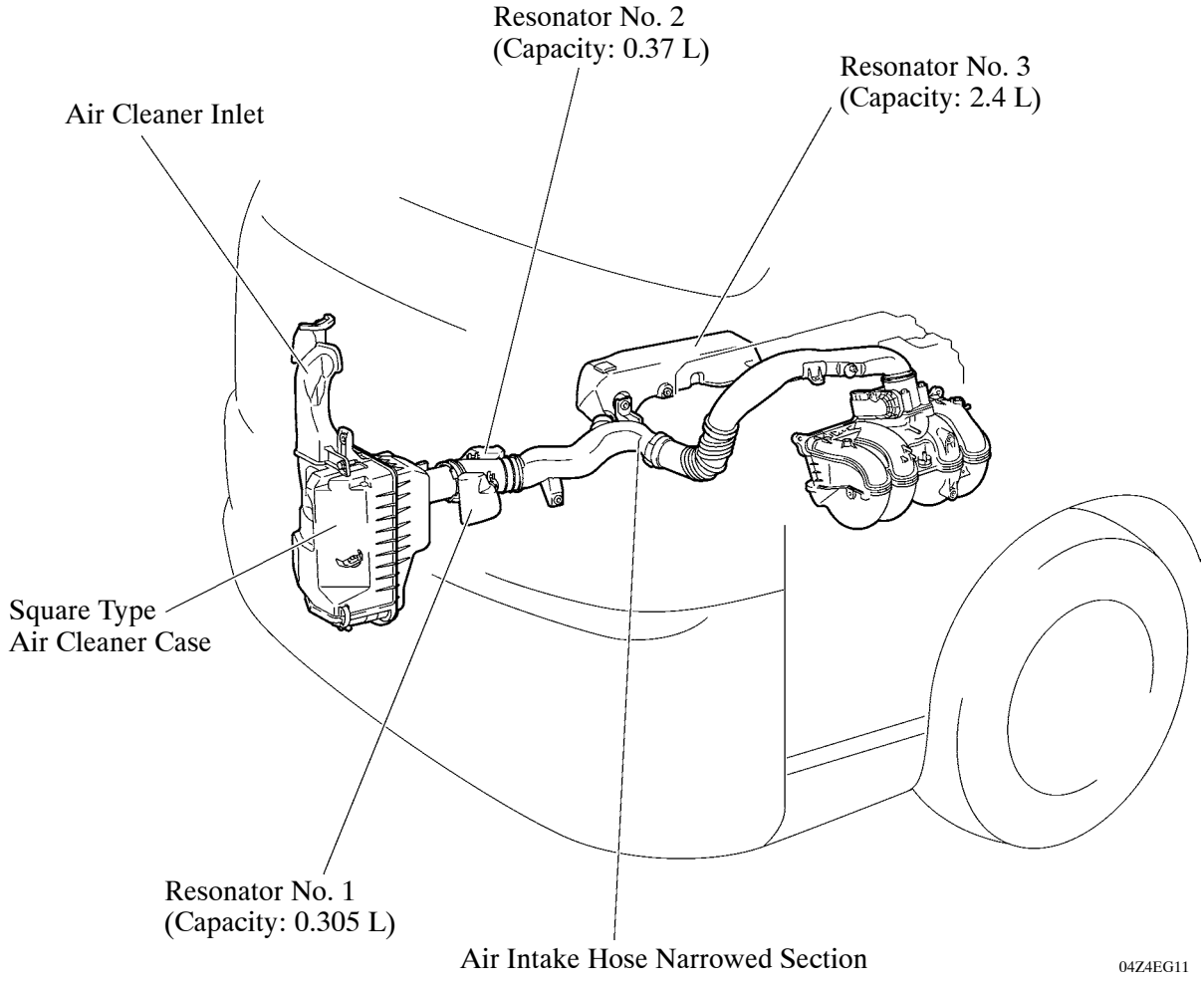
■ ENGINE

1. 2TR-FE Engine

Intake and Exhaust System (excluding Thailand, Peru and China models)

1) General

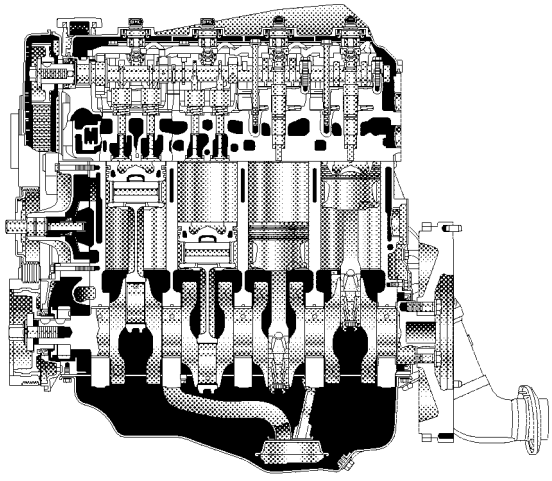
- A lightweight, square type air cleaner case has been adopted. In addition, the installation method for the air cleaner inlet has been changed.
- A narrowed section has been provided on the air intake hose and the capacity and layout of the resonator have been optimized to reduce the air intake noise.



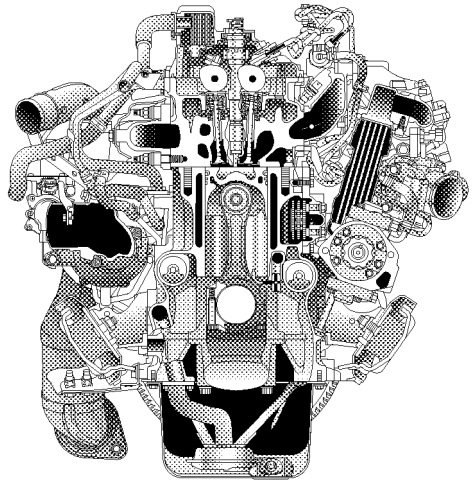
2. 1KD-FTV Engine (Euro IV C/D mode)

General

- A new specification 1KD-FTV engine that complies with the EURO IV C/D mode (Chassis Dynamo mode) regulations has been adopted for the models for Australia, New Zealand, Hong Kong, Singapore, and Chile.
- The EURO IV C/D mode specification 1KD-FTV engine is an engine that is based on the conventional EURO IV specification 1KD-FTV engine, but which has undergone a variety of modifications. This has led to a substantial improvement in power output, and allows it to conform to the EURO IV C/D mode regulations without using complex and expensive systems such as DPF, as well as realizing higher performance and cleaner emissions.
- For details of the changes from the conventional EURO IV specification 1KD-FTV engine, see the Major Differences section (see page 22).



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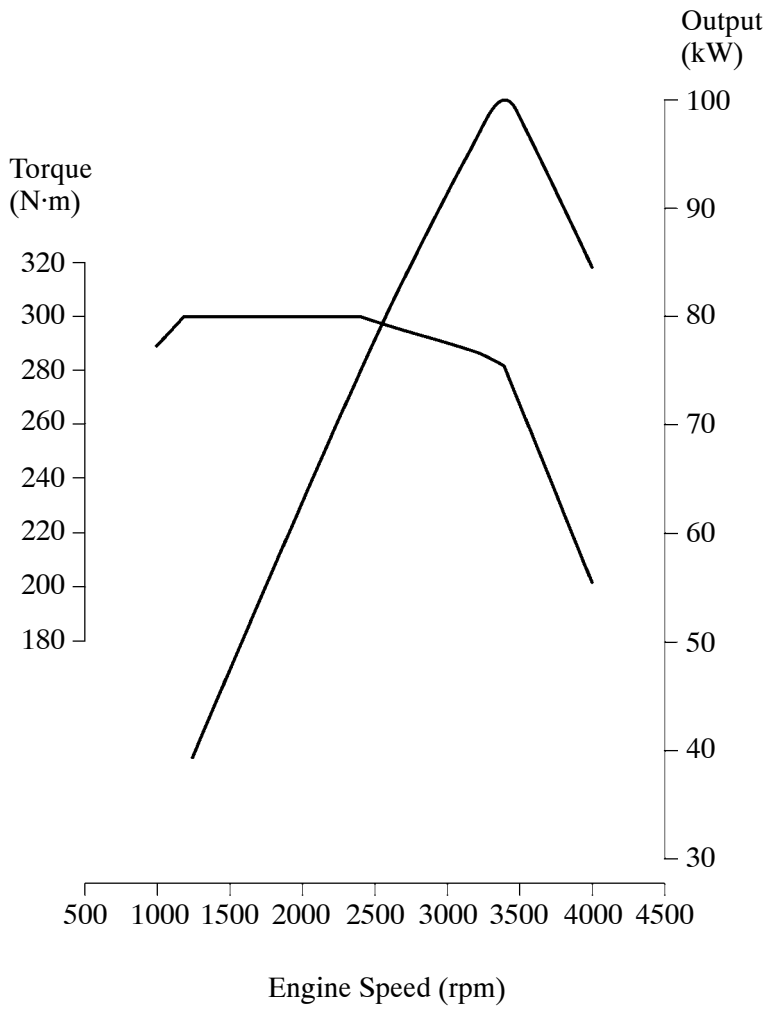
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▶ Engine Specifications ◀

Model			New Model	Previous Model
Engine Type			1KD-FTV	1KD-FTV
No. of Cyls. & Arrangement			4-cylinder, In-line	←
Valve Mechanism			16-valves, DOHC, Belt & Gear Drive	←
Combustion Chamber			Direct Injection Type	←
Manifolds			Cross-flow	←
Fuel System			Common-rail Type	←
Displacement cm^3 (cu. in.)			2982 (182.0)	←
Bore × Stroke mm (in.)			96 × 103 (3.78 × 4.06)	←
Compression Ratio			16.0 : 1	←
Max. Output (EEC)			100 kW @ 3400 rpm	80 kW @ 3000 rpm
Max. Torque (EEC)			300 N·m @ 1200 – 2400 rpm	286 N·m @ 1200 – 1600 rpm
Valve Timing	Intake	Open	2° BTDC	←
		Close	37° ABDC	←
	Exhaust	Open	45° BBDC	←
		Close	0° ATDC	←
Firing Order			1 – 3 – 4 – 2	←
Fuel Cetane Number			48 or higher	←
Emission Regulations			EURO IV (C/D mode)	EURO IV
Oil Grade (Australia, New Zealand Models)			API: CF-4, CF or ACEA B1, 5W-30 or G-DLD-1	←
Oil Grade (Other Country Models)			API: CF-4, CF or ACEA B1, 10W-30 or G-DLD-1	←
Engine Service Mass* (Reference) kg (lb)			263 (580)	260 (573)

*: Weight shows the figure with the oil fully filled.

▶ Performance Curve ◀



032EG48Y

Major Differences

The major differences between the newly adopted EURO IV C/D mode specification engine and the conventional EURO IV specification engine are as shown in the table below.

System	Outline
Engine Specifications	In accordance with various changes, the following specifications have been changed. ● Max. output and Max. torque ● The engine conforms to EURO IV (C/D mode) with regards to emission regulations.
Engine Proper	● The shape of the cylinder head has been changed. ● A stiffening plate has been added between the cylinder block and the oil pan. ● The shape of the piston combustion chamber has been changed.
Lubrication System	● With the changes to the turbocharger, the turbo oil inlet pipe has also been changed. ● The oil cooler has been changed. (from the 4-step type to a 3-step type)
Cooling System	● With the changes to the turbocharger, the use of a large EGR cooler, and the abolishment of the water-cooled type fuel cooler, etc., the coolant passage has been partially changed. ● The sub-radiator has been abolished. ● A controller-integrated brushless DC motor has been adopted for the cooling fan motor.
Intake and Exhaust System	● The turbocharger has been changed. ● The EGR valve has been changed. ● A large EGR cooler is used. ● The intake manifold has been changed. ● An oxidation catalyst is newly provided directly behind the turbocharger, and the capacity of the oxidation catalyst under the floor has been changed.
Fuel System	● The water-cooled type fuel cooler has been abolished. ● A new type of injector is used.
Engine Control System	● The air flow meter has been changed. ● The accelerator pedal position sensor has been changed. ● Small injection volume correction control and extensive intra-cylinder injection volume correction control have been added to the fuel injection volume control. ● The construction of the variable nozzle vane of the turbocharger has been changed. ● EGR control with a cooler bypass switching valve is used.

Features of 1KD-FTV engine

The 1KD-FTV engine achieves achieve the following through the adoption of the items listed in the table below.

(1) High performance and fuel economy

(2) Low noise and vibration

(3) Lightweight and compact design

(4) Good serviceability

(5) Clean emissions

Item		(1)	(2)	(3)	(4)	(5)	New Model	Previous Model
							1KD-FTV	1KD-FTV
Engine Proper	The cylinder head cover is made of plastic and the cylinder head is made of aluminum alloy.			○			○	○
	2 balance shafts are built into the cylinder block.		○				○	○
	An injector is provided in the bore center to improve the air utilization rate.	○				○	○	○
	The passage for the EGR is provided in the cylinder head.					○	○	○
	A piston provided with a combustion chamber is used in conjunction with the adoption of direct injection.	○				○	○	○
	A high swirl ratio is ensured by optimizing the shape of the combustion chambers of the cylinder head and pistons.	○				○	○	—
	The crankshaft pulley uses a torsional damper.		○				○	○
	A stiffening plate is provided between the cylinder block and the oil pan.		○				○	—
Valve Mechanism	The camshaft is driven by a timing belt and gear.		○	○			○	○
	An automatic tensioner is provided for the timing belt.				○		○	○
Cooling System	TOYOTA Genuine SLLC (Super Long Life Coolant) is used.				○		○	○
	The cooling fan is driven by a brushless DC motor.	○	○				○	—
Intake and Exhaust System	A swirl control valve is used.	○	○			○	○	○
	An oxidation catalytic converter is provided directly behind the turbocharger.					○	○	—
	An oxidation catalytic converter is used in the front exhaust pipe.					○	○	○

(Continued)

Item		(1)	(2)	(3)	(4)	(5)	New Model	Previous Model
							1KD-FTV	1KD-FTV
Intake and Exhaust System	A rotary solenoid motor type throttle control motor is used in the throttle body.	○	○			○	○	○
	A variable nozzle vane type turbocharger and high efficiency intercooler are used.	○		○		○	○	○
	EGR is used.					○	○	○
	An EGR valve position sensor is used.					○	○	○
	A water-cooled type EGR cooler is used.					○	○	○
	A large EGR cooler with a bypass switching valve is used.					○	○	—
Fuel System	An HP3 type supply pump is used.	○	○	○			○	○
	A common-rail type fuel injection system is used.	○	○			○	○	○
	An injector on which the compensation value and QR (Quick Response) code are printed is used.	○				○	○	○
	A fuel cooler is used.	○				○	○	○
Charging System	A segment conductor type alternator is used.			○			○	○
Serpentine Belt Drive System	A serpentine belt drive system is used.				○		○	○
Engine Control System	A non-contact type throttle position sensor is used.	○					○	○
	A non-contact type accelerator pedal position sensor is used.	○					○	○
	A pilot injection control system is used.	○	○			○	○	○
	Small injection volume correction control and extensive intra-cylinder injection volume correction control have been added to the fuel injection volume control.	○	○			○	○	—

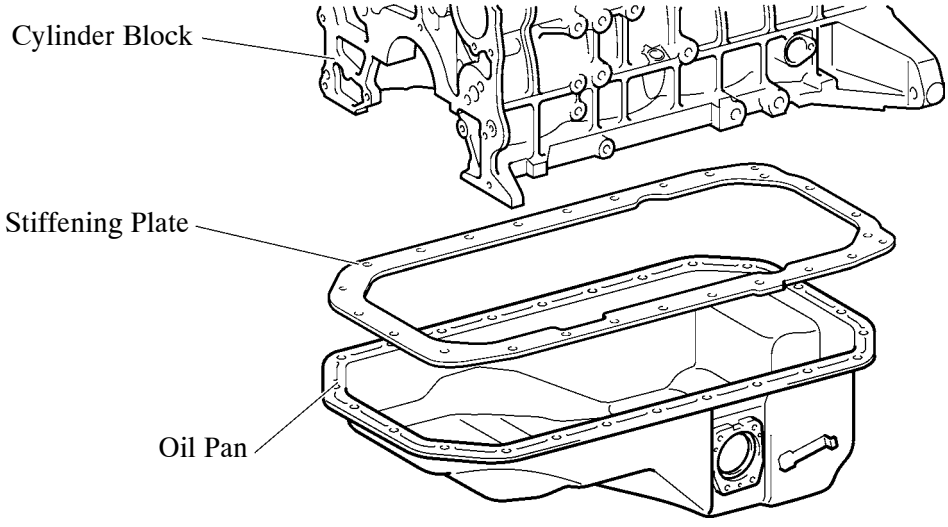
Engine Proper

1) Cylinder Head

- The cylinder head has been changed, and a newly shaped piston combustion chamber and an intake manifold with newly shaped SCVs (Swirl Control Valves) are used. The swirl ratio has been increased (1.48 → 1.85) in accordance with such changes.

