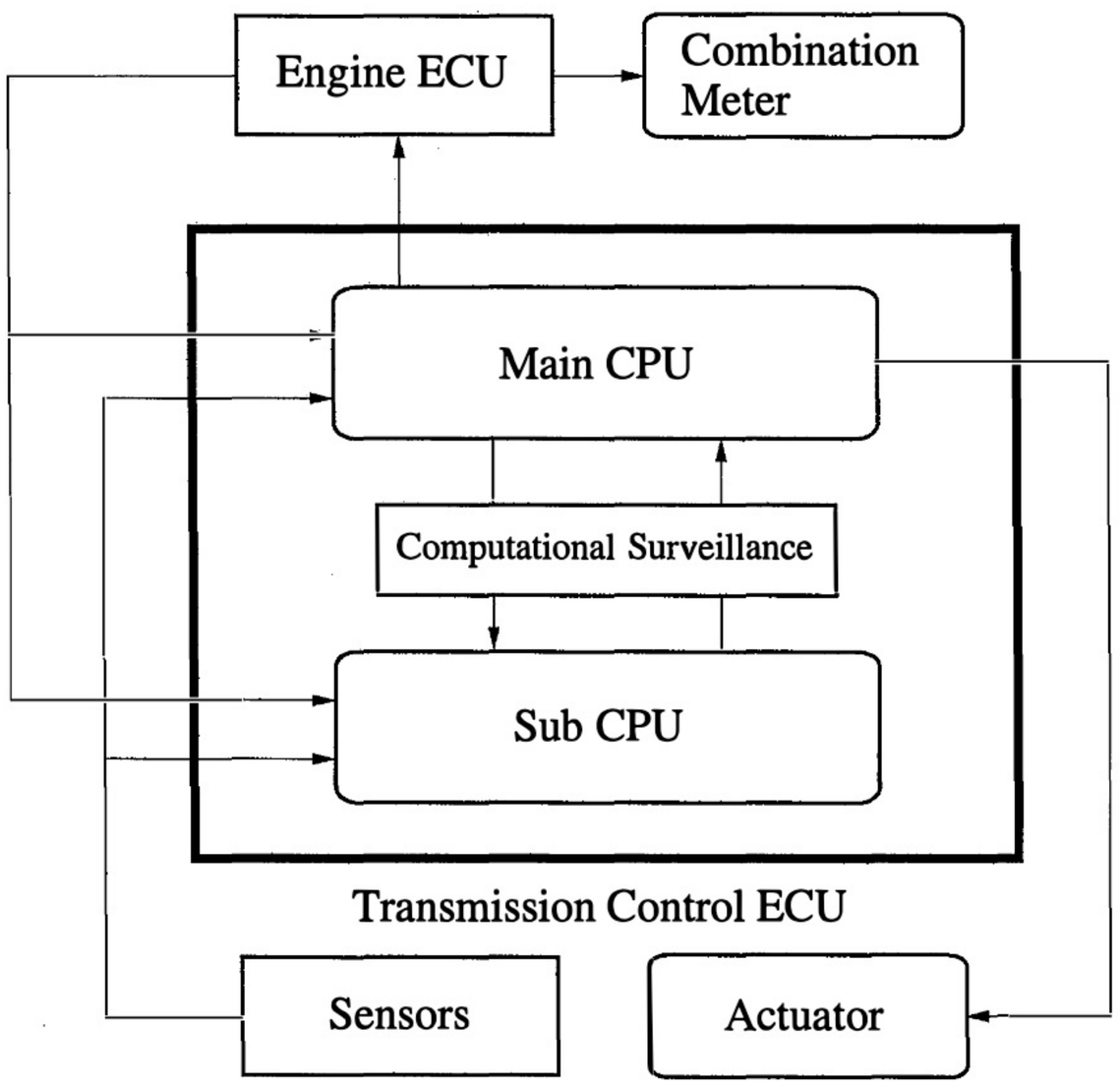
Fail-Safe

1) System

If an abnormal condition such as a sensor malfunction occurs in the sequential manual transmission system, the transmission control ECU instructs the engine ECU to illuminate the warning indicator in the combination meter and to sound the buzzer to alert the driver of the abnormal condition. In addition, the system enables the vehicle to be driven in the limp mode under predetermined conditions.

2) Transmission Control ECU

- In addition to the main CPU that controls the system, a sub CPU is provided inside the transmission control ECU. Both the main and sub CPUs compute the signals that are input from the various sensors and switches. The CPUs compare each other's computations to reach a computational judgment.
- The transmission control ECU has the function of detecting an open or short circuit in the main electronic components comprised in the sequential manual transmission.



Fail-Safe Signal Transmission Path

191MR25

3) Shift Lever

If a malfunction occurs in the position switches that detect the position of the shift lever, the transmission control ECU alerts the driver of the abnormal condition through the warning indicator and the buzzer. Then, it enables the vehicle to be driven under predetermined conditions or causes the vehicle to stop.

Self-Diagnosis

If the transmission control ECU detects a malfunction in the sequential manual transmission, it blinks the warning indicator in the combination meter and sounds the buzzer to alert the driver that a malfunction has occurred. The ECU will also store the codes of malfunction. See the MR2 Chassis and Body Repair Manual Supplement (Pub. No. RM803E) for the DTC (Diagnostic Trouble Code) check method, DTC and DTC clearance.

MAJOR TECHNICAL SPECIFICATIONS

Item			Area	Europe			
Body Type				Convertible			
Vehicle Grade				G			
Model Code				ZZW30R-AKMQHW	ZZW30L-AKMQHW	ZZW30R-AKGQHW	ZZW30L-AKGQHW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	3885 (153.0)	←	←	←
		Width	mm (in.)	1695 (66.7)	←	←	←
		Height	mm (in.)	1240 (48.8)*1, 1250 (49.2)*2	←	←	←
	Wheel Base		mm (in.)	2450 (96.5)	←	←	←
	Tread	Front	mm (in.)	1475 (58.1)	←	←	←
		Rear	mm (in.)	1460 (57.5)	←	←	←
	Room	Length	mm (in.)	1000 (39.4)	←	←	←
		Width	mm (in.)	1350 (53.1)	←	←	←
		Height	mm (in.)	1055 (41.5)	←	←	←
	Overhang	Front	mm (in.)	765 (30.1)	←	←	←
		Rear	mm (in.)	670 (26.4)	←	←	←
	Min. Running Ground Clearance		mm (in.)	140 (5.5)	←	←	←
	Angle of Approach		degrees	16.1	←	←	←
	Angle of Departure		degrees	20.2	←	←	←
	Curb Weight	Front	kg (lb)	410 ~ 425 (904 ~ 937)	←	←	←
		Rear	kg (lb)	565 ~ 590 (1246 ~ 1301)	←	575 ~ 600 (1268 ~ 1323)	←
		Total	kg (lb)	975 ~ 1015 (2149 ~ 2238)	←	985 ~ 1025 (2172 ~ 2260)	←
	Gross Vehicle Weight	Front	kg (lb)	515 (1135)	←	←	←
		Rear	kg (lb)	710 (1565)	←	720 (1587)	←
		Total	kg (lb)	1225 (2701)	←	1235 (2723)	←
	Fuel Tank Capacity		ℓ (Imp.gal)	48 (10.6)	←	←	←
	Luggage Compartment Capacity		m^3 (cu.ft.)	0.09 (3.18)	←	←	←
Performance	Max. Speed		km/h (mph)	210 (131.3)	←	←	←
	Max. Cruising Speed		km/h (mph)	170 (106.3)	←	←	←
	Acceleration	0 to 100 km/h	sec.	7.5	←	←	←
		0 to 400 m	sec.	15.2	←	←	←
	Max. Permissible Speed	1st Gear	km/h (mph)	58 (36)	←	←	←
		2nd Gear	km/h (mph)	96 (60)	←	←	←
		3rd Gear	km/h (mph)	140 (87)	←	←	←
		4th Gear	km/h (mph)	190 (118)	←	←	←
	Min. Turning Radius	Tire	m (ft.)	5.0 (16.4)	←	←	←
		Body	m (ft.)	5.3 (17.4)	←	←	←
Engine	Engine Type			1ZZ-FE	←	←	←
	Valve Mechanism			16-Valve, DOHC	←	←	←
	Bore x Stroke		mm (in.)	79.0 x 91.5 (3.11 x 3.60)	←	←	←
	Displacement		cm^3 (cu.in.)	1794 (109.5)	←	←	←
	Compression Ratio			10.0 : 1	←	←	←
	Carburetor Type or Injection Pump Type (Diesel)			EFI	←	←	←
	Research Octane No. or Cetane No. (Diesel)			95 or more	←	←	←
	Max. Output (EEC)		kW/rpm	103/6400	←	←	←
	Max. Torque (EEC)		N·m/rpm	107/4200	←	←	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12 – 36	←	←	←
	Alternator Output		Watts	960	←	←	←
	Starter Output		kW	0.8	0.8, 1.0*3	0.8	0.8, 1.0*3
Chassis	Clutch Type			Dry, Single	←	←	←
	Transaxle Type			C52	←	←	←
	Transmission Gear Ratio	In First		3.166	←	←	←
		In Second		1.904	←	←	←
		In Third		1.310	←	←	←
		In Fourth		0.969	←	←	←
		In Fifth		0.815	←	←	←
		In Reverse		3.250	←	←	←
	Counter Gear Ratio			—	—	—	—
	Differential Gear Ratio (Final)			3.941	←	←	←
	Brake Type	Front		Disc	←	←	←
		Rear		Disc	←	←	←
	Parking Brake Type			Disc	←	←	←
	Brake Booster Type and Size		in.	Single, 8"	←	←	←
	Proportioning Valve Type			—	—	—	—
	Suspension Type	Front		MacPherson Strut	←	←	←
		Rear		MacPherson Srrut	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack and Pinion	←	←	←
	Steering Gear Ratio (Overall)			13.6	←	←	←
	Power Steering Type			Integral Type	←	←	←

*1: Convertible top
*2: Detachable top
*3: Option

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Convertible
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425 ~ 430 (937 ~ 948)
580 ~ 585 (1279 ~ 1290)
1005 ~ 1015 (2216 ~ 2238)
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AVENSIS

AVENSIS

OUTLINE OF NEW FEATURES

1. Model Line-Up

- The 4A-FE and 7A-FE engine models have been discontinued.
- The 1AZ-FSE, 1ZZ-FE and 3ZZ-FE engine models have been added.

2. Exterior

A tether has been provided to prevent the fuel filler cap from being lost.

3. Interior

- A damper has been added to the glove box.
- A push-and-open type ashtray has been adopted in the center cluster.

4. 1ZZ-FE Engine

- The 1ZZ-FE engine which is an in-line, 4-cylinder, 1.8 litter, 16-valve DOHC has been adopted.
- The VVT-i (Variable Valve Timing-intelligent) system, the DIS (Direct Ignition System) and a plastic intake manifold have been adopted.

5. 3ZZ-FE Engine

- The 3ZZ-FE engine which is an in-line, 4-cylinder, 1.6 litter, 16-valve DOHC has been adopted.
- The VVT-i (Variable Valve Timing-intelligent) system, the DIS (Direct Ignition System) and a plastic intake manifold have been adopted.

6. 1AZ-FSE Engine

- The 1AZ-FSE TOYOTA D-4 (Direct injection 4-stroke gasoline engine) which is a newly developed in-line 4-cylinder, 2.0 litter, 16-valve DOHC engine is added.
- The direct injection system, VVT-i (Variable Valve Timing-intelligent) system and ETCS-i (Electronic Throttle Control System-intelligent) have been adopted.

7. Clutch

In accordance with the adoption of 1ZZ-FE, 3ZZ-FE and 1AZ-FSE engines, the clutch disc and the clutch cover are optimized to each feature of engine.

8. S55 Manual Transaxle

The S55 manual transaxle is used for the 1AZ-FSE engine model.

9. C50 and C250 Manual Transaxles

- The C50 manual transaxle is used for the 3ZZ-FE engine model.
- The C250 manual transaxle is used for the 1ZZ-FE engine model.

10. E351 Manual Transaxle

The E351 manual transaxle, which is based on the previous E251, has been adopted on the 1CD-FTV engine model to realize improved performance and weight reduction.

11. U240E Automatic Transaxle

- The U240E automatic transaxle is used for the 1AZ-FSE engine model.
- The shift lock mechanism has been newly adopted.

12. A246E Automatic Transaxle

- The A246E automatic transaxle is used for the 1ZZ-FE engine model.
- The shift lock mechanism has been newly adopted.

13. Drive Shaft

The same type of drive shaft that is used on the 1CD-FTV engine model has been adopted on the 1AZ-FSE engine model.

14. Brake

- The 7" + 8" tandem brake booster has been adopted on the 1AZ-FSE engine model as a standard, and on the 1ZZ-FE and 3ZZ-FE engine models as an option.
- The ABS with EBD is standard equipment on all models. The ABS with EBD & Brake Assist & TRC & VSC System is standard equipment on the LENEA SOL grade with the 1AZ-FSE engine, and offered as an option on the LINEA TERRA grade.

  ABS (Anti-lock Brake System), EBD (Electronic Brake force Distribution),
  TRC (Traction Control), VSC (Vehicle Stability Control)

15. Body

- ISO-FIX rigid anchor for securing child seats (CRS: Child Restraint System), which comply with ISO-FIX, have been provided behind the seat cushion of both outer rear seats.
- A radiator support cover has been provided between the radiator grille and the radiator support to improve the appearance of the engine compartment.

16. Lighting

Multi-reflector type headlights and front fog lights have been adopted.

17. Combination Meter

- The color of the illumination, letters and numbers, and the dial plates has been changed to improve product appeal.
- An indicator that points to the (right or left) position of the fuel lid has been added.
- Indicator lights that are related to the VSC system have been added to the models equipped with VSC (Vehicle Stability Control).

18. Heater Control System

- Air inlet mode selector has been changed to push and lock button type from lever type.
- The control of the mode selector switch, fan speed selector switch, and temperature selector switch has been changed from the manual to the electric type in order to improve the operating feel. Accordingly, the switching of the mode doors has been changed from the previous cable-driven type to the servomotor-driven type.

19. SRS Airbag System

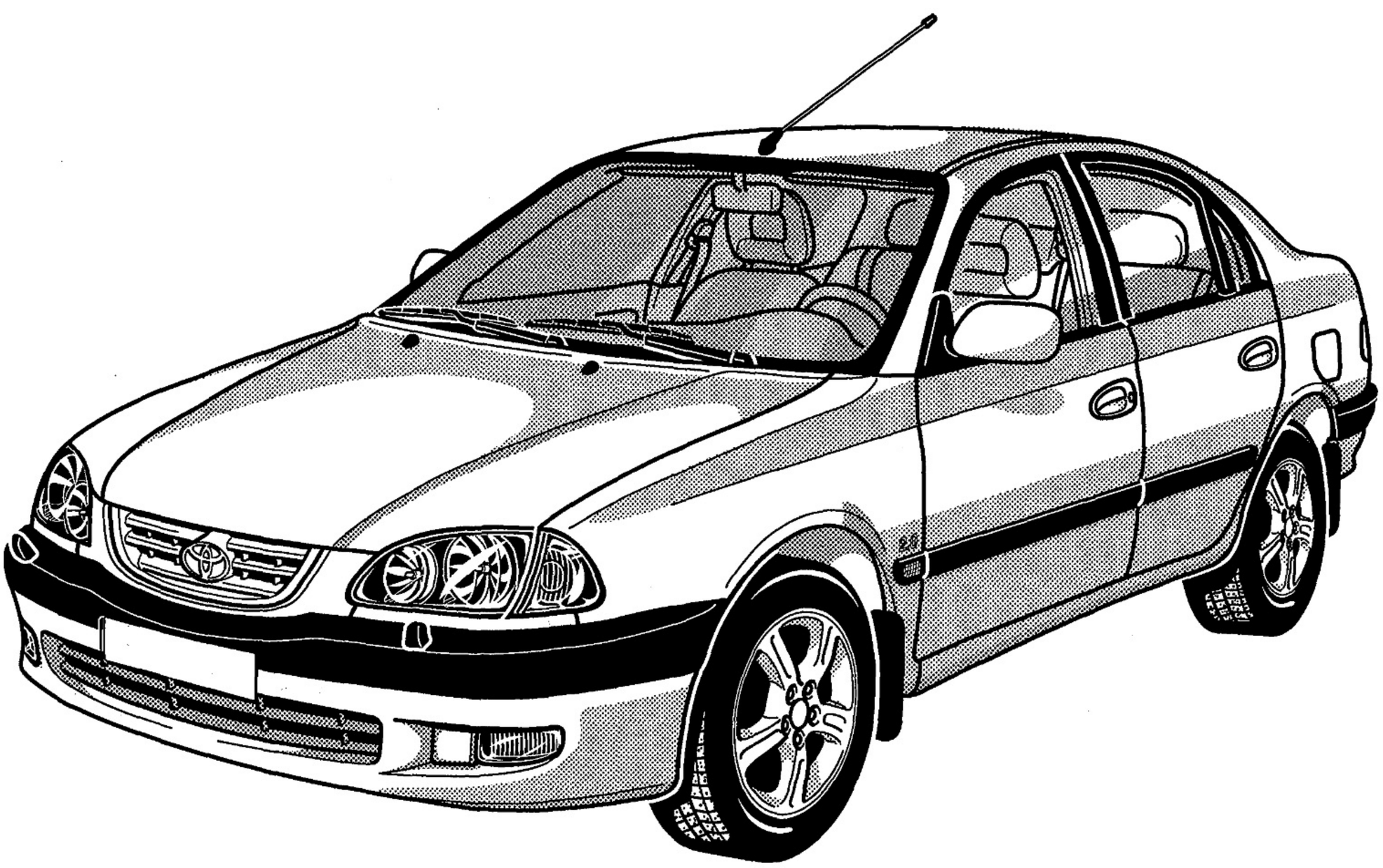
A fuel cut control is adopted to stop the fuel pump when the airbag is deployed at the front or side collision.

20. Door Lock Control System

The double locking system is standard equipment on the RHD model.

21. Audio

- A multi-information display panel has been provided on the audio unit to indicate various types of information, including the audio, average vehicle speed, fuel consumption, continuous drivable distance, time, and outside temperature.
- A steering pad switch that operates the audio unit has been provided on the steering wheel as an option.



195MO01

MODEL CODE

AZT220 L – A E M E H W

1 2 3 4 5 6 7 8

1	BASIC MODEL CODE
	ZZT220 : With 3ZZ-FE Engine ZZT221 : With 1ZZ-FE Engine AZT220 : With 1AZ-FSE Engine CDT220 : With 1CD-FTV Engine

2	STEERING WHEEL POSITION
	L : Left-Hand Drive R : Right-Hand Drive

3	MODEL NAME
	A : AVENSIS

4	BODY TYPE
	E : 4-Door Sedan L : 5-Door Liftback W : 5-Door Wagon

5	GEARSHIFT TYPE
	M : 5-Speed Manual, Floor P : 4-Speed Automatic, Floor

6	GRADE
	N : LINEA TERRA E : LINEA SOL

7	ENGINE SPECIFICATION
	K : DOHC and EFI H : DOHC, EFI and Direct Injection Y : Common-Rail Diesel

8	DESTINATION
	W : Europe

3

MODEL LINE-UP

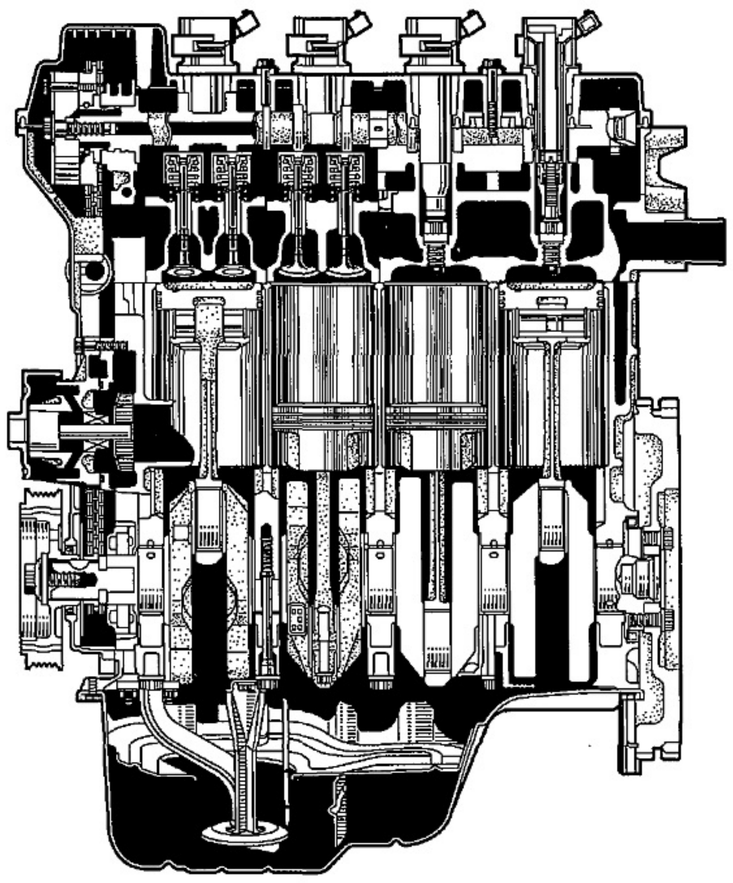
DESTINATION	BODY TYPE	ENGINE	GRADE	TRANSAXLE					
				5-Speed Manual				4-Speed Automatic	
				C50	C250	S55	E351	A246E	U240E
Europe	4-Door Sedan	3ZZ-FE	LINEA TERRA	ZZT220$^{R}_{L}$ – AEMNKW					
			LINEA SOL	ZZT220L– AEMEKW					
		1ZZ-FE	LINEA TERRA		ZZT221$^{R}_{L}$ – AEMNKW			ZZT221$^{R}_{L}$ – AEPNKW	
			LINEA SOL		ZZT221$^{R}_{L}$ – AEMEKW			ZZT221$^{R}_{L}$ – AEPEKW	
		1AZ-FSE	LINEA TERRA			AZT220$^{R}_{L}$ – AEMNHW			
			LINEA SOL			AZT220$^{R}_{L}$ – AEMEHW			AZT220$^{R}_{L}$ – AEPEHW
		1CD-FTV	LINEA TERRA				CDT220$^{R}_{L}$ – AEMNYW		
			LINEA SOL				CDT220$^{R}_{L}$ – AEMEYW		
	5-Door Liftback	3ZZ-FE	LINEA TERRA	ZZT220$^{R}_{L}$ – ALMNKW					
			LINEA SOL	ZZT220L– ALMEKW					
		1ZZ-FE	LINEA TERRA		ZZT221$^{R}_{L}$ – ALMNKW			ZZT221$^{R}_{L}$ – ALPNKW	
			LINEA SOL		ZZT221$^{R}_{L}$ – ALMEKW			ZZT221$^{R}_{L}$ – ALPEKW	
		1AZ-FSE	LINEA TERRA			AZT220$^{R}_{L}$ – ALMNHW			
			LINEA SOL			AZT220$^{R}_{L}$ – ALMEHW			AZT220$^{R}_{L}$ – ALPEHW
		1CD-FTV	LINEA TERRA				CDT220$^{R}_{L}$ – ALMNYW		
			LINEA SOL				CDT220$^{R}_{L}$ – ALMEYW		
	5-Door Wagon	3ZZ-FE	LINEA TERRA	ZZT220$^{R}_{L}$ – AWMNKW					
			LINEA SOL	ZZT220L– AWMEKW					
		1ZZ-FE	LINEA TERRA		ZZT221$^{R}_{L}$ – AWMNKW			ZZT221L– AWPNKW	
			LILNEA SOL		ZZT221L– AWMEKW			ZZT221L– AWPEKW	
		1AZ-FSE	LINEA TERRA			AZT220$^{R}_{L}$ – AWMNHW			
			LINEA SOL			AZT220$^{R}_{L}$ – AWMEHW			AZT220$^{R}_{L}$ – AWPEHW
		1CD-FTV	LINEA TERRA				CDT220$^{R}_{L}$ – AWMNYW		
			LINEA SOL				CDT220L– AWMEYW		

NEW FEATURES

■ 1ZZ-FE AND 3ZZ-FE ENGINES

1. General

The 1ZZ-FE engine is an in-line, 4-cylinder, 1.8 liter, 16-valve DOHC engine. The 3ZZ-FE engine is an in-line, 4-cylinder, 1.6 liter, 16-valve DOHC engine.
The VVT-i (Variable Valve Timing-intelligent) system, the DIS (Direct Ignition System), and a plastic intake manifold have been adopted on these engines in order to improve their engine performance and fuel economy and reduce exhaust emissions.



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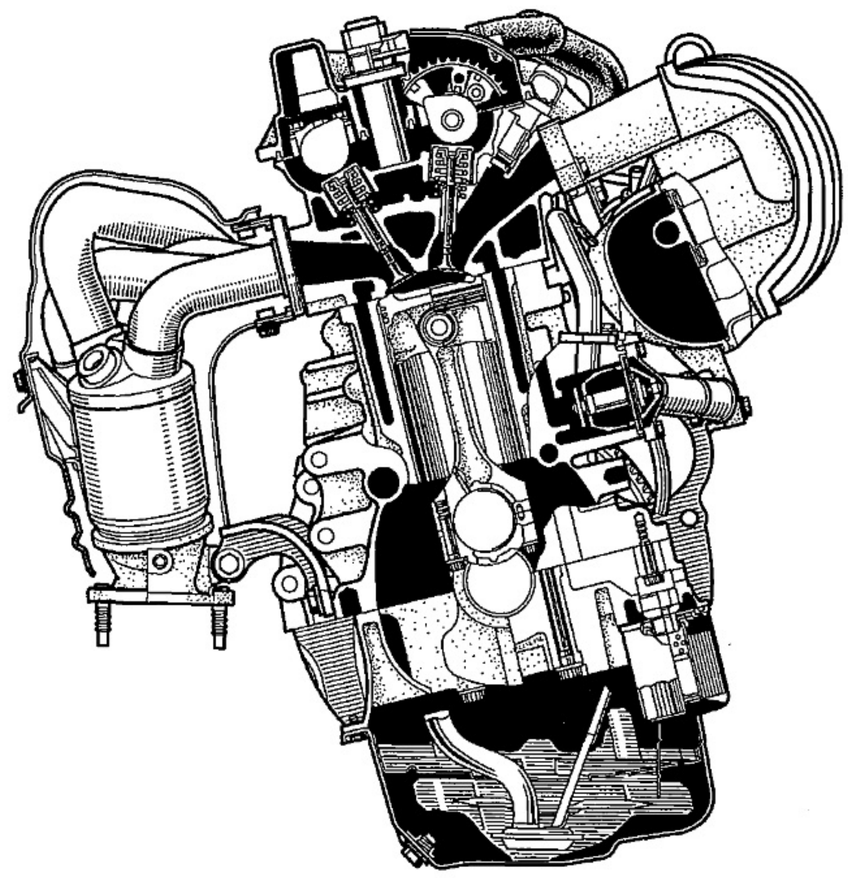
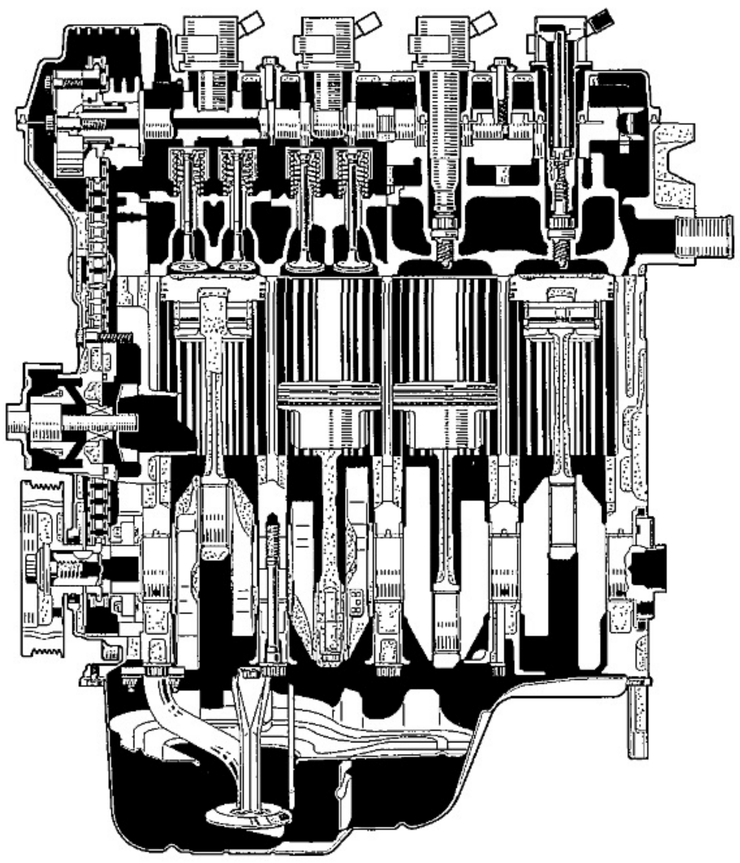


195EG110

1ZZ-FE Engine



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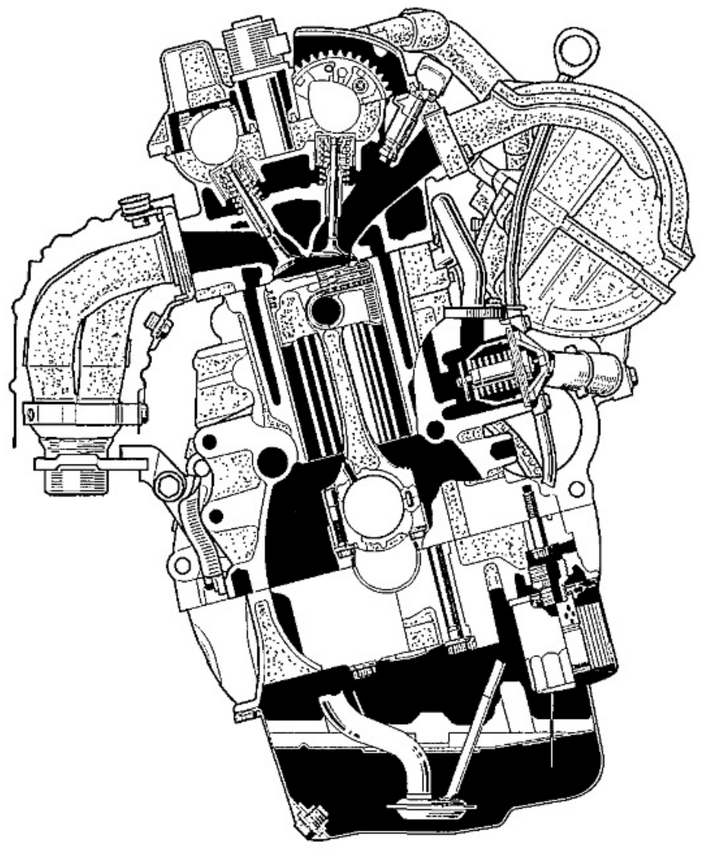


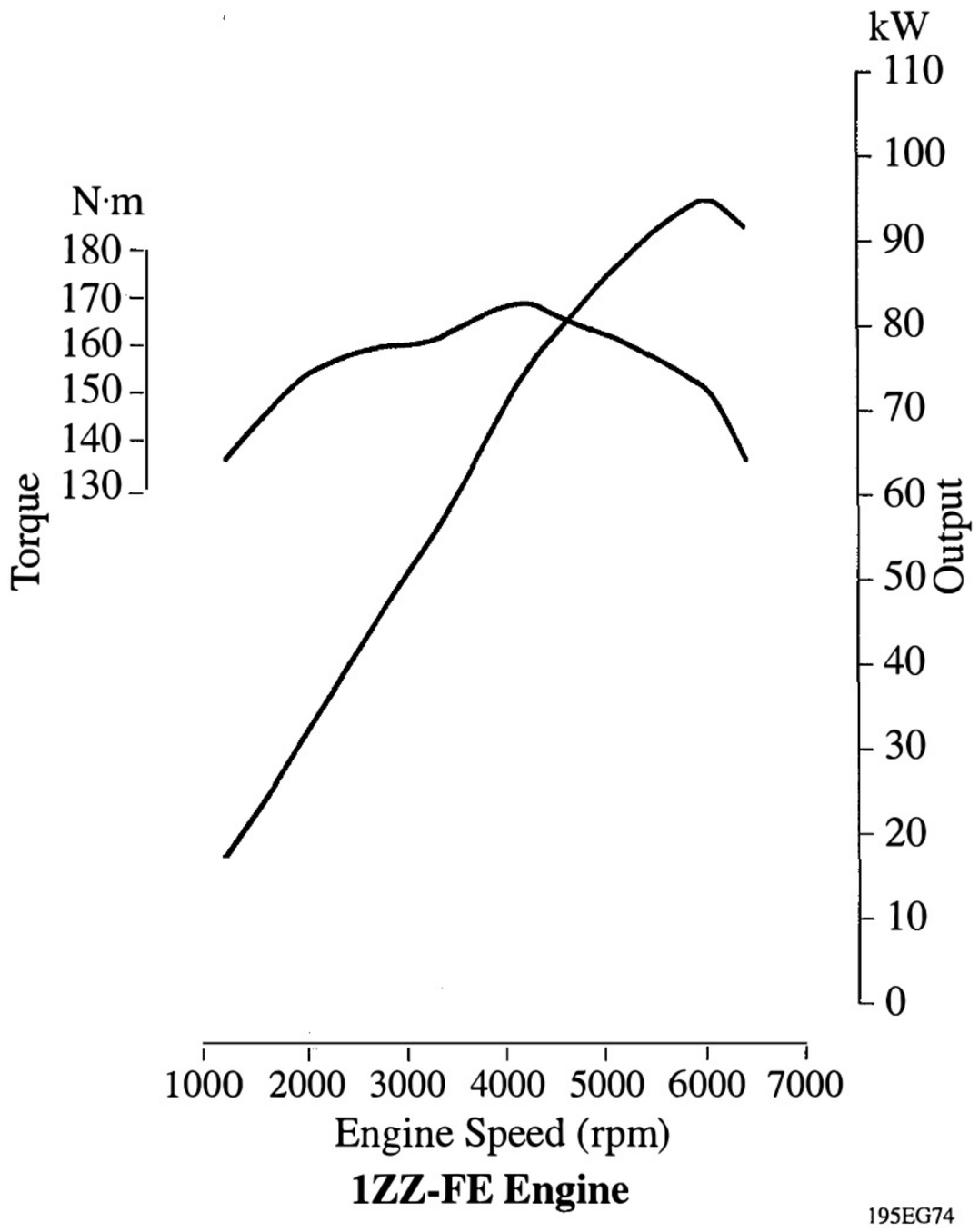
178EG02

3ZZ-FE Engine

▶ Engine Specifications ◀

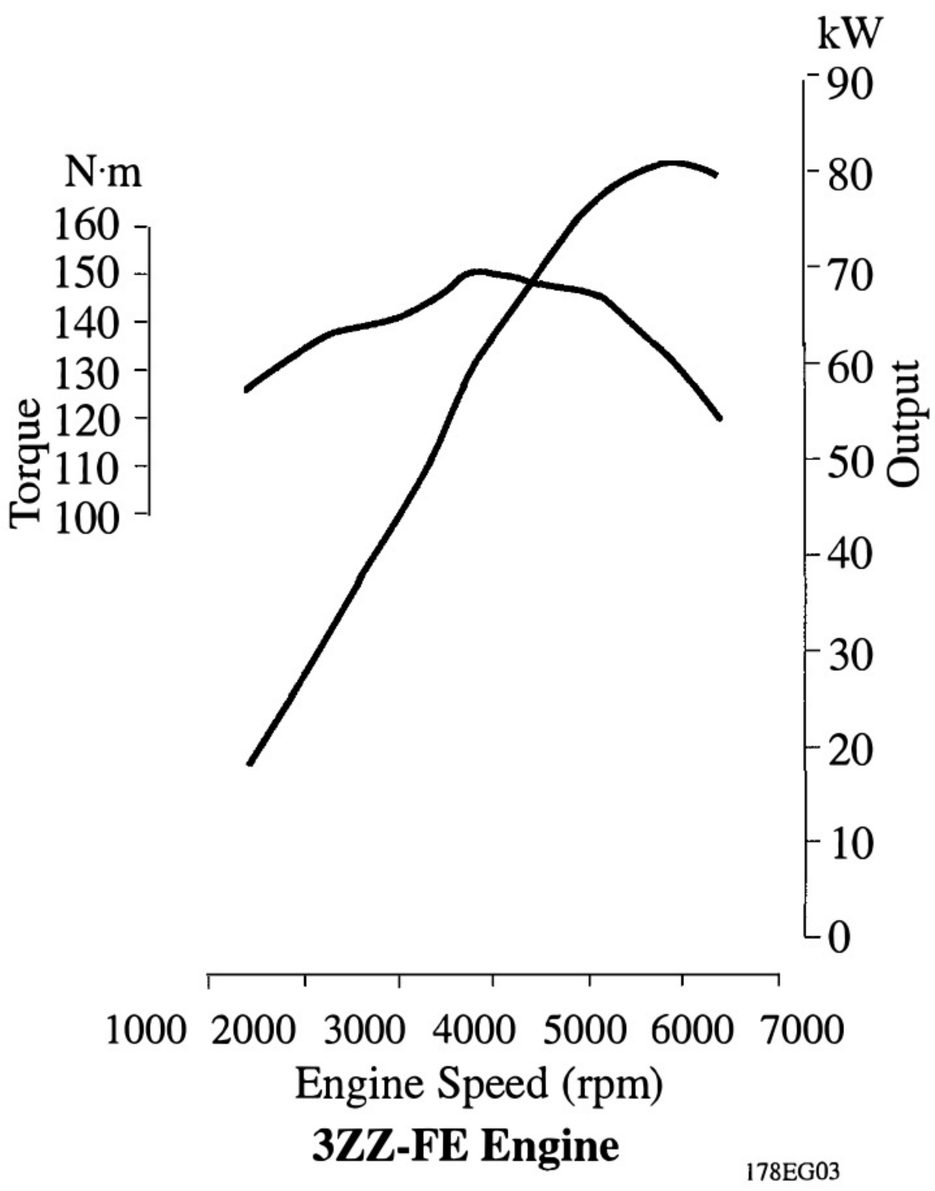
Engine Type			1ZZ-FE	3ZZ-FE
No. of Cyls. & Arrangement			4-Cylinder, In-line	←
Valve Mechanism			16-Valve DOHC, Chain Drive	←
Combustion Chamber			Pentroof Type	←
Manifolds			Cross-Flow	←
Fuel System			EFI	←
Displacement		cm^3 (cu.in.)	1794 (109.5)	1598 (97.5)
Bore x Stroke		mm (in.)	79.0 x 91.5 (3.11 x 3.60)	79.0 x 81.5 (3.11 x 3.21)
Compression Ratio			10.0 : 1	10.5 : 1
Max. Output		(EEC)	95 kW @ 6000 rpm	81 kW @ 6000 rpm
Max. Torque		(EEC)	170 N·m @ 4200 rpm	150 N·m @ 3800 rpm
Valve Timing	Intake	Open	2° ~ 42° BTDC	←
		Close	50° ~ 10° ABDC	←
	Exhaust	Open	42° BBDC	←
		Close	2° ATDC	←
Fuel Octane Number		RON	95 or More	←
Oil Grade			API SJ, EC or ILSAC	←

▶ Performance Curve ◀



1ZZ-FE Engine

195EG74



3ZZ-FE Engine

178EG03

2. Feature of 1ZZ-FE and 3ZZ-FE Engines

The 1ZZ-FE and 3ZZ-FE engines have been able to achieve the following performance through the adoption of the items listed below.

(1) High performance and fuel economy

(2) Low noise and vibration

(3) Lightweight and compact design

(4) Good serviceability

(5) Clean emission

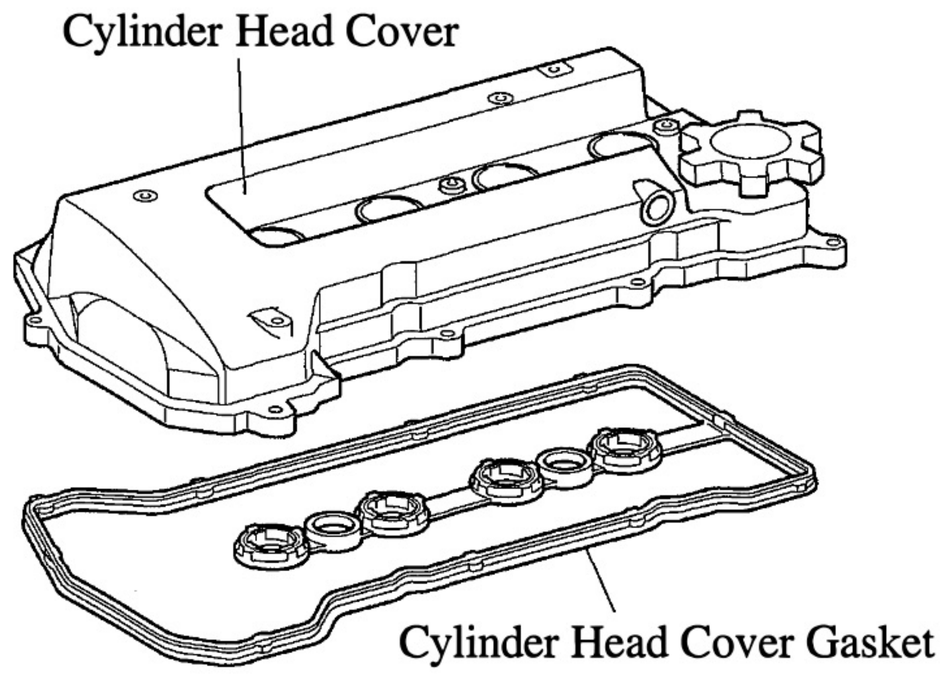
Item	(1)	(2)	(3)	(4)	(5)
The VVT-i system is used.	○				○
A cylinder block made of aluminum alloy has been adopted.			○		
The DIS (Direct Ignition System) makes ignition timing adjustment unnecessary.	○			○	
A serpentine belt drive system has been adopted.			○	○	
The fuel retrunless system has been adopted.			○	○	○
Quick connectors are used to connect the fuel hose with the fuel pipe.				○	
12-hole type fuel injectors have been adopted.*	○				○
Intake manifold made of plastic has been adopted.			○		
A dual WU-TWC (Warm Up Three-Way Catalytic Converter) for reducing exhaust emissions during engine warming has been adopted.*	○				○
A rearward exhaust layout has been adopted to realize an early activation of the catalyst.					○
Timing chain has been used.				○	
A stainless steel exhaust manifold is used for weight reduction.			○		
The crankshaft bearing caps with ladder-frame construction have been adopted.		○			

*: Only for 1ZZ-FE engine

3. Engine Proper

Cylinder Head Cover

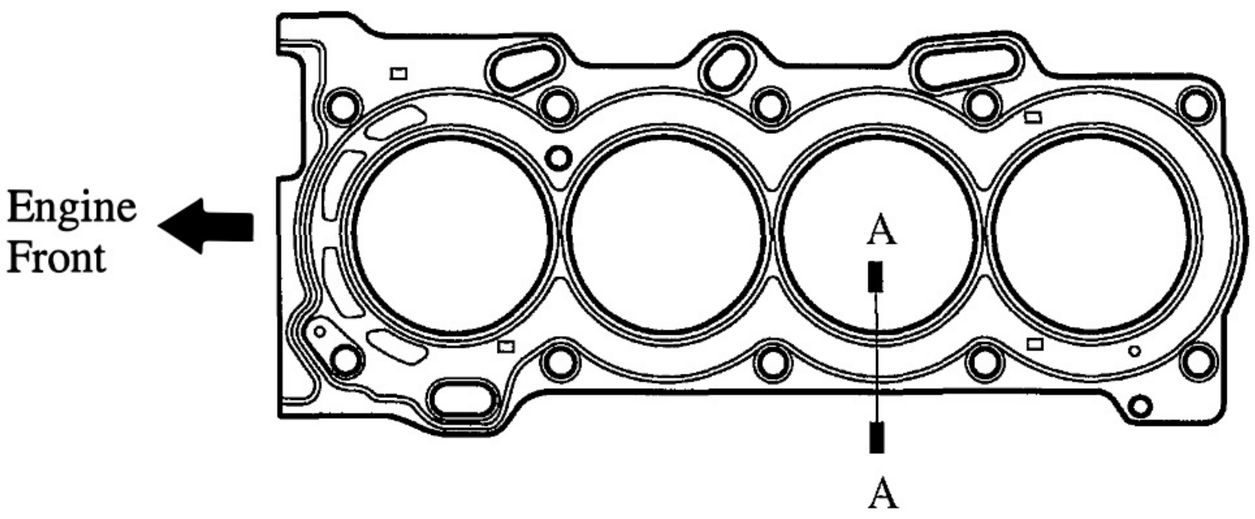
- Lightweight yet high-strength aluminum die-cast cylinder head cover is used.
- The cylinder head cover gasket and the spark plug gasket have been integrated to reduce the number of parts.
- Acrylic rubber, which excels in heat resistance and reliability, has been adopted for the cylinder head cover gasket.

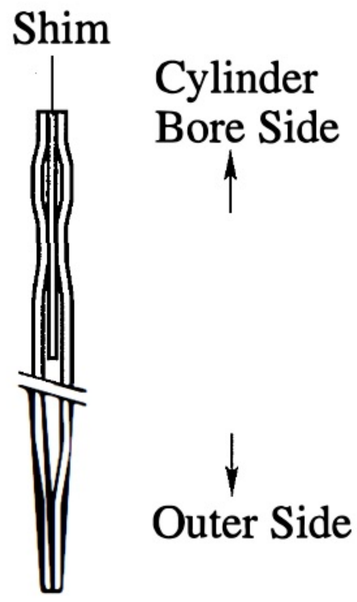


174EG03

Cylinder Head Gasket

A steel-laminate type cylinder head gasket has been adopted. A shim has been added around the cylinder bore to increase the sealing surface, thus improving the sealing performance and durability.



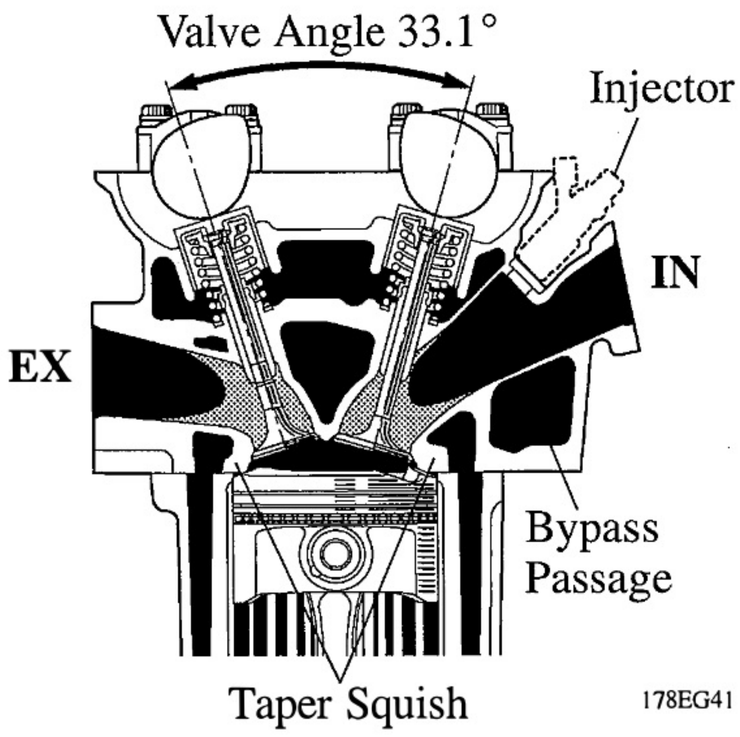


A – A Cross Section

174EG04 178EG40

Cylinder Head

- Upright intake port have been adopted to improve the intake efficiency.
- The injectors have been installed in the cylinder head to prevent the fuel from adhering onto the intake port walls, thus reducing exhaust emissions.
- The routing of the water jacket in the cylinder head has been optimized to improve the cooling performance. In addtion, a water bypass passage has been provided below the intake ports to reduce the number of parts and to achieve weight reduction.
- The angle of the intake and exhaust valves is narrowed and set at 33.1° to permit a compact cylinder head.
- A compression ratio of 10.0 : 1 (1ZZ-FE engine) and 10.5 : 1 (3ZZ-FE engine) have been adopted and the variances in the combustion chamber volume between the cylinders have been minimized to improve the power output.
- Through the adoption of the laser-clad valve seat and the taper squish combustion chamber, the engine's knocking resistane and fuel efficiency have been improved. In addition, the valve diameter has been increased through the adoption of the laser-clad valve seat. However, the laser-clad valve seats are provided only in the 1ZZ-FE engine.



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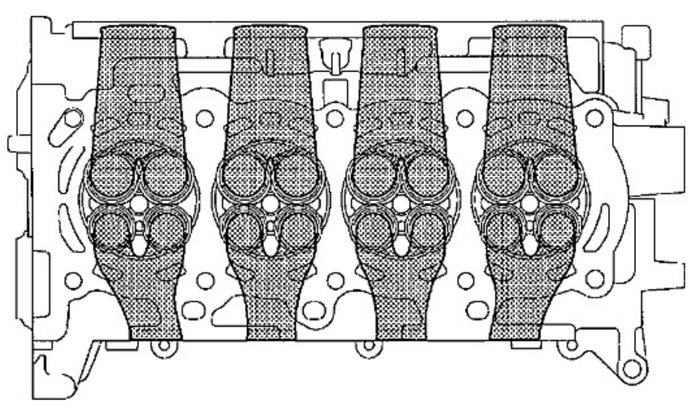
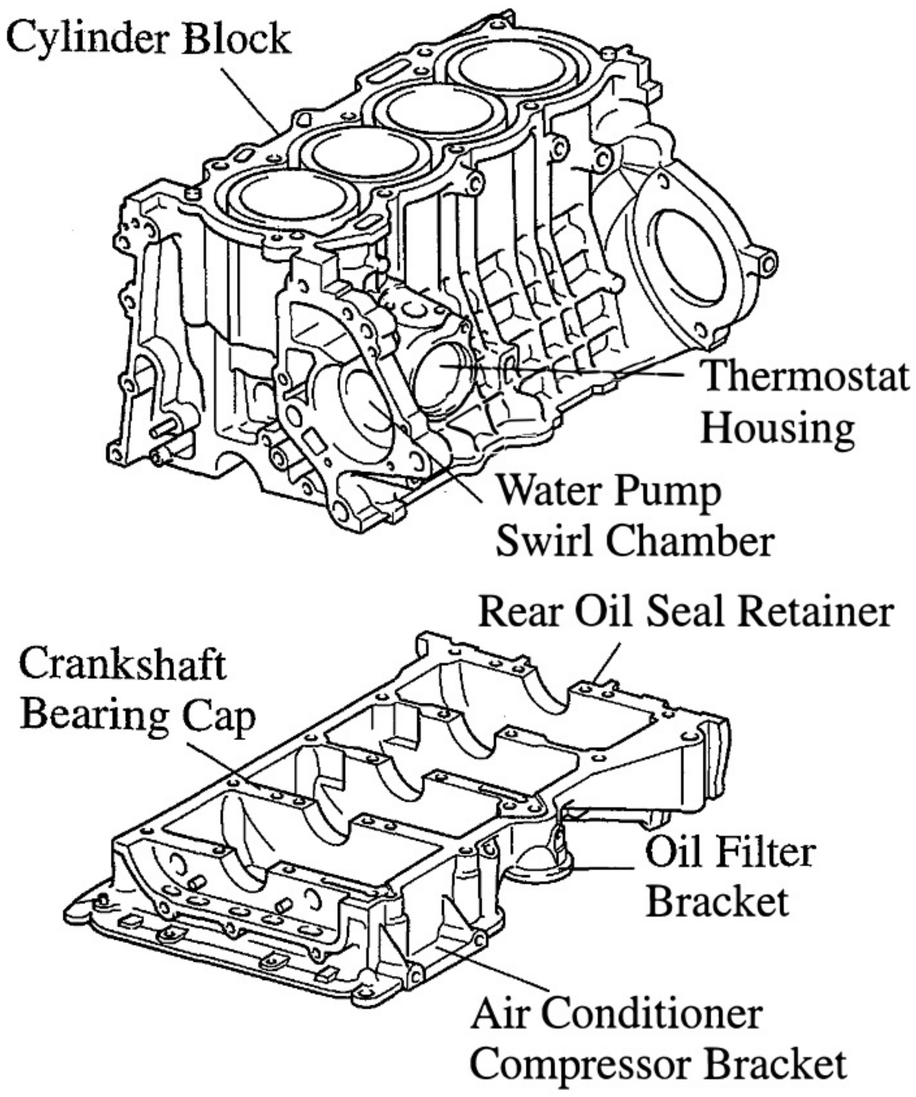


148EG26

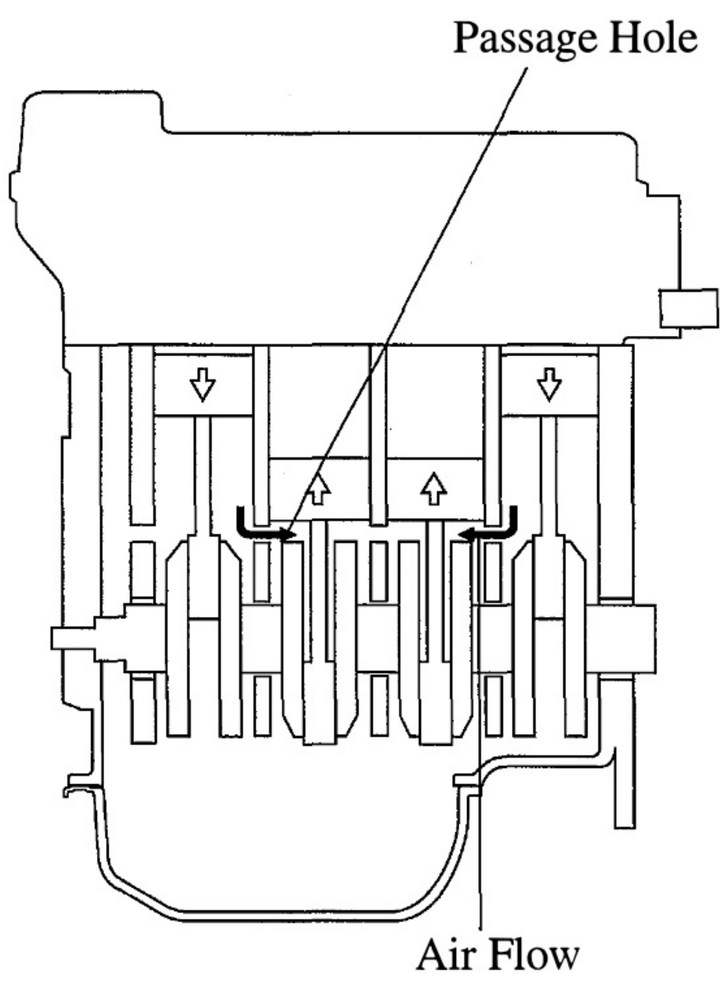
Cylinder Block

- Lightweight aluminum alloy is used for the cylinder block.
- By producing the thin cast-iron liners and cylinder block as a unit, compaction is realized. This liner is thin, so that boring is not possible.
- A water pump swirl chamber and an inlet passage to the pump are provided in the cylinder block.
- Passage holes are provided in the crankshaft bearing area of the cylinder block. As a result, the air at the bottom of the cylinder flows smoother, and pumping loss (back pressure at the bottom of the piston generated by the piston's reciprocal movement) is reduced to improve the engine's output.
- The crankshaft bearing caps with ladder-frame construction have been adopted to improve the rigidity, to reduce noise, and to improve the coupling rigidity with the transaxle.
- Cast-iron is adopted as a material for a part of a bearing journal of a crankshaft bearing cap and thus restraints the heat deformation. In addition, the oil filter bracket, the air conditioner compressor bracket, the water pump swirl chamber, the thermostat housing and the rear oil seal retainer have been integrated to reduce the number of parts.



148EG25

▶ Air Flow During Engine Revolution ◀



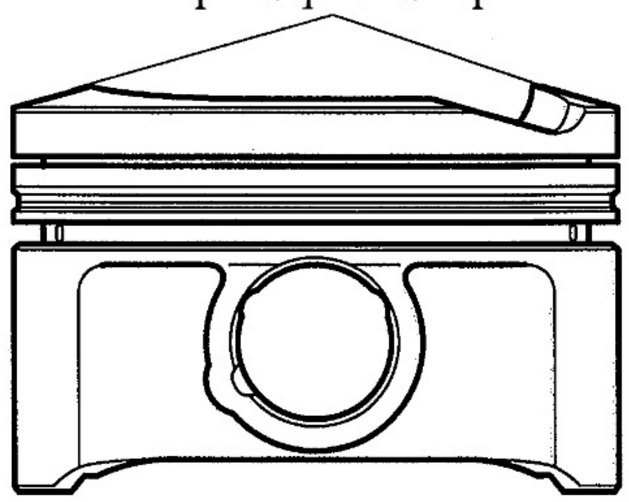
179EG04

Ladder-frame Construction

Piston

- The piston is made of aluminum alloy and skirt area is made compact and lightweight.
- The piston head portion has adopted a taper squish shape to improve the fuel combustion efficiency.
- Full floating type piston pins are used.
- By increasing the machining precision of the cylinder bore diameter, the outer diameter of the piston has been made into one type.

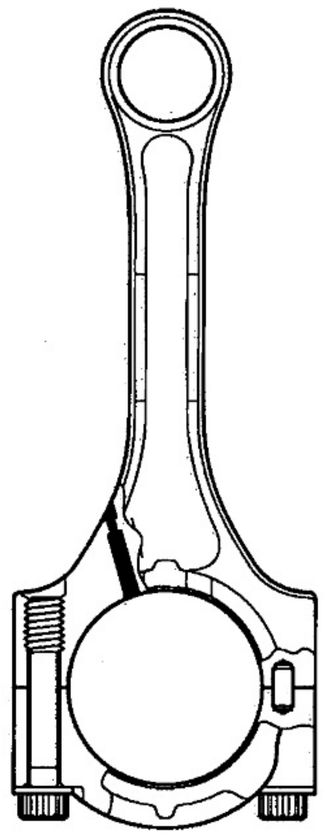
Taper Squish Shape



178EG28

Connecting Rod

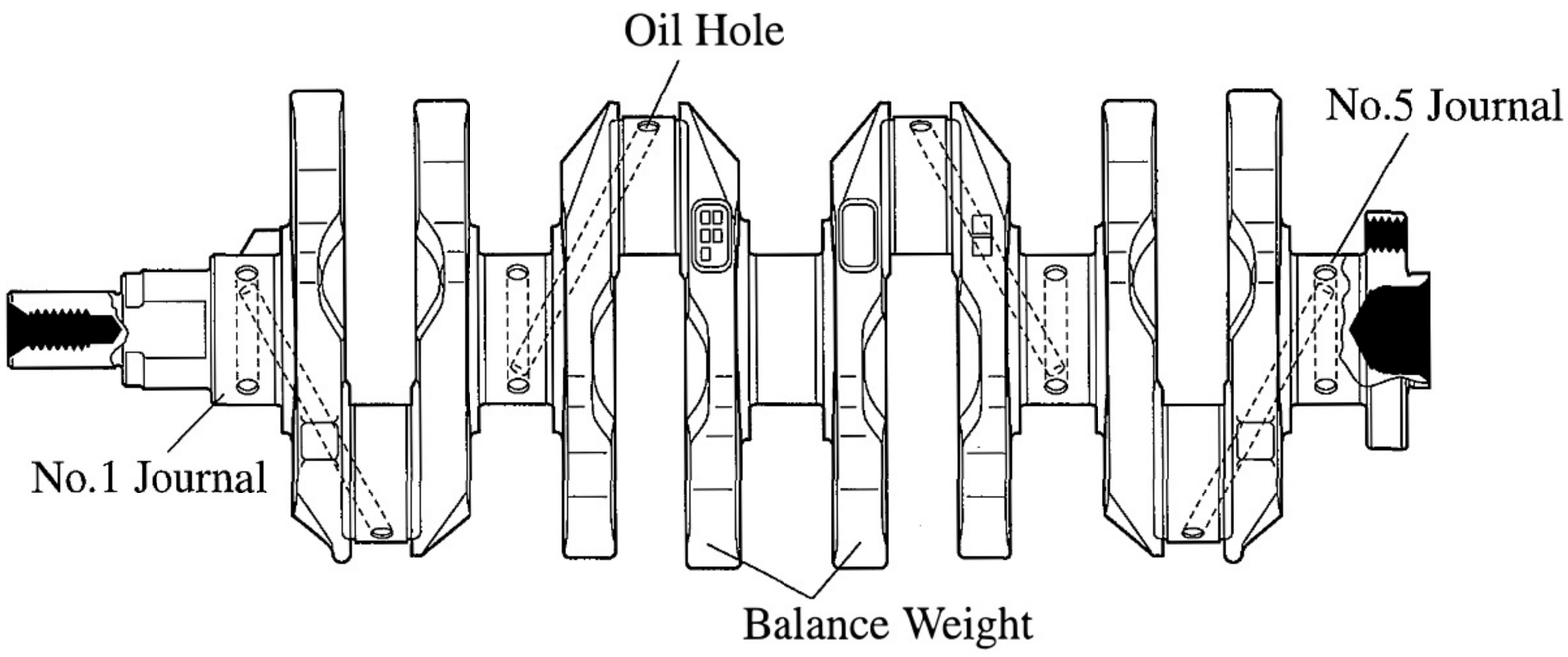
- The connecting rods are made of high-strength material for weight reduction.
- The connecting rod bearings have been reduced in width to reduce friction.
- Nutless-type plastic region tightening bolts of the connecting rod are adopted for a lighter design.



178EG29

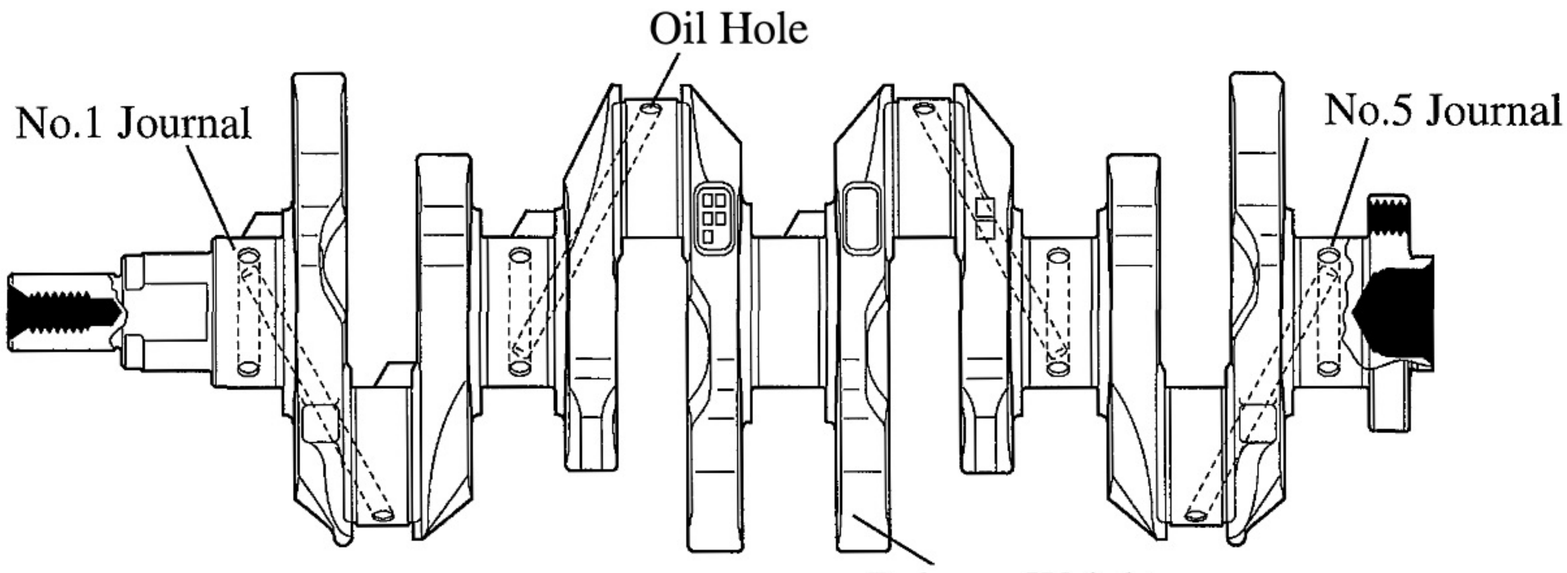
Crankshaft

- The forged crankshaft (for 1ZZ-FE engine) has 5 journals and 8 balance weights.
- The casting crankshaft (for 3ZZ-FE engine) has 5 journals and 4 balance weights.
- The crankshaft bearings have been reduced in width to reduce friction.
- The precision and surface roughness of the pins and journals have been improved to reduce friction.



148EG04

For 1ZZ-FE Engine



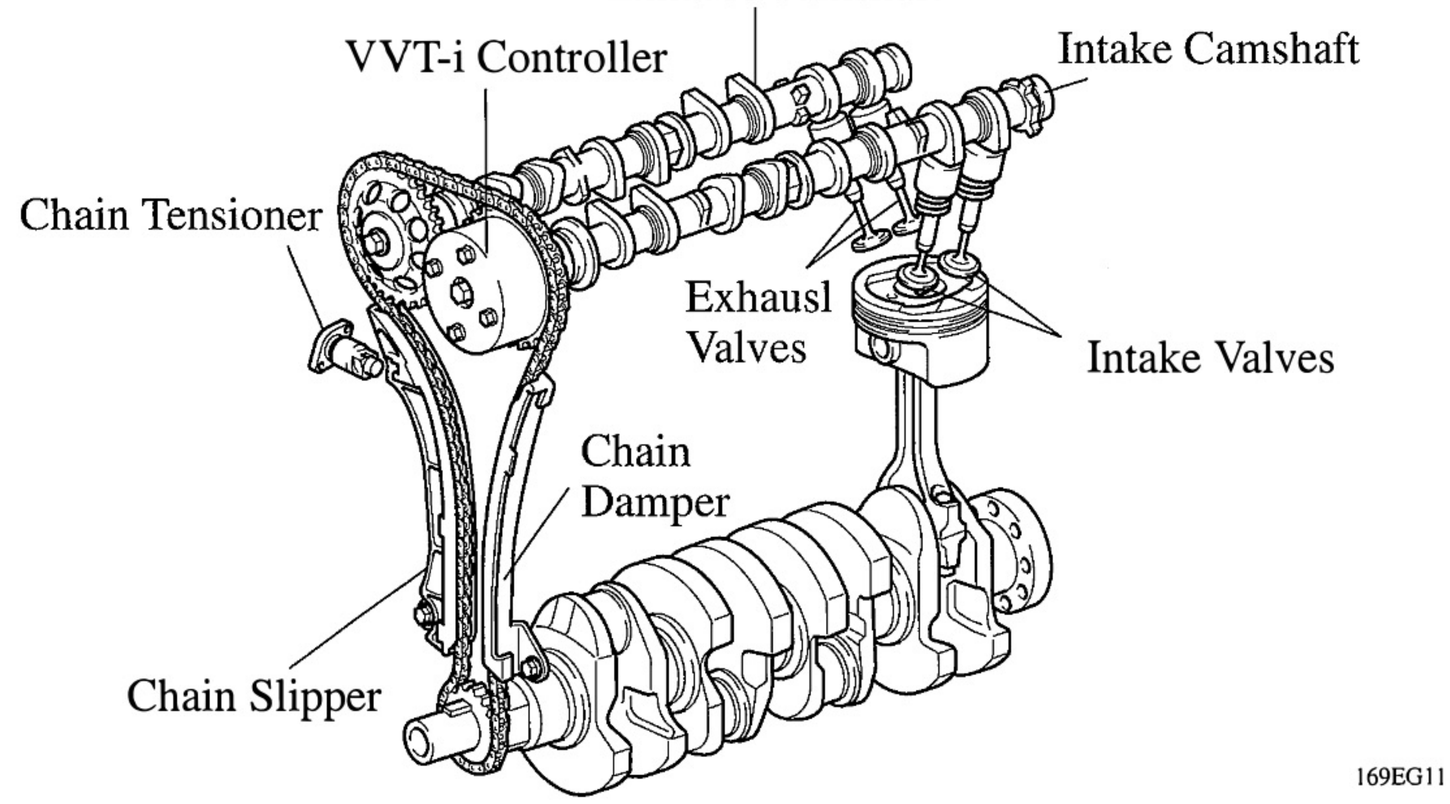
For 3ZZ-FE Engine

178EG31

4. Valve Mechanism

General

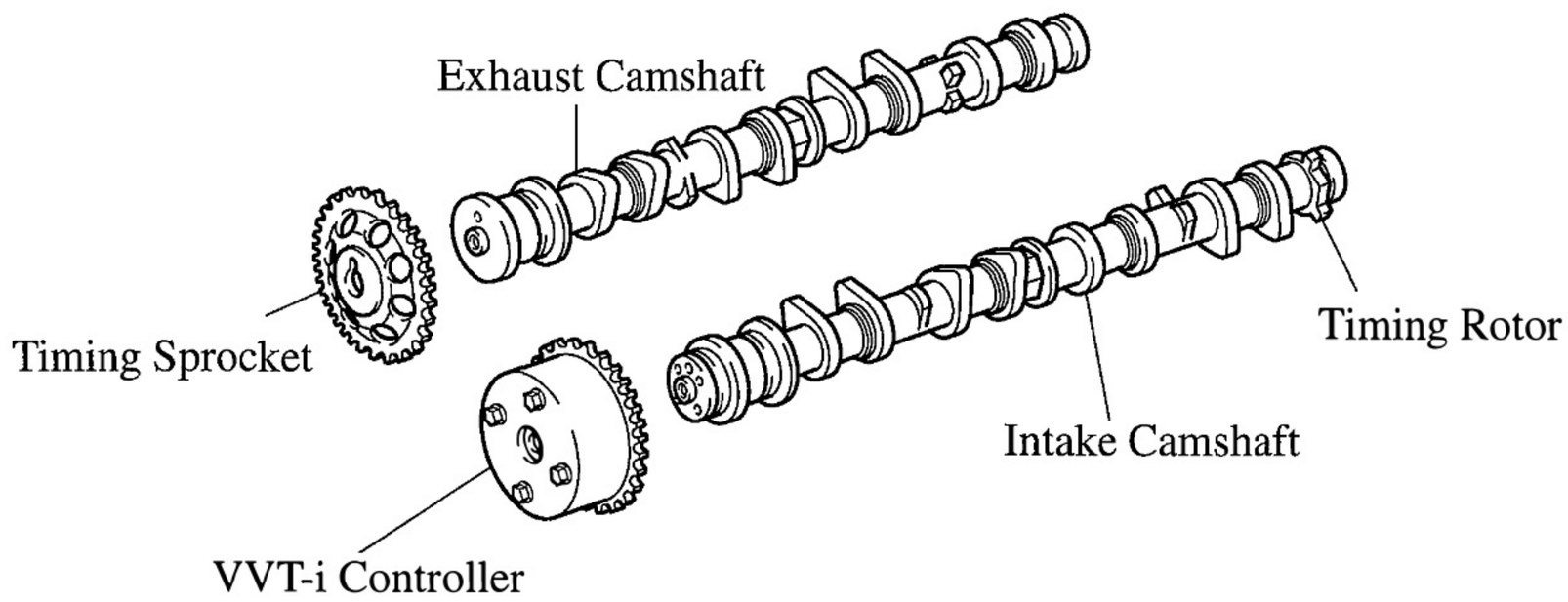
- Each cylinder is equipped with 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency has been increased due to the larger total port areas.
- The valves are directly opened and closed by 2 camshafts.
- The shimless type valve lifter is used.
- The intake and exhaust camshafts are driven by a chain.
- The VVT-i (Variable Valve Timing-intelligent) system is used to improve fuel economy, engine performance and reduce exhaust emissions. For details, refer to page 98.



For 1ZZ-FE Engine

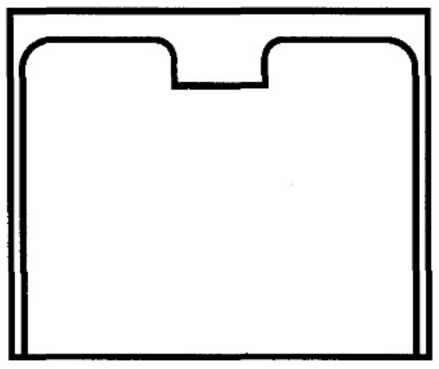
Camshaft

- In conjunction with the adoption of the VVT-i system, an oil passage is provided in the intake camshaft in order to supply engine oil pressure to the VVT-i system.
- A VVT-i controller has been installed on the front of the intake camshaft to vary the timing of the intake valves.
- The intake camshaft is provided with timing rotor to trigger the camshaft position sensor.



Valve Lifter

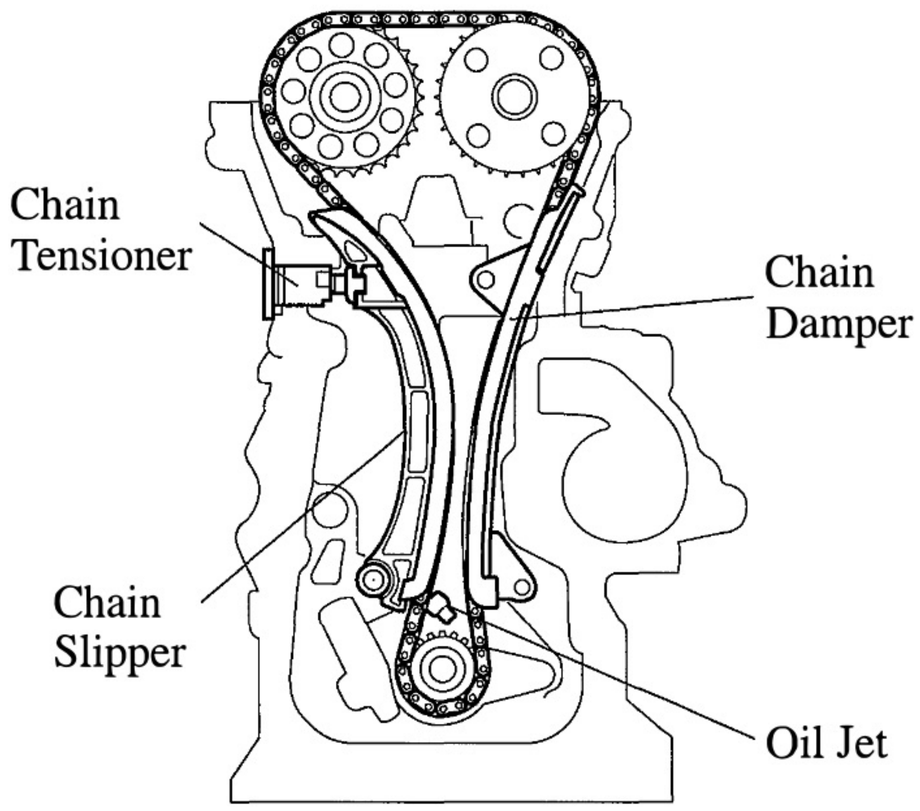
Along with the increase of the amount of valve lift, the valve adjusting shims have been discontinued and the shimless type of the valve lifter has been adopted. This valve lifter enables to make the cam contact surface greater.
The adjustment of the valve clearances is accomplished by selecting and replacing the appropriate valve lifters.



148EG05

Timing Chain

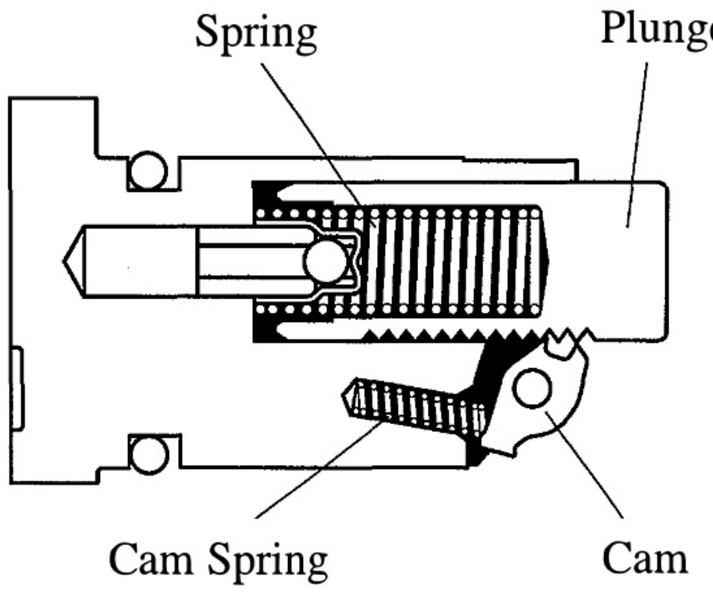
- A roller chain with an 8 mm pitch has been adopted to make the engine more compact.
- A material which has excellent wear resistance has been selected for the timing chain to improve reliability.
- The timing chain is lubricated by an oil jet.



185EG02

Chain Tensioner

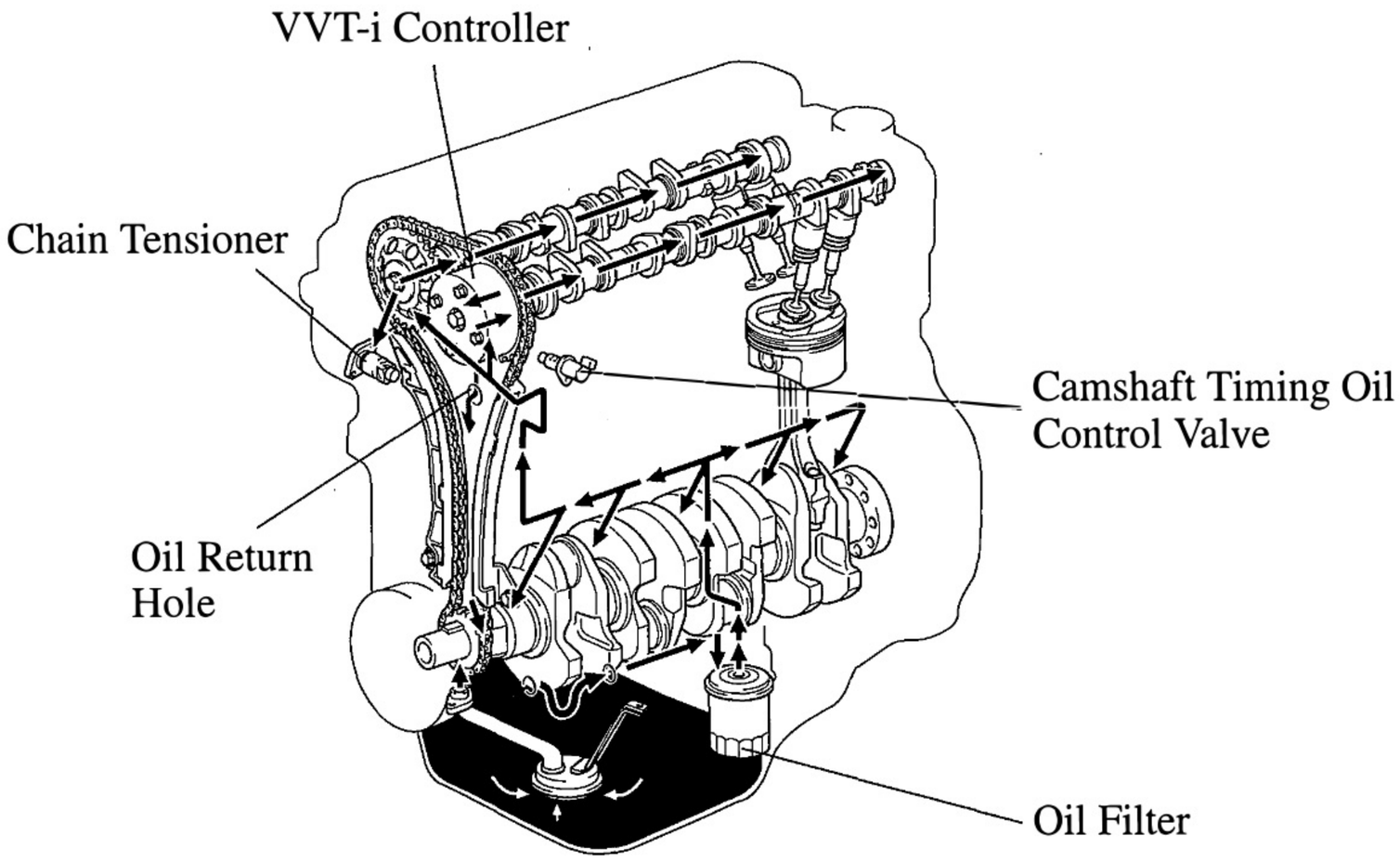
- The chain tensioner uses a spring and oil pressure to maintain proper chain tension at all times.
  The chain tensioner suppresses noise generated by the chain.
- A ratchet type non-return mechanism is also used.
- To improve serviceability, the chain tensioner is constructed so that it can be removed and installed from the outside of the timing chain cover.



178EG05

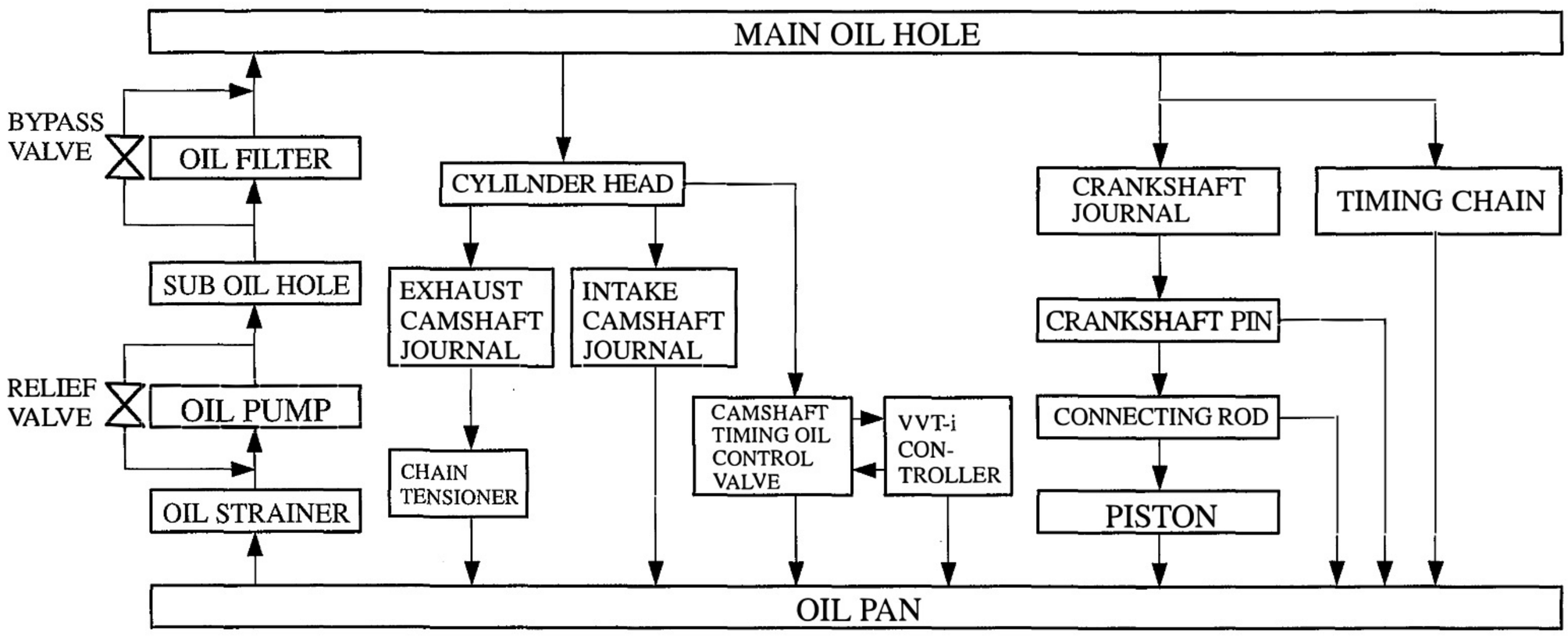
5. Lubrication System

- The lubrication circuit is fully pressurized and oil passes through an oil filter.
- The cycloid gear type oil pump is directly driven by the crankshaft.
- This engine has an oil return structure in which the oil force-fed to the upper cylinder head returns to the oil pan through the oil return hole established in the cylinder head.
- The oil filter is attached downward from the crankshaft bearing cap to improve serviceability.
- Along with the adoption of the VVT-i system, the cylinder head is provided with a VVT-i controller and a camshaft timing oil control valve. This system is operated by the engine oil.



185EG34

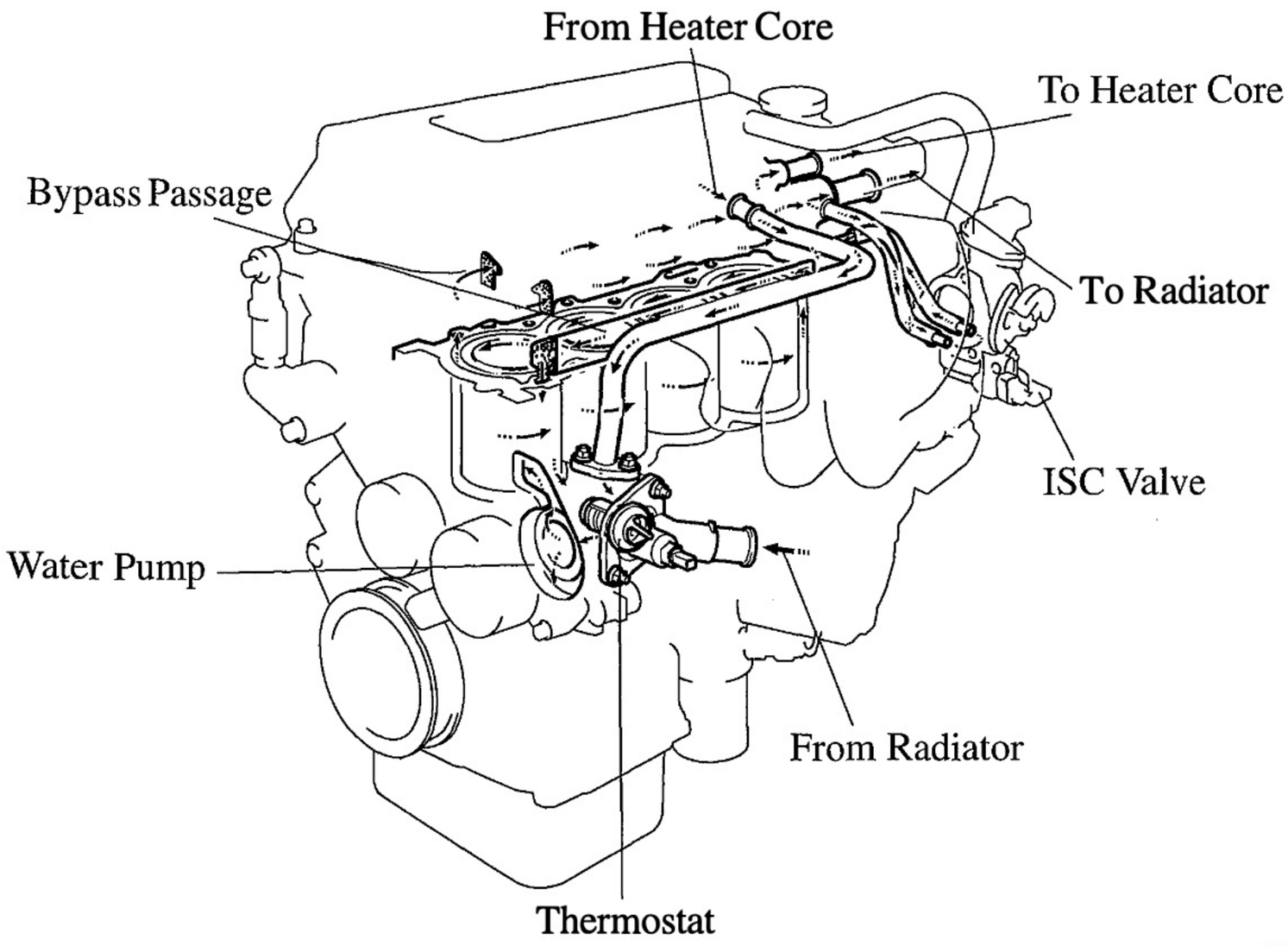
For 1ZZ-FE Engine



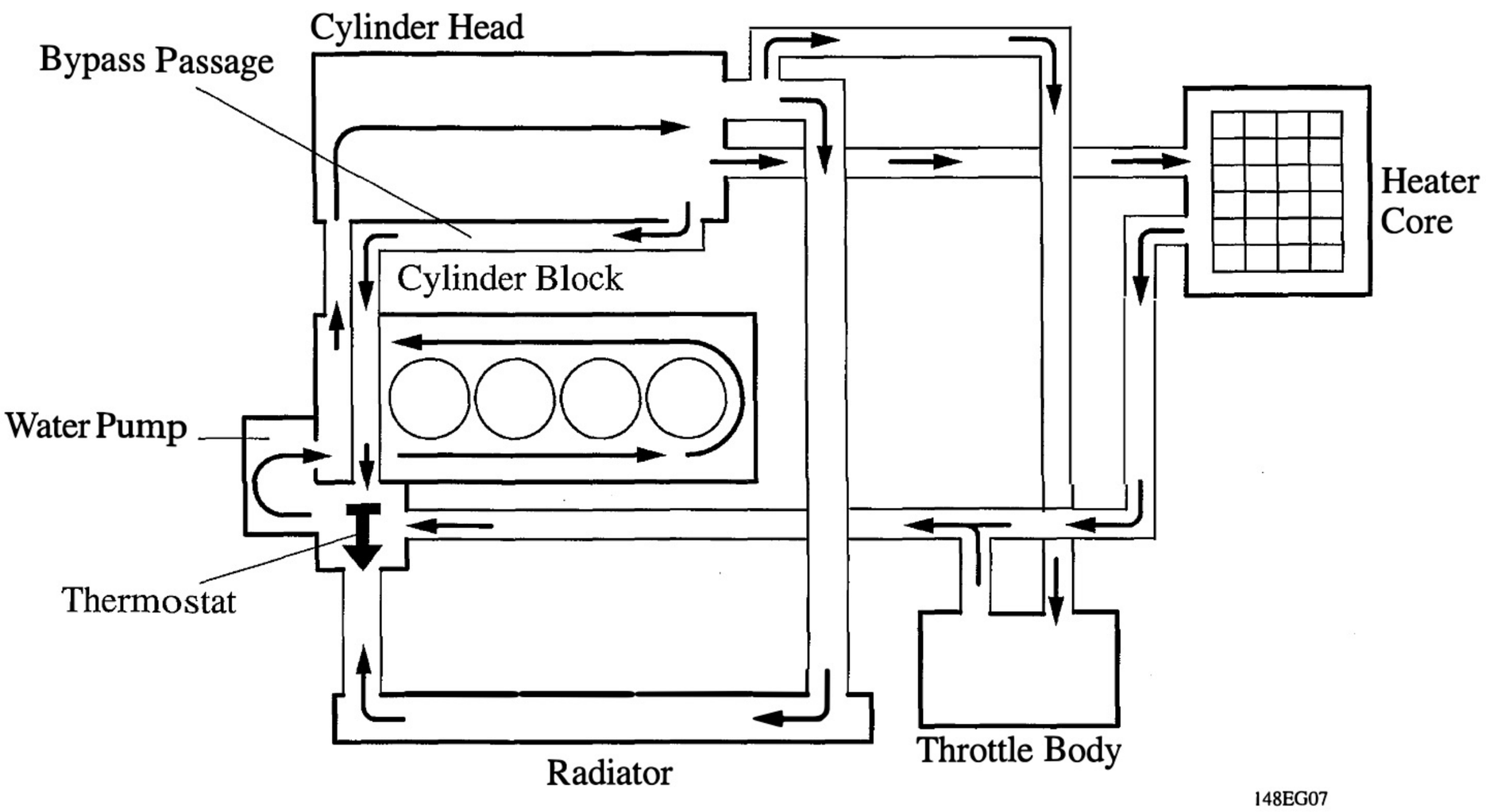
195EG04

6. Cooling System

- The cooling system is a pressurized, forced-circulation type.
- A thermostat with a bypass valve is located on the water inlet housing to maintain suitable temperature distribution in the cooling system.
- An aluminium radiator core is used for weight reduction.
- The flow of the engine coolant makes a U-turn in the cylinder block to ensure a smooth flow of the engine coolant. In addition, a bypass passage is enclosed in the cylinder head and the cylinder block.
- Warm water from the engine is sent to the throttle body to prevent freeze-up.



185EG51

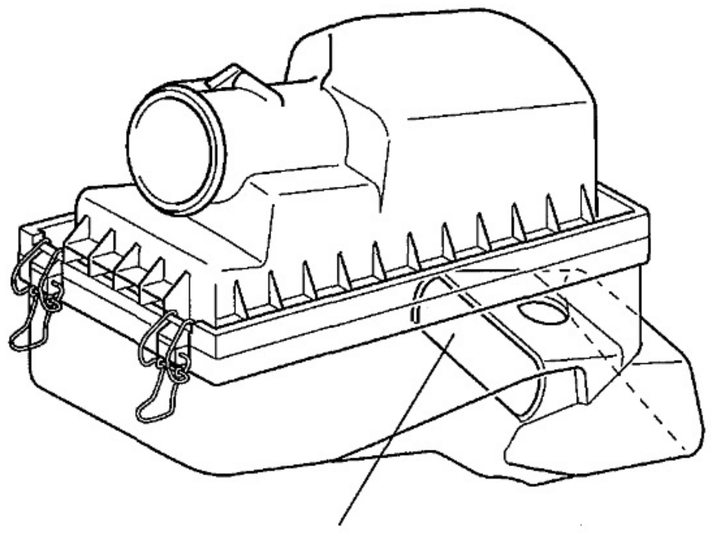


148EG07

7. Intake and Exhaust System

Air Cleaner

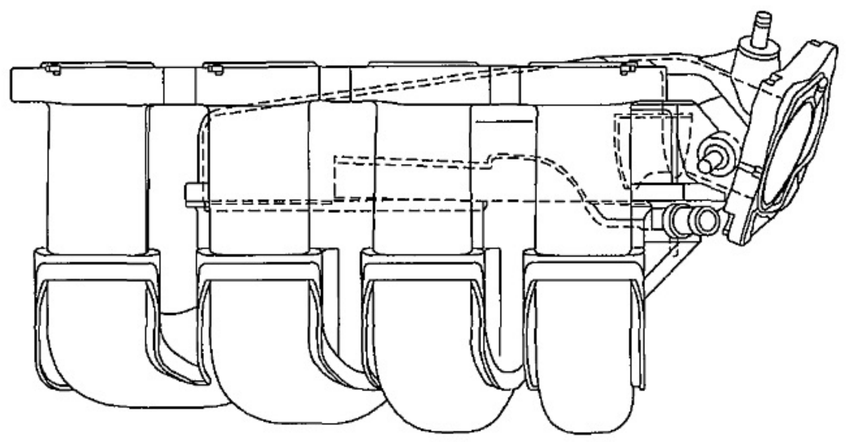
- A protruded pipe that is composite-formed with the case has been added in the air cleaner case to reduce the amount of the intake sound.



195EG06

Intake Manifold

- The intake manifold has been made of plastic to reduce the weight and the amount of heat transferred from the cylinder head. As a result, it has become possible to reduce the intake air temperature and improve the intake volumetric efficiency.
- A resonator is provided in the air intake chamber to optimize the intake pulsation in order to improve the engine performance in the midspeed range.

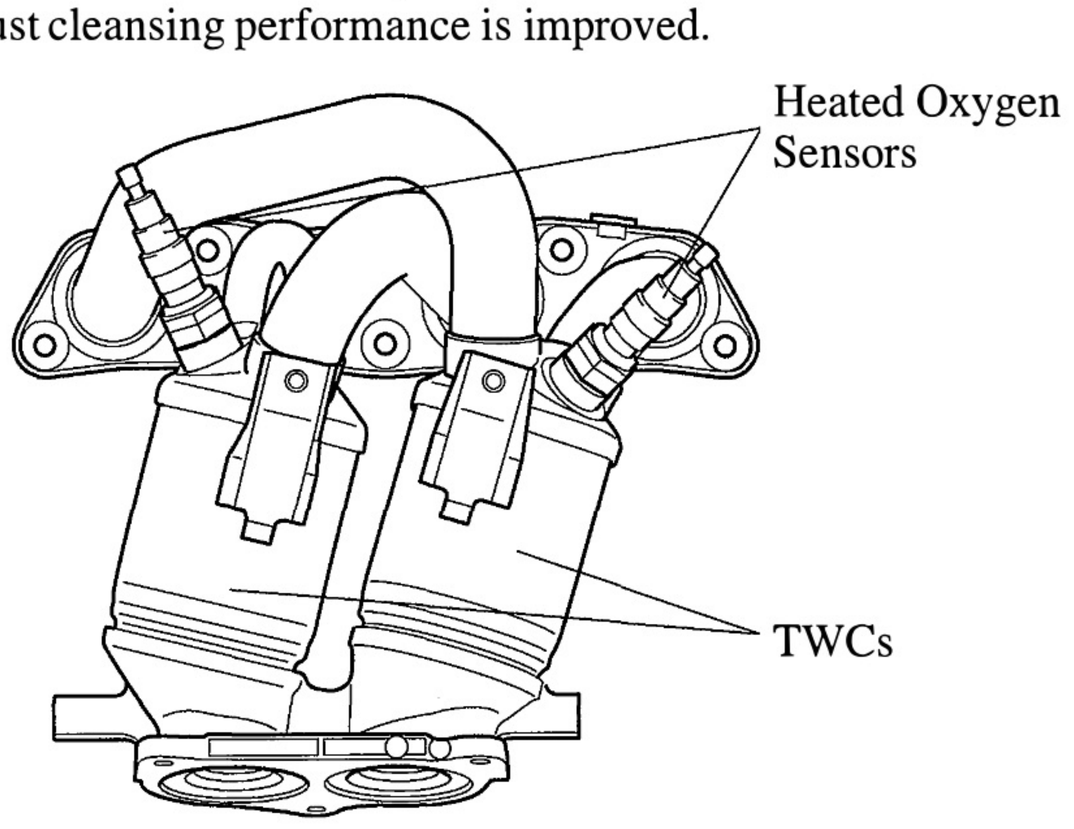


For 1ZZ-FE Engine

169EG21

Exhaust Manifold

- A dual type exhaust manifold has been installed on the front of the vehicle, in the 1ZZ-FE engine.
- A stainless steel exhaust manifold is used for weight reduction.
- A thin-wall ceramic WU-TWC (Warm Up Three-Way Catalytic Converter) has been adopted for the 1ZZ-FE engine. By decreasing the thermal capacity in this manner, it becomes easier to heat the catalyst and the catalyst's exhaust cleansing performance is improved.



195EG05

For 1ZZ-FE Engine

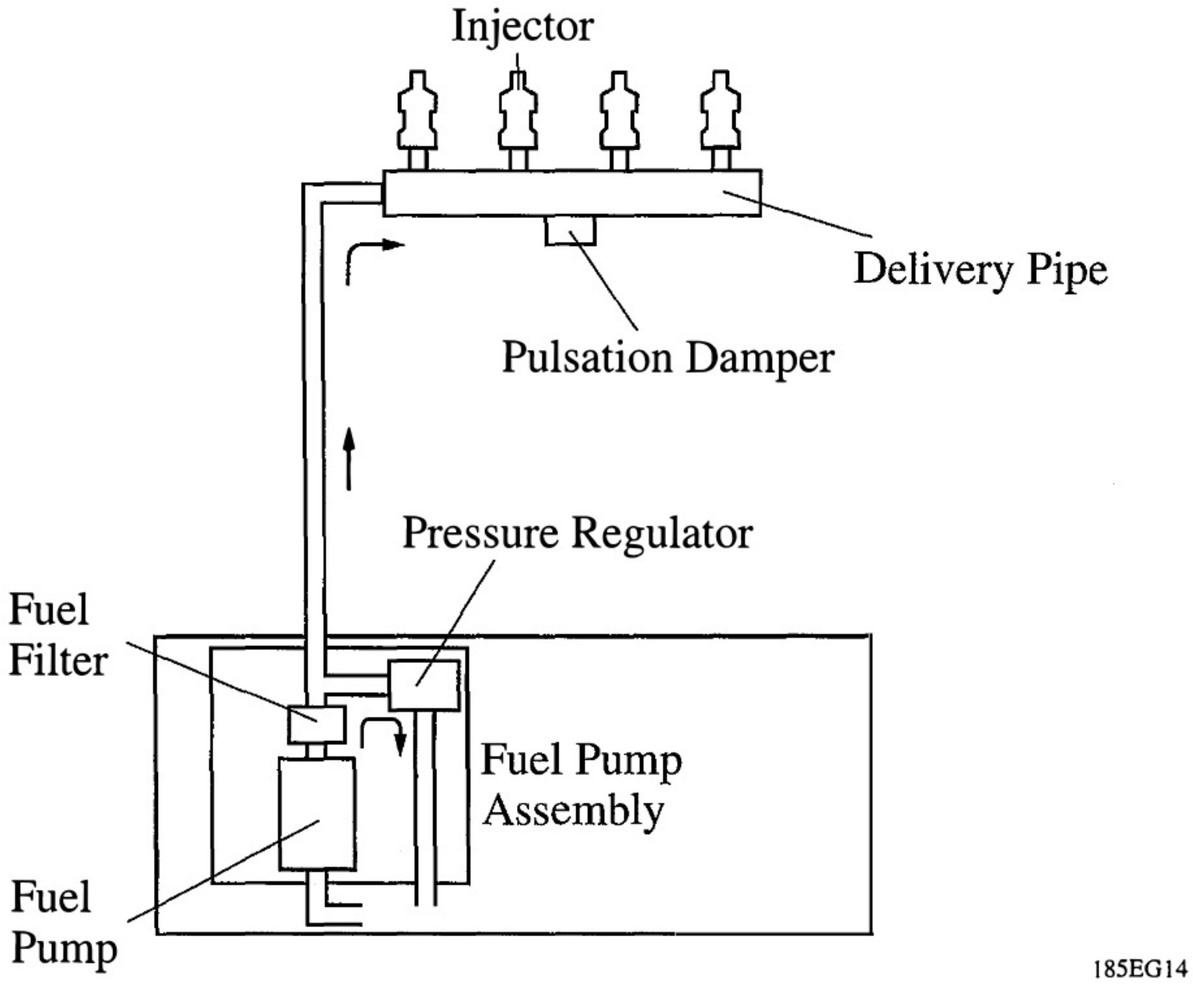
8. Fuel System

General

- The fuel returnless system has been adopted to reduce evaporative emissions.
- A fuel cut control has been adopted to stop the fuel pump when the airbag is deployed at the front or side collision.
- A quick connector has been adopted to connect the fuel pipe with the fuel hose to improve serviceability
- A compact 12-hole type injector has been adopted in the 1ZZ-FE engine.
- A compact 4-hole type injector has been adopted in the 3ZZ-FE engine.

Fuel Returnless System

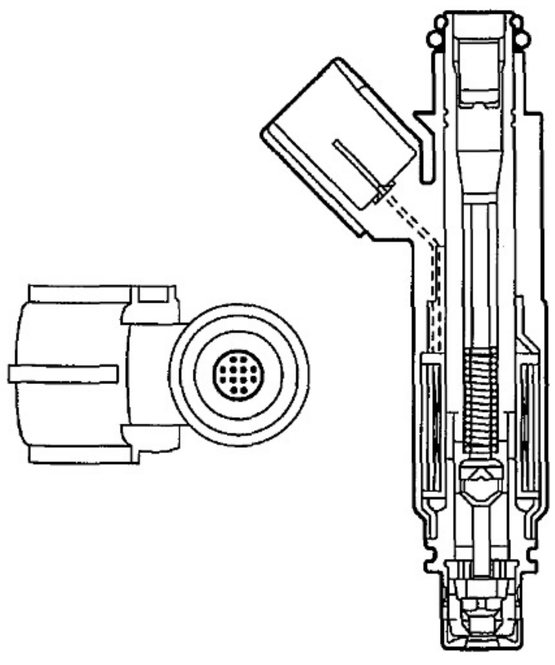
This system has been adopted to reduce the evaporative emission. As shown below, integrating the fuel filter, pressure regulator, and fuel sender gauge with fuel pump assembly it possible to discontinue the return of fuel from the engine area and prevent temperature rise inside the fuel tank.



185EG14

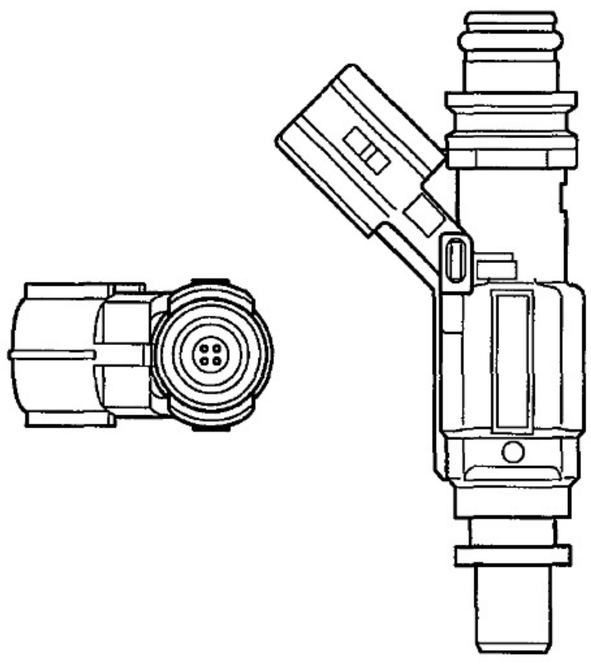
Injector

- A compact 12-hole type injector has been adopted in the 1ZZ-FE engine.
- A compact 4-hole type injector has been adopted in the 3ZZ-FE engine.



185EG04

For 1ZZ-FE Engine



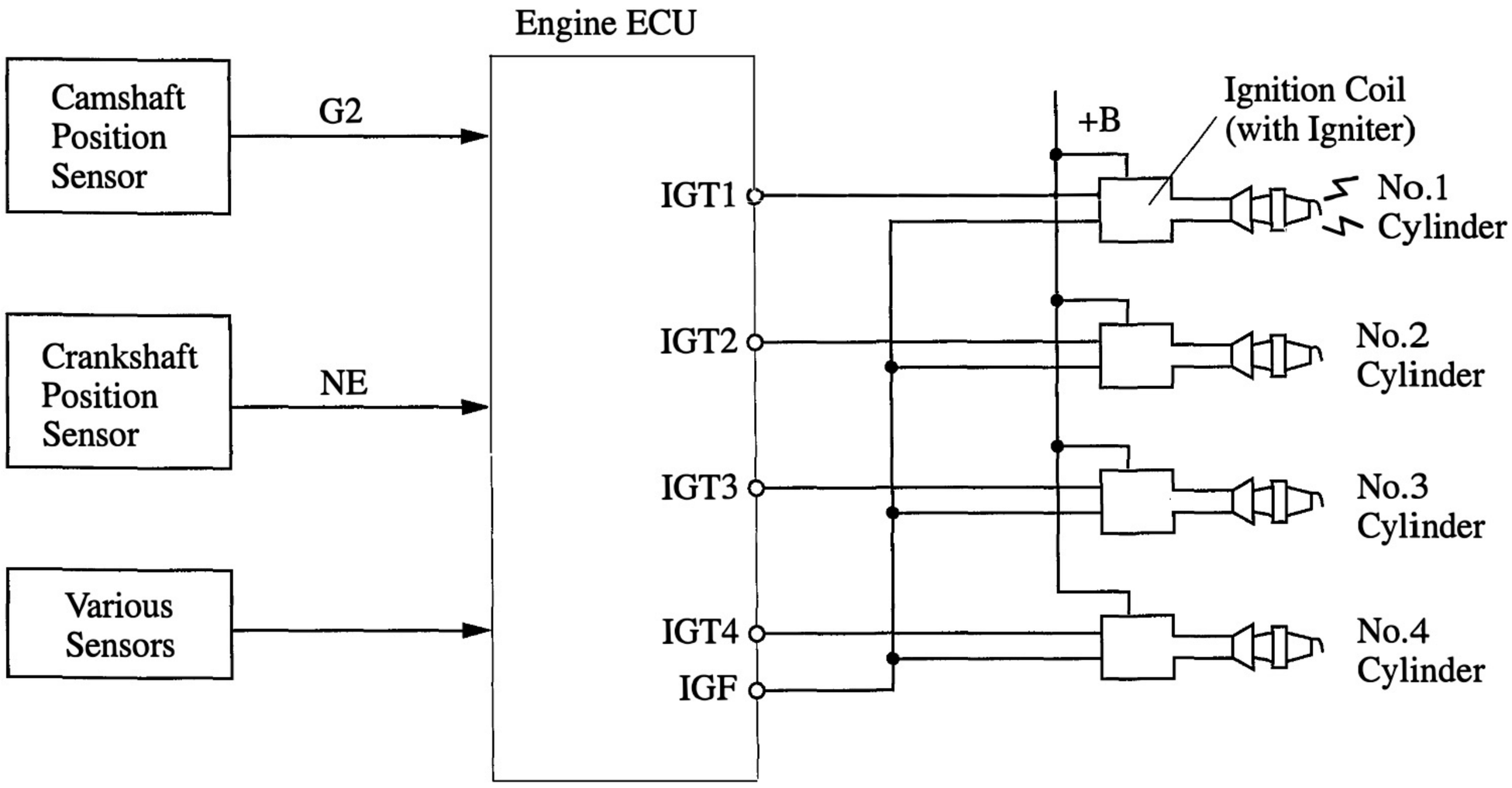
195EG83

For 3ZZ-FE Engine

9. Ignition System

General

A DIS (Direct Ignition System) has been adopted. The DIS improves the ignition timing accuracy, reduces high-voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor. The DIS is an independent ignition system which has one ignition coil (with igniter) for each cylinder.

