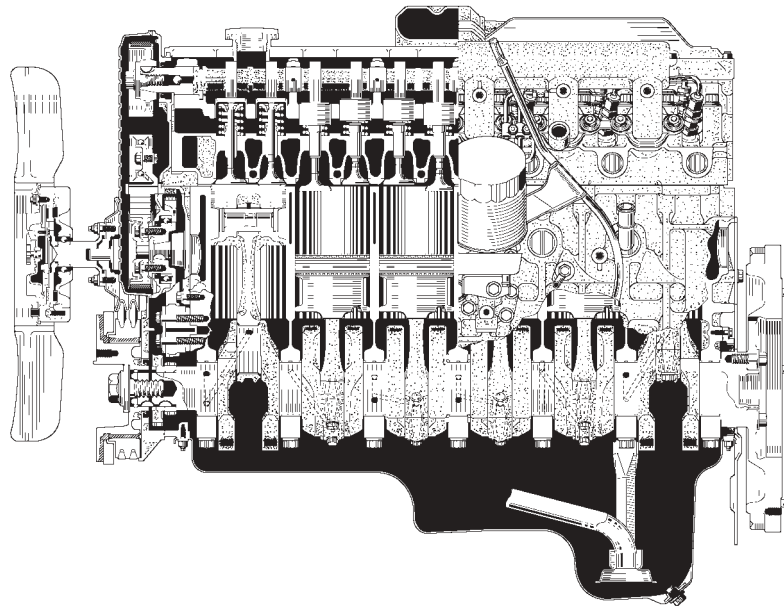


## 1HZ AND 1HD-T ENGINES

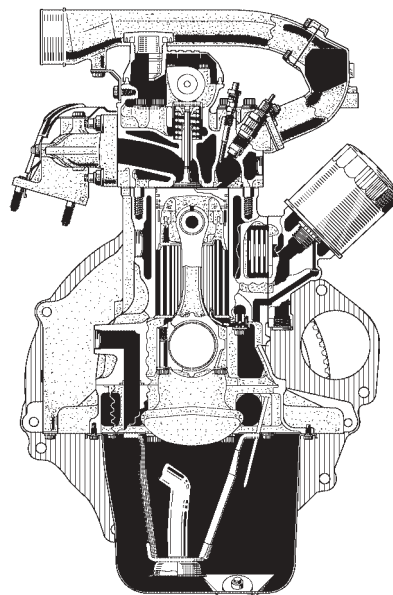
### ■ DESCRIPTION

In the 1HZ engine, the injection nozzles have been changed and the shape of the combustion chamber has been changed to reduce exhaust emissions and the rigidity of the cylinder block has been improved to reduce noise and vibration. Similar to the 1HZ engine, the rigidity of the cylinder block of the 1HD-T engine has been improved to reduce noise and vibration.

