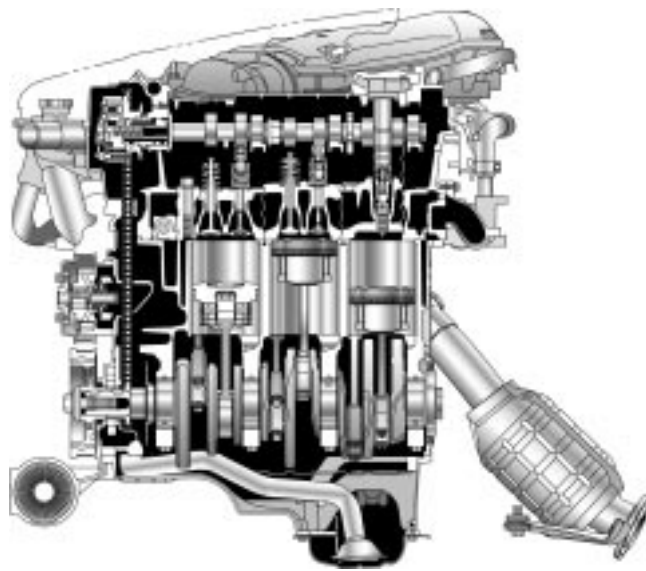


ENGINE

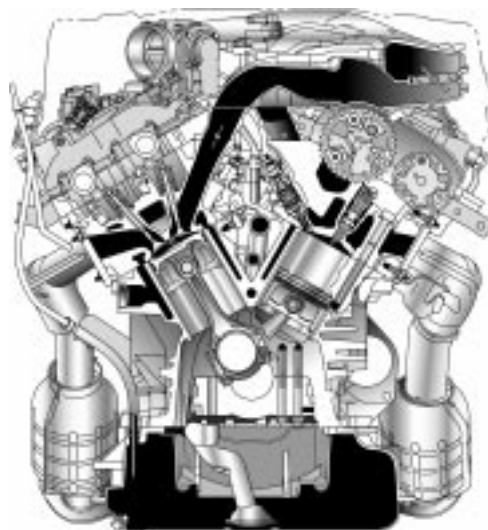
4GR-FSE ENGINE

■ DESCRIPTION

The newly developed 4GR-FSE D-4 (Direct injection 4-stroke gasoline engine) is a 2.5-liter, 24-valve DOHC V6 engine. This engine uses a Direct injection system, Dual VVT-i (Variable Valve Timing-intelligent) system, DIS (Direct Ignition System), ACIS (Acoustic Control Induction System), Electronic SCV (Swirl Control Valve) and ETCS-i (Electronic Throttle Control System-intelligent). These control functions achieve improved engine performance, fuel economy, and clean emissions.