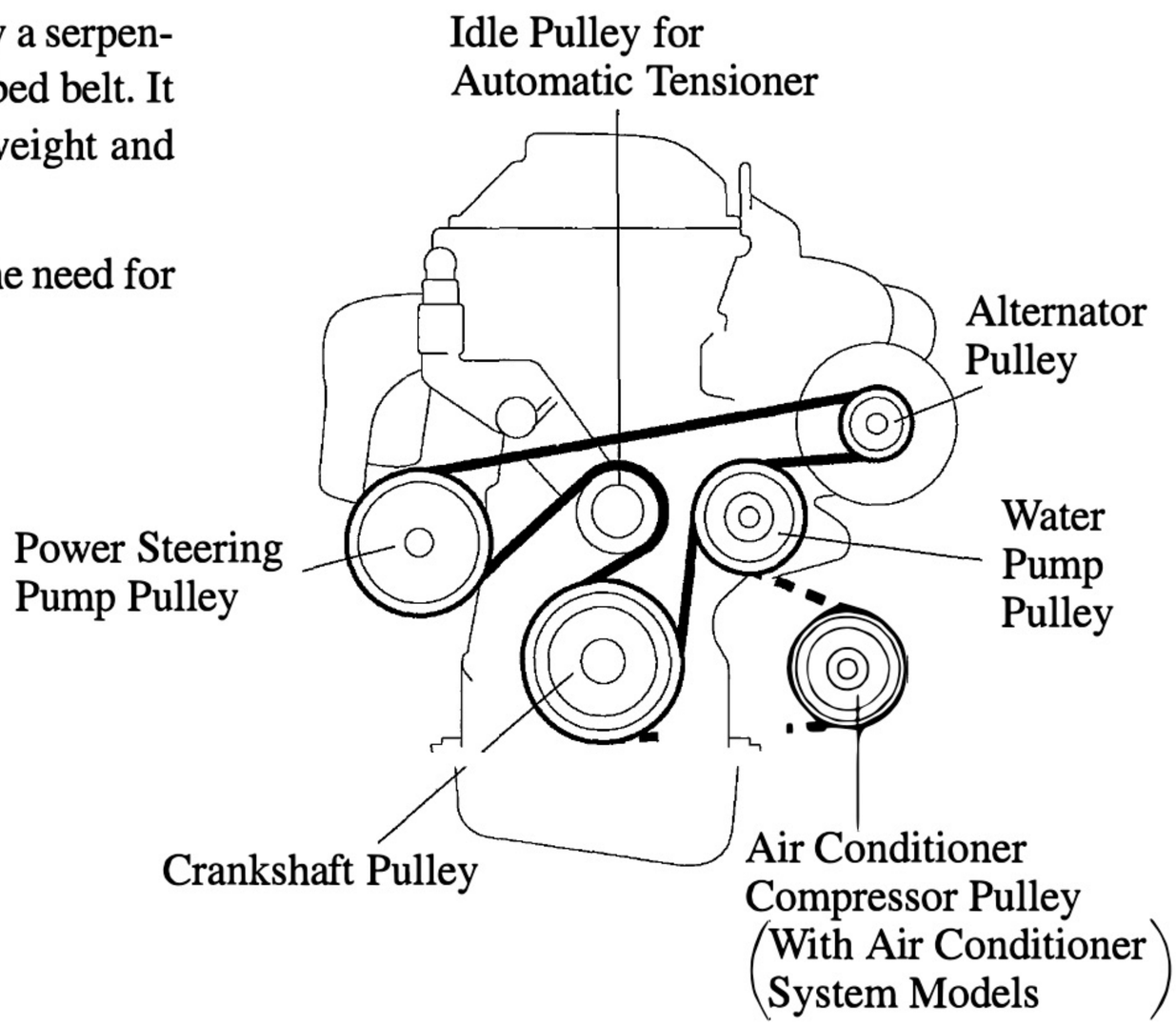


Ignition Coil

The DIS provides 4 ignition coils, one for each cylinder. The spark plug caps, which provide contact to the spark plugs, are integrated with an ignition coil. Also, an igniter is enclosed to simplify the system.

10. Serpentine Belt Drive System

- Accessory components are driven by a serpentine belt consisting of a single V-ribbed belt. It reduces the overall engine length, weight and number of engine parts.
- An automatic tensioner eliminates the need for tension adjustment.



180EG07

11. Engine Control System

General

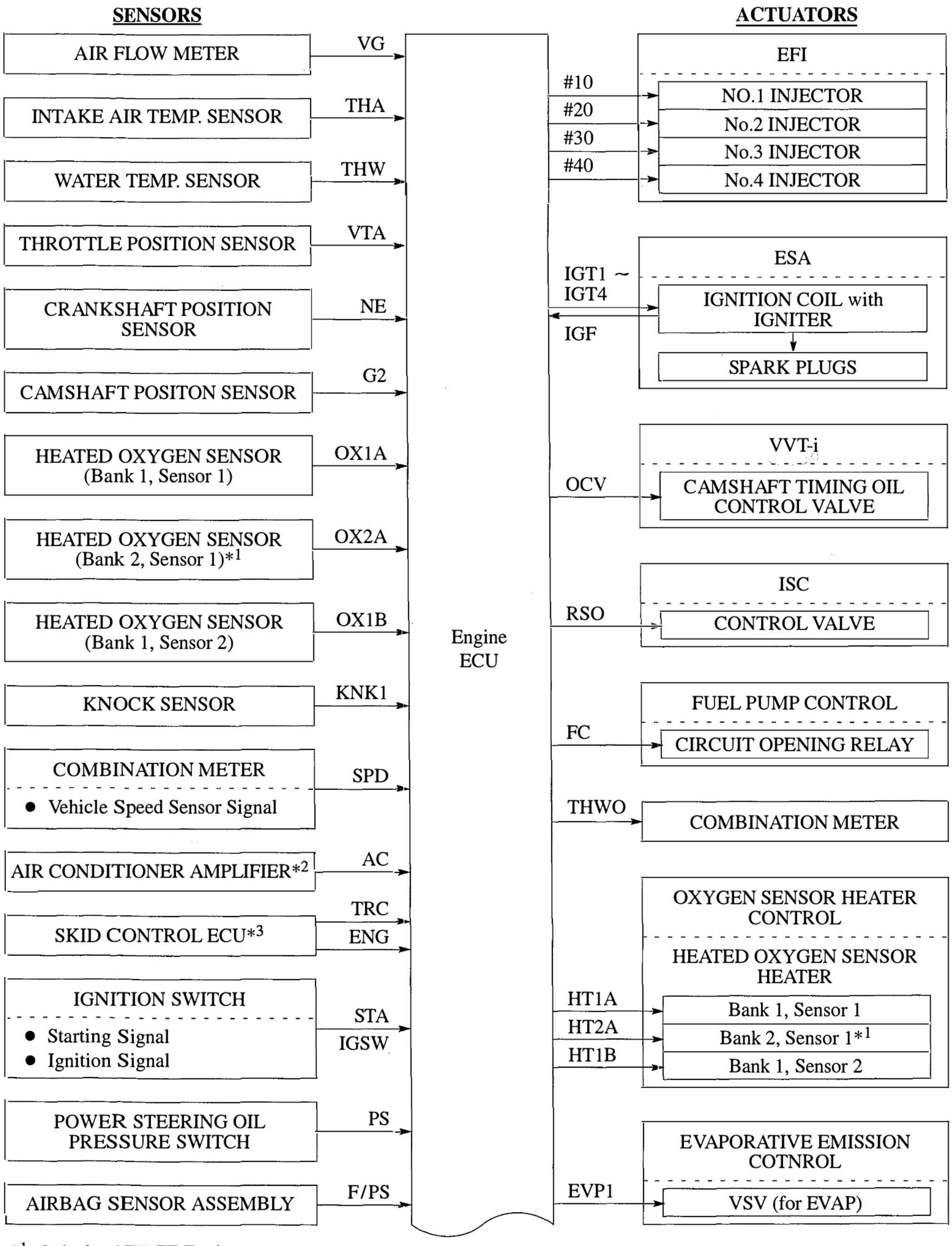
The engine control system for the 1ZZ-FE and 3ZZ-FE engines have following features.

System	Outline
EFI (Electronic Fuel Injection)	• An L-type EFI system directly detects the intake air volume with a hot-wire type air 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.
VVT-i (Variable Valve Timing-intelligent)	Controls the intake camshaft to an optimal valve timing in accordance with the engine condition. For details, see page 98.
Fuel Pump Control	• Fuel pump operation is controlled by signal from the engine ECU. • To stop the fuel pump when the airbag is deployed at the front and side collision. For details, see page 103.
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 defects a malfunction, the engine ECU stops or controls the engine according to the data already stored in memory.

*: With Air Conditioner Model

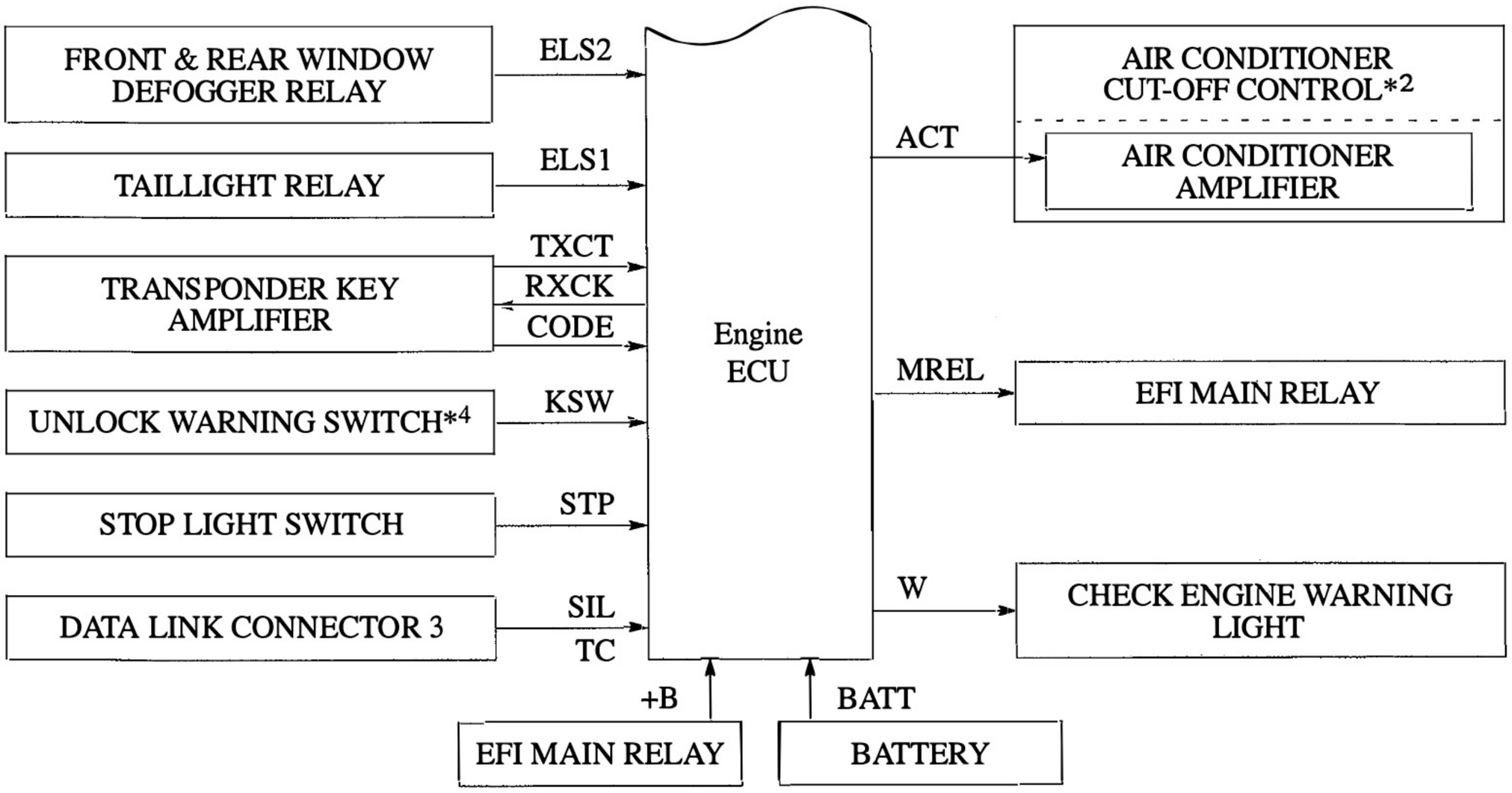
Construction

The configuration of the engine control system is as shown in the following chart.



*1: Only for 1ZZ-FE Engine
*2: With Air Conditioner Model
*3: With ABS & EBD & Brake Assist & TRC & VSC

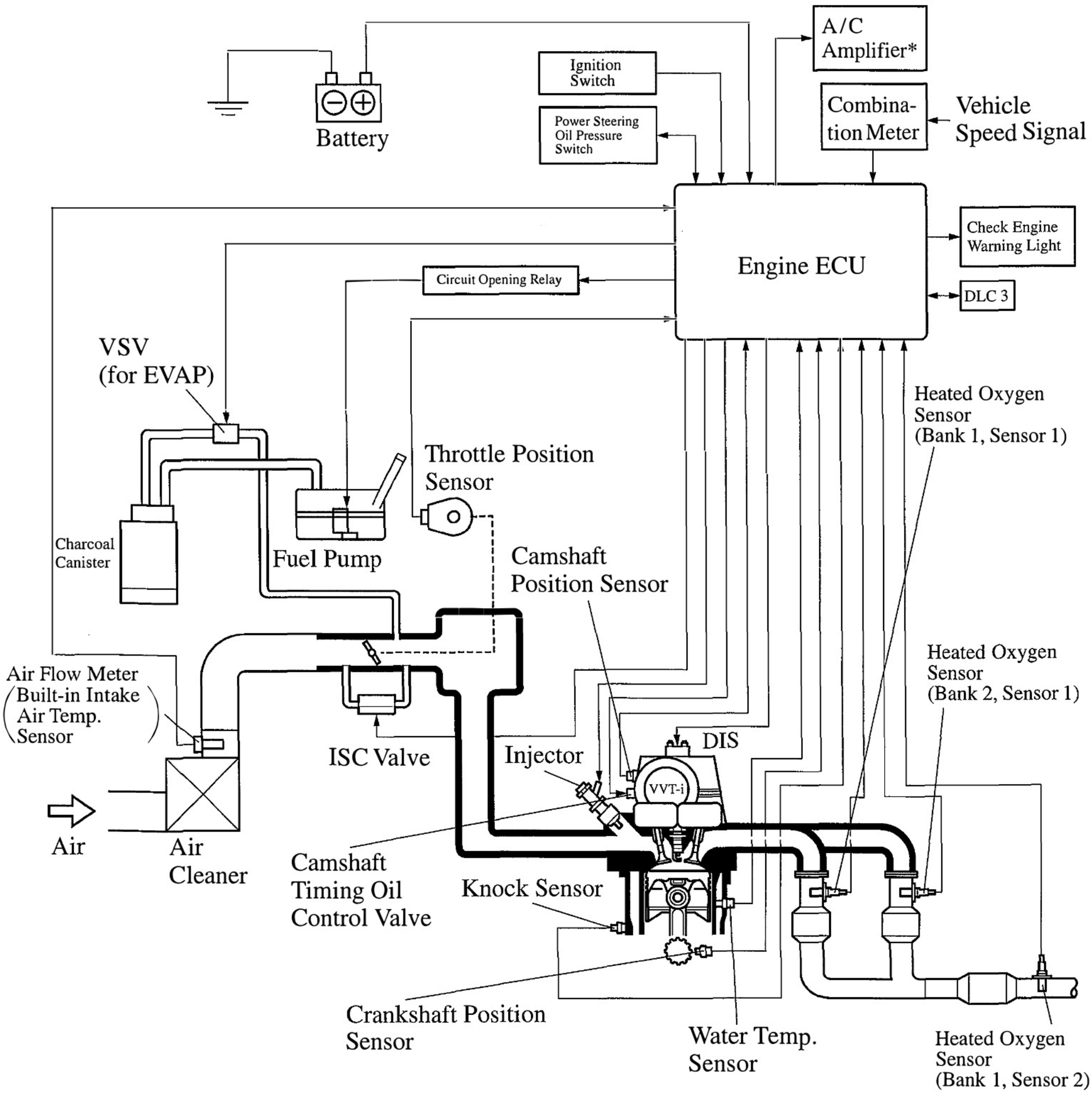
(Continued)



*2: With Air Conditioner Model
*4: Only for Automatic Transaxle

3

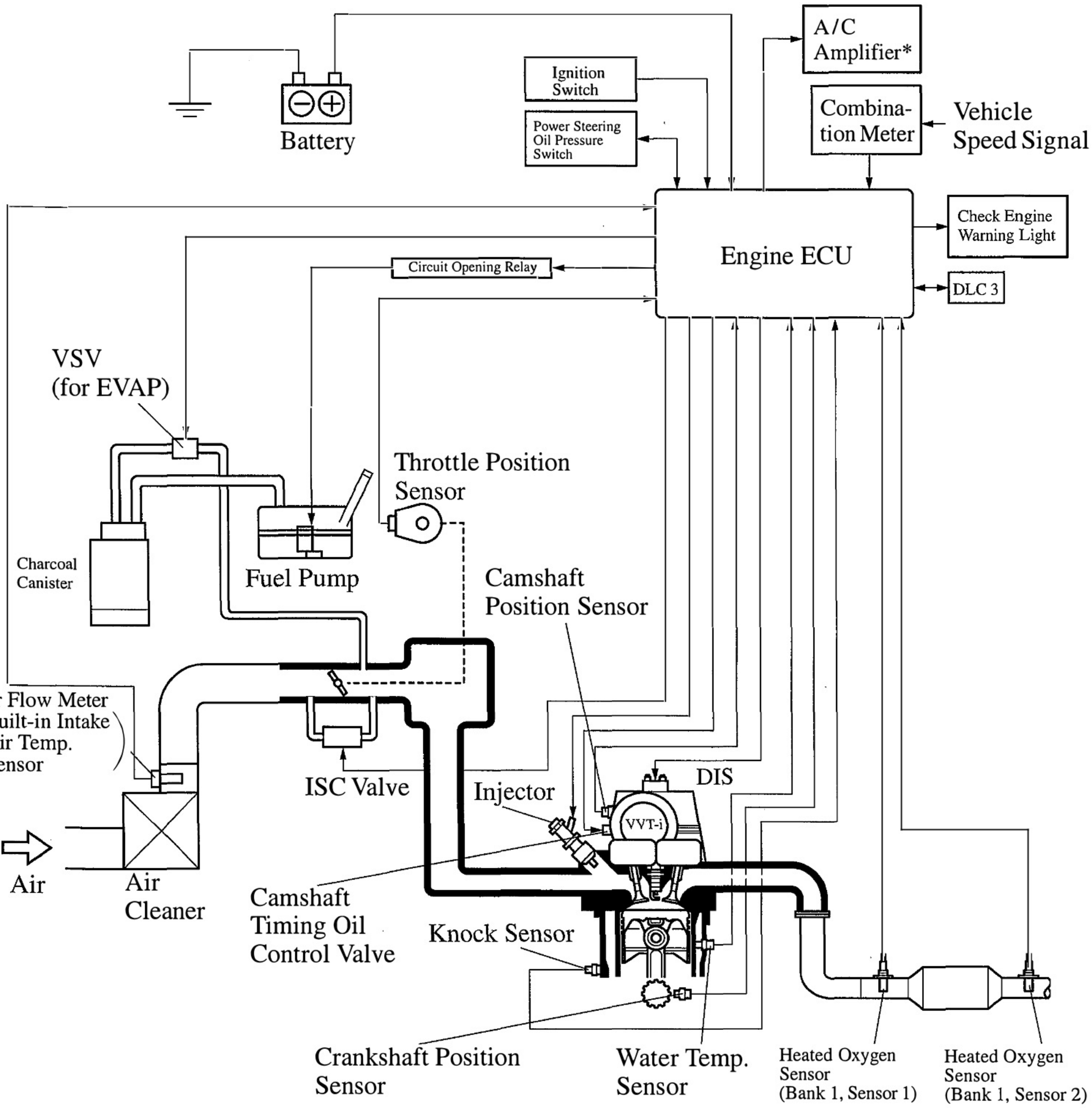
Engine Control System Diagram



*: With Air Conditioner

For 1ZZ-FE Engine

195EG07

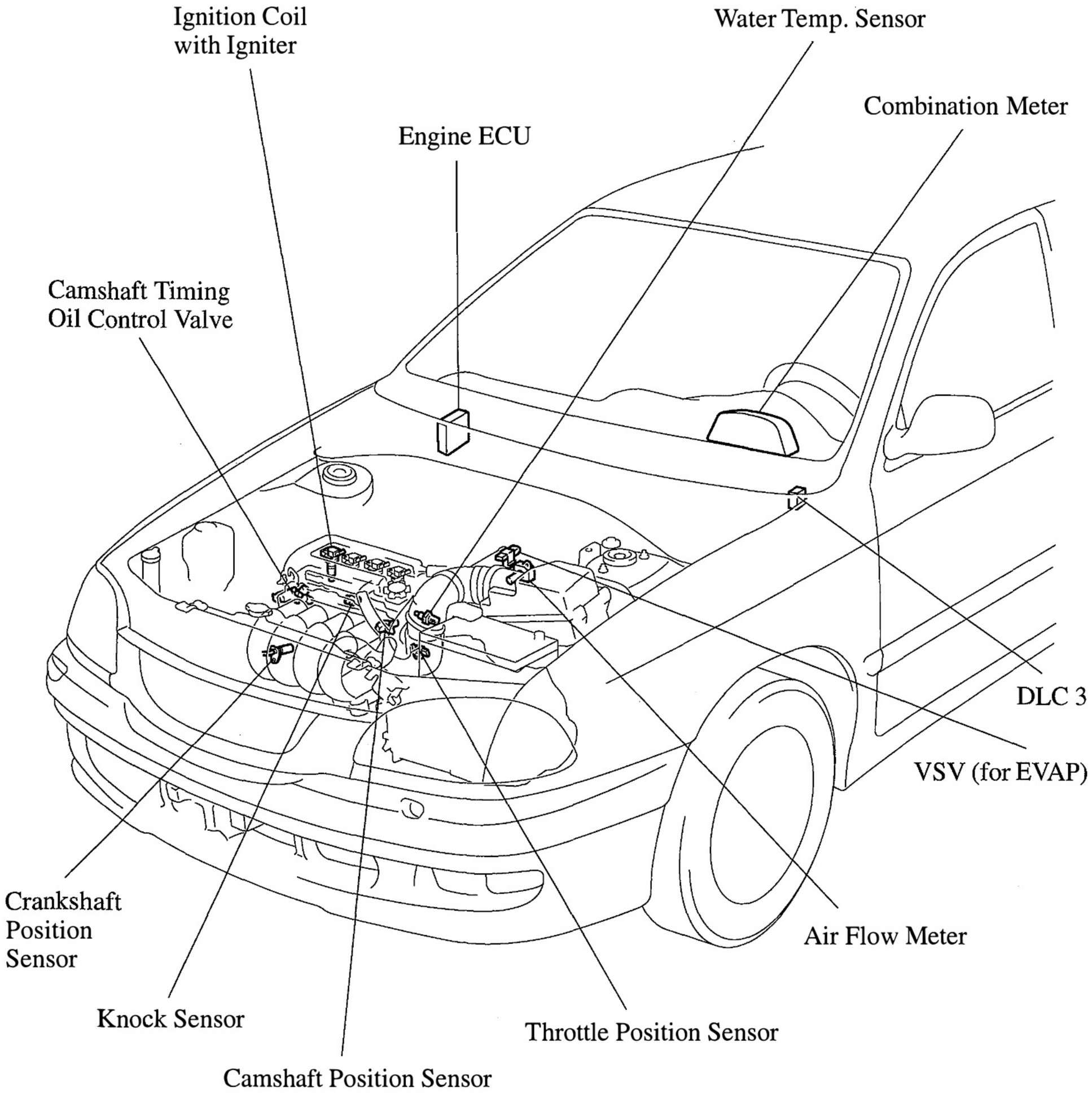


*: With Air Conditioner

For 3ZZ-FE Engine

195EG101

Layout of Main Components



195EG08

Main Components of Engine Control System

1) General

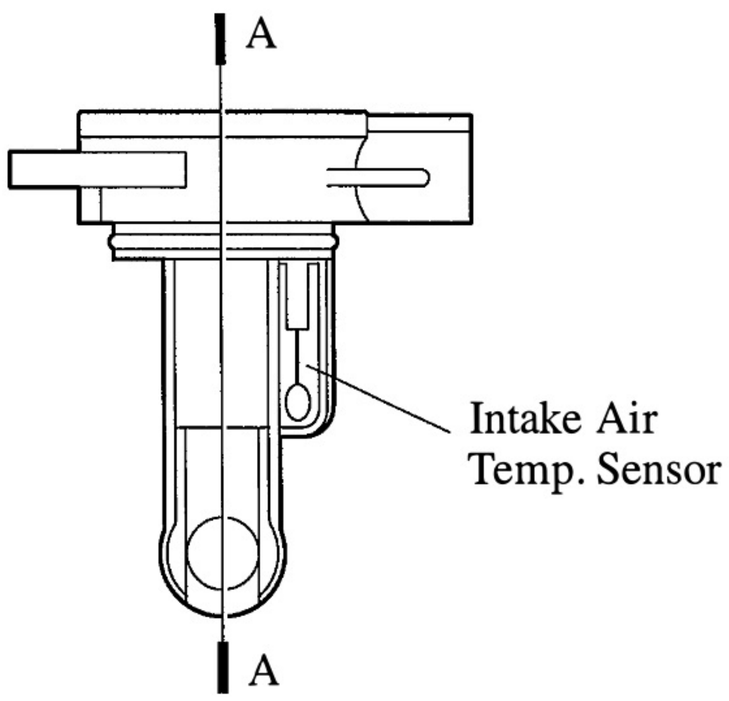
The main components of the 1ZZ-FE and 3ZZ-FE engines control system are as follows:

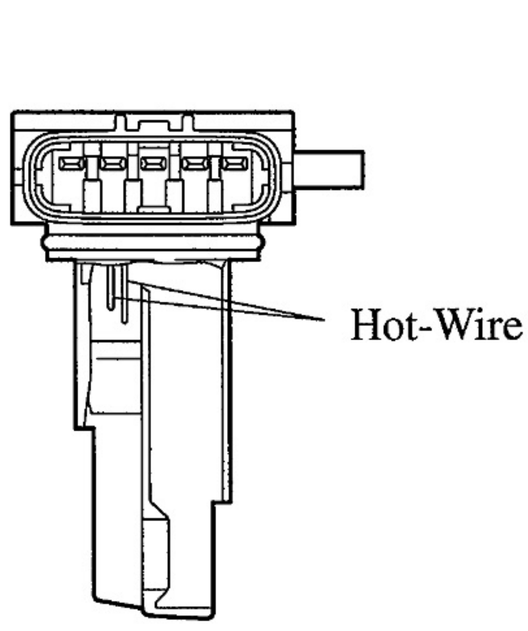
Components	Outline	Quantity
Air Flow Meter	Hot-Wire Type	1
Crankshaft Position Sensor (Rotor Teeth)	Pick-Up Coil Type (36-2)	1
Camshaft Position Sensor (Rotor Teeth)	Pick-Up Coil Type (3)	1
Throttle Position Sensor	Linear Type	1
Knock Sensor	Built-In Piezoelectric Element Type	1
Oxygen Sensor (Bank 1, Sensor 1) (Bank 2, Sensor 1)*1 (Bank 1, Sensor 2)	Type with Heater	2
Injector	12-Hole Type*1, 4-Hole Type*2	4
ISC Valve	Rotary Solenoid Type (1-Coil Type)	1

*1: Only for 1ZZ-FE Engine
*2: Only for 3ZZ-FE Engine

2) Air Flow Meter

A hot-wire type air flow meter has been adopted.
This air flow meter, which is a plug-in type, 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 has been improved and the intake air resistance has been reduced.





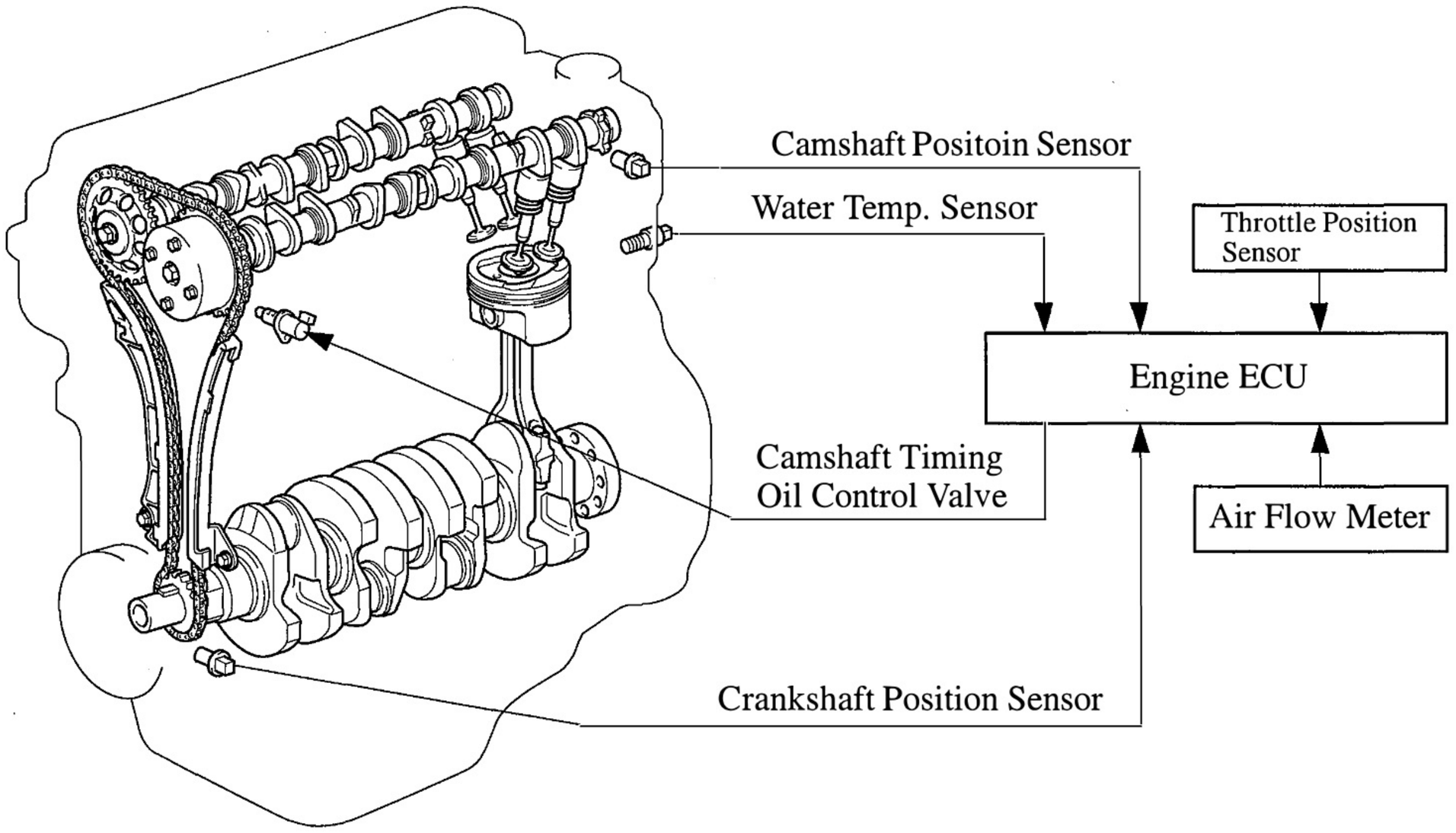
A – A Cross Section

195EG88

VVT-i (Variable Valve Timing-intelligent) System

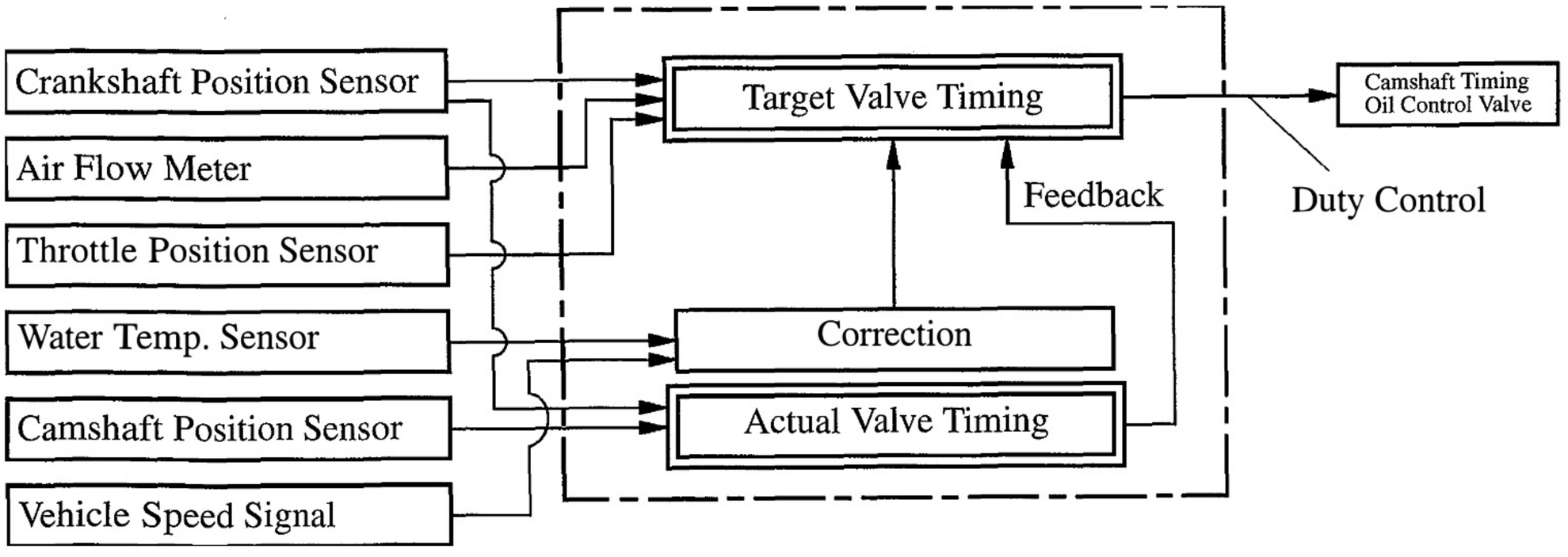
1) General

The VVT-i system is designed to control the intake camshaft within a wide range of 40° (of crankshaft angle) to provide a valve timing that is optimally suited to the engine condition, thus realizing improved torque in all the speed ranges and fuel economy, and reduce exhaust emissions. The actual intake side valve timing is feedback by means of the camshaft position sensor for constant control to the target valve timing.



169EG35

Engine ECU

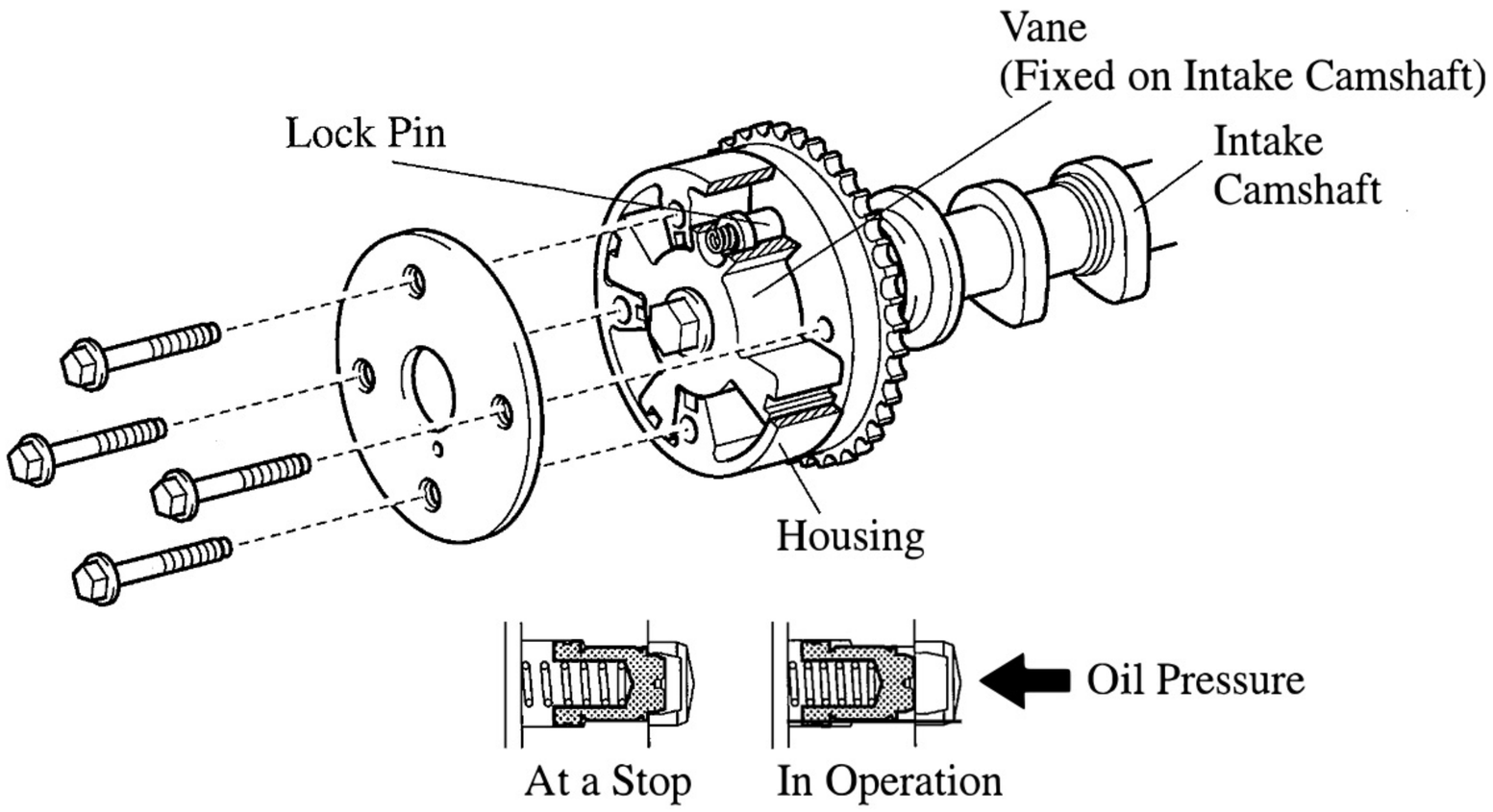


172CR07

2) Construction

VVT-i Controller

This controller consists of the housing driven from the timing chain and the vane coupled with the intake camshaft.
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 hydraulic 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.

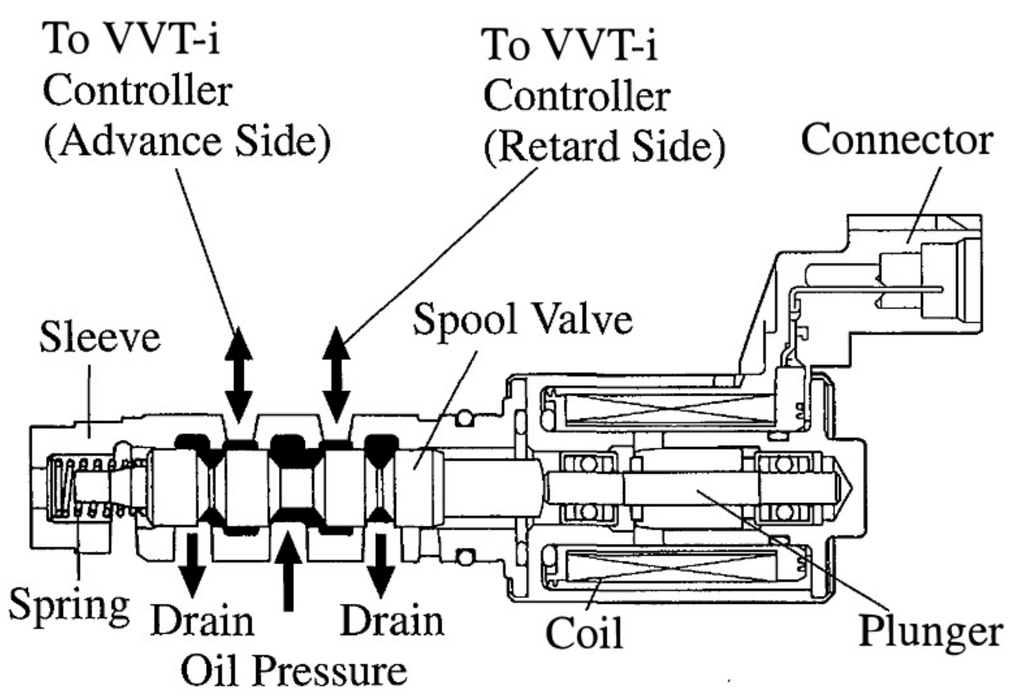


Lock Pin

169EG36

Camshaft Timing Oil Control Valve

The camshaft timing oil control valve 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 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.



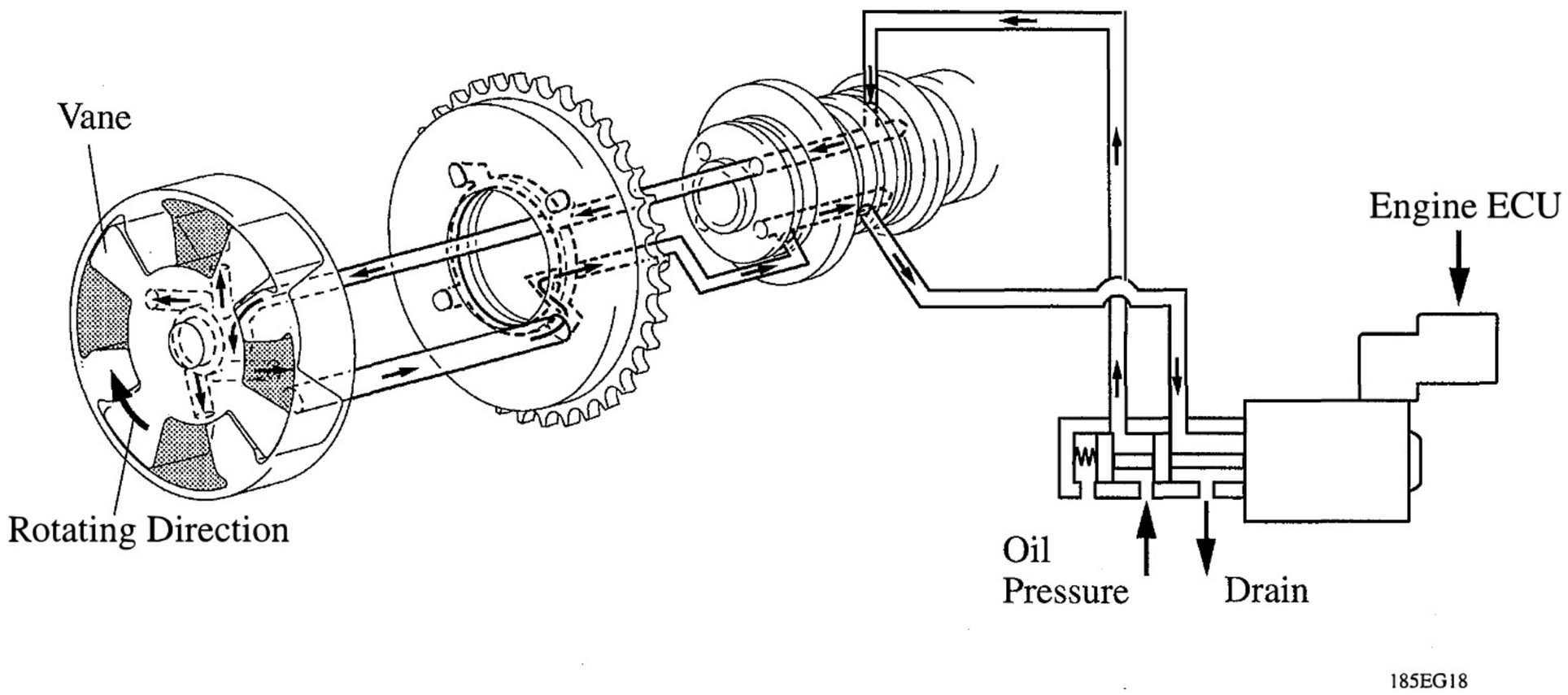
165EG34

3) Operation

- The camshaft timing oil control valve selects the path to the VVT-i controller according to the advance, retard or hold signal from the engine ECU. The VVT-i controller rotates the intake camshaft in the timing advance or retard position or holds it according to the position where the oil pressure is applied.

a. Advance

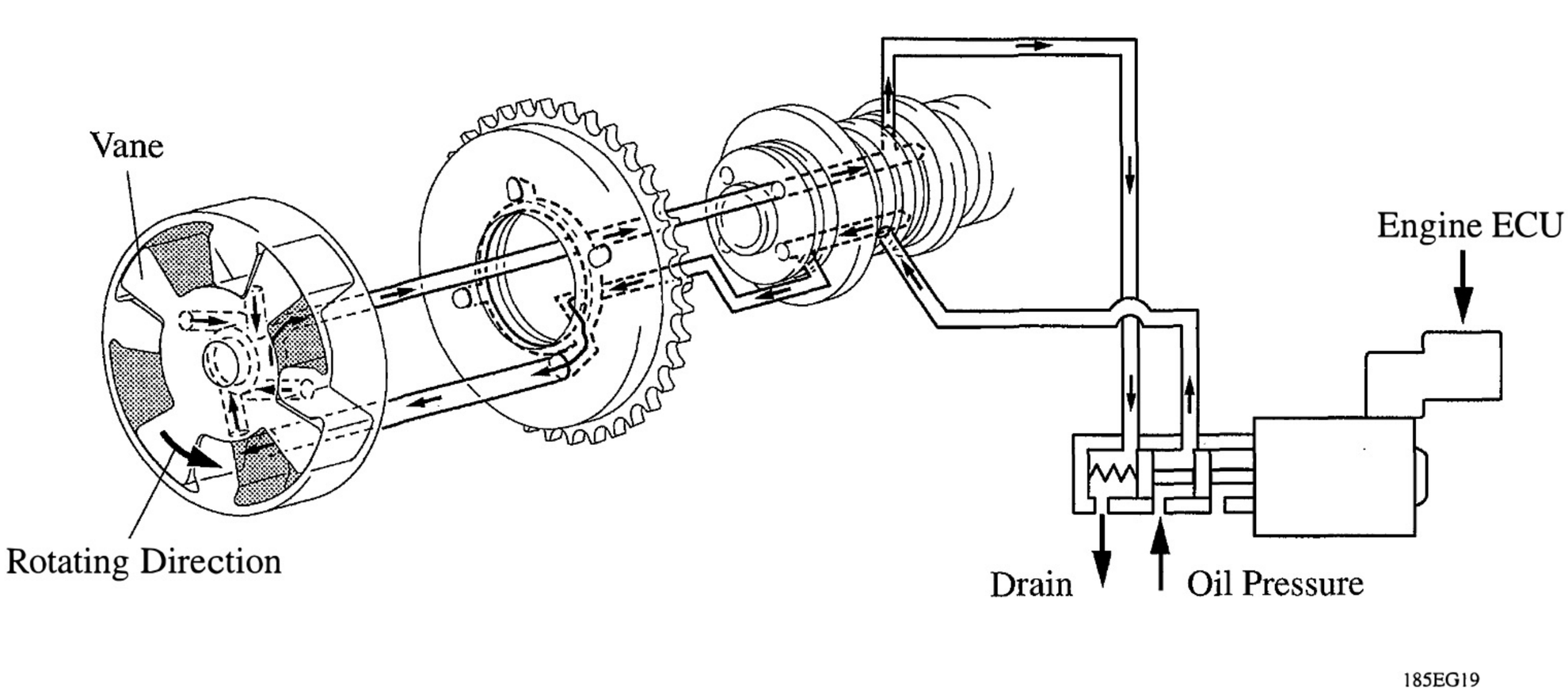
When the camshaft timing oil control valve is positioned as illustrated below by the advance signal from the engine ECU, the resultant oil pressure is applied to the timing advance side vane chamber to rotate the camshaft in the timing advance direction.



185EG18

b. Retard

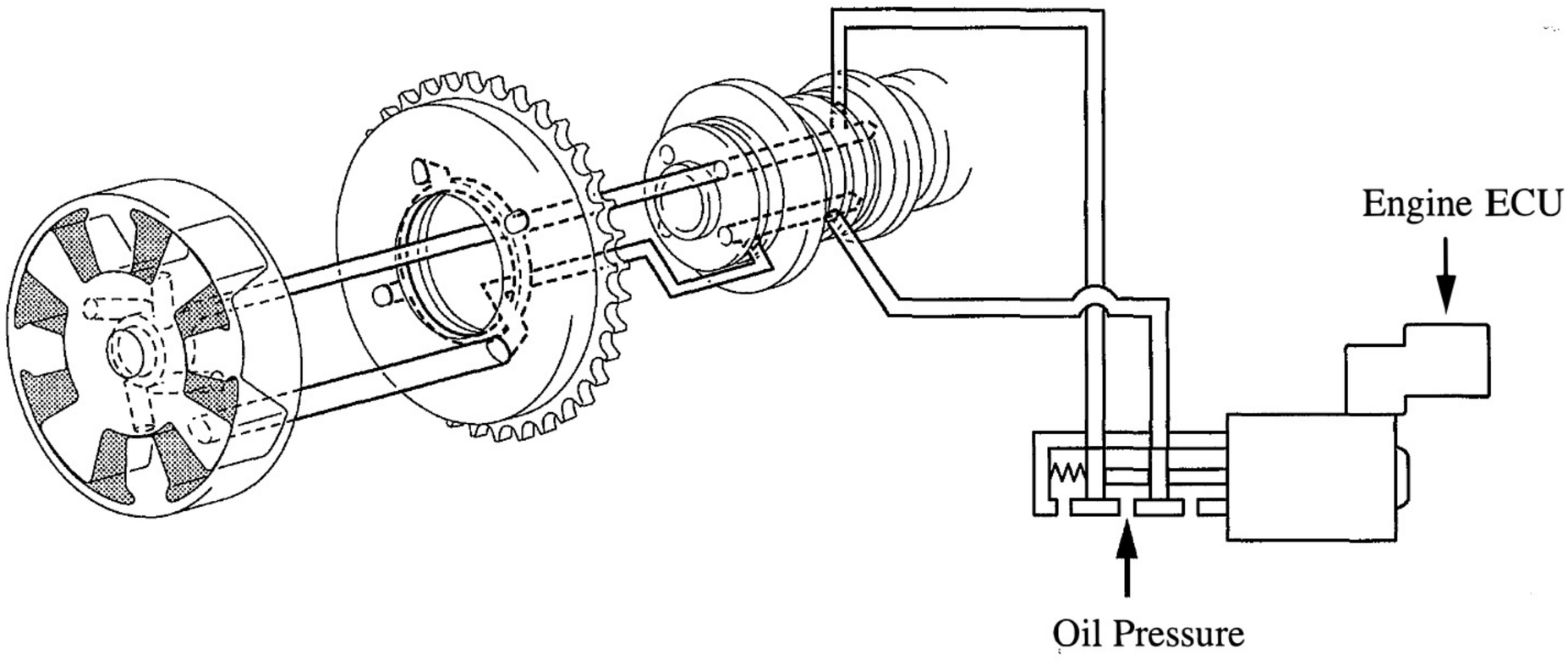
When the camshaft timing oil control valve is positioned as illustrated below by the retard signal from the engine ECU, the resultant oil pressure is applied to the timing retard side vane chamber to rotate the camshaft in the timing retard direction.



185EG19

c. Hold

The engine ECU calculates the target timing angle according to the traveling state to perform control as described the previous page. After setting at 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.

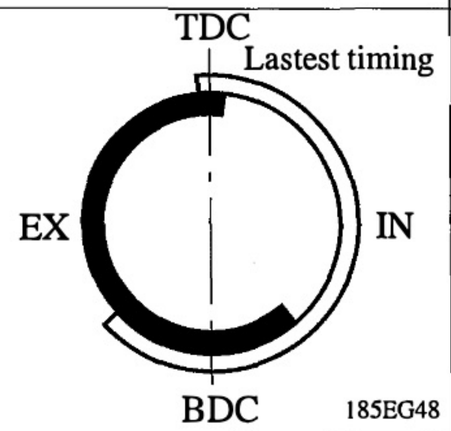
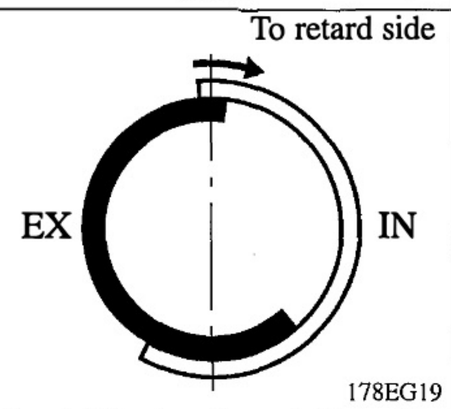
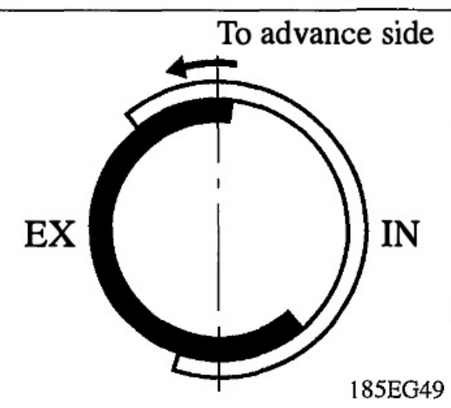
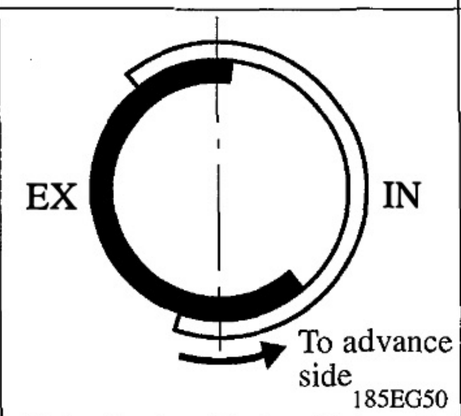
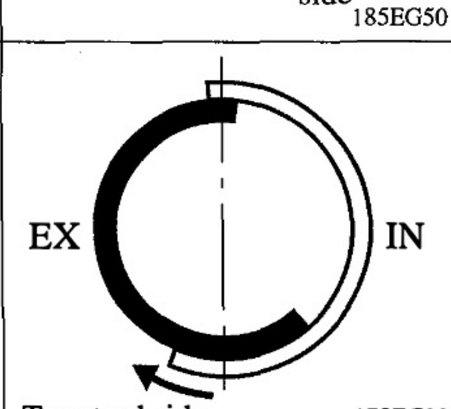
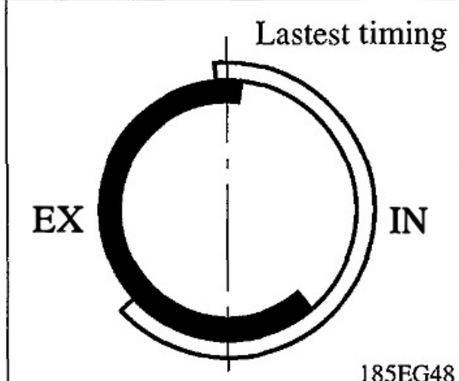
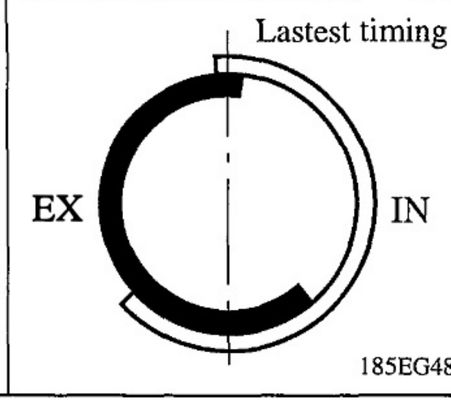


185EG20

- In proportion to the engine speed, intake air volume, throttle position and water temperature, the engine ECU calculates an optimal valve timing under each driving condition and controls the camshaft timing oil control valve. In addition, the engine ECU uses signal from the camshaft position sensor and the crankshaft position sensor to detect the actual valve timing, thus it is possible to perform feedback control to achieve the target valve timing.

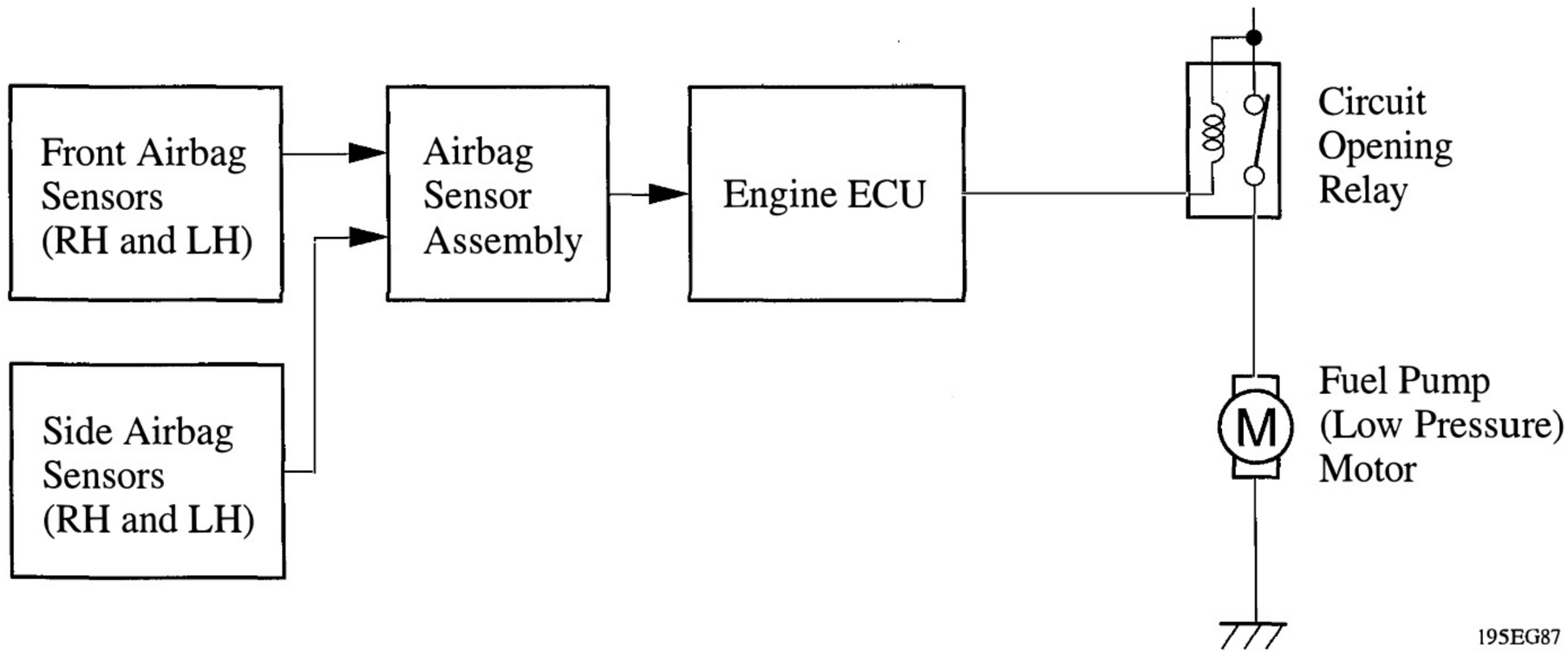
▶ Operation During Various Driving Conditoin (Conceptual Diagram) ◀

162EG46

Operation State	Range	Valve Timing	Objective	Effect
During Idling	1		Minimizing overlap to reduce blow back to the intake side	Stabilized idling rpm Better fuel economy
At Light Load	2		Decreasing overlap to reduce blow back to the intake side	Ensured engine stability
At Medium Load	3		Increasing overlap to increase internal EGR for pumping loss reduce	Better fuel economy Improved emission control
In Low to Medium Speed Range with Heavy Load	4		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	5		Retarding the intake valve close timing for volumetric efficiency improvement	Improved output
At Low Temperatures	–		Minimizing overlap to prevent blow back to the intake side leads to the lean burning condition, and stabilizes the idling speed at fast idling	Stabilized fast idle rpm Better fuel economy
Upon Starting/ Stopping the Engine	–		Minimizing overlap to minimize blow back to the intake side	Improved startability

Fuel Pump Control

A fuel cut control is adopted to stop the fuel pump when the airbag is deployed at the front or side collision. In this system, the airbag deployment signal from the airbag sensor assembly is detected by the engine ECU, and it turns OFF the circuit opening relay.
After the fuel cut control has been activated, turning the ignition switch from OFF to ON cancels the fuel cut control, thus engine can be restarted.



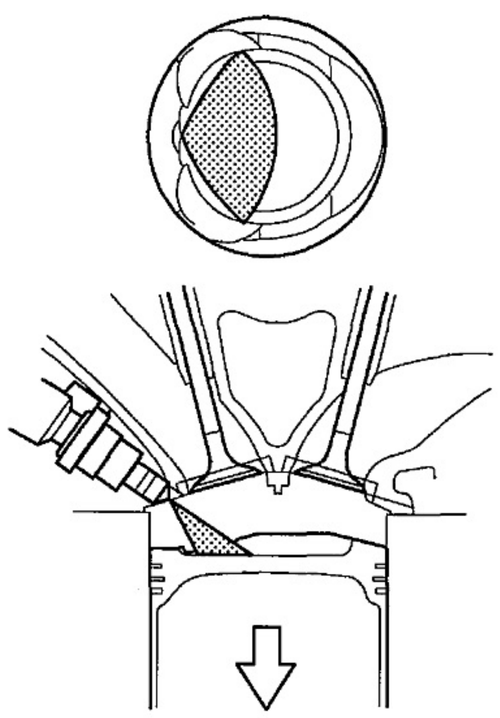
■1AZ-FSE ENGINE

1.General

The 1AZ-FSE TOYOTA D-4 (Direct injection 4-stroke gasoline engine) is a newly developed in-line 4-cylinder, 2.0 litter, 16-valve DOHC engine.
This engine is a newly adopted direct injection system, high pressure fuel control system and VVT-i (Variable Valve Timing-intelligent) system to realize high performance, fuel economy, clean emission, low noise and low vibration. In addition, it has adopted the ETCS-i (Electronic Throttle Control System-intelligent) to ensure excellent controllability of the vehicle and to improve its comfort.

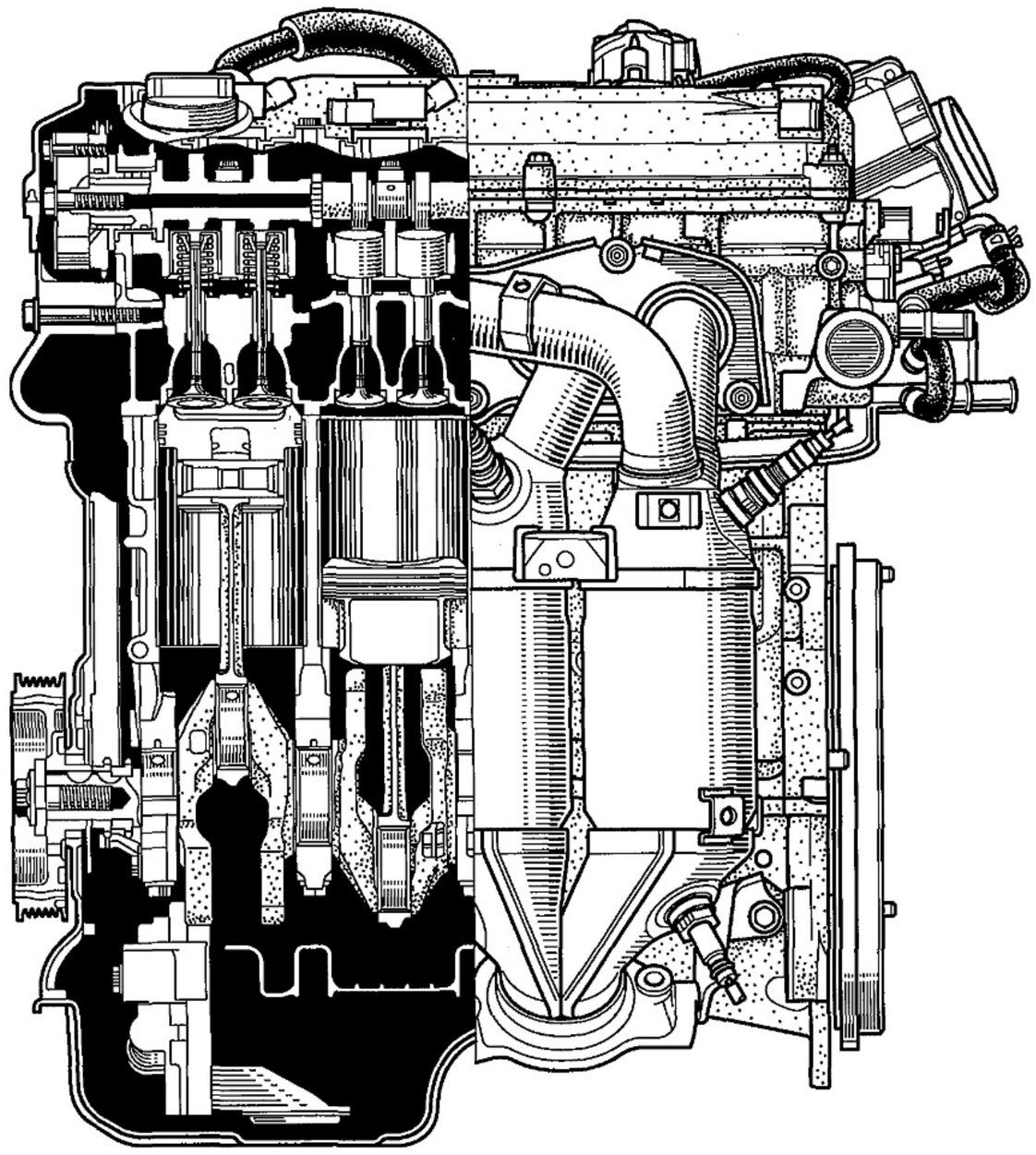
– Reference –
TOYOTA D-4 (Direct injection 4-stroke gasoline engine)

- Usual gasoline EFI engine has the injector installed on the intake port and the air and fuel injected inside the intake port is mixed and suctioned into the cylinder. On the other hand, TOYOTA D-4 has the injector installed on the combustion chamber which injects the fuel pressurized in the fuel pump (high pressure) to the combustion chamber directly. With this, vaporized latent heat effect is obtained, then the cubic footage has been improved and the knocking limit has been expanded resulting in the out improvement.
- Depending on the driving condition, by injecting the fuel at an optimal timing in the suctioning process, equal air-fuel mixture is uniformed.
- Slit nozzle type injector which enables to adjust the quantity of the high pressure fuel precisely and implement the fine-grain atomization has been adopted, thus improved the fuel efficiency.

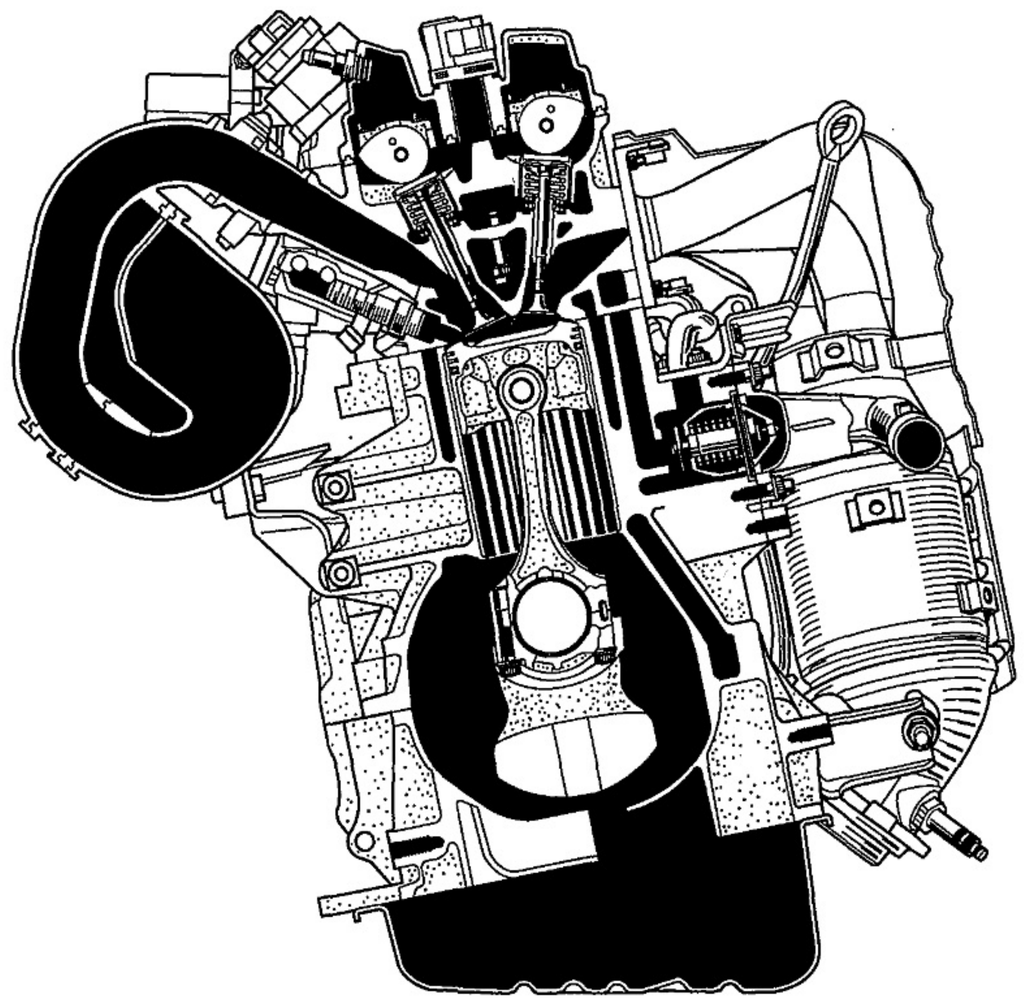


195EG85

▶ 1AZ-FSE Engine ◀



195EG86

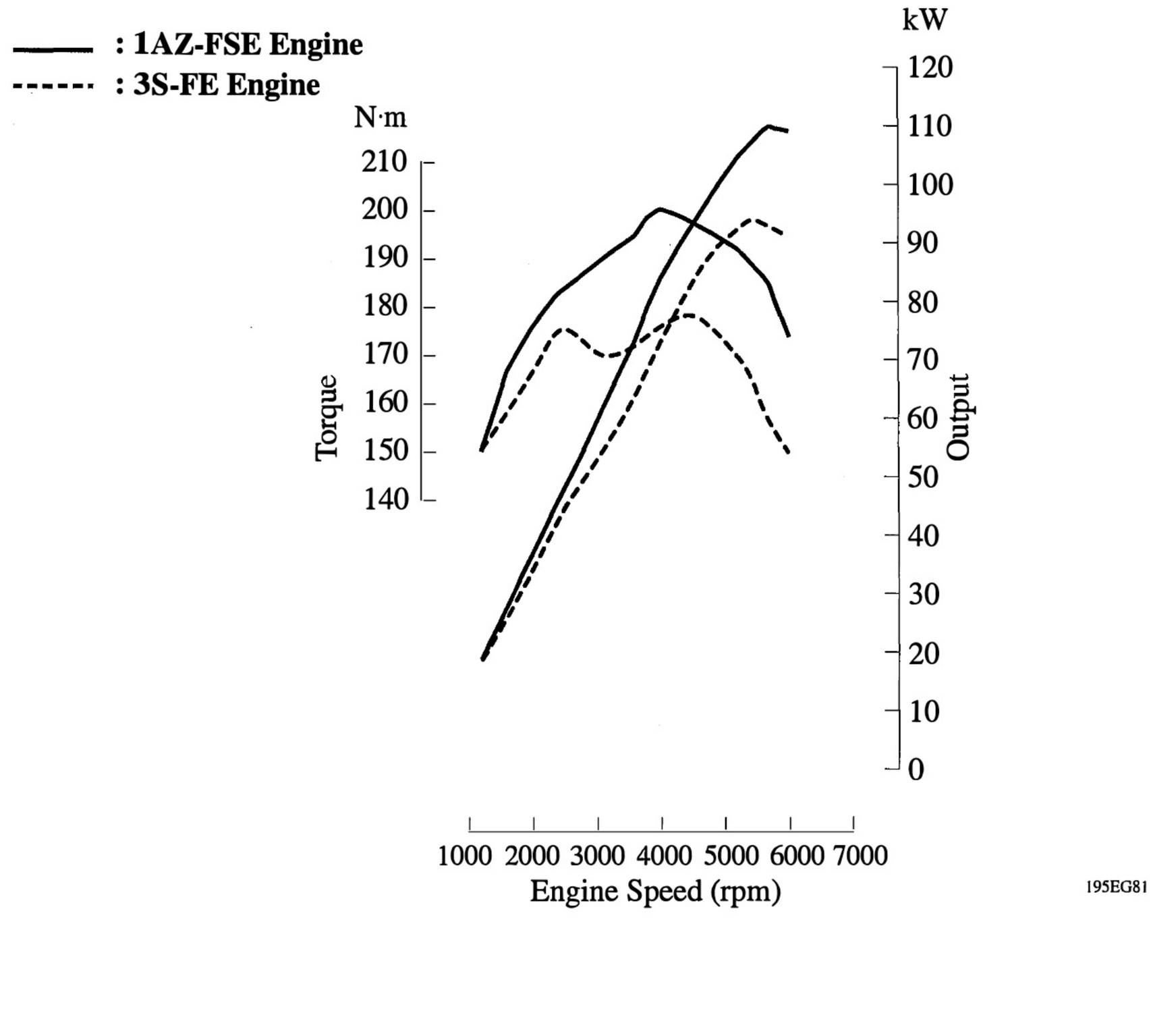


195EG09

▶ Engine Specifications ◀

Engine Type			1AZ-FSE	3S-FE
No. of Cyls. & Arrangement			4-Cylinder, In-line	←
Valve Mechanism			16-Valve DOHC, Chain Drive	16-Valve DOHC, Belt & Gear Drive
Combustion Chamber			Pentroof Type	←
Manifolds			Cross-Flow	←
Fuel System			EFI D-4	EFI
Displacement	cm^3 (cu. in.)		1998 (121.9)	←
Bore x Stroke	mm (in.)		86.0 x 86.0 (3.39 x 3.39)	←
Compression Ratio			11.0 : 1	9.8 : 1
Max. Output	(EEC)		110 kW @ 5700 rpm	94 kW @ 5400 rpm
Max. Torque	(EEC)		200 N·m @ 4000 rpm	178 N·m @ 4400 rpm
Valve Timing	Intake	Open	41° BTDC ~ 12 ATDC	3° BTDC
		Close	5° BBDC ~ 58° ABDC	43° ABDC
	Exhaust	Open	45° BBDC	←
		Close	3° ATDC	←
Fuel Octane Number	RON		95 or More	←
Oil Grade			API SJ, EC or ILSAC	←

▶ Performance Curve ◀



195EG81

2. Features of 1AZ-FSE Engine

The 1AZ-FSE engine has been able to achieve the following performance through the adoption of the items listed below.

(1) High performance and fuel economy

(2) Low noise and vibration

(3) Lightweight and compact design

(4) Good serviceability

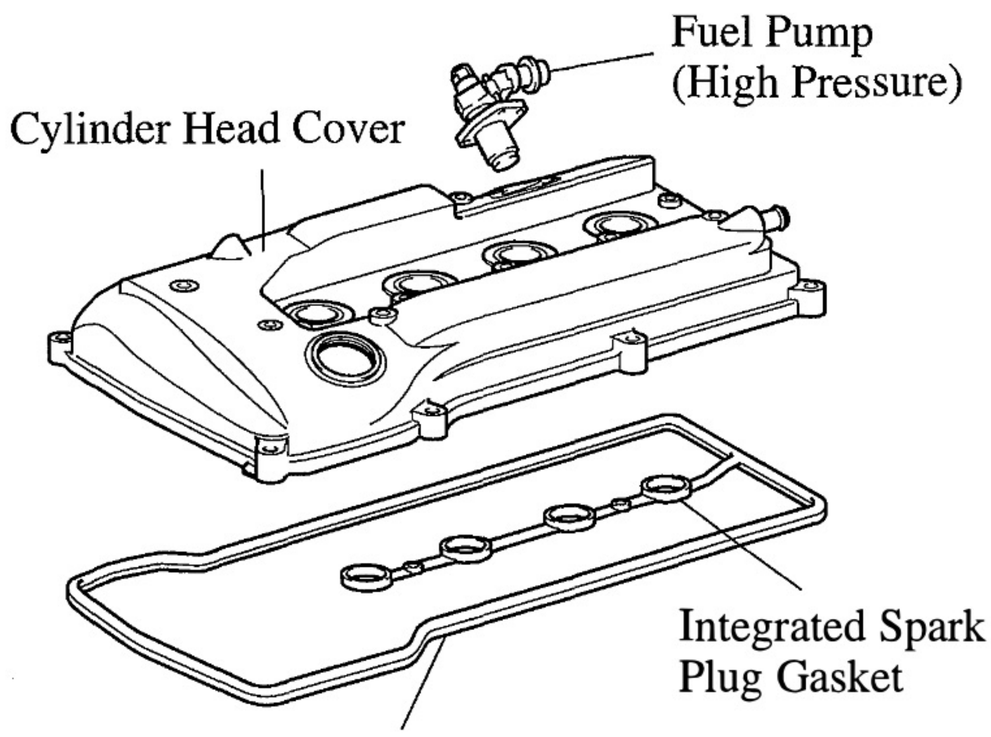
(5) Clean emission

Item	(1)	(2)	(3)	(4)	(5)
Direct injection has been adopted.	○				○
Slit nozzle type injectors that support high-pressure fuel injection have been adopted.	○				○
The VVT-i system is used.	○				○
The intake air control system has been adopted.	○				○
A cylinder block made of aluminum alloy along with a magnesium head cover has been adopted.			○		
Rigidity of the cylinder block has been improved.		○			
The DIS (Direct Ignition System) makes ignition timing adjustment unnecessary.	○			○	
A serpentine belt drive system has been adopted.			○	○	
Intake manifold made of plastic has been adopted.			○		
A dual WU-TWC (Warm Up Three-Way Catalytic Converter) for reducing exhaust emissions during engine warming has been adopted.	○				○
Iridium-tipped spark plugs have been adopted.				○	
Timing chain has been used.				○	

3. Engine Proper

Cylinder Head Cover

- A lightweight magnesium alloy diecast cylinder head cover is used.
- The fuel pump (high pressure) has been mounted on the cylinder head cover for compactness.
- The cylinder head cover gasket and the spark plug gasket have been integrated to reduce the number of parts.
- Acrylic rubber, which excels in heat resistance and reliability, has been adopted for the cylinder head cover gasket.

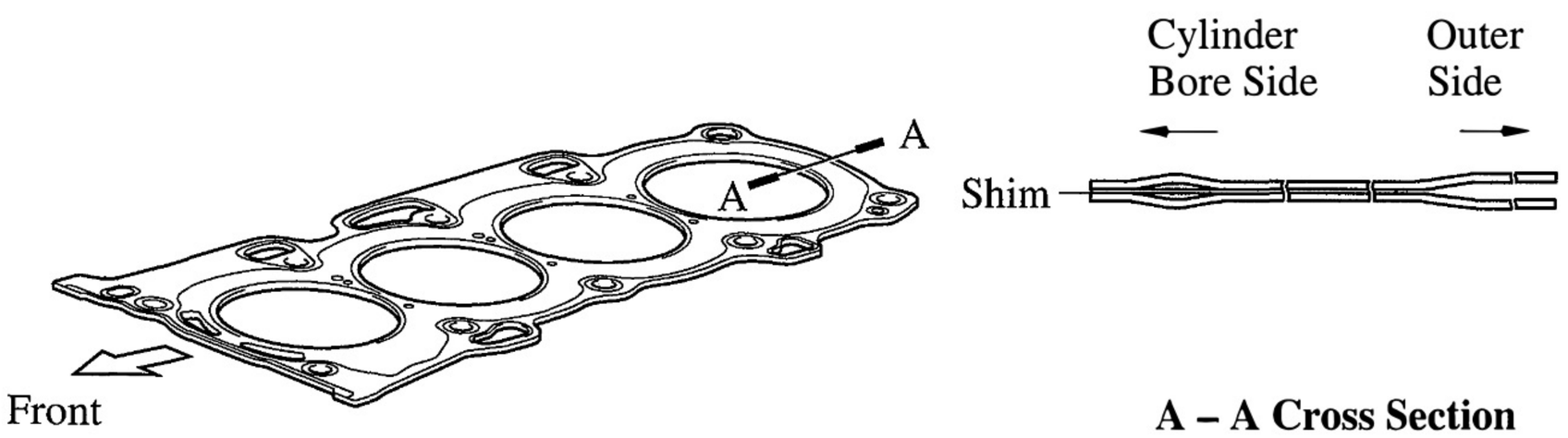


Cylinder Head Cover Gasket

195EG10

Cylinder Head Gasket

A steel-laminate type cylinder head gasket has been adopted.
A shim has been added around the cylinder bore to increase the sealing surface, thus improving the sealing performance and durability.

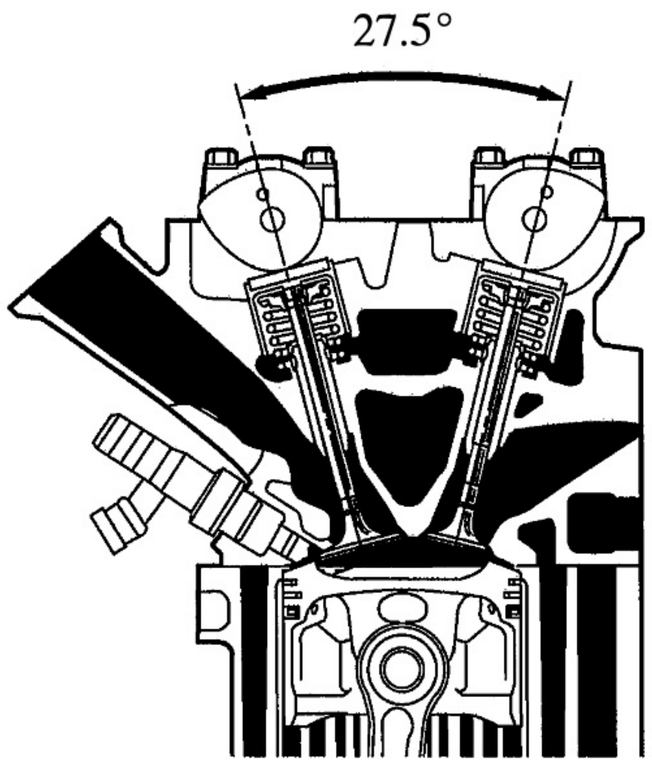


A – A Cross Section

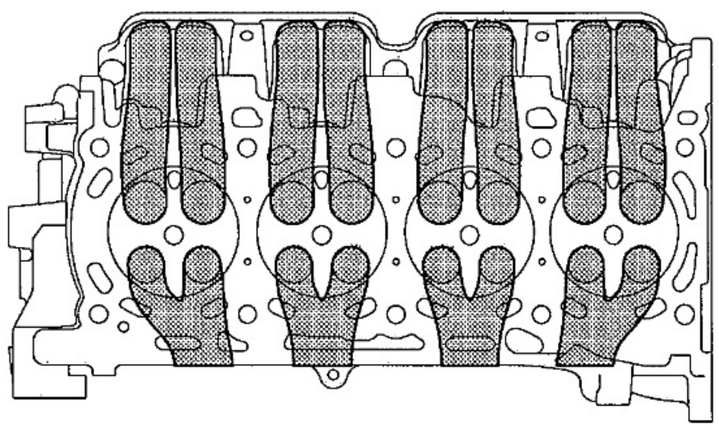
195EG11

Cylinder Head

- Through the adoption of the taper squish combustion chamber, the anti-knocking performance and fuel efficiency have been improved.
- An upright intake port has been adopted to improve the intake efficiency.
- Compression ratios of 11.0 : 1 has been adopted.
- The injectors have been installed in the cylinder head.
- The routing of the water jacket in the cylinder head has been optimized to improve the cooling performance. In addition, a water bypass passage has been provided below the exhaust ports to reduce the number of parts and to achieve weight reduction.
- The water outlet has been integrated to reduce the number of parts.
- The angle of the intake and exhaust valves is narrowed and set at 27.5° to permit a compact cylinder head.



195EG12

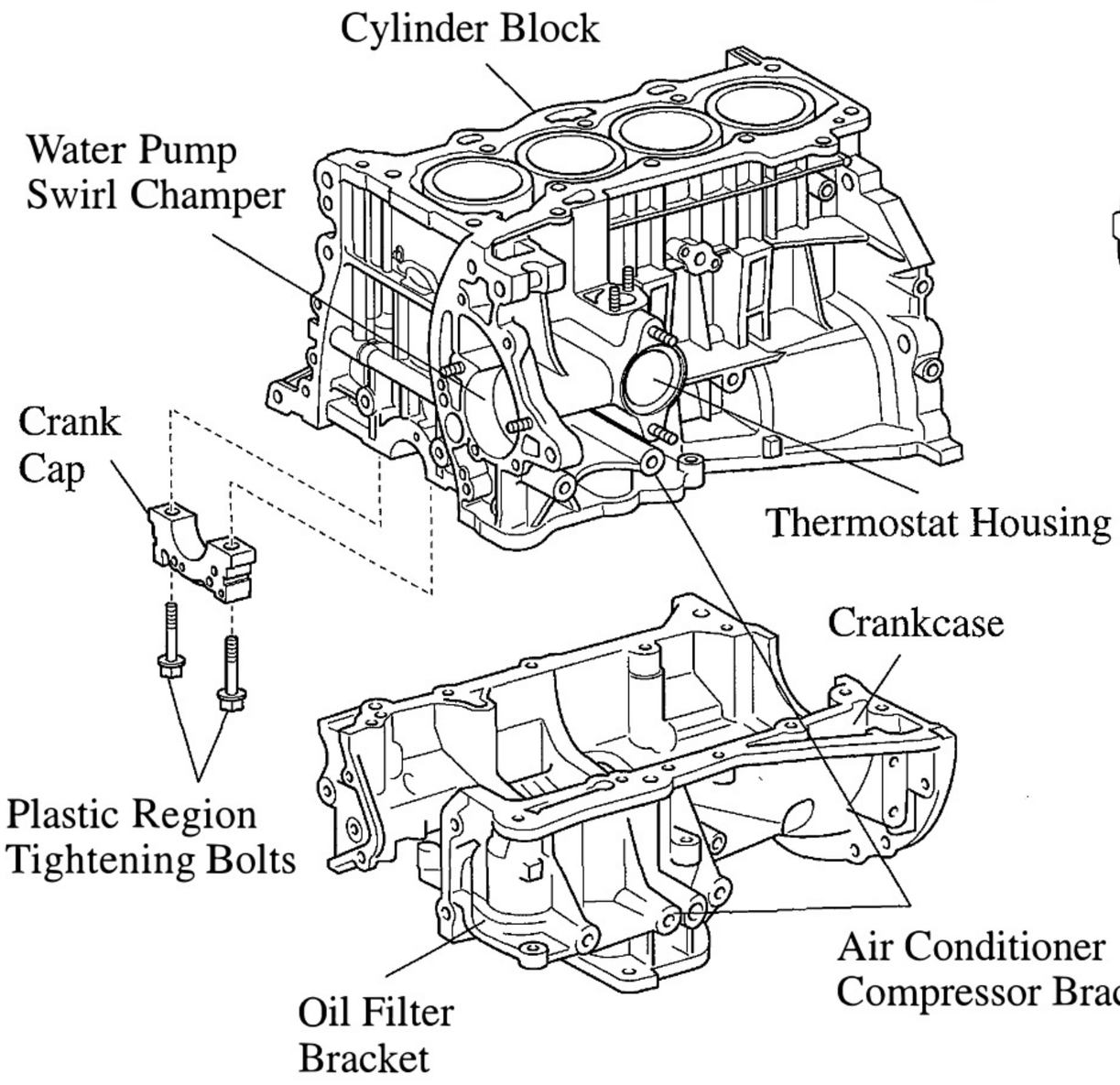


195EG13

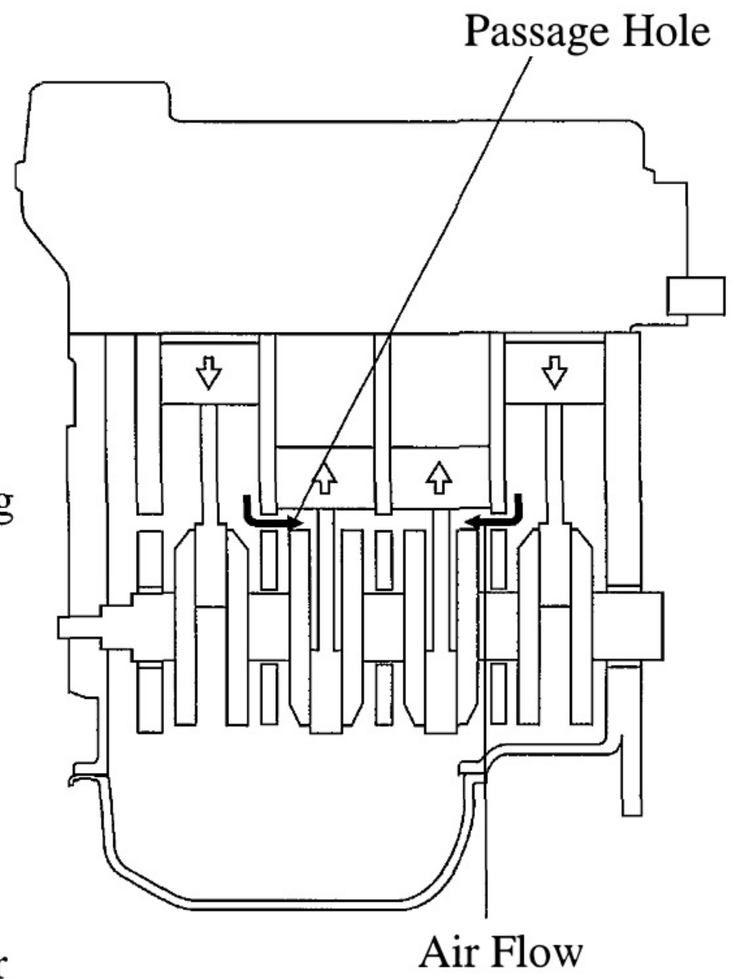
Cylinder Block

- Lightweight aluminum alloy is used for the cylinder block.
- Rigidity of the cylinder block side has been improved by curving the skirt portion of the cylinder block and optimizing the rib position on the side.
- By producing the thin cast-iron liners and cylinder block as a unit, compaction is realized. This liner is thin, so that boring is not possible.
- Passage holes are provided in the crankshaft bearing area of the cylinder block. As a result, the air at the bottom of the cylinder flows smoother, and pumping loss (back pressure at the bottom of the piston generated by the piston's reciprocal movement) is reduced to improve the engine's output.
- The oil filter and the air conditioner compressor bracket are integrated the crankcase, also the water pump swirl chamber, the thermostat housing and the rear oil seal retainer integrated the cylinder block to reduce the number of parts.
- Through the adoption of the offset crankshaft, the bore center has been shifted 10 mm towards the exhaust in relation to the cranksahft center. Thus, the side force when the maximum pressure is applied has been reduced and fuel economy has been improved.
- Plastic region tightening bolts have been adopted for tightening the crank caps.

▶ Air Flow During Engine Revolution ◀



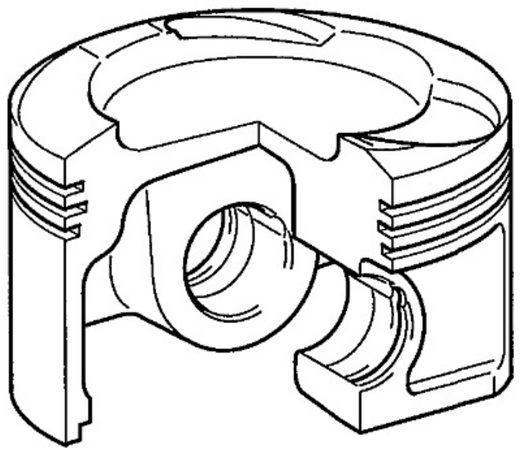
195EG14



179EG04

Piston

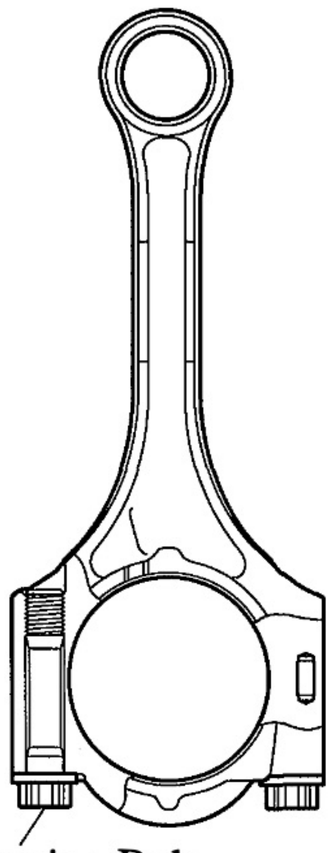
- To achieve uniform combustion through direct injection, an optimal piston head shape that promotes the mixing of the injected fuel and intake air has been adopted.
- The piston is made of aluminum alloy and skirt area is made compact and lightweight.
- Full floating type piston pins are used.
- The top ring groove is provided with alumite finish to improve its wear resistance.
- The piston skirt has been resin-coated to reduce friction.
- By increasing the machining precision of the cylinder bore diameter, the outer diameter of the piston has been made into the one type.



195EG15

Connecting Rod

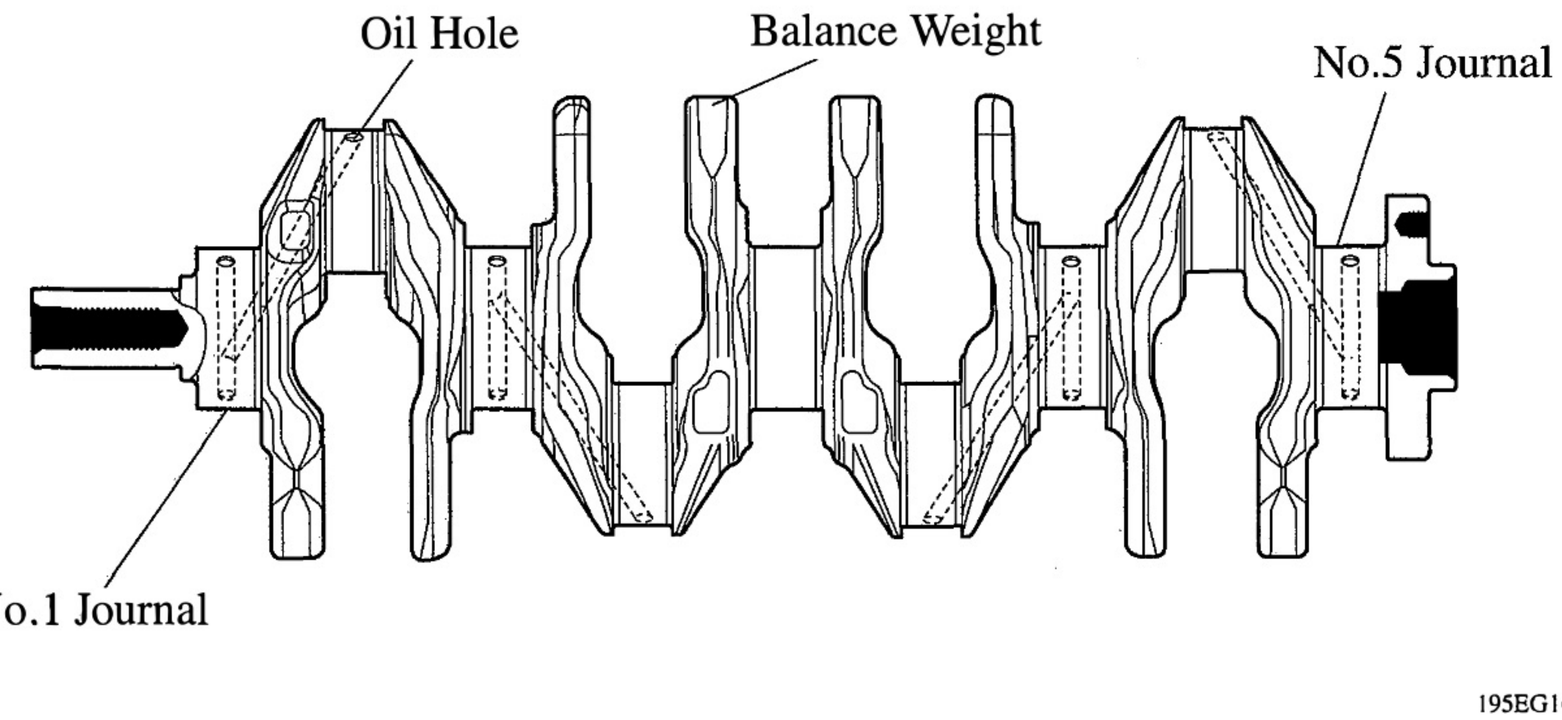
- The connecting rods and cap are made of highstrength material for weight reduction.
- Nutless-type plastic region tightening bolts of the connecting rod are adopted for a lighter design.
- The connecting rod bearings have been reduced in width to reduce friction.



181EG08

Crankshaft

- The forged crankshaft has 5 journals and 8 balance weights.
- The crankshaft bearings have been reduced in width to reduce friction.
- The precision and surface roughness of the pins and journals have been improved to reduce friction.

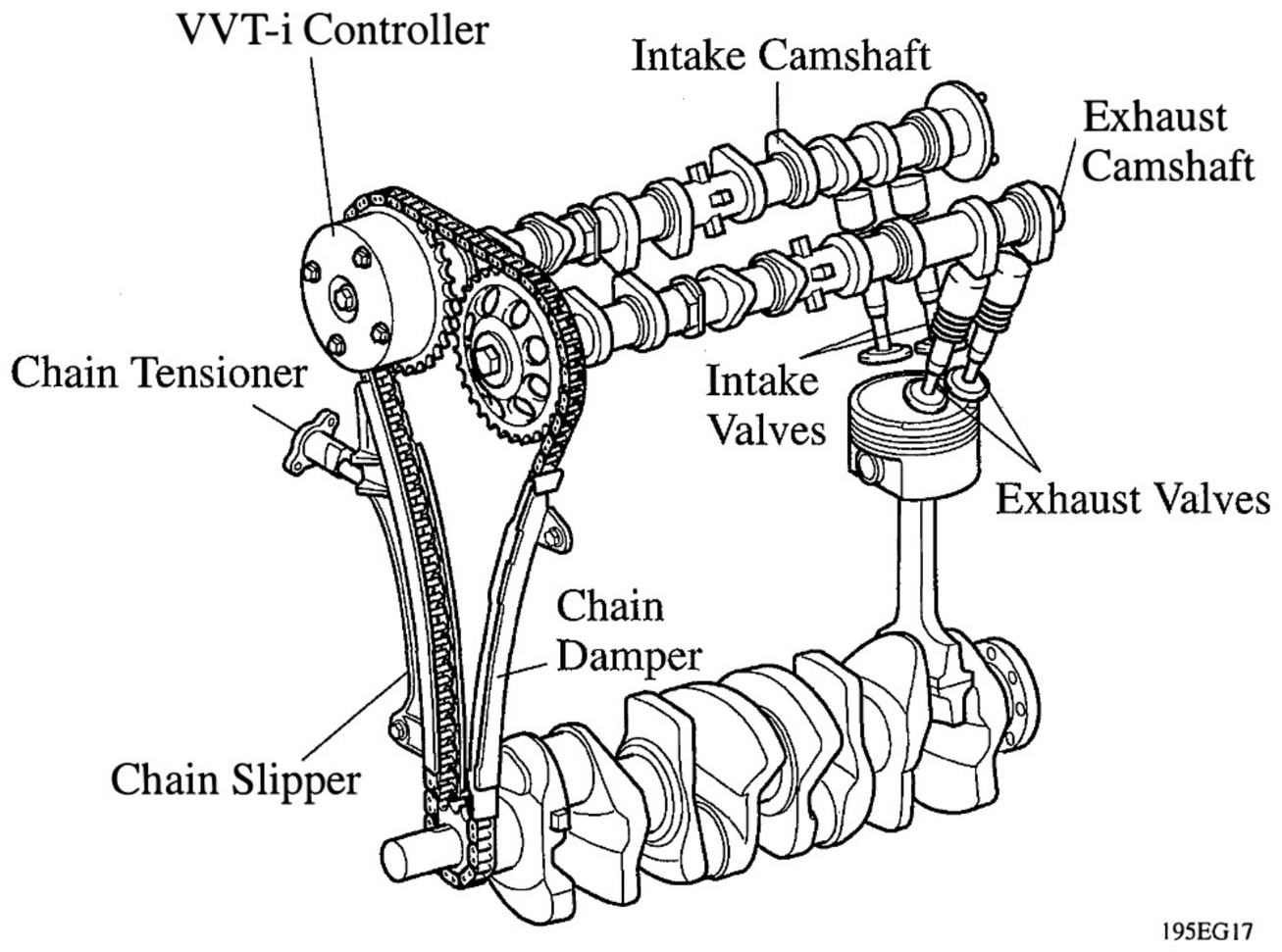


195EG16

4. Valve Mechanism

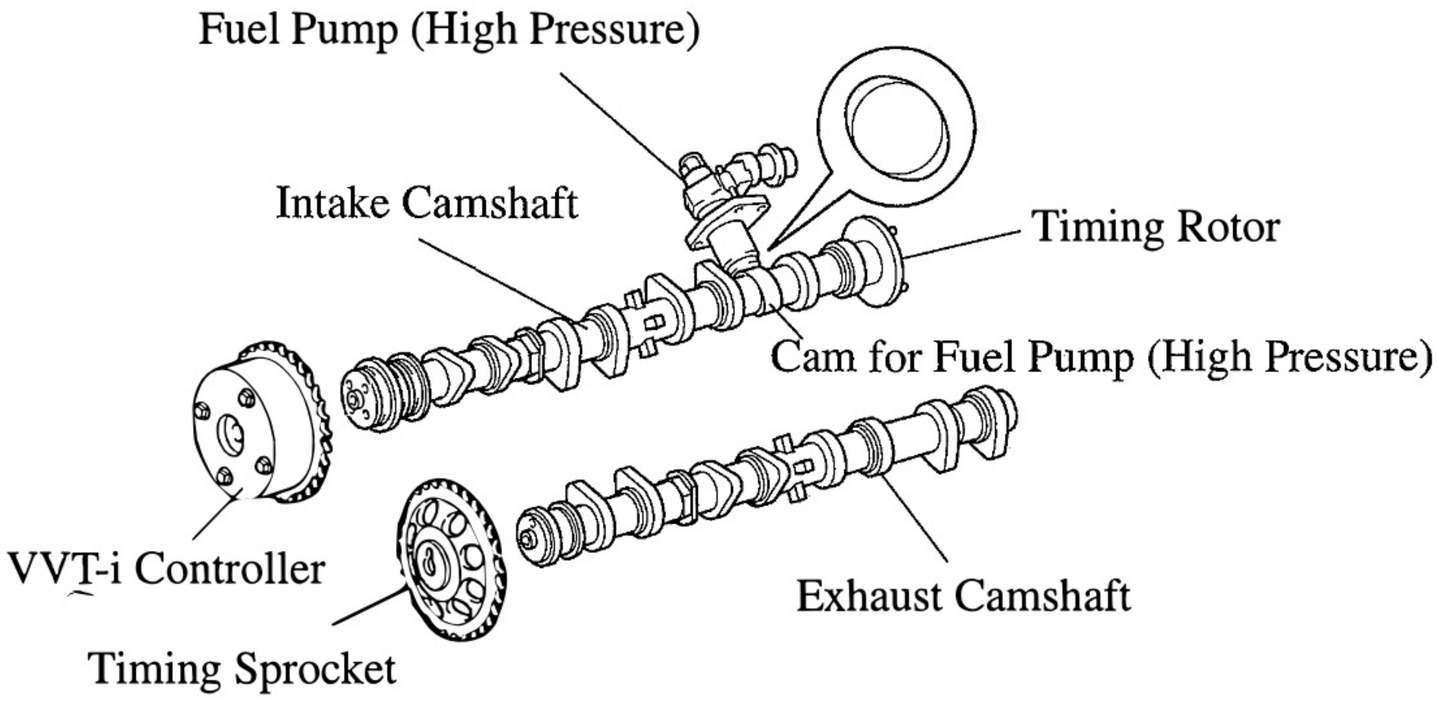
General

- Each cylinder is equipped with 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency has been increased due to the larger total port areas.
- The valves are directly opened and closed by 2 camshafts.
- The intake and exhaust camshafts are driven by a chain.
- The VVT-i (Variable Valve Timing-intelligent) system is used to improve fuel economy, engine performance and reduce exhaust emissions. For details, see page 136.
- The shimless type valve lifter is used.



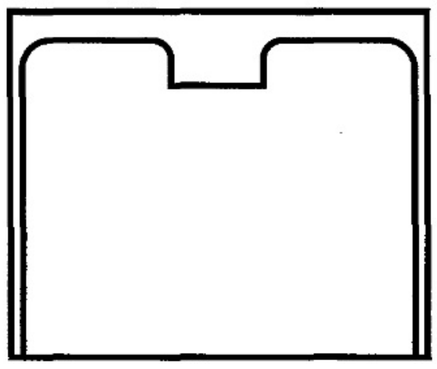
Camshaft

- The intake camshaft is provided with the timing rotor to trigger the camshaft position sensor, and the cam to drive the fuel pump (high pressure).
- In conjunction with the adoption of the VVT-i system, an oil passage is provided in the intake camshaft in order to supply engine oil pressure to the VVT-i system.
- A VVT-i controller has been installed on the front of the intake camshaft to very the timing of the intake valves.



Valve Lifter

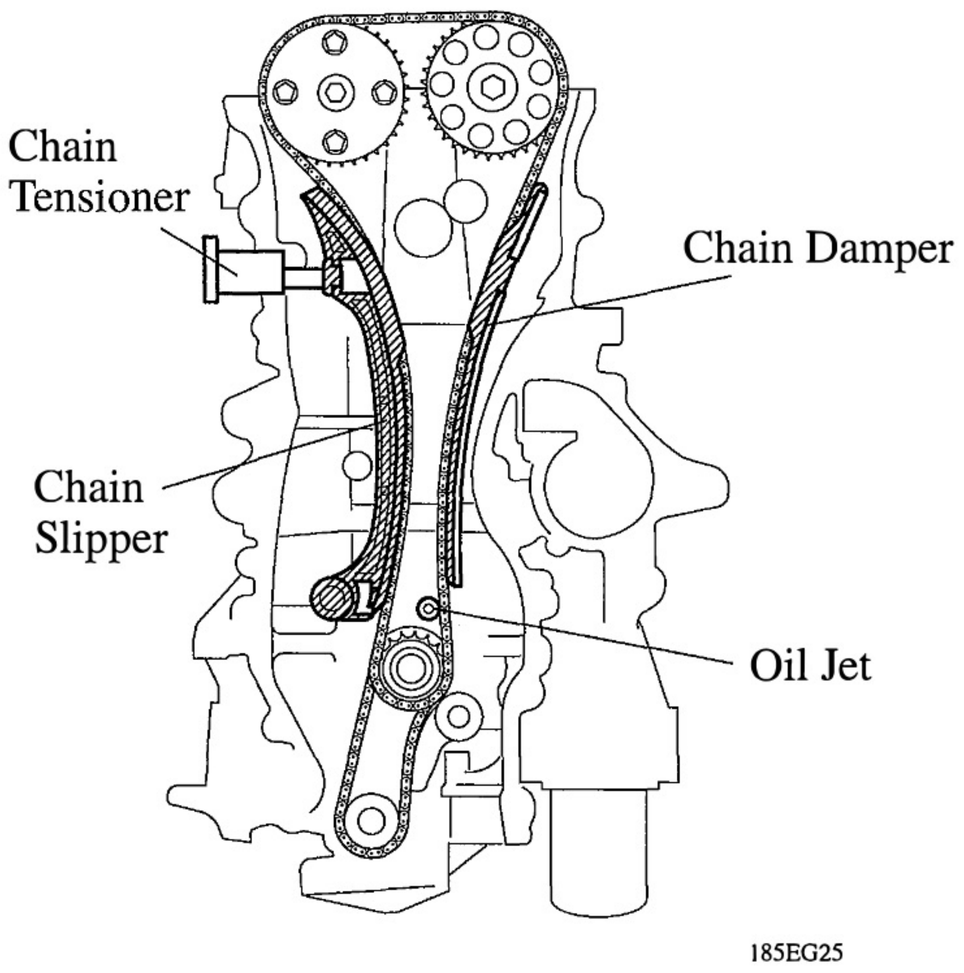
Along with the increase of the amount of valve lift, the valve adjusting shims have been discontinued and the shimless type of the valve lifter has been adopted. This valve lifter enables to make the cam contact surface greater.
The adjustment of the valve clearances is accomplished by selecting and replacing the appropriate valve lifters.



148EG05

Timing Chain

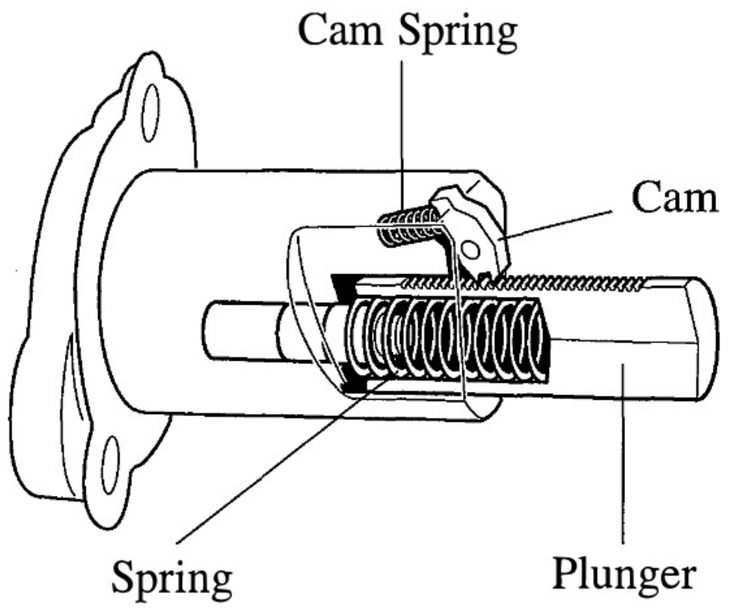
- A roller chain with an 8 mm pitch has been adopted to make the engine more compact.
- A material which has excellent wear resistance has been selected for the timing chain to improve reliability.
- The timing chian is lubricated by an oil jet.



185EG25

Chain Tensioner

- The chain tensioner uses a spring and oil pressure to maintain proper chain tension at all times. The chain tensioner suppresses noise generated by the chain.
- A ratchet type non-return mechanism is also used.
- To improve serviceability, the chain tensioner is constructed so that it can be removed and installed from the outside of timing chain cover.

