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GASOLINE DIRECT-INJECTION SYSTEMS

Figure 79-1 A gasoline direct-injection system injects fuel under high pressure directly into the combustion chamber.

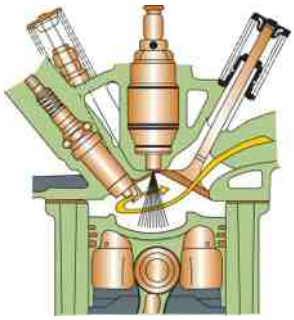

Figure 79-2 An engine equipped with a gasoline direct injection (GDI) sometimes requires a NO_x catalyst to meet exhaust emission standards.

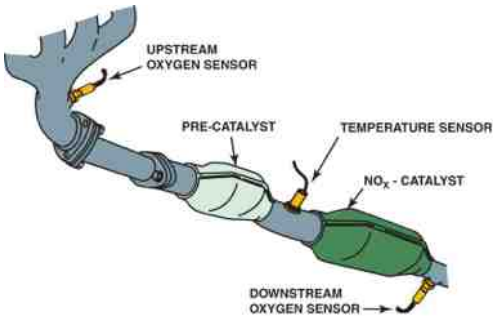

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Figure 79-3 A typical direct-injection system uses two pumps—one low-pressure electric pump in the fuel tank and the other a high-pressure pump driven by the camshaft. The high pressure fuel system operates at a pressure as low as 500 PSI during light load conditions and as high as 2,900 PSI under heavy loads.

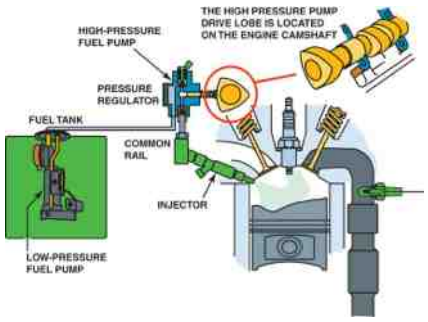

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Figure 79-4 A typical camshaft-driven high-pressure pump used to increase fuel pressure to 2,000 PSI or higher.

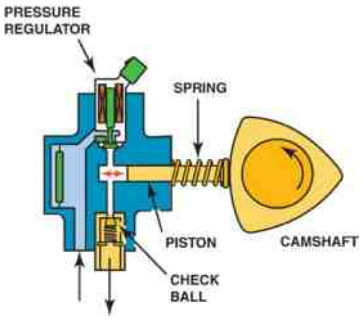

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Figure 79-5 A gasoline direct-injection (GDI) fuel rail and pump assembly with the electric pressure control valve.

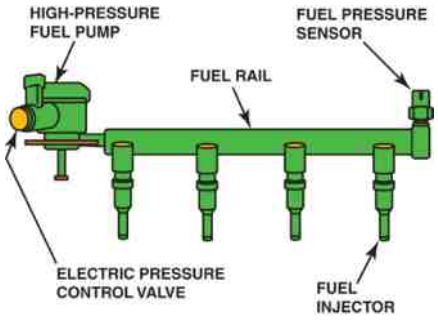

CHART 79–1 A comparison chart showing the major differences between a port fuel-injection system and a gasoline direct-injection system.

PORT FUEL-INJECTION SYSTEM COMPARED WITH GDI SYSTEM

	PORT FUEL-INJECTION	GASOLINE DIRECT INJECTION
Fuel pressure	35 to 80 PSI	Lift pump—50 to 80 PSI High-pressure pump—500 to 2,000 PSI
Injection pulse width at idle	1.0 to 3.5 ms	About 0.4 ms (400 µs)
Injector resistance	12 to 18 ohms	1 to 3 ohms
Injector voltage	6 V for low-resistance injectors, 12 V for most injectors	50 to 90 V
Number of injections per event	One	1 to 3
Engine compression ratio	8:1 to 11:1	11:1 to 13:1

CHART 79–1

Figure 79-6 In this design, the fuel injector is at the top of the cylinder and sprays fuel into the cavity of the piston.

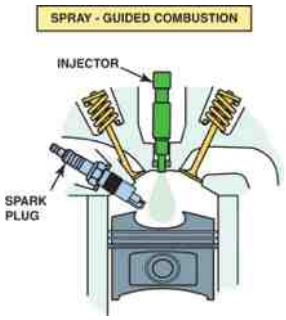

Figure 79-7 The side injector combines with the shape of the piston to create a swirl as the piston moves up on the compression stroke.

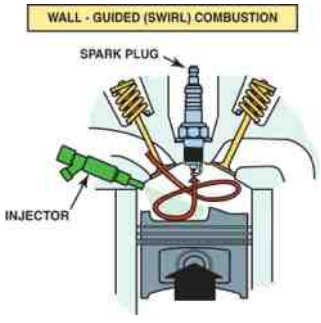

Figure 79-8 The piston creates a tumbling force as the piston moves upward.

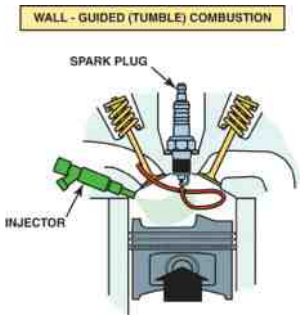

Figure 79-9 Notice that there are conditions when the port fuel-injector located in the intake manifold, and the gasoline direct injector, located in the cylinder both operate to provide the proper air–fuel mixture.

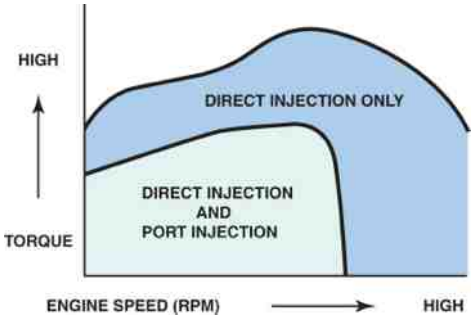

Figure 79-10 There may become a driveability issue because the gasoline direct-injection injector is exposed to combustion carbon and fuel residue.