#### ► 1HZ Engine (Manual Transmission Model) ◀

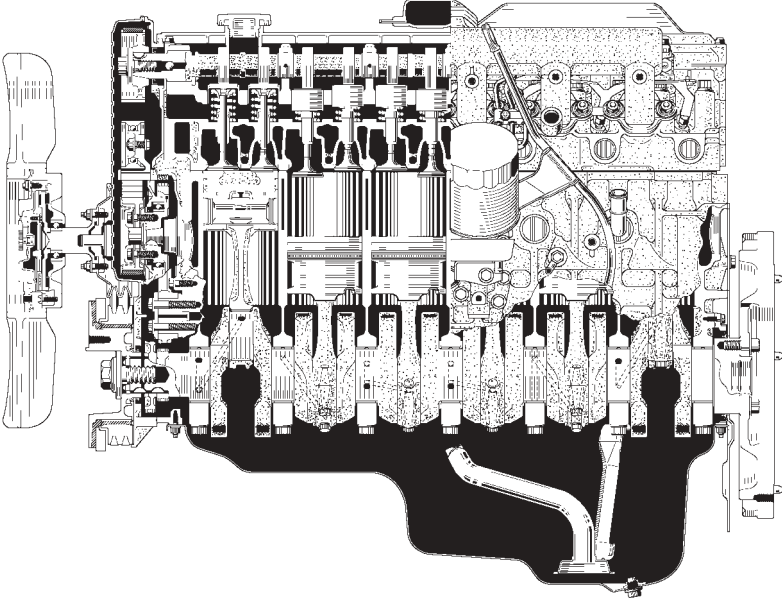


147EG37

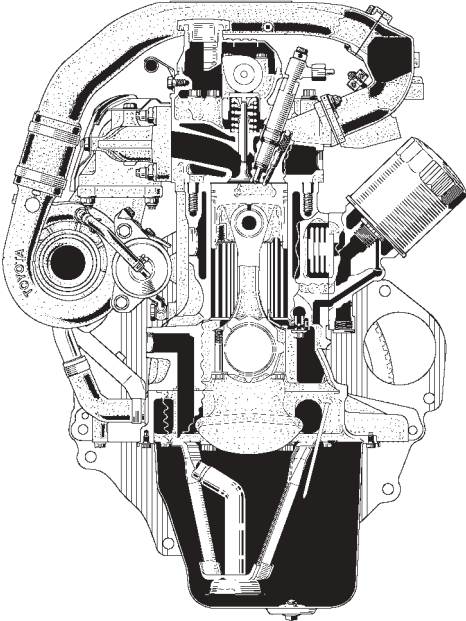


147EG38

► 1HD-T Engine (Manual Transmission Model) ◀



147EG39

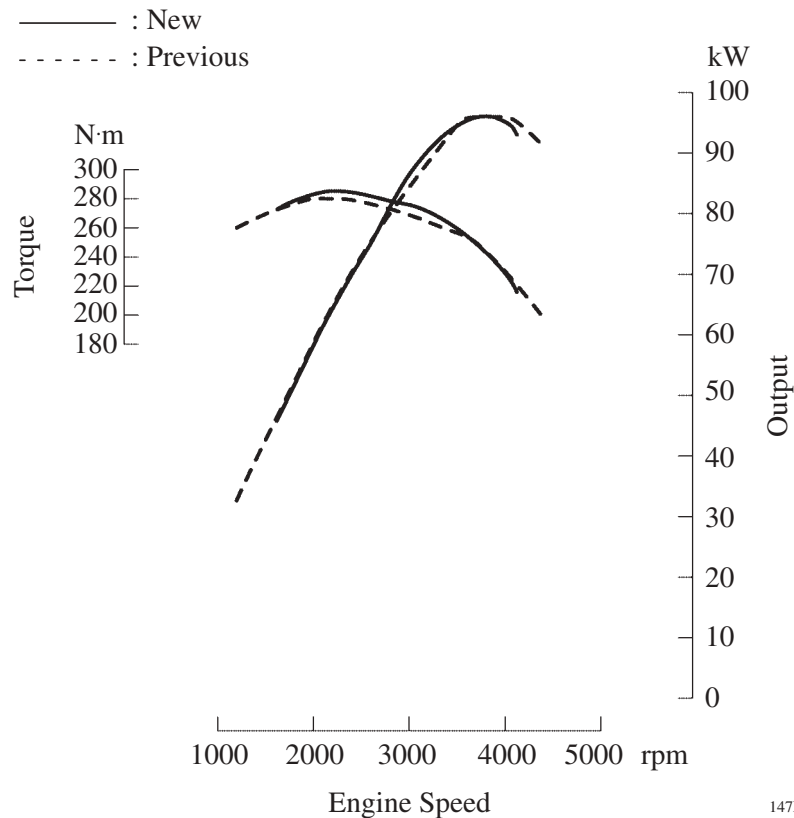


147EG40

### ENGINE SPECIFICATIONS AND PERFORMANCE CURVE (1HZ ENGINE)

Item		1HZ Engine	New	Previous
No. of Cyls. & Arrangement			6-Cylinder, In-Line	←
Valve Mechanism			12-Valve, OHC, Gear and Belt Drive	←
Combustion Chamber			Swirl Type	←
Manifolds			Cross-Flow	←
Displacement		cm <sup>3</sup> (cu. in.)	4164 (254.0)	←
Bore x Stroke		mm (in.)	94.0 x 100.0 (3.70 x 3.94)	←
Compression Ratio			22.4 : 1	22.7 : 1
Max. Output		SAE-NET	96 kW @ 3800 rpm	96 kW @ 4000 rpm
		SAE-GROSS	100 kW @ 3800 rpm	100 kW @ 4000 rpm
Max. Torque		SAE-NET	285 N·m @ 2200 rpm	280 N·m @ 2000 rpm
		SAE-GROSS	290 N·m @ 2200 rpm	285 N·m @ 2000 rpm
Valve Timing	Intake	Open	8° BTDC	←
		Close	36° ABDC	←
	Exhaust	Open	51° BBDC	←
		Close	5° ATDC	←
Fuel Cetane Number			48 or higher	←
Oil Grade			API CF-4	API CD or Better