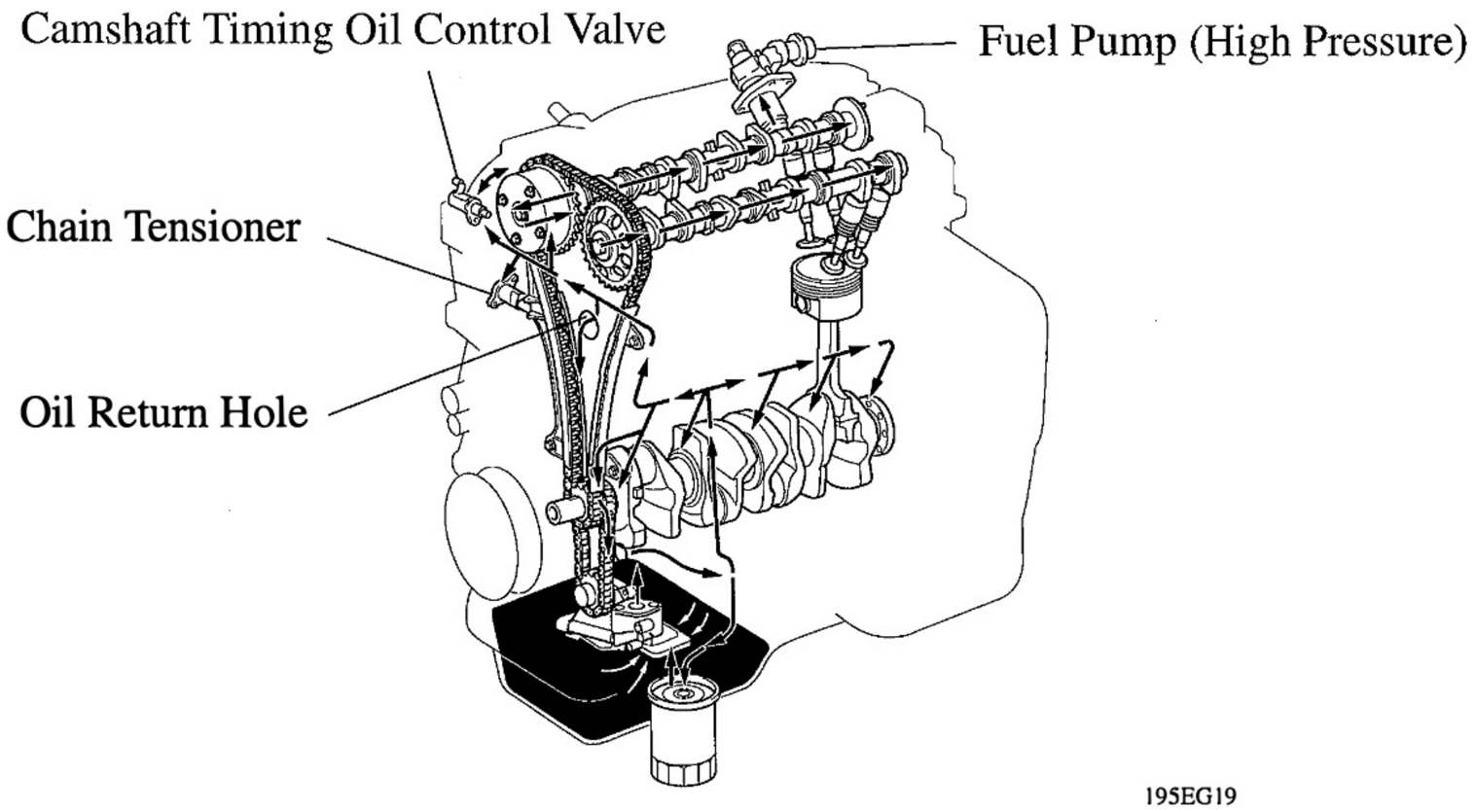


181EG14

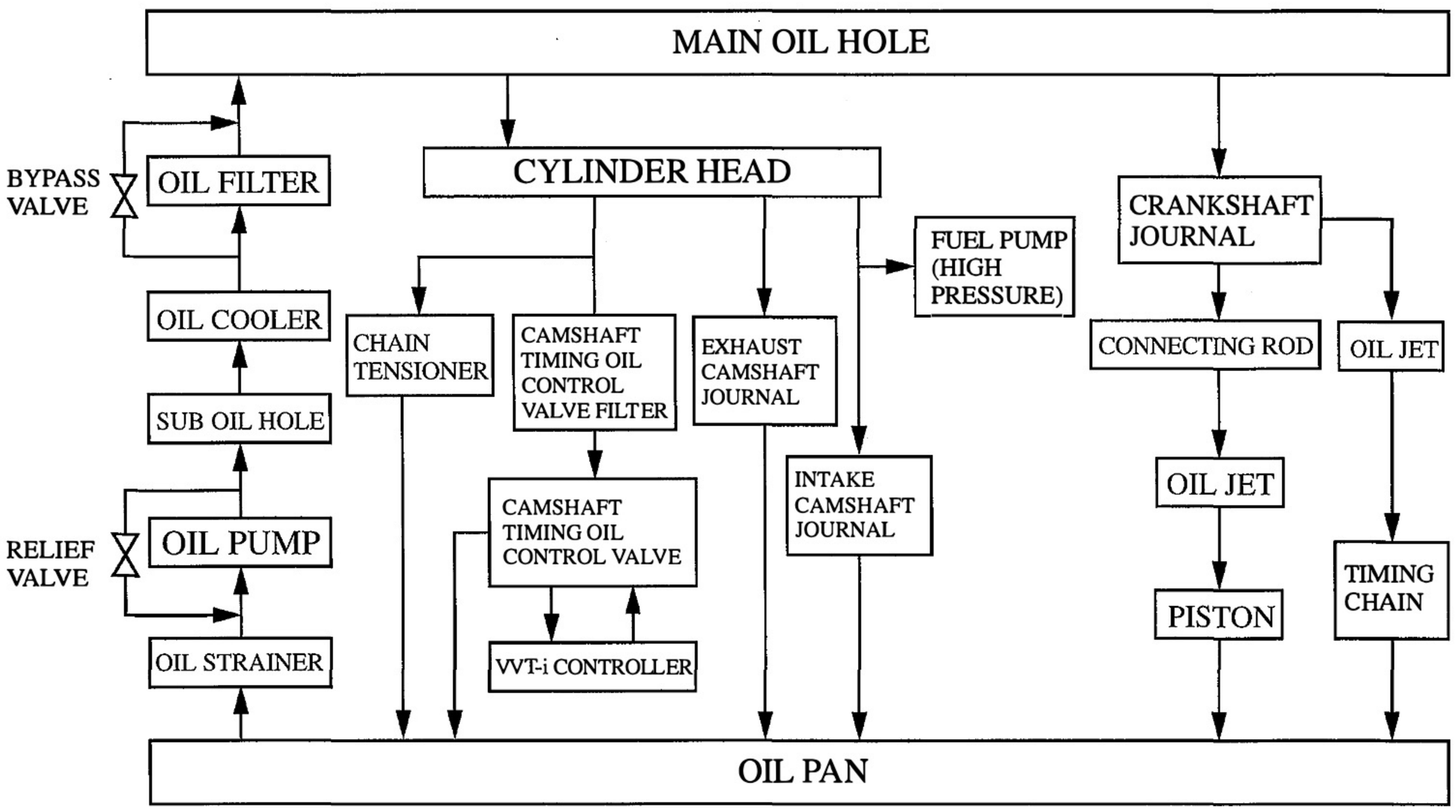
5. Lubrication System

General

- The lubrication circuit is fully pressurized and oil passes through an oil filter.
- The trochoidal type oil pump is chain-driven by the crankshaft.
- This engine has an oil return structure in which the oil force-fed to the upper cylinder head returns to the oil pan through the cylinder block and chain cover.
- The oil filter is attached downward from the crankcase to improve serviceability.
- Along with the adoption of the VVT-i system, the cylinder head is provided with a VVT-i controller and a camshaft timing oil control valve. This system is operated by the engien oil.
- Along with the adoption of the (high pressure) fuel pump, engine oil is supplied from the cylinder head to the fuel pump (high pressure).
- A water-cooled oil cooler has been installed between the crank case and the oil filter.



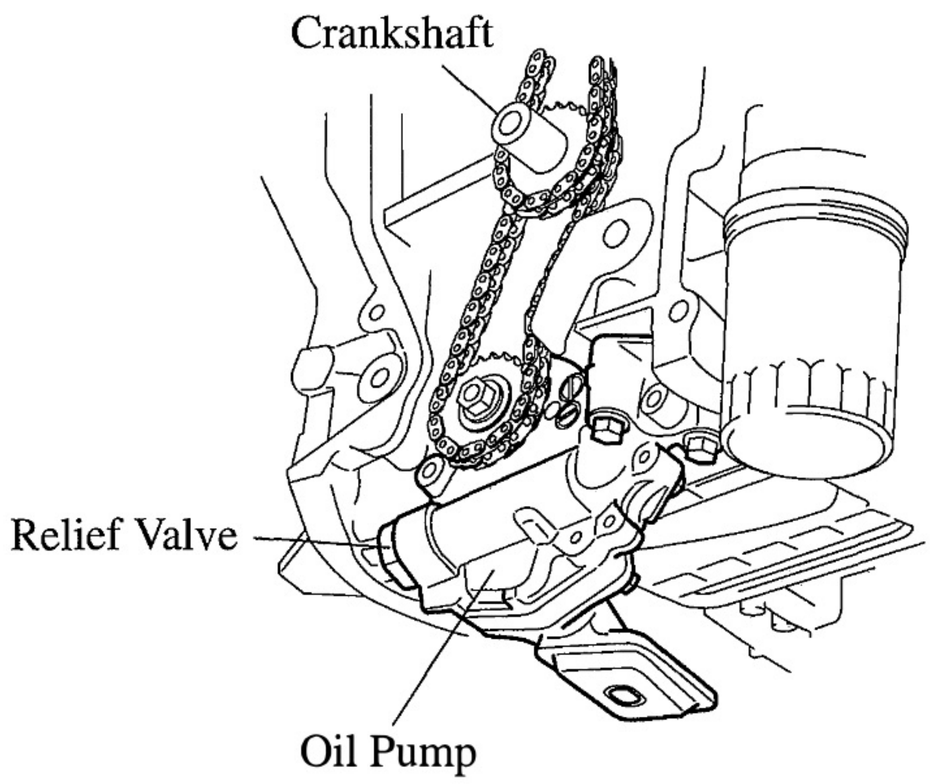
195EG19



195EG20

Oil Pump

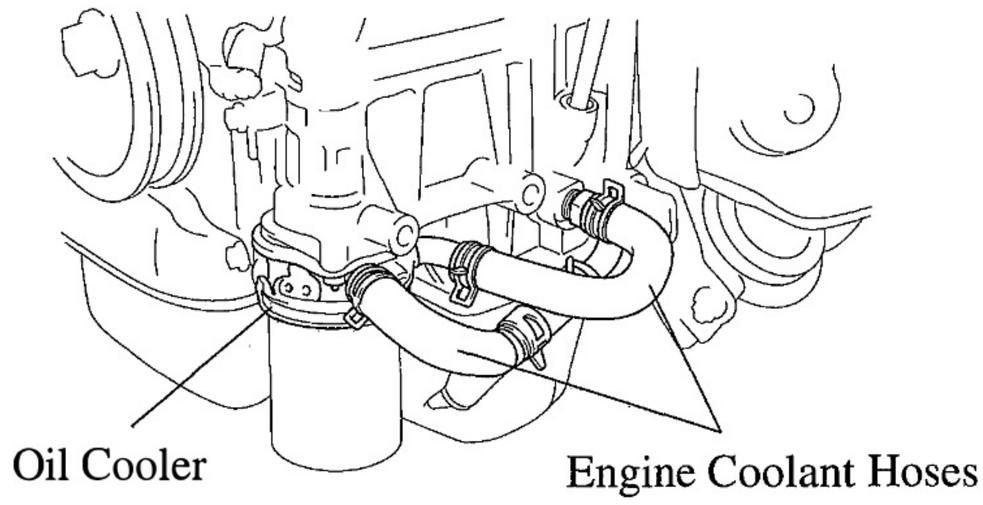
- The trochoidal type oil pump is chain-driven by the crankshaft, and fits compactly inside the oil pan.
- Friction has been reduced by means of 2 relief holes in the internal relief system.



185EG27

Oil Cooler

A water-cooled oil cooler has been installed between the crank case and the oil filter.

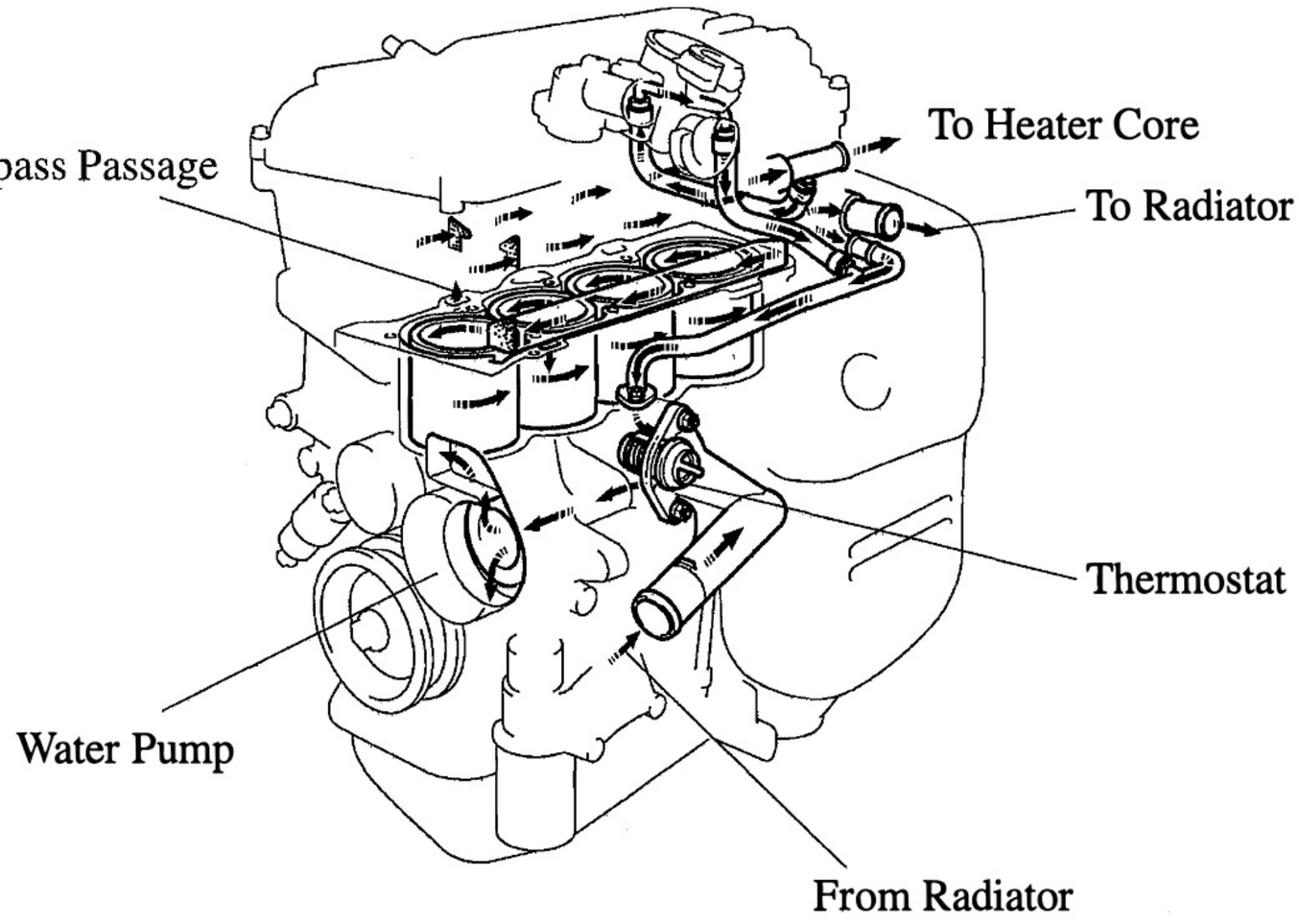


195EG21

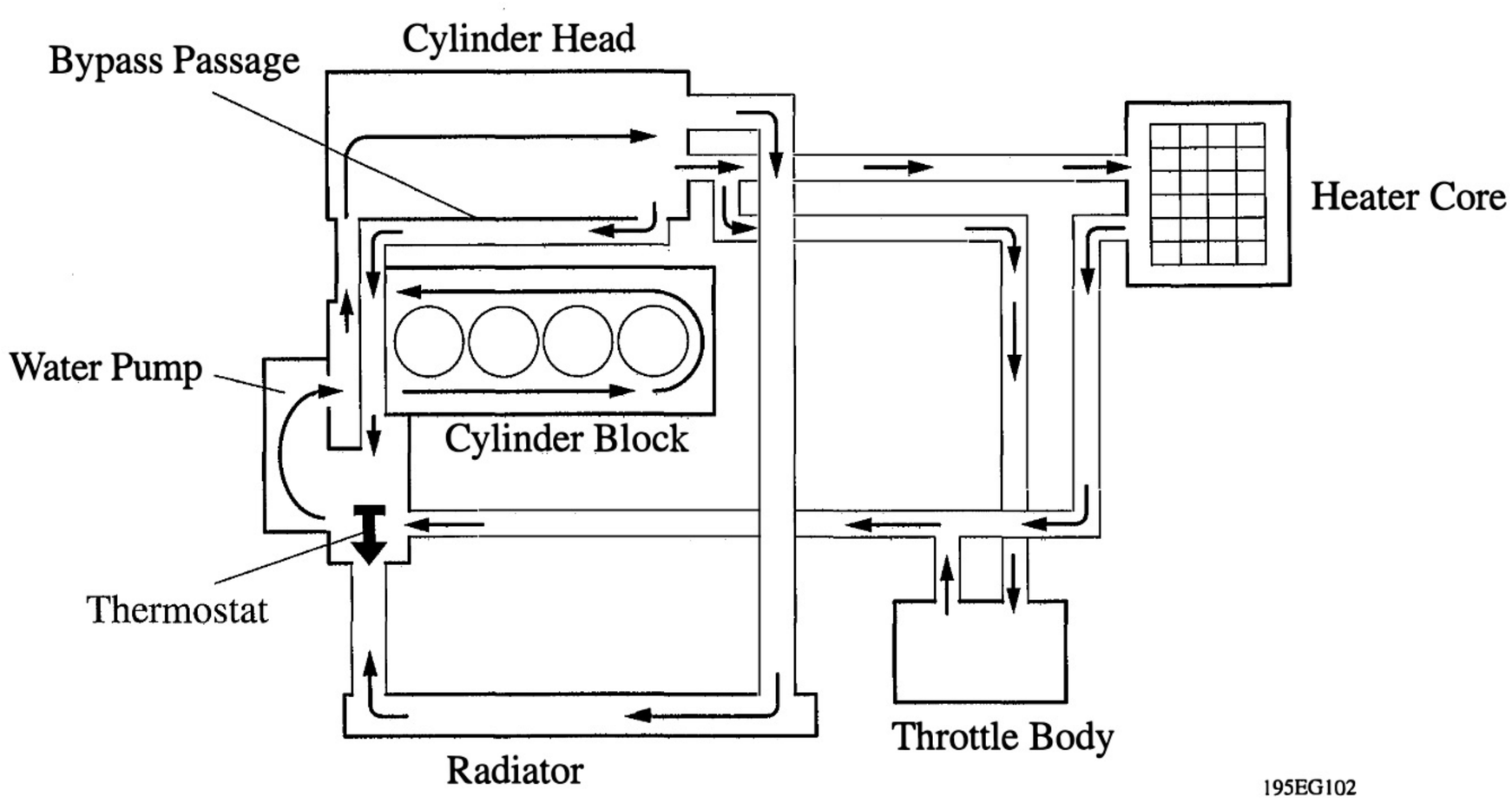
6. Cooling System

General

- The cooling system is a pressurized, forced-circulation type.
- A thermostat with a bypass valve is located on the water inlet housing to maintain suitable temperature distribution in the cooling system.
- An aluminum radiator core is used for weight reduction.
- The flow of the engine coolant makes a U-turn in the cylinder block to ensure a smooth flow of the engine coolant. In addition, a bypass passage is enclosed in the cylinder head and the cylinder block.
- Warm water from the engine is sent to the throttle body to prevent freeze-up.
- A swirl chamber for the water pump has been provided in the cylinder block to make the water pump more compact.
- To improve serviceability, a drain cock for engine coolant is included to the oil cooler.



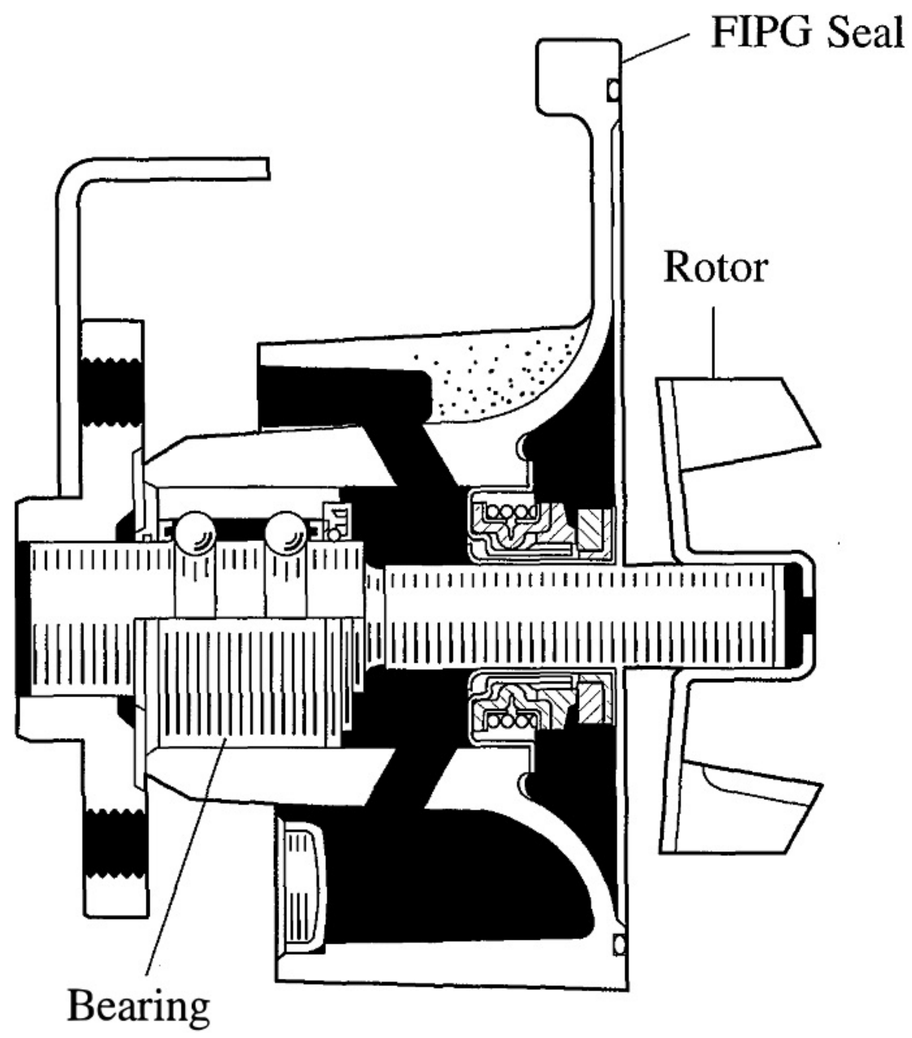
185EG28



195EG102

Water Pump

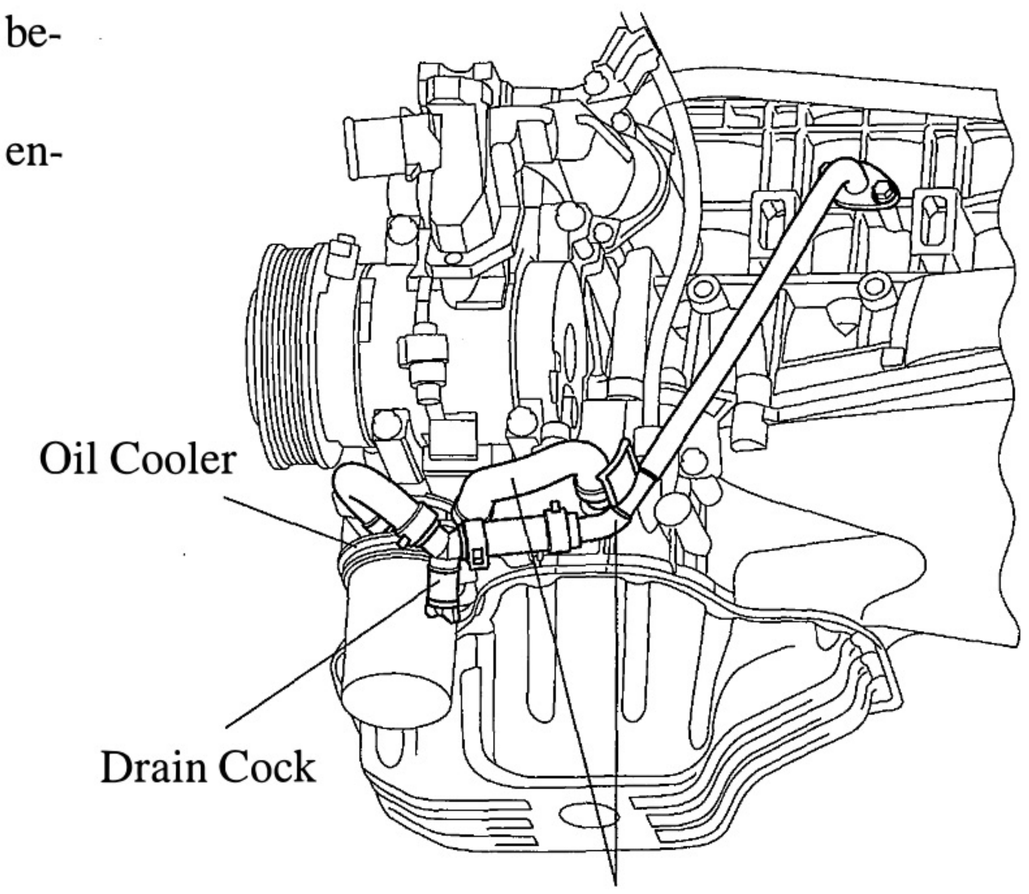
- A swirl chamber for the water pump has been provided in the cylinder block to make the water pump more compact.
- An FIPG (Formed-In-Place Gasket) has been adopted for sealing the water pump to the cylinder block, in order to reduce the number of parts.



195EG22

Oil Cooler

A water-cooled oil cooler has been installed between the crankcase and the oil filter.
To improve serviceability, a drain cock for engine coolant is also included.

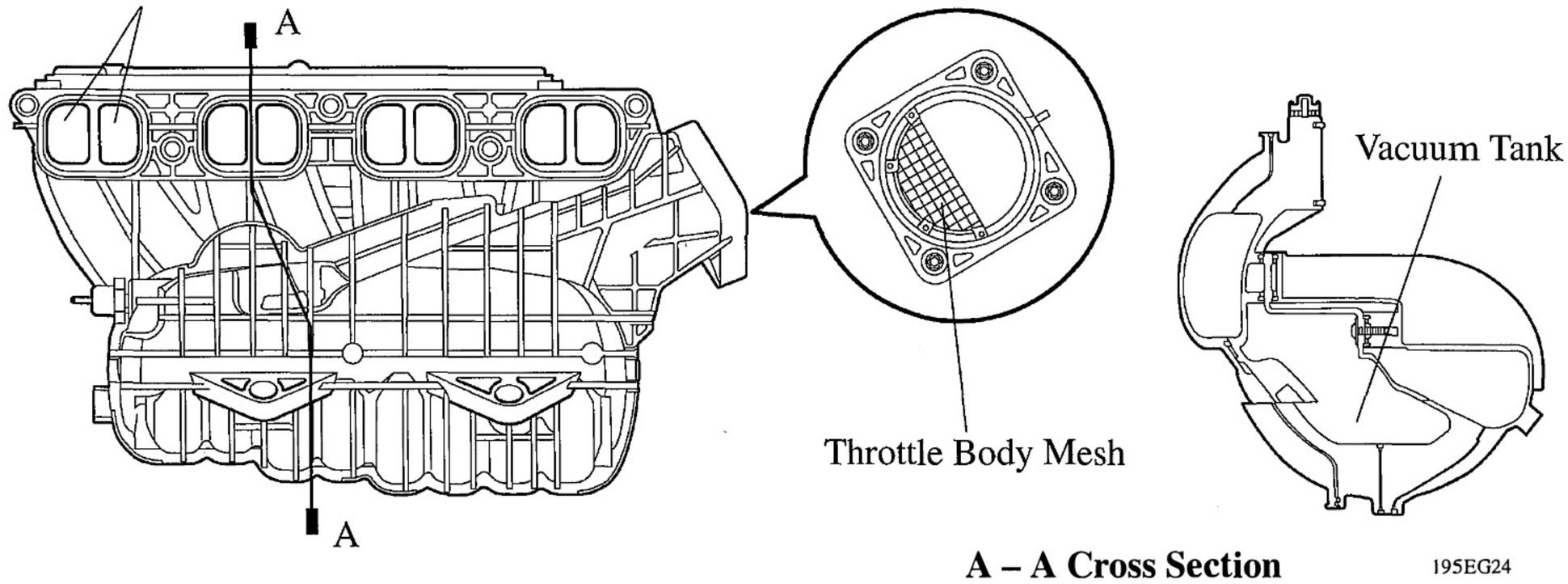


195EG23

7. Intake and Exhaust System

Intake Manifold

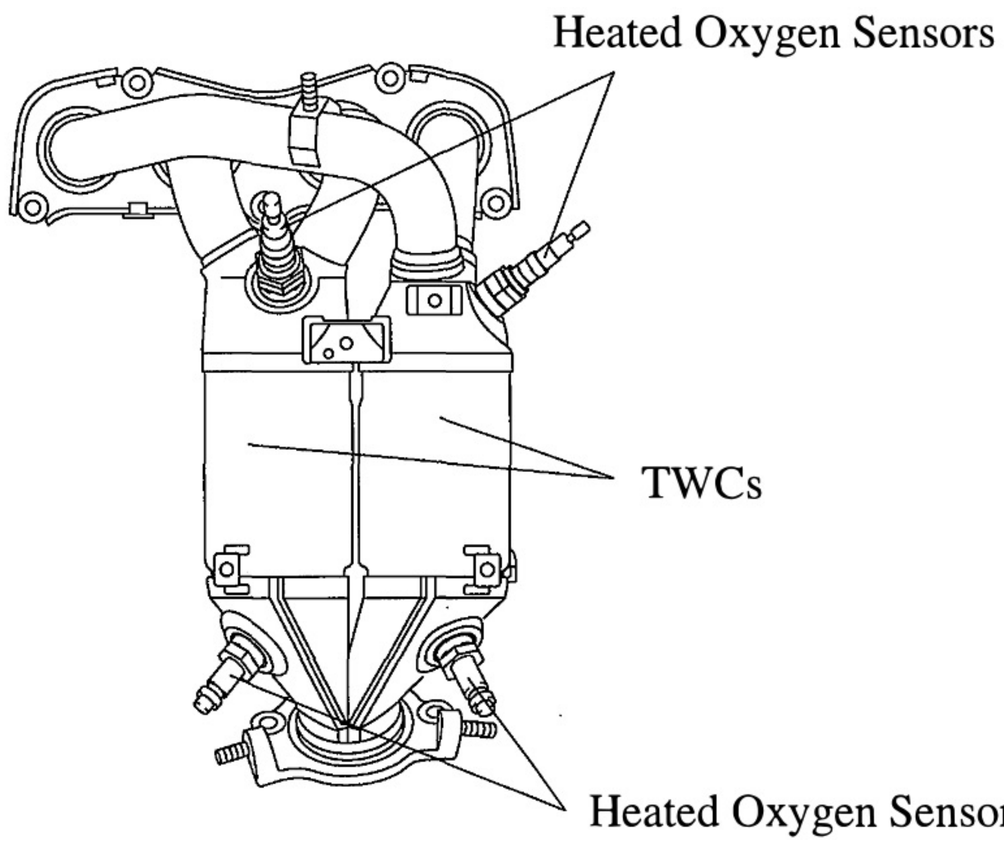
- The intake manifold has been made of plastic to reduce the weight and the amount of heat transferred from the cylinder head. As a result, it has become possible to reduce the intake air temperature and improve the intake volumetric efficiency.
- Eight, independent long ports have been adopted to improve the torque in the low-to mid-range engine speeds.
- A vacuum tank for intake air control has been built in to achieve a compact package with fewer parts. Refer to page 146 for details on intake air control.
- Throttle body mesh is used between the throttle body and intake manifold and integrated with the gasket between them to improve the air flow whithin the intake manifold.



A – A Cross Section 195EG24

Exhaust Manifold

- A dual type exhaust manifold has been installed on the front of the vehicle.
- A stainless stell exhaust manifold is used for weight reduction.
- A thin-wall ceramic WU-TWC (Warm Up Three-Way Catalytic Converter) has been adopted. By decreasing the thermal capacity in this manner, it becomes easier to heat the catalyst and the catalyst's exhaust cleansing performance is improved.



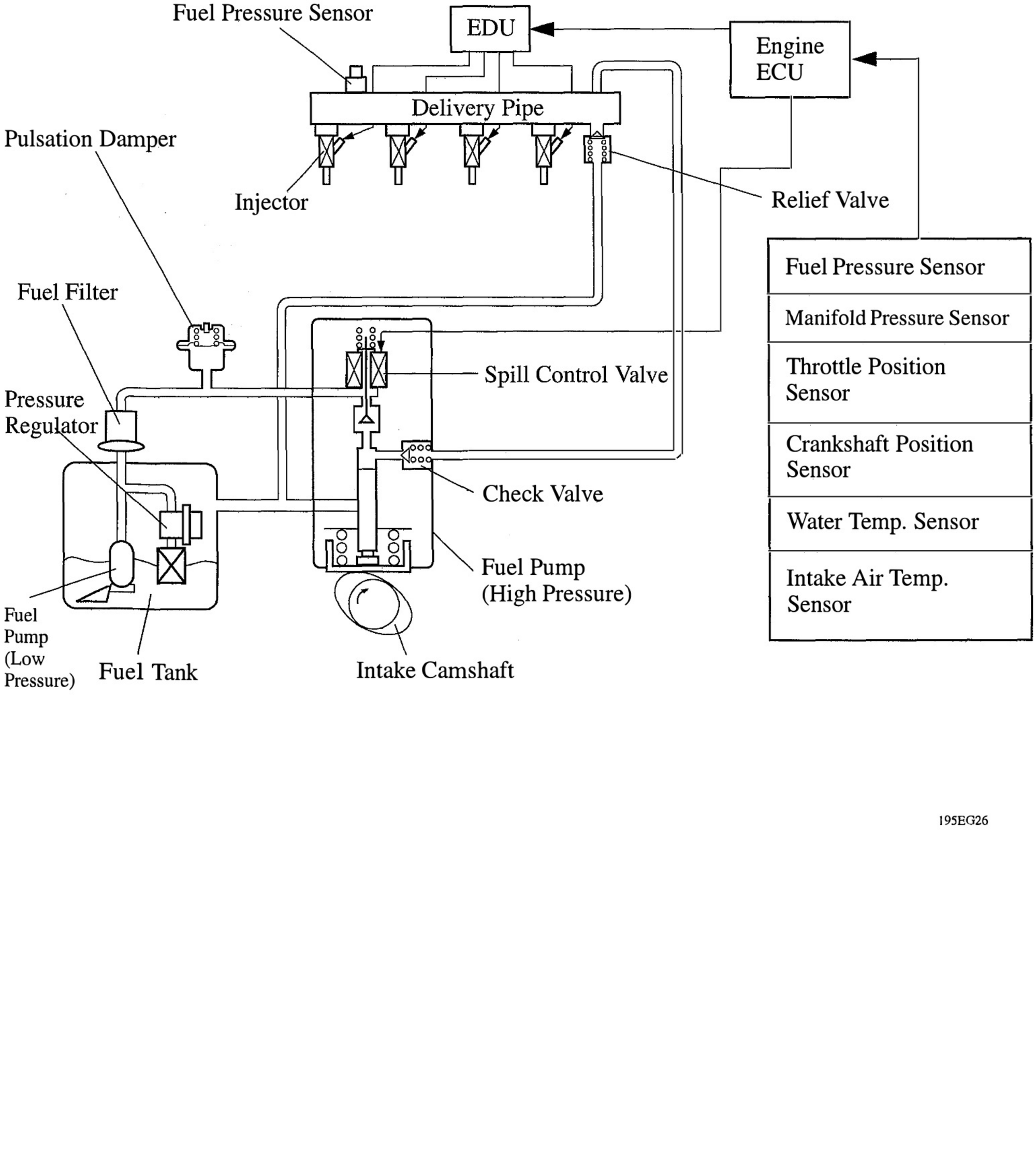
195EG25

8. Direct Injection System

General

- A direct injection system has been adopted in the fuel system of the 1AZ-FSE engine.
- Mainly consisting of a fuel pump (high pressure), delivery pipe, and slit nozzle type injectors, this sytem effects optimal control for combustion by controlling the fuel pressure, injection volume, and the injection timing via the engine ECU and EDU (Electronic Driver Unit).

▶ System Diagram ◀



195EG26

Component of Function

The direct injection system for the 1AZ-FSE has following components and functions.

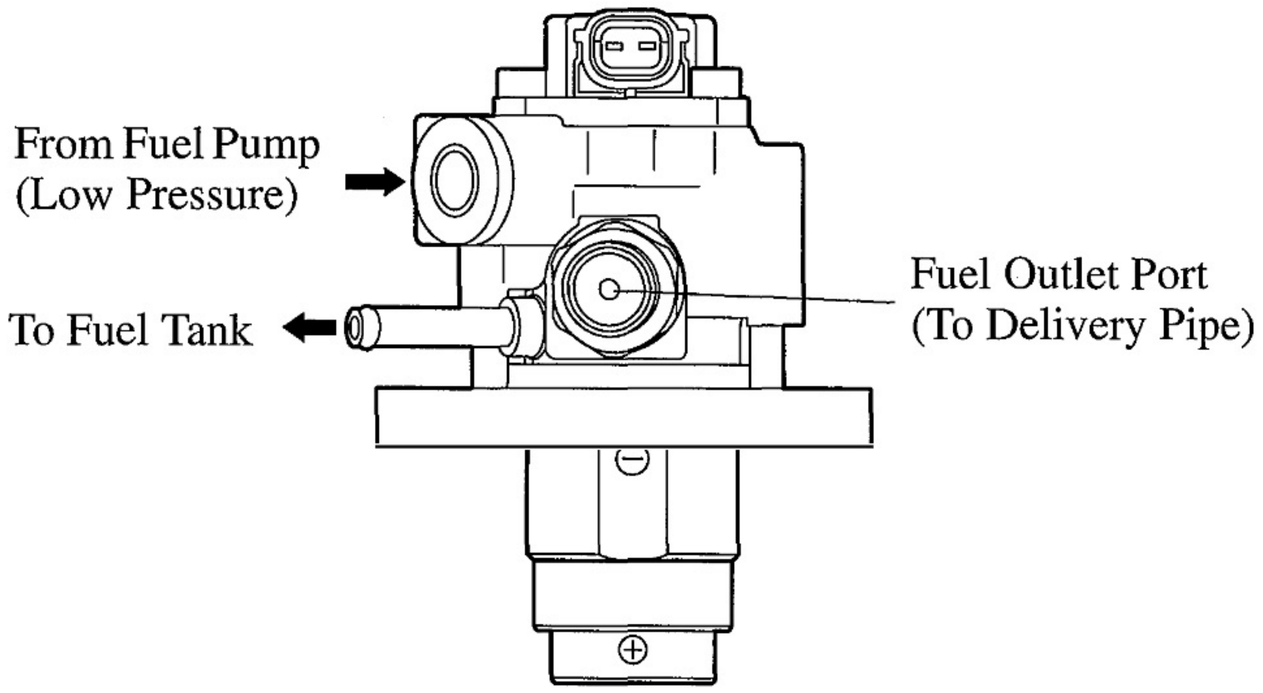
Component	Outline
Fuel Pump (High Pressure)	To pressurize the fuel from the fuel pump (low pressure) from 8 to 13 MPa and send it to the delivery pipe.
Delivery Pipe	To deliver the high pressure fuel to the injector.
Fuel Pressure Sensor	The fuel pressure sensor senses the fuel pressure and outputs the signal to the engine ECU.
Relief Valve	When the pressure in the delivery pipe is abnormally high, the relief valve leaks the fuel to the fuel tank to reduce pressure.
Injector	To adjust the quantity of the high pressure fuel and inject the fuel directly into the combustion chamber.
EDU (Electronic Driver Unit)	The EDU drives the injector at high speed.
Engine ECU	Depending on the vehicle condition, and based on the signal from each sensor, calculate the optimized injection timing and injection volume, and control the injector and fuel pump (high pressure).

Construction and Operation

1) Fuel Pump (High Pressure)

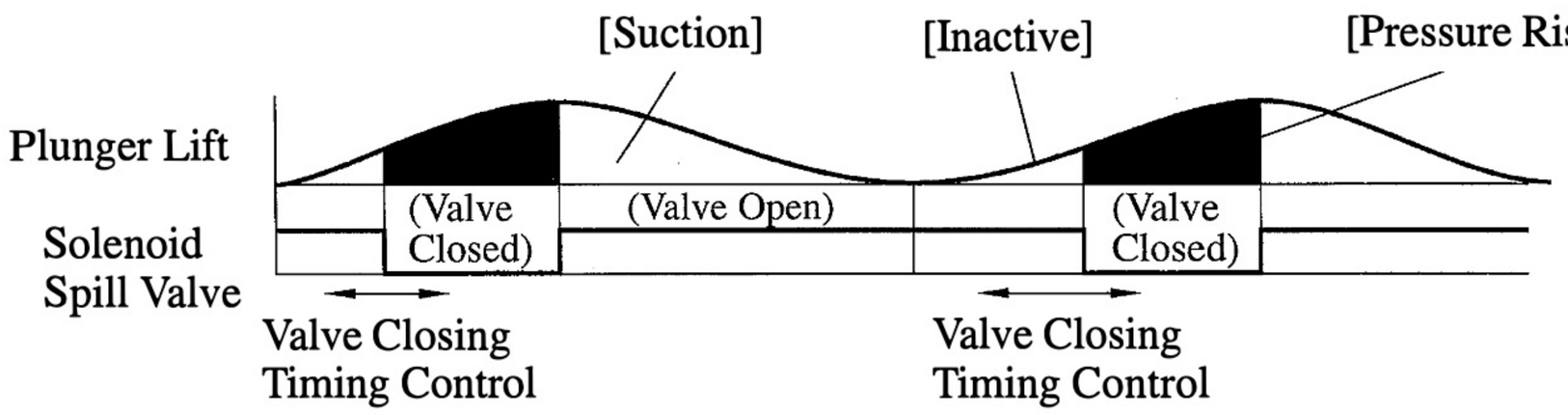
a. Construction

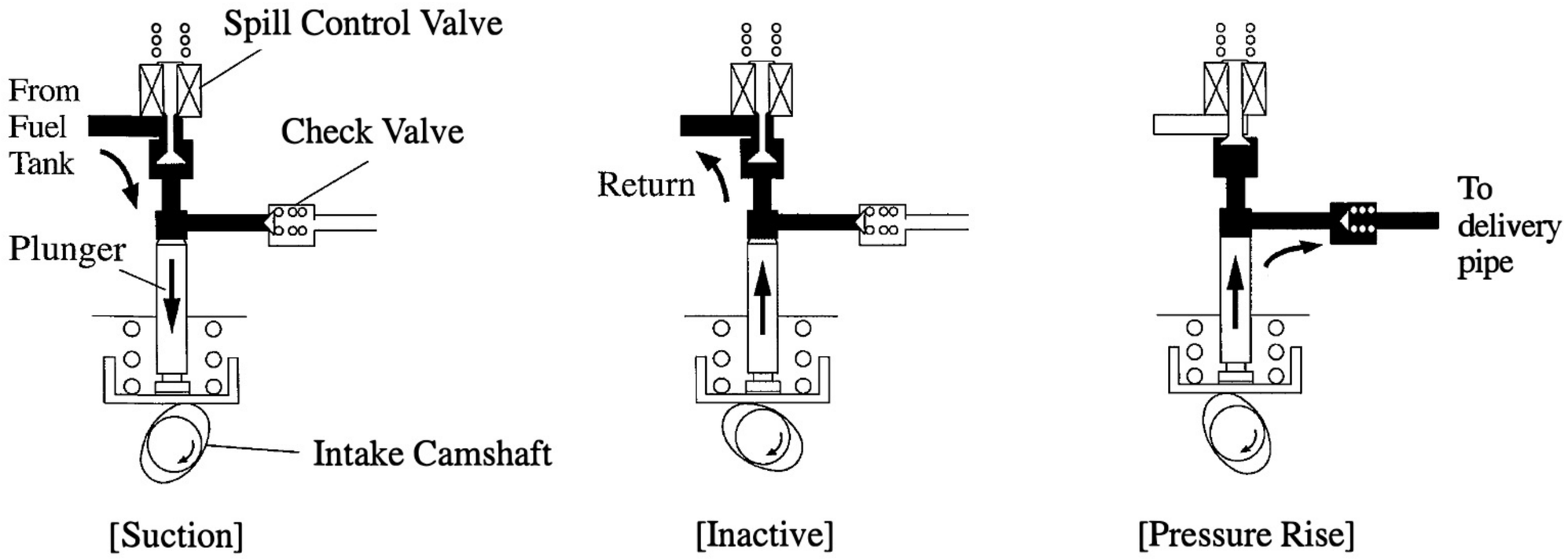
Fuel pump (high pressure) consists of a plunger, spill control valve and check valve. The plunger moves up and down by a pump driving cam (2 waves) of the intake camshaft. The spill control valve is established in the inlet pass of the pump, and electrically opens and closes the valve by a signal from the engine ECU and controls the pump discharging pressure. Check valve is equipped in the outlet of the pump, and it opens the valve when the fuel pressure in the pump has becomes 50 kPa and discharges the fuel to the delivery pipe.



b. Operation

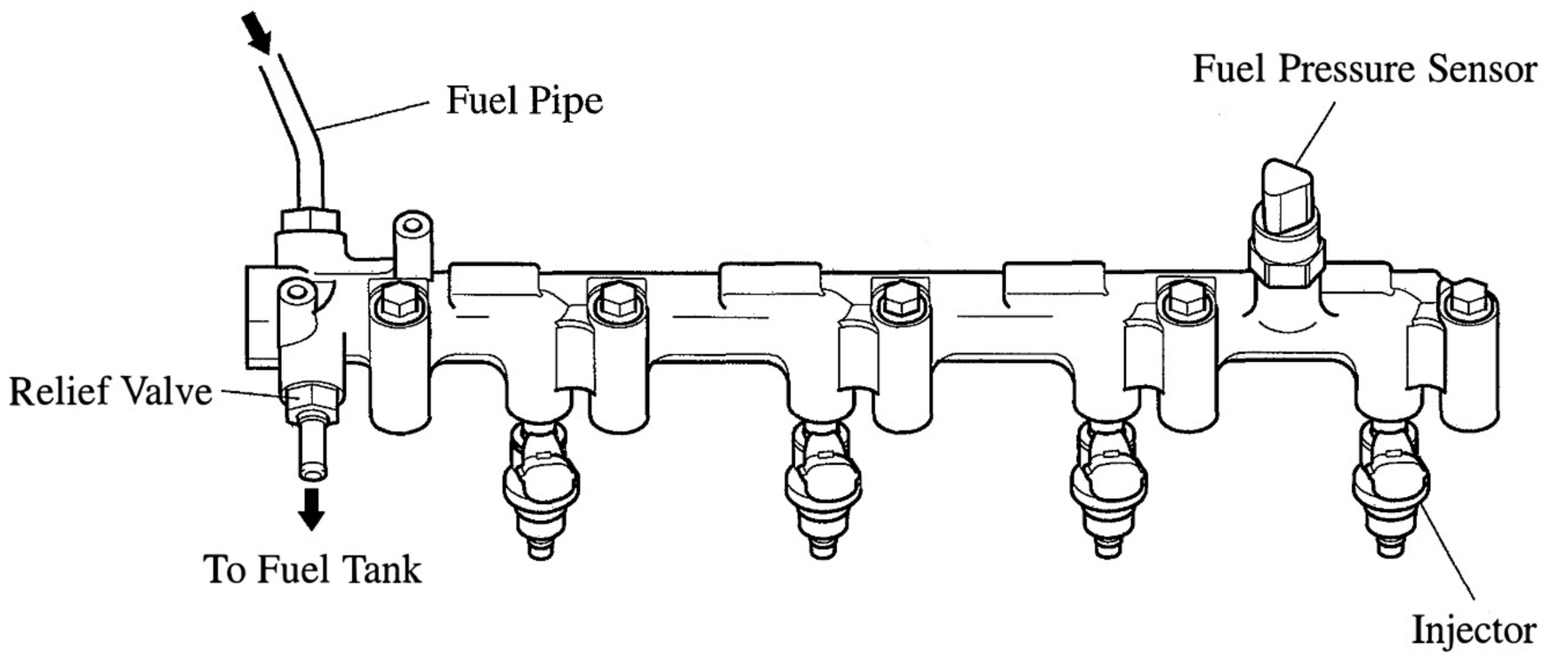
In the suctioning process of the pump, the spill control valve opens and the plunger strokes downward by a spring force, and the fuel is suctioned into the cylinder. Then, by the action of the cam, the plunger strokes upward, but at this time the spill control valve has not closed yet, so the part of the fuel in the cylinder is pushed back to the fuel tank side (while it is not pressurized). On the way in which the plunger is stroking upward (in the compressed process), the engine ECU closes the spill control valve and rise the fuel pressure in the cylinder. When the fuel pressure in the cylinder has exceeded 50 kPa, the check valve starts to open and discharged the fuel to the delivery pipe. The engine ECU controls the fuel discharging pressure from 8 to 13 MPa depending on the driving condition by controlling the timing to close the spill control valve valiantly.





2) Delivery Pipe

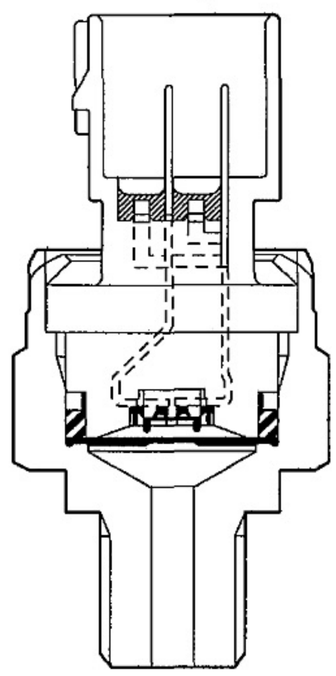
A delivery pipe made of aluminum die cast has been adopted. On the delivery pipe, injectors, fuel pressure sensor and relief valve are directly installed. By storing fuel at a high-pressure (8 to 13 MPa), the peak torque during the pumping of fuel under high load conditions has been restrained, thus reducing the vibration and noise of the fuel injection system.



195EG28

3) Fuel Pressure Sensor

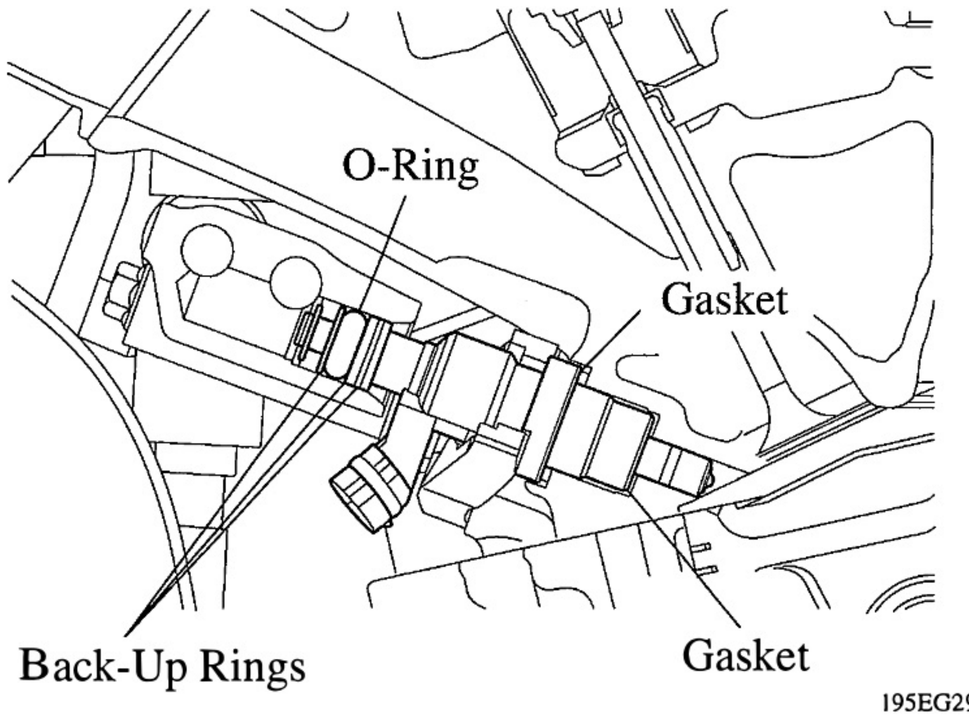
The fuel pressure sensor, which is mounted on the delivery pipe, outputs a signal that represents the fuel pressure in the delivery pipe to the engine ECU in order to constantly regulate the fuel at an optimal pressure.



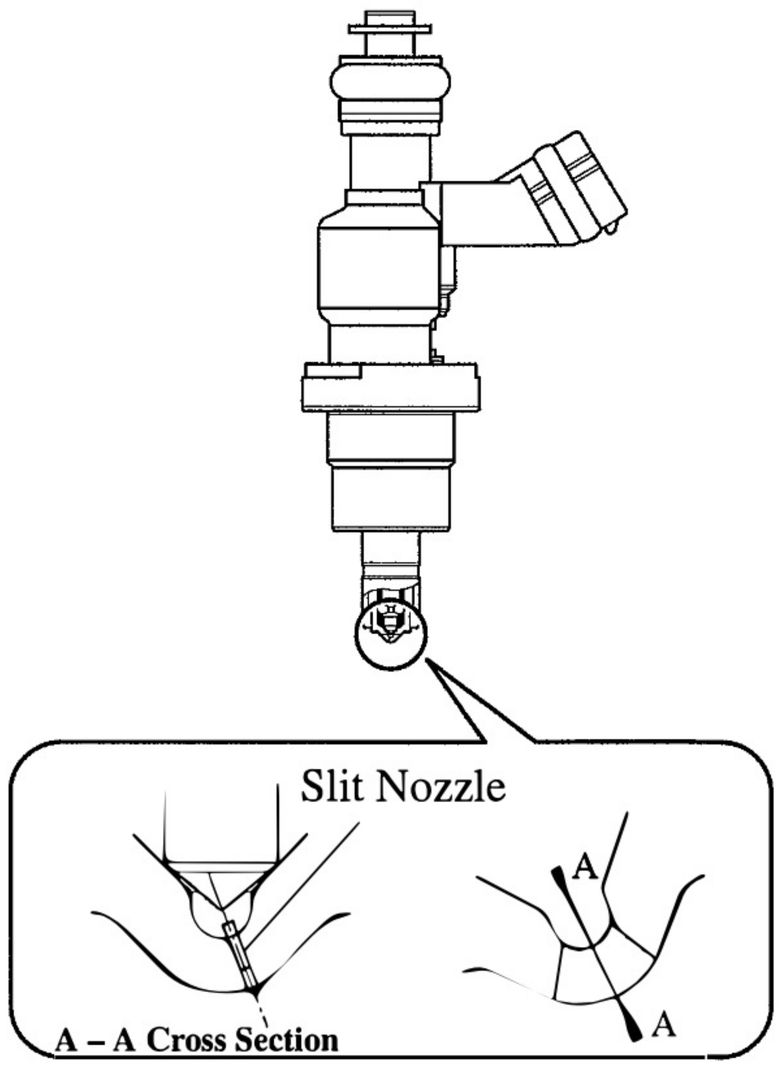
195EG77

4) Injector

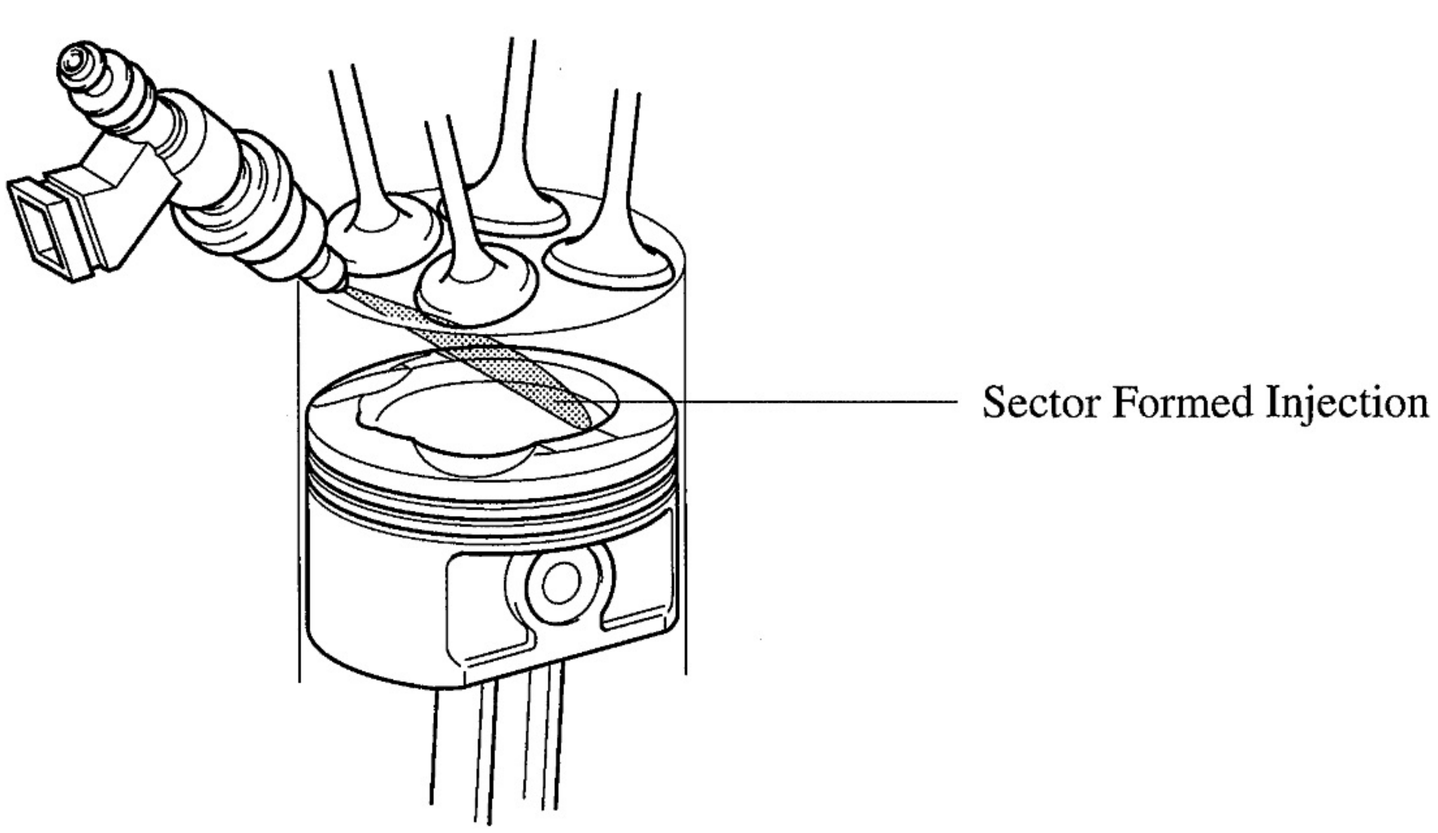
High-pressure, slit-nozzle type injectors have been adopted in conjunction with the adoption of the TOYOTA D-4 (Direct injection, 4-stroke gasoline engine). The injectors are secured to the cylinder head by way of a clamp, and the gaskets are used to seal the combustion gas in the cylinder. In addition, an O-ring and the back-up rings are used to seal the fuel and to reduce noise. And the nozzle hole has been coated to restrain the adhesion of deposits. The injectors, based on a signal from the engine ECU, adjusts the flow of the high pressure fuel and injects the fine-grain sector formed fuel directly to the combustion chamber by a slit nozzle. The injectors are actuated under high-voltage and constant-current control by the EDU in order to inject high-pressure fuel in a short time.



195EG29



195EG30



195EG31

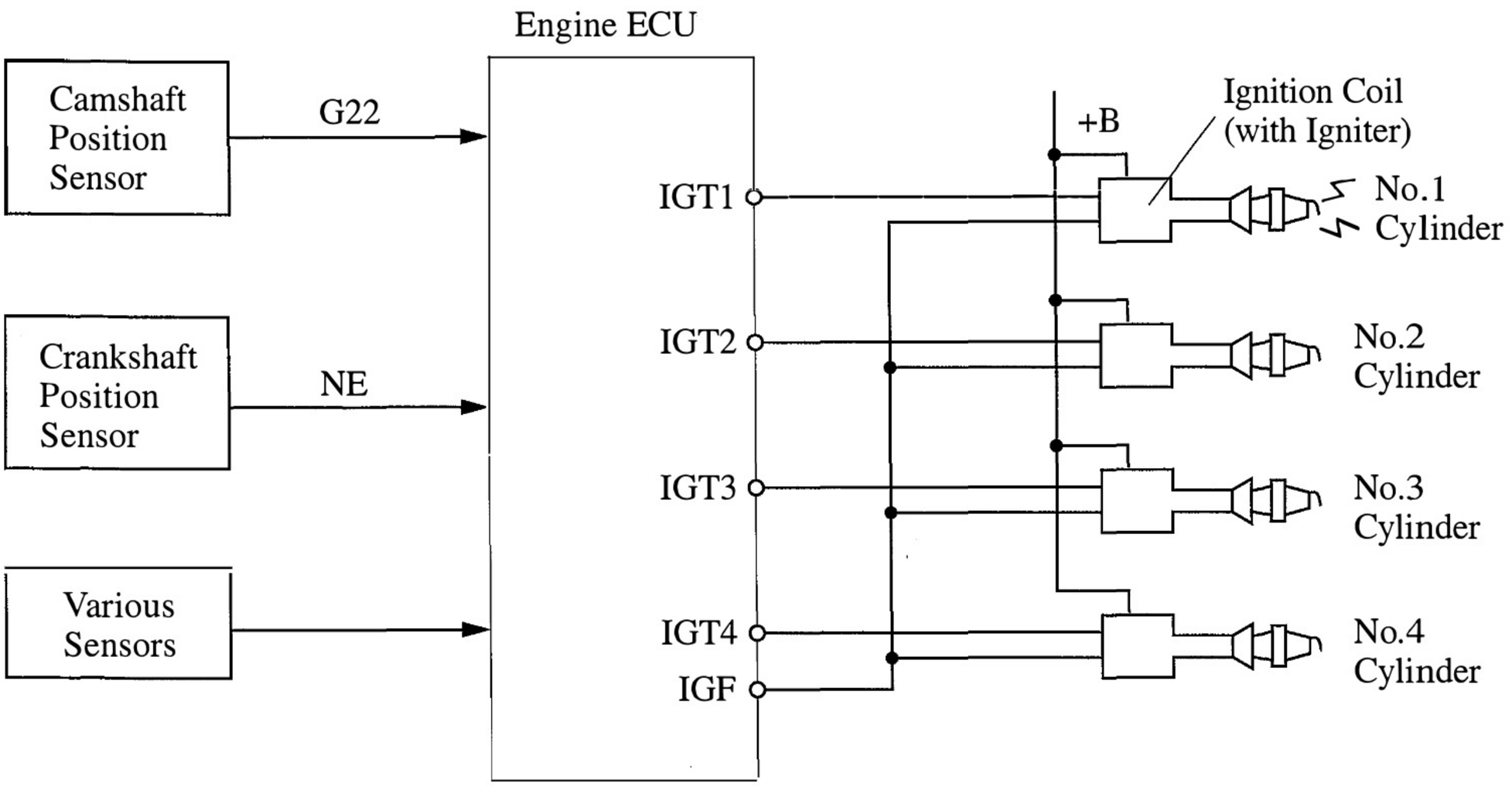
5) EDU (Electronic Driver Unit)

- The EDU has been adopted to drive the injector at high speeds. The EDU has realized high-speed driving under high fuel pressure conditions through the use of a DC/DC converter that provides a high-voltage, quick-charging system.
- The engine ECU constantly monitors the EDU and stops the engine in case an abnormal condition is detected.

9. Ignition System

General

A DIS (Direct Ignition System) has been adopted. The DIS improves the ignition timing accuracy, reduces high-voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor. The DIS in the 1AZ-FSE engine is an independent ignition system which has one ignition coil (with igniter) for each cylinder.



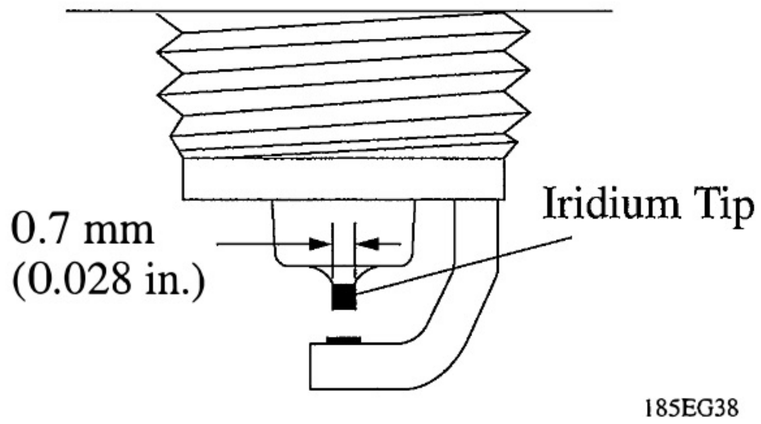
165EG25

Ignition Coil

The DIS provides 4 ignition coils, one for each cylinder. The spark plug caps, which provide contact to the spark plugs, are integrated with an ignition coil. Also, an igniter is enclosed to simplify the system.

Spark Plug

Iridium-tipped spark plugs have been adopted to improve ignition performance while maintaining the same level of durability of the platinum-tipped spark plugs.



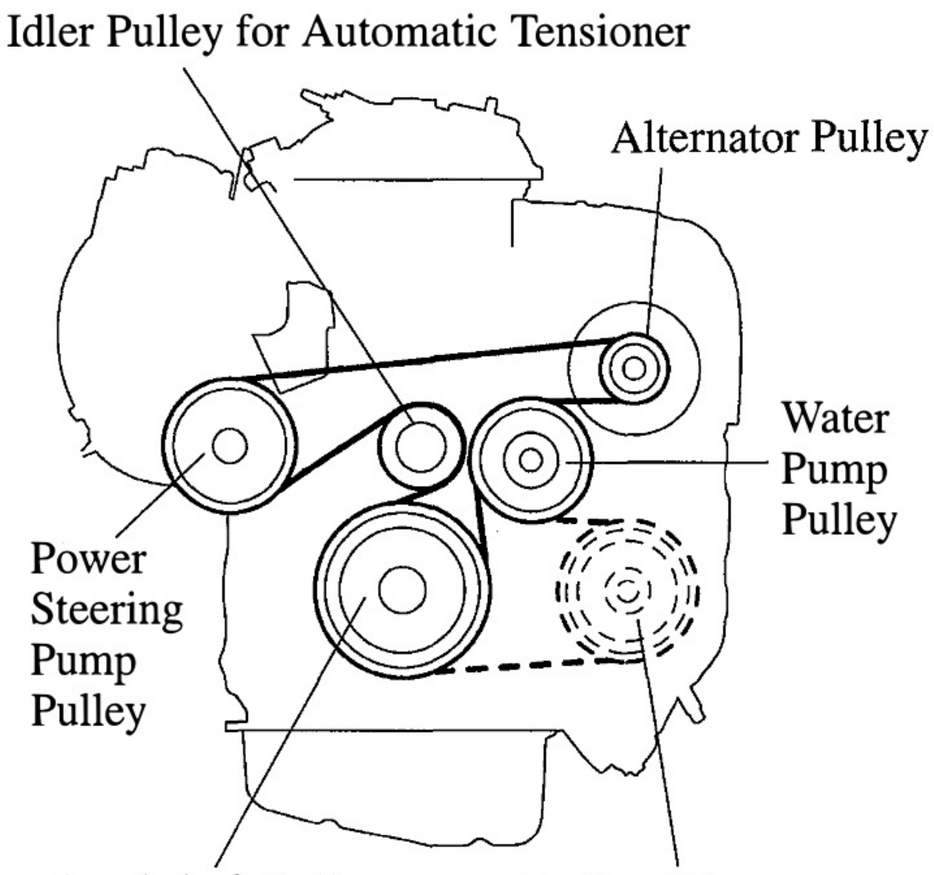
185EG38

▶ Recommended Spark Plugs ◀

DENSO	SK20R11
NGK	IFR6A11
Plug Gap	1.0 – 1.1 mm (0.039 – 0.043 in.)

10. Serpentine Belt Drive System

- Accessory components are driven by a serpentine belt consisting of a single V-ribbed belt. It reduces the overall engine length, weight and number of engine parts.
- An automatic tensioner eliminates the need for tension adjustment.



181EG17

11. Engine Control System

General

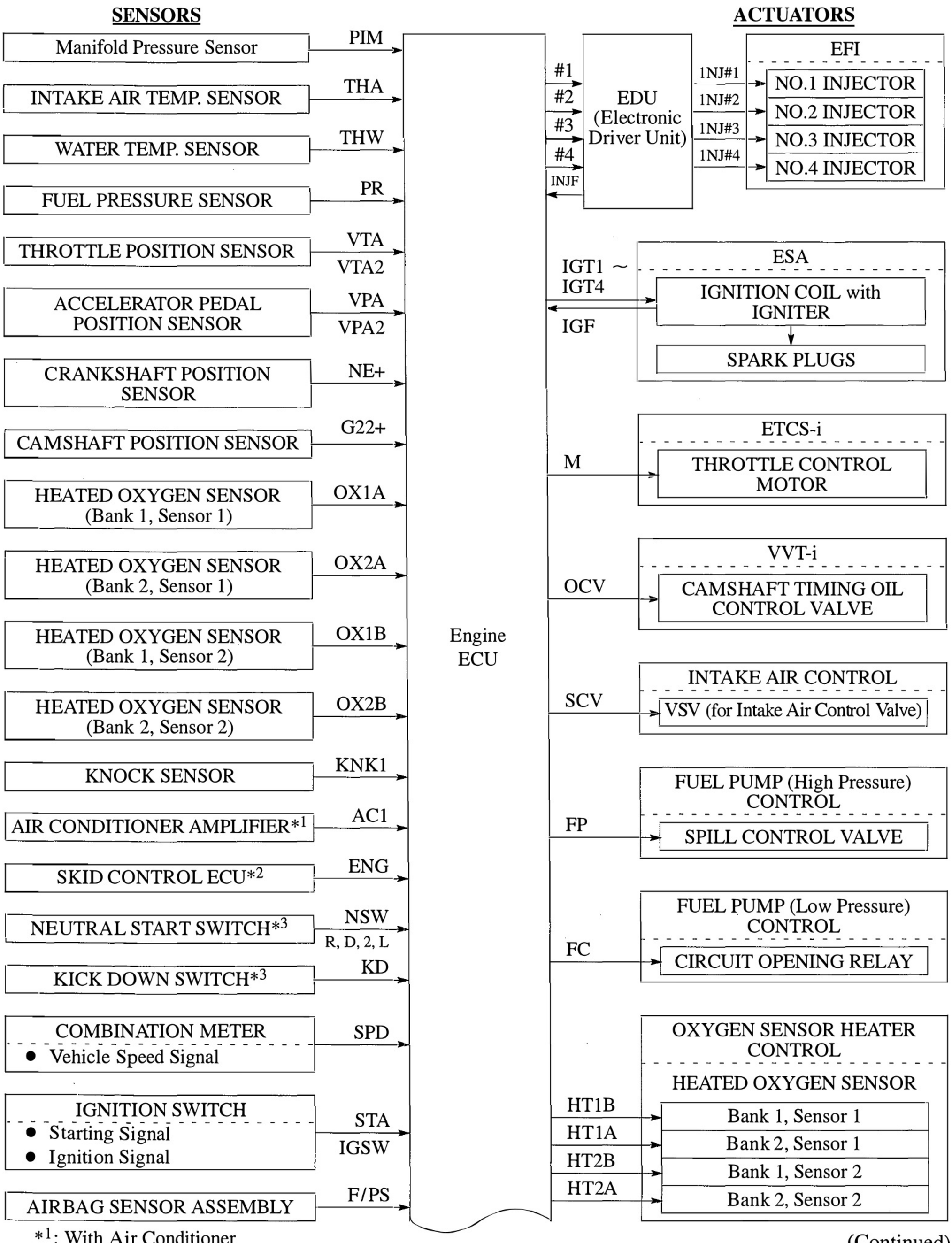
The engine control system for the 1AZ-FSE engine has following features.

System		Outline
D-4 EFI (Electronic Fuel Injection)		• A D-type EFI system is used, which indirectly detects intake air volume by the manifold pressure sensor signal. • Incontrast to the conventional EFI, D-4 EFI conducts the injection volume control and injection timing control simultaneously. • The fuel injection system is a sequential multiport fuel injection system. For details, refer to page 135.
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.
VVT-i (Variable Valve Timing-intelligent)		Controls the intake camshaft to an optimal valve timing in accordance with the engine condition. For details, refer to page 136.
ETCS-i (Electronic Throttle Control System-intelligent)		Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle. In addition, comprehensively controls the ISC, VSC system, and TRC systems. For details, refer to page 141.
Intake Air Control		Controls the intake air control valve via the VSV and the diaphragm in accordance with the engine conditions. For details, refer to page 146.
Fuel Pump Control	High Pressure Side	Regulates the fuel pressure within a range of 8 to 13 MPa in accordance with driving conditions. For details, refer to page 120.
	Low Pressure Side	• Fuel pump operation is controlled by signal from the engine ECU. • To stop the fuel pump when the airbag is deployed at the front or side collision. For details, refer to page 147.
Oxygen Sensor Heater Control		Maintains the temperature of the air fuel ratio sensor and oxygen sensor 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. For details, refer to page 147.
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.

*: With Air Conditioner

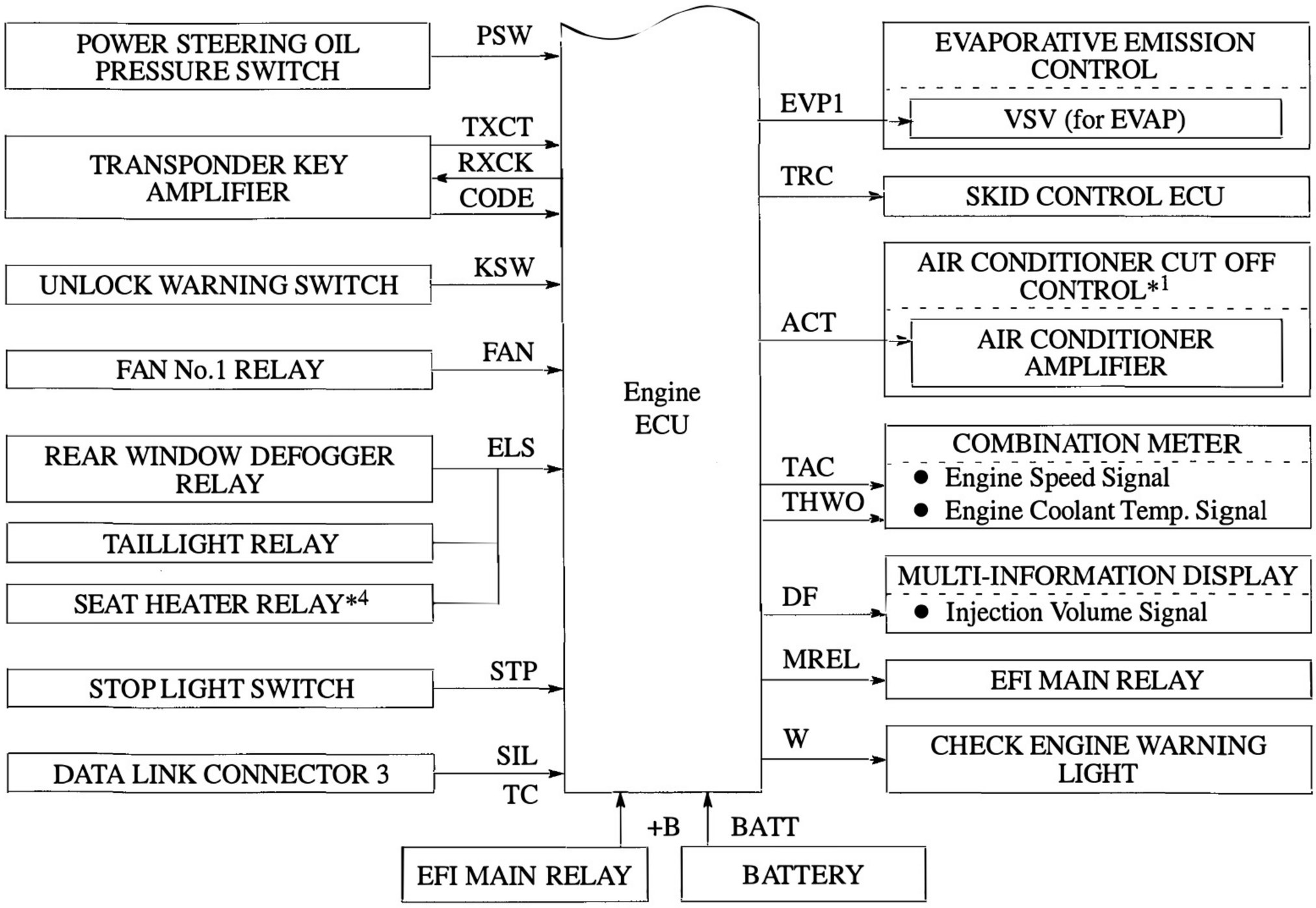
Construction

The configuration of the engine control system in the 1AZ-FSE engine is as shown in the following chart.



*1: With Air Conditioner
*2: With ABS & EBD & Brake Assist & TRC & VSC
*3: Only for Automatic Transaxle

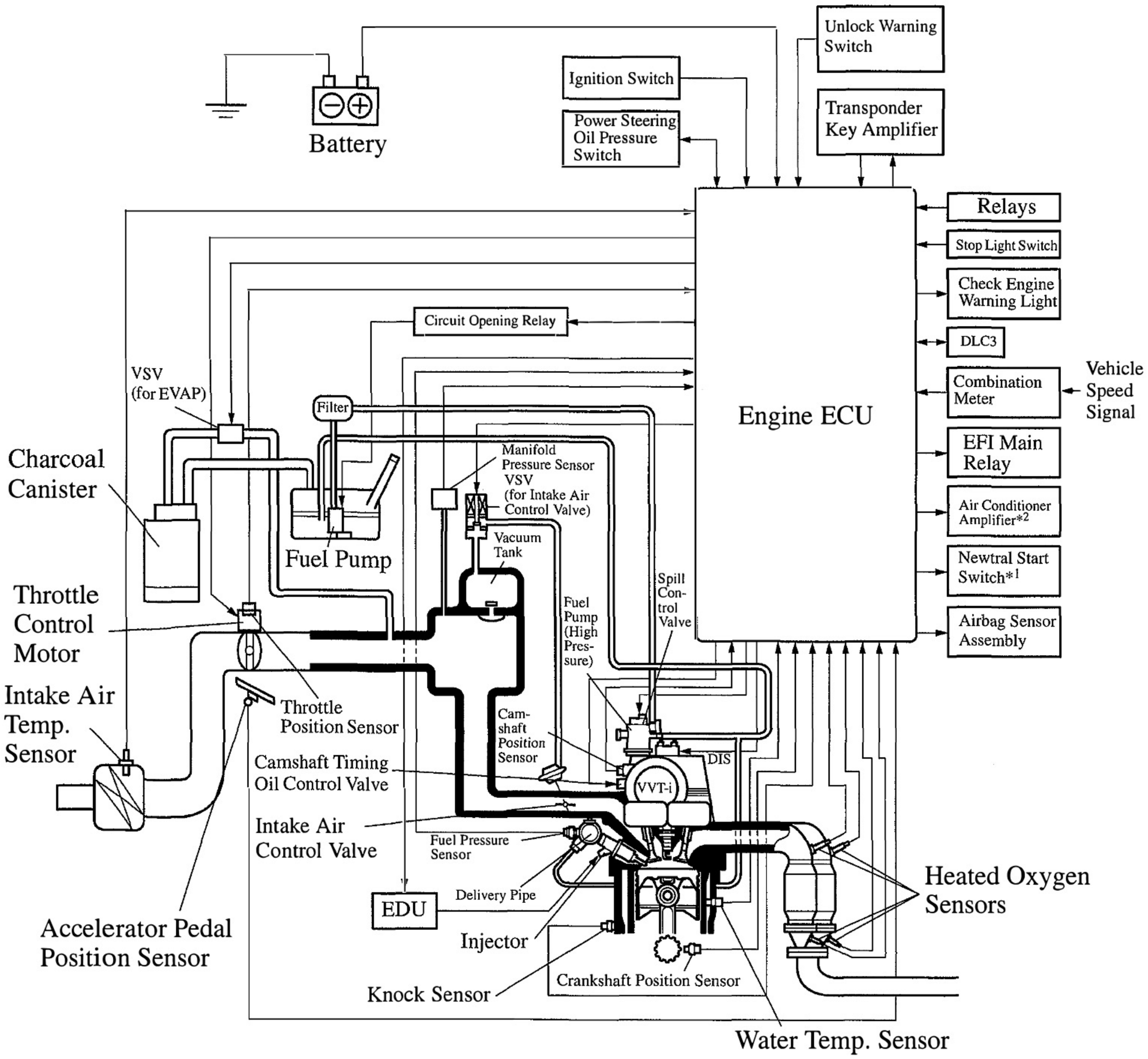
(Continued)



*1: With Air Conditioner
*2: With ABS & EBD & Brake Assist & TRC & VSC
*3: Only for Automatic Transaxle
*4: With Seat Heater

3

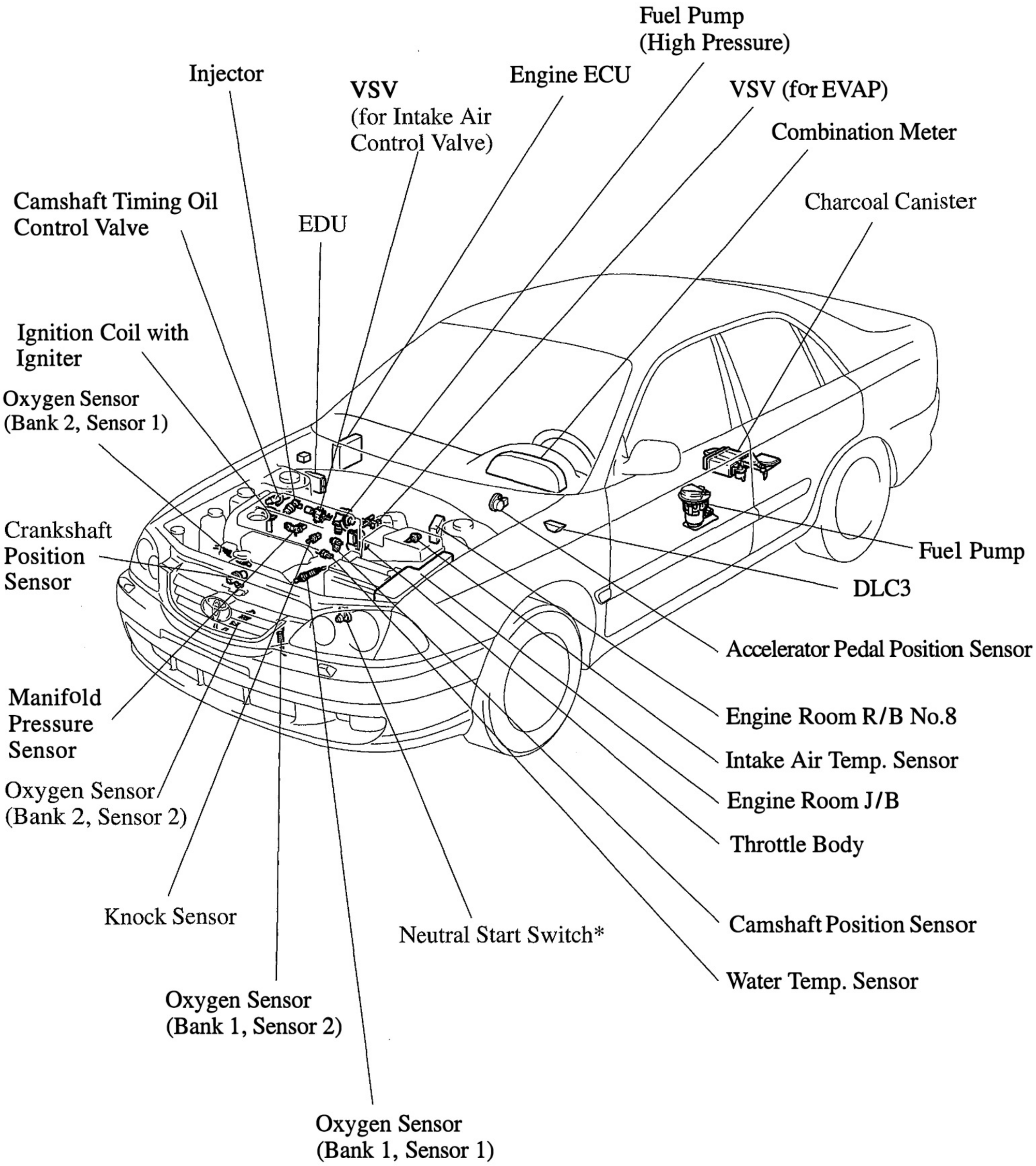
Engine Control System Diagram



195EG01

*1: Only for Automatic Transaxle
*2: With Air Conditioner

Layout of Main Components



195EG32

* Only for Automatic Transaxle

Main Components of Engine Control System

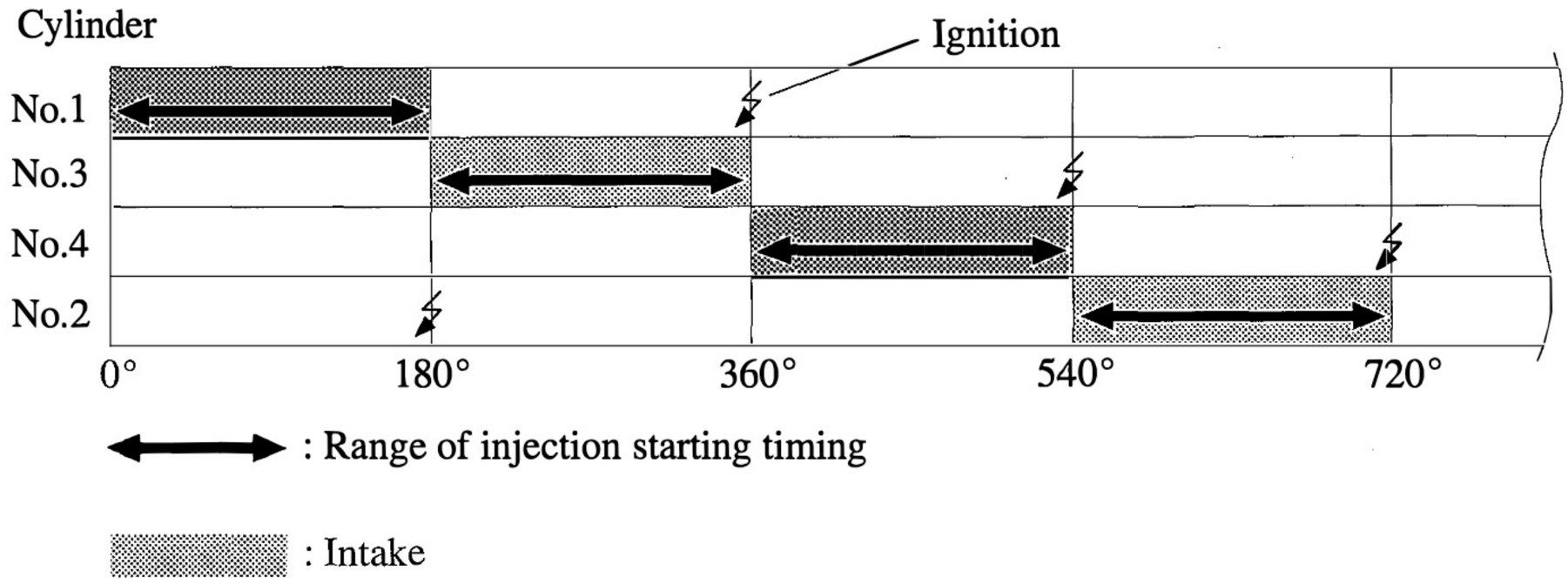
1) General

The main components of the 1AZ-FSE engine control system are as follows:

Components	Outline	Quantity
Manifold Pressure Sensor	Silicon Chip Type	1
Fuel Pressure Sensor	Semiconductor Strain Gauge Type	1
Crankshaft Position Sensor (Rotor Teeth)	Pick-Up Coil Type (36 – 2)	1
Camshaft Position Sensor (Rotor Teeth)	Pick-Up Coil Type (3)	1
Throttle Position Sensor	Linear Type	1
Accelerator Pedal Position Sensor	Linear Type	1
Knock Sensor	Built-In Piezoelectric Type	1
Oxygen Sensor (Bank 1, Sensor 1) (Bank 2, Sensor 1) (Bank 1, Sensor 2) (Bank 2, Sensor 2)	Type with Heater	4
Injector	High Pressure Slit Nozzle Type	4
EDU (Electronic Driver Unit)	Built-in DC/DC Converter	1

D-4 EFI (Electronic Fuel Injection) System

- In contrast to the conventional EFI (Electronic Fuel Injection), the D-4 (Direct Injection 4-Stroke Gasoline Engine) EFI conducts the injection volume control and injection timing control simultaneously.
- The injection volume is determined by the engine ECU, based on the signals from the vacuum sensor, to which corrections from various sensors are added. The engine ECU achieves optimal injection volume by controlling the fuel pressure and the opening time of the injector nozzle.
- A sequential multiport fuel injection system is used. The engine ECU calculates the optimal injection timing independently into each cylinder in accordance with the driving conditions.

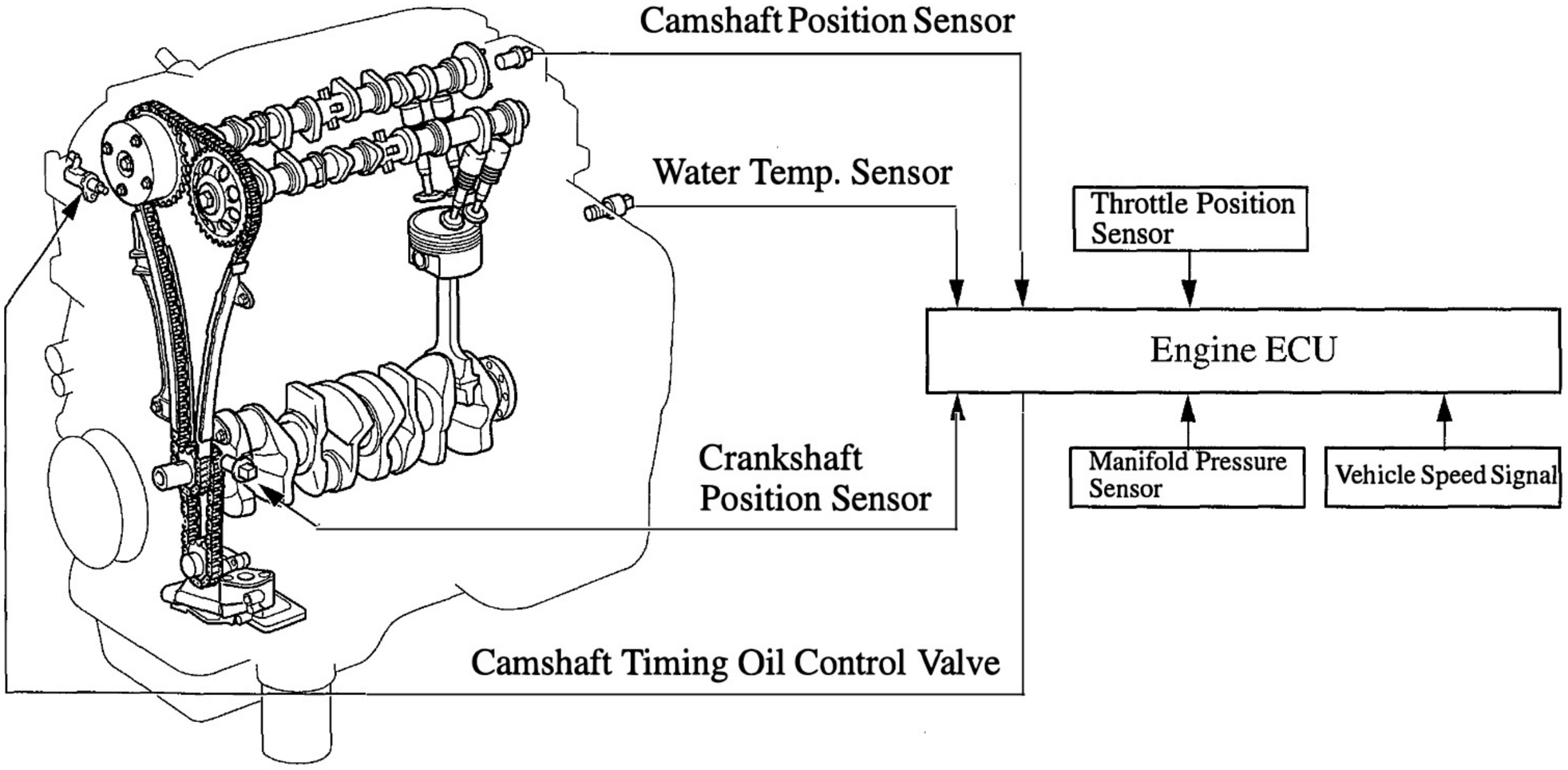


195EG33

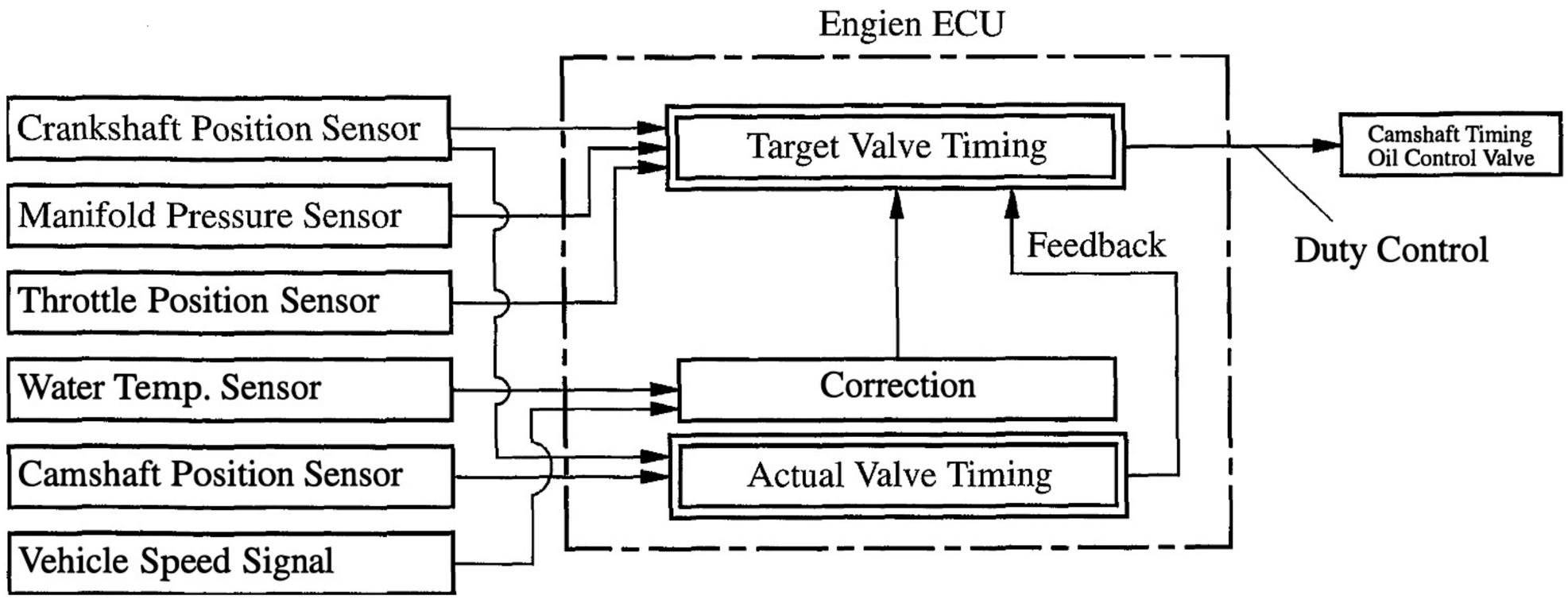
VVT-i (Variable Valve Timing-intelligent) System

1) General

The VVT-i system is designed to control the intake camshaft within a wide range of 53° (of crankshaft angle) to provide a valve timing that is optimally suited to the engine condition, thus realizing improved torque in all the speed ranges and fuel economy, and reduce exhaust emissions. The actual intake side valve timing is feedback by means of the camshaft position sensor for constant control to the target valve timing.



195EG34

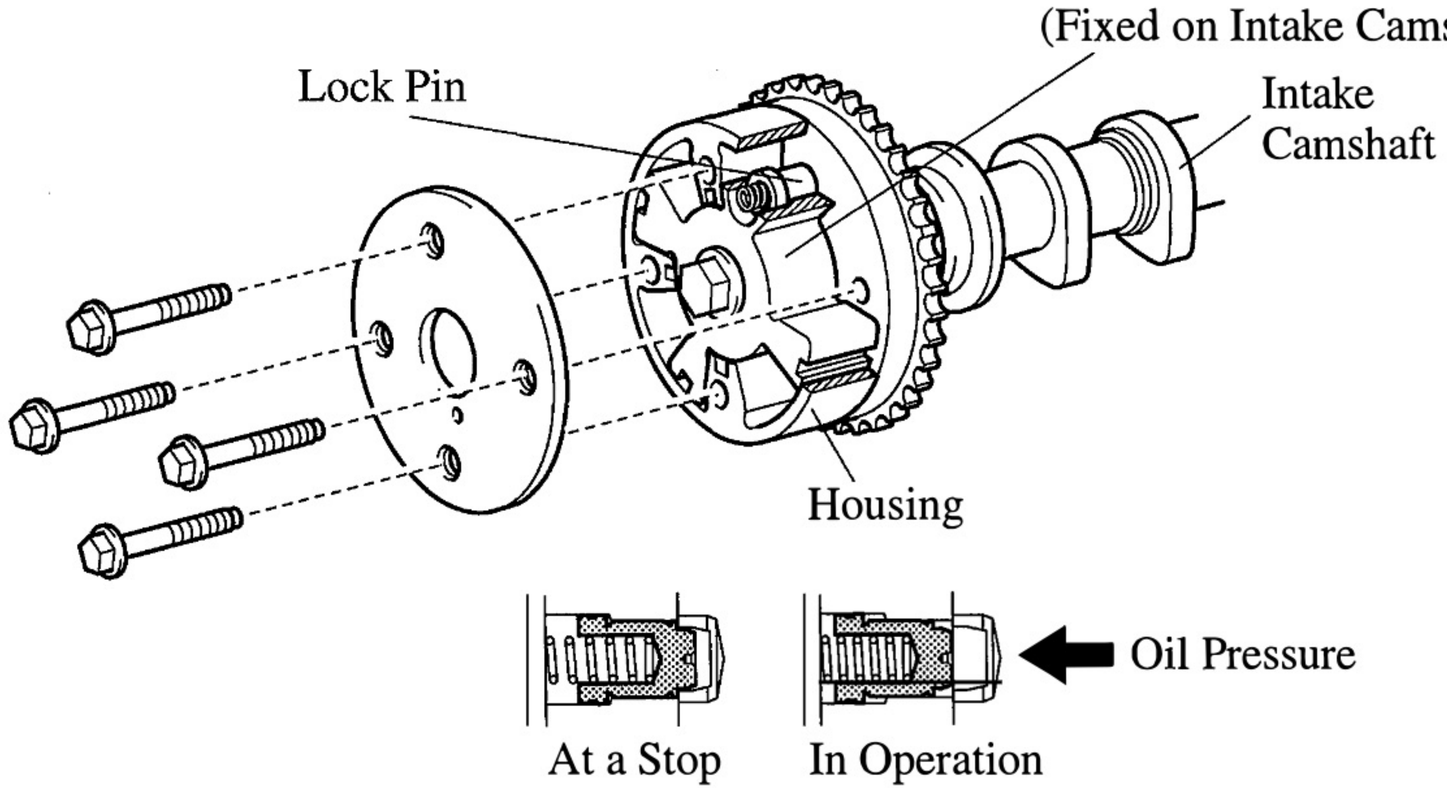


172CR07

2) Construction

a. VVT-i Controller

This controller consists of the housing driven from the timing chain and the vane coupled with the intake camshaft.
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 hydraulic 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.

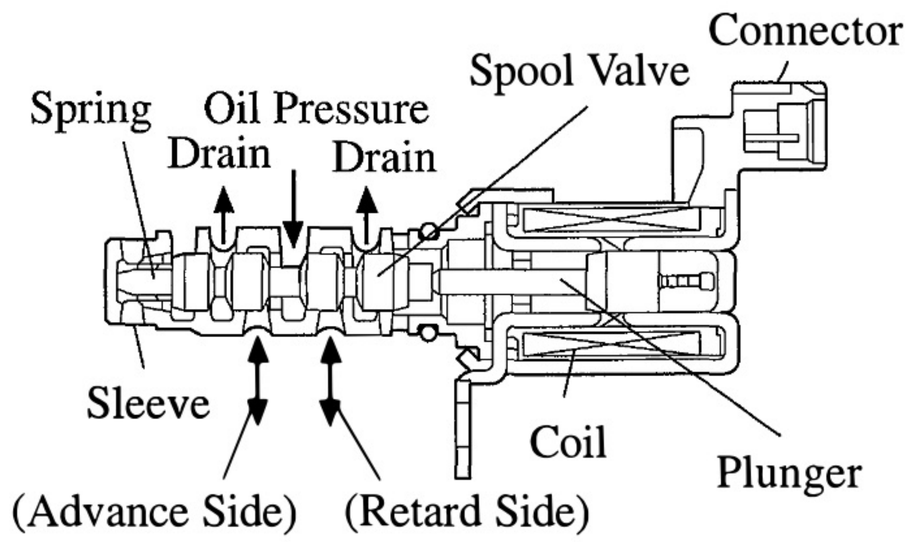


Lock Pin

169EG36

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 engine ECU 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.



To VVT-i Controller

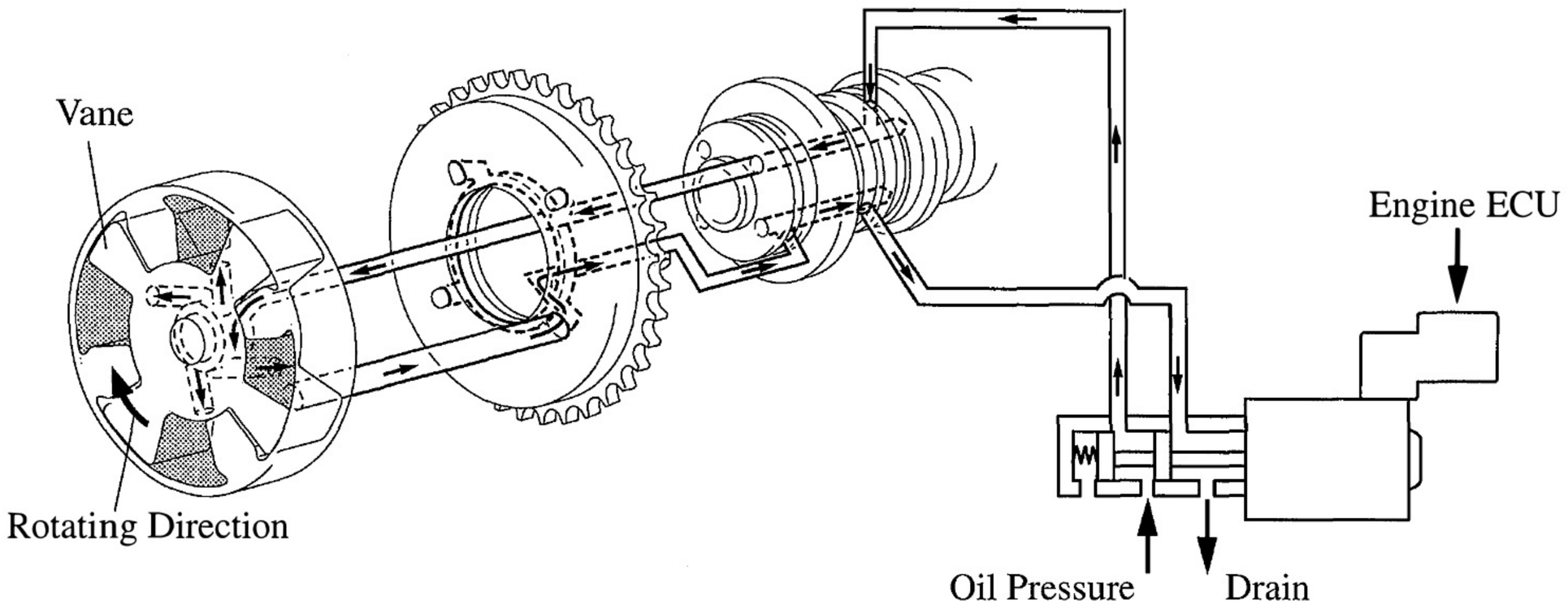
181EG39

c. Operation

- The camshaft timing oil control valve selects the path to the VVT-i controller according to the advance, retard or hold signal from the engine ECU. The VVT-i controller rotates the intake camshaft in the timing advance or retard position or holds it according to the position where the oil pressure is applied.

Advance

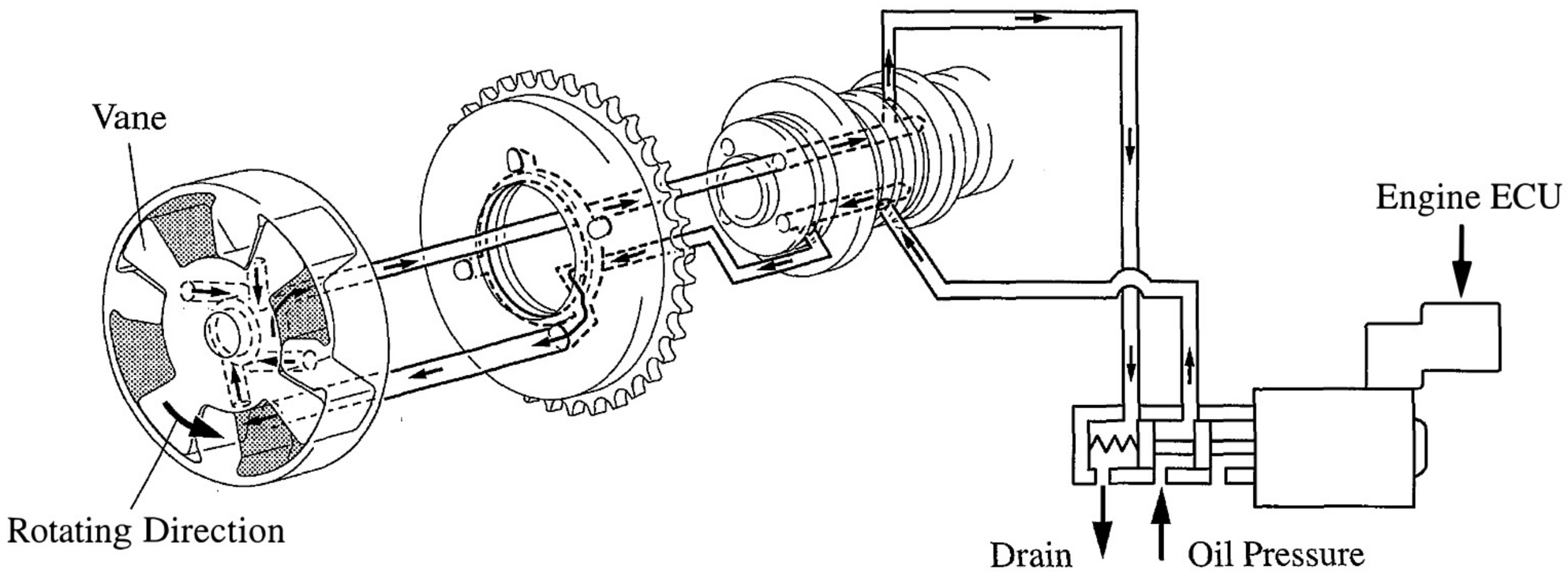
When the camshaft timing oil control valve is positioned as illustrated below by the advance signal from the engine ECU, the resultant oil pressure is applied to the timing advance side vane chamber to rotate the camshaft in the timing advance direction.



185EG18

Retard

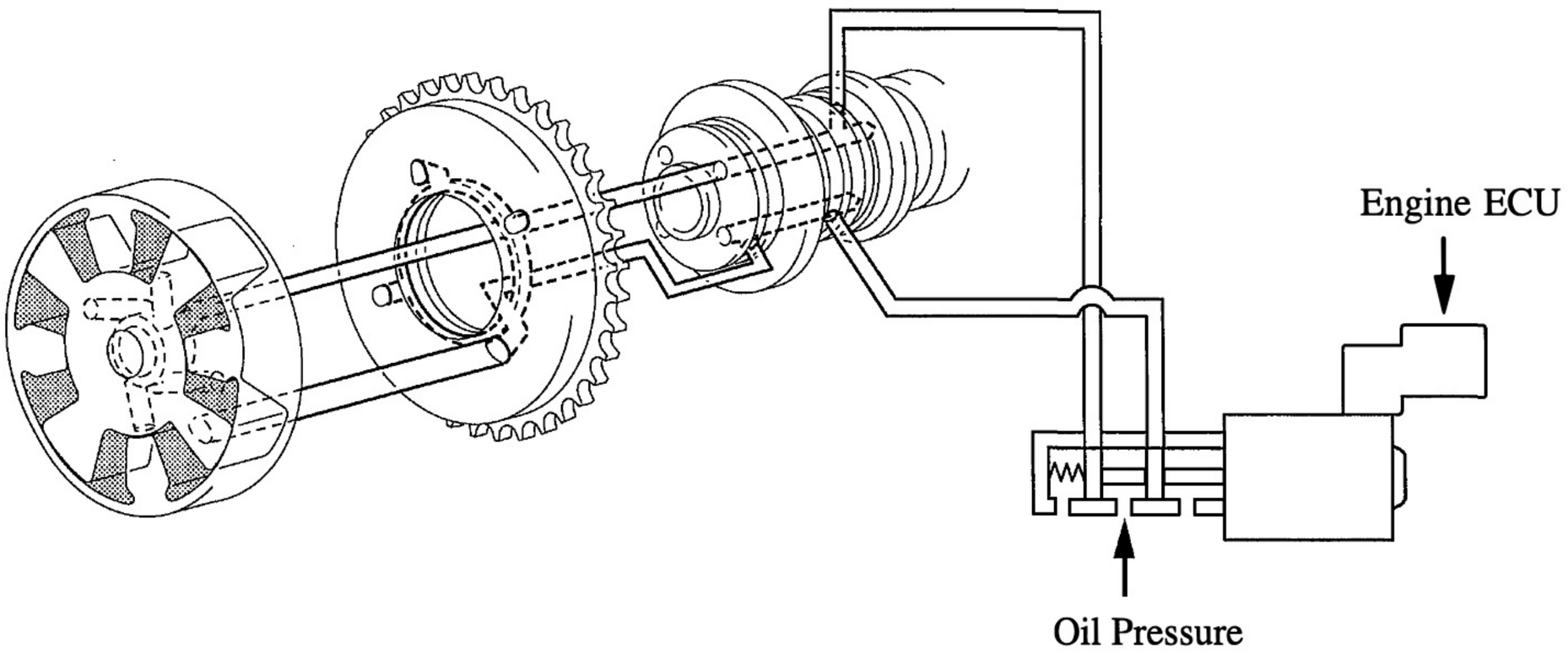
When the camshaft timing oil control valve is positioned as illustrated below by the retard signal from the engine ECU, the resultant oil pressure is applied to the timing retard side vane chamber to rotate the camshaft in the timing retard direction.



