

Vacuum System Issues

(and what to do about them!)

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Section One:

Vacuum Powered Emmissions Systems

So, now you have your freshly modified throttle assembly and you're wondering what's next. What I'm about to tell you should be read through once before you do the install, and then kept next to you as you complete the process.

The first thing you'll want to do is check the mounting surface to ensure the gasket isn't damaged. If so, there are two things you can do. 1) Replace the gasket, and 2) Use a good RTV in the place of the gasket material (if it's good enough for the NASCAR circuit...). I have performed hundreds of these modifications and have had to replace less than a dozen, so if it isn't broken, don't fix it (unless it makes you feel better!).

If you decide to do either of these, it is **HIGHLY** recommended you remove **ALL** gasket material from both surfaces, or you're begging for a leak. **THIS** is unacceptable, as all leaks must be completely sealed to get the greatest possible gains from The Gadgetman Groove. Any leak (vapor of any kind including exhaust gases-hint hint!) will diminish the low end pressures that generate the vaporization.

Once you're certain, reinstall the throttle assembly. Just bolt it back up and get ready to reconnect the vacuum lines. Before you do that, you will find it very advisable to check **EACH AND EVERY LINE FOR INTEGRITY**. There is a wonderful tool for this already on the market. Just Google "Hand pump vacuum tester" and you'll find a variety to choose from. If you find any leaks in this process, then cap that port. Worry about the repairs later, and please **REPAIR THOSE LEAKS!**

Any vacuum lines that are dry and/or dry-rotted should be replaced as part of your routine maintenance. If you're looking at a line from the open end, squeeze it between your fingers and look closely at the end. You will find many present cracks that you won't be able to see otherwise. Don't waste your time cutting the ends and re-attaching them. The line is bad. Replace it. Gasoline is expensive. Vacuum lines are cheap!

Oil and gasoline have deleterious effects on the hoses as well. If your engine is one of the leaky ones, then you should look **REAL CLOSELY** at the hoses in the area of the leaks. That is, **AFTER** you clean the nasty thing! Take the vehicle in and have a thorough steam-cleaning done, or all the work you're doing will not last.

Hoses (*AND the wire insulation!!!*) so affected swell and become soft. When they become soft, they won't hold as well and can become porous (leak!). Wires and oil fight against one another as oil degrades the insulator, penetrating through to the wire. Once the oil touches the wire inside, it will conduct electricity and degrade the value of the signals that are being sent to the computer, rendering fault conditions that may or may not cause intermittent check engine lights for the affected system, not to mention throwing off the computer fuel management.

There are three particular systems that you will want to look closely at. Those follow, and should be addressed in the order given. Now, you don't **HAVE** to do all of these, but the better you restore the integrity of your intake manifold, the better your engine will run afterward, so be **BOLD**. Be **DARING!**

Be A GADGETMAN!!!

1)-PCV (Positive Crankcase Ventilation) see the Wikipedia article on [Crankcase Ventilation Systems](#)

This is a two-hose system. One is attached to what is known as “Dynamic” (or active) vacuum, the other Passive. The Dynamic vacuum is what we're interested in here because that's after the throttle plate (and The Gadgetman Groove). Passive vacuum is between the air filter and the throttle plate. Don't worry about that one. It is quite essential and can't hurt you none.

What you'll want to do with the Dynamic line (the line that goes to your PCV Valve) is to simply remove the line from the intake manifold or throttle and put a vacuum cap on it. Some of these are quite large and you may have to be creative to figure a way to cap that port. For the larger ports, standard vacuum caps will not do. For those, you buy “Heater Hose By-Pass Caps”. While designed for another app, they will work marvelously for those oversized lines most prevalent on Ford applications.

Some of the later and more advanced systems actually have sensors (switches) on these lines that tell the computer when there's vapor passing through. This type may need to be adjusted by filling the valve with JB or another sealant. BE SURE you wait an appropriate length of time to allow the sealant to set up before you apply vacuum or your patch will blow out. Just remove the PCV, clean it thoroughly and apply your goo.

If your system throws an error code, then you will want to pull into your friendly neighborhood Auto Zone and have them check it. They will tell you what the error is about, but won't clear the code. Just knowing it's a vacuum issue will let you know there's nothing to worry about. (Get your own scanner!)

2)-Evaporative Emissions- The Evaporative Emissions is the second area that should be addressed. This is an emissions control system designed to take the fuel vapor generated from your tank and allow it to be recirculated into the engine for burning. While all that is necessary for the vehicle systems to be “Legal” is to have it routed into the intake air stream, it does NOT have to be attached to Dynamic vacuum to work. Just a tap on the intake air tube before the throttle body is fine and meets all requirements of the EPA.

Using a LOT of vacuum hoses, there is a high potential for leaks here.

This system, once capped at the intake manifold, is extremely likely to present an error code. There is no way around this one (without additional parts), but, once again, to get the highest gains possible it must be capped at the intake manifold. To maintain its legality (this does NOT mean it will pass emissions inspection!) it should be attached as discussed in the previous paragraph.

