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 inline 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.

3

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

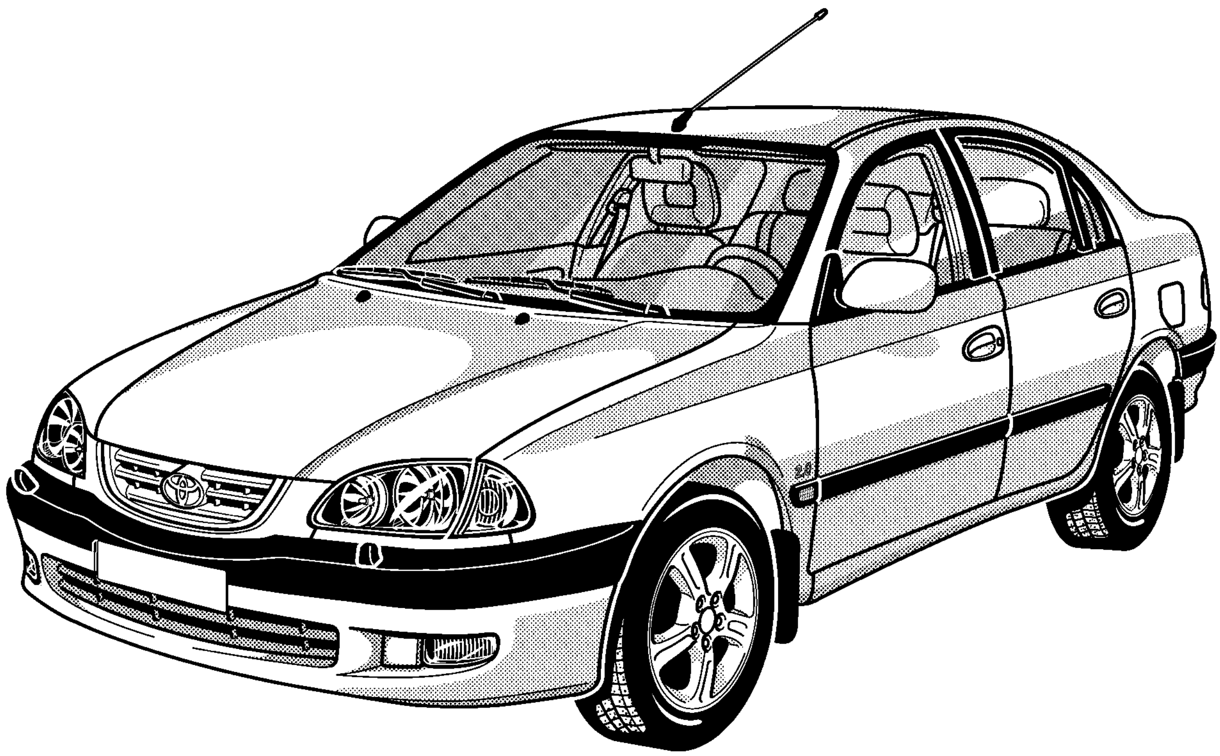
A fuel cut control is adopted to stop the fuel pump when the airbag is deployed at the front or side collision.

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

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

MODEL LINE-UP

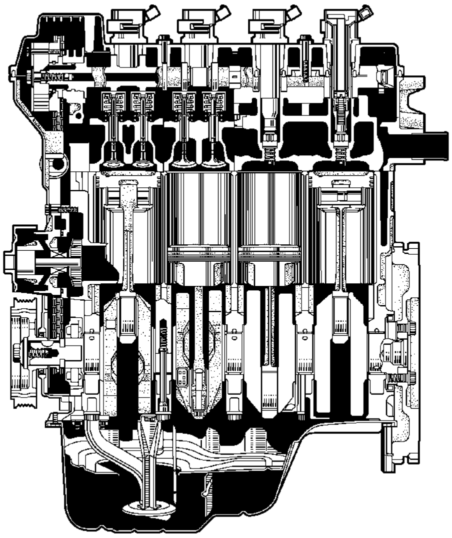
DESTINA-TION	BODY TYPE	ENGINE	GRADE	TRANSAXLE					
				5-Speed Manual				4-Speed Automatic	
				C50	C250	S55	E351	A246E	U240E
Europe	4-Door Sedan	3ZZ-FE	LINEA TERRA	ZZT220 $^{R}_{L}$– AEMNKW					
			LINEA SOL	ZZT220L– AEMEKW					
		1ZZ-FE	LINEA TERRA		ZZT221 $^{R}_{L}$– AEMNKW			ZZT221 $^{R}_{L}$– AEPNKW	
			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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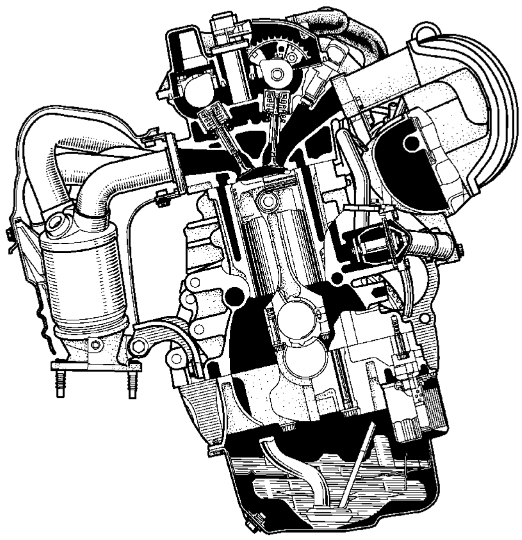
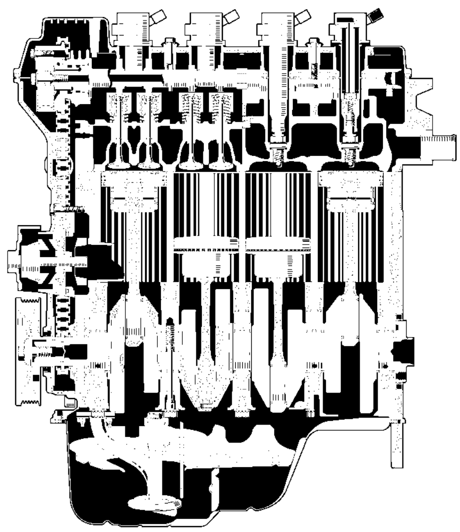
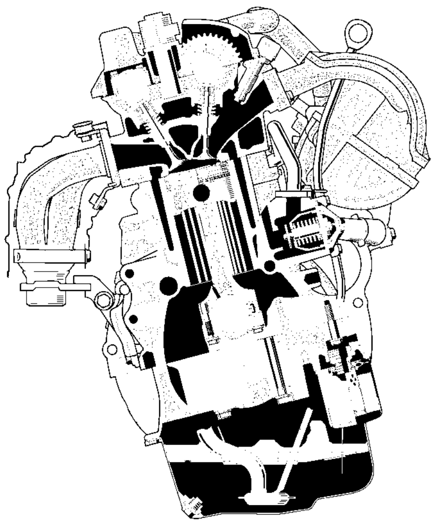


195EG110

1ZZ-FE Engine



178EG01



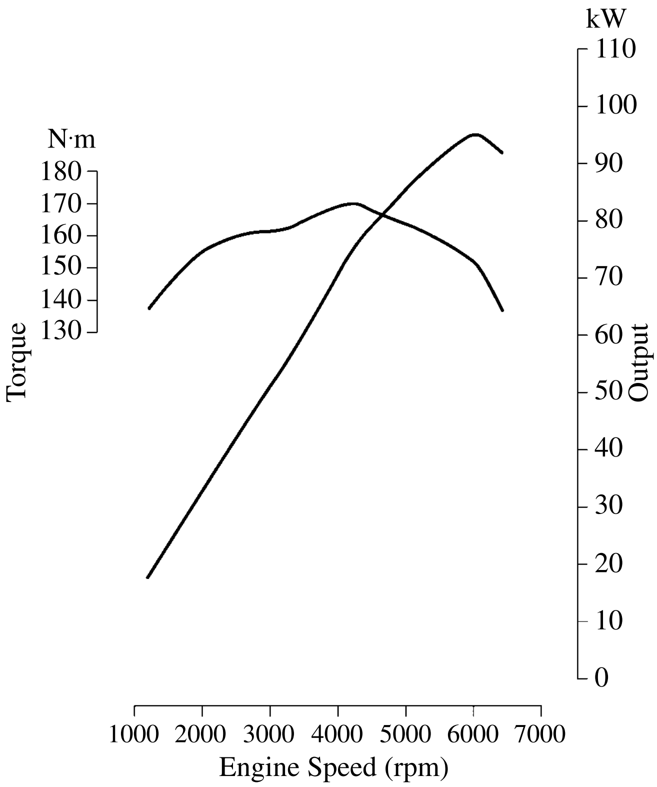
178EG02

3ZZ-FE Engine

▶ Engine Specifications ◀

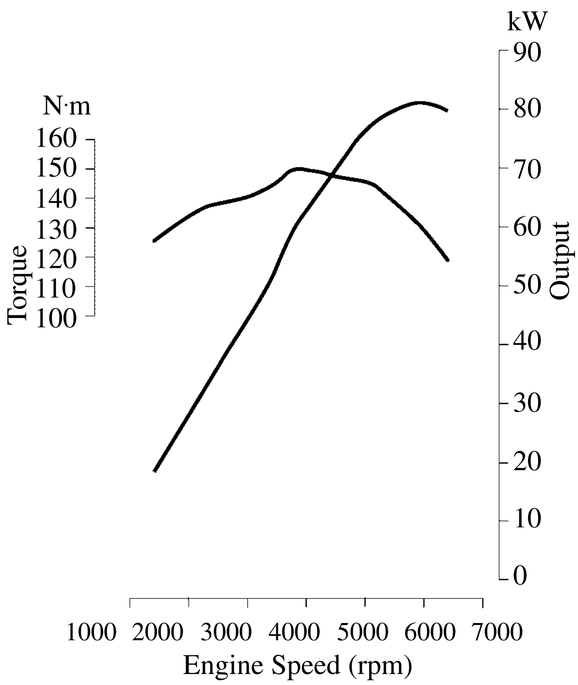
Engine Type			1ZZ-FE	3ZZ-FE
No. of Cyls. & Arrangement			4-Cylinder, In-line	←
Valve Mechanism			16-Valve DOHC, Chain Drive	←
Combustion Chamber			Pentroof Type	←
Manifolds			Cross-Flow	←
Fuel System			EFI	←
Displacement cm^3 (cu.in.)			1794 (109.5)	1598 (97.5)
Bore x Stroke mm (in.)			79.0 x 91.5 (3.11 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

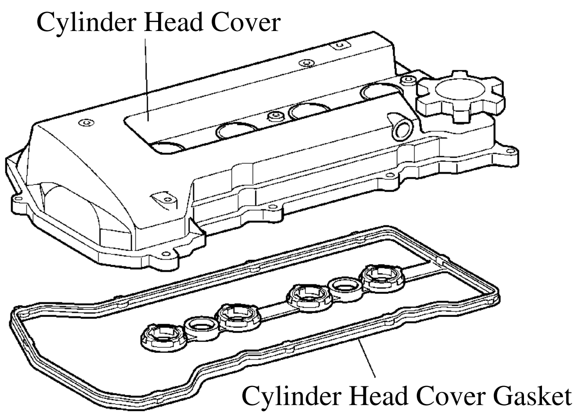
Item	(1)	(2)	(3)	(4)	(5)
The VVT-i system is used.	○				○
A cylinder block made of aluminum alloy has been adopted.			○		
The DIS (Direct Ignition System) makes ignition timing adjustment unnecessary.	○			○	
A serpentine belt drive system has been adopted.			○	○	
The fuel retrunless system has been adopted.			○	○	○
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

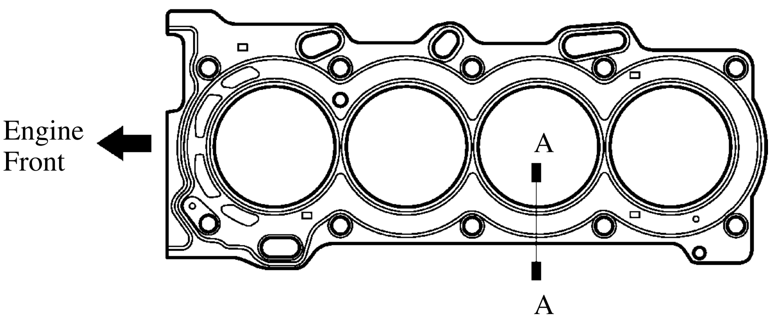
- Lightweight yet high-strength aluminum die-cast cylinder head cover is used.
- The cylinder head cover gasket and the spark plug gasket have been integrated to reduce the number of parts.
- Acrylic rubber, which excels in heat resistance and reliability, has been adopted for the cylinder head cover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

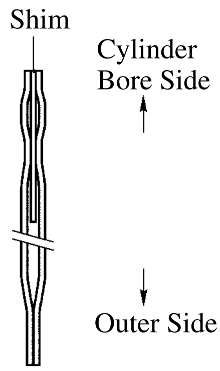


174EG03

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.





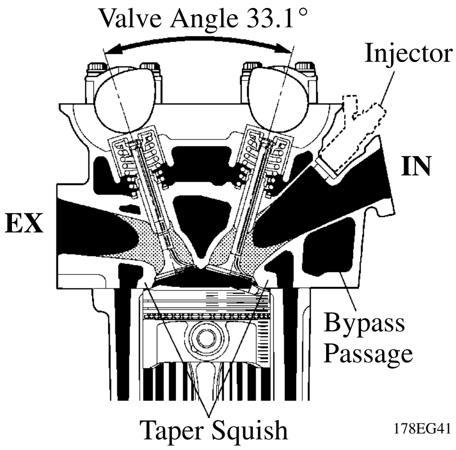
A – A Cross Section

174EG04 178EG40

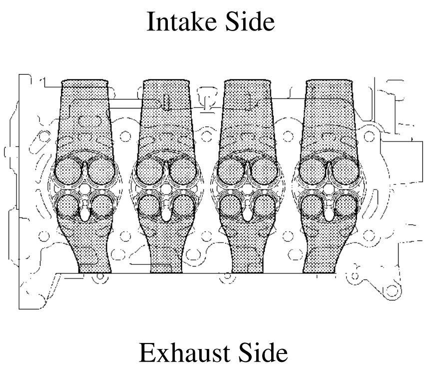
Cylinder Head

- 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.

3



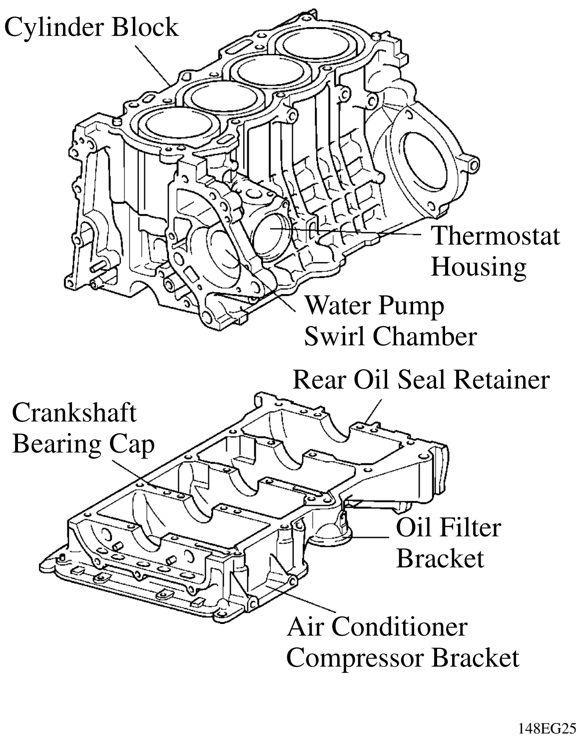
178EG41



148EG26

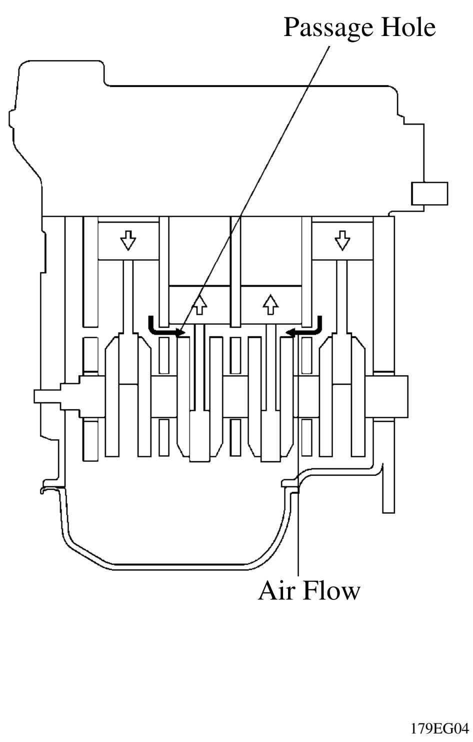
Cylinder Block

- 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.



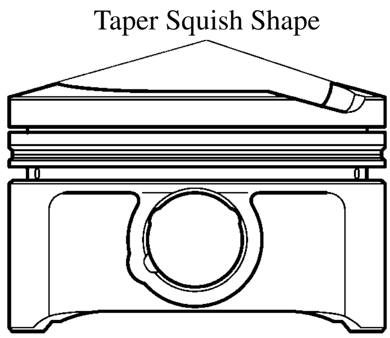
Ladder-frame Construction

▶ Air Flow During Engine Revolution ◀



Piston

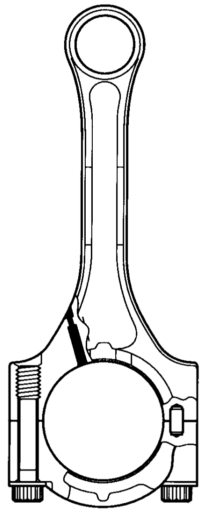
- The piston is made of aluminum alloy and skirt area is made compact and lightweight.
- The piston head portion has adopted a taper squish shape to improve the fuel combustion efficiency.
- Full floating type piston pins are used.
- By increasing the machining precision of the cylinder bore diameter,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



178EG28

Connecting Rod

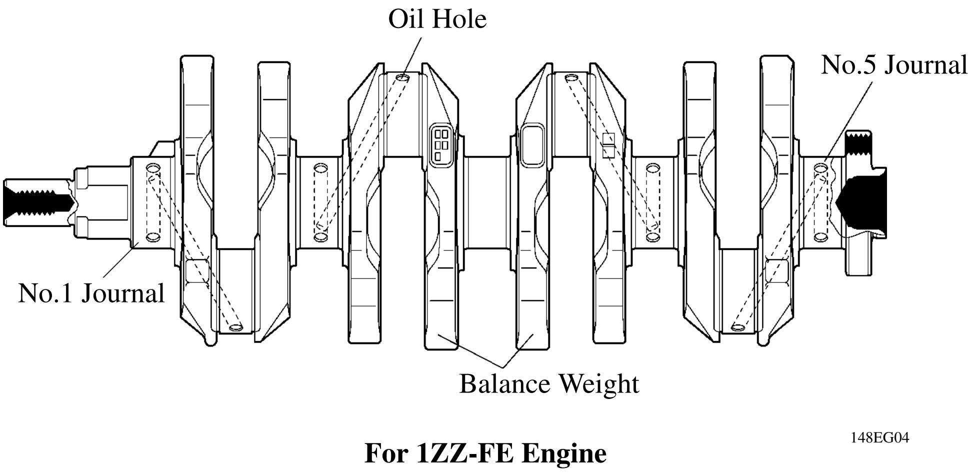
- The connecting rods are made of high-strength material for weight reduction.
- The connecting rod bearings have been reduced in width to reduce friction.
- Nutless-type plastic region tightening bolts of the connecting rod are adopted for a lighter design.



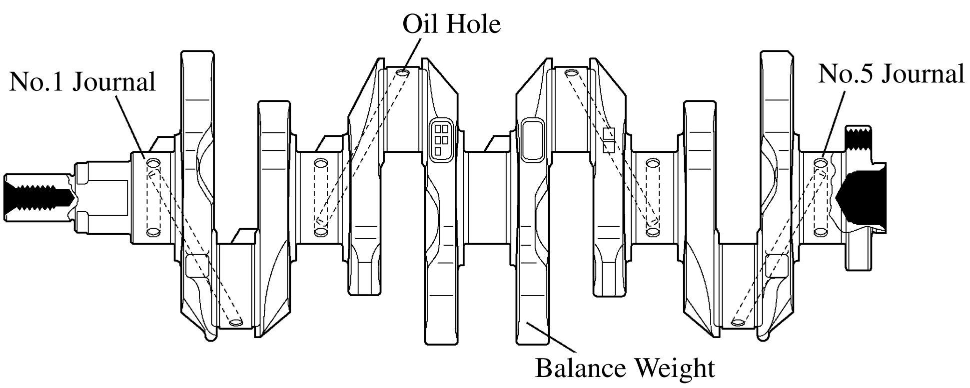
178EG29

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.



For 1ZZ-FE Engine

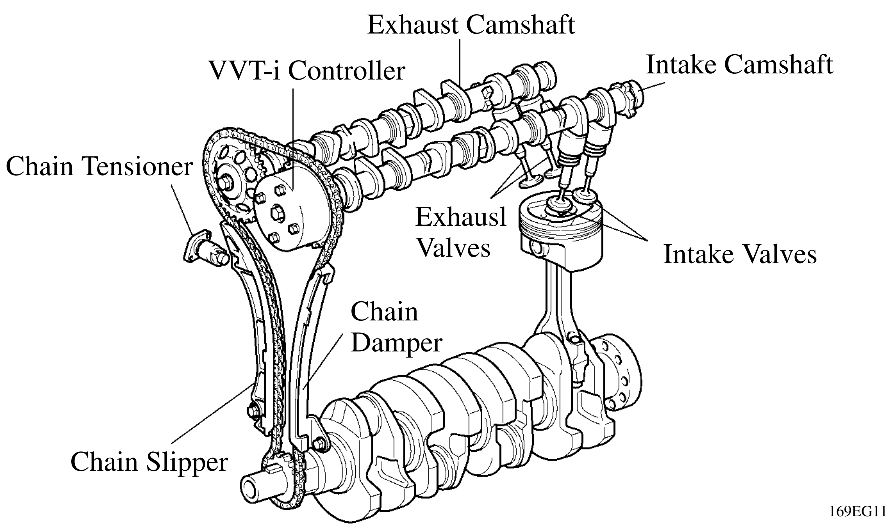


For 3ZZ-FE Engine

4. Valve Mechanism

General

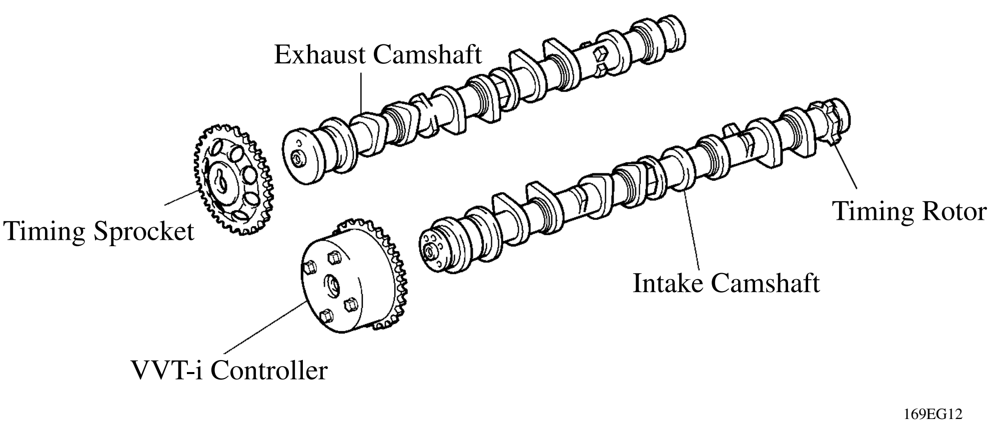
- Each cylinder is equipped with 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency has been increased due to the larger total port areas.
- The valves are directly opened and closed by 2 camshafts.
- The shimless type valve lifter is used.
- The intake and exhaust camshafts are driven 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

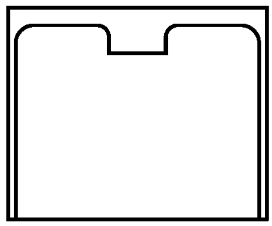
Camshaft

- 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

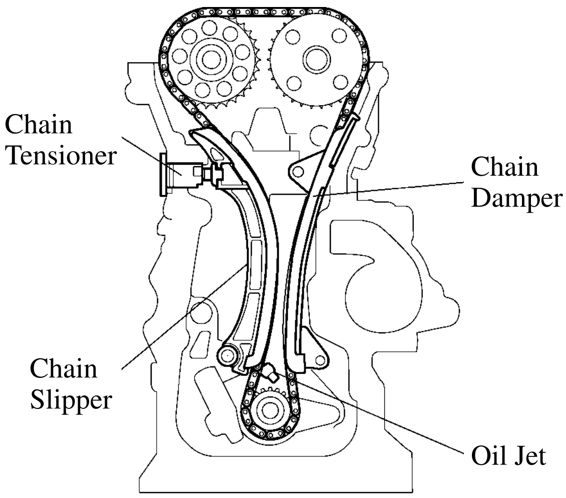
Along with the increase of the amount of valve lift, the valve adjusting shims have been discontinued and the shimless type of the valve lifter has been adopted. This valve lifter enables to make the cam contact surface greater.
The adjustment of the valve clearances is accomplished by selecting and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



148EG05

Timing Chain

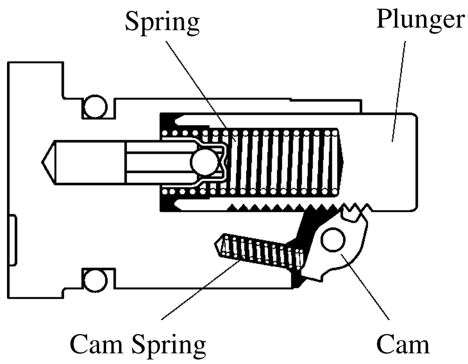
- A roller chain with an 8 mm pitch has been adopted to make the engine more compact.
- A material which has excellent wear resistance has been selected for the timing chain to improve reliability.
- The timing chain is lubricated by an oil jet.



185EG02

Chain Tensioner

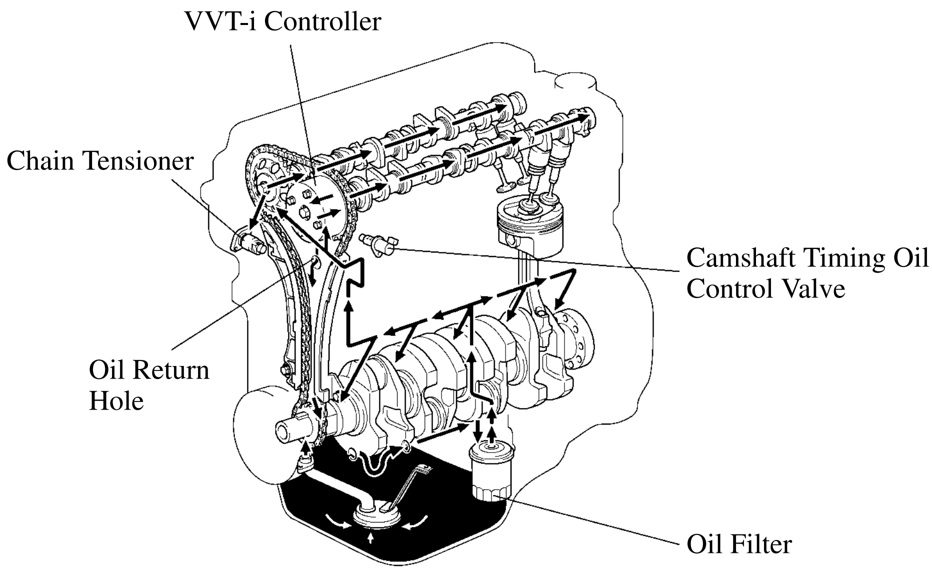
- The chain tensioner uses a spring and oil pressure to maintain proper chain tension at all times.
  The chain tensioner suppresses noise generated by the chain.
- A ratchet type non-return mechanism is also used.
- To improve serviceability, the chain tensioner is constructed so that it can be removed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



178EG05

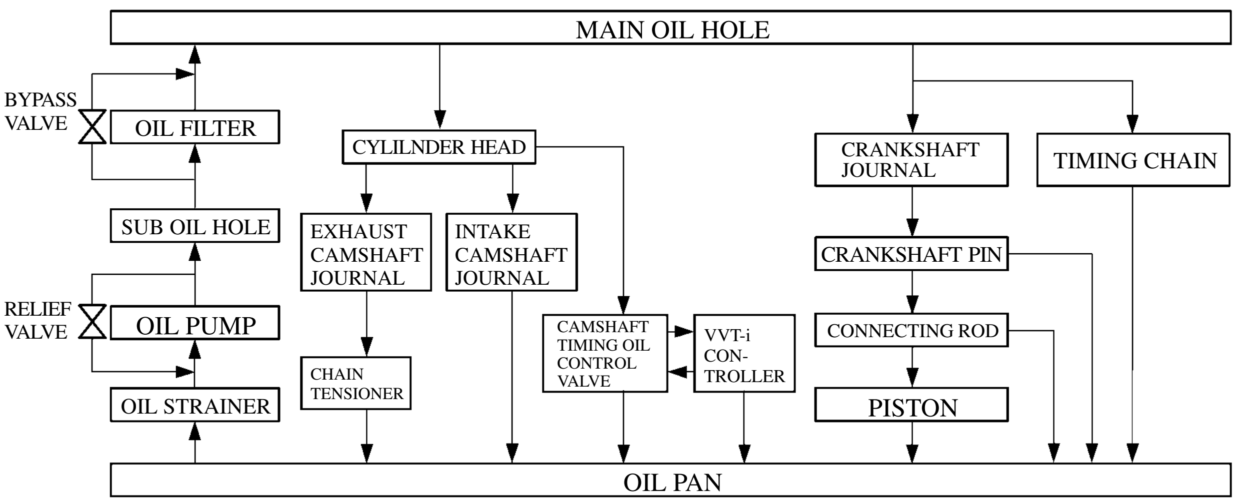
5. Lubrication System

- 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

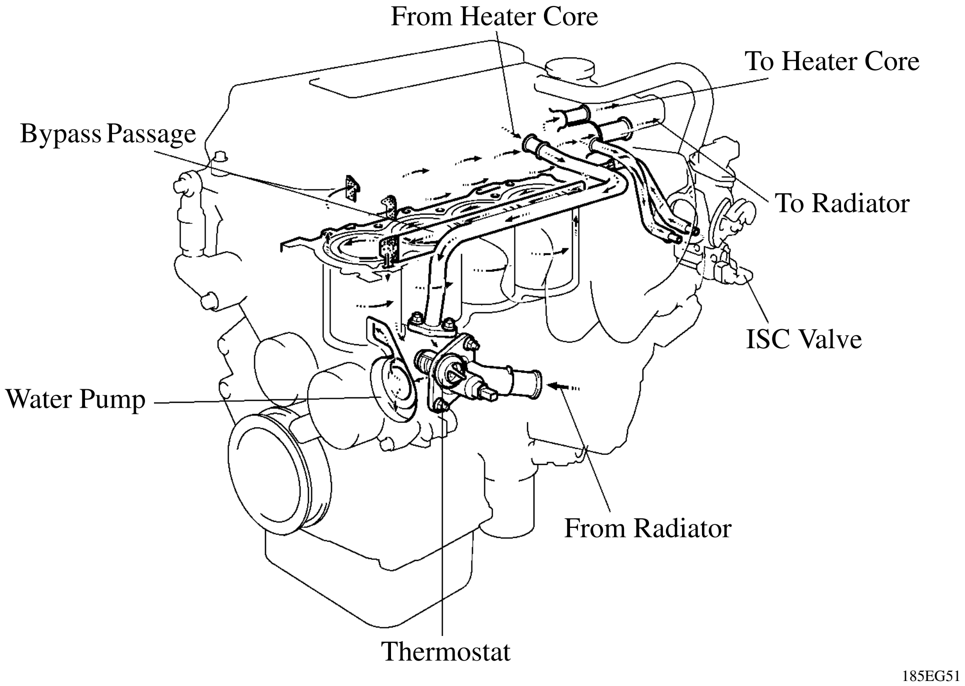
For 1ZZ-FE Engine

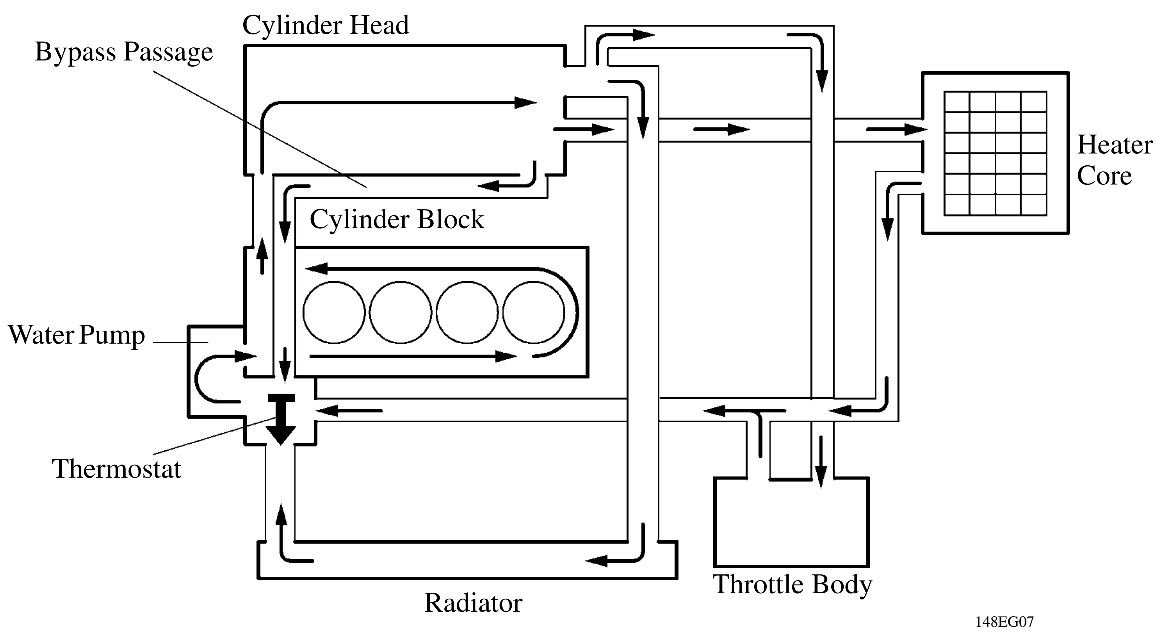


195EG04

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.





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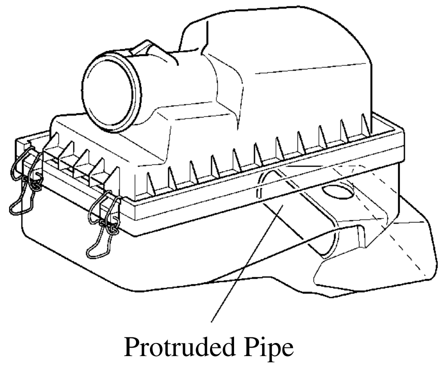
7. Intake and Exhaust System

Air Cleaner

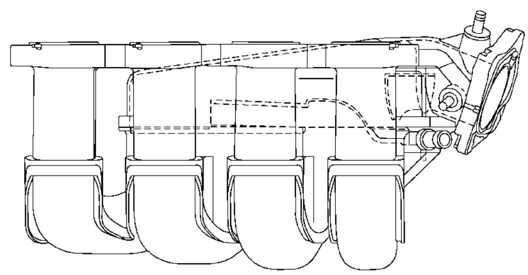
- A protruded pipe that is composite-formed with the case has been added in the air cleaner case to reduce the amount of the intake sound.



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.

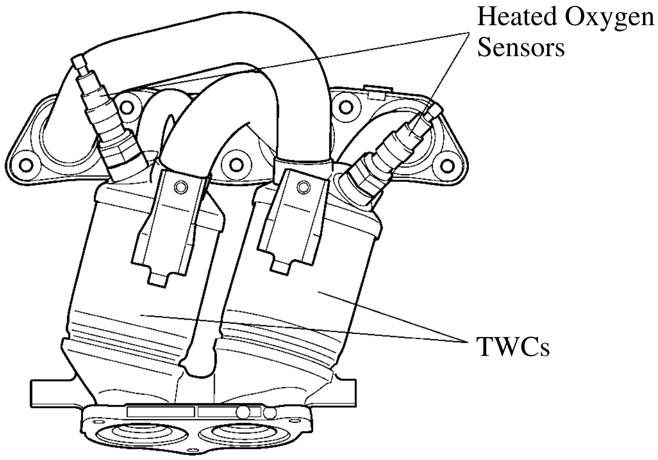


For 1ZZ-FE Engine

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

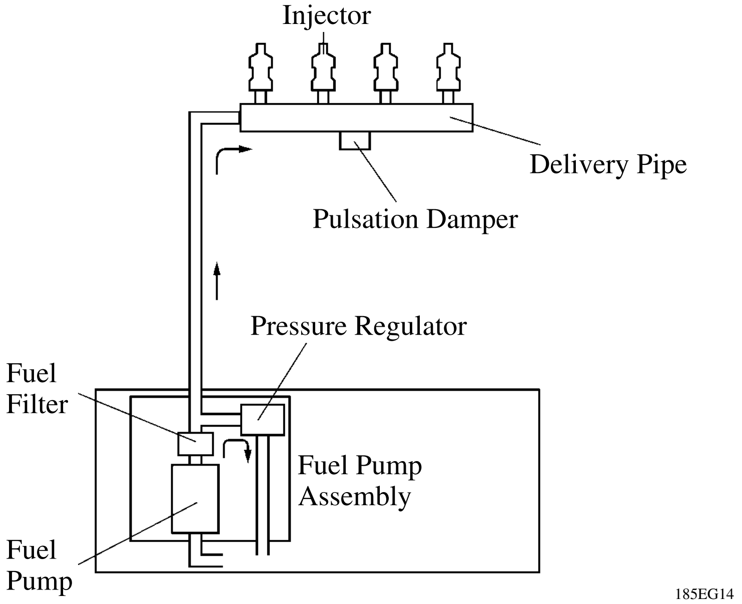
8. Fuel System

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.