185EG19

Hold

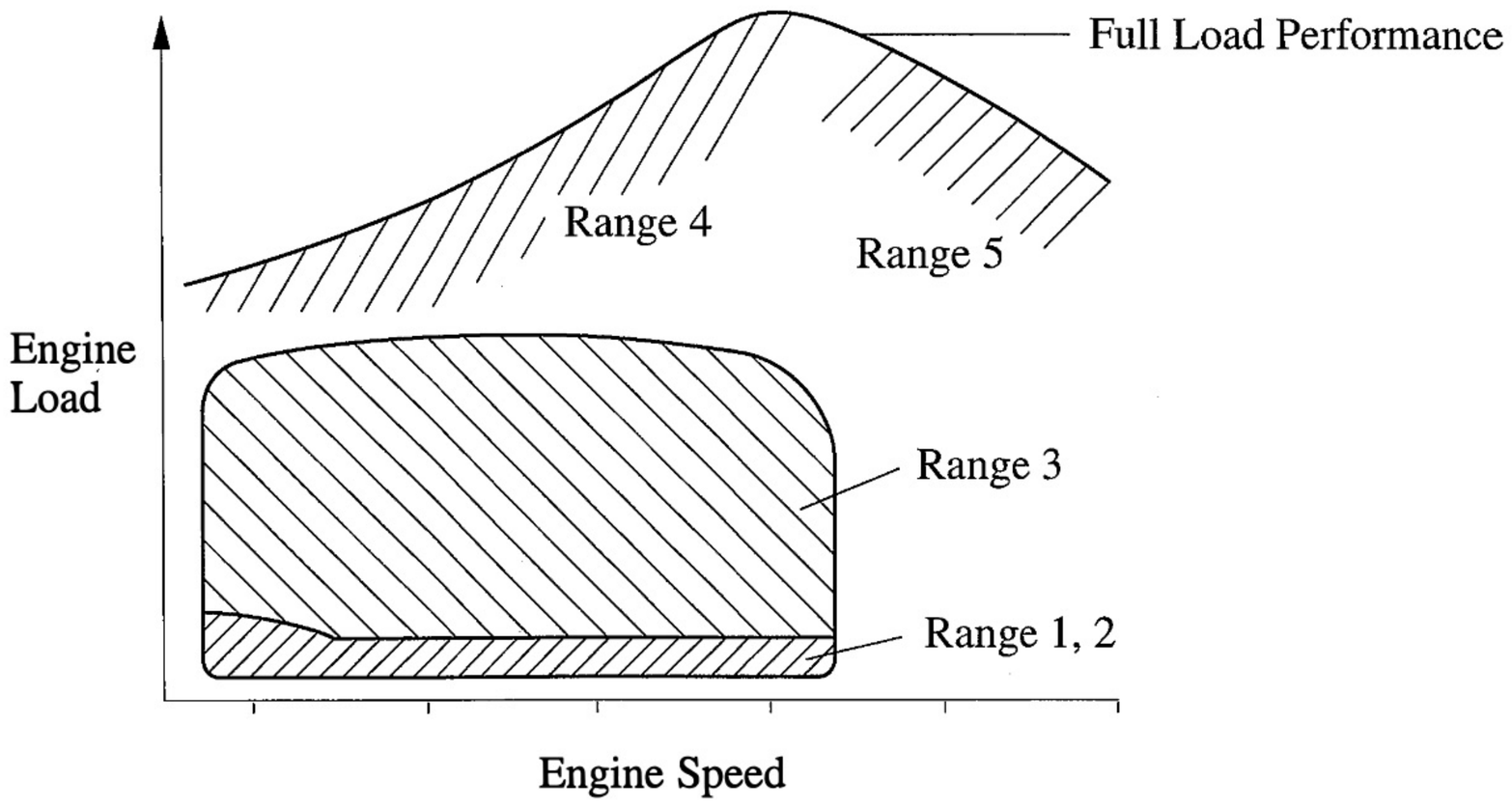
The engine ECU calculated the target timing angle according to the traveling state to perform control as described in the previous page. After setting at the target timing, the valve timing is held by keeping the camshaft timing oil control valve in the neutral position unless the traveling state changes.
The adjusts the valve timing at the desired target position and prevents the engine oil from running out when it is unnecessary.



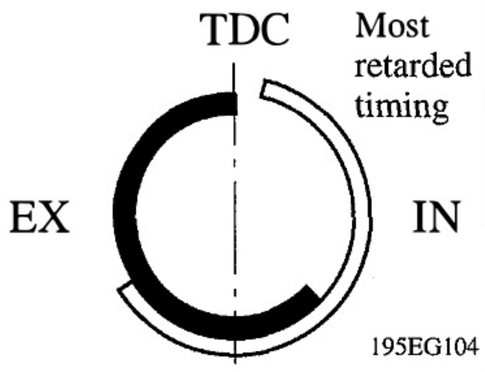
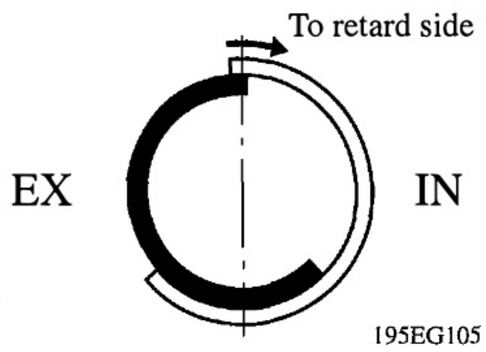
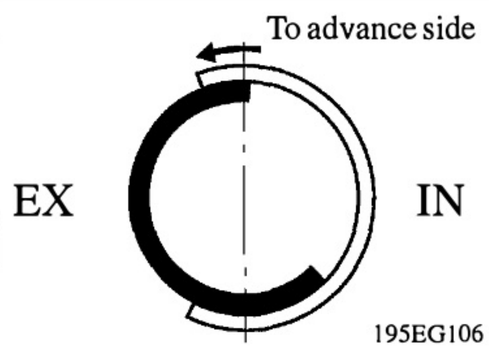
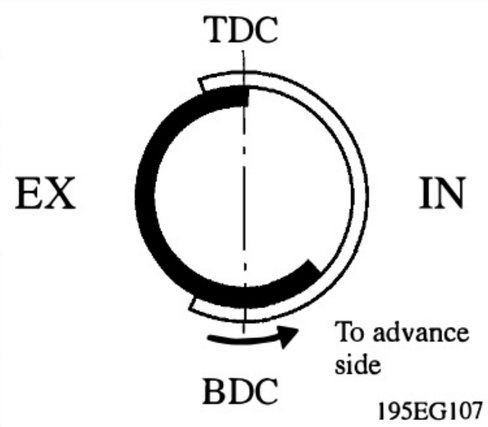
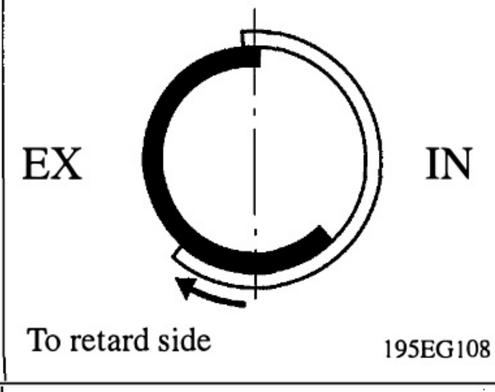
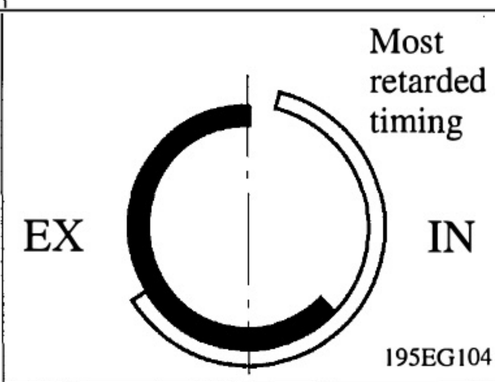
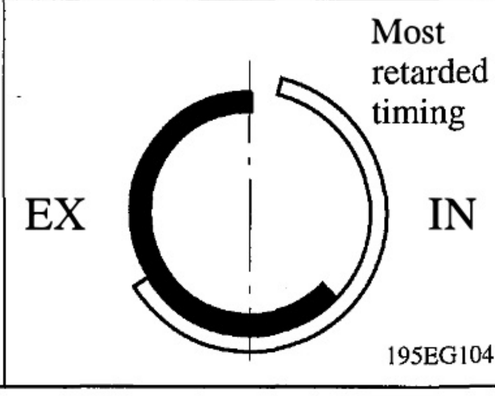
185EG20

- In proportion to the engine speed, intake air volume, throttle position and water temperature, the engine ECU calculates an optimal valve timing under each driving condition and controls the camshaft timing oil control valve. In addition, the engine ECU uses signal from the camshaft position sensor and the crankshaft position sensor to detect the actual valve timing, thus it is possible to perform feedback control to achieve the target valve timing.

▶ Operation During Various Driving Conditions (Conceptual Diagram) ◀



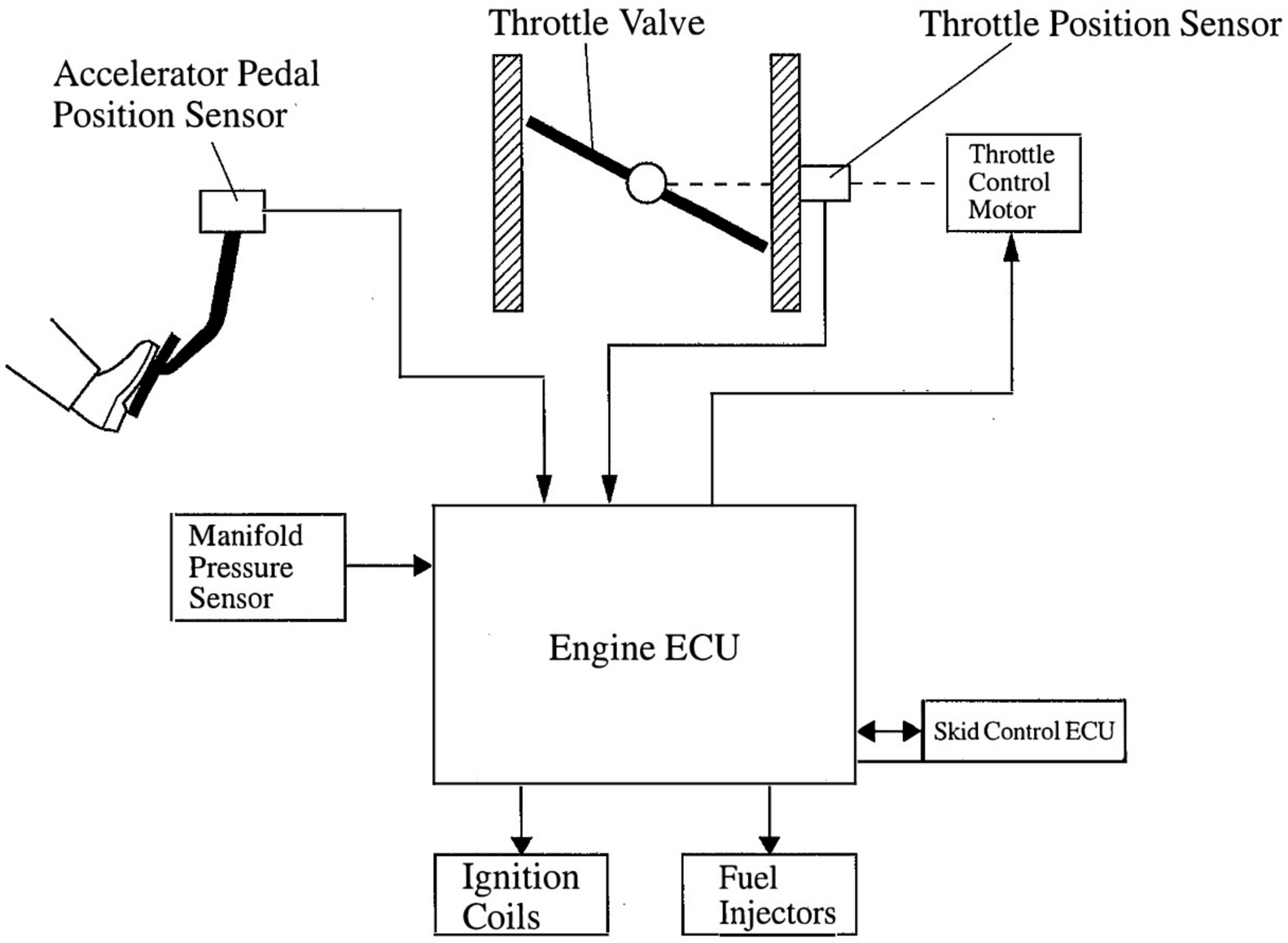
162EG46

Operation State	Range	Valve Timing	Objective	Effect
During Idling	1		Most retarded timing reduces blow back to the intake side	Stabilized idling rpm Better fuel economy
At Light Load	2		Decreasing overlap to eliminate blow back to the intake side	Ensured engine stability
At Medium Load	3		Increasing overlap to increase internal EGR for pumping loss elimination	Better fuel economy Improved emission control
In Low to Medium Speed Range with Heavy Load	4		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	5		Retarding the intake valve close timing for volumetric efficiency improvement	Improved output
At Low Temperatures	–		Most retarded timing to prevent blow back to the intake side leads to the lean burning condition, and stabilizes the idle speed at fast idling	Stabilized fast idle rpm Better fuel economy
Upon Starting/ Stopping the Engine	–		Most retarded timing minimizes blow back to the intake side	Improved startability

ETCS-i (Electronic Throttle Control System-intelligent)

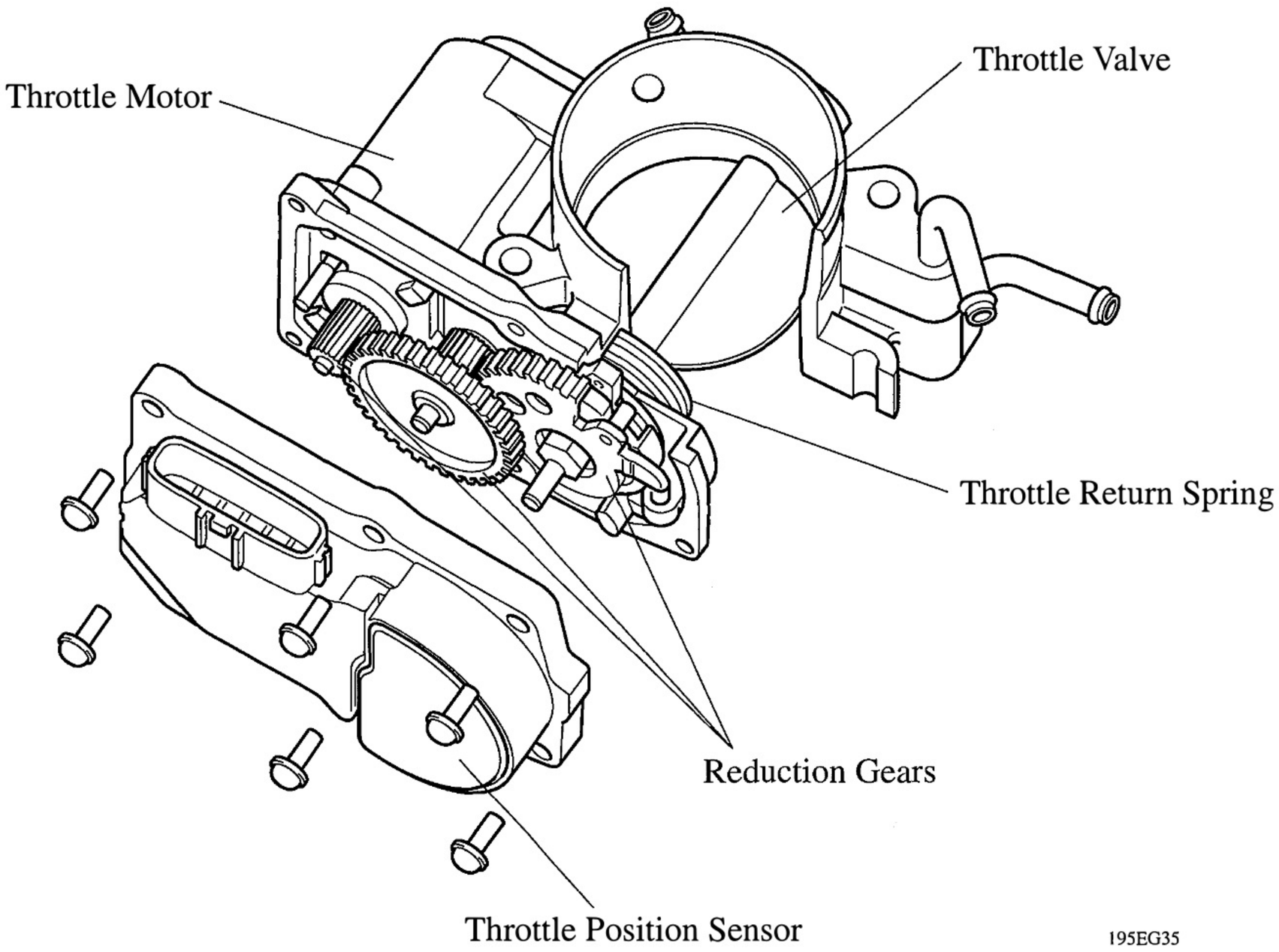
1) General

- The ETCS-i system, which realizes excellent throttle control in all the operating ranges, has been adopted. However, in the 1AZ-FSE engine, the accelerator cable has been discontinued, and an accelerator position sensor has been provided on the accelerator pedal. Accordingly, the limp-mode control during the fail-safe mode has been changed.
- In the conventional throttle body, the throttle valve opening is determined invariably by the amount of the accelerator pedal effort. In contrast, the ETCS-i uses the engine ECU to calculate the optimal throttle valve opening that is appropriate for the respective driving condition and uses a throttle control motor to control the opening.
- The ETCS-i controls the ISC (Idle Speed Control) system, the TRC (Traction Control) system and the VSC (Vehicle Stability Control) system.



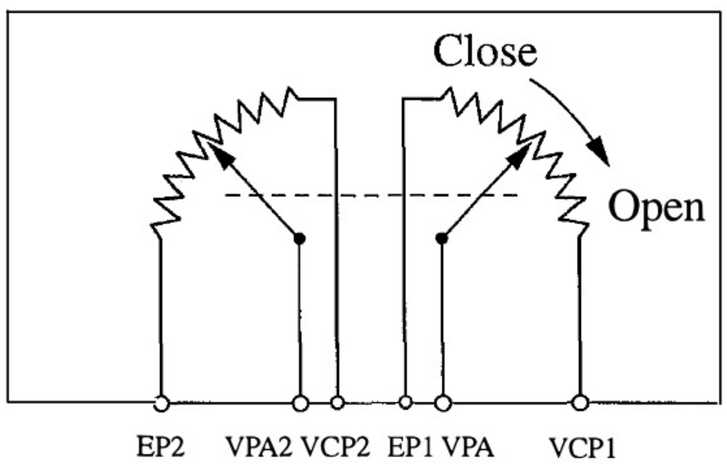
188EG54

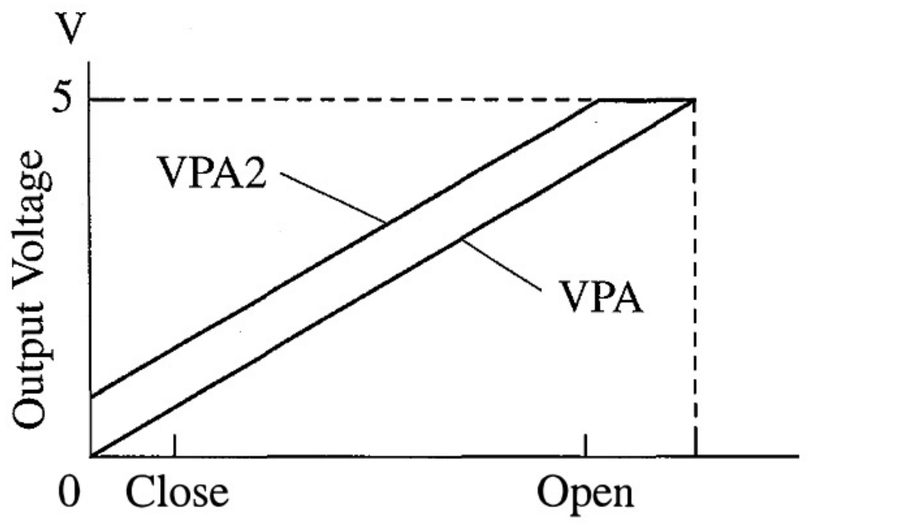
2) Construction



a. Accelerator Pedal Position Sensor

The accelerator pedal position sensor is attached to the accelerator pedal. This sensor converts the accelerator pedal depressed angles into electric signals with two differing characteristics and outputs them to the ECM. One is the VPA signal that linearly outputs the voltage along the entire range of the accelerator pedal depressed angle. The other is the VPA2 signal that outputs an offset voltage.

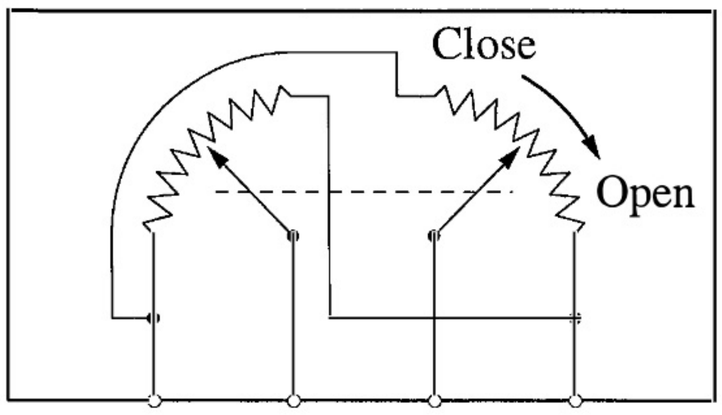




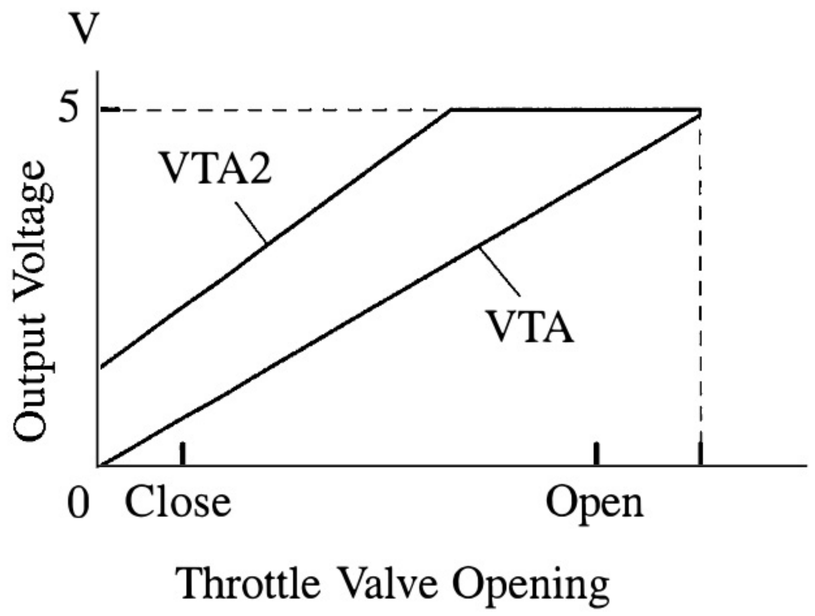
Accelerator Pedal Depressed Angle

b. Throttle Position Sensor

The throttle position sensor is attached to the throttle body.
This sensor converts the throttle valve opening angles into electric signals with two differing characteristics and outputs them to the engine ECU. One is the VTA signal that linearly outputs the voltage along the entire range of the throttle valve opening angle. The other is the VTA2 signal that outputs an offset voltage.



150EG40



150EG39

c. Throttle Control Motor

A DC motor with excellent response and minimal power consumption is used for the throttle control motor. The engine ECU performs the duty ratio control of the direction and the amperage of the current that flows to the throttle control motor in order to regulate the opening angle of the throttle valve.

3) Operation

The engine ECU drives the throttle control motor by determining the target throttle valve opening in accordance with the respective operating condition. The 1AZ-FSE engine mainly has the following ETCS-i controls.

a. Idle Speed Control

b. TRC Throttle Control

c. VSC Coordination Control

d. Maximum Vehicle Speed Control

e. Power Train Protection Control

f. Wheel Locking Protection Control

a. Idle Speed Control

Controls the engine ECU and the throttle valve in order to constantly effect ideal idle speed control.

b. TRC Throttle Control

As part of the TRC system, the throttle valve is closed by a demand signal from the skid control ECU if an excessive amount of slippage is created at a driving wheel, thus facilitating the vehicle in ensuring stability and driving force.

c. VSC Coordination Control

In order to bring the effectiveness of the VSC system control into full play, the throttle valve opening angle is controlled by effecting a coordination control with the skid control ECU.

d. Maximum Vehicle Speed Control

When the vehicle speed is exceeded the target speed, the engine ECU operates the throttle valve to the closing side and controls the maximum vehicle speed.

e. Power train protection control

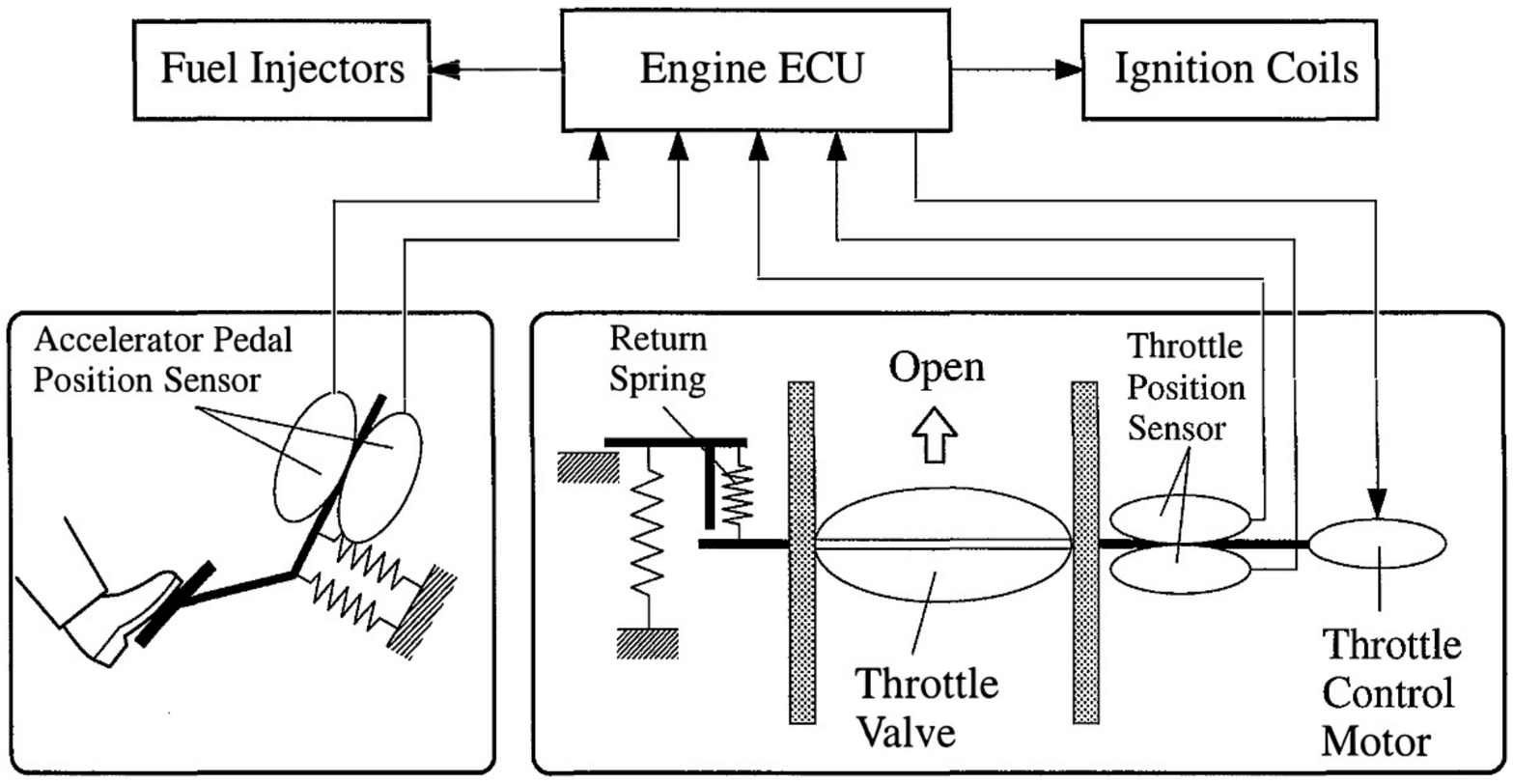
At the time of multiple shifting down when accelerating, the throttle valve opening is gradually controlled soon after the shift down in order to smooth the driving force change and to protect the driving system parts.

f. Wheel locking protection control

On the low μ road, when the driver down-shifted manually to decelerate, ECT (Electronically Controlled Transaxle) controls the opening of the throttle valve gradually in order to protect the driving wheels from locking soon after the deceleration.

4) Fail-Safe

If an abnormal condition occurs with the ETCS-i system, the check engine warning light in the combination meter illuminates to inform the driver. The accelerator pedal position sensor comprises two sensor circuits. Therefore, if an abnormal condition occurs in the accelerator pedal position sensor, and the engine ECU detects the abnormal voltage difference of the signals between these two sensor circuits, the engine ECU transfers to the limp mode by limiting the maximum opening angle of the throttle valve.
If an abnormal condition occurs in the throttle body system which comprises two sensor circuits, the engine ECU detects the abnormal voltage difference as the signals between these two circuits and cuts off the current to the throttle motor, causing the throttle valve to close. However, when the throttle motor is OFF, because a return spring is provided in the throttle valve, the force of the spring keeps the throttle valve slightly open from the fully closed state. In this state, fuel injection cutoff control and ignition timing retard control are effected in accordance with the accelerator opening, thus enabling the vehicle to be operated within the range of idling and limp mode.

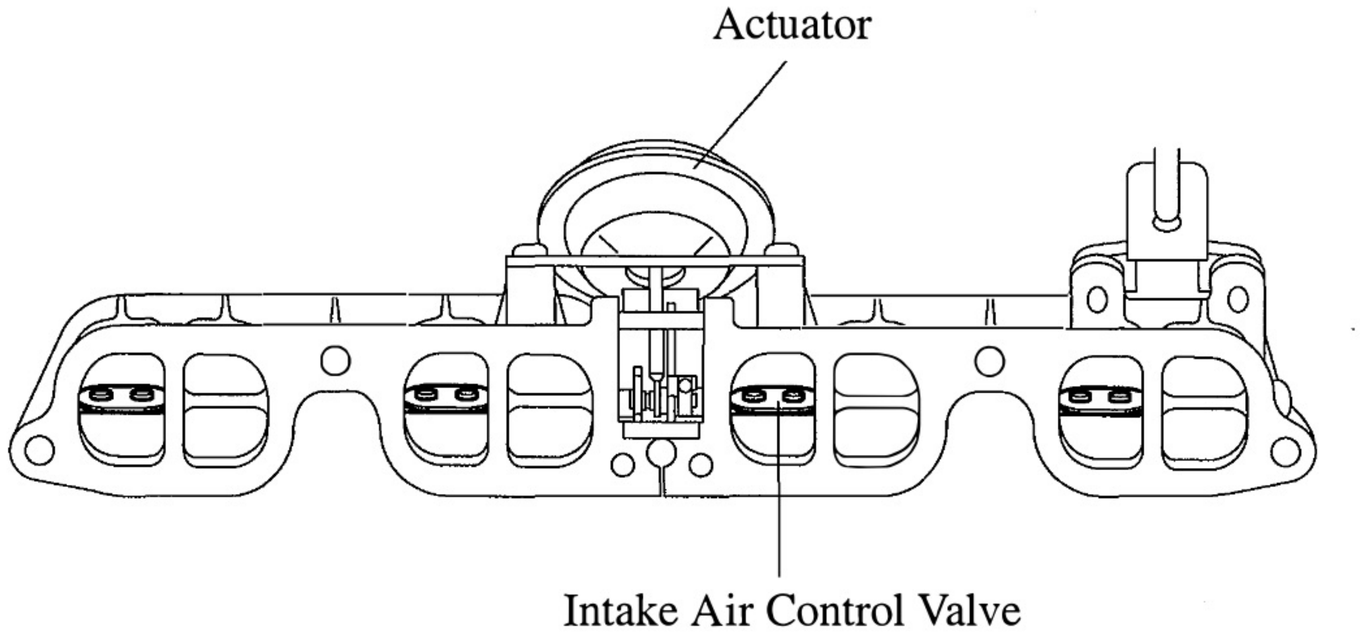


5) Diagnosis

The diagnostic trouble codes can be output via DLC3 to a hand-held tester. For details, refer to the 1AZ-FSE Engine Repair Manual (Pub. No. RM783E).

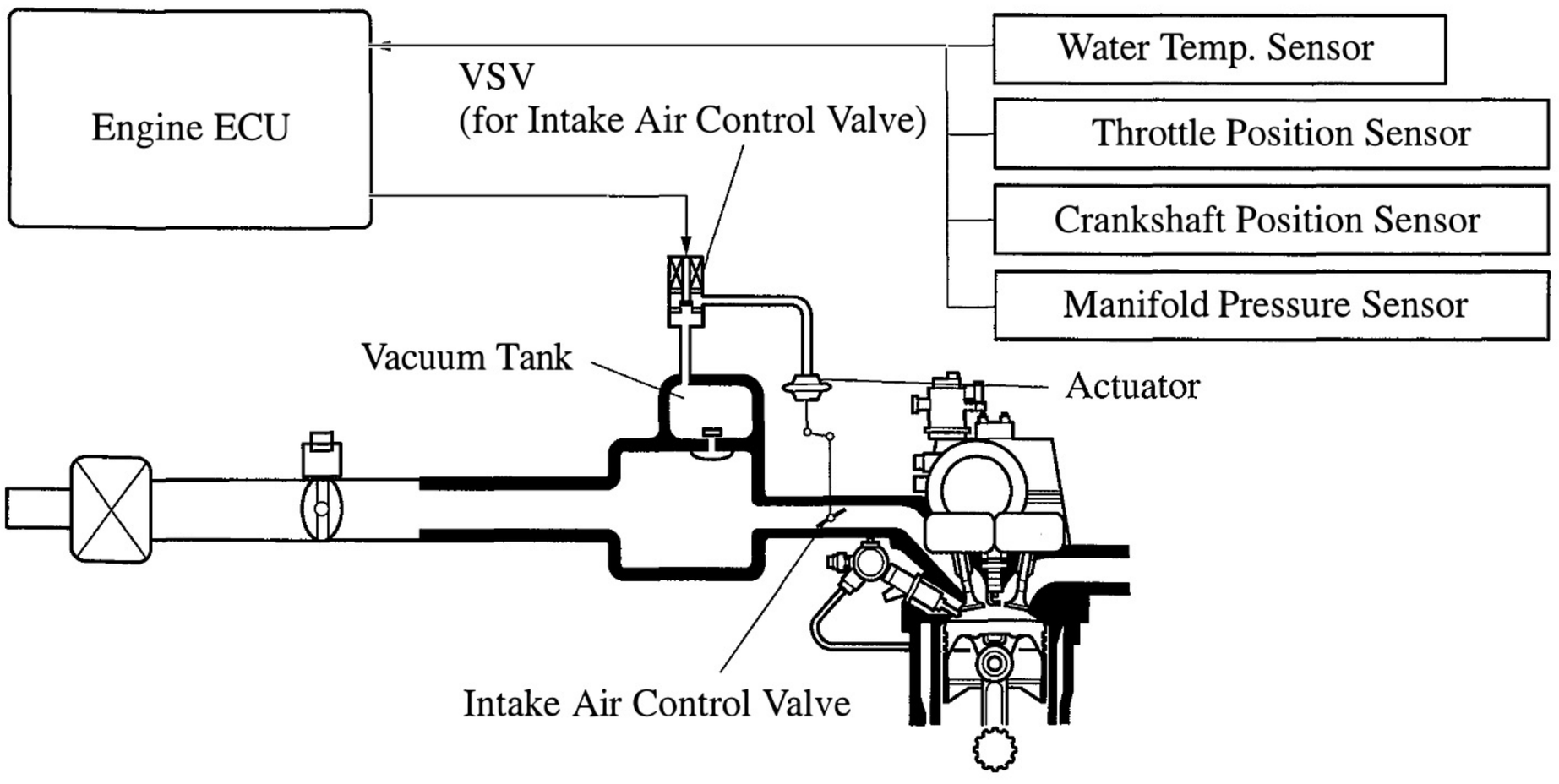
Intake Air Control System

- An aluminum die-cast intake air control valve has been provided between the intake manifold and the cylinder head.
- A valve is provided on one of the two intake ports that are provided for each cylinder, and this valve is closed when the engine is operating at low speeds. Thus, increasing the intake air flow velocity and improving the volumetric efficiency. The valve is also closed when the engine coolant temperature is low to promote the atomization of fuel by strengthening the swirl in the combustion chamber. As a result, combustion is stabilized.
- According to the operating conditions of the engine, the engine ECU actuates the VSV (for intake air control valve) to turn the intake air control valve ON/OFF by regulating the vacuum that is applied to the actuator. This uses the vacuum that is stored in the vacuum tank, which is integrated in the intake manifold.



195EG36

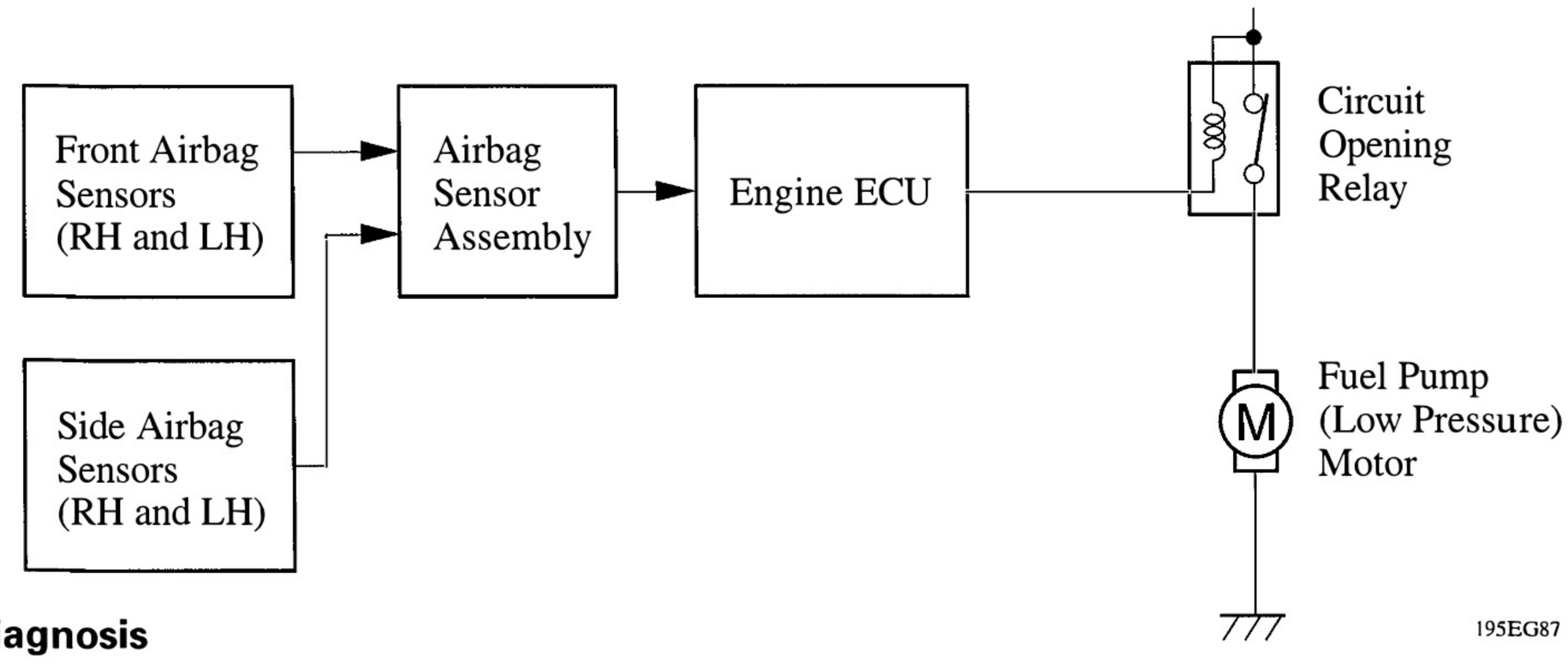
▶ System Diagram ◀



195EG37

Fuel Pump (Low Pressure) Control

A fuel cut control is adopted to stop the fuel pump when the airbag is deployed at the front or side collision. In this system, the airbag deployment signal from the airbag sensor assembly is detected by the engine ECU, and it turns OFF the circuit opening relay.
After the fuel cut control has been activated, turning the ignition switch from OFF to ON cancels the fuel cut control, thus engine can be restarted.



Diagnosis

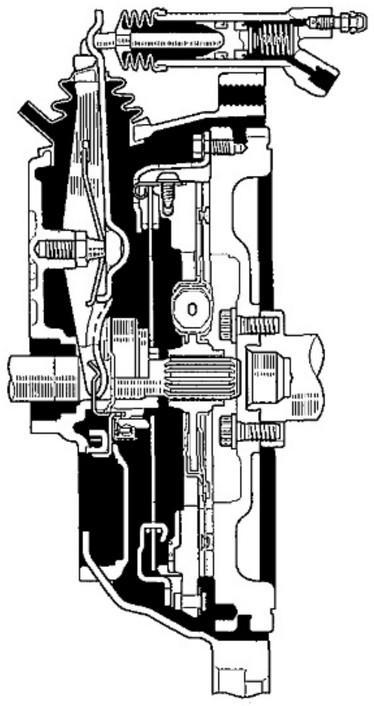
In accordance with the adoption of TOYOTA D-4 engine, DTSs (Diagnostic Trouble Codes) in the chart below are added. For details, refer to the 1AZ-FSE Engine Repair Manual (Pub. No. RM783E).

DTC No.	Detection Item	Trouble Area	Check Engine Warning Light	Memory
P0190	Fuel Rail Pressure Sensor Circuit Malfunction	● Open or short in fuel pressure sensor circuit ● Fuel pressure sensor ● Engine ECU	○	○
P0191	Fuel Rail Pressure Sensor Circuit Malfunction Range/Performance	● Fuel pressure sensor ● Engine ECU	○	○
P1215	EDU Circuit Malfunction	● Open or short in EDU circuit ● EDU ● Injector ● Engine ECU	○	○
P1235	Fuel Pump (High Pressure) Circuit Malfunction (Fuel leak)	● Open or short in fuel pump (high pressure) ● Fuel pump (high pressure) ● Engine ECU	○	○
P1653	VSV for IAC Valve Circuit Malfunction	● Open or short in VSV circuit for IAC Valve ● VSV for IAC Valve ● Engine ECU	○	○

■CLUTCH

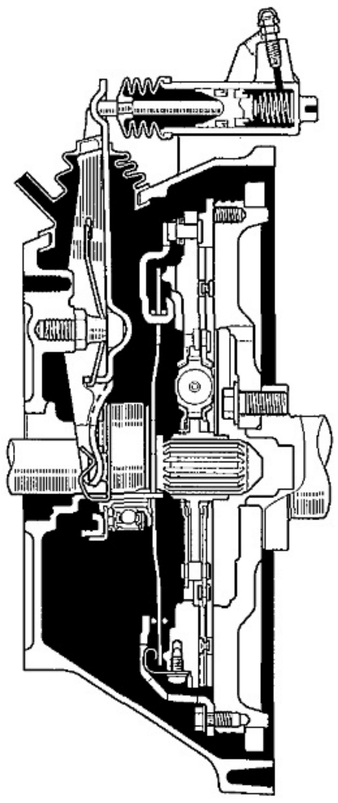
1. General

- In accordance with the adoption of 1ZZ-FE, 3ZZ-FE and 1AZ-FSE engines, the clutch disc and the clutch cover are optimized to each feature of engine.
- The clutch pedal has a turn-over mechanism to reduce clutch pedal effort on the 1AZ-FSE engine model.



185CH01

1ZZ-FE and 3ZZ-FE Engine Models



185CH02

1AZ-FSE Engine Model

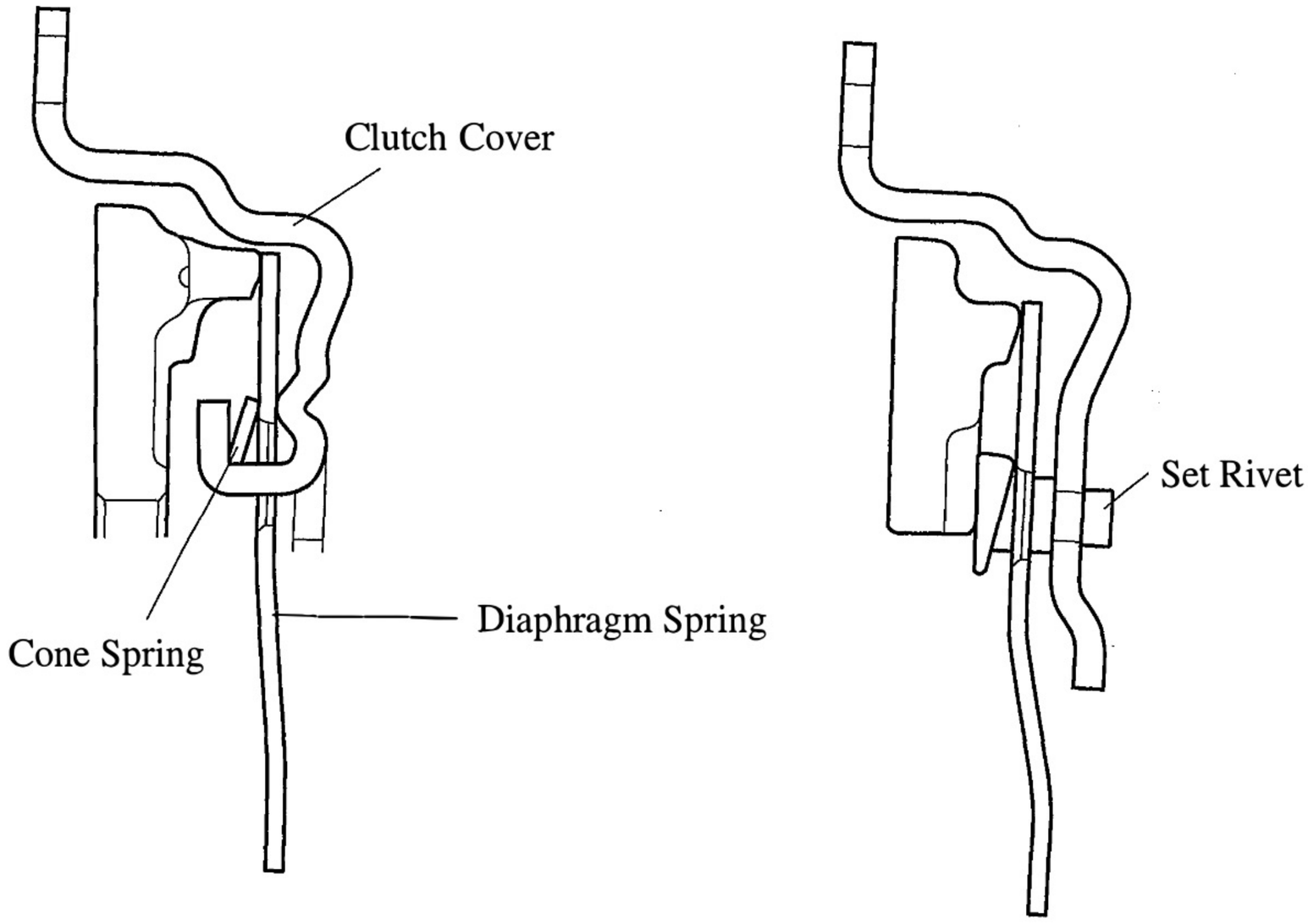
▶ Specifications ◀

Engine Type		1ZZ-FE	3ZZ-FE	1AZ-FSE
Clutch	Type	Dry Type Single Plate Clutch Diaphragm Spring	←	←
	Operation	Hydraulic	←	←
Clutch Cover	Type	CPO	←	←
	Size mm (in.)	212 (8.35)	←	224 (8.82)
	Installed Load N	4800	4300	5200
Clutch Disc	Facing Size* mm (in.)	212 x 140 x 3.4 (8.35 x 5.51 x 0.13)	←	224 x 150 x 3.4 (8.82 x 5.91 x 0.13)
	Facing Area cm^2 ($in.^2$)	199 (30.8)	←	217 (33.6)
Master Cylinder	Type	Conventional	←	←
	Cylinder Diameter mm (in.)	15.87 (0.62)	←	←
Release Cylinder	Type	Non-Adjustable	←	←
	Cylinder Diameter mm (in.)	20.64 (0.81)	←	←

*: Outer Diameter x Inner Diameter x Thickness

2. Clutch Cover

As compared with usual set rivet type, by using the cone spring at the fulcrum of the diaphragm spring, the clutch cover which has a structure to clog up the free play has been newly adopted for 1ZZ-FE, 3ZZ-FE and 1AZ-FSE engine models. Thus, performance of clutch releasing and reduction of the vibration have been improved.



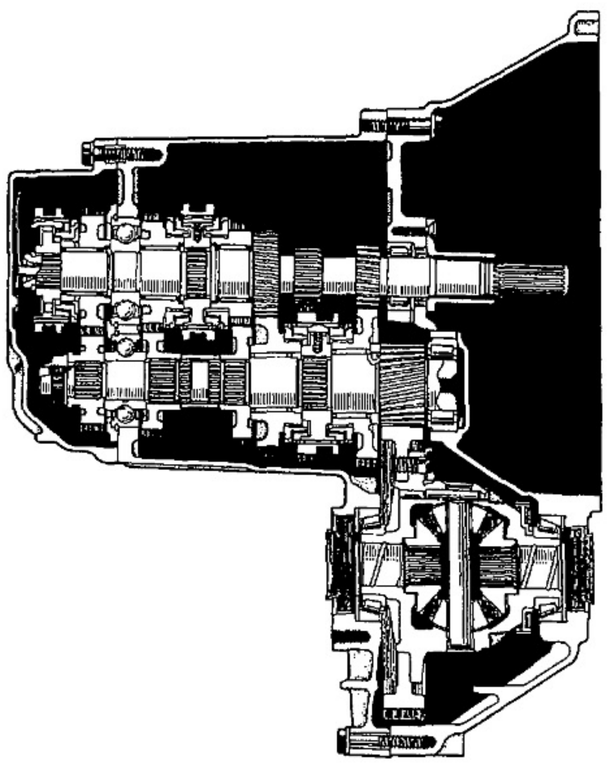
CPO Type **Set Rivet Type**

195CH01

■MANUAL TRANSAXLE

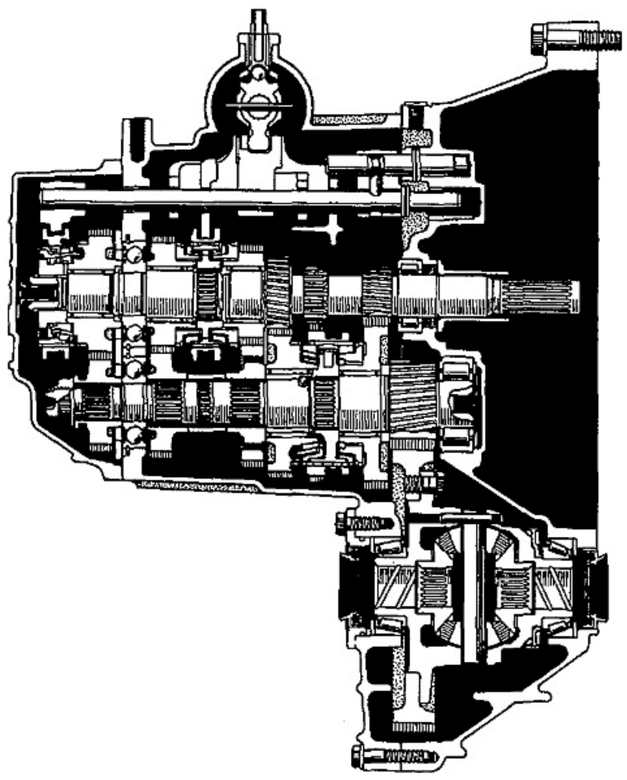
1. General

- The 1ZZ-FE engine model uses the C250 manual transaxle. However, in contrast to the previous model, a double-cone type synchromesh in the 2nd gear and a rolling type lock ball have been adopted.
- The 3ZZ-FE engine model uses the C50 manual transaxle. However, in contrast to the previous model, a rolling type lock ball has been adopted.
- 1AZ-FSE engine model uses the S55 manual transaxle.
- The 1CD-FTV engine model uses the E351 manual transaxle, instead of the previous E251 manual transaxle.
- The E351 manual transaxle has discontinued the use of an oil pump to reduce the volume of oil. The differential gear has been changed from the 4 pinion type of the previous (E251 manual transaxle) to the 2 pinion type to reduce weight.



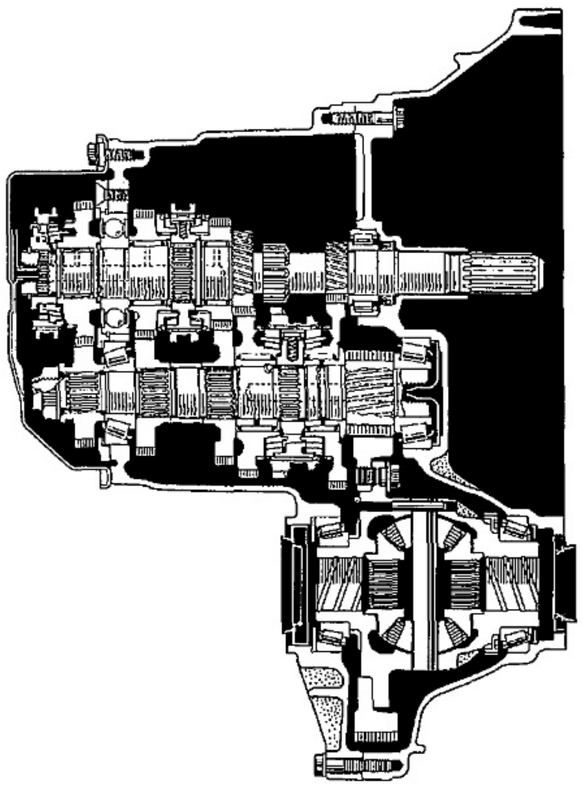
145CH07

C50 Series Manual Transaxle



145CH05

S54 Manual Transaxle



195CH27

E351 Manual Transaxle

▶ Specifications ◀

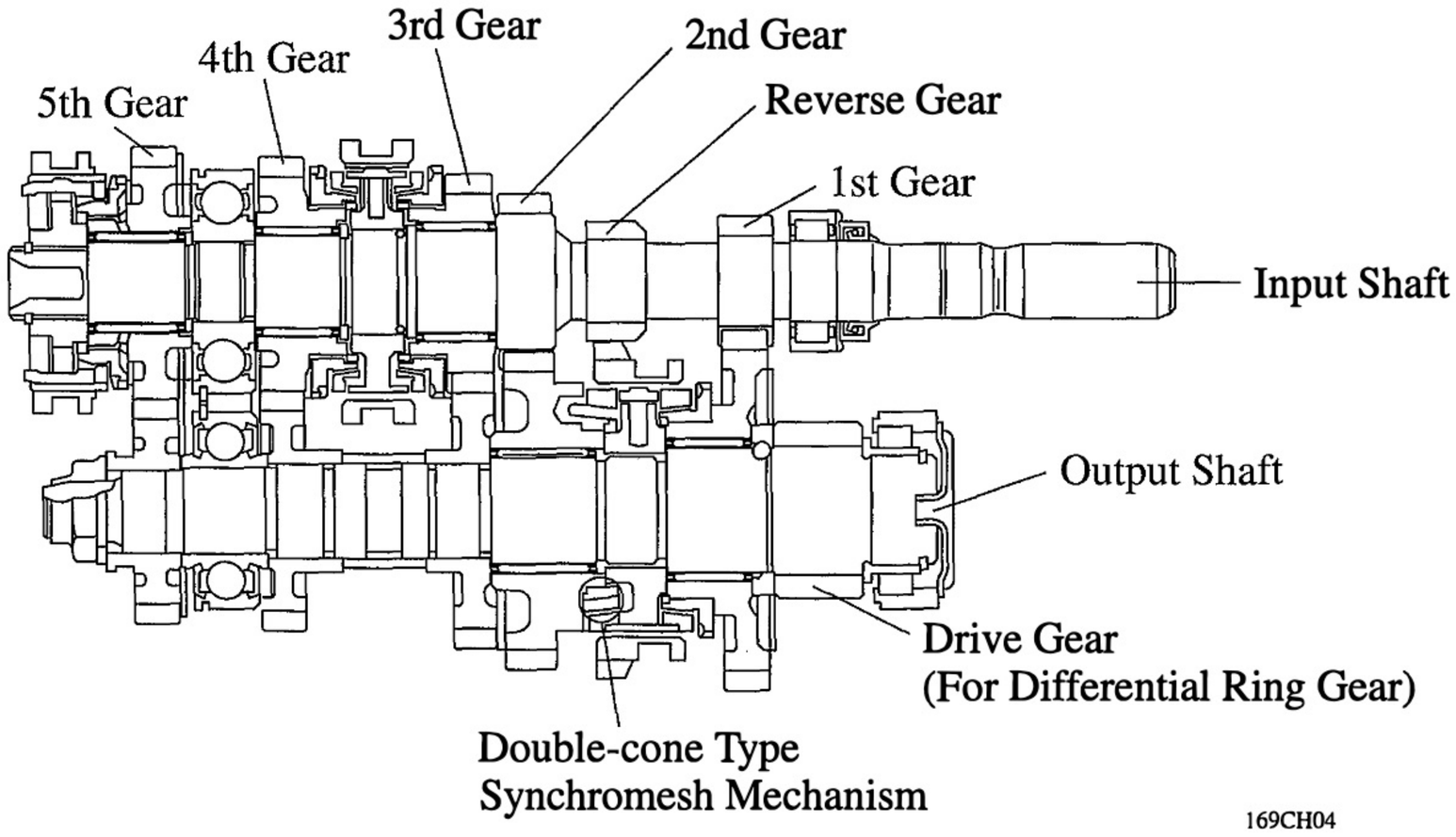
Engine Type		1ZZ-FE	3ZZ-FE	1AZ-FSE	1CD-FTV
Transaxle Type		C250	C50	S55	E351
Gear Ratio	1st	3.545	←	3.538	3.538
	2nd	1.904	←	2.041	2.045
	3rd	1.310	←	1.322	1.333
	4th	1.031	0.969	1.028	0.972
	5th	0.815	←	0.820	0.731
	Reverse	3.250	←	3.153	3.583
Differential Gear Ratio		3.941	4.058	3.736	3.684
Oil Capacity Liters (US qts, Imp. qts)		1.9 (2.0, 1.7)	←	2.2 (2.3, 1.9)	2.5 (2.6, 2.2)
Oil Viscosity		SAE 75W-90	←	←	←
Oil Grade		API GL-4 or GL-5	←	←	←

3

2. Transmission Gear

C250 Manual Transaxle

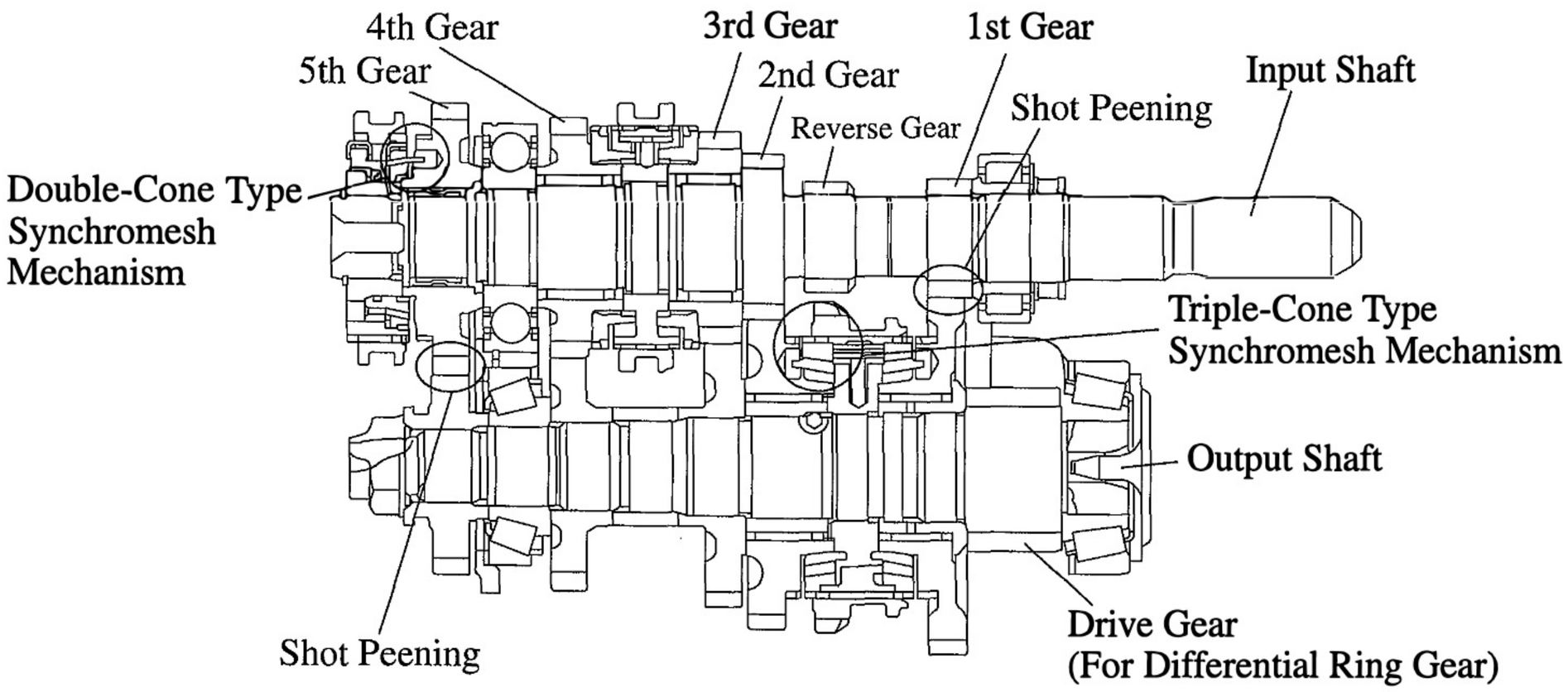
A double-cone type synchromesh mechanism is used for the 2nd gear to reduce the shift effort.



169CH04

E351 Manual Transaxle

- The gears have been strengthened by adopting shot-peened 1st and 5th gears and by optimizing the gear tooth flanks.
- A triple-cone type synchromesh mechanism is used for the 1st gear and 2nd gear to increase the synchronizer capacity. This helps to reduce the shifting effort and provide smoother shifting.
- A double-cone type synchromesh mechanism is used in the 5th gear to suppress gear engagement noise.

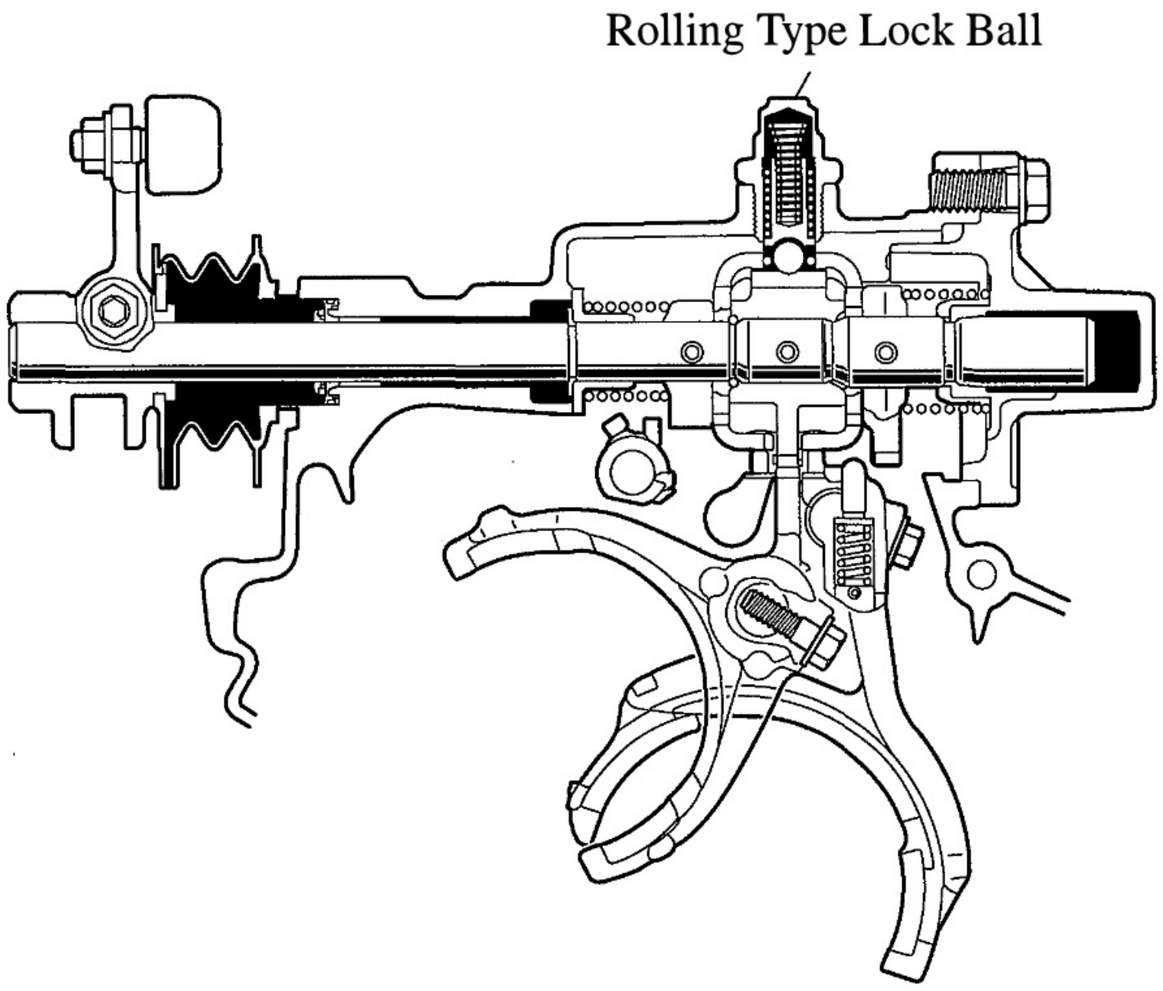


195CH02

3. Shift and Select Mechanism

C50 and C250 Manual Transaxles

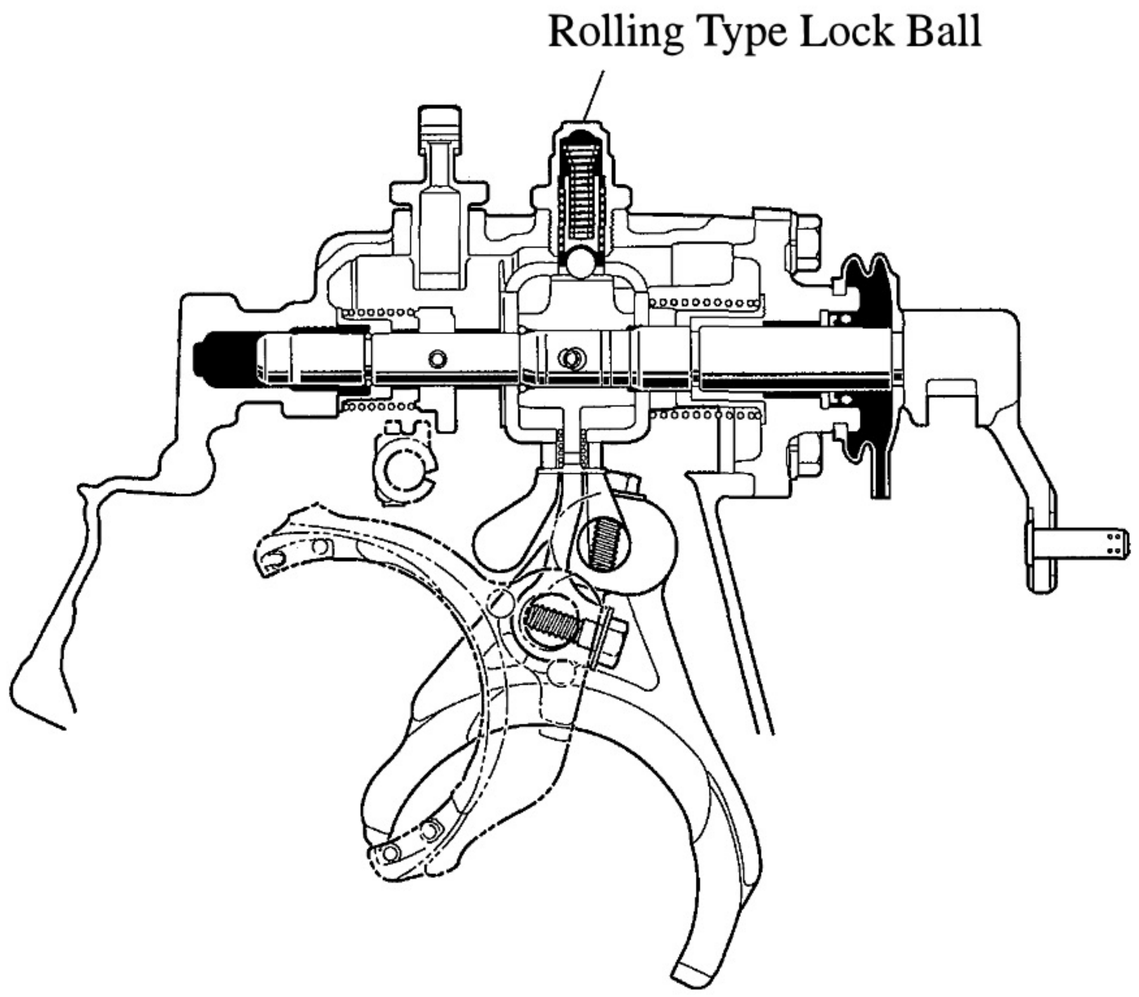
The shift feel has been improved through the adoption of the rolling type lock ball.



195CH03

E351 Manual Transaxle

The shift feel has been improved through the adoption of the rolling type lock ball.

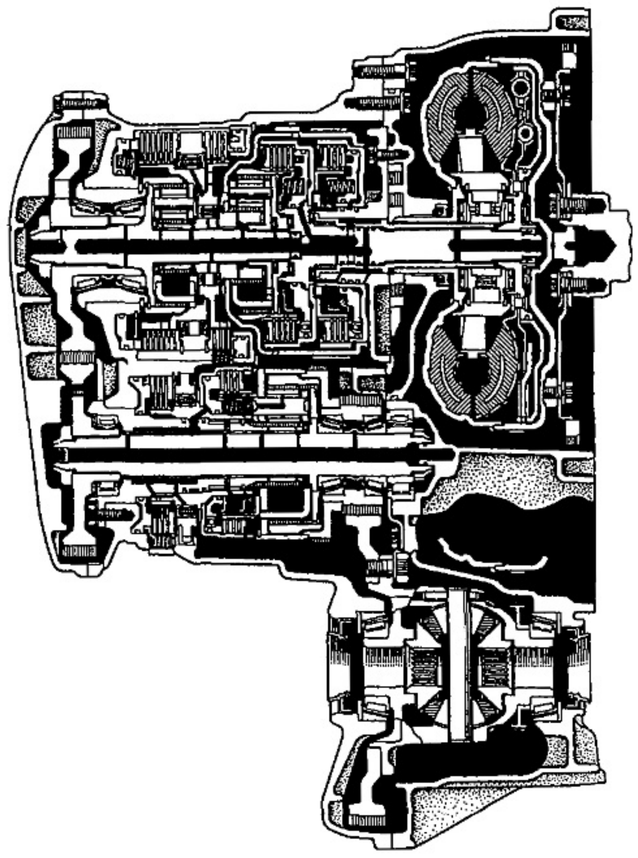


195CH04

■A246E AUTOMATIC TRANSAXLE

1. General

The 1ZZ-FE engine model uses the A246E automatic transaxle [ECT (Electronically Controlled Transaxle)]. In contrast to the previous model, an SLT solenoid valve has been adopted to effect optimal line pressure and clutch pressure control in accordance with the engine output and driving conditions. As a result, smooth shift characteristics have been realized.



145CH09

A246E Automatic Transaxle

▶ Specifications ◀

Engine Type		1ZZ-FE
Gear Ratio*1	1st	4.005
	2nd	2.208
	3rd	1.425
	4th	0.981
	Reverse	3.272
Differential Gear Ratio		2.962
Fluid Capacity	Liters (US qts, Imp. qts)	7.6 (8.0, 6.7)*2
Fluid Type		ATF Type D-II

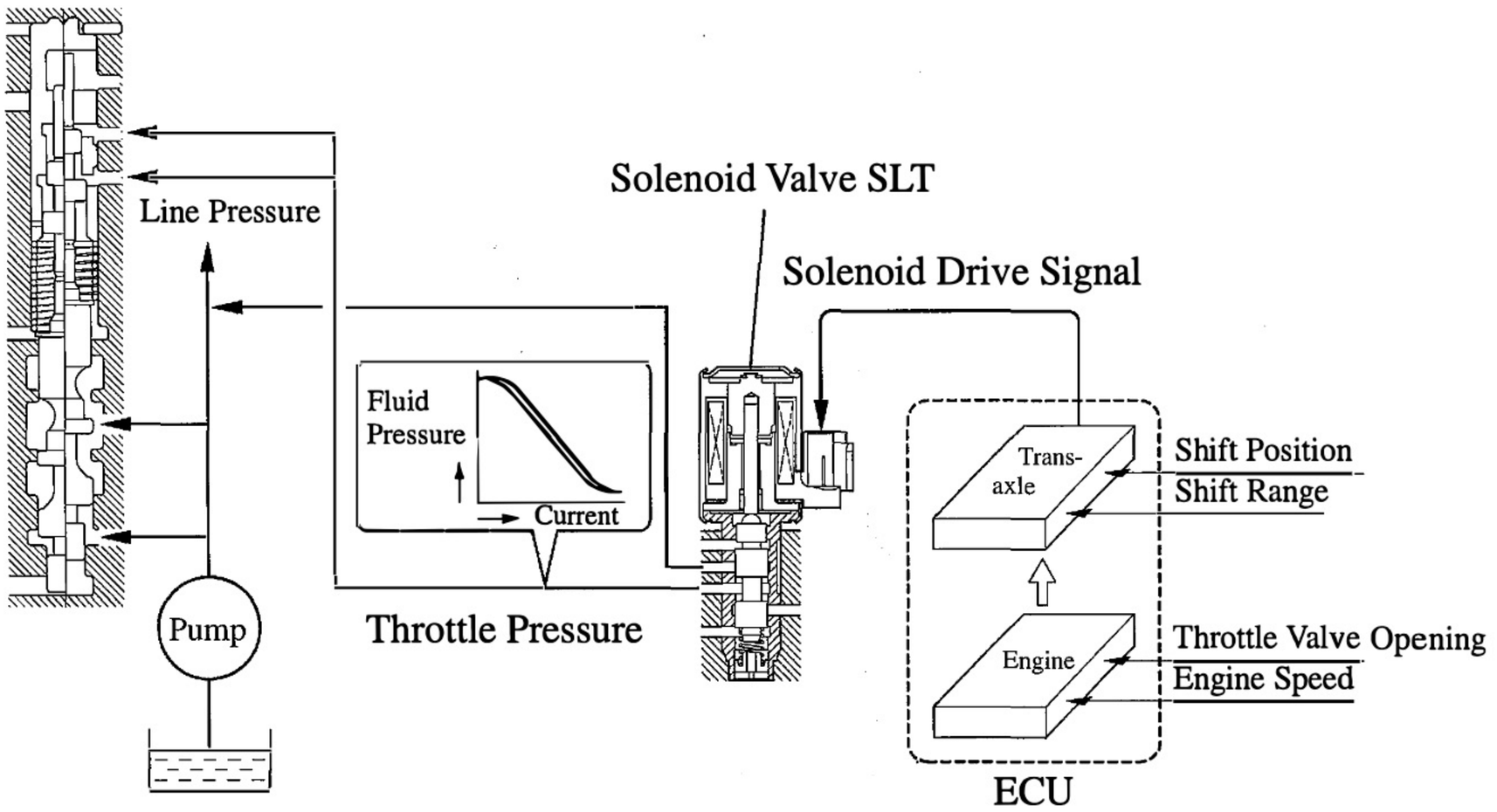
*1: Counter Gear Ratio Included

*2: Differential Included

2. Line Pressure Optimal Control

The line pressure is controlled by using a solenoid valve SLT. Through the use of the solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transaxle. Accordingly, the line pressure can be controlled minutely in accordance with the engine output, driving condition, thus realizing smooth shift characteristics and optimizing the workload on the oil pump.

Primary Regulator

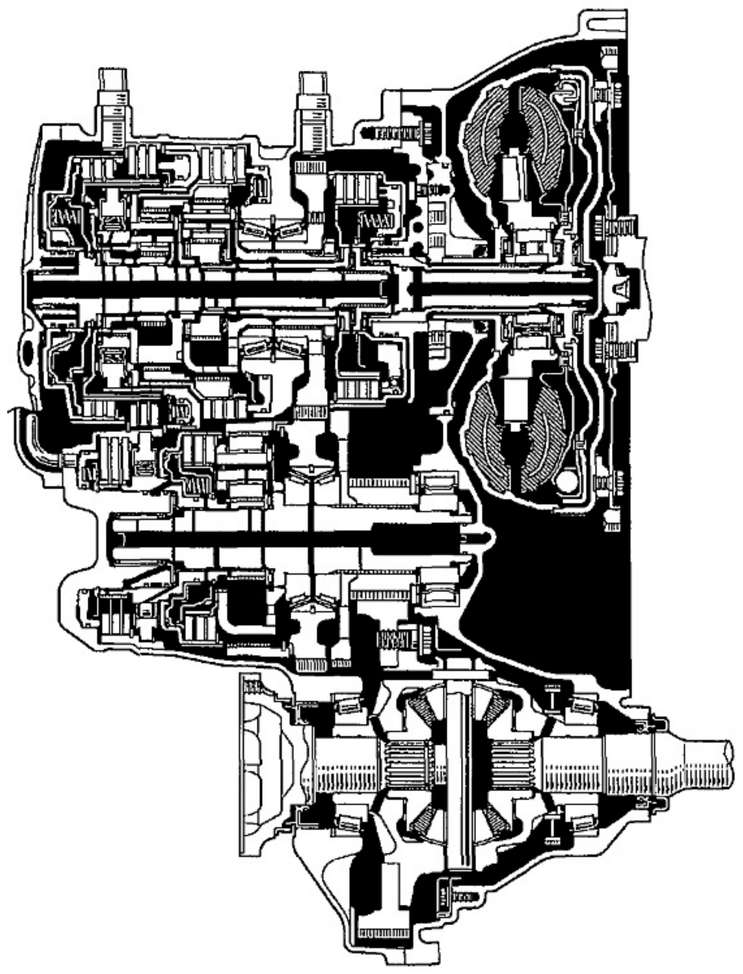


178CH09

■U240E AUTOMATIC TRANSAXLE

1. General

- The compact and high-capacity 4-speed U240E automatic transaxle [Super ECT (Electronically Controlled Transaxle)] has been newly adopted on the models for 1AZ-FSE engine.
- The U240E automatic transaxle has adopted a planetary gear unit with a new gear layout.
- It is equipped with a diagnosis function, and its diagnostic trouble codes can be accessed through the O/D indicator light or by connecting a hand-held tester. For details, refer to the AVENSIS Chassis & Body Repair Manual Supplement (Pub. No. RM781E)
- A shift lock mechanism in incorporated to minimize the possibility of incorrect operation of the automatic transaxle.
- Automatic transaxle fluid is used T-IV.



169CH12

▶ Specifications ◀

Gear Ratio*1	1st	3.943
	2nd	2.197
	3rd	1.413
	4th	1.020
	Reverse	3.145
Differential Gear Ratio		2.923
Fluid Capacity Liters (US qts, Imp. qts)		7.6 (8.0, 6.7)*2
Fluid Type		ATF Type T-IV

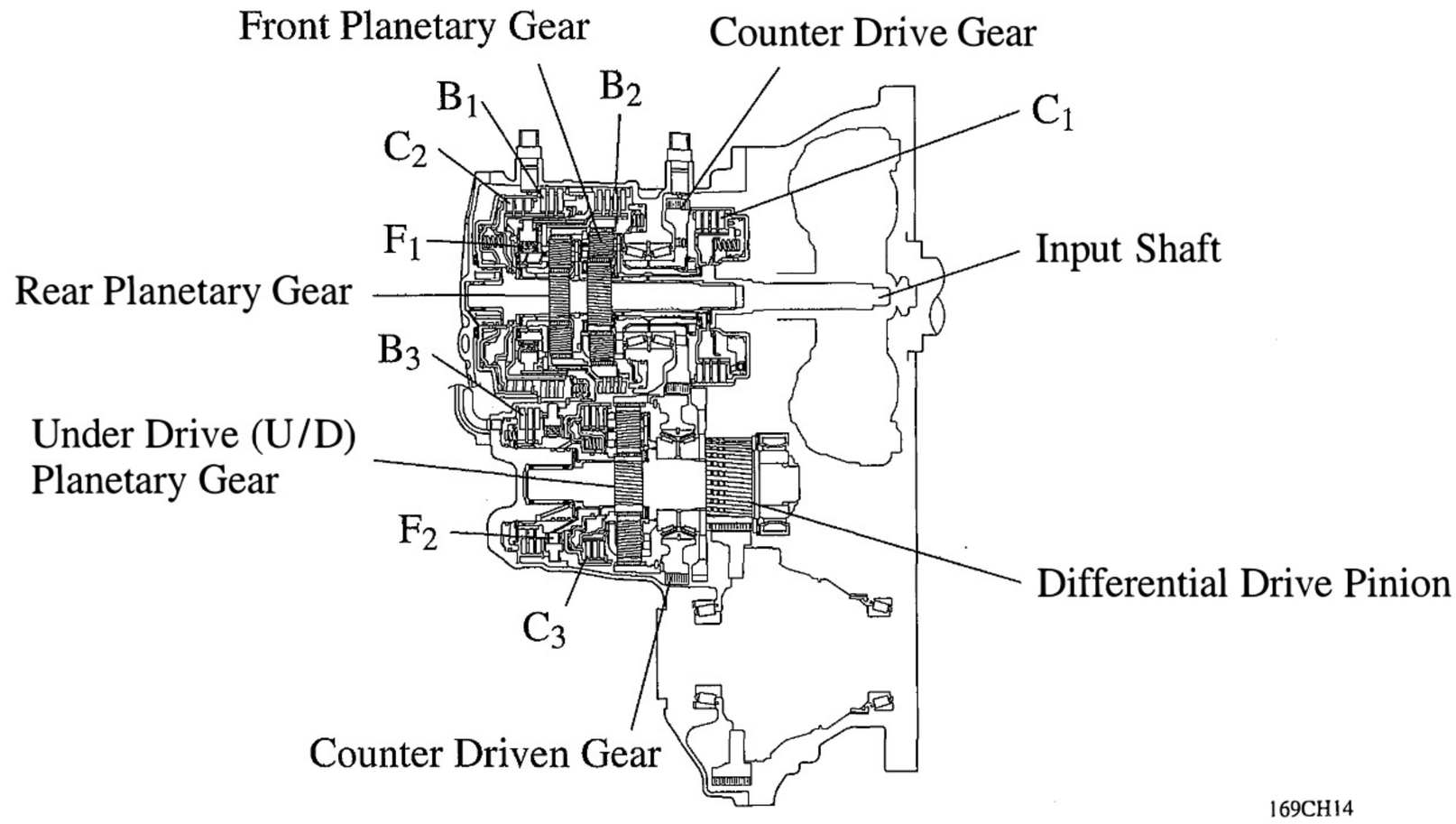
*1: Counter Gear Ratio Included

*2: Differential Included

2. Planetary Gear Unit

General

The U240E automatic transaxle has adopted a new gear layout. In the new gear layout, the counter drive and driven gear are placed in front of the front planetary gear and the under drive (U/D) planetary gear unit is placed above the counter shaft. Furthermore, the force transmission method has been changed by eliminating the brake and the one-way clutch. As a result, a torque capacity that accommodates the high output engine has been attained, while realizing a compact gear unit.



169CH14

▶ Specifications ◀

C_1	Forward Clutch	The No. of Discs	4
C_2	Direct Clutch		4
C_3	U/D Direct Clutch		3
B_1	2nd Brake		4
B_2	1st & Reverse Brake		5
B_3	U/D Brake		3
F_1	No.1 One-Way Clutch	The No. of Sprags	28
F_2	U/D One-Way Clutch		15
Front Planetary Gear		The No. of Sun Gear Teeth	43
		The No. of Pinion Gear Teeth	17
		The No. of Ring Gear Teeth	77
Rear Planetary Gear		The No. of Sun Gear Teeth	31
		The No. of Pinion Gear Teeth	19
		The No. of Ring Gear Teeth	69
U/D Planetary Gear		The No. of Sun Gear Teeth	32
		The No. of Pinion Gear Teeth	26
		The No. of Ring Gear Teeth	83
Counter Gear		The No. of Drive Gear Teeth	50
		The No. of Driven Gear Teeth	51

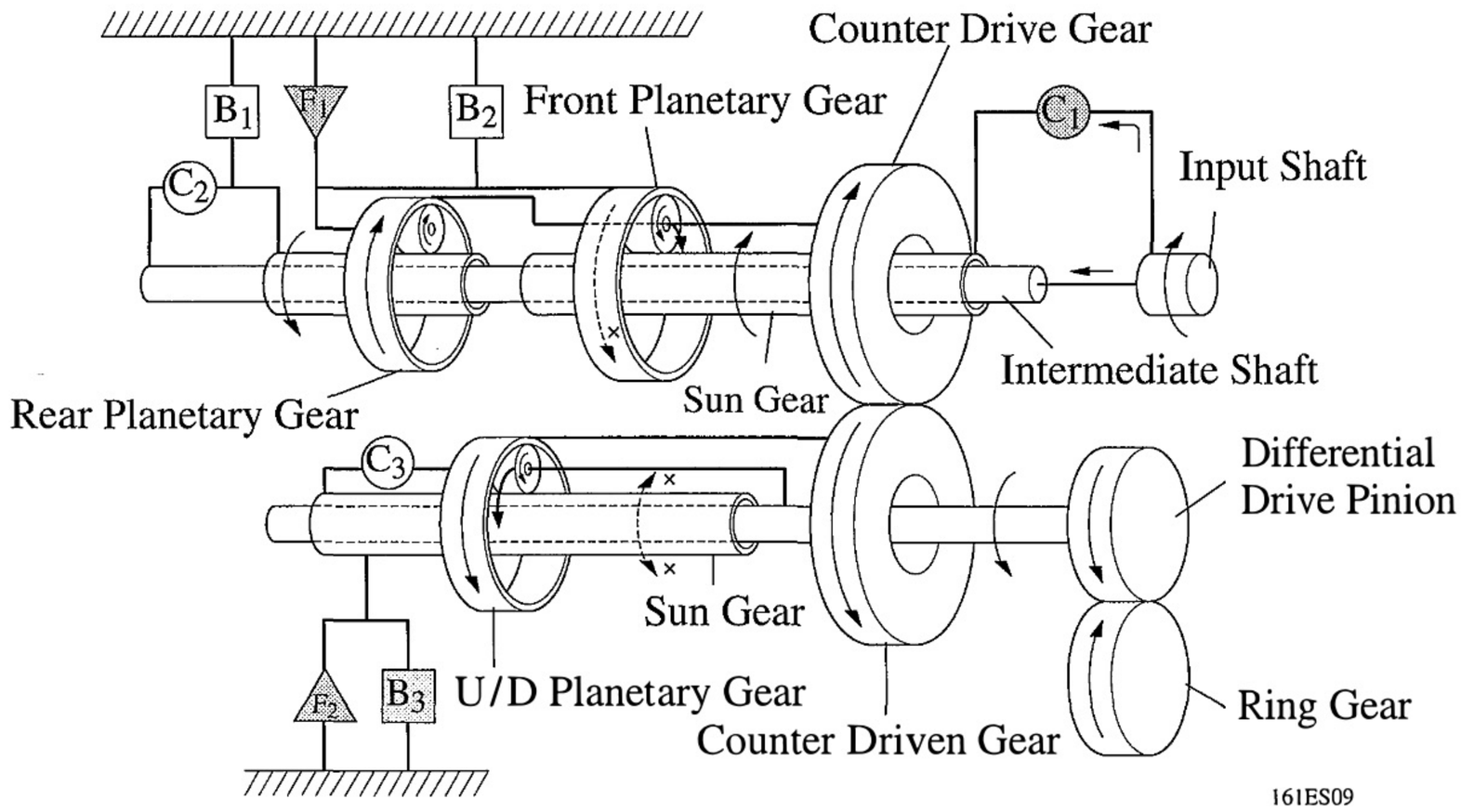
Motive Power Transaxle

▶ Operating Conditions ◀

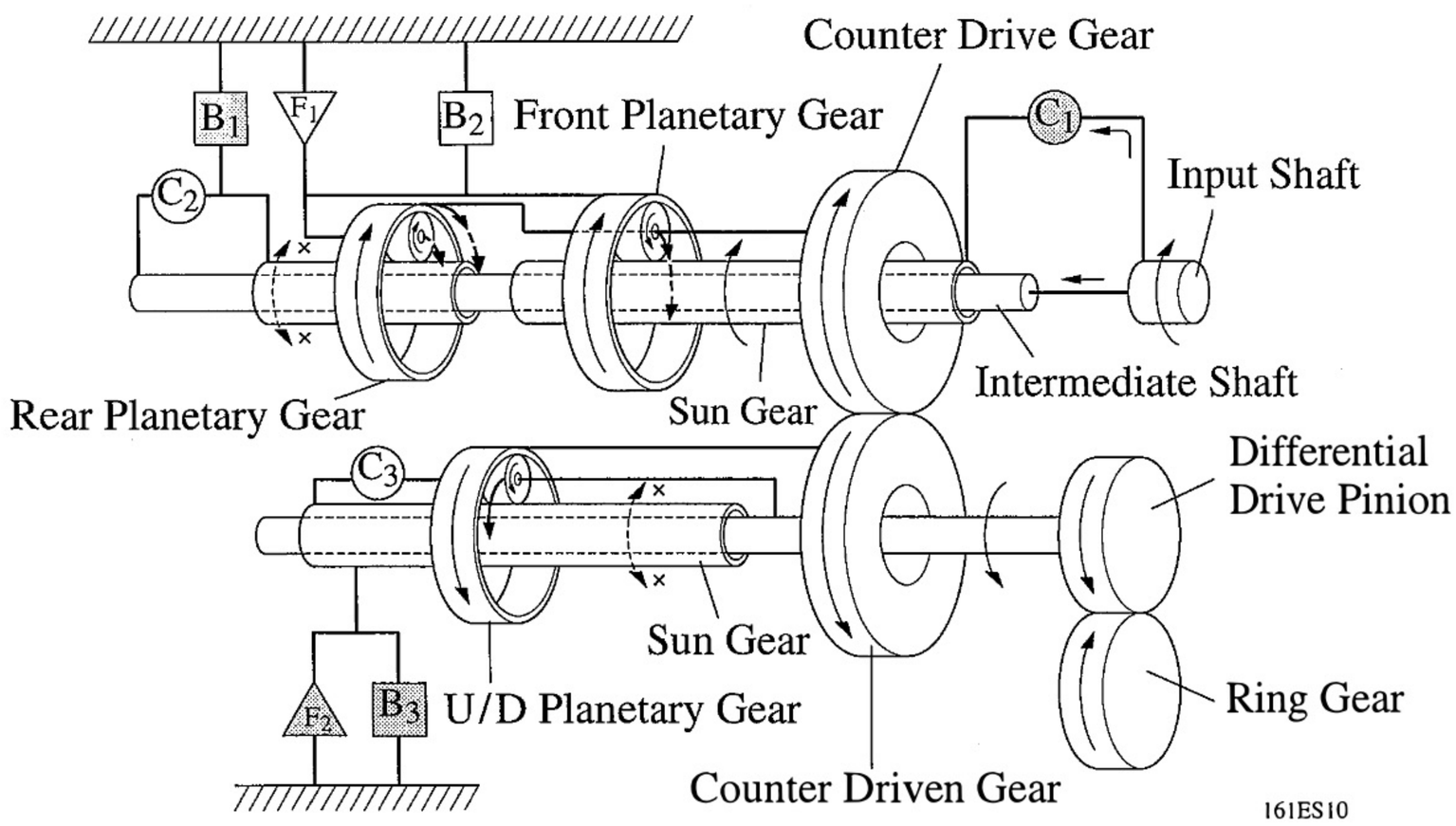
Shift Lever Position	Gear	Solenoid Valve SL1	Solenoid Valve SL2	Solenoid Valve S4	Solenoid Valve DSL	C_1	C_2	C_3	B_1	B_2	B_3	F_1	F_2
P	Park	ON	ON	OFF	OFF						○		
R	Reverse	ON	OFF	OFF	OFF		○			○	○		
N	Neutral	ON	ON	OFF	OFF						○		
D	1st	ON	ON	OFF	OFF	○					○	○	○
	2nd	OFF	ON	OFF	OFF	○			○		○		○
	3rd	OFF/ON*	OFF	OFF	OFF	○	○				○		○
	4th	OFF/ON*	OFF	ON	OFF	○	○	○					
2	1st	ON	ON	OFF	OFF	○					○	○	○
	2nd	OFF	ON	OFF	OFF	○			○		○		○
L	1st	ON	ON	OFF	ON	○				○	○	○	○

*: Lock-up ON

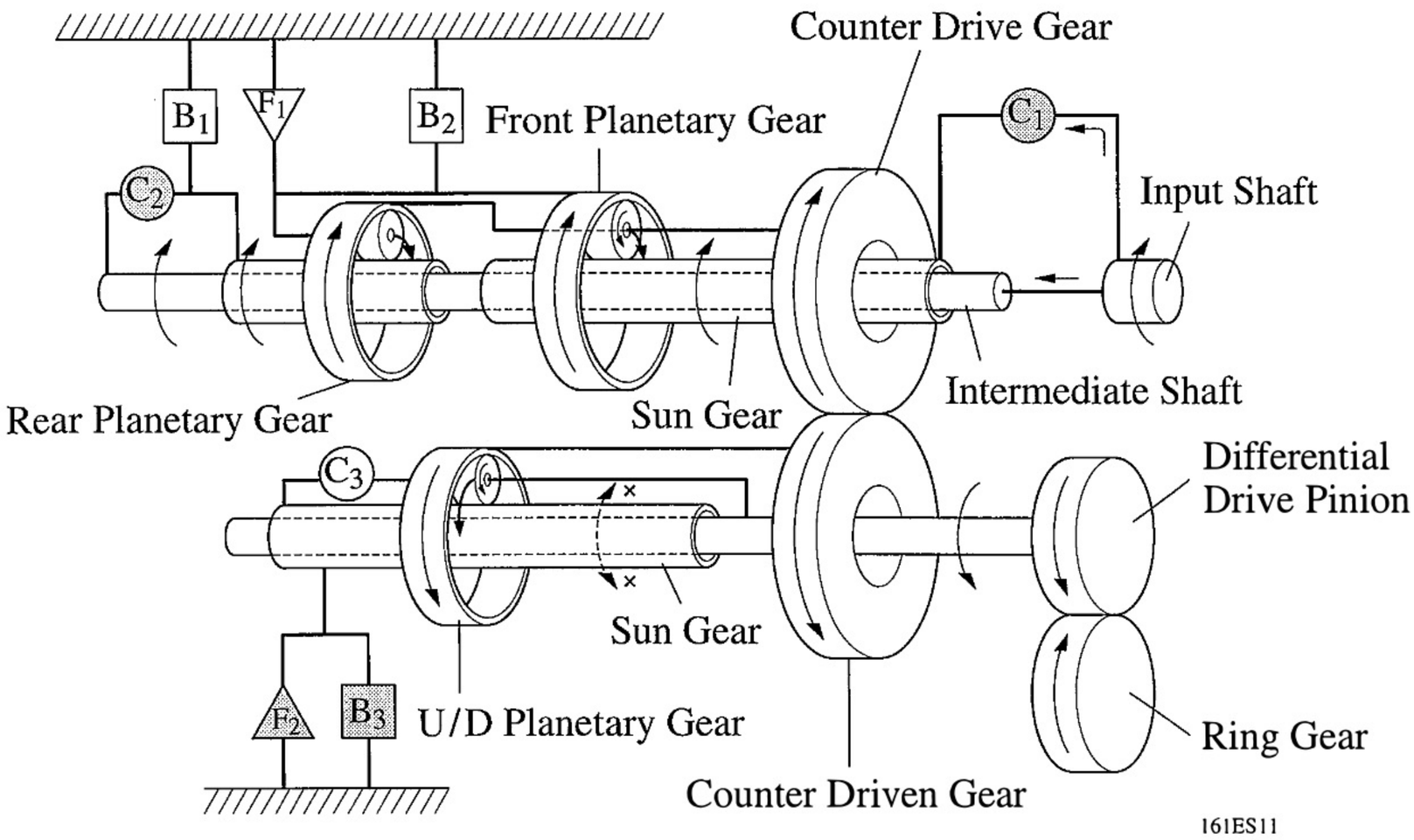
1) 1st Gear (D or 2 Position)



2) 2nd Gear (D or 2 Position)

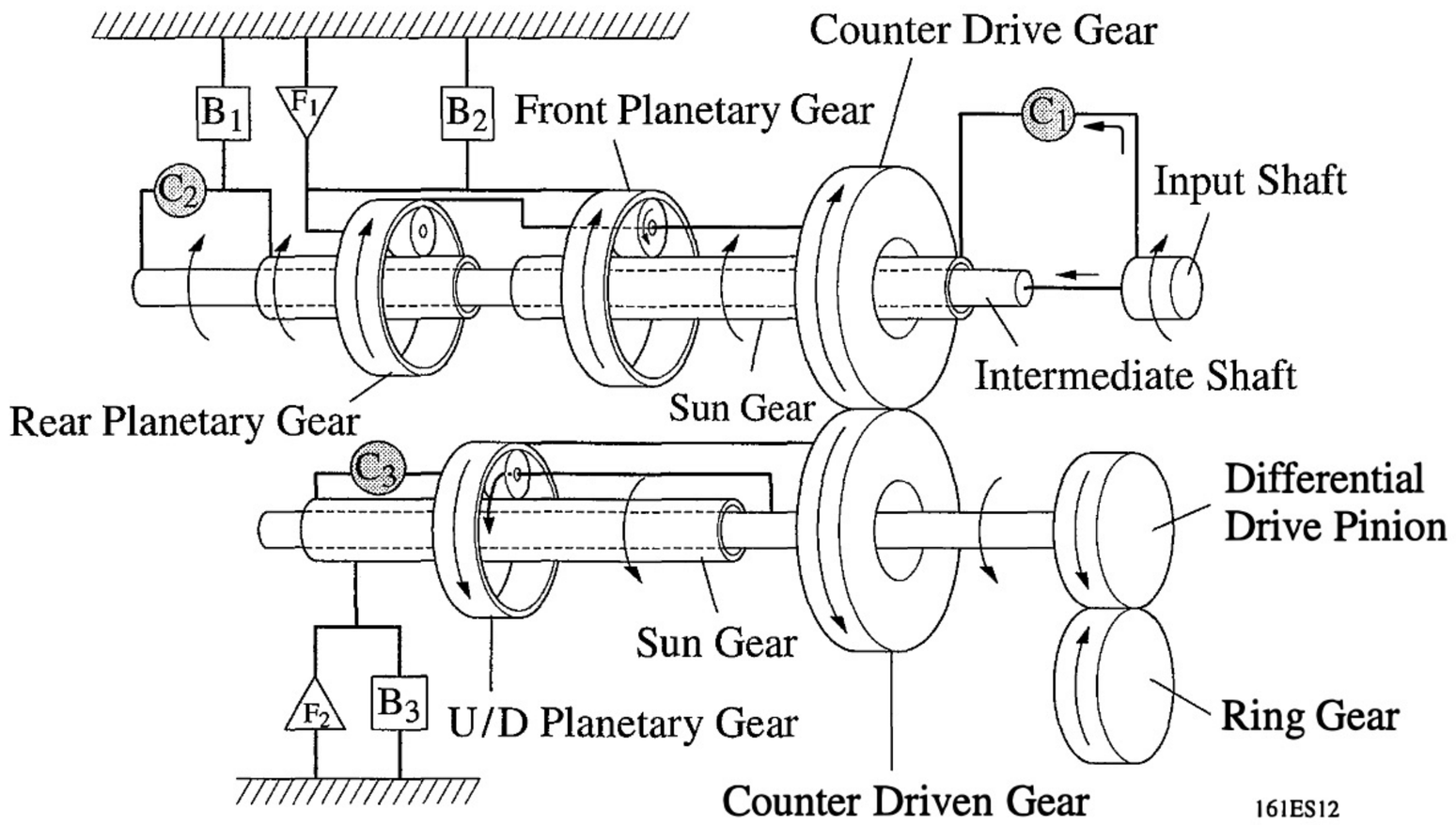


3) 3rd Gear (D Position)

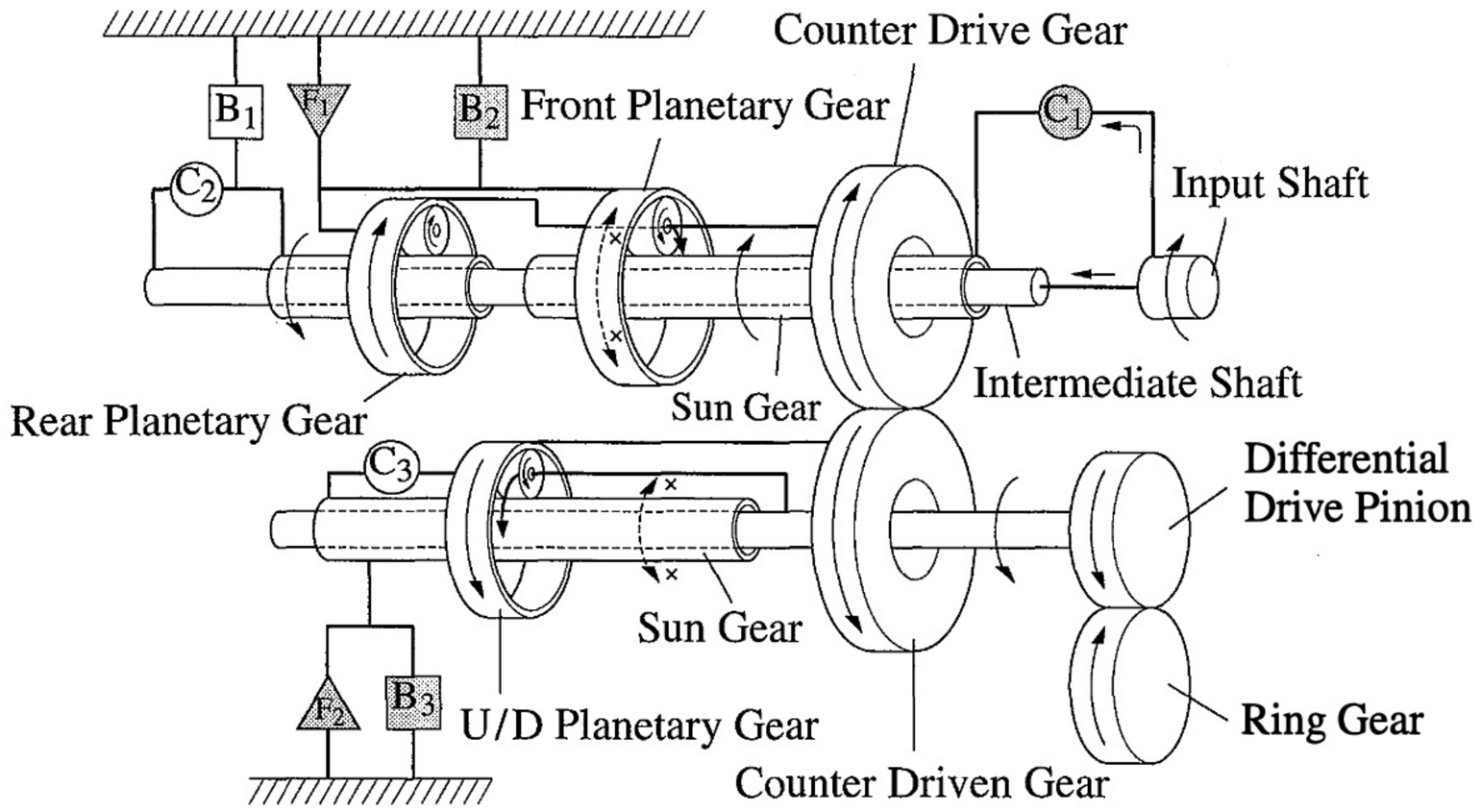


3

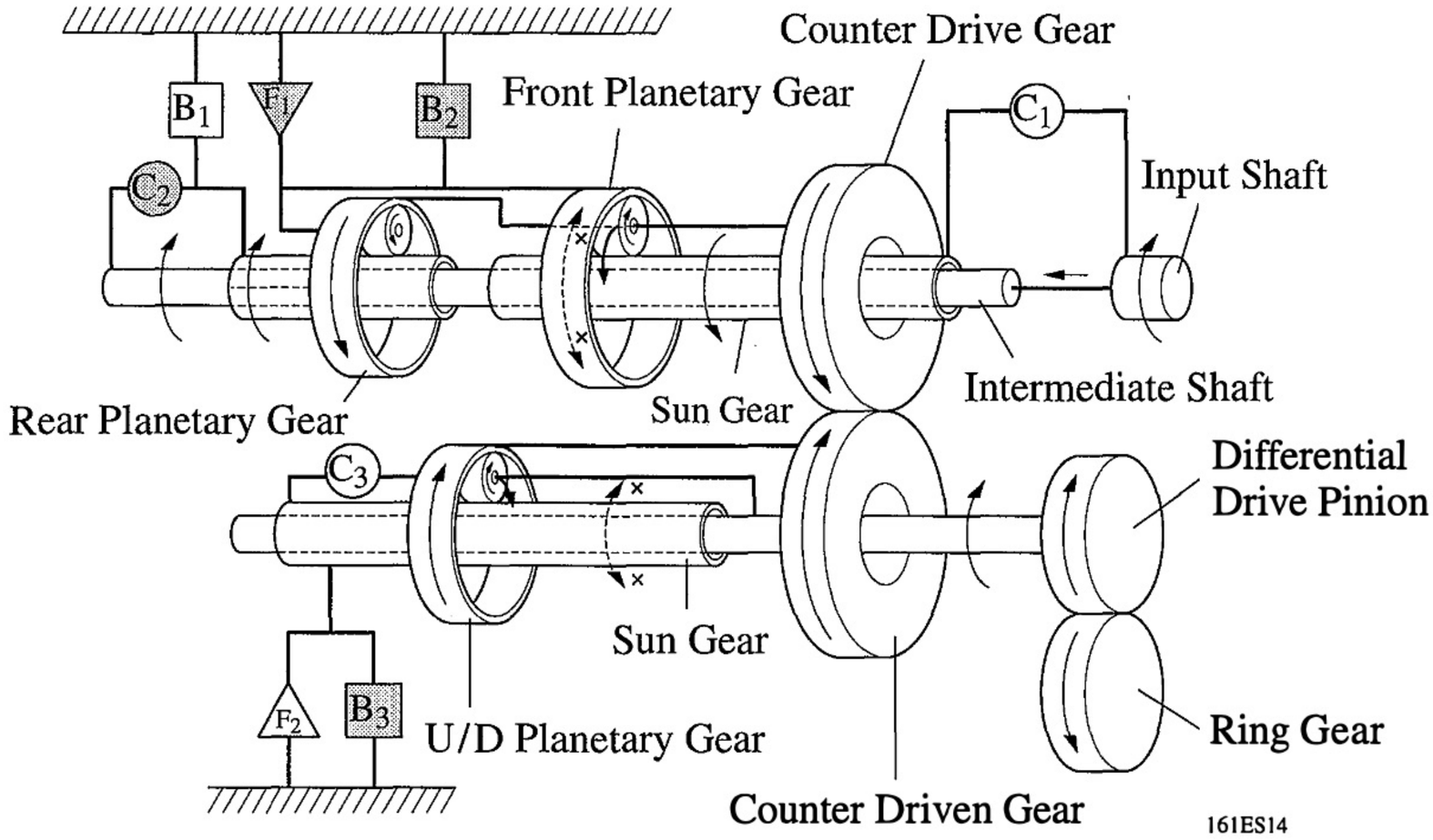
4) 4th Gear (D Position)



5) 1st Gear (L Position)



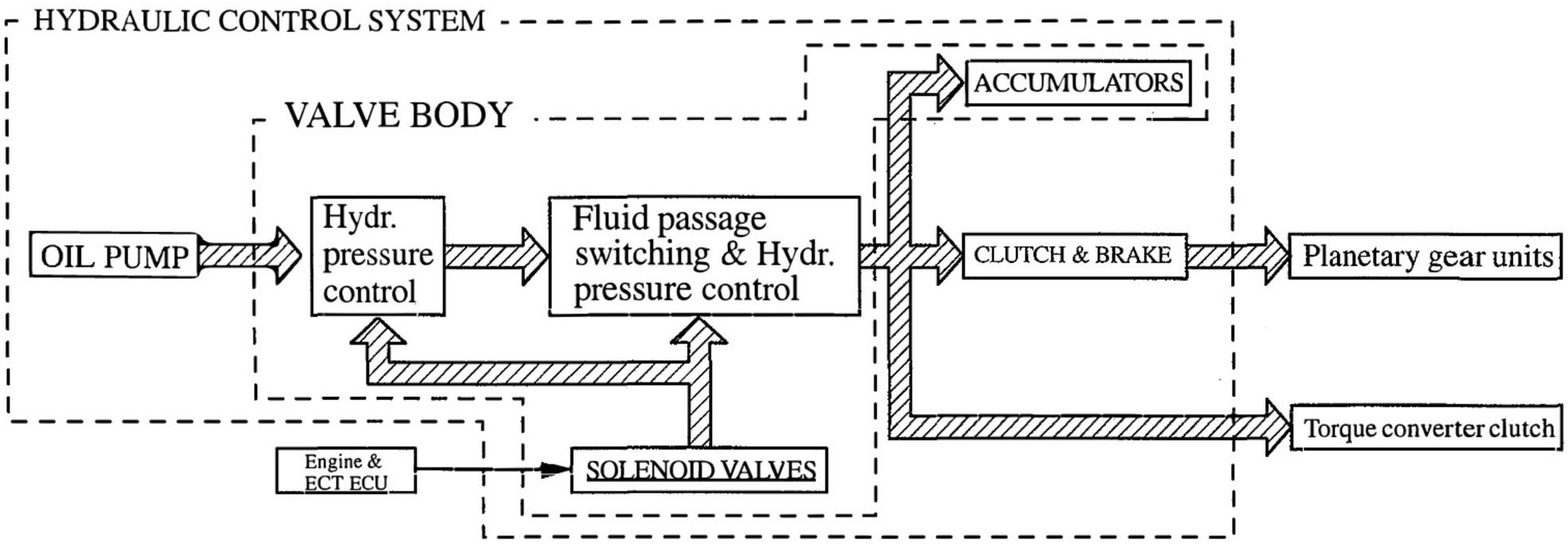
6) Reverse Gear (R Position)



3. Hydraulic Control System

General

The hydraulic control system is composed of the oil pump, the valve body, the solenoid valves, the accumulators, the clutches and brakes as well as the fluid passages which connected all of these components. Based on the hydraulic pressure acting on the torque converter clutch, clutches and brakes in accordance with the vehicle driving conditions.



