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LLOYD'Z Tech Tips: That pesky Backfire

In this installment I'll cover the main items that comprise the condition that vexes so many of you: that pesky backfire. These items are...

FUEL - In this case **gasoline**.

AIR - (We'll use the simplified term) primarily it's made up of **oxygen**.

SPARK - A source of **ignition**.

These are the 3 major elements needed to make combustion and are also responsible for causing backing when combined in a certain order. As we proceed I'm also going to throw in some sub-categories, and those are the topics that will most likely set the light bulbs off in your head and give you the answers you're looking for on this HUGELY discussed topic.

— **Much of what I see on the forums is inaccurate, incomplete or completely false.** —

Now that's all fine for the guys that sit there and put down that B.S., but what you don't understand is that it makes my life a pain in the ass - I'm the one that fields the calls and e-mails on why so-and-so wrote that and we know it's wrong.

The three main issues that result in a backfire on a motorcycle engine & exhaust system:

1. Lean conditions
2. Intake leaks

3. Exhaust leaks

Lean Conditions:

This is by far the most complex condition in terms of tracking down the culprit because there are many factors that can mimic or contribute to a lean fuel condition.

For instance, as the intake stroke occurs it is also pulling the charge of fuel into the cylinder, sometimes that cylinder fill doesn't contain enough fuel to make a complete or adequate combustion and a miss-fire occurs. This is the surging effect that can sometimes be felt at low speeds and which also causes a jerky throttle. The miss-fire contains super-heated, but not yet combusted, fuel & air mixture. As the exhaust valve opens and sends the mixture out the exhaust port into the exhaust system, a number of things can occur. On its way out, it passes its first potential obstacle, a leaky exhaust gasket at the head pipe. If the gasket is leaking, there is a fresh supply of air (oxygen) available and that nice cool air meets the super-hot and gaseous mixture and lights it off resulting in combustion and the resulting backfire. Your exhaust system in sense just became the engines combustion chamber, only the energy is now wasted, and the motor needs to pull in another charge of fuel and air hopefully this time it has enough to make adequate combustion. The engine now needs to work harder to overcome that miss-fire and combined with a lean air fuel ratio runs hotter, predisposing it to further exhaust pipe combustion. Moving further down the exhaust path, let's just say that the head pipe isn't leaky. The exhaust rushes down to the next obstacle, the joints where the pipes meet, if they're leaking the same situation occurs. There are at least 2-4 points of leaking pipes on a Vision alone. Now as that mixture moves further down the pipe it gets cooled and the further it travels the less the effect of it being light off by an air leak.

So why is a stock exhaust system less prone to backfiring? It has to do with lack of reversion and more backpressure. A stock system has an intentional blockage in the rear of the pipe, which increases backpressure inside the system and keeps fresh oxygen from being drawn in from the rear of the pipe forward. This 'back up' of pressure also forces more air out of areas that have leaks. A constant pressure to a leak of outgoing gas will not allow it to be sucked back in. If there is enough constant back pressure or just pressure that's builds in the exhaust system, it doesn't allow anything it re-enter it by reversion. If you look at an engine and the way it pumps air, it does it in pulses. If the exhaust is less restrictive it gives the negative pulse a chance to draw air back into the system in any way it can, mostly from the rear of the pipe where it is mostly open. However, it can also draw it through any leak that's not sealed off. The stock system, because of the increase of backpressure throughout the system, never gives the system enough time to pulse. As an example, take a rag and place it behind the exhaust of an open muffler. It will suck the rag into the system and push it out over and over again. A stock or blocked exhaust will only push it away.

Intake leaks that are problematic occur between the area below the throttle plates and the intake valve-sealing surface. It's the only area for which any additional induction of air can occur and affect the

process of normal combustion. It is also the shortest distance compared to the exhaust system. Pre-2008 bikes were easier to diagnose since they had a fixed state of idle adjusted by the throttle plates themselves. The only 4 areas of a possible leak on these early bikes occurred at the vacuum caps on the throttle body (just below the throttle plates), the area between the throttle body and rubber manifold, a leaky O-ring on the lower portion of the fuel injector, or a leaky intake valve seal. On 2008 and newer bikes we have a non-adjustable I.A.C. (Idle Air Controller) which introduces the biggest air leak of all.

