Gasoline Problems

Over the past year or so, many auto dealers and service shops have noticed that they are having many more customer complaints about so called "drivability issues" including hard starting, engine knock, hesitation, stalling, rough idle, poor fuel economy, and even misfiring.

Most of these problems are related to the buildup of varnish deposits in the fuel injectors and throttle body and carbon deposits on the intake valves and in the combustion chamber. This buildup is directly related to the very significant reduction in the use of detergent-dispersants by many of the major refiners.

These problems were common in the late 80's and early 90's until the EPA forced refiners to add Detergents to meet a "Lowest Additive Concentration requirement. This level although lower than many experts felt necessary seemed to resolve the problems for a time.

Depending on who you talk to, it is suggested that starting around 2001 refiners have been reducing the use of these detergent-dispersants by 40%-66%, that's up to a 2/3 reduction. This was made worse by additional reductions allowed and encouraged by the EPA in the wake of the 2005 hurricane season to alleviate spot shortages caused by the damage these storms did to our overall refining capacity. These reductions in the additive level and octane rating may save the refiners money an possibly increased supply, however it causes many engine problems, raises emissions, and lowers mileage for the users of their fuel.

It is also suspected that some oil companies (but not all) used this opportunity to cut back their use of detergents and deposit control additives even further in their gasolines.

Because nearly all of today's engines have knock sensors and other computer controls, they can adjust to somewhat lower quality fuels. However as the computer retards the ignition timing to control knock, it reduces horsepower, raises emissions, and reduces fuel mileage. Some engines, particularly those with higher compression ratios can suffer physical damage if they use low quality gasoline over a long period of time.

To the best of our knowledge there have not been any recent studies by the government or anybody else that addresses the issue of the quality fuels currently being produced and whether the level of detergent and deposit control additives in gasoline is sufficient to keep today's engines clean. It is reasonable to assume that if such a study were undertaken now, it would have reveal significant and widespread problems with inadequate levels of these necessary additives in most gasolines.
Deposit Formation

When deposit control additives (detergent-dispersants) are not used at adequate levels in gasoline, harmful deposits can build up inside the engine:

Fuel varnish deposits that form inside the injectors which restrict fuel delivery and cause the engine to run lean. This may cause lean misfire, rough idle, hesitation, poor fuel economy and increased HC emissions. A lean fuel mixture also increases the risk of detonation and pre-ignition. These deposits also distort the spray pattern of the injectors which causes uneven atomization of the fuel. This in turn causes poor fuel ignition and burning which leads to rough running, lower power, higher emissions, and higher fuel consumption. These deposits tend to form during the heat soak period that occurs after the engine is shut off. The shorter the trips and the more frequent the drive cycles, the faster these deposits build up.

Deposits that form in the throttle body can reduce airflow through the idle bypass circuit affecting idle quality and smoothness. These deposits are formed by fuel vapors that rise up through the intake manifold.

Deposits that form on the intake valves can restrict airflow through the intake ports, causing a loss of high speed power. The deposits also can act like a sponge and momentarily soak up fuel spray from the injectors. This disrupts the mixing of air and fuel causing a lean fuel condition, hesitation and reduced performance. Deposits also can cause valve sticking and valve burning. Intake valve deposits are formed by normal combustion byproducts, but may build up more rapidly if the valve guides or seals are worn and the engine is sucking oil down the guides.

Deposits that form inside the combustion chamber and on top of the pistons increases the compression ratio of the engine and the octane requirements of the fuel. Too much compression can cause spark knock (detonation) if the fuel's octane rating isn't high enough. Over time, detonation can damage the head gasket, piston rings and rod bearings if it is not controlled. The knock sensor will detect detonation and tell the PCM to retard spark timing. This will take care of the knock, but retarded timing also increases fuel consumption and emissions.

A buildup of carbon deposits inside the combustion chamber also increases the risk of hot spots forming that may cause engine-damaging pre-ignition. The hot spot ignites the fuel before the spark plug fires, causing a sharp rise in combustion pressure. Under extreme conditions (high rpm and high load), pre-ignition can burn a hole right through the top of a piston!

A condition known as Combustion Chamber Deposit Interference (CCDI) also can occur when the carbon deposits are so thick the deposits on the piston and head make physical contact. This area, known as the Squish Area (piston to top of chamber), has a clearance that is about as thick as a paper clip. This can cause a loud, metallic banging sound when a cold engine is first started. The deposits are soft and will gradually flake off. But the flakes may lodge between the valves and seats causing a loss of compression, misfiring and rough running when the engine is cold (a condition called Combustion Chamber Deposit Flaking or CCDF).
Deposit Control

The formation of harmful deposits can be controlled by adding detergent-dispersants to gasoline, the most common of which is polybutene succinimide. Used with a petroleum carrier oil, detergent-dispersants help keep the intake manifold and ports clean. These chemicals are more effective than the carburetor detergents that were once used in gasoline, but they must be used at concentrations that are three to five times higher than the older carburetor detergents.

Deposit control additives such as polybutene amine (PBA) were introduced in 1970 to help keep injectors and intake valves clean. The only drawback with PBA is that too much of it can increase combustion chamber deposits. Polyether amine (PEA), by comparison, cleans fuel injectors and valves, and does not increase combustion chamber deposits. In fact, it helps remove accumulated deposits inside the combustion chamber to reduce the risk of spark knock. In 1995, the U.S. Environmental Protection Agency set minimum standards for additives in gasoline to prevent the formation of deposits in fuel injectors. Gasoline refiners had to certify that their additive packages met these standards, but some experts now say the original standards were set too low and do not provide adequate protection with some fuels and engines. The minimum EPA-required level is referred to as the "Lowest Additive Concentration" (LAC), and is typically found in the cheapest priced gasoline.