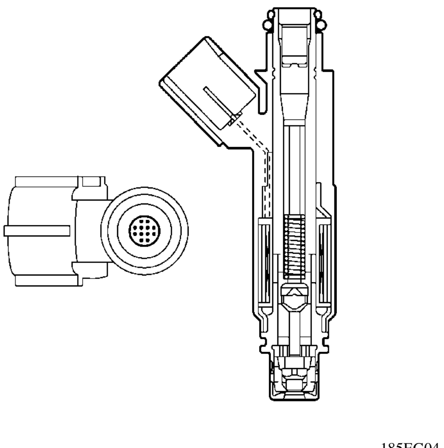
Fuel Returnless System

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.

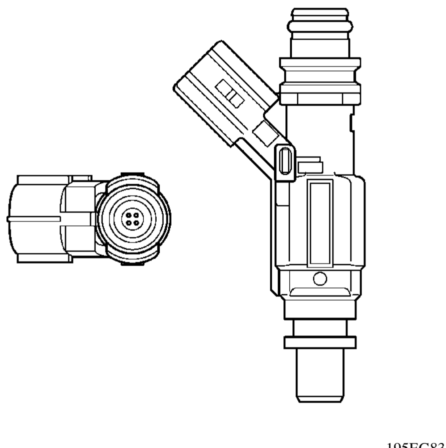


Injector

- 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.



For 1ZZ-FE Engine

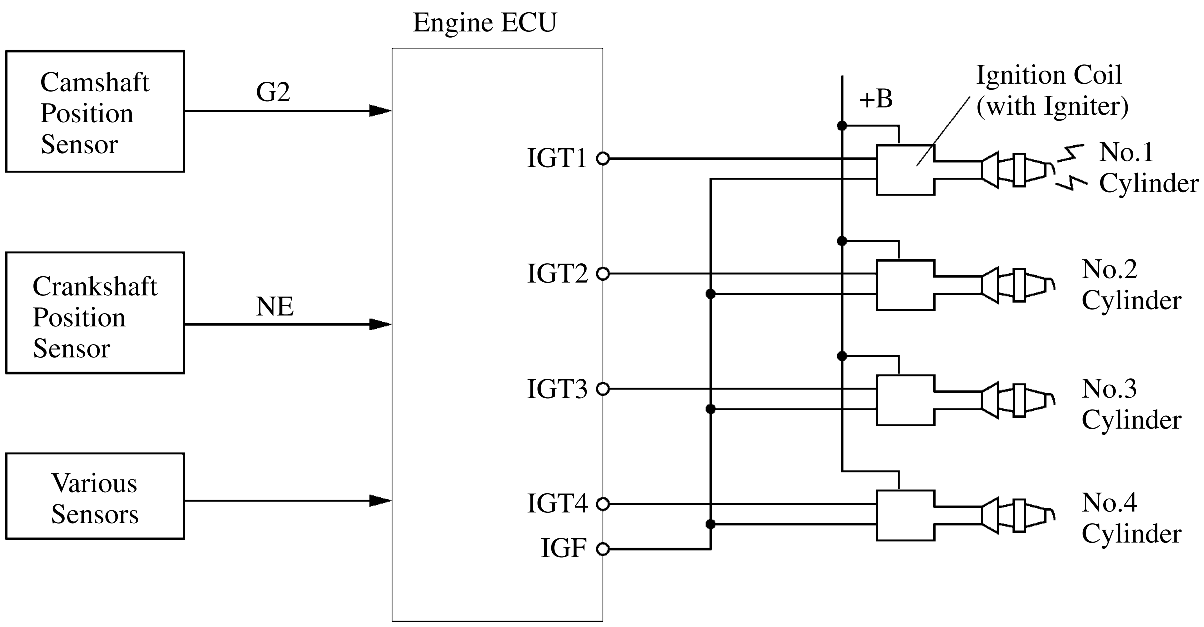


For 3ZZ-FE Engine

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.



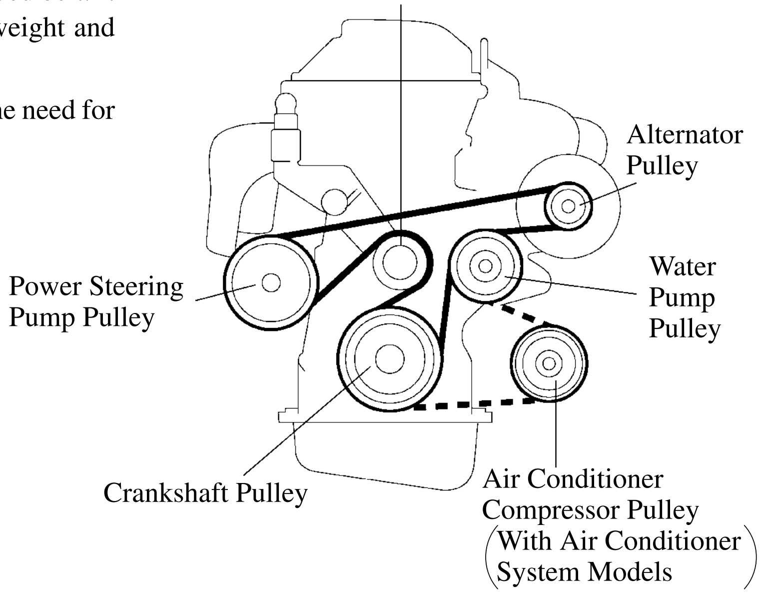
165EG25

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.

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

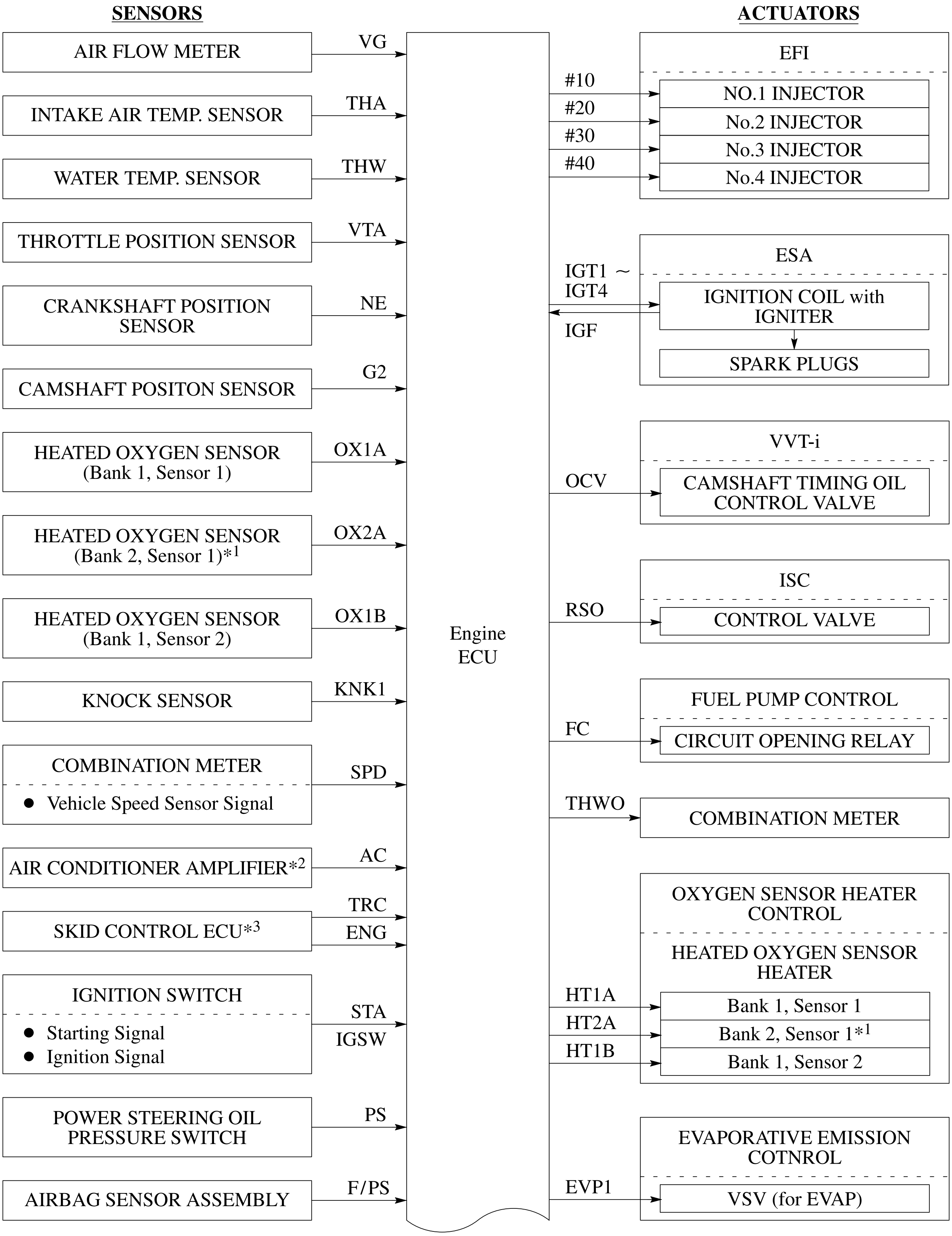
The engine control system for the 1ZZ-FE and 3ZZ-FE engines have following features.

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

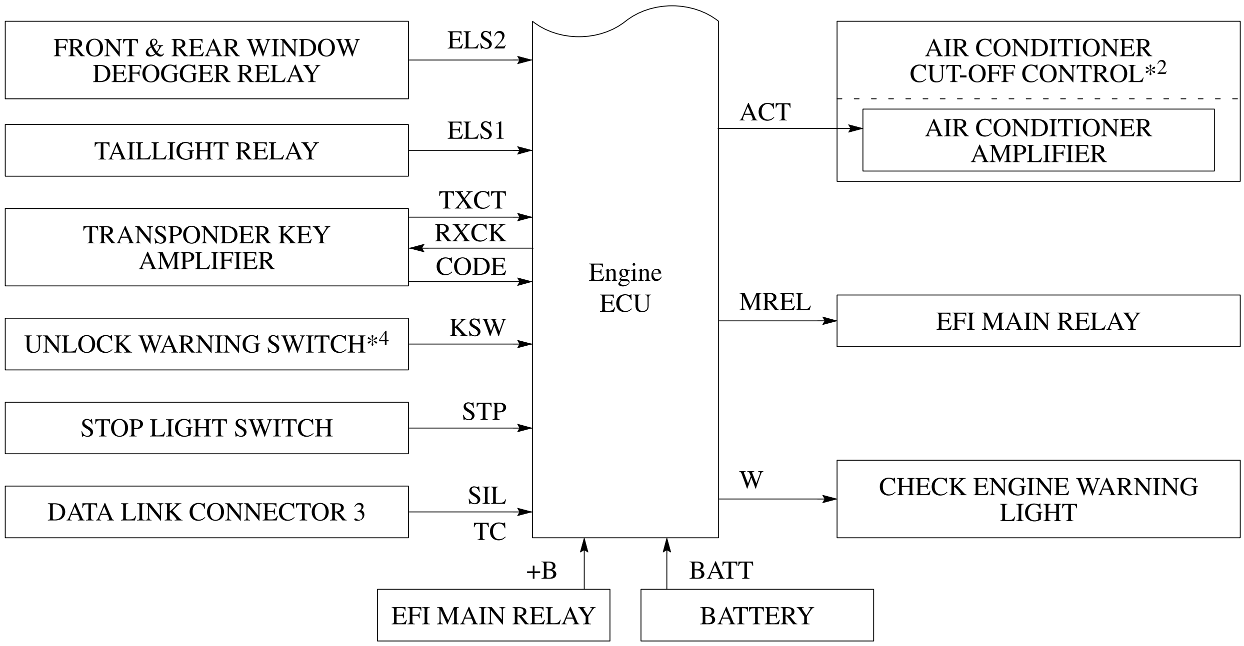
Construction

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

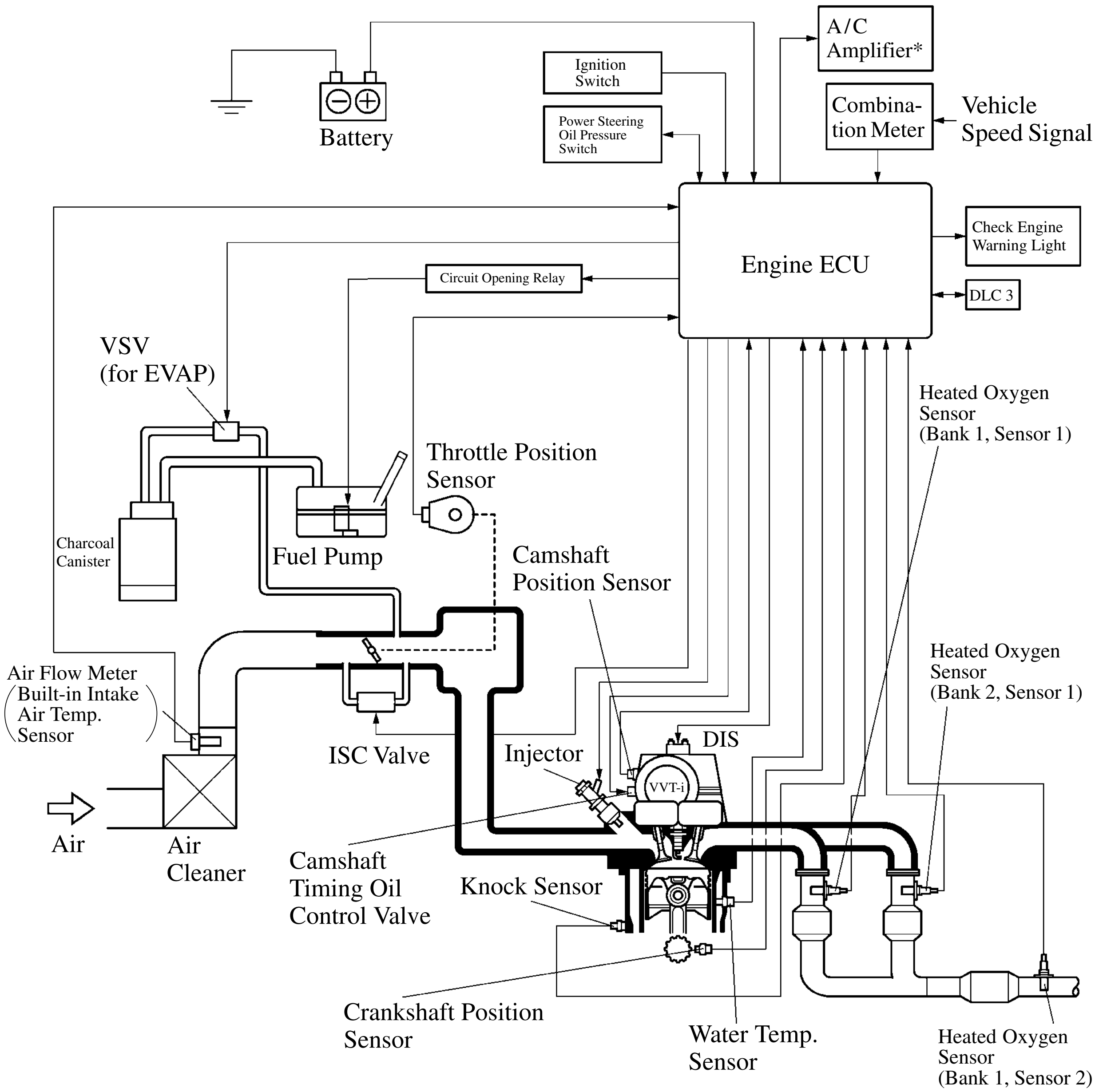
(Continued)



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

3

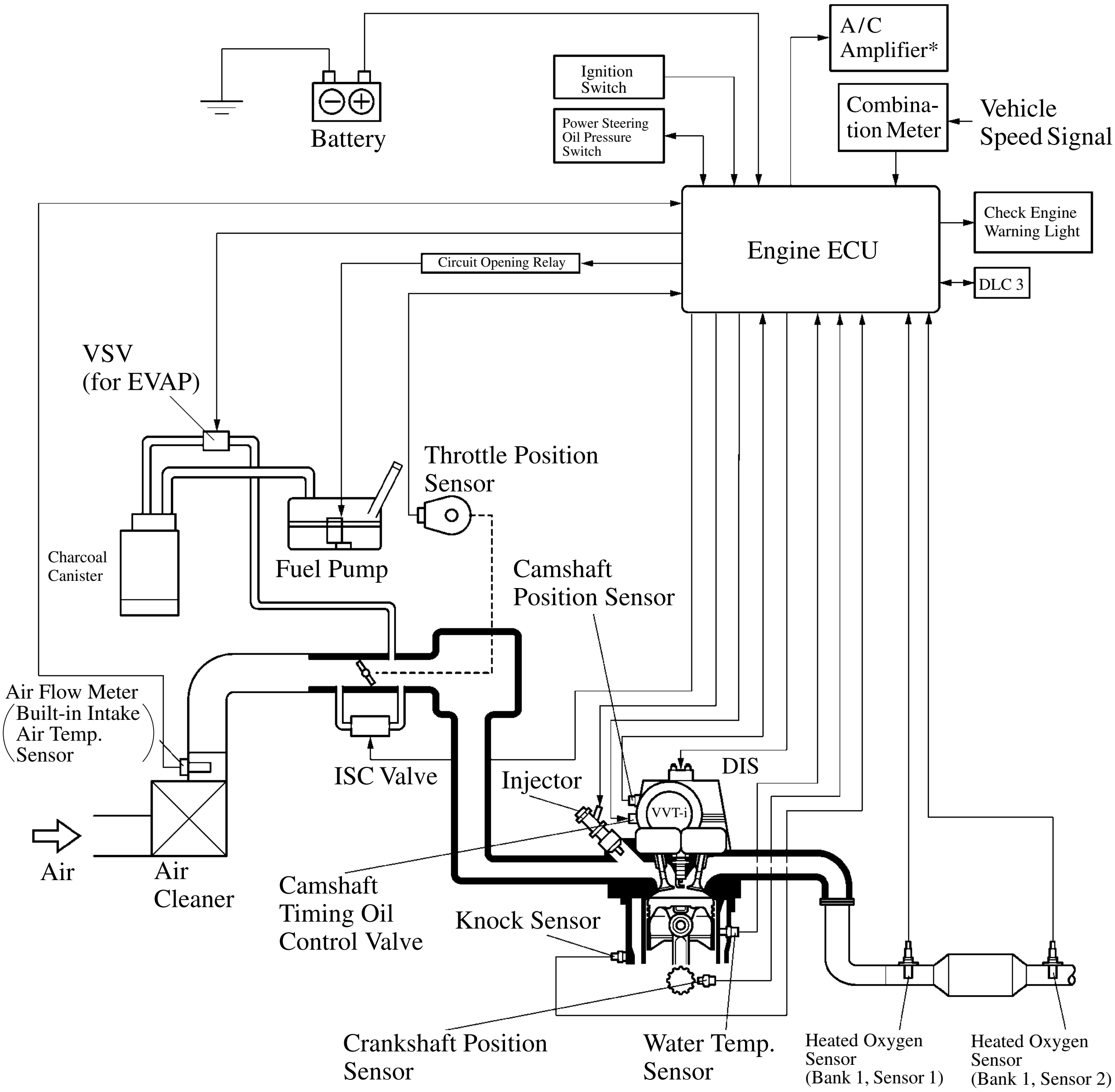
Engine Control System Diagram



*: With Air Conditioner

For 1ZZ-FE Engine

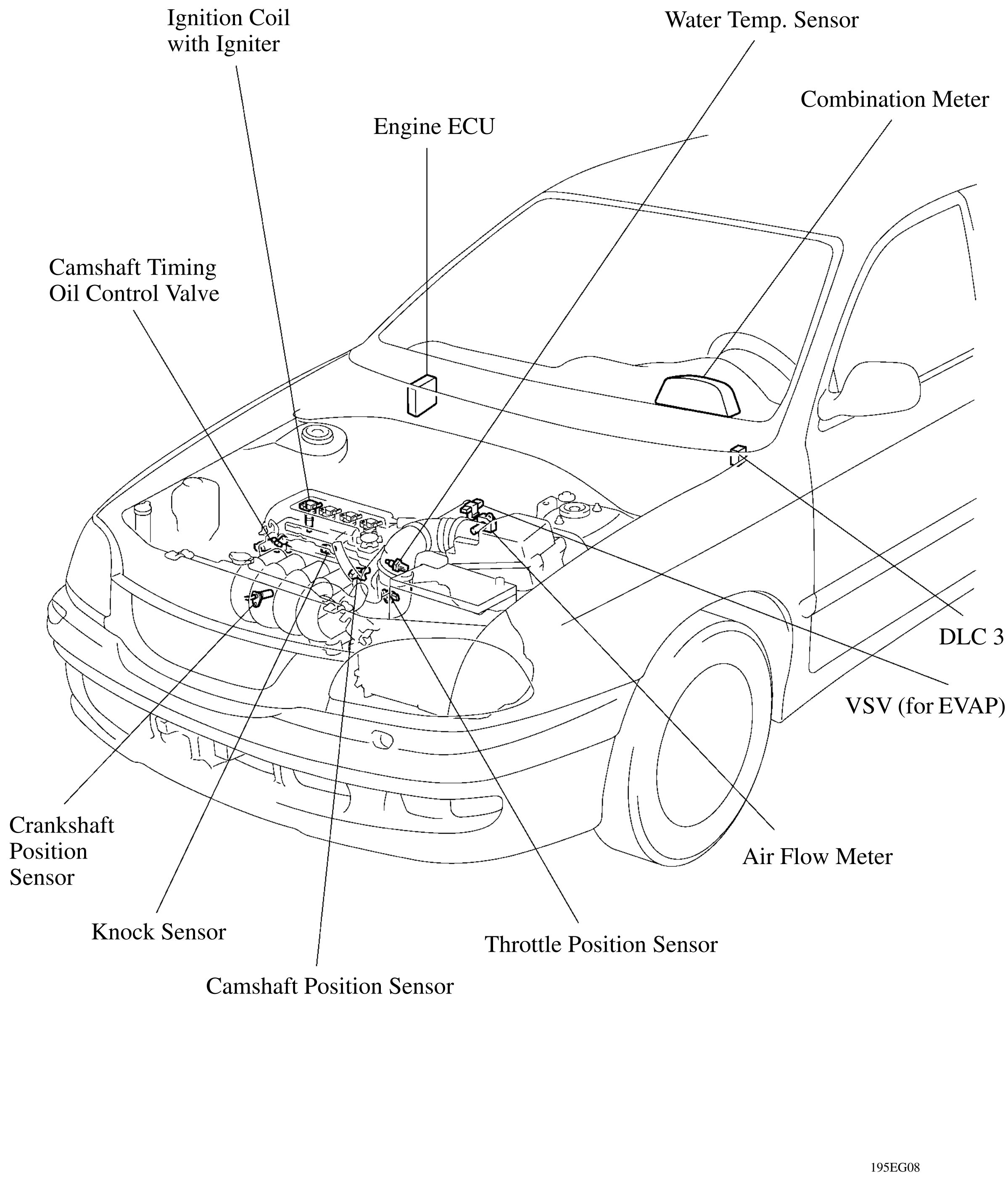
195EG07



*: With Air Conditioner

For 3ZZ-FE Engine

Layout of Main Components



Main Components of Engine Control System

1) General

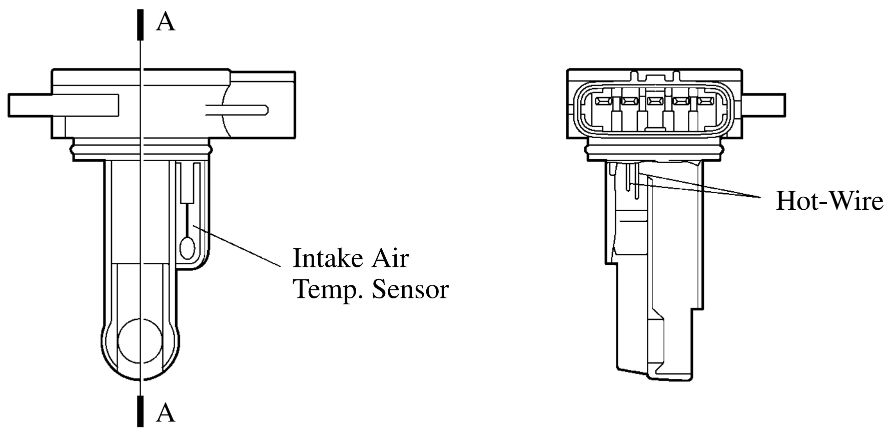
The main components of the 1ZZ-FE and 3ZZ-FE engines control system are as follows:

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.



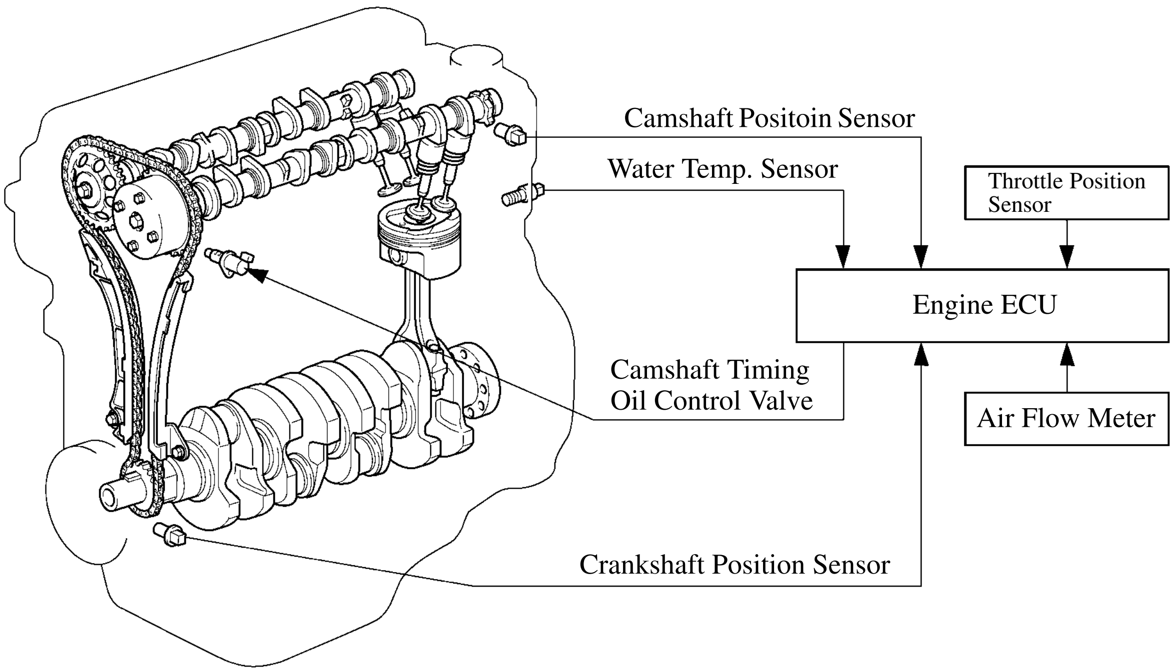
A – A Cross Section

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.



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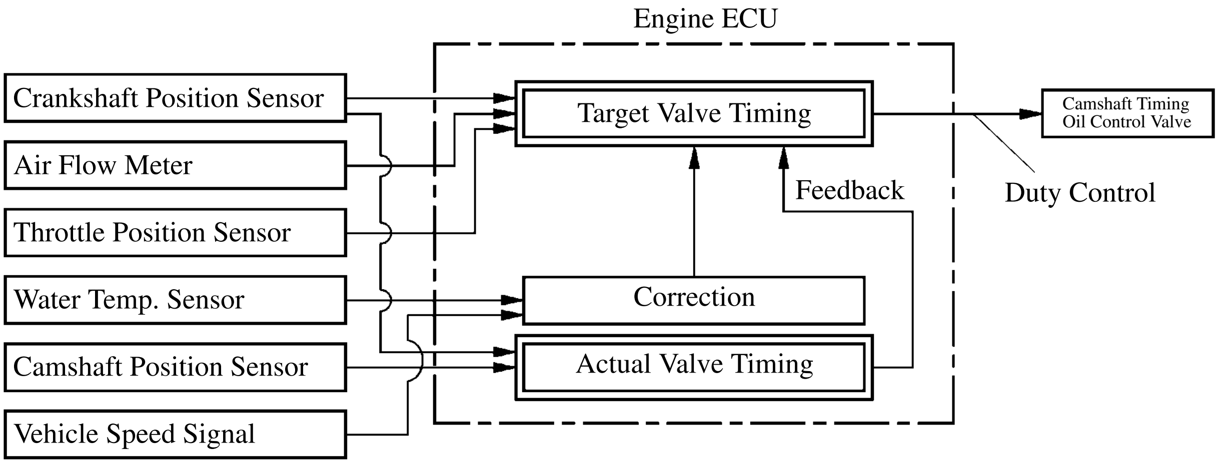
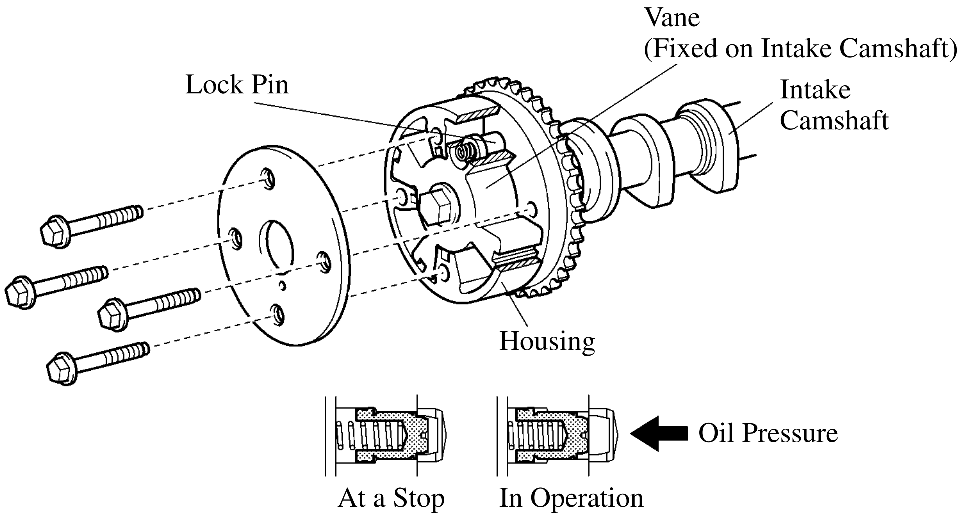


172CR07

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.

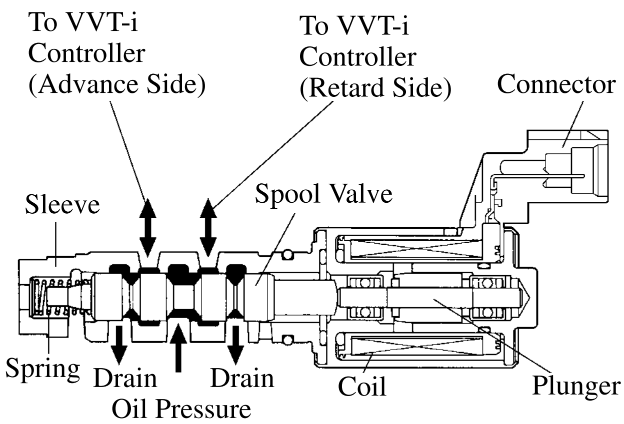


Lock Pin

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.



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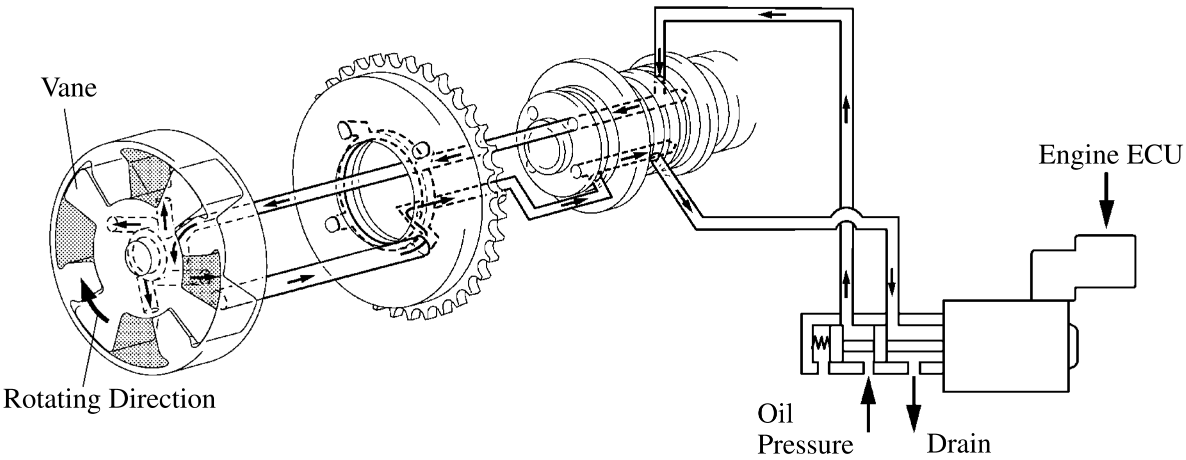
3) Operation

- 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

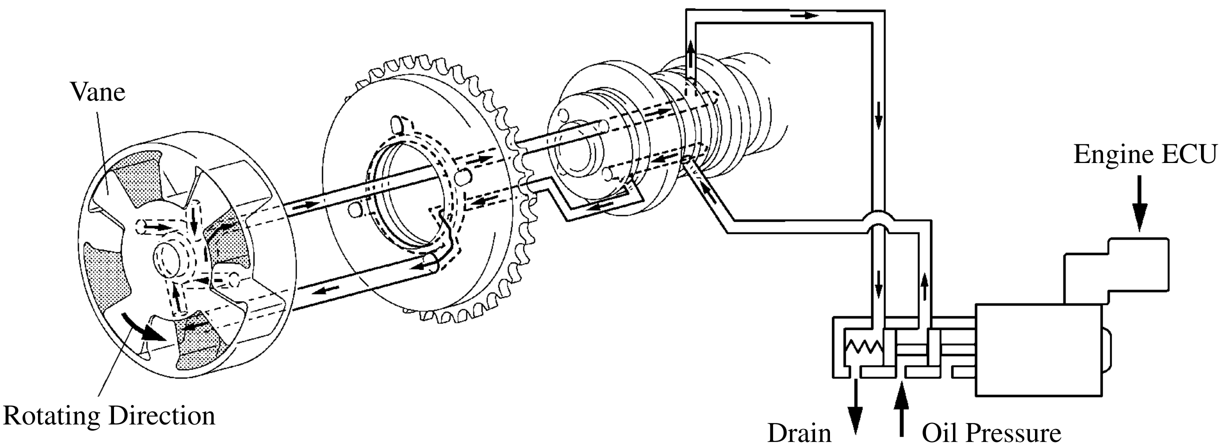
When the camshaft timing oil control valve is positioned as illustrated below by the advance signal from the engine ECU, the resultant oil pressure is applied to the timing advance side vane chamber to rotate the camshaft in the timing advance direction.



185EG18

b. Retard

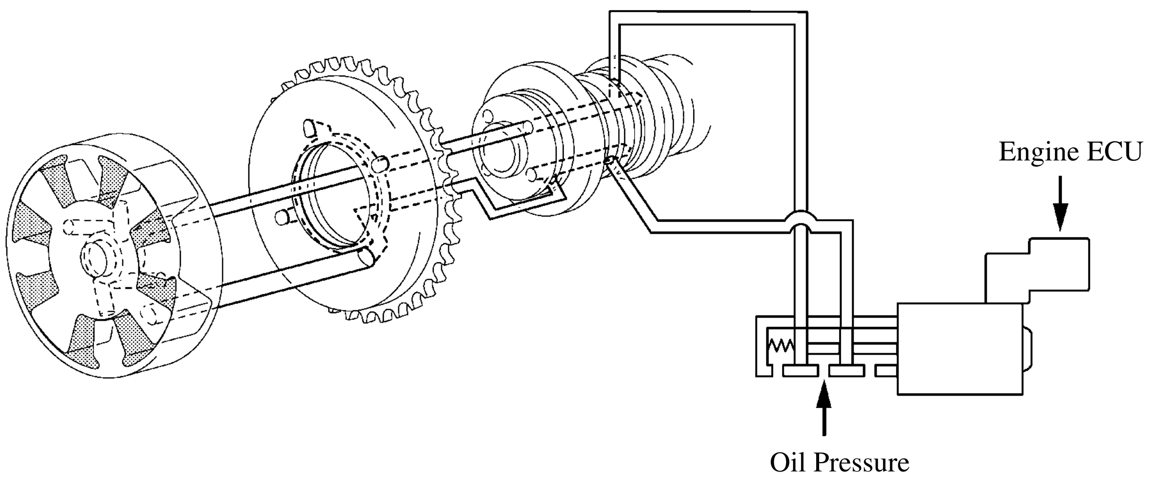
When the camshaft timing oil control valve is positioned as illustrated below by the retard signal from the engine ECU, the resultant oil pressure is applied to the timing retard side vane chamber to rotate the camshaft in the timing retard direction.



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.