165CH56

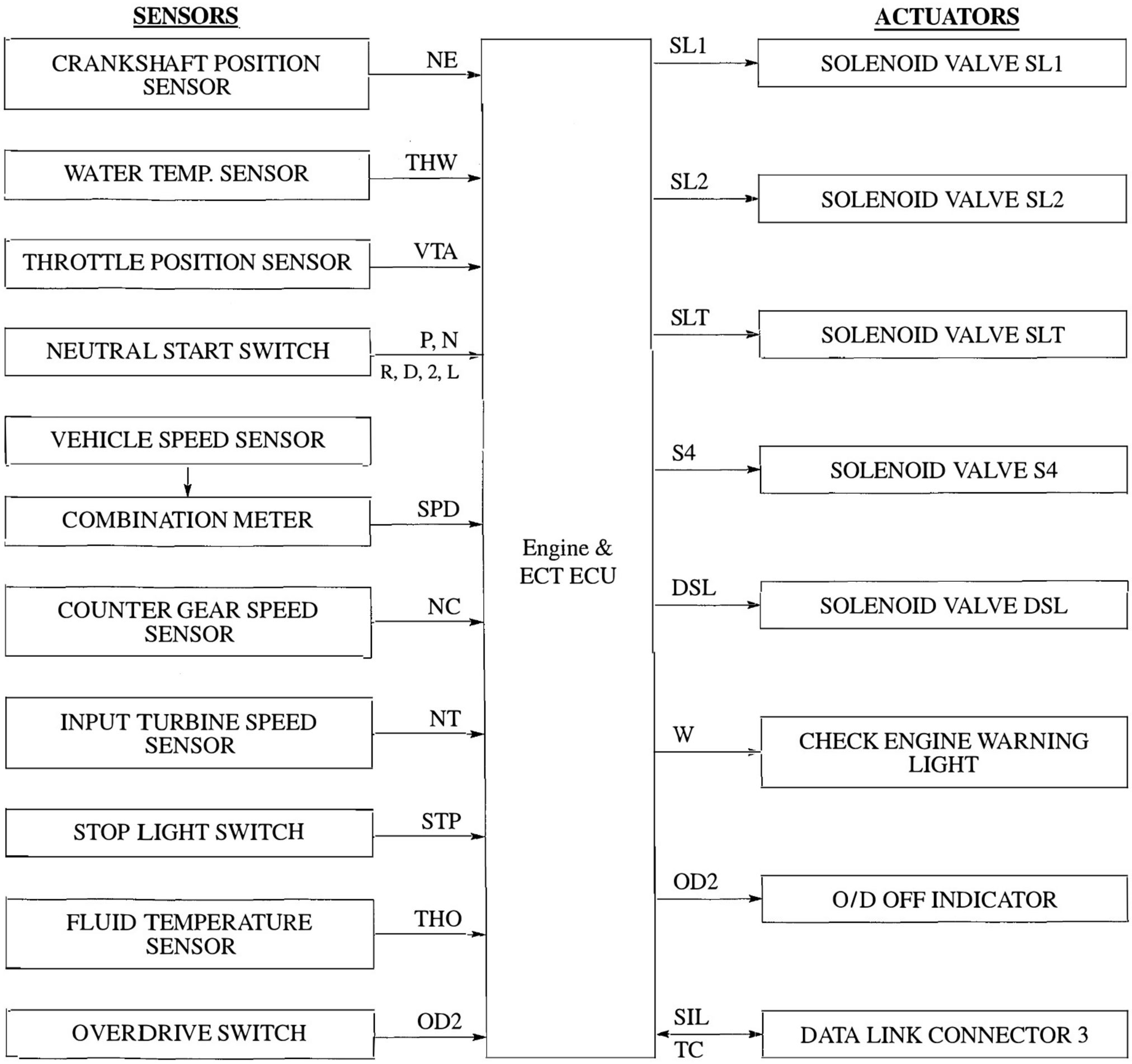
Valve Body

The valve body has a two-stage construction. Also, a compact, lightweight, and highly rigid valve body has been realized. All the solenoid valves are installed in the lower valve body.

4. Electronic Control System

Construction

The configuration of the electronic control system in the U240E automatic transaxle is as shown in the following chart.

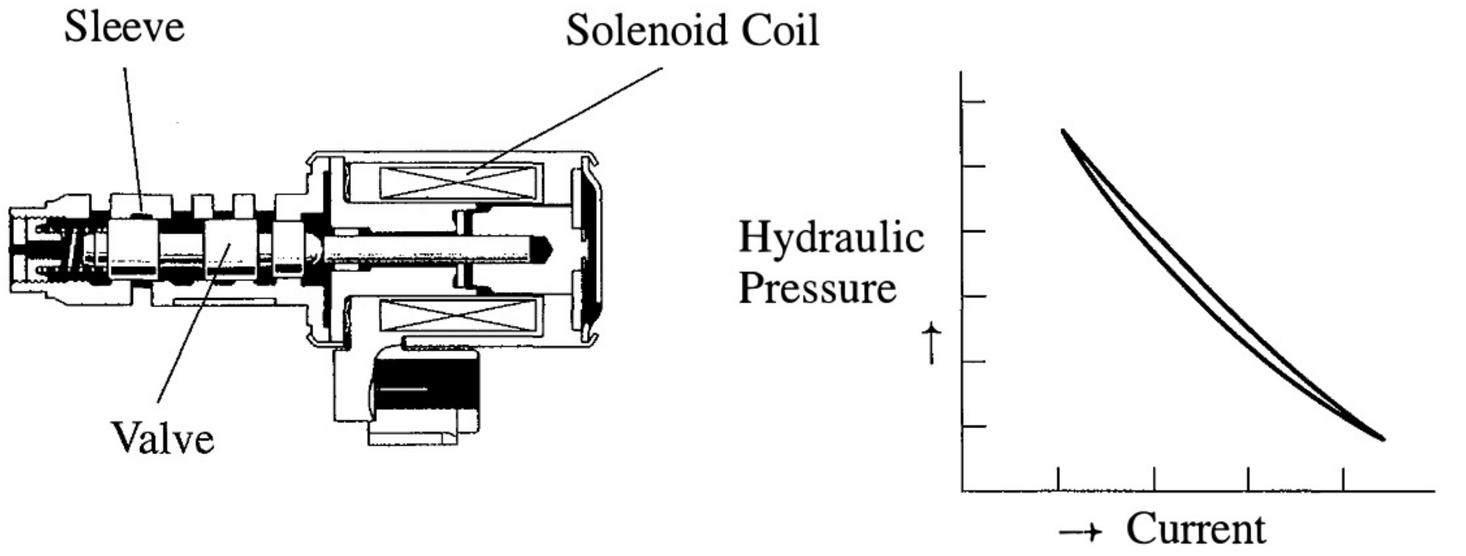


Solenoid Valves

1) Solenoid Valves SL1, SL2 and SLT

a. General

In order to provide a hydraulic pressure that is proportion to current that flows to the solenoid coil, the solenoid valve SL1, SL2 and SLT linearly controls the line pressure based on the signals it receives from the engine & ECT ECU.
The solenoid valves SL1, SL2 and SLT have the same basic structure.



161ES22

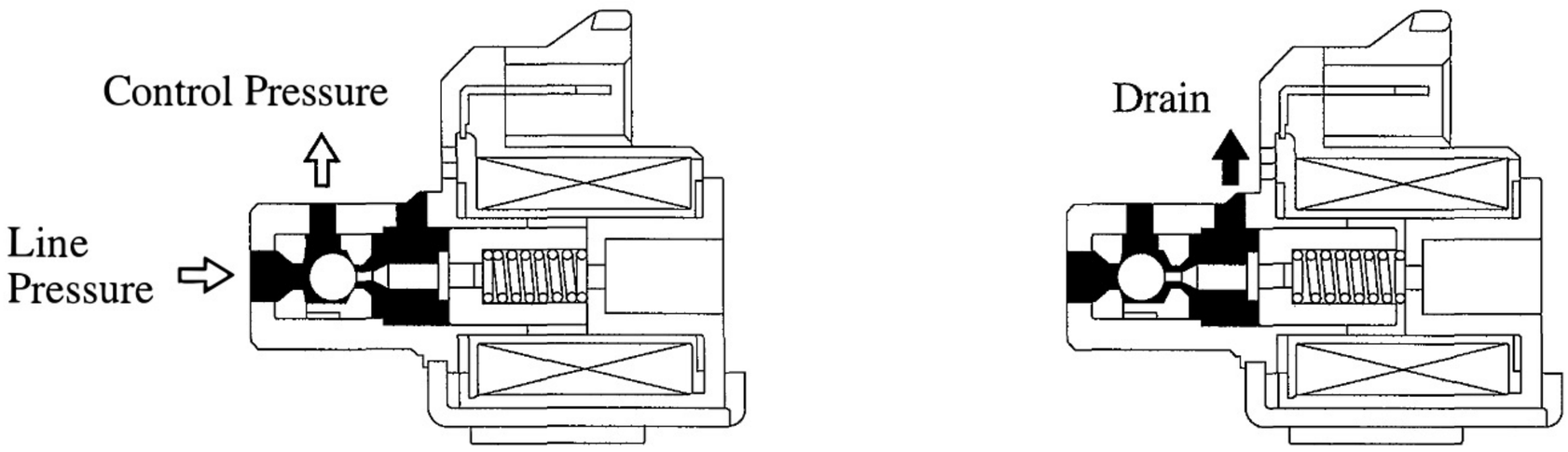
b. Functions of Solenoid Valve SL1, SL2 and SLT

Solenoid Valve	Action	Function
SL1	For clutch engagement pressure control	• B_1 brake pressure control • Lock-up clutch pressure control
SL2		C_2 clutch pressure control
SLT	For line pressure control	• Line pressure control • Secondary pressure control

2) Solenoid Valves S4 and DSL

a. General

The solenoid valves S4 and DSL use a three-way solenoid valve.

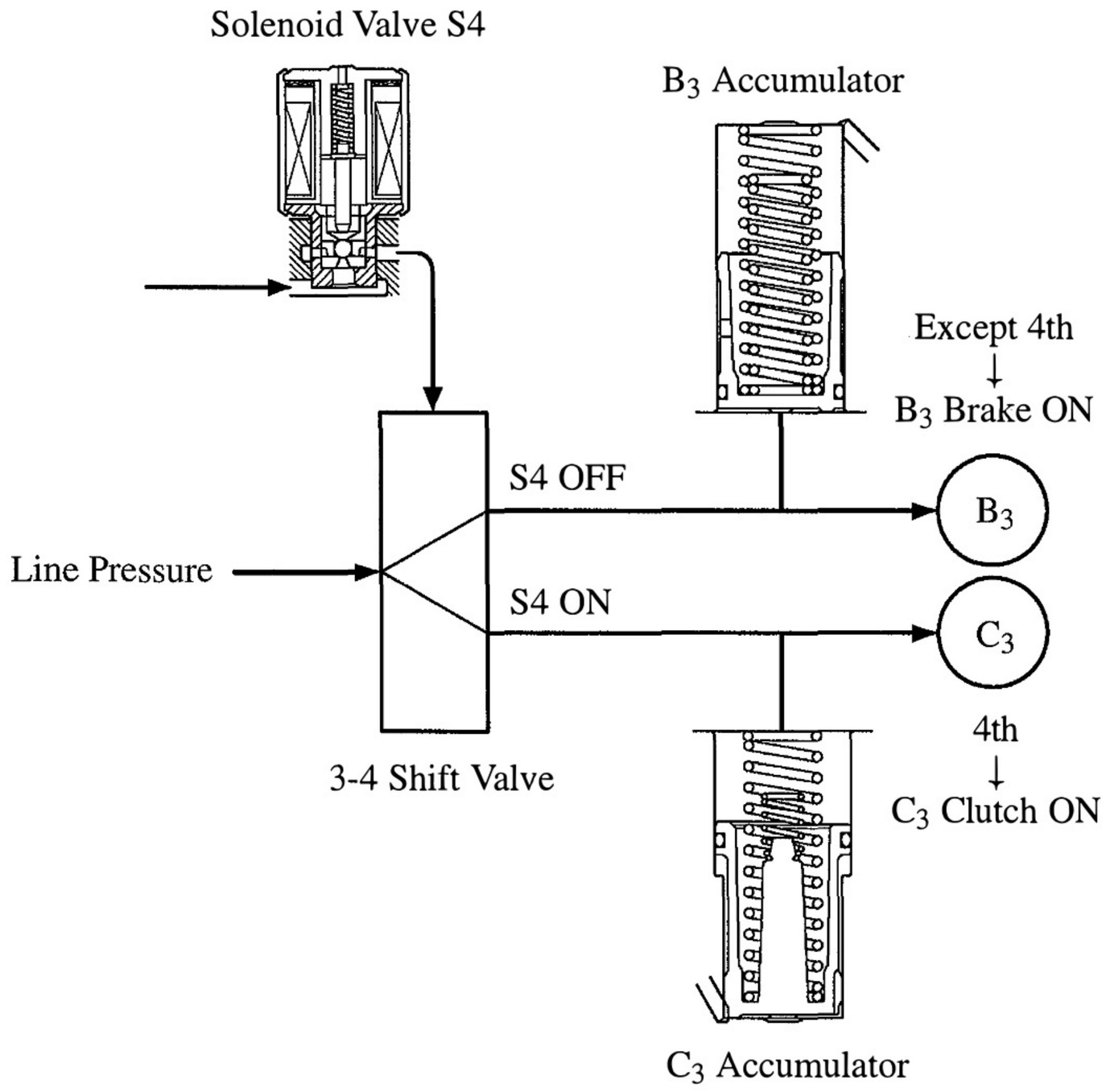


Solenoid Valve ON — Solenoid Valve OFF

161ES65 161ES64

b. Function of Solenoid Valve S4

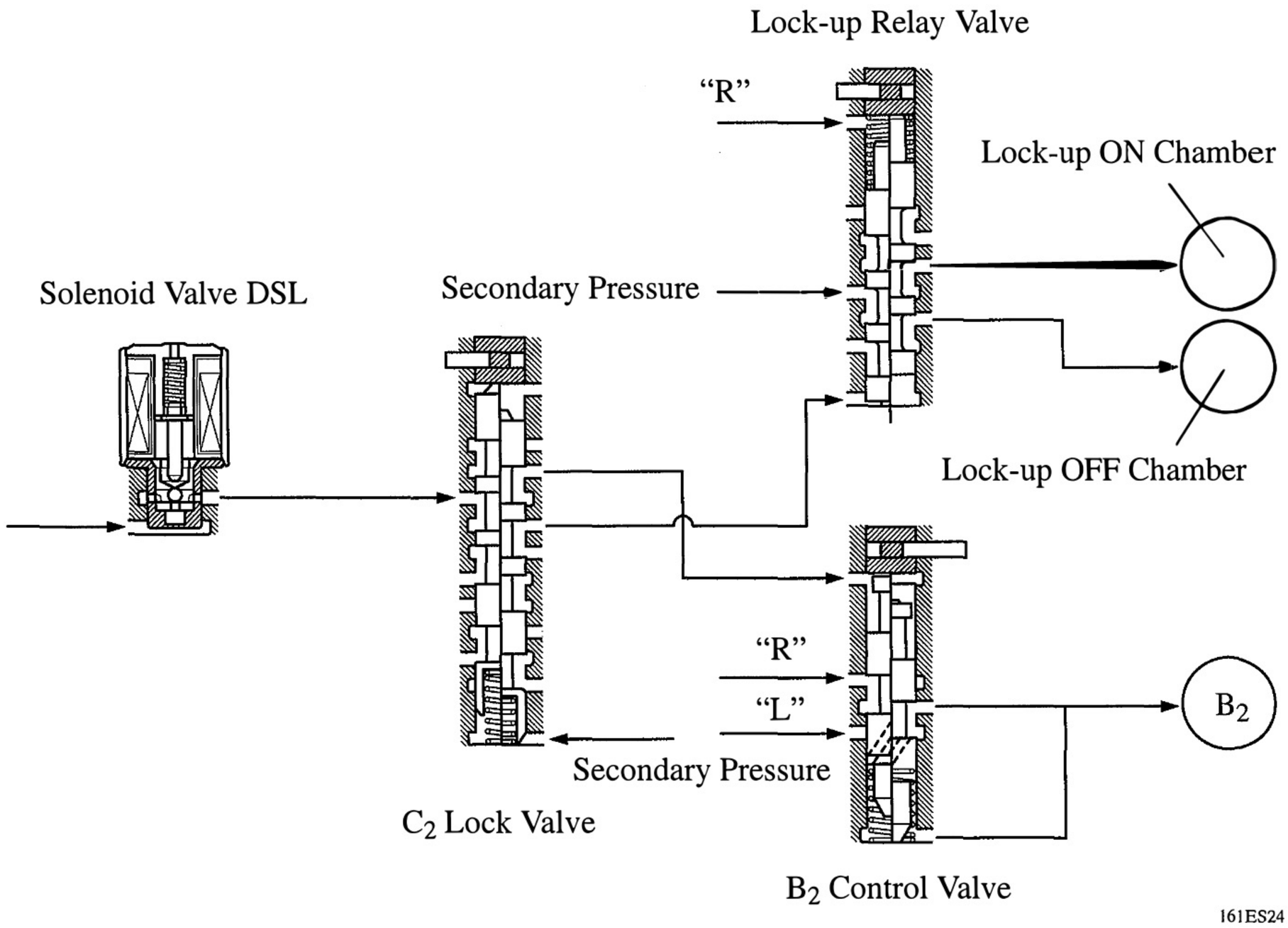
The solenoid valves S4 when set to ON controls the 3-4 shift valve to establish the 4th by changing over the fluid pressure applied to B_3 brake and C_3 clutch.



161ES23

c. Function of Solenoid Valve DSL

The solenoid valve DSL controls the B_2 control valve when the transaxle is shifted in the R or L position. During lock-up, the lock-up relay valve is controlled via the C_2 lock valve.



Fluid Temperature Sensor

A fluid temperature sensor is installed inside the valve body for direct detection of the fluid temperature.

Speed Sensors

The U240E automatic transaxle has adopted an input turbine speed sensor (for the NT signal) and a counter gear speed sensor (for the NC signal). Thus, the engine ECU can detect the timing of the shifting of the gears and appropriately control the engine torque and hydraulic pressure in response to the various conditions.

5. Automatic Transaxle Control System

General

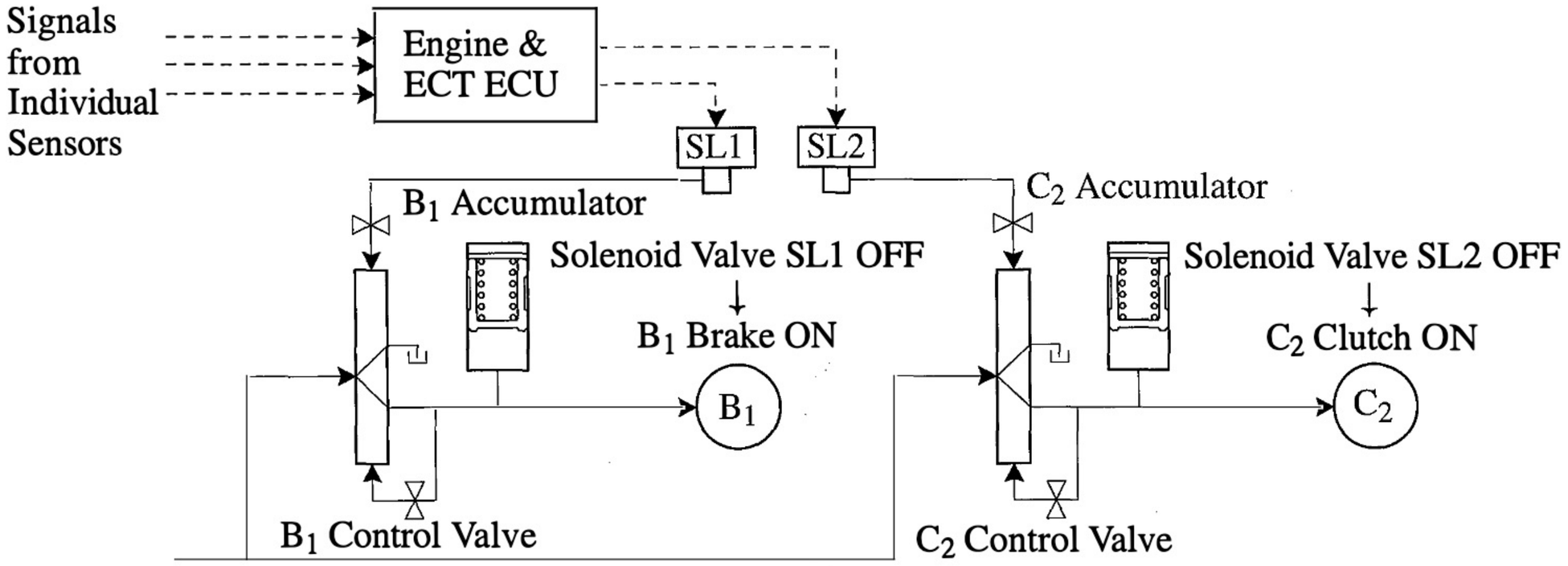
The automatic transaxle control system of the U240E automatic transaxle consists of the control listed below.

System	Function
Clutch Pressure Control	• Controls the pressure that is applied directly to B_1 brake and C_2 clutch by actuating the shift solenoid valve in accordance with the engine ECU signals. • The solenoid valves SL1 and SL2 minutely controls the clutch pressure in accordance with the engine output and driving conditions.
Apply Orifice Control	The apply orifice control valve varies the apply orifice to control the flow volume supplied to the B_3 brake.
Centrifugal Fluid Pressure Cancelling Mechanism	Applies an equal pressure from the opposite side to cancel the influence of the pressure that is created by centrifugal force.
Line Pressure Optimal Control	Actuates the solenoid valve SLT to control the line pressure in accordance with information from the engine & ECT ECU and the operating conditions of the transaxle.
Engine Torque Control	Retards the engine ignition timing temporarily to improve shift feeling during up or down shifting.
Shifting Control in Uphill Traveling	Controls to restrict the 4th upshift by using the engine & ECT ECU to determine whether the vehicle is traveling uphill.
High Response Shift Control	The shift time lag has been reduced to half by the centrifugal fluid pressure cancelling mechanism and clutch pressure optimal control.
Shift Timing Control	The engine & ECT ECU sends current to the solenoid valve SL1 and/or SL2 based on signals from each sensor and shifts the gear.
Lock-Up Timing Control	The engine & ECT ECU sends current to the shift solenoid valve based on signals from each sensor and engages or disengages the lock-up clutch.
"N" to "D" Squat Control	When the shift lever is shifted from "N" to "D" range, the gear is temporarily shifted to 3rd and then to 1st to reduce vehicle squat.

Clutch Pressure Control

1) Clutch to Clutch Pressure Control

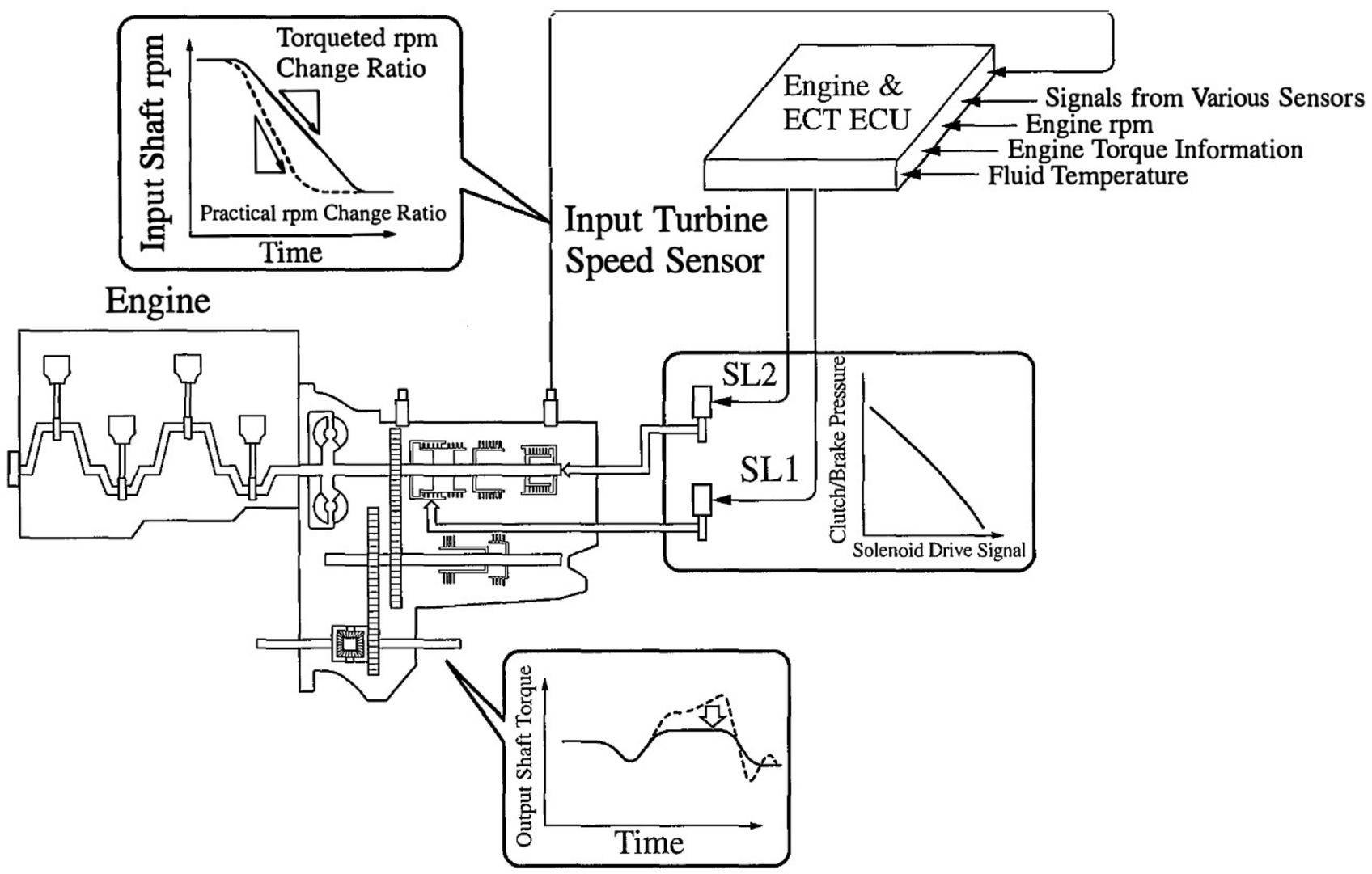
A direct clutch pressure control has been adopted for shifting from the 1st to 2nd gear, and from the 2nd to 3rd gear. Actuates solenoid valves SL1 and LS2 in accordance with the signals from the engine & ECT ECU, and guides this output pressure directly to control valves B_1 and C_2 in order to regulate the line pressure that acts on the B_1 brake and C_2 clutch. As a result, compact B_1 and C_2 accumulators without a back pressure chamber have been realized.



161ES15

2) Clutch Pressure Optimal Control

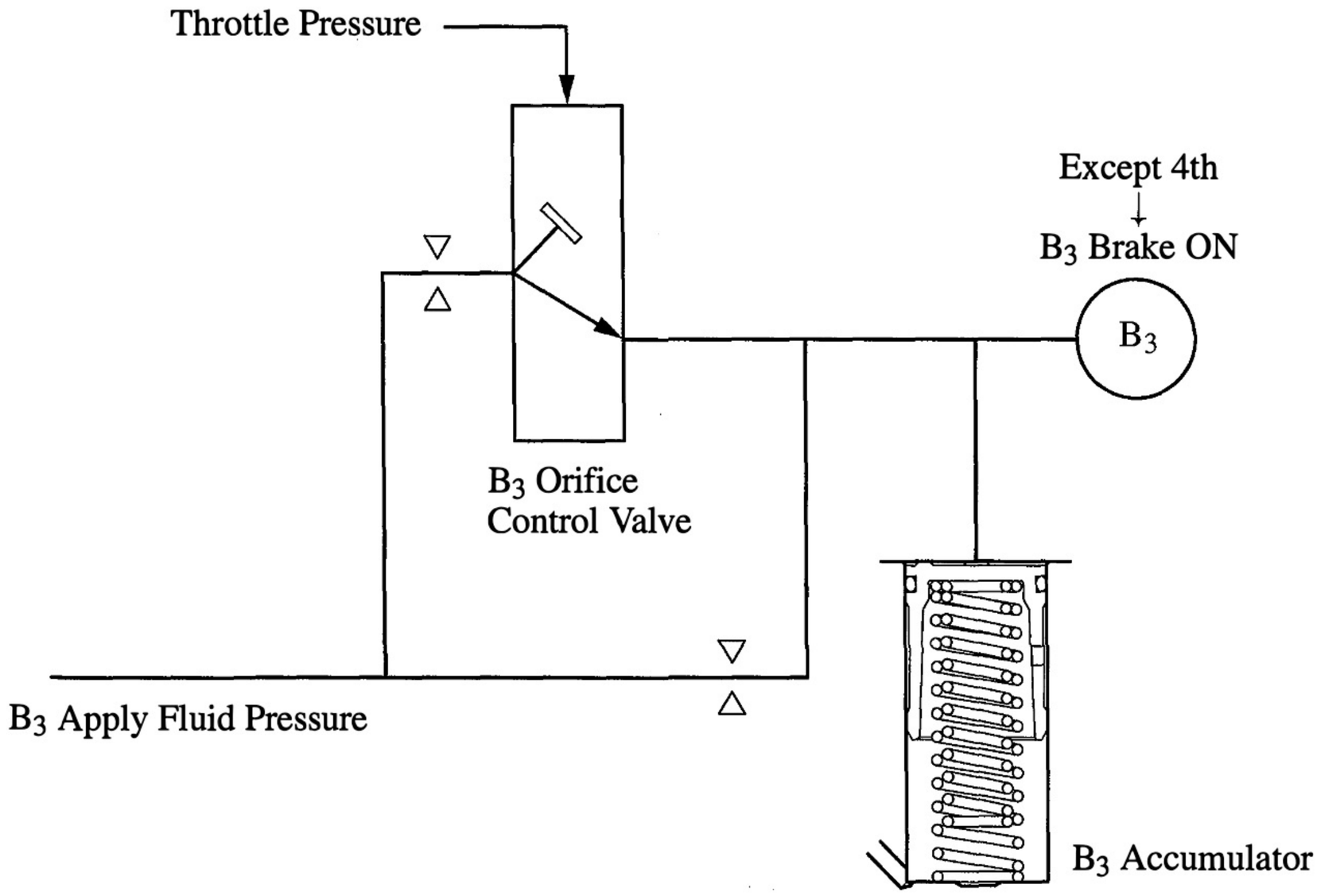
Solenoid valves SL1 and SL2 are used for optimal control of clutch pressure. The engine & ECT ECU monitors the signals from various types of sensors such as the input turbine speed sensor, allowing shift solenoid valves SL1 and SL2 to minutely control the clutch pressure in accordance with engine output and driving conditions. As a result, smooth shift characteristics have been realized.



169CH16

Apply Orifice Control

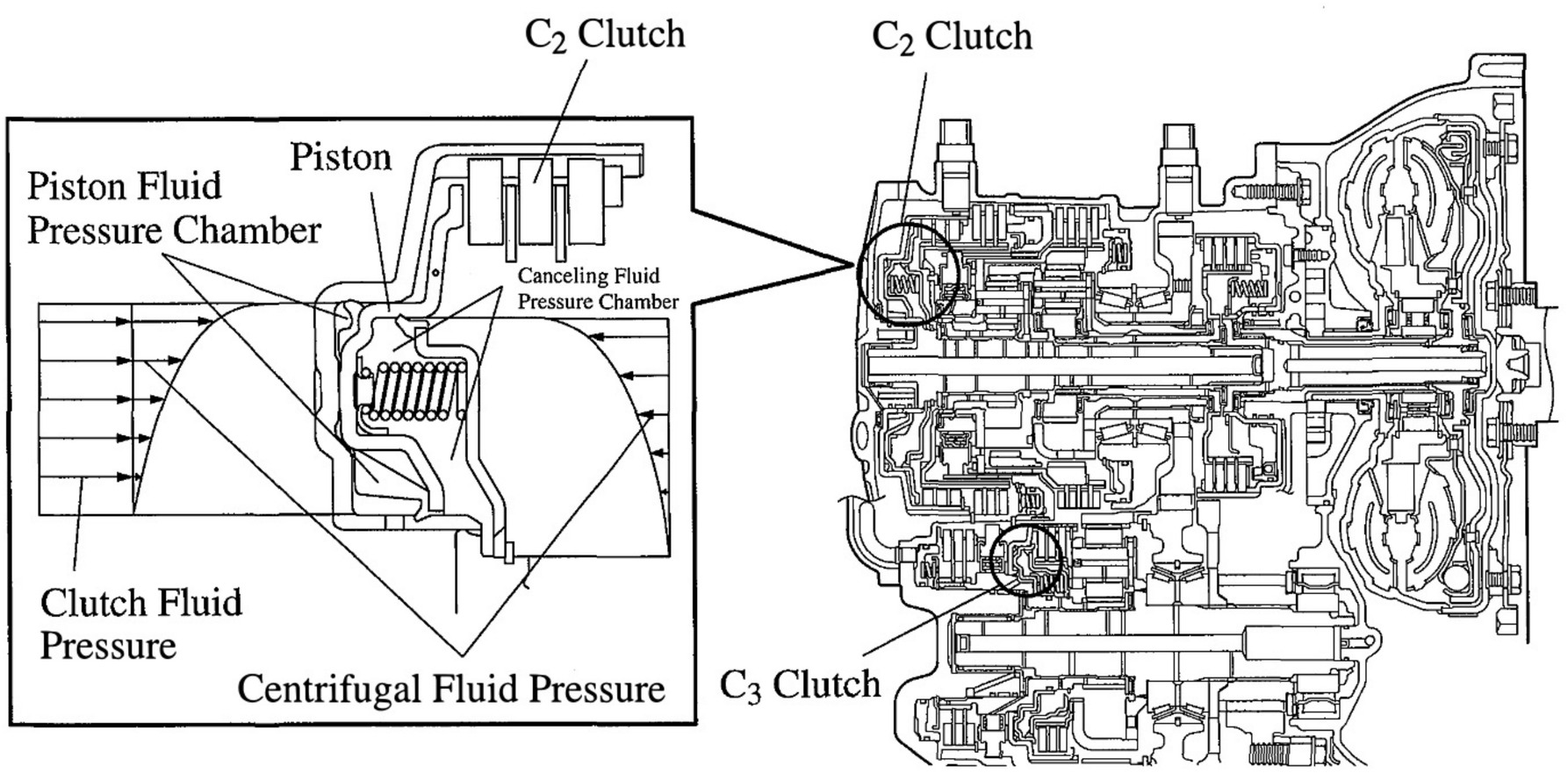
The B_3 orifice control valve has been provided for the B_3 brake, which is applied when shifting from 4th to 3rd. The B_3 orifice control valve is controlled by the amount of the throttle pressure in accordance with shifting conditions, and the flow volume of the fluid that is supplied to the B_3 brake is controlled by varying the size of the control valve's apply orifice.



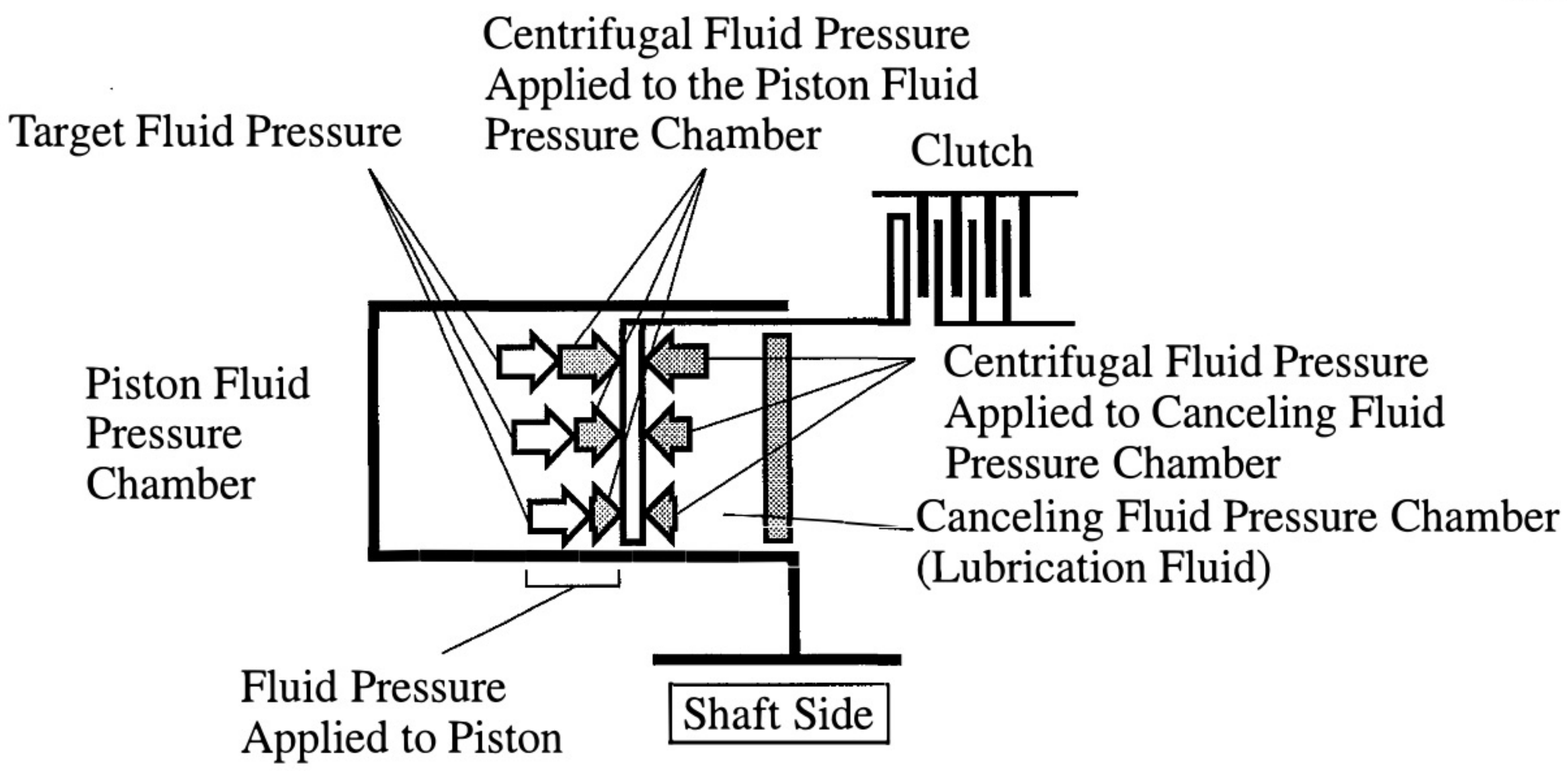
Centrifugal Fluid Pressure Canceling Mechanism

A centrifugal fluid pressure canceling mechanism has been adopted in the C_2 and C_3 clutches that are applied when shifting from 2nd to 3rd and from 3rd to 4th. In the conventional clutch mechanism, to prevent the generation of pressure by the centrifugal force that is applied to the fluid in the piston fluid pressure chamber when the clutch is released, a check ball is provided to discharge the fluid. Therefore, before the clutch can be subsequently applied, it took time for the fluid to fill the piston fluid pressure chamber. During shifting, in addition to the pressure that is controlled by the valve body, the pressure that acts on the fluid in the piston fluid pressure chamber also exerts influence, which is dependent upon rpm fluctuations. In order to eliminate this influence, a canceling fluid pressure chamber is provided opposite to the piston fluid pressure chamber.

By utilizing the lubrication fluid such as that of the shaft, the same amount of centrifugal force is applied, thus canceling the centrifugal force that is applied to the piston itself. Accordingly, it is not necessary to discharge the fluid through the use of a check ball, and a highly responsive and smooth shifting characteristic has been achieved.



169CH47



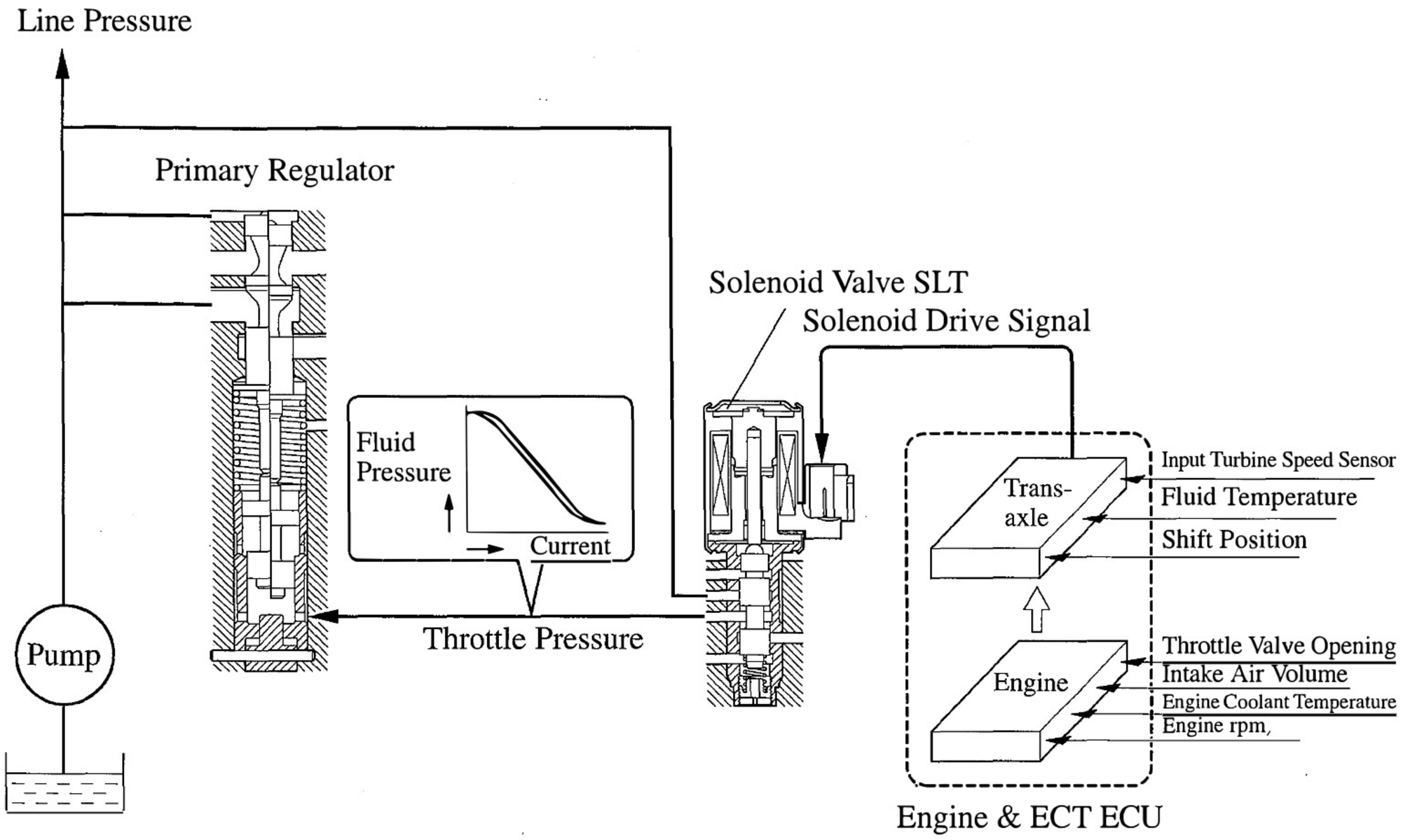
157CH17

Fluid pressure applied to piston	–	Centrifugal fluid pressure applied to canceling fluid pressure chamber	=	Target fluid pressure (original clutch pressure)

3

Line Pressure Optimal Control

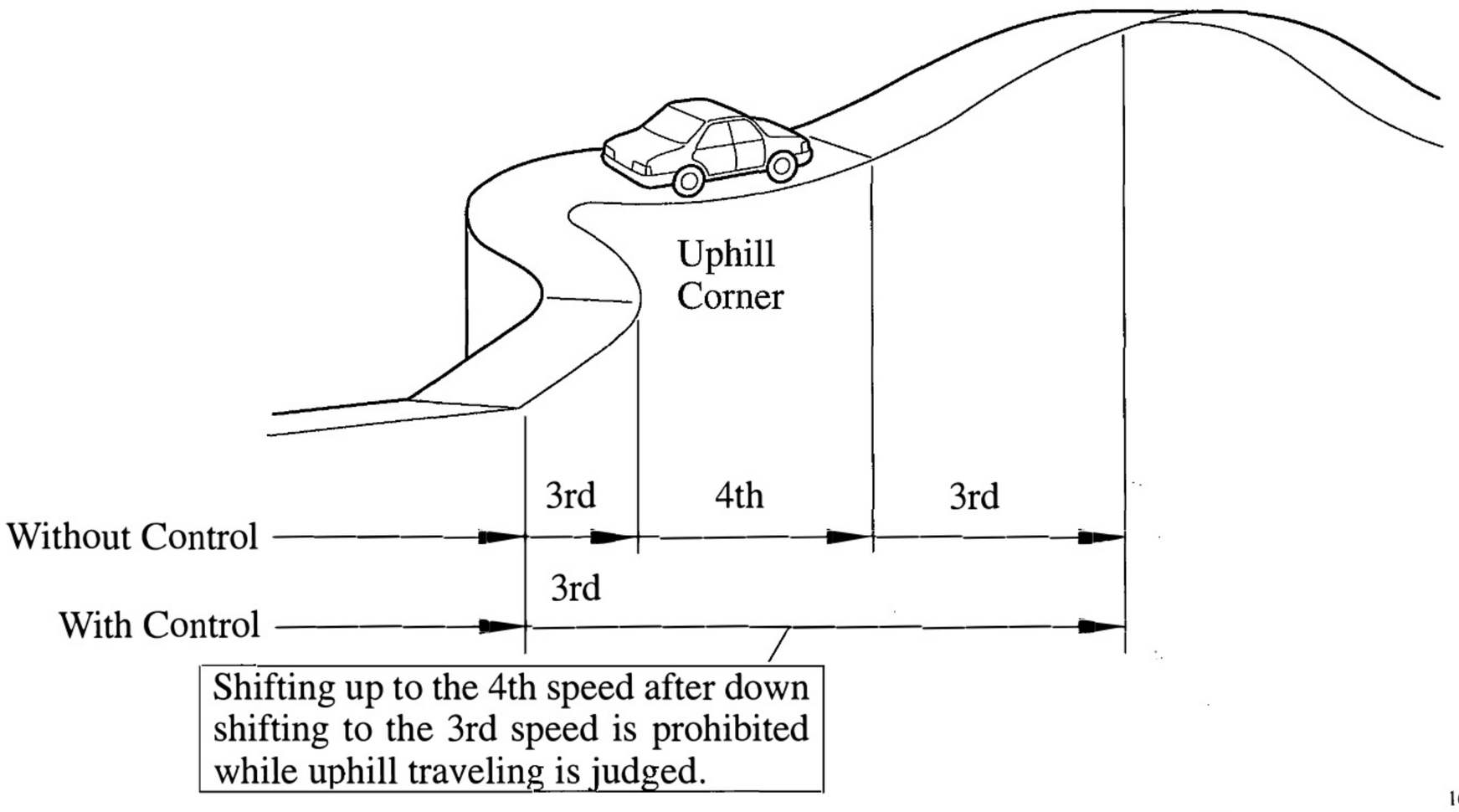
The line pressure is controlled by using a solenoid valve SLT. Through the use of the solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transaxle. Accordingly, the line pressure can be controlled minutely in accordance with the engine output, traveling condition, and the ATF temperature, thus realizing smooth shift characteristics and optimizing the workload on the oil pump.



161ES26

Shifting Control in Uphill Traveling

With shifting control in uphill traveling, the engine & ECT ECU calculates the throttle opening angle and the acceleration rate to determine whether the vehicle is in the uphill. While driving uphill on a winding road with ups and downs, the 4th upshift is restricted to ensure a smooth drive.



169CH53

High Response Shift Control

Due to the use of the previously mentioned centrifugal fluid pressure canceling mechanism and the clutch pressure optimal control, not only smooth shifting has been achieved, but the shift time lag has been halved to realize excellent response.

6. Fail Safe Function

This function minimizes the loss of operability when any abnormality occurs in each sensor or solenoid. Control is effected as follows if a malfunction occurs in the sensors and solenoids:

- During a speed sensor malfunction, the vehicle speed is detected through the signals from the counter gear speed sensor to effect normal control.
- During a counter gear speed sensor malfunction, 4th upshift is prohibited.
- During an ATF temperature sensor malfunction, 4th upshift is prohibited.
- During a malfunction in the solenoid valve SL1, SL2, or S4, the current to the faulty solenoid valve is cut off and control is effected by operating the normal solenoid valves. Shift control is effected as described in the table below, depending on the faulty solenoid.

When all solenoids are normal				When shift solenoid SL1 is abnormal								When SL2 is abnormal				When S4 is abnormal			
				Traveling 3rd or 4th				Traveling 1st or 2nd											
Solenoid			Gear	Solenoid			Gear	Solenoid			Gear	Solenoid			Gear	Solenoid			Gear
SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4	
ON	ON	OFF	1st	X	ON ↓ OFF	OFF	3rd	X*2	ON	OFF	2nd	ON ↓ OFF	X	OFF	3rd	ON	ON	X	1st
OFF	ON	OFF	2nd	X	ON ↓ OFF	OFF	3rd	X*2	ON	OFF	2nd	OFF	X	OFF	3rd	OFF	ON	X	2nd
OFF/ ON*1	OFF	OFF	3rd	X	OFF	OFF	3rd	X*2	OFF ↓ ON	OFF ↓ ON	3rd	OFF/ ON*1	X	OFF	3rd	OFF/ ON*1	OFF	X	3rd
OFF/ ON*1	OFF	ON	4th	X	OFF	ON	4th	X*2	OFF ↓ ON	ON	3rd	OFF/ ON*1	X	ON	4th	OFF/ ON*1	OFF	X	3rd

When SL1 and SL2 are abnormal				When SL1 and S4 are abnormal								When SL2 and S4 are abnormal				When SL1, SL2 and S4 are abnormal			
				Traveling 3rd or 4th				Traveling 1st or 2nd											
Solenoid			Gear	Solenoid			Gear	Solenoid			Gear	Solenoid			Gear	Solenoid			Gear
SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4	
X	X	OFF	3rd	X	ON ↓ OFF	X	3rd	X	ON	X	2nd	ON ↓ OFF	X	X	3rd	X	X	X	3rd
X	X	OFF	3rd	X	ON ↓ OFF	X	3rd	X	ON	X	2nd	OFF	X	X	3rd	X	X	X	3rd
X	X	OFF	3rd	X	OFF	X	3rd	X	OFF ↓ ON	X	2nd	OFF/ ON*1	X	X	3rd	X	X	X	3rd
X	X	ON	4th	X	OFF	X	3rd	X	OFF ↓ ON	X	2nd	OFF/ ON*1	X	X	3rd	X	X	X	3rd

*1: Lock-up ON

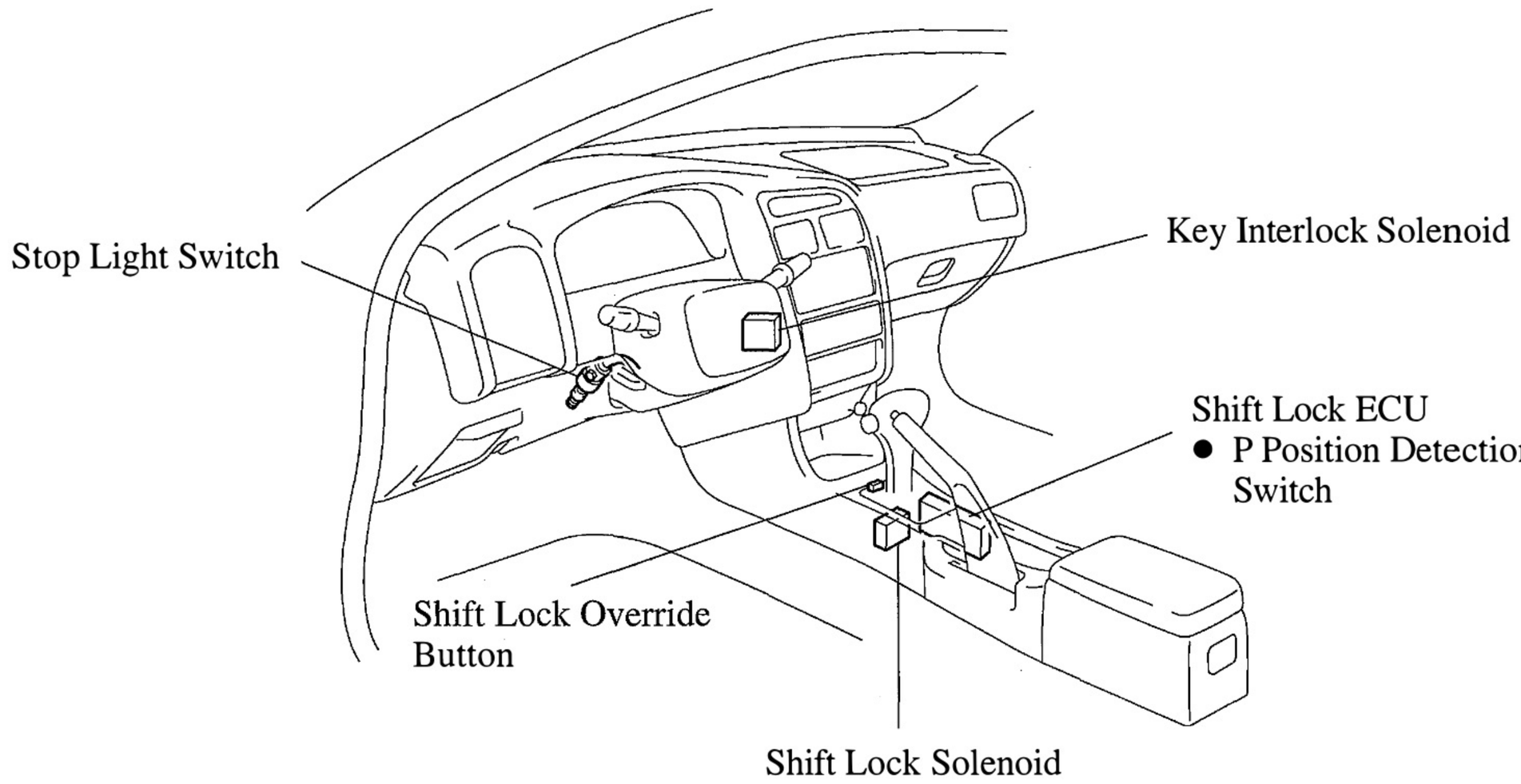
*2: B_1 is constantly operating

■SHIFT LOCK SYSTEM

1. General

A shift lock system that help prevent the unintended operation of the shift lever has been provided.
The shift lock system consists of a key interlock device and shift lock mechanism.

2. Layout of Components



195CH23

3. Function of Components

Components	Function
P Position Detection Switch	Detects whether or not the shift lever is in P position and sends signals to the shift lock ECU.
Key Interlock Solenoid	Regulates the movement of the ignition key cylinder.
Shift Lock Solenoid	Regulates the operation of the shift lever at P position.
Stop Light Switch	Sends the brake signal to the shift lock ECU.
Shift Lock ECU	Receives inputs of various types of signals and regulates the operation of the two solenoids.

4. Key Interlock Device

The activation of the key interlock solenoid that is mounted on the upper column bracket moves the lock pin to restrict the movement of the key cylinder.
Therefore, if the shift lever is shifted to any position other than “P”, the ignition key cannot be moved from “ACC” to the “LOCK” position.

5. Shift Lock Mechanism

The shift lock mechanism prevents the shift lever from being shifted out of the “P” position to any other position unless the ignition switch is turned ON and the brake pedal is pressed.
A shift lock override lever, which manually overrides the shift lock mechanism, is provided.

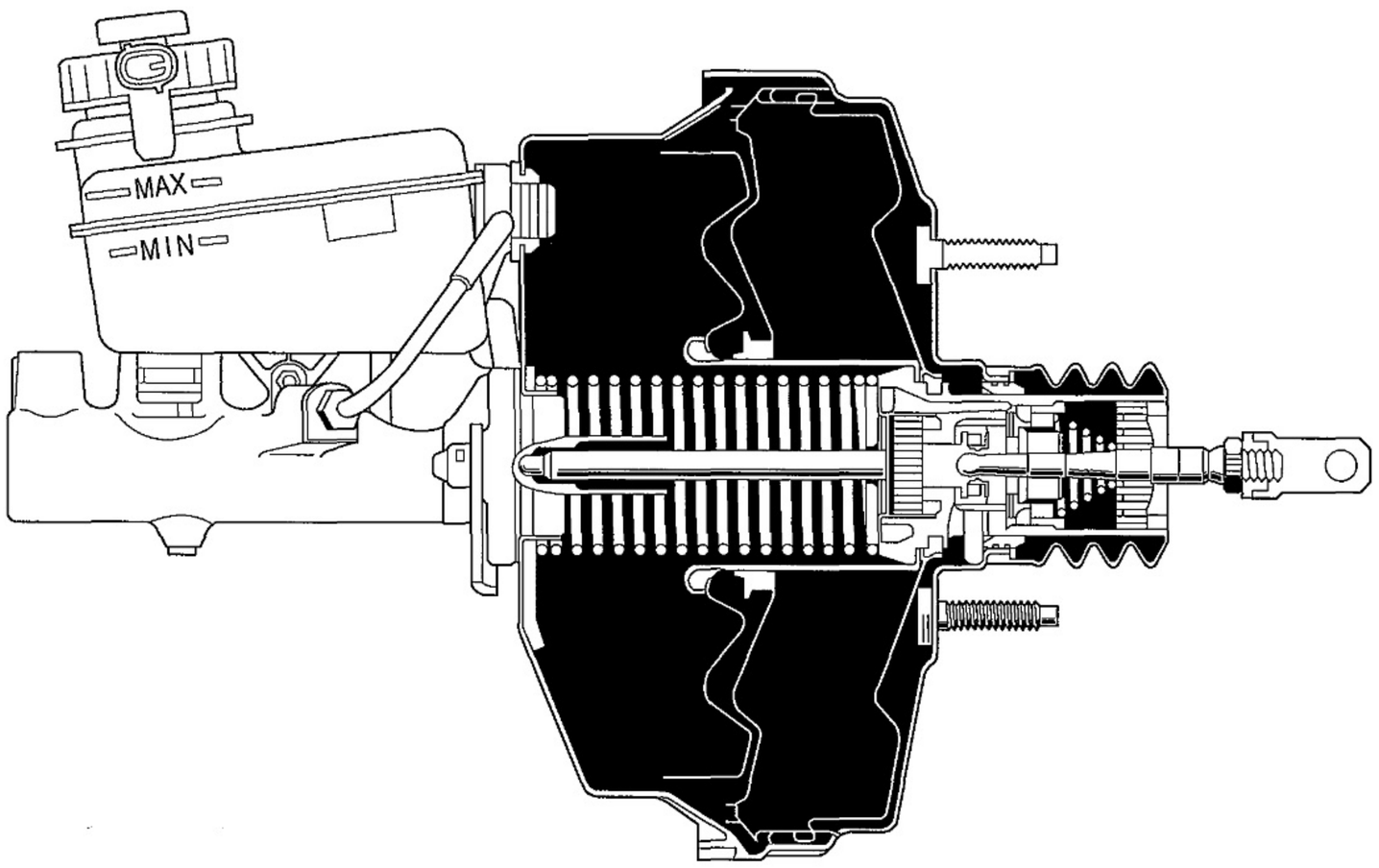
■BRAKE

1. General

- The 7" + 8" tandem brake booster has been adopted on the 1AZ-FSE engine model as a standard, and on the 1ZZ-FE and 3ZZ-FE engine models as an option.
- EBD (Electronic Brake force Distribution) control has been added to the previous ABS (Antilock Brake System) as standard equipment on all models.
- ABS with EBD & Brake Assist & TRC (Traction Control) & VSC (Vehicle Stability Control) has been provided as standard equipment on the LINEA SOL grade of the 1AZ-FSE engine model and as an option on the LINEA TERRA grade.
  The skid control ECU and the brake actuator have been integrated.

2. Brake Booster

The 7" + 8" tandem brake booster has been adopted to achieve an optimal braking force.



LHD Model

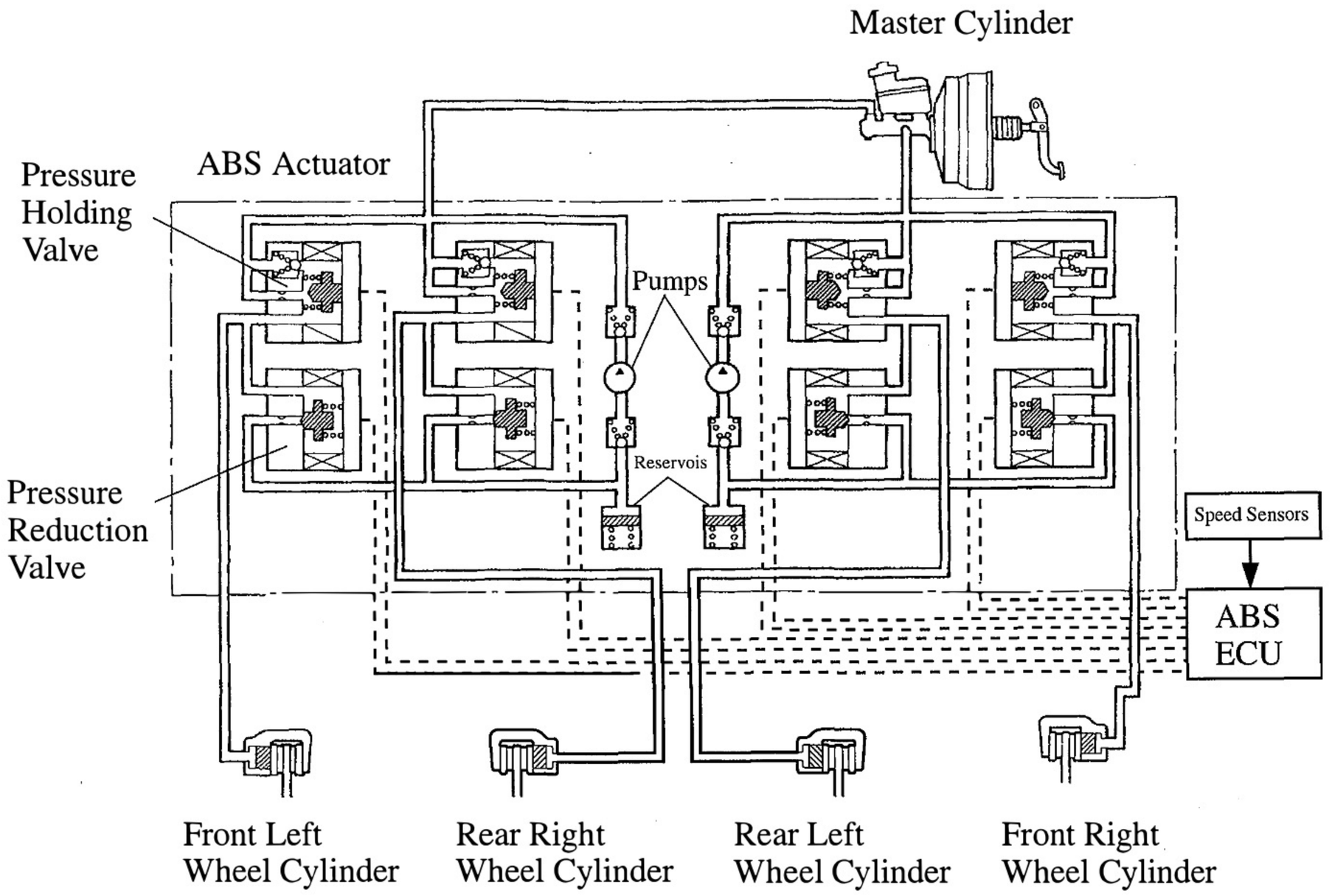
195CH05

3. ABS with EBD

General

ABS equipped with the EBD control has been adopted.
The EBD control utilizes ABS, realizing the proper brake force distribution between front and rear wheels in accordance with the driving conditions.

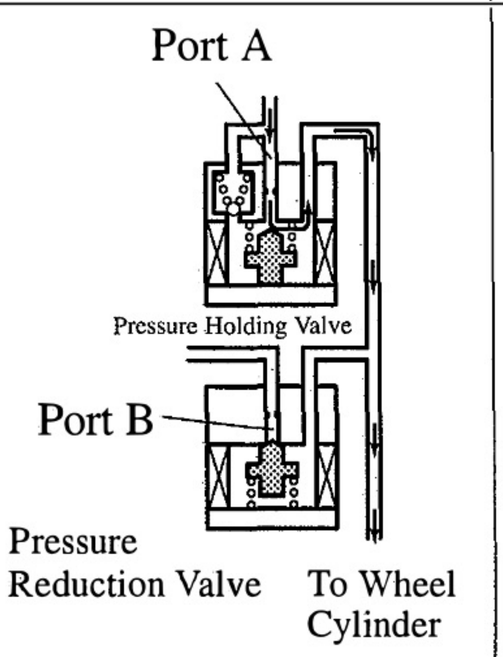
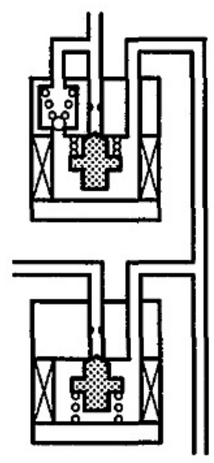
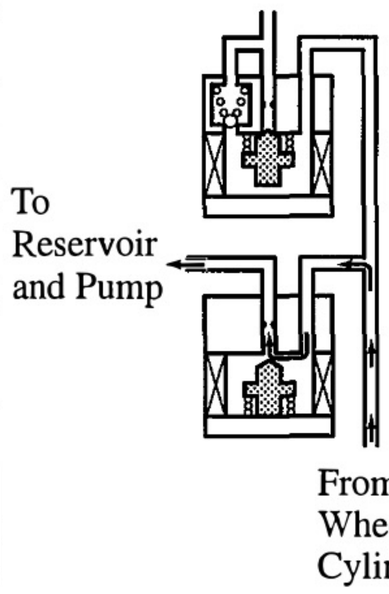
Hydraulic Circuit



195CH06

Operation

Based on the signals received from the 4 wheel speed sensors, the skid control ECU calculates each wheel speed and deceleration, and checks wheel slipping condition. And according to the slipping condition, the ECU controls the pressure holding valve and pressure reduction valve in order to adjust the fluid pressure of each wheel cylinder in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes.

Not Activated	Normal Braking	—	—
Activated	Pressure Increase Mode	Pressure Holding Mode	Pressure Reduction Mode
Hydraulic Circuit			
Pressure Holding Valve (Port A)	OFF (Open)	ON (Close)	ON (Close)
Pressure Reduction Valve (Port B)	OFF (Close)	OFF (Close)	ON (Open)
Wheel Cylinder Pressure	Increase	Hold	Reduction

Self Diagnosis

If the skid control ECU detects a malfunction in the ABS or EBD control, the warning lights will turn on.

The ECU will also store the code of the malfunctions. See the AVENSIS Chassis & Body Repair Manual Supplement (Pub. No. RM781E) for the diagnostic trouble code check method, diagnostic code and diagnostic code clearance.

Fail Safe

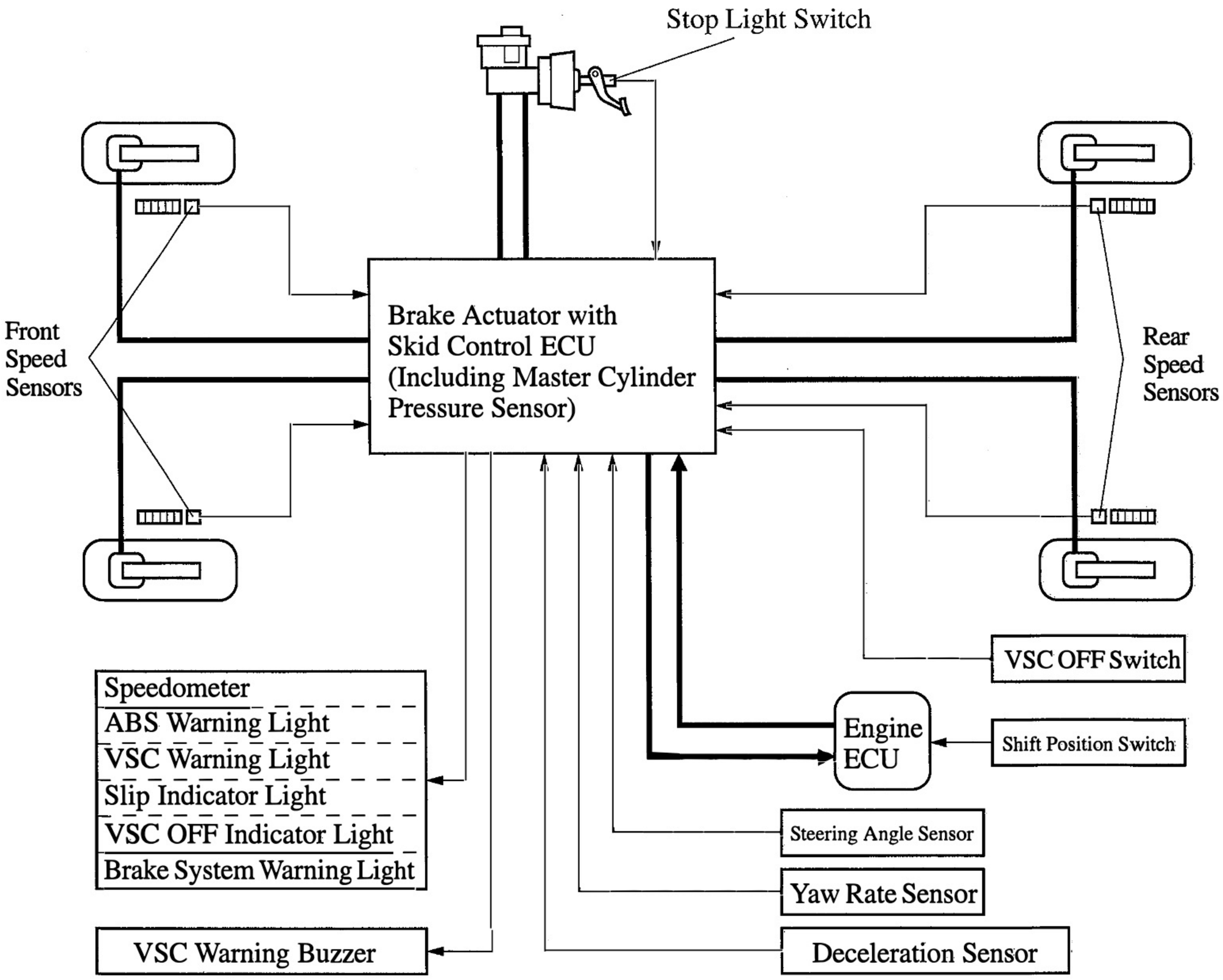
In the event of a malfunction in the ABS, the skid control ECU turns on the ABS warning light and prohibits the ABS control. In the case of the malfunction that the EBD control can not be carried out, the ABS ECU also turns on the brake system warning light and prohibits the EBD control.

4. ABS with EBD & Brake Assist & TRC & VSC System

General

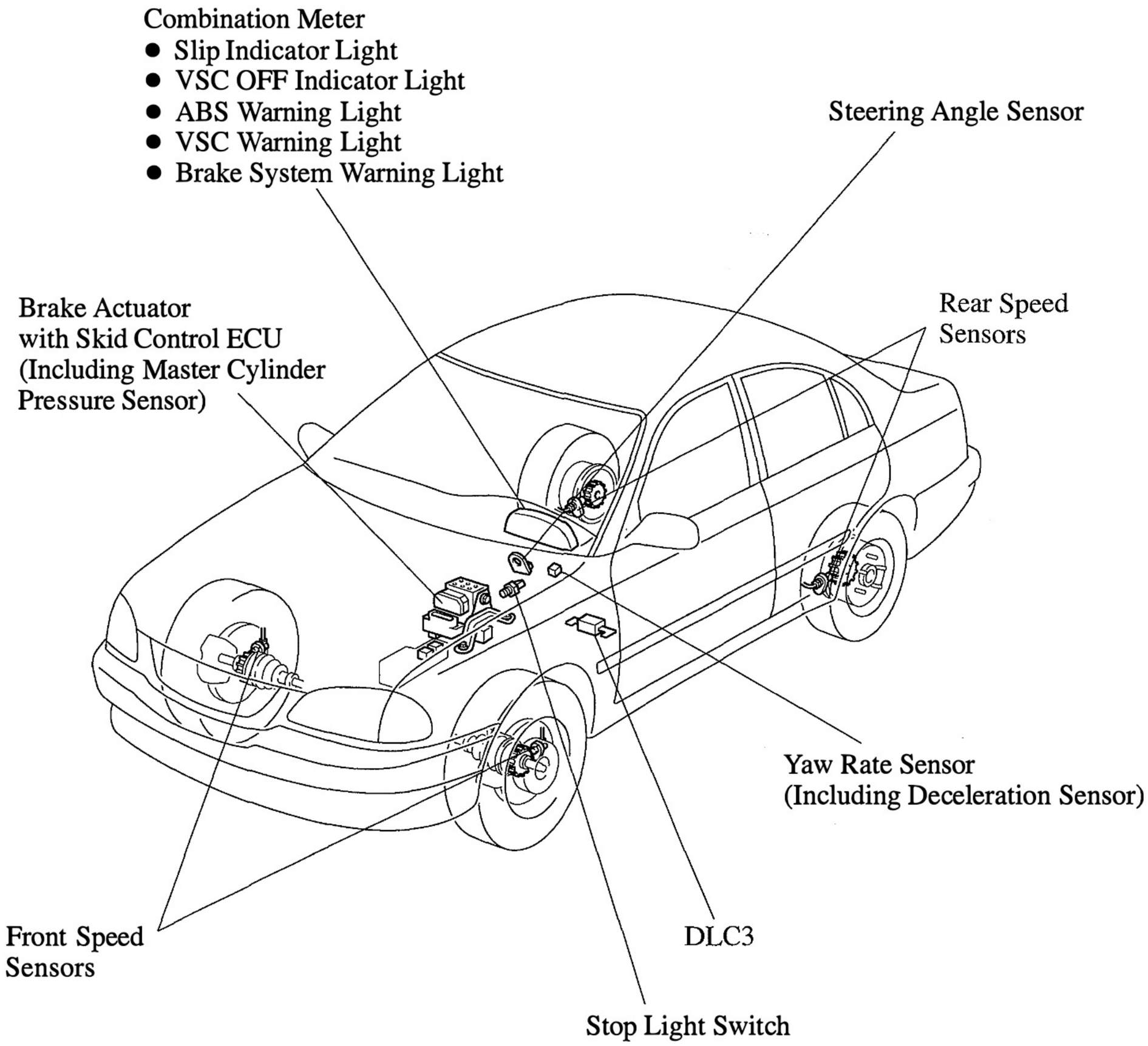
- The primary purpose of the ABS and TRC system has been to help the vehicle's stability during braking and acceleration. In contrast, the purpose of the VSC system is to help the vehicle's stability during cornering.
- Ordinarily, the vehicle corners in a stable manner in accordance with the steering operation. However, depending on the unexpected situations or external elements such as the ground surface conditions, vehicle speed, and emergency avoidance maneuvers, the vehicle may exhibit strong understeer or oversteer tendencies. In such situations, the VSC system dampens the strong understeer or oversteer to help vehicle stability.
- The primary purpose of the Brake Assist system is to provide an auxiliary brake force assist to the driver who cannot generate a large brake force during emergency braking, thus maximizing the vehicle's brake performance.
- The EBD control utilizes ABS, realizing the proper brake force distribution between front and rear wheels in accordance with the driving conditions.

System Diagram



195CH07

Layout of Main Components



195CH22

Function of Main Components

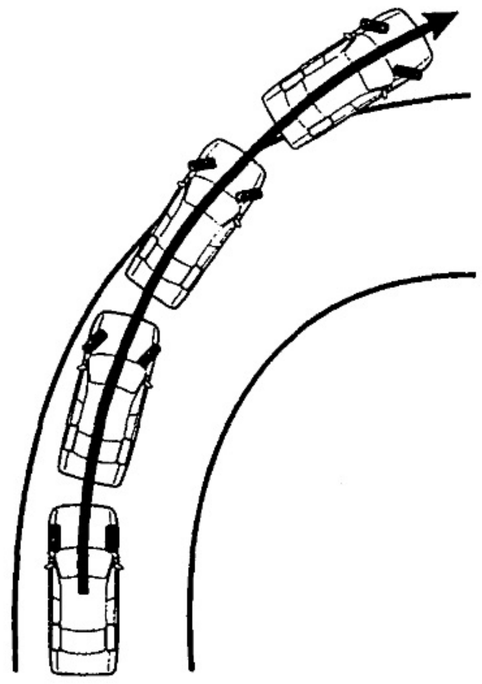
Components		Function
Warning Light and Indicator Light	ABS Warning Light	Lights up to alert the driver when the ECU detects the malfunction in the ABS or Brake Assist System.
	VSC Warning Light	Lights up to alert the driver when the ECU detects the malfunction in the TRC or VSC system.
	Slip Indicator Light	Blinks to inform the driver when the TRC system or the VSC system is operated.
	VSC OFF Indicator Light	Lights up to inform the driver when the TRC and VSC system is turned OFF by the VSC OFF switch. When the skid control ECU detects the malfunction in the TRC or VSC system.
	Brake System Warning Light	Lights up together with the ABS warning light to alert the driver when the ECU detects the malfunction not only in the ABS but also in the EBD control.
Engine ECU		Sends the throttle valve opening angle signal, shift position signal, etc., to the skid control ECU.
Skid Control ECU		Judges the vehicle driving condition based on signals from each sensor, and sends brake control signal to the brake actuator. Also transmits the control information to the engine ECU.
Brake Actuator		Changes the fluid path based on the signals from the skid control ECU during the operation of the ABS with EBD & Brake Assist & TRC & VSC system, in order to control the fluid pressure that is applied to the wheel cylinders.
Speed Sensors		Detect the wheel speed of each of four wheels.
Master Cylinder Pressure Sensor		Assembled in the brake actuator and detects the master cylinder pressure.
Control Relay	Pump Motor Relay	Controls the pump motor operation in the actuator.
	Solenoid Relay	Supply power to the solenoid valves in the actuator.
VSC OFF Switch		Turns the TRC and VSC system inoperative.
VSC Warning Buzzer		Emits an intermittent sound to inform the driver that the ECU detects the strong understeer tendency or strong oversteer tendency.
Stop Light Switch		Detects the brake depressing signal.
Yaw Rate Sensor		Detects the vehicle's yaw rate.
Deceleration Sensor		Detects the vehicle's acceleration in the lateral directions.
Steering Angle Sensor		Detects the steering direction and angle of the steering wheel.

Outline of VSC System

1) General

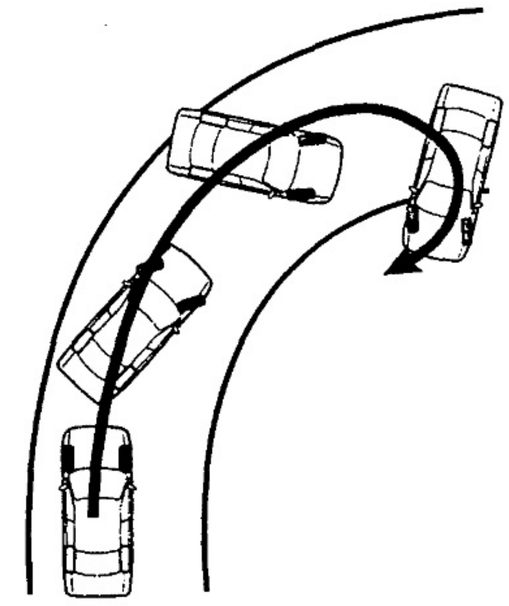
The followings are two examples that can be considered as circumstances in which the tires overcome their lateral grip limit.

- When the front wheels lose grip in relation to the rear wheels (strong understeer tendency).
- When the rear wheels lose grip in relation to the front wheels (strong oversteer tendency).



151CH17

Strong Understeer Tendency



151CH16

Strong Oversteer Tendency

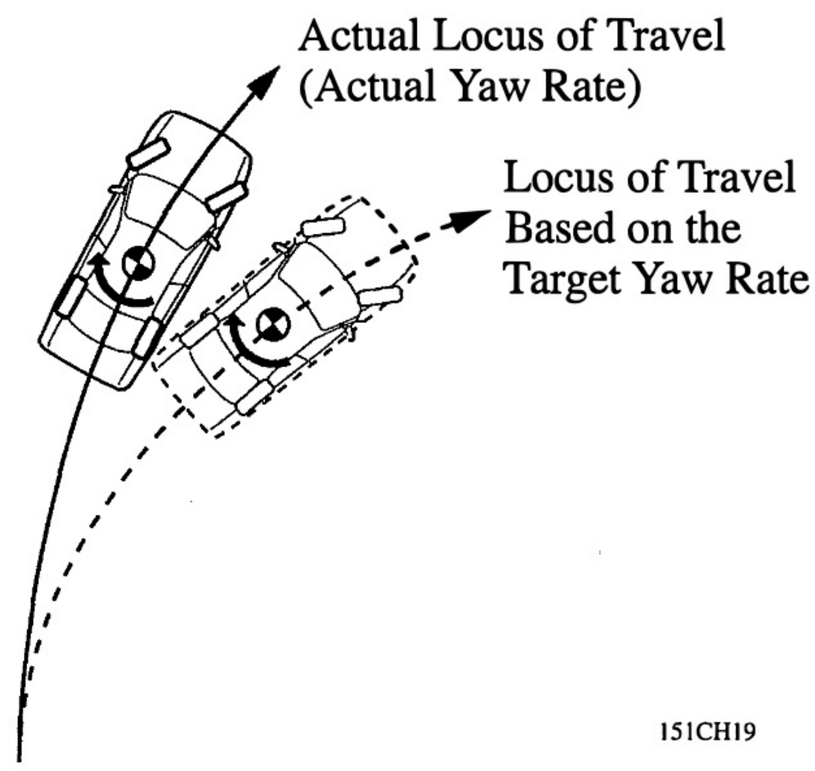
2) Method for Determining the Vehicle Condition

To determine the condition of the vehicle, sensors detect the steering angle, vehicle speed, vehicle's yaw rate, and the vehicle's lateral acceleration, which are then calculated by the skid control ECU.

a. Determining Understeer

Whether or not the vehicle is in the state of understeer is determined by the difference between the target yaw rate and the vehicle's actual yaw rate.

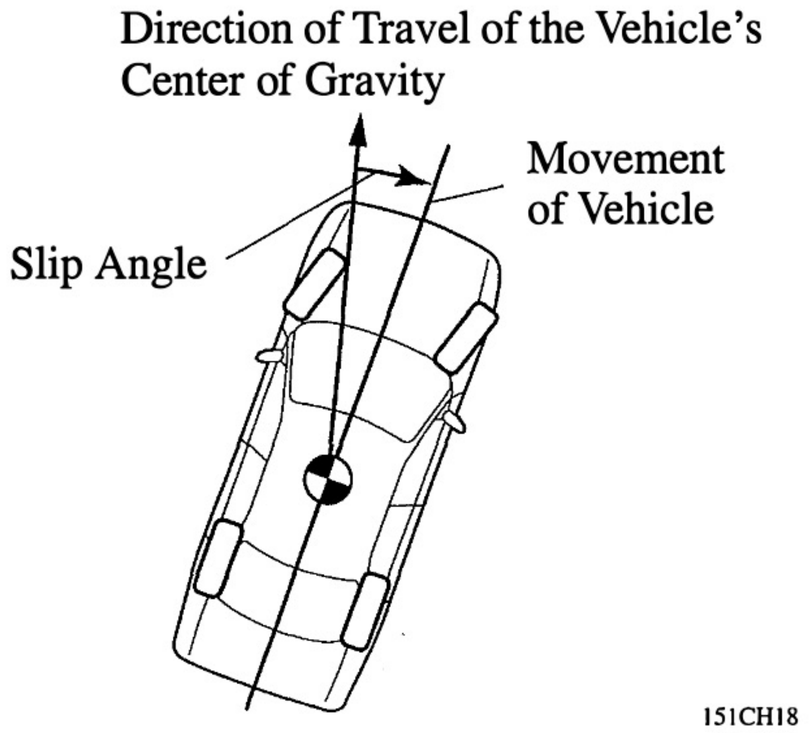
When the vehicle's actual yaw rate is smaller than the yaw rate (a target yaw rate that is determined by the vehicle speed and steering angle) that should be rightfully generated when the driver operates the steering wheel, it means the vehicle is making a turn at a greater angle than the loss of travel. Thus, the ECU determines that there is a large tendency to understeer.



151CH19

b. Determining Oversteer

Whether or not the vehicle is in the state of oversteer is determined by the values of the vehicle's slip angle and the vehicle's slip angular velocity (time-dependent changes in the vehicle's slip angle). When the vehicle's slip angle is large, and the slip angular velocity is also large, the ECU determines that the vehicle has a large oversteer tendency.



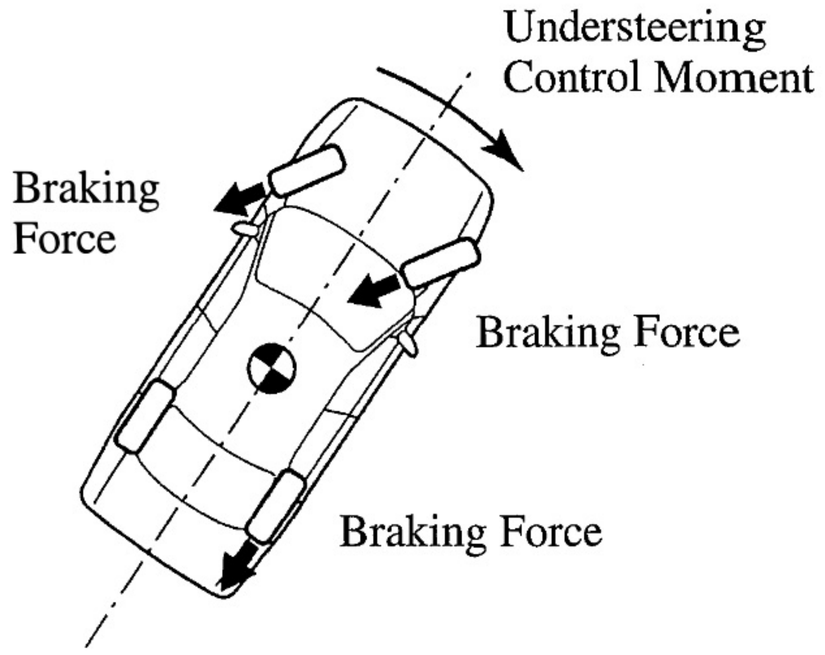
151CH18

3) Method of VSC Operation

When the skid control ECU determines that the vehicle exhibits a tendency to understeer or oversteer, it decreases the engine output and applies the brake of a front or rear wheel to control the vehicle's yaw moment.

a. Dampening a Strong Understeer

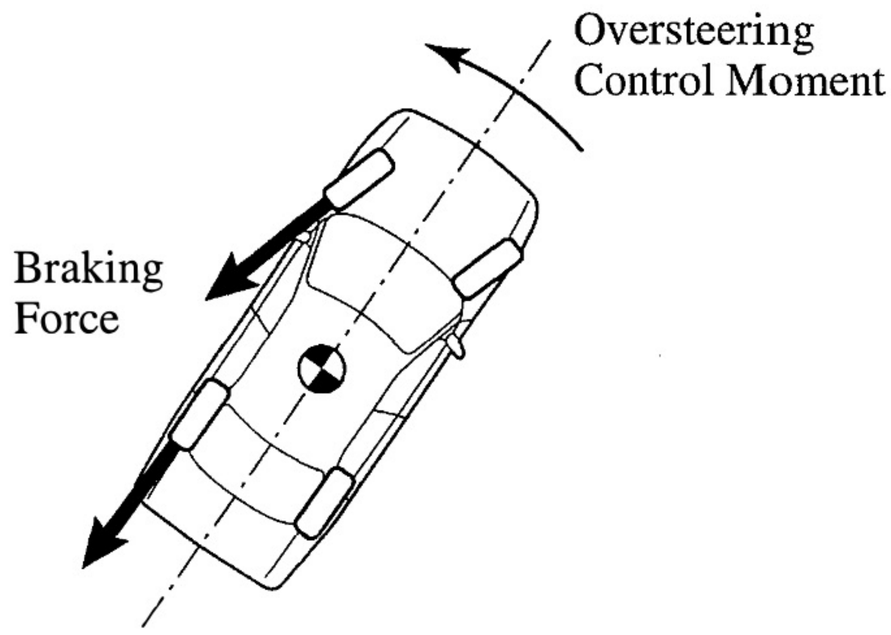
When the skid control ECU determines that the vehicle exhibits a strong tendency to understeer, depending on the extent of that tendency, it controls the engine output and applies the brakes of the front wheels and inside rear wheel, thus providing the vehicle with an understeer control moment, which helps dampen its tendency to understeer. Also, depending on whether the brakes are ON or OFF and the condition of the vehicle, there are circumstances in which the brakes might not be applied to the wheels even if those wheels are targeted for braking.



Making a Right Turn 161ES30

b. Dampening a Strong Oversteer

When the skid control ECU determines that the vehicle exhibits a strong tendency to oversteer, depending on the extent of that tendency, it controls the engine output and applies the brakes of the front and rear wheels of the outside of the turn, thus generating an inertial moment in the vehicle's outward direction, which helps dampen its tendency to oversteer.



170CH07

Making a Right Turn

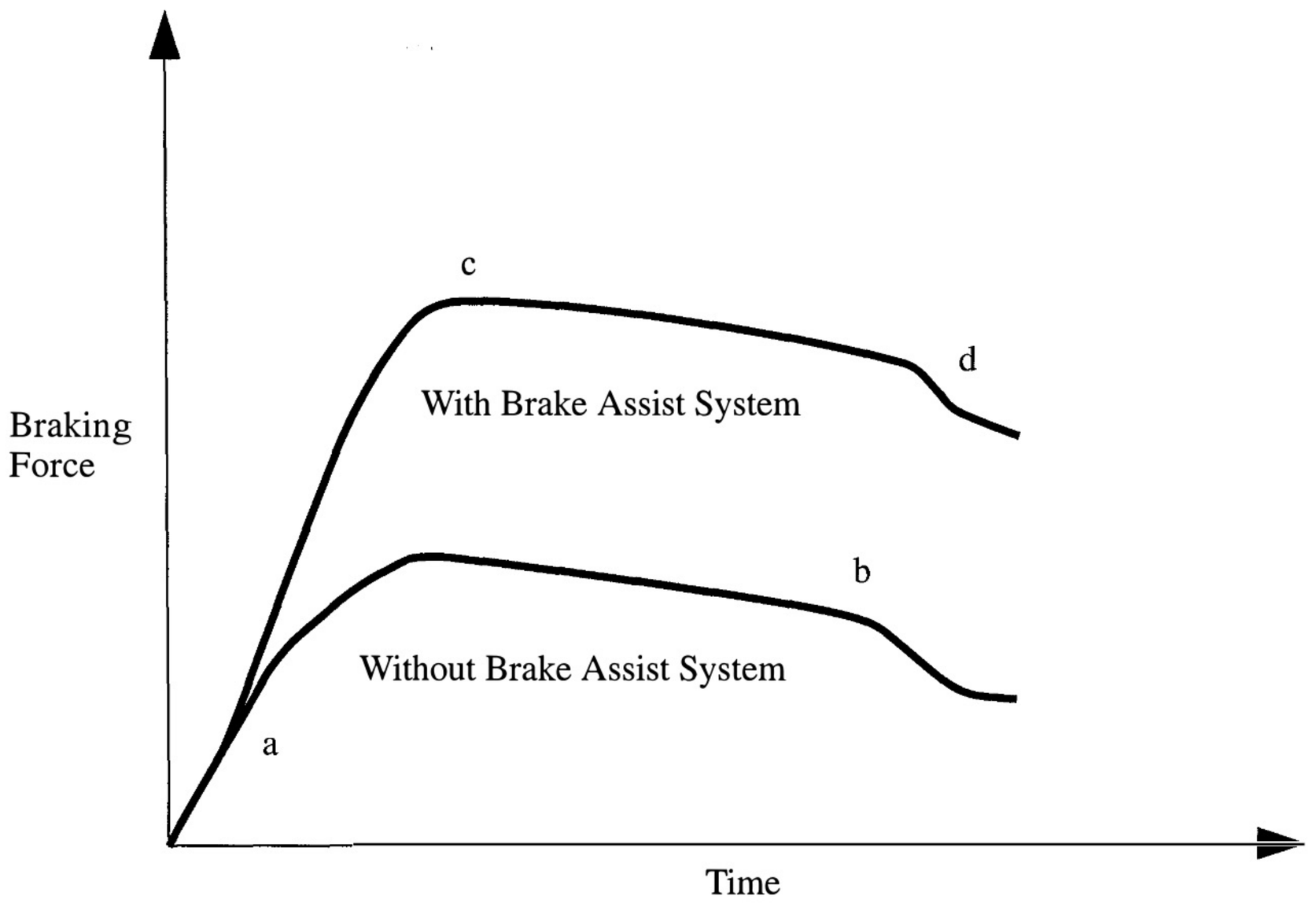
Outline of Brake Assist System

Brake Assist interprets a quick push of the brake pedal as emergency braking and supplements the braking power applied if the driver has not stepped hard enough on the brake pedal.
In emergencies, drivers, especially inexperienced ones, often panic and do not apply sufficient pressure on the brake pedal.
Brake Assist system measures the speed and force with which the brake pedal is pushed to determine whether the driver is attempting to brake rapidly, and applies additional pressure to maximize braking performance of both conventional brakes and ABS equipped brakes.
A key feature of Brake Assist is that the timing the degree of braking assistance are designed to ensure that the driver does not discern anything unusual about the braking operation. When the driver intentionally eases up on the brake pedal, the system reduce the amount of assistance it provides.

– REFERENCE –

Effectiveness of the Brake Assist Operation:

a. During emergency braking, an inexperienced driver, or a driver in a state of panic might not be able to firmly depress the brake pedal, although driver can depress it quickly. As a result, only a small amount of brake force is generated.
b. The pedal effort of this type of driver might weaken as time passes, causing a reduction in the braking force.
c. Based on how quickly the brake pedal is depressed, the Brake Assist operation assesses the intention of the driver to apply emergency braking and increases the brake force.
d. After the Brake Assist operation, if the driver intentionally releases the brake pedal, the assist operation reduces the amount of Brake Assist in order to reduce the feeling of uneasiness.

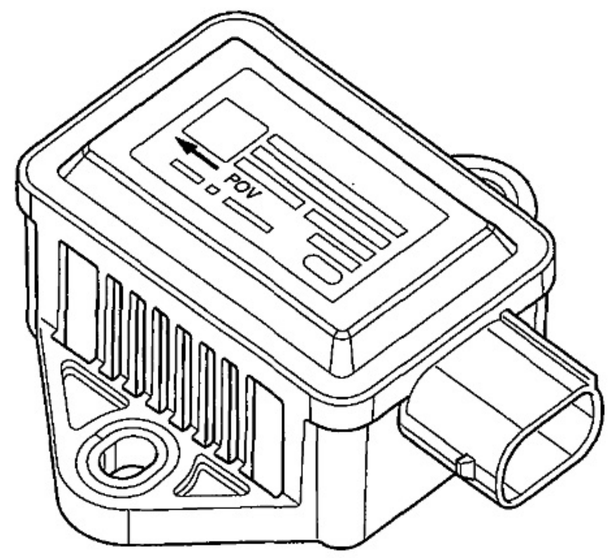


170CH18

Construction and Operation of Main Components

1) Yaw Rate Sensor

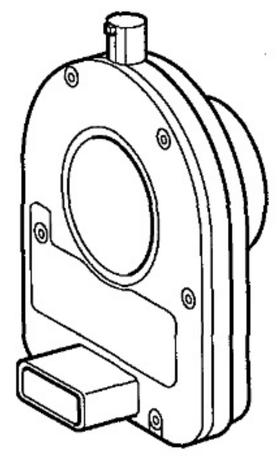
A deceleration sensor is built into the yaw rate sensor. This sensor detects the yaw rate and deceleration, and sends this signal to the Skid Control ECU.



195CH24

2) Steering Angle Sensor

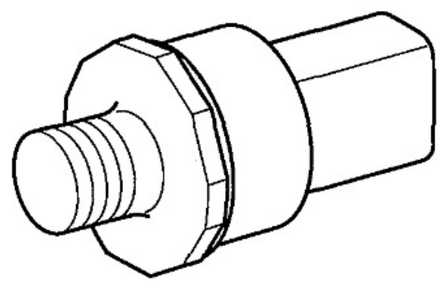
The steering angle sensor detects the steering direction and angle, and sends this signal to the skid control ECU.



195CH08

3) Master Cylinder Pressure Sensor

The master cylinder pressure sensor detects the hydraulic pressure that is generated in accordance with the pedal effort applied to the brake pedal and outputs the signals to the skid control ECU.



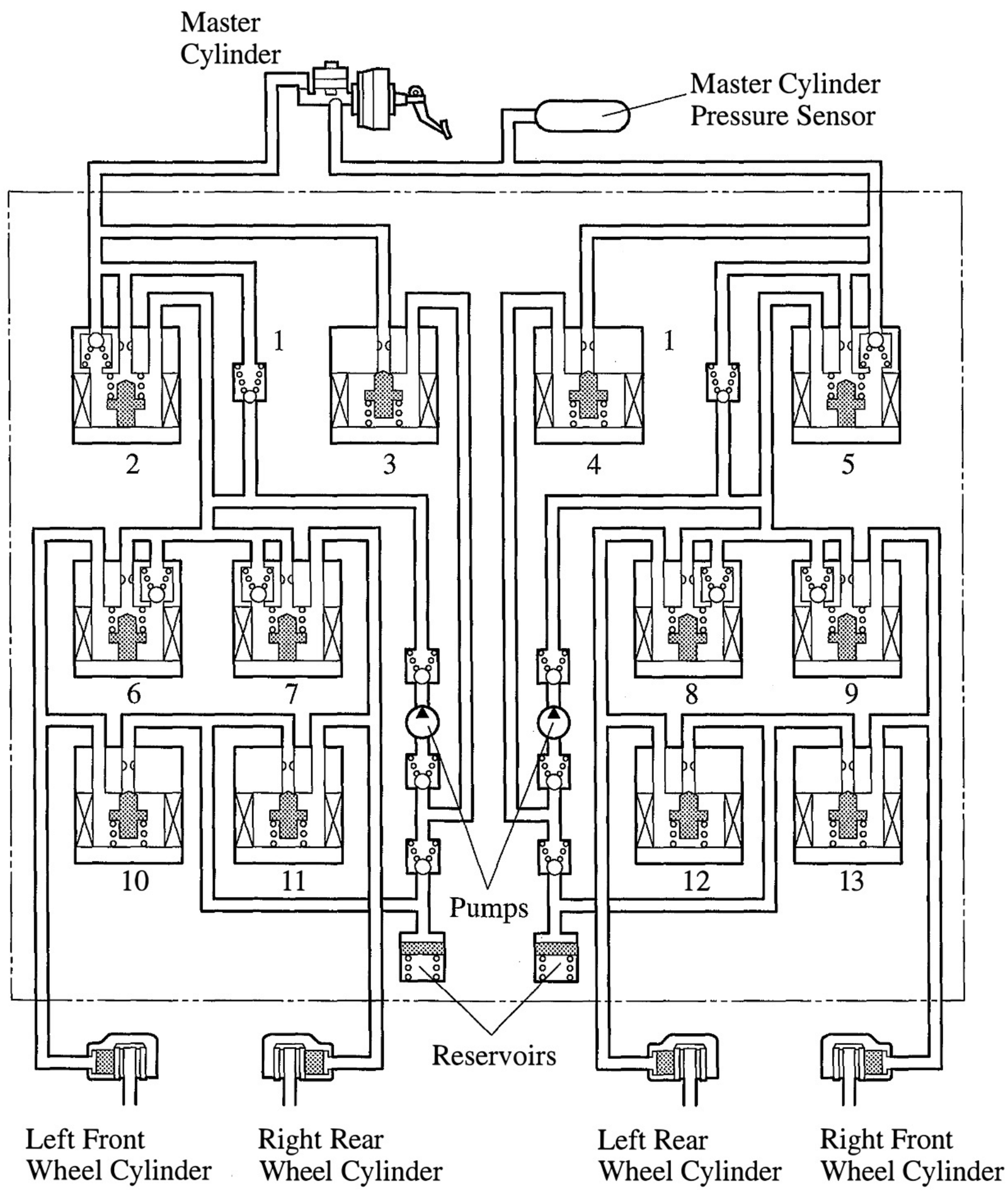
195CH09

4) Brake Actuator (ABS with EBD & Brake Assist & TRC & VSC Actuator)

a. Construction

The brake actuator consists of 12 two-position solenoid valves, 1 motor 2 pumps, 2 reservoirs and 2 pressure regulator valves (1). The 12 two-position solenoid valves consist of 2 master cylinder cut solenoid valves (2, 5), 2 reservoir cut solenoid valves (3, 4), 4 pressure holding valves (6, 7, 8, 9) and 4 pressure reduction valves (10, 11, 12, 13).
Pressure regulator valves (1) are assembled into the master cylinder cut solenoid valve (3, 5).

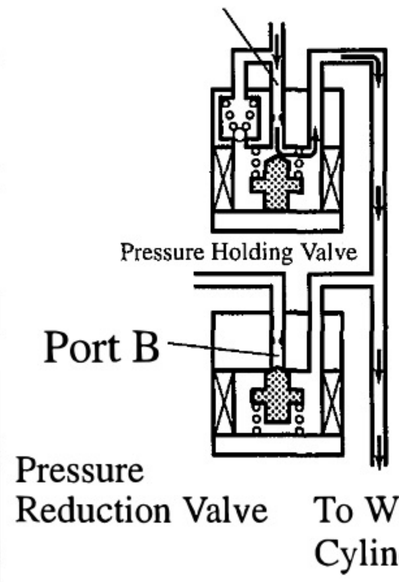
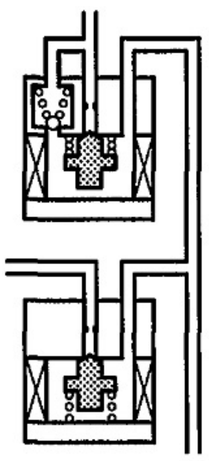
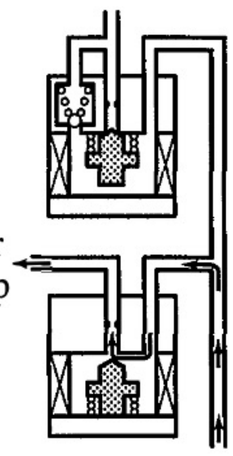
b. Hydraulic Circuit



195CH10

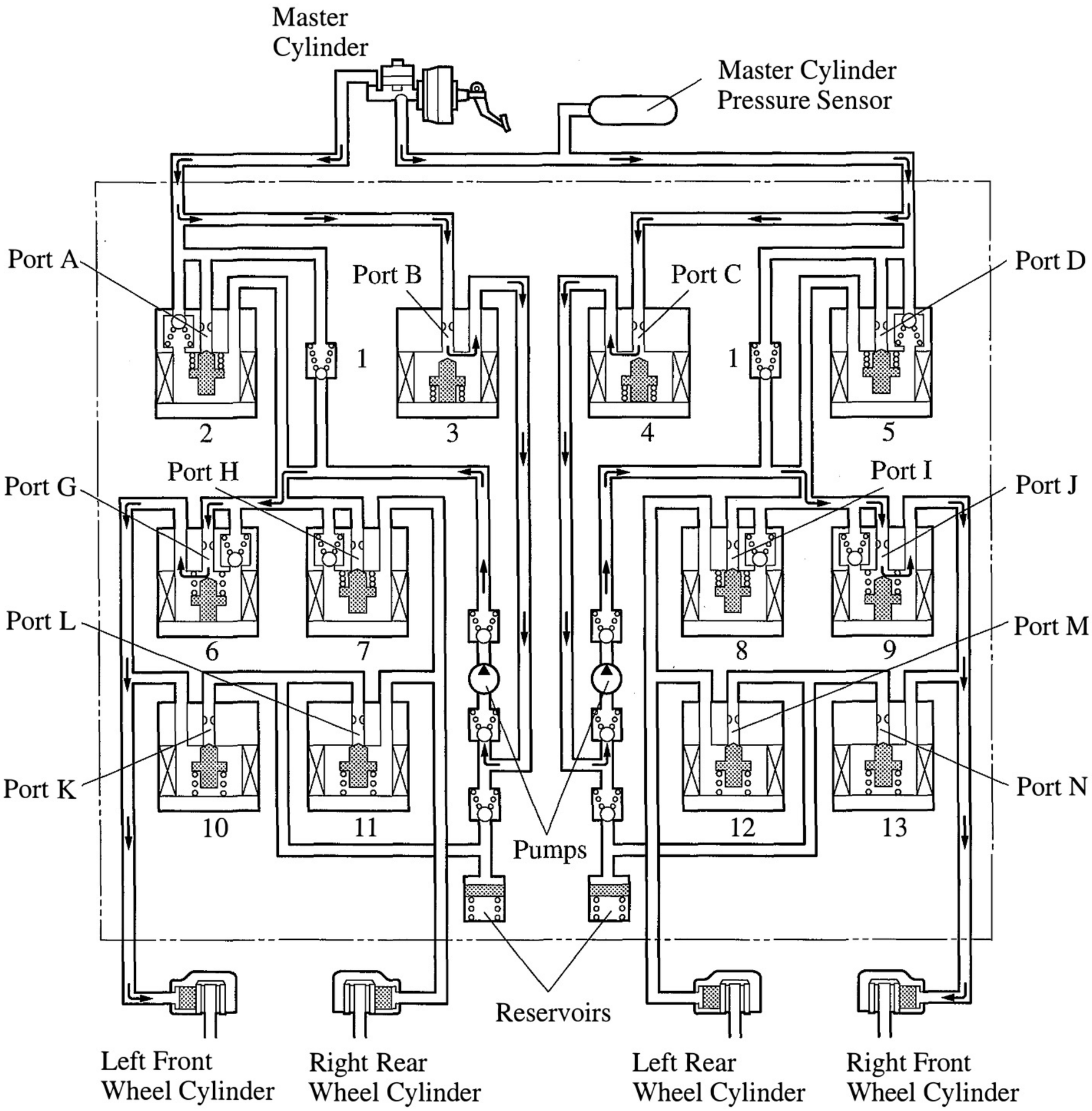
c. ABS with EBD Operation

Based on the signals received from the 4 wheel speed sensors, the skid control ECU calculates each wheel speed and deceleration, and checks wheel slipping condition. And according to the slipping condition, the ECU controls the pressure holding valve and pressure reduction valve in order to adjust the fluid pressure of each wheel cylinder in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes.

Not Activated	Normal Braking	—	—
Activated	Pressure Increase Mode	Pressure Holding Mode	Pressure Reduction Mode
Hydraulic Circuit	 169CH54	 169CH55	 169CH56
Pressure Holding Valve (Port A)	OFF (Open)	ON (Close)	ON (Close)
Pressure Reduction Valve (Port B)	OFF (Close)	OFF (Close)	ON (Open)
Wheel Cylinder Pressure	Increase	Hold	Reduction

d. TRC Operation

The fluid pressure that is generated by the pump, is regulated by the pressure regulator valve to the required pressure. Thus, the wheel cylinder of the drive wheel (front wheels) are controlled in the following 3 modes : pressure reduction, pressure holding, and pressure increase modes, to restrain the slippage of the drive wheels. The diagram below shows the hydraulic circuit in the pressure increase mode when the TRC operation is activated. In other operating modes, the pressure holding valve and the pressure reduction valve are turned ON/OFF according to the ABS operation pattern described on the previous page.



195CH11

Increase Mode

Item		TRC Not Activated	TRC Activated		
			Pressure Increase Mode	Pressure Holding Mode	Pressure Reduction Mode
2	Master Cylinder Cut Solenoid Valve (Front and Rear)	OFF	ON	ON	ON
5	Port: A, D	Open	Close	Close	Close
3	Reservoir Cut Solenoid Valve (Front and Rear)	OFF	ON	ON	ON
4	Port: B, C	Close	Open	Open	Open
6	Pressure Holding Valve (Front)	OFF	OFF	ON	ON
9	Port: G, J	Open	Open	Close	Close
7	Pressure Holding Valve (Rear)	OFF	ON	ON	ON
8	Port: H, I	Open	Close	Close	Close
10	Pressure Reduction Valve (Front)	OFF	OFF	OFF	ON
13	Port: K, N	Close	Close	Close	Open
11	Pressure Reduction Valve (Rear)	OFF	OFF	OFF	OFF
12	Port: L, M	Close	Close	Close	Close
Wheel Cylinder Pressure	Front Wheels	—	Increase	Hold	Reduction
	Rear Wheels	—	—	—	—

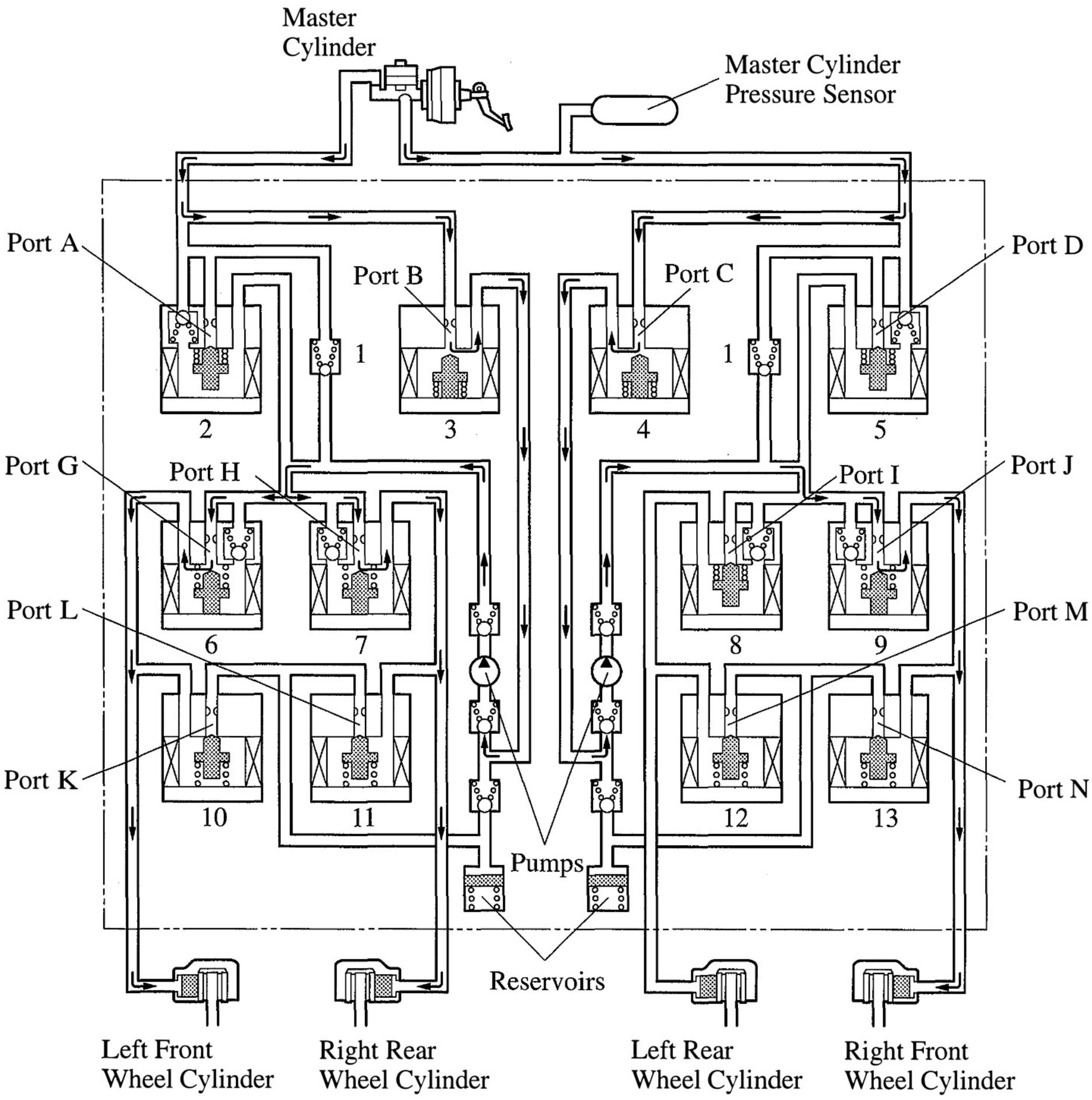
e. VSC Operation

General

The VSC operation, by way of solenoid valves, controls the fluid pressure that is generated by the pump and applies it to the brake wheel cylinder of each wheel in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes. As a result, the tendency to understeer or oversteer is restrained.

