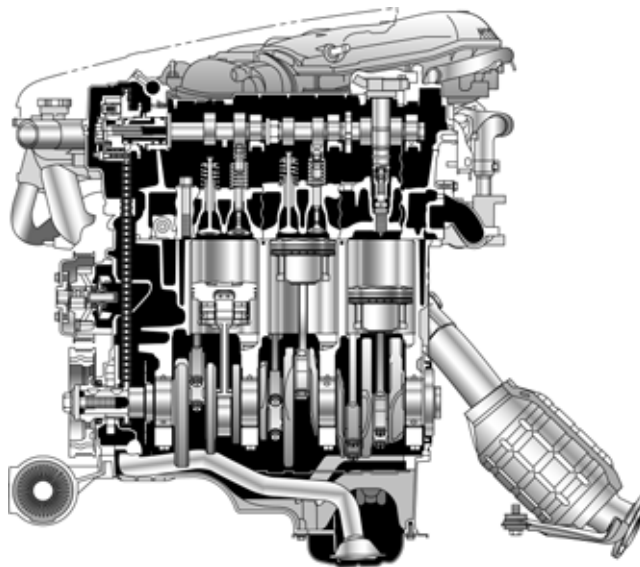


ENGINE

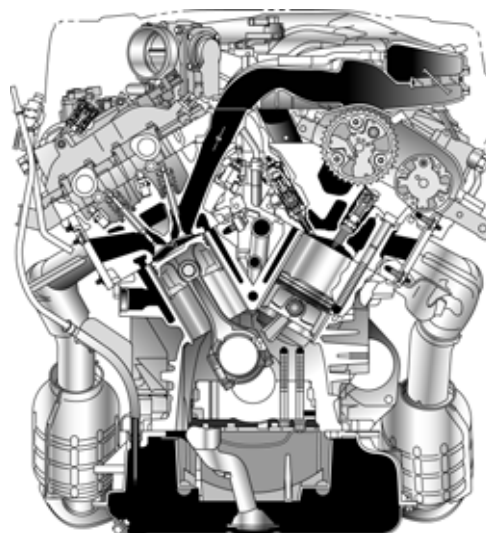
4GR-FSE ENGINE

■ 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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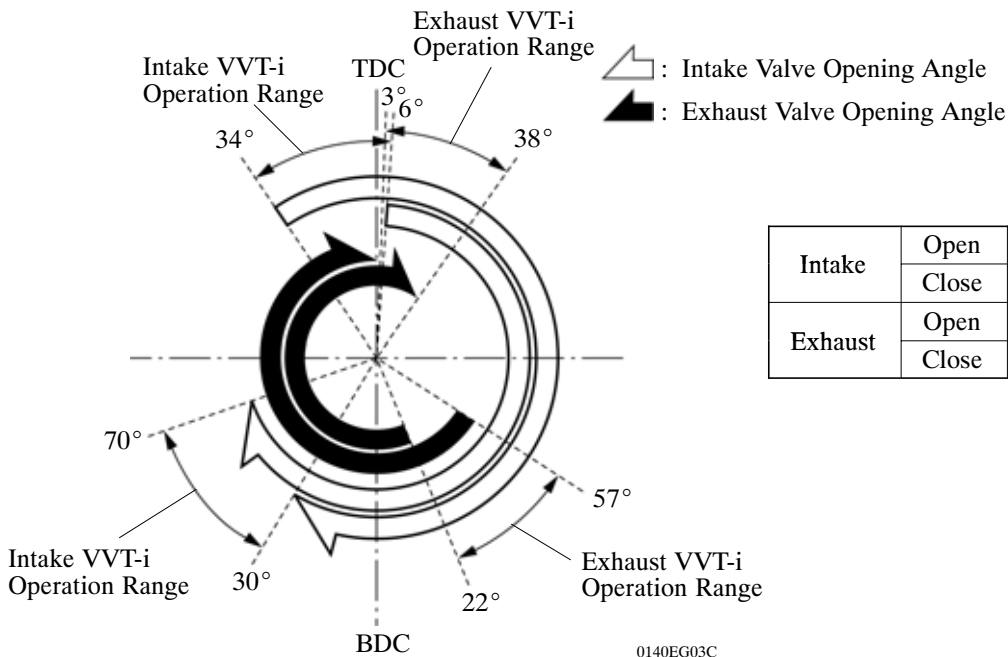
► Engine Specification ◀

