

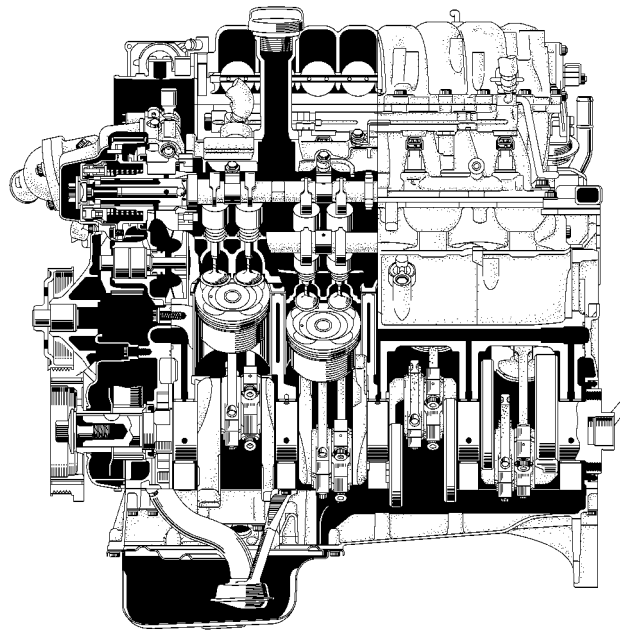
■ 3UZ-FE ENGINE

1. General

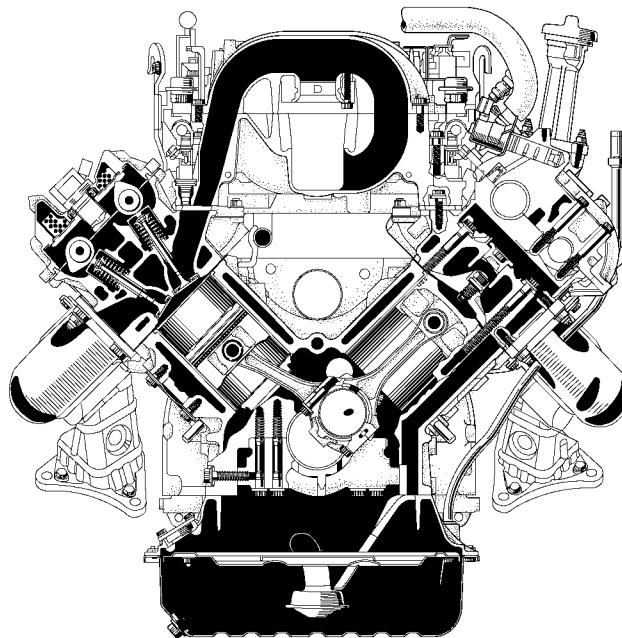
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On '01 GS430, base on the 1UZ-FE engine adopted on '00 GS400, 3UZ-FE engine of V8, 4.3-liter, 32-valve DOHC with the enlarged boar has been adopted.

This engine has adopted the VVT-i (Variable Valve Timing-intelligent system), ACIS (Acoustic Control Induction System) and ETCS-i (Electronic Throttle Control System-intelligent), and these control functions have been optimized in order to realize the further improvement of the engine performance, fuel economy and to reduce exhaust emissions.



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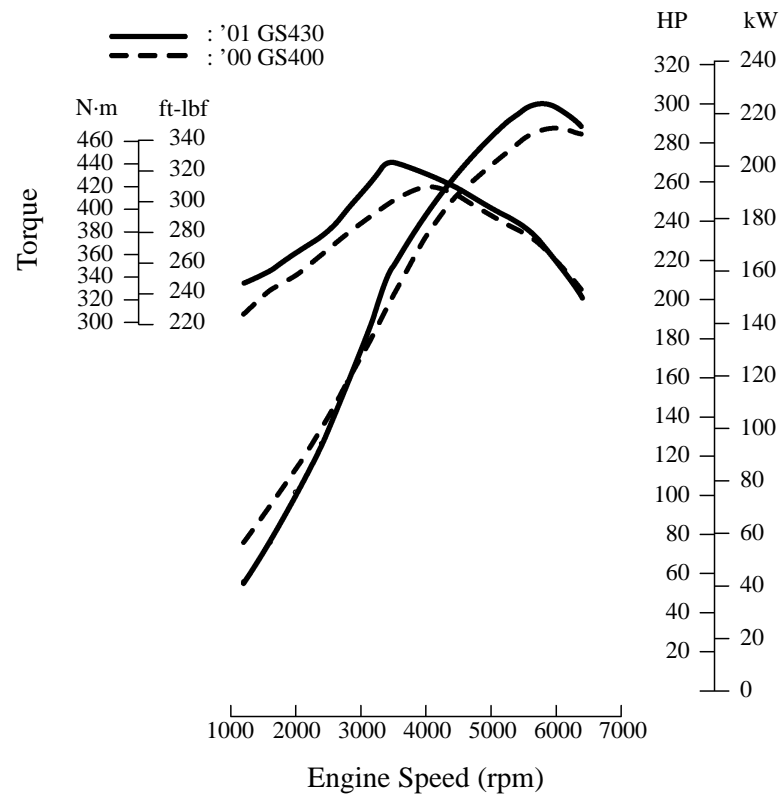


188EG04

► Engine Specifications ◀

Engine Type			3UZ-FE	1UZ-FE
No. of Cyls. & Arrangement			8-Cylinder, V Type	←
Valve Mechanism			32 Valve DOHC, Belt & Gear Drive	←
Combustion Chamber			Pentroof Type	←
Manifolds			Cross-Flow	←
Fuel System			SFI	←
Displacement cm ³ (cu. in.)			4293 (261.9)	3969 (242.1)
Bore × Stroke mm (in.)			91.0 × 82.5 (3.58 × 3.25)	87.5 × 82.5 (3.44 × 3.25)
Compression Ratio			10.5 : 1	←
Max. Output [SAE-NET]			223.4 kW @ 5600 rpm (300 HP @ 5600 rpm)	←
Max. Torque [SAE-NET]			440 N·m @ 3400 rpm (325 ft·lbf @ 3400 rpm)	420 N·m @ 4000 rpm (310 ft·lbf @ 4000 rpm)
Valve Timing	Intake	Open	−14° ~ 31° BTDC	−14° ~ 36° BTDC
		Close	64° ~ 19° ABDC	64° ~ 14° ABDC
	Exhaust	Open	46° BBDC	←
		Close	3° ATDC	←
Fuel Octane Number RON			95 or more	96
Oil Grade			API SJ, EC or ILSAC	←

► Performance Curve ◀



2. Major Differences

The major differences between the 3UZ-FE on the '01 GS430 and the 1UZ-FE engine on the '00 GS400 are the following:

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System	Features
Engine Proper	<ul style="list-style-type: none"> • The water passage of the cylinder head has been changed to improve the flow of the water around the valve seats, thus reducing the temperature of the combustion chamber. • The cylinder bore has been increased in size, and the thickness of the liner has been reduced. • The shape of the cylinder head gasket has been changed in conjunction with the increase in the size of the cylinder bore. • The material of the cylinder head bolts have been changed to increase their axial tension. As a result, the head gasket's tightening has been improved. • The piston diameter has been increased in size, and its shape has been optimized to achieve weight reduction. • The material of the inner surface of the bushing in the small end of the connecting rod has been changed from lead bronze alloy to phosphor bronze alloy. • The material of the sliding surface of the crankshaft bearing has been changed from kelmet to aluminum alloy.
Cooling System	The shape of the water inlet housing has been optimized to increase the water flow and to achieve weight reduction.
Intake and Exhaust System	<ul style="list-style-type: none"> • A resonator and a tuning hole have been provided in the air cleaner inlet to reduce the amount of intake air noise. • The air cleaner case has been increased in size to reduce the amount of intake air sound, and the construction of the air cleaner element has been optimized to achieve weight reduction. • A plug-in type air flow meter with a plastic housing has been adopted for weight reduction. • A stainless steel exhaust manifold with a single-pipe construction has been adopted. As a result, the warm-up performance of the TWC (Three-way Catalytic Converter) has been improved. • Two TWCs (Three-way Catalytic Converters) have been provided in the front, and one in the center. • Ultra thin-wall, high-cell ceramic type TWCs have been adopted. • A link-less type throttle body has been adopted.
Ignition System	The construction of the ignition coil has been optimized to achieve a compact and lightweight configuration.
Engine Control System	<ul style="list-style-type: none"> • Torque activated power train control has been newly adopted for the control of ETCS-i. Also, the fail-safe control has been reconsidered with the adoption of the link-less type throttle body. • A fuel cut control is adopted to stop the fuel pump when SRS driver's and front passenger's airbags are deployed.

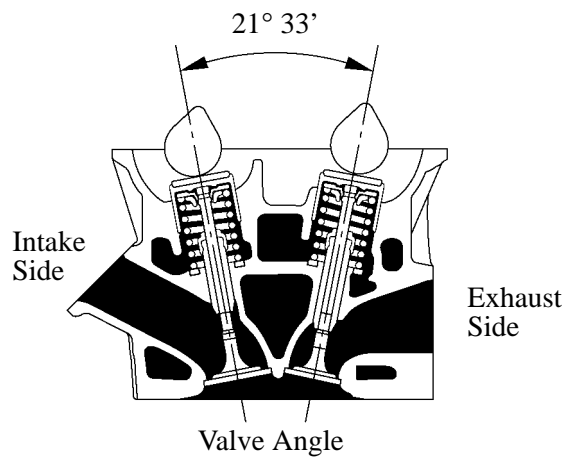
3. Engine Proper

Cylinder Head

- The cylinder head is made of aluminum and has intake and exhaust ports in a cross-flow arrangement. The intake ports are on the inside and the exhaust ports on the outside of the left and right banks respectively.
- The pitch of the intake and exhaust camshafts is shortened and the valve angle is narrowed to $21^{\circ} 33'$.
- The left and right banks of cylinder heads are common in configuration.

NOTICE

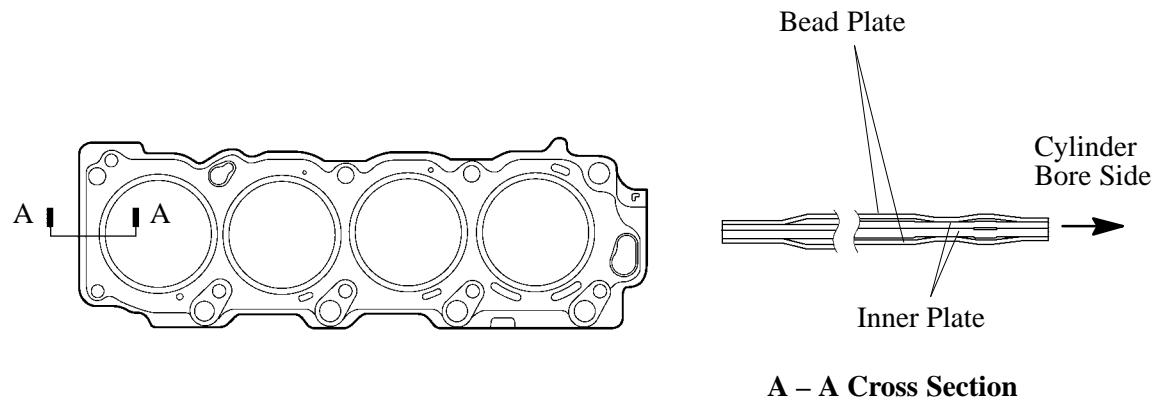
When the cylinder heads are disassembled for servicing, be sure to assemble each cylinder head to the correct right or left bank. The camshaft may seize if they are assembled incorrectly.



