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Your Amsoil Information News Source

Fuel Data...what can it tell you?

In last month's newsletter (February 2021 - Issue 114) I began discussion the analysis of fuel economy. Specifically, I took a look at our 2019 Jeep Compass. This month I will take a look at our 2008 Hyundai Elantra.

*****Spoiler Alert*****

After taking a look at the data, I have concluded that something is going to break or need replaced within the next one or two months. I just don't know what it is yet, although I have a couple ideas of what it might be.

We purchased this vehicle new in 2008 from the Dealer. I slowly switched the fluids over to Amsoil throughout the years. I have made an attempt to keep fairly meticulous records throughout the ownership of the vehicle.

The EPA mileage estimates are 24 mpg in the city and 33 mpg on the highway. These numbers will prove to be very important in my analysis of the fuel economy with this vehicle over the past five years.

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2008 Hyundai Elantra, 2.0L 4-cyl Engine

What's Inside This Issue?

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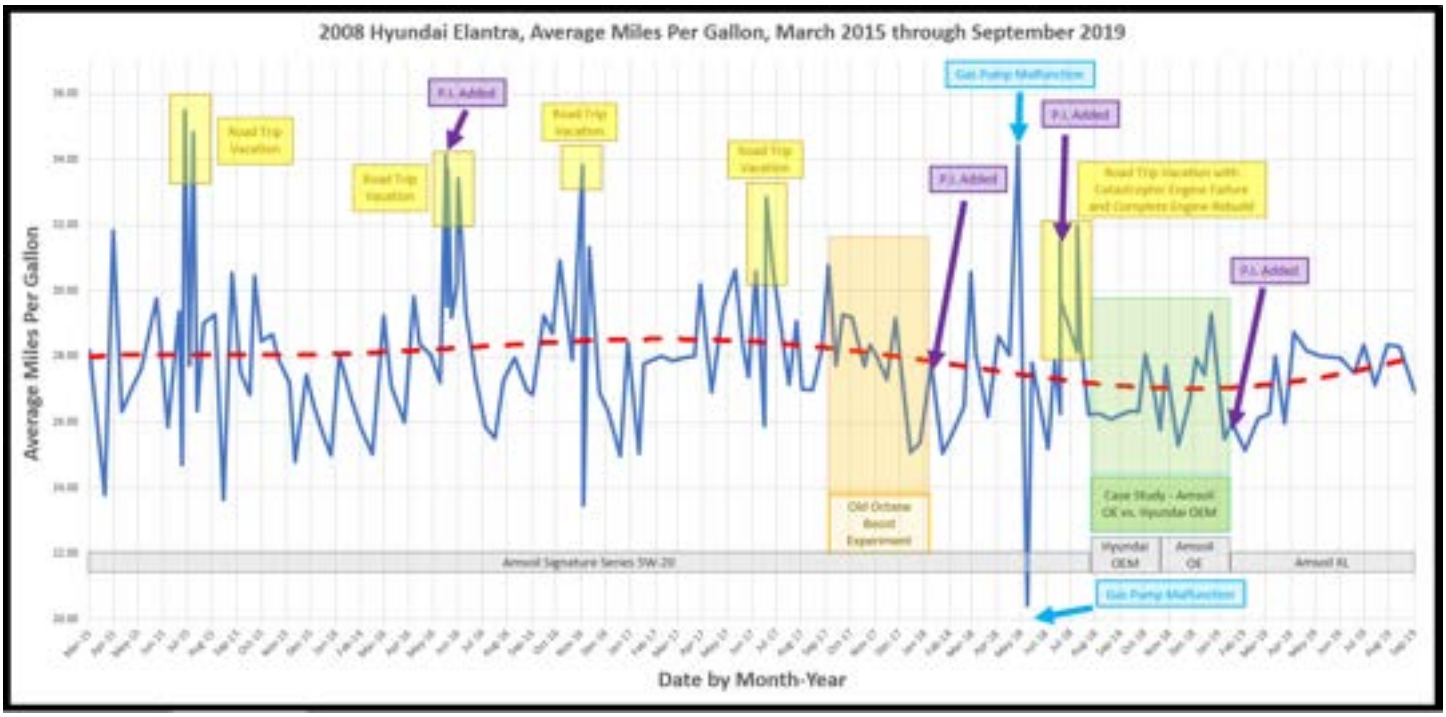

The chart at the top of the screen shows our Hyundai Elantra fuel economy from March 2015 through September 2019. The jagged blue line signifies each time the vehicle was taken to the gas station to fill up and the miles per gallon was calculated. The red smooth dashed line identifies polynomial trending based upon the data points. The high peaks (in yellow) typically correspond with road trips that were taken where one or more tanks of gasoline were used on the highway.