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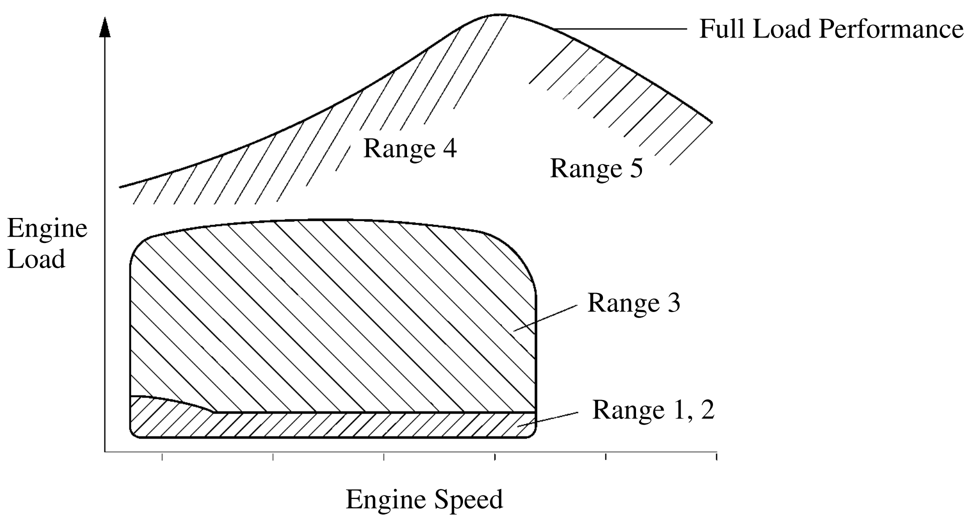
- In proportion to the engine speed, intake air volume, throttle position and water temperature, the engine ECU calculates an optimal valve timing under each driving condition and controls the camshaft timing oil control valve. In addition, the engine ECU uses signal from the camshaft position sensor 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) ◀



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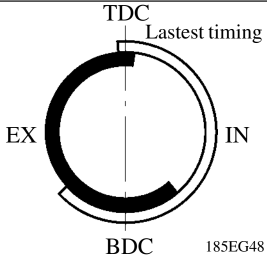
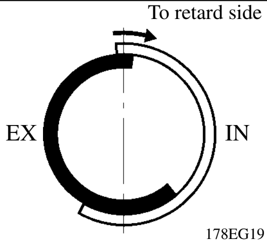
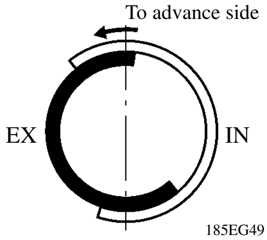
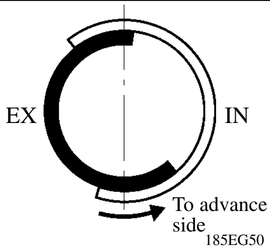
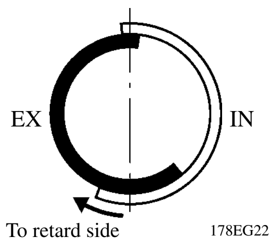
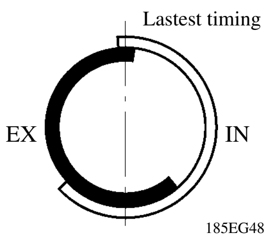
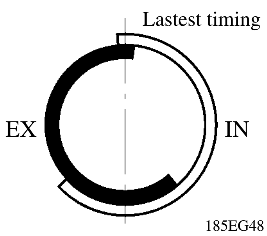
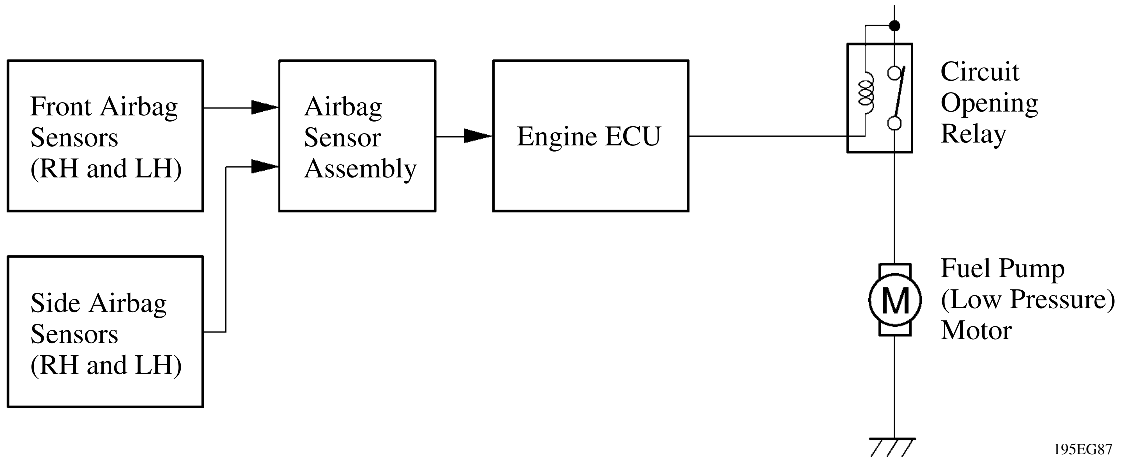
Operation State	Range	Valve Timing	Objective	Effect
During Idling	1		Minimizing overlap to reduce blow back to the intake side	Stabilized idling rpm Better fuel economy
At Light Load	2		Decreasing overlap to reduce blow back to the intake side	Ensured engine stability
At Medium Load	3		Increasing overlap 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.



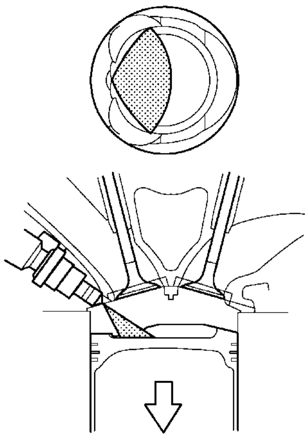
■ 1AZ-FSE ENGINE

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.



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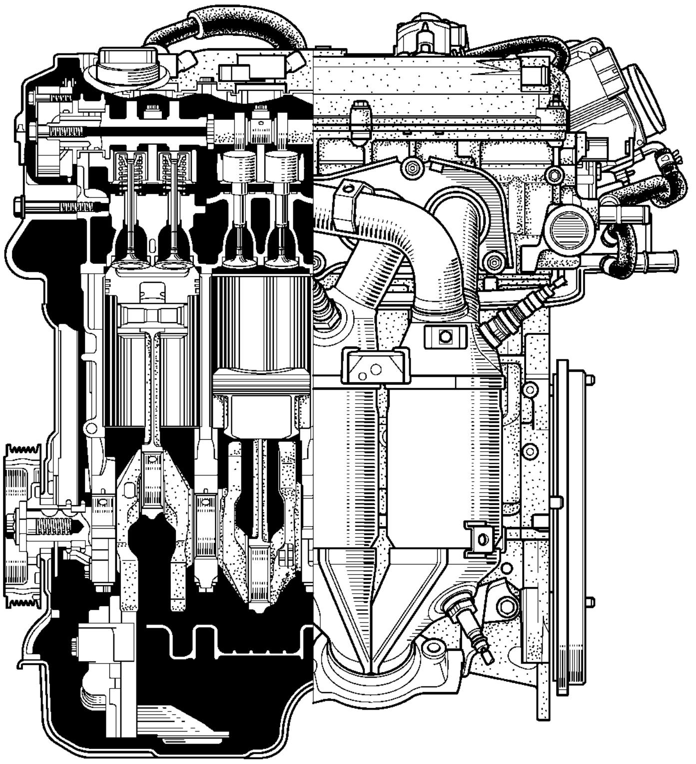
▶ 1AZ-FSE Engine ◀



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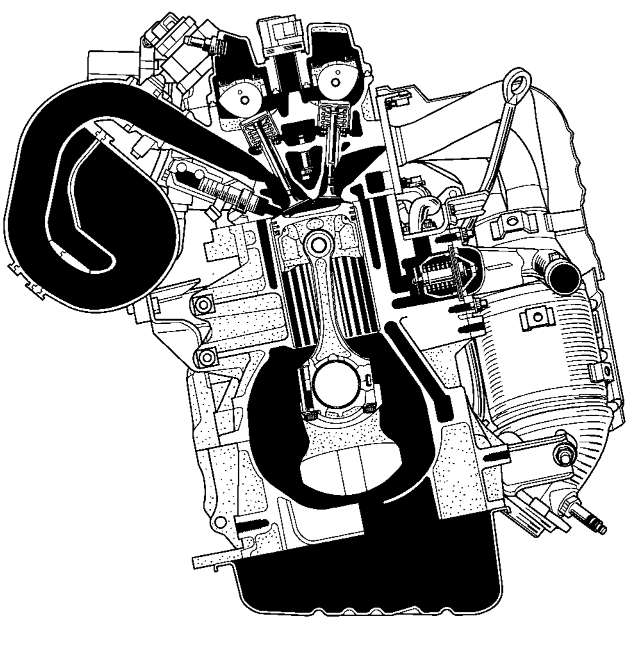

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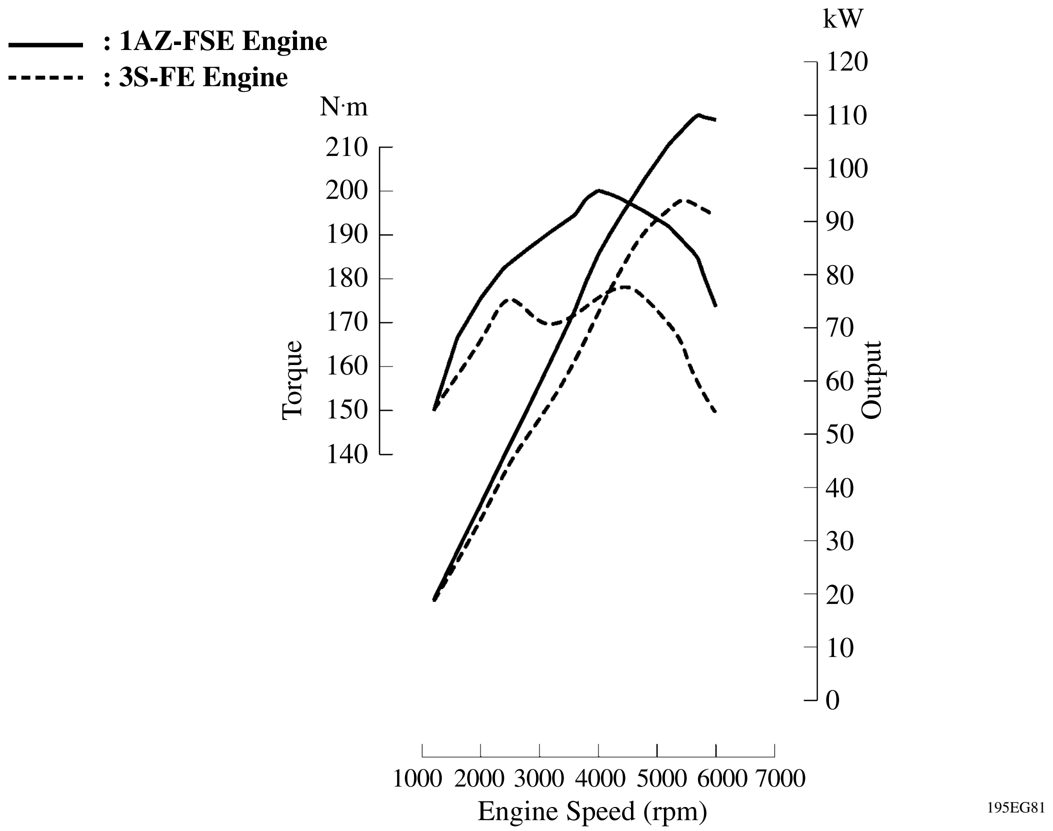
▶ Engine Specifications ◀

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 ◀



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

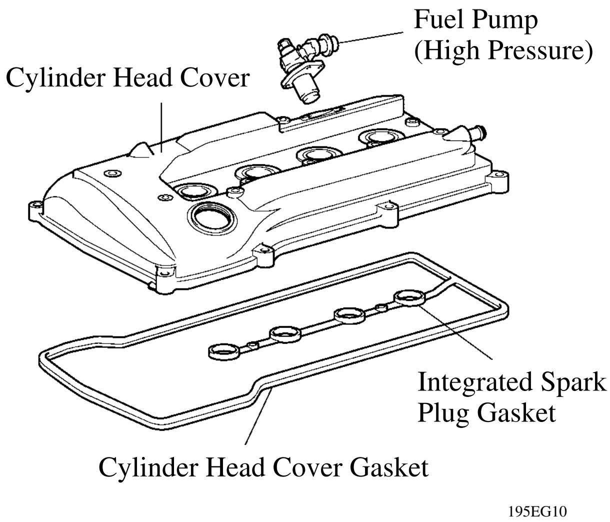
(5) Clean emission

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

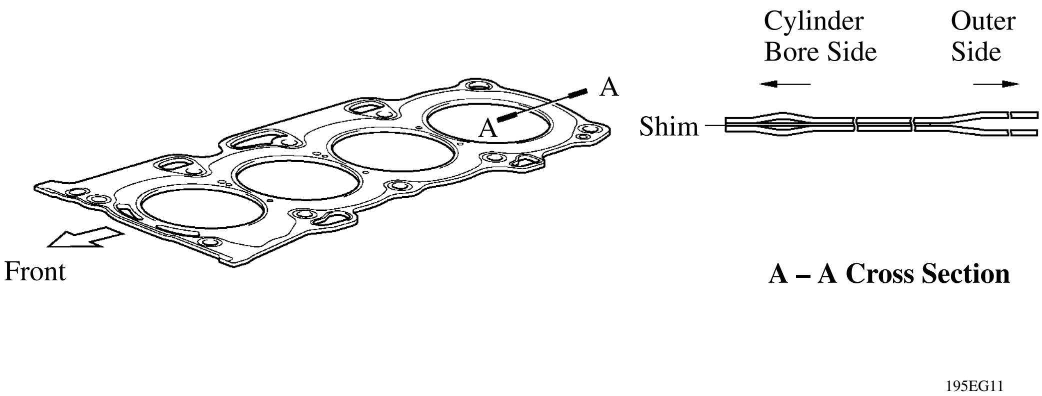
Cylinder Head Cover

- 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 Gasket

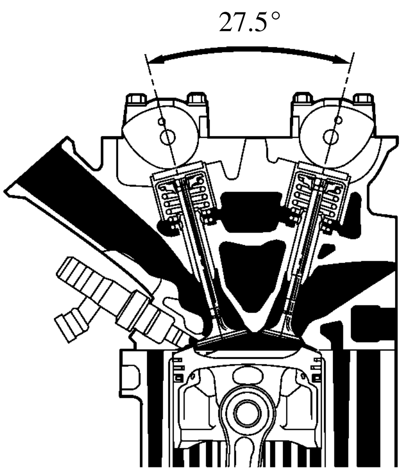
A steel-laminate type cylinder head gasket has been adopted.
A shim has been added around the cylinder bore to increase the sealing surface, thus improving the sealing performance and durability.



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.

3



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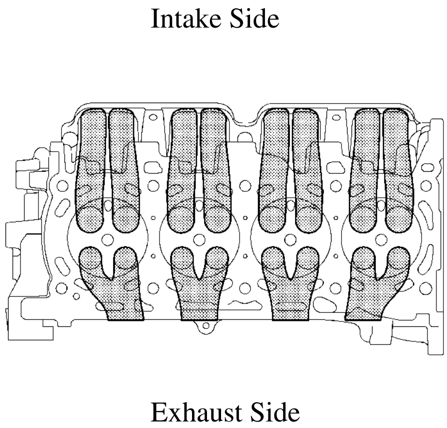

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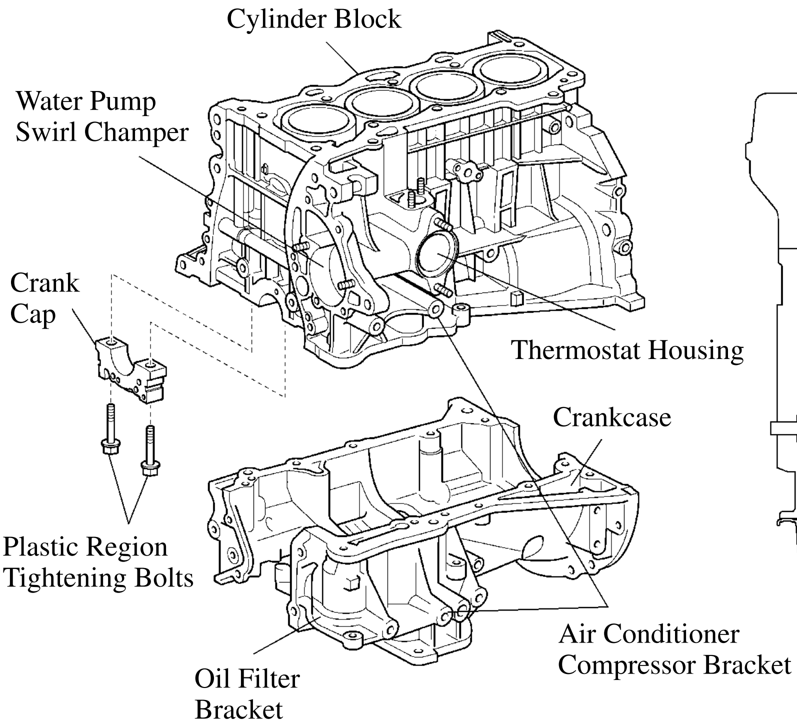
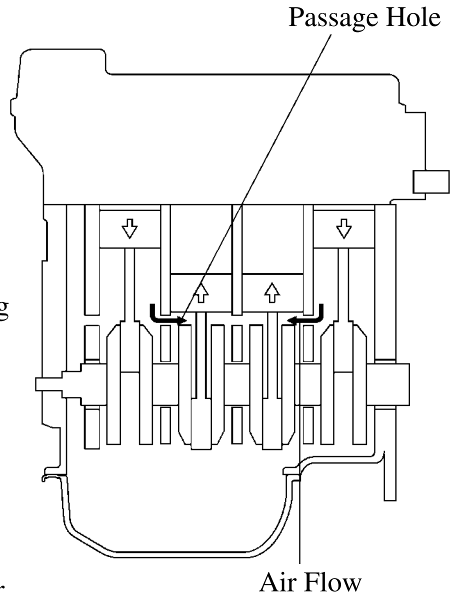
Cylinder Block

- 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.



195EG14

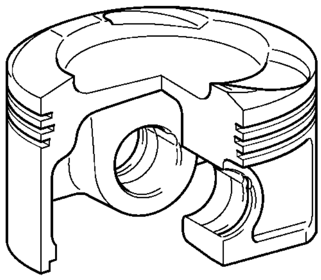
▶ Air Flow During Engine Revolution ◀



179EG04

Piston

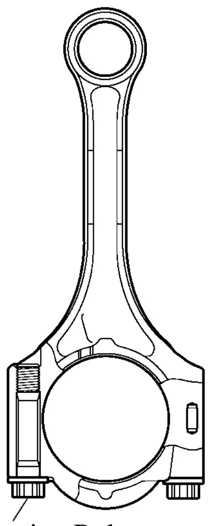
- To achieve uniform combustion through direct injection, an optimal piston head shape that promotes the mixing of the injected fuel and intake air has been adopted.
- The piston is made of aluminum alloy and skirt area is made compact and lightweight.
- Full floating type piston pins are used.
- The 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

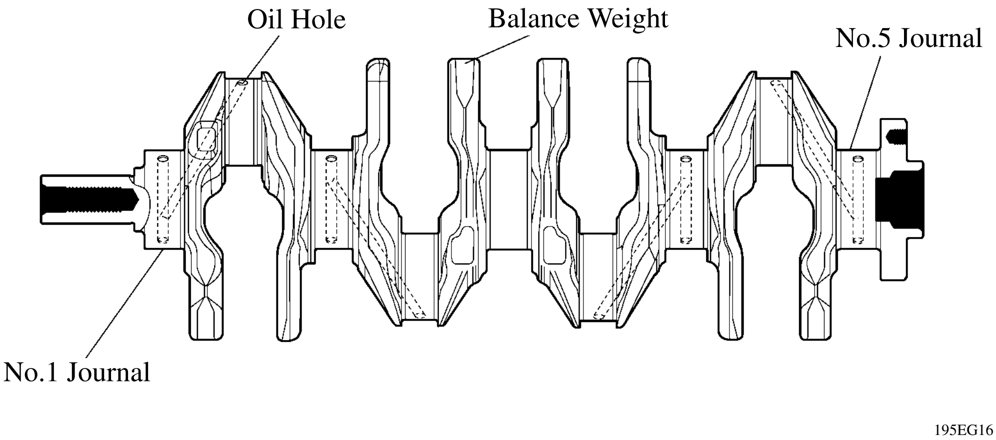
- The connecting rods and cap are made of highstrength material for weight reduction.
- Nutless-type plastic region tightening bolts of the connecting rod are adopted for a lighter design.
- The connecting rod bearings have been reduced in width to reduce friction.



181EG08

Crankshaft

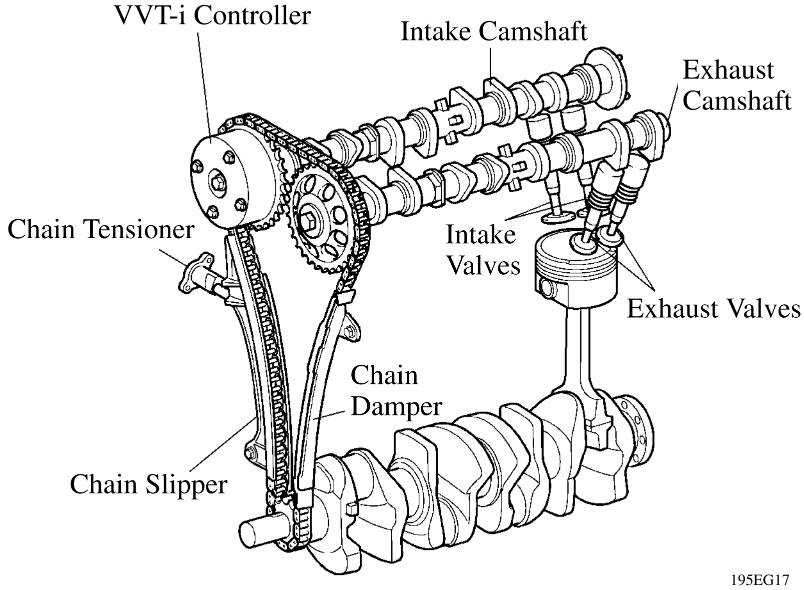
- The forged crankshaft has 5 journals and 8 balance weights.
- The crankshaft bearings have been reduced in width to reduce friction.
- The precision and surface roughness of the pins and journals have been improved to reduce friction.



4. Valve Mechanism

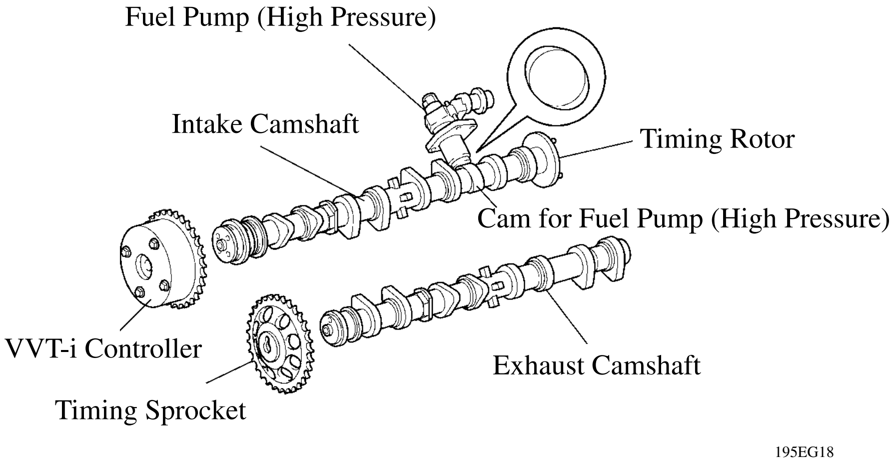
General

- 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.



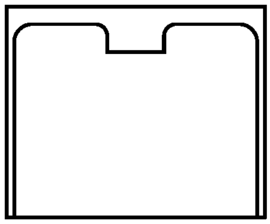
Camshaft

- 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

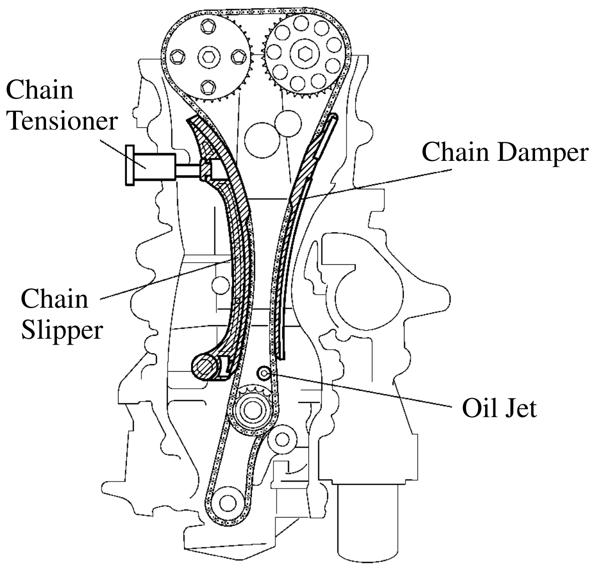
Along with the increase of the amount of valve lift, the valve adjusting shims have been discontinued and the shimless type of the valve lifter has been adopted. This valve lifter enables to make the cam contact surface greater.
The adjustment of the valve clearances is accomplished by selecting and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



148EG05

Timing Chain

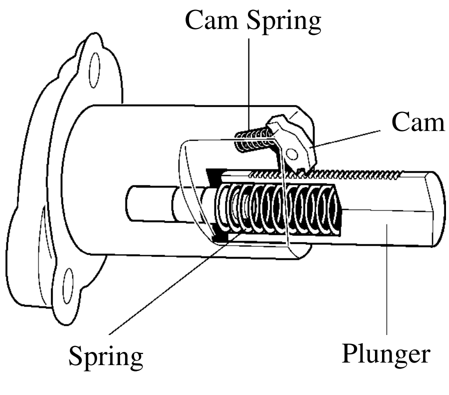
- A roller chain with an 8 mm pitch has been adopted to make the engine more compact.
- A material which has excellent wear resistance has been selected for the timing chain to improve reliability.
- The timing chian is lubricated by an oil jet.



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.

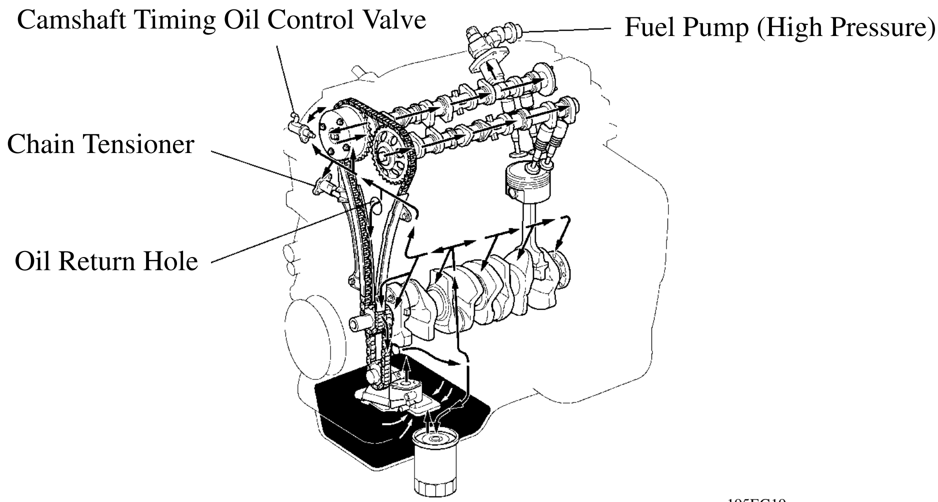


181EG14

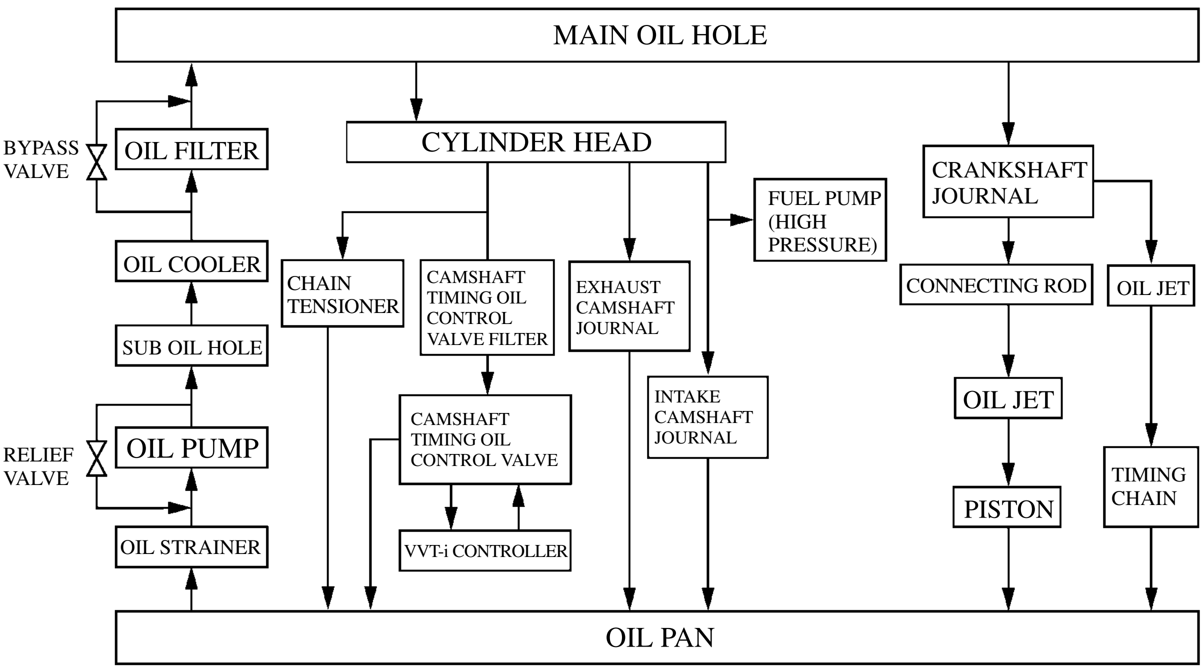
5. Lubrication System

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.



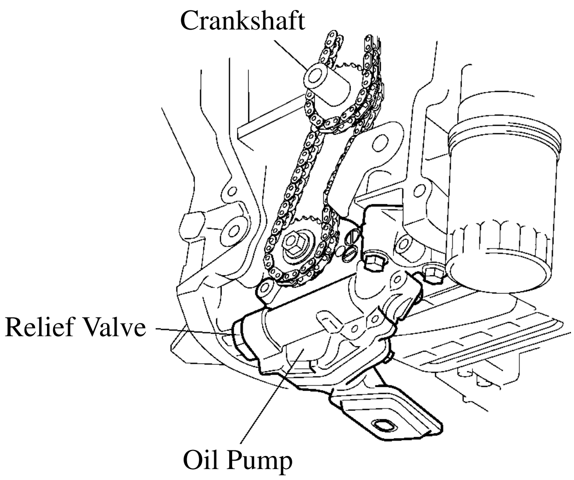
195EG19



195EG20

Oil Pump

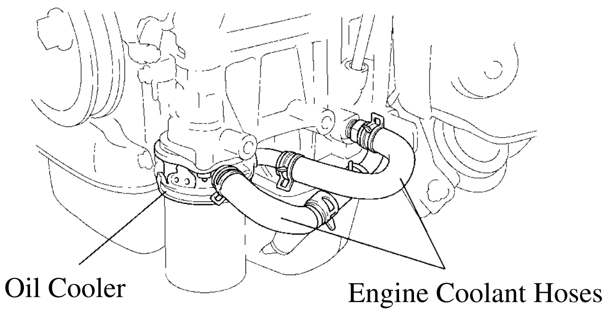
- The trochoidal type oil pump is chain-driven by the crankshaft, and fits compactly inside the oil pan.
- Friction has been reduced by means of 2 relief holes in the internal relief system.



185EG27

Oil Cooler

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

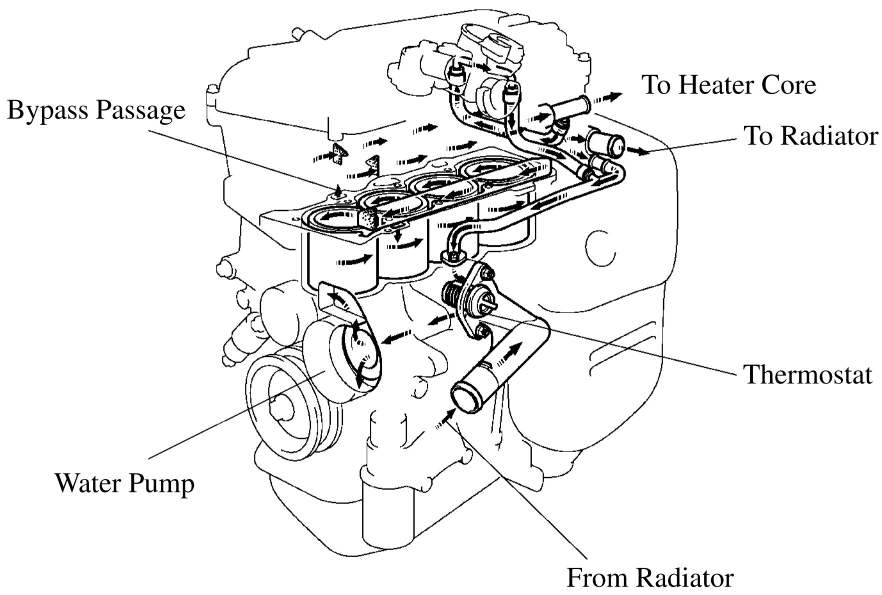


195EG21

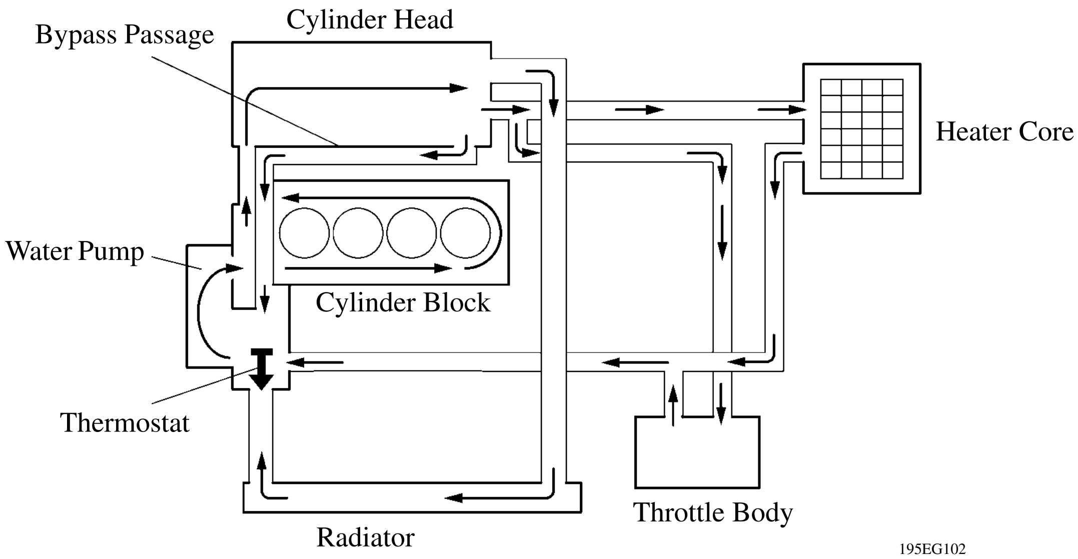
6. Cooling System

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.



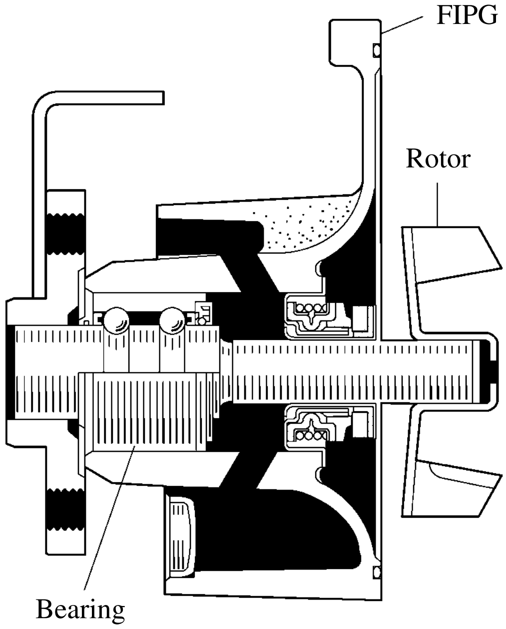
185EG28



195EG102

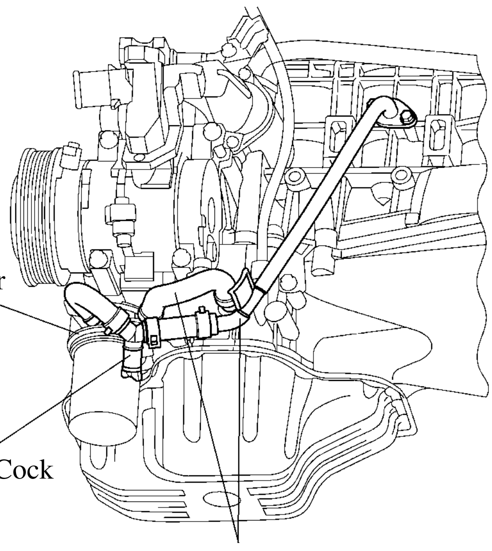
Water Pump

- 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.



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.

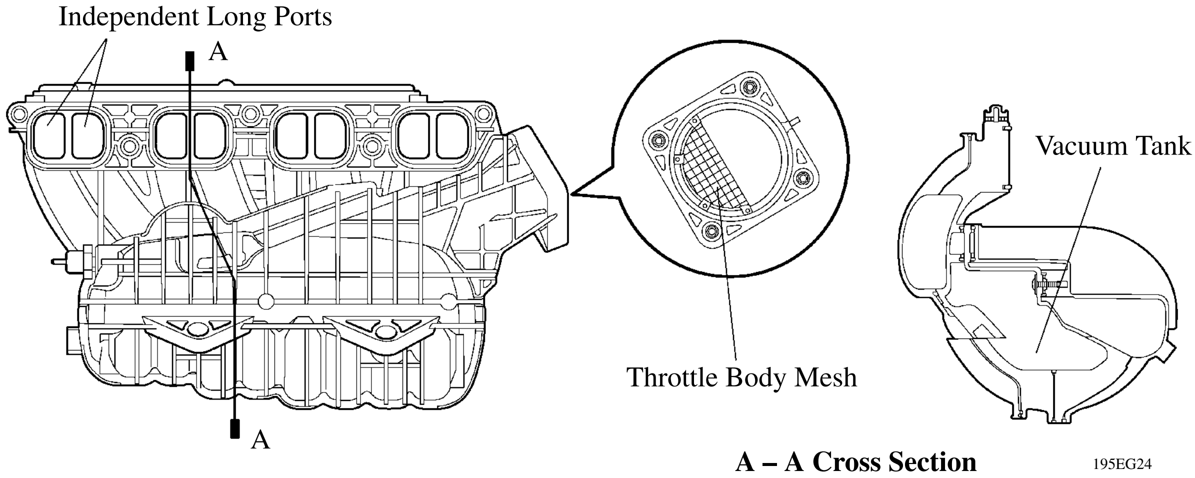


7. Intake and Exhaust System

Intake Manifold

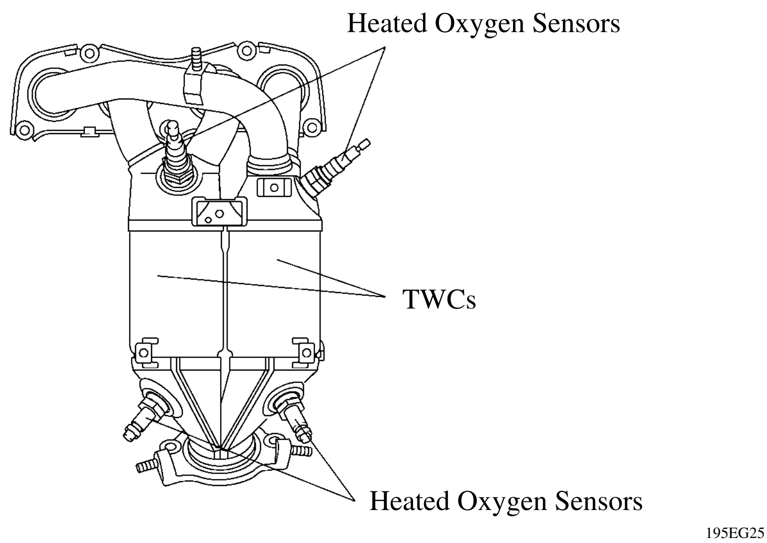
- The intake manifold has been made of plastic to reduce the weight and the amount of heat transferred from the cylinder head. As a result, it has become possible to reduce the intake air temperature and improve the intake volumetric efficiency.
- Eight, independent long ports have been adopted to improve 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.