2) Cylinder Block

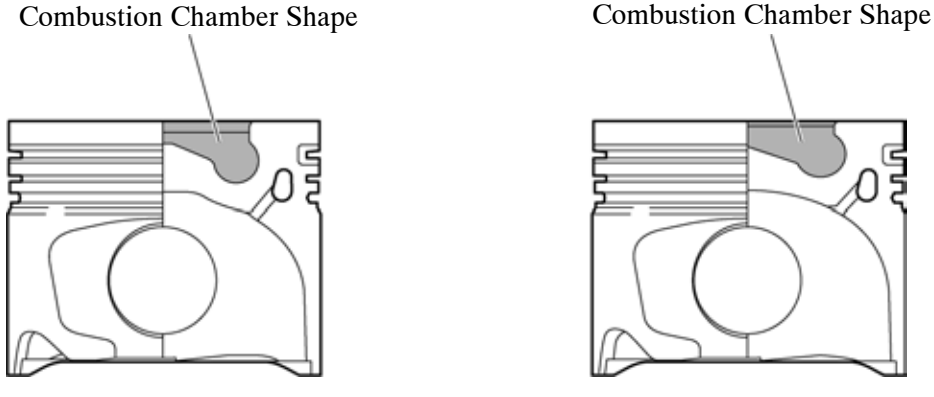
- A stiffening plate has been added between the cylinder block and the oil pan to enhance the rigidity of the skirt section of the cylinder block and to reduce noise due to structural damping.



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3) Piston

- The shape of the combustion chambers has been changed, and the swirl ratio has been increased. This has improved fuel efficiency, emission reduction efficiency, and reliability.



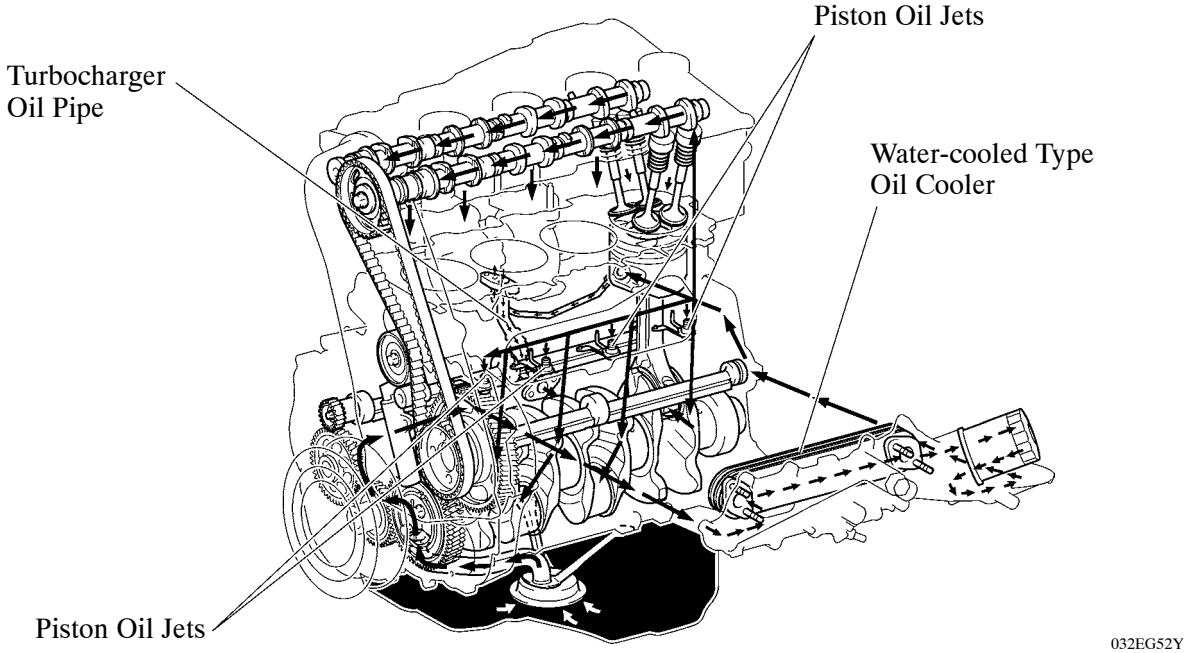
Piston Cross Section

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Lubrication System

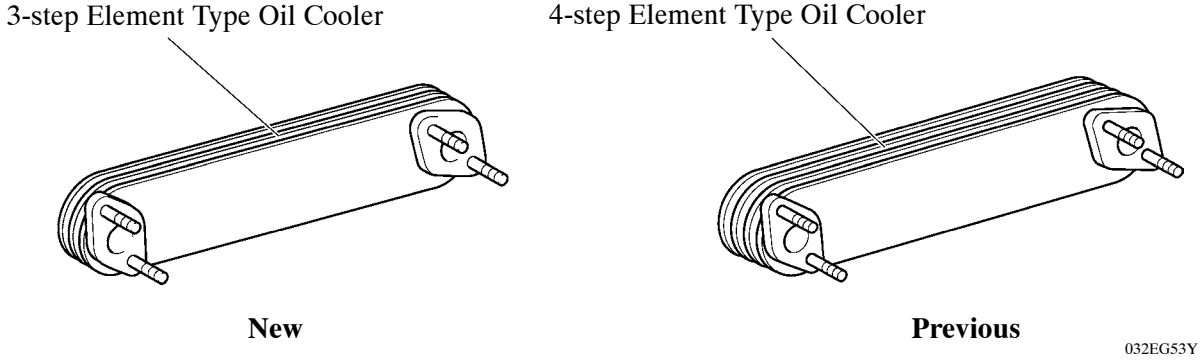
1) General

- The turbocharger has been changed, and changes have been made to the turbocharger oil pipe accordingly.
- The 4-step water-cooled type engine oil cooler used in the previous model has been changed to a 3-step type.
- The valve opening pressure of the check valves of the piston oil jets has been changed.
- The oil capacity is the same as for the conventional EURO IV specification 1KD-FTV engine.



2) Oil Cooler

- The 4-step water-cooled type engine oil cooler used in the previous model has been changed to a 3-step type.



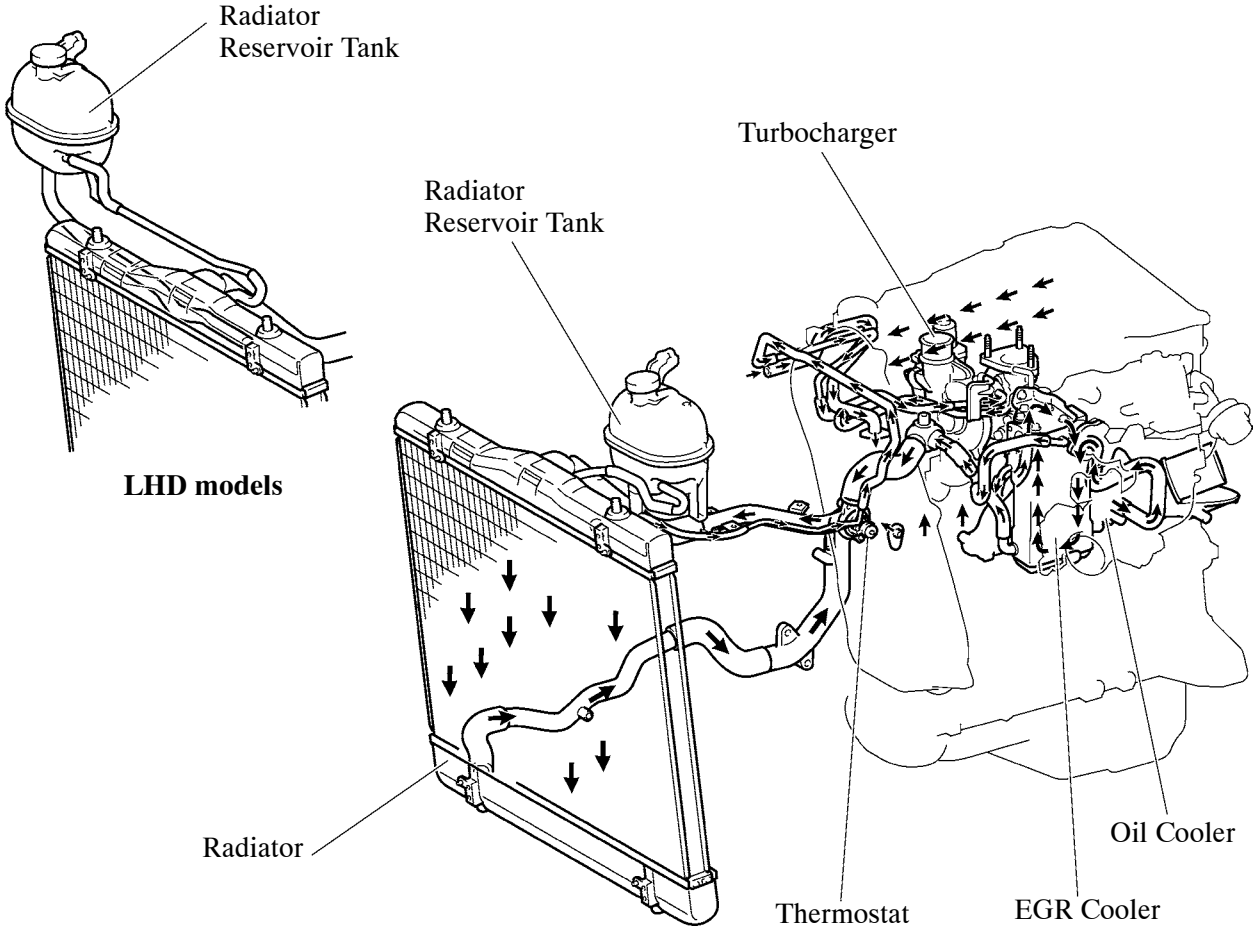
3) Piston Oil Jet

- The valve opening pressure of the check valves of the piston oil jets has been changed from approximately 150 kPa to approximately 100 kPa.

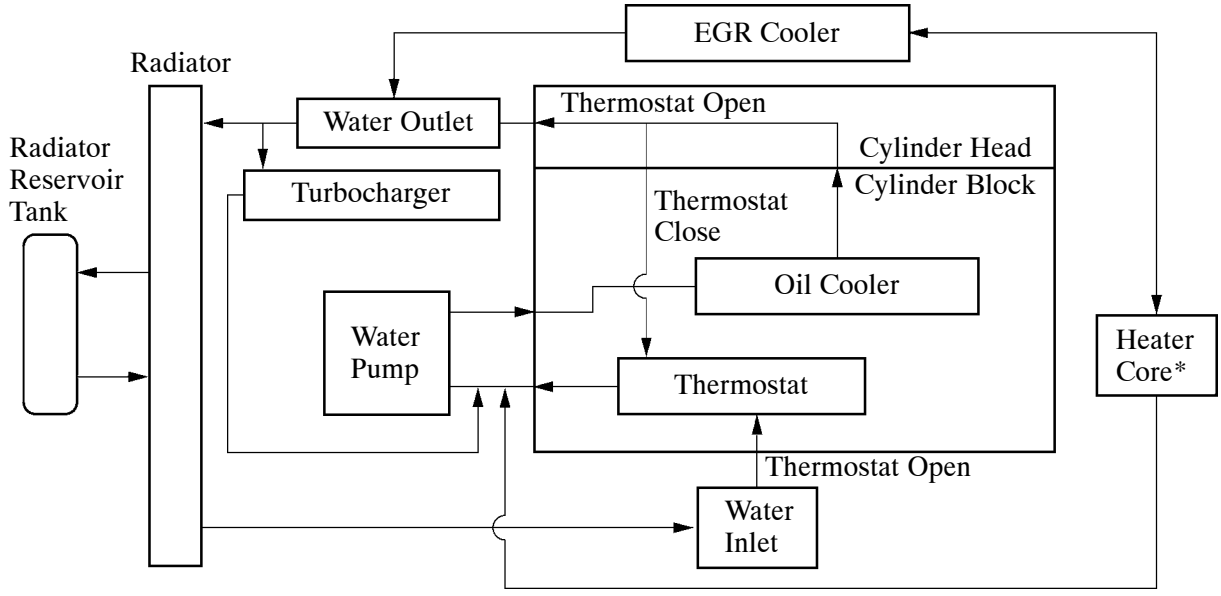
Cooling System

1) General

- The sub-radiator has been abolished.
- With the use of a compact turbocharger and a large capacity EGR cooler, and the abolishment of the water-cooled type fuel cooler, etc., the coolant route has been changed.
- By adopting a brushless DC motor for the cooling fan motor to improve the rated output (from 240 W to 300 W), the cooling performance has been optimized.
- In accordance with the provision of the 1KD-FTV engine equipped LHD models (General Countries specification models for Chile), the layout of the radiator reservoir tank for LHD models has been optimized.



▶ System Diagram ◀



*: Models with Heater

▶ Specifications ◀

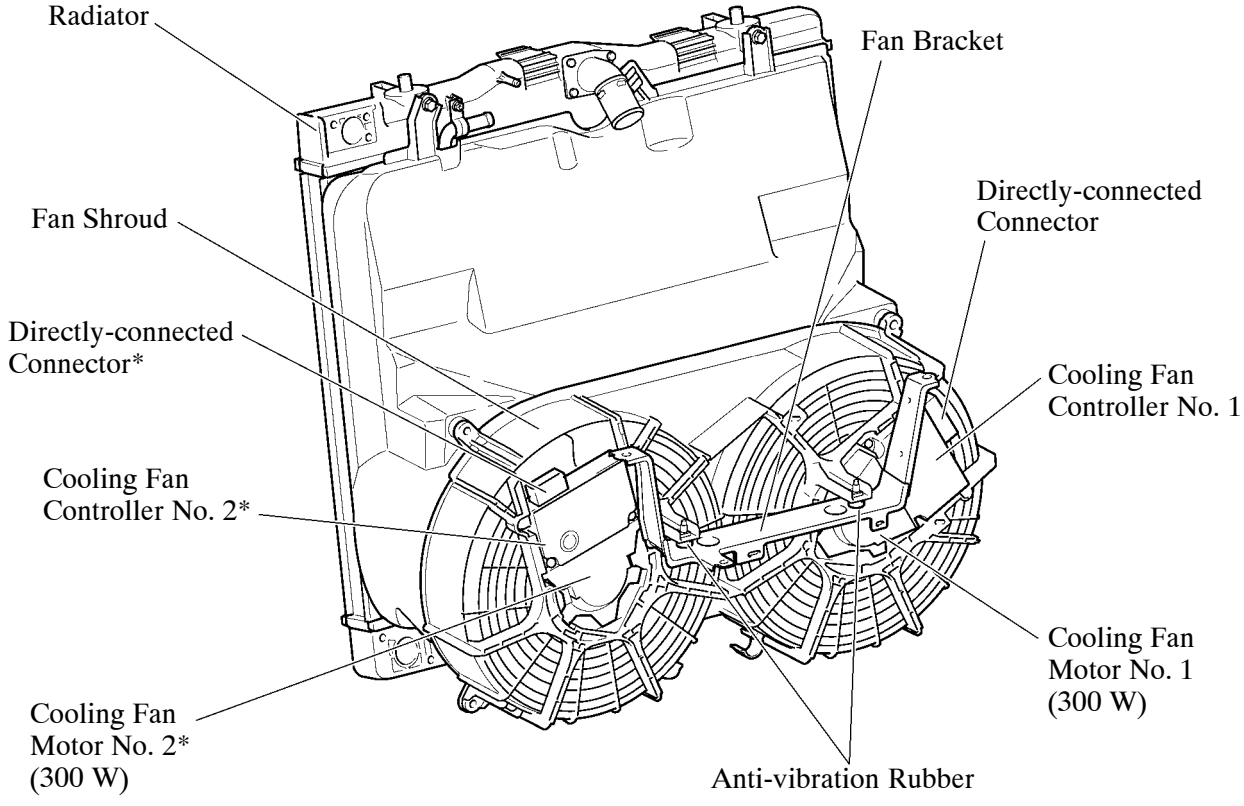
Engine Coolant	Type		TOYOTA Genuine Super Long Life Coolant (SLLC) or similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite and non-borate coolant with long-life hybrid organic acid technology (coolant with long-life hybrid organic acid technology is a combination of low phosphates and organic acids). Do not use plain water alone.
	Color		Pink
	Capacity	With Rear Heater	17.0 Liters (17.9 US qts, 14.9 Imp. qts)
		Without Heater (Singapore Models)	14.0 Liters (14.8 US qts, 12.3 Imp. qts)
	Maintenance Intervals	First time	160,000 km (100,000 miles)
		Subsequent	Every 80,000 km (50,000 miles)
Thermostat	Opening Temperature °C (°F)		80 – 84 (176 – 183)

SLLC is pre-mixed (50% coolant and 50% deionized water). Therefore, no dilution is needed when SLLC in the vehicle is added or replaced.