188EG05

Cylinder Head Gasket

The same type of (4-layer) steel laminate cylinder head gasket used in the 1UZ-FE engine on the '00 GS400 is used in the 3UZ-FE engine on the '01 GS430, except that its shape has been slightly changed in accordance with the increased cylinder displacement of the new engine.

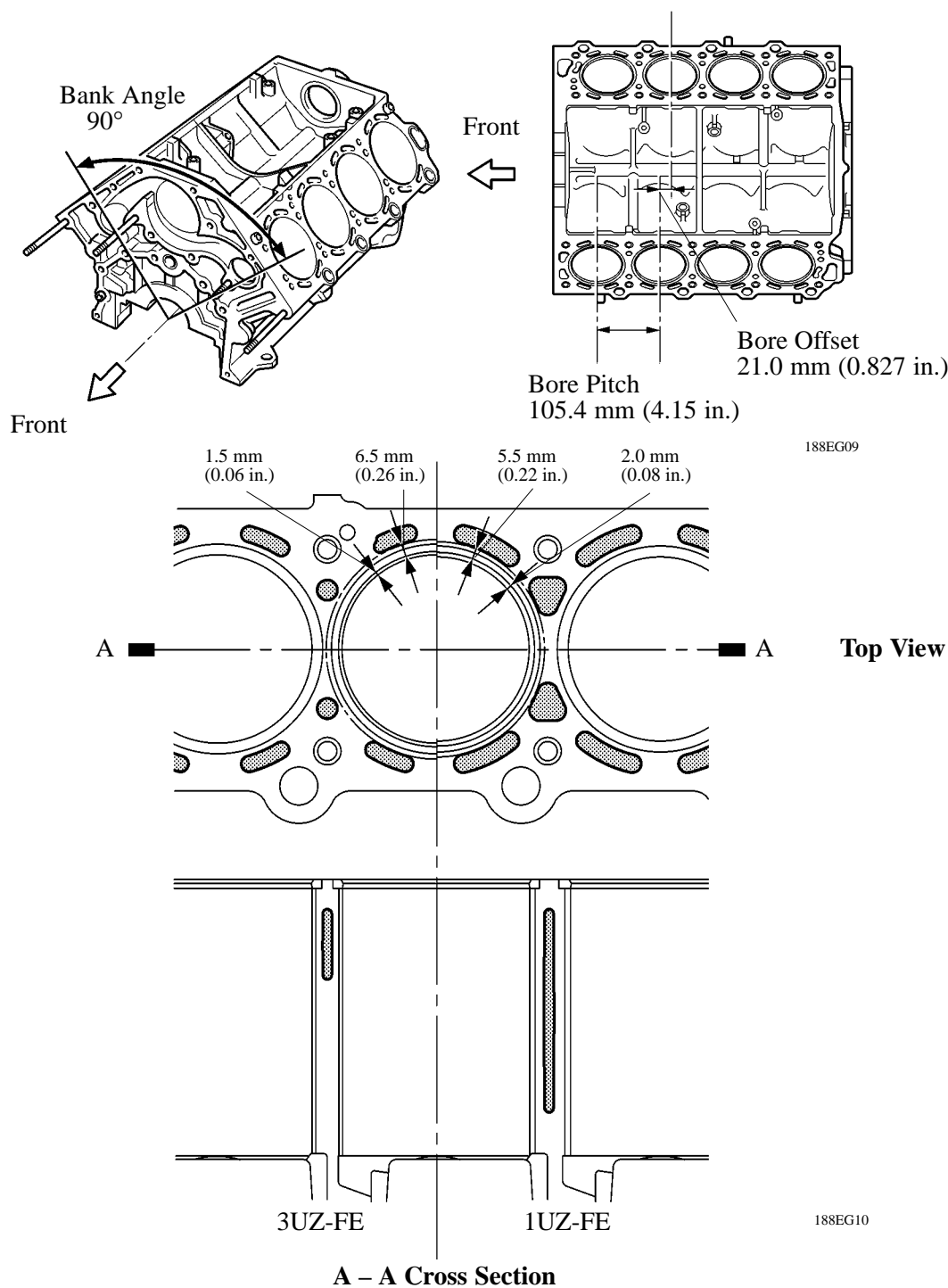


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Cylinder Block

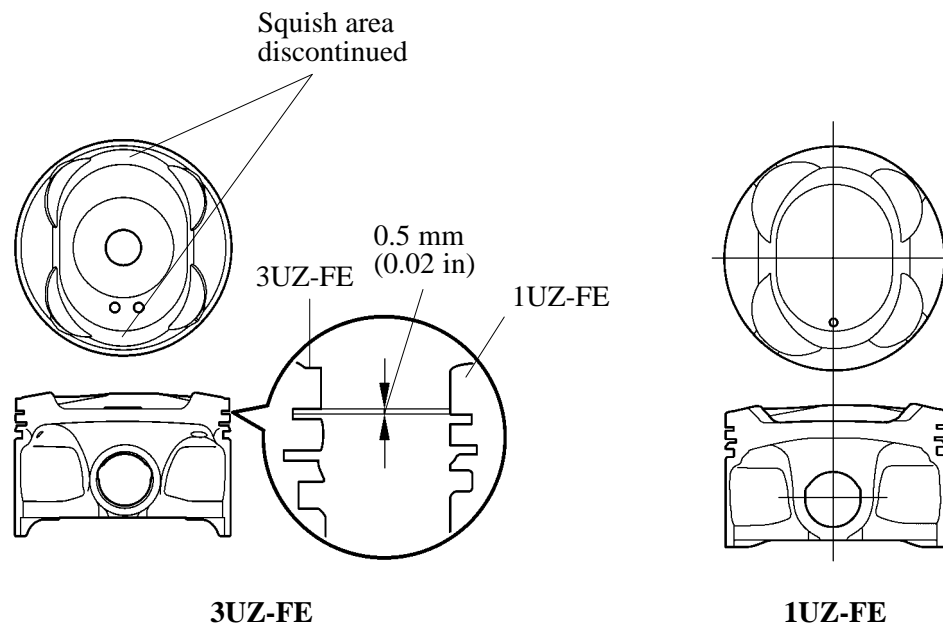
- The cylinder block has a bank angle of 90°, a bore offset of 21 mm (0.827 in.) and a bore pitch of 105.5 mm (4.15 in.), resulting in a compact block in its length and width even for its displacement.
- Light weight aluminum alloy is used for the cylinder block.
- In contrast to the 1UZ-FE engine on the '00 GS400, the liner thickness in the 3UZ-FE engine on the '01 GS430 has been changed from 2 mm (0.08 in.) to 1.5 mm (0.06 in.) to achieve weight reduction and improved cooling performance. It is not possible to bore this liner due to its thinness. The thickness of the wall has been changed from 5.5 mm (0.22 in.) to 6.5 mm (0.26 in.), and the shape of the water passage between the bores has been optimized to improve both cooling performance and rigidity.

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Piston

- The piston head portion has adopted a taper squish shape to improve the fuel combustion efficiency.
- The sliding surface of the piston skirt has been coated with resin to reduce the amount of friction loss.
- 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.
- In contrast to the 1UZ-FE engine on the '00 GS400, the placement position of the piston rings has been slightly raised in the 3UZ-FE engine on the '01 GS430 in order to reduce the area in which unburned fuel is likely to accumulate during the combustion process. Furthermore, the squish area in the thrust direction of the piston head has been discontinued and the combustion chamber has been made shallower in order to further improve the combustion efficiency, thus improving fuel economy.



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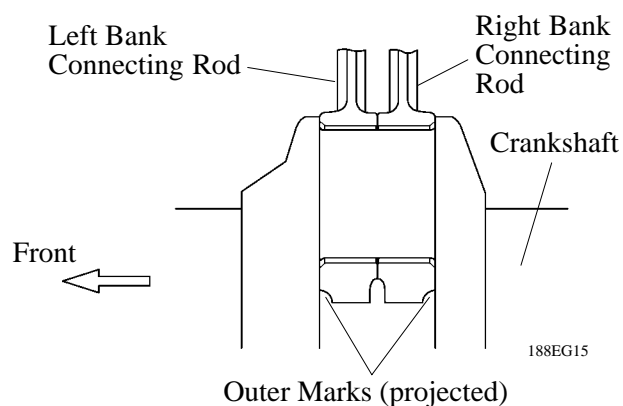
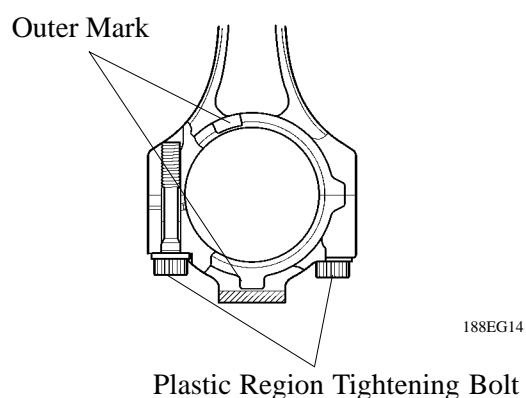
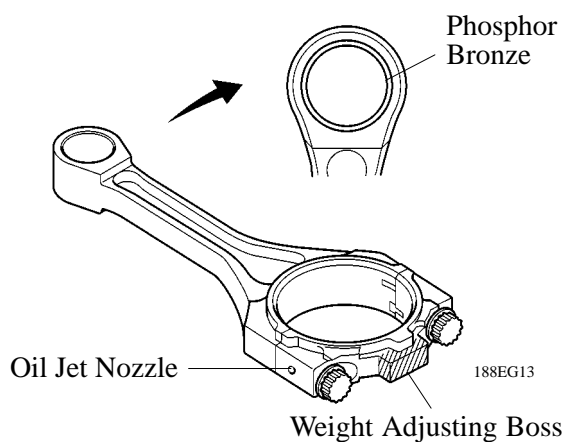
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Connecting Rod

- The sintered and forged connecting rod is highly rigid and has little weight fluctuation.
- A weight-adjusting boss is provided at the big end to reduce fluctuation of weight and balance the engine assembly.
- In contrast to the 1UZ-FE engine on the '00 GS400, the material of the inner surface of the bushing in the small end of the connecting rod in the 3UZ-FE engine on the '01 GS430 has been changed from lead bronze alloy to phosphor bronze alloy to reduce the lead quantity and to further improve the wear resistance.
- The connecting rod cap is held by plastic region tightening bolts.

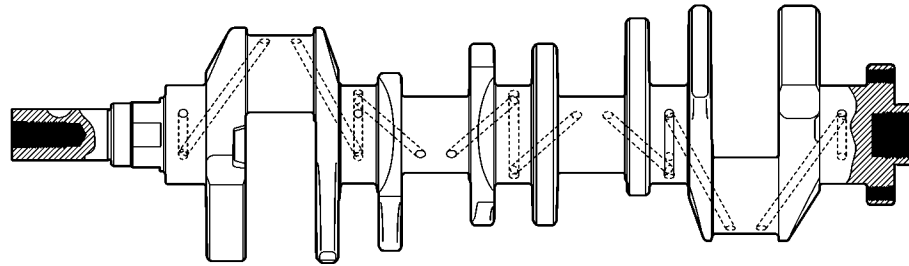
NOTE: When reusing the connecting rod cap bolts, if the diameter at the thread is less than 7.0 mm (0.275 in.), it is necessary to replace them with new ones.