3



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.

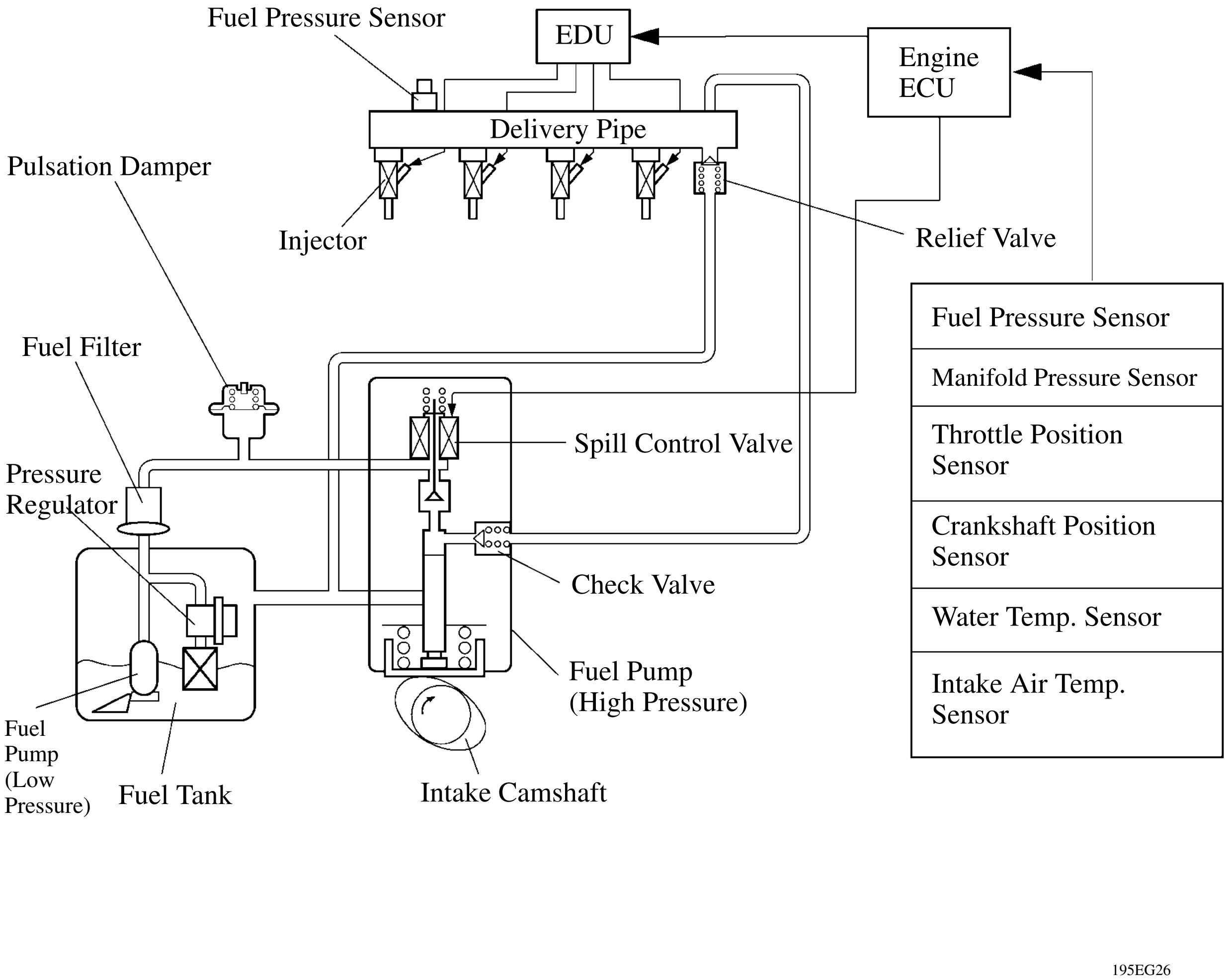


8. Direct Injection System

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** ◀



Component of Function

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

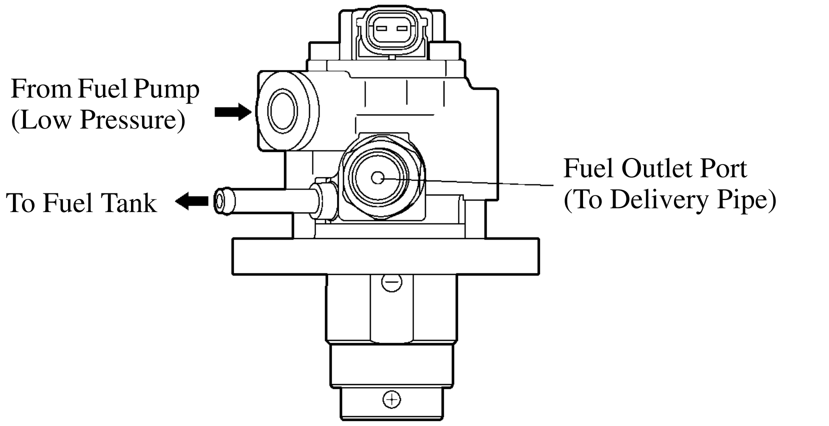
Component	Outline
Fuel Pump (High Pressure)	To pressurize the fuel from the fuel pump (low pressure) from 8 to 13 MPa and send it to the delivery pipe.
Delivery Pipe	To deliver the high pressure fuel to the injector.
Fuel Pressure Sensor	The fuel pressure sensor senses the fuel pressure and outputs the 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)

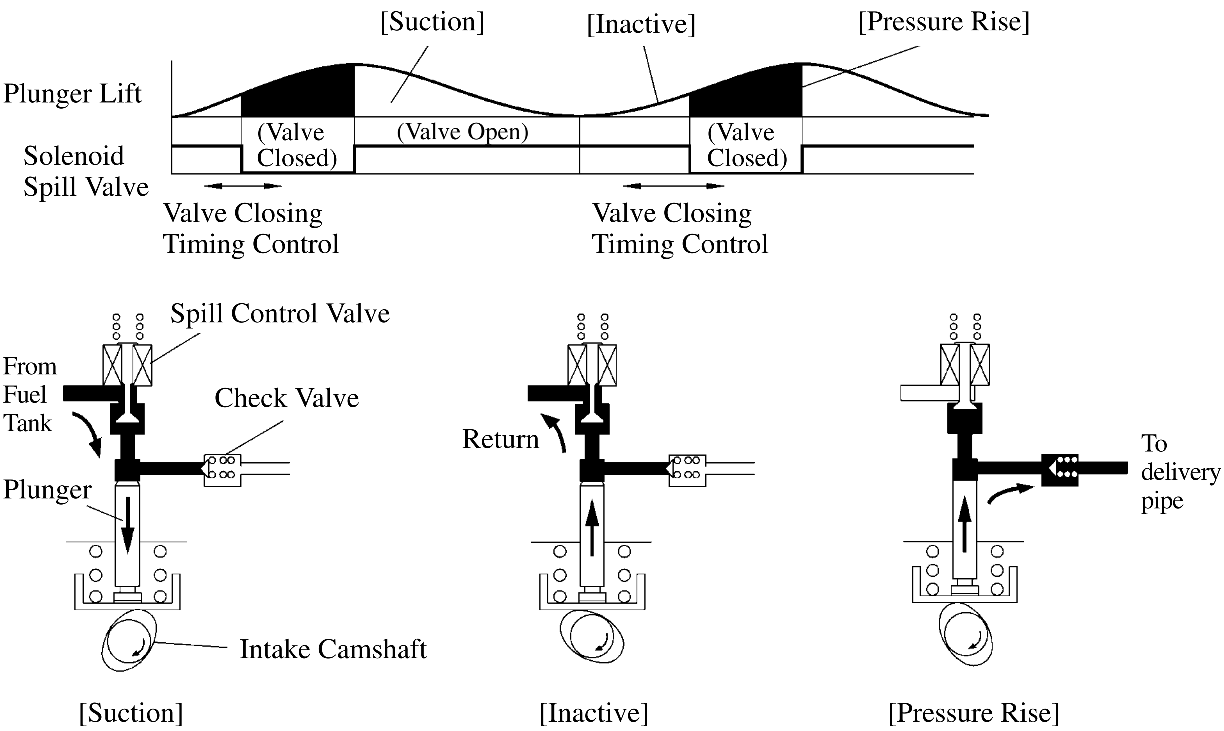
a. Construction

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

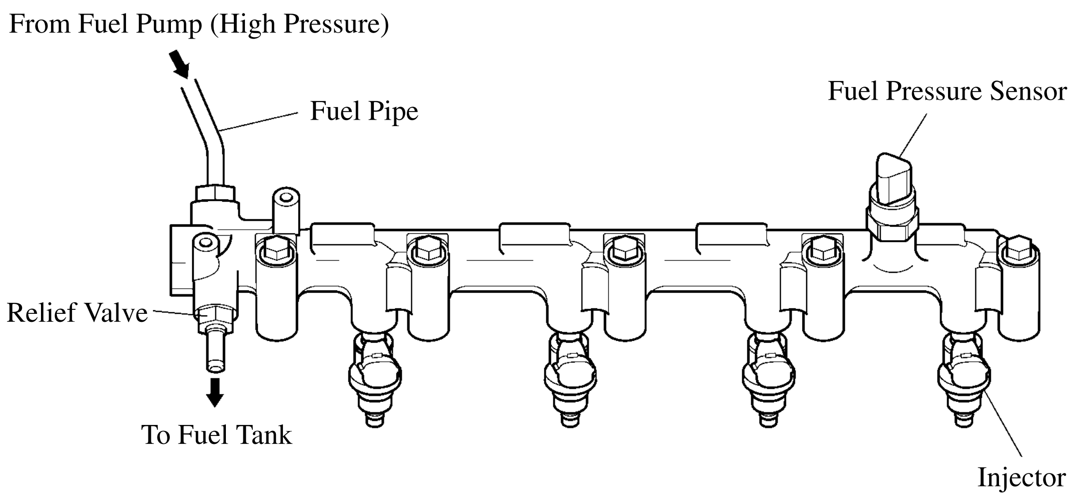
In the suctioning process of the pump, the spill control valve opens and the plunger strokes downward by a spring force, and the fuel is suctioned into the cylinder. Then, by the action of the cam, the plunger strokes upward, but at this time the spill control valve has not closed yet, so the part of 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.



195EG27

2) Delivery Pipe

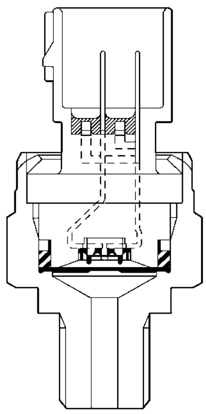
A delivery pipe made of aluminum die cast has been adopted. On the delivery pipe, injectors, fuel pressure sensor and relief valve are directly installed. By storing fuel at a high-pressure (8 to 13 MPa), the peak torque during the pumping of fuel under high load conditions has been restrained, thus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



195EG28

3) Fuel Pressure Sensor

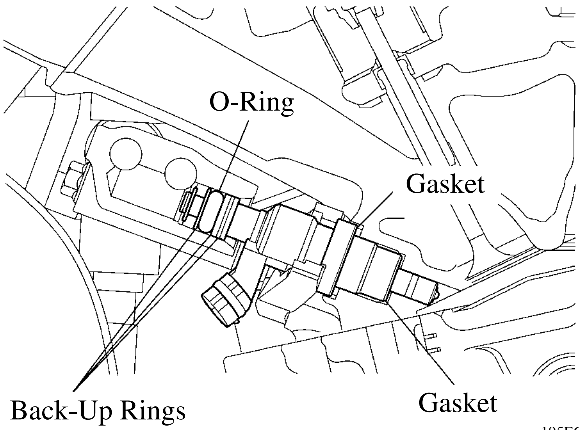
The fuel pressure sensor, which is mounted on the delivery pipe, outputs a signal that represents the fuel pressure in the delivery pipe to the engine ECU in order to constantly regulate the fuel at an optimal pressure.



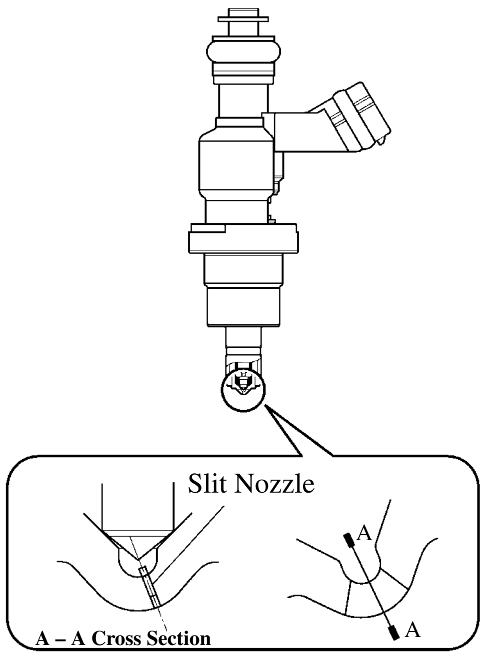
195EG77

4) Injector

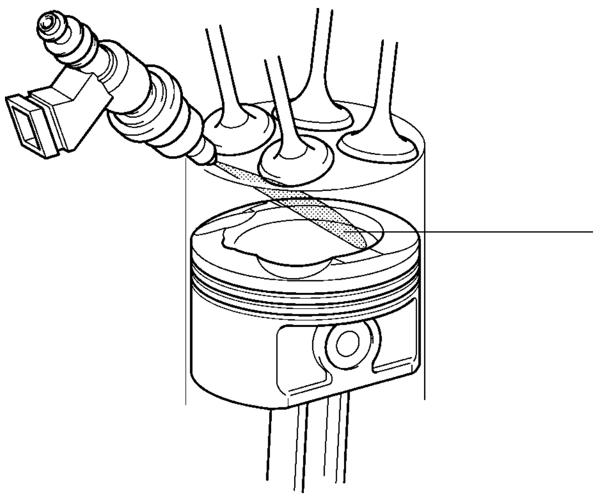
High-pressure, slit-nozzle type injectors have been adopted in conjunction with the adoption of the TOYOTA D-4 (Direct injection, 4-stroke gasoline engine). The injectors are secured to the cylinder head by way of a clamp, and the gaskets are used to seal the combustion gas in the cylinder. In addition, 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

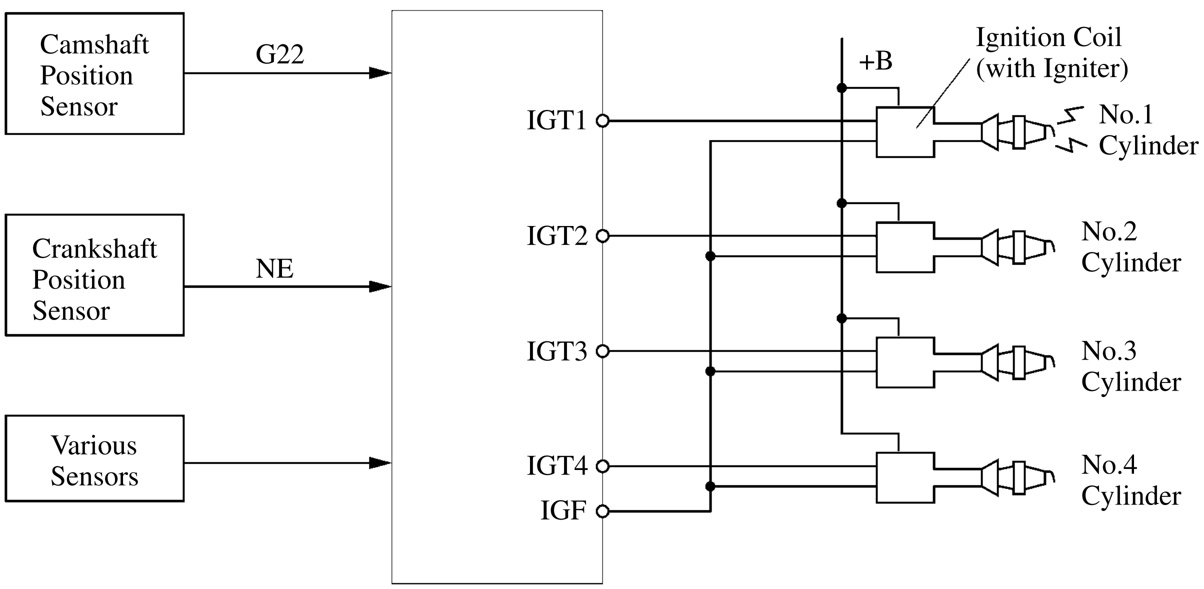
5) EDU (Electronic Driver Unit)

- 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.



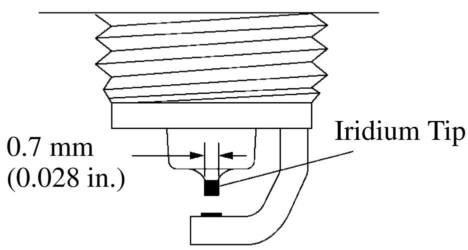
165EG25

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.



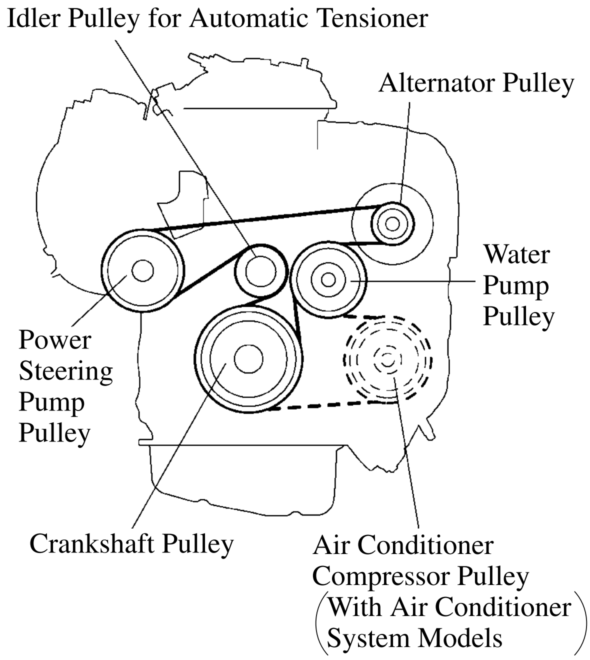
185EG38

▶ 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

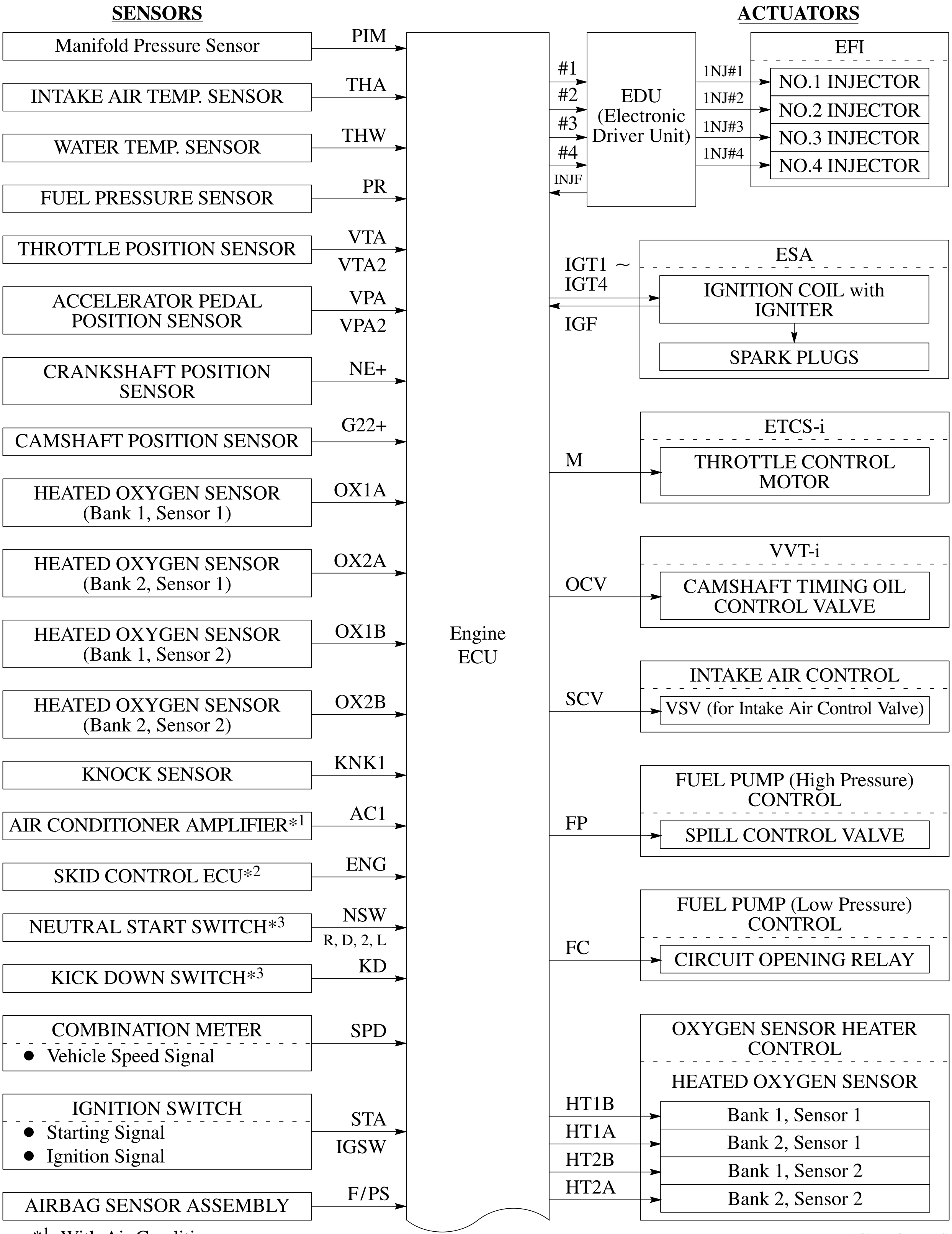
The engine control system for the 1AZ-FSE engine has following features.

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

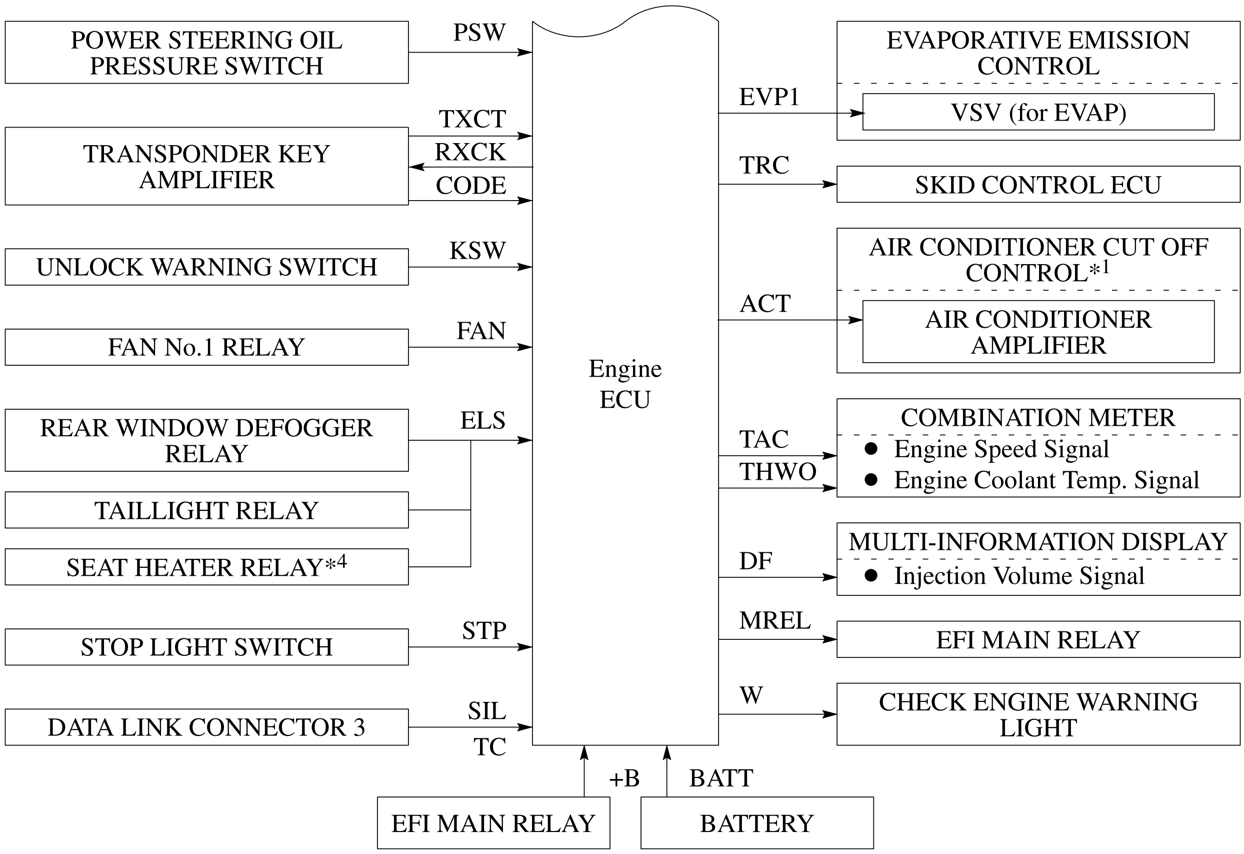
Construction

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



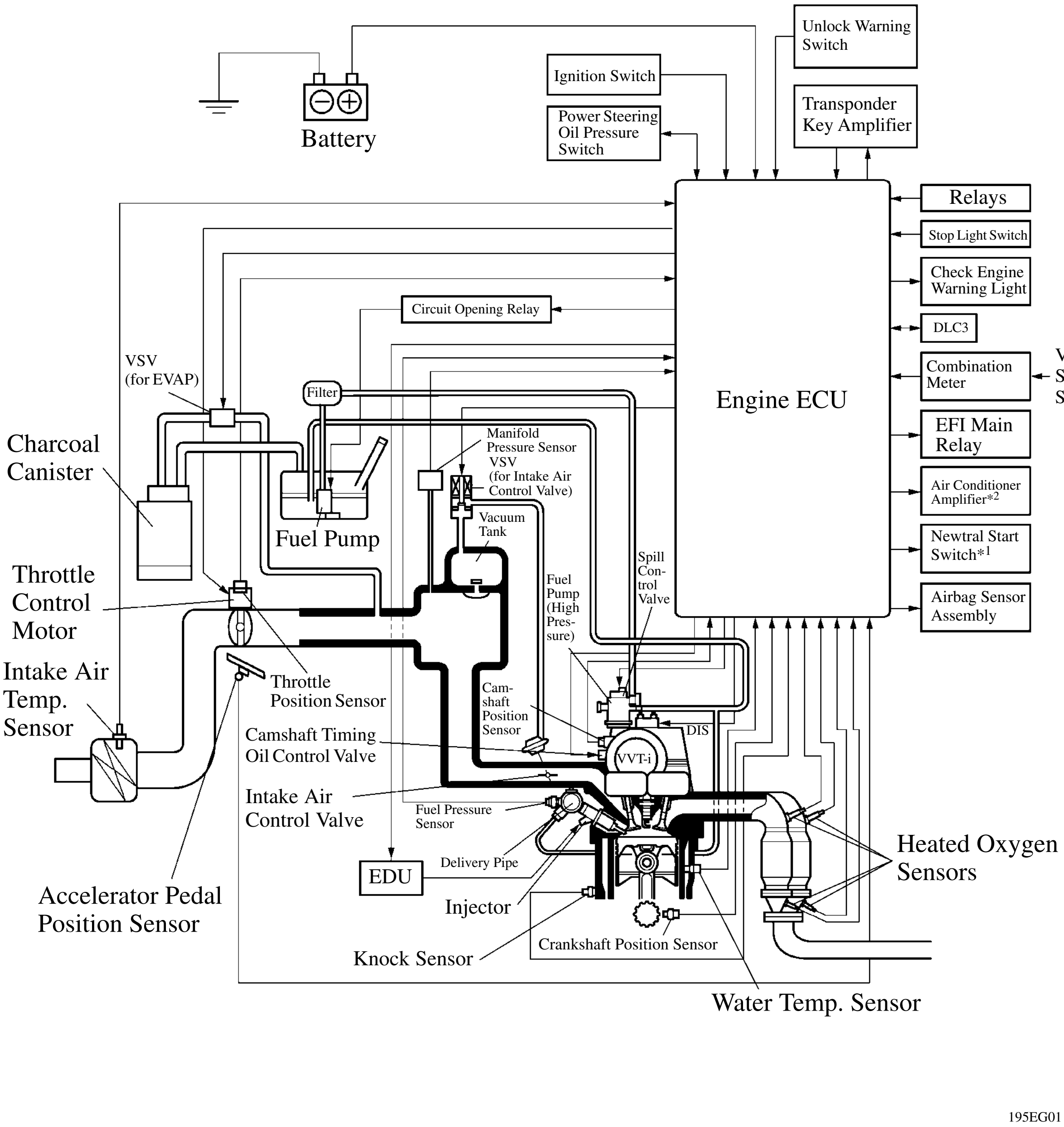
*1: With Air Conditioner
*2: With ABS & EBD & Brake Assist & TRC & VSC
*3: Only for Automatic Transaxle

(Continued)



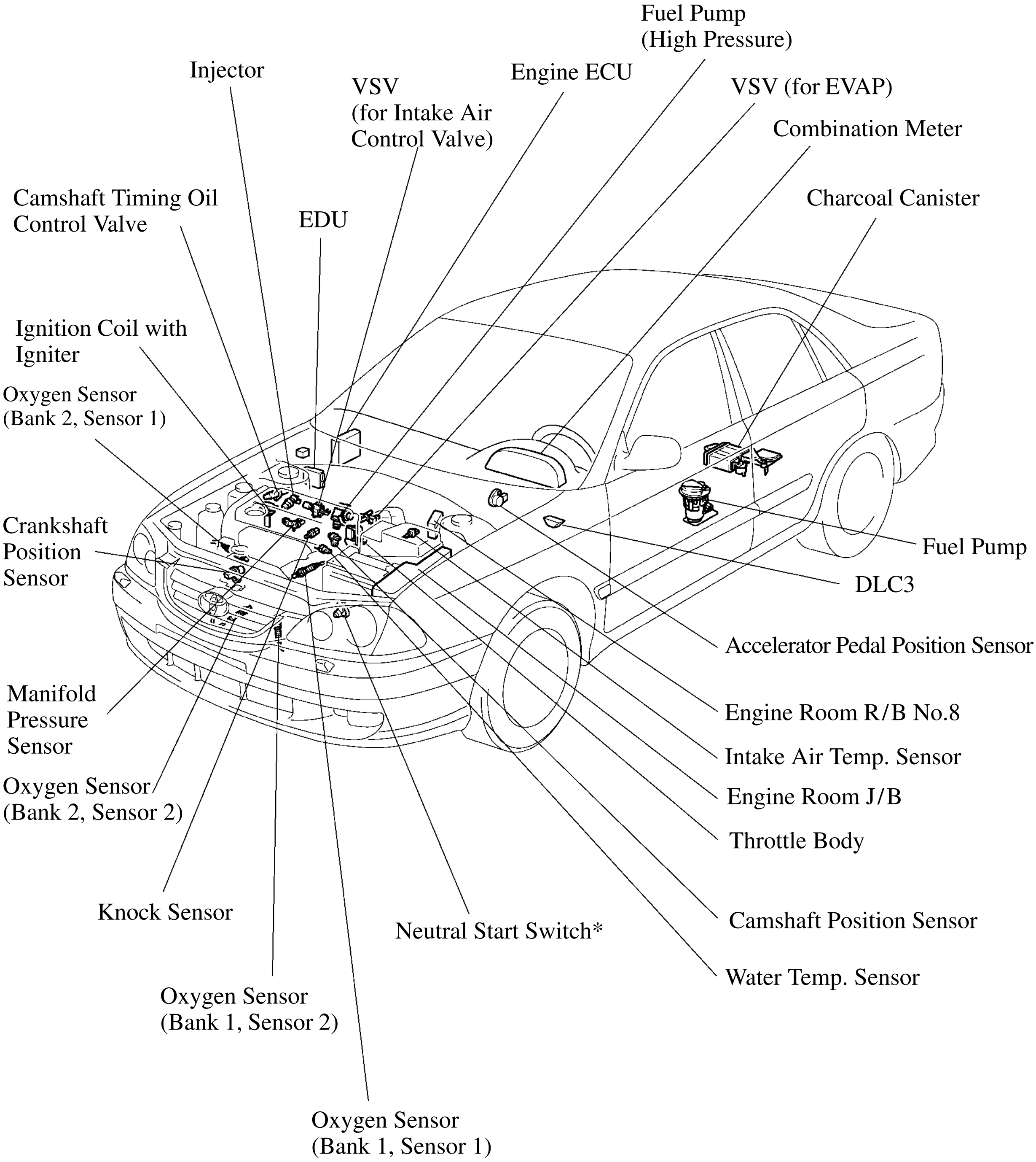
*1: With Air Conditioner
*2: With ABS & EBD & Brake Assist & TRC & VSC
*3: Only for Automatic Transaxle
*4: With Seat Heater

Engine Control System Diagram



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

Layout of Main Components



* Only for Automatic Transaxle

Main Components of Engine Control System

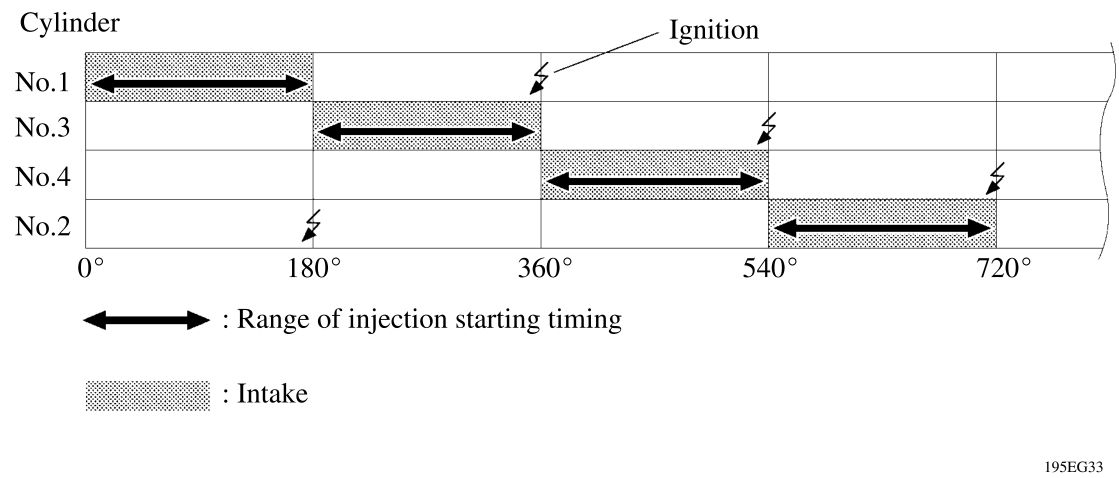
1) General

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

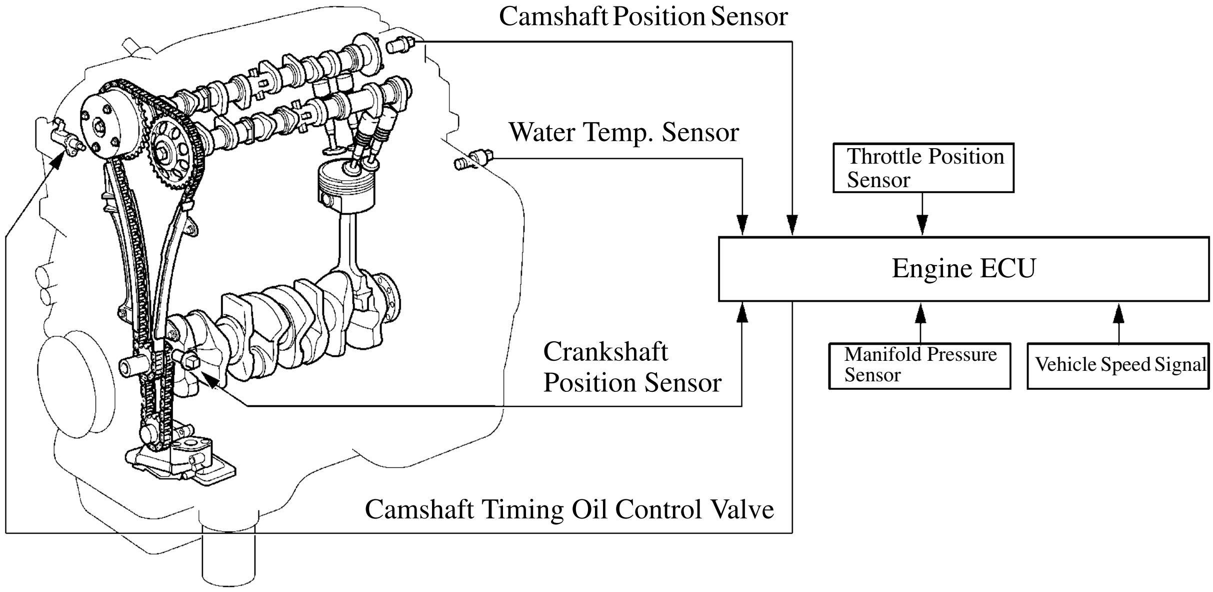
- In contrast to the conventional EFI (Electronic Fuel Injection), the D-4 (Direct Injection 4-Stroke Gasoline Engine) EFI conducts the injection volume control and injection timing control simultaneously.
- The injection volume is determined by the engine ECU, based on the signals from the vacuum sensor, 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.



