

## New 3.0-litre D-4D diesel

### A remarkable engine

- New, second-generation common-rail system
- Compression ratio lowered to 17.9:1, enabling a more efficient combustion process
- New pistons improve combustion and reduce friction losses
- Electric DC motor for turbo nozzle vane activation improves low-end engine response
- Swirl Control System generates more torque at low engine speeds
- An EGR valve position sensor and a new type of EGR cooler are now adopted
- 3.0 D-4D engine is now the 'torquiest' 4 cylinder on the market (410 Nm)
- 0-100 km/h drops to 11.2 sec. (with automatic transmission), the quickest among competitors
- Combined fuel consumption reduced by 13.5% (with automatic transmission)
- Highest driving range among diesel core SUVs

The new common-rail injection system now available on the Toyota Land Cruiser has already been adopted in the 2.0 D-4D engine (available in Corolla, Corolla Verso and Avensis) and works off greatly increased fuel pressure. The common-rail develops a **maximum pressure of 1600 bar**, an increase of 18% in comparison with the previous system.

**Injector nozzles have a smaller diameter and contain more holes (8) than previously.** As a result, air-fuel mixture is now more homogeneous, improving the efficiency of the combustion process. This translates into more performance with lower emissions and lower fuel consumption.

Furthermore, the common-rail system **supply pump is now 35% lighter and more compact.**

In a wide range of driving conditions the new common-rail system performs a **double pilot injection** per cycle (prior to the main injection), distributing the same amount of fuel with three distinct injections. This reduces the combustion noise and engine vibration, greatly improving NVH levels from this high performance diesel.

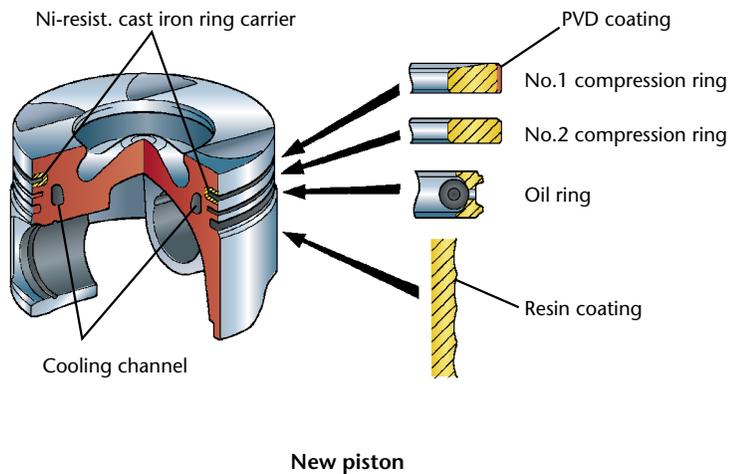
The improvements introduced to the combustion process allow the **compression ratio to be reduced** (despite the increased power and torque output) from 18.4:1 to 17.9:1. This will result in less heat build-up in the piston bowl and a more efficient combustion process, therefore enabling more performance with lower emissions.

Computerised control of the engine management system is more sophisticated than ever, with a **32-bit ECU** replacing the more conventional 16-bit unit. This allows faster and more precise control of a wide range of functions including fuel pressure injection timing and emissions control such as exhaust gas recirculation.

## New pistons

- New shape for the combustion chamber
- Optimised cooling performance
- Special coating reduces friction losses

A number of improvements have been made to the pistons in order to increase combustion efficiency and reduce friction losses. These include revising the shape of the combustion chamber and improving the cooling efficiency with an optimised cooling channel.



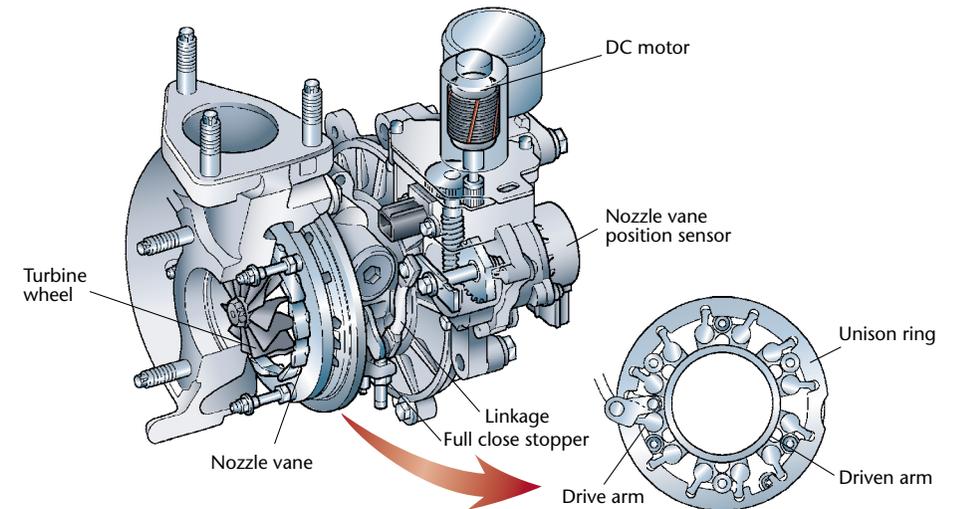
The piston skirt has been resin coated to reduce friction and improve initial resistance, and there is also a PVD (Physical Vapour Deposition) coating on the first compression ring.