2) Radiator (Cooling Fan, Fan Shroud)

- A brushless DC motor with low noise output and good serviceability characteristics has been adopted for the cooling fan motor. In addition, the rated output has been increased to 300 W* to optimize the cooling performance.
- The cooling fan controller and the cooling fan motor have been integrated to form a single module. A large capacity, lever type, directly-connected connector and power supply circuit have been adopted for this module to reduce the wiring resistance and secure the performance of the large capacity motor. The shape of the fan shroud has also been changed to fit the shape of the module.
- With the abolishment of the sub-radiator, the inlet/outlet pipe for connecting the main radiator to the sub-radiator has also been abolished.
- The fan bracket and the anti-vibration rubber have been optimized to further reduce noise and vibration.

*: The rated output of the air conditioner equipped models is 300 W × 2.

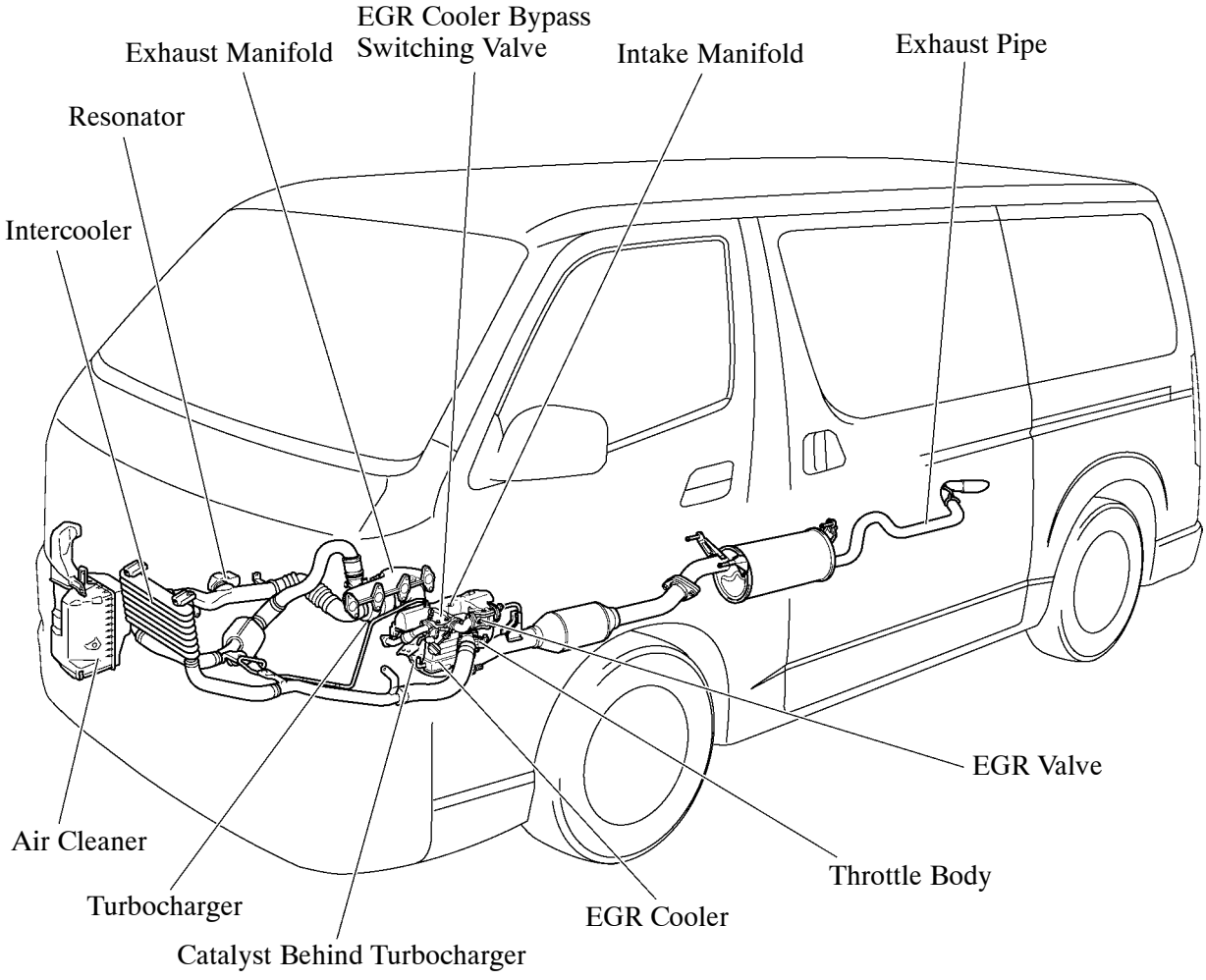


*: Models with Air Conditioner

Intake and Exhaust System

1) General

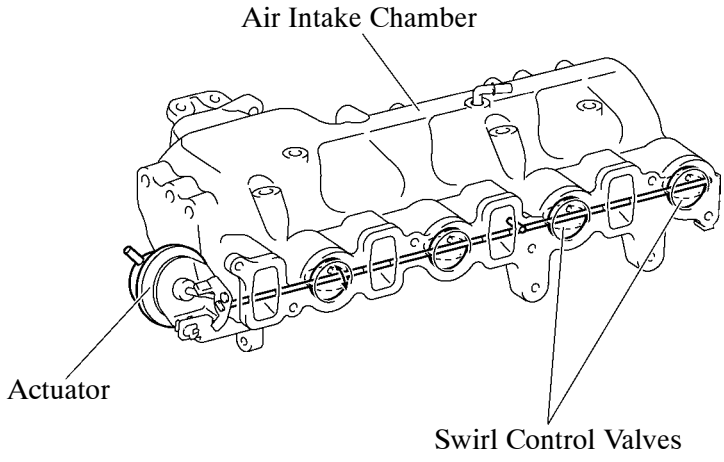
- A compact, lightweight turbocharger is used to increase the output power and improve the emission reduction efficiency.
- A new outward-opening type EGR valve is used.
- A large capacity EGR cooler equipped with a cooler bypass switching valve which stabilizes the temperature of the EGR gas is used.
- The shape of the intake manifold has been changed to ensure a high swirl ratio and improve the EGR gas distribution efficiency.
- An oxidation catalyst is newly provided directly behind the turbocharger, and the capacity of the oxidation catalyst under the floor has been changed, optimizing the exhaust gas purifying function of the engine and enabling it to conform to EURO IV C/D mode.



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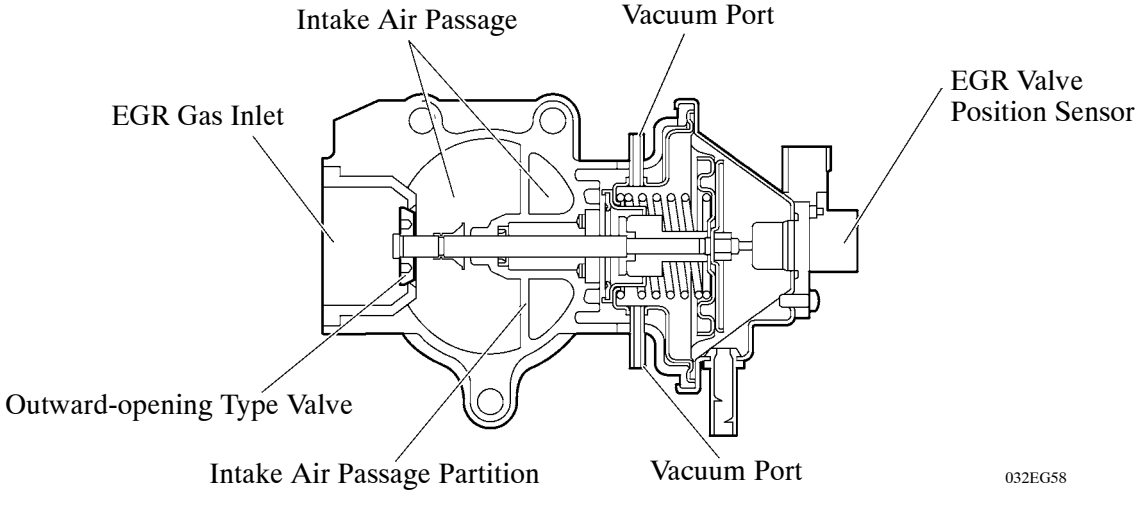
2) Intake Manifold

- The shape of the intake manifold has been changed. As with the previous model, it is equipped with swirl control valves, and uses isometrical ports with surge tanks to generate an appropriate swirl for each cylinder.
- By increasing the distance to the surge tanks, the mixing distance for the intake air and the EGR gas has been optimized and the EGR gas can be evenly distributed to each cylinder.



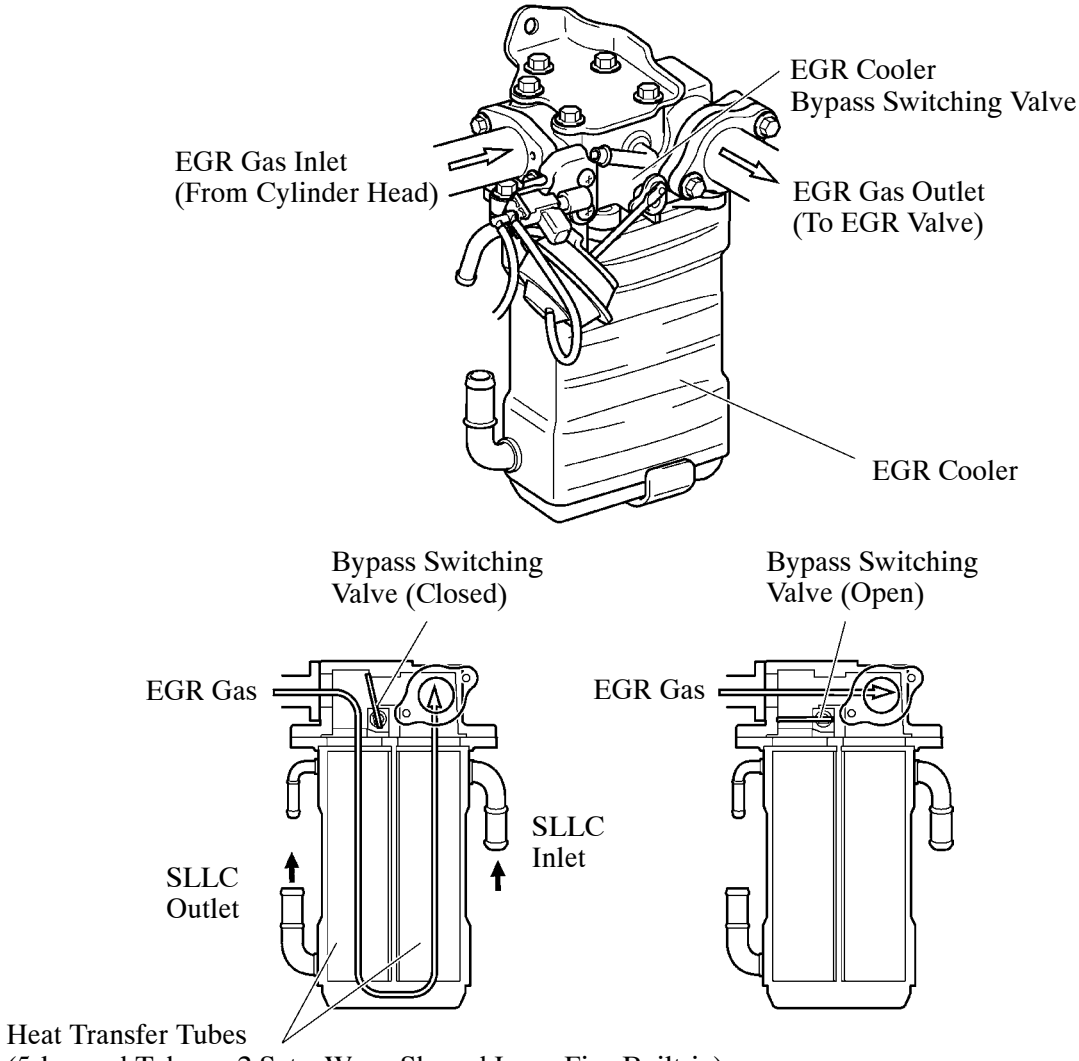
3) EGR Valve

- As with the previous model, an EGR valve is provided in the intake air passage to make EGR valve cooling by intake air possible, and, in combination with the use of a large capacity EGR cooler, has ensured reliability and an increased volume of EGR, reducing the level of NOx.
- An outward-opening type EGR valve that is able to cope with the high back pressure of the exhaust system is used.
- A partition is provided in the intake passage, taking the mixing characteristics of the EGR gas and intake air into consideration, and this has improved the efficiency of the distribution of the EGR gas to each cylinder.
- As with the previous model, an EGR valve lift sensor is provided. The movement of the valve is stabilized by accurate monitoring of the actual amount of EGR valve lift by the ECM, and more precise EGR control is realized.
- For details of EGR control, see page 51.