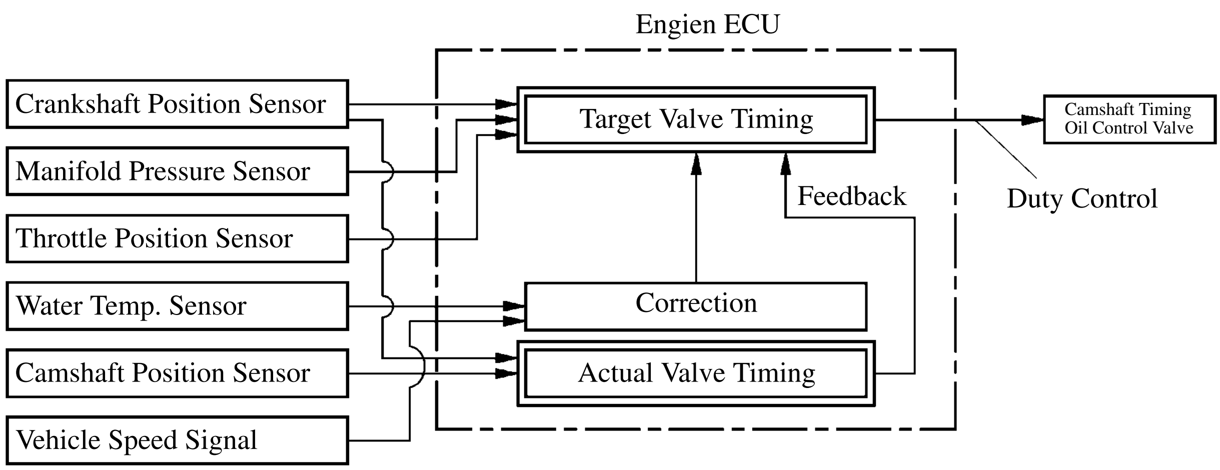
VVT-i (Variable Valve Timing-intelligent) System

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

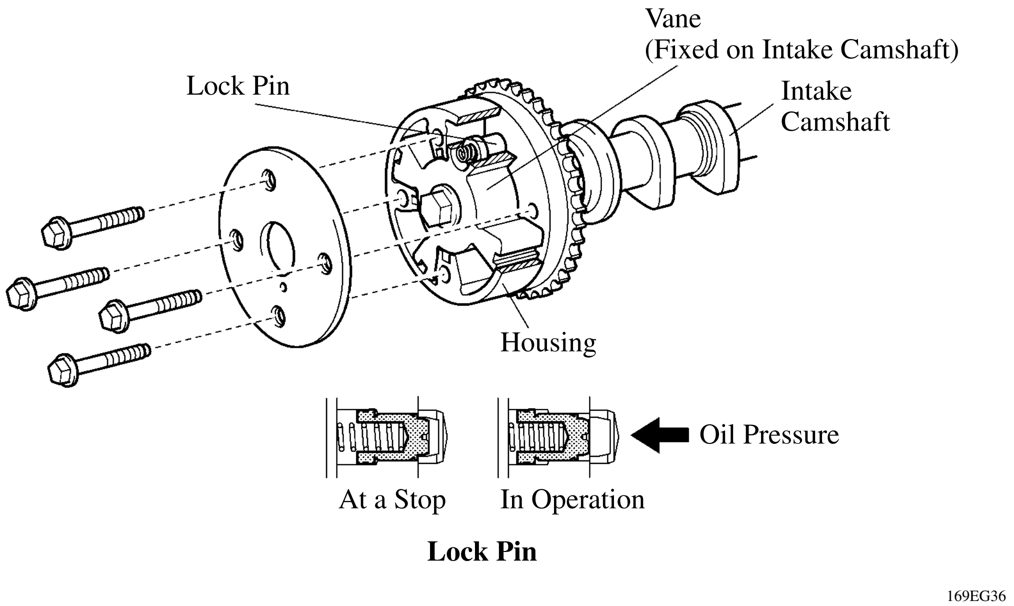


172CR07

2) Construction

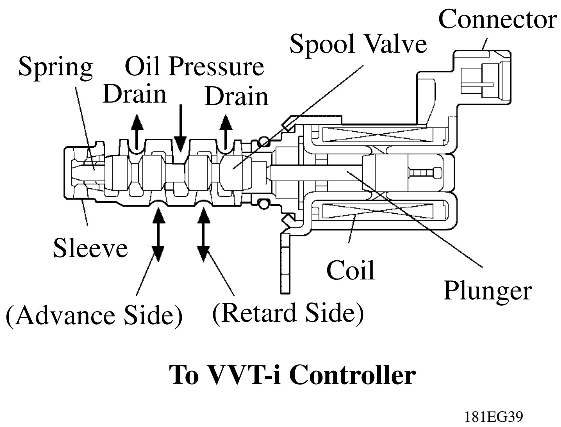
a. VVT-i Controller

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.



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.

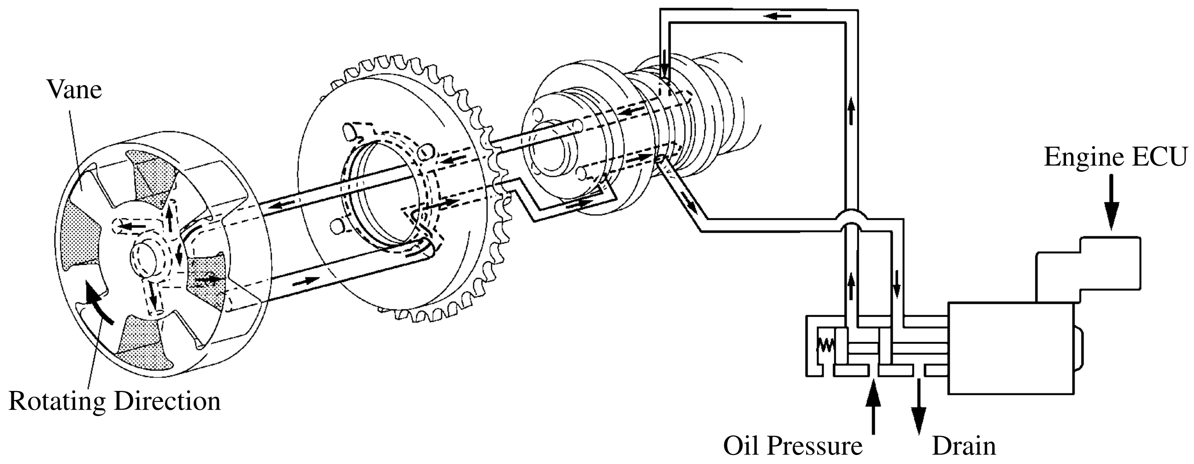


c. Operation

- 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

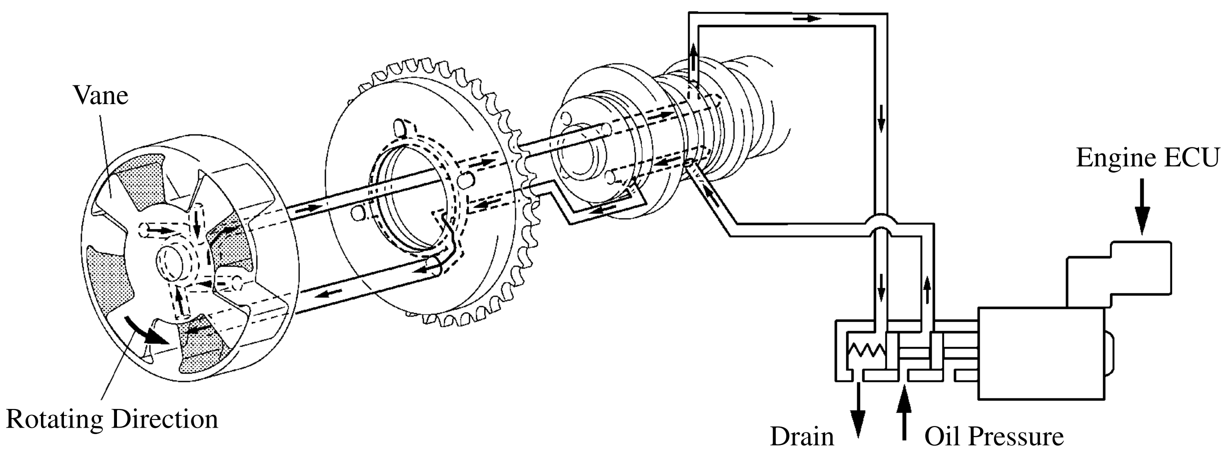
When the camshaft timing oil control valve is positioned as illustrated below by the advance signal from the engine ECU, the resultant oil pressure is applied to the timing advance side vane chamber to rotate the camshaft in the timing advance direction.



185EG18

Retard

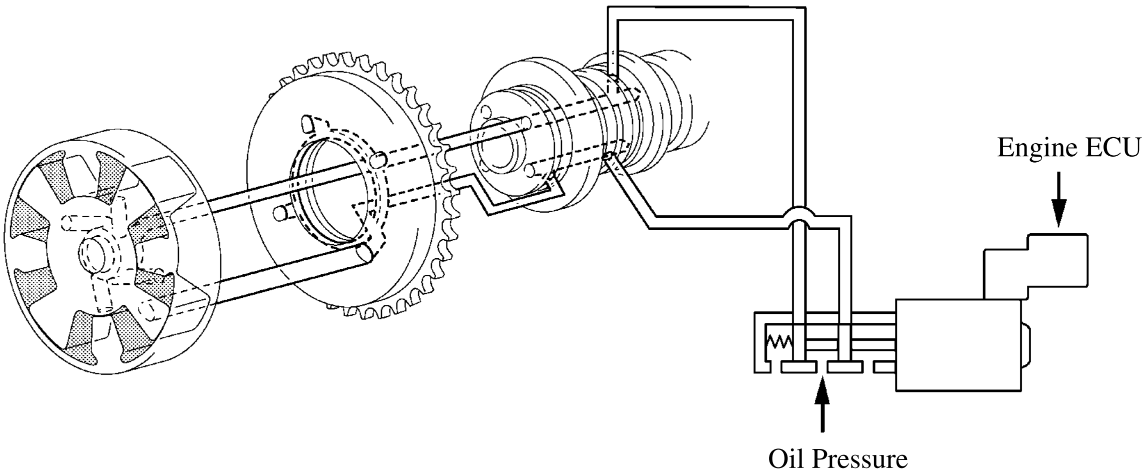
When the camshaft timing oil control valve is positioned as illustrated below by the retard signal from the engine ECU, the resultant oil pressure is applied to the timing retard side vane chamber to rotate the camshaft in the timing retard direction.



185EG19

Hold

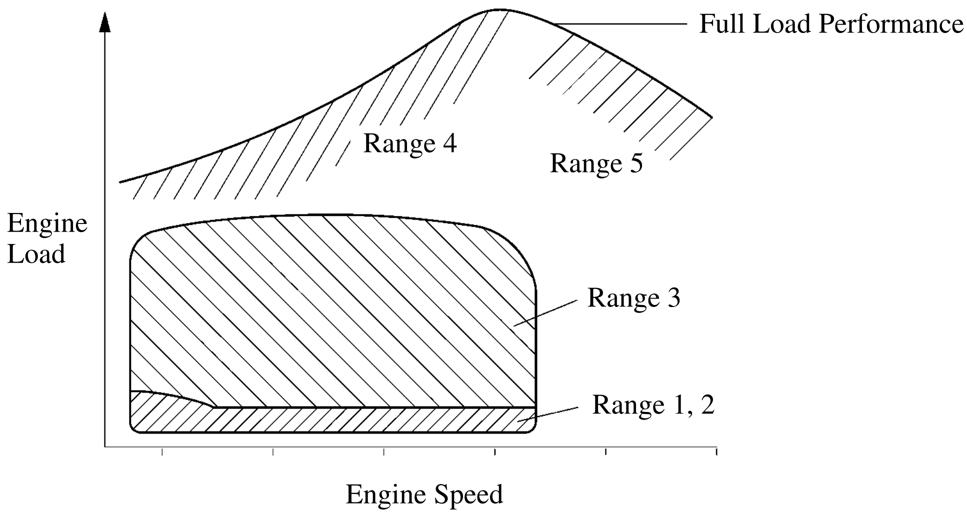
The engine ECU calculated the target timing angle according to the traveling state to perform control as described in the previous page. After setting at the target timing, the valve timing is held by keeping the camshaft timing oil control valve in the neutral position unless the traveling state changes.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



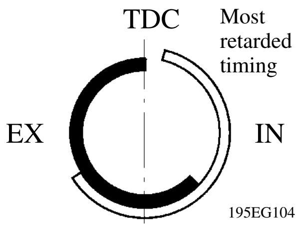
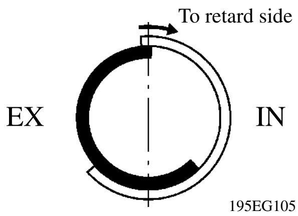
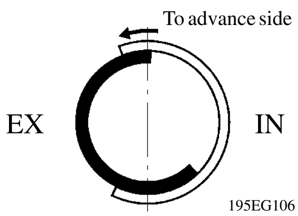
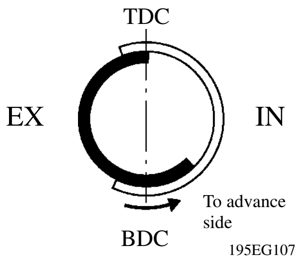
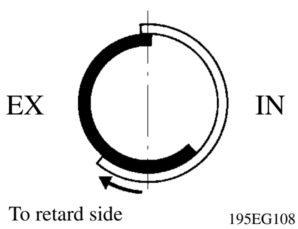
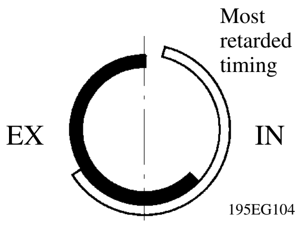
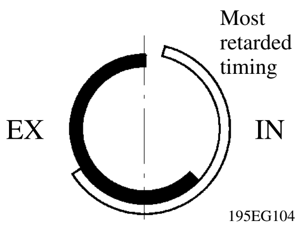
185EG20

- 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) ◀



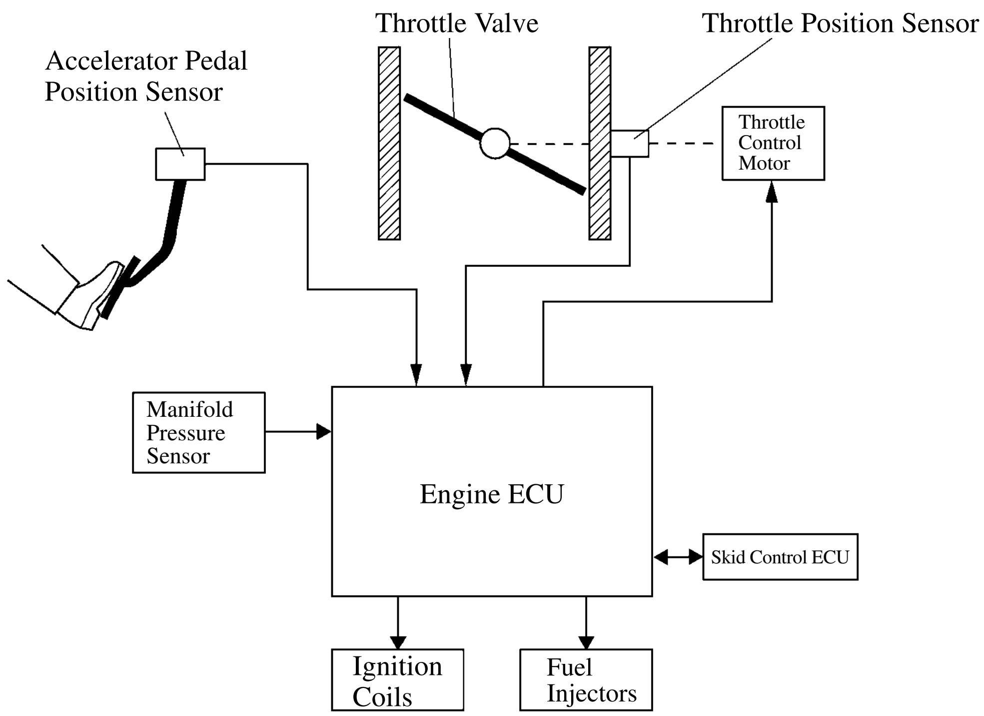
162EG46

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)

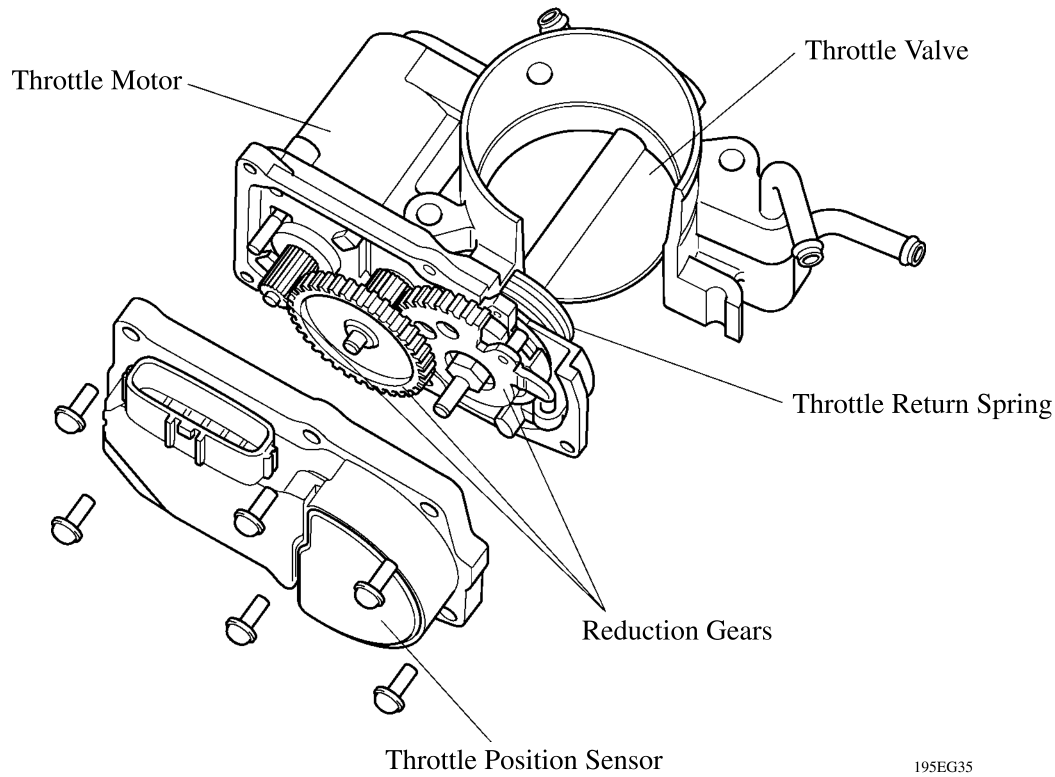
1) General

- 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.



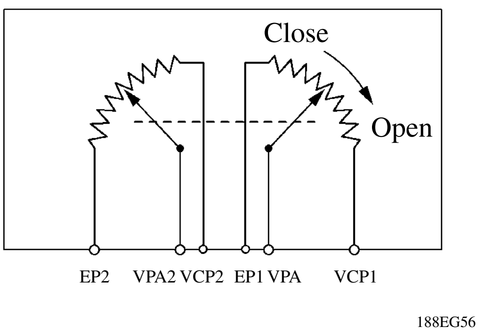
188EG54

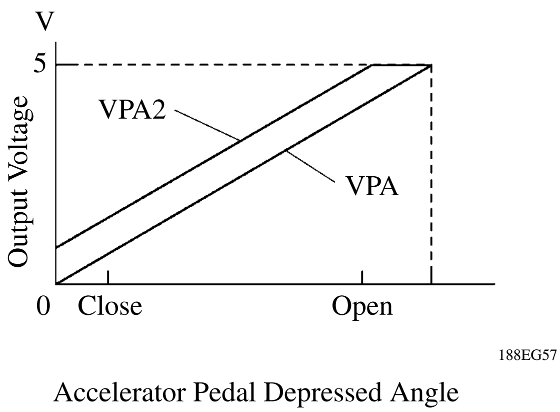
2) Construction



a. Accelerator Pedal Position Sensor

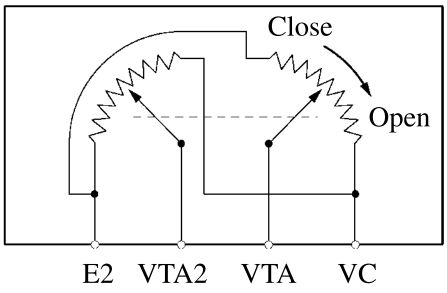
The accelerator pedal position sensor is attached to the accelerator pedal. This sensor converts the accelerator pedal depressed angles into electric signals with two differing characteristics and outputs them to the ECM. One is the VPA signal that linearly outputs the voltage along the entire range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



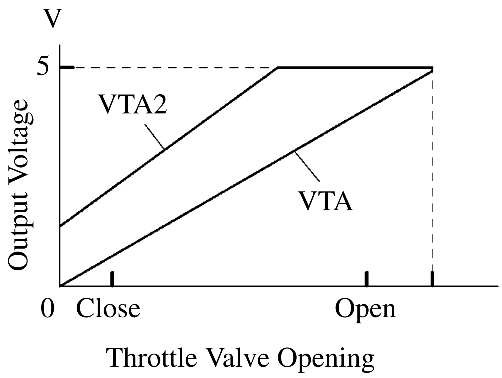


b. Throttle Position Sensor

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

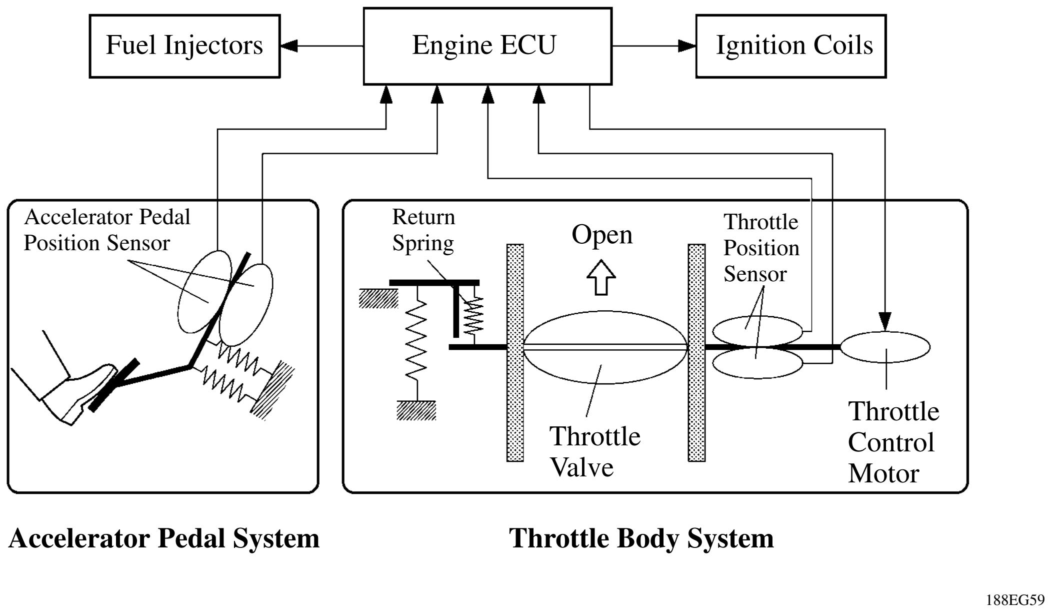
At the time of multiple shifting down when accelerating, the throttle valve opening is gradually controlled soon after the shift down in order to smooth the driving force change and to protect the driving system parts.

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.

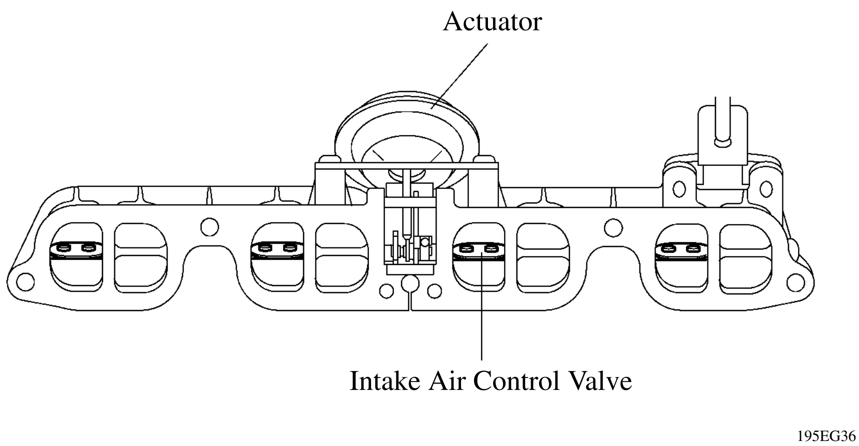


5) Diagnosis

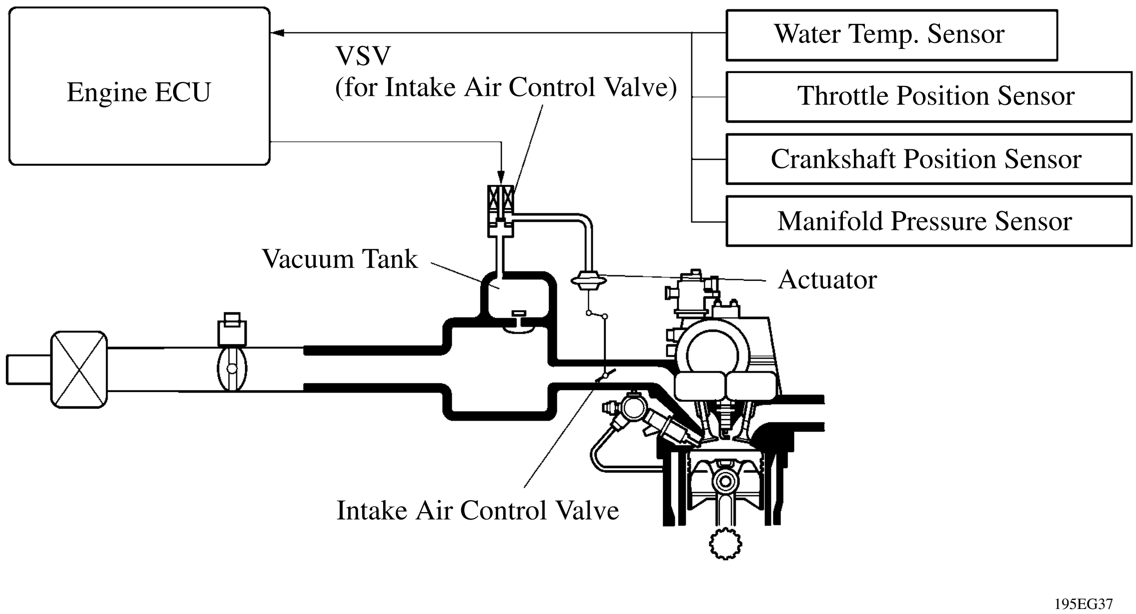
The diagnostic trouble codes can be output via DLC3 to a hand-held tester. For details, refer to the 1AZ-FSE Engine Repair Manual (Pub. No. RM783E).

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.

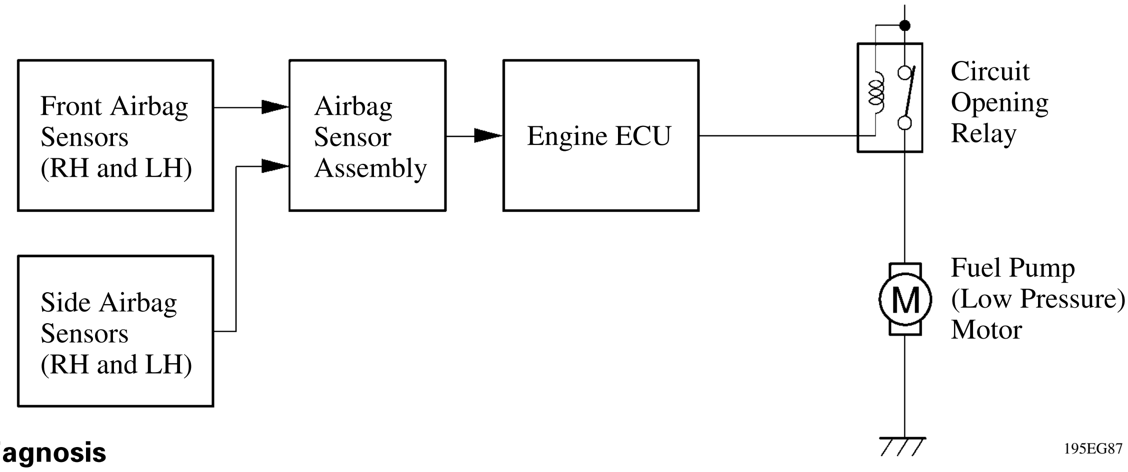


▶ **System Diagram** ◀



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

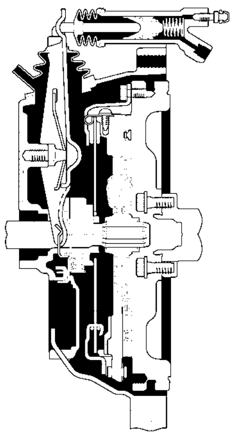
In accordance with the adoption of TOYOTA D-4 engine, DTSs (Diagnostic Trouble Codes) in the chart below are added. For details, refer to the 1AZ-FSE Engine Repair Manual (Pub. No. RM783E).

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

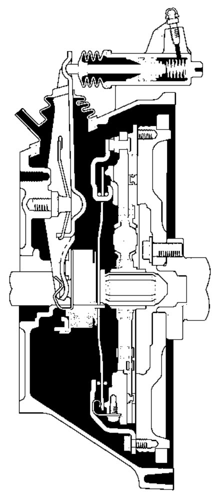
1. General

- 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

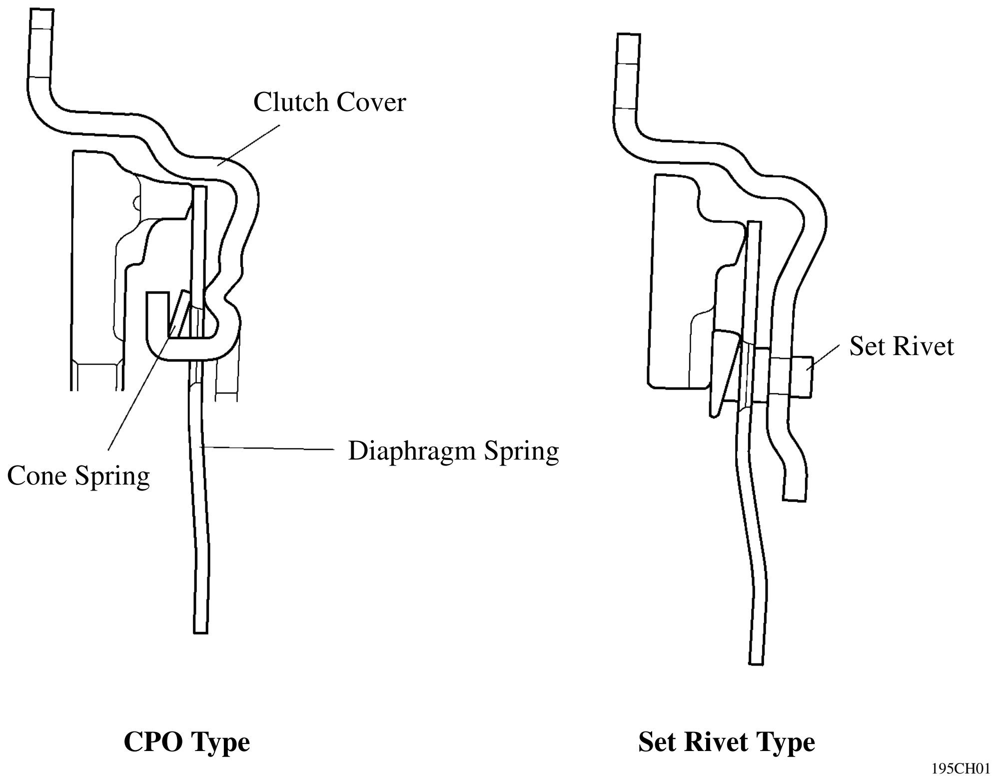
▶ Specifications ◀

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

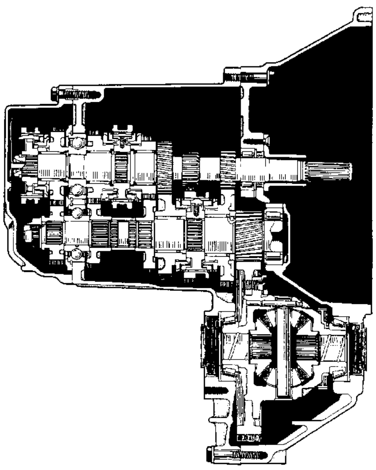
As compared with usual set rivet type, by using the cone spring at the fulcrum of the diaphragm spring, the clutch cover which has a structure to clog up the free play has been newly adopted for 1ZZ-FE, 3ZZ-FE and 1AZ-FSE engine models. Thus, performance of clutch releasing and reduction of the vibration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



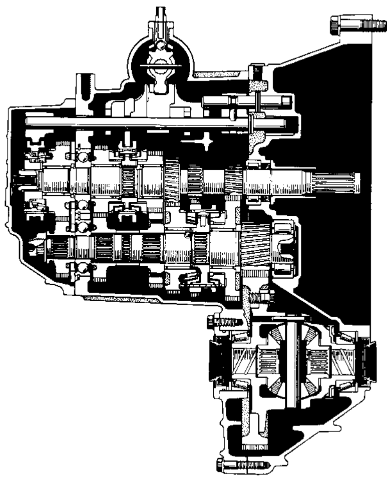
■MANUAL TRANSAXLE

1. General

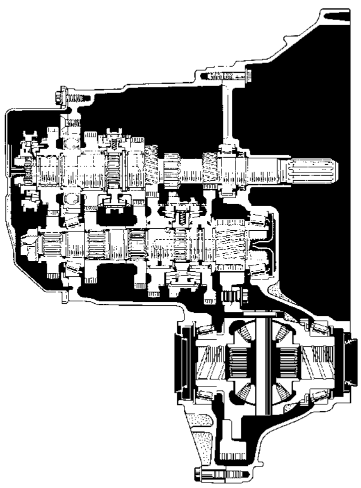
- The 1ZZ-FE engine model uses the C250 manual transaxle. However, in contrast to the previous model, a double-cone type synchromesh in the 2nd gear and a rolling type lock ball have been adopted.
- The 3ZZ-FE engine model uses the C50 manual transaxle. However, in contrast to the previous model, a rolling 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.



