Mighty AUTO PARTS Tech Tip

FUEL 196

FUEL FACTS

Troubleshooting Rough Idle, Surging, Stalling, Hard Starts and Noises

Determining if the performance symptom is due to the vapor pressure of the fuel, carbon build-up, or sticking valves due to gum and varnish can be a challenge.

FUEL VAPOR PRESSURE

Seasonal adjustments must be made to the fuel in terms of vapor pressure to promote easy starting and to prevent fuel foaming or vapor locking. The Reid Vapor Pressure (RVP) of the fuel must be adjusted in relation to seasonal changes in the weather. The required RVP for summer driving will be in the 9 RVP range. If this fuel is used during the winter conditions, a rough idle, surging, hard starts or backfiring symptoms will likely occur. For winter performance a fuel rated at 12 RVP is necessary to promote adequate vaporization. On a hot day the 12 RVP fuel will turn to vapor, especially following a heat soak. Seasonal changes in the weather require adjustments to the vapor pressure of the fuel. Additives for the fuel tank are not recommended, as they are not effective for these symptoms.

FUEL QUALITY

The quality of the fuel is a major factor in controlling carbon build-up. Vehicle manufacturers promote the use of Top Tier Fuel, as the required detergent level in this fuel is 2-3 times greater than the minimum standard set by the EPA and Canadian General Standards Board. Top Tier Fuel is not to be confused with high octane fuel. This is a voluntary program where petroleum companies can have their fuel designated by the auto manufacturers as meeting certain detergent levels. The process involves a certification and registration of compliance. These additional detergents and additives have proven to reduce the formation of deposits on the fuel injectors and intake valves. When performance conditions occur, consider adding a Top Tier Fuel to the vehicle's fuel tank.

GUM AND VARNISH

Fuel oxidation promotes gum and varnish. Oxidation begins when the reaction between hydrocarbons and oxygen creates compounds that affect the composition of the fuel, promoting the formation of gum and varnish deposits that can restrict valve movement. Fuel that has been stored in containers is highly susceptible to these forms of contamination. Antioxidants are added to the fuel to minimize the formation of these deposits.

Case in point: While helping a neighbor diagnose a no-start condition on a 4000 Ford tractor, which had undergone a total engine rebuild the previous year, it was determined that gum and varnish deposits on the valve stems was the reason for the no-start condition.

When performing the basic checks, it became obvious that fuel contamination was the culprit, as it would take several seconds for the valves to completely close while bumping the engine over, checking the valve to rocker arm clearance. The formation of gum and varnish was restricting valve movement. He had been cautioned not to use the fuel that he had been holding in a storage tank for the past two years. Periodically, he would add fuel, thinking it would keep the fuel in the container fresh.

FUEL SAMPLE

When diagnosing engine performance symptoms, it is wise to take a fuel sample from the fuel tank and check it for contaminates once the sample has settled on the bench for two hours. If contaminates are present, it may be necessary to pull the fuel tank for cleaning and to check the tank and strainer for the presence of a build-up, blockage or contamination. Extensive use of E85 fuel has been known to promote fuel pump related issues on some vehicles. Periodically, running a tank of Top Tier E10 fuel through the system can assist in the cleaning of fuel system components.

CARBON BUILD-UP PROMOTES PERFORMANCE SYMPTOMS

Where do you start when diagnosing performance symptoms such as crank but no-start, extended crank time, misfires, or rough idle symptoms?

If the customer complaint involves one of the mentioned conditions accompanied with misfire

codes on multiple cylinders, a good start would be with excessive carbon build-up. The formation of carbon deposits on vehicles equipped with Gasoline Direct Injection (GDI) is in relation to how the fuel is delivered to the combustion chambers. The effect of fuel wash on the intake valve is not there with GDI, as the fuel bypasses the intake valve and is injected directly into the combustion chambers.

Both carbon deposits or an accumulation of gum and varnish residue may result in a backfire or popping through the intake or exhaust while cranking. Some engines may encounter damage to the valves or pistons during this encounter, requiring major mechanical repairs.

Preventive maintenance is the key in preventing extreme deposit formations from accumulating, which can make the clean-up more difficult. Excessive deposits can result in large fragments dislodging during the cleaning process, causing damage to the pistons, valves, cylinder walls, oxygen sensors and catalytic converters. Performing an annual cleaning helps prevent the accumulation and excessive build-up of these harmful deposits. Make certain that you use a chemical that will not create a hydro-lock condition, which can damage connecting rods, pistons and bearings. Allowing large deposits to accumulate may require the removal of the cylinder heads for cleaning. This is a labor intensive and expensive process. Ask your Mighty Rep about his intake manifold and valve cleaning chemicals.

EXTENDED CRANK TIME

Engines equipped with GDI have slightly longer crank times compared to vehicles with port fuel injection. The GDI system operates at a higher fuel system pressure, which requires additional time for the mechanical fuel pump on the engine to build the required pressure before the first injection event occurs. Based on ambient temperature, the crank time can vary from 1.5 seconds to 7 seconds in extreme cold temperatures. The crank time on engines burning E85 fuel may be twice as long compared to an engine burning 87 octane E10 fuel.

BLACK SMOKE ON START-UP

Black smoke during cold starts is a normal characteristic on vehicles equipped with GDI. GM addressed this concern in a service bulletin reflecting the following:

Condition... With the introduction of direct fuel injection systems, GM has revised the cold start control system to reduce cold start emissions. Quicker catalytic converter heating helps meet the changing emission requirements and improves fuel economy.

Instructions... During cold starts a dual-pulse injection strategy is utilized to reduce the time required to get the catalytic converter up to operating temperature. This injection strategy will last for approximately 60 seconds following a cold start. It should be explained to the customer that some black smoke or soot following a cold start is a normal characteristic for this injection system.

The use of a Top Tier fuel can lessen the effects during this cold start mode by reducing the amount of carbon forming on the valve train components and providing a cleaner burn.

CLICKING/TICKING NOISES

It is not uncommon to receive complaints of clicking or ticking noises on vehicles equipped with GDI. Often these noises are assumed to be noisy valve lifters when the condition is a normal characteristic of the high-pressure injection system.

The noises are most evident when standing outside the vehicle and especially with the hood raised. The noise is more pronounced during a cold start and lessens when the engine reaches normal operating temperature. The noise is coming from the high-pressure fuel pump as it builds the high pressure required for the system. The fuel pump will click at a lower rate (approximately one click per second at idle) once the engine reaches normal operating temperature. In addition, the fuel injectors are pulsing under high pressure.

SUMMARY: Fuel related symptoms can create some diagnostic challenges for the technician. Misfires, rough idle, long crank times and no-start conditions are often due to an accumulation of carbon deposits. The deposits can create an increase in the compression ratio, requiring a higher-octane fuel to prevent spark knock. This can present a problem for turbocharged engines, as the boost pressure increases the compression ratio, resulting in detonation. The higher compression ratio can cause pre-ignition, resulting in detonation. The build-up of carbon can result in the pistons making contact with the carbon, resulting in a knock. Annual induction cleaning can help prevent the formation of heavy carbon deposits. Ask your Mighty Rep for a demonstration.

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