EG

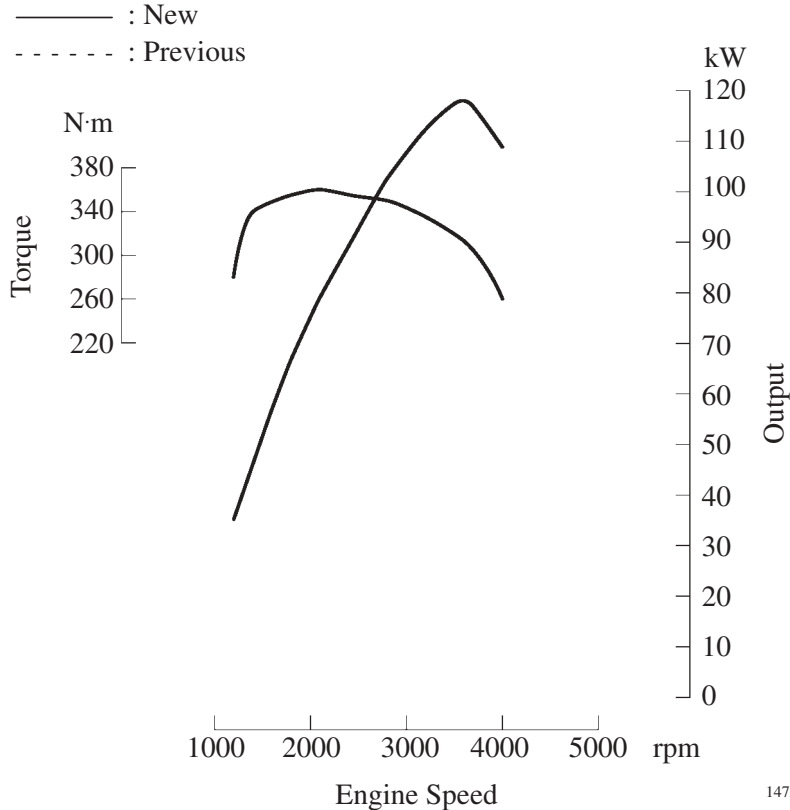


147EG29

The engine performance curve above is shown in SAE-NET figures.

### ENGINE SPECIFICATIONS AND PERFORMANCE CURVE (1HD-T ENGINE)

1HD-T Engine		New	Previous	
Item				
No. of Cyls. & Arrangement		6-Cylinder, In-Line	←	
Valve Mechanism		12-Valve, OHC, Gear and Belt Drive	←	
Combustion Chamber		Direct Injection Type	←	
Manifolds		Cross-Flow	←	
Displacement	cm <sup>3</sup> (cu. in.)	4164 (254.0)	←	
Bore x Stroke	mm (in.)	94.0 x 100.0 (3.70 x 3.94)	←	
Compression Ratio		18.6 : 1	←	
Max. Output	SAE-NET	118 kW @ 3600 rpm	←	
Max. Torque	SAE-NET	360 N·m @ 2100 rpm	←	
Valve Timing	Intake	Open	8° BTDC	←
		Close	29° ABDC	←
	Exhaust	Open	51° BBDC	←
		Close	5° ATDC	←
Fuel Cetane Number		48 or higher	←	
Oil Grade		API CF-4	API CD or Better	



## MAJOR DIFFERENCES

The following changes have been made to the 1HZ and 1HD-T engines.

- The changes described below are the same as those of the 1HD-FTE engine. For details, see the 1HD-FTE engine section.

Item	Details	1HZ	1HD-T
Engine Proper	<ul style="list-style-type: none"> <li>• The rigidity of the cylinder block has been improved to reduce noise and vibration.</li> <li>• The crankshaft has been made highly rigid to reduce noise and vibration.</li> <li>• The crankshaft bearings have been machine-bored to improve their reliability.</li> </ul>	○	○
Cooling System	<ul style="list-style-type: none"> <li>• An aluminum radiator core is used for weight reduction.</li> <li>• A step-up linear type temperature controlled fluid coupling has been adopted to improve cooling performance.</li> </ul>	○	○
Lubrication System	<ul style="list-style-type: none"> <li>• A high-performance oil filter element has been adopted to improve the cleanliness of the engine oil.</li> <li>• A drip pan is provided on the oil cooler cover to improve serviceability.</li> </ul>	○	○
	The oil capacity of the engine has been increased to improve its reliability.	–	○
Intake and Exhaust System	<ul style="list-style-type: none"> <li>• A ball joint has been adopted in the front exhaust pipe to reduce noise and vibration.</li> <li>• A clamp type joint is used to join the center pipe and tail pipe to realize weight reduction.</li> </ul>	–	○

