

TECHNICAL TIPS – “WENCH WITH A WRENCH”

Gail Wagner

“Jumping Jack Flash, It’s a Gas, Gas, Gas !”

Gasoline, Octane and Ethanol



Hi Miata Folks,

Here’s a “burning question” (sorry about the pun). What octane* grade of gas to use in your Miata/MX5: regular, premium, 10% ethanol, or “pure/clear” (no ethanol). (* Definition: Octane, a hydrocarbon component of gasoline, is a colloquial word for “octane rating”, a standard measure of the performance of engine fuel.) There’s lots of controversy and lots of opinions but I’ll give you some research I’ve uncovered and let you make your own personal decision.

As for me, I’ll tell you what I feed my NC ’06 *Scarlet* towards the end of this article just to keep up the suspense and maybe keeping you reading. ☺ My apologies to The Rolling Stones for using their song title references. Guess what I’m listening to while writing this article? ☺

Regular or Premium? Actually, the answer varies depending on the year of your Miata/MX5 and any aftermarket modifications you may have made. *Moss Miata*, my premier go-to Miata parts guru, suggests the following: the latest NC Miata (2006 - 2015) should definitely use 91 octane or higher while earlier 1989-2001 unmodified Miatas can opt for the good old regular 87 octane stuff.

They assert that if you have modified your engine timing or are running any forced induction (turbo or supercharged) on NA’s or NB’s, then you should probably be running premium. The higher the octane number, the more [compression](#) the fuel can withstand before detonating (igniting). Therefore, fuels with a higher octane rating are used in high performance [gasoline engines](#) that require higher [compression ratios](#).

“Can’t You Hear Me Knocking...”

Engine Knock

Using lower octane fuel than recommended in your owner’s manual may reduce your miles-per-gallon (mpg) and reduce engine torque (look up “engine torque” if you don’t know what it is. Too long to explain here but important). Using lower octane than recommended also causes increased engine temperatures that could result in damage when driving in extremely hot summer weather. Higher engine compression ratios will, however, make gasoline engines subject to engine-knocking* if lower octane-rated fuel is used, also known as detonation. (*Definition of Engine Knock: When fuel is improperly ignited using low octane fuel in a high compression engine, it causes a fireball-like explosion that can interfere with the engine’s cycles and can even damage [engine components](#) – as in possibly bending a connecting rod or burning a hole in the top of a piston as has been reported. These premature detonations are the source of the "pinging/knocking" noise.)

That said....if your engine “knock sensors” are working fine, then 87 shouldn't be a problem but the engine will detect knock from the 87 octane gas and will retard the ignition timing automatically, reducing the effective compression of the engine, thus giving you less power per stroke but keeping the engine protected from pre-detonation.

It's better to use 91 or 93 but 87 won't hurt it as long as the knock sensors are functioning. If they stop working, you should get a check engine light. If you have a check engine light and you don't know why it is on, I would not use anything below 91 octane.

For the difference in price - I

“Play With Fire” **Compression Ratio and Octane**

2001-2015 Miata/MX5 engines have a higher “compression ratio”* than earlier models by design and are recommended to run on 91+ octane gas. (Another Motorhead Geek Alert: Definition: “Compression Ratio”: The compression ratio of an internal combustion engine is a value that represents the ratio of the volume of its combustion chamber from its largest capacity to its smallest capacity. It is a fundamental specification for many common combustion engines. When the piston has moved up to the top of its stroke inside the cylinder and the remaining volume inside the head or combustion chamber has been reduced to, say, 100 cc, then the compression ratio would be described as 1000:100 or a “10:1 compression ratio”.) High compression ratio is desirable because it allows an engine to extract more energy from air-fuel mixture due to its higher engine temperature/heat efficiency. And because internal combustion engines are heat engines, higher efficiency is created because higher compression ratios permit the same combustion temperature to be reached with less fuel. Isn't that fascinating as hell? ☺

But Dear Intrepid Miata Folks, not to worry. Government regulations say all cars sold in the U.S.A. must be capable of running 87 octane in case of an emergency. Because of this, if you insist on running regular 87 octane in your 2001-2015 Miata/MX5 for whatever reason, your engine has a computerized “knock sensor” that automatically retards the timing when a distinctive metallic pinging knock can be heard to prevent possible engine damage. Believe me, you'll hear it and then I recommend it's a good idea to start switching to the premium stuff soon unless you expect to sell your car in the near future to someone you don't like very much.

Remember, octane doesn't give your engine more power. It allows your engine to produce the power it was designed to produce.

“You Can't Always Get What You Want But If You Try Sometimes...You Get What Ya' Need”: **Regular 87 or Premium 93 Octane?**

It appears that most gas companies all start with nearly the same basic ingredients and then formulate their own additives to achieve octane rating and fuel injector cleaning. That said, it's recommended that you don't jump around from one brand to another, if possible, as you're effectively unbalancing that formulation possibly resulting in a drop in fuel economy (more on fuel economy later too). Use your own judgement, but *Moss Miata* also recommends not using the “cheap-no-name” stuff as it may cause your Miata to run poorly, i.e., crusted deposits on your valves causing them to not close and seal properly. Personally, me and *Scarlet* run no-name Premium 91 Octane Ethanol-Free and she has never experienced any problems, at least not yet, but hey, it's your choice of el cheapo or brand name. Frankly, my dear, *Scarlet* and I don't give a damn. ☺

You can check your owner's manual. I suspect Mazda engineers know which fuel rating will provide the best performance and reliability. At a dealership not too long ago, I stared point-blank at the Mazda factory rep and asked his frank opinion with nobody around about NC's and octane and he stared right back at me and said “Yes, premium”. Okay, okay, I get it - right from the Factory Mouth. ☺

Older 1989 to 2000 Miatas were designed to run solely on 87 octane. Running higher octane than recommended does not increase power or mpg on any stock Miata. Here's a good one: *Moss Miata* asserts that if you are running a completely unmodified NA (1989-1997) or NB (1998 – 2004), "treating" your car to premium gas will actually result in a slight degradation of performance and fuel economy as well as a loss of wallet-economy. Who would have thought?