- The connecting rods for the right and left banks are placed in opposite directions with the outer marks facing the crankshaft.



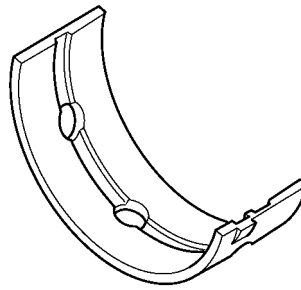
Crankshaft and Crankshaft Bearings

- A forged crankshaft with five main journals, four connecting rod pins and eight balance weight is used.
- Connecting rod pins and journals are induction-hardened to ensure an added reliability.



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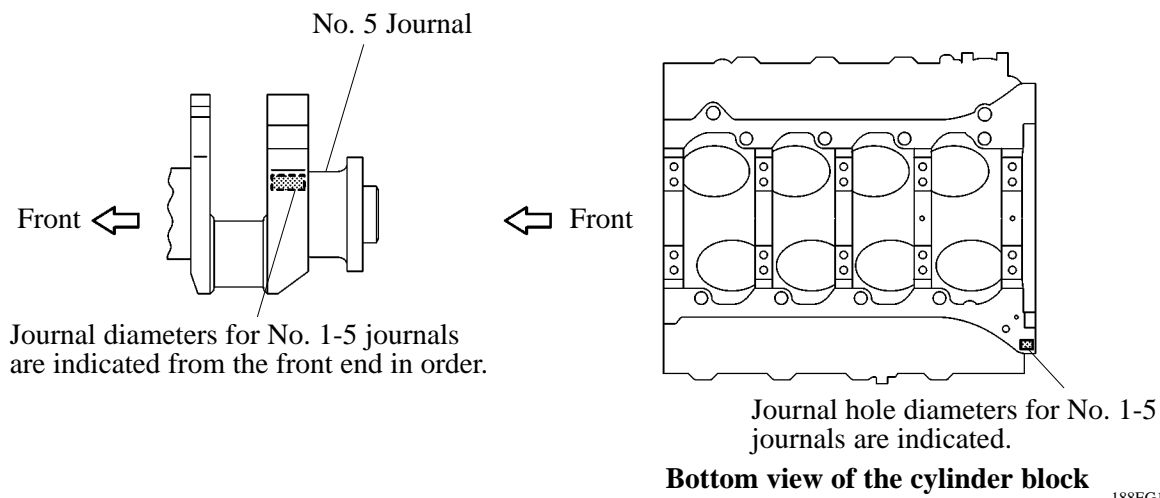
- In contrast to the 1UZ-FE engine on the '00 GS400, the material of the sliding surface of the crankshaft bearing in the 3UZ-FE engine on the '01 GS430 has been changed from kelmet to aluminum alloy to discontinue the use of lead and to further enhance the engine's quiet operation.



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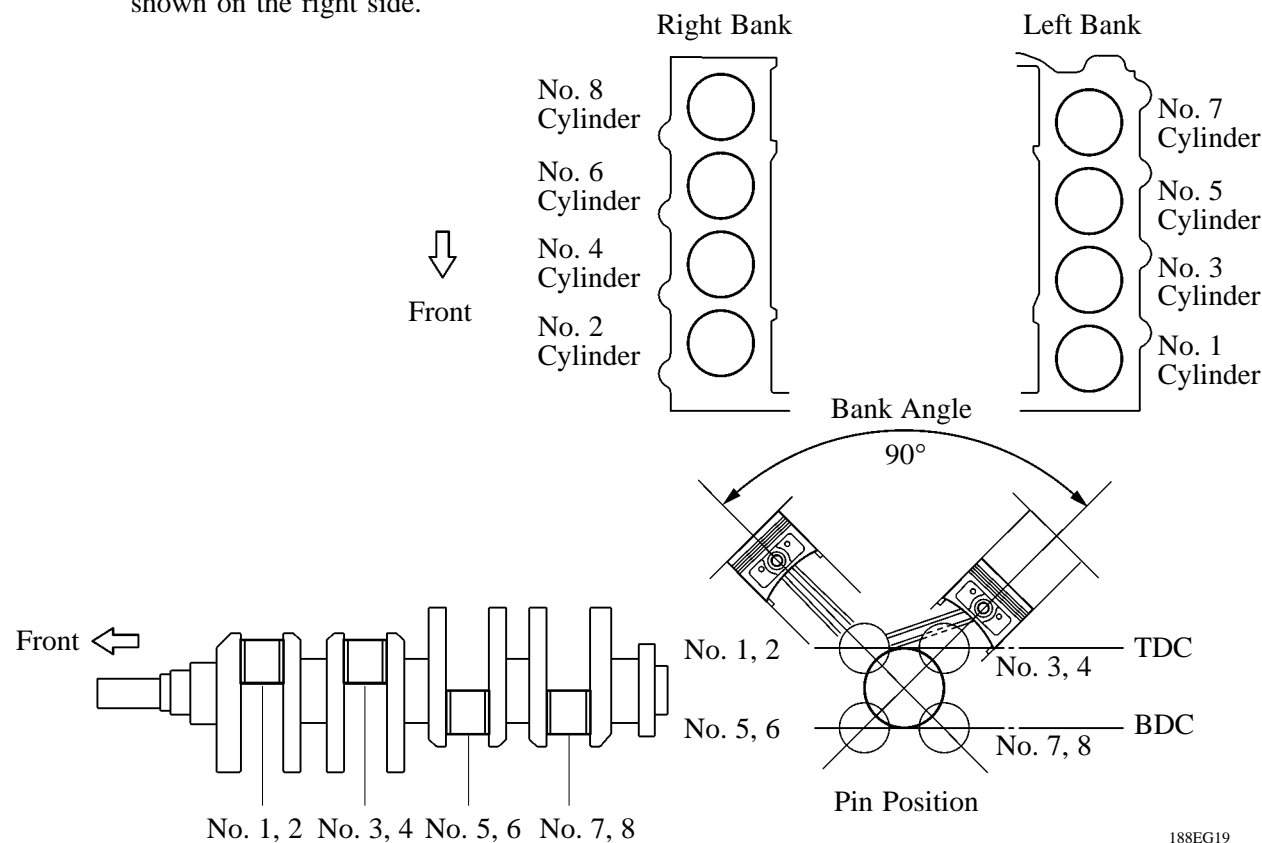
- Crankshaft bearings are selected carefully according to the measured diameters of the crank journal and cylinder block journal holes.

NOTE: The diameter of the crank journal and the cylinder block journal hole is indicated at the places shown below.



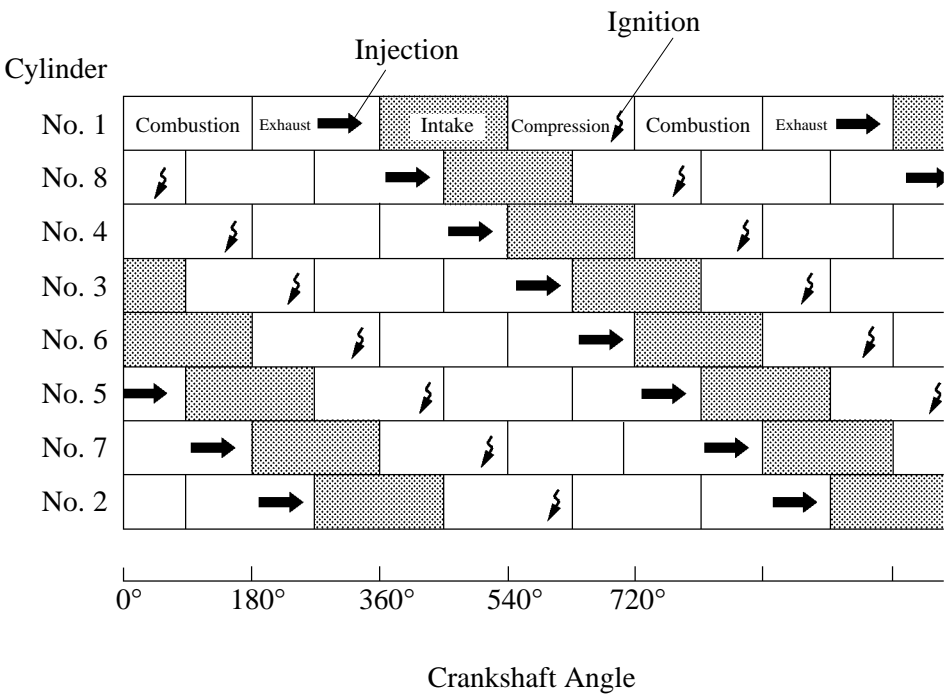
188EG18

NOTE: Numbers of the crankshaft and pistons are shown on the right side.



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Crankshaft angles and engine strokes (intake, compression, combustion and exhaust) are shown in the table below. The firing order is 1 - 8 - 4 - 3 - 6 - 5 - 7 - 2.