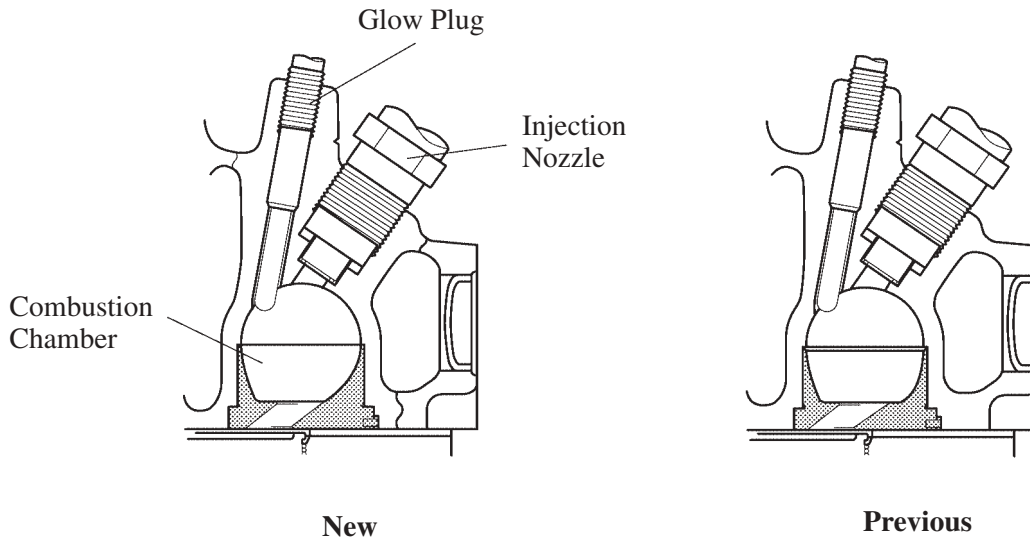
- In addition to those listed above, the following changes have been made to the 1HZ and 1HD-T engines.

Item	Detail	1HZ	1HD-T
Engine Proper	<ul style="list-style-type: none"> <li>• The shape of the combustion chamber of the cylinder head and the piston has been optimized to reduce exhaust emissions.</li> <li>• The inertial weight of the flywheel has been increased to reduce the fluctuations in engine speed.</li> </ul>	○	–
Valve Mechanism	<ul style="list-style-type: none"> <li>• A hydraulic type auto tensioner has been adopted to achieve proper timing belt tension.</li> <li>• The shape of the timing gear cover has been changed for quieter operation.</li> </ul>	○	○
Fuel System	<ul style="list-style-type: none"> <li>• The orifice of the injection nozzle has been increased to optimize the injection rate.</li> </ul>	○	–
	<ul style="list-style-type: none"> <li>• The injection pump is provided with FCVC (Fuel Cut Valve Control) in conjunction with the adoption of the engine immobiliser system.</li> </ul>	○	○
Glow System	<ul style="list-style-type: none"> <li>• New glow plugs made of metal have been adopted and the glow plug resistor and sub-relay have been discontinued.</li> </ul>	○	○