It is very clear that between March 2015 and September 2019 the average miles per gallon has remained about the same. During this entire time frame, the fuel economy average calculates to 27.93 mpg. If you remember from the previous page, the EPA mileage estimates are 24 mpg in the city and 33 mpg on the highway. It has obviously maintained great fuel economy.

In Issue #78 (February 2018), I discussed an experiment that I conducted which involved using very old, outdated, inappropriately stored Amsoil Octane Boost in my vehicles. The resulting data analysis concluded that it is not good to use products that are very old, outdated, and inappropriately stored. This area shown in orange.

The two blue notations on the chart identify a time where I filled up at a gas station and the pump shut off before the tank was completely filled. Thus one fill up calculated as having great gas mileage immediately followed by the next fill up getting very poor gas mileage. If you average the two calculations, it puts the total right in line where it should be.

In July of 2018, we experienced an oil pump malfunction which led to a catastrophic engine failure during a road trip to Colorado. This, in turn, led to Hyundai honoring their warranty and completing a full rebuild of the engine. This was outlined in the following newsletters:

September 2018, Issue #85
October 2018, Issue #86
November 2018, Issue #87
December 2018, Issue #88

This experience ultimately led me to complete a 6 month comparative case study where I performed a series of oil analytics on both Amsoil OE and Hyundai's OEM oil (green area on chart). This was outlined in detail in the following newsletters:

January 2019, Issue #89
February 2019, Issue #90
March 2019, Issue #91
April 2019, Issue #92

Now, let us attempt to figure out what the current problem is with our 2008 Hyundai Elantra.

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continued...Fuel Data...what can it tell you?

It is clear that everything has been pretty decent up until September 2019, as far as fuel economy is concerned. Up until this point 28 mpg is the baseline, standard number (thick red dashed line). The chart at the bottom of the page identifies the time frame from August 2019 through present day. It is clear that a very different trend can be seen when compared to the Lifetime Average Trendline.

In March 2020, the vehicle's check engine light came on. After hooking up my scan tool, it was clear that an Oxygen Sensor had failed. The Oxygen Sensor is about the same size and shape of a spark plug and protrudes into the car engine's exhaust stream. It determines if there is a lot or a little oxygen in the exhaust, so the engine can make adjustments to the amount of fuel being used in the engine to run at maximum efficiency. Taking a look at the chart at the bottom of the screen, the first orange circle marks the point at time where the oxygen sensor presumably began acting up. The second orange circle notes the date that the check engine light came on and I replaced both of the oxygen sensors.

Downstream O2 Sensor Replacement

Upstream O2 Sensor Replacement

After replacing both oxygen sensors, fuel economy jumped above the Lifetime Average Trendline for several months.

The purple arrows notes the time frame that the vehicle was involved in an auto collision and when the repair was complete. Although the check engine light did not and has not illuminated, there is obviously an engine related issue based solely upon the fuel economy over the last five months.

The trend line is similar to the previous oxygen sensor failure trend line, yet no check engine light has came on as of yet. Presumably, I can assume that the engine will throw a code within the next month based on the previous oxygen sensor fuel data.