C50 Series Manual Transaxle



S54 Manual Transaxle



E351 Manual Transaxle

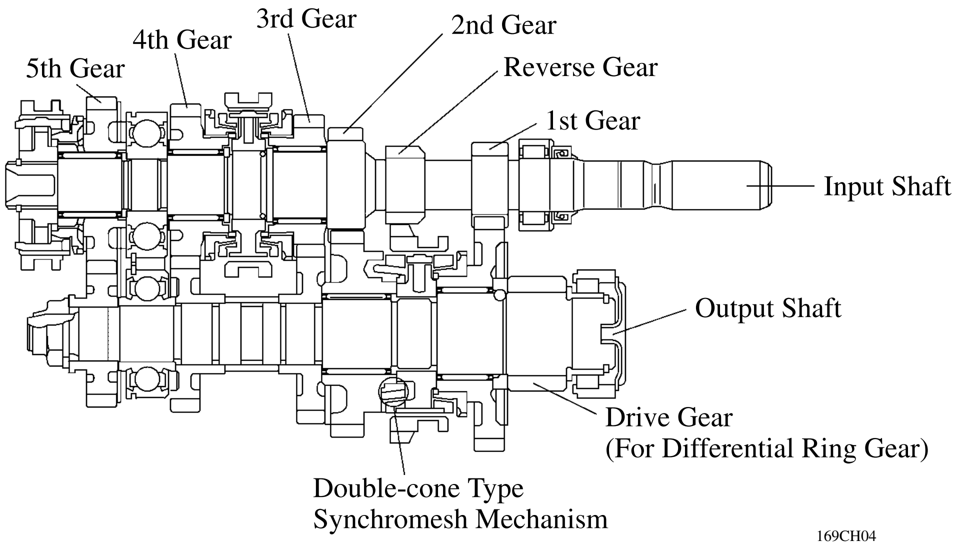
▶ Specifications ◀

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	←	←	←

2. Transmission Gear

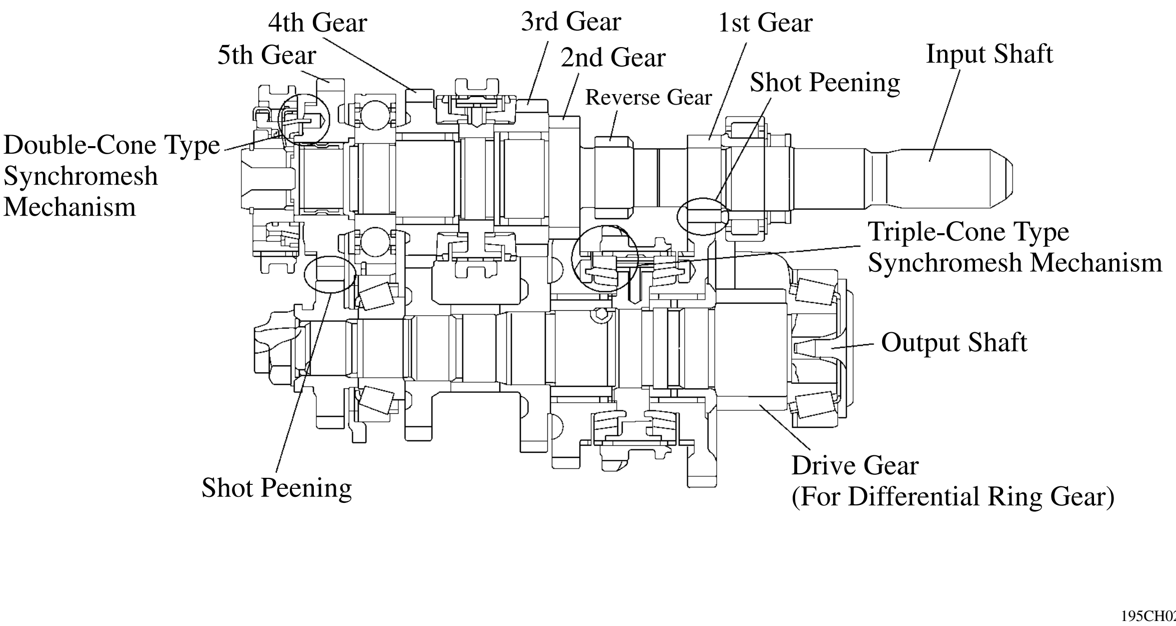
C250 Manual Transaxle

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



E351 Manual Transaxle

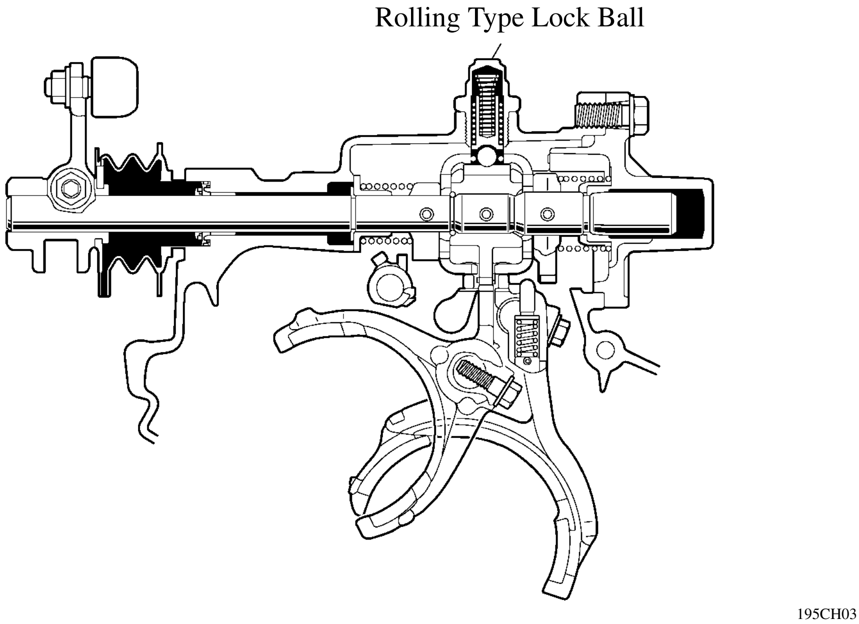
- The gears have been strengthened by adopting shot-peened 1st and 5th gears and by optimizing the gear tooth flanks.
- A triple-cone type synchromesh mechanism is used for the 1st gear and 2nd gear to increase the synchronizer capacity. This helps to reduce the shifting effort and provide smoother shifting.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



3. Shift and Select Mechanism

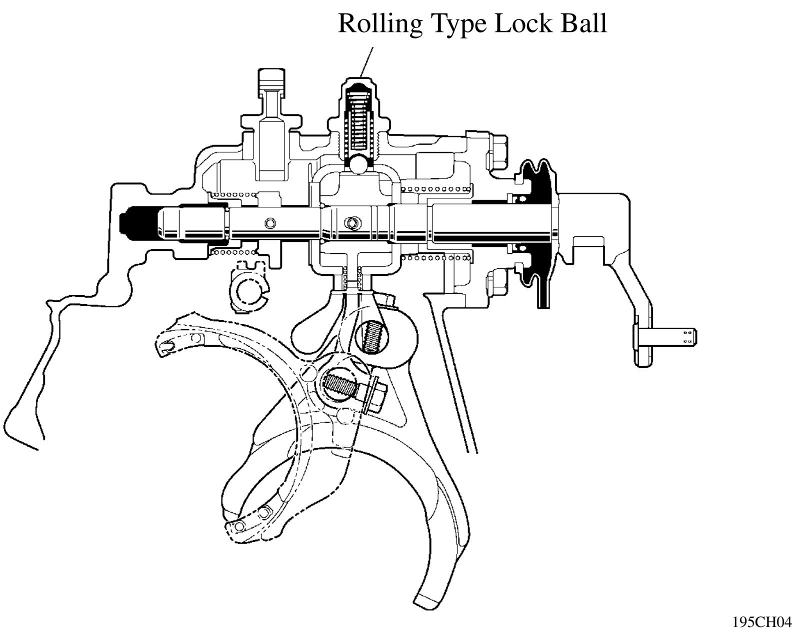
C50 and C250 Manual Transaxles

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



E351 Manual Transaxle

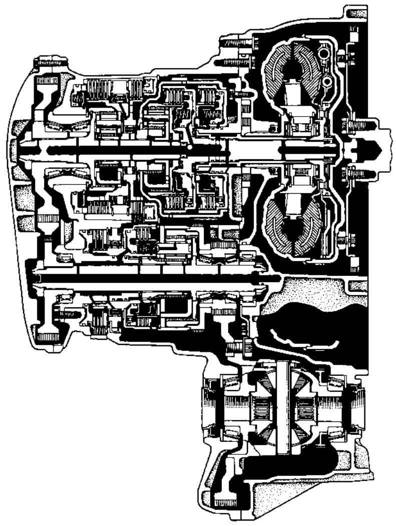
The shift feel has been improved through the adoption of the rolling type lock ball.



■ 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

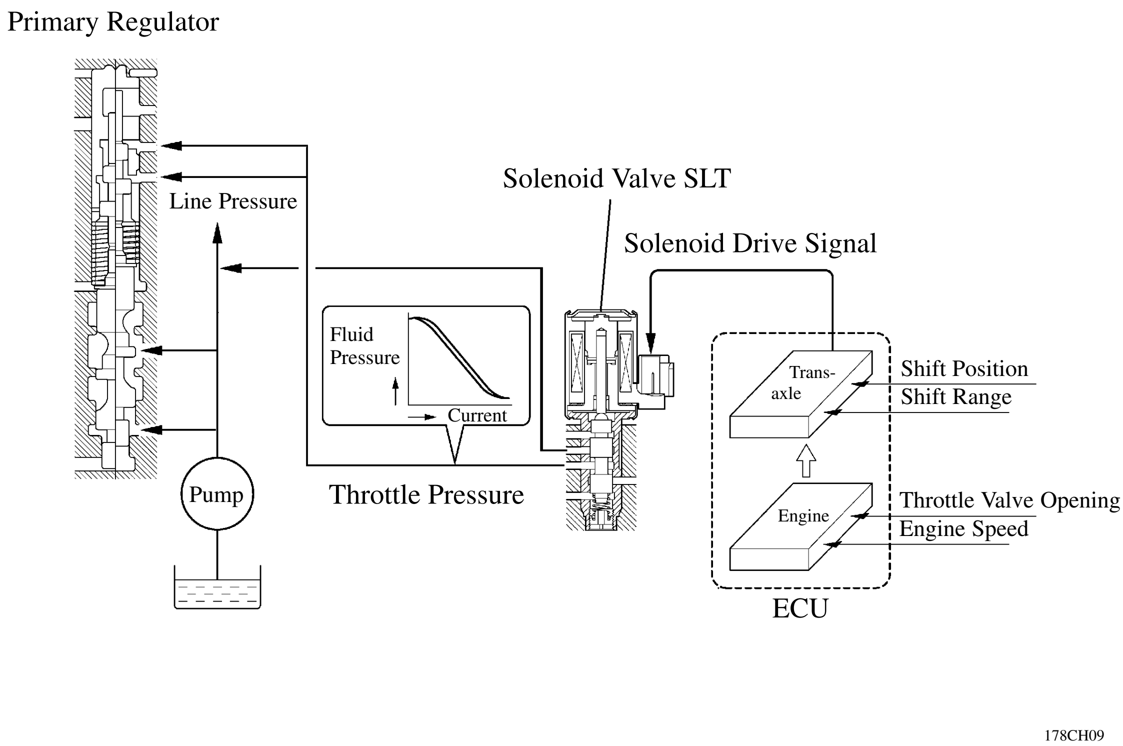
▶ Specifications ◀

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

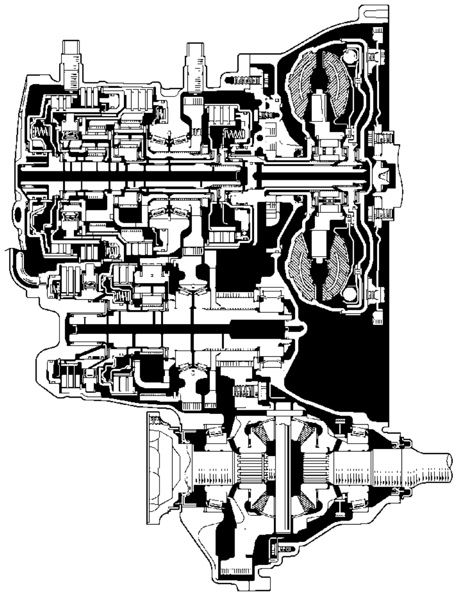
The line pressure is controlled by using a solenoid valve SLT. Through the use of the solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transaxle. Accordingly, 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.



■ 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 ◀

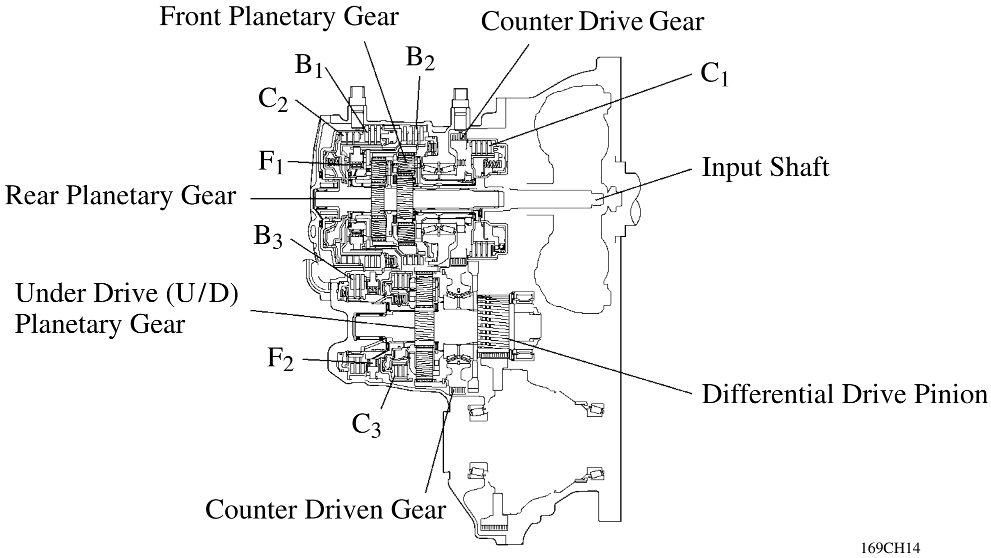
Gear Ratio*[1]	1st	3.943
	2nd	2.197
	3rd	1.413
	4th	1.020
	Reverse	3.145
Differential Gear Ratio		2.923
Fluid Capacity	Liters (US qts, Imp. qts)	7.6 (8.0, 6.7)*[2]
Fluid Type		ATF Type T-IV

*[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.



▶ 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

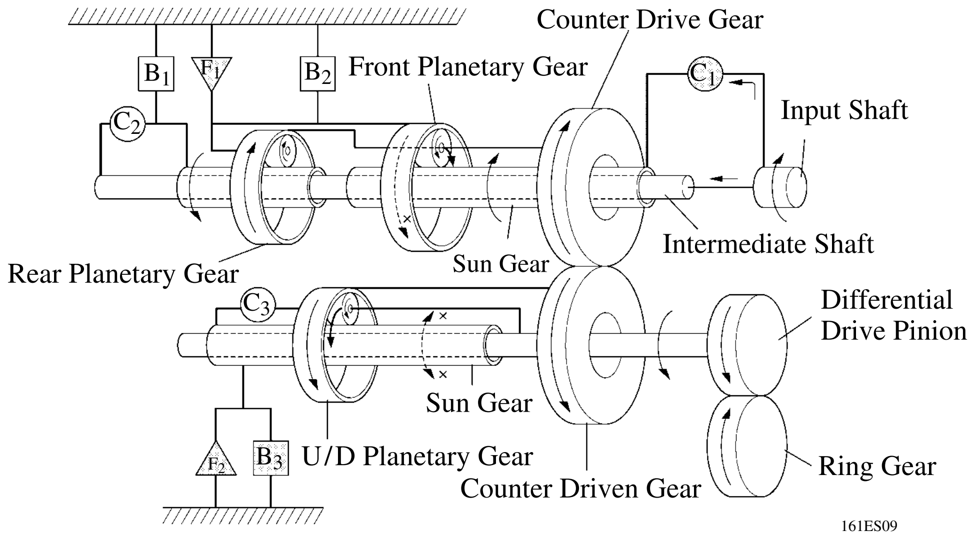
Motive Power Transaxle

▶ Operating Conditions ◀

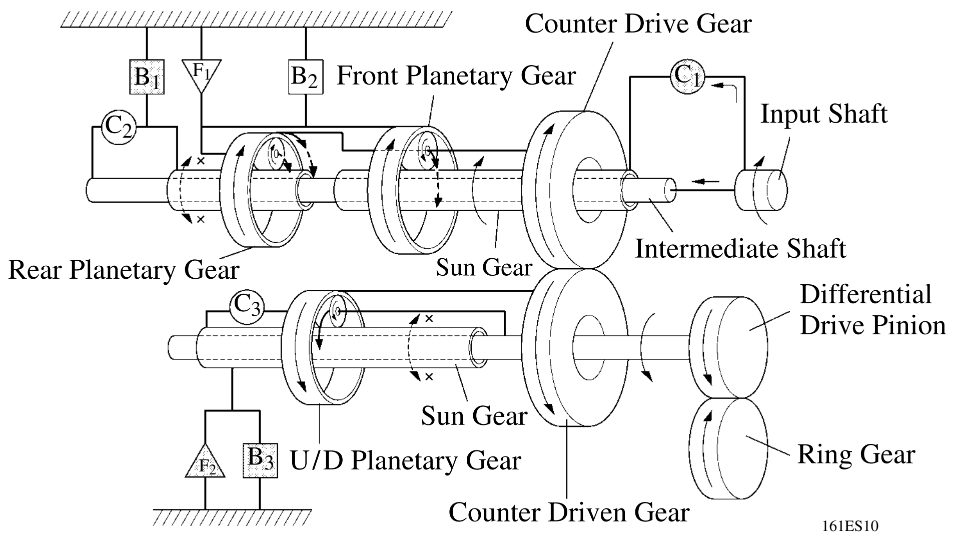
Shift Lever Position	Gear	Solenoid Valve SL1	Solenoid Valve SL2	Solenoid Valve S4	Solenoid Valve DSL	C_1	C_2	C_3	B_1	B_2	B_3	F_1	F_2
P	Park	ON	ON	OFF	OFF						○		
R	Reverse	ON	OFF	OFF	OFF		○			○	○		
N	Neutral	ON	ON	OFF	OFF						○		
D	1st	ON	ON	OFF	OFF	○					○	○	○
	2nd	OFF	ON	OFF	OFF	○			○		○		○
	3rd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

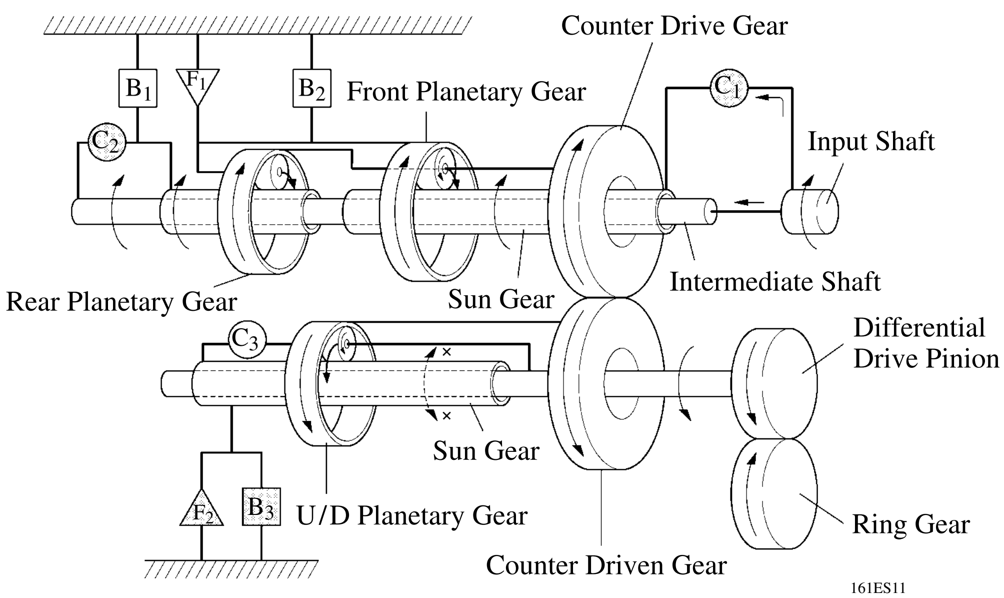
1) 1st Gear (D or 2 Position)



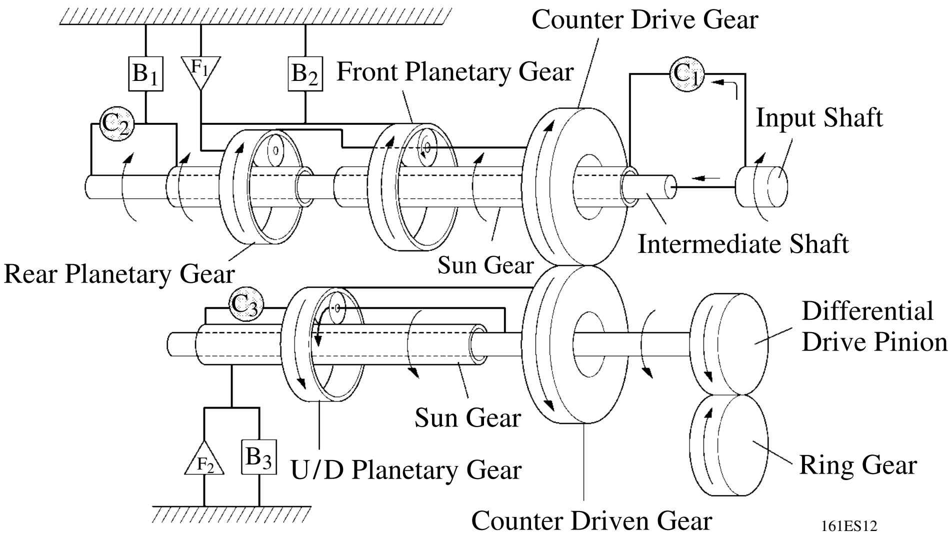
2) 2nd Gear (D or 2 Position)



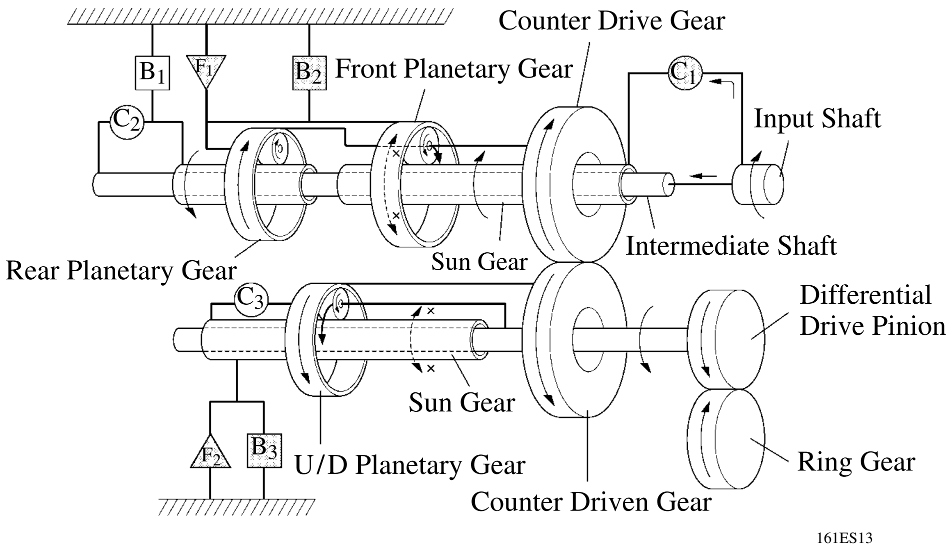
3) 3rd Gear (D Position)



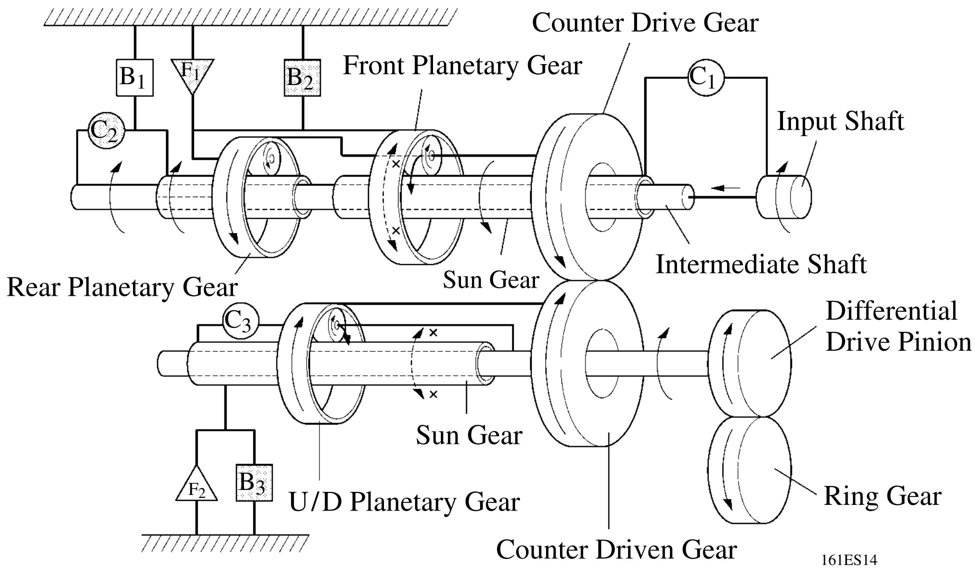
4) 4th Gear (D Position)



5) 1st Gear (L Position)



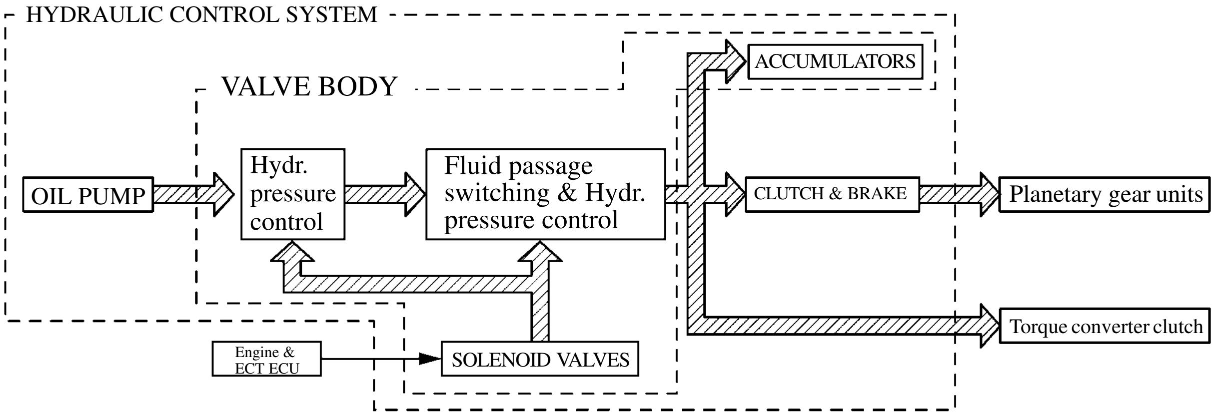
6) Reverse Gear (R Position)



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

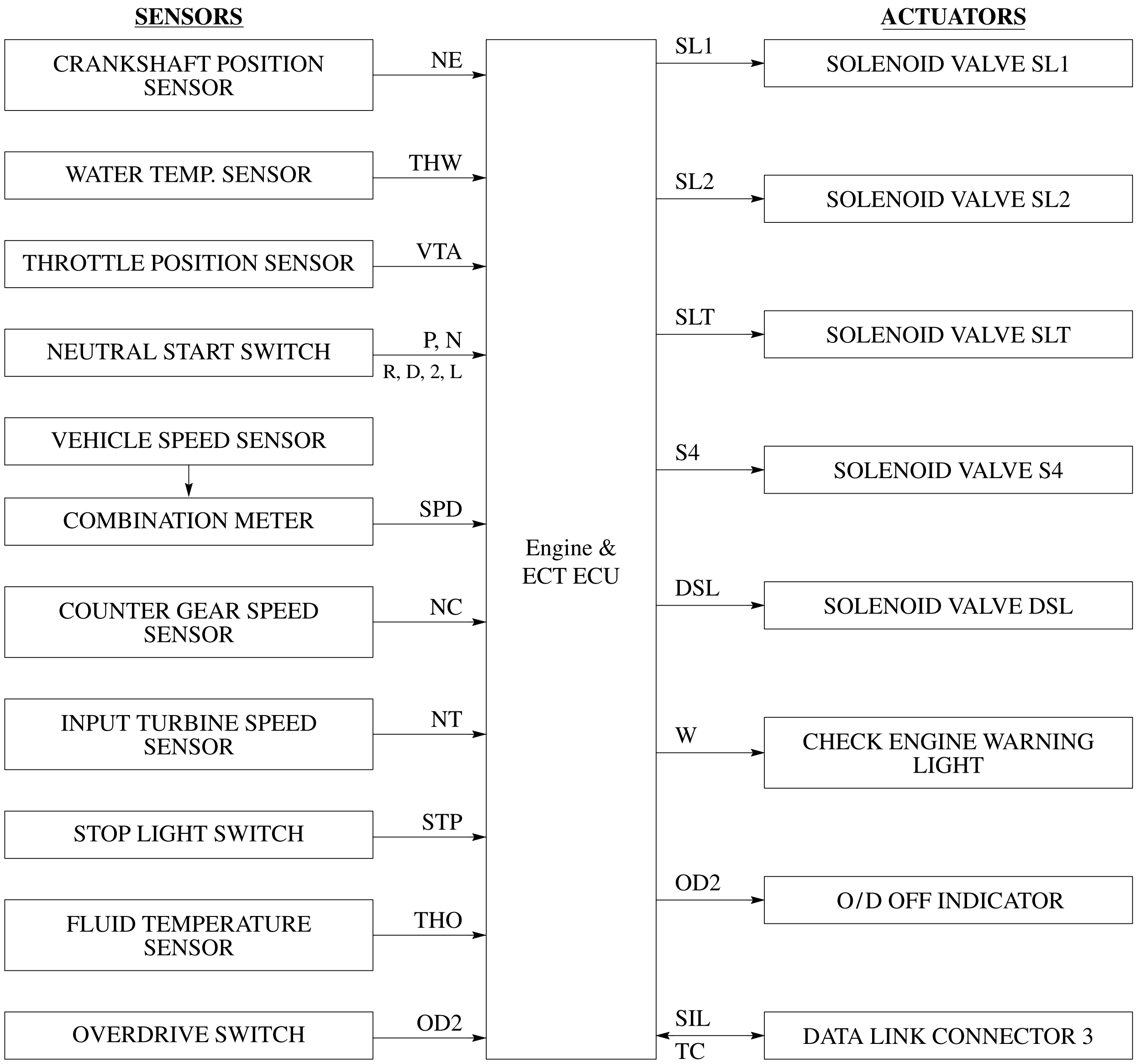
Valve Body

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.

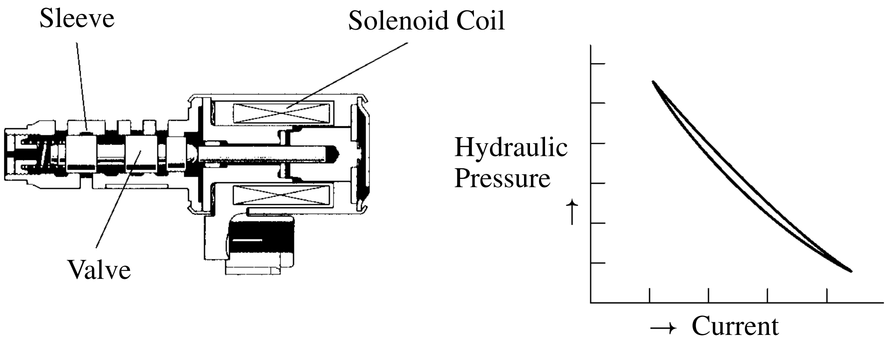


Solenoid Valves

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

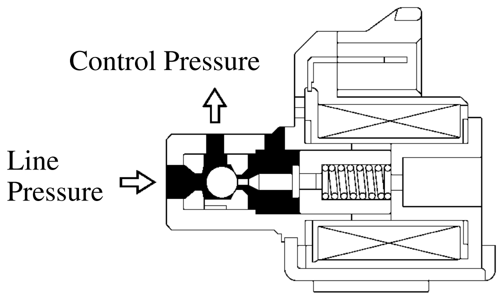
b. Functions of Solenoid Valve SL1, SL2 and SLT

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

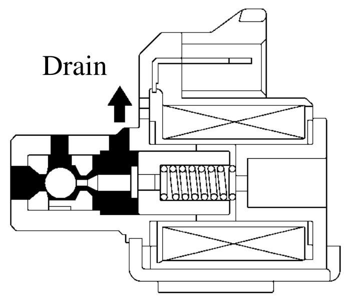
a. General

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



Solenoid Valve ON

161ES65

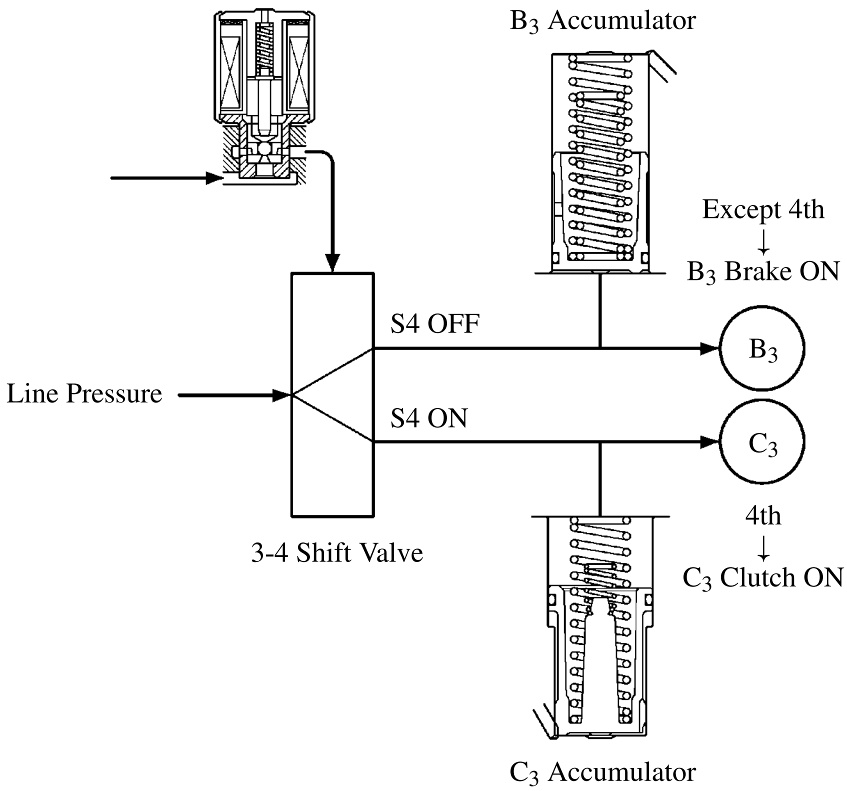


Solenoid Valve OFF

161ES64

b. Function of Solenoid Valve S4

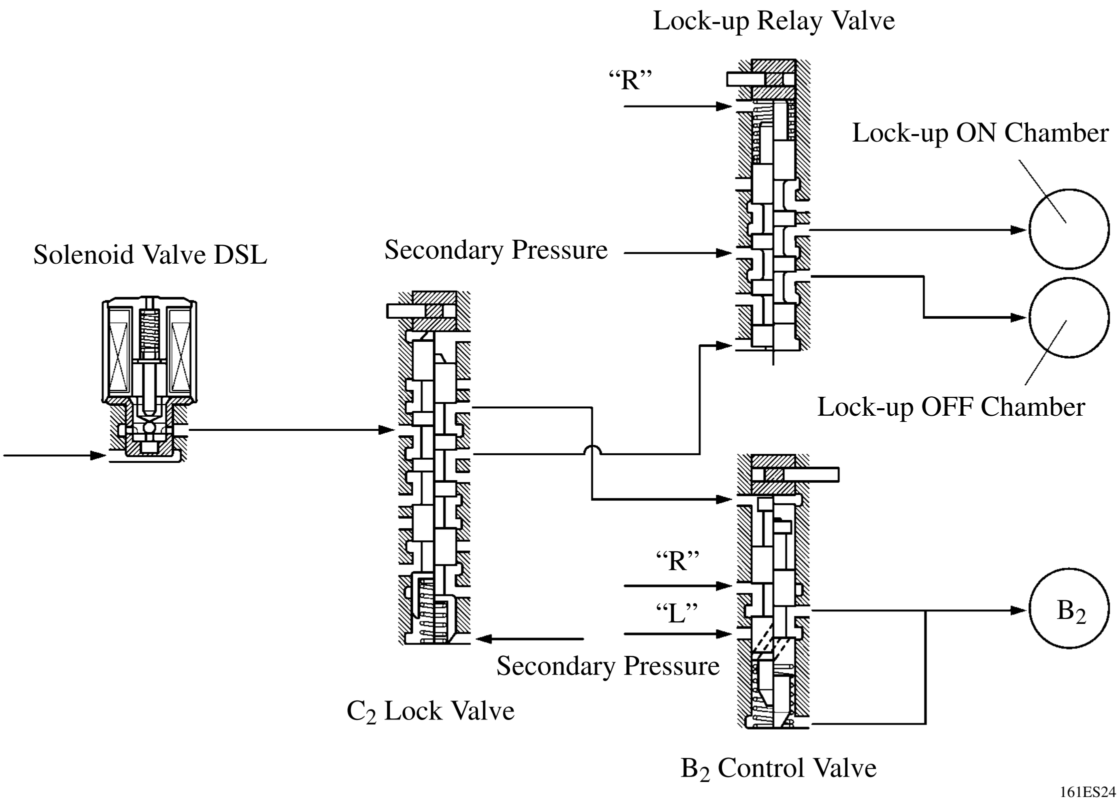
The solenoid valves S4 when set to ON controls the 3-4 shift valve to establish the 4th by changing over the fluid pressure applied to B_3 brake and C_3 clutch.



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.



3

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

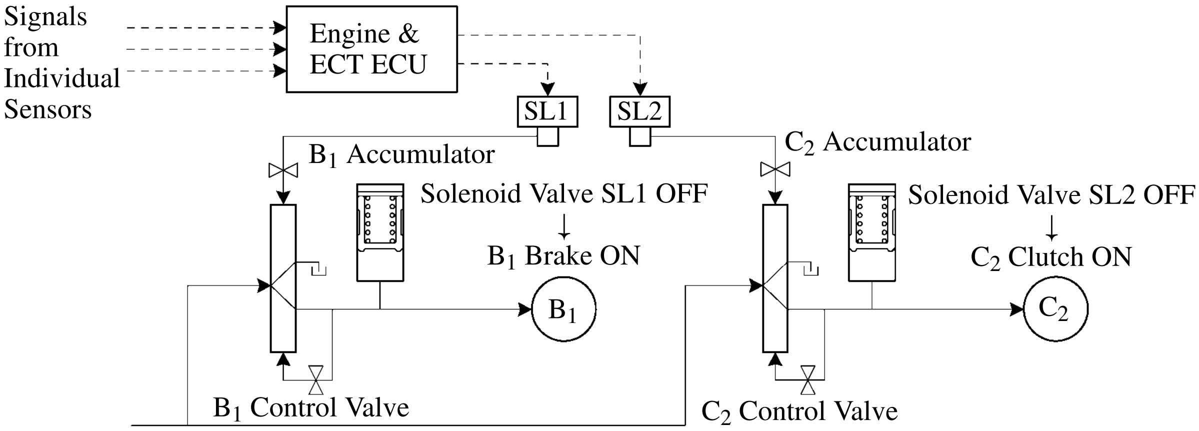
The automatic transaxle control system of the U240E automatic transaxle consists of the control listed below.