## ENGINE PROPER (1HZ ENGINE)

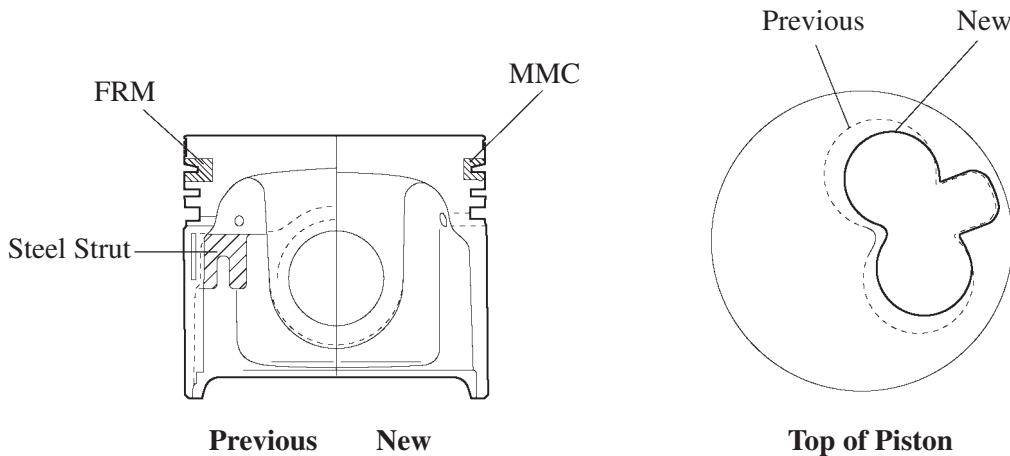
### 1. Cylinder Head

The shape of the combustion chamber has been optimized to reduce exhaust emissions.



### 2. Piston

- The piston is made of aluminum alloy that offers high temperature strength. The top ring groove has been treated with MMC (Metal Matrix Composites) to improve its wear resistance.
- The shape of the piston skirt has been optimized to improve its rigidity. Accordingly, the steel strut has been discontinued.
- The shape of the combustion chamber at the top of the piston has been changed. Along with the change in the shape of the combustion chamber in the cylinder head, improved combustion efficiency has been realized.



#### – REFERENCE –

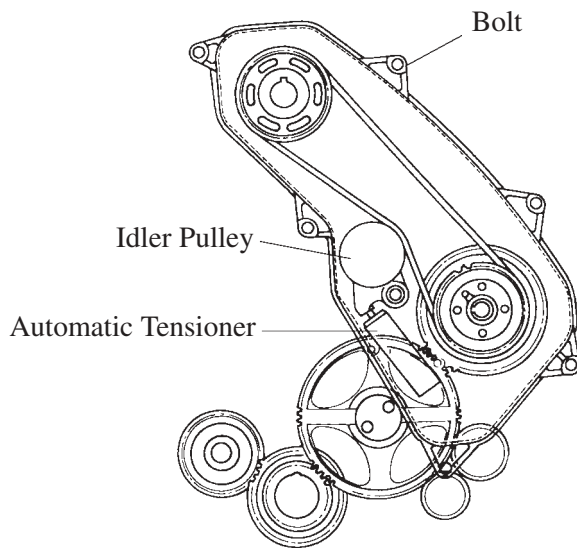
MMC (Metal Matrix Composites)

It is a type of composite material that is made of a metal matrix for the purpose of obtaining characteristics such as high strength, high elasticity, and low thermal expansion. Because of its excellent heat transmission performance, this material helps to dissipate the piston's heat through the piston ring to the cylinder block.

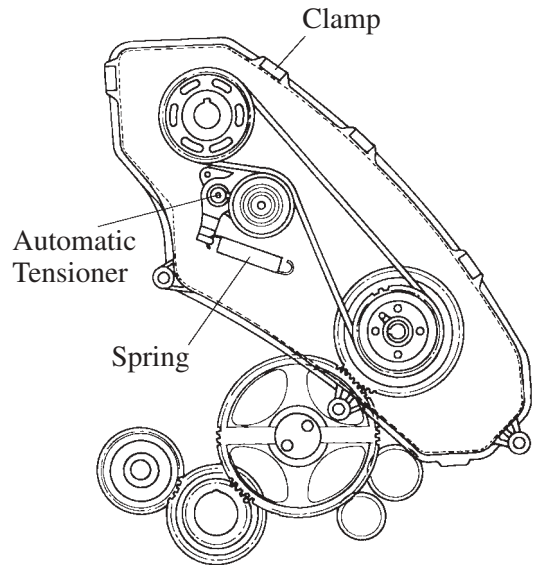
## ■ VALVE MECHANISM

### 1. General

- The auto tensioner has been changed from the wear reducing type to the hydraulic type. As a result, proper timing belt tension has been realized.
- For the timing belt cover gasket, a cover with integrated foam rubber has been adopted for improved serviceability.
- The timing belt cover installation portion has adopted a floating construction to reduce noise.

