

VM Carb Rebuild

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A big thank you to all the folks at GS Resources (www.thegsresources.com) for their invaluable assistance. Much of the information for this document came from studying threads and posts in the forum. Special thanks to Keith Krause for his help reviewing the document and his many suggestions for improvement.

This document and pictures are based on a 1978 GS750EC. Other 1977-1979 4 cylinder GS bikes should be similar. 1980 and later 4 cylinder GSs (and the '77 and later two cylinder bikes) use a CV carb which is a little different. There's another document on the GS Resources site that covers rebuilding the CV carbs.

Before you start

Read your manuals and study the diagrams. If at all possible while rebuilding, clean and reuse the stock parts (the metal parts, not the o-rings and gaskets) instead of the lower-quality items in the rebuild kits. Sometimes it's unavoidable if there's damage, severe wear, or no way to get the stock parts clean.

Find a place to work with enough room to lay out the parts as you remove them. Keep all parts on a towel. I used four egg cartons for the small parts—one for each carb. That way I could easily keep the parts for each carb together.

If you're worried about putting things back correctly, you can do one carb at a time or take them all apart except one, but it's harder to do that way and it's not necessary. There are enough differences between the parts that you can't mistakenly put one part in another's place.

When unscrewing the small brass parts with a slotted screwdriver, be sure to use a screwdriver with a tip that fits the slot. That will greatly increase the chance of removing them without stripping the slot.

Use carb spray with a tube attached to the nozzle. This really does a good job with varnish build-up. Use compressed air to blow out all the small passages. Be careful of back spray in your face or on painted or plastic items in the area. Sometimes when you spray or blow in a hole it comes right back at you or in some other unexpected direction.

If you have a digital camera, take lots of pictures—especially before you remove the carbs and before you disassemble them. They will be a huge help when putting things back together, especially routing hoses.

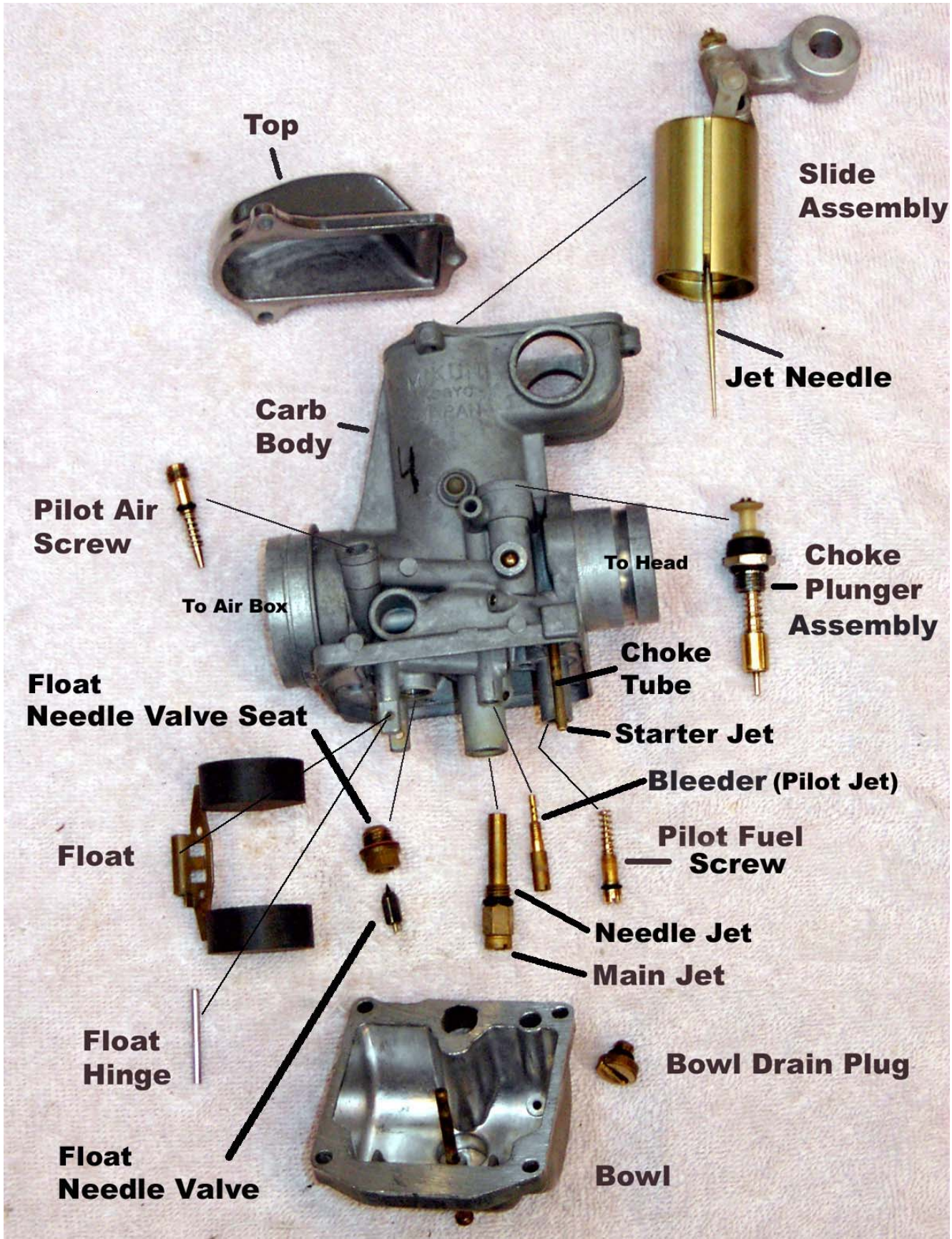
Parts you will need:

- Carb o-ring set. Complete, well-labeled sets are available from a GS Resources member at <http://www.cycleorings.com>.
- O-rings for carb/cylinder head boots. Get genuine Suzuki parts; they are made from a special rubber.
- Bowl gaskets
- Top cover gaskets

You may be able to reuse the top and bowl gaskets, but I would have some on hand in case they have to be replaced. You don't want to have to wait for a week or two to get them. You can purchase 'carb rebuild' kits from a lot of sources. They don't all have the same parts so be sure you know what you're getting. They almost all have the top and bowl gaskets, and a new float needle valve and seat. Others will have some or all of the jets, o-rings, and/or springs.

Tools and materials you will need:

- Carb dip. Berryman's is one brand—it's a gallon can with a tray for parts that you can submerge so they can soak in the cleaner. Gunk also makes one that is reported to be more environmentally friendly and do a better job.
- Carb cleaner spray with nozzle
- High-temp synthetic grease – for the pivots on the slide assemblies.
- High-temp bearing grease for the o-rings on the carb/cylinder head boots.
- Air compressor or other compressed air source
- Dental picks, toothpicks and Q-tips for the nooks and crannies– be careful not to leave strands of cotton anywhere
- Assorted screwdrivers and wrenches
- Wax pencil or crayon to label the carb bodies
- Lots of rags



Top

Slide Assembly

Jet Needle

Carb Body

Pilot Air Screw

Choke Plunger Assembly

To Air Box

To Head

Float Needle Valve Seat

Choke Tube

Starter Jet

Float

Bleeder (Pilot Jet)

Pilot Fuel Screw

Needle Jet

Main Jet

Float Hinge

Bowl Drain Plug

Float Needle Valve

Bowl

Remove carbs from bike

1. Remove the fuel line and vacuum hose from the petcock.
2. Remove the fuel tank.
3. Remove the crankcase breather hose at the airbox.
4. Remove the two bolts holding the airbox to the frame.
5. Loosen the screws on the carb/airbox boot clamps.
6. Remove the airbox. It can be a little tricky. Watch out for wires—you can snag them. And watch out for the drain hose on the bottom of the airbox.
7. Detach the throttle cables.
8. Before you take the carbs off, loosen the bolt for the throttle shaft stopper plate. It can be very tight and more difficult to loosen when the carbs are off the bike. It's between the #1 and #2 carb and fits in a groove in the throttle shaft to keep the shaft from moving side to side.
9. Loosen the screws on the head/carb boot clamps.
10. Remove the carbs.
11. Label each carb body with wax pencil 1-4. #1 is on the far left as you sit on the bike.
12. Remove the rubber manifold boots that go between the carbs and cylinder head.

Carb bodies

1. Remove the screws holding the carb bodies to the mounting plate and remove the plate.
2. Separate the carb bodies; remove the fuel lines and tee and the short sections of hose between the vacuum ports.
3. Remove the rubber seals that the throttle shaft runs through.
4. Once all rubber and plastic parts are off, use a carb dip and/or liberal amounts of spray carb cleaner and clean the carb bodies thoroughly. Use compressed air to blow out all passages. Pay special attention to the small hole(s) in the main throat. Carefully (watch for back spray in your face) spray every hole and passage you can see. Try to see spray exiting out at some other point to be sure that passage is clear. Clean them one at a time and relabel each one after it is cleaned (1, 2, 3, or 4).

Disassemble Carbs

Remove Throttle Shaft

1. Remove the throttle pulley spring.
2. Remove the carb tops.
3. Remove the stopper plate—note the little pin on one side.
4. Remove the bolts that mount to the throttle shaft. One bolt holds the throttle cable pulley on the shaft and the other 4 are under the carb tops.
5. Take off the outside rubber plugs and push the throttle shaft out. It helps to twist as you pull.
6. Take out the 4 slide assemblies. Keep them in order so they can be returned to the same carb body.