Here's a tip and I know you already know this but I can't say I personally practice it all the time: If you want to increase mpg and make your gas money go further, use the right grade of gasoline, reduce hard gas pedal starts and high rpm shifting that burns fuel. Not much fun admittedly, but practical.

"I Can't Get No" Non-Ethanol-Added Gasoline

What the heck is ethanol anyway?

Ethanol is a renewable, domestically produced alcohol fuel made from biomass plant material, such as corn, sugar cane, or grasses. The "E" indicates the percentage of ethanol by volume (E10, E15). It's a volatile, flammable, colorless liquid with a slight chemical odor used as an antiseptic, a solvent, a fuel and due to its low freezing point, the active fluid in post-mercury thermometers! Commonly called ethyl alcohol, drinking alcohol, or simply alcohol, it's also the principal alcohol found in your margarita or pale ale, produced by the fermentation of sugars by yeasts.

So, for purposes of this article, I'm discussing the fuel use of ethanol, although the beverage use is a lot more fun. Don't get the two confused if you're personally consuming internally. ☺

If you're into saving our planet from certain death, doom and destruction, using ethanol can reduce oil dependence and greenhouse gas emissions by burning "cleaner", although opinions differ factoring in actual methods of ethanol production and greenhouse gas emissions. You decide. And, of course, thanks to U.S. oil shale production, we aren't totally dependent on oil imports for domestic gasoline production. Ethanol fuel use in the U.S. has increased dramatically from about 1.7 billion gallons in 2001 to about 13.2 billion in 2013 thanks to certain environmentalists and the Corn Lobby, a big, powerful agribusiness in the U.S.

Start Me Up Some Ethanol Facts

Most of the gasoline sold in the U.S. contains up to 10% ethanol—the amount varies by region—and all auto manufacturers approve blends up to E10 (up to E85 in "flex-fuel" vehicles) in their gasoline vehicles but "pure" gasoline is still available at gas stations if you look around. As of 2011, the EPA (U.S. Environmental Protection Agency) began allowing the use of E15 in model year 2001 and newer gasoline vehicles. Many car manufacturers have put out warnings and are considering using it will void car warranties. Note that your owner's manual may indicate the manufacturer's maximum recommended ethanol content.

Since ethanol contains about two-thirds as much energy as "pure" gasoline, vehicles will experience approximately 3% to 4% fewer mpg on E10 and 4% to 5% fewer on E15 than on 100% pure gasoline, so sez' the E.P.A. (although we all know their new vehicle mpg ratings have not been very trustworthy in reality). Reports of 6% to 10% mileage drops by owners have been reported according to "Road & Track Magazine" but then again, it's conceded many factors cause accurate mpg checking to be difficult.

Big fact here: Ethanol is hygroscopic – that is it aggressively attracts and absorbs water including water from the air. When the ethanol absorbs enough water, water contamination can occur in the gas tank and affect engine performance. One of the reasons fuel stabilizer (i.e., Sta-Bil) additive is strongly recommended for

vehicle winter storage is that long-term storage can cause fuel separation and if the engine sucks the H2O layer into the engine, guess what? Definitely not a good thing.

Another fact: Ethanol is alcohol and alcohol can cause corrosion in the fuel system especially in older cars, marine engines, lawn movers and such. Metal parts rust and plastic parts become deformed or cracked.

ANY Benefits to Using Ethanol-Blended Gasoline? Well.....

Okay, I'll try to be unbiased here with some additional facts with a few personal caveats. Sorry, can't help it. I've given you my opinions and you all know what opinions are worth. ☺ The decision is yours. Me and *Scarlet* are going to remain "pure". I'm sticking with non-ethanol high-test when I can find it.

- Ethanol is a renewable source (there's the debate about how much water and energy it takes to produce ethanol and the ethics of using a food source for fuel thus causing higher prices for corn world-wide).
- Ethanol gas has a higher octane rating (see about definition), so it supports a higher compression ratio (see above definition) and more aggressive ignition timing (yes, but your mpg will suffer).
- Ethanol makes good racing fuel. NASCAR is running E85 (good politically astute decision).
- Ethanol is said to reduce gasoline consumption for a reduction in greenhouse gasses and less dependence on imported oil (the U.S. is said to no longer be dependent on oil imports and mpg mileage will drop).
- If your knock sensors are working fine then 87 shouldn't be a problem. The engine will detect knock from the 87 octane gas and will retard the ignition timing automatically, reducing the effective compression of the engine, thus giving you less power per stroke but keeping the engine protected from pre-detonation.
- It's better to use 91 or 93 but 87 won't hurt it as long as the knock sensors are functioning. If they stop working, you should get a check engine light. If you have a check engine light and you don't know why it is on, I would NOT use anything below 91 octane.

"It's All Over Now"

I hope you enjoyed this month's column and don't forget to wave to your fellow Miata/MX5's when you pass them on the highway!

Zoom-Zoom and Drive Safely,

Gail, Honky Tonk Woman

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