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			EFI 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)			153 kW @ 6400 rpm
Max. Torque (SAE-NET)			252 N·m @ 4800 rpm
Oil Capacity	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)
Oil Grade			20W-50 and 15W-40 API grade SL or SM multigrade engine oil 10W-30 and 5W-30 API grade SL “Energy-Conserving”, “Energy-Conserving” SM or ILSAC multigrade engine oil
Engine Coolant	Type		TOYOTA Genuine Super Long Life Coolant or the following* ¹
	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
Research Octane Number			95 or higher
Tailpipe Emission Regulation			EURO IV
Engine Service Mass* ² (Reference)		kg (lb)	180 (397)

*¹: 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.)

*²: Weight shows the figure with the oil and engine coolant fully filled.

► Valve Timing ◀



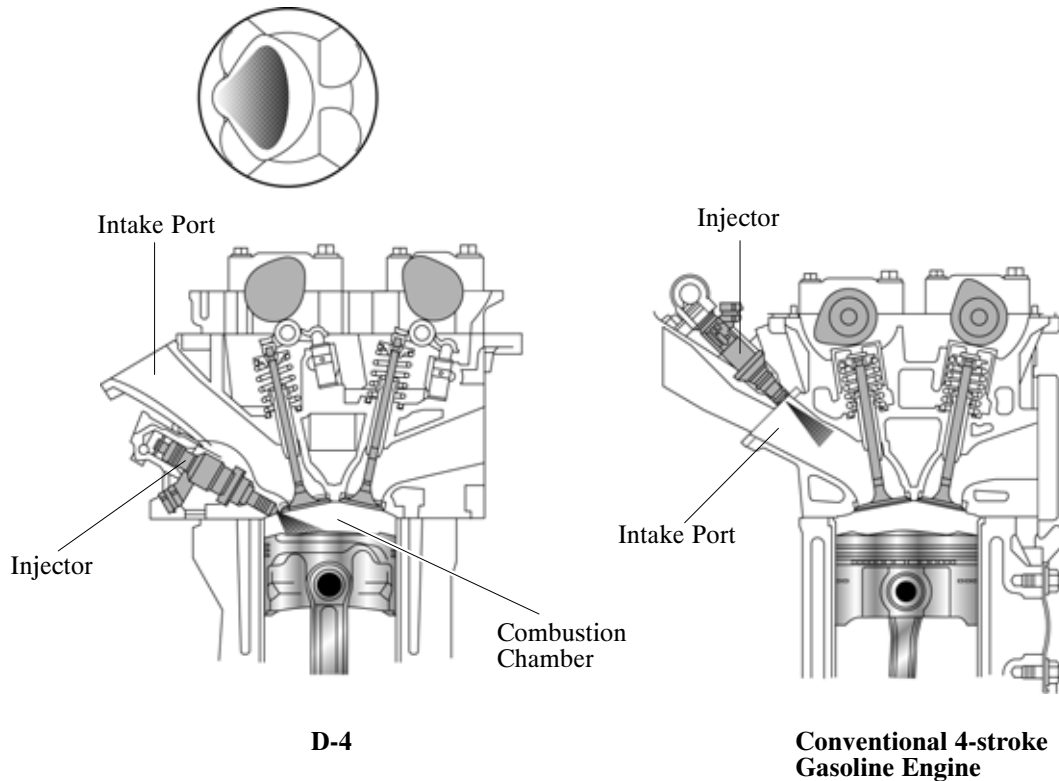
Intake	Open	-6° to 34° BTDC
	Close	70° to 30° ABDC
Exhaust	Open	57° to 22° BBDC
	Close	3° to 38° ATDC

—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 EFI engine has the injector installed in the intake port and the air and fuel injected inside the intake port are 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.