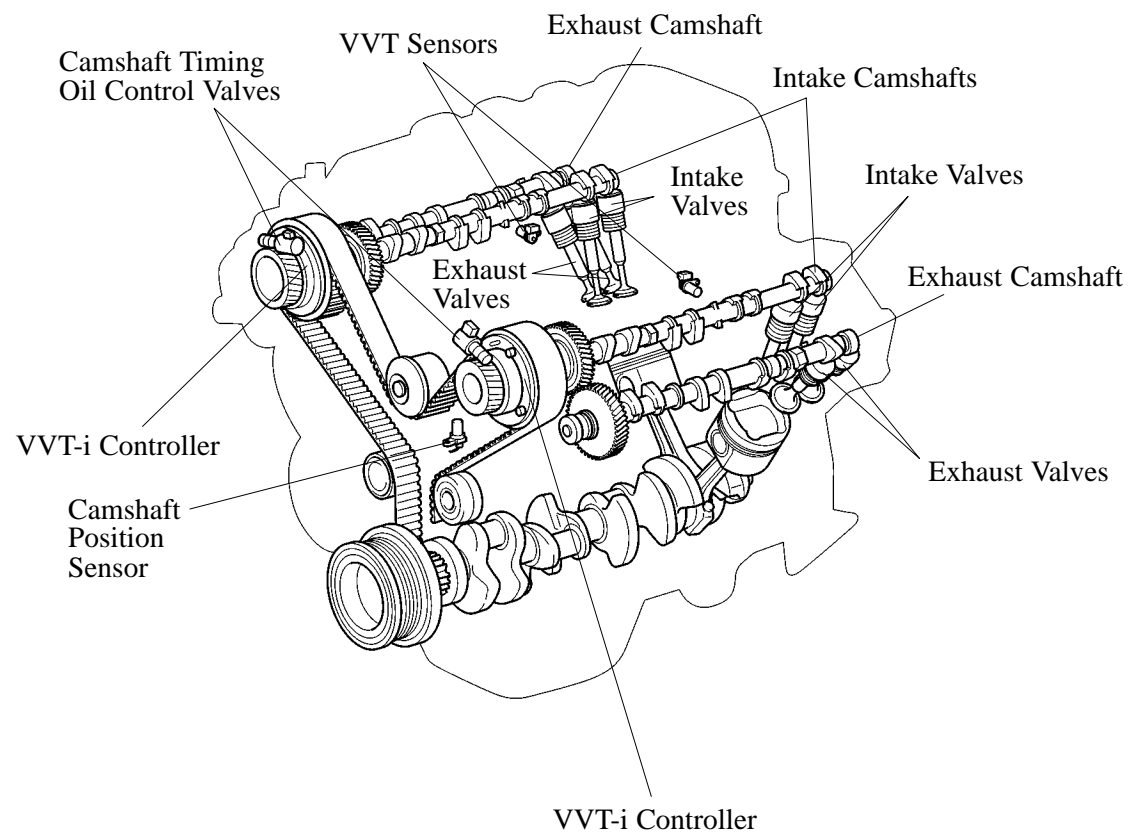


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4. Valve Mechanism

General

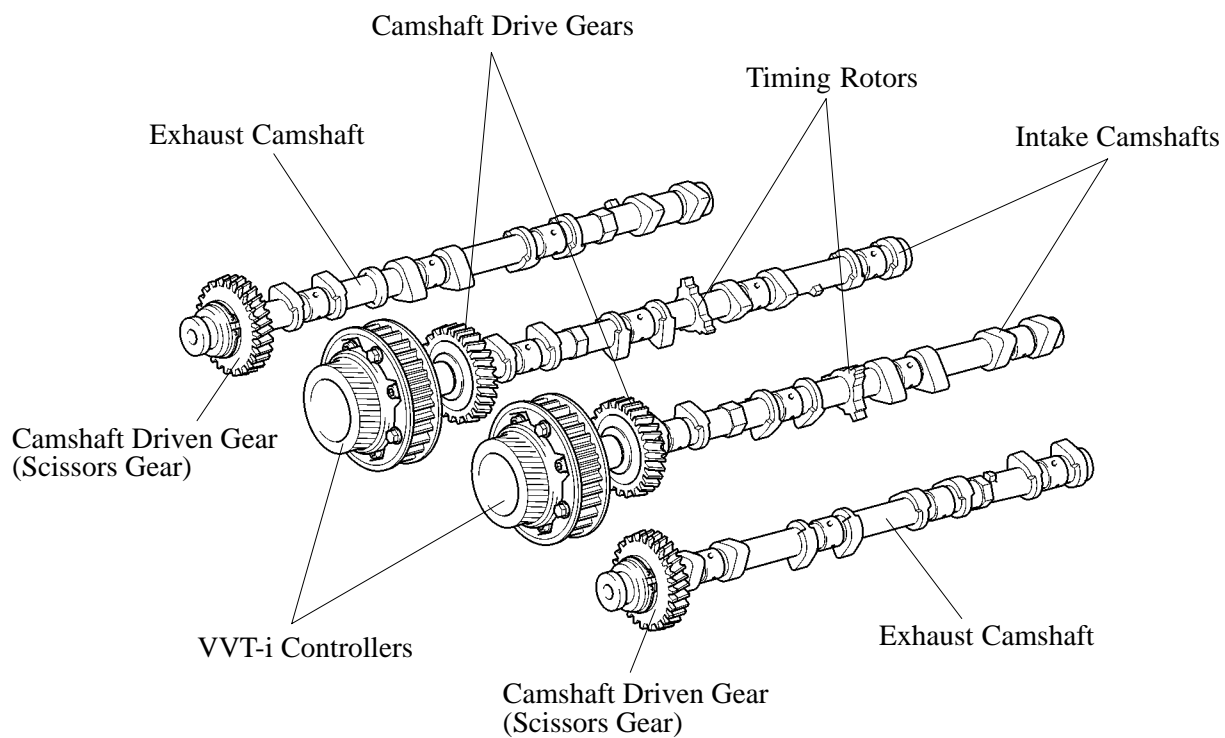
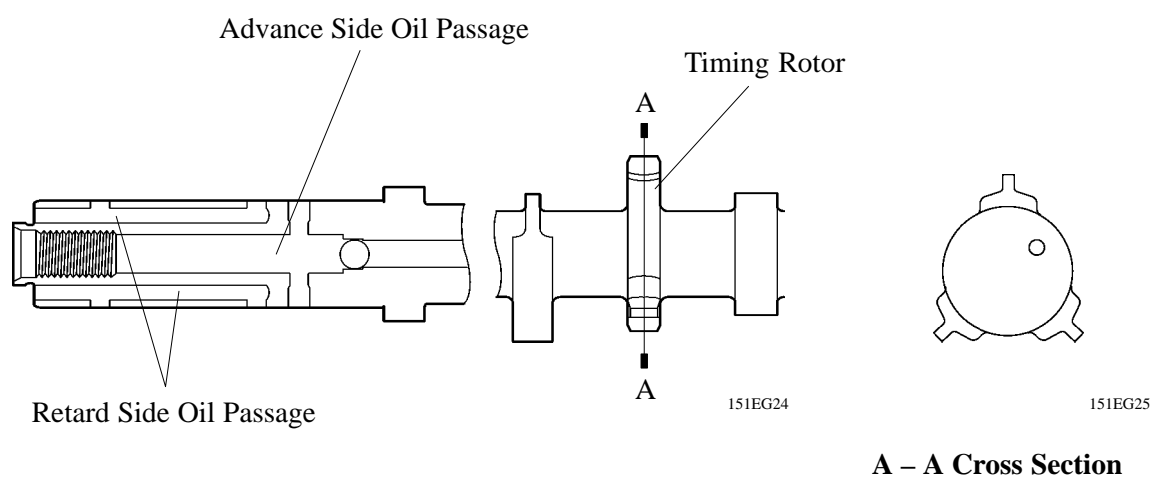
- Each cylinder has 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency has been increased due to the larger total port areas.
- The valves are directly opened and closed by 4 camshafts.
- The intake camshafts are driven by a timing belt, while the exhaust camshafts are driven through gears on the intake camshafts.
- The VVT-i (Variable Valve Timing-intelligent) system is used to improve fuel economy, engine performance and reduce exhaust emissions. For details, see page 42.
- In contrast to the 1UZ-FE engine on the '00 GS400, an automatic timing belt tensioner with optimized construction and body material that has been changed to aluminum has been adopted in the 3UZ-FE engine on the '01 GS430.



Camshafts

- The exhaust camshafts are driven by gears on the intake camshafts. The scissors gear mechanism has been used on the exhaust camshaft to control backlash and reduce gear noise.
- A VVT-i controllers have been installed on the front of the intake camshafts to vary the timing of the intake valves.
- 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 to the VVT-i system.
- The intake camshaft is provided with timing rotor to trigger the VVT sensor.

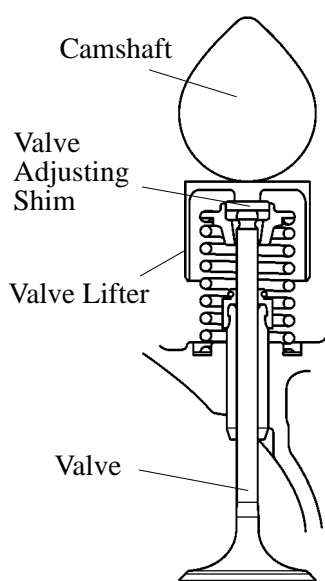
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Intake and Exhaust Valve and Valve Lifter

- An inner shim type valve adjusting shim has been adopted as well as the 1UZ-FE engine of '00 GS400.
- The valve lifter, which has been made lighter and thinner.
- High-strength, heat-resistant steel is used in both the intake and exhaust valves, and soft nitriding treatment has been applied to the stem and the face areas of the valves.
- Carbon steel with a round-shaped cross section has been adopted for the valve spring, which is used for both the intake and exhaust valves.



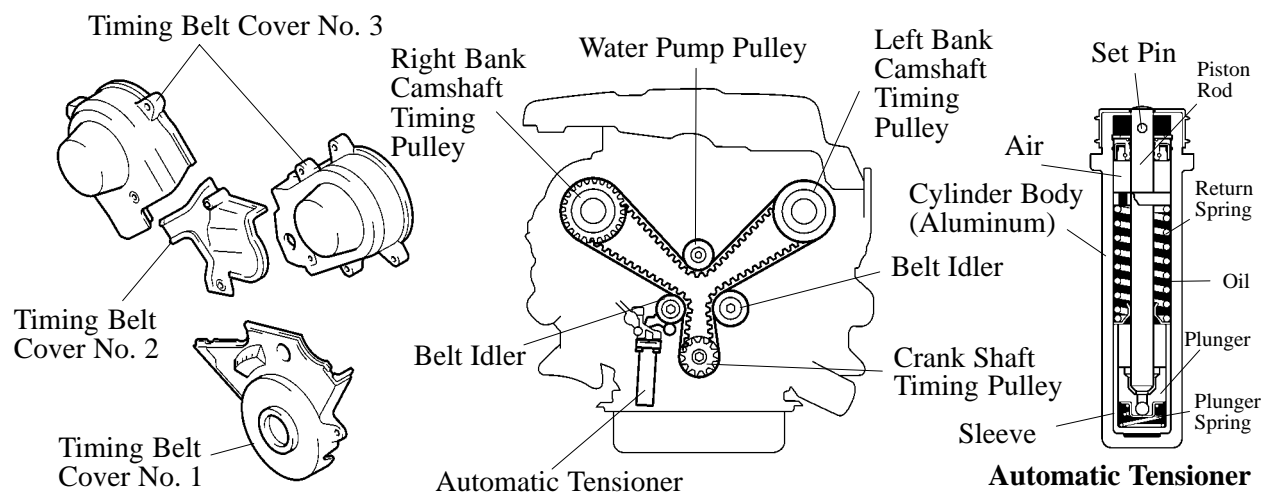
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► Specifications ◀ mm (in.)

Item	Intake Valve	Exhaust Valve
Face Diameter	34.5 (1.36)	29.0 (1.14)
Stem Diameter	5.5 (0.22)	5.5 (0.22)

Timing Pulleys, Automatic Tensioner and Timing Belt Cover

- In contrast to the 1UZ-FE engine on the '00 GS400, an automatic timing belt tensioner with optimized construction and body material that has been changed to aluminum has been adopted in the 3UZ-FE engine on the '01 GS430.
- The timing belt cover No. 3 is made of aluminum to reduce noise.
- The timing belt cover No. 1 and No. 2 are composite formed with a gasket to improve serviceability.