4) EGR Cooler

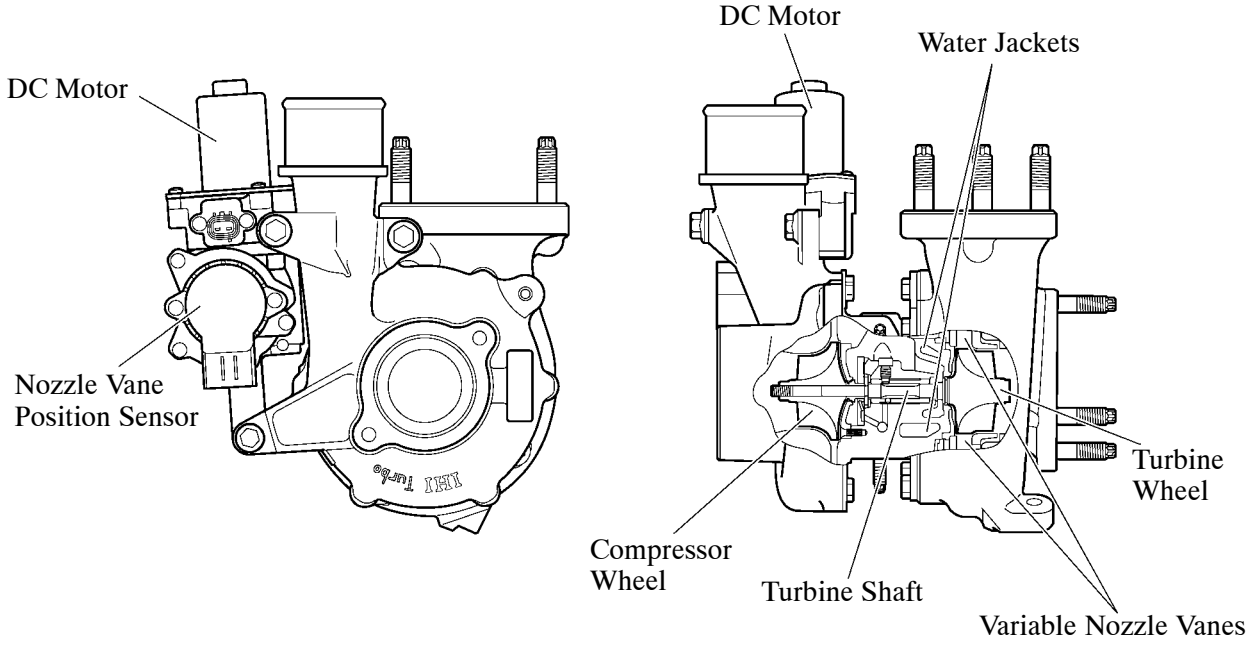
- The EGR cooler has been changed to a large capacity layered type to improve the EGR gas cooling efficiency. In this way, the EGR volume has been increased, the temperature of the intake air during EGR operation is controlled, and the volume of NOx emissions has been significantly reduced, ensuring improved emission reduction efficiency.
- An EGR cooler bypass switching valve which opens or closes the gas route to the EGR cooler in accordance with the running conditions of the engine is provided. This has led to the stabilization of the temperature of the EGR gas, and ensures stable emission reduction efficiency for a variety of running conditions.
- By making the gas route of the EGR cooler a U-shape, both improved cooling efficiency, due to its increased capacity, and better use of space have been realized.
- The main body section of the EGR cooler contains 2 sets of 5-layered heat transfer tubes (10 in total), and the EGR gas that flows through these heat transfer tubes is cooled by the surrounding coolant. By installing wavy shaped fins inside the heat transfer tubes, the cooling efficiency has been improved, and the EGR cooler has become more lightweight and compact.
- For details of EGR control, see page 51.



5) Turbocharger

a. General

- A new water-cooled variable nozzle vane type turbocharger manufactured by IHI Turbo is used.
- By using the lightweight RHV4L turbocharger with a small turbine capacity and low-inertia momentum, the low speed engine torque and output power have been improved through ample supercharging at low engine speeds. This has improved the vehicle's usability as a commercial vehicle.
- As with the previous model, a high-response DC motor is used to drive the variable nozzle vane unit. A nozzle vane position sensor has also been fitted.
- A cartridge-type variable nozzle vane unit which is supported by both axles is used to improve the performance of the turbocharger and to reduce its weight and size. For details, see page 49.
- Semi-floating bearings are used on the turbine shaft to reduce the generation of oil whirl vibration.

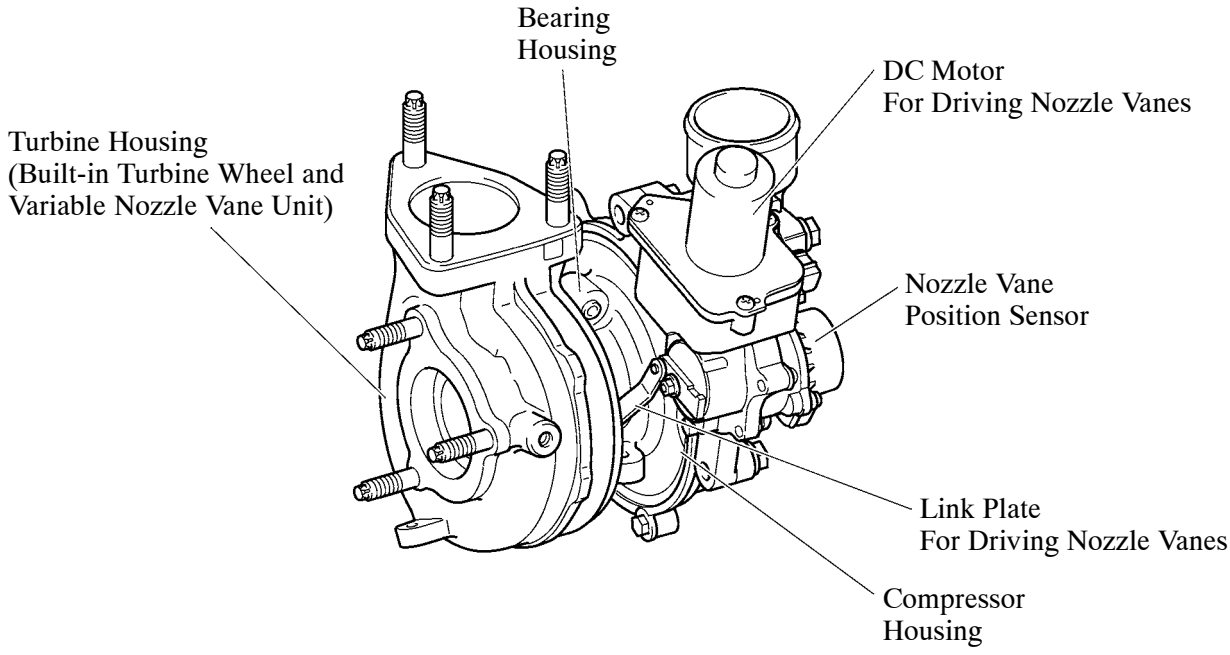


RHV4L Turbocharger

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b. Variable Nozzle Vane Type Turbocharger

- The variable nozzle vane type turbocharger consists primarily of a turbine with a built-in variable nozzle vane unit, a compressor, a DC motor and a nozzle vane position sensor.
- By combining the newly-structured variable nozzle vane unit with a small-diameter turbine wheel, the turbine housing capacity and the inertia momentum have been reduced.
- As with the previous model, the balance between back pressure and supercharging pressure is controlled optimally, in accordance with the engine speed and the vehicle load, by changing the nozzle vanes attached to the outer periphery of the turbine wheel and adjusting the flow speed and pressure of the exhaust gas input into the turbine. In addition, the engine ECU outputs a signal to the turbo motor driver, which actuates the DC motor, to control the nozzle vane position.

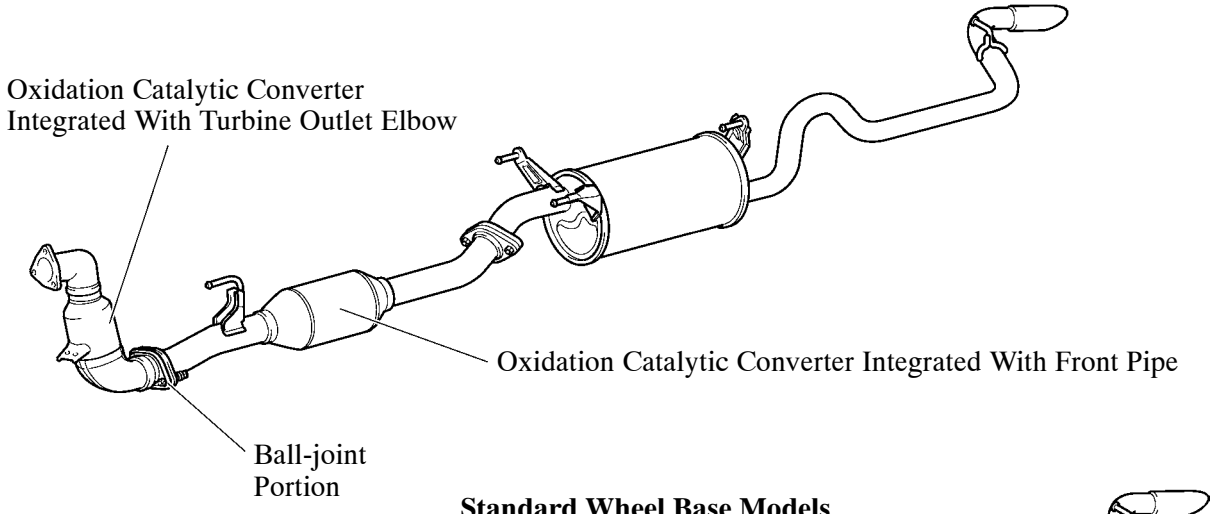


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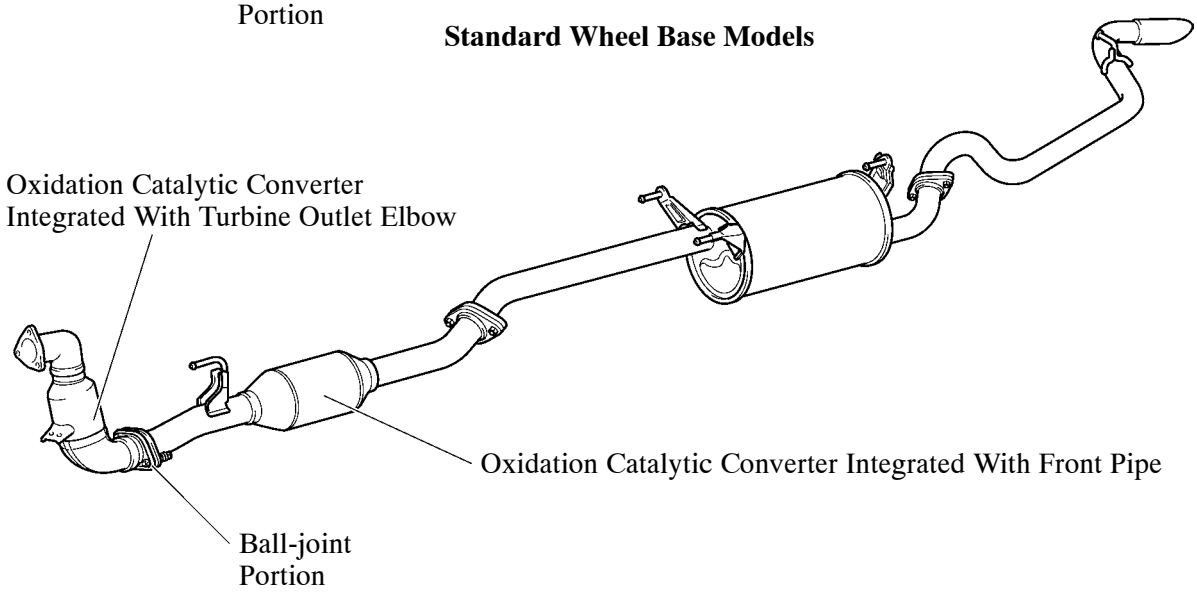
6) Exhaust Pipe

- An oxidation catalytic converter which is integrated with the turbine outlet elbow has been added directly behind the turbocharger. In accordance with this addition, the position of the join between the turbine outlet elbow and the exhaust front pipe has been changed. The join section's ball-joint mechanism is the same as that used in the previous model.
- The size of the oxidation catalytic converter under the floor has been changed to optimize the exhaust gas purifying function of the engine.
- Through optimal positioning of the two oxidation catalytic converters (directly behind the turbocharger and under the floor), the exhaust gas purifying function has been optimized.

Model	New Model	Previous Model
Oxidation Catalytic Converter Size	0.5 L + 1.3 L	2.0 L × 2



Standard Wheel Base Models



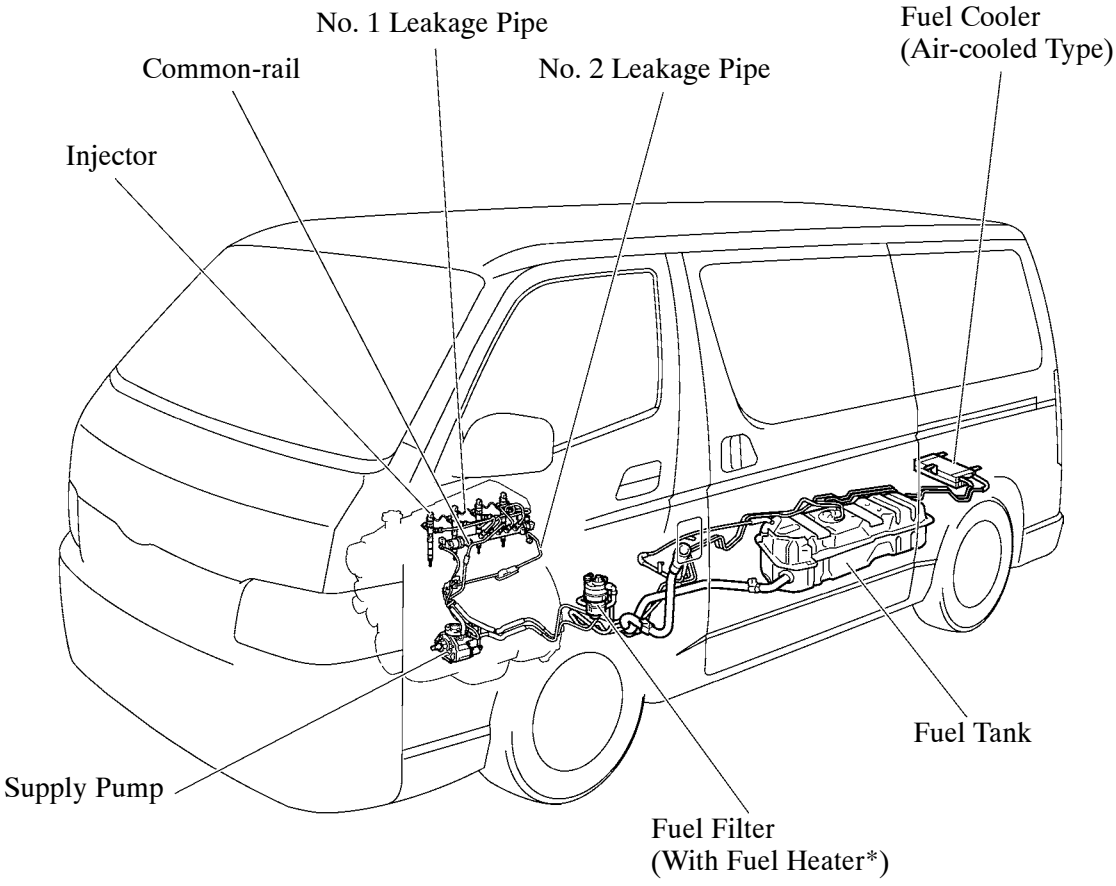
Super Long Wheel Base Models

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Fuel System

1) General

- New high-response injectors that are able to withstand high pressure are used. A common-rail and a supply pump with the same specifications as in the previous model are also used.
- The water-cooled type fuel cooler that was attached to the cylinder block has been abolished. Accordingly, the leakage pipe has been partially changed. The air-cooled type fuel cooler is still used.
- A recirculation type fuel heater is used in cold area specification models.