Bottom line, this system should be left alone. Other than checking for leaks, the Evaporative Emissions System presents only a periodic leak and it's really not worth messing with (IMHO).

3)-Exhaust Gas Recirculation (EGR)- In some engines, the [EGR System](#) is a benefit to mileage, and in some it is not. That depends on far too many factors to list here. Original intent was to reduce NOx emissions, which is a GOOD thing, but not essential for reduced emissions with The Gadgetman Grooved engine.

What I am about to tell you is ILLEGAL according to the EPA. If you want to take the chance, then you have been warned! (Don't worry. That's my disclaimer of responsibility. I believe your engine is your engine and if what you do reduces our pollution, it should be supported by our "Guardians" NOT condemned!)

Find some way to STOP the EGR from allowing exhaust gases into the intake manifold. If you want to, you can still vent it into the intake stream as in the PCV and Evap Emissions, but I think it's STOO-PID. Just let the exhaust go out like it's supposed to do-ALL of it. If you're pretty handy with working on metal, get hod of me and I'll give you a simple method of capturing the densest stream of HC's leaving the engine to recirc through the intake. That will allow for enhanced efficiency, as no matter how good The Groove is, there is still "Waste Fuel" exiting the engine.

You see, with The Gadgetman Groove Modification, ALL emissions are so dramatically reduced, it will only hurt you, and NEVER help! Still, to affect the PURPOSE of the EGR, the gases should be re-introduced into the airstream It is illegal to tamper with it, but I have never known an INDIVIDUAL to be fined for this act, although you might be held accountable for the ones you do IF you're a mechanic for a living.

There are many other places where you might be experiencing vacuum leaks, but if you use your tools, are thorough about your testing, and replace all questionable parts and lines, you are sure to get all the gains you read about and see at our YouTube channel (www.YouTube.com/GadgetmanGlobal).

You've got your Throttle Assembly reinstalled and your vacuum restored to your engine. For carbureted engines, you'll want to consider re-jetting to gain further efficiency. One can EASILY triple the mileage in most carbureted engines if you're willing to work for it! For Fuel Injected engines, you won't have to worry about that. The Computer is "Da BOSS".

For you folks with either TBI (Throttle Body Injected) or MPFI (Multi-Port Fuel Injection) systems, it's time to help your (vicious!) computer to adjust to the changes. In those cases, all that's really necessary is to drive your vehicle. The computer will adapt over time, but this process can be sped up dramatically if you want to follow the following process.

With your vehicle parked, start the engine. Once it reaches operating temperature (You can tell this by the idle speed. Generally within two minutes.) turn the engine off and re-start. Repeat this cycle at least six times.

Each time you restart the engine, you are programming your computer. (I bet you didn't know you could do THAT, did you?) Every time you turn the engine on, the computer starts with a set of operating parameters based on the previous requirements and demands. As the engine runs, the computer will adjust itself according to the new conditions. These new conditions are called the "Short Term Fuel Trims" or STFT. When you turn the engine off, these new parameters are recorded as the latest data in yet another table called the "Long-Term Fuel Trims" or LTFT.

This table is heavily weighted for the last conditions, so as the engine adapts, the STFT's are used to completely re-program the fuel delivery requirements. The more of these cycles you complete, the more complete your re-programming and the better your efficiency.

Most vehicles require only a few (20 or less) cycles to reprogram to a greatly enhanced level. Some (like late model Honda's) require as many as three to FIVE tanks of fuel used during city driving to see gains.

Honda's usually lose 1-2 MPG's on the first tank, gain 10%MPG's the second tank and then jump

SHARPLY by 40-60%! So, if your mod loses a mile or two initially, don't worry. It's the computer being a stubborn little wench! She will come around in time. If after three tanks you still don't see a gain, then go back and check the vacuum and clear the computer memory. That usually clears up what I consider "locked" computers (those that neither increase nor decrease).

Section Two: Other Modifications to Enhance **The Gadgetman Groove**

Oxygen Sensors

Since what we're talking about here is re-engineering the internal combustion engine, we have to redesign some of the controls and systems the automotive companies have engineered into our engines that reduce their efficiency. The most important to us are the Oxygen Sensors at this point.

While the oxygen sensor is an integral part of a computer-controlled gasoline engine, we count on them to do their job. IF, however, you feel more gains are possible, the Oxygen Sensor(s) is the place to begin "Correcting" the native inefficiency in the programming. We do this with a device known as an Electronic Fuel Injection Enhancer of "EFIE".

This is a device that is fairly simple to install, and available from a variety of vendors. The people I prefer to do business with is Mike Kerhli at <http://www.FuelSaver-MPG.com>. Your best bet is to ask them "**What type of EFIE do I need?**" Follow that link and it'll take you right to their form. You will find Mike and his crew extremely willing to help you, no matter what stage you're at, and no matter what type of problem you may be experiencing.