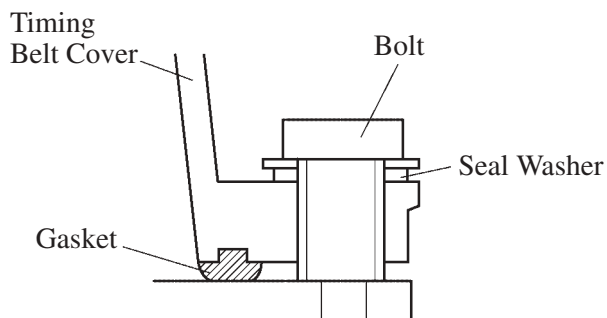


**New**

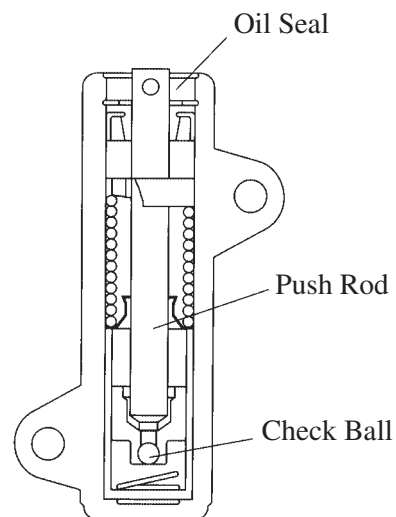


**Previous**

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**Timing Belt Cover Installation Portion**



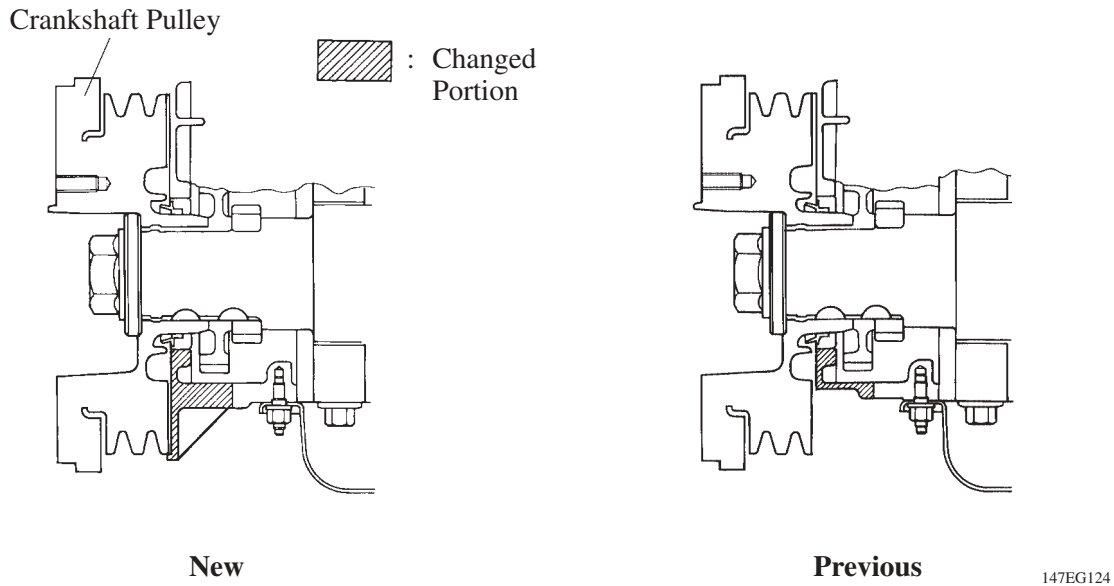
**Hydraulic Automatic Tensioner**

147EG122

147EG123

## 2. Timing Gear Cover

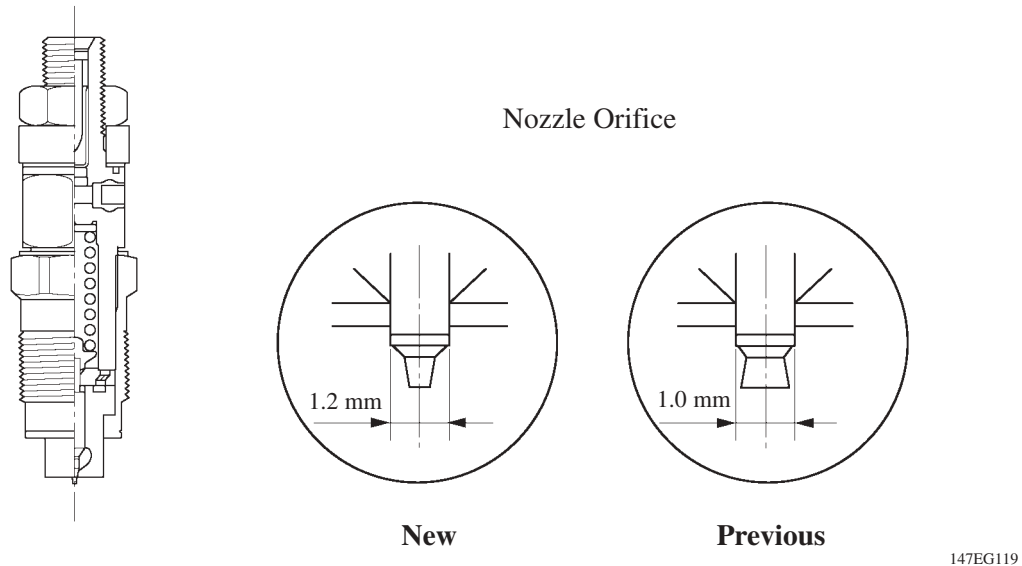
The shape of the bottom of the timing gear cover has been changed to reduce the amount of sound that is radiated towards the bottom of the engine.