## More precise turbo control

- Electric DC activation of the variable nozzle mechanism
- Redesigned compressor impeller

One key to the impressive power and torque output of the 3.0-litre D-4D has always been the sophisticated, variable vane, turbocharger. By controlling the turbo nozzle vane variably and making the most suitable amount of the exhaust gas inflow to the turbine, great improvements in low speed torque, maximum output, fuel consumption and noise and emission reductions have been achieved.

Now this turbocharger has been improved still further. An electric DC (direct current) motor, replacing the conventional step motor, now activates the variable nozzle vane mechanism. Electrical activation by a DC motor allows the engine ECU to have a more precise control on the vanes' position. The result is sharper response from the turbocharger, particularly at lower speeds.



**Variable Nozzle Turbocharger with electric DC motor activation**

At the same time, Toyota engineers took the opportunity to redesign the compressor impeller to improve pressure-charging efficiency.

These two developments mean the turbocharger can start to generate a higher air intake pressure at lower rpm, which in turn results in higher torque at lower speeds - an important advantage when driving both on- or off-road.

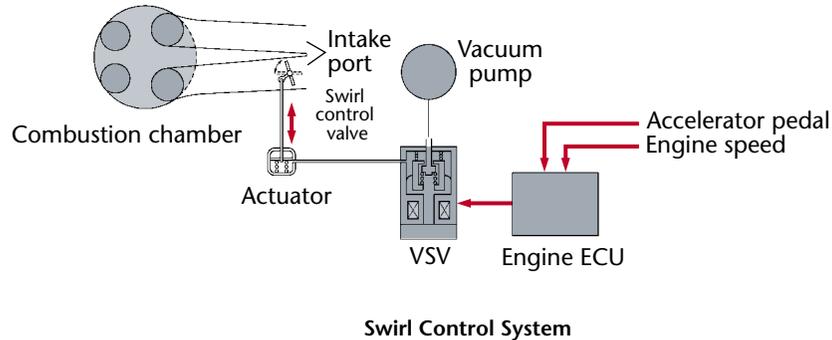
## Swirl control introduced

- Better low-end response
- Lower emissions

The revised engine also benefits from a **Swirl Control System**.

Each cylinder is supplied with air/exhaust gas mixture through two different ducts. Butterfly valves operated by the Swirl Control System can shut off one of these ducts according to the engine speed and load, increasing the mixture's swirl rate.

At low engine speeds this device improves the air-fuel mixture, thus increasing torque availability at low speeds along with lower emissions.



## Better exhaust gas recirculation

- EGR valve position sensor provides better control
- A new EGR cooler has been adopted

The exhaust gas recirculation (EGR) system also received changes that aim to improve its precision and efficiency.

An EGR valve position sensor has been adopted which directly measures the actual amount of valve opening and relays this information to the 32-bit engine ECU, further improving the precision of EGR control.

An EGR cooler with eight heat exchanger tubes and inner fins increases the cooling efficiency of the EGR system as the exhaust gases flow through the inside of the heat exchanger tubes. This, in turn, increases EGR efficiency and reduces emission levels.

## Powerful, smooth combination

- Maximum power now climbs to 166 DIN hp
- 410 Nm, the 'torquiest' 4-cylinder on the market
- More performance with lower CO<sub>2</sub> emissions

Taken together, these continuous enhancements have further improved the performance and driving pleasure of the 3.0-litre D-4D Land Cruiser.

The modifications generate 3 DIN hp (2 kW) more, raising the 3.0 D-4D's maximum power to 166 DIN hp (122 kW) at 3,400 rpm.

Torque has been increased by a full 20%, up from 343 Nm (253 lb.ft) developed between 1,600 rpm and 3,200 rpm, to 410 Nm (302 lb.ft) developed between 1,800 rpm and 2,600 rpm.

This means the maximum torque of the Toyota 3.0-litre D-4D is **the highest** of any four-cylinder engine on the market today. In addition, it delivers almost 90% of the maximum torque already at 1,500 rpm.

This increase in torque brings better response and increased driving pleasure – 0-100 km/h acceleration is performed in just 11.2 seconds (with automatic transmission), **the quickest time in the segment among diesels**. Because the engine responds better at lower speeds, it more easily overcomes the vehicle's inertia and both fuel economy and exhaust emissions are improved as well. Fuel consumption for the 3-door version equipped with automatic transmission falls to 8.9 litres/100 km, **an improvement of 13.6%**.

At the same time, CO<sub>2</sub> emissions are also slashed, especially on the versions equipped with automatic transmission, where a reduction of **more than 12%** occurs (for combined cycle).

Furthermore, thanks to its 87-litre fuel tank and exceptional fuel economy, the Land Cruiser D-4D has the highest driving range in the segment – achieving **close to 1000 km on a single tank** (calculation based on the combined fuel consumption figure).