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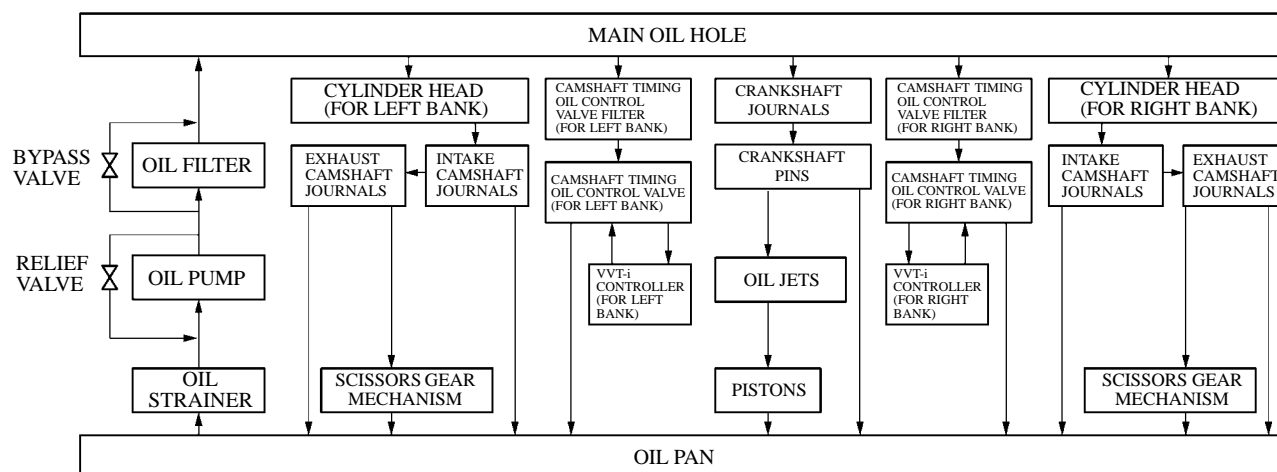
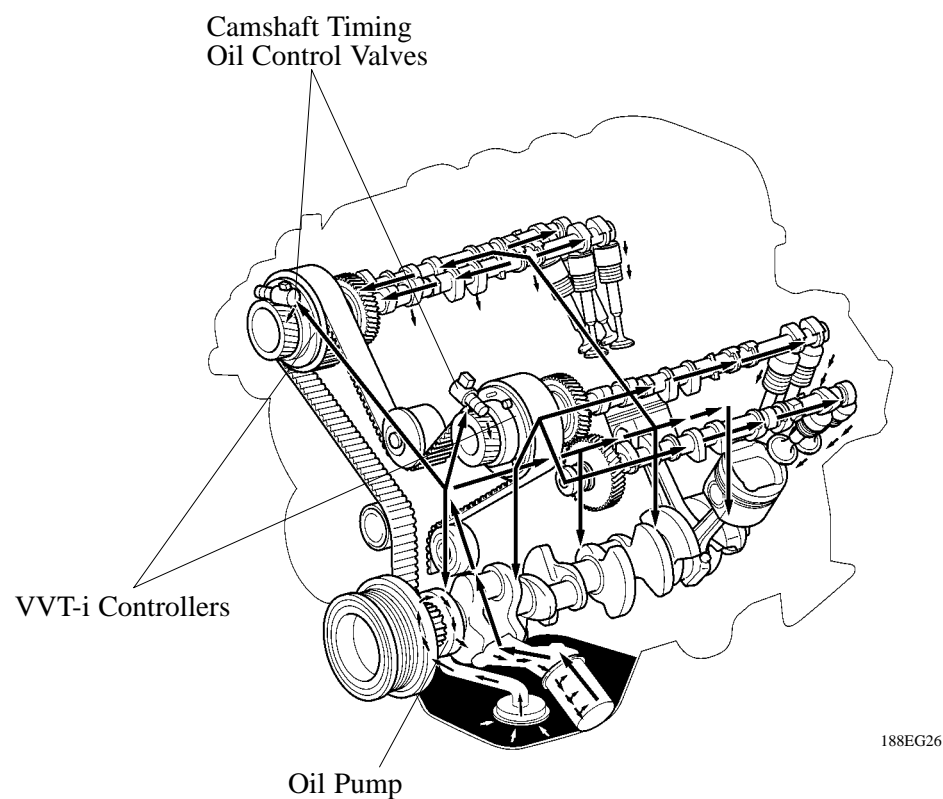
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5. Lubrication System

- The lubrication circuit is fully pressurized and oil passes through an oil filter.
- The trochoid gear type oil pump is directly driven by the crankshaft.
- Along with the adoption of the VVT-i (Variable Valve Timing-intelligent), right bank and left bank cylinder heads are provided with VVT-i controllers and camshaft timing oil control valves. This system is operated by the engine oil.

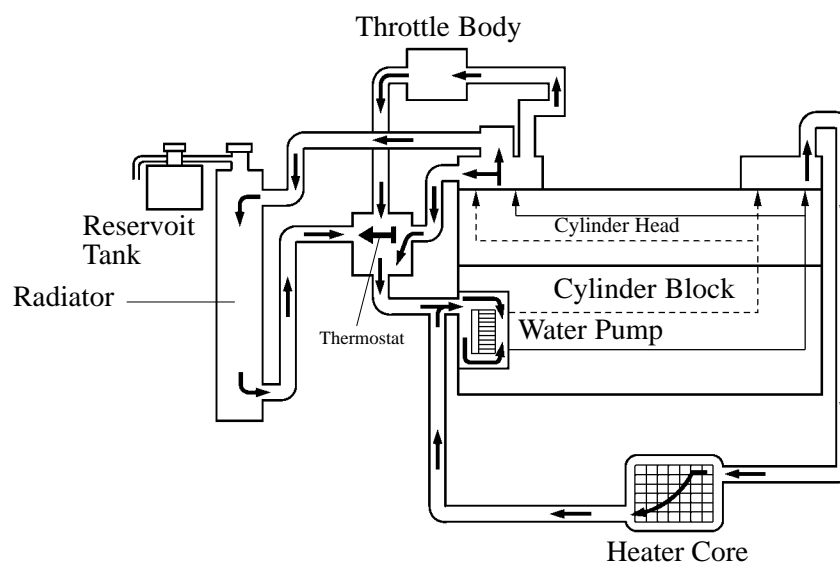
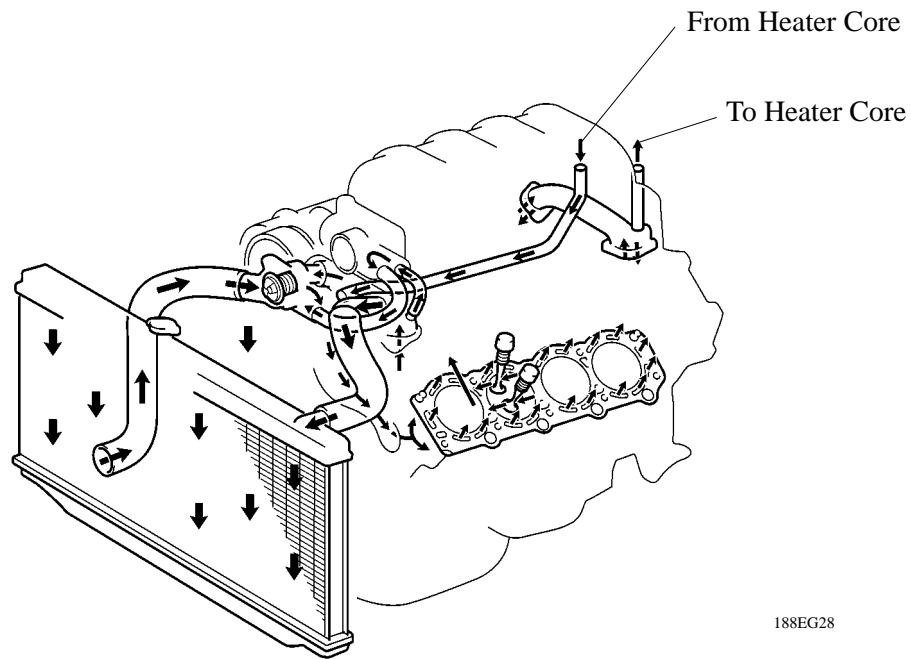
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6. Cooling System

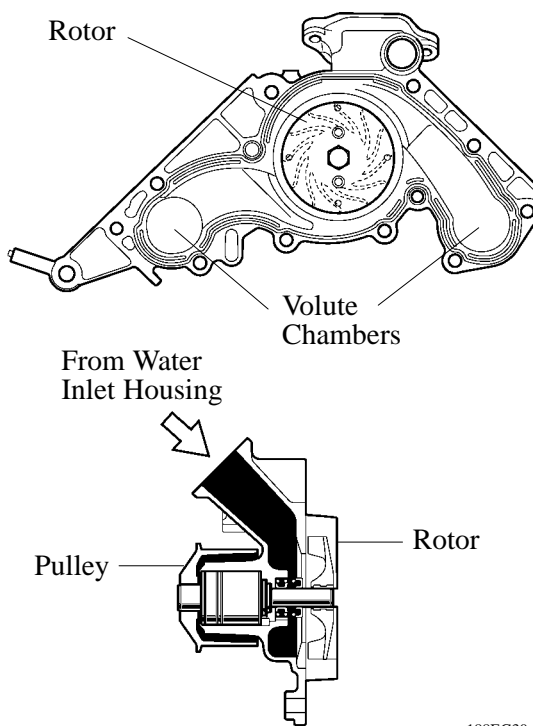
General

- The cooling system is a pressurized, forced-circulation type.
- A thermostat, having a by-pass valve, is located on the water pump inlet side of the cooling circuit. As the coolant temperature rises, the thermostat opens and the by-pass valve closes, so the system maintains suitable temperature distribution in the cylinder head.
- In contrast to the 1UZ-FE engine on the '00 GS400, the shape of the water inlet housing has been optimized in the 3UZ-FE engine on the '01 GS430 to achieve the smooth flow of the engine coolant.



Water Pump

- The water pump has two volute chambers, and circulates coolant uniformly to the left and right banks of the cylinder block.
- The water pump is driven by the back surface of the timing belt.
- The rotor is made of resin.

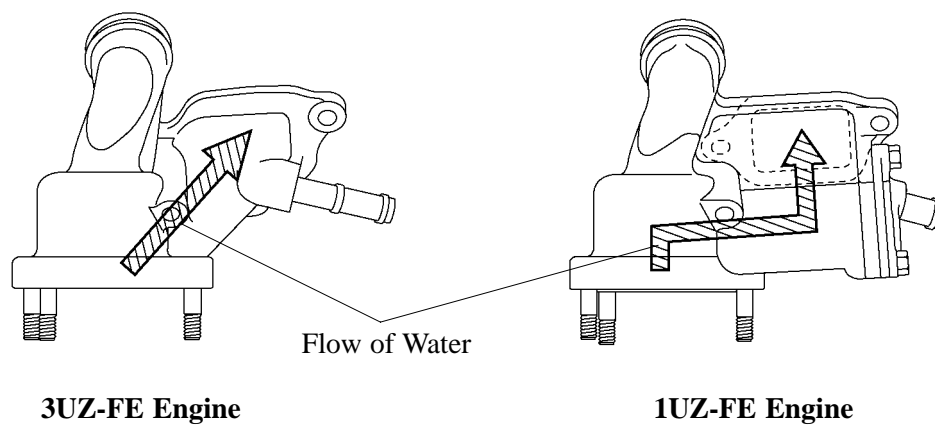


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Water Inlet Housing

In contrast to the 1UZ-FE engine on the '00 GS400, the shape of the water inlet housing has been optimized in the 3UZ-FE engine on the '01 GS430 to achieve the smooth flow of the engine coolant.