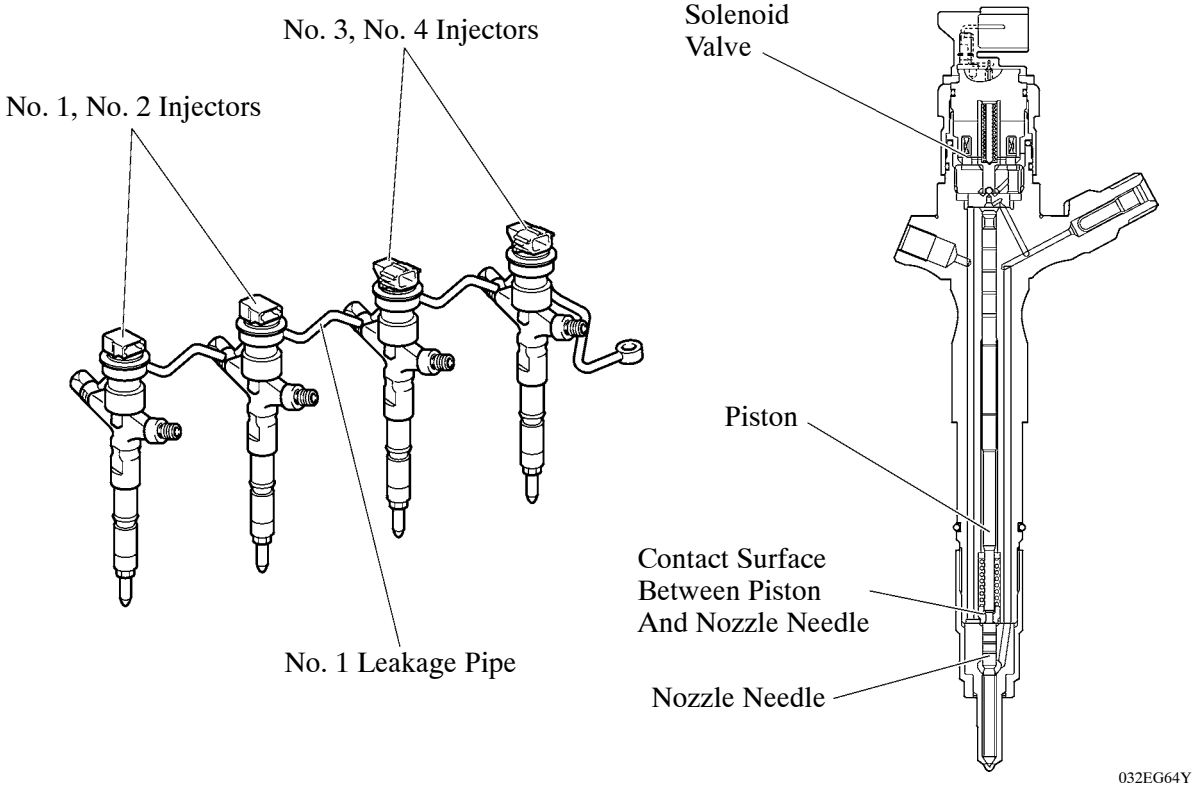


*: Cold Area Specification Models

2) Common-rail System

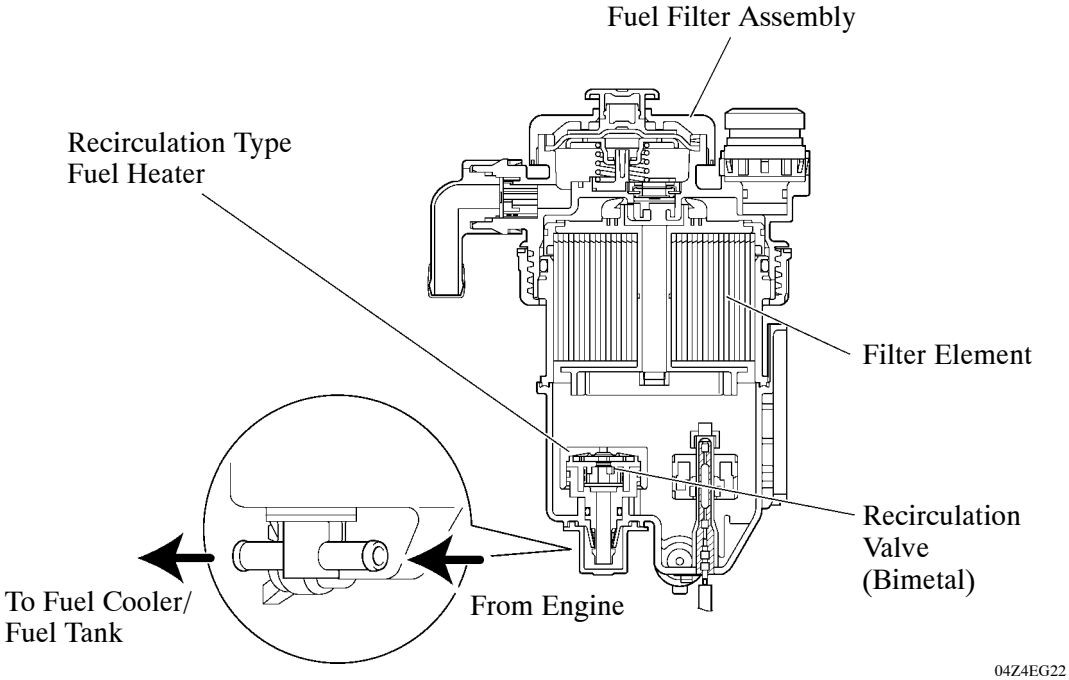
a. Injector

- New solenoid valve control injectors are used. As with the previous model, the injectors are individually controlled using the QR (Quick Response) code, making them suited to high-accuracy fuel injection control.
- By optimizing the shape of the contact surface between the piston and the nozzle needle, improving the seals, and applying a DLC (Diamond Like Carbon) coating, the wear resistance of the nozzle needles has been improved. As a result, the new injectors are able to withstand high pressure.
- By improving the fuel suction power of the solenoid valves and reducing the diameters of both the pistons and the nozzle needles, the responsiveness of the new injectors has been further increased. This has led to a reduction in the difference in the injection volumes of the injectors.



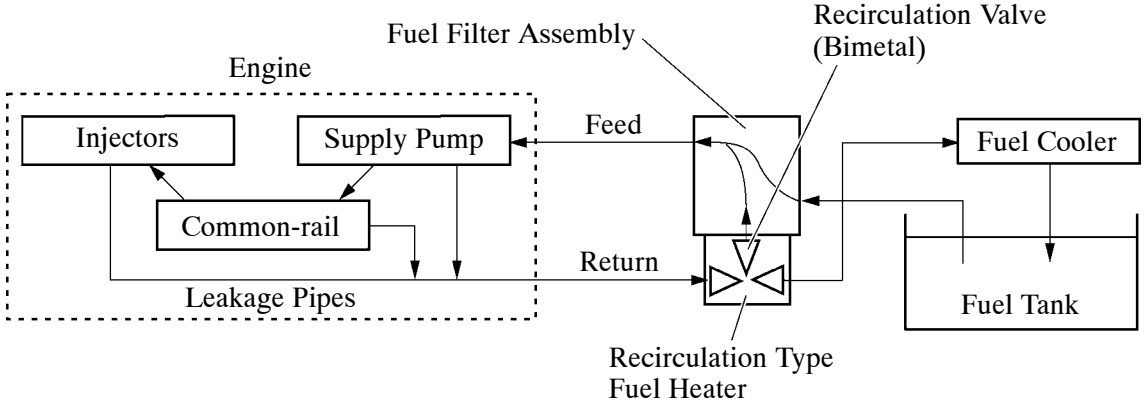
3) Fuel Heater

- A recirculation type fuel heater is used in cold area specification models. This limits the precipitation of the wax component of light oil fuel at low temperatures, thus inhibiting the clogging of the filter element.



a. Operation

- This heater heats the fuel by recirculating the return fuel, which that has reached a high temperature as a result of the pumping of the supply pump, to the fuel filter.
- While the engine is cold, the recirculation valve inside the fuel heater will be open due to the bimetal action, so the return fuel will return to the fuel filter and the fuel tank.
- While the engine is warm, the recirculation valve will be closed due to the bimetal action, so all the return fuel will return to the fuel tank.



Engine Control System

1) General

The following list shows a comparison of the engine control systems of the 1KD-FTV engine of the new HIACE and the 1KD-FTV engine of the previous HIACE.

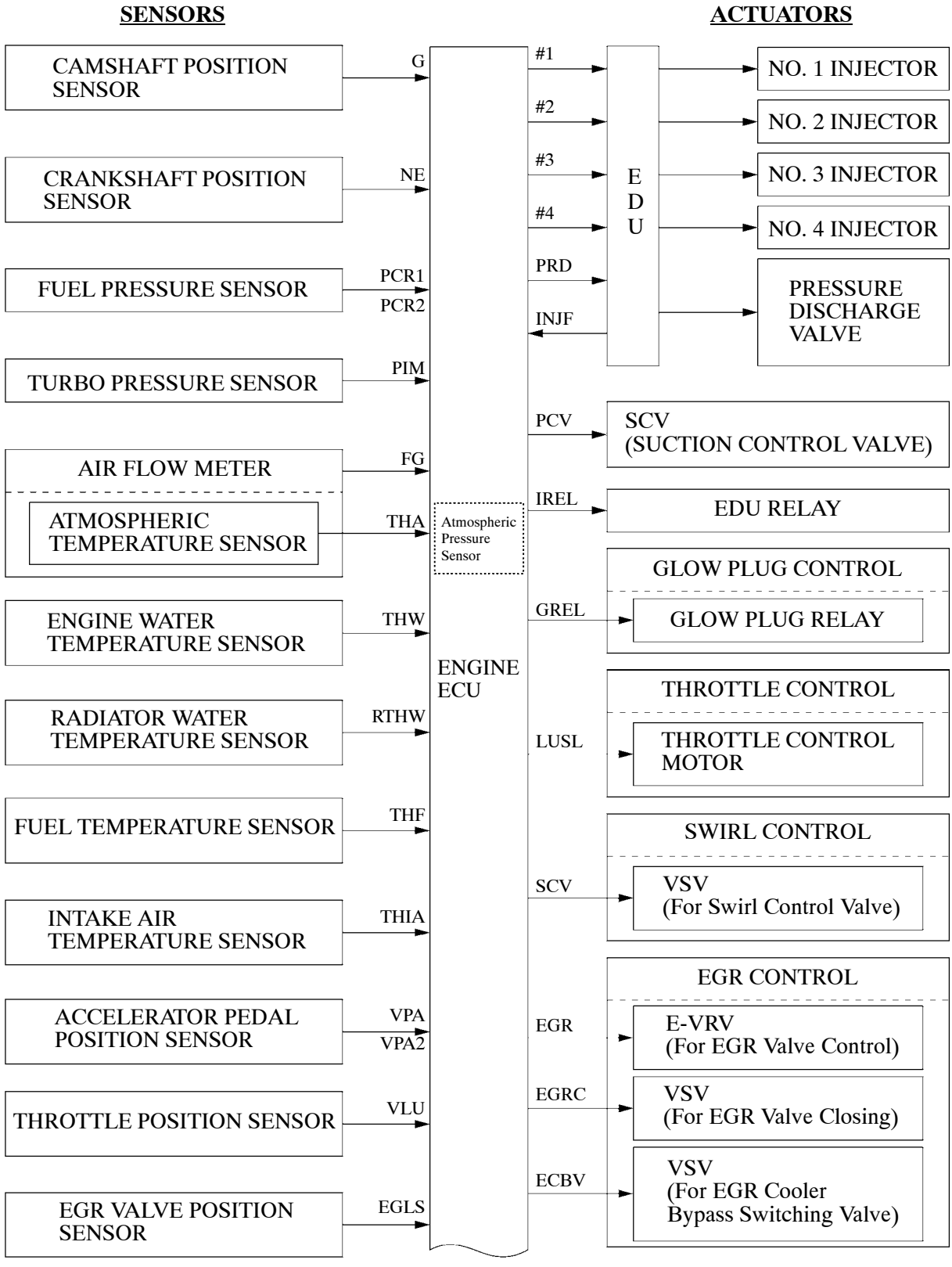
System	Outline	New Model	Previous Model
		1KD-FTV	1KD-FTV
Fuel Injection Volume Control (See Page 47)	Based on the signals received from the sensors, the engine ECU determines the fuel injection volume in accordance with the engine condition. It also corrects the injection volume for each injector, based on the signals input from the crankshaft position sensor and the clutch switch, etc.	○	—
	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 controls the fuel pressure using the SCV (Suction Control Valve) and pressure discharge valve in accordance with the engine condition.	○	○
Pilot Injection Control	Based on the signals received from the sensors, the engine ECU determines the pilot injection volume/timing, and the interval (between pilot injection and main injection) in accordance with the engine condition.	○	○
During Starting Control	To facilitate startability, the engine ECU optimally controls the injection volume and injection timing during starting.	○	○
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 that the current is applied to the glow plugs, in accordance with the water temperature.	○	○
Throttle Control	Based on the signals received from the various sensors, the engine ECU determines the throttle valve position in accordance with the engine condition.	○	○
	Fully close the throttle valve in order to reduce the vibration when the engine is stopped.	○	○
Swirl Control	Based on the signals received from the sensors, the engine ECU controls the vacuum that is directed to the actuator via the VSV, in order to open and close the valve.	○	○

(Continued)

System	Outline	New Model	Previous Model
		1KD-FTV	1KD-FTV
Turbocharger Control	Based on the signals received from the sensors, the engine ECU controls the actuator in accordance with the engine condition.	○	○
EGR Control (See Page 51)	Based on the signals received from the sensors, the engine ECU determines the EGR volume using the EGR valve, EGR cooler bypass switching valve and throttle valve in accordance with the engine condition.	○	—
	Based on the signals received from the sensors, the engine ECU determines the EGR volume using the EGR valve and throttle valve in accordance with the engine condition.	—	○
Diagnosis	When the engine ECU detects a malfunction, it diagnoses and memorizes the malfunctioning section.	○	○
Fail-safe	When the engine ECU detects a malfunction, it stops or controls the engine according to the data already stored in the memory.	○	○