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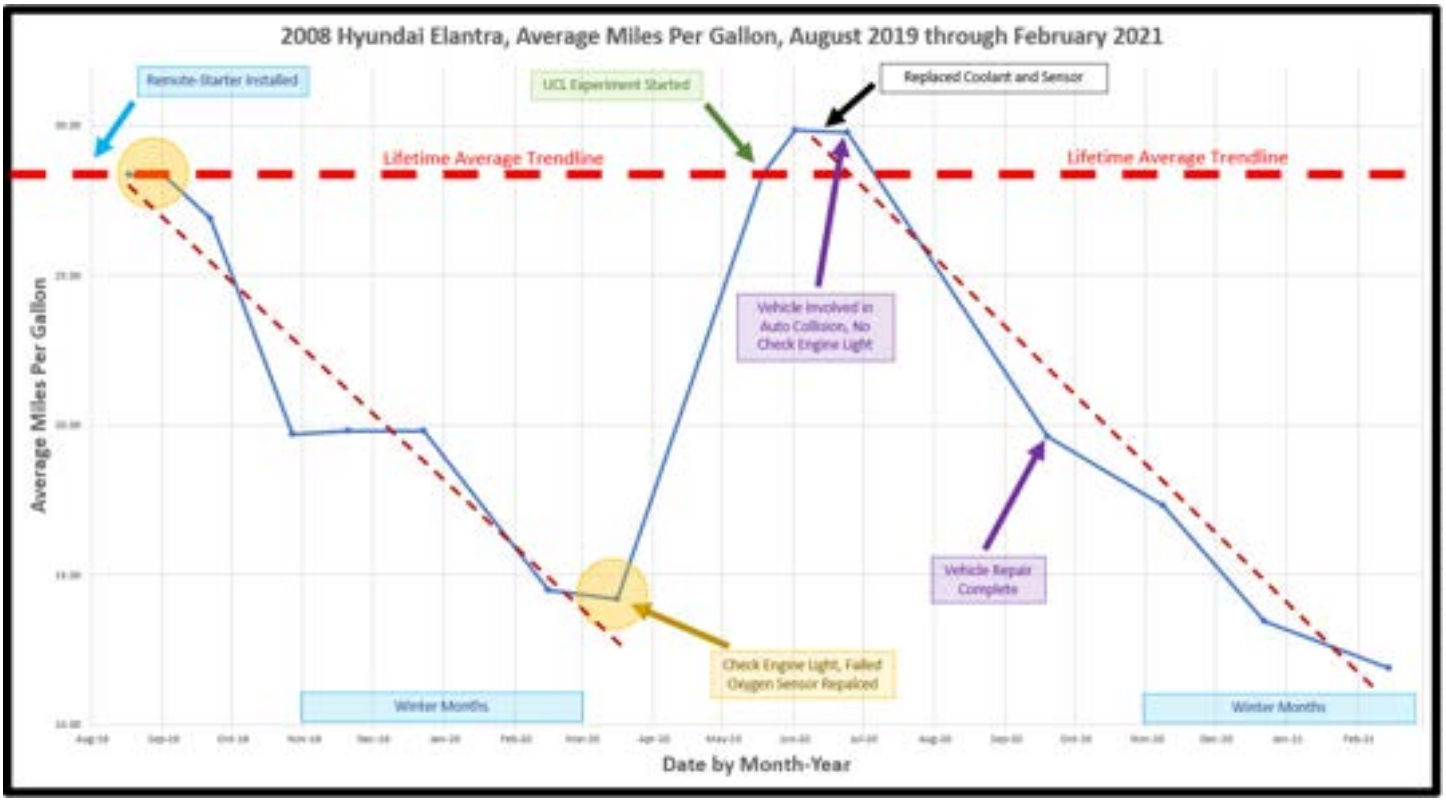

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There are a number of reasons for poor fuel economy. I am going to take a little time to unpack these issues as some are easy to correct and others require more work.

1. Tire Pressure - Under inflated, overinflated, and inflation pressures that vary from tire to tire can cause an increase in friction, thus lowering fuel economy and causing premature tire wear. My tires are properly inflated, this is not the cause.

2. Air Filter - Old and dirty air filters won't allow the correct amount of required clean air into the engine causing the computer to adjust fuel delivery and affecting the performance of your engine. I clean my air filter monthly and replace it every two years.

3. Oxygen Sensors - We saw the data how failing oxygen sensors can affect fuel economy. I have replaced both already. It is unlikely, but possible that one or both of the new oxygen sensors have failed.

4. Spark Plugs - These provide the necessary "spark" to ignite the air/fuel mixture within the engine. Misfiring or malfunctioning spark plugs will definitely affect the engine's ability to properly burn the air/fuel mixture, leading to poor fuel economy. However, this is usually partnered with a check engine light and a noticeably rough running engine. I have neither of these, but the engine does have the original spark plugs as they were not replaced during the engine rebuild.

5. Fuel system - A bad fuel injector or dirty/old fuel filter can drastically affect the flow of fuel into the engine. A fuel system problem is one of the most common causes of poor gas mileage. However, on my vehicle I run Amsoil Performance Improver and Amsoil Upper Cylinder Lubricant as a part of my preventative maintenance program. These two products help ensure the fuel system is clean and operating properly. Additionally, I am fairly certain that the fuel injectors are fully operational as a failing injector is usually partnered with a noticeably rough engine. Much in the same, an old/dirty fuel filter can lead to hesitation when starting or driving the vehicle as there is not a proper flow of fuel to the engine. I show none of these symptoms.

6. Air Conditioner - The more you run your A/C, the lower gas mileage you will get. Currently as I write this, I am not in need of Air Conditioning and have not used it for some time.

7. Exhaust System - Whether it is an oxygen sensor, catalytic converter, an exhaust pipe leak, muffler or some other emissions issue, the exhaust system plays a crucial role in fuel economy. When the accident occurred I initially thought it was frame and body damage, which were both fixed. However, I didn't dive into the exhaust system. It is possible that a hard jostle of the vehicle could have damaged one of the exhaust system components.