Understeer Restraining Control

In understeer restraining control, the brakes of the front wheels and rear wheel of the inner side of the turn is applied. Also, depending on whether the brake is ON or OFF and the condition of the vehicle, there are circumstances in which the brake might not be applied to the wheels even if those wheels are targeted for braking. The diagram below shows the hydraulic circuit in the pressure increase mode, as it restrains an understeer condition while the vehicle makes a right turn.
In other operating modes, the pressure holding valve and the pressure reduction valve are turned ON/OFF according to the ABS operation pattern.



Increase Mode

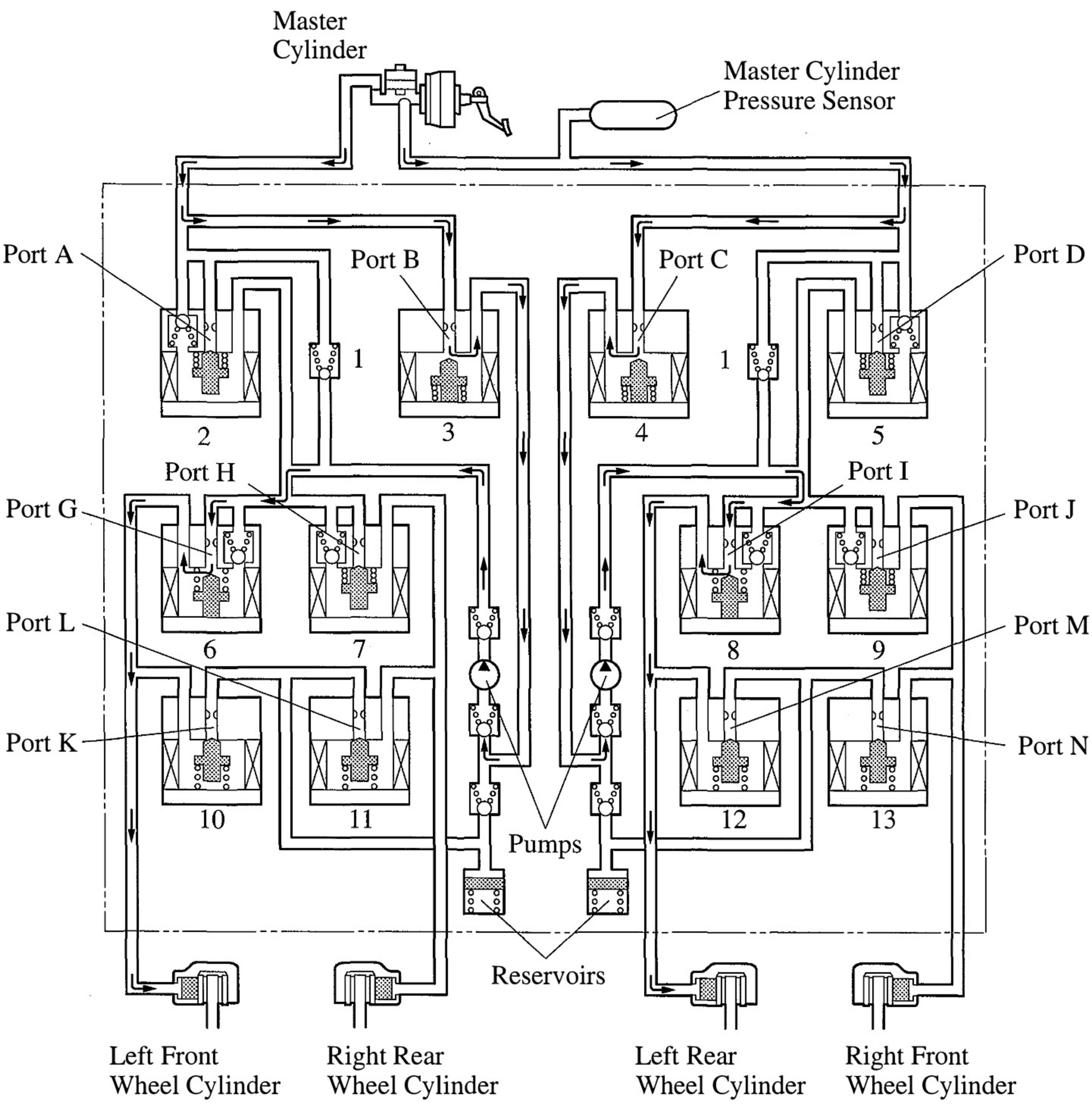
195CH12

▶ While the Vehicle Makes a Right Turn ◀

Item		VSC Not Activated	VSC Activated		
			Pressure Increase Mode	Pressure Holding Mode	Pressure Reduction Mode
2	Master Cylinder Cut Solenoid Valve (Front and Rear)	OFF	ON	ON	ON
5	Port: A, D	Open	Close	Close	Close
3	Reservoir Cut Solenoid Valve (Front and Rear)	OFF	ON	ON	ON
4	Port: B, C	Close	Open	Open	Open
6 7	Pressure Holding Valve (Left and Right Front, Right Rear)	OFF	OFF	ON	ON
9	Port: G, H, J	Open	Open	Close	Close
8	Pressure Holding Valve (Left Rear)	OFF	ON	ON	ON
	Port: I	Open	Close	Close	Close
10 11 13	Pressure Reduction Valve (Left and Right Front, Right Rear)	OFF	OFF	OFF	ON
	Port: K, L, N	Close	Close	Close	Open
12	Pressure Reduction Valve (Left Rear)	OFF	OFF	OFF	OFF
	Port: M	Close	Close	Close	Close
Wheel Cylinder Pressure	Right Front Wheel	—	Increase	Hold	Reduction
	Left Front Wheel	—	Increase	Hold	Reduction
	Right Rear Wheel	—	Increase	Hold	Reduction
	Left Rear Wheel	—	—	—	—

Oversteer Restraining Control

In oversteer restraining control, the brake of the front and rear wheels of the outer side of the turn is applied.
As an example, the diagram below shows the hydraulic circuit in the pressure increase mode, as it restrains an oversteer condition while the vehicle makes a right turn.
As in understeer restraining control, in other operating modes, the pressure holding valve and the pressure reduction valve are turned ON/OFF according to the ABS operation pattern.
However, in oversteer control, the pressure holding valve is turned ON and blocks the hydraulic passage to the frot inner wheel in order to prevent applying the brake to the front inner wheel.



Increase Mode

195CH13

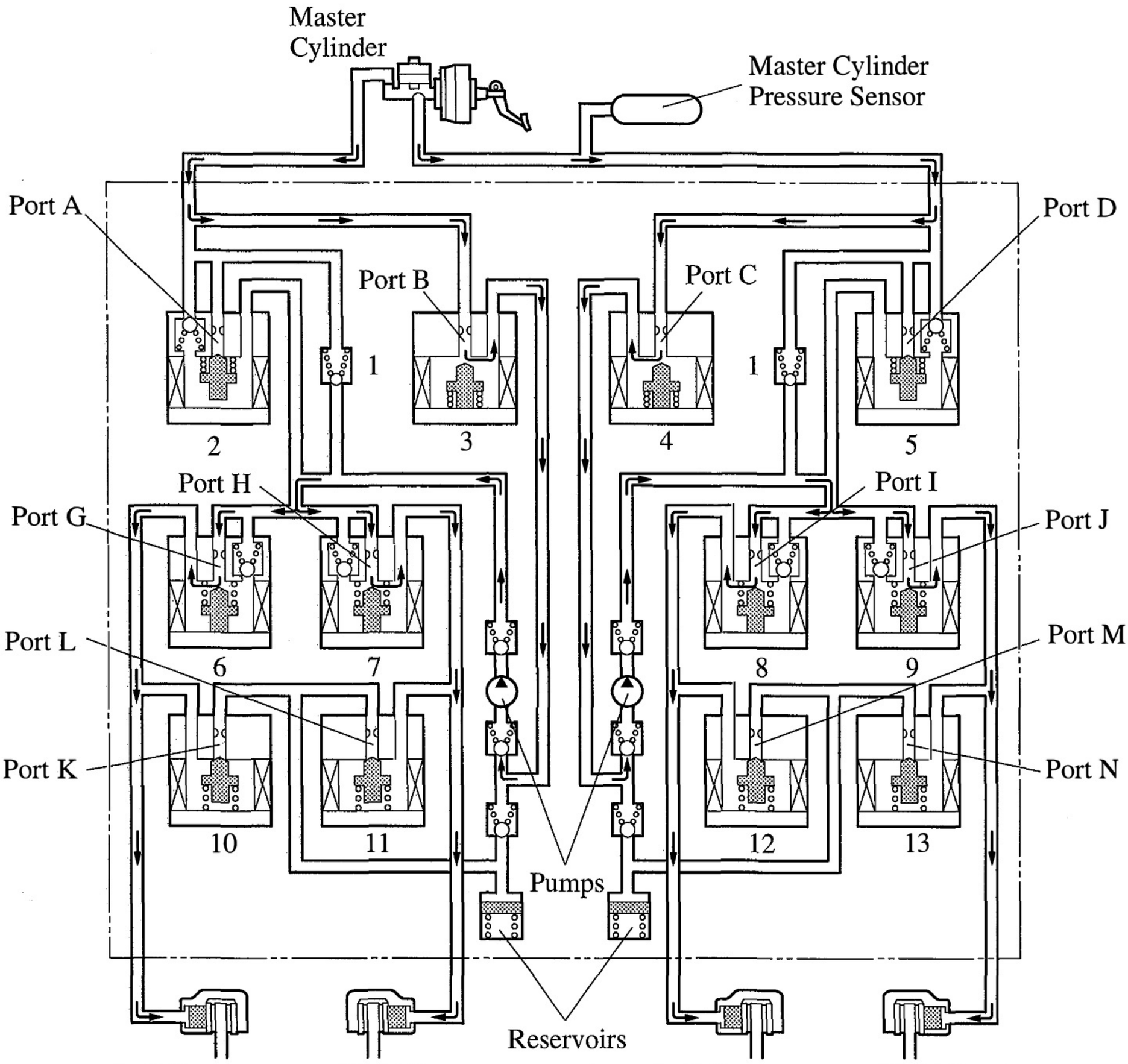
▶ While the Vehicle Makes a Right Turn ◀

Item		VSC Not Activated	VSC Activated		
			Pressure Increase Mode	Pressure Holding Mode	Pressure Reduction Mode
2	Master Cylinder Cut Solenoid Valve (Front and Rear)	OFF	ON	ON	ON
5	Port: A, D	Open	Close	Close	Close
3	Reservoir Cut Solenoid Valve (Front and Rear)	OFF	ON	ON	ON
4	Port: B, C	Close	Open	Open	Open
7	Pressure Holding Valve (Front and Rear Right)	OFF	ON	ON	ON
9	Port: H, J	Open	Close	Close	Close
6	Pressure Holding Valve (Front and Rear Left)	OFF	OFF	ON	ON
8	Port: G, I	Open	Open	Close	Close
10	Pressure Reduction Valve (Front and Rear Left)	OFF	OFF	OFF	ON
12	Port: K, M	Close	Close	Close	Open
11	Pressure Reduction Valve (Front and Rear Right)	OFF	OFF	OFF	OFF
13	Port: L, N	Close	Close	Close	Close
Wheel Cylinder Pressure	Right Front Wheel	—	—	—	—
	Left Front Wheel	—	Increase	Hold	Reduction
	Right Rear Wheel	—	—	—	—
	Left Rear Wheel	—	Increase	Hold	Reduction

3

f. Brake Assist Operation

The fluid pressure that has been generated by the pump in the brake actuator is directed to the wheel cylinders. By applying a greater fluid pressure than the master cylinder, a greater braking force is achieved.



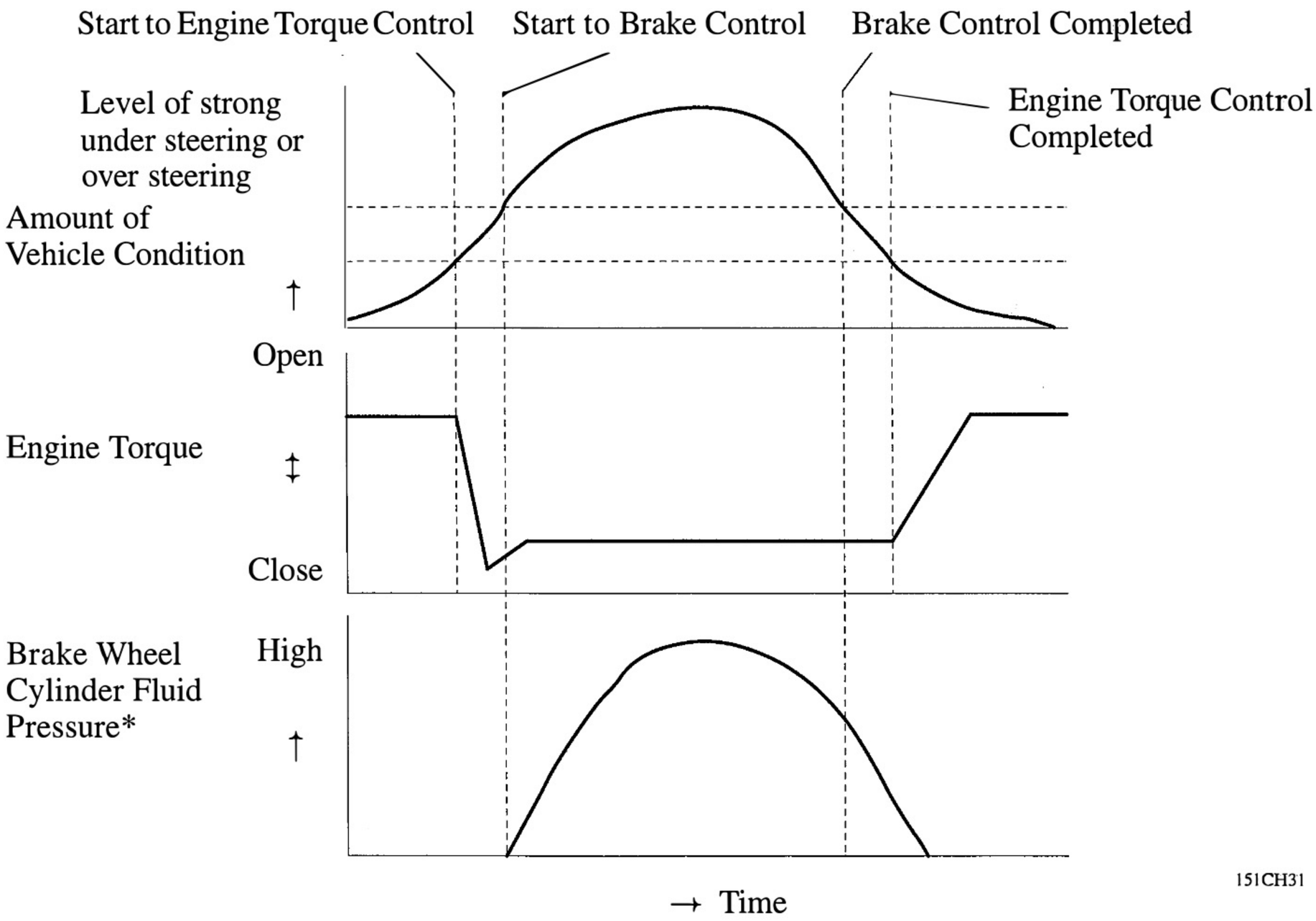
195CH14

Item		Brake Assist Not Activated	Brake Assist Activated
2	Master Cylinder Cut Solenoid Valve (Front and Rear)	OFF	ON
5	Port: A, D	Open	Close
3	Reservoir Cut Solenoid Valve (Front and Rear)	OFF	ON
4	Port: B, C	Close	Open
6, 7	Pressure Holding Valve (Front and Rear)	OFF	OFF
8, 9	Port: G, H, I, J	Open	Open
10, 11	Pressure Reduction Valve (Front and Rear)	OFF	OFF
12, 13	Port: K, L, M, N	Close	Close

5) Skid Control ECU

a. Vehicle Stability Control

Based on the 4 types of sensor signals received from the speed sensors, yaw rate sensor (including deceleration sensor) and steering sensor, the Skid Control ECU calculates the amount of vehicle condition. If a strong understeer or oversteer tendency is created during an emergency avoidance maneuver or cornering, and the Skid Control ECU determines that the amount of vehicle condition exceeds a prescribed value, it controls the engine torque control and the brake fluid pressure according to the amount of the vehicle condition.



151CH31

*: The wheel cylinder that activates varies depending on the condition of the vehicle.

b. Self-Diagnosis

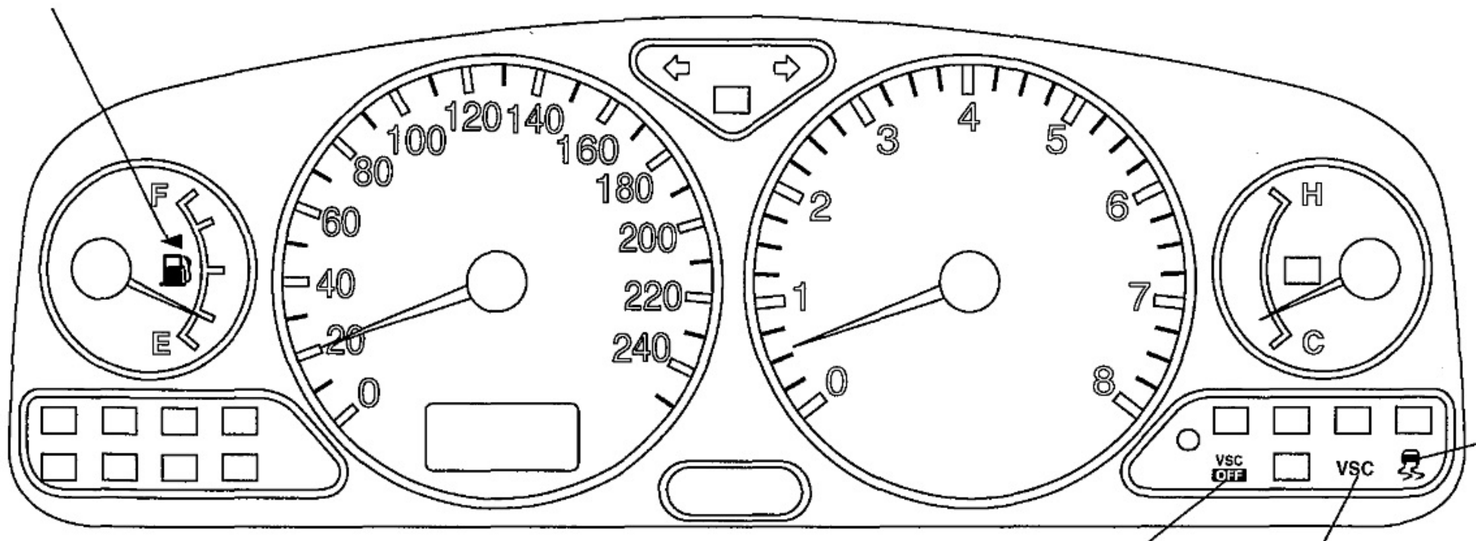
If the Skid Control ECU detects a malfunction in the VSC system, the warning light or the indicator light that corresponds to the function in which the malfunction has been detected lights up, to alert the driver of the malfunction. The ECU will also store the codes of the malfunctions. The DTCs (Diagnostic Trouble Codes) can be accessed through the blinking of the VSC warning light or the use of a hand-held tester. For details, see the AVENSIS Chassis & Body Repair Manual Supplement (Pub. RM781E).

c. Fail Safe

In the event of a malfunction in the Skid Control ECU turns on the ABS warning light and the VSC warning light and prohibits the ABS, TRC, VSC and Brake Assist control. In the case of the malfunction that the EBD control can not be carried out, the ECU also turns on the brake system warning light and prohibits the EBD control.

■COMBINATION METER

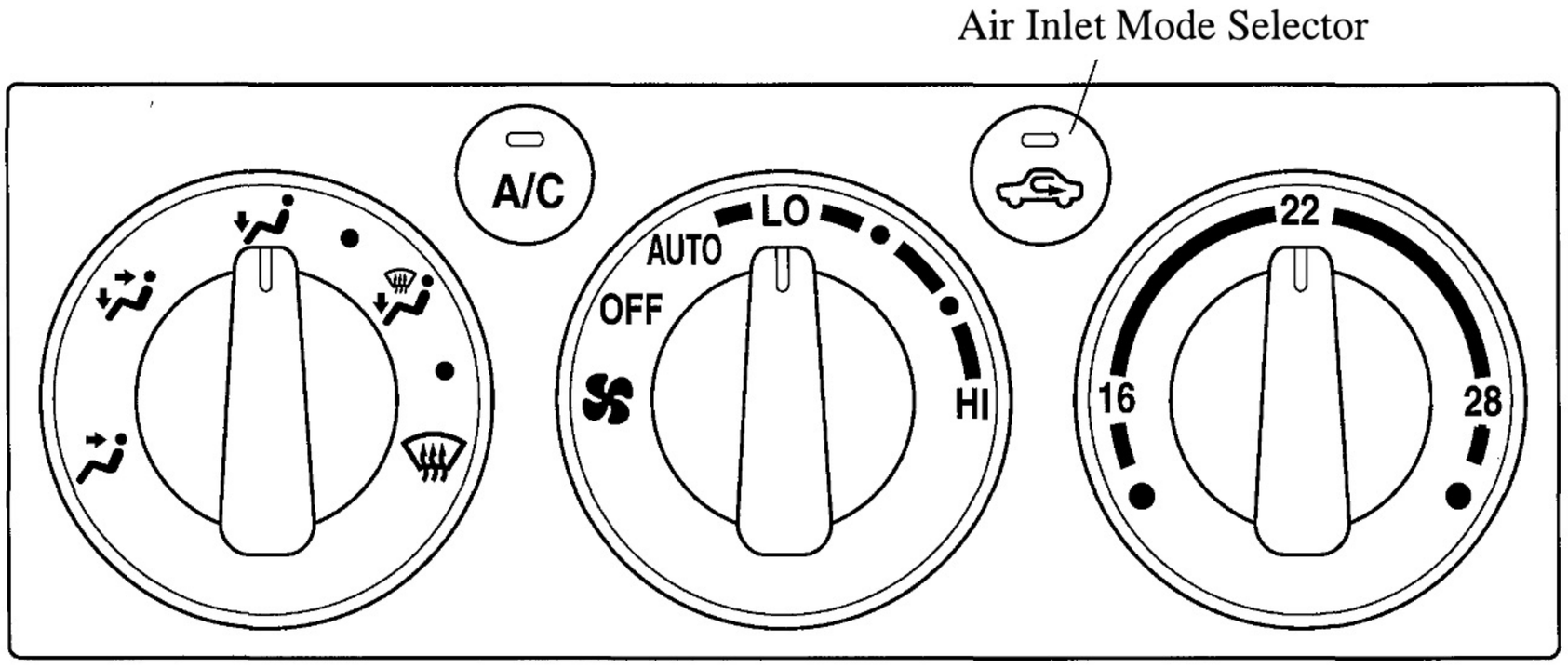
- The color of the illumination, letters and numbers, and the dial plates has been changed to improve product appeal.
- An indicator that points to the (right or left) position of the fuel lid has been added.
- Indicator lights that are related to the VSC system have been added to the models equipped with VSC (Vehicle Stability Control).



195BE01

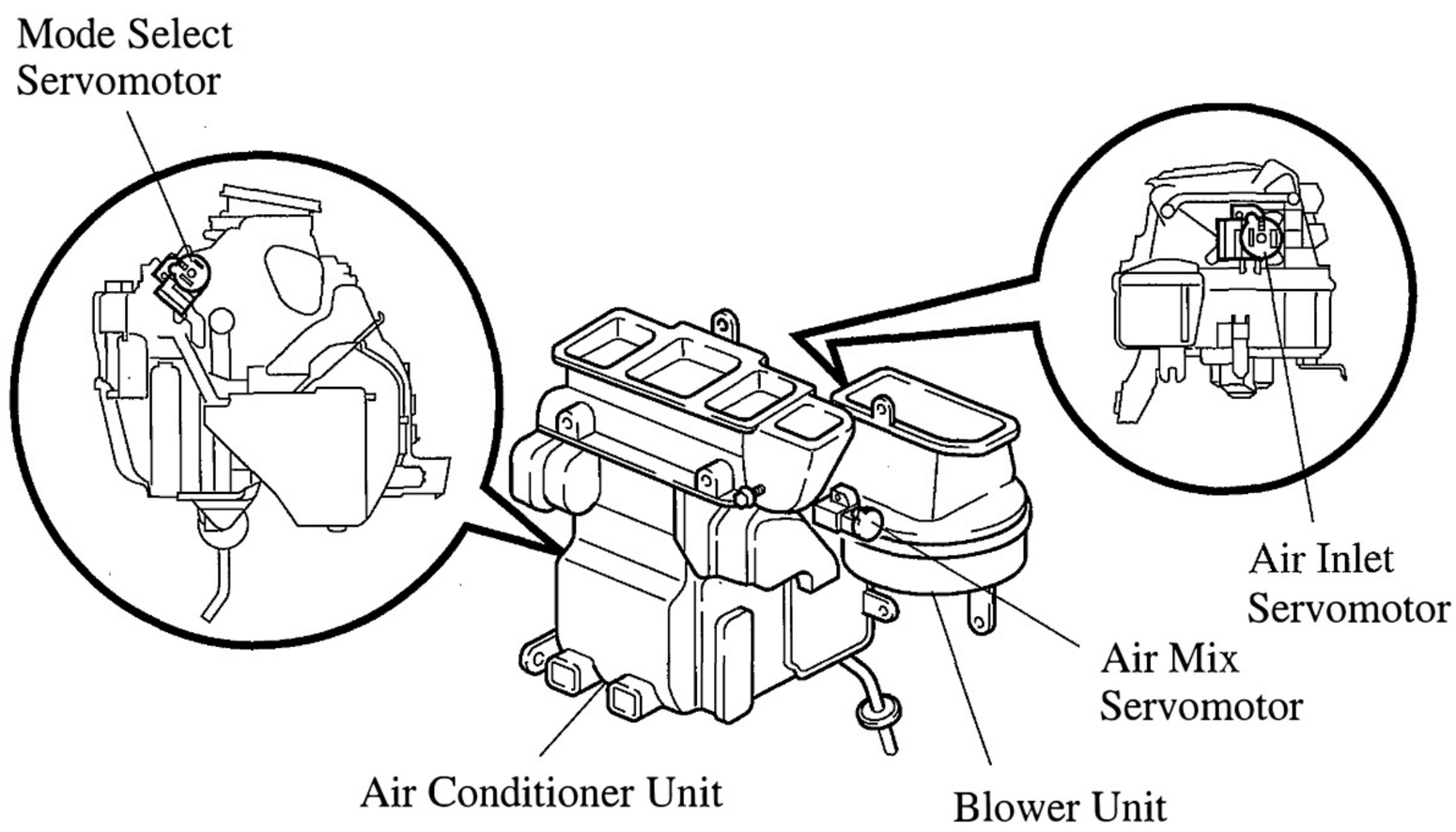
■HEATER CONTROL SYSTEM

- Air inlet mode selector has been changed to push and lock button type from lever type.
- The control of the mode selector switch, fan speed selector switch, and temperature selector switch has been changed from the manual to the electric type in order to improve the operating feel. Accordingly, the switching of the mode doors has been changed from the previous cable-driven type to the servomotor-driven type.



195BE02

with Air Conditioner Model



195BE03

■DOOR LOCK CONTROL SYSTEM

1. General

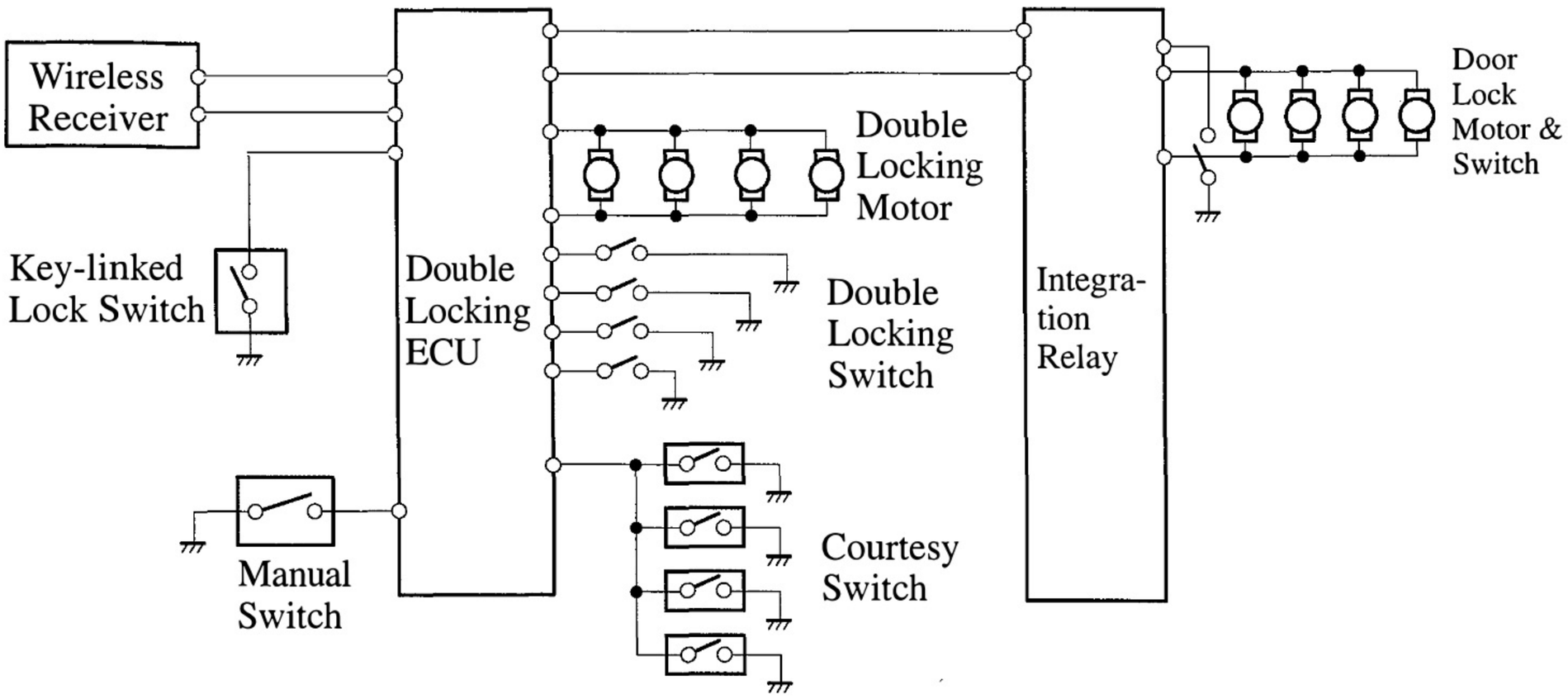
The double locking system is standard equipment on the RHD model for Europe.

2. Double Locking System

General

- The double locking system also prevents the doors from being opened through the operation of the inside door knobs. Thus, the doors cannot be opened either from the inside or the outside of the vehicle.
- To lock the doors with this system, pressing the transmitter's LOCK switch, then pressing it again within 5 seconds activates the double locking system.

▶ System Diagram ◀



4-Door Sedan Model

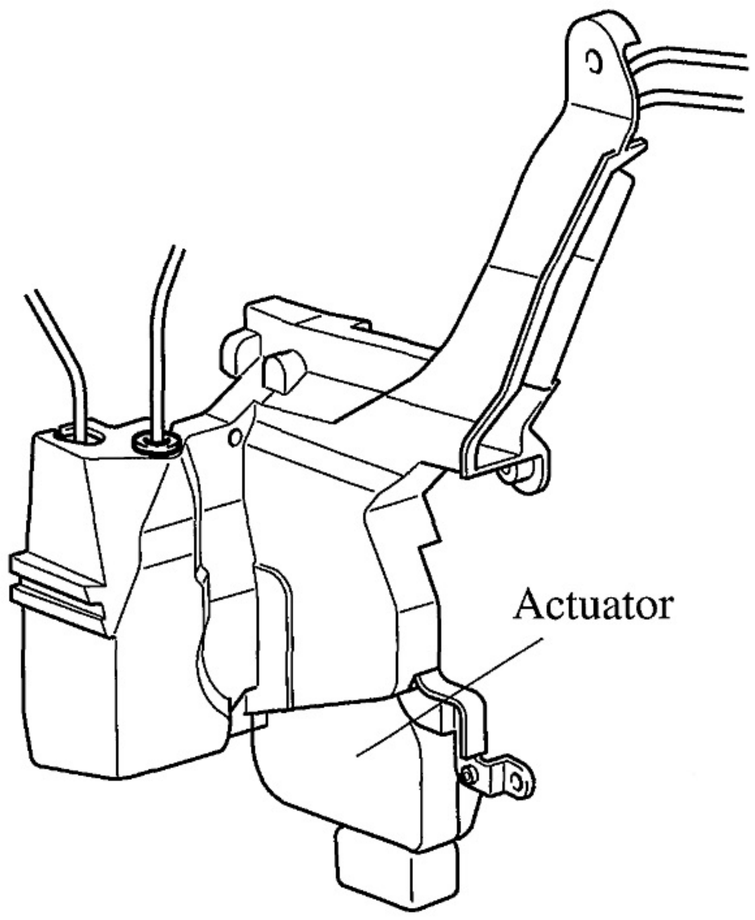
195BE12

CAUTION

Never activate the double locking system when there are people in the vehicle because the doors cannot be opened from the inside of the vehicle.
If locking the doors by accident, press "Unlock" button of the transmitter.

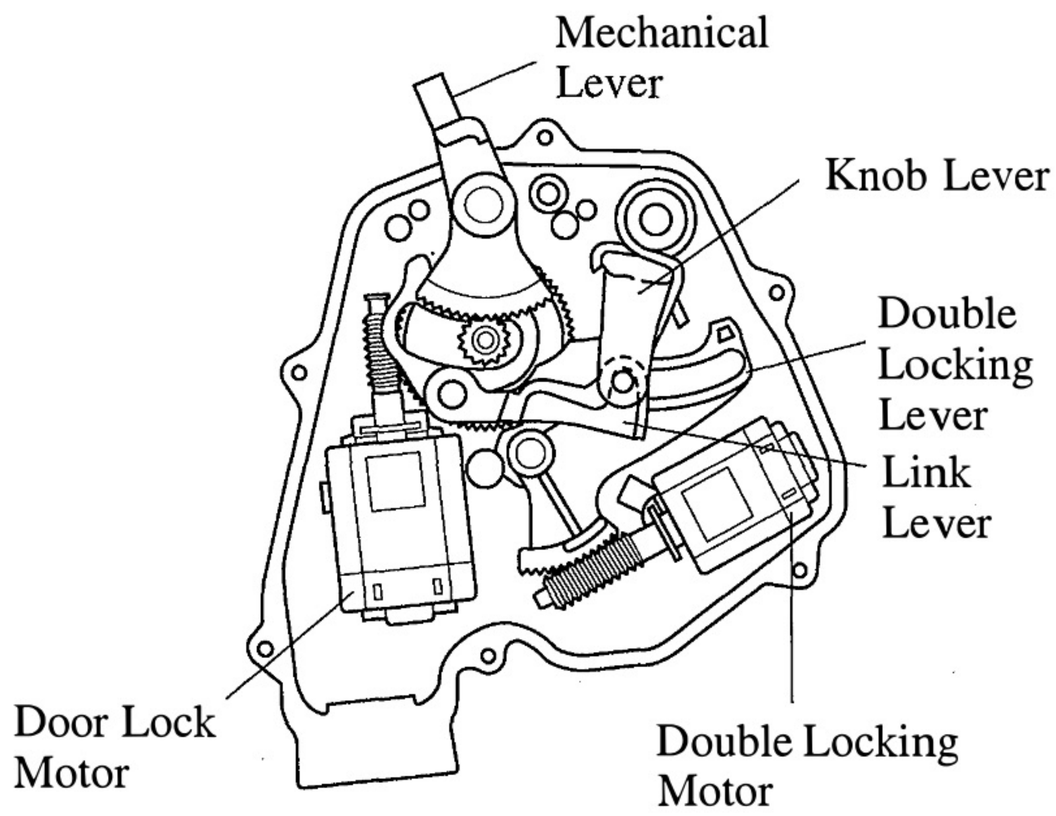
Construction

The actuator contains both the mechanism for the door lock system and the double locking system including a motor and a link.



Lock Assy

185BE11



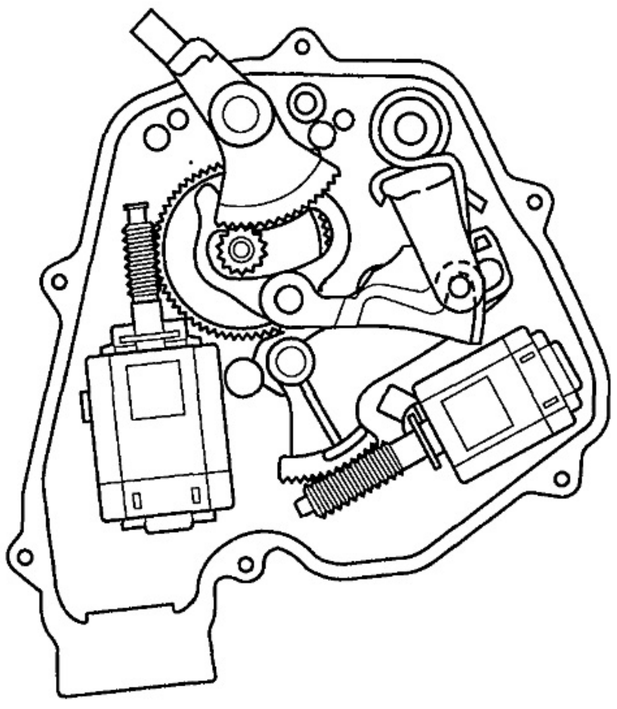
Actuator

195BE04

Item	Function
Knob Lever	An input/output lever connected directly to the inside door knob.
Link Lever	Connects the knob lever and the mechanical lever.
Double Locking Lever	Engages and disengages the link lever.
Double Locking Motor	A motor that moves the double locking lever.
Mechanical Lever	A lever that outputs to the mechanical locking portion.
Door Lock Motor	A motor that moves the mechanical lever.

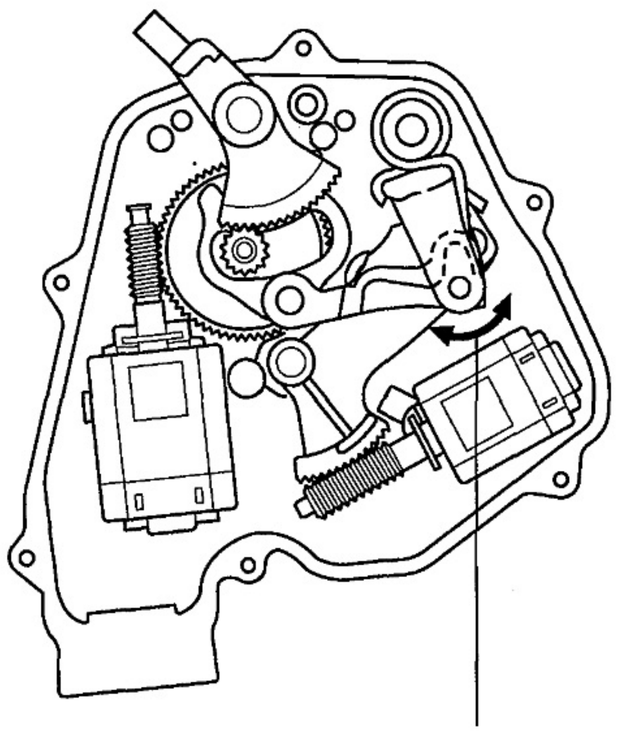
Operation

- When a door is locked through the operation of the transmitter, it locks in the normal manner; furthermore, the knob lever becomes disengaged by the function of the double locking motor. As a result, if an attempt is made to unlock the door by operating the inside knob, the knob lever will merely mis-swing, without being able to unlock the door.
- The locking/unlocking function of the double locking system is normally activated by operating the transmitter.



195BE05

Normal Lock Condition



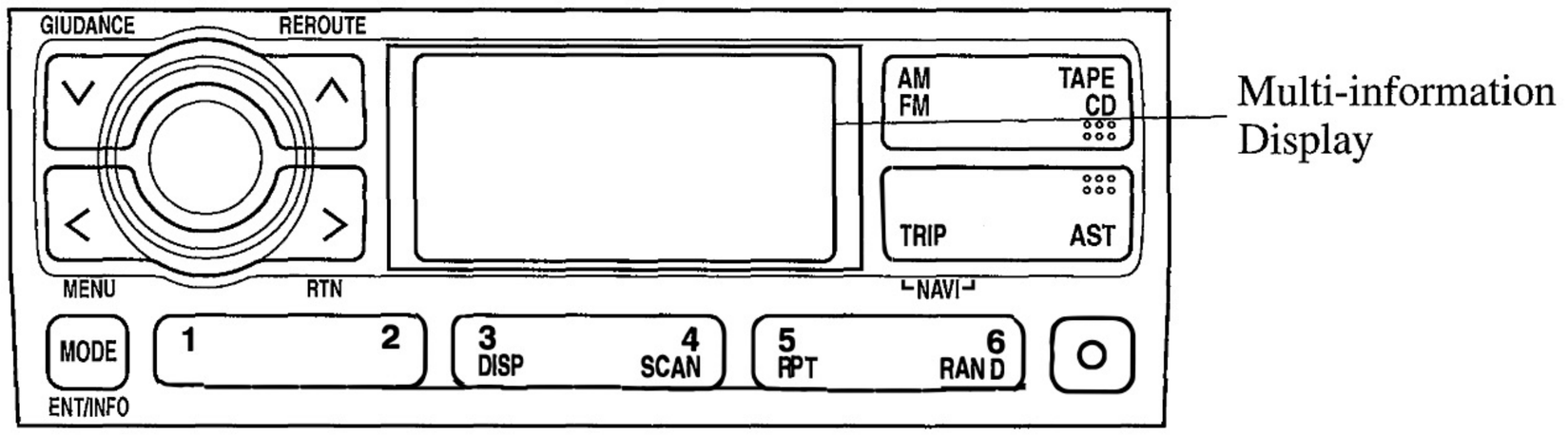
195BE06

Double Locking Condition

■AUDIO

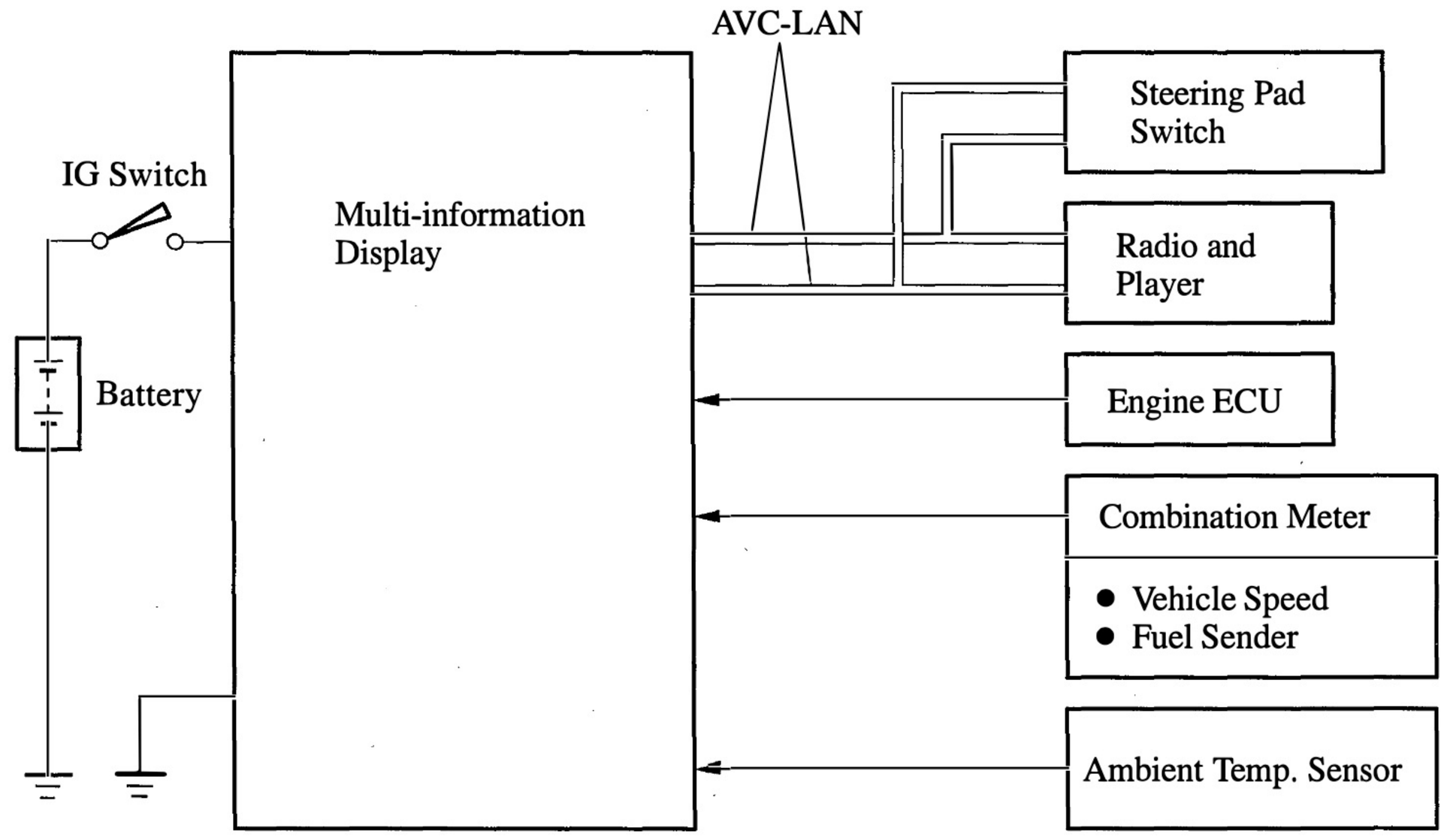
1. General

- A multi-information display panel has been provided on the audio unit to indicate various types of information, including the audio, average vehicle speed, fuel consumption, continuous drivable distance, time, and outside temperature.
- A steering pad switch that operates the audio unit has been provided on the steering wheel as an option. This switch has a built-in ECU that transmits the operating conditions of the switch to the multi-information display and the radio and player via the AVC-LAN (Audio Visual Communication-Local Area Network).



195BE08

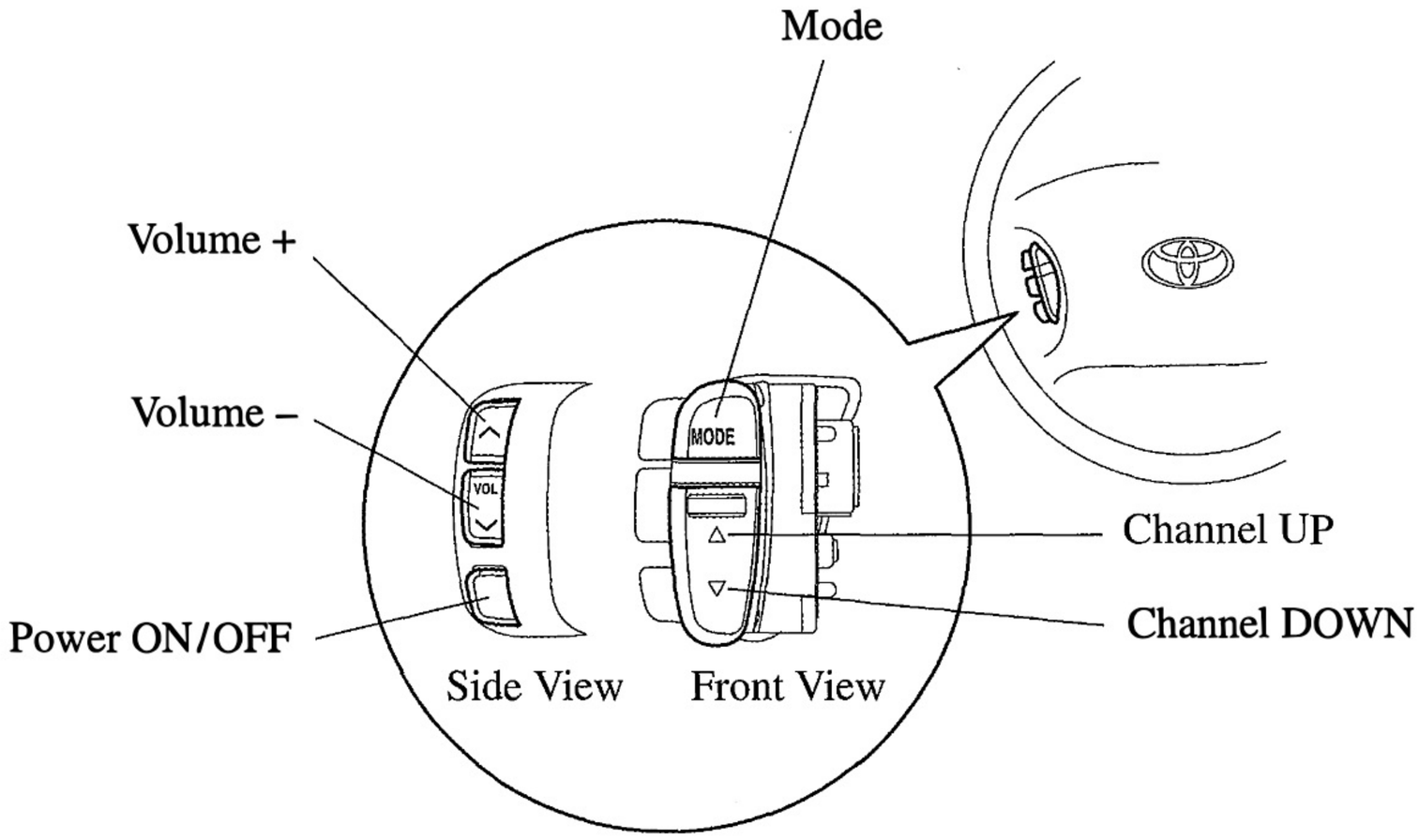
▶ System Diagram ◀



195BE07

2. Steering Pad Switch

The steering pad switch contains frequently used audio switches (volume +, volume –, power ON/OFF, mode, and channel up/down) to improve the ease of use of the audio unit. This switch has a built-in ECU that transmits the operating conditions of the switch to the multi-information display.



160SI22

MAJOR TECHNICAL SPECIFICATIONS

Item \ Area				Europe			
Body Type				4-Door Sedan			
Vehicle Grade				LINEA TERRA		LINEA SOL	LINEA TERRA
Model Code				ZZT220R-AEMNKW	ZZT220L-AEMNKW	ZZT220L-AEMEKW	ZZT221R-AEMNKW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4520 (178.0)	←	←	←
		Width	mm (in.)	1710 (67.3)	←	←	←
		Height	mm (in.)	1425 (56.1)	←	←	←
	Wheel Base		mm (in.)	2630 (103.5)	←	←	←
	Tread	Front	mm (in.)	1480 (58.3)	←	←	←
		Rear	mm (in.)	1450 (57.1)	←	←	←
	Room	Length	mm (in.)	1930 (76.0)	←	←	←
		Width	mm (in.)	1455 (57.3)	←	←	←
		Height	mm (in.)	1160 (45.7), 1110 (43.7)*1	←	←	←
	Overhang	Front	mm (in.)	905 (35.6)	←	←	←
		Rear	mm (in.)	985 (38.8)	←	←	←
	Min. Running Ground Clearance		mm (in.)	145 (5.7)	←	←	140 (5.5)
	Angle of Approach		degrees	14.4°	←	←	←
	Angle of Departure		degrees	18.4°	←	←	←
	Curb Weight	Front	kg (lb)	685 ~ 735 (1510 ~ 1620)	←	←	685 ~ 740 (1510 ~ 1631)
		Rear	kg (lb)	515 ~ 545 (1135 ~ 1202)	←	←	←
		Total	kg (lb)	1200 ~ 1280 (2646 ~ 2822)	←	←	1200 ~ 1285 (2646 ~ 2833)
	Gross Vehicle Weight	Front	kg (lb)	860 (1896)	←	←	890 (1962)
		Rear	kg (lb)	870 (1918)	←	←	870 (1918)
		Total	kg (lb)	1730 (3814)	←	←	1760 (3880)
	Fuel Tank Capacity		ℓ (Imp.gal.)	60 (13.2)	←	←	←
	Luggage Compartment Capacity		m³ (cu.ft.)	0.50 (17.7)	←	←	←
Performance	Max. Speed		km/h (mph)	195 (121)	←	←	200 (124)
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Acceleration	0 to 100 km/h	sec.	11.3	←	←	10.0
		0 to 400 m	sec.	17.7	←	←	17.1
	Max. Permissible Speed	1st Gear	km/h (mph)	49 (30)	←	←	50 (31)
		2nd Gear	km/h (mph)	92 (57)	←	←	94 (58)
		3rd Gear	km/h (mph)	134 (83)	←	←	137 (85)
		4th Gear	km/h (mph)	181 (112)	←	←	175 (108)
	Min. Turning Radius	Tire	m (ft.)	5.4 (17.7)	←	←	←
		Body	m (ft.)	5.8 (19.0)	←	←	←
Engine	Engine Type			3ZZ-FE	←	←	1ZZ-FE
	Valve Mechanism			16-Valve, DOHC	←	←	←
	Bore x Stroke		mm (in.)	79.0 x 81.5 (3.11 x 3.21)	←	←	79.0 x 91.5 (3.11 x 3.60)
	Displacement		cm³ (cu.in.)	1598 (97.5)	←	←	1794 (109.5)
	Compression Ratio			10.5 : 1	←	←	10.0 : 1
	Carburetor Type or Injection Pump Type (Diesel)			EFI	←	←	←
	Research Octane No. or Cetane No. (Diesel)			95 or More	←	←	←
	Max. Output (EEC)		kW/rpm	81/6000	←	←	95/6000
	Max. Torque (EEC)		N·m/rpm	150/3800	←	←	170/4200
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-32, 48*2	←	←	←
	Alternator Output		Watts	960	←	←	←
	Starter Output		kW	1.1	←	←	←
Chassis	Clutch Type			Dry, Single	←	←	←
	Transaxle Type			C50	←	←	C250
	Transmission Gear Ratio	In First		3.545	←	←	←
		In Second		1.904	←	←	←
		In Third		1.310	←	←	←
		In Fourth		0.969	←	←	1.031
		In Fifth		0.815	←	←	←
		In Reverse		3.250	←	←	←
	Counter Gear Ratio			—	—	—	—
	Differential Gear Ratio (Final)			4.058	←	←	3.941
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Leading Trailing Drum, Solid Disc*2	←	←	←
	Parking Brake Type			Drum	←	←	←
	Brake Booster Type and Size		in.	Single 9", Tandem 7" + 8"*2	←	←	←
	Proportioning Valve Type			—	—	—	—
	Suspension Type	Front		MacPherson Strut	←	←	←
		Rear		MacPherson Strut	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack and Pinion	←	←	←
	Steering Gear Ratio (Overall)			15.66	←	←	←
	Power Steering Type			Integral Type	←	←	←

*1: With Moon Roof
*2: Option

Europe					
4-Door Sedan					
LINEA TERRA			LINEA SOL		
ZZT221L-AEMNKW	ZZT221R-AEPNKW	ZZT221L-AEPNKW	ZZT221R-AEMEKW	ZZT221L-AEMEKW	ZZT221R-AEPEKW
←	←	←	←	←	←
←	←	←	←	←	←
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←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	715 ~ 770 (1576 ~ 1698)	←	685 ~ 740 (1510 ~ 1631)	←	715 ~ 770 (1576 ~ 1698)
←	←	←	←	←	←
←	1230 ~ 1315 (2712 ~ 2899)	←	1200 ~ 1285 (2646 ~ 2833)	←	1230 ~ 1315 (2712 ~ 2899)
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	195 (121)	←	200 (124)	←	195 (121)
—	—	—	—	—	—
←	11.4	←	10.0	←	11.4
←	18.1	←	17.1	←	18.1
←	58 (36)	←	50 (31)	←	58 (36)
←	105 (65)	←	94 (58)	←	105 (65)
←	—	—	137 (85)	←	—
—	—	—	175 (108)	←	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
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←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	—	—	Dry, Single	←	—
←	A246E	←	C250	←	A246E
←	4.005	←	3.545	←	4.005
←	2.208	←	1.904	←	2.208
←	1.425	←	1.310	←	1.425
←	0.981	←	1.031	←	0.981
←	—	—	0.815	←	—
←	3.272	←	3.250	←	3.272
—	—	—	—	—	—
←	2.962	←	3.941	←	2.962
←	←	←	←	←	←
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←	←	←	←	←	←
←	←	←	←	←	←

3

Item			Area	Europe			
Body Type				4-Door Sedan			
Vehicle Grade				LINEA SOL	LINEA TERRA		LINEA SOL
Model Code				ZZT221L-AEPEKW	AZT220R-AEMNHW	AZT220L-AEMNHW	AZT220R-AEMEHW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4520 (178.0)	←	←	←
		Width	mm (in.)	1710 (67.3)	←	←	←
		Height	mm (in.)	1425 (56.1)	←	←	←
	Wheel Base		mm (in.)	2630 (103.5)	←	←	←
	Tread	Front	mm (in.)	1480 (58.3)	←	←	←
		Rear	mm (in.)	1450 (57.1)	←	←	←
	Room	Length	mm (in.)	1930 (76.0)	←	←	←
		Width	mm (in.)	1455 (57.3)	←	←	←
		Height	mm (in.)	1160 (45.7), 1110 (43.7)*1	←	←	←
	Overhang	Front	mm (in.)	905 (35.6)	←	←	←
		Rear	mm (in.)	985 (38.8)	←	←	←
	Min. Running Ground Clearance		mm (in.)	140 (5.5)	145 (5.7)	←	←
	Angle of Approach		degrees	14.4°	←	←	←
	Angle of Departure		degrees	18.4°	←	←	←
	Curb Weight	Front	kg (lb)	715 ~ 770 (1576 ~ 1698)	730 ~ 780 (1609 ~ 1720)	←	←
		Rear	kg (lb)	515 ~ 545 (1135 ~ 1202)	515 ~ 540 (1135 ~ 1190)	←	←
		Total	kg (lb)	1230 ~ 1315 (2712 ~ 2899)	1245 ~ 1320 (2745 ~ 2910)	←	←
	Gross Vehicle Weight	Front	kg (lb)	890 (1962)	920 (2028)	←	←
		Rear	kg (lb)	870 (1918)	880 (1940)	←	←
		Total	kg (lb)	1760 (3880)	1800 (3968)	←	←
	Fuel Tank Capacity		ℓ (Imp.gal.)	60 (13.2)	←	←	←
	Luggage Compartment Capacity		m^3 (cu.ft.)	0.50 (17.7)	←	←	←
Performance	Max. Speed		km/h (mph)	195 (121)	210 (130)	←	←
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Acceleration	0 to 100 km/h	sec.	11.4	9.1	←	←
		0 to 400 m	sec.	18.1	16.6	←	←
	Max. Permissible Speed	1st Gear	km/h (mph)	58 (36)	54 (33)	←	←
		2nd Gear	km/h (mph)	105 (65)	93 (58)	←	←
		3rd Gear	km/h (mph)	—	144 (89)	←	←
		4th Gear	km/h (mph)	—	185 (115)	←	←
	Min. Turning Radius	Tire	m (ft.)	5.4 (17.7)	←	←	←
		Body	m (ft.)	5.8 (19.0)	←	←	←
Engine	Engine Type			1ZZ-FE	1AZ-FSE	←	←
	Valve Mechanism			16-Valve, DOHC	←	←	←
	Bore x Stroke		mm (in.)	79.0 x 91.5 (3.11 x 3.60)	86.0 x 86.0 (3.39 x 3.39)	←	←
	Displacement		cm^3 (cu.in.)	1794 (109.5)	1998 (121.9)	←	←
	Compression Ratio			10.0 : 1	11.0 : 1	←	←
	Carburetor Type or Injection Pump Type (Diesel)			EFI	←	←	←
	Research Octane No. or Cetane No. (Diesel)			95 or More	←	←	←
	Max. Output (EEC)		kW/rpm	95/6000	110/5700	←	←
	Max. Torque (EEC)		N·m/rpm	170/4200	200/4000	←	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-32, 48*2	←	←	←
	Alternator Output		Watts	960	←	←	←
	Starter Output		kW	1.1	1.0, 1.2*2	←	←
Chassis	Clutch Type			—	Dry, Single	←	←
	Transaxle Type			A246E	S55	←	←
	Transmission Gear Ratio	In First		4.005	3.538	←	←
		In Second		2.208	2.041	←	←
		In Third		1.425	1.322	←	←
		In Fourth		0.981	1.028	←	←
		In Fifth		←	0.820	←	←
		In Reverse		3.272	3.153	←	←
	Counter Gear Ratio			—	—	—	—
	Differential Gear Ratio (Final)			2.962	3.736	←	←
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Leading Trailing Drum, Solid Disc*2	←	←	Solid Disc
	Parking Brake Type			Drum	←	←	←
	Brake Booster Type and Size		in.	Single 9", Tandem 7" + 8"*2	Tandem 7" + 8"	←	←
	Proportioning Valve Type			—	—	—	—
	Suspension Type	Front		MacPherson Strut	←	←	←
		Rear		MacPherson Strut	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack and Pinion	←	←	←
	Steering Gear Ratio (Overall)			15.66	←	←	←
	Power Steering Type			Integral Type	←	←	←

*1: With Moon Roof
*2: Option

Europe					
4-Door Sedan					
LINEA SOL			LINEA TERRA		LINEA SOL
AZT220L-AEMEHW	AZT220R-AEPEHW	AZT220L-AEPEHW	CDT220R-AEMNYW	CDT220L-AEMNYW	CDT220R-AEMEYW
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	155 (6.1)	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	755 ~ 805 (1664 ~ 1774)	←	805 ~ 855 (1775 ~ 1885)	←	←
←	←	←	515 ~ 540 (1135 ~ 1190)	←	←
←	1270 ~ 1345 (2800 ~ 2965)	←	1320 ~ 1395 (2910 ~ 3075)	←	←
←	←	←	950 (2094)	←	←
←	←	←	880 (1940)	←	←
←	←	←	1830 (4034)	←	←
←	←	←	60 (13.2)	←	←
←	←	←	0.50 (17.7)	←	←
←	205 (127)	←	195 (121)	←	←
—	—	—	—	—	—
←	9.9	←	11.4	←	←
←	17.1	←	17.8	←	←
←	60 (37)	←	44 (27)	←	←
←	107 (67)	←	77 (48)	←	←
←	—	—	118 (73)	←	←
←	—	—	162 (100)	←	←
←	←	←	5.4 (17.7)	←	←
←	←	←	5.8 (19.0)	←	←
←	←	←	1CD-FTV	←	←
←	←	←	←	←	←
←	←	←	82.2 x 94.0 (3.24 x 3.70)	←	←
←	←	←	1995 (121.7)	←	←
←	←	←	18.6 : 1	←	←
←	←	—	Common-Rail Type	←	←
←	←	←	52	←	←
←	←	←	81 / 4000	←	←
←	←	←	250 / 2000 ~ 2400	←	←
←	←	←	12-64	←	←
←	←	←	1440	←	←
←	←	←	2.0	←	←
←	—	—	Dry, Single	←	←
←	U240E	←	E351	←	←
←	3.943	←	3.538	←	←
←	2.197	←	2.045	←	←
←	1.413	←	1.333	←	←
←	1.020	←	0.972	←	←
←	—	—	0.731	←	←
←	3.145	←	3.583	←	←
—	—	—	—	—	—
←	2.923	←	3.684	←	←
←	←	←	←	←	←
←	←	←	Leading Trailing Drum, Solid Disc*2	←	←
←	←	←	←	←	←
←	←	←	Single 9"	←	←
—	—	—	—	—	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←

3

Item \ Area				Europe			
Body Type				4-Door Sedan	5-Door Liftback		
Vehicle Grade				LINEA SOL	LINEA TERRA		LINEA SOL
Model Code				CDT220L-AEMEYW	ZZT220R-ALMNKW	ZZT220L-ALMNKW	ZZT220L-ALMEKW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4520 (178.0)	←	←	←
		Width	mm (in.)	1710 (67.3)	←	←	←
		Height	mm (in.)	1425 (56.1)	←	←	←
	Wheel Base		mm (in.)	2630 (103.5)	←	←	←
	Tread	Front	mm (in.)	1480 (58.3)	←	←	←
		Rear	mm (in.)	1450 (57.1)	←	←	←
	Room	Length	mm (in.)	1930 (76.0)	←	←	←
		Width	mm (in.)	1455 (57.3)	←	←	←
		Height	mm (in.)	1160 (45.7), 1110 (43.7)*1	←	←	←
	Overhang	Front	mm (in.)	905 (35.6)	←	←	←
		Rear	mm (in.)	985 (38.8)	←	←	←
	Min. Running Ground Clearance		mm (in.)	155 (6.1)	145 (5.7)	←	←
	Angle of Approach		degrees	14.4°	←	←	←
	Angle of Departure		degrees	18.4°	←	←	←
	Curb Weight	Front	kg (lb)	805 ~ 855 (1775 ~ 1885)	685 ~ 735 (1510 ~ 1620)	←	←
		Rear	kg (lb)	515 ~ 540 (1135 ~ 1190)	535 ~ 565 (1179 ~ 1246)	←	←
		Total	kg (lb)	1320 ~ 1395 (2910 ~ 3075)	1220 ~ 1300 (2690 ~ 2860)	←	←
	Gross Vehicle Weight	Front	kg (lb)	950 (2094)	860 (1896)	←	←
		Rear	kg (lb)	880 (1940)	870 (1918)	←	←
		Total	kg (lb)	1830 (4034)	1730 (3814)	←	←
	Fuel Tank Capacity		ℓ (Imp.gal.)	60 (13.2)	←	←	←
	Luggage Compartment Capacity		m³ (cu.ft.)	0.50 (17.7)	0.51 (18.0)	←	←
Performance	Max. Speed		km/h (mph)	195 (121)	←	←	←
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Acceleration	0 to 100 km/h	sec.	11.4	11.3	←	←
		0 to 400 m	sec.	17.8	17.7	←	←
	Max. Permissible Speed	1st Gear	km/h (mph)	44 (27)	49 (30)	←	←
		2nd Gear	km/h (mph)	77 (48)	92 (57)	←	←
		3rd Gear	km/h (mph)	118 (73)	134 (83)	←	←
		4th Gear	km/h (mph)	162 (100)	181 (112)	←	←
	Min. Turning Radius	Tire	m (ft.)	5.4 (17.8)	←	←	←
		Body	m (ft.)	5.8 (19.0)	←	←	←
Engine	Engine Type			1CD-FTV	3ZZ-FE	←	←
	Valve Mechanism			16-Valve, DOHC	16-Valve, DOHC	←	←
	Bore x Stroke		mm (in.)	82.2 x 94.0 (3.24 x 3.70)	79.0 x 81.5 (3.11 x 3.21)	←	←
	Displacement		cm³ (cu.in.)	1995 (121.7)	1598 (97.5)	←	←
	Compression Ratio			18.6 : 1	10.5 : 1	←	←
	Carburetor Type or Injection Pump Type (Diesel)			Common-Rail Type	EFI	←	←
	Research Octane No. or Cetane No. (Diesel)			52	95 or More	←	←
	Max. Output (EEC)		kW/rpm	81/4000	81/6000	←	←
	Max. Torque (EEC)		N·m/rpm	250/2000 ~ 2400	150/3800	←	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-64	12-32, 48*2	←	←
	Alternator Output		Watts	1440	960	←	←
	Starter Output		kW	2.0	1.1	←	←
Chassis	Clutch Type			Dry, Single	Dry, Single	←	←
	Transaxle Type			E351	C50	←	←
	Transmission Gear Ratio	In First		3.538	3.545	←	←
		In Second		2.045	1.904	←	←
		In Third		1.333	1.310	←	←
		In Fourth		0.972	0.969	←	←
		In Fifth		0.731	0.815	←	←
		In Reverse		3.583	3.250	←	←
	Counter Gear Ratio			—	—	—	—
	Differential Gear Ratio (Final)			3.684	4.058	←	←
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Leading Trailing Drum, Solid Disc*2	←	←	←
	Parking Brake Type			Drum	←	←	←
	Brake Booster Type and Size		in.	Single 9"	Single 9", Tandem 7" + 8"*2	←	←
	Proportioning Valve Type			—	—	—	—
	Suspension Type	Front		MacPherson Strut	←	←	←
		Rear		MacPherson Strut	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack and Pinion	←	←	←
	Steering Gear Ratio (Overall)			15.66	←	←	←
	Power Steering Type			Integral Type	←	←	←

*1: With Moon Roof
*2: Option

Europe					
5-Door Liftback					
LINEA TERRA				LINEA SOL	
ZZT221R-ALMNKW	ZZT221L-ALMNKW	ZZT221R-ALPNKW	ZZT221L-ALPNKW	ZZT221R-ALMEKW	ZZT221L-ALMEKW
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
140 (5.5)	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
685 ~ 740 (1510 ~ 1631)	←	715 ~ 770 (1576 ~ 1698)	←	685 ~ 740 (1510 ~ 1631)	←
535 ~ 565 (1179 ~ 1246)	←	535 ~ 565 (1179 ~ 1246)	←	535 ~ 565 (1179 ~ 1246)	←
1220 ~ 1305 (2690 ~ 2877)	←	1250 ~ 1335 (2756 ~ 2943)	←	1220 ~ 1305 (2690 ~ 2877)	←
890 (1962)	←	←	←	←	←
870 (1918)	←	←	←	←	←
1760 (3880)	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
200 (124)	←	195 (121)	←	200 (124)	←
—	—	—	—	—	—
10.0	←	11.4	←	10.0	←
17.1	←	18.1	←	17.1	←
50 (31)	←	58 (36)	←	50 (31)	←
94 (58)	←	105 (65)	←	94 (58)	←
137 (85)	←	—	—	137 (85)	←
175 (108)	←	—	—	175 (108)	←
←	←	←	←	←	←
←	←	←	←	←	←
1ZZ-FE	←	←	←	←	←
←	←	←	←	←	←
79.0 x 91.5 (3.11 x 3.60)	←	←	←	←	←
1794 (109.5)	←	←	←	←	←
10.0 : 1	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
95 / 6000	←	←	←	←	←
170 / 4200	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	—	—	Dry, Single	←
C250	←	A246E	←	C250	←
←	←	4.005	←	3.545	←
←	←	2.208	←	1.904	←
←	←	1.425	←	1.310	←
1.031	←	0.981	←	1.031	←
←	←	—	—	0.815	←
←	←	3.272	←	3.250	←
—	—	—	—	—	—
3.941	←	2.962	←	3.941	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
—	—	—	—	—	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←

3

Item			Area	Europe			
Body Type				5-Door Liftback			
Vehicle Grade				LINEA SOL		LINEA TERRA	
Model Code				ZZT221R-ALPEKW	ZZT221L-ALPEKW	AZT220R-ALMNHW	AZT220L-ALMNHW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4520 (178.0)	←	←	←
		Width	mm (in.)	1710 (67.3)	←	←	←
		Height	mm (in.)	1425 (56.1)	←	←	←
	Wheel Base		mm (in.)	2630 (103.5)	←	←	←
	Tread	Front	mm (in.)	1480 (58.3)	←	←	←
		Rear	mm (in.)	1450 (57.1)	←	←	←
	Room	Length	mm (in.)	1930 (76.0)	←	←	←
		Width	mm (in.)	1455 (57.3)	←	←	←
		Height	mm (in.)	1160 (45.7), 1110 (43.7)*1	←	←	←
	Overhang	Front	mm (in.)	905 (35.6)	←	←	←
		Rear	mm (in.)	985 (38.8)	←	←	←
	Min. Running Ground Clearance		mm (in.)	140 (5.5)	←	145 (5.7)	←
	Angle of Approach		degrees	14.4°	←	←	←
	Angle of Departure		degrees	18.4°	←	←	←
	Curb Weight	Front	kg (lb)	715 ~ 770 (1576 ~ 1698)	←	730 ~ 780 (1609 ~ 1720)	←
		Rear	kg (lb)	535 ~ 565 (1179 ~ 1246)	←	535 ~ 560 (1179 ~ 1235)	←
		Total	kg (lb)	1250 ~ 1335 (2756 ~ 2943)	←	1265 ~ 1340 (2789 ~ 2954)	←
	Gross Vehicle Weight	Front	kg (lb)	890 (1962)	←	920 (2028)	←
		Rear	kg (lb)	870 (1918)	←	880 (1940)	←
		Total	kg (lb)	1760 (3880)	←	1800 (3968)	←
	Fuel Tank Capacity		ℓ (Imp.gal.)	60 (13.2)	←	←	←
	Luggage Compartment Capacity		m³ (cu.ft.)	0.51 (18.0)	←	←	←
Performance	Max. Speed		km/h (mph)	195 (121)	←	210 (130)	←
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Acceleration	0 to 100 km/h	sec.	11.4	←	9.1	←
		0 to 400 m	sec.	18.1	←	16.6	←
	Max. Permissible Speed	1st Gear	km/h (mph)	58 (36)	←	54 (33)	←
		2nd Gear	km/h (mph)	105 (65)	←	93 (58)	←
		3rd Gear	km/h (mph)	—	—	144 (89)	←
		4th Gear	km/h (mph)	—	—	185 (115)	←
	Min. Turning Radius	Tire	m (ft.)	5.4 (17.7)	←	←	←
		Body	m (ft.)	5.8 (19.0)	←	←	←
Engine	Engine Type			1ZZ-FE	←	1AZ-FSE	←
	Valve Mechanism			16-Valve, DOHC	←	←	←
	Bore x Stroke		mm (in.)	79.0 x 91.5 (3.11 x 3.60)	←	86.0 x 86.0 (3.39 x 3.39)	←
	Displacement		cm³ (cu.in.)	1794 (109.5)	←	1998 (121.9)	←
	Compression Ratio			10.1 : 1	←	11.0 : 1	←
	Carburetor Type or Injection Pump Type (Diesel)			EFI	←	←	←
	Research Octane No. or Cetane No. (Diesel)			95 or More	←	←	←
	Max. Output (EEC)		kW/rpm	95/6000	←	110/5700	←
	Max. Torque (EEC)		N·m/rpm	170/4200	←	200/4000	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-32, 48*2	←	←	←
	Alternator Output		Watts	960	←	←	←
	Starter Output		kW	1.1	←	1.0, 1.2*2	←
Chassis	Clutch Type			—	—	Dry, Single	←
	Transaxle Type			A246E	←	S55	←
	Transmission Gear Ratio	In First		4.005	←	3.538	←
		In Second		2.208	←	2.041	←
		In Third		1.425	←	1.322	←
		In Fourth		0.981	←	1.028	←
		In Fifth		—	—	0.820	←
		In Reverse		3.272	←	3.153	←
	Counter Gear Ratio			—	—	—	—
	Differential Gear Ratio (Final)			2.962	←	3.736	←
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Leading Trailing Drum, Solid Disc*2	←	←	←
	Parking Brake Type			Drum	←	←	←
	Brake Booster Type and Size		in.	Single 9", Tandem 7" + 8"*2	←	Tandem 7" + 8"	←
	Proportioning Valve Type			—	—	—	—
	Suspension Type	Front		MacPherson Strut	←	←	←
		Rear		MacPherson Strut	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack and Pinion	←	←	←
	Steering Gear Ratio (Overall)			15.66	←	←	←
	Power Steering Type			Integral Type	←	←	←

*1: With Moon Roof
*2: Option

	Europe					
	5-Door Liftback					
	LINEA SOL				LINEA TERRA	
	AZT220R-ALMEHW	AZT220L-ALMEHW	AZT220R-ALPEHW	AZT220L-ALPEHW	CDT220R-ALMNYW	CDT220L-ALMNYW
5	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
10	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
15	←	←	←	←	←	←
	←	←	←	←	155 (6.1)	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	755 ~ 805 (1664 ~ 1775)	←	805 ~ 855 (1775 ~ 1885)	←
20	←	←	←	←	535 ~ 560 (1179 ~ 1235)	←
	←	←	1290 ~ 1365 (2844 ~ 3009)	←	1340 ~ 1415 (2954 ~ 3120)	←
	←	←	←	←	950 (2094)	←
	←	←	←	←	880 (1940)	←
	←	←	←	←	1830 (4034)	←
25	←	←	←	←	60 (13.2)	←
	←	←	←	←	←	←
	←	←	205 (127)	←	195 (121)	←
	—	—	—	—	—	—
	←	←	9.9	←	11.4	←
30	←	←	17.1	←	17.8	←
	←	←	60 (37)	←	44 (27)	←
	←	←	107 (67)	←	77 (48)	←
	←	←	—	—	118 (73)	←
	←	←	—	—	162 (100)	←
35	←	←	←	←	5.4 (17.7)	←
	←	←	←	←	5.8 (19.0)	←
	←	←	←	←	1CD-FTV	←
	←	←	←	←	←	←
	←	←	←	←	82.2 x 94.0 (3.24 x 3.70)	←
40	←	←	←	←	1995 (121.7)	←
	←	←	←	←	18.6 : 1	←
	←	←	←	←	Common-Rail Type	←
	←	←	←	←	52	←
	←	←	←	←	81 / 4000	←
45	←	←	←	←	250 / 2000 ~ 2400	←
	←	←	←	←	12-64	←
	←	←	←	←	1440	←
	←	←	←	←	2.0	←
	←	←	—	—	Dry, Single	←
50	←	←	U240E	←	E351	←
	←	←	3.943	←	3.538	←
	←	←	2.197	←	2.045	←
	←	←	1.413	←	1.333	←
	←	←	1.020	←	0.972	←
55	←	←	—	—	0.731	←
	←	←	3.145	←	3.683	←
	—	—	—	—	—	—
	←	←	2.923	←	3.583	←
	←	←	←	←	←	←
60	Solid Disc	←	←	←	Leading Trailing Drum, Solid Disc*2	←
	←	←	←	←	←	←
	←	←	←	←	Single 9"	←
	—	—	—	—	—	—
	←	←	←	←	←	←
65	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
70	←	←	←	←	←	←

Item			Area	Europe			
Body Type				5-Door Liftback		5-Door Wagon	
Vehicle Grade				LINEA SOL		LINEA TERRA	
Model Code				CDT220R-ALMEYW	CDT220L-ALMEYW	ZZT220-R-AWMNKW	ZZT220L-AWMNKW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4520 (178.0)	←	4600 (181.1)	←
		Width	mm (in.)	1710 (67.3)	←	←	←
		Height	mm (in.)	1425 (56.1)	←	1500 (59.1)	←
	Wheel Base		mm (in.)	2630 (103.5)	←	←	←
	Tread	Front	mm (in.)	1480 (58.3)	←	←	←
		Rear	mm (in.)	1450 (57.1)	←	←	←
	Room	Length	mm (in.)	1930 (76.0)	←	←	←
		Width	mm (in.)	1455 (57.3)	←	←	←
		Height	mm (in.)	1160 (45.7), 1110 (43.7)*1	←	1170 (46.1), 1120 (44.1)*1	←
	Overhang	Front	mm (in.)	905 (35.6)	←	←	←
		Rear	mm (in.)	985 (38.8)	←	1065 (41.9)	←
	Min. Running Ground Clearance		mm (in.)	155 (6.1)	←	145 (5.7)	←
	Angle of Approach		degrees	14.4°	←	←	←
	Angle of Departure		degrees	18.4°	←	17.4°	←
	Curb Weight	Front	kg (lb)	805 ~ 855 (1775 ~ 1885)	←	685 ~ 735 (1510 ~ 1620)	←
		Rear	kg (lb)	535 ~ 560 (1179 ~ 1235)	←	550 ~ 580 (1213 ~ 1279)	←
		Total	kg (lb)	1340 ~ 1415 (2954 ~ 3120)	←	1235 ~ 1315 (2723 ~ 2900)	←
	Gross Vehicle Weight	Front	kg (lb)	950 (2094)	←	860 (1896)	←
		Rear	kg (lb)	880 (1940)	←	870 (1918)	←
		Total	kg (lb)	1830 (4034)	←	1730 (3814)	←
	Fuel Tank Capacity		ℓ (lmp.gal.)	60 (13.2)	←	←	←
	Luggage Compartment Capacity		m^3 (cu.ft.)	0.51 (18.0)	←	0.53 (18.7)	←
Performance	Max. Speed		km/h (mph)	195 (121)	←	190 (118)	←
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Acceleration	0 to 100 km/h	sec.	11.4	←	11.5	←
		0 to 400 m	sec.	17.8	←	17.8	←
	Max. Permissible Speed	1st Gear	km/h (mph)	44 (27)	←	49 (30)	←
		2nd Gear	km/h (mph)	77 (48)	←	92 (57)	←
		3rd Gear	km/h (mph)	118 (73)	←	134 (83)	←
		4th Gear	km/h (mph)	162 (100)	←	181 (112)	←
	Min. Turning Radius	Tire	m (ft.)	5.4 (17.7)	←	←	←
		Body	m (ft.)	5.8 (19.0)	←	←	←
Engine	Engine Type			1CD-FTV	←	3ZZ-FE	←
	Valve Mechanism			16-Valve, DOHC	←	16-Valve, DOHC	←
	Bore x Stroke		mm (in.)	82.2 x 94.0 (3.24 x 3.70)	←	79.0 x 81.5 (3.11 x 3.21)	←
	Displacement		cm^3 (cu.in.)	1995 (121.7)	←	1598 (97.5)	←
	Compression Ratio			18.6 : 1	←	10.5 : 1	←
	Carburetor Type or Injection Pump Type (Diesel)			Common-Rail Type	←	EFI	←
	Research Octane No. or Cetane No. (Diesel)			52	←	95 or More	←
	Max. Output (EEC)		kW/rpm	81/4000	←	81/6000	←
	Max. Torque (EEC)		N·m/rpm	250/2000 ~ 2400	←	150/3800	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-64	←	12-32, 48*2	←
	Alternator Output		Watts	1440	←	960	←
	Starter Output		kW	2.0	←	1.1	←
Chassis	Clutch Type			Dry, Single	←	←	←
	Transaxle Type			E351	←	C50	←
	Transmission Gear Ratio	In First		3.538	←	3.545	←
		In Second		2.045	←	1.904	←
		In Third		1.333	←	1.310	←
		In Fourth		0.972	←	0.969	←
		In Fifth		0.731	←	0.815	←
		In Reverse		3.583	←	3.250	←
	Counter Gear Ratio			—	—	—	—
	Differential Gear Ratio (Final)			3.684	←	4.058	←
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Leading Trailing Drum, Solid Disc*2	←	←	←
	Parking Brake Type			Drum	←	←	←
	Brake Booster Type and Size		in.	Single 9"	←	Single 9", Tandem 7" + 8"*2	←
	Proportioning Valve Type			—	—	—	—
	Suspension Type	Front		MacPherson Strut	←	←	←
		Rear		MacPherson Strut	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack and Pinion	←	←	←
	Steering Gear Ratio (Overall)			15.66	←	←	←
	Power Steering Type			Integral Type	←	←	←

*1: With Moon Roof
*2: Option

Europe					
5-Door Wagon					
LINEA SOL	LINEA TERRA			LINEA SOL	
ZZT220L-AWMEKW	ZZT221R-AWMNKW	ZZT221L-AWMNKW	ZZT221L-AWPNKW	ZZT221L-AWMEKW	ZZT221L-AWPEKW
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	140 (5.5)	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	685 ~ 740 (1510 ~ 1631)	←	715 ~ 770 (1576 ~ 1698)	685 ~ 740 (1510 ~ 1631)	715 ~ 770 (1576 ~ 1698)
←	←	←	←	←	←
←	1235 ~ 1320 (2723 ~ 2910)	←	1265 ~ 1350 (2789 ~ 2976)	1235 ~ 1320 (2723 ~ 2910)	1265 ~ 1350 (2789 ~ 2976)
←	890 (1962)	←	←	←	←
←	←	←	←	←	←
←	1760 (3880)	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	195 (121)	←	190 (118)	195 (121)	190 (118)
—	—	—	—	—	—
←	10.2	←	11.6	10.2	11.6
←	17.2	←	18.2	17.2	18.2
←	50 (31)	←	58 (36)	50 (31)	58 (36)
←	94 (58)	←	105 (65)	94 (58)	105 (65)
←	137 (85)	←	—	137 (85)	—
←	175 (108)	←	—	175 (108)	—
←	←	←	←	←	←
←	←	←	←	←	←
←	1ZZ-FE	←	←	←	←
←	←	←	←	←	←
←	79.0 x 91.5 (3.11 x 3.60)	←	←	←	←
←	1794 (109.5)	←	←	←	←
←	10.1 : 1	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	95/6000	←	←	←	←
←	170/4200	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	—	Dry, Single	—
←	C250	←	A246E	C250	A246E
←	←	←	4.005	3.545	4.005
←	←	←	2.208	1.904	2.208
←	←	←	1.425	1.310	1.425
←	1.031	←	0.981	1.031	0.981
←	←	←	—	0.815	—
←	←	←	3.272	3.250	3.272
←	←	←	←	←	←
←	3.941	←	2.962	3.941	2.962
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
—	—	—	—	—	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←

Item			Area	Europe			
Body Type				5-Door Wagon			
Vehicle Grade				LINEA TERRA		LINEA SOL	
Model Code				AZT220R-AWMNHW	AZT220L-AWMNHW	AZT220R-AWMEHW	AZT220L-AWMEHW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4600 (181.1)	←	←	←
		Width	mm (in.)	1710 (67.3)	←	←	←
		Height	mm (in.)	1500 (59.1)	←	←	←
	Wheel Base		mm (in.)	2630 (103.5)	←	←	←
	Tread	Front	mm (in.)	1480 (58.3)	←	←	←
		Rear	mm (in.)	1450 (57.1)	←	←	←
	Room	Length	mm (in.)	1930 (76.0)	←	←	←
		Width	mm (in.)	1455 (57.3)	←	←	←
		Height	mm (in.)	1170 (46.1), 1120 (44.1)*1	←	←	←
	Overhang	Front	mm (in.)	905 (35.6)	←	←	←
		Rear	mm (in.)	1065 (41.9)	←	←	←
	Min. Running Ground Clearance		mm (in.)	145 (5.7)	←	←	←
	Angle of Approach		degrees	14.4°	←	←	←
	Angle of Departure		degrees	17.4°	←	←	←
	Curb Weight	Front	kg (lb)	730 ~ 780 (1609 ~ 1720)	←	←	←
		Rear	kg (lb)	550 ~ 575 (1213 ~ 1268)	←	←	←
		Total	kg (lb)	1280 ~ 1355 (2822 ~ 2987)	←	←	←
	Gross Vehicle Weight	Front	kg (lb)	920 (2028)	←	←	←
		Rear	kg (lb)	880 (1940)	←	←	←
		Total	kg (lb)	1800 (3968)	←	←	←
	Fuel Tank Capacity		ℓ (Imp.gal.)	60 (13.2)	←	←	←
	Luggage Compartment Capacity		m³ (cu.ft.)	0.53 (18.7)	←	←	←
Performance	Max. Speed		km/h (mph)	205 (127)	←	←	←
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Acceleration	0 to 100 km/h	sec.	9.3	←	←	←
		0 to 400 m	sec.	16.7	←	←	←
	Max. Permissible Speed	1st Gear	km/h (mph)	54 (33)	←	←	←
		2nd Gear	km/h (mph)	93 (58)	←	←	←
		3rd Gear	km/h (mph)	144 (89)	←	←	←
		4th Gear	km/h (mph)	185 (115)	←	←	←
	Min. Turning Radius	Tire	m (ft.)	5.4 (17.7)	←	←	←
		Body	m (ft.)	5.8 (19.0)	←	←	←
Engine	Engine Type			1AZ-FSE	←	←	←
	Valve Mechanism			16-Valve, DOHC	←	←	←
	Bore x Stroke		mm (in.)	86.0 x 86.0 (3.39 x 3.39)	←	←	←
	Displacement		cm³ (cu.in.)	1998 (121.9)	←	←	←
	Compression Ratio			11.0 : 1	←	←	←
	Carburetor Type or Injection Pump Type (Diesel)			EFI	←	←	←
	Research Octane No. or Cetane No. (Diesel)			95 or More	←	←	←
	Max. Output (EEC)		kW/rpm	110/5700	←	←	←
	Max. Torque (EEC)		N·m/rpm	200/4000	←	←	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-34, 48*2	←	←	←
	Alternator Output		Watts	960	←	←	←
	Starter Output		kW	1.0, 1.2*2	←	←	←
Chassis	Clutch Type			Dry, Single	←	←	←
	Transaxle Type			S55	←	←	←
	Transmission Gear Ratio	In First		3.538	←	←	←
		In Second		2.041	←	←	←
		In Third		1.322	←	←	←
		In Fourth		1.028	←	←	←
		In Fifth		0.820	←	←	←
		In Reverse		3.153	←	←	←
	Counter Gear Ratio			—	—	—	—
	Differential Gear Ratio (Final)			3.736	←	←	←
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Leading Trailing Drum, Solid Disc*2	←	Solid Disc	←
	Parking Brake Type			Drum	←	←	←
	Brake Booster Type and Size		in.	Tandem 7" + 8"	←	←	←
	Proportioning Valve Type			—	—	—	—
	Suspension Type	Front		MacPherson Strut	←	←	←
		Rear		MacPherson Strut	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack and Pinion	←	←	←
	Steering Gear Ratio (Overall)			15.66	←	←	←
	Power Steering Type			Integral Type	←	←	←

*1: With Moon Roof
*2: Option

Europe				
5-Door Wagon				
LINEA SOL		LINEA TERRA		LINEA SOL
AZT220R-AWPEHW	AZT220L-AWPEHW	CDT220R-AWMNYW	CDT220L-AWMNYW	CDT220L-AWMEYN
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	155 (6.1)	←	←
←	←	←	←	←
←	←	←	←	←
755 ~ 805 (1664 ~ 1775)	←	805 ~ 855 (1775 ~ 1885)	←	←
←	←	←	←	←
1305 ~ 1380 (2877 ~ 3042)	←	1335 ~ 1430 (2943 ~ 3153)	←	←
←	←	950 (2094)	←	←
←	←	880 (1940)	←	←
←	←	1830 (4034)	←	←
←	←	60 (13.2)	←	←
←	←	←	←	←
200 (124)	←	190 (118)	←	←
—	—	—	—	—
10.1	←	11.6	←	←
17.2	←	17.9	←	←
60 (37)	←	44 (27)	←	←
107 (67)	←	77 (48)	←	←
—	—	118 (73)	←	←
—	—	162 (100)	←	←
←	←	5.4 (17.7)	←	←
←	←	5.8 (19.0)	←	←
←	←	1CD-FTV	←	←
←	←	←	←	←
←	←	82.2 x 94.0 (3.24 x 3.70)	←	←
←	←	1995 (121.7)	←	←
←	←	18.6 : 1	←	←
←	←	Common-Rail Type	←	←
←	←	52	←	←
←	←	81/4000	←	←
←	←	250/2000 ~ 2400	←	←
←	←	12-64	←	←
←	←	1440	←	←
←	←	2.0	←	←
—	←	Dry, Single	←	←
U240E	←	E351	←	←
3.943	←	3.538	←	←
2.197	←	2.045	←	←
1.413	←	1.333	←	←
1.020	←	0.972	←	←
—	—	0.731	←	←
3.145	←	3.583	←	←
—	—	—	—	—
2.923	←	3.684	←	←
←	←	←	←	←
←	←	Leading Trailing Drum, Solid Disc*2	←	←
←	←	←	←	←
←	←	Single 9”	←	←
—	—	—	—	—
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←

3

LAND CRUISER/ LAND CRUISER PRADO

LAND CRUISER/LAND CRUISER PRADO

OUTLINE OF NEW FEATURES

1. Model Line-Up

- The 1KZ-TE engine model for Europe has been discontinued.
- The 1KD-FTV engine model for Europe has been added.

2. 1KD-FTV Engine

The newly developed 1KD-FTV TOYOTA D-4D (Direct injection 4 stroke common-rail Diesel engine) is added for Europe.

3. Clutch

The specifications of the clutch have been changed along with the adoption of the 1KD-FTV engine.

4. R150F and R151F Manual Transmissions

- The R150F manual transmission is used for the 1KD-FTV engine model.
- A triple-cone type synchromesh has been adopted in the 1st gear of the R150F and R151F manual transmissions.

5. A343F Automatic Transmission

The A343F automatic transmission is used for the 1KD-FTV engine model.

6. VF3B Transfer

The switching operation of the center differential lock has been changed from the previous shift lever to an actuator type.

7. Air Conditioner

- An automatic air conditioner has been provided on the 50th Anniversary model for Europe.
- A viscous type power heater that improves heating performance is provided as optional equipment for the cold area specification model with 1KD-FTV engine.
- A lock sensor has been added to the compressor along with the adoption of the serpentine belt drive system on the 1KD-FTV engine model.

MODEL CODE

KDJ95 L – G K M N Y W

1 2 3 4 5 6 7 8

1 BASIC MODEL CODE

CODE	ENGINE	BODY TYPE
RZJ95	3RZ-FE	5-Door Wagon
VZJ90	5VZ-FE	3-Door Wagon
VZJ95		5-Door Wagon
KZJ95	1KZ-TE	
KDJ90	1KD-FTV	3-Door Wagon
KDJ95		5-Door Wagon

2 STEERING WHEEL POSITION

L : Left-Hand Drive
R : Right-Hand Drive

3 ROOF TYPE

G : Standard Roof

4 BODY TYPE

J : 3-Door
K : 5-Door

5 GEARSHIFT TYPE

M : 5-Speed Manual
P : 4-Speed Automatic

6 GRADE

N : GX
E : VX

7 ENGINE SPECIFICATION

K : DOHC and EFI
T : Turbocharger and EFI
Y : Common-Rail Diesel

8 DESTINATION

W : Europe
Q : Australia

MODEL LINE-UP

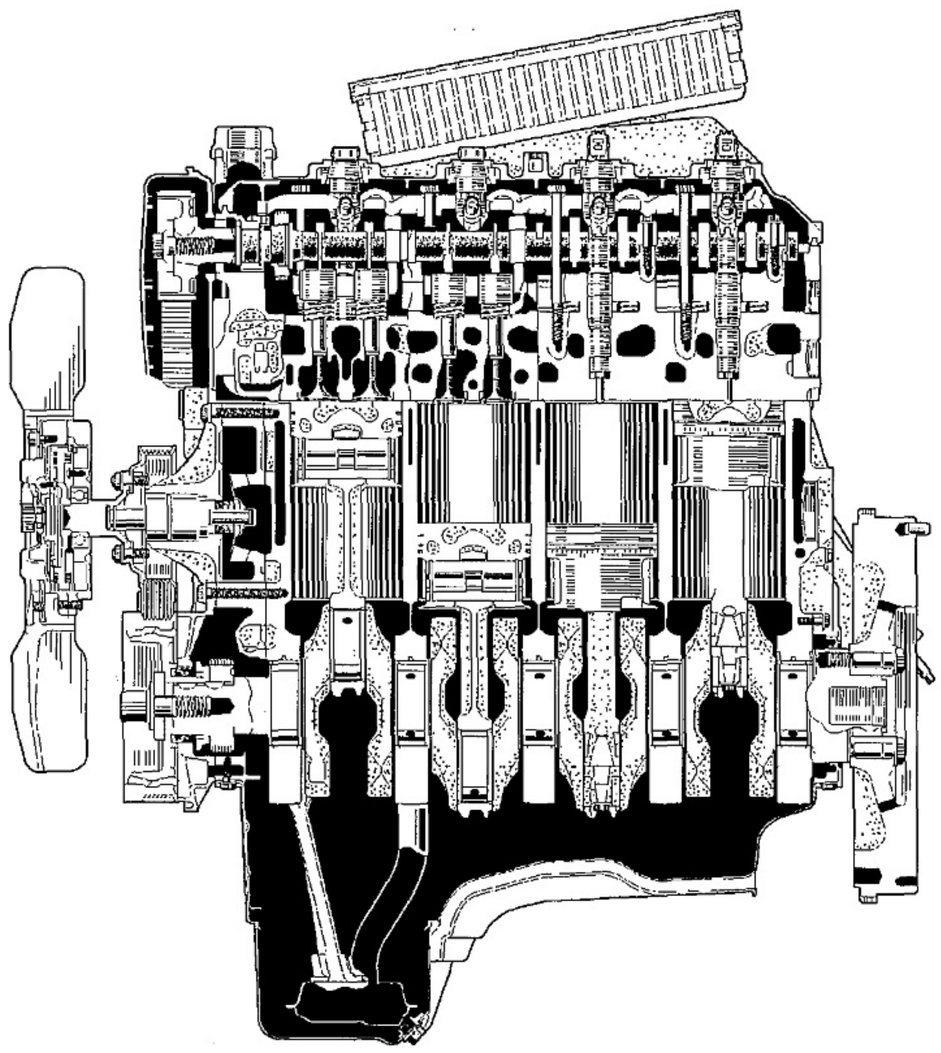
MODEL NAME	DESTI-NATION	ENGINE	BODY TYPE	GRADE	DRIVE TYPE	TRANSMISSION			
						5-Speed Manual			4-Speed Automatic
						W56	R150F	R151F	A343F
Land Cruiser	Europe	5VZ-FE	3-Door Wagon	–	Full Time 4WD		VZJ90L-GJMNKW		VZJ90L-GJPNKW
			5-Door Wagon				VZJ95L-GKMNKW		VZJ95 R/L -GKPNKW
		1KD-FTV	3-Door Wagon				KDJ90 R/L -GJMNYW		KDJ90L-GJPNYW
			5-Door Wagon				KDJ95 R/L -GKMNYW		KDJ95 R/L -GKPNYW
Land Cruiser Prado	Australia	3RZ-FE	5-Door Wagon	GX		RZJ95R-GKMNKQ			RZJ95-GKPNKQ
		5VZ-FE					VZJ95R-GKMNKQ		VZJ95R-GKPNKQ
				VX					VZJ95R-GKPEKQ
		1KZ-TE		GX				KZJ95R-GKMNTQ	KZJ95R-GKPNTQ

NEW FEATURES

■ 1KD-FTV ENGINE

1. General

The 1KD-FTV TOYOTA D-4D (Direct injection 4 stroke common-rail Diesel engine) is a newly developed in-line 4-cylinder, 3.0-liter, 16-valve DOHC with intercooler turbocharged diesel engine.
This engine is based on the 1KZ-TE engine and a newly adopted direct injection system and common-rail system to realize high performance, clean emission, low noise and low vibration.



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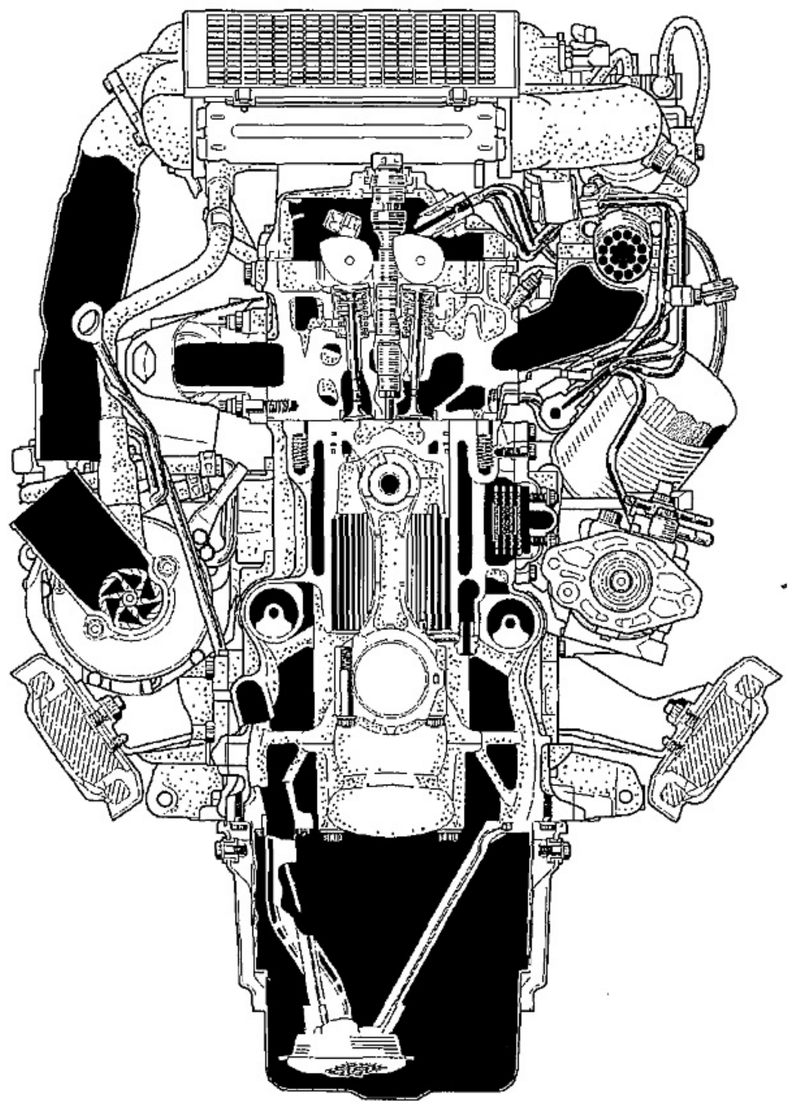
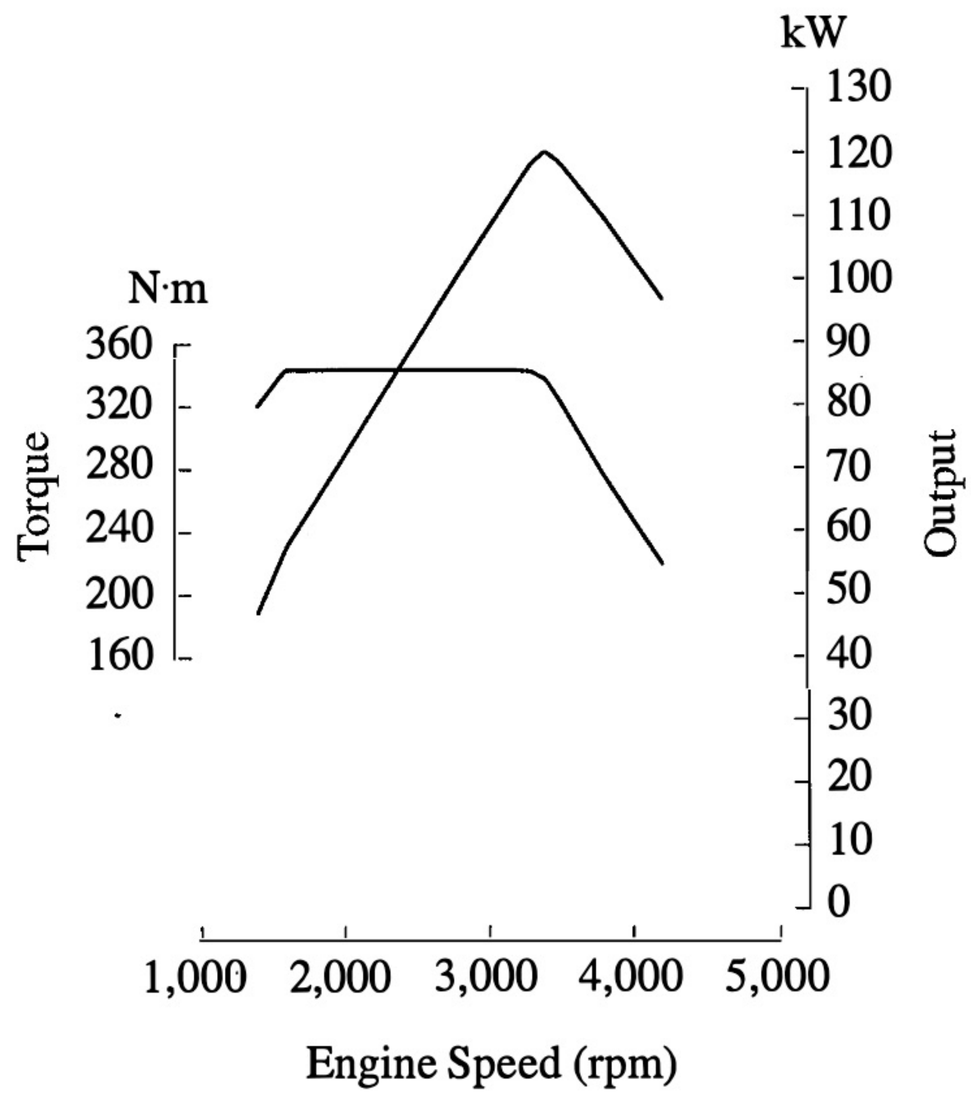


195EG39

▶ Engine Specifications ◀

Engine Type			1KD-FTV
No. of Cyls. & Arrangement			4-Cylinder, In-Line
Valve Mechanism			16-Valve, DOHC, Gear and Belt Drive
Combustion Chamber			Direct Injection Type
Manifolds			Cross-Flow
Fuel System			Common-Rail Type
Displacement cm^3 (cu. in.)			2982 (182.0)
Bore x Stroke mm (in.)			96 x 103 (3.78 x 4.06)
Compression Ratio			18.4 : 1
Max. Output [EEC]			120 kW @ 3400 rpm
Max. Torque [EEC]			343 N·m @ 1600 ~ 3200 rpm
Valve Timing	Intake	Open	2° BTDC
		Close	37° ABDC
	Exhaust	Open	45° BBDC
		Close	0° ATDC
Fuel Cetan Number			48 or more
Oil Grade			CF-4 10W-30

▶ Performance Curve ◀



195EG111

4

2. Features of 1KD-FTV Engine

The 1KD-FTV engine has been able to achieve the following performance through the adoption of the items listed below.

(1) High performance and fuel economy

(2) Low noise and vibration

(3) Light weight and compact design

(4) Good serviceability

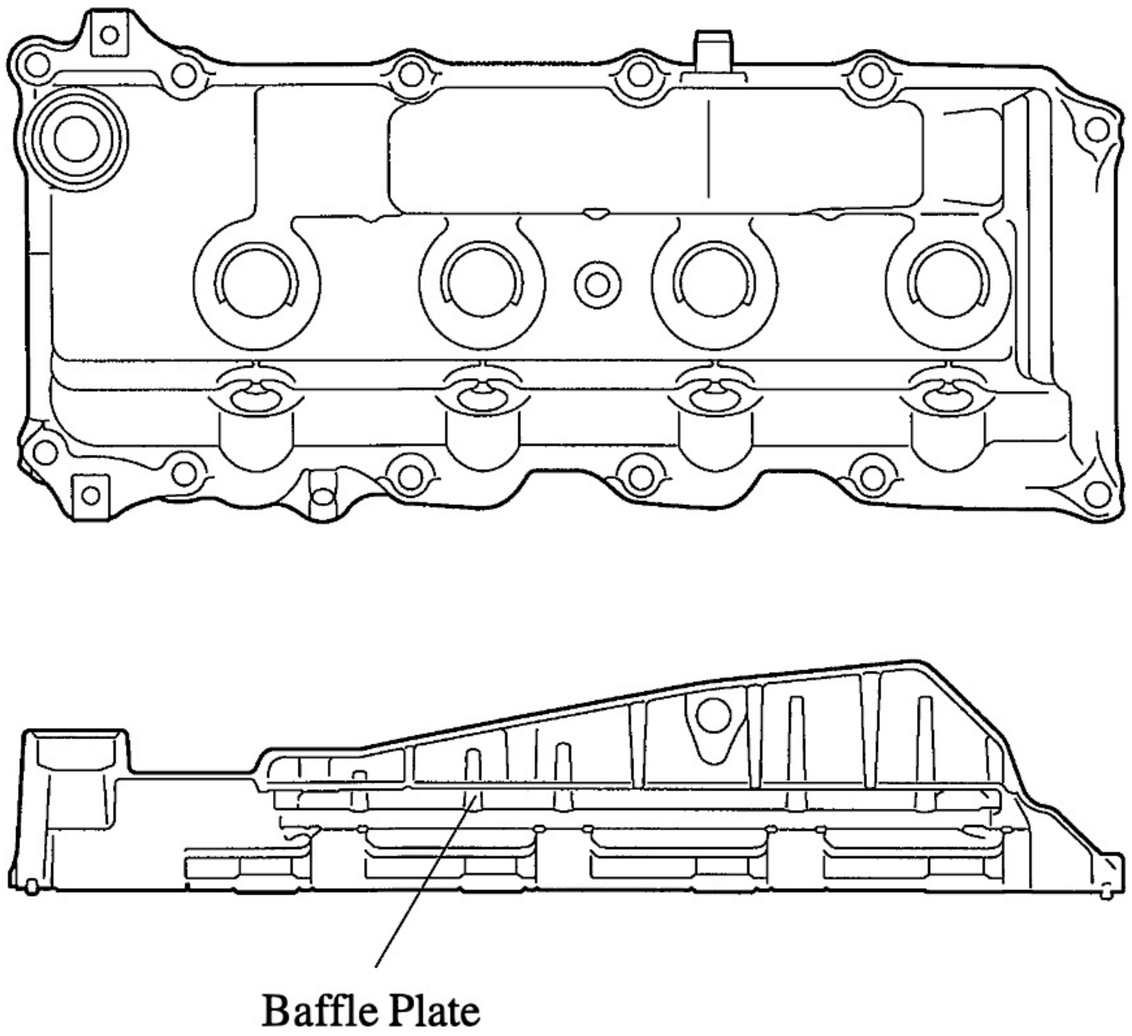
(5) Clean emission

Item	(1)	(2)	(3)	(4)	(5)
Cylinder head cover is made of plastic and cylinder head is made of alminum alloy.			○		
Cylinder block has been optimally reinforced.		○	○		
2 balance shafts built into the cylinder block.		○			
Crankshaft pulley has adopted a torsional damper.		○			
A common-rail type fuel injection system is used.	○	○			○
A pilot injection control system is used.	○	○			○
Injector is provided in the bore center to improve its air utilization rate.	○				○
Piston provided with combustion chamber has been adopted in conjunction with the adoption of direct injection.	○				○
A variable nozzle vane type turbocharger and high efficiency intercooler are used.	○		○		○
A camshaft is driven by a timing belt and gear.		○	○		
Diesel throttle and air flow meter are used.	○	○			○
An automatic tensioner is provided for the timing belt.				○	
A serpentine belt drive system to drive accessory components is used.				○	
An EGR and a catalytic converter are used.					○
The passage for the EGR is provided in the cylinder head and water cooling type EGR cooler is used.					○

3. Engine Proper

Cylinder Head Cover

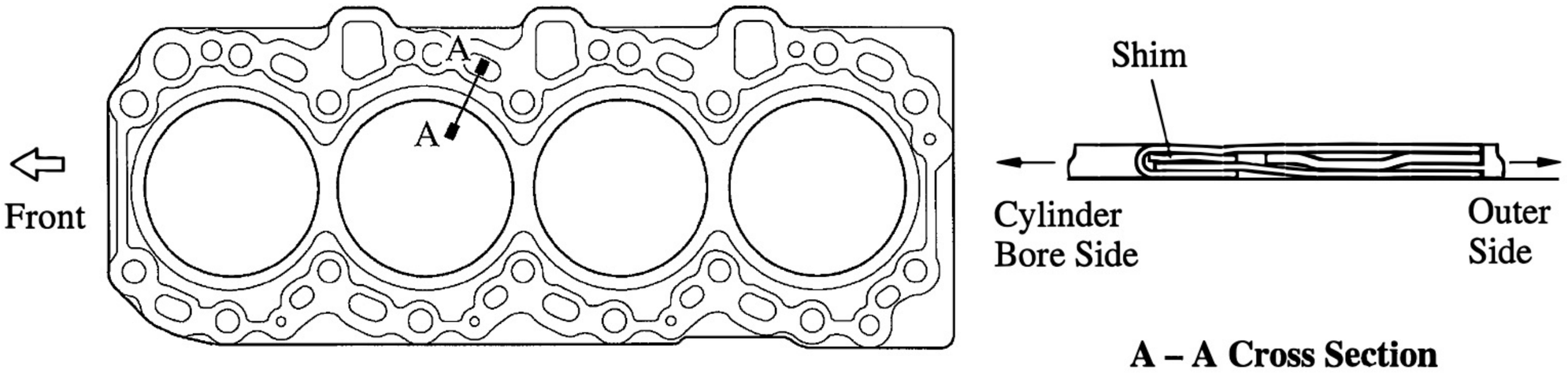
- The cylinder head cover is made of plastic to reduce weight and noise.
- A baffle plate is provided on the inside of the cylinder head cover to reduce the consumption of engine oil through blow-by gas.