Generally, Victory motors can yield a stable idle from a combined .130 orifice hole. The hole size in the I.A.C. is roughly .375, 4-5 times larger than needed to support idle alone resulting in the potential for all kinds of additional and unwanted air. Luckily, the I.A.C. doesn't allow the full potential of its .375 hole to be open at idle. It would be just too much and cause the motor to rev extremely high or not idle at all without the support of more fuel. It does however open further from its idle position when the throttle is activated and that's the problem. The more throttle the motor sees, the more the I.A.C. opens. When the throttle plates are snapped shut (such as when you blip the throttle or quickly throttle down to change gears), this is in effect a huge momentary intake leak resulting in a backfire. A slow deliberate return of the throttle can give the I.A.C. enough time to return to a closing position allowing only a small percentage of air through.

So, I've discussed how lean conditions are intertwined with exhaust and intake leaks. Now I'll talk a little about some of the subtler (aka mysterious) effects that produce backfiring and popping. I'm sure by now everyone knows that you need three things in order for combustion to take place; Fuel /Oxygen/Spark (ignition). You might never guess that when these are combined in a certain sequence, they too can produce backfiring.

Leaky injectors! The normal working order for an injector is to hold fuel at pressure until the signal from the ECU tells it to open sending the fuel out of the nozzle at a high pressure and in a fine particulate form. Now this next sentence was discussed to me from one of the top people in the field of Motorcycle electronic fuel injection. I may not always agree with all his statements all the time but this is a topic for which he has adequate real time experience with and I do not. Did you ever see a fuel injector leak? No I have personally NOT! Is it possible? Sure. When the throttle of your bike is closed the ECU shuts off the signal to the injector and tells it not to fire any more fuel. However at 53 psi, and with a faulty seal an injector can leak! Now you can't see it leaking because it's inside your motor, but if it does that can be the key to resolving a backfire when all other avenues have been extensively covered.

So what can be done? Well you can replace it and hopefully this new one doesn't have the same issue. You can control it by say, leaving some extra fuel constantly there and the injector working under decal. Nope that's an issue. There too much uncontrollable run on when that happens that can cause a severely unsafe condition. There is one more possibility and I can't say it as its effects are not yet known and were working on this to see if it's a plausible option. I don't want to give thought to someone and

have them try something that may cause an unsafe condition or issue HOWEVER I will keep you posted if it does indeed work. Ok that's one sub-category covered briefly.

Ok, take a deep breath now. The other is possibly YOU. Yup, some of you guys are just plain throttle jockys that love to wack the throttle. Is it a manly thing to do? Like Tim Allan would say HAR-HAR almost ape-ish. I know you don't have to explain it to me, your pipes sound really good and you like to hear them, OFTEN. I don't know who many of you are familiar with carbureted bikes.

Oddly, some carbs operate the same as these fuel injection bikes. A Harley with a stock C-V carb. (Constant Velocity Carb) works from air flow entering the venturi of the carb to raise or lower the slide as appose to a manual opening of the slide. At idle when properly tuned and warmed up you whack the throttle fast and hard from close to wide open and back closed again. What you'll get is a lazy but responsive rpm increase. Now let's take that same bike and throw a HSR Mukuni carb on, which is a flat slide 42 mm carburetor in good tune. You hit the starter button and it fires quicker and stabilizes idle faster. You whack the throttle in the same manner as the stock carb to find that response is much quicker and faster, and the rpms rise more in the same time. Now take that one off and install an S&S E carb. In a tuned state and warmed up, you can whack the throttle fast and hard the same way as the other two to find that it didn't even rev up. Hum what happened there? Well were not going to discuss carburetor function on this where just going to use them as examples as to their differences in response and function. All three deliver fuel and air but the manner in which they do effects their ability to perform differently from each other, the same way different fuel injection units do. It maybe the long and lengthy part to get to where I'm heading but I'm trying to do so in a way that most can relate and follow along. So how do you fix the response of a stock or S&S carb to make it respond like the Mukuni? Well you install the Mukuni. So how do we fix the response popping and backfiring of our systems? We sit down and try to understand exactly what's going on in each circumstance and move in a direction to eliminate/add and correct to obtain the best possible results.

