

High-Tech Atomizers

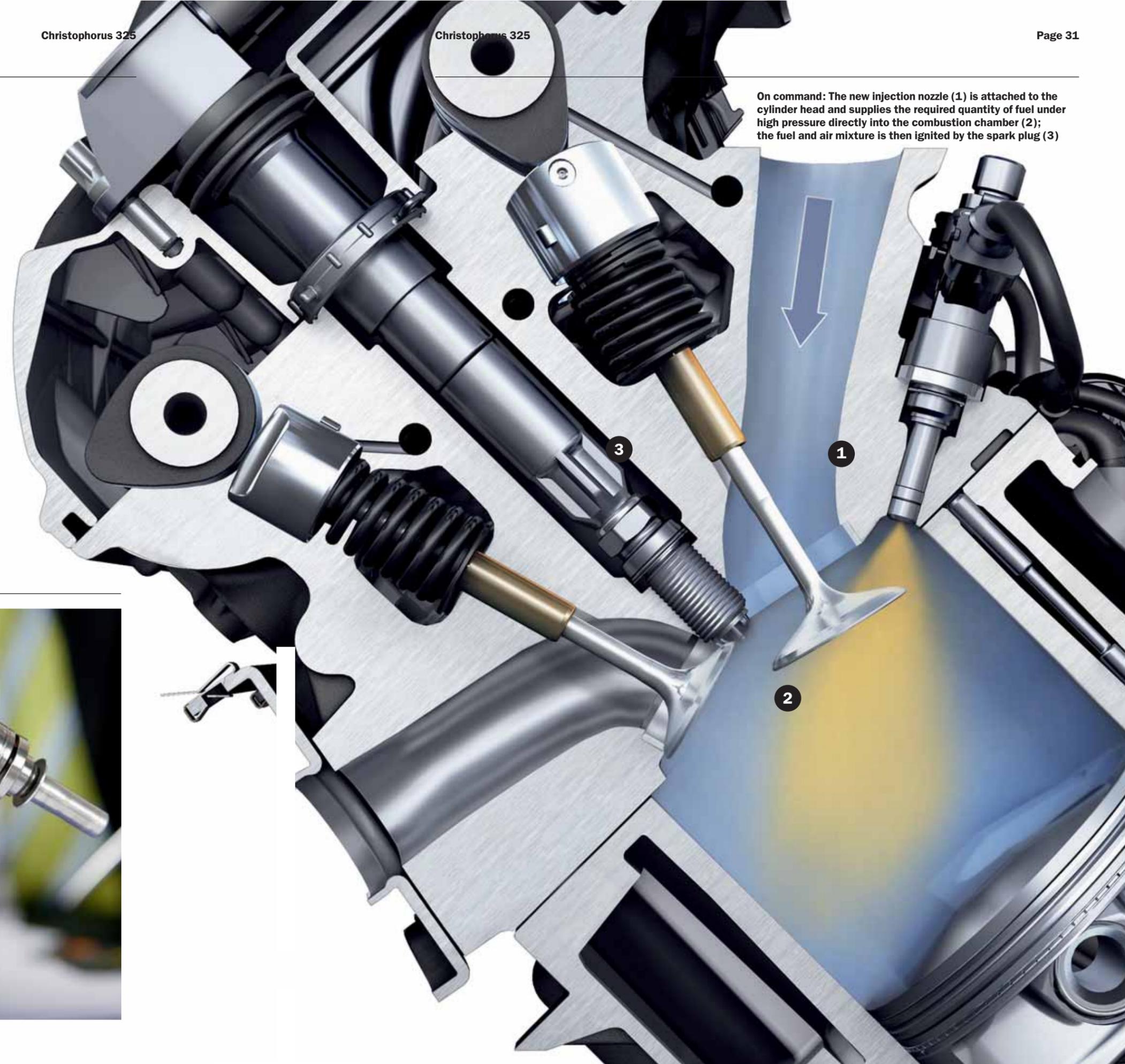
Technology

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Photos by
Porsche AG, Becker Lacour

With its newly developed Direct Fuel Injection (DFI), Porsche is giving the new Cayenne engines a boost—providing perceptibly more performance with lower fuel consumption.

A small component with major clout: Project leader Bernd Hemminger shows the DFI nozzle, with a protective cap for shipping



On command: The new injection nozzle (1) is attached to the cylinder head and supplies the required quantity of fuel under high pressure directly into the combustion chamber (2); the fuel and air mixture is then ignited by the spark plug (3)



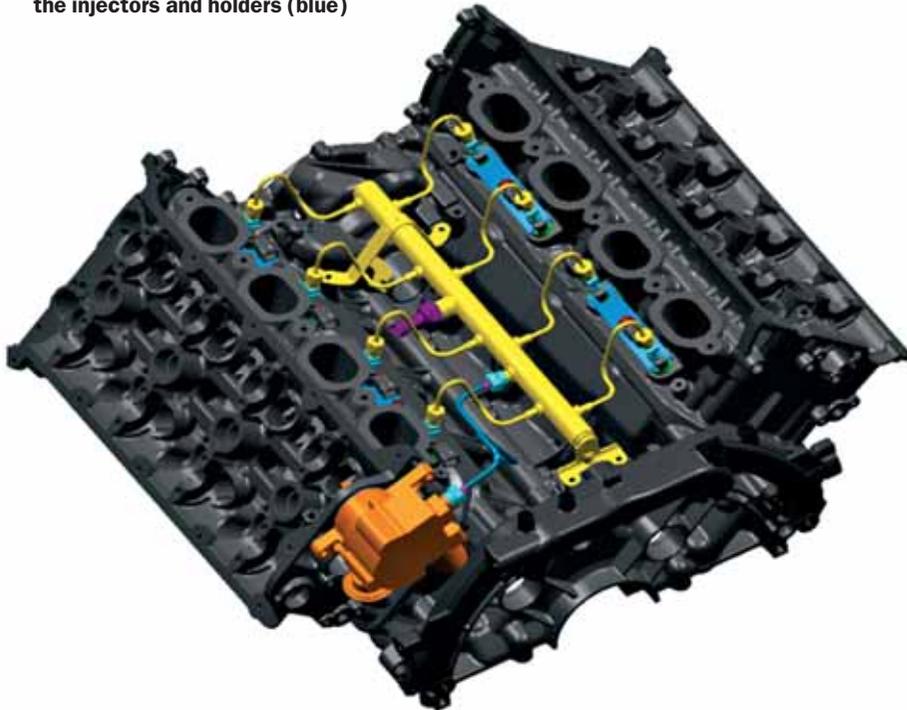
On target: The unobtrusive injection nozzle plays a major role in boosting performance in the new Cayenne models