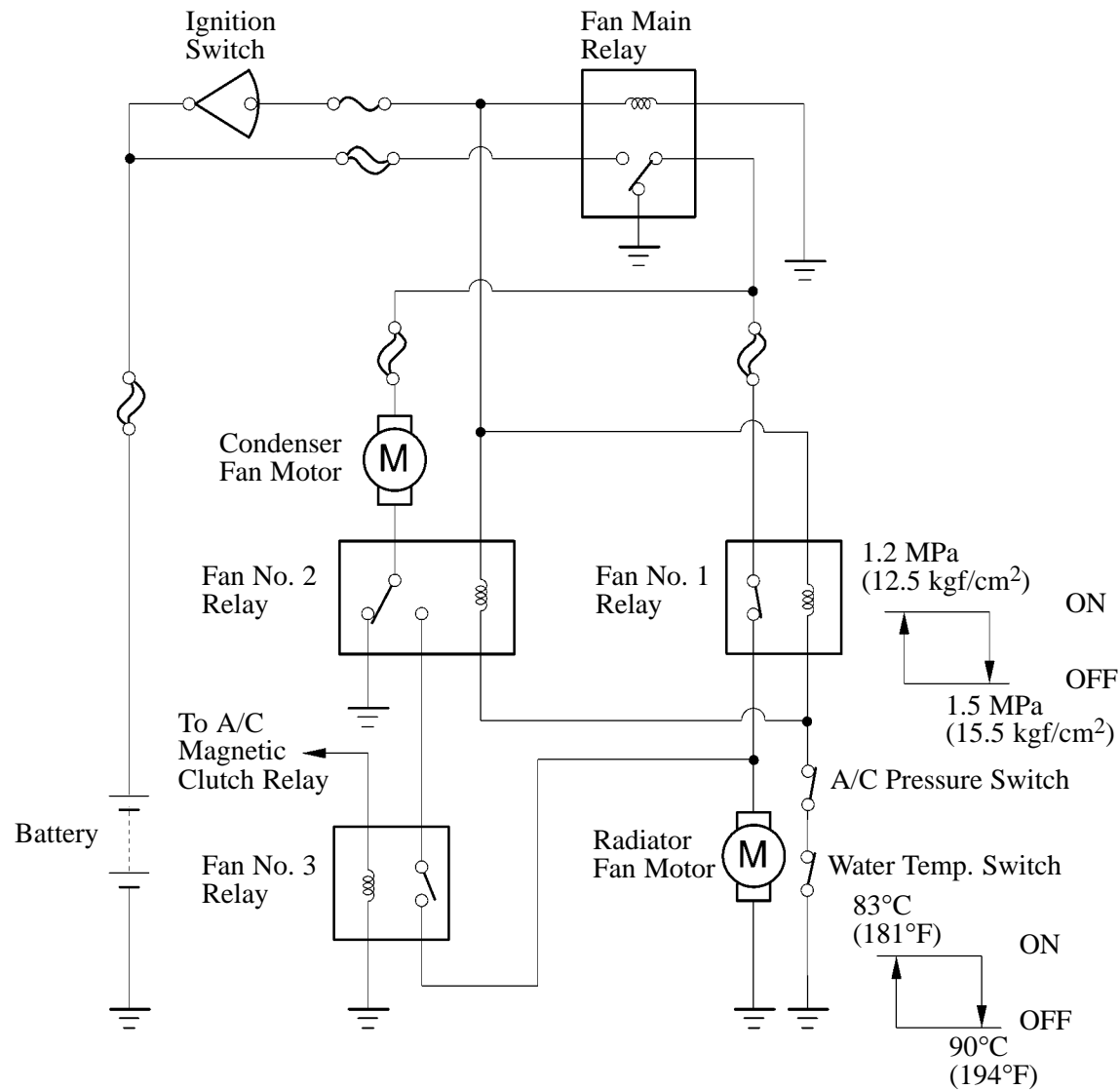
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Cooling Fan System

The same electric cooling fan system used on the '00 GS400 has been adopted on the '01 GS430. The cooling fan controls the fan speed in 3 steps (OFF, Low, High) by using the water temperature switch in accordance with the engine coolant temperature and the operating condition of the air conditioner and by turning the 3 fan relays ON and OFF and connecting 2 fan motors in a series or parallel circuit.

► Wiring Diagram ◀



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► Cooling Fan Operation ◀

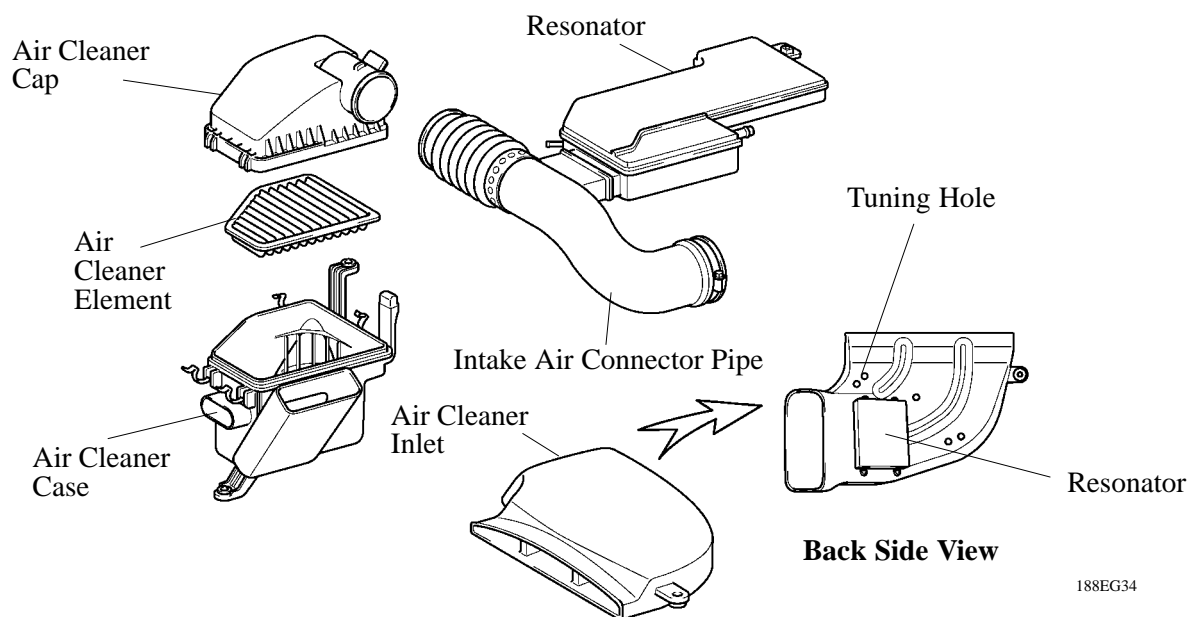
Air Conditioner Condition		Water Temperature	
Compressor	Refrigerant Pressure	About 83°C (181°F) or Lower	About 90°C (194°F) or Higher
OFF	1.2 MPa (12.5 kgf/cm ²) or Lower	OFF	High
ON	1.2 MPa (12.5 kgf/cm ²) or Lower	Low	High
	1.5 MPa (15.5 kgf/cm ²) or Higher	High	High

7. Intake and Exhaust System

Air Cleaner Inlet Pipe, Box and Air Connector

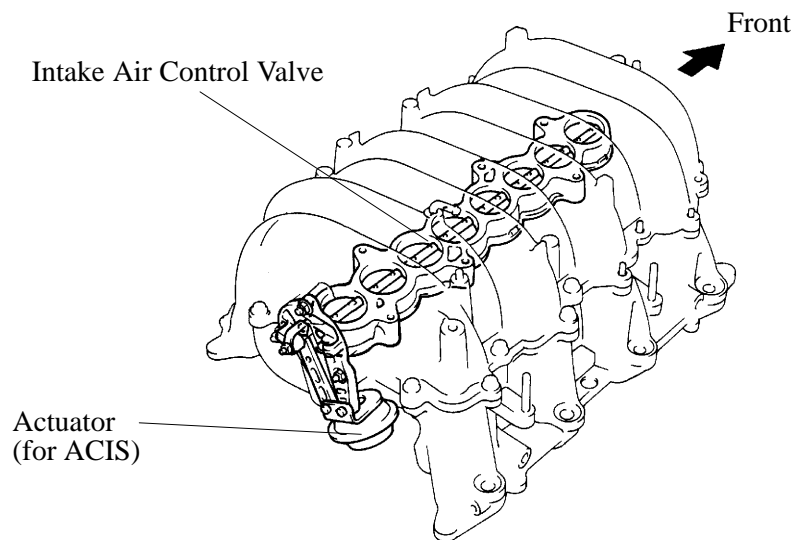
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- A resonator and a tuning hole have been provided in the air cleaner inlet to reduce the amount of intake air noise.
- The air cleaner case has been increased in size to reduce the amount of intake air noise, and the construction of the air cleaner element has been optimized to achieve weight reduction.



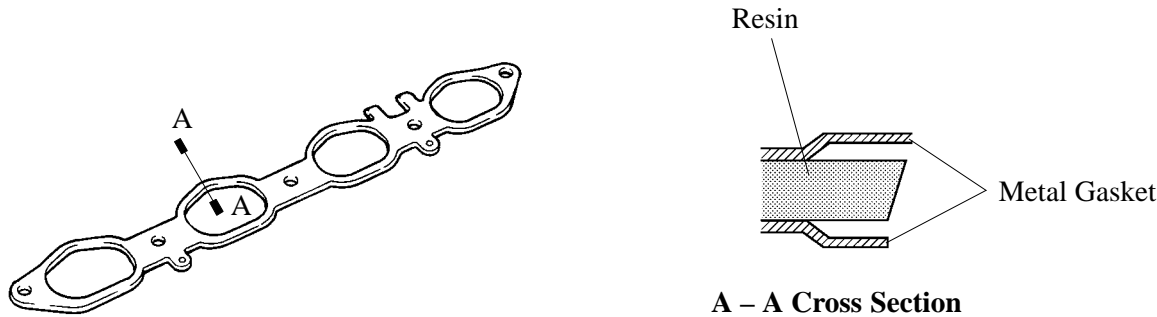
Intake Manifold

- The low-to mid-speed range torque has been improved by increasing the length of the intake manifold port.
- The air intake chamber consists of upper and lower sections and contains an intake air control valve. This valve is activated by ACIS (Acoustic Control Induction System) and is used to alter the intake pipe length to improve the engine performance in all speed ranges. For details, see page 53.



Intake Manifold Gasket

- A heat-barrier gasket has been adopted for use between the cylinder head and the intake manifold. This gasket, which restrains the heat transfer from the cylinder head to the intake manifold, helps restrain the intake air temperature and improve the charging efficiency.
- The construction of the gasket consists of resin that is sandwiched between metal gaskets.



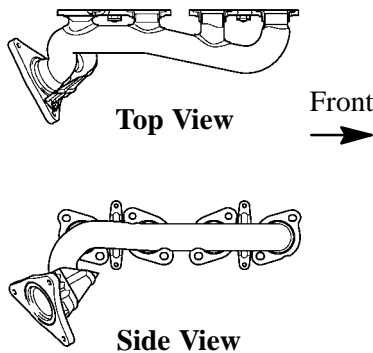
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Exhaust Manifold

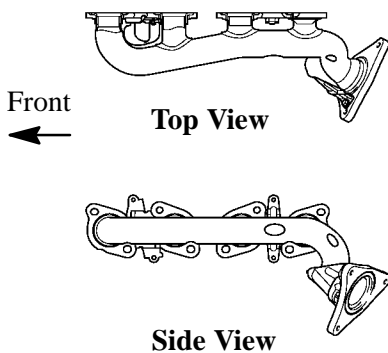
- The front exhaust pipe has been shortened and the warm-up performance of the TWC (Three-Way Catalytic Converter) has been improved.
- Cooling holes have been provided in the heat insulator for cooling the exhaust manifold.

