Petroleum primer: Five things to know about gasoline

Gasoline is probably the substance that inspires the strongest opinions in automotive hobbyists. At one time, that often meant brand loyalty, whether that was to Mobilgas Ethyl, Sunoco 260, or Shell Green Streak. Now it's more likely to take the form of preferences for octane and ethanol content.

Refinery technology has changed tremendously since 1900, and the gasoline that powered early automobiles was radically different from the gasoline of 1940, which in turn was quite different from the super-premium fuel blends of the mid-1960s. Modern fuels are an even different creature yet. It can be a dizzying experience to try to select the correct 21st-century gasoline for a car built 50-plus years ago. An engine with the wrong gas will quickly make that known through a variety of unpleasant noises, badly reduced power, and even potential failure.

Being an educated consumer of gasoline means separating fact from fiction. There are also lots of additives out there that proclaim various improvements and refinements to pump gasoline—some are legitimate, and some are more akin to snake oil. Getting familiar with gasoline is worthwhile for any car enthusiast. It will protect your car from harm and may even help it run better.

1. Under Pressure

Liquid gasoline doesn't want to burn, so it has to be in vapor form in order to ignite properly. **Modern gasolines, especially winter blends, are designed to be more volatile** and will thus turn to vapor even more easily. In other words, they have a higher vapor pressure. That tendency toward vaporization means easier cold starts but it can also mean easier vapor lock in older vehicles, which occurs when the fuel vaporizes in the line. **Vaporization is good when you want to burn fuel, but bad when you want to move fuel to the engine—vapor lock all but stops the fuel from pumping. Hot weather or a hot-running engine exacerbates the issue. Modern vehicles use tank-mounted pumps to push gas forward, maintaining the pressure in the lines. In an older car, an electric fuel pump mounted closer to the tank than to the engine can help avoid vapor lock.**

The octane ratings of a motor fuel are determined by running that fuel in a test engine with variable compression and measuring its resistance to knock. Octane has nothing to do with the amount of potential energy in a fuel, only how much it can be squeezed before it will explode on its own. High compression ratios and forced induction squeeze the air/fuel mixture more to obtain better efficiency and power, but if the fuel ignites before the spark, the power is wasted, and engine damage can occur. **Electronic sensors, along with ultra-precise ignition and valve timing, permit modern engines—which typically run rather high compression ratios—to safely run on lower octane fuels, albeit sometimes sacrificing mid-range torque (and subsequently, fuel economy). On older vehicles with high-compression engines or that call for higher-octane, don't skimp at the pump. A few more cents per gallon could save your from expensive engine repairs.**

3. Knock knock, who's there?

The kerosene byproduct, natural-gas derivative and **drip gas originally marketed as gasoline would only be around 30 to 50 octane. This so-called "straight run" gas was all that was available to pioneering motorists up to about 1913**. New blending and cracking processes introduced about that time added octane-boosting substances like benzene and naphtha (lighter fluid) to the mix. **In the 1920s, tetraethyl lead came on the scene under the Ethyl brand name. Lead remained the primary anti-knock additive up through the introduction of the catalytic converter in the 1970s, but today has been largely replaced with MTBE and ethanol.** Gasoline remains toxic and a carcinogen, but its immediate neurological risks have been greatly reduced.

4. Ethanol-proofing old cars.

With ethanol likely to remain on the scene as long as most cars continue using internal-combustion engines, older cars still on the road will benefit a lot from a fuel systems rebuild to handle it. **Natural rubber components held up fine to older gas but will degrade if exposed to ethanol. The degraded fuel line material ends up downstream, causing issues with other equipment, like the small passages in carburetors**. Some owners even re-jet their carburetors to compensate for the different energy density of the 10-percent ethanol blend (E10) that is common in modern gasoline. Even a car owner who makes it a habit to seek out non-ethanol gas will benefit from a system that will survive accidental or emergency exposure to E10 or E15. **More heavily blended ethanol fuels, such as E85 (70 to 85 percent alcohol) require special engine tuning and should be avoided for vehicles not already optimized for them.**

Sta-Bil is a popular brand of fuel stabilizer. Its proprietary formulas are intended to prevent phase separation and other issues faced by gasoline intended to remain in storage.

5. Keeping stable

Perhaps the biggest complaint about ethanol fuel is that it suffers from phase separation over time, where the lighter elements separate from the heavier, leaving two different octanes layered atop one another. Vehicles that are going to be stored, such as collector cars (or even boats or lawn tractors) should be either drained of fuel or treated with a fuel stabilizer. Ethanol is also hygroscopic, meaning it will absorb moisture from the air. Water in fuel lines causes corrosion, can freeze, and certainly won't burn in your engine. Stabilizers are a proactive way to keep fuel fresh for up to 24 months, and water removers can help deal with tanks of fuel that have already absorbed too much moisture.