Posted 13 April 2004 - 09:12 PM “Jeff in Ohio”

A proper procedure:

1. set TPS with everything backed off and disconnected to the correct 150mv value.

2. Balance throttlebodies using the throttle stop screws with the air bleeds screwed in and the linkage unhooked so that the TPS reads the correct value as indicated in the service manual (3.4 deg +/- .2 deg, roughly 500-525mv) The ECU is now set up so it knows the throttle plates are in the correct position for idle so all the mapping vs. throttle angle works out correctly. Your idle at this point will probably be be BELOW 1000 rpm and rather rough.

3. Open airbleeds and use them to balance to achieve the final appropriate idle speed of around 1100 rpm. Your idle should have smoothed out now. The airbleed screws are there to set your idle speed. **You will find that your airbleeds will end up being around 1/2 turn open** as stated in the factory manual.

4. Adjust the linkage so that it can be reassembled without having to open one of the throttlebodies more than the other - that is, the socket on the link should drop back on the ball without having to move anything.

5. NOW rev your bike up and synch using the white knob. You might find that of you took great care in step 4, that the white knob has to be turned very little if any at all.

6. NOW use the factory software and a CO meter to set the correct idle mixture. In a pinch without a CO meter, you can set the trim “like a mixture screw on a carb by adjusting it up and down” to achieve the best quality of idle. That is why the **software** is needed - **it is used to set the idle mix, NOT the airbleeds**.

The factory P7/P8 **EFI manual is a very good reference** since the system architecture is the same, even though final tuning values have changed. The new factory manuals are very good also, but some of the steps got jumbled in translation which is obvious when you read the two different sections they have (one to balance bodies, one to set the CO). Guzziology needs updated. It's section is very jumbled with some steps missing/mixed around possibly due to editing**. I have done this procedure on V11's and Cali's and it works - EVERYTIME. I have also received quite a bit of feedback from others on how simple it was to do and how much better their bikes ran afterwards...** Worthy of note in the manual, is that the **throttle stop screws** you guys are going off about. The manual says **'these are not used to adjust the idle'**, which they aren't **- thats what the bleeds are for**. Some of the values in the manual are off since it is for the old computers, but the **system architecture for the new machines is the same**, so the whole tuning procedure, etc holds. The main difference is when they say to adjust the throttle stops (with bleeds closed!!) to get the RPM to 800, you should be **adjusting them to get the 3.2 to 3.6 degrees (500 to 525 mv** or so). That, and the idle should be closer to 1100 rpm for the sport models, not the 900-1000 they give for Cali's. I've tinkered with a lot of bikes and **everything in the manual makes good sense**, thats why my procedure closely mirrors it. **Set the throttle plates up for the right TPS reading with balance, set the bleeds with correct idle speed with balance, balance the linkage holding everything together**, **set the mix.**

Go back tou your carb days. What was always first? Synch them, right? Then set the idle, the smooth out the idle with the mixture!

I'd like to offer some explanation behind my procedure and the one listed in the P7/P8 manual (procedure only, not end settings!) and the latest factory manuals. For a typical 1.5M equipped bike, the new factory manuals list the following specs….

For 1.5M equipped machines!!!!

Air bleeds – ½ turn out

TPS – 150mv +/- 15mv with linkage unhooked and throttle plates closed all the way (throttle stop screws backed off)

TPS – 3.2 to 3.6 degrees at idle. I have found this to be 500mv to 525mv using the factory software and a multimeter

Idle speed 1050 to 1150 RPM

CO% around 3.5% or so for Europe models (1.9% if you want to lean out your motor for the US EPA) 3.5% CO is an air fuel ratio of 13.4:1. Likewise a CO% of 1.9 is an air/fuel ratio of 14.2:1. If you have a lambda meter, you can use linear interpolation knowing that a lambda of 1.00 is air/fuel of 14.7 and a lambda of .9 is an air/fuel of 13.2 Or, if your are really on the ball, you will know that…

Lambda = (your air/fuel) divided by 14.7

OK, knowing this, lets examine what the motor and ECU actually do. An internal combustion engine is an air pump basically. Knowing this**, the best way to increase/decrease the idle speed is to introduce more/less air, not fuel. Increasing or decreasing the fuel at idle will have more effect on the quality of idle than the speed of the idle** (although speed will be effected some, the idle quality will go to hell before the speed sees a large effect by adding just gas). That is why the gas mixture adjustment is last and you set up all the air intake stuff first. The motor requires gas based on the amount of air. Think back to the good ol' carb says (that's what the ECU is trying to act like). We meter air with our throttle grip, NOT gas! As a consequence of air rushing thru the venturi of a carb, it picks up a metered amount of fuel from a jet. This fuel pick up is based on airflow, which is controlled by our hand. We directly affect airflow, which indirectly affects fuel flow. Fuel is controlled by airflow; the hand controls airflow. So, we must get the airflow fixed first! Knee bone connected to the thighbone, thighbone connected to the… so on and so forth.

The ECU takes in RPM, throttle position, air temp, engine temp, and air pressure to calculate the fuel required and sends a pulse to an injector instead of relying on air flow past an orifice in a venturi like on a carb. We are still not controlling fuel flow directly with EFI though! Our hand is still connected to a big ol' air valve (throttle body) on the inlet side of the motor. The settings of the air valve help the ECU figure out how much fuel to squirt. The ECU uses the RPM and throttle position ONLY when calculating timing and ignores the air pressure, etc.