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► Engine Specification ◀

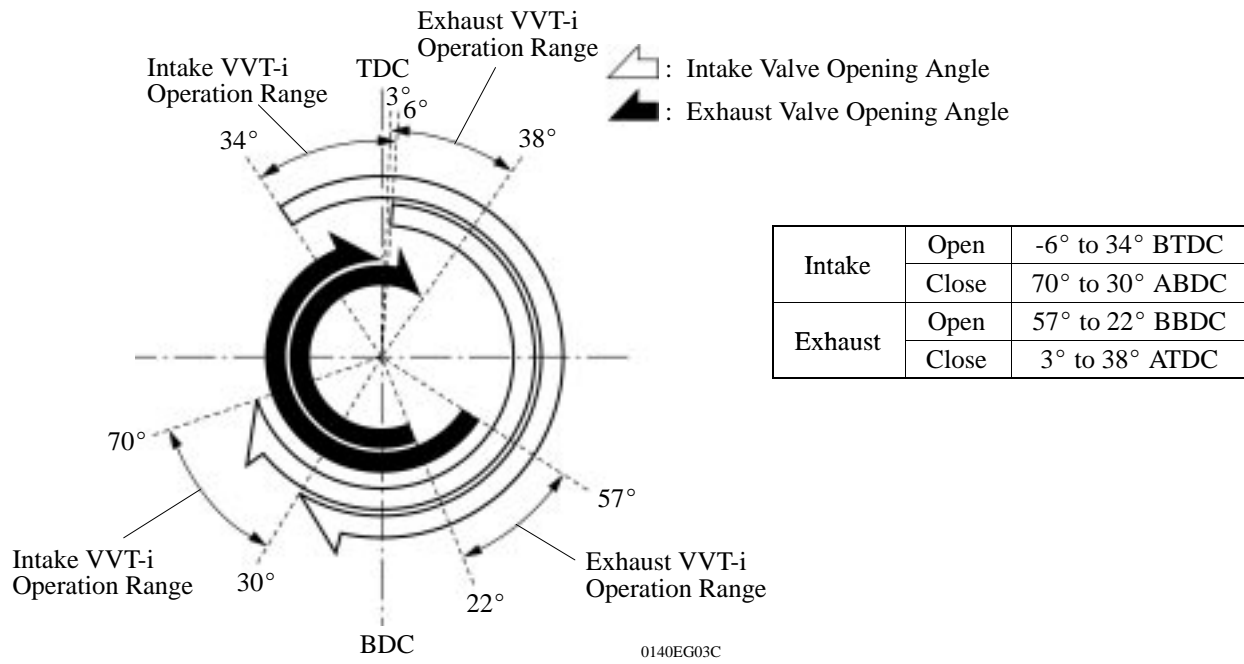
No. of Cyls. & Arrangement		6-Cylinder, V Type	
Valve Mechanism		24-Valve DOHC, Chain Drive (with Dual VVT-i)	
Combustion Chamber		Pentroof Type	
Manifolds		Parallel-Flow	
Fuel System		SFI D-4	
Ignition System		DIS	
Displacement		cm ³ (cu. in.)	2500 (152.6)
Bore × Stroke		mm (in.)	83.0 × 77.0 (3.27 × 3.03)
Compression Ratio		12.0 : 1	
Max. Output (SAE-NET)* ¹		152 kW @ 6400 rpm (204 HP @ 6400 rpm)	
Max. Torque (SAE-NET)* ¹		250 N·m @ 4800 rpm (185 ft·lbf @ 4800 rpm)	
Oil Capacity	2WD Model	Dry	7.2 liters (7.6 US qts, 6.3 Imp. qts)
		With Oil Filter	6.3 liters (6.7 US qts, 5.5 Imp. qts)
		Without Oil Filter	5.9 liters (6.2 US qts, 5.2 Imp. qts)
	4WD Model	Dry	7.7 liters (8.1 US qts, 6.8 Imp. qts)
		With Oil Filter	6.4 liters (6.8 US qts, 5.6 Imp. qts)
		Without Oil Filter	6.0 liters (6.3 US qts, 5.3 Imp. qts)
Oil Grade		ILSAC	
Engine Coolant	Type	TOYOTA Genuine Super Long Life Coolant or the following* ²	
	Capacity	9.1 liters (9.6 US qts, 8.0 Imp. qts)	
Spark Plug	Type	DENSO	FK20HBR11 (Iridium)
	Plug Gap	mm (in.)	1.0 - 1.1 (0.0394 - 0.0433)
Firing Order		1 - 2 - 3 - 4 - 5 - 6	
Fuel Octane Rating		91 or higher	
Emission Regulation	Tailpipe	California	ULEVII, SFTP
		Except California	Tier2-Bin5, SFTP
	Evaporative	LEVII, ORVR	
Engine Service Mass* ³ (Reference)		kg (lb)	180 (397)

*¹: Maximum output and torque rating is determined by revised SAE J1394 standard.

