

# On the Line

## Gasoline Direct Injection

### Identifying Normal System Characteristics

In the last *On The Line* article titled “Gasoline Direct Injection...And New Service Opportunities,” we addressed the benefits of the direct injection system in improved performance and fuel efficiency. With this system, fuel is injected directly into the combustion chambers at pressures that can exceed 2,000 psi. With the assistance of a turbocharger, this arrangement allows a small engine to perform like a big engine. The fuel delivery route with this fuel injection system poses a new set of challenges in the form of carbon build-up on the intake valves due to the absence of fuel wash, creating a myriad of performance issues that can include surging, stalling and hard starts. The mentioned article illustrates the problem and offers some solutions to minimize the formation of carbon deposits. New technology often presents a new set of challenges and service opportunities.

#### NORMAL CHARACTERISTICS

The information contained in this article will focus on some symptoms that may be encountered with the Gasoline Direct Injection System (GDI) that should be considered a normal characteristic and no correction should be attempted. Familiarizing yourself with these symptoms can save you and your customer much concern, as they may be convinced their vehicle has mechanical issues.

**Clicking/Ticking Noise During Cold Starts...** GM has addressed clicking/ticking noises during cold starts on applications equipped with GDI. Fuel injectors and fuel pumps have been replaced in a futile effort to quieten the noise. The described noises can be heard from the engine compartment and is more evident when standing outside the vehicle with the hood raised. The noise is more noticeable at idle and more frequent during a cold start. The noise may lessen once the engine reaches normal operating temperature. The noise emanates from the high pressure fuel pump, as it builds the required high pressure. Once the engine reaches normal operating temperature, the fuel pump will tick at a lower rate of approximately one tick per second at idle. The clicking sounds are from the fuel injectors pulsing under high fuel pressures. These are normal sounds for the system and no attempts to quieten the noises should be made.

**Black Smoke and Rough Idle On Cold Start...** GM has revised the cold start control system on applications

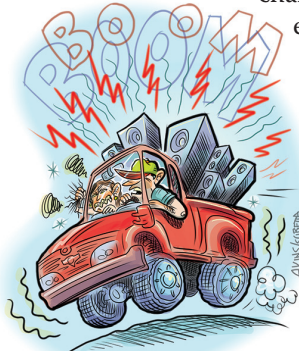
equipped with GDI to help reduce cold start emissions. A dual-pulse injection strategy during cold start helps reduce the time required to get the converter up to its normal operating temperature. This dual-pulse strategy may last for 20-60 seconds. During this time the customer may observe black smoke, soot, rough idle and minimal misfires during this cycle. Once completed, the engine will smooth out. These conditions should be considered a normal characteristic and no attempts should be made to eliminate those symptoms. This function can be verified by observing the injector pulse width via a scan tool.

**Extended Crank Time...** Longer crank times in comparison to port fuel injected engines are also a normal characteristic. Vehicles equipped with GDI may encounter an extended crank time during cold ambient temperatures. GDI systems operate at higher fuel pressures, which requires the mechanical pump to build up the required pressure before the first injection event occurs. Based on ambient temperature the crank time can vary from 1.5 seconds to as much as 7 seconds in extreme cold ambient temperatures. Extended crank times may also occur when using E85 fuel. The crank time required for E85 fuel may be twice as long as an engine burning 87 octane fuel. During colder weather, an increase in the amount of gasoline is required in the ethanol mix to reduce the start times.

**Exhaust Tone Changes...** Complaints of a change in exhaust tones are common with vehicles equipped with Active Fuel Management (AFM). This is a variable displacement technology that allows half of the engine's cylinders to be deactivated under light load conditions for fuel economy purposes. Occasionally, customers also complain of a slight vibration felt in the accelerator pedal, floor pan or steering wheel. These are normal encounters for the system and no corrective action should be taken. The change in the exhaust tone generates many complaints, especially from truck owners who are looking for a distinct sound. Explain to the customer that any modification to the combustion in the engine results in a variation in the tone of the engine and this should be considered a normal characteristic for the AFM equipped vehicles.



By Larry Hammer  
Technical Services



“I DON'T LIKE RAP EITHER, ZELDA!!!  
BUT IT'S A LOT BETTER THAN THE  
SOUND O' THAT GULDARN FUEL PUMP!!!”