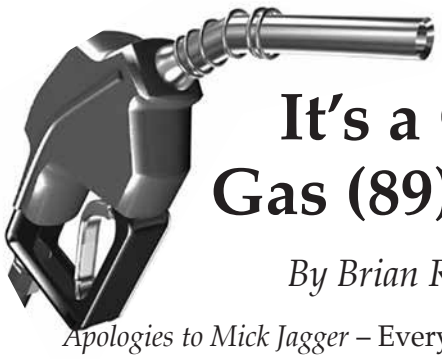
Meandering Through the Oil Industry: Part 1

This technical article is the first in a series characterizing the process that the oil industry follows to bring us one of our favorite commodities, the gasoline that powers our Classics. First up, our relationship with the pump.



It's a Gas (87), Gas (89), Gas (91)

By Brian Rohrback

Apologies to Mick Jagger – Every time you pull up to a gas station pump, you have a decision to make. OK, two decisions, which credit card to use and what grade of gasoline to select. I would like to pick apart the latter decision. But, like a dog with a bone, I plan to provide you with far more information than you thought possible from this, the only real interaction you likely have with the petroleum industry. There is a lot that happens prior to the pump and extracting what I hope are the interesting bits is my goal with this technical series.

Gasoline is priced based on a grading system called the octane rating. Nominally, we think of this as being a measure of the energy content in the fuel, but that is not strictly true. First, let's look at the pump and then work back to how the oil company builds the gasoline that sits in a tank underneath it.

Octane, as a quality rating for gasoline, is a bit of a misnomer. This fuel is a complex mixture of hydrocarbons. Certainly, octane is one of the compounds present, but there are approximately 900 other compounds that can be in the mix and most of that number are. They span compounds with 4 carbon atoms to 10 carbon atoms, but there is a dizzying array of chains, branches, rings, etc. that can be made from this 4 to 10 range. The higher the octane rating, the more it can be compressed before it will detonate.

If you look closely at the pump, you will see the fine print that the octane is calculated by the (R+M)/2 method. Most everybody has noticed this; no one seems to know what it means. Prepare to be enlightened!

- ☞ The "R" stands for Research Octane
- ☞ The "M" represents Motor Octane
- ☞ Taking the average gives us the Pump Octane (i.e., R+M/2)

Defining Research and Motor Octanes requires an introduction to the Octane Engine (or if you want historical precision, the Waukesha Cooperative Fuel Research Engine). This measurement device is an internal combustion engine that is housed in the refinery or in a support laboratory and gasoline is extracted from the refinery process line, added to the engine and then the system is tuned by varying the compression ratio until the motor starts to ping, or knock. The design is unique in that tuning really means that the operator moves the entire cylinder up and down with respect to the piston, which quickly and accurately varies the compression ratio without affecting valve clearances or basic combustion chamber configuration. Even though this procedure akes it simpler to run the Octane Engine, it still takes 15 minutes to run an octane measurement.

Research Octane is evaluated with the engine running essentially without a load; to do the assessment, the engine is run at 600 RPM. Kicking the RPM up to 900 gives you the Motor Octane value. So, MON is always lower than RON. Do note that if you drive in Europe, expect the listing on the pump to be about 6 octane numbers higher. That is because they list only the RON value. You were paying so much more at your fueling stop, you probably thought you were getting much higher-quality gasoline - you weren't.

But, as you pick up your cell phone to make your next call, think a bit about how much that technology has changes in the last 20, 10, 5 years. Well, the oil refinery is much slower about adopting new technologies, but change does occur. In the next article in this series, I will address the replacement for the Octane Engine; it is a light topic.