Well, back in a lab in Italy somewhere, a Marelli and Guzzi engineer had a test engine. They determined that the above settings give the optimal idle performance to set the foundation for engine performance/efficiency. After establishing this foundation, they then proceeded to develop the fuel map and ignition map for the motor. Now to properly set everything in motion, the ECU in your bike needs to think it is back in the old country controlling that test motor. This means, it is expecting to see a prescribed RPM and throttle position at idle so it can set it's foundation to apply the appropriate ignition timing and initial fuel delivery signal.

So, how does one achieve the correct RPM and throttle position so the ECU thinks it is running that test motor? Well, that's why those tricky engineers gave you the air bleeds. Think of them as an air make-up screw. Since setting the throttle to give 3.2 to 3.6 degrees probably will not give you the 1050 to 1150 RPM right off the bat and we know adding more air will increase the idle, that is why the air bleeds are there. They provide 'make-up' air to get the idle RPM up to where the ECU expects it to be for the 3.2 to 3.6 degree throttle setting so it thinks your motor is that test motor. Turns out **that on Luigi's and Guido's test motor in Italy, the ½ turn made everything A-Ok to get the proper idle RPM at the prescribed throttle setting. You will probably find that your air bleed**

setting is very close to this.

So where does this whole balance thing come in at? Well, **your motor has two cylinders, so everything has to be matched from side to side as closely as possible. It is best to match each side as closely as possible before you link them with that silly linkage**, that's why you unhook it in the very first step! **You need to get each throttle body set up as damn near as close as possible before you even think of hooking them together** with some linkage. Also, the balance at each step needs to be achieved. That is why **you balance them with the air bleeds shut and the throttle position at 3.2 to 3.6 degrees (using the throttle stop screws) to begin with**. This ensures that the initial opening of each throttle plate is the same and that they will pass the same amount of air when they are cracked open with the throttle grip. The 3.2 to 3.6 degree setting is the first key value at idle the ECU is expecting. After we do that, the air bleeds (remember, they are giving make up air!) are cracked open to bring the idle up to 1050 to 1150 RPM to give the ECU that second key value it is expecting so that it can establish the proper base ignition timing and fuel delivery to establish a foundation for future action. **The air bleeds are balanced to ensure that both cylinders at idle are now receiving the same amount of air since the ECU assumes that they are since it does not have independent control/monitoring of each injector**. **The synch of the throttle plates with the throttle stop screws ensures equal airflow from side to side at idle and when the plates are opened by the twist grip. The air bleeds help assure proper idle RPM and equal air from side to side <u>at idle only</u>.**

So now at this point, you have two throttle bodies that are functioning identically at idle. NOW is when you can hook that linkage back up. The linkage is adjusted so that it slides together on everything without having to change any of the throttle stop screws or without having to lift one of the throttle plates off of it's stop screw. You will note that the linkage has a certain amount of slop in it. That slop is taken out using **the linkage synch screw so that both throttle plates open and close together**. That is why you do the revving up to 2500 rpm or so. **You need to synch to be maintained as the idle revs up to 2500 rpm and falls back down to idle**. So as you rev up the motor, **adjust the linkage screw so that good synch is maintained as the RPM goes up and down**. Notice I did not say hold the throttle at 2500 RPM and adjust the sync. You are looking for good synchronization at idle and as the RPM goes up and down**. If you have balance at idle and balance as the motor revs up and down, you will have good balance at a fixed throttle setting riding down the road**. After you balance the linkage **any minor imperfections** (unlikely you will have any**) in balance at idle can be taken out with the air bleeds screws**, NOT the throttle stop screws.

Now for the final piece to the puzzle. The ECU is seeing the expected RPM and throttle position for what the engineers deemed is idle and your throttle bodies are set up identical and the linkage is adjusted properly. Time to **sniff that exhaust and adjust the fuel mixture**. Trimming up the amount of fuel delivered at idle will now allow you to **smooth up that idle**, or in the EPA's view, provide the proper emissions. This fuel trim now gets your motor running the correct CO% that the Marelli/Guzzi engineers determined is correct for the foundation of their fuel map. With the fuel trimmer dialed up correctly, your motor is now running very much like that test motor back in the lab used to develop the fuel map. The fuel trimmer in the ECU is very much like a fuel mixture needle on MOST carbs (some Mikuni mixture screws actually control air, not fuel like on everybody else's carbs). What this means is that as you adjust the fuel trim to achieve a nice smooth idle (or a CO% if you have a gas analyzer), you may find that the idle speed changes ever so slightly just like when you used to fiddle with the mix screw on an old carb. If the fuel trim was way off, you may find yourself **re-adjusting the idle speed** ever so slightly – **use the air bleeds for this only**! If your mix was pretty close and very little fuel trim is needed to get a nice smooth idle (or correct CO% if you have a gas analyzer), you will find that your idle speed is not effected at all. You may notice by now I keep referring to smooth idle or CO% if you have a meter. Since the fuel trim in the ECU is essentially like a fuel mixture screw on a carb, if you are lacking a CO meter, it can be adjusted to give the best idle quality and everything (the CO%) will be close enough. You will note as you crank the fuel trim in the ECU up and down, it acts just like a mix screw on an old carb. So….. **crank it down until the idle quality goes to pot, then crank it up until the idle quality gets better then goes back to pot and set it right in the middle of that range and you should have the smoothest idle, and more than likely, your CO% will be right about where it should be.**

Now, hopefully the above clears up any questions that might be running around in your head behind why I wrote my adjustment procedure the way I did. And hopefully the next time you start twisting adjustments and fiddling with things on your throttle bodies, you will have a better understanding for what is actually happening……