There are things such as intakes, exhausts, fuel controllers and adjustable air valves on the market that all of us want to swap over to. Now keep in mind that your bike was tested in 1 (ONE) form, STOCK! It did everything it needed to do in that condition to make it to market. It may or may not have performed how you like it but let's face the facts guys. They can't make them the way you want them to run. It's IMPOSSIBLE with today's emission compliance. I don't want to hear well this other blah blah blah manufacturer doesn't have a problem. B.S! They all have the problem. Some show it more in different ways but it's all there.

So, we want to take our bikes and throw on a set of pipes, you're the 90 percenters, the stage 1 guys. This is where you find things changed and you don't like them. So, you look on line or ask around and end up on my web site where there is all kinds of eye candy and items to help cure what ails you bike. Now here comes the hard part to go along with the topics mentioned above about Air/Fuel/ Spark and intake leaks/exhaust leaks/and lean conditions. For every action there's a subsequent and equal

reaction. Some of those are good and some are bad. For the most part you can throw on a fuel controller and suppress or eliminate your issues, other unfortunate souls must dive deeper. IAV valves, exhaust gaskets are the next step. The ones with bad luck still have issues. Those that are still having issues still for the most part have not completed the full spectrum of fixing the leaks or curing the lean condition. I've talked to people on the phone and they've set up appointments to get the backfiring taken care of, the first thing I look for is a leak in the exhaust, 9 out of 10 times there's still one left and even a little bitty one is enough to cause problem.

So now we move on to you guys that have been playing Lotto for 30 years and still haven't even won a free ticket. (These are all just fictitious statements of course). You can't cut a break and still encounter that damn backfire. So, let's move onto the one condition you never want to admit. You throttle whackers! Remember that S&S carb that never rose off idle when you hit it hard? I can bet a dollar every time I get done tuning a carbureted Harley the first thing they do is start it up and WACK the throttle hard! And of course, it doesn't rev and sometimes falls on its face, then they look at you and say "It's never did that before," and I walk slowly down to them and say YUP! And you've never hit the throttle like that before. Try this, and I'll show them a nice smooth and linear throttle opening, now you can do it fast, but you need to know and have the feel of HOW FAST. Then they'll respond, "Yeah it does sound better now." So, what happened?

What happened was a learning curve. The excitement made them do something they don't normally do and a brief statement by me made them realize that they don't normally do that. Sometimes you must stop and look at the way you do something in order for you to realize how you're actually doing it. Your throttle behavior maybe a culprit in what causes a backfire or pop/cough through the intake. By being too fast or twitchy you're sending a gulp of air into the motor without its necessary fuel and the results are usually a cough or backfire. Now if you have a VFC-III you can move the Yellow/Blue down the scale to the lower numbers and this will speed up the fuel shot time, this may cause a drop in fuel economy but it something you can try and record the results. The IAV can be installed to decrease airflow from the IAC, some people have installed this and had remarkable results. Others haven't. Now if you install certain items such as the VFC and IAV on your bike and they don't give back favorable results then it just means you haven't solved the actual problem yet. Let me say this again.

If you install certain items such as the VFC and IAV on your bike and they don't return favorable results, then it just means you haven't solved the actual problem yet.

Not every product is a cure all, sometimes the things we cannot see are the ones hardest to correct. Don't forget about those leaky injectors. So how does one go about finding the cure?

My parting words are, start from the top.

1. Cure the lean condition
2. Cure all the exhaust leaks
3. Cure the intake leak
4. Cure the happy hand movements
5. Cure the leaky injectors

-Lloyd