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

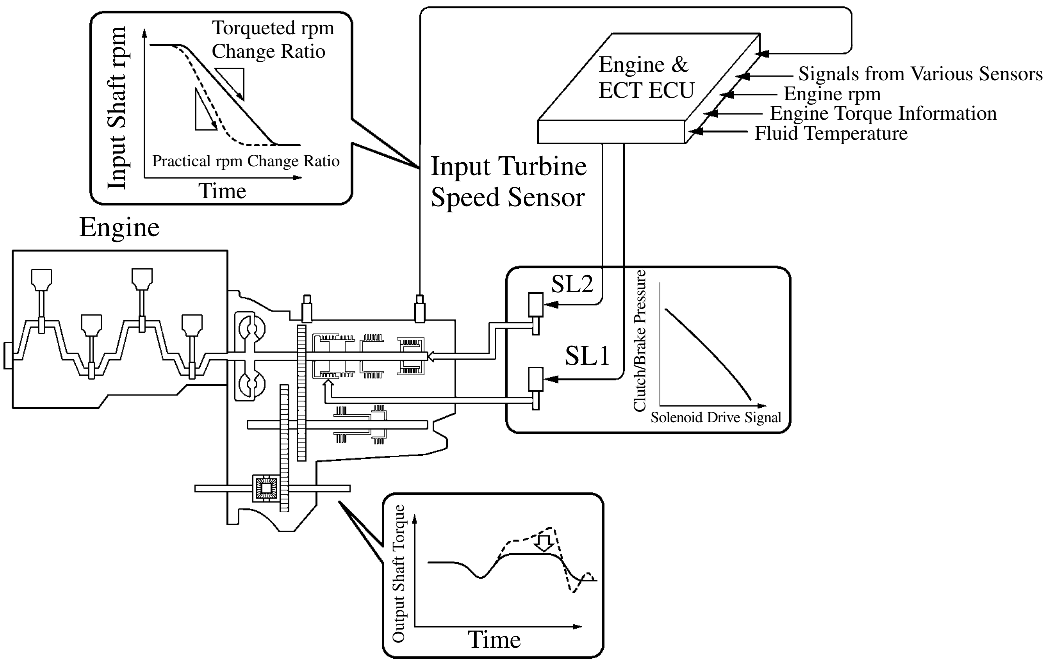
A direct clutch pressure control has been adopted for shifting from the 1st to 2nd gear, and from the 2nd to 3rd gear. Actuates solenoid valves SL1 and LS2 in accordance with the signals from the engine & ECT ECU, and guides this output pressure directly to control valves B_1 and C_2 in order to regulate 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

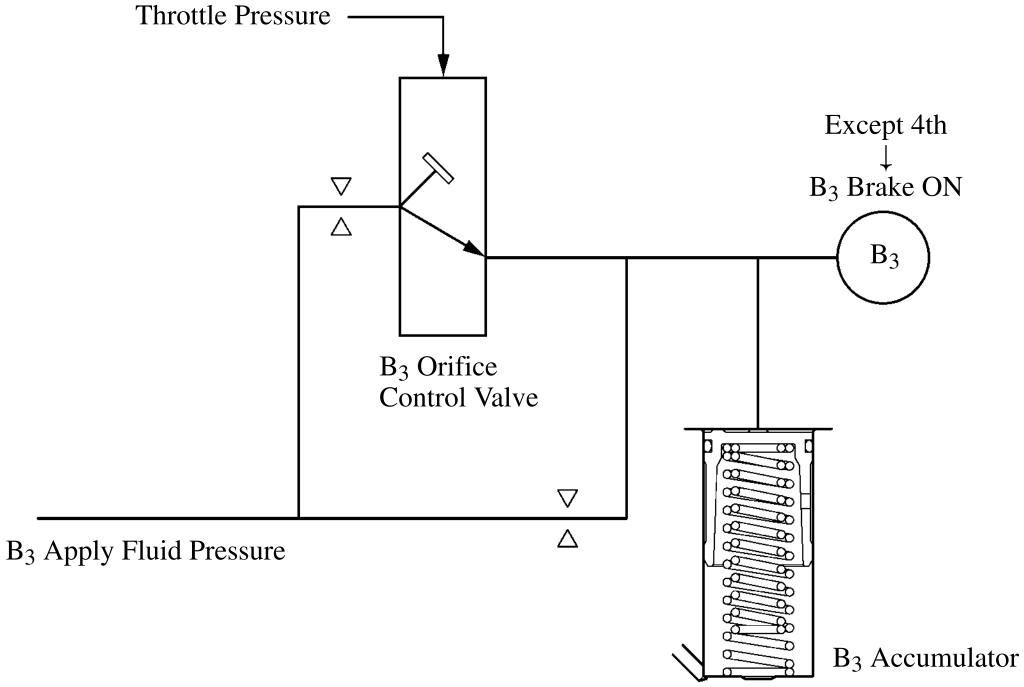
Solenoid valves SL1 and SL2 are used for optimal control of clutch pressure. The engine & ECT ECU monitors the signals from various types of sensors such as the input turbine speed sensor, allowing shift solenoid valves SL1 and SL2 to minutely control the clutch pressure in accordance with engine output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



169CH16

Apply Orifice Control

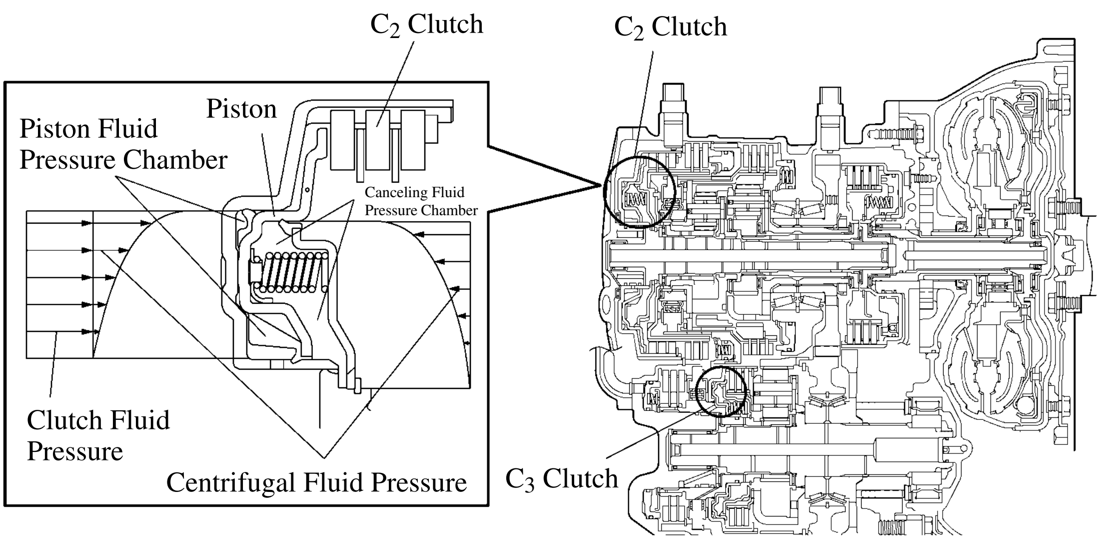
The B_3 orifice control valve has been provided for the B_3 brake, which is applied when shifting from 4th to 3rd. The B_3 orifice control valve is controlled by the amount of the throttle pressure in accordance with shifting conditions, and the flow volume of the fluid that is supplied to the B_3 brake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



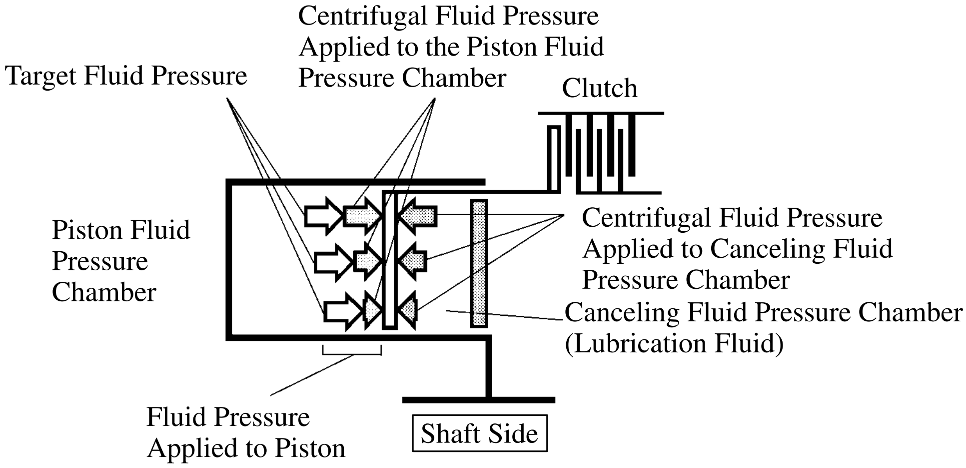
157CH19

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

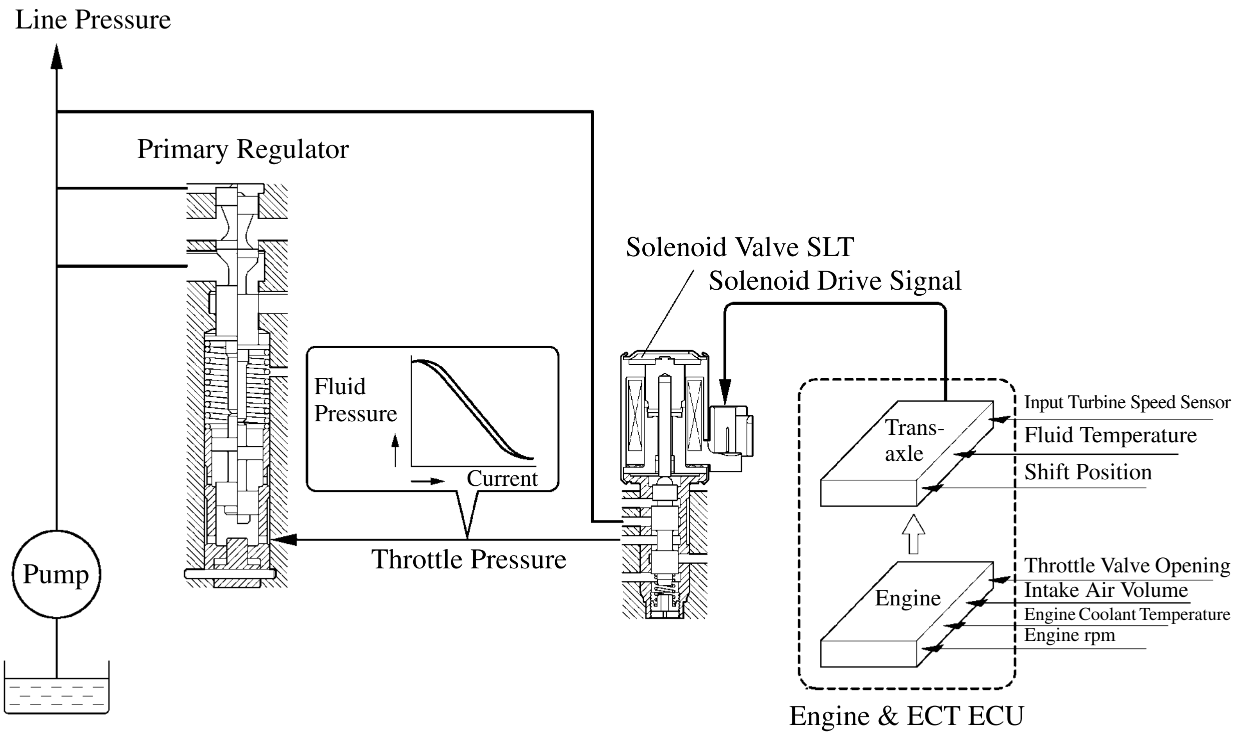


157CH17

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

Line Pressure Optimal Control

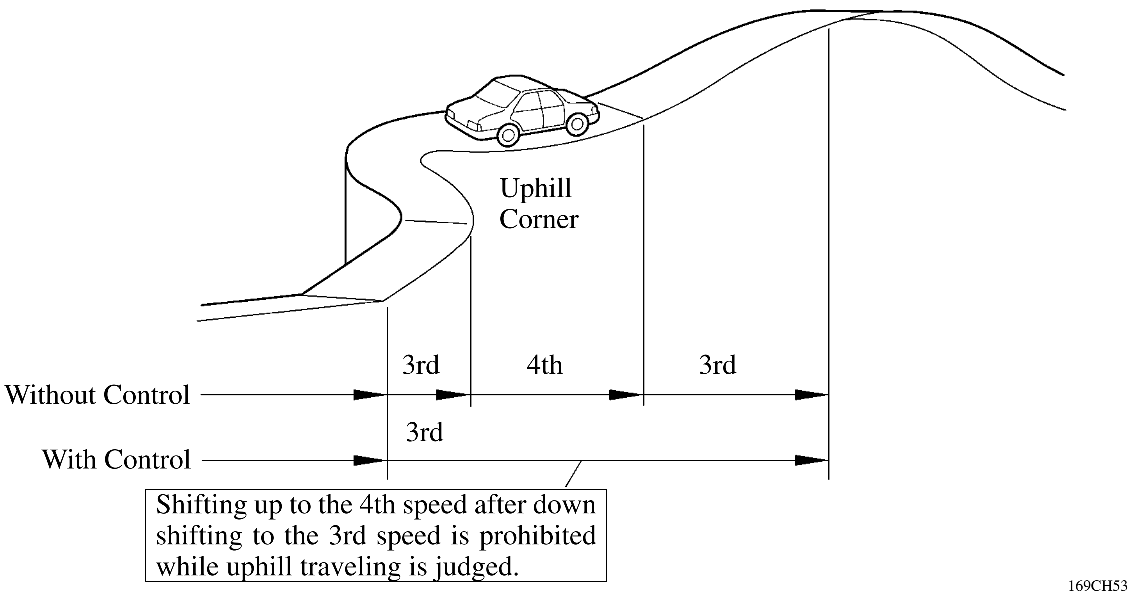
The line pressure is controlled by using a solenoid valve SLT. Through the use of the solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transaxle. Accordingly, 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.



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

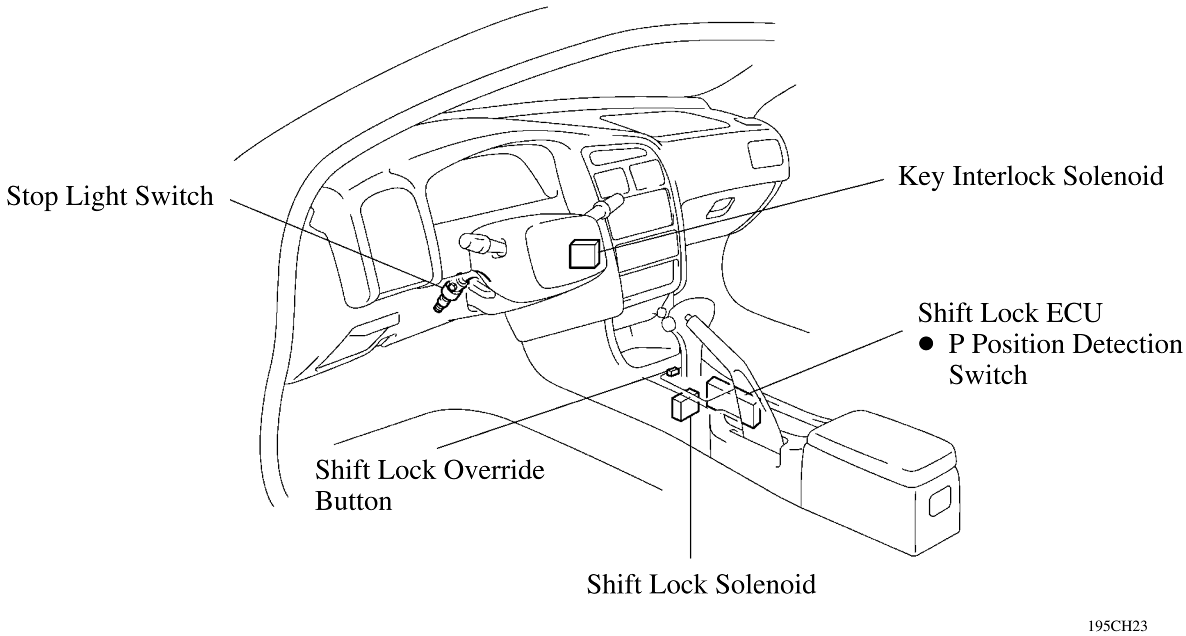
*1: Lock-up ON
*2: B_1 is constantly operating

■ 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



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.

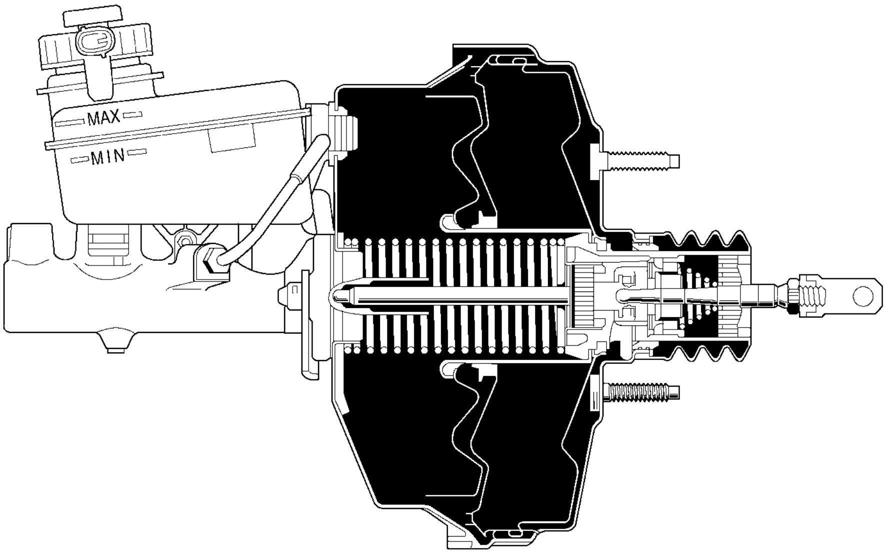
■BRAKE

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

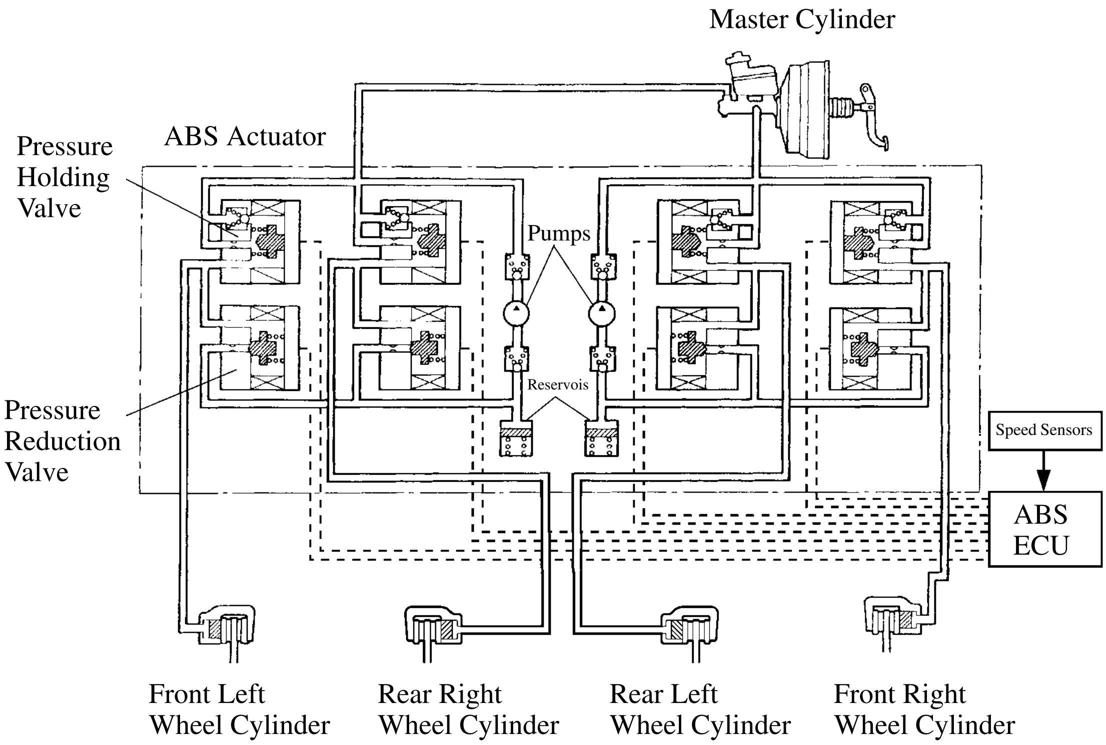
195CH05

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.

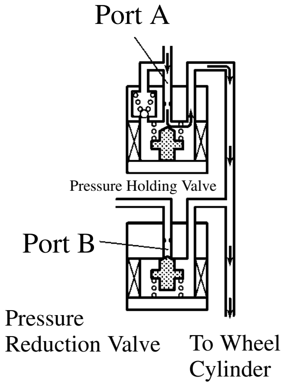
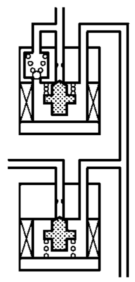
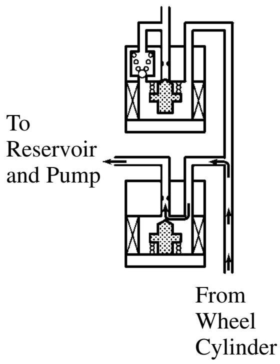
Hydraulic Circuit



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	 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

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

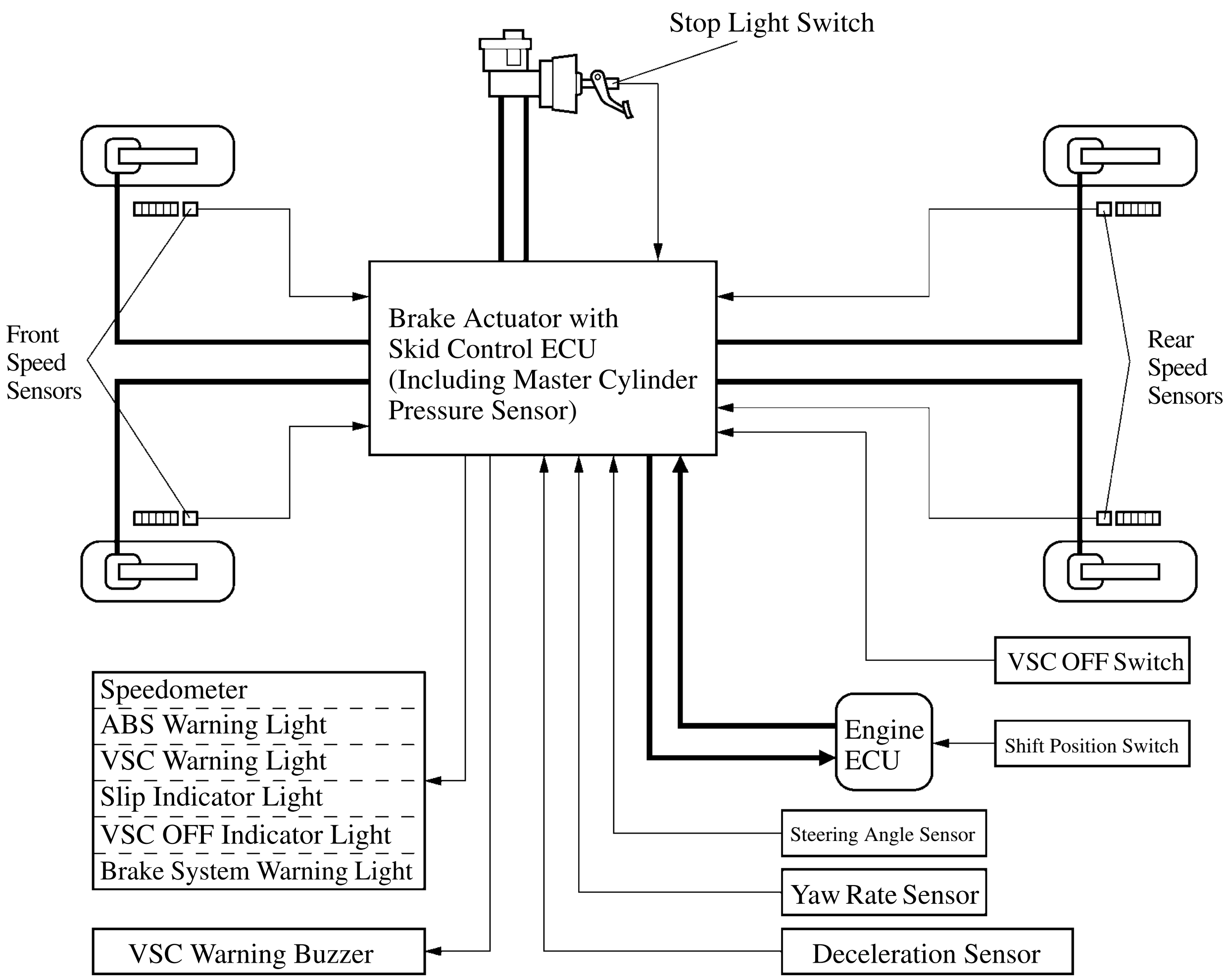
In the event of a malfunction in the ABS, the skid control ECU turns on the ABS warning light and prohibits the ABS control. In the case of the malfunction that the EBD control can not be carried out, the ABS ECU also turns on the brake system warning light and prohibits the EBD control.

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

General

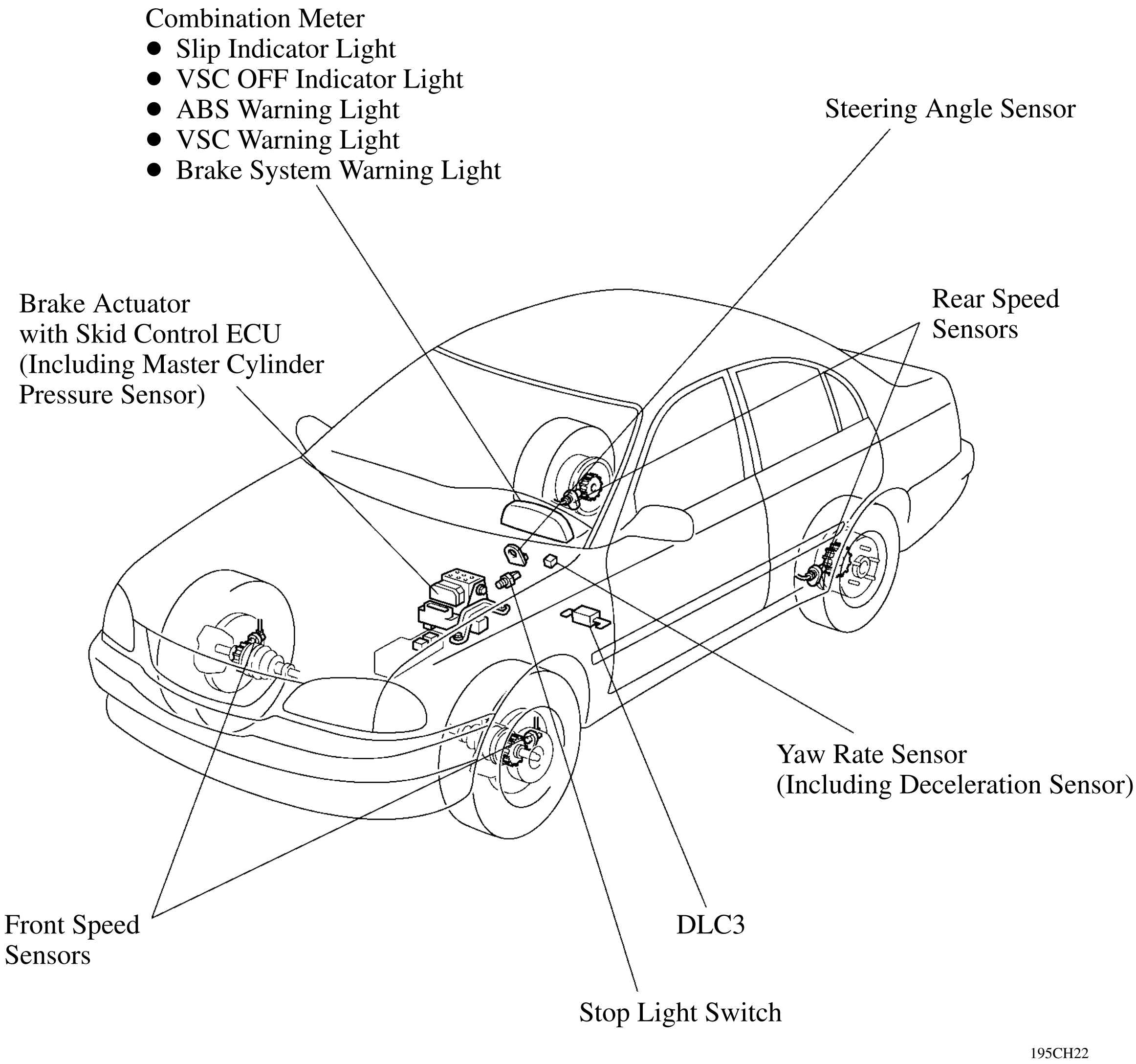
- The primary purpose of the ABS and TRC system has been to help the vehicle's stability during braking and acceleration. In contrast, the purpose of the VSC system is to help the vehicle's stability during cornering.
- Ordinarily, the vehicle corners in a stable manner in accordance with the steering 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



Function of Main Components

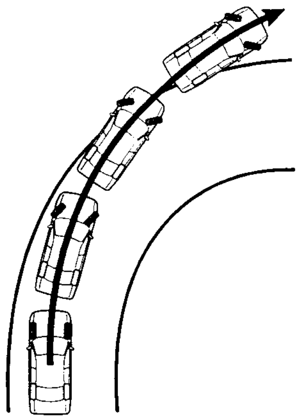
Components		Function
Warning Light and Indicator Light	ABS Warning Light	Lights up to alert the driver when the ECU detects the malfunction in the ABS or Brake Assist System.
	VSC Warning Light	Lights up to alert the driver when the ECU detects the malfunction in the TRC or VSC system.
	Slip Indicator 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

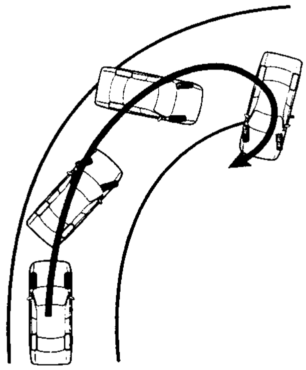
The followings are two examples that can be considered as circumstances in which the tires overcome their lateral grip limit.

- 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

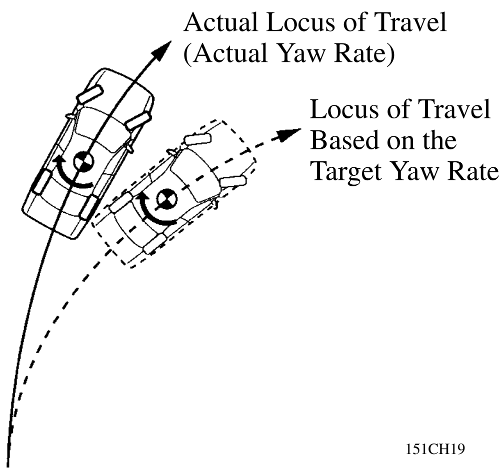
2) Method for Determining the Vehicle Condition

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.

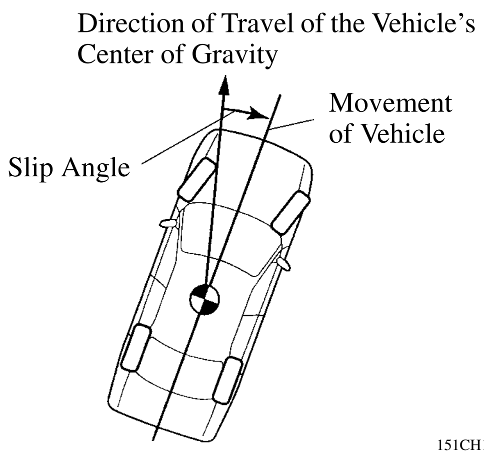
When the vehicle’s actual yaw rate is smaller than the yaw rate (a target yaw rate that is determined by the vehicle speed and steering angle) that should be rightfully generated when the driver operates the steering wheel, it means the vehicle is making a turn at a greater angle than the loss of travel.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

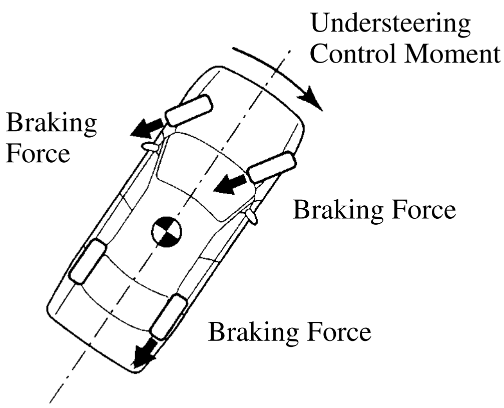
3

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

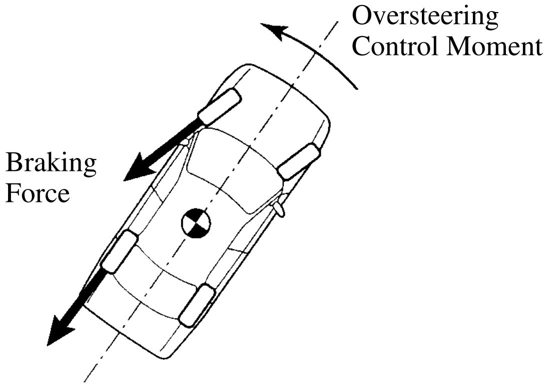
When the skid control ECU determines that the vehicle exhibits a strong tendency to understeer, depending on the extent of that tendency, it controls the engine output and applies the brakes of the front wheels and inside rear wheel, thus providing the vehicle with an understeer control moment, which 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

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.



Making a Right Turn

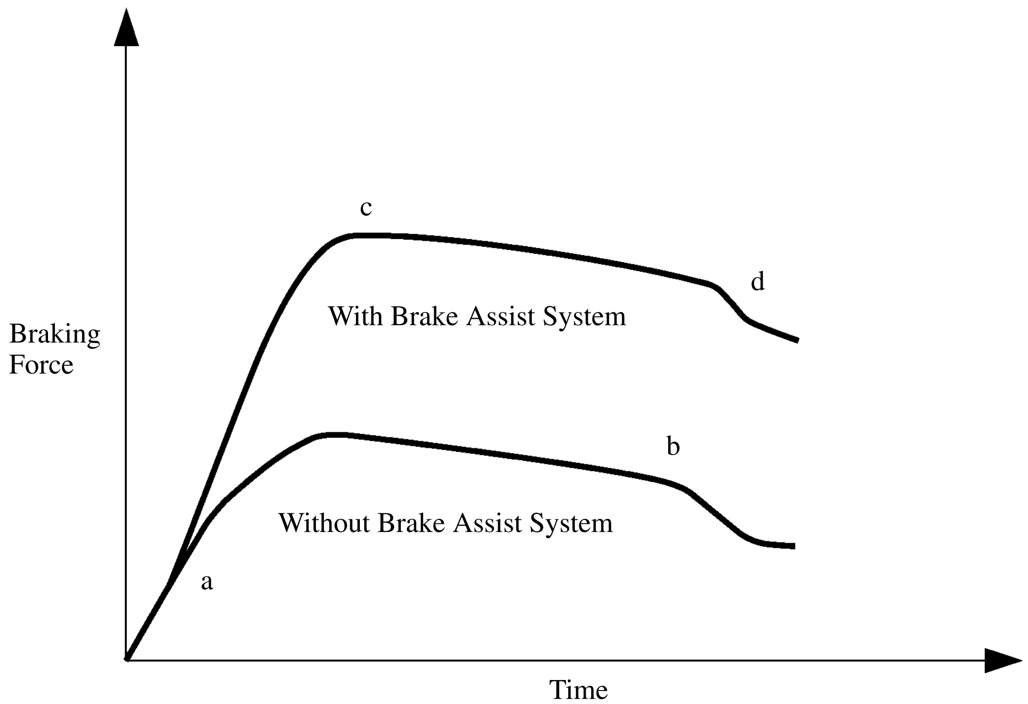
Outline of Brake Assist System

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.

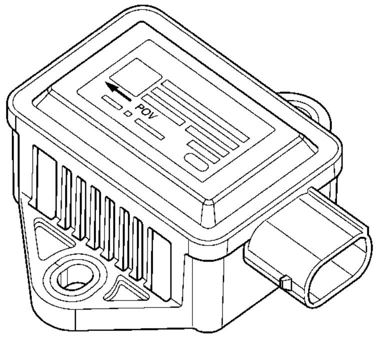


170CH18

Construction and Operation of Main Components

1) Yaw Rate Sensor

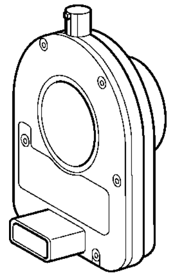
A deceleration sensor is built into the yaw rate sensor. This sensor detects the yaw rate and deceleration, and sends this signal to the Skid Control ECU.



195CH24

2) Steering Angle Sensor

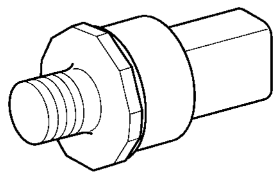
The steering angle sensor detects the steering direction and angle, and sends this signal to the skid control ECU.



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.