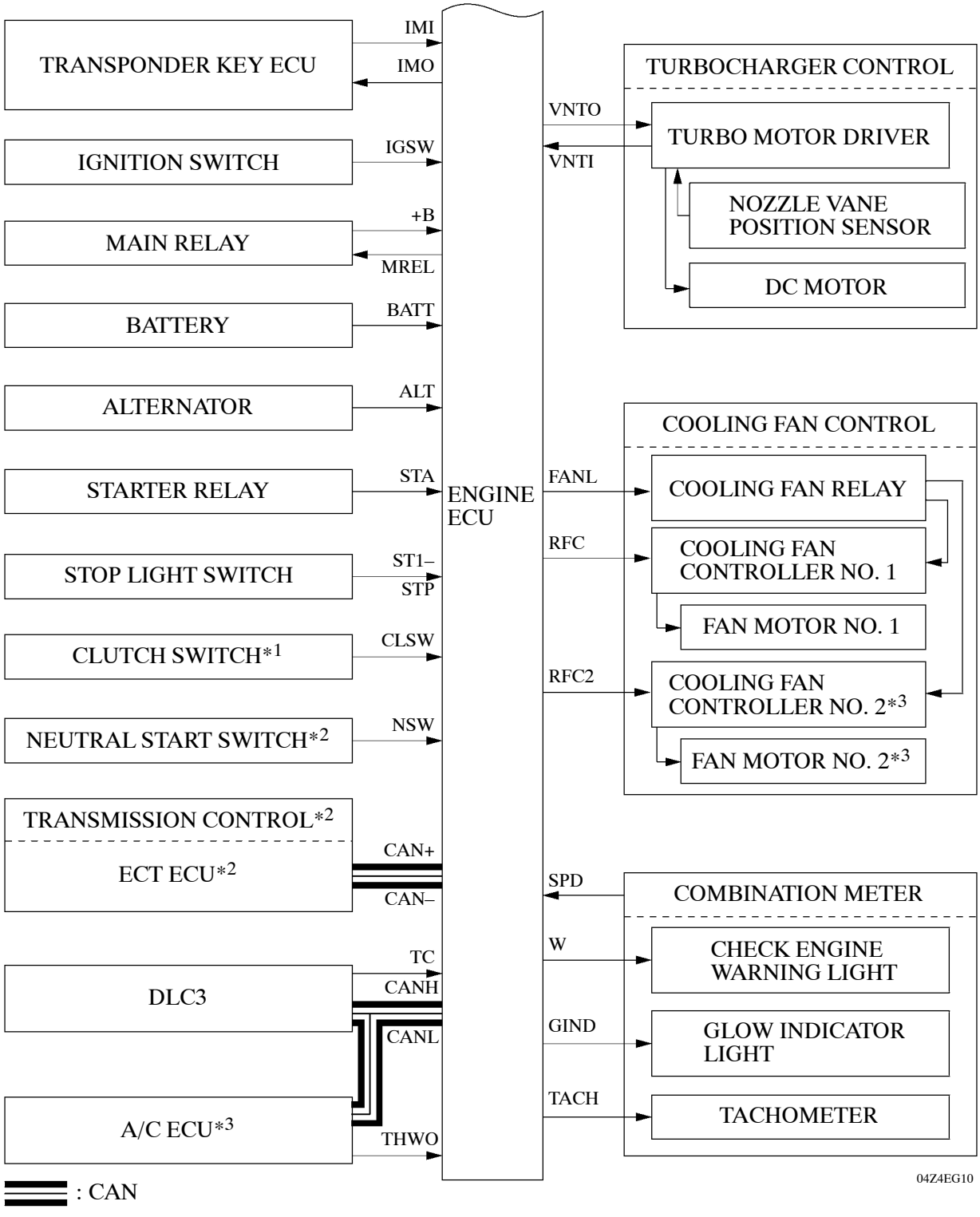
2) Construction

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



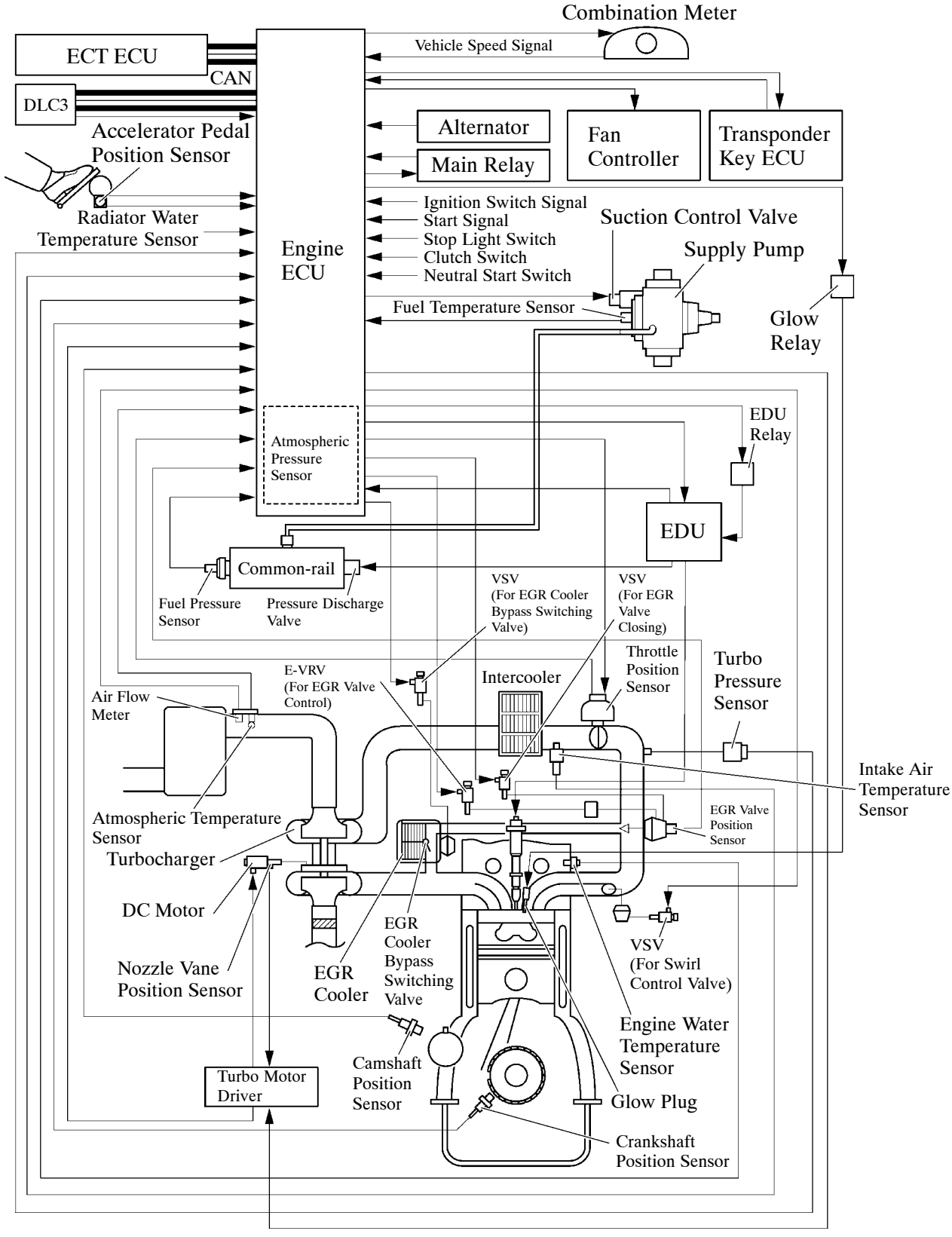
04Z4EG09

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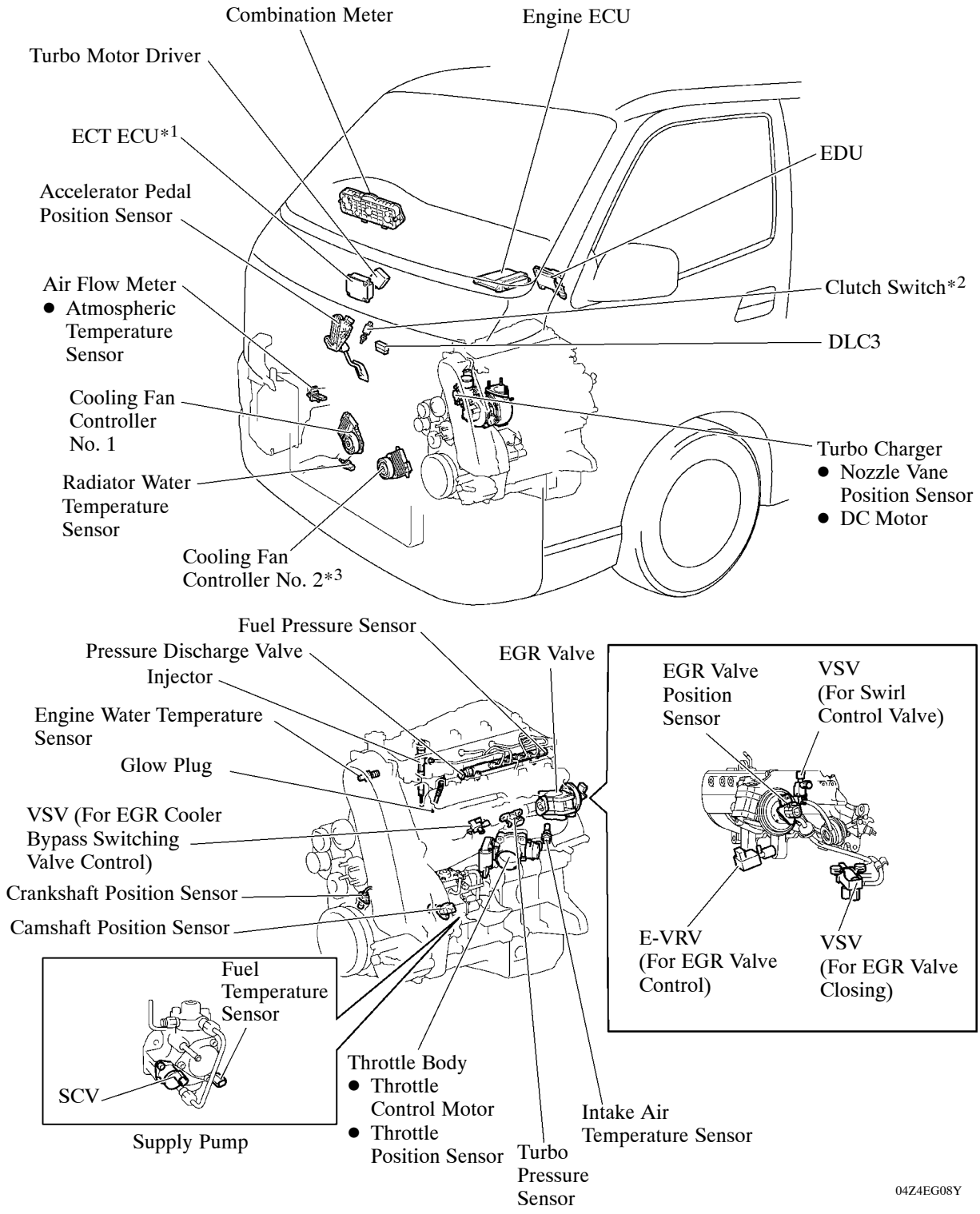
*1: Models of Manual Transmission
*2: Models of Automatic Transmission
*3: Models with Air Conditioner

3) Engine Control System Diagram



04Z4EG19

4) Layout of Main Components



*1: Models of Automatic Transmission
*2: Models of Manual Transmission
*3: Models with Air Conditioner

5) Main Components of Engine Control System

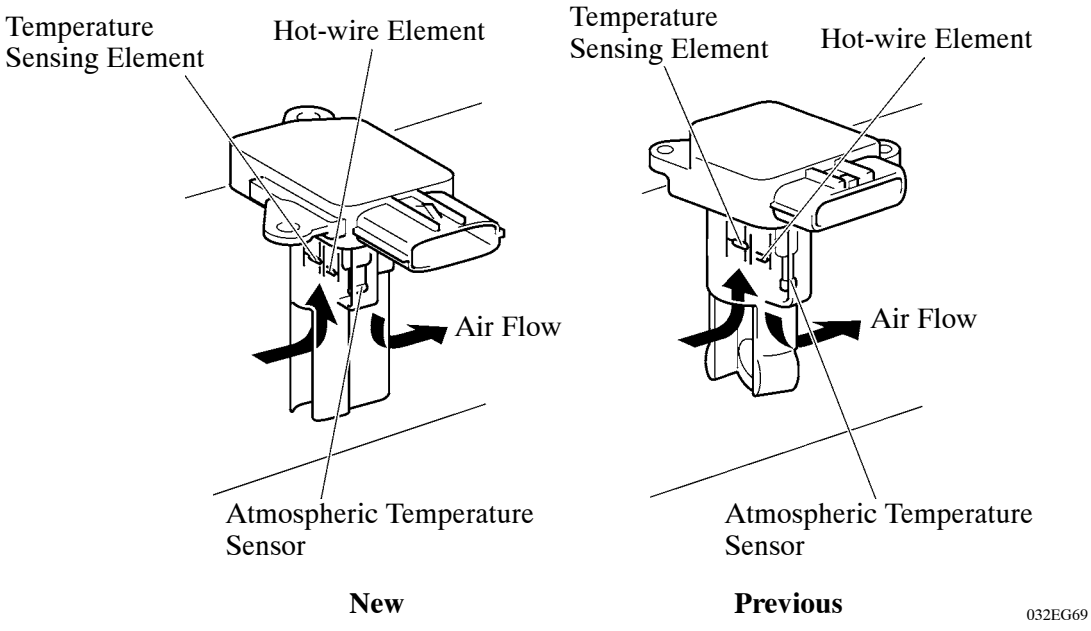
a. General

The main components of the 1KD-FTV engine control system are as follows:

Model	New HIACE (EURO IV C/D mode)		Previous HIACE (EURO IV)	
Component	Outline	Quantity	Outline	Quantity
Engine ECU	32-bit CPU	1	←	←
EDU	DC/DC Converter	1	←	←
Turbo Pressure Sensor	Semiconductor Silicon Chip Type	1	←	←
Atmospheric Pressure Sensor	Semiconductor Silicon Chip Type	1	←	←
Fuel Pressure Sensor	Semiconductor Strain Gauge Type	1	←	←
Crankshaft Position Sensor	Pick-up Coil Type (Rotor Teeth/36 - 2)	1	←	←
Camshaft Position Sensor	Pick-up Coil Type (Rotor Teeth/5)	1	←	←
Air Flow Meter	Hot-wire Type (Digital Type)	1	Hot-wire Type (Analog Type)	1
Atmospheric Temperature Sensor	Thermistor Type	1	←	←
Water Temperature Sensor	Thermistor Type	1	←	←
Intake Air Temperature Sensor	Thermistor Type	1	←	←
Fuel Temperature Sensor	Thermistor Type	1	←	←
Throttle Position Sensor	Non-contact Type	1	←	←
Accelerator Pedal Position Sensor	Non-contact Type	1	←	1
EGR Valve Position Sensor	Contact Type	1	←	←
SCV (Suction Control Valve)	Linear Solenoid Valve	1	←	←
Injectors	8-hole Type (High-response)	1	8-hole Type	1

b. Air Flow Meter

- The air flow meter has been changed from the analog type to a digital type. Its installation position and function are the same as in the previous model.
- As with the previous model, the air flow meter has a built-in atmospheric temperature sensor.

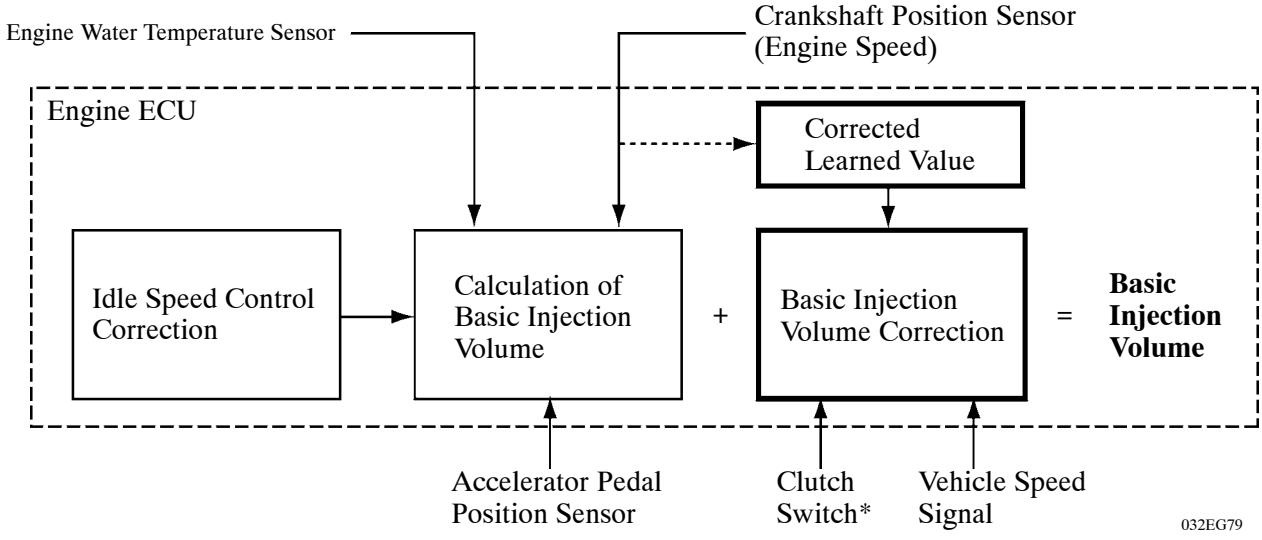


6) Fuel Injection Volume Control

Small injection volume correction control and extensive intra-cylinder injection volume correction control have been added to the fuel injection volume control. With the implementation of these injection volume correction controls when the engine ECU calculates the basic injection volume, more accurate fuel injection control has been realized.