8. Motor Oil - The type of motor oil you use will have an impact on your gas mileage. Always make sure you use the right weight and type for your vehicle to ensure optimal engine performance. I currently run Amsoil XL 5W-20 in this vehicle. I have been running this type since I completed my 6 month case study back in February 2019 (see chart on page 2).

9. Driving Habits - Your own driving habits also make a difference. Aggressive driving causes you to accelerate quicker which leads to higher RPMs and lower fuel economy. Driving sensibly will help you conserve gas. The driving habits with this vehicle have remained the same. This is not the issue.

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10. Excessive Idling - When your car is parked and turned on, it is using fuel. If you have a remote-starter for your vehicle, you will tend to burn a lot of extra fuel by always having your vehicle warm up in the mornings, especially during the winter months. We had a remote-starter installed in our Elantra in August 2019. Coincidently, August 2019 was when fuel economy started to decrease all the way through April 2020 after replacing the O2 Sensors. Then in about August of 2020 it began to decrease again down to where we are at. Had the O2 Sensor Issue and Collision not taken place and the fuel economy calculations remained the same, one could conclude that utilization of the remote-starter directly correlates to decreased fuel economy. Although possibly a contributing factor, I don't believe this is the primary cause of diminishing fuel economy.

11. Cooling System - If the coolant sensor is malfunctioning, it could read a lower than normal (or always cold) temperature. When this occurs, the engine will continue to operate in "open" loop, running rich. A richer fuel mixture is required while a cold engine is warming up to prevent it from stalling. If the mixture remains rich, it wastes the extra fuel. A faulty thermostat could also cause issues. If the thermostat is stuck in the open position it does not allow a cold engine to warm up which can delay the powertrain control module from going into the closed loop, causing a rich fuel mixture and poor fuel economy. Coincidently, I replaced the coolant, thermostat, radiator cap and sensor in late June of 2020 (see chart on page 3). Succeeding that service, fuel economy started diminishing. However, the collision took place right after this service as well. It is possible I installed a faulty sensor or thermostat. Or maybe at this point you are thinking I installed something incorrectly... because that is what I am hoping **didn't** happen.

Cooling System Service

12. Dragging Brakes - A parking brake that is not fully releasing, or brake caliper that is sticking can cause the brakes to drag and your engine to waste fuel.

13. Junk In Your Trunk - More weight equals less fuel economy. Removing unnecessary weight will improve MPGs.

14. EGR Valve or Intake Manifold - A vacuum leak at the intake manifold gasket, in the manifold itself or any of its vacuum hose connections can lean out the air/fuel mixture and cause the engine to misfire and deliver poor fuel economy. Much in the same, an EGR valve that does not close at idle, when the engine is cold or when it is not under load can allow exhaust to leak back into the manifold.

12. Mass Air Flow Sensor - If the engine runs too rich because of a bad Mass Air Flow Sensor, you can expect poor fuel economy as a result. The engine control unit might send too much fuel into the cylinders of the engine because it doesn't know how much air flow mass is in there. Symptoms of a bad MAF sensor include: Check Engine Light, Trouble Accelerating, Rough Idle, Poor Fuel Economy, Black Exhaust Smoke, Hesitation or Surging, Hard Starting

13. Throttle Body - Over time the engine's throttle body collects debris that can make your engine idle rough and decrease fuel economy. Use of Amsoil Power Foam can clean off the many components within the upper intake system.

So at this point, I have a bunch of different ideas and things for me to try out. With any repair, I always recommend starting with the cheapest and easiest solutions first and gradually work toward the more invasive and complex methods.

I am going to begin by double checking the air filter, tire pressure and brakes. From there I will move to checking the EGR Valve (if equipped), Intake Manifold, Exhaust System, Throttle Body, and MAF Sensor. After that, I will move on to start replacing some parts.

Shop Talk...

with Dr. Jonathan D. Olson, EdD
(Independent Amsoil Dealer #10458)

One of the many challenges I face on a regular basis is working with a wide variety of equipment in a plethora of different situations.

This last month my task was to fit a $20,000, 57" wide machine through a 48" cinder-block door opening. The machine weighed 900 pounds and could not be tipped due to it being a precision machine.

After carefully disassembling a good portion of the machine I was able to get it down to 48 1/2" wide and with a little ingenuity got it through the doorway.

The next steps are solving the electrical hookup issues, creating a dust collection solution that works, training individuals on the computer programming side of things and plumbing in the cooling system. I will be using Amsoil Low Toxicity Propylene Glycol Antifreeze and Engine Coolant to ensure the equipment stays cool and corrosion free for the foreseeable future of the equipment.

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