

## Why High Test Gas? IN 2001 to 2015 Miatas.

I had a reader ask me to write about why his Miata needs to run High Test gas, I am certainly not an expert on this subject, but willing to share what I know and have read. This has been an important topic to me ever since my Drag Racing days in the early 1970s. I just do not accept any responsibility over what you do after reading this article. Please read on.

The Motor in our cars is like a large Air Compressor. They suck in air thru the intake and air filter, and the end result is exhaust is pushed out the muffler. What happens in between is the important part.

Have you ever put air in your tires? You understand this is compressing the air in your tire and the compressed air pressure holds up the car. When the piston in your motor moves upward, it compresses the air in the cylinder. The 2001 to 2005 Miata motor compresses the air volume 10.5 to 1 as the compression ratio. The NC Miata compresses its air volume 10.8 to 1 as its compression ratio. As the air is compressed, heat is generated. The higher the compression ratio the more heat is generated. Imagine taking 2, 5-gallon bottles of air, and squeezing it all into a 1 gallon jug. Imagine the pressure created inside the 1 gallon jug.

OK, lets now spray some gasoline into the air as it is being compressed. The "ideal" mix of air to gasoline is 14.7 to 1. This is 14.7 parts air, to 1 part gas, but can vary as the motor workload changes. So now even more heat is created as the piston goes to the top of the stroke. Up to now we understand the piston goes up and compresses the air and gasoline creating HEAT. This is the part to remember so far.

I have learned the combustion chamber in the head is designed in part to control the rate of BURN of the gas/air mix. When the spark plug fires, it starts the gas and air mix to BURN. Remember this word BURN. The flame front then quickly spreads across the face of the piston. This happens in just a millisecond, so we think of it as an explosion, but in reality it is an Extremely Fast Controlled Burn. So now remember the compression of the gas and air creates HEAT, and the mix BURNS in a controlled manner.

Now we get to the gasoline. We know Gas is very flammable. When a motor is running, there is a lot of HEAT inside the combustion chamber. So you ask why doesn't the gas and air ignite automatically when the piston gets to the top of the stroke like a diesel? Here comes the next important word to remember – OCTANE.

The OCTANE Rating is a measurement of a gasoline's resistance to EXPLODE in the motor. A chemical is added to the gasoline to make it actually Less Flammable. The Higher the Octane rating, the lower the chance of the gas Exploding in the cylinder so it can have the desired controlled burn in the combustion chamber. The controlled burn creates sort of a "gentle push" of the piston back down the cylinder. The timing of the spark in the mix occurs at a time that ensures the piston is ready to go back down, and NOT still on its way up. This direction is important.

A motor like in the NA (up to 1997) has a lower 9:1 compression ratio. This motor will run fine using the 87 octane, or "Regular" Gas. The NB has a 10.5:1, and NC has a 10.8:1 compression ratio. Mazda recommends a minimum of 91 Octane, or "High-Test/Premium" for these motors.

So here is what can, and has happened using the Wrong Octane gas. You are out enjoying the Miata, you are running it kind of sportily like on a club drive, but you only have Regular – 87 octane gas in the tank instead of 91. Because of the heat from compression, and the heat in the motor from running it, the gas and air mix can EXPLODE before the piston gets to the top of the stroke even before the spark plug fires. This Explosion can push back down on the piston so hard it can bend the connecting rod, or the heat can burn a hole in the top of the piston! I have seen both of these, so I know it can happen. It can be very violent, as the motor can stop turning over instantly. Now I admit, this is a worst case scenario, but it can happen.

Now you ask why have you gotten away with it up to now? Government regulations state all cars sold in the USA must be capable of running 87 octane gas in case of an emergency. Because of this there is a "Knock Sensor" on the block of every motor. This is then hooked to the computer. This knock sensor is like a very sensitive microphone. When it hears a knock starting, it sends a signal to the computer to retard the motor timing, and reduce power output of the motor. Thus saving the motor, but giving you less power to enjoy the car.

I definitely do not recommend using regular 87 Octane gas in the 2001 to 2015 Miata Motors. You may get away with it, but "maybe" the next Hot Afternoon drive will be the day you won't. If you must save a little money, put a ½ tank of 89 Octane and a ½ tank of 93 Octane where 91 octane is not available. I just use 93 Octane as that is what Costco sells.

One more thought..... Don't waste your money using High Test gas in a NA Miata. As Octane resists the gas to explode, it actually gives a lower compression motor less power.

Remember - Octane does not GIVE your motor more power. Octane ALLOWS your motor to produce the power it is designed to produce.

Feel free to ask if you have any questions!

Zoom-Zoom! Bill Latsha