## ■ FUEL SYSTEM

### 1. Injection Nozzle (1HZ Engine)

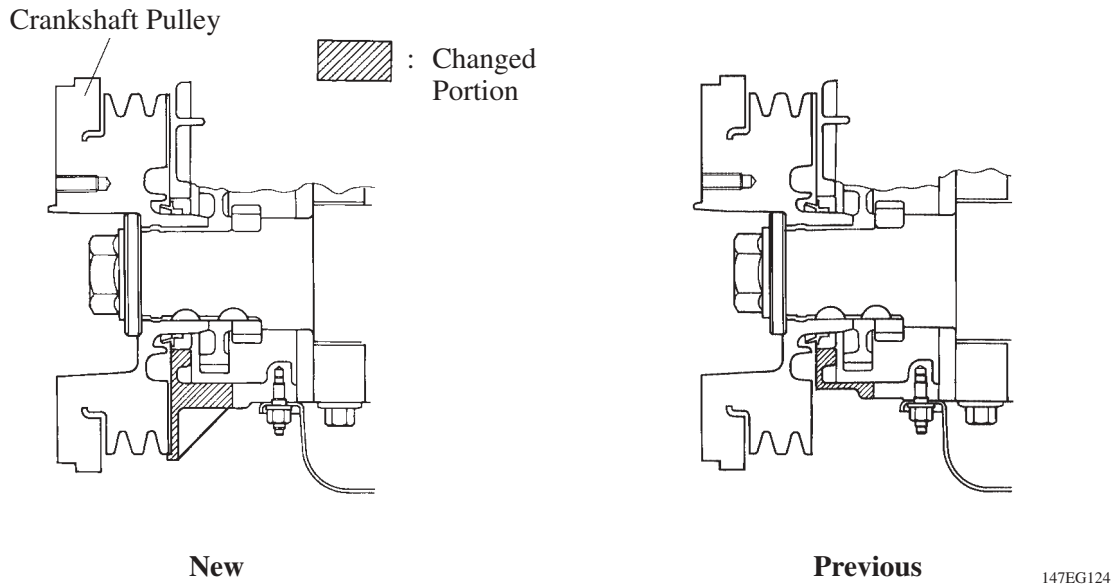
The injection nozzle's orifice has been changed in shape and enlarged to optimize the injection efficiency.





## 2. Timing Gear Cover

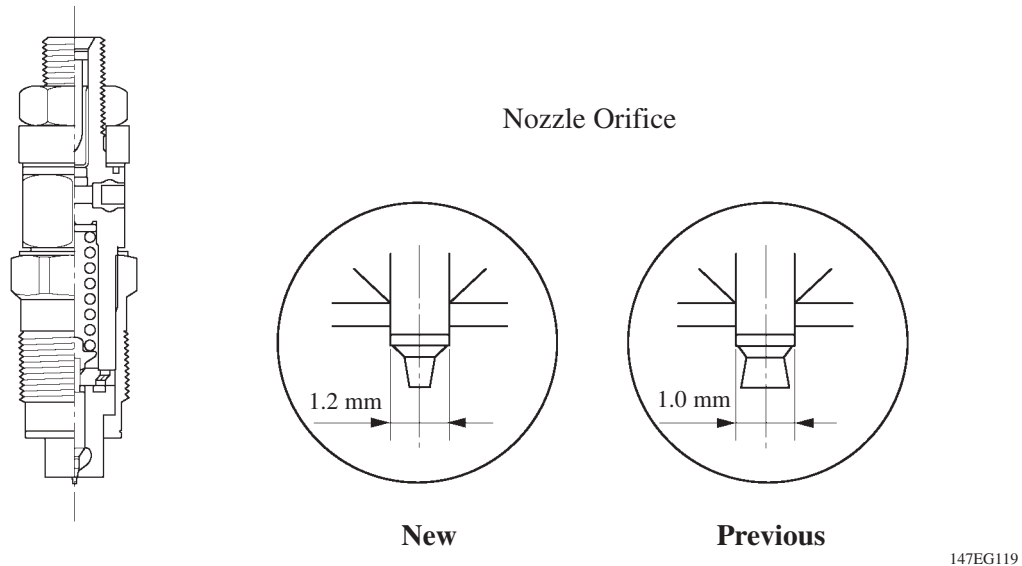
The shape of the bottom of the timing gear cover has been changed to reduce the amount of sound that is radiated towards the bottom of the engine.