195EG40

Cylinder Head Gasket

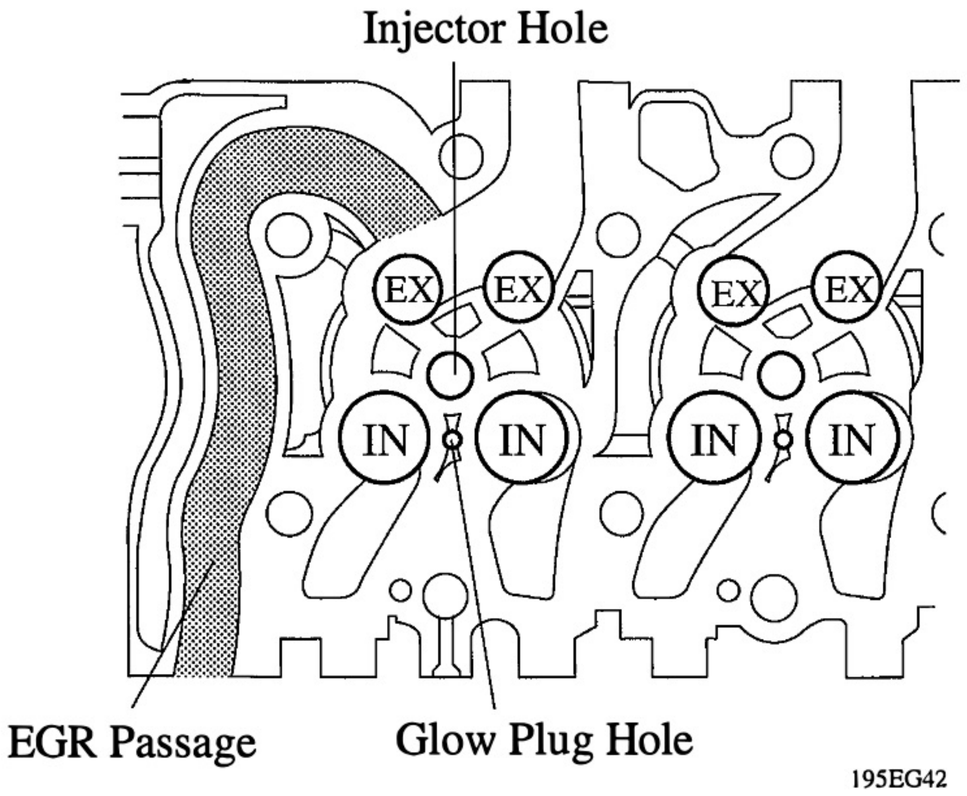
A steel-laminate type cylinder head gasket has been adopted. A shim has been added around the cylinder bore to increase the sealing surface, thus improving the sealing performance and durability.



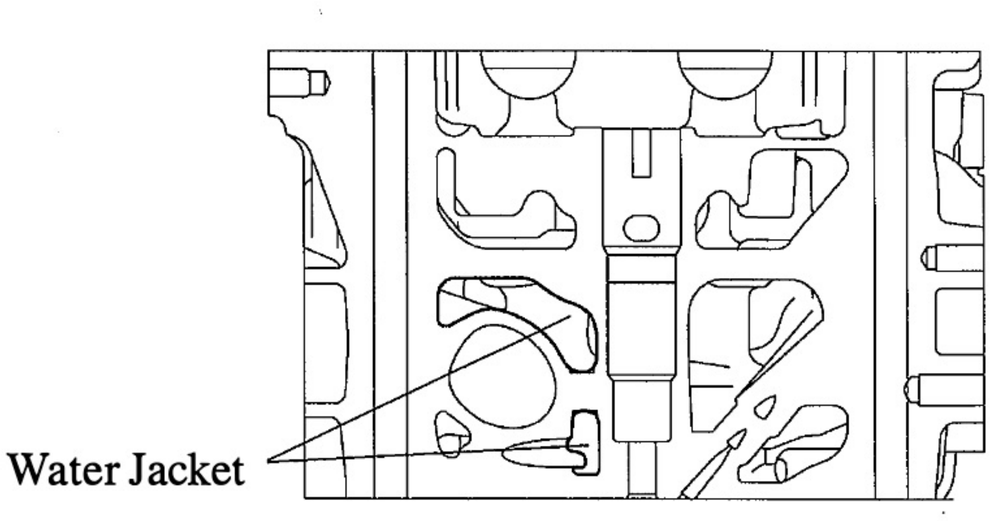
195EG43

Cylinder Head

- The cylinder head is made of aluminum alloy.
  The injector has been located in the center of the combusion chamber in order to improve engine performance and clean emission.
- Two intake ports with different shapes have been combined to promote the mixture of fuel and air by optimizing the swirl in the cylinder.
- A vertical two-stage construction has been adopted for the water jacket to improve cooling performance.
- A glow plug is placed between the intake ports of each cylinder to ensure startability.
- The passage for the EGR is provided in the cylinder head. By cooling the exhaust gas, this makes it possible to re-circulate the great amount of exhaust gas.



195EG42



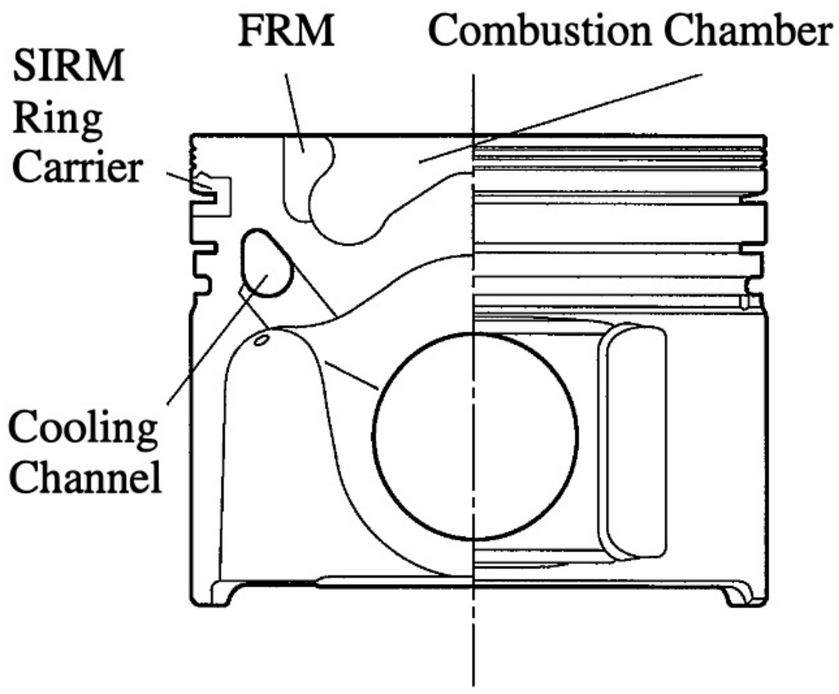
195EG41

Cylinder Block

Based on the cylinder block that was used in the previous 1KZ-TE engine, its rigidity and weight reduction have been improved.

Piston

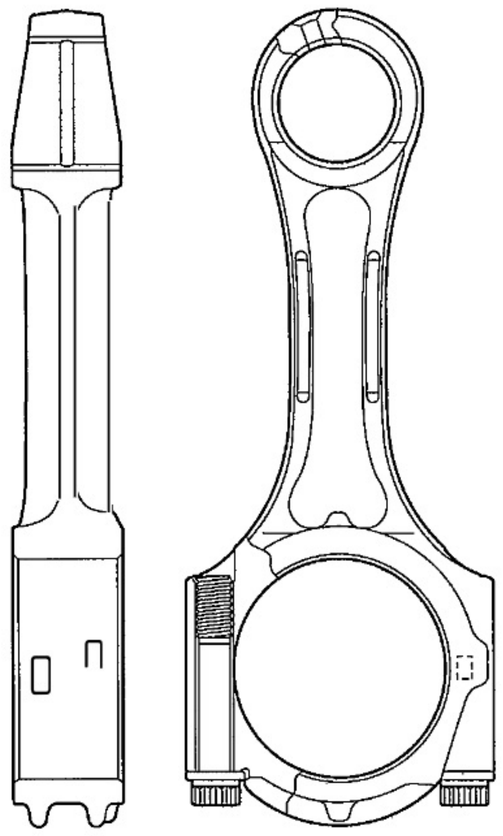
- In conjunction with the adoption of direct injection, piston provided with combustion chamber has been adopted.
- The piston is made of aluminum alloy.
- A cooling channel has been provided to reduce the piston temperature.
- To improve the wear resistance of the top ring groove, a SIRM (Sintered Iron Reinforced Metal) ring carrier has been adopted.
- Along with the improved engine performance, FRM (Fiber Reinforced Metal) has been cast into the area surrounding the combustion chamber to ensure the proper strength.



195EG44

Connecting Rod

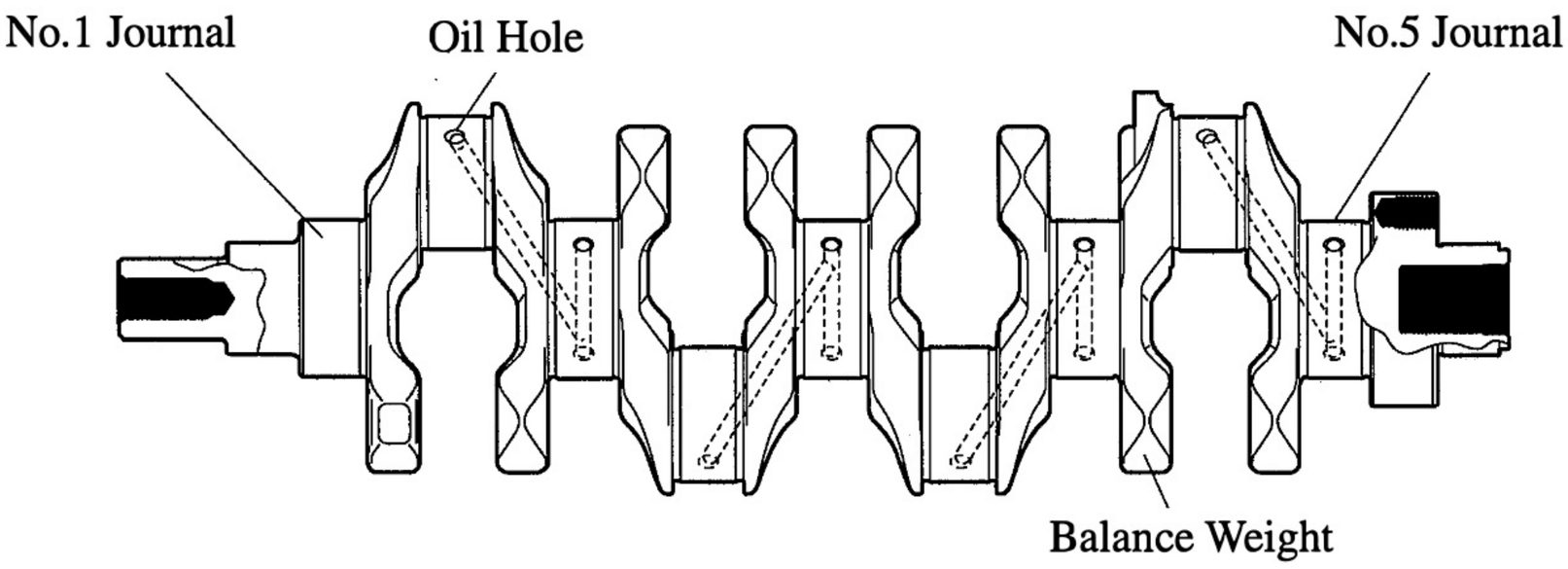
The connecting rods are made of high-strength material to ensure the proper strength.



195EG45

Crankshaft

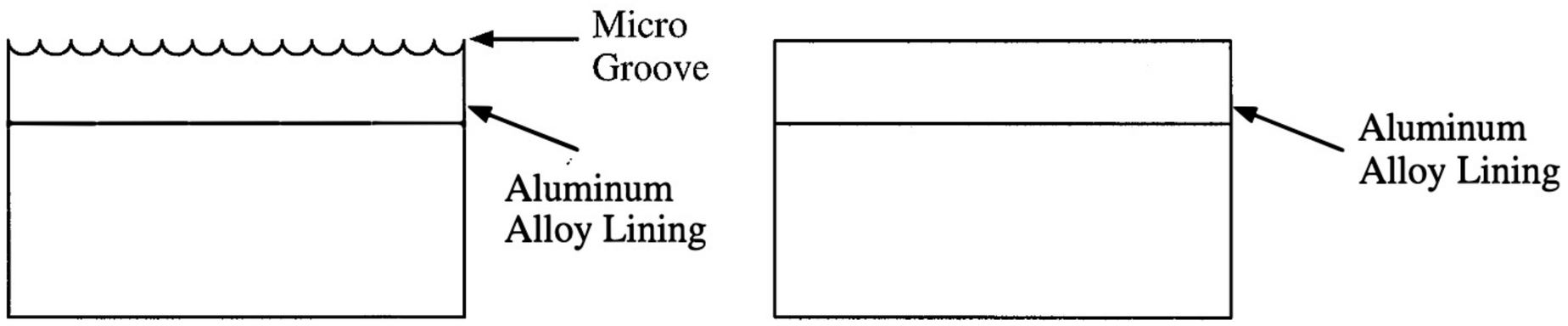
- The crankshaft has 5 journals and 8 balance weight.
- A newly developed crankshaft is made of a highly-strengthened material without lead.



195EG46

Connecting Rod Bearing & Crankshaft Bearing

To improve the conformance with the shaft and the retention of engine oil, microgroove bearings that have fine grooves on the bearing surface have been adopted.

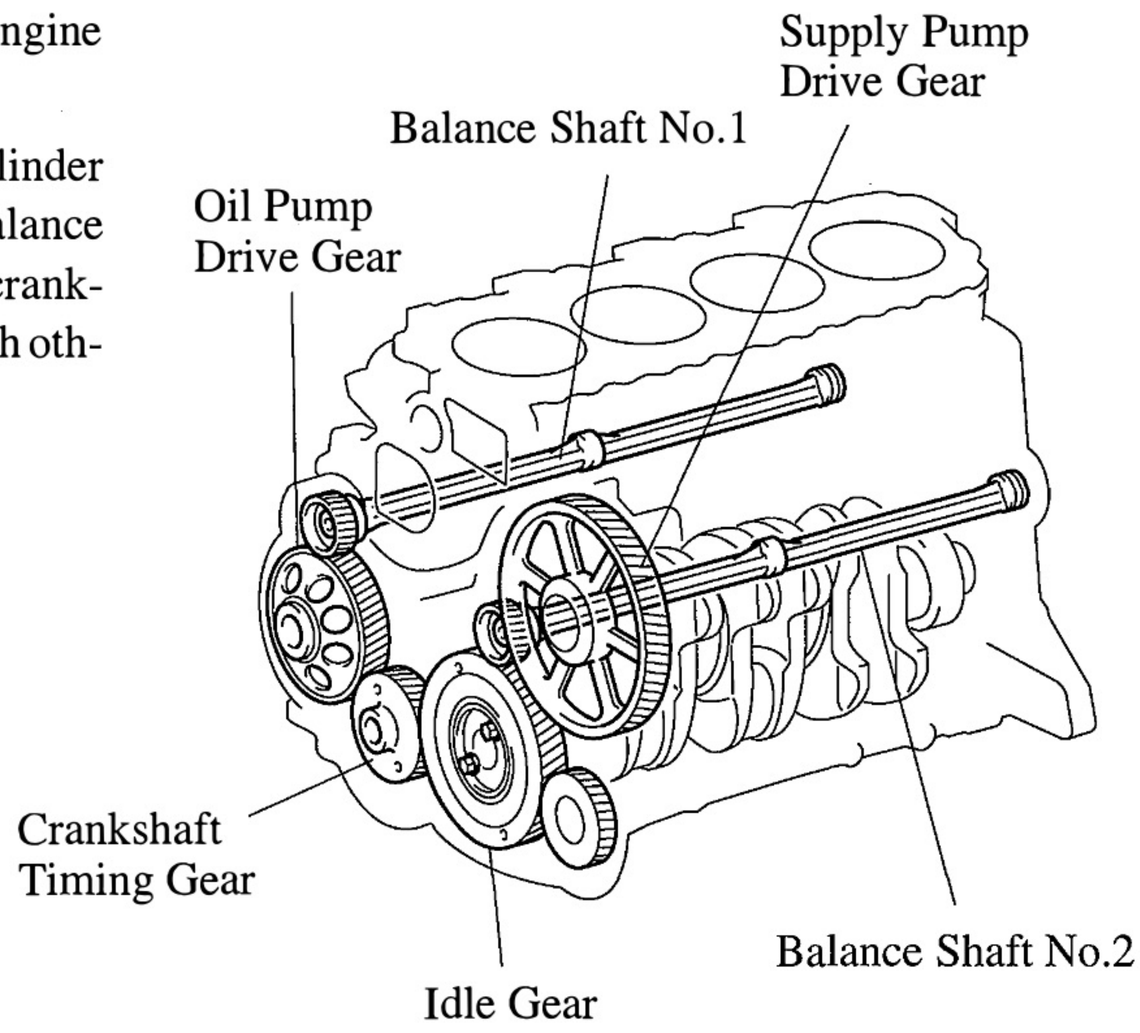


1KD-FTV Engine **1KZ-TE Engine**

168EG06

Balance Shaft

- Balance shafts are used to reduce engine vibration.
- 2 balance shafts are built into the cylinder block. Driven by the timing gear, the balance shafts rotate at twice the speed of the crankshaft and in the opposite direction of each other.

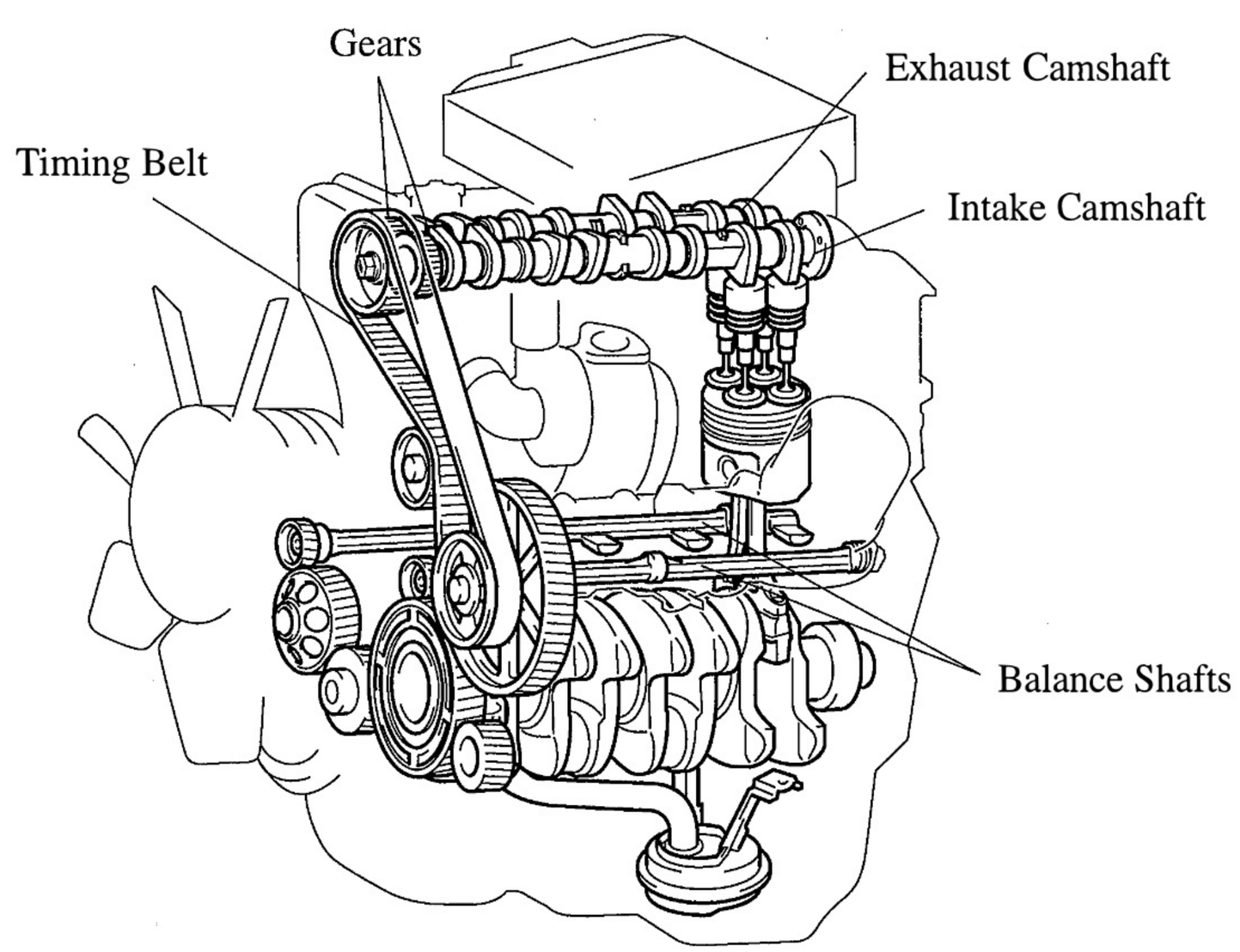


195EG47

4. Valve Mechanism

General

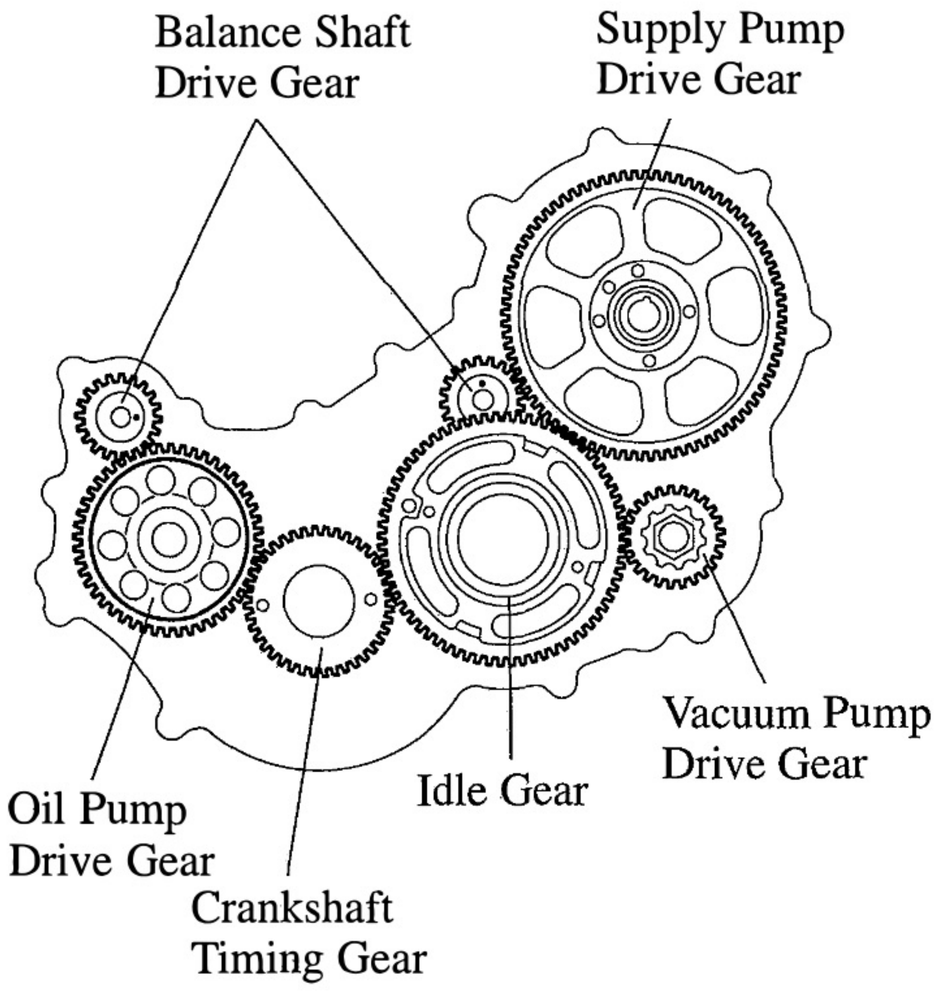
- Each cylinder has 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency is increased by means of the larger total port areas.
- The valves are directly opened and closed by 2 camshafts.
- The intake camshaft is driven by a timing belt, while the exhaust camshaft is driven through gear on the intake camshaft.
- Small-diameter, and flat-teeth gears are used for driving the exhaust camshaft in order to reduce gear noise.



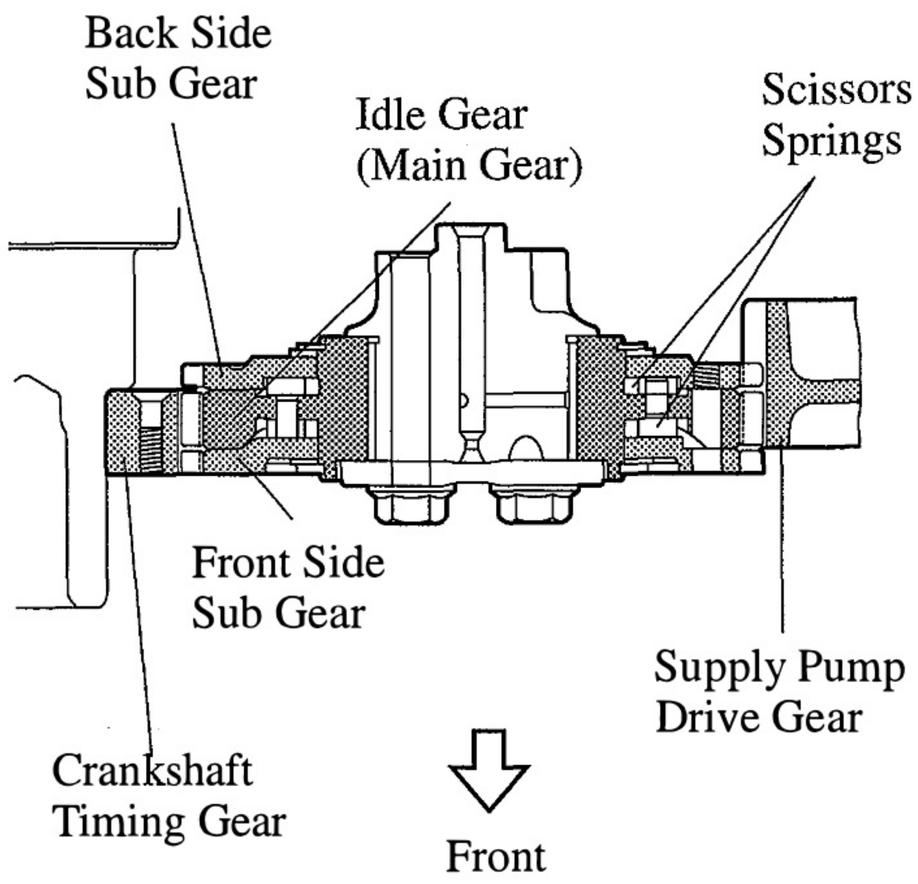
195EG48

Timing Gear Train

- The supply pump, vacuum pump, oil pump, and balance shafts are driven by the camshaft timing gear.
- The idler gear is constructed with a scissors gear on its front and back to reduce noise.



195EG49

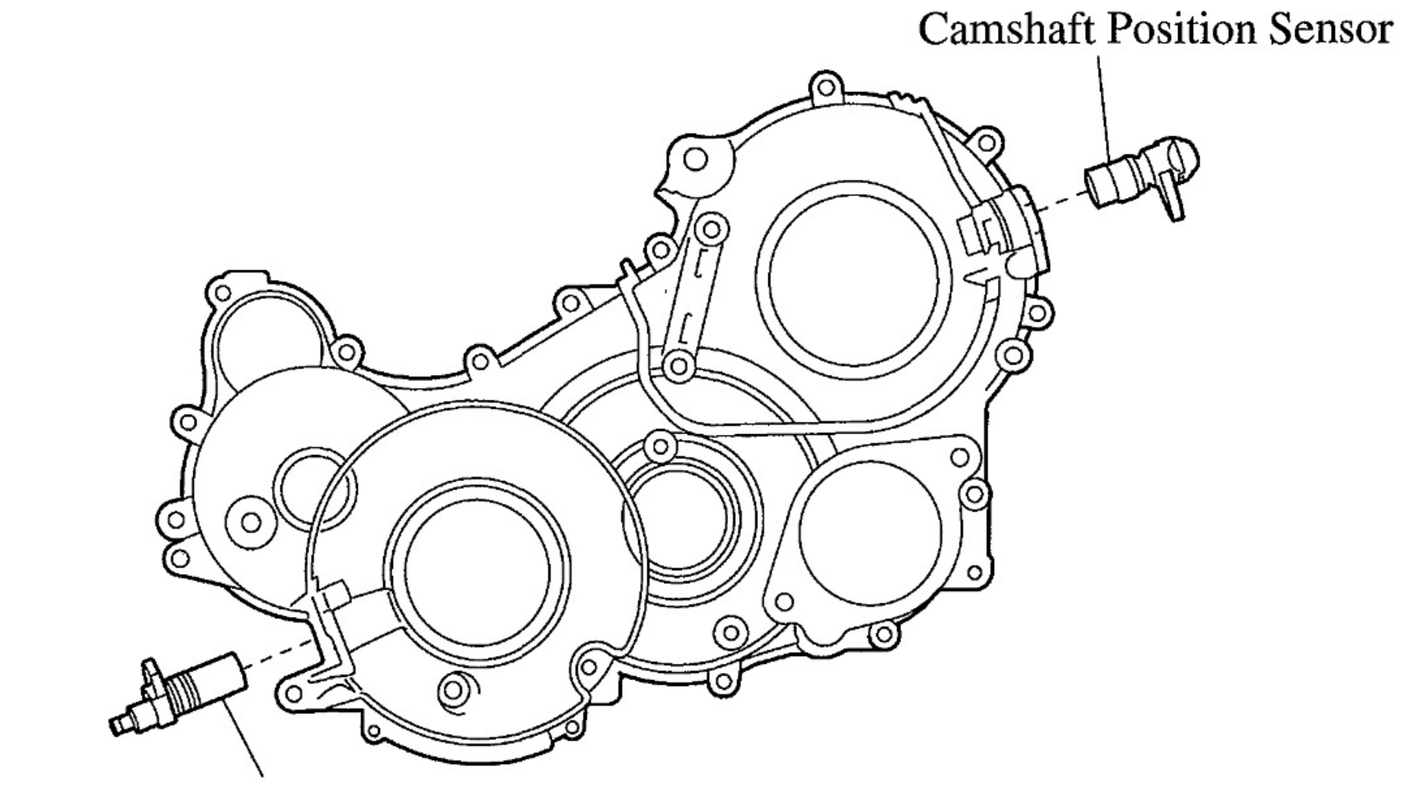


Idle Gear Cross Section

195EG50

Timing Gear Cover

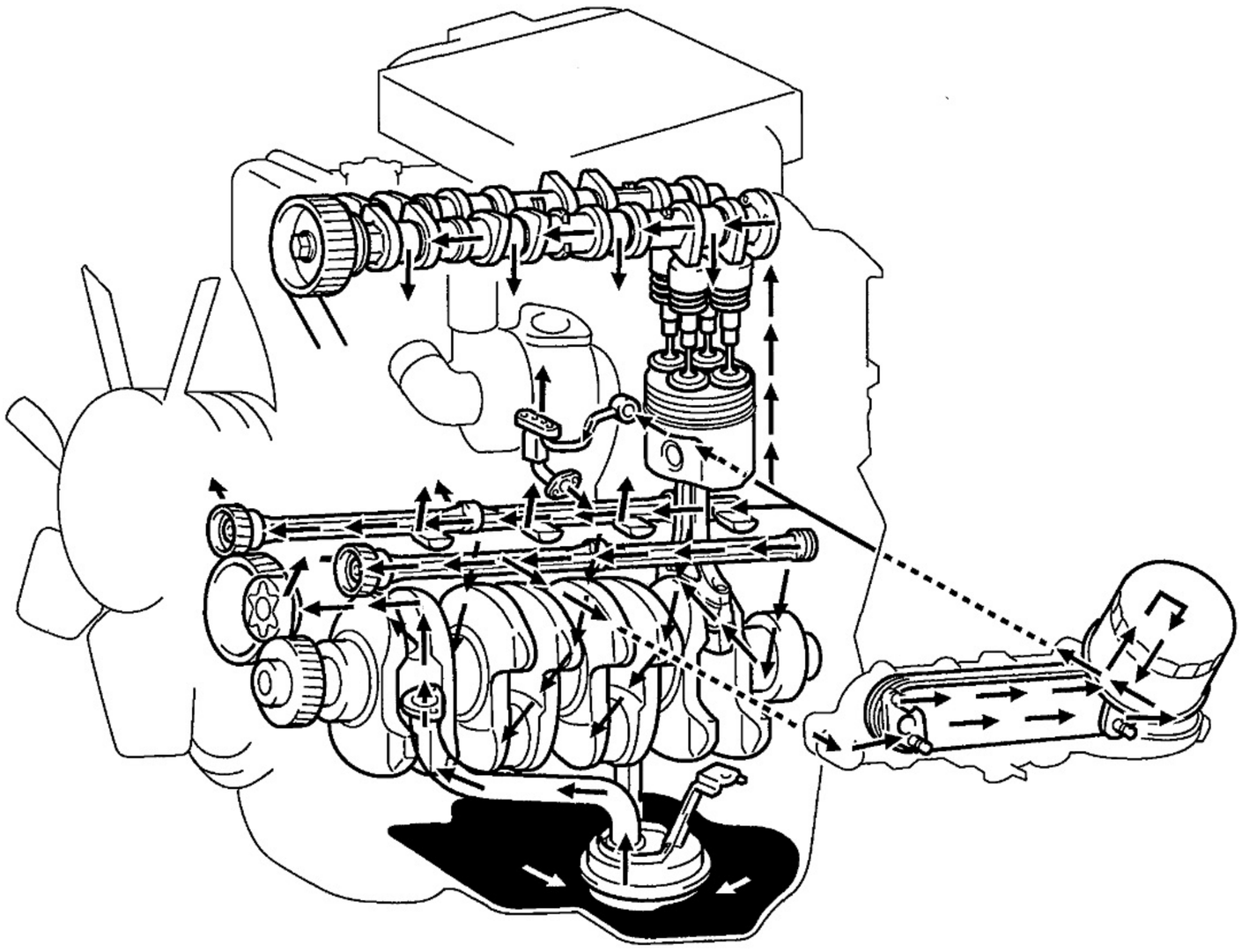
A crankshaft position sensor and camshaft position sensor are mounted on the timing gear cover.



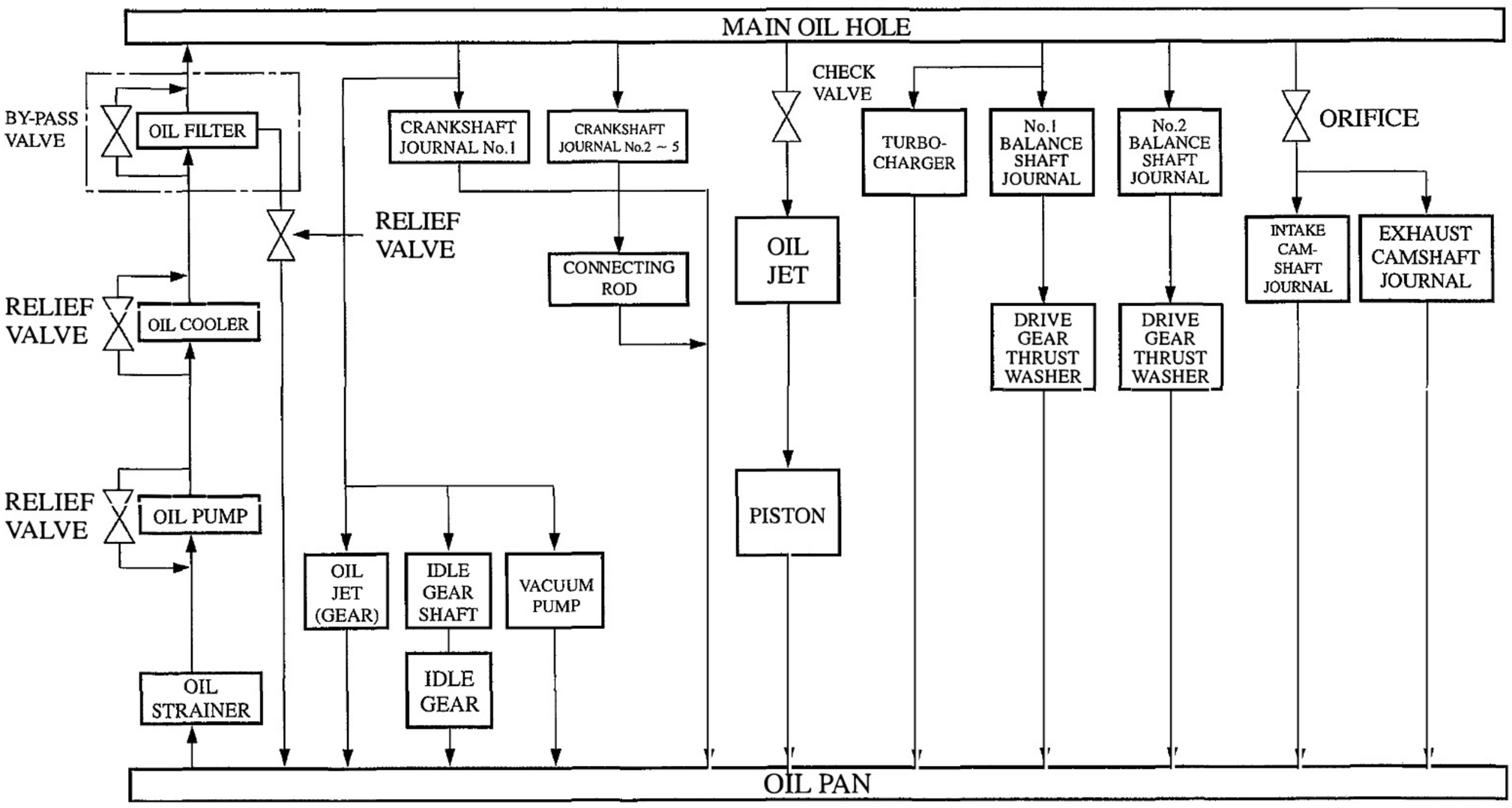
195EG51

5. Lubrication System

- The lubrication is fully pressurized and all oil passes through an oil cooler and an oil filter.
- A trochoid oil pump driven by a gear engaged with the crankshaft is used.



195EG52

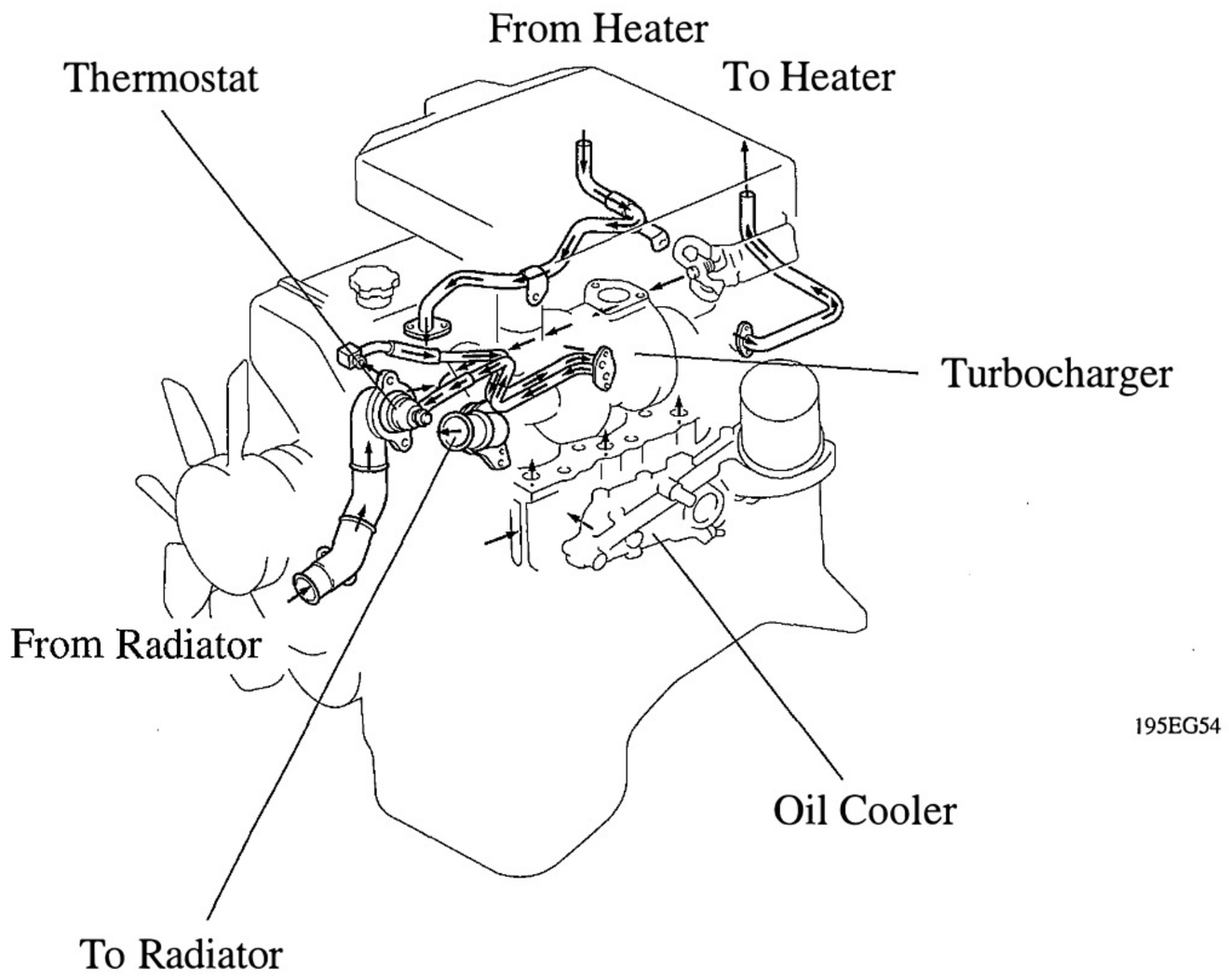


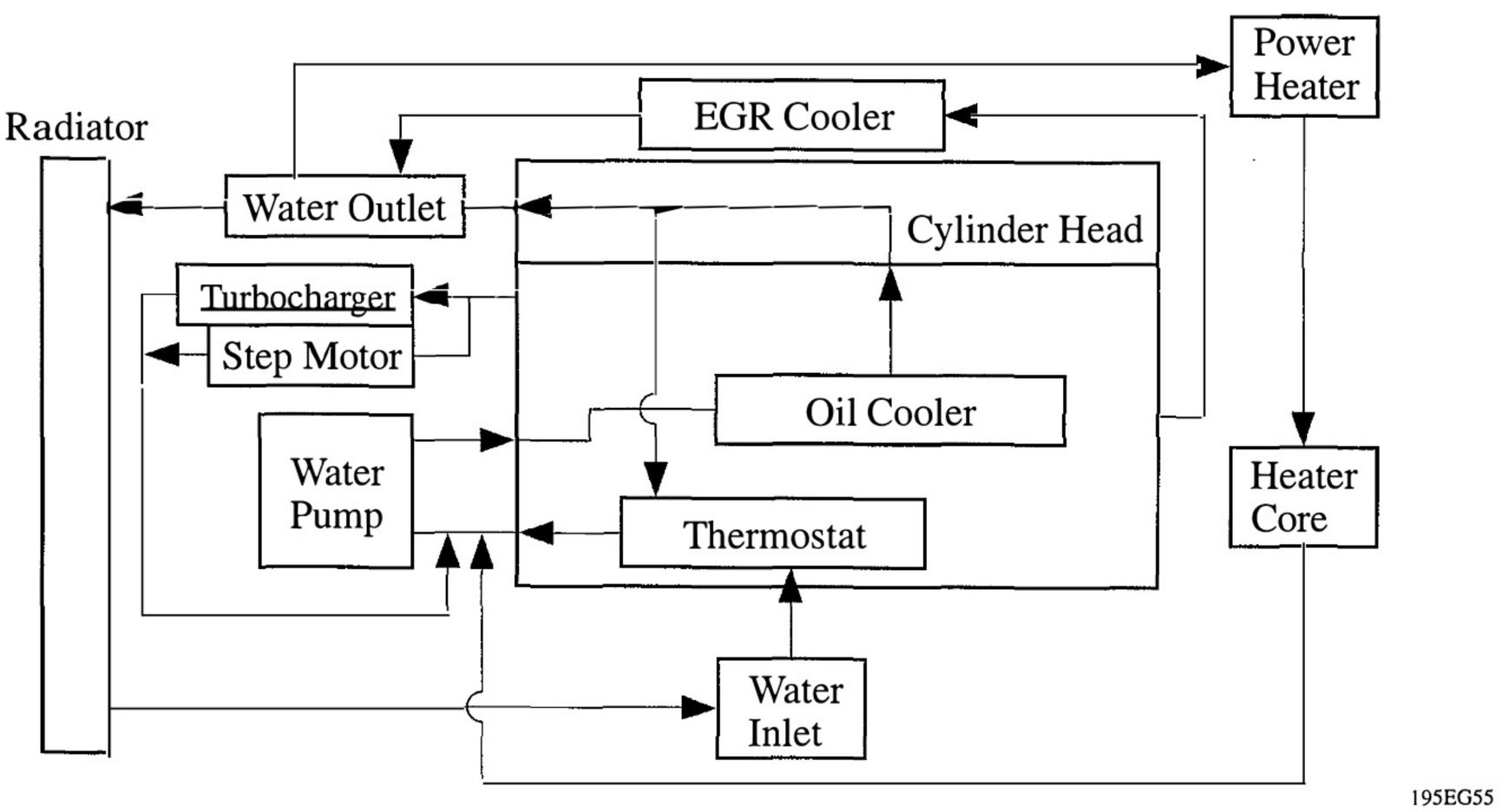
195EG53

6. Cooling System

General

- The cooling system is a pressurized, forced-circulation type.
- A thermostat with a bypass valve is located on the water inlet housing to maintain suitable temperature distribution in the cooling system.
- A vertical two-stage construction has been adopted for the water jacket in the cylinder head to improve cooling performance.
- An aluminum radiator core is used for weight reduction.
- A viscous type power heater has been adopted on the cold area specification model to promote the warming of the engine and to improve the heating performance of the heater during extremely cold temperatures.
- EGR cooler to cool down the intake air temperature during EGR operation has been adopted.
- In accordance with the adoption of the variable nozzle vane type turbocharger, a cooling circuit for the step motor has been added.

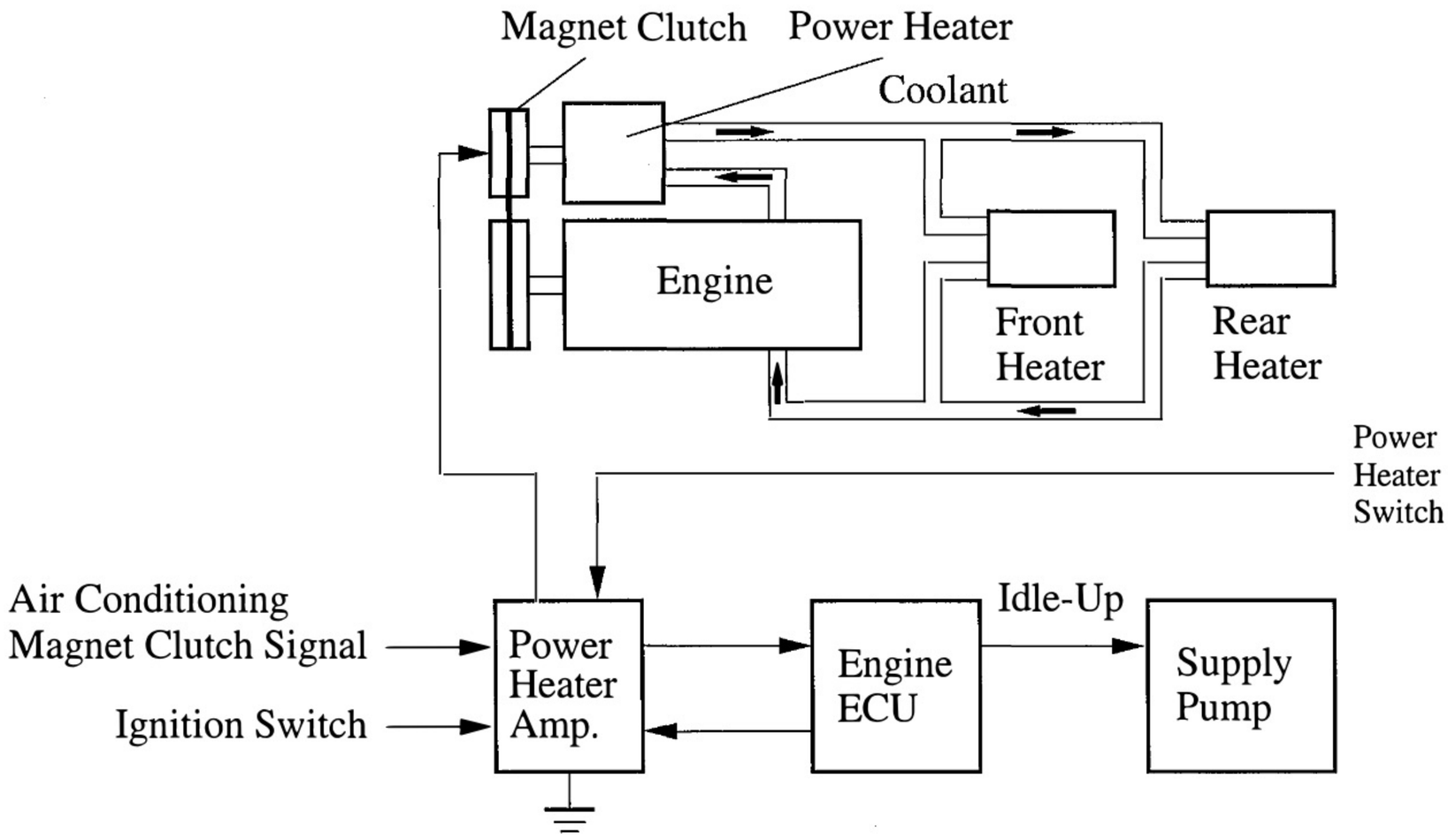




Power Heater

A viscous type power heater has been adopted on the cold specification model. The power heater increases the coolant temperature by utilizing the shear heat of the silicon oil and by increasing the engine load.

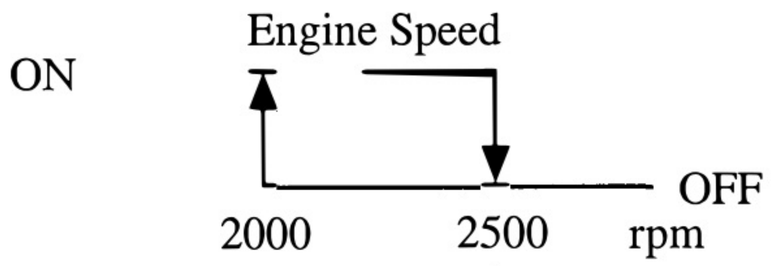
▶ System Diagram ◀



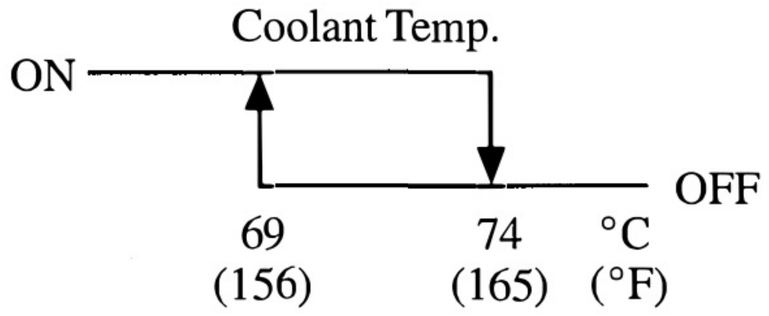
195EG89

Construction and Operation

- The power heater, which is located on top of the engine, is driven by a drive belt. Pressing the power heater switch provided in the instrument panel engages the magnetic clutch, causing the rotor in the power heater to rotate and the silicon oil to mix. The shear heat that is thus generated heats the coolant.
- The power heater is controlled according to engine speed and coolant temperature as described below. While the power heater is engaged, the engine idling speed increases to 1200 rpm.



147EG44



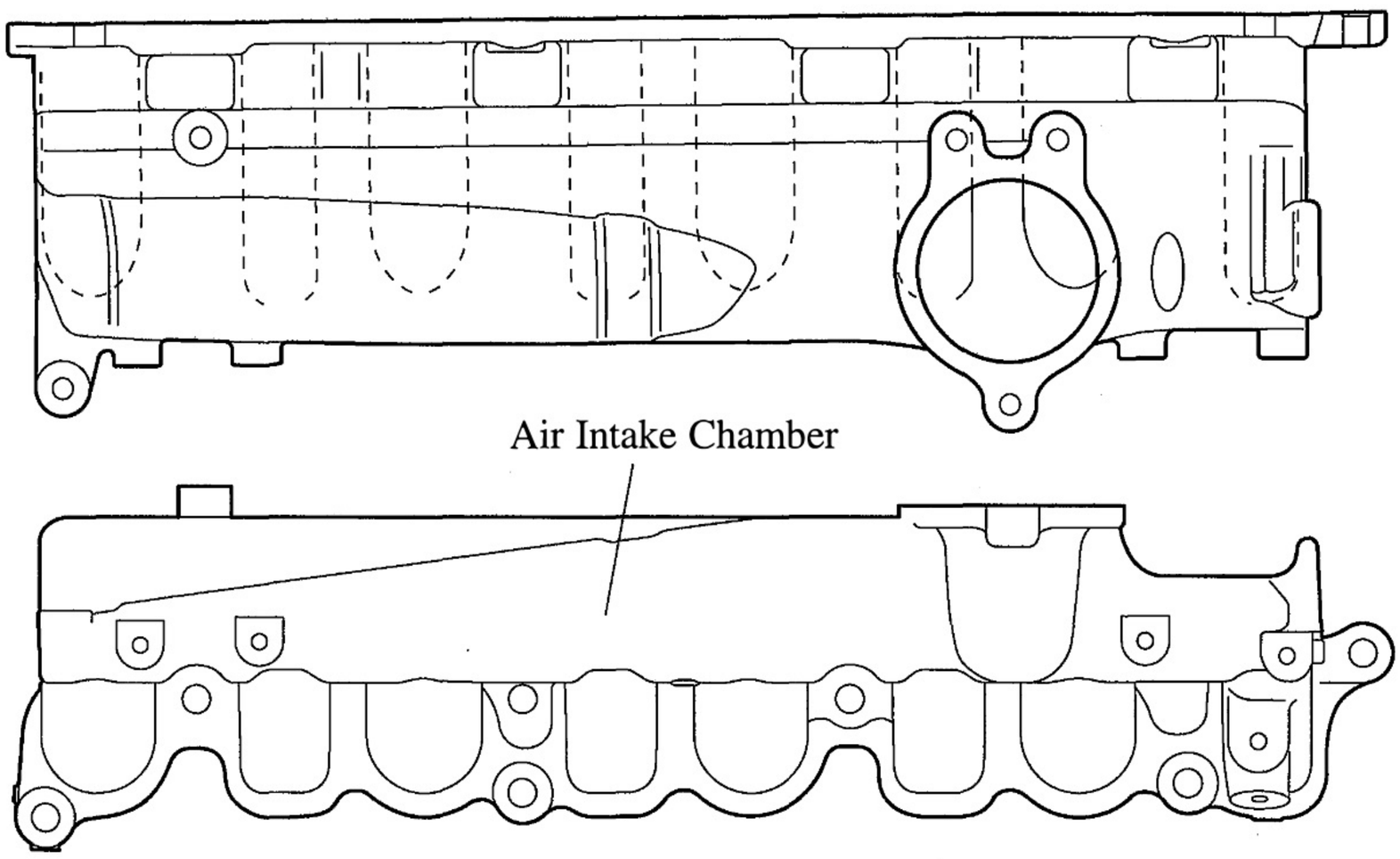
147EG44

However, the power heater is turned OFF when the engine is cranking or the vehicle is accelerating (for 5 seconds while the vehicle speed is under 30 km/h (19 mph) and the throttle opening angle is more than 45%).

7. Intake and Exhaust System

Intake Manifold

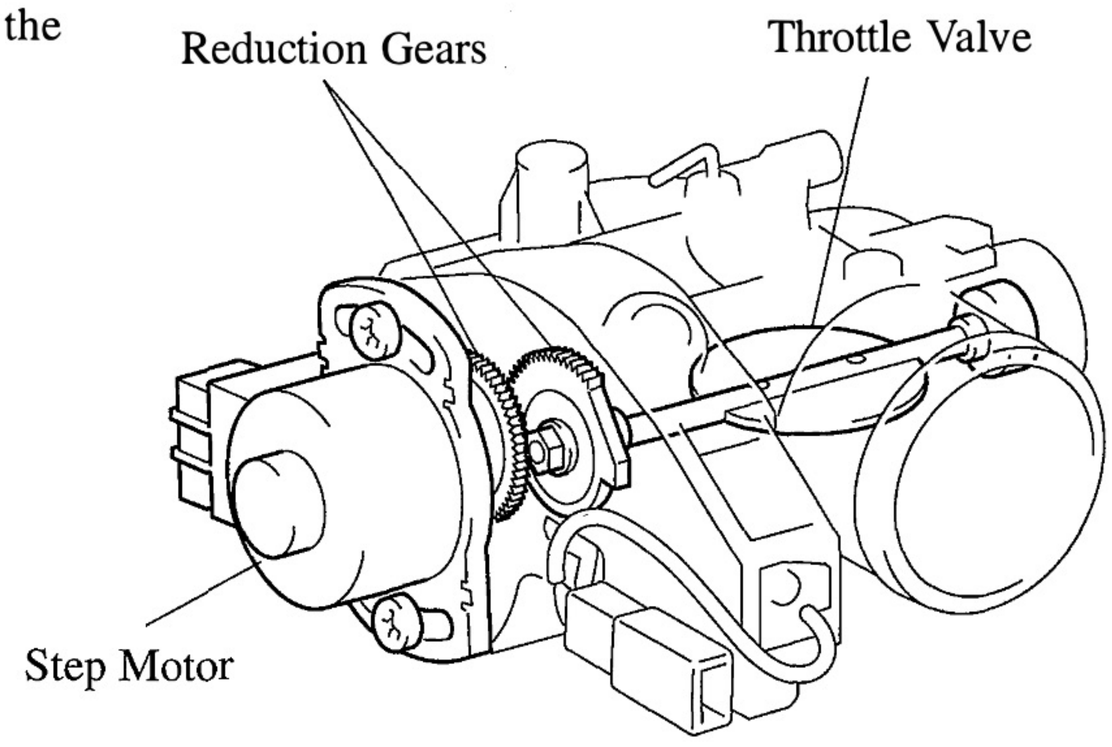
In conjunction with the adoption of the direct injection system, an intake manifold provided with an air intake chamber has been adopted in order to reduce the swirl variances between the cylinders.



195EG56

Diesel Throttle

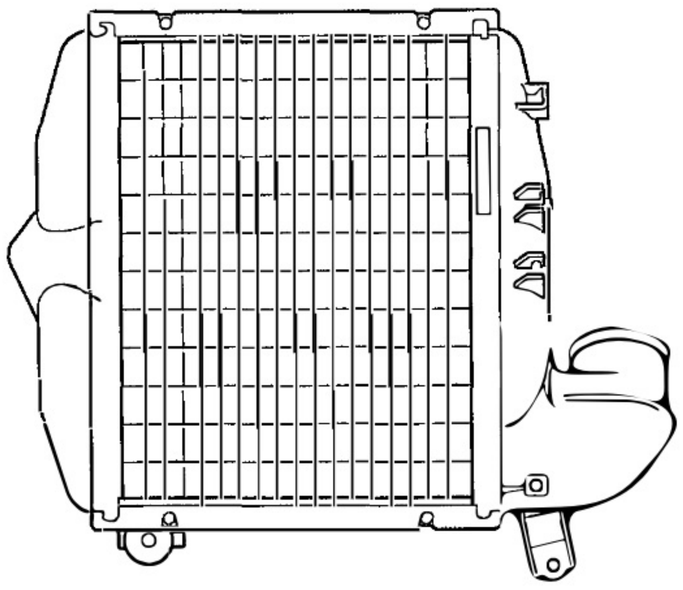
A step motor type throttle has been adopted to improve EGR performance and to reduce the vibration when stopping the engine.



195EG84

Inter Cooler

- An air-cooled intercooler has been adopted in order to lower the intake air temperature, improve engine performance, and to realize cleaner exhaust gas emissions. It is located directly on top of the engine.
- The inlet tank is made of aluminum and the outlet tank is made of plastic to reduce intake air noise.
- A dual construction, high-frequency cavity resonator has been adopted for the pipe between the turbocharger and the intercooler.

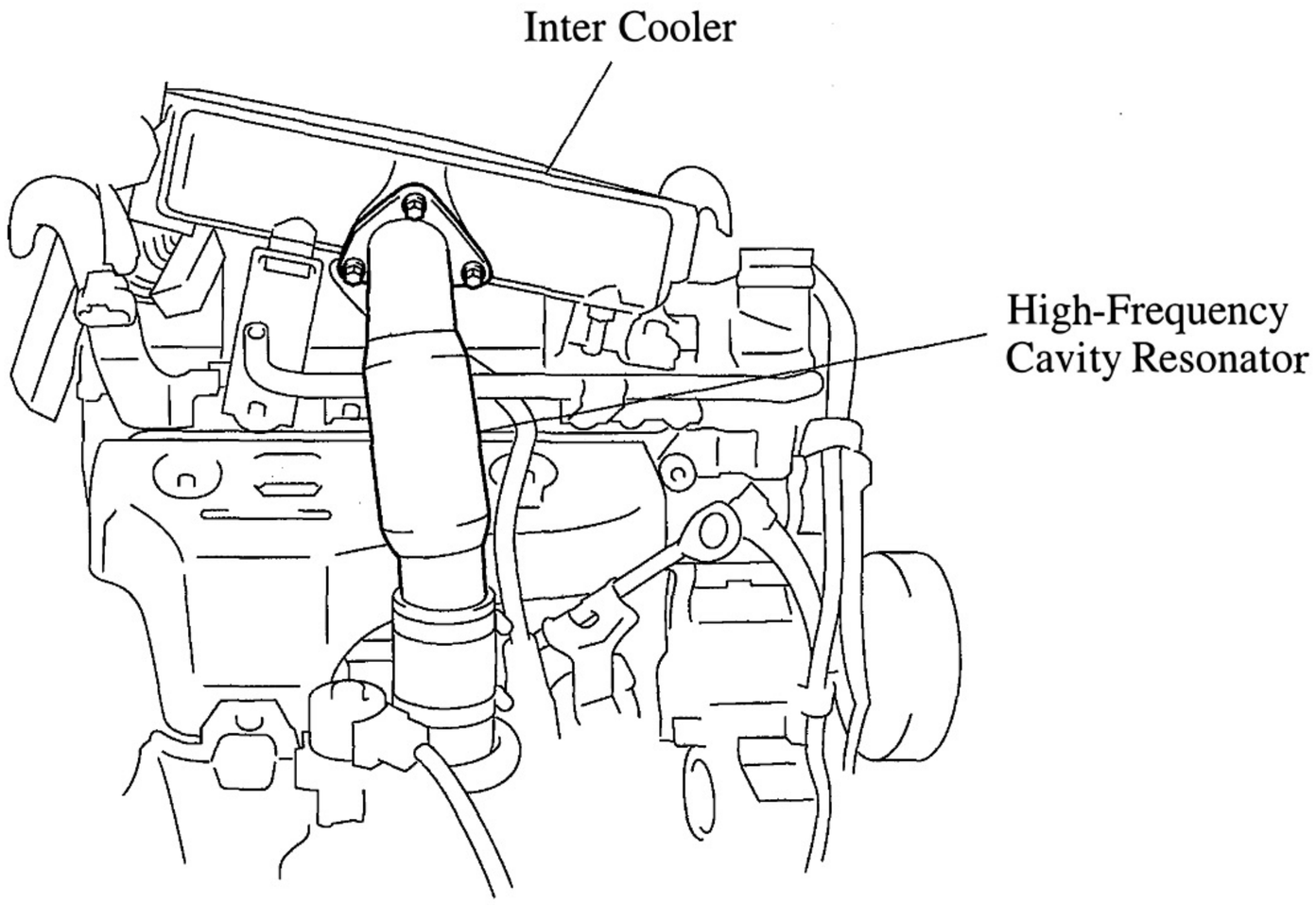


195EG57

▶ Specification ◀

Cooling Type	Air-Cooled Type
Core Shape	Tube
Core Size* mm (in.)	237.5 (9.350) x 305.4 (12.024) x 49 (1.929)
Fin Pitch mm (in.)	2.5 (0.098)

*: Width x Height x Thickness

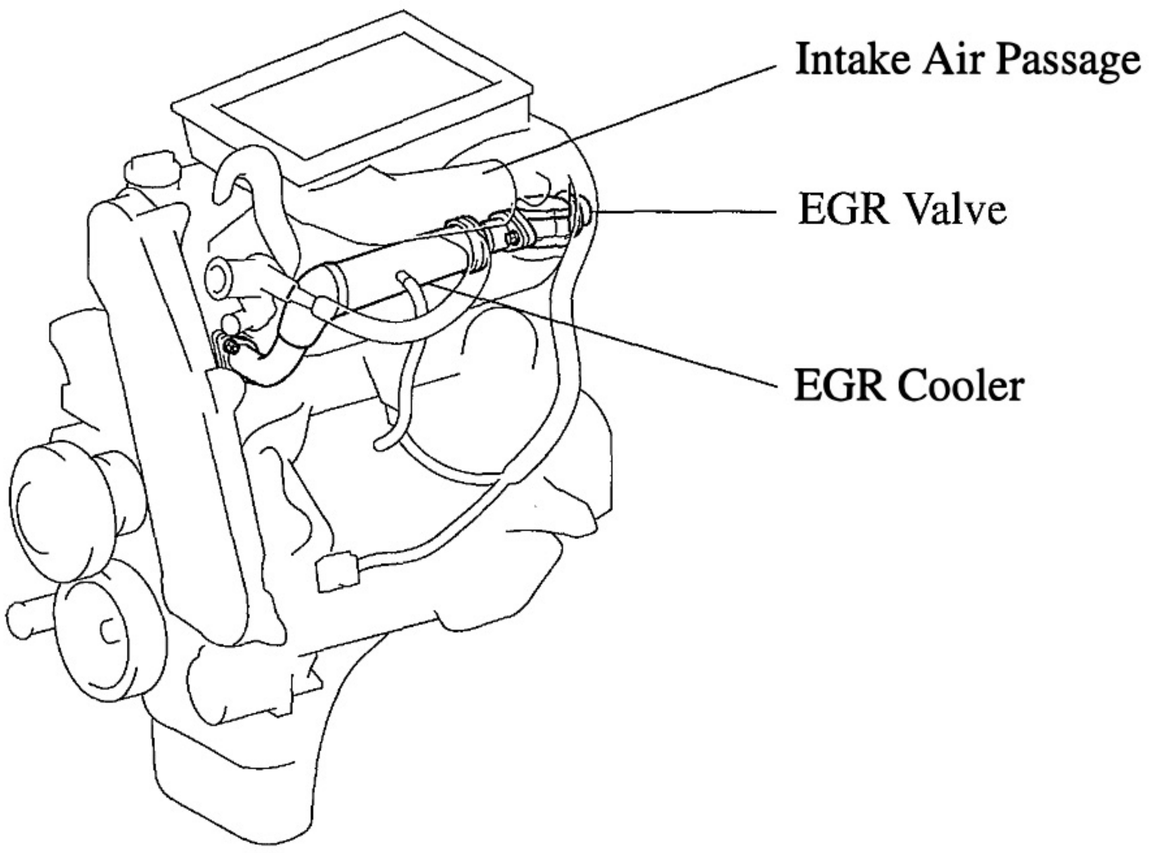


195EG69

EGR

1) General

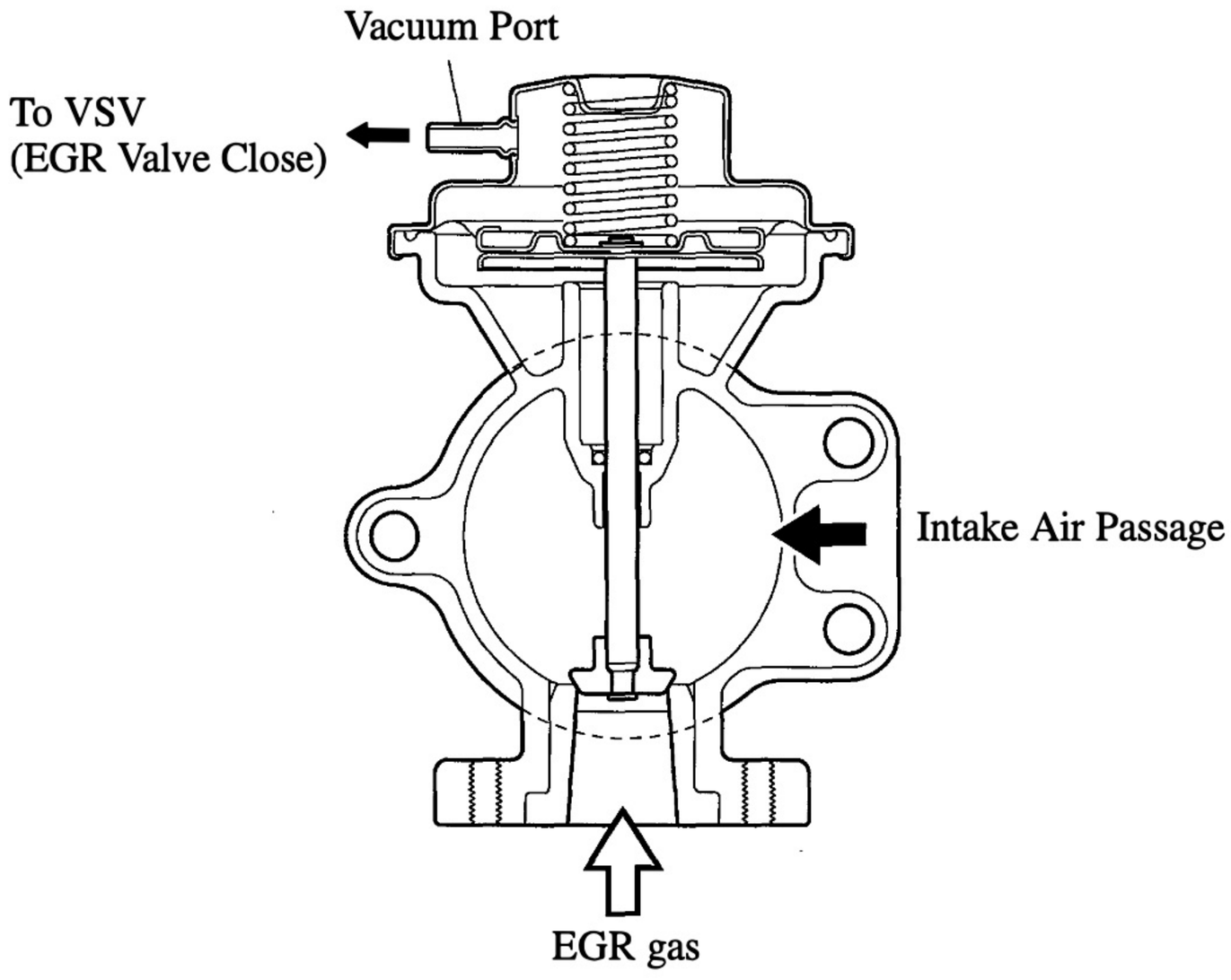
- An EGR valve is provided midstream in the intake air passage. By cooling the EGR valve in this manner, a greater volume of exhaust gas can be processed. For the EGR control system, refer to page 252.
- By adopting the exhaust gas passage in the cylinder head and the water cooling type EGR cooler, this makes it possible to lower the temperature of the exhaust gas and re-circulate the great amount of exhaust gas.



195EG68

2) EGR Valve

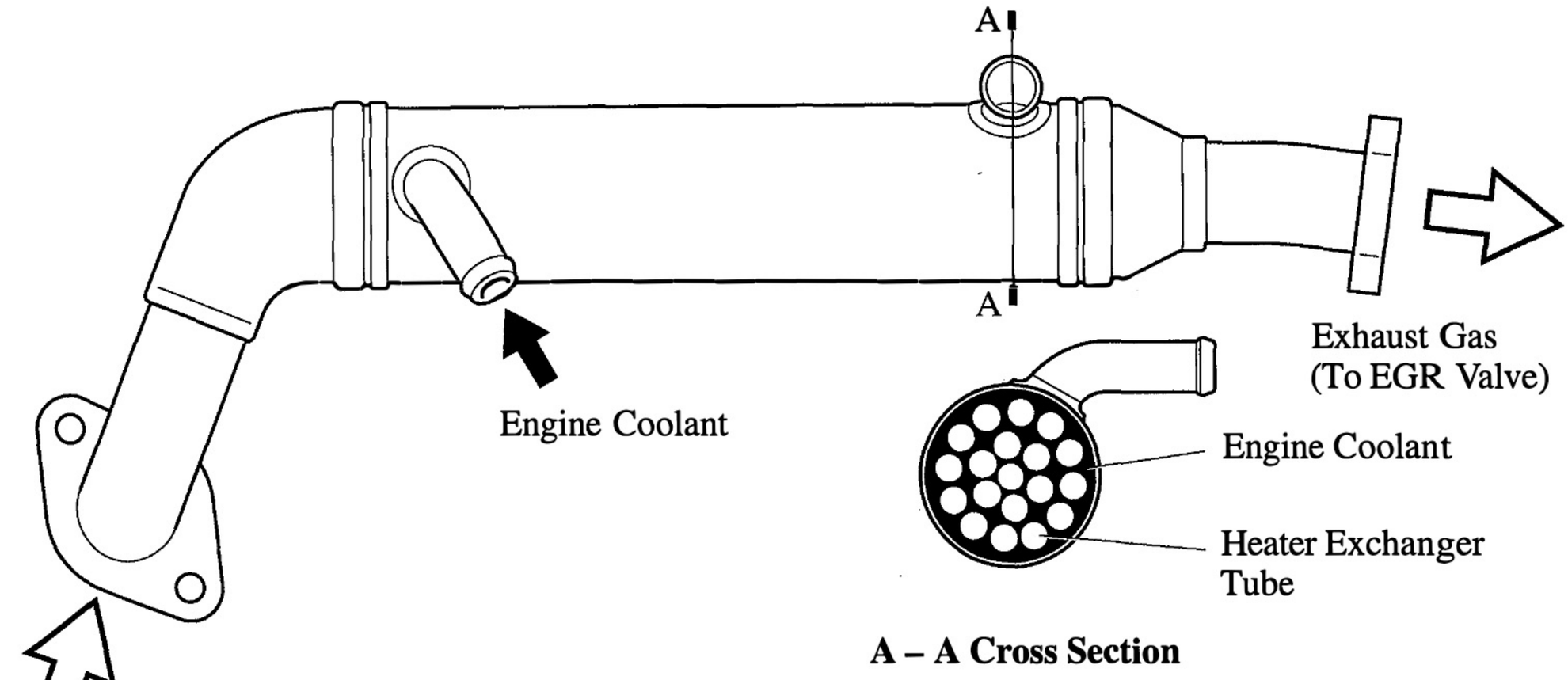
A vacuum port for a VSV (for EGR Valve Close) to cut off EGR has been added to improve the valve closing response.



195EG58

3) EGR Cooler

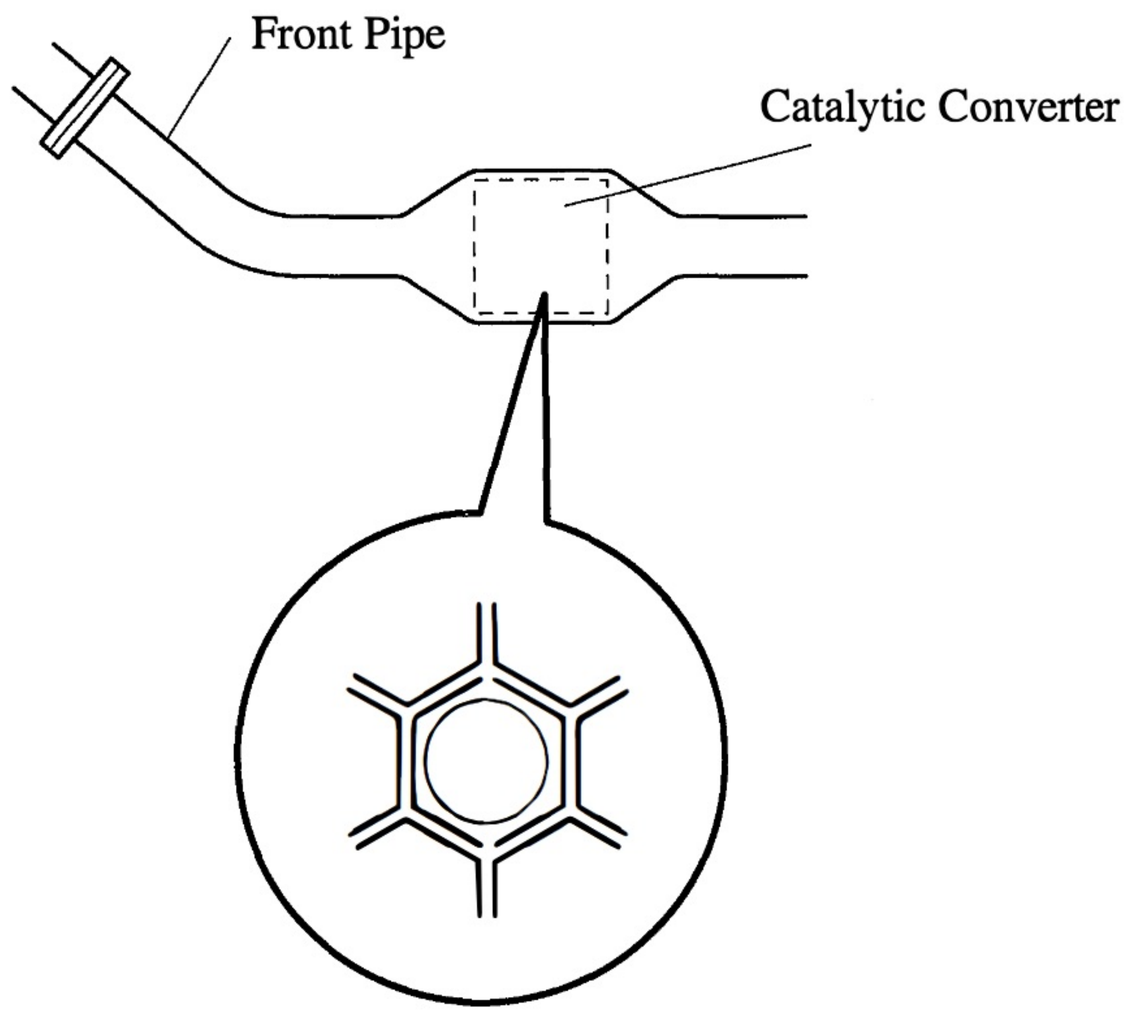
The water cooling type EGR cooler has been established in the EGR passage between the cylinder head and the EGR valve. Thus makes it possible to lower the exhaust gas temperature and to re-circulate the great amount of exhaust gas and realizes the reduction of Nox. There are 19 heat exchanger tubes in the EGR cooler, and exhaust gas goes through each tube. Around the heat exchanger tubes runs the engine coolant and absorbs the temperature of the exhaust gas through the tubes.



195EG59

Catalytic Converter

- A large-capacity, oxidizing catalytic converter with a hexagon cell construction is used to clean the exhaust gas particulates, HC and CO.
- The catalytic converter is integrated in the front pipe.

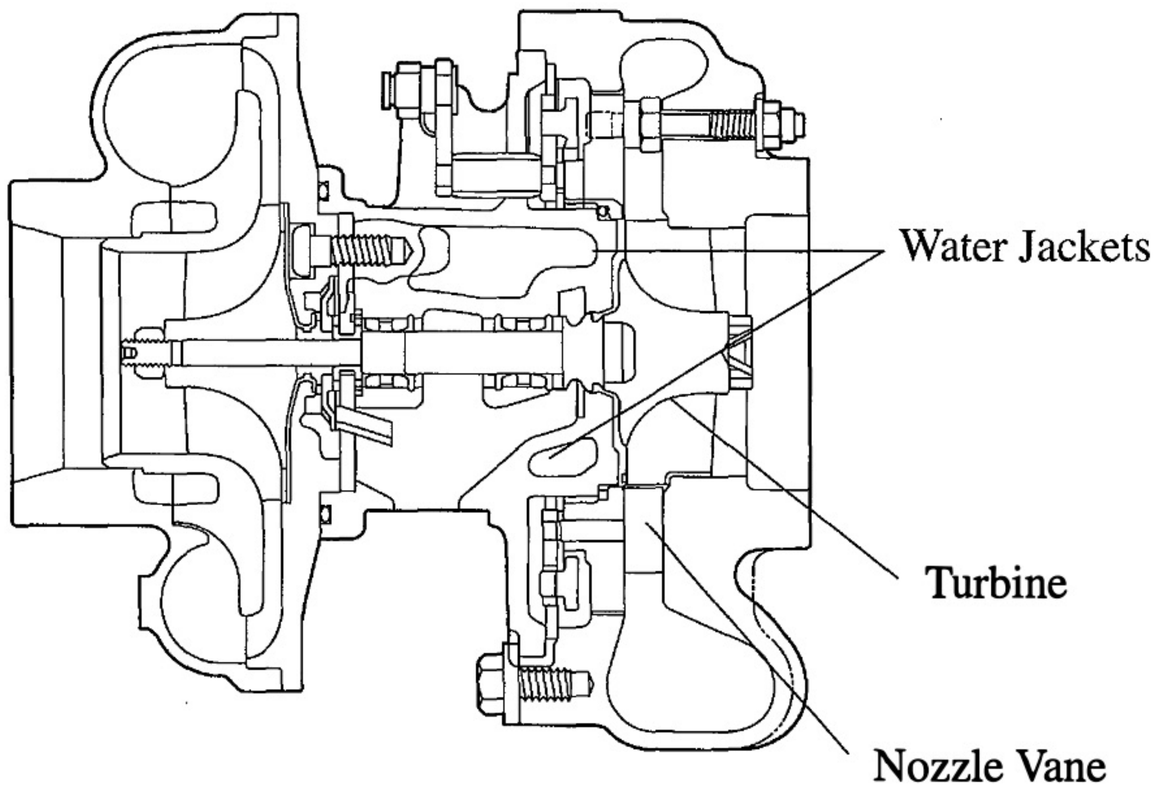


195EG60

8. Turbocharger

General

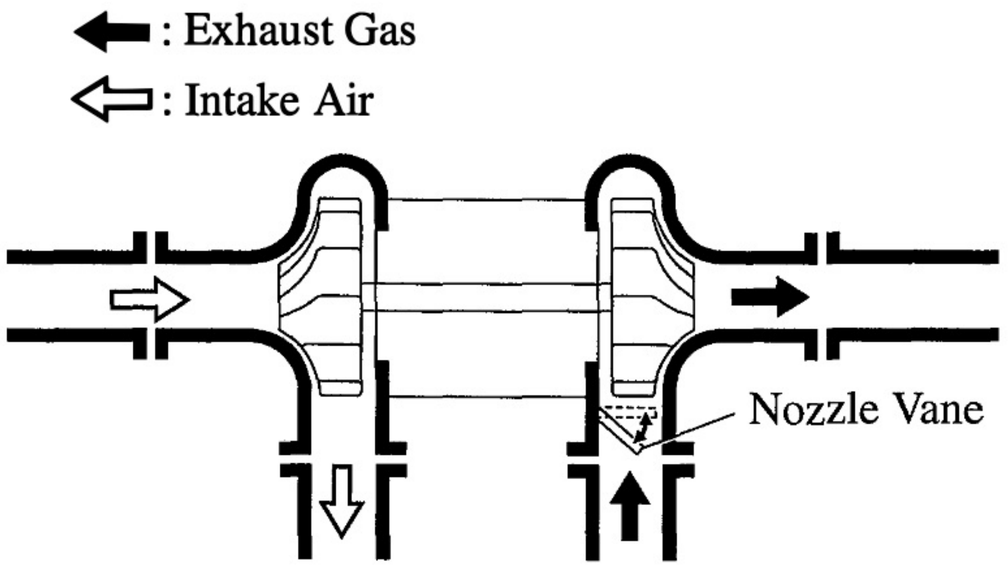
- A variable nozzle vane type turbocharger has been newly adopted. In response to the engine condition, by controlling the nozzle vane variably and making the most suitable amount of the exhaust gas inflow to the turbine, great improvements of low speed torque, maximum output, fuel consumption and noise and emission reductions have been realized.
  For details, refer to page 249.
- A water jacket is provided in the bearing housing to improve the cooling performance of the turbocharger.



195EG70

Operation

The exhaust gas from the exhaust manifold goes through the nozzle vane inside the turbo charger housing, and flows to the exhaust pipe through the turbine. The speed of the turbine (supercharging pressure) differs depending on the flow velocity of the exhaust gas going through the turbine and the flow velocity of the exhaust gas is controlled by the opening. In such a time like idling, when the exhaust gas is less, the nozzle vane is fully closed, but as there is a slight clearance between the vanes, the exhaust gas flows through this clearance to the exhaust pipe. Therefore, there is no bypass.



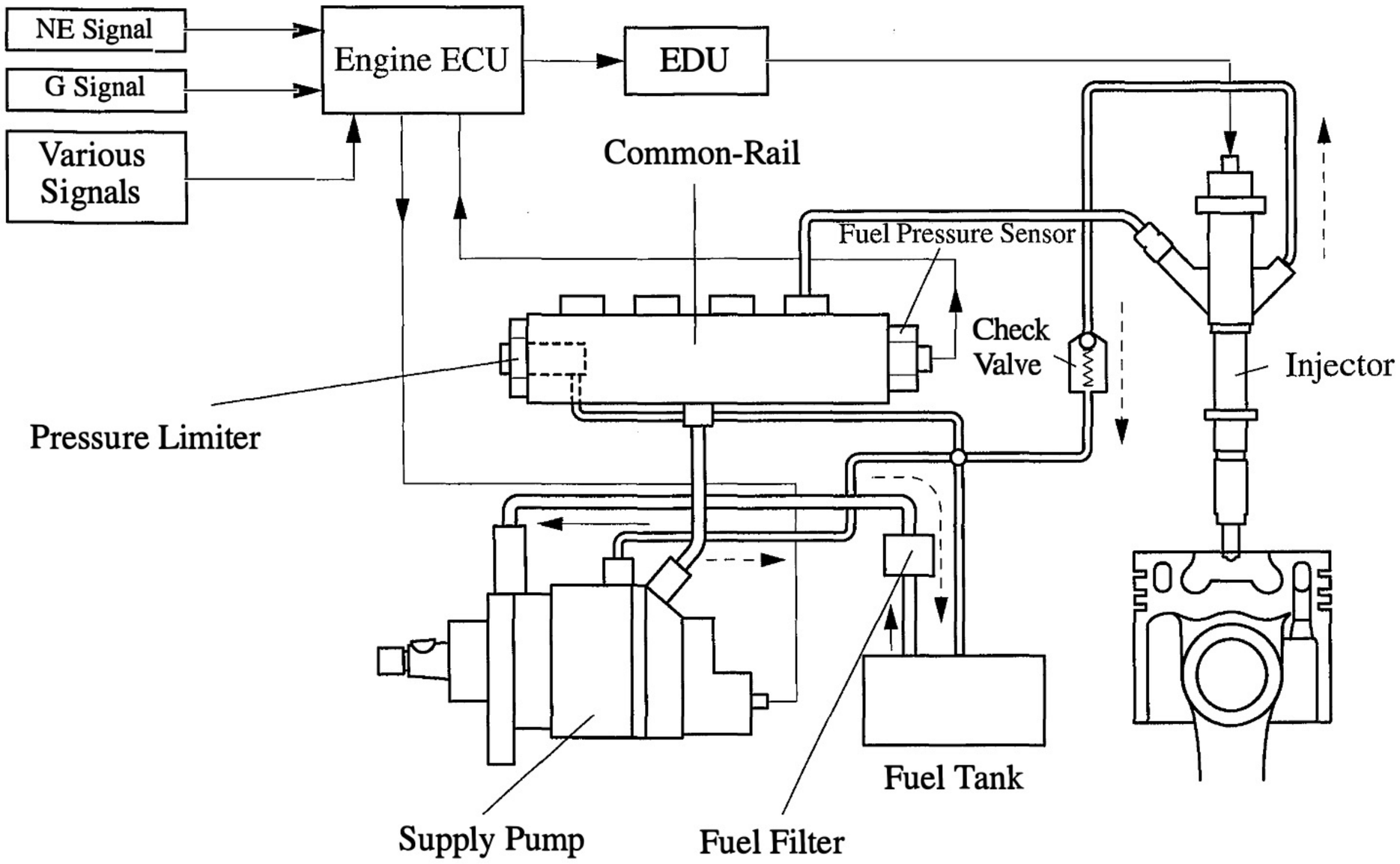
195EG72

9. Fuel System

General

- A common-rail type fuel injection system has been adopted in the fuel system of the 1KD-FTV engine.
- Consisting of a supply pump, common-rail, electric control injector, and fuel pipe, this system effects optimal control for combustion by controlling the fuel pressure, injection volume, and the injection timing via the engine ECU and EDU (Electronic Driver Unit).

▶ System Diagram ◀

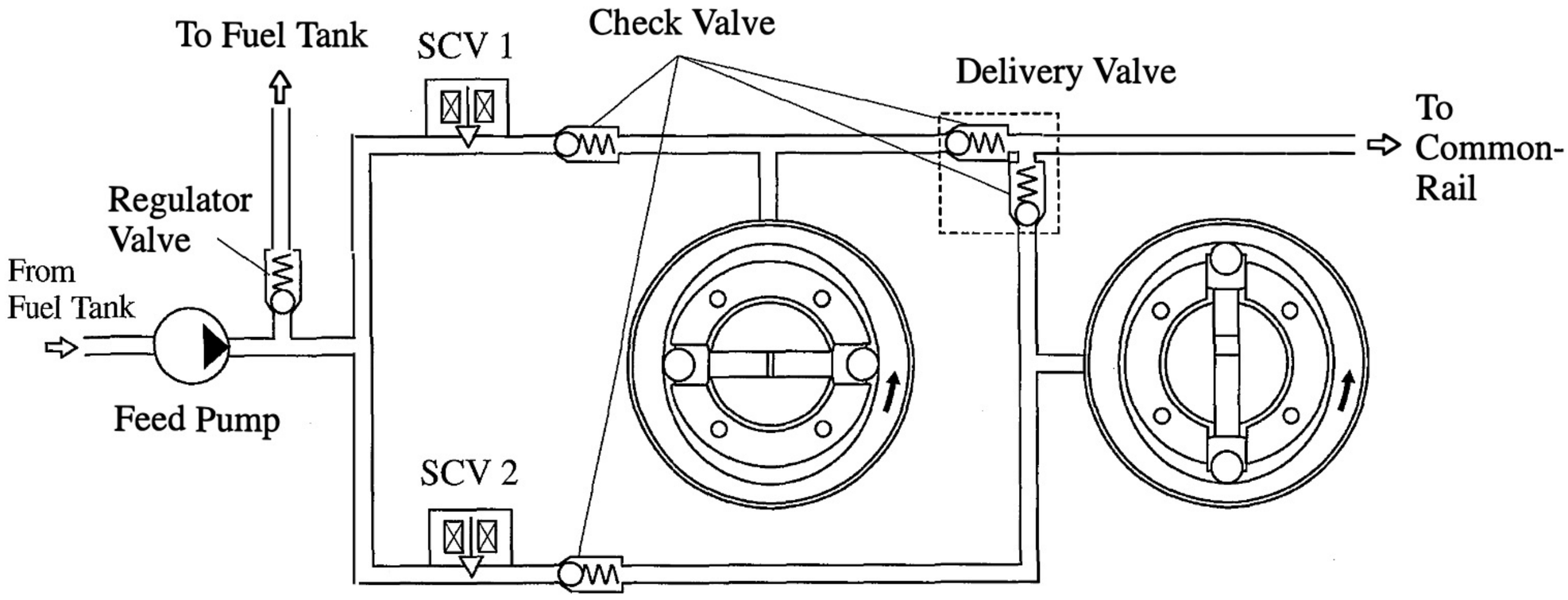


195EG67

Supply Pump

1) General

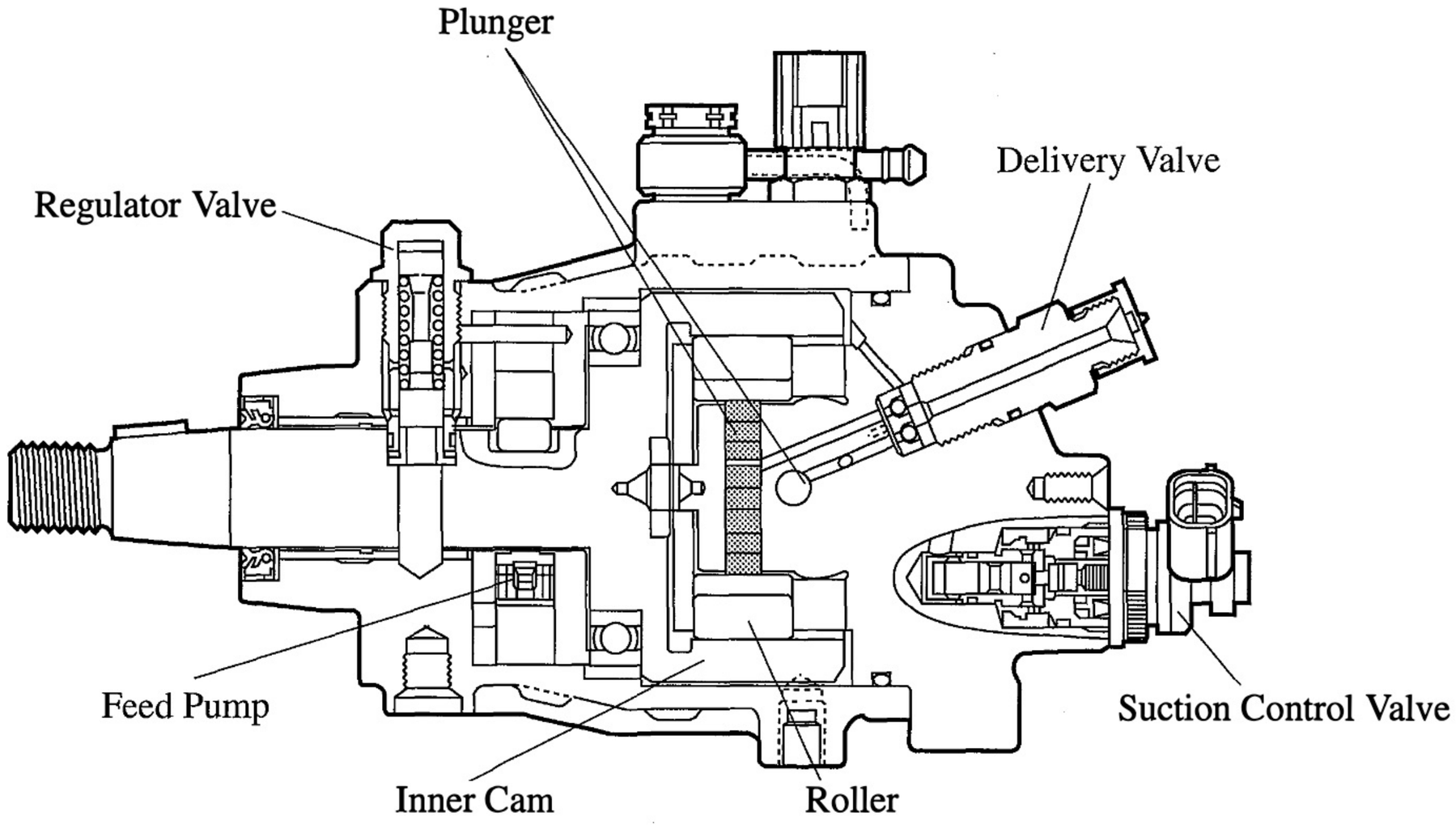
- An electric control type supply pump has been adopted for the common-rail system.
- The supply pump is a tandem type that have two functions of fuel suction and fuel delivery. This pump achieves both the high-pressure pumping of fuel and the reduction of driving torque fluctuation.
- An SCV (Suction Control Valve) that controls the amount of fuel drawn in supply pump during the suction stroke has been adopted.



168EG19

2) Construction

The supply pump consists of an inner cam, roller, and plunger.



195EG103

3) Operation

In its oval-shaped inner cam, this pump contains two systems of plungers, each repeating its respective suction and pumping function.
As shown in Fig. 1 below, plunger A becomes positioned at the shorter diameter of the inner cam. The suction stroke starts as plunger A expands with the fuel pressure created by the feed pump. Meanwhile, plunger B becomes positioned at the longer diameter of the inner cam. The pumping stroke starts as plunger B is pushed by the inner cam.
As the inner cam rotates further, and assumes the position shown in Fig. 2 below, plunger A becomes positioned at the longer diameter of the inner cam. The pumping stroke starts as plunger A is pushed by the inner cam. Meanwhile, plunger B becomes positioned at the shorter diameter of the inner cam. The suction stroke starts as plunger B expands with the fuel pressure created by the feed pump.
The suction and pumping of fuel is effected by repeating these strokes.
However, because the volume of fuel drawn in by the plunger is regulated by the engine ECU via SCV, the plunger stops upon having drawn in the regulated amount of fuel. Thereafter, the inner cam resumes pumping. To regulate the volume of fuel drawn in by the plunger, the engine ECU calculates the target commonrail pressure in accordance with the vehicle driving conditions and controls the SCV (Suction Control Valve) so that the target fuel pressure is achieved by the output of the fuel pressure sensor.

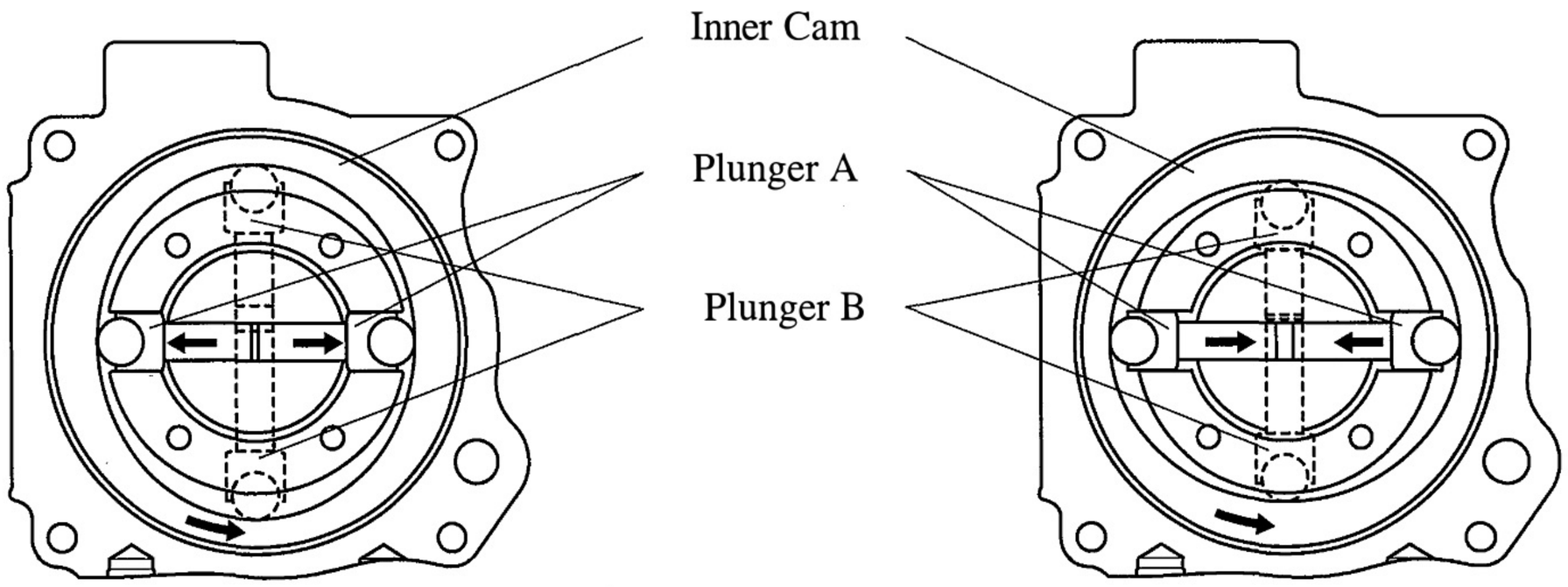


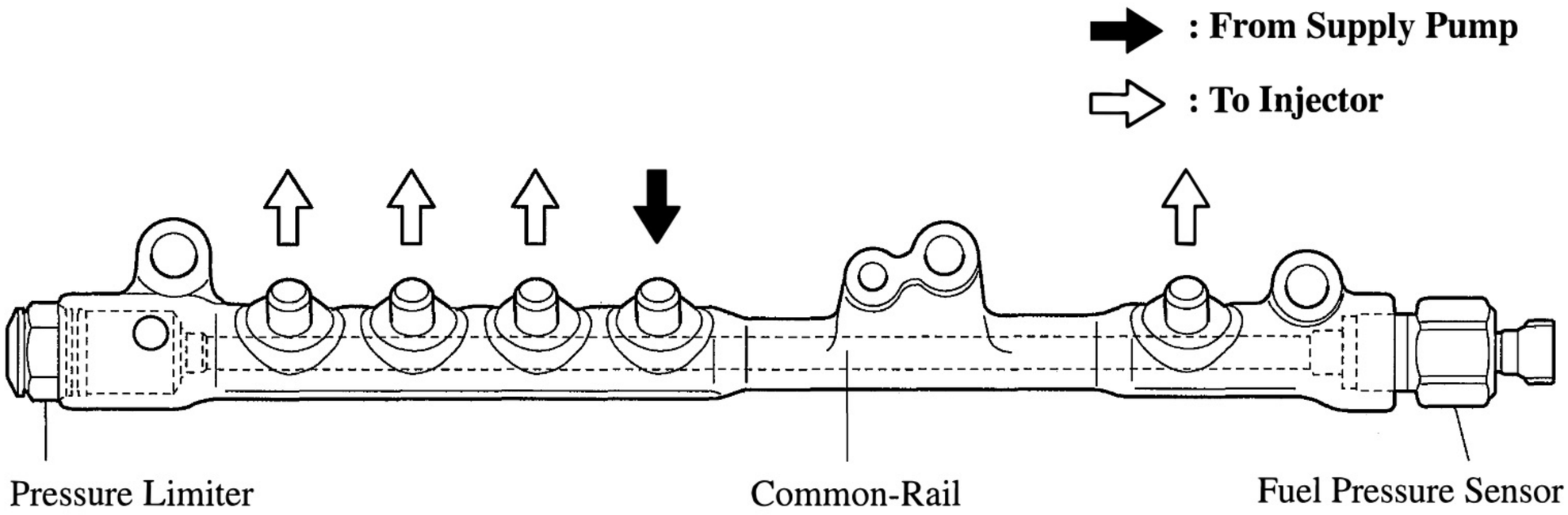
Fig. 1. Starting Suction

Fig. 2. Starting Pumping

168EG21

Common-Rail

- By storing fuel at a high pressure (20 to 135 MPa), the peak torque during the pumping of fuel under high load conditions has been restrained, thus reducing the vibration and noise of the fuel injection system.
- The fuel pressure sensor senses the fuel pressure and outputs the resultant signal to the engine ECU.
- When the pressure in the common-rail is abnormally high, the pressure limiter leaks the fuel to the fuel tank to reduce pressure.



195EG64

Service Tip

- Fuel pressure sensor has its sealing portion (plastic-deformed) in order to keep sealing performance, so do not reuse it after disassembling.
- Do not disassemble the pressure limiter because its operating pressure has been adjusted after assembly.
- If parts that affect the alignment has been changed, make sure to replace the pipe with a new one as well. The parts that require the replacement of a pipe are listed below.

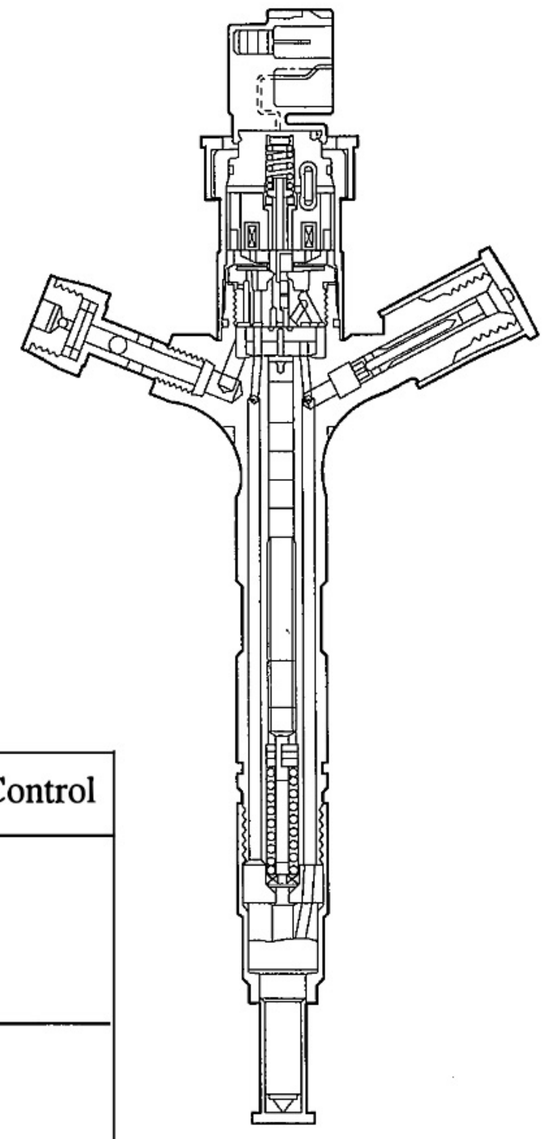
  Injection Pipe: Injector, Common-Rail, Cylinder Head
  Fuel Inlet Pipe: Supply Pump, Common-Rail, Cylinder Block, Gear Case, Cylinder Head, Head Gasket

- Refer to the 1KD-FTV Engine Repair Manual (Pub. No. RM806E)

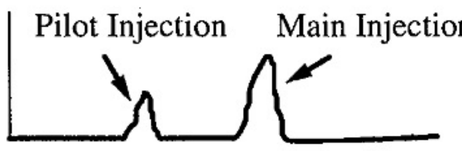
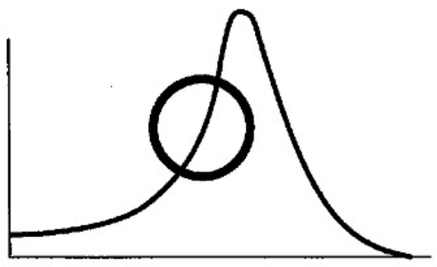
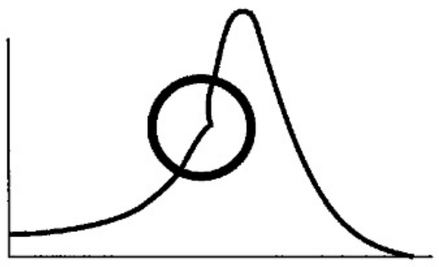
Injector

1) General

- Compact and saving electricity injectors are used.
- The injectors are actuated by the EDU (Electronic Driver Unit).
- Pilot injection control has been adopted in the injection system. By injecting a small amount of fuel in advance as pilot injection, it helps shorten the fuel ignition lag during main injection.
  As a result, the sudden rise in cylinder pressure has been restrained and low noise operation has been realized.