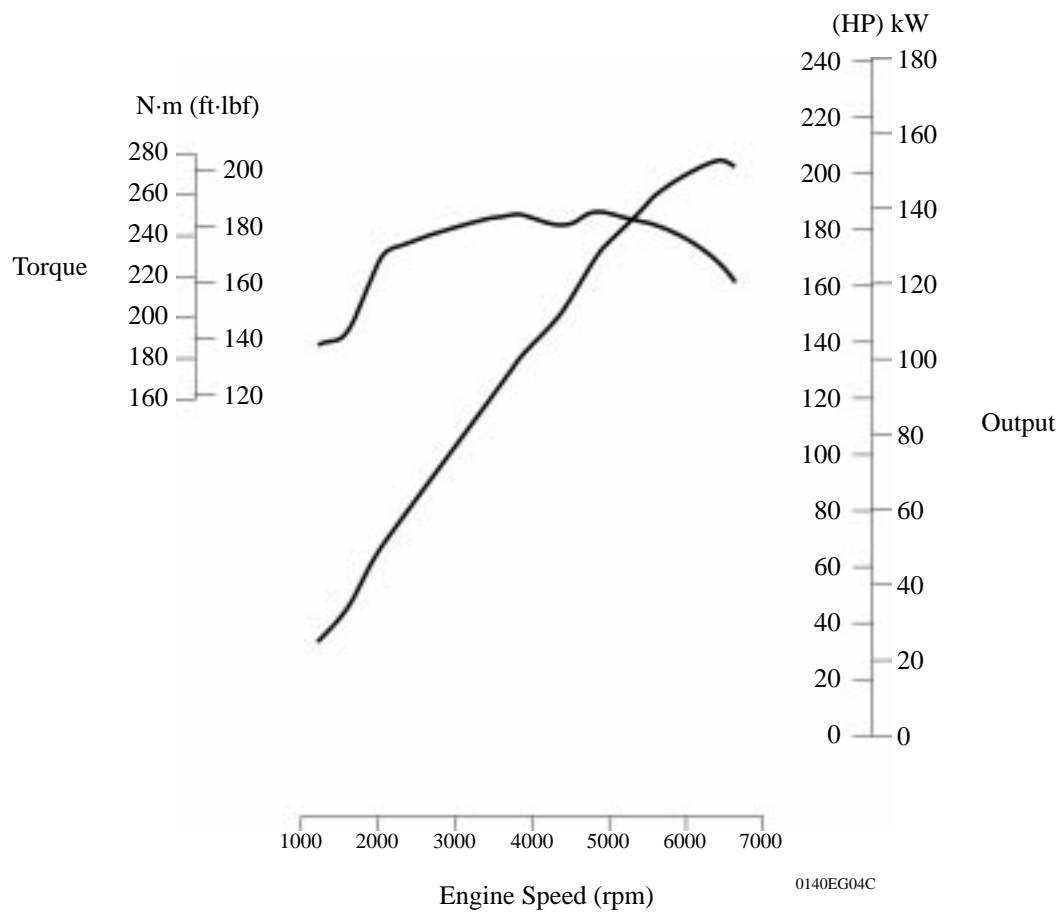
*²: Similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite, and non-borate coolant with long-life hybrid organic acid technology. (Coolant with hybrid organic acid technology consists of a combination of low phosphates and organic acids.)

*³: Weight shows the figure with the oil and engine coolant fully filled.