## ■ FUEL SYSTEM

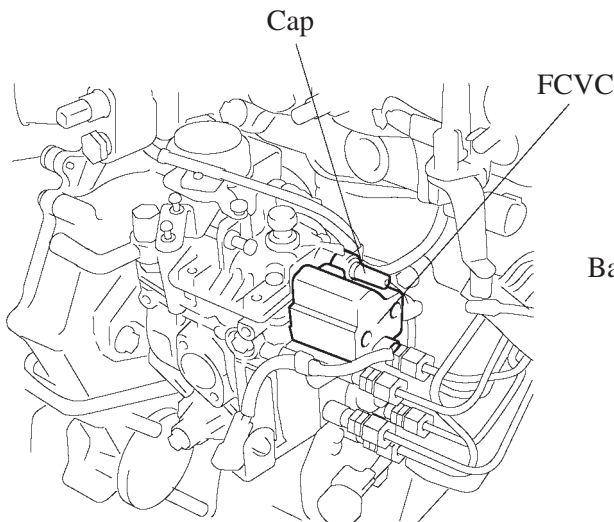
### 1. Injection Nozzle (1HZ Engine)

The injection nozzle's orifice has been changed in shape and enlarged to optimize the injection efficiency.

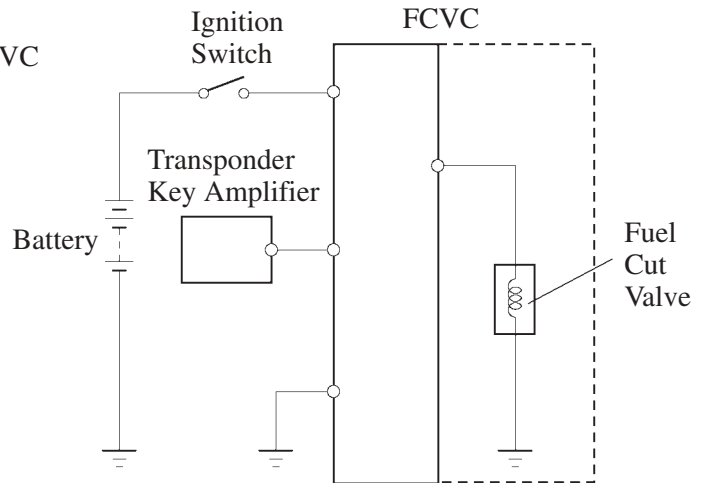


## 2. Injection Pump

- Along with the changes made to the shape of its combustion chamber, the 1HZ engine has realized optimal injection volume, injection characteristics, and injection timing.
- The injection pump is provided with FCVC (Fuel Cut Valve Control) in conjunction with the adoption of the engine immobiliser system. Upon receiving communication from the transponder key computer, the FCVC turns OFF the fuel cut valve to prohibit the engine from starting if an invalid ignition key is used in an attempt to start the engine.
- A tampering-proof cap is placed over the full-load setting screw on the models for the General Countries.



147EG125



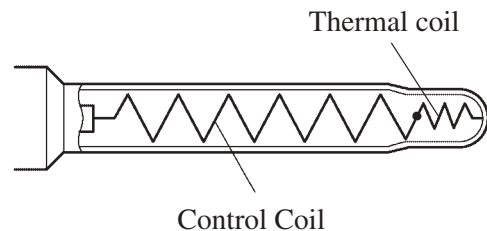
147EG120

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## ■ GLOW SYSTEM

### 1. Glow Plug

- New glow plugs made of metal have been adopted. Using an optimal control coil material and providing a temperature control function in the glow plug itself, the system has been simplified by discontinuing the glow plug resistor and sub-relay.



147EG127