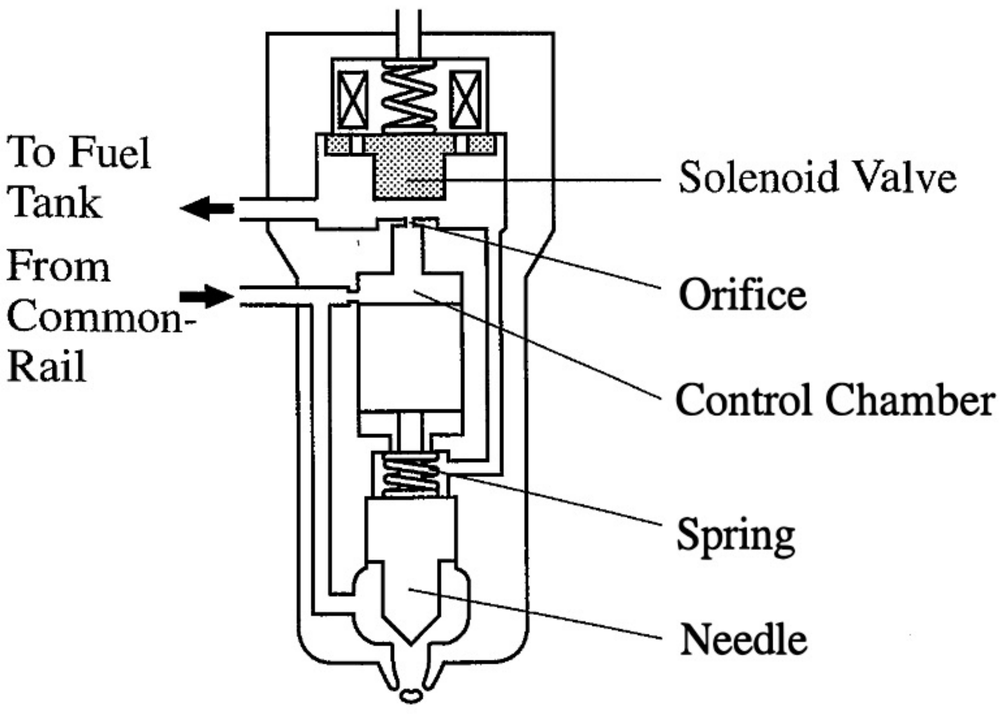
168EG24

	Pilot Injection Control	Conventional Injection Control
Nozzle Lift		
Cylinder Pressure		

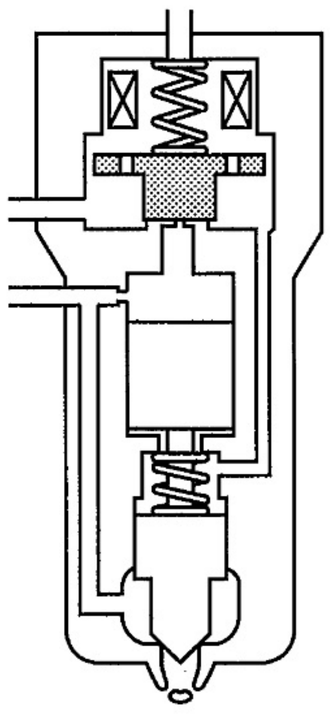
195EG90

2) Operation

As the solenoid valve opens in accordance with the signal from the EDU, the control chamber pressure decreases, causing the needle valve to open and allowing the fuel to be injected.
As the solenoid valve turns OFF and closes orifice in accordance with the signal from the EDU, the control chamber pressure increases, causing the needle valve to close and ending the injection.
The solenoid valve turns ON/OFF in accordance with the signal from the EDU to effect the control of the injection timing, injection volume, and pilot injection.



Injection (Solenoid Valve "ON")

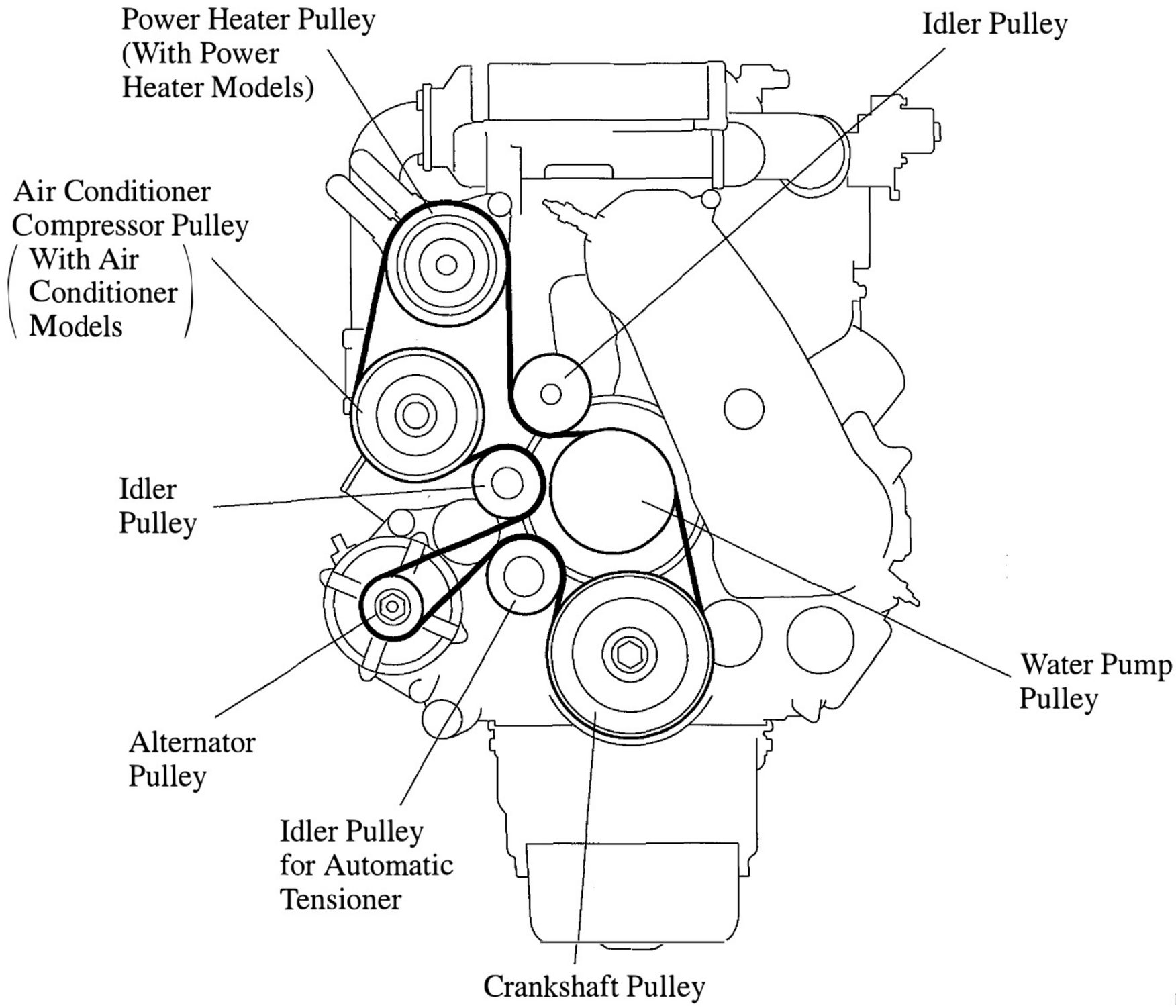


No Injection (Solenoid Valve "OFF")

195EG92

10. Serpentine Belt Drive System

- Accessory components are driven by a serpentine belt consisting of a single V-ribbed belt. It reduces the overall engine length, weight and number of engine parts.
- An automatic tensioner eliminates the need for tension adjustment.



11. Engine Control System

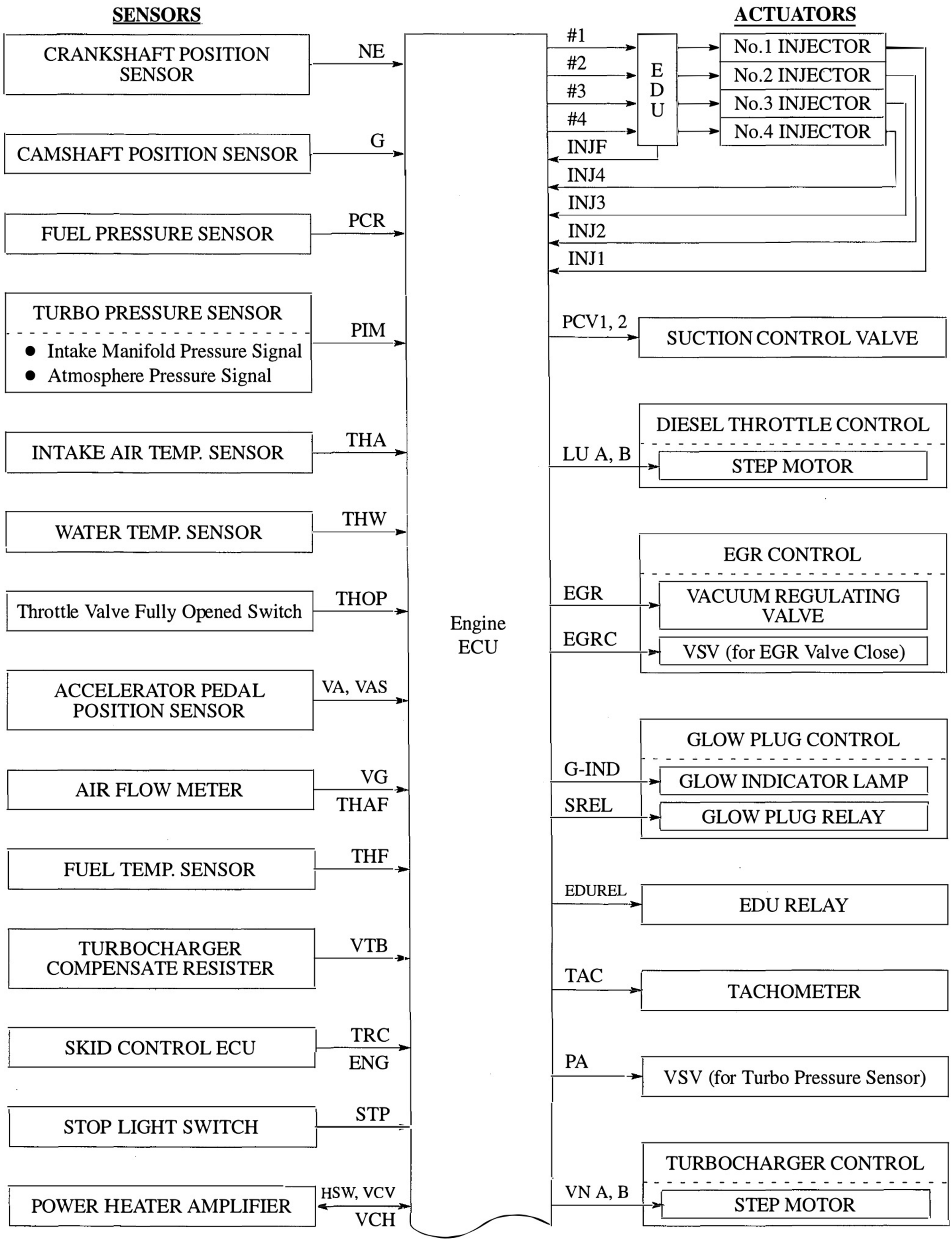
General

The engine control system for the 1KD-FTV engine has following system.

System	Outline
Fuel Injection Volume Control	Based on the signals received from the sensors, the engine ECU determines the fuel injection volume in accordance with the engine condition.
Fuel Injection Timing Control	Based on the signals received from the sensors, the engine ECU determines the fuel injection timing in accordance with the engine condition.
Fuel Pressure Control	Based on the signals received from the sensors, the engine ECU determines the fuel pressure in accordance with the engine condition.
Pilot Injection Control	Controls the fuel injection. For details, refer to page 237 in the fuel section.
Idle Speed Control	The engine ECU determines the idle speed in accordance with the engine condition, and controls the fuel injection volume in order to maintain the target idle speed.
Glow Plug Control	Controls the length of time when the current is applied to the glow plugs, in accordance with the coolant temperature.
Diesel Throttle Control	● Controls the throttle valve opening angle in accordance with the engine condition. ● Fully close the throttle in order to reduce the vibration when the engine is stopped.
Turbocharger Control	Based on the signals received from the sensors, the engine ECU controls the actuator in accordance with the engine condition. For details, refer to page 249.
EGR Control	Controls the EGR volume via EGR valve in accordance with the engine condition.
Air Conditioning Cut-Off Control	By controlling the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Power Heater Control	By controlling the power heater magnetic clutch ON or OFF in accordance with the engine condition. For details, refer to page 227 in the cooling section.
Engine Immobiliser	Prohibits fuel injection 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 the memory.

Construction

The configuration of the engine control system in the 1KD-FTV engine is shown in the following chart.



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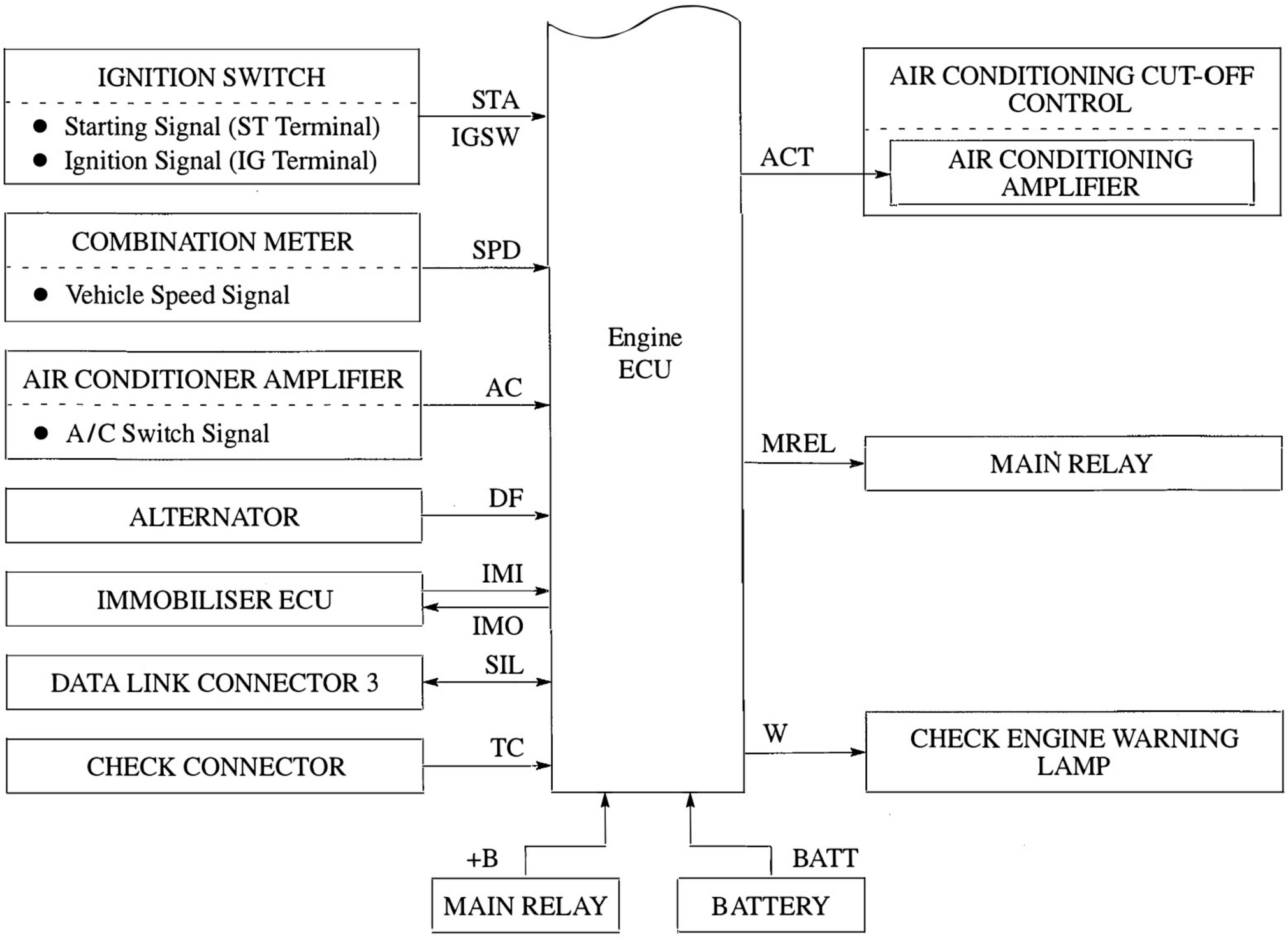
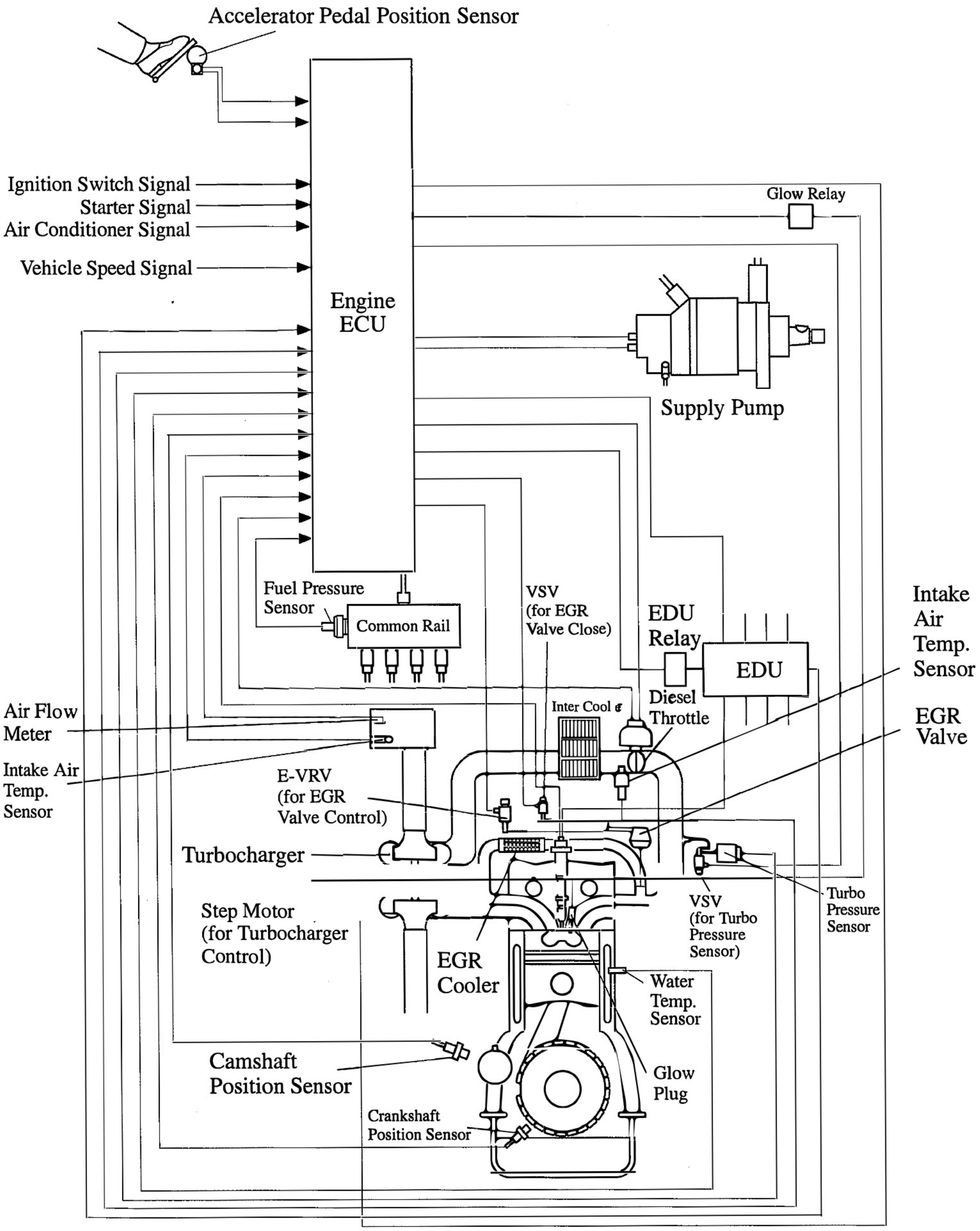
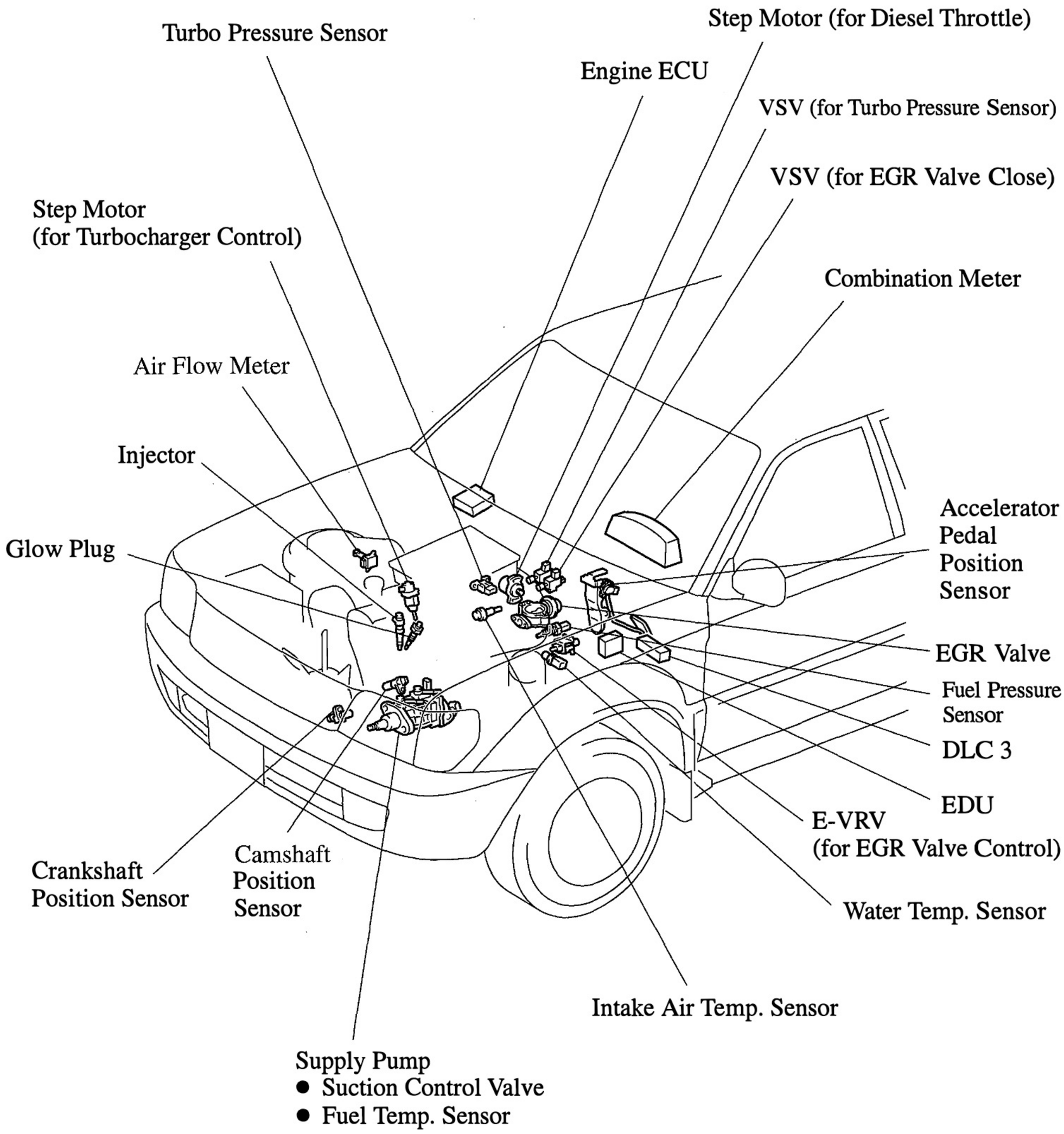

IGNITION SWITCH
● Starting Signal (ST Terminal)
● Ignition Signal (IG Terminal)
STA
IGSW
COMBINATION METER
● Vehicle Speed Signal
SPD
AIR CONDITIONER AMPLIFIER
● A/C Switch Signal
AC
ALTERNATOR
DF
IMMOBILISER ECU
IMI
IMO
DATA LINK CONNECTOR 3
SIL
CHECK CONNECTOR
TC
Engine ECU
AIR CONDITIONING CUT-OFF CONTROL
AIR CONDITIONING AMPLIFIER
ACT
MREL
MAIN RELAY
W
CHECK ENGINE WARNING LAMP
+B
MAIN RELAY
BATT
BATTERY

Engine Control System Diagram



195EG03

Layout of Main Components

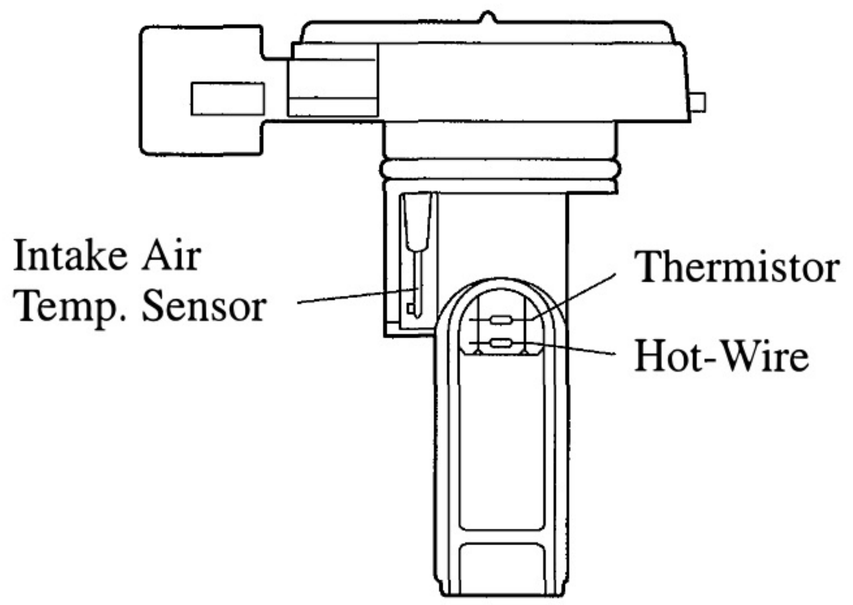


195EG82

Main Components of Engine Control System

1) Air Flow Meter

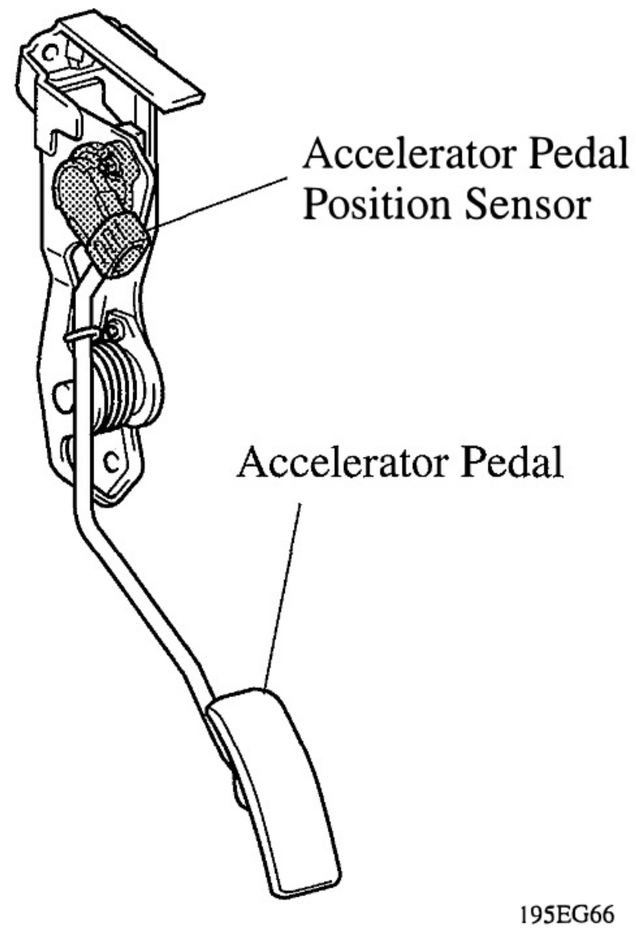
The 1KD-FTV engine adopts the hot-wire type air flow meter designed for direct electrical measurement of the intake air mass flow.



168EG32

2) Accelerator Pedal Position Sensor

The accelerator pedal position sensor uses a resistance circuit that outputs voltage that changes linearly in relation to the amount of pedal effort that is applied to the accelerator pedal.



195EG66

3) EDU (Electronic Driver Unit)

- The EDU has been adopted to drive the injector at high speeds. The EDU has realized high-speed driving under high fuel pressure conditions through the use of a DC/DC converter that provides a high-voltage, quick-charging system.
- The engine ECU constantly monitors the EDU and stops the engine in case an abnormal condition is detected.

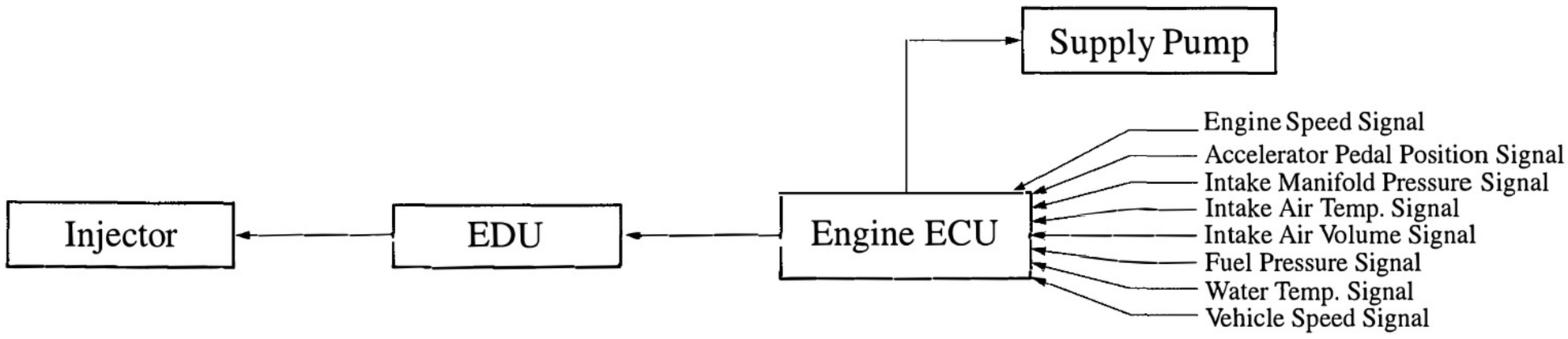
4) Turbo Pressure Sensor

The turbo pressure sensor consists of a semiconductor which utilizes the characteristic of a silicon chip that changes its electrical resistance when pressure is applied to it. The sensor converts the intake air pressure into an electrical signal, and sends it to the engine ECU in an amplified flow.
In addition, the atmospheric pressure can be detected by switching the piping passage through the operation of the VSV.

Fuel Injection Volume Control

1) General

Based on sensor signals, the engine ECU calculates and controls the fuel injection volume that is appropriate for the engine condition.



168EG28

2) Function of Engine ECU

The engine ECU calculates the basic injection volume based on the accelerator pedal position and engine speed, and the maximum injection volume for the engine condition. The two injection volumes are then compared, and the lesser of the two is selected. A correction value, which is obtained via the correction resistors, is added to that injection volume, thus determining the final injection volume.

a. Basic Injection Volume

Determined in accordance with the accelerator pedal position and the engine speed.

b. Maximum Injection Volume

Based on the signals received from the sensors, correction values are added to the theoretically required injection volume (basic maximum injection volume) to determine the maximum injection volume during engine operation.

Basic Maximum Injection Volume

Determined in accordance with the engine speed.

Intake Manifold Pressure Correction

Corrects the basic maximum injection volume in accordance with the intake manifold pressure. The higher the intake manifold pressure becomes, the larger the injection volume becomes.

Intake Air Temperature Correction

Corrects the variance in the air-fuel ratio that is created by the difference in the density of the intake air in accordance with the intake air temperature. The higher the intake air temperature becomes, the smaller the injection volume becomes.

Fuel Pressure Correction

In case that the fuel pressure inside the common-rail than the target value, it reduces the injection volume and revises the follow-up delay.

Water Temperature Correction

The lower the engine coolant temperature, the greater the injection volume becomes in order to ensure drivability immediately following cold-starting.

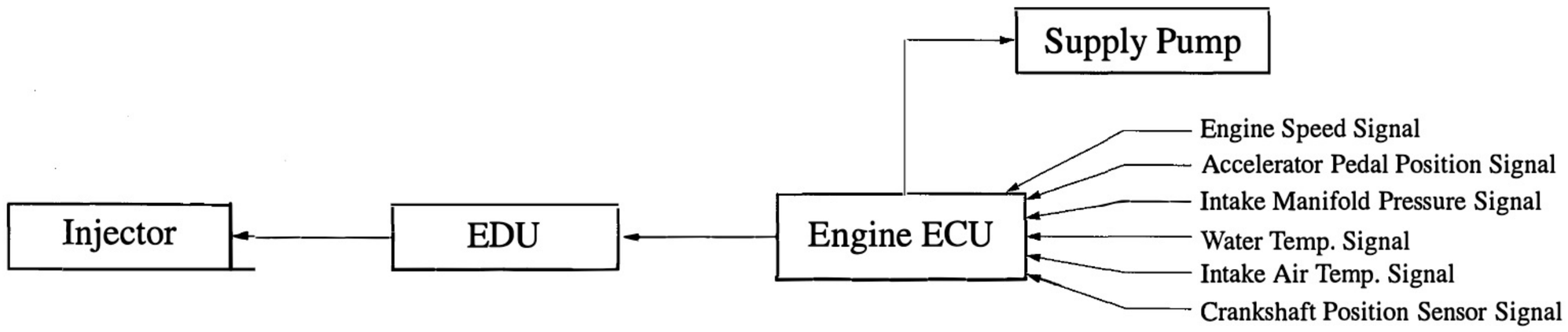
c. Starting Injection Volume Control

Determines the fuel injection volume during starting in accordance with the starting signal and the water temperature signal. When the engine is cold, the lower the coolant temperature becomes, the larger the injection volume becomes.

Fuel Injection Timing Control

1) General

Based on the signals received from the sensors, the engine ECU calculates and controls the fuel injection timing to be optimal for the engine condition.



168EG29

2) Function of Engine ECU

The engine ECU adds the corrections from the sensor signals to the basic fuel injection timing to calculate the fuel injection timing that is optimal for the engine condition.

a. Basic Injection Timing

The basic injection timing is determined in accordance with the accelerator pedal position and the engine speed.

b. Injection Timing Correction

Intake Manifold Pressure Correction

Corrects the basic fuel injection timing in accordance with the intake air pressure. The injection timing is advanced when the intake air pressure is low in such the case as of high altitude areas.

Water Temperature Correction

Corrects the basic fuel injection timing in accordance with the water temperature. The injection timing is advanced when the water temperature is low.

Intake Air Temperature Correction

Corrects the basic fuel injection timing in accordance with the intake air temperature.
The injection timing is advanced when the intake air temperature is low.

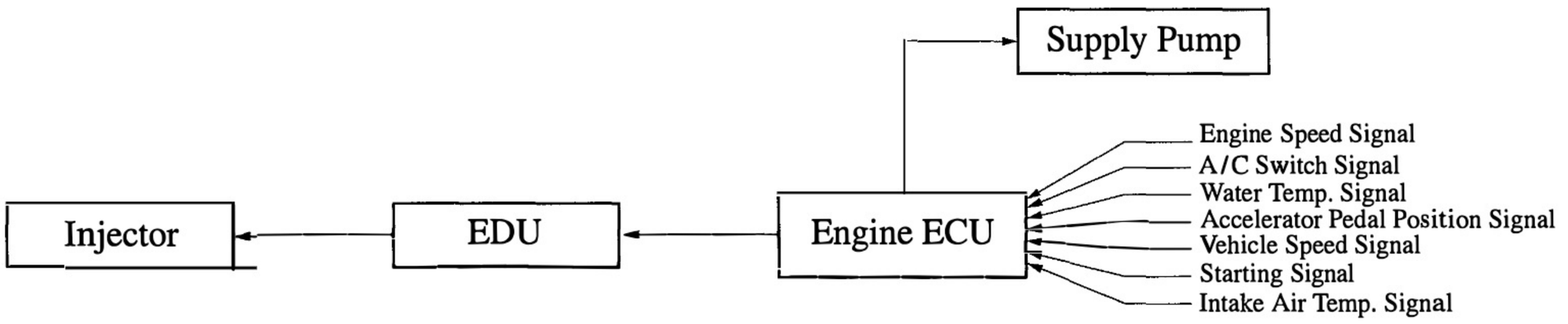
c. Starting Injection Timing Control

The starting injection timing is determined in accordance with the starting signal, water temperature signal, and engine speed. The injection timing is advanced when the engine speed is high.

Idle Speed Control

1) General

- In this system, the engine ECU calculates the target engine speed in accordance with the engine condition, and determines the fuel injection volume, thus controlling the idle speed rpm.
- During cold operation, the idle is increased by turning ON the blower switch and MAX-HOT switch, thus improving the heating performance of the heater.



168EG30

2) Function of Engine ECU

a. Feedback Control

During idling, injection volume is controlled to maintain the target idle speed, if there is a difference between the target idle speed calculated by the engine ECU and the actual idle speed.

b. Warm-Up Control

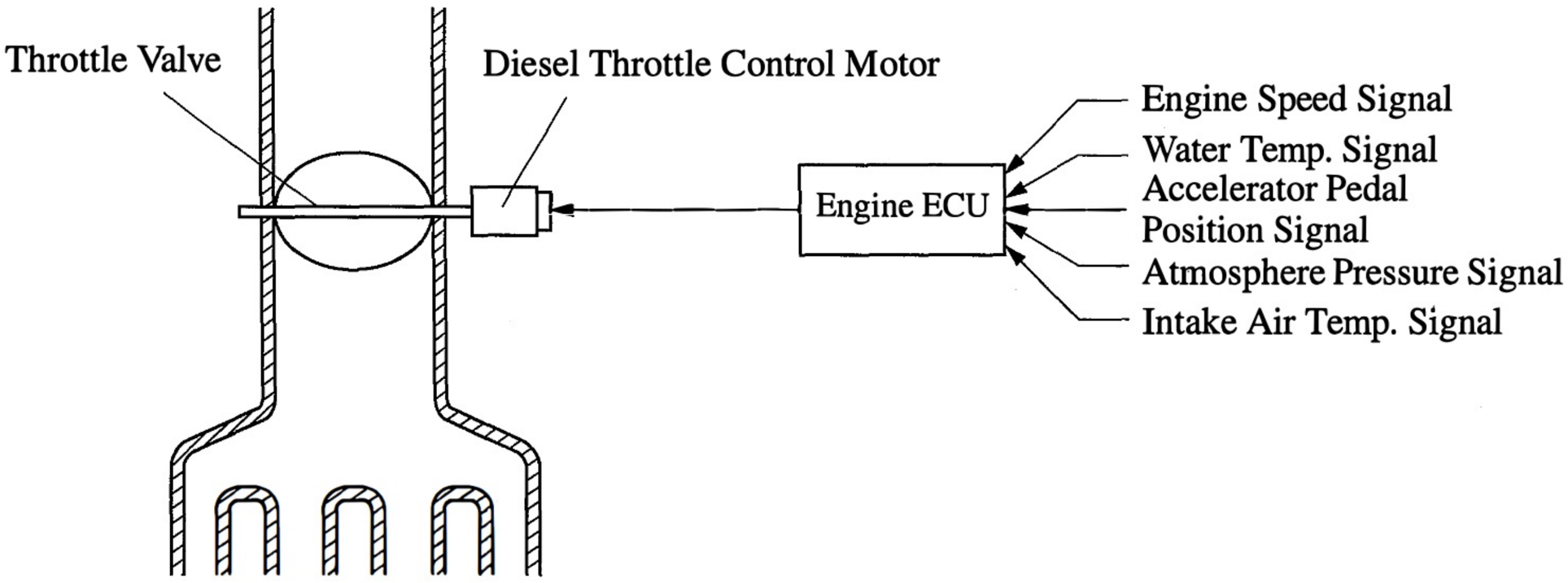
Controls the injection volume during warm-up to achieve an optimal fast idle speed in accordance with water temperature and intake air temp.

c. Engine Speed Change Estimate Control

Immediately after the air conditioning switch is engaged, the idle speed can be affected by the change in the load that is applied to the engine. To prevent this symptom, the control engine speed-change estimate injection volume before the idle speed changes.

Diesel Throttle Control

The opening of the throttle valve that is installed on the intake manifold is controlled by the engine ECU in accordance with the engine condition.
As a result, the noise that is generated during idling and deceleration, as well as the noise and vibration that are generated when the engine is stopped, have been reduced and this control makes it possible to re-circulate the exhaust gas in accordance with the driving condition.



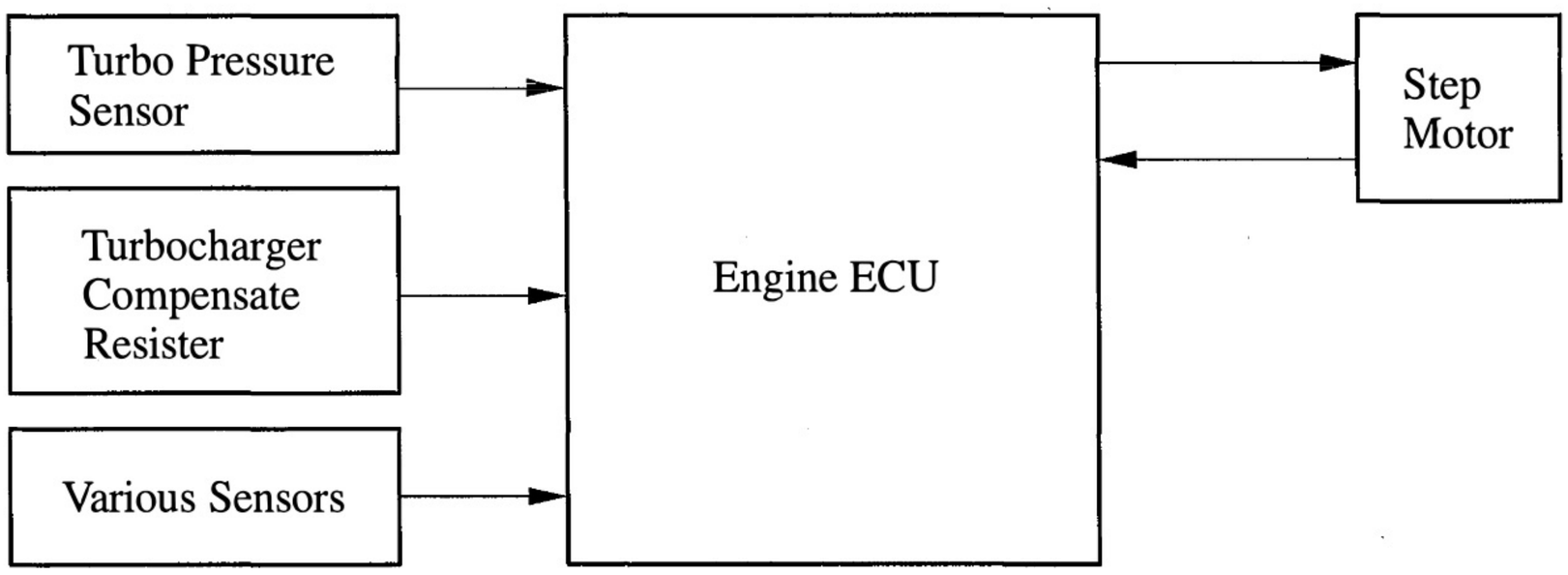
195EG91

Turbocharger Control System

1) General

- A variable nozzle vane type turbocharger system has been newly adopted. In response to the engine condition, by controlling the nozzle vane variably and making the most suitable velocity of the exhaust gas inflow to the turbine at all times, great improvements of low speed torque, maximum output, fuel consumption and noise and emission reductions have been realized.
- A step motor has been adopted to drive the nozzle vanes and it controls the most suitable opening for the vanes by the signal from the engine ECU.
- The engine coolant circuit has been established to cool the step motor.

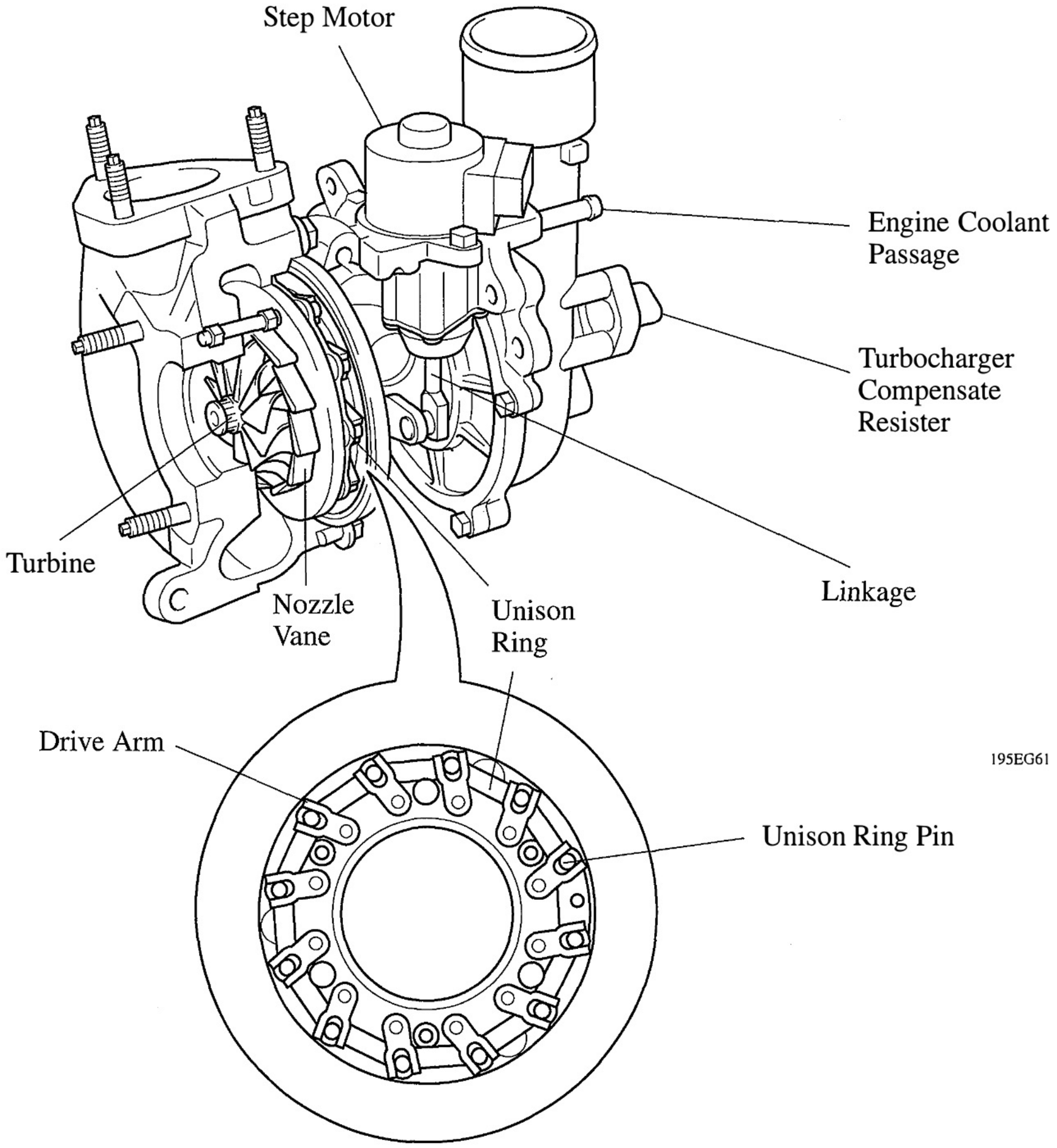
▶ System Diagram ◀



195EG63

2) Constructions

Variable nozzle vane device is established on the turbine (exhaust) side, and consisted of a step motor, linkage, unison ring, unison ring pins, drive arms and nozzle vanes. In order to adjust the unbalance of the exhaust gas flow generated among the solid bodies of each turbocharger, a turbocharger compensate resister is installed on the compressor housing.



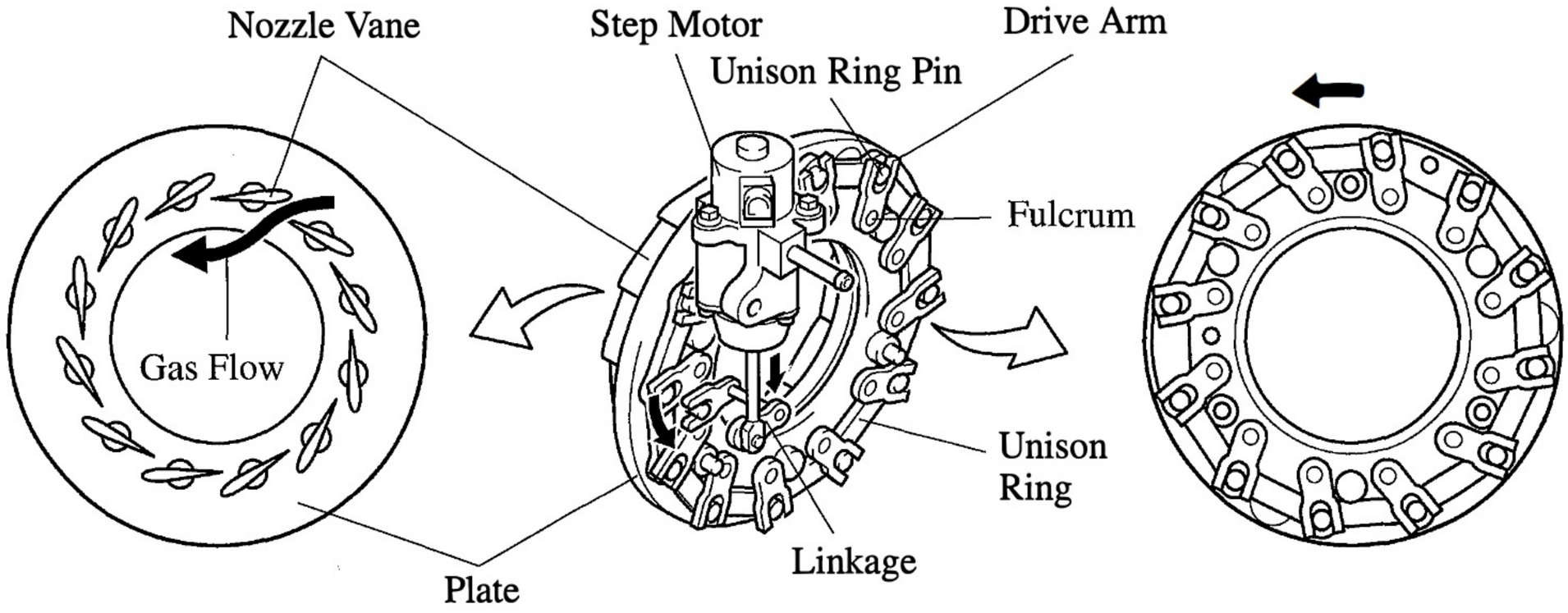
Service Tip

When exchanging the turbocharger compensate resister, select the new part with the same number* of the turbocharger.
*: The numbers are stamped on the side of the turbocharger compensate resister and on the intake side housing of the turbocharger.

3) Operation

a. At Engine Low Speed Range

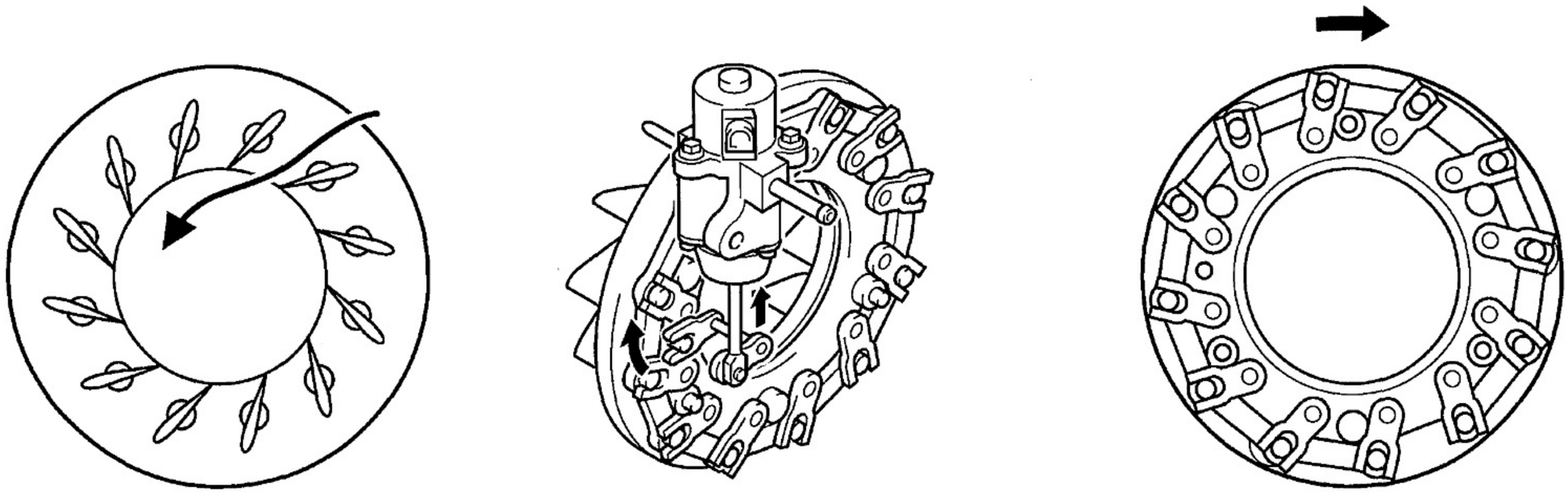
When the engine is running in a low speed range, the step motor press down the linkage by a signal from the engine ECU. The tip of the linkage is connected to the unison ring and turns it counterclockwise. The unison ring has a drive arm through the unison ring pin and this drive arm also moves according to the rotation direction of the unison ring. The fulcrum of the drive arm is an axis which is integrated with a nozzle vane behind the plate. When the drive arm moves counterclockwise, the nozzle vane moves toward closing direction resulting in increasing the velocity of the exhaust gas running to the turbine and speed of the turbine, and then the torque will be improved when the engine is running at a low speed.



195EG62

b. At Engine Medium-to-High Speed Range

When the engine is running in a medium-to-high speed range, the step motor pull up the linkage by a signal from the engine ECU. With this, the drive arm moves clockwise and this opens the nozzle vane and holds the specified supercharging pressure. Thus, lowering the back pressure and improving the out put and fuel consumption.

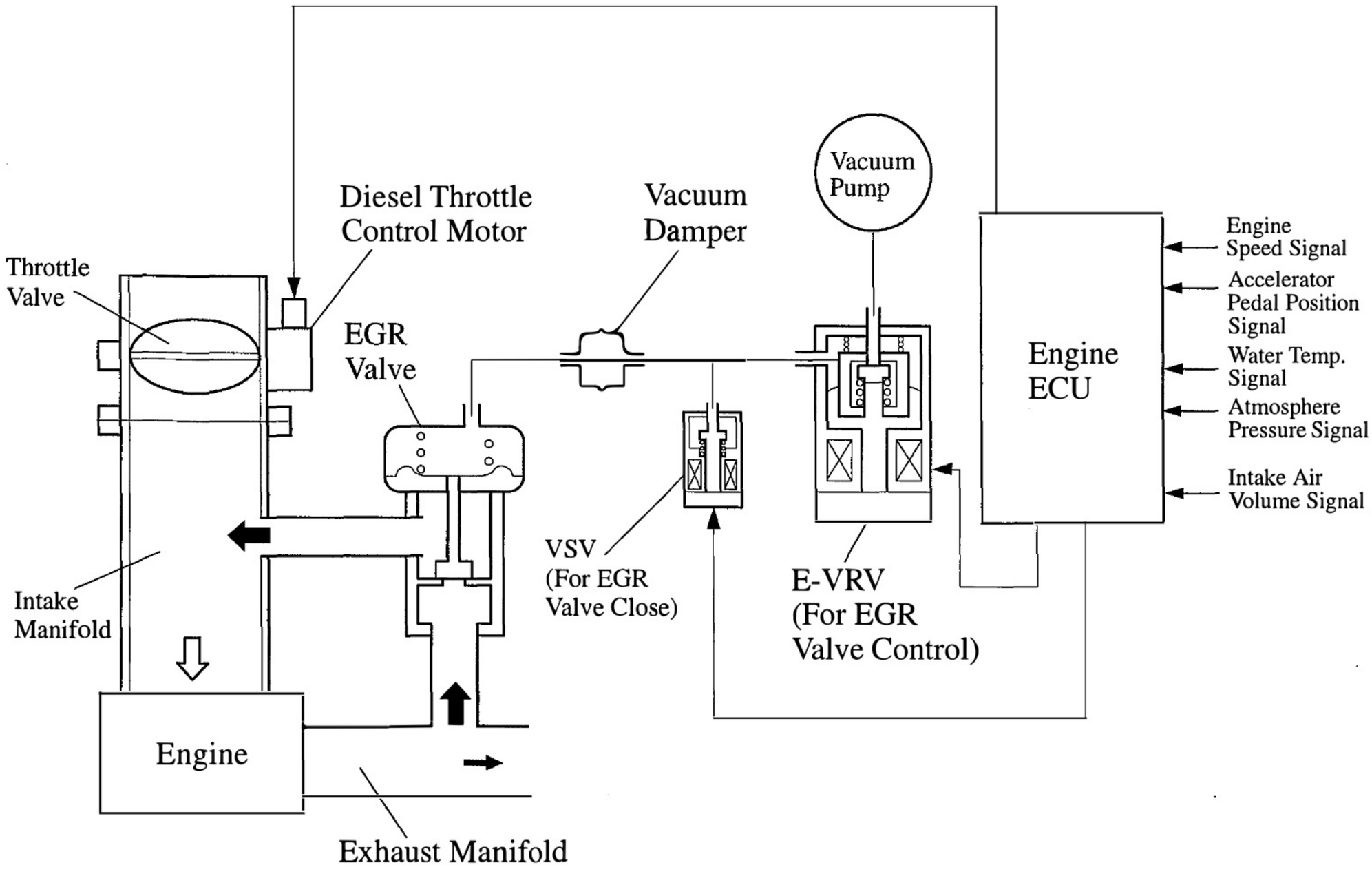


195EG71

EGR Control System

This system is designed to reduce and control NOx formation due to a slight reduction of peak temperature in the engine combustion chamber, which is accomplished by introducing a small amount of inert gas into intake manifold.

By sensing the engine driving conditions, the control unit electrically operates both the E-VRV (for EGR valve control) and VSV (for EGR valve close), which controls the magnitude of vacuum introduced into diaphragm of EGR valve and throttle opening position with stepping motor and the amount of recirculating exhaust gas is regulated. EGR valve opening lift is controlled by modulated negative pressure.



195EG99

Engine Immobiliser System

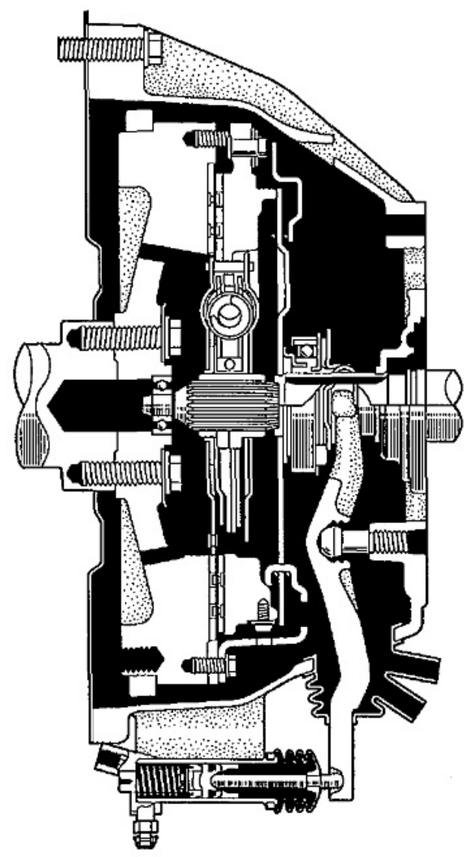
The engine immobiliser system has been designed to prevent the vehicle from being stolen. This system uses a transponder key computer that stores the ID code of the authorized ignition key. If an attempt is made to start the engine using an unauthorized key, the transponder key computer emits a signal to the engine ECU to prohibit both the supply pump and injector operation in order to disable the engine.

Diagnosis

- If the engine ECU detects any problem with a sensor or an electrical circuit, it turns on the check engine warning lamp in the combination meter to inform the driver. In addition, the malfunction code will be stored in memory.
- An M-OBD (Multiplex On-Board Diagnostic) System has been adopted to improve serviceability.

■CLUTCH

On the new Land Cruiser/Land Cruiser Prado, the specifications of the clutch have been changed along with the adoption of the 1KD-FTV engine.



195CH21

▶ Specification ◀

Engine Type			1KD-FTV	1KZ-TE
Clutch	Type		Dry Type Single Plate Clutch Diaghram Spring	←
	Operation		Hydraulic	←
Clutch Cover	Type		DST*1	←
	Size	mm (in.)	260 (10.24)	←
	Installed Load	N	7350	6374
Clutch Disc	Facing Size*2	mm (in.)	260 x 170 x 3.5 (10.24 x 6.69 x 0.14)	←
	Facing Area	cm^2 (in^2)	303 (46.97)	←
Master Cylinder	Type		Conventional	←
	Cylinder Diameter	mm (in.)	15.87 (0.62)	←
Release Cylinder	Type		Non-Adjustable	←
	Cylinder Diameter	mm (in.)	19.05 (0.75)	←

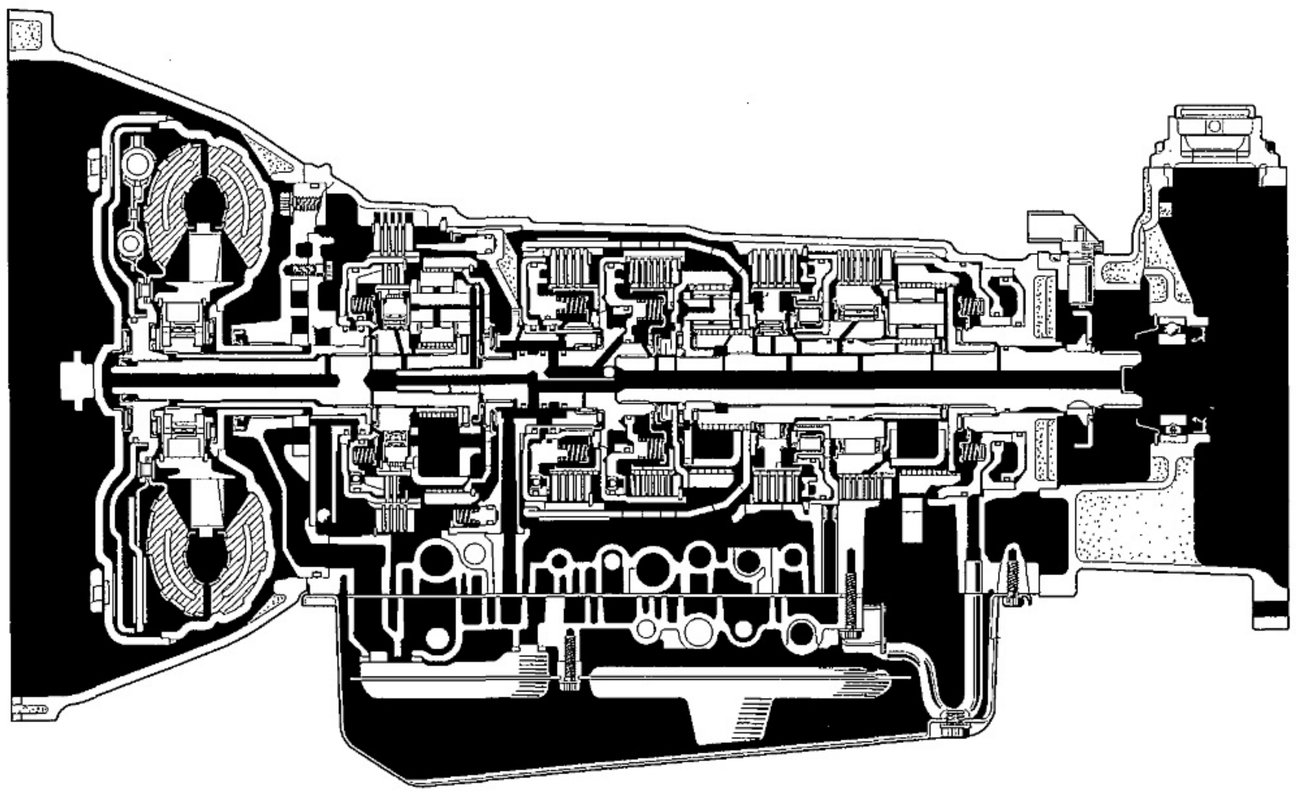
*1: DST (Diaphragm Spring Turnover)

*2: Outer Diameter x Inner Diameter x Thickness

■A343F AUTOMATIC TRANSMISSION

1. General

On the new Land Cruiser/Land Cruiser Prado, the A343F automatic transmission is used for the 1KD-FTV engine model.
Basic structure and the operation are the same as those of the previous model, however, they are made optimum to the feature of 1KD-FTV engine.



195CH20

▶ Specifications ◀

Transmission Type / Item		A343F
Gear Ratio	1st	2.804
	2nd	1.531
	3rd	1.000
	4th (Overdrive)	0.753
	Reverse	2.393
Fluid Capacity	liters (US qts, Imp. qts)	10.1 (10.7, 8.9)
Fluid Type		ATF Type D-II or DEXRON®II, DEXRON®III

2. Torque Converter and Planetary Gear Unit

The torque converter has optimally designed fluid passages and impeller configuration resulting in substantially enhanced torque ratio and transmission efficiency to ensure better starting, acceleration and fuel economy.
The specifications of the torque converter and planetary gear unit have been matched 1KD-FTV engine.

▶ Specifications ◀

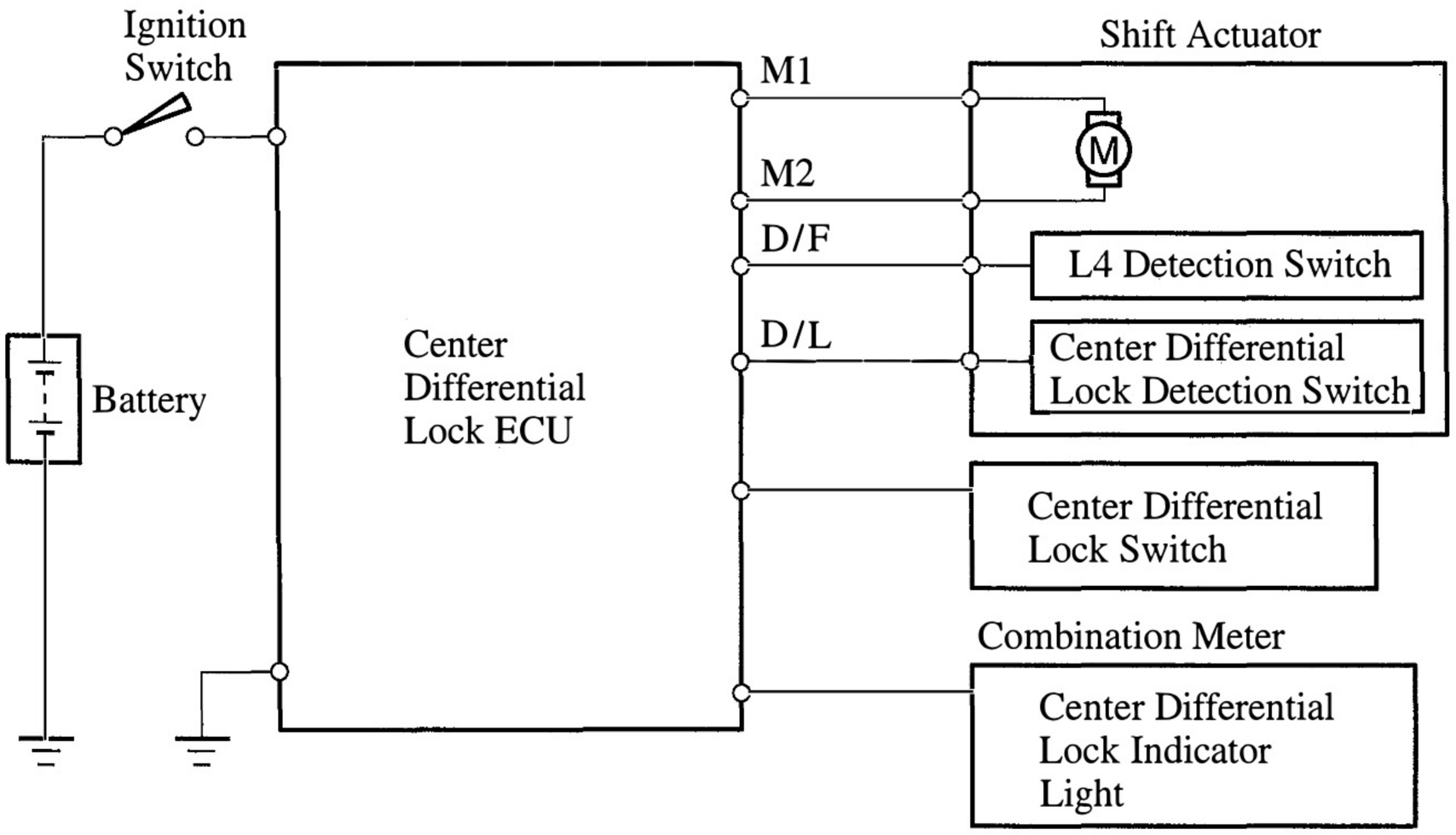
Item \ Engine Type				1KD-FTV
Torque Converter	Converter Type			3–Element, 1-Step, 2-Phase, with Lock-Up Mechanism
	Stall Torque Ratio			1.850
Planetary Gear Unit	C_0	OD Direct Clutch	No. of Discs	2
	C_1	Forward Clutch	No. of Discs	6
	C_2	Direct Clutch	No. of Discs	4
	B_0	OD Brake	No. of Discs	4
	B_1	2nd Coast Brake	Band Width mm (in.)	40 (1.57)
	B_2	2nd Brake	No. of Discs	5
	B_3	1st & Reverse Brake	No. of Discs	7
	F_0	OD One-Way Clutch	No. of Sprags	24
	F_1	No.1 One-Way Clutch	No. of Sprags	22
	F_2	No.2 One-Way Clutch	No. of Sprags	28
	Front Planetary Gear		No. of Sun Gear Teeth	42
			No. of Pinion Gear Teeth	19
			No. of Ring Gear Teeth	79
	Rear Planetary Gear		No. of Sun Gear Teeth	33
			No. of Pinion Gear Teeth	23
			No. of Ring Gear Teeth	79
	OD Planetary Gear		No. of Sun Gear Teeth	31
			No. of Pinion Gear Teeth	33
			No. of Ring Gear Teeth	95

■VF3B TRANSFER

1. General

- On the new Land Cruiser/Land Cruiser Prado, the switching operation of the center differential lock has been changed from the previous shift lever to an actuator type.
- When the center differential is locked, the operation of the VSC (Vehicle Stability Control) and Active-TRC (Traction Control) is stopped.

▶ System Diagram ◀



195CH15

2. Function

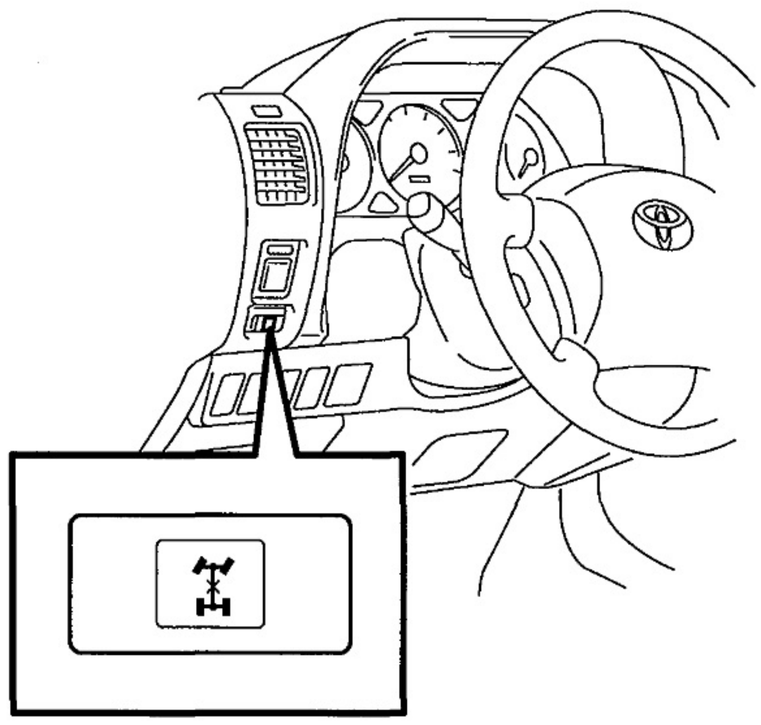
The main components of the center differential lock system provides the following functions:

Item	Function
Center Differential Lock Indicator Light	Illuminates when the center differential is locked.
Shift Actuator	Switches the center differential between the "Lock" and "Free" modes.
L4 Detection Switch	Detects that the transfer unit is in the L4 mode.
Center Differential Lock Detection Switch	Detects that the center differential is locked.
Center Differential ECU	Actuates the shift actuator in accordance with the signals from the center differential lock switch and the skid control ECU.

3. Construction and Operation

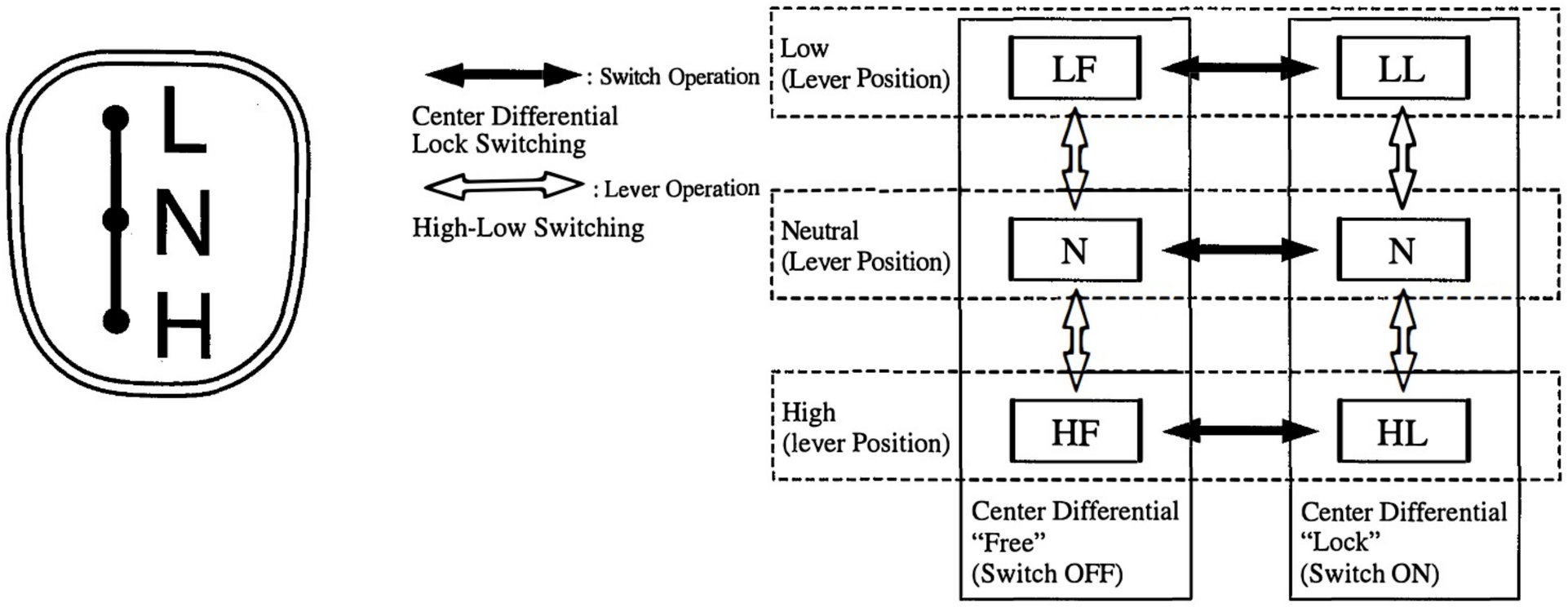
1) Transfer Lever and Center Differential Lock Switch

The transfer gear can be switched between the "Low" and "High" modes by operating the transfer lever switch. The center differential, via the actuator, can be switched between the "Lock" and "Free" modes by operating the center differential lock switch. Through these two functions, a transfer mode can be selected from 4 patterns.



Center Differential Lock Switch

195CH16

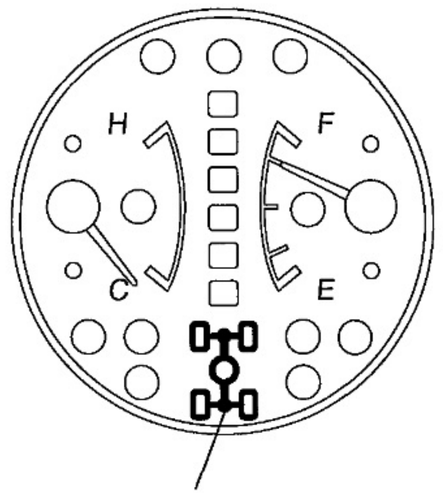


195CH17

HF: High mode & Center differential "Free"
HL: High mode & Center differential "Lock"
N: Neutral mode
LF: Low mode & Center differential "Free"
LL: Low mode & Center differential "Lock"

2) Center Differential Indicator Light

When the center differential is switched from "Free" to "Lock", the center differential indicator light illuminates in the combination meter. If the switching from "Free" to "Lock" is not completed after 3 seconds have elapsed following the operation of the center differential lock switch, or if there is a malfunction in the center differential switching system, the indicator light flashes to warn the driver.

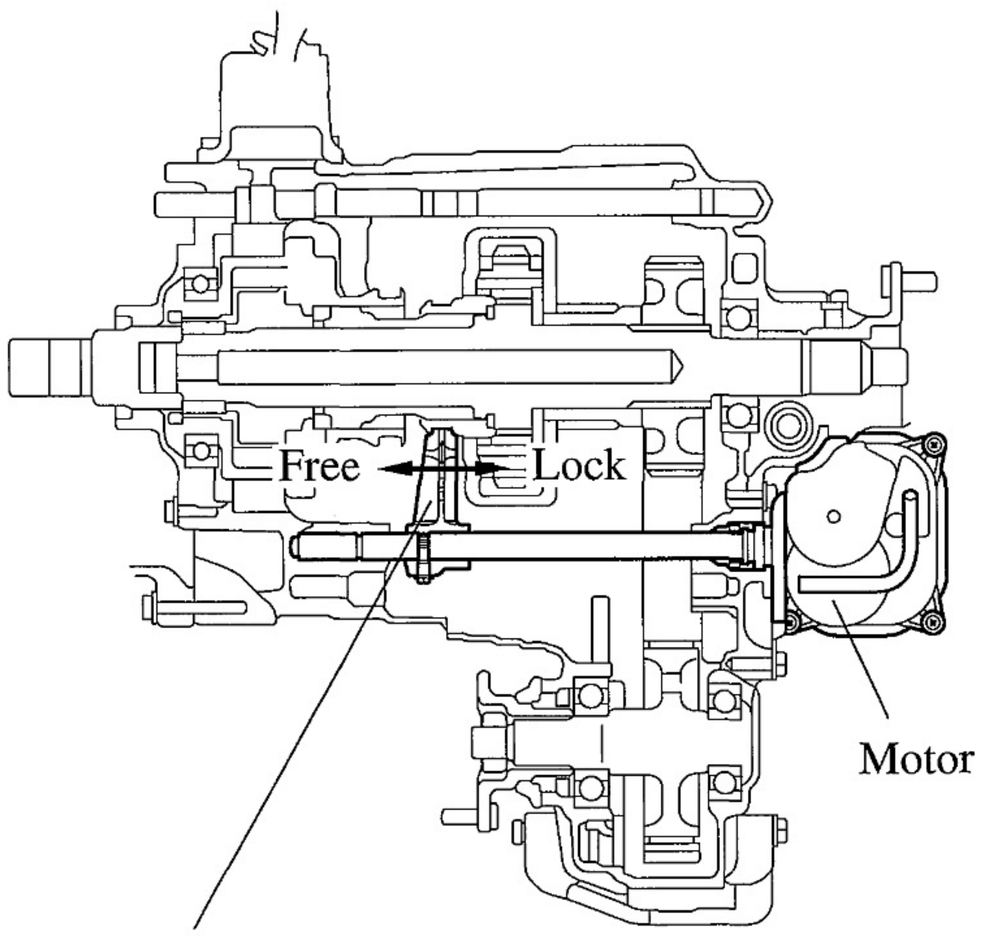


Center Differential Indicator Light

195CH19

3) Shift Actuator

The actuator, which is mounted on the back of the transfer unit, consists of a motor, center differential lock detection switch, gears, and a shift fork shaft. The relay turns ON in accordance with the signals from the center differential ECU, to rotate the motor forward (lock) or in reverse (free) in order to slide the shift fork shaft. Thus, the switching of the center differential between "Free" to "Lock" is accomplished.



195CH18

■AIR CONDITIONER

1. General

- An automatic air conditioner has been provided on the 50th Anniversary model for Europe. A dual type automatic air conditioner has been provided on the 5-door wagon.
- A push button type heater control panel has been adopted on the models with the automatic air conditioner.
- A viscous type power heater that improves heating performance is provided as optional equipment for the cold area specification model with 1KD-FTV engine.
- A lock sensor has been added to the compressor along with the adoption of the serpentine belt drive system on the 1KD-FTV engine model.

▶ Performance ◀

Model			50th Anniversary model for Europe
Heater	Heat Output	W (Kcal/h)	4200 (3610)*1
			4500 (3870)*2
	Air Flow Volume	m^3/h	260*1, 280*2
	Power Consumption	W	160*1, 180*2
Air Conditioner	Heat Output	W (Kcal/h)	5000 (4300)
	Air Flow Volume	m^3/h	410
	Power Consumption	W	180

*1: LHD Model
*2: RHD Model

▶ Specifications ◀

Model				50th Anniversary model for Europe
Ventilation and Heater	Heater Core	Type		Flat Tube Type
		Size W x H x L	mm (in.)	155.7 x 220 x 27 (6.1 x 8.7 x 1.1)
		Fin Pitch	mm (in.)	1.6 (0.06)
	Blower	Motor Type		S70F14T
		Fan Size Dia. x H	mm (in.)	150 x 75 (5.9 x 3.0)
Air Conditioner	Condenser	Type		Multi-Flow Type
		Size W x H x L	mm (in.)	570 x 463 x 16 (22.4 x 18.2 x 0.6)
		Fin Pitch	mm (in.)	3.2 (0.13)
	Evaporator	Type		Drawn Cup Type
		Size W x H x L	mm (in.)	264 x 210 x 90 (10.4 x 8.3 x 3.5)
		Fin Pitch	mm (in.)	3.5 (0.14)
	Compressor	Type		10PA17

4

Rear Air Conditioner (Rear Heater and Rear Cooler)

▶ Performance of Rear Heater and Rear Cooler ◀

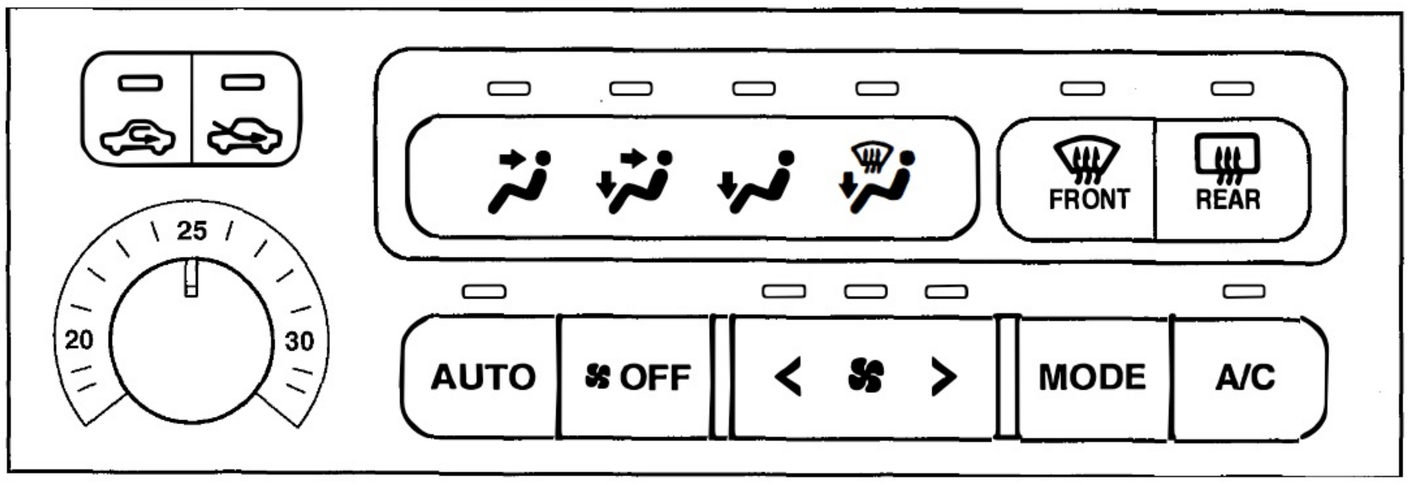
Model			50th Anniversary model for Europe
Rear Heater	Heat Output	W (Kcal/h)	1900 (1630)
	Air Flow Volume	m^3/h	100
	Power Consumption	W	35
Rear Cooler	Heat Output	W (Kcal/h)	2900 (2490)
	Air Flow Volume	m^3/h	235
	Power Consumption	W	100

▶ Specifications of Rear Heater and Rear Cooler ◀

Model				50th Anniversary model for Europe
Rear Heater	Heater Core	Type		Flat Tube Type
		Size W x H x L	mm (in.)	105 x 140 x 27 (4.1 x 5.5 x 1.1)
		Fin Pitch	mm (in.)	1.8 (0.07)
	Blower	Motor Type		60F22T
		Fan Size Dia. x H	mm (in.)	130 x 65 (5.1 x 2.6)
Rear Cooler	Evaporator	Type		Drawn Cup Type
		Size W x H x L	mm (in.)	159 x 170 x 90 (6.3 x 6.7 x 3.5)
		Fin Pitch	mm (in.)	4.0 (0.16)
	Blower	Motor Type		S70F14T
		Fan Size Dia. x H	mm (in.)	130 x 65 (5.1 x 2.6)

2. Heater Control Panel

The push button type heater control panel is adopted for the automatic air conditioner.



195BE09

3. Power Heater

A viscous type power heater is provided as optional equipment for the cold area specification model with 1KD-FTV engine.

The power heater raises the coolant temperature by the shearing heat that is generated by the silicon oil when the silicon oil that is sealed in the heater is stirred by a rotor. Consequently, the temperature of the coolant that flows through the heater core becomes higher than normal, thus improving the output performance of the heater.

For details, see page 227.

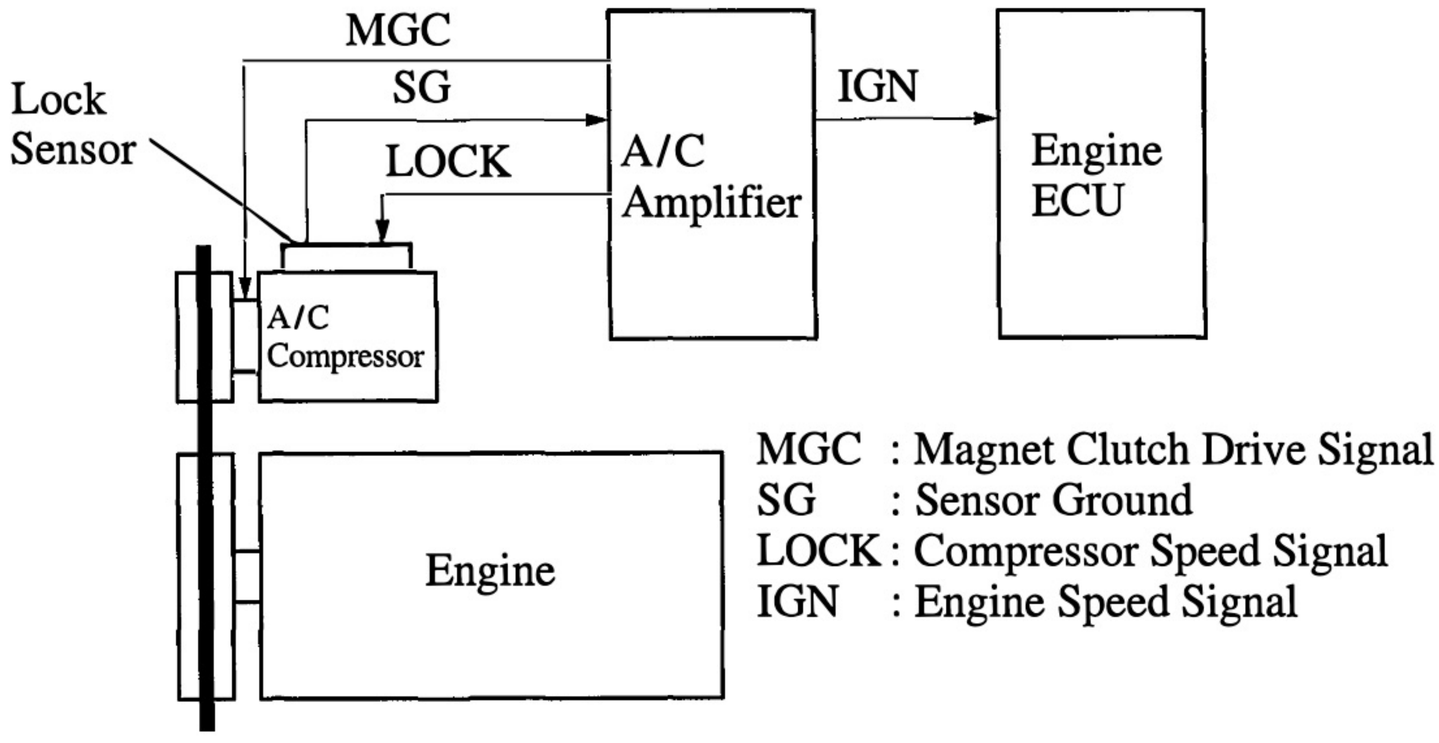
4. A/C Compressor

- A lock sensor has been added to the A/C compressor along with the adoption of the serpentine belt drive system on the 1KD-FTV engine model.
- While the magnetic clutch of the compressor is ON, if the condition described below continues for approximately 3 seconds or longer, the air conditioner amplifier determines that the compressor has locked and turns OFF the magnetic clutch.

Condition:

$$1 - \frac{\text{Compressor rpm / Pulley Ratio (1.29)}}{\text{Engine rpm}} \geqq 0.8$$

▶ System Diagram ◀



195BE10

MAJOR TECHNICAL SPECIFICATIONS

Item \ Area				Europe			
Body Type				3-Door		5-Door	
Vehicle Grade				—			
Model Code				VZJ90L-GJMNKW	VZJ90L-GJPNKW	VZJ95L-GKMNKW	VZJ95R-GKPNKW
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4290 (168.9), 4315 (199.9)*1	←	4730 (186.2), 4755 (187.2)*1	←
		Width	mm (in.)	1730 (68.1), 1820 (71.7)*1	←	←	←
		Height*	mm (in.)	1855 (73.0), 1870 (73.6)*1	←	1860 (73.2), 1875 (73.8)*1	←
	Wheel Base		mm (in.)	2370 (93.3)	←	2675 (105.3)	←
	Tread	Front	mm (in.)	1475 (58.1), 1505 (59.3)*1	←	←	←
		Rear	mm (in.)	1480 (58.3), 1510 (59.4)*1	←	←	←
	Room	Length	mm (in.)	1285 (50.6)	←	1725 (67.9)	←
		Width	mm (in.)	1385 (54.5)	←	1450 (57.1)	←
		Height	mm (in.)	1260 (49.6)	←	←	←
	Cargo Space	Length	mm (in.)	540 (21.3)	←	975 (38.4)	←
		Width	mm (in.)	1405 (55.3)	←	1425 (56.1)	←
		Height	mm (in.)	1110 (43.7)	←	1115 (43.9)	←
	Overhang	Front	mm (in.)	855 (33.7)	←	←	←
		Rear	mm (in.)	1060 (41.7), 1085 (42.7)*1	←	1200 (47.2), 1225 (48.2)*1	←
	Min. Running Ground Clearance		mm (in.)	230 (9.1), 245 (9.6)*1	←	←	←
	Angle of Approach		degrees	36°	←	←	←
	Angle of Departure		degrees	34°	←	30°	←
	Curb Weight	Front	kg (lb)	880 ~ 930 (1940 ~ 2050)	890 ~ 940 (1962 ~ 2072)	920 ~ 1000 (2028 ~ 2205)	930 ~ 1010 (2050 ~ 2227)
		Rear	kg (lb)	830 ~ 880 (1830 ~ 1940)	←	880 ~ 930 (1940 ~ 2050) 920 ~ 970 (2028 ~ 2138)*4	←
		Total	kg (lb)	1710 ~ 1810 (3770 ~ 3990)	1720 ~ 1820 (3792 ~ 4012)	1800 ~ 1930 (3968 ~ 4255) 1840 ~ 1970 (4056 ~ 4343)*4	1810 ~ 1940 (3990 ~ 4277) 1850 ~ 1980 (4079 ~ 4365)*4
	Gross Vehicle Weight	Front	kg (lb)	950 (2094)	965 (2127)	1060 (2337), 1045 (2304)*4	1070 (2359), 1060 (2337)*4
		Rear	kg (lb)	1560 (3439)	1545 (3406)	1650 (3638), 1665 (3671)*4	1640 (3616), 1650 (3638)*4
		Total	kg (lb)	2510 (5534)	←	2710 (5974)	←
	Fuel Tank Capacity		ℓ (Imp.gal)	90 (19.8)	←	←	←
	Luggage Compartment Capacity		m^3 (cu.ft.)	—	—	—	—
Performance	Max. Speed		km/h (mph)	—	—	—	—
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Max. Permissible Speed	1st Gear	km/h (mph)	47 (29)*3	64 (29)*3	47 (29)*3	64 (29)*3
		2nd Gear	km/h (mph)	87 (54)*3	118 (74)*3	87 (54)*3	118 (74)*3
		3rd Gear	km/h (mph)	125 (78)*3	—	125 (78)*3	—
		4th Gear	km/h (mph)	—	—	—	—
	Min. Turning Radius	Tire	m (ft.)	5.1 (16.7)	←	57 (18.7)	←
		Body	m (ft.)	5.5 (18.0)	←	6.1 (20.1)	←
Engine	Engine Type			5VZ-FE	←	←	←
	Valve Mechanism			24 Valves, DOHC	←	←	←
	Bore x Stroke		mm (in.)	93.5 x 82.0 (3.68 x 3.23)	←	←	←
	Displacement		cm^3 (cu.in.)	3378 (206.1)	←	←	←
	Compression Ratio			9.6 : 1	←	←	←
	Carburetor Type or Injection Pump Type (Diesel)			EFI	←	←	←
	Research Octane No. or Cetane No. (Diesel)			95	←	←	←
	Max. Output		kw/rpm	131/4600 (EEC)	←	←	←
	Max. Torque		N·m/rpm	303/3600 (EEC)	←	←	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-48	←	←	←
	Alternator Output		Watts	840	←	←	←
	Starter Output		kW	1.2	1.2, 1.4*2	1.2	1.2, 1.4*2
Chassis	Clutch Type			Dry, Single Plate	—	Dry, Single Plate	—
	Transmission Type			R150F	A343F	R150F	A343F
	Transmission Gear Ratio	In First		3.830	2.804	3.830	2.804
		In Second		2.062	1.531	2.062	1.531
		In Third		1.436	1.000	1.436	1.000
		In Fourth		1.000	0.753	1.000	0.753
		In Fifth		0.838	—	0.838	—
		In Reverse		4.220	2.393	4.220	2.393
	Transfer Gear Ratio H4/L4			1.000/2.566	←	←	←
	Differential Gear Ratio (Front/Rear)			4.100/4.100, 4.300/4.300*1	←	←	←
	Differential Gear Size (Front/Rear)		in.	7.5/8.0	←	←	←
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Ventilated Disc	←	←	←
	Parking Brake Type			Duo-Servo	←	←	←
	Brake Booster Type and Size		in.	Tandem 8.5" + 8.5"	←	←	←
	Proportioning Valve Type			LSP & BV	←	←	←
	Suspension Type	Front		Double Wishbone	←	←	←
		Rear		4-Link with Lateral Rod	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack & Pinion	←	←	←
	Steering Gear Ratio (Overall)			20.0 : 1	←	←	←
	Power Steering Type			Integral Type	←	←	←

*: Unladen Vehicle
*1: With 265/70R16 Tire
*2: Option
*3: Transfer in H range
*4: 8 Seater

	Europe					
	5-Door	3-Door			5-Door	
	—					
	VZJ95L-GKPNKW	KDJ90R-GJMNYW	KDJ90L-GJMNYW	KDJ90L-GJPNYW	KDJ95R-GKMNYW	KDJ95L-GKMNYW
5	←	4290 (168.9), 4315 (199.9)*1	←	←	4730 (186.2), 4755 (187.2)*1	←
	←	←	←	←	←	←
	←	1855 (73.0), 1870 (73.6)*1	←	←	1860 (73.2), 1875 (73.8)*1	←
	←	2370 (93.3)	←	←	2675 (105.3)	←
	←	←	←	←	←	←
10	←	←	←	←	←	←
	←	1285 (50.6)	←	←	1725 (67.9)	←
	←	1385 (54.5)	←	←	1450 (57.1)	←
	←	←	←	←	←	←
	←	540 (21.3)	←	←	975 (38.4)	←
15	←	1405 (55.3)	←	←	1425 (56.1)	←
	←	1110 (43.7)	←	←	1115 (43.9)	←
	←	←	←	←	←	←
	←	1060 (41.7), 1085 (42.7)*1	←	←	1200 (47.2), 1225 (48.2)*1	←
	←	←	←	←	←	←
20	←	←	←	←	←	←
	←	34°	←	←	30°	←
	←	←	←	940 ~ 1020 (2072 ~ 2249)	960 ~ 1070 (2116 ~ 2359)	←
	←	830 ~ 880 (1830 ~ 1940)	←	←	900 ~ 950 (1984 ~ 2094) 940 ~ 990 (2072 ~ 2183)*4	←
	←	1760 ~ 1890 (3880 ~ 4167)	←	1770 ~ 1900 (3902 ~ 4189)	1860 ~ 2020 (4101 ~ 4453) 1900 ~ 2060 (4189 ~ 4541)*4	←
25	←	1045 (2304)	←	1060 (2337)	1050 (2315)	←
	←	1465 (3230)	←	1450 (3197)	1700 (3748)	←
	←	2510 (5534)	←	←	2750 (6063)	←
	←	←	←	←	←	←
	—	—	—	—	—	—
30	—	—	—	—	—	—
	—	—	—	—	—	—
	←	39 (24)*3	←	53 (33)*3	39 (24)*3	←
	←	73 (45)*3	←	98 (61)*3	73 (45)*3	←
	—	104 (65)*3	←	—	104 (65)*3	←
35	—	—	—	—	—	—
	←	5.1 (16.7)	←	←	5.7 (18.7)	←
	←	5.5 (18.0)	←	←	6.1 (20.1)	←
	←	1KD-FTV	←	←	←	←
	←	16-Valve, DOHC	←	←	←	←
40	←	96.0 x 103.0 (3.78 x 4.06)	←	←	←	←
	←	2982 (181.9)	←	←	←	←
	←	18.4 : 1	←	←	←	←
	←	Common-Rail Type	←	←	←	←
	←	48 or more	←	←	←	←
45	←	120/3400 (EEC)	←	←	←	←
	←	343/1600 ~ 3200 (EEC)	←	←	←	←
	←	12-64, 52 x 2*2	12-64, 64 x 2*2	←	12-64, 52 x 2*2	←
	←	←	←	←	←	←
	←	2.2, 2.7*2	←	2.7, 3.0*2	2.2, 2.7*2	2.7, 3.0*2
	←	←	←	←	←	←
	←	2.2, 2.7*2	←	2.7, 3.0*2	2.2, 2.7*2	2.7, 3.0*2
50	—	Dry, Single Plate	←	—	Dry, Single Plate	←
	←	R150F	←	A343F	R150F	←
	←	3.830	←	2.804	3.830	←
	←	2.062	←	1.531	2.062	←
	←	1.436	←	1.000	1.436	←
55	←	1.000	←	0.753	1.000	←
	—	0.838	←	—	0.838	←
	←	4.220	←	2.393	4.220	←
	←	←	←	←	←	←
	←	3.909/3.909, 4.100/4.100*1	←	←	←	←
60	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	Tandem 7.5" + 7.5"	←	Tandem 7.5" + 7.5", Hydraulic*2	Tandem 7.5" + 7.5"	←
65	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←
70	←	←	←	←	←	←
	←	←	←	←	←	←
	←	←	←	←	←	←

4

Item / Area				Europe		Australia	
Body Type				5-Door			
Vehicle Grade				—		GX	
Model Code				KDJ95R-GKPNYW	KDJ95L-GKPNYW	RZJ95R-GKMNKQ	RZJ95R-GKPNKQ
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4730 (186.2), 4755 (187.2)*1	←	←	←
		Width	mm (in.)	1730 (68.1), 1820 (71.7)*1	←	←	←
		Height*	mm (in.)	1860 (73.2), 1875 (73.8)*1	←	1865 (68.1), 1880 (74.0)*1	←
	Wheel Base		mm (in.)	2675 (105.3)	←	←	←
	Tread	Front	mm (in.)	1475 (58.1), 1505 (59.3)*1	←	←	←
		Rear	mm (in.)	1480 (58.3), 1510 (59.4)*1	←	←	←
	Room	Length	mm (in.)	1725 (67.9)	←	1700 (66.9)	←
		Width	mm (in.)	1450 (57.1)	←	←	←
		Height	mm (in.)	1260 (49.6)	←	←	←
	Cargo Space	Length	mm (in.)	975 (38.4)	←	270 (10.6)	←
		Width	mm (in.)	1425 (56.1)	←	1250 (49.2)	←
		Height	mm (in.)	1115 (43.9)	←	1020 (40.2)	←
	Overhang	Front	mm (in.)	855 (33.7)	←	←	←
		Rear	mm (in.)	1200 (47.2), 1225 (48.2)*1	←	←	←
	Min. Running Ground Clearance		mm (in.)	230 (9.1), 245 (9.6)*1	←	←	←
	Angle of Approach		degrees	36°	←	←	←
	Angle of Departure		degrees	30°	←	←	←
	Curb Weight	Front	kg (lb)	970 ~ 1080 (2138 ~ 2381)	←	880 ~ 940 (1940 ~ 2072), 880 ~ 960 (1940 ~ 2116)*4	890 ~ 950 (1962 ~ 2094), 890 ~ 970 (1962 ~ 2138)*4
		Rear	kg (lb)	←	←	870 ~ 930 (1918 ~ 2050), 910 ~ 980 (2006 ~ 2161)*4	←
		Total	kg (lb)	1870 ~ 2030 (4123 ~ 4475), 1910 ~ 2070 (4211 ~ 4564)*4	←	1750 ~ 1870 (3858 ~ 4123), 1790 ~ 1940 (3946 ~ 4277)*4	1760 ~ 1880 (3880 ~ 4145), 1800 ~ 1950 (3968 ~ 4299)*4
	Gross Vehicle Weight	Front	kg (lb)	1145 (2524), 1050 (2315)*4	←	1070 (2359), 1055 (2326)*4	1085 (2392), 1065 (2348)*4
		Rear	kg (lb)	1605 (3538), 1700 (3748)*4	←	1640 (3616), 1655 (3649)*4	1625 (3582), 1645 (3627)*4
		Total	kg (lb)	←	←	2710 (5974)	←
	Fuel Tank Capacity		ℓ (Imp.gal)	90 (19.8)	←	90 (19.8), 90 + 70 (19.8 + 15.4)*3	←
	Luggage Compartment Capacity		m³ (cu.ft.)	—	—	—	—
Performance	Max. Speed		km/h (mph)	—	—	—	—
	Max. Cruising Speed		km/h (mph)	—	—	—	—
	Max. Permissible Speed	1st Gear	km/h (mph)	53 (33)*3	←	43 (27)	61 (38)
		2nd Gear	km/h (mph)	98 (61)*3	←	79 (49)	111 (69)
		3rd Gear	km/h (mph)	—	—	123 (77)	—
		4th Gear	km/h (mph)	—	—	—	—
	Min. Turning Radius	Tire	m (ft.)	5.7 (18.7)	←	←	←
		Body	m (ft.)	6.1 (20.1)	←	←	←
Engine	Engine Type			1KD-FTV	←	3RZ-FE	←
	Valve Mechanism			16-Valve, DOHC	←	16-Valves, DOHC	←
	Bore x Stroke		mm (in.)	96.0 x 103.0 (3.78 x 4.06)	←	95.0 x 95.0 (3.74 x 3.74)	←
	Displacement		cm³ (cu.in.)	2982 (181.9)	←	2694 (164.4)	←
	Compression Ratio			18.4 :1	←	9.5 : 1	←
	Carburetor Type or Injection Pump Type (Diesel)			Common-Rail Type	←	EFI	←
	Research Octane No. or Cetane No. (Diesel)			48 or more	←	91	←
	Max. Output		kw/rpm	120/3400 (EEC)	←	112/4800 (EEC)	←
	Max. Torque		N·m/rpm	343/1600 ~ 3200 (EEC)	←	240/4000 (EEC)	←
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.	12-64, 64 x 2*2	←	12-48	←
	Alternator Output		Watts	840	←	←	960
	Starter Output		kW	2.7, 3.0*2	←	1.2	←
Chassis	Clutch Type			—	—	Dry, Single Plate	—
	Transmission Type			A343F	←	W56	A343F
	Transmission Gear Ratio	In First		2.804	←	3.954	2.804
		In Second		1.531	←	2.141	1.531
		In Third		1.000	←	1.384	1.000
		In Fourth		0.753	←	1.000	0.753
		In Fifth		—	—	0.850	—
		In Reverse		2.393	←	4.091	2.393
	Transfer Gear Ratio H4/L4			1.000/2.566	←	←	←
	Differential Gear Ratio (Front/Rear)			3.909/3.909, 4.100/4.100*1	←	4.300/4.300, 4.556/4.556*1	←
	Differential Gear Size (Front/Rear)		in.	7.5/8.0	←	←	←
	Brake Type	Front		Ventilated Disc	←	←	←
		Rear		Venti lated Disc	←	L.T. Drum, Ventilated Disc*2, 3, 4	←
	Parking Brake Type			Duo-Servo	←	L.T. Drum, Duo-Servo*5	←
	Brake Booster Type and Size		in.	Tandem 7.5" + 7.5", Hydraulic*2	←	Tandem 8.5" + 8.5"	←
	Proportioning Valve Type			LSP & BV	←	←	←
	Suspension Type	Front		Double Wishbone	←	←	←
		Rear		4-Link with Lateral Rod	←	←	←
	Stabilizer Bar	Front		STD	←	←	←
		Rear		STD	←	←	←
	Steering Gear Type			Rack & Pinion	←	←	←
	Steering Gear Ratio (Overall)			20.0 : 1	←	←	←
	Power Steering Type			Integral Type	←	←	←

*: Unladen Vehicle
*1: With 265/70R16 Tire
*2: Option
*3: Transfer in H range
*4: 8 Seater

	Australia				
	5-Door				
	GX		VX	GX	
	VZJ95R-GKMNKQ	VZJ95R-GKPNKQ	VZJ95R-GKPEKQ	KZJ95R-GKMNTQ	KZJ95R-GKPNTQ
5	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
10	←	←	←	←	←
	1725 (67.9)	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	975 (38.4)	←	←	←	←
15	1425 (56.1)	←	←	←	←
	1115 (43.9)	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
20	←	←	←	←	←
	←	←	←	←	←
	910 ~ 970 (2006 ~ 2138), 910 ~ 990 (2006 ~ 2183)*4	920 ~ 990 (2028 ~ 2183), 920 ~ 1010 (2028 ~ 2227)*4	920 ~ 990 (2028 ~ 2183), 920 ~ 1020 (2028 ~ 2249)*4	950 ~ 1010 (2094 ~ 2227), 950 ~ 1030 (2094 ~ 2271)*4	960 ~ 1030 (2116 ~ 2271), 960 ~ 1050 (2116 ~ 2315)*4
	←	←	880 ~ 940 (1940 ~ 2072), 920 ~ 990 (2028 ~ 2183)*4	←	←
	1780 ~ 1900 (3924 ~ 4189), 1820 ~ 1970 (4012 ~ 4343)*4	1790 ~ 1920 (3946 ~ 4233), 1830 ~ 1990 (4034 ~ 4387)*4	1800 ~ 1930 (3968 ~ 4255), 1840 ~ 2010 (4056 ~ 4431)*4	1830 ~ 1950 (4034 ~ 4299), 1870 ~ 2020 (4123 ~ 4453)*4	1840 ~ 1970 (4056 ~ 4343), 1880 ~ 2040 (4145 ~ 4497)*4
25	1095 (2414), 1075 (2370)*4	1120 (2469), 1100 (2425)*4	1120 (2469), 1115 (2458)*4	1145 (2524), 1130 (2491)*4	1165 (2568), 1155 (2546)*4
	1675 (3693), 1695 (3737)*4	1650 (3638), 1670 (3682)*4	1650 (3638), 1655 (3649)*4	1625 (3582), 1640 (3616)*4	1605 (3538), 1615 (3560)*4
	2770 (6107)	←	←	←	←
	←	←	←		←
	—	—	—	—	—
30	—	—	—	—	—
	—	—	—	—	—
	47 (29)*3	64 (40)*3	←	35 (22)*3	53 (33)*3
	87 (54)*3	118 (74)*3	←	67 (41)*3	98 (61)*3
	125 (78)*3	—	—	104 (64)*3	←
35	—	—	—	—	←
	←	←	←	←	←
	←	←	←	←	←
	5VZ-FE	←	←	1KZ-TE	←
	24 Valves, DOHC	←	←	8 Valves, OHC	←
40	93.5 x 82.0 (3.68 x 3.23)	←	←	96.0 x 103.0 (3.78 x 4.06)	←
	3378 (206.1)	←	←	2982 (181.9)	←
	9.6 : 1	←	←	21.2 : 1	←
	EFI	←	←	Distributor Type	←
	91	←	←	50 or more	←
45	132 / 4800 (SAE-NET)	←	←	96 / 3600 (SAE-NET)	←
	290 / 3600 (SAE-NET)	←	←	343 / 2000 (SAE-NET)	←
	←	←	←	—	—
	←	←	←	—	—
	←	←	←	—	—
50	Dry, Single Plate	—	—	Dry, Single Plate	—
	R150F	A343F	A343F	R151F	A343F
	3.830	2.804	←	4.313	2.804
	2.062	1.531	←	2.330	1.531
	1.436	1.000	←	1.436	1.000
55	1.000	0.753	←	1.000	0.753
	0.838	—	—	0.838	—
	4.220	2.393	←	4.220	2.393
	←	←	←	1.000 / 2.566	←
	4.100 / 4.100, 4.300 / 4.300*1	←	←	3.909 / 3.909, 4.100 / 4.100*1	←
60	←	←	←	←	←
	←	←	←	←	←
	Ventilated Disc	←	←	←	←
	Duo-Servo	←	←	←	←
	←	Tandem 8.5" + 8.5", Hydraulic*2	←	Tandem 7.5" + 7.5"	Tandem 7.5" + 7.5", Hydraulic*2
65	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←
70	←	←	←	←	←
	←	←	←	←	←
	←	←	←	←	←

4