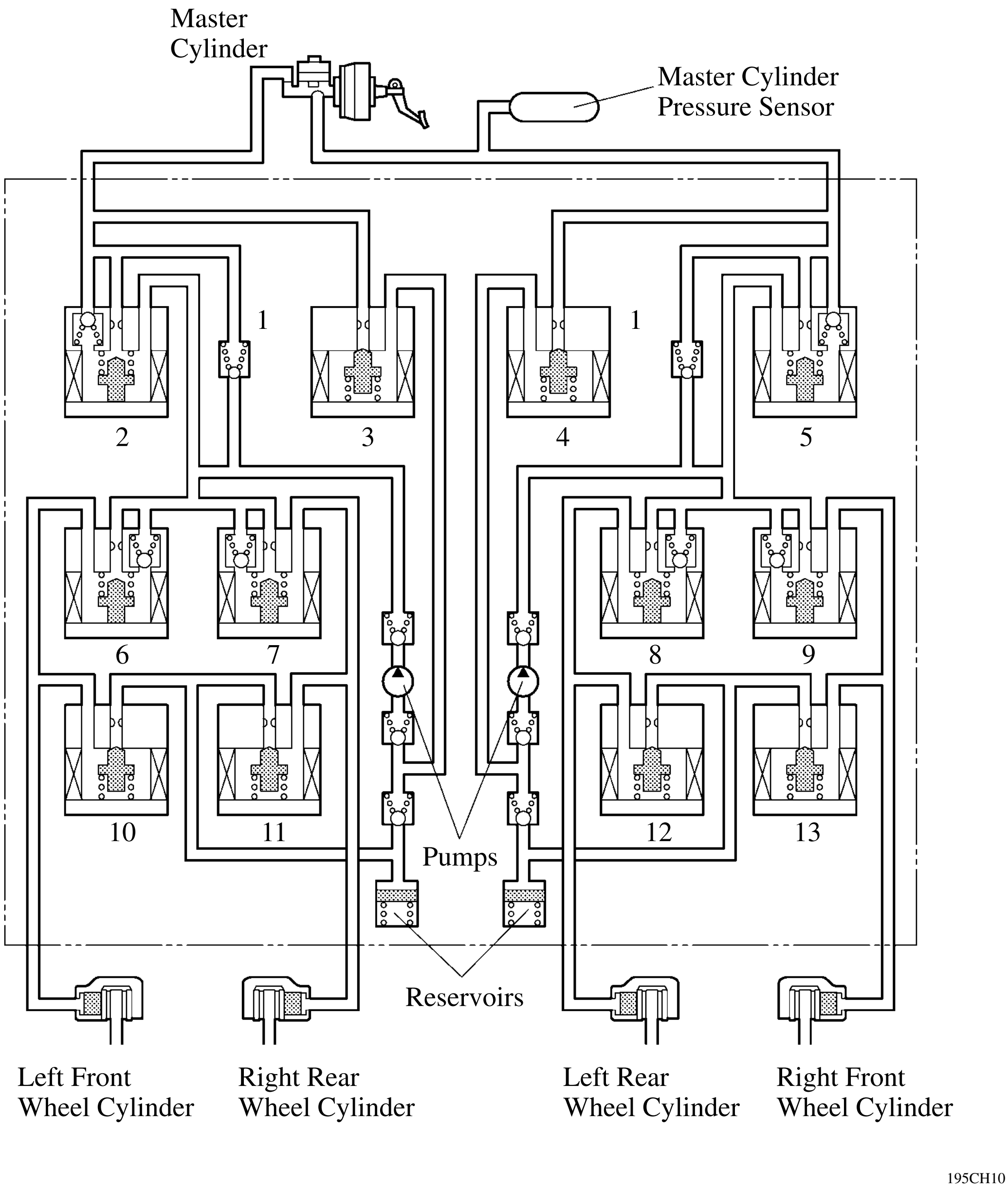
195CH09

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

a. Construction

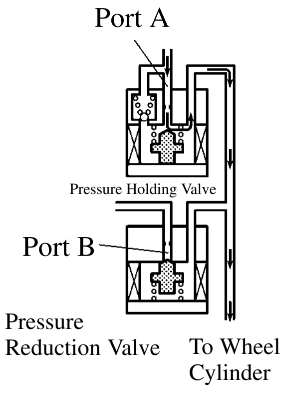
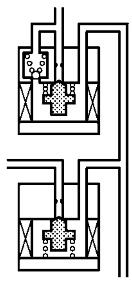
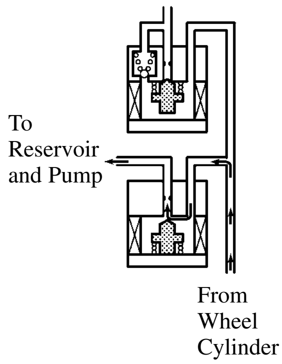
The brake actuator consists of 12 two-position solenoid valves, 1 motor 2 pumps, 2 reservoirs and 2 pressure regulator valves (1). The 12 two-position solenoid valves consist of 2 master cylinder cut solenoid valves (2, 5), 2 reservoir cut solenoid valves (3, 4), 4 pressure holding valves (6, 7, 8, 9) 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



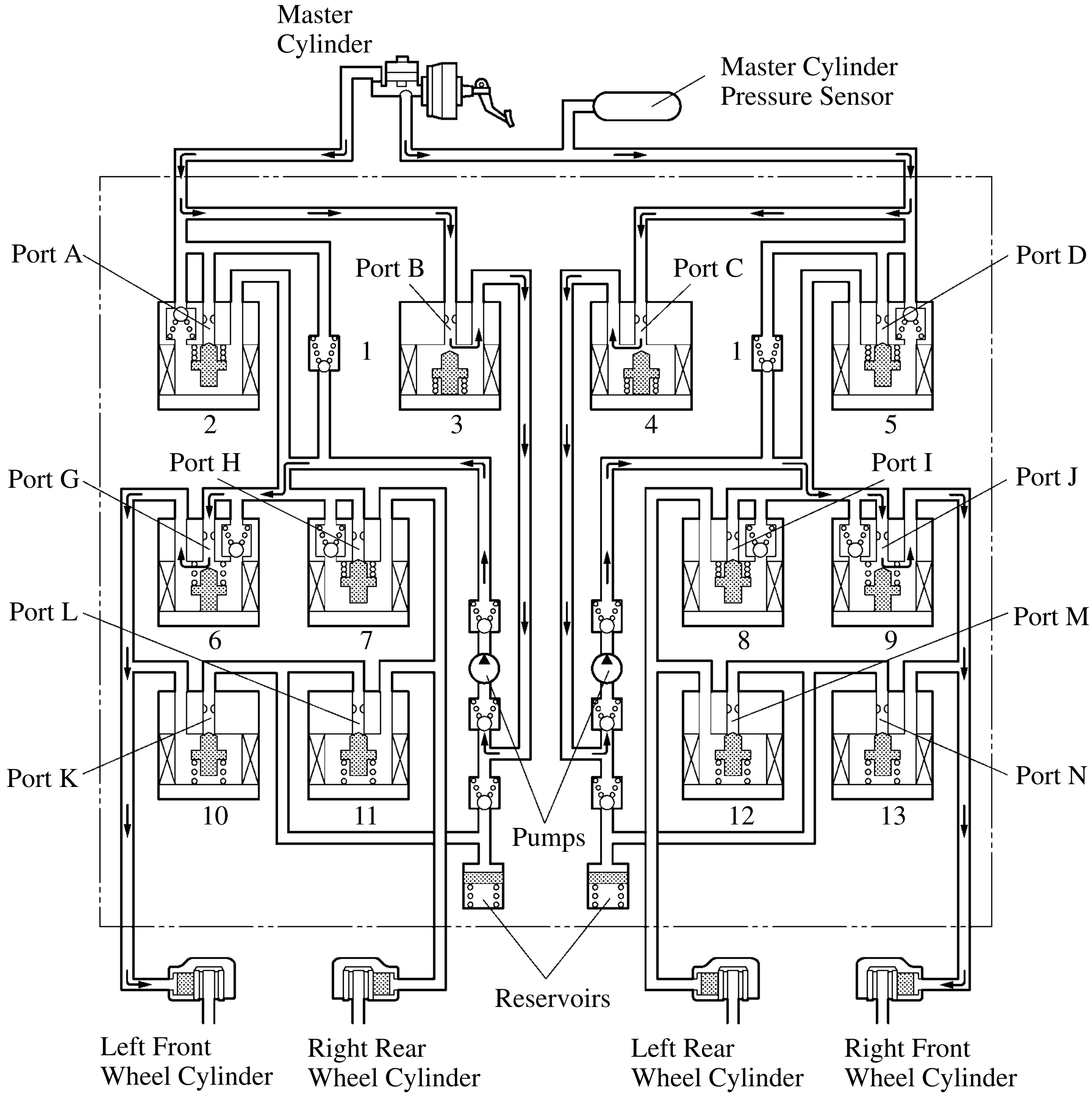
c. ABS with EBD Operation

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.



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	—	—	—	—

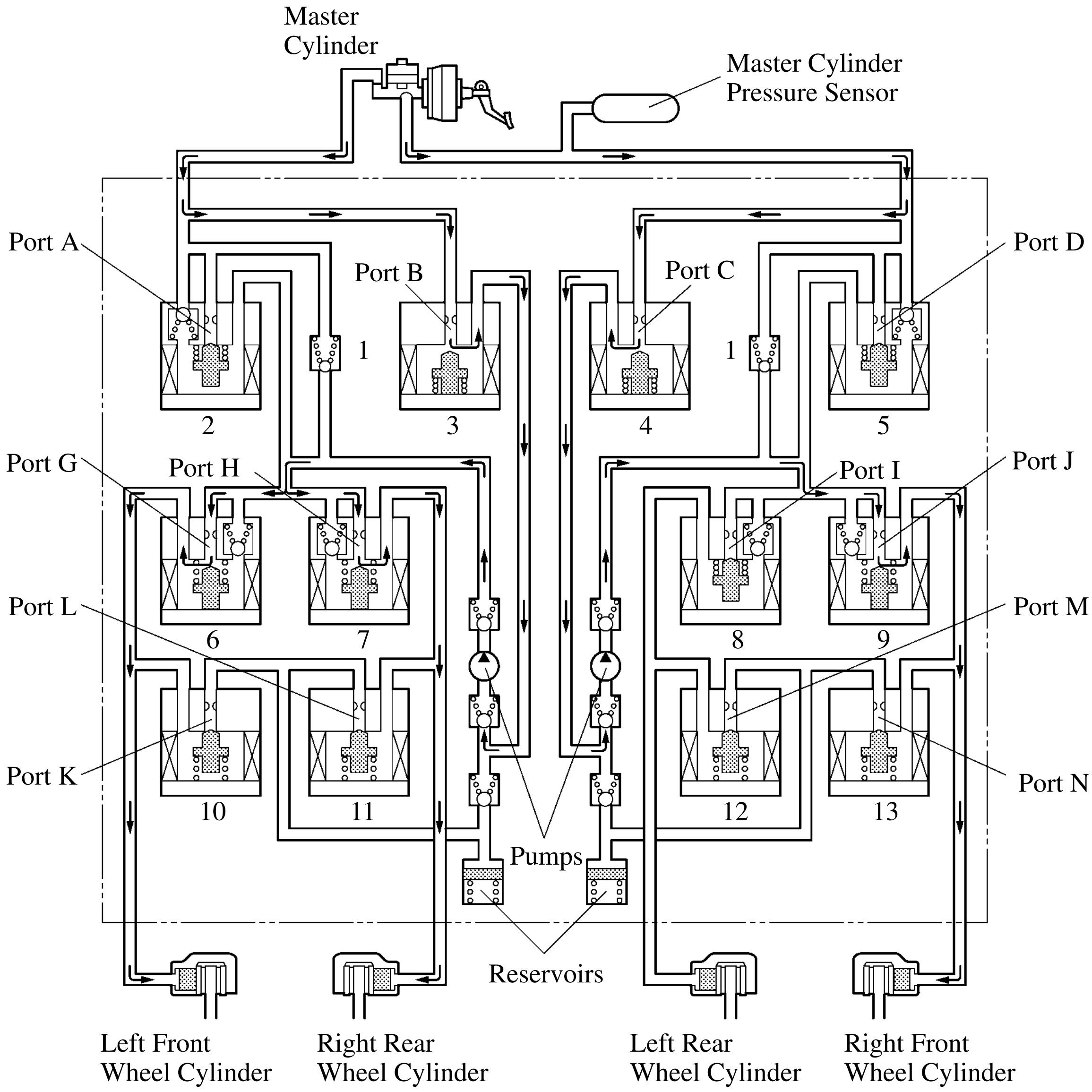
e. VSC Operation

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

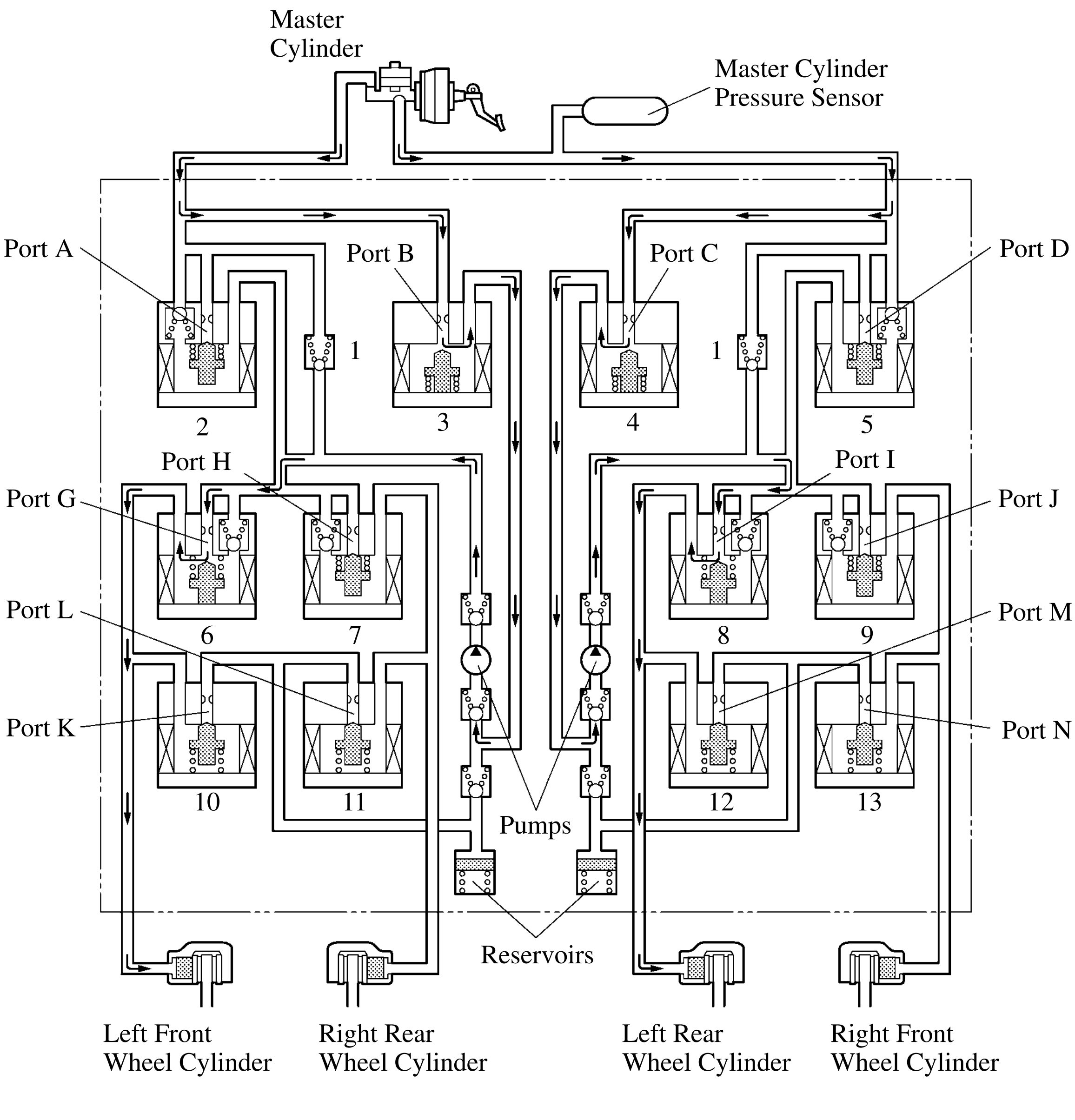
▶ **While the Vehicle Makes a Right Turn** ◀

Item		VSC Not Activated	VSC Activated		
			Pressure Increase Mode	Pressure Holding Mode	Pressure Reduction Mode
2 5	Master Cylinder Cut Solenoid Valve (Front and Rear)	OFF	ON	ON	ON
	Port: A, D	Open	Close	Close	Close
3 4	Reservoir Cut Solenoid Valve (Front and Rear)	OFF	ON	ON	ON
	Port: B, C	Close	Open	Open	Open
6 7 9	Pressure Holding Valve (Left and Right Front, Right Rear)	OFF	OFF	ON	ON
	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	—	—	—	—

3

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

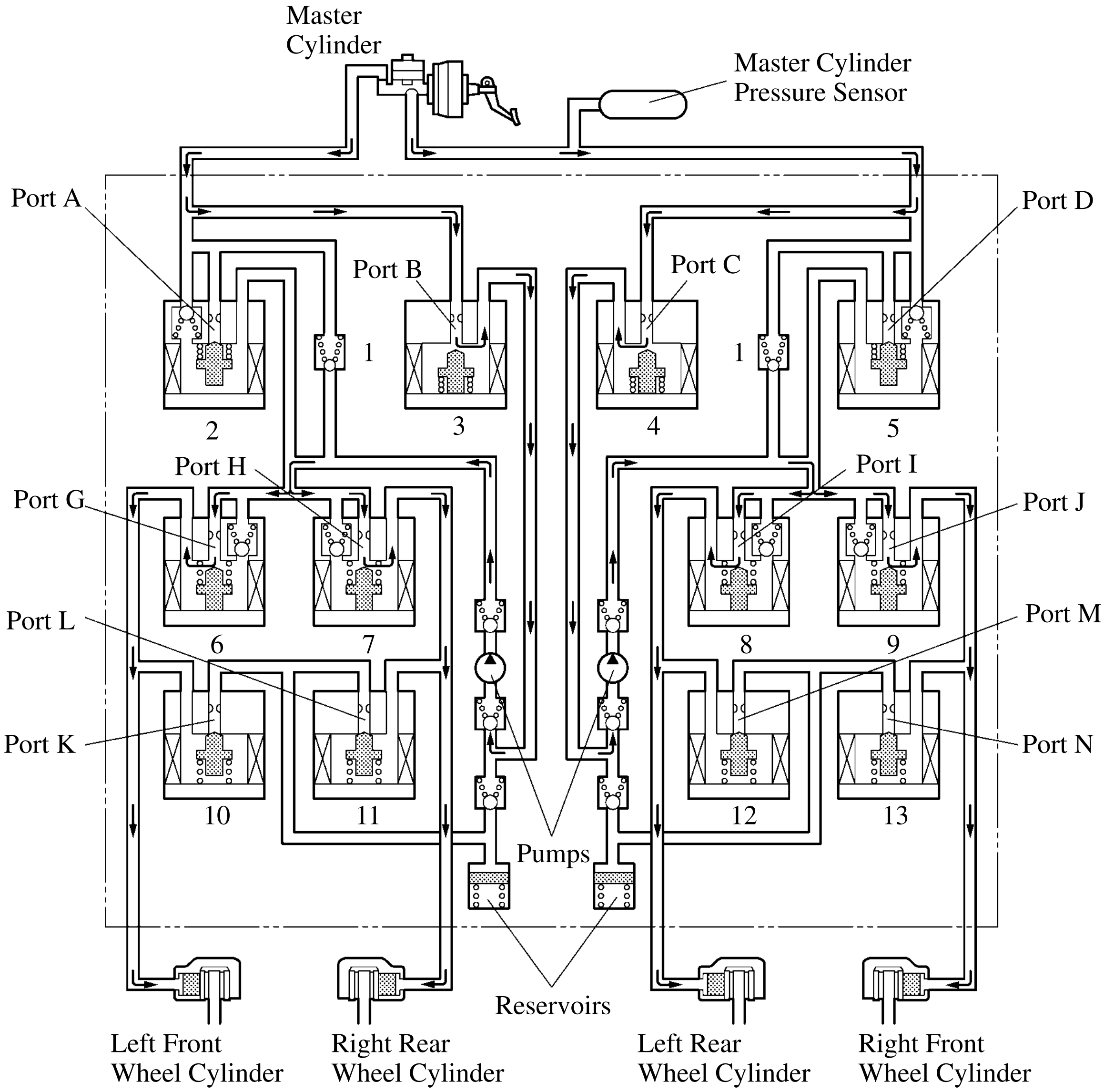
195CH13

▶ 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

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.



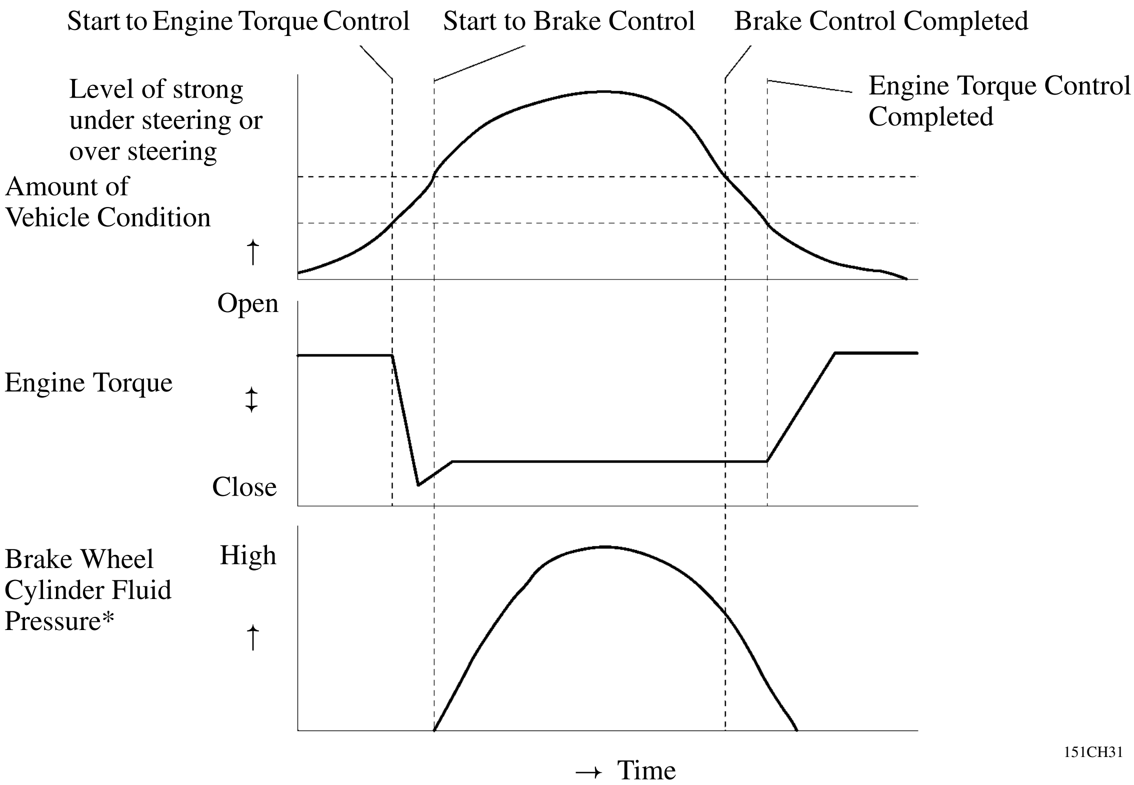
195CH14

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.



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

b. Self-Diagnosis

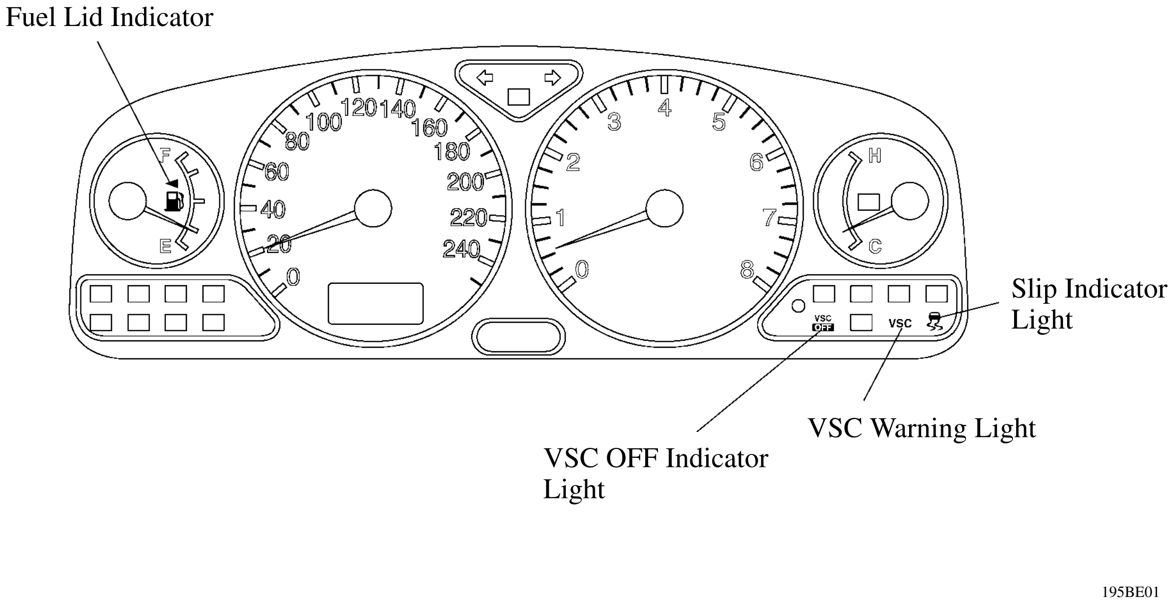
If the Skid Control ECU detects a malfunction in the VSC system, the warning light or the indicator light that corresponds to the function in which the malfunction has been detected lights up, to alert the driver of the malfunction. The ECU will also store the codes of the malfunctions. The DTCs (Diagnostic 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.

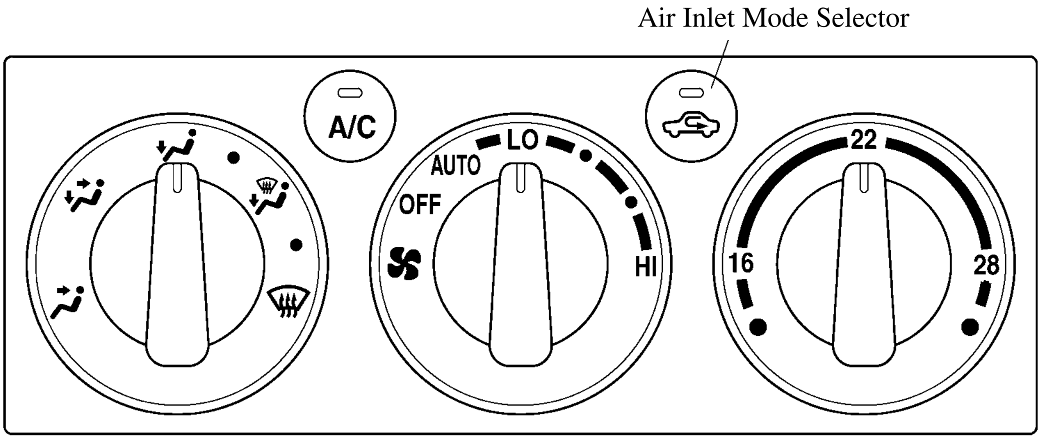
■ COMBINATION METER

- 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).

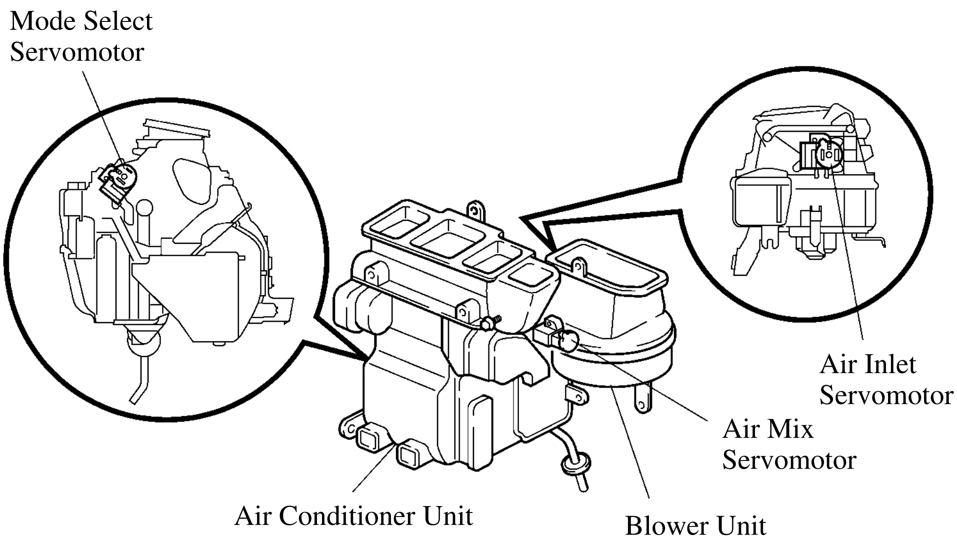


■ HEATER CONTROL SYSTEM

- 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.



with Air Conditioner Model



■DOOR LOCK CONTROL SYSTEM

1. General

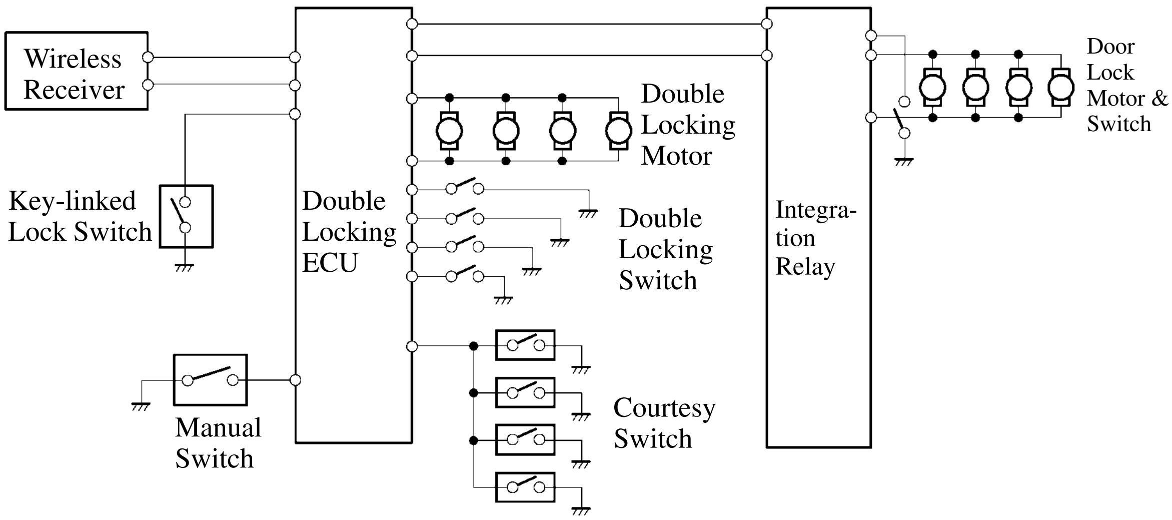
The double locking system is standard equipment on the RHD model for Europe.

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

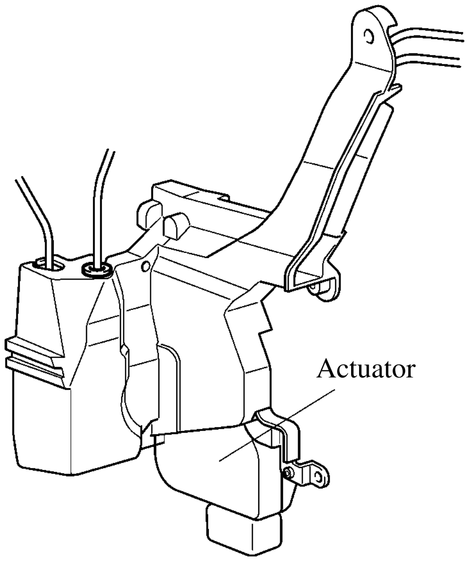
CAUTION

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.

3

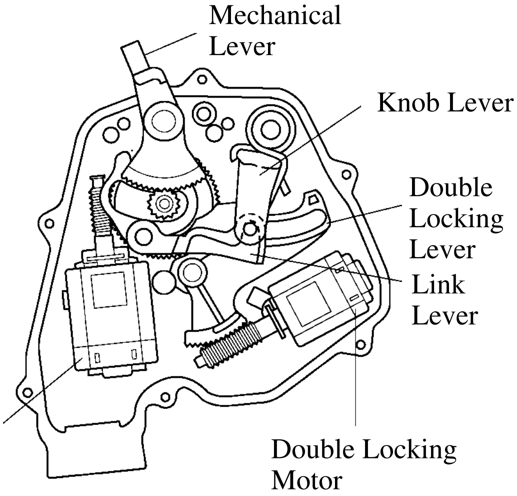
Construction

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



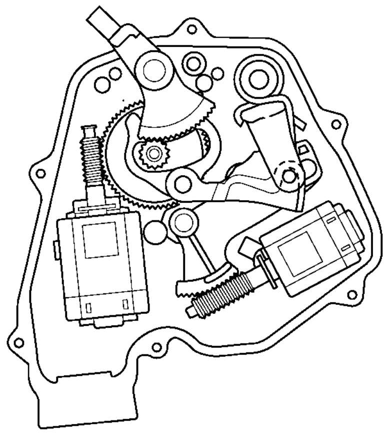
Actuator

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.

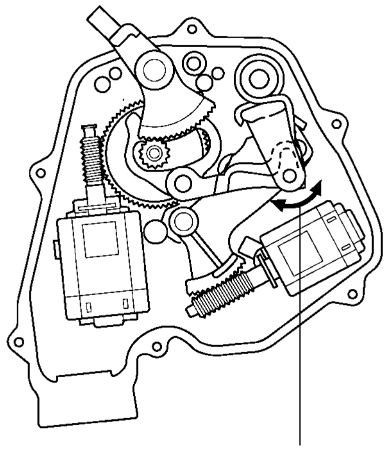
Operation

- 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



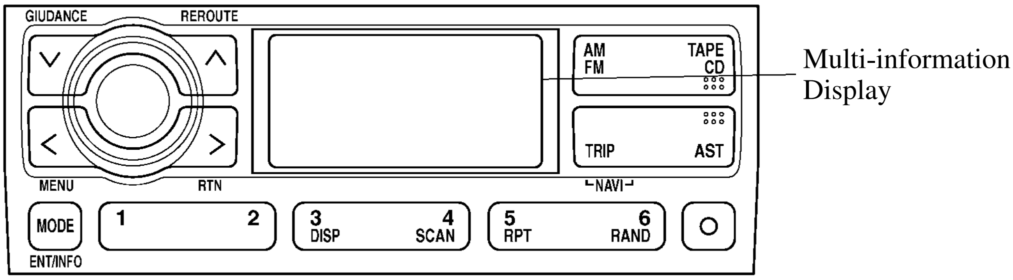
195BE06

Double Locking Condition

■AUDIO

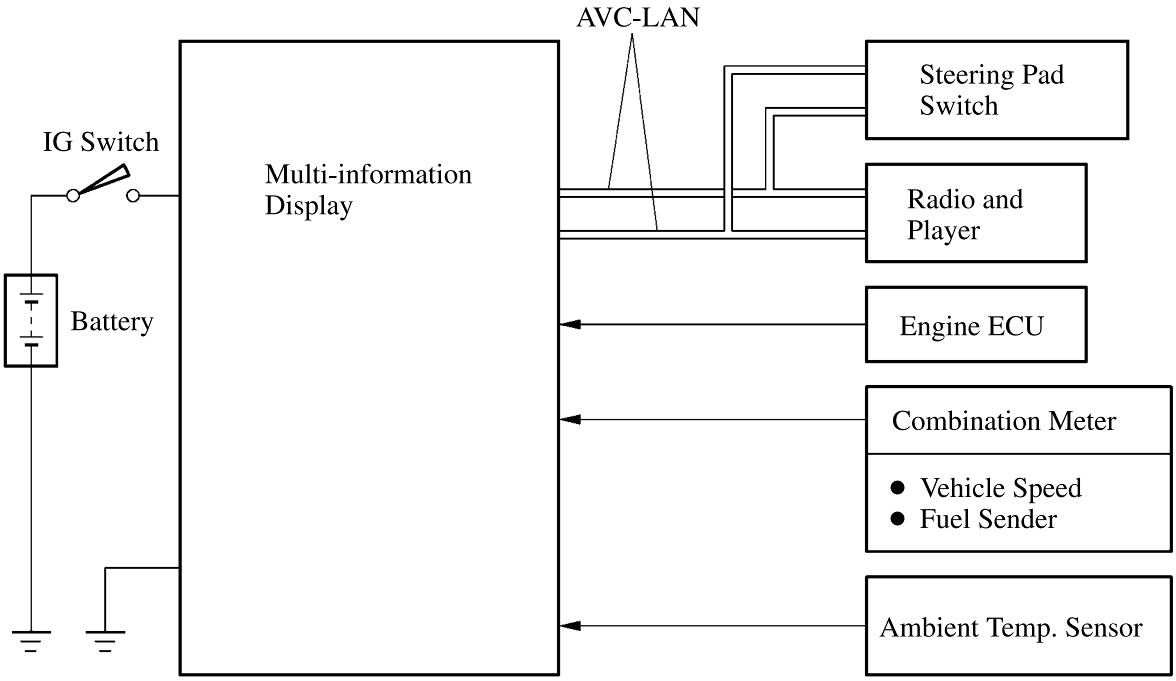
1. General

- 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

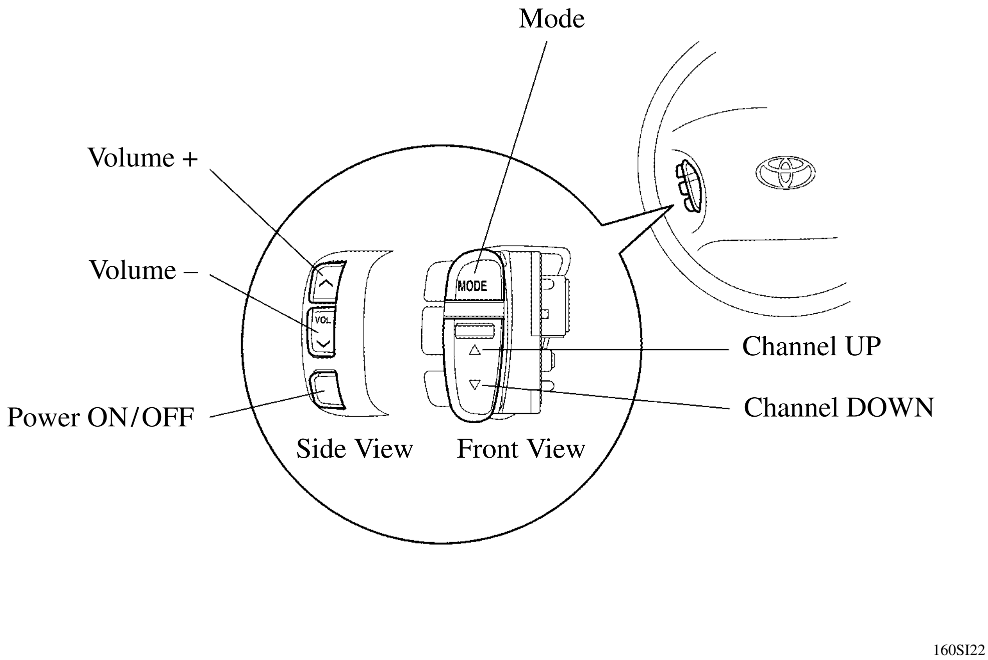
▶ System Diagram ◀



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.



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 m^3 (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 cm^3 (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
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	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)	←	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	—	—	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
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
—	—	—	—	—	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←

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 (lmp.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”	←	←
—	—	—	—	—	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←

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 m^3 (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 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	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	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
—	—	—	—	—	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←

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
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	155 (6.1)	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	755 ~ 805 (1664 ~ 1775)	←	805 ~ 855 (1775 ~ 1885)	←
←	←	←	←	535 ~ 560 (1179 ~ 1235)	←
←	←	1290 ~ 1365 (2844 ~ 3009)	←	1340 ~ 1415 (2954 ~ 3120)	←
←	←	←	←	950 (2094)	←
←	←	←	←	880 (1940)	←
←	←	←	←	1830 (4034)	←
←	←	←	←	60 (13.2)	←
←	←	←	←	←	←
←	←	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	←	3.683	←
—	—	—	—	—	—
←	←	2.923	←	3.583	←
←	←	←	←	←	←
Solid Disc	←	←	←	Leading Trailing Drum, Solid Disc*2	←
←	←	←	←	←	←
←	←	←	←	Single 9”	←
—	—	—	—	—	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←

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
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
—	—	—	—	—	—
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←
←	←	←	←	←	←

3

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 (lmp.gal.)		60 (13.2)	←	←	←
	Luggage Compartment Capacity m^3 (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 cm^3 (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”	←	←
—	—	—	—	—
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←
←	←	←	←	←

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– MEMO –