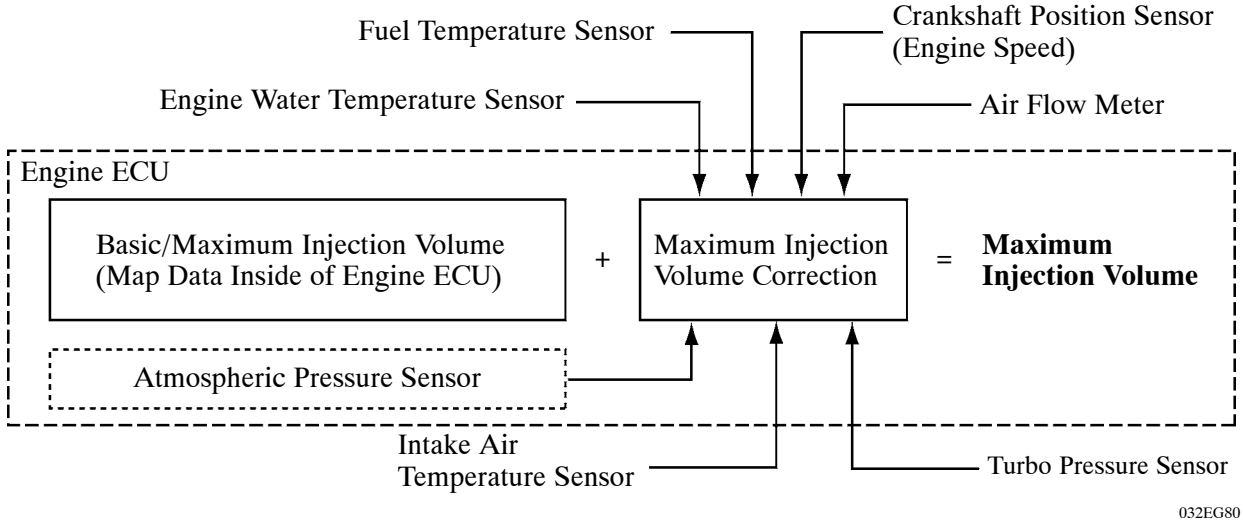
- Small injection volume correction control is a type of control, performed for pilot injection volume, etc., that detects the change in the engine speed when the engine ECU outputs a small injection volume instruction, and determines the differences between the injection instruction and the actual injection volume for each injector.
- Extensive intra-cylinder injection volume correction control is a type of control, performed for each injector, whereby the engine ECU detects the combustion status of each cylinder based on the signals from the crankshaft position sensor to balance the torque generated by each cylinder.

▶ Basic Injection Volume ◀

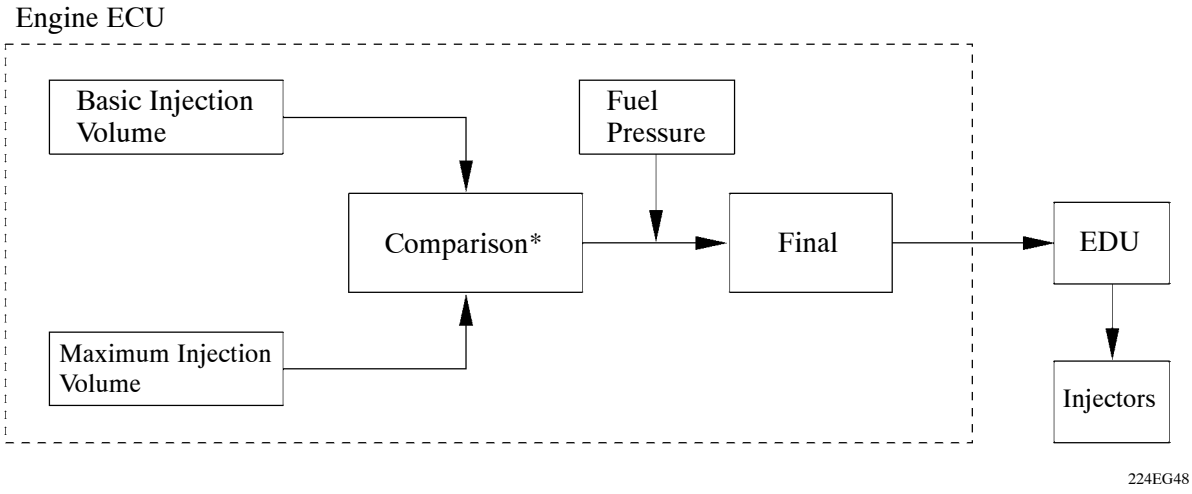


*: Models of Manual Transmission

▶ Maximum Injection Volume ◀



▶ Final Injection Volume Decision ◀



*: Selects lower injection volume

Service Tip

- As the learned values for the small injection volume correction of each injector are stored in the engine ECU, it will be necessary for the small injection volume correction values to be relearned or for the learned values to be read or rewritten when the injectors (and engine Assy) or the engine ECU is replaced. For details, refer to the HIACE Repair Manual Supplement (Pub. No. RM04Z4E).
- As the engine ECU corrects the NE signals (engine speed signals) sent from the crankshaft position sensor and stores them as learned values before performing extensive intra-cylinder injection volume correction, it will be necessary for the extensive intra-cylinder injection volume correction values to be reset or for the learned values to be read or rewritten when the crankshaft position rotor (and engine Assy) or the engine ECU is replaced. If these operations are not carried out after the corresponding parts are replaced, there is the possibility that engine vibration will be generated. For details, refer to the HIACE Repair Manual Supplement (Pub. No. RM04Z4E).

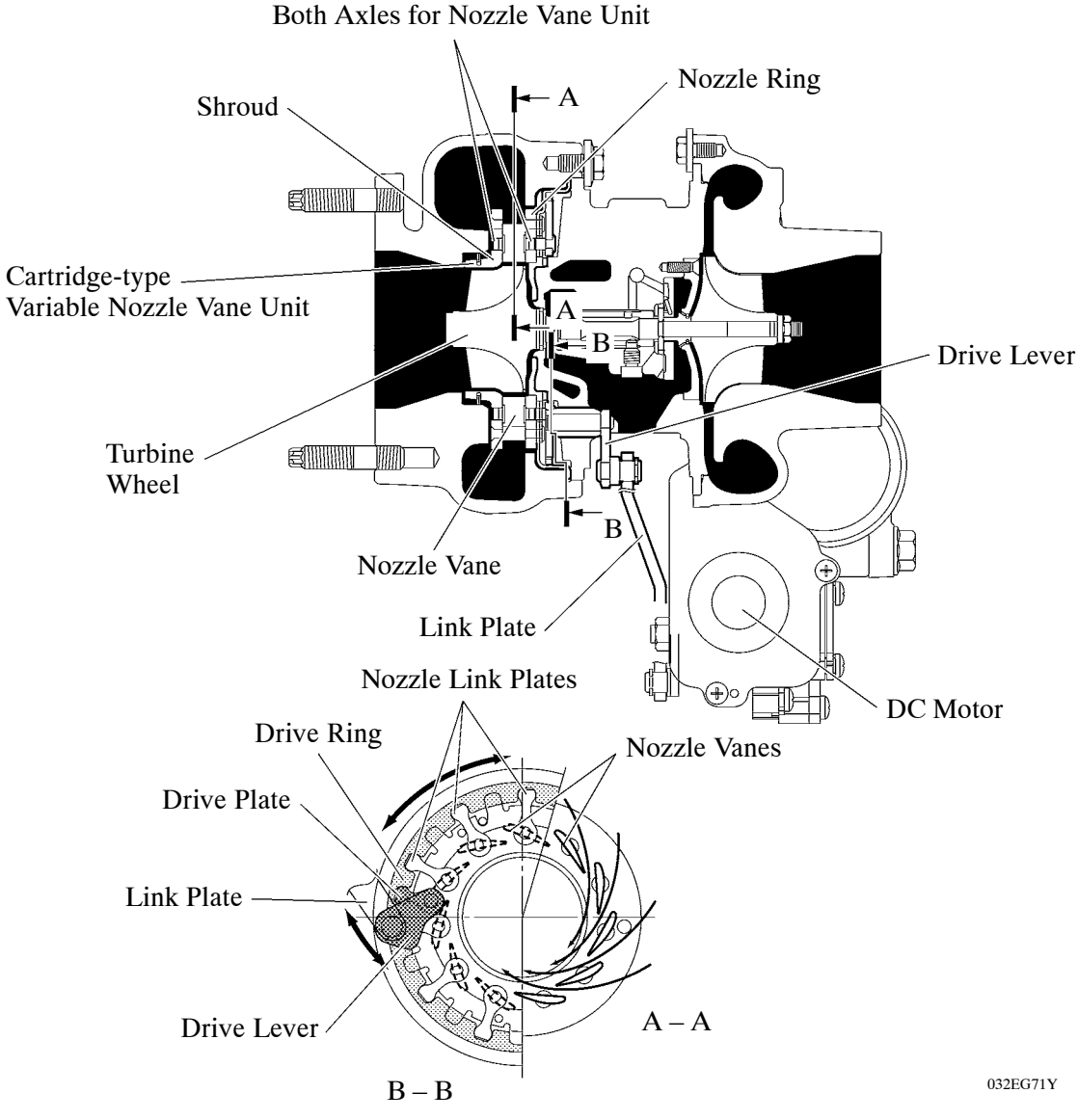
7) Turbocharger Control

a. General

- With the use of a new turbocharger with a small turbine capacity, the structure of the area around the variable nozzle vane unit has been changed.
- As with the previous model, turbocharger control performed by the engine ECU, and a DC motor and nozzle vane position sensor are provided to ensure high responsiveness and realize feedback control.

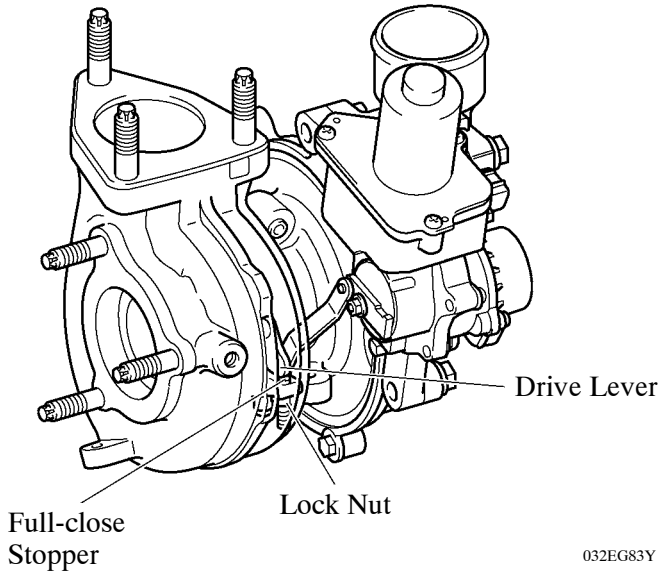
b. Construction

- The variable nozzle vane unit is a cartridge-type unit which is built into the turbine housing, and consists of a shroud, nozzle ring, drive ring, drive ring support, and nozzle link plate, etc.
- Each movable nozzle vane of the variable nozzle vane unit is supported by two axles; one on the shroud side and one on the nozzle ring side. The movement of the drive lever driven by the DC motor is transmitted to the drive ring as rotation, and the nozzle link plates and nozzle vanes that are combined with the drive ring are movable.



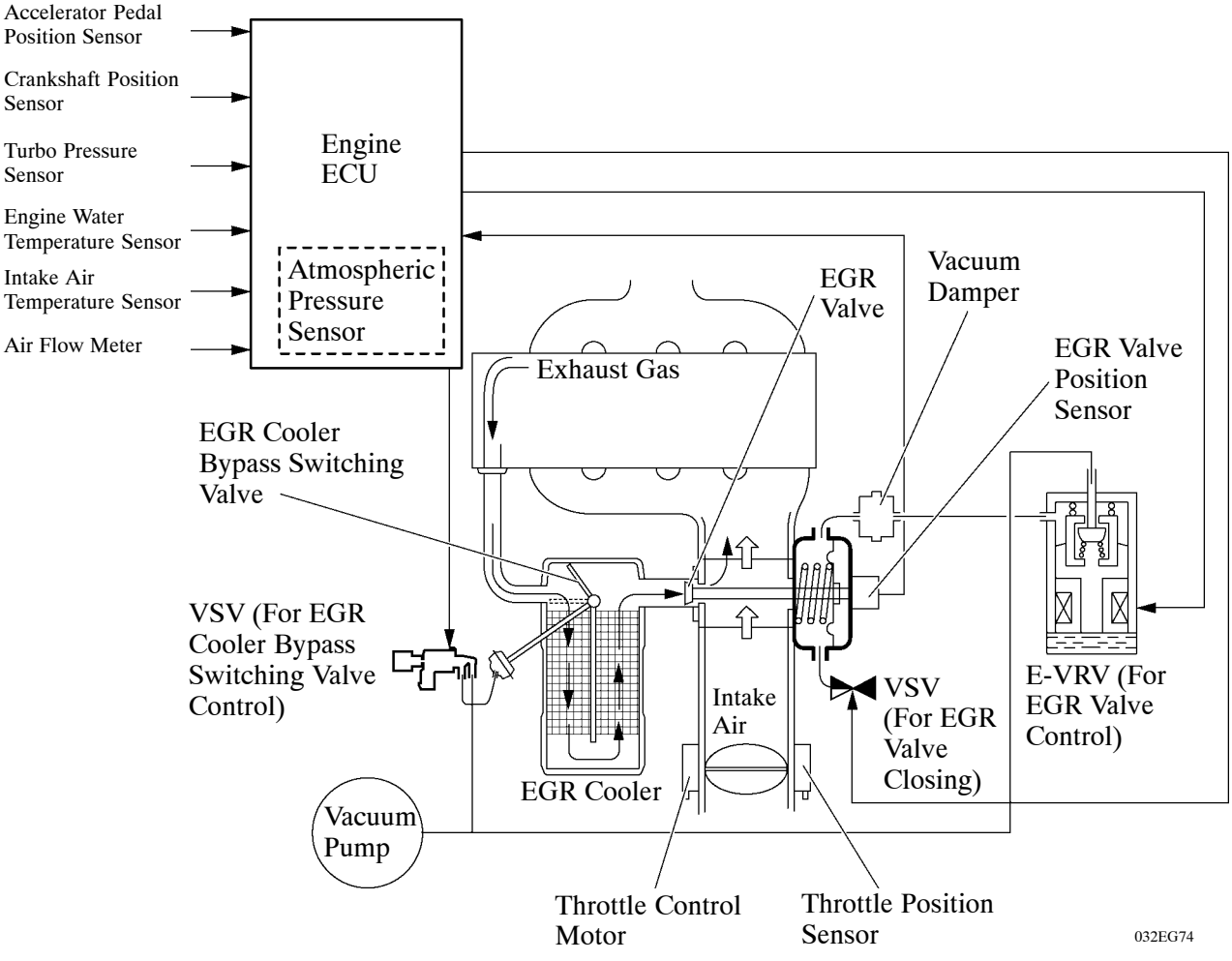
Service Tip

- To control the nozzle vane position, the turbo motor driver renders the contact position of the drive lever and the full-close stopper (nozzle vane fully closed) as the zero point for the nozzle vane position sensor.
- If the turbocharger has been reinstalled or replaced, turn the ignition switch from ON to OFF once, and make sure that the drive lever comes in contact with the full-close stopper.
- The full-close stopper position, which is adjusted at the factory at the time of shipment, is not serviceable in the field. For this reason, if the drive lever does not come in contact with the full-close stopper during an inspection, the turbocharger assembly must be replaced. Never attempt to loosen or tighten the lock nut of the full-close stopper because it will adversely affect the performance of the engine.
- For details, refer to the HIACE Repair Manual Supplement (Pub. No. RM04Z4E).