► Valve Timing ◀



► Performance Curve ◀

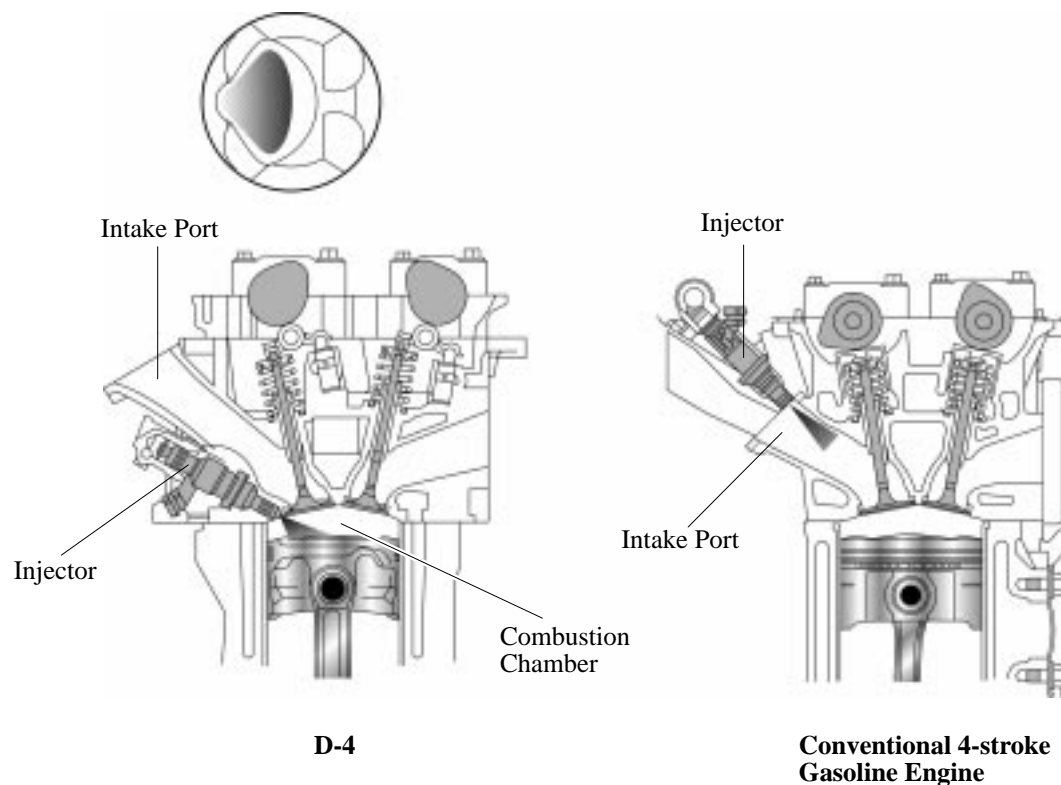


— REFERENCE —

D-4 (Direct injection 4-stroke gasoline engine) System

- An engine equipped with a D-4 system has the injector installed on the combustion chamber, which injects the fuel pressurized in the fuel pump (high pressure) directly into the combustion chamber. Due to the injection directly in the cylinder, it is possible to increase the compression ratio. It is possible to increase the compression ratio due to direct injection taking advantage of the “latent heat of vaporization*” of the fuel. This principle results in a cooling effect on the compressed mixture. The lower temperature of the compressed mixture reduces the tendency of the mixture to detonate or preignite in the engine. The increased compression ratio of the engine results in improved power output.
- A conventional gasoline SFI engine has the injector installed in the intake port and the air and fuel injected inside the intake port is drawn into the cylinder by the intake stroke of the piston.
- In the D-4 system, a slit nozzle type injector precisely controls the quantity of the high pressure fuel and produces a fine-grain atomization to thus improve the fuel efficiency.

* Latent heat of vaporization is an effect that results in a temperature drop when a liquid changes from a liquid to a gas. An example is the cooling effect produced when alcohol evaporates from skin, or when liquid refrigerant changes to a gas.



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- Depending on the driving conditions, by injecting the fuel at an optimal time during the intake stroke, an equal air-fuel mixture (homogenous mixture) is produced.
- When the engine is cold, fuel is injected at the end of the compression stroke. Due to the combustion time being lengthened by providing a leaner mixture, the exhaust temperature is raised to accelerate engine and catalyst warm-up. Catalysts that are warmed up earlier accelerate exhaust emission purification.