► **Right-Hand Exhaust Manifold** ◀



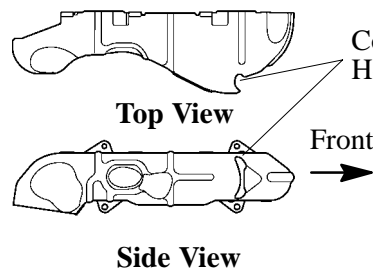
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► **Left-Hand Exhaust Manifold** ◀



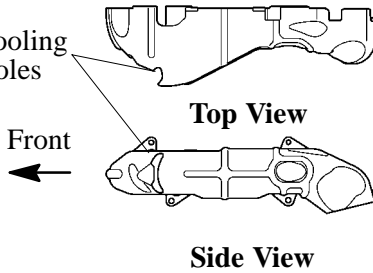
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► **Right-Hand Heat Insulator** ◀



188EG38

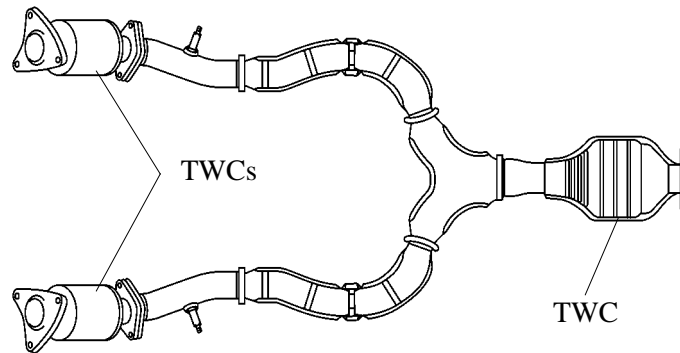
► **Left-Hand Heat Insulator** ◀



188EG39

Exhaust Pipe

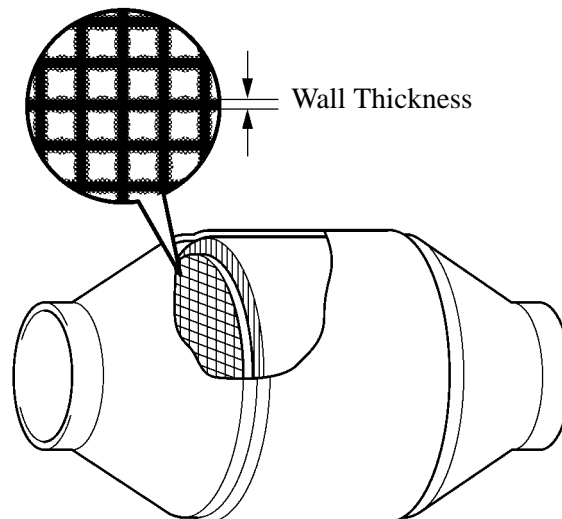
Two TWCs (Three-way Catalytic Converters) have been provided in the front, and one in the center.

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188EG40

Three-Way Catalytic Converter

An ultra thin-wall, high-cell ceramic type TWC has been adopted. This TWC enables to optimize the cells density and to reduce wall thickness. In addition, it enables to achieve cleaner exhaust emission by double-coating the alumina material on the ceramic surface.



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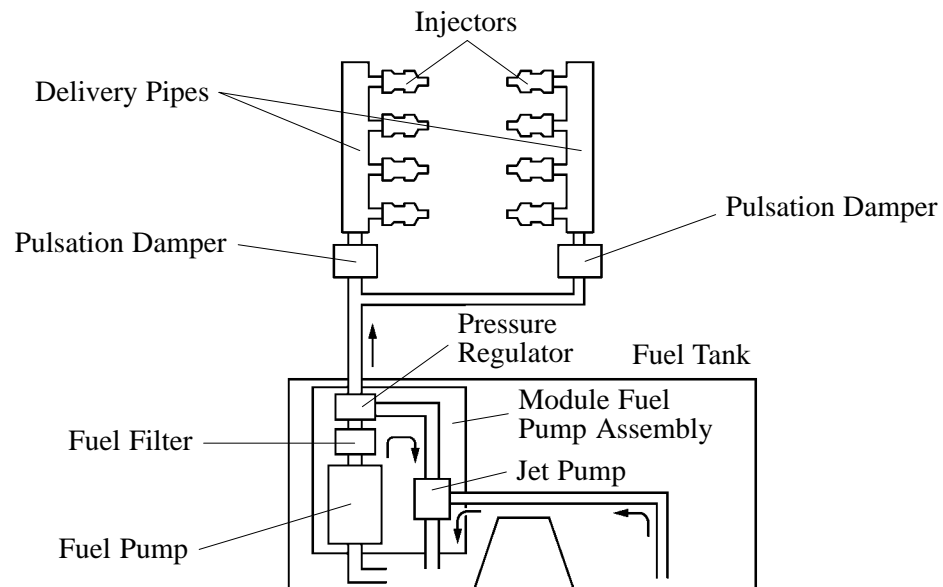
8. Fuel System

General

- A fuel returnless system has been used to simplify the routing of the fuel pipe.
- An air-assist system has been adopted to improve the atomization of fuel, thus improving the performance of the evaporative emissions.
- A compact 4-hole type fuel injector has been used.

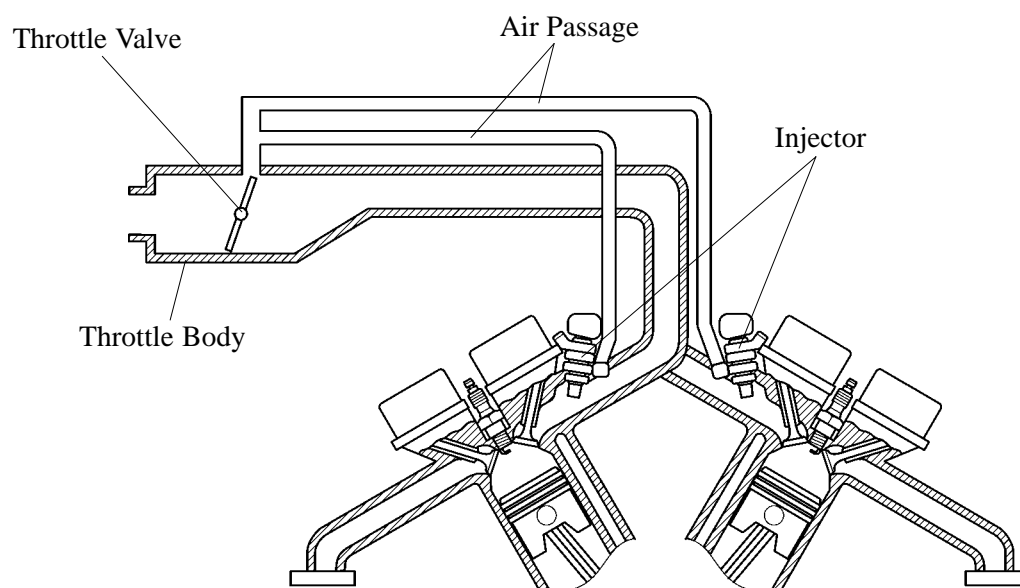
Fuel Returnless System

- The fuel returnless system has been used to reduce evaporative emissions. With the pressure regulator and the fuel filter-integrated fuel pump are housed inside the fuel tank, this system eliminates the return of fuel from the engine area. This helps prevent the internal temperature of the fuel tank from rising, and reduces evaporative emissions.
- 2 pulsation dampers are used to realize a quieter operation.



Air Assist System

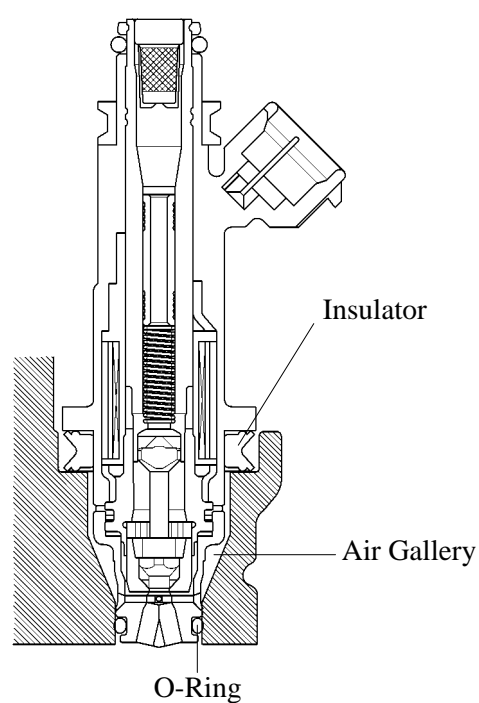
This system is designed to regulate air intake (atmospheric side) using the throttle valve, and direct it to the nozzle of the fuel injector inside the intake manifold (negative pressure side). This promotes atomization of the fuel while reducing emissions and improving fuel economy and idle stability.

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Fuel Injector

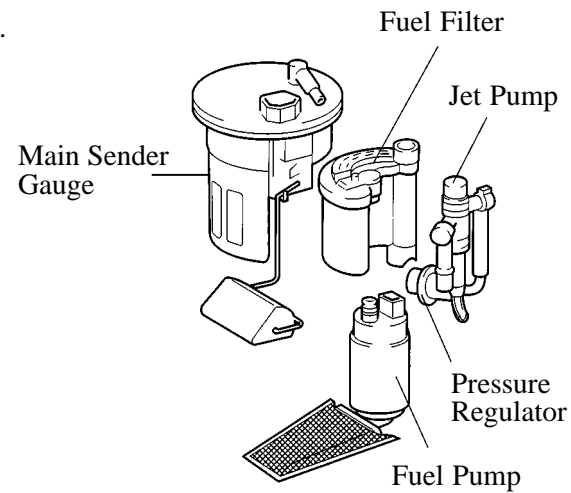
- A compact 4-hole type fuel injector has been used.
- Air introduced from the throttle body and air gallery flows through the air chamber formed by the o-ring and insulator under the fuel injector and then is mixed with the fuel. This design promotes atomization of the fuel.



151EG36

Module Fuel Pump Assembly

The main sender gauge, fuel pump, fuel filter, pressure regulator and jet pump have been integrated.



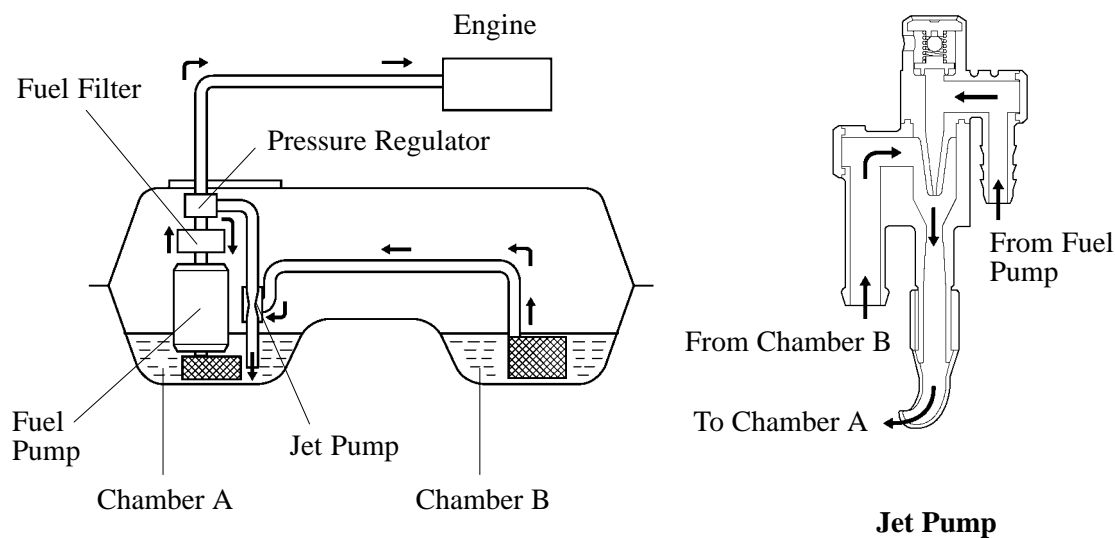
163EG35

Jet Pump

A jet pump is adopted in the fuel tank. Since the propeller shaft is located below its center bottom, the fuel tank of the GS430 is shaped as indicated below.