At the center of it all is a nozzle. To be exact, an electrically operated valve combined with a nozzle. The correct term is “injector.” It’s hidden deep inside the engine, directly at the cylinder head, and supplies the combustion chamber with the required quantity of fuel, under high pressure, which is then mixed carefully with air. The Porsche engineers have introduced this type of fuel injection for the first time in the new Cayenne engines. The nozzle operates under high pressure, and leaves impressive tracks. When one sees the nozzle lying on a table, unconnected to its workplace, it’s hard to imagine what it does. But Bernd Hemminger, project leader for the Cayenne Powertrain, assures us: “The nozzle is a small part with a big punch.”

Direct Fuel Injection (DFI) is probably the most important innovation in the second-generation Cayenne engines. It’s part of an overall upgrade that provides an average of 12 percent higher output with up to 15 percent less fuel consumption. As always, when the engine designers in Weissach address the question of boosting power, it’s not only a matter of simply enlarging the displacement. The V-8 engines for the Cayenne S and the Cayenne Turbo have been further enhanced with the VarioCam Plus variable valve control system. And the Cayenne S has also received a variable intake manifold. For speed ranges of up to 4,000 rpm, long intake runners ensure powerful torque; beyond that, it switches to shorter intake runners for more immediate response and performance. The Turbo, too, stands out with its higher torque. With two new turbochargers and 500 bhp, it now produces 700 Nm (516 lb.-ft.) from 2,250 to 4,500 rpm.

The top high-tech feature, however, is the DFI system, starting with a multi-piston axial pump run off the camshaft. The pump supplies the injection nozzles with fuel via the fuel rail between the two cylinder banks. Gasoline is injected into the combustion chamber at pressure levels of 40 to 120 bar (580–1,740 psi). As Hemminger says, “Higher pressures cause the mixture to be ▶

Power pack: The V-8 engine with its high-pressure pump (orange), which supplies the injection nozzles (not visible) with fuel via the central high-pressure rail (yellow) and the injectors and holders (blue)



Cayenne engines: A trio with plenty of power

The second-generation Cayenne engines are considerably more powerful than their predecessors. Here's an overview:

Cayenne V-6

Engine: V-6
Displacement: 3.6 liters
Output: 213 kW (290 bhp)
Max. torque: 385 Nm (284 lb.-ft.) at 3,000 rpm
Max. track speed: 227 km/h (141 mph); 227 km/h (141 mph)*
Acceleration: 0–100 km/h (0–62 mph): 8.1 sec.; 8.5 sec.*

Cayenne S

Engine: V-8
Displacement: 4.8 liters
Output: 283 kW (385 bhp)
Max. torque: 500 Nm (369 lb.-ft.) at 3,500 rpm
Max. track speed: 252 km/h (156 mph); 250 km/h (155 mph)*
Acceleration: 0–100 km/h (0–62 mph): 6.6 sec.; 6.8 sec.*

Cayenne Turbo

Engine: V-8, bi-turbo
Displacement: 4.8 liters
Output: 368 kW (500 bhp)
Max. torque: 700 Nm (516 lb.-ft.) between 2,250 and 4,500 rpm
Max. track speed: 275 km/h (171 mph)*
Acceleration: 0–100 km/h (0–62 mph): 5.1 sec.*

* = with Tiptronic S

atomized more finely, so it can mix better with the air flowing in through the intake valves.” The DFI helps reduce combustion chamber temperatures, allowing higher compression than before—now 12.5:1 in the Cayenne S—while enhancing knock resistance. Higher compression increases the energy density of the mixture, and hence the performance under optimum conditions. Fuel quantity is precisely controlled via the injection timing and pressure. Because the engine operates more efficiently, fuel consumption is reduced. Thus, output in the Cayenne S rose by 13 percent from 340 bhp (250 kW) to 385 bhp (283 kW), and torque by 19 percent from 420 to 500 Nm (now 369 lb.-ft.). At the same time, fuel consumption fell by 8.1 percent, to 13.7 liters per 100 km (17.17 mpg). In a test cycle developed by Porsche that also includes a stretch of freeway at high speed, consumption was actually reduced by nearly 15 percent.

DFI even enhances operation of the catalytic converters, particularly during cold starts. Normally, the nozzle injects the required amount of fuel into the cylinder all at once. However, the fuel may also be injected twice under certain conditions, such as just after the engine starts. The injection nozzle is designed to provide its second shot when it's already too late for the combustion process. Therefore, that part of the process takes place not in the cylinder, but rather in the exhaust manifold. This trick helps the catalytic converter reach operating temperature more quickly to start its cleaning duties sooner.

“We set high goals from the outset,” Hemminger says. “And the results are respectable.” And also tangible. A tap on the accelerator is all it takes to feel the effect of DFI. ◀