At the other end of the fuel quality spectrum are "Top Tier" gasolines. These fuels are recognized by the vehicle manufacturers as having the most effective additives and in the highest concentrations. Gasoline retailers must meet the high Top Tier standards with all their grades of gasoline (not just premium) to be designated a Top Tier supplier. In addition, all the gasoline outlets carrying the brand of approved gasoline also must meet the same standards. There are very few refiners that meet this qualification.

Unfortunately, fuel quality isn't something that is easily policed. Many states have programs in place to monitor fuel quality on either an ongoing basis or "incident specific" basis. Most are run by the state's Department of Weights and Measures. Even so, the focus of most of these programs is to make sure consumers aren't being cheated at the pump and get the full gallon they pay for. Some programs also check fuels to make sure they do not contain too much alcohol. The specific density of gasoline can be field tested to determine its volatility and alcohol content. But testing octane and the amount and type of additives in the fuel requires expensive laboratory testing. So this type of quality testing is rarely done.

According to some industry experts, many gasoline marketers have reduced the concentration of fuel additives in their fuel up to 50% in recent years!

Most gasoline refiners don't want to sell the public bad gas because they obviously want repeat customers. Generally though they know that deposit formation is a gradual thing that occurs over time. So if they cut back on the additive package to save a few cents per gallon, nobody is likely to find out and it can be explained away until hard evidence is found. This hard evidence is expensive and time consuming to obtain. The only agency likely to be able to do this is the Federal Government via the EPA. Even if they decide to do this today, it will likely take years to complete and more years to do anything about it. In the meantime refiners will pocket millions of dollars in savings.

People who buy the cheapest LAC gas they can find every time they fill their tank will sooner or later have problems. The low level of additives (or low quality additives) in the fuel will not be adequate to
keep their engine clean, and eventually they'll start to experience drivability problems and or actual engine damage.

More seriously, if a bad batch of fuel leaves a refinery and ends up in people's vehicles, it can cause even more expensive problems. There have been several instances in the past several years where too much residual sulfur in a bad batches of gasoline has caused a rash of fuel pump and gas gauge sending unit failures.

Immediate drivability problems also may occur if the fuel is contaminated with water contains too much alcohol or the wrong type of alcohol (methanol instead of ethanol). Alcohol is a great octane booster, but for ordinary gasoline the amount of ethanol should not exceed 10% (or 5% for methanol). **Note:**

**Ethanol is being used extensively to replace MTBE as an oxygenate in motor fuels.** The only exception here is G85 fuel for "flex-fuel" vehicles that is 85% ethanol and 15% gasoline. G85 contains considerably less energy per gallon than gasoline and runs much leaner, so the vehicle must have a special fuel sensor so the PCM can compensate for the alcohol to maintain the proper air/fuel ratio. G85 contains only about 75% of the energy found in regular gasoline, so be prepared to go to the pump more often.

**Getting Rid of Deposits**

When a vehicle is experiencing deposit-related drivability, performance or emissions problems, the deposits have to be removed. There are several ways troublesome deposits can be removed. One cost-effective solution to deposit-related drivability issues is to simply add a can of fuel system cleaner such as **Ultra-X, Xcelerate, or** **Power Up** to the fuel tank. The cleaner will slowly remove the deposits while the vehicle is driven. The only drawback with this approach is that it takes time - maybe one or two tankfuls with the additive to make a noticeable difference. That may be too long for some people.

For those who want an immediate fix, the best option usually consists of cleaning the throttle body with an aerosol cleaner, flushing the injectors with a concentrated solvent or cleaning product, and/or feeding an intake system cleaner of some type into the engine while it is running to clean the intake ports, valves and combustion chamber.

Remember, it is far better to dissolve deposits as opposed to breaking them up. The last things you want is have chunks of hard carbon floating around anywhere in your engine.

To prevent the formation of new deposits once the engine has been cleaned, you should recommend using a top tier gasoline or adding a bottle of fuel system cleaner as **Ultra-X, Xcelerate, or** **Power Up** periodically to the fuel tank (say every four or five fill-ups or when changing the oil every 3,000 miles) or by treating your bulk fuel with **OctiPlus**.

**Fuel Cleaning Additives Not the Same**

One very important point to keep in mind about aftermarket fuel system cleaners that are added to the gas tank is that they use different chemistries to achieve different results. As mentioned earlier, some chemicals used in low cost additives such as PBA can clean injectors and valves but may actually increase combustion chamber deposits. Other chemicals slightly more expensive components such as PEA can clean the entire fuel system as well as the combustion chambers.
For dirty fuel systems, you should use a product that is concentrated enough to provide some real cleaning action (OctiPlus and Ultra-X). But for maintenance, you only need a product that keeps deposits from forming (Power Up, Xcelerate, Octiplus, and Ultra-X).

OctiPlus and Ultra X fuel system cleaning product does something that no other product does. They actually clean and protect the contacts on fuel gauge sending units. The contacts on the sending unit are typically plated with silver-palladium to resist corrosion. But over time, residual sulfur in gasoline can corrode the contacts causing the gauge to rear erratically or not at all. Replacing the sending unit is an expensive job because you have to drop the fuel tank, so a more affordable alternative is to simply add a bottle of this product to the tank or to treat your bulk fuel and let it take care of the corrosion.

Applies to:

Octi-Plus, Fuel-Fix, Pro-Shock, Top Shot, IV2 Purge, EOA, E-Flush, Power Up