Remove Choke Shaft, Lifters, and Plunger Assemblies

1. Loosen the 4 screws that hold the choke lifters to the choke shaft.
2. Remove the shaft spring and screw on the left and pull out the shaft. Watch for a small spacer washer under the slotted part.
3. Remove the 4 choke plunger assemblies.
4. Disassemble and clean thoroughly. There is a rubber seal on the bottom of the plunger that cannot be removed and should not be exposed to carb cleaner. Clean with kerosene and brush.
5. Replace the o-rings.



Pilot air screws—also known as **side air screws, or pilot screws**, control air flow into the idle circuit. These are set at the factory for each cylinder—there is no standard setting. Before removing them, count the turns to bottom each screw and record the number so you can set them back there when you reassemble.

1. If they are sealed with paint, put a few drops of spray carb cleaner on them and let it sit for a few minutes. That should soften the paint. Use a GOOD fitting tool.
2. See if there is a nick next to the screw head lined up with one end of the screw slot. That is put there by the factory to help reposition the screw if it's removed. Turn each one in until it bottoms, counting the turn(s). Write down the number of turns then unscrew and remove.
3. Clean out any junk in the screw threads and remove the screws and spring and any washers.
4. Clean thoroughly.
5. Replace the o-rings.



Float Bowl, drain plug, float, and float needle valve

1. Remove the float bowl. Be careful scraping off the gasket material—the bowl has a ridge under the gasket to improve the seal—a razor blade or knife can easily scrape the ridge off.
2. Remove the drain plug and clean thoroughly—especially the center and side holes. They allow the bowl to drain without completely removing the plug.
3. Replace the drain plug o-ring.
4. Remove the float pin and note which way is "up" on the float.
5. Remove the float needle valve and the seat that the valve sits in. You should be able to reuse the washer under the seat. Keep the float needle valve and seat for each carb together and replace (if necessary) as a pair.
6. Pay close attention to the spring tension on the jet needles—the aftermarket ones are commonly very weak, and will allow the gas level in the float bowls to be too high.



Pilot fuel screws, also known as **Pilot Screws**, control fuel flow into the idle circuit. These are set at the factory for each cylinder—there is no standard setting. They are generally $\frac{3}{4}$ to $1\frac{1}{4}$ turns out from the factory. For a bike with a stock airbox and exhaust start at 1 turn.



Before removing them, count the turns to gently bottom each screw and record the number so you can set them back there when you reassemble.

1. If they are sealed with paint, put a few drops of carb cleaner on them and let it sit for a few minutes. That should soften the paint. Use a screwdriver that fits the slot.

2. See if there is a nick next to the screw head lined up with one end of the screw slot. That is put there by the factory to help reposition the screw if it's removed. Turn them IN first, counting the turn(s). Write down the number for each carb.
CAUTION, when seating these screws, seat them LIGHTLY. They have a sharp tip that can easily break off in the carb body. Because the threads are gunked up with the paint, they may be very stiff to turn, making it even harder to tell when they're bottomed. Put some carb cleaner on the screw and wait for it to soften the paint. As you're turning the screw in, go back and forth to further loosen the paint in the threads. (Don't lose your count!) Adding a few more drops of carb cleaner will also help. By the time you're close to the bottom, it should be turning easily enough so you can tell when it is gently bottomed.
3. Clean out any paint in the threads while the screw is bottomed so it doesn't build up when the screw is removed.
4. Remove the screws and springs.
5. Clean thoroughly.
6. Replace the o-ring.

Main jet and needle jet

1. Remove the needle jet and main jet.
2. Clean thoroughly.
3. Replace the o-ring on needle jet.



Bleeder (Pilot Jet)

1. Remove the bleeder.
 2. Clean thoroughly.
- Note – it does not have an o-ring.



Slide assembly

1. Remove the two phillips screws (down inside the top of the slide) that hold the linkage to the slide. Note the orientation of the plate under the linkage—the third hole lines up with the hole in the top of the slide.
2. Remove the needle. Note the position of the plastic washer and spacer, and write down the position of the clip.
3. Clean thoroughly, including each end of the linkage.





Slide assembly disassembled

Fuel lines and Tee

1. There are two types of fuel lines and tees—some have slots for o-rings (preferred) and some have a rubber sleeve with o-ring-like ridges (pictured). The rubber sleeves are no longer available and if disturbed may not seal again. You will then be forced to fabricate custom fittings or find some that use the o-rings. If extensive deep cleaning of the carb bodies is not necessary you may want to consider keeping them together and cleaning them as a unit. To tell if you have the sleeve type, look between the fitting and the fuel inlet on the carb body. The rubber sleeve is visible.
2. Clean thoroughly.
3. Replace the o-rings if they have them.



