Vacuum and
The Gadgetman Groove

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THE BASICS

In order to understand why vacuum is so important when you're deciding the effects of The Gadgetman Groove on any engine, it's important that you understand the normal processes inside an engine, and how they are affected by this simple modification.

Truth isn't Fact

If you take your car to a garage and ask them to do a vacuum test, odds are real high what they're going to do is put a vacuum gauge on the end of a vacuum line and read the output. If it falls into a certain range, they're going to pull their gauge and tell you "All's well in THAT department!" when nothing could be farther from the truth.

Since "Truth" is what we're interested in here, you need to be aware of what the vacuum system is, how it works, and why it's absolutely **CRITICAL** to be certain you have NO vacuum leaks before you decide whether The Gadgetman Groove works on **YOUR** engine.

Why Vacuum Changes

The normal process of the intake cycle generates a condition of reduced pressure inside the intake manifold. This is called "Vacuum" and represents anything below normal atmospheric pressure and is measured in Inches of Mercury (Hg). As an engine ages, the seals that create this vacuum deteriorate (ring wear, broken lines, dried and cracking diaphragms). As the vacuum drops, so does the efficiency of your engine.

This is because of a little considered scientific law called **"The Law of Standard Temperature and Pressure"** or **"The Ideal Gas Law"** which, simply stated, is "At a standard pressure and a standard temperature, fluid X requires Y amount of BTU's to change states." As it applies to us here in the world of fuel efficiency, if you reduce the pressure on a liquid, it will vaporize at a lower relative temperature.

Why is Pressure Important?

Gasoline is a liquid. Oxygen is a vapor. You cannot mix the two under normal conditions. They must both be in the same state to blend (liquid to liquid, vapor to vapor). As you will never see the amount of pressure inside an engine necessary to liquify oxygen, you can forget that approach. BUT! Since there is already a vacuum present, you CAN enhance the wave already present, providing the conditions appropriate for blending the fuel with the oxygen, a prerequisite for combustion.

What's "Normal" Vacuum?

Normal engine vacuum is considered "ideal" at about 17" Hg. But, as we discussed earlier, this is just a figure, and all engines will have different values here, as will the temperature-to a greater or lesser degree. It is the vacuum (in conjunction with the manifold temperature) that causes some of the fuel

vaporization, enabling the fuel to burn faster at the point of ignition.

These vapors, when ignited, then supply the BTU's the rest of the fuel compounds require to vaporize, so they may complete the combustion process. Combustion will continue until either the fuel or the oxygen is depleted to the point it will not support further combustion. Unfortunately, the fuel we are given today to run our engines burns so slowly that most of it is consumed in the catalytic converter. The raw *(unburned)* fuel is held up there, coming into contact with certain heavy metals which, when heated, allows the fuel to burn *(or catalyze)* leaving compounds less harmful to the environment than the raw fuel.

In short, the catalytic converter burns what is considered to be
"Waste Fuel"
(the fuel the engine can not consume
-under* "normal" *conditions.)

Connecting the Dots...

So, if you want to increase the rate of combustion (and clean up your emissions!) you have to be able to reduce the amount of fuel in the exhaust. The best way to do this is to change the conditions the computer bases its fuel delivery on. Simply, burn more of the fuel *(and the oxygen!)* **in the combustion chamber**. The only way to do that is to get it to mix better with the oxygen, and the BEST way to do that: ***vaporize more of the fuel!***

The Problem in a Nutshell

Liquid fuel must evaporate to burn completely. Combustion happens so fast that the fuel doesn't evaporate completely, resulting in unburned fuel being sent to the catalytic converter. This is where the emissions are processed, and where the computer takes most of the information which it uses as the basis for its calculations to determine the fuel requirements.

Effects of The Gadgetman Groove

You see, you can't increase the vacuum, because that forces the engine to work too hard to breathe. You can't increase the temperature, or loss of the engine can result. So, what do you do?

Using The Vacuum Process

As the piston begins its downstroke, the intake air begins to enter the combustion chamber, increasing in speed to about 90 degrees rotation. This causes an increasing demand, reducing the pressure *(vacuum)*. At the midpoint of the downstroke, the piston begins to slow, and the vacuum decreases. This generates a low-level wave, with the vacuum ranging from a (theoretical) 15" Hg to a maximum of 18.5. At the height of the vacuum, the lighter hydrocarbons in the fuel compound are vaporized, the heavier remain, waiting for delivery of additional BTU's.