Anyone with a low- to moderate level of ability can install one of these, so don't be scared! After all, you ARE a Gadget Man, right? There's NOTHING you can't do!

Spark Plug Gap

Adjusting the O2 Sensor signal(s) to assist in the enhancement of combustion experienced with The Gadgetman Groove modification is just one more thing you can do to further increase your MPG's. In addition to that, you may opt to increase the gap on your spark plugs. This can change the amount of energy delivered to your fuel dramatically.

You see, a coil is a lot like a capacitor. When you apply a voltage to a coil, it begins to build a charge. In internal combustion engines (ICE's), a 12 VDC source voltage is applied, and the output is multiplied many times over. Many modern vehicles have coils that can output over 100,000 VDC, aimed at your spark plugs. The higher the voltage you want delivered, the wider the gap should be.

So, why don't the manufacturers set them that way? (just a question...)

As the spark plug fires, it literally burns away some of the metal. With each successive spark, more of the contact points degrade, resulting in what is known as "Gap Creep". Just check your spark plugs after they've been in your engine for a few thousand miles and you'll see exactly what I'm talking about. This is unavoidable. To extend the periods between service, they compensate by using a narrower gap.

But your plugs are working just fine, aren't they?

That's not the question here, but rather how to maximize the amount of power delivered to your fuel. More power delivered from your coil equals more power at the point of combustion. This is done very simply, by widening the gap. Most systems can easily handle a 20% increase in the width of the gap, without any problems whatsoever. As you increase the distance between the electrodes, you force the coil to charge longer (which delays the timing-a GOOD thing!) and to deliver a higher charge.

If you are getting a 50 KVDC discharge, you can greatly enhance your combustion by getting 60 KVDC. (Higher voltage means more energy) If your coil CAN deliver more, then by golly, LET IT! Most vehicles (post Gadgetman Groove) see increases of 4 mpgs and more following this simple procedure. So, give it a shot. All you're investing is a little time, and you are guaranteed to be delighted with the increased performance!

The method is simple. Remove a plug and increase the gap in increments of 20%. (.040 to .048 to .056 and so on) Once you pass max output for the coil, the spark plug will begin to misfire on that cylinder. Reduce the gap to the last setting and apply that value to the rest of your plugs and drive it. If the mileage is DOWN then you're still too wide. Back off to the next lower gap setting and drive again.

Fortunately, you only have to go through this once. Record the value that works best for your engine so when you replace the plugs again, you can apply this more enhanced gap to your plugs and guarantee you MAXIMUM power from your ignition system!

Mass Air Flow Sensors (or) Intake Air Temperature Sensors

In order to properly meter the fuel delivery, the computer uses a device known either as a Mass Air Flow Sensor (MAF) or an Intake Air Temperature Sensor (IAT). Whichever your engine uses (and it WILL be one or the other-rarely BOTH) it is a very simple thing to adjust.

First, how they operate.

In electrical theory, it is proven that a cooler circuit conducts more electricity. A warmer one, less. So, what they do is they provide a low or "control" voltage of about 5 VDC to a simple series of resistors, then mount them in the intake air stream somewhere before the throttle assembly. When the air passes over the resistors, it carries off some of the heat thereby cooling the circuit and allowing more current to flow back to the computer.

Reading this return (or "sensor") voltage and comparing it to a set of known values for that sensor, it determines how much air is entering the engine. With that value, and in conjunction with various other sensors, it determines the amount of fuel to be delivered.

Knowing this, you can see there are two ways to adjust that signal for higher efficiency. One, you can install a variable resistor to the sensor wire. This requires identifying the correct line and applying just the right resistor. The second method (one I ascribe to) is to simply reduce the amount of air allowed to pass over the resistors.

All I do (when I have done this in the past) is to take some real good tape and block off a portion of the passage in which the resistors are mounted. Some have wrapped the openings with wire. This allows for more finite control of the gap. You can easily reduce the size of the opening by 25% or more without throwing a code.

For certain IAT's, these can be simply turned in position to present a narrower face to the air stream. These are used in certain Dodge products and in many of the 3100, 3400 and 3800 Series of GM engines.

Too simple, right? What can I say? I like “Simple” best!

You decide which is best for you, but you can't go wrong with a little piece of tape, now can you?

Anyway, there are a host of other little tips and tricks that your Certified Gadgetman can supply you with to help you get more out of that money you're burning called “Gasoline”. Ask him about them, and he will be more than happy to help.

Congratulations on challenging the paradigm of 20 MPG's and the “14.7 to 1” myths. They are lies, and have ALWAYS been lies, and we are proving it every day. Every time we eek out another mile per gallon, we prove the fact that we CAN do better than the car companies want us to believe.

Keep looking for “The Truth” and you will eventually find it, and it will rock your faith in The Powers That Be.

Welcome to a new world and a NEW age in Fuel Efficiency!

Ron Hatton

Gadgetman

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