A fuel tank with such a shape tends to cause the fuel to be dispersed into both chamber A and chamber B when the fuel level is low, stopping the fuel in chamber B from being pumped out. To prevent this from occurring, a jet pump has been provided to transfer the fuel from chamber B to chamber A.

This is accomplished by utilizing the flow of the fuel, so that the vacuum created by the fuel, as it passes through the venturi is used to suck the fuel out of chamber B and send it to chamber A.



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152EG07

9. Ignition System

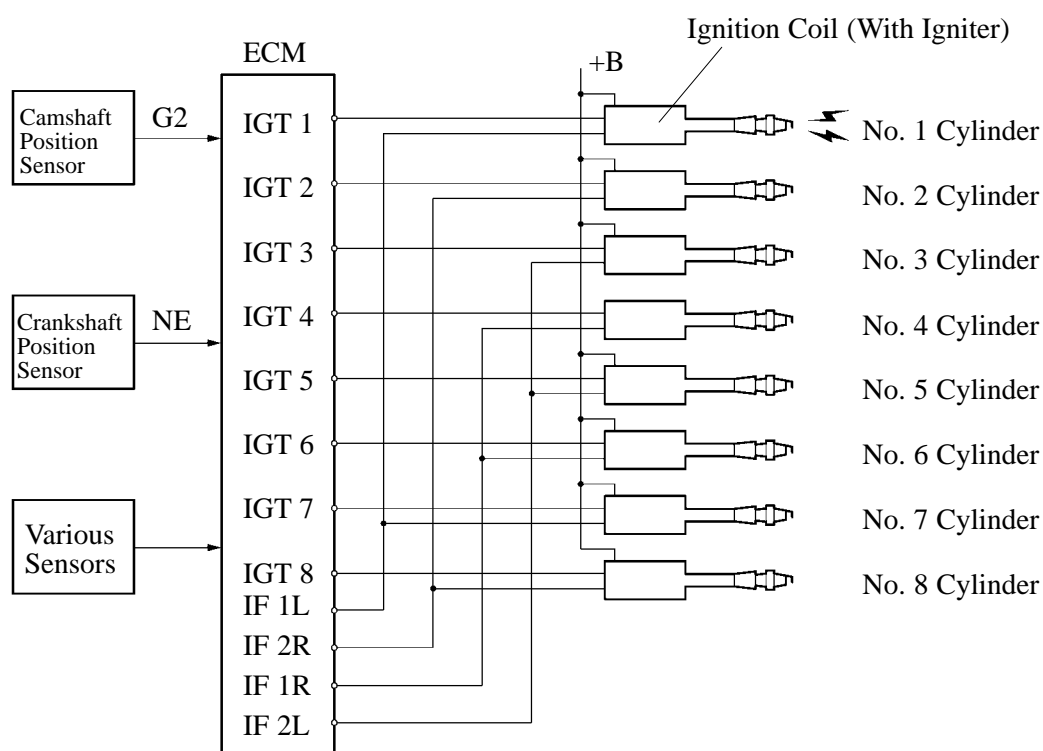
General

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- 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.

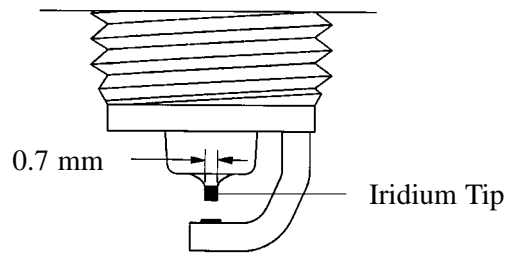
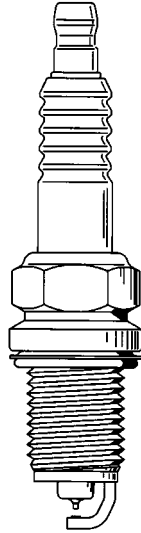
The DIS in this engine is an independent ignition system which has one ignition coil (with igniter) for each cylinder.

- Iridium-tipped spark plugs have been adopted.
- In contrast to the 1UZ-FE engine on the '00 GS400, compact and lightweight ignition coils with an optimized construction have been adopted in the 3UZ-FE engine on the '01 GS430.



Spark Plug

Iridium-tipped spark plugs have been adopted to realize a 120,000-mile (192,000 km) maintenance-free operation. Their center electrode is made of iridium, which excels in wear resistance. As a result, the center electrode is made with a smaller diameter and improved the ignition performance.



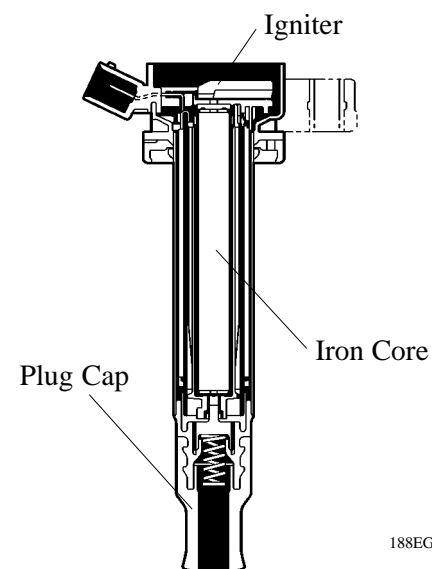
151EG39

► Recommended Spark Plugs ◀

DENSO	SK20R11
NGK	IFR6A11
Plug Gap	1.0 – 1.1 mm (0.0394 – 0.043 in.)

Ignition Coil (with Igniter)

The DIS provides 8 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. However, in contrast to the 1UZ-FE engine on the '00 GS400, compact and lightweight ignition coils with an optimized construction have been adopted in the 3UZ-FE engine on the '01 GS430.



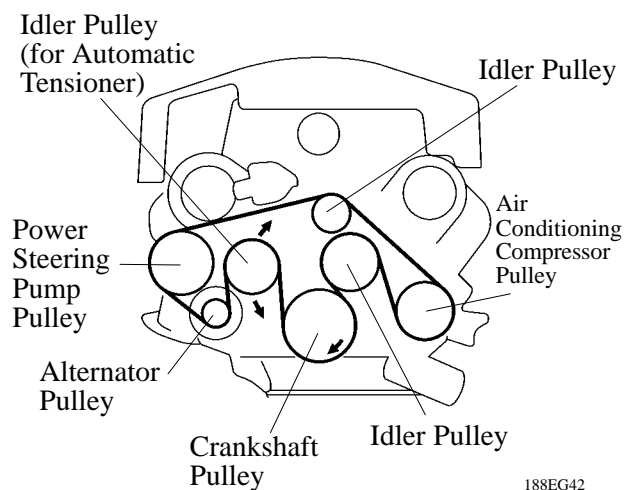
188EG41

Ignition Coil Cross Section

10. Serpentine Belt Drive System

General

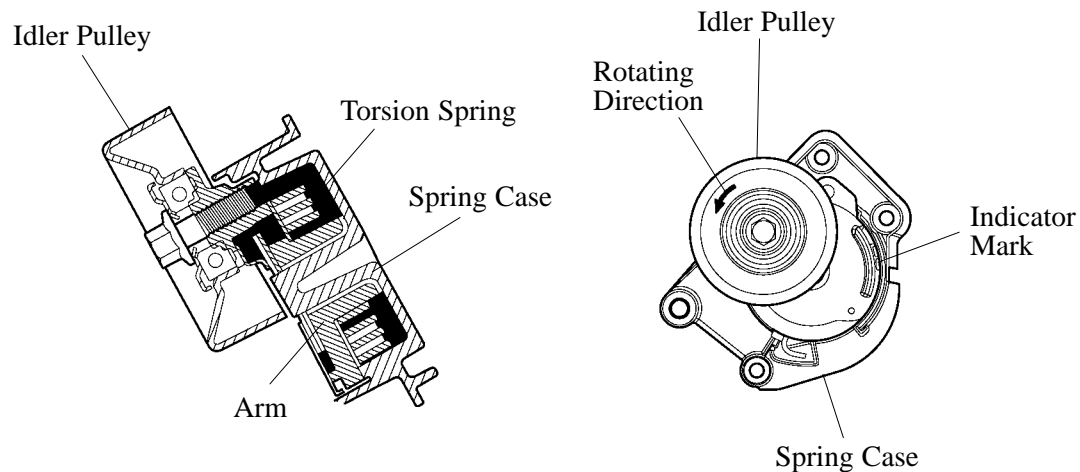
- Accessory components are driven by a serpentine belt consisting of a single V-ribbed belt. It reduces the overall engine length, weight and number of engine parts.
- An automatic tensioner eliminates the need for tension adjustment.



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Automatic Tensioner

The automatic tensioner, which mainly consists of an idler pulley, an arm, a spring case, and a torsion spring, maintains the tension of the V-ribbed belt constant through the force of the torsion spring.



Cross Section

188EG43

11. Engine Control System

General

The engine control system of the 3UZ-FE engine on the '01 GS430 is basically same in construction and operation as that of the 1UZ-FE engine on the '00 GS400.

The engine control system of the 3UZ-FE engine and 1UZ-FE engine are compared below.

System	Outline	3UZ-FE	1UZ-FE
SFI (Electronic Fuel Injection)	An L-type EFI system directly detects the intake air mass with a hot wire type air flow meter.	○	○
ESA (Electronic Spark Advance)	Ignition timing is determined by the ECM based on signals from various sensors. The ECM corrects ignition timing in response to engine knocking.	○	○
	2 knock sensors are used to improve knock detection.	○	○
	The torque control correction during gear shifting has been used to minimize the shift shock.	○	○
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 42.	○	○
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 IAC, snow mode control, cruise control, VSC system, and TRAC systems. For details, see page 47.	○	○
	Torque activated power train control has been adopted. Also, the fail-safe control has been reconsidered with the adoption of the link-less type throttle body. For details, see page 47.	○	—
ACIS (Acoustic Control Induction System)	The intake air passages are switched according to the engine speed and throttle valve angle to increase performance in all speed ranges. For details, see page 53.	○	○
Fuel Pump Control	Under light engine loads, pump speed is low to reduce electric power loss. The fuel pump ECU controls the fuel pump speed in 3 steps.	○	○
	The operation of the fuel pump will stop when the airbag is deployed at the front or side collision. For details, see page 56.	○	—
Oxygen Sensor Heater Control	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	○	○
Air Conditioning Cut-Off Control	By controlling the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.	○	○

(Continued)

System	Outline	3UZ-FE	1UZ-FE
Evaporative Emission Control	The ECM controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.	○	○
	Using 3 VSVs and a vapor pressure sensor, the ECM detects any evaporative emission leakage occurring between the fuel tank and the charcoal canister through the changes in the tank pressure.	○	—
Engine Immobiliser	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.	○	○
Function to communicate with multiplex communication system	Communicates with the body ECU, A/C ECU, etc., on the body side, to input/output necessary signals.	○	○
Diagnosis	When the ECM detects a malfunction, the ECM diagnoses and memorizes the failed section.	○	○
Fail-Safe	When the ECM detects a malfunction, the ECM stops or controls the engine according to the data already stored in the memory.	○	○