Amplifying the Waveform

With The Gadgetman Groove, that dynamic changes. At TDC (Top Dead Center), the intake air speed is at its slowest (zero). At this point, the Gadgetman Groove starts collecting air from the intake air stream (for the first 90 degrees of rotation). This causes the vacuum to spike. This spike in vacuum rips the fuel into fuel vapor, and in a state that enables it to mix with the available oxygen.

Completing the Blend

When the piston passes the midpoint, it begins to slow. This causes a reaction inside the groove itself,

and the ball of air that built up in the first part of the cycle is released into the intake passage to complete its journey to the piston. When it hits the intake valve, it has no where else to go and so expands in an explosive fashion, blending the fuel vapor just created with the intake air.

The BIG BANG...

With more fuel burning at the point of ignition, you are now delivering what *was* latent energy in the combustion chamber, delivering more power to the top of the piston. More horsepower and torque being the natural result.

Air Fuel Ratio (AFR)

With the enhanced combustion, you are not consuming more fuel. You only burn it in a different location-*In The ENGINE.* Since in the combustion process, you are also consuming oxygen, when the O2 sensor picks up this change, the computer responds as it is programmed. It cannot increase the amount of oxygen the engine draws in, it must reduce the amount of fuel it delivers until the correct Air-Fuel Ratio is restored.

A vacuum leak will destroy all or part of these gains.
In extreme cases, an engine with a severe vacuum leak
can even LOSE mileage because of it!

What do you mean "LOSE" mileage?!?!

Because of the change in the pressurcurve, a small, normally innocuous leak will let in a tremendous amount of air once the vacuum is enhanced by The Gadgetman Groove. This will kill the spike that vaporizes the fuel, and thereby kills the efficiency gain you would otherwise achieve.

The Leaky Hose

To gain a better understanding of how this can happen, look at a garden hose. Put a pin hole in a hose and put five pounds of pressure on the hose. You will get a small drip. Put fifty pounds of pressure and it will shoot a stream of water 30 feet in the air. Because of the amplified pressure difference, VASTLY more is allowed through the same size hose. A vacuum leak operates in exactly the same way.

Testing Your System

Testing your system for vacuum leaks may not be essential to success with The Gadgetman Groove, but it is strongly advised when you get a loss or only minimal gains. In this test, you are certain to find several leaks. If the line does not hold a 20" vacuum, then there is a leak there, and whatever is on the end of that line, or in the line itself, will need to be repaired.

TEST EVERY VACUUM LINE
THAT LEADS FROM THE INTAKE MANIFOLD!

In order to be SURE you have no vacuum leaks, to get the most out of your Groovy Ride, you are going to want to perform a vacuum test. Doing this is quite simple, although it can be quite a pain in the butt with more complex systems. Do NOT allow any mechanic with a "Smoke Machine" to tell you there are no leaks. Filling the engine with smoke *(pressure)* is definitely NOT pumping the system down *(vacuum)*. To eb certain you have no leaks, you must use a vacuum pump on every line.

The Tool for the Job

There is a variety of companies that now manufacture simple, hand-held pump-down units for this purpose. I use a cheapy, the MityVac 8000, but you can pick your own poison. Craftsman makes a

whole kit in a carrying case that runs about $100. Almost every parts house offers at least one, and the pricing runs around $40. Online, they can be found for as little as $20. We will also be making them available through our store in a very short while. These are predominantly used for bleeding brake systems. Just attach the pump to a line and squeeze the handle.

When You Find a Leak

What I recommend is putting a cap on the vacuum port wherever such a leak is found. The first concern is identifying a leak. Fix it later. The exception to this rule is the brake booster, as that would cause almost complete inoperability of the brakes. And THAT, we cannot have! Simply reconnect it and tell the owner (or your wife!) that it needs to be replaced. Then do it. (It was going bad any way!). Once you have sealed all the leaky spots, do *ANOTHER* mileage test. **THAT** is where the proof lies: in the results.

As to the actual process of testing, I am going to refer you to the owners manual. They all say basically the same thing, and one thing you should have learned by now, if you can't figure it out, and before you destroy anything, READ THE INSTRUCTIONS!!!

God bless you all and HAPPY MOTORING!

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