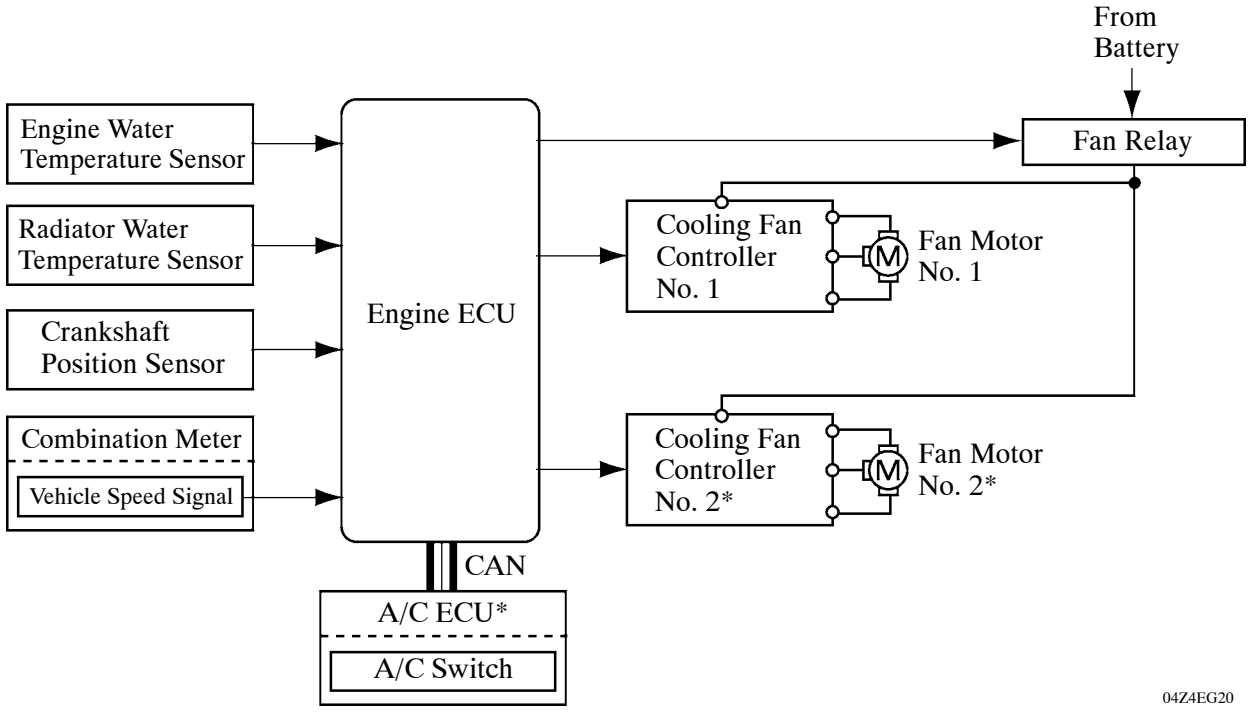
8) EGR Control

- 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 the intake manifold.
- By sensing the engine driving conditions and actual amount of EGR valve opening, the engine ECU electrically operates the E-VRV (for EGR valve control) and VSV (for EGR valve closing), which controls the magnitude of vacuum introduced into the diaphragm of EGR valve and throttle valve opening angle by the throttle control motor, and the amount of recirculating exhaust gas is regulated. EGR valve opening amount is controlled by modulated negative pressure.
- The VSV (for EGR valve closing) is activated when the EGR control is stopped, in order to introduce the atmospheric pressure to the EGR valve diaphragm and improve EGR valve closure response to maintain drivability.
- The engine ECU switches the bypass passage of the EGR cooler via the VSV (for EGR cooler bypass switching valve control) in order to optimize the temperature of the EGR gas and clean exhaust gases.



9) Cooling Fan Control

- In accordance with the abolishment of the sub-radiator, the sub-radiator fan motor control has also been abolished.
- A brushless DC motor that is driven by the three-phase alternative current controlled by the cooling fan controller has been adopted for the fan motor.
- The other fundamental control methods are the same as for the conventional 1KD-FTV engine.



*: Models with Air Conditioner

10) Diagnosis

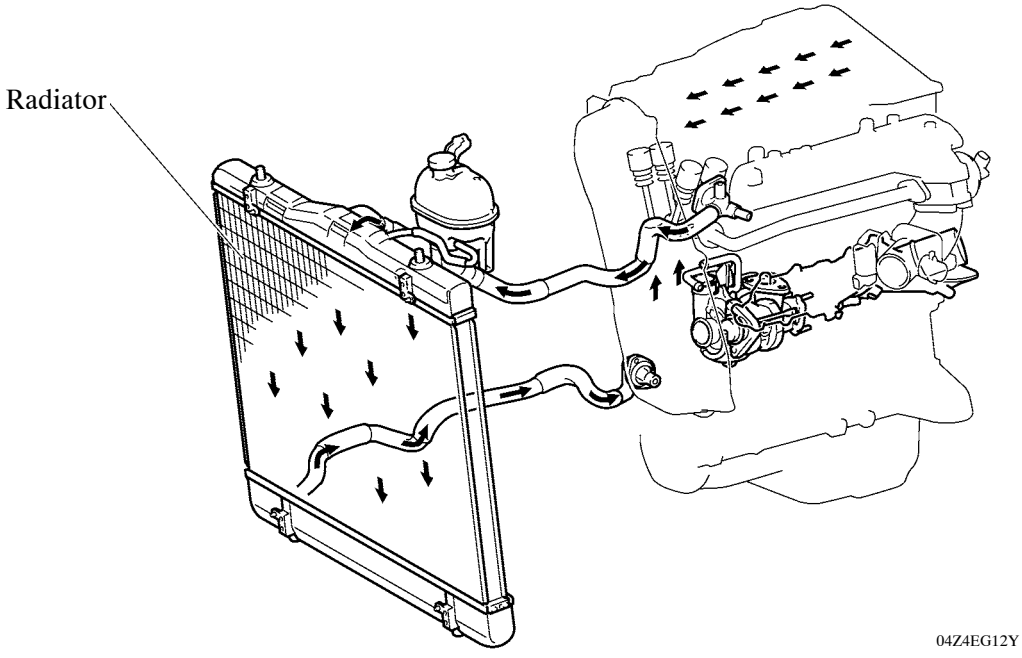
- In accordance with the changes to the engine control system, some DTCs (Diagnostic Trouble Codes) have been added and others have been changed. For details, refer to the HIACE Repair Manual Supplement (Pub. No. RM04Z4E).

3. 2KD-FTV Engine

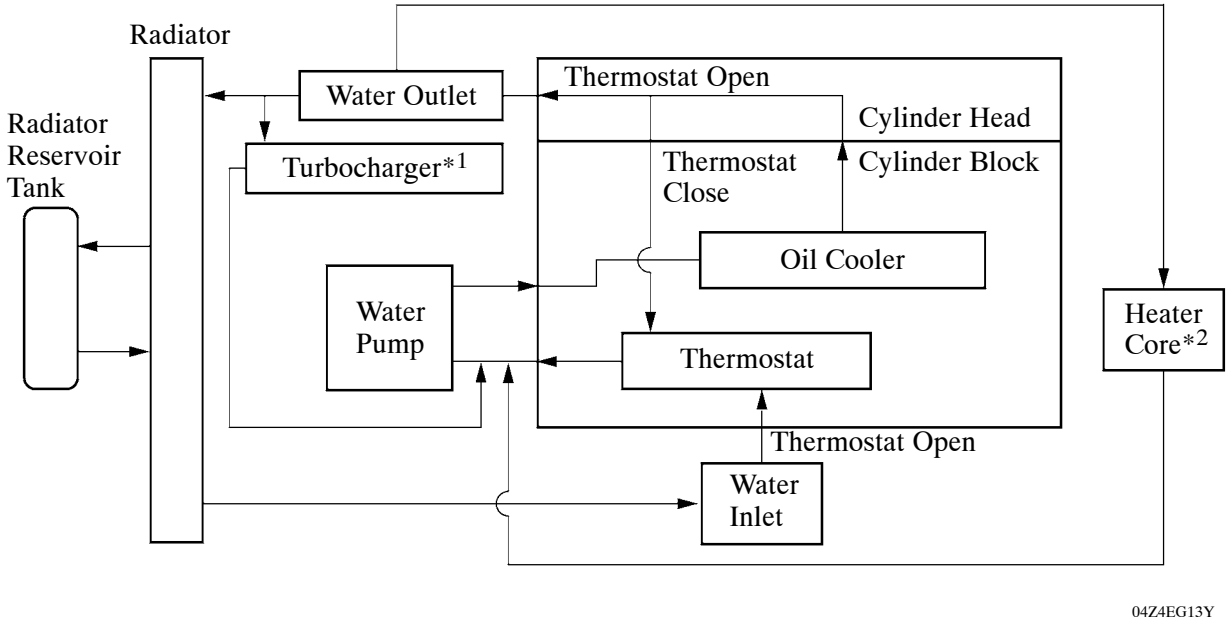
Cooling System

1) General

- The sub-radiator has been abolished.
- By adopting a brushless DC motor for the cooling fan motor to improve the rated output (from 240 W to 300 W), the cooling performance has been optimized. For details, see the 1KD-FTV Engine section (see page 29).



▶ System Diagram ◀



*1: Models without Intercooler
*2: Models with Heater

▶ Specifications ◀

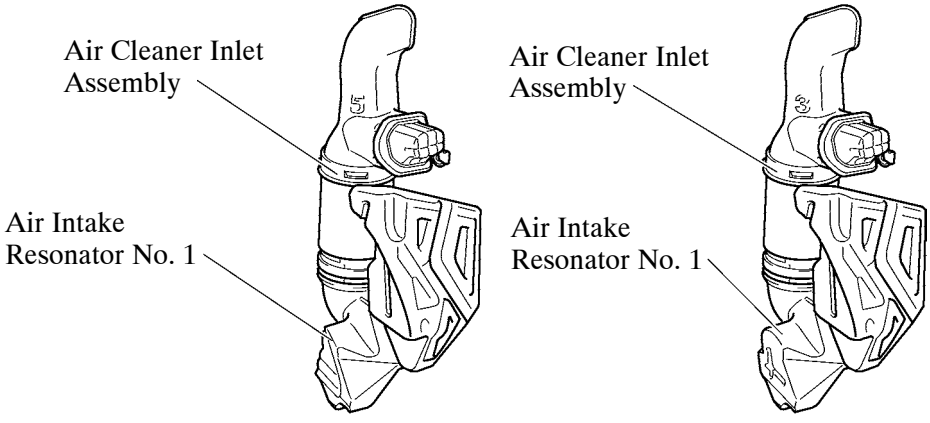
Engine Coolant	Type		TOYOTA Genuine Super Long Life Coolant (SLLC) or similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite and non-borate coolant with long-life hybrid organic acid technology (coolant with long-life hybrid organic acid technology is a combination of low phosphates and organic acids). Do not use plain water alone.
	Color		Pink
	Capacity	With Rear Heater	17.0 Liters (17.9 US qts, 14.9 Imp. qts)
		Without Rear Heater	15.0 Liters (15.9 US qts, 13.2 Imp. qts)
	Maintenance Intervals	First time	160,000 km (100,000 miles)
		Subsequent	Every 80,000 km (50,000 miles)
Thermostat	Opening Temperature °C (°F)		80 – 84 (176 – 183)

SLLC is pre-mixed (50% coolant and 50% deionized water). Therefore, no dilution is needed when SLLC in the vehicle is added or replaced.

Intake and Exhaust System

1) General

- In accordance with the shape change of the front bumper related parts, the shape of the air intake resonator No. 1 provided to the air cleaner inlet assembly has been changed.



Engine Control System

1) Cooling Fan Control

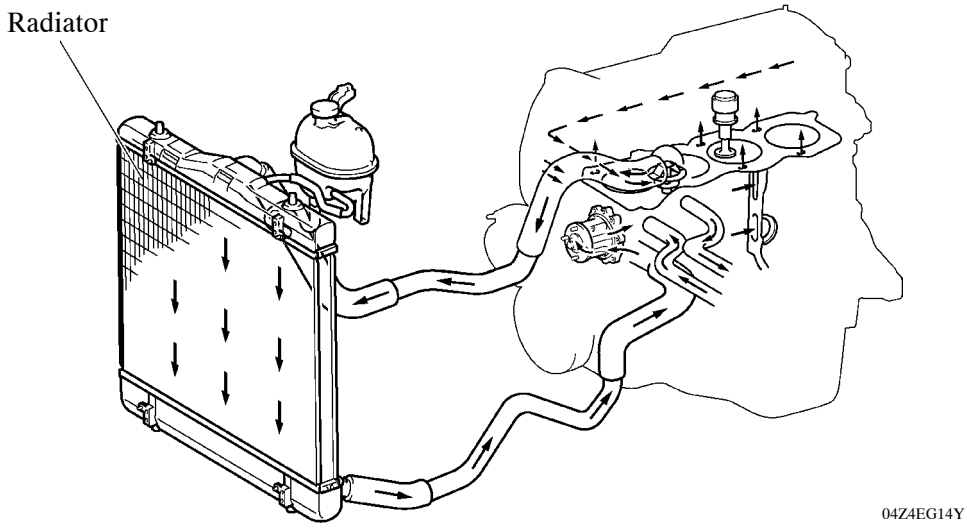
- In accordance with the abolishment of the sub-radiator, the sub-radiator fan motor control has also been abolished.
- A brushless DC motor that is driven by the three-phase alternative current controlled by the cooling fan controller has been adopted for the fan motor. For details, see the 1KD-FTV Engine section (see page 52).

4. 5L-E Engine

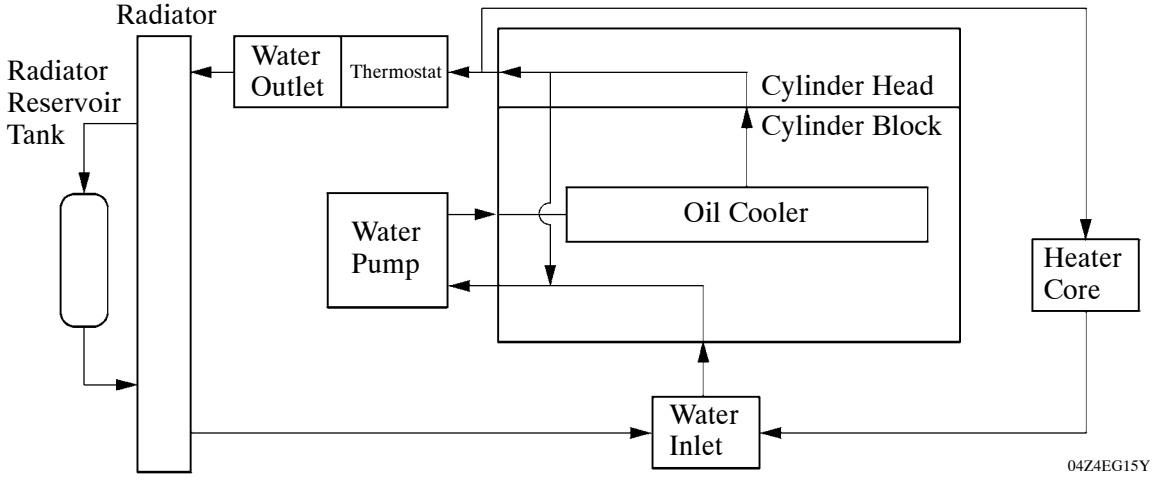
Cooling System

1) General

- The sub-radiator has been abolished.
- By adopting a brushless DC motor for the cooling fan motor to improve the rated output (from 240 W to 300 W), the cooling performance has been optimized. For details, see the 1KD-FTV Engine section (see page 29).



▶ System Diagram ◀



▶ **Specifications** ◀

Engine Coolant	Type		TOYOTA Genuine Super Long Life Coolant (SLLC) or similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite and non-borate coolant with long-life hybrid organic acid technology (coolant with long-life hybrid organic acid technology is a combination of low phosphates and organic acids). Do not use plain water alone.
	Color		Pink
	Capacity	With Rear Heater	16.0 Liters (16.9 US qts, 14.1 Imp. qts)
		Without Rear Heater	14.0 Liters (14.8 US qts, 12.3 Imp. qts)
	Maintenance Intervals	First time	160,000 km (100,000 miles)
		Subsequent	Every 80,000 km (50,000 miles)
Thermostat	Opening Temperature °C (°F)		80 – 84 (176 – 183)

SLLC is pre-mixed (50% coolant and 50% deionized water). Therefore, no dilution is needed when SLLC in the vehicle is added or replaced.

Intake and Exhaust System

1) General

- In accordance with the shape change of the front bumper related parts, the shape of the air intake resonator No. 1 provided to the air cleaner inlet assembly has been changed. For details, see the 2KD-FTV Engine section (see page 54).

Engine Control System

1) Cooling Fan Control

- In accordance with the abolishment of the sub-radiator, the sub-radiator fan motor control has also been abolished.
- A brushless DC motor that is driven by the three-phase alternative current controlled by the cooling fan controller has been adopted for the fan motor. For details, see the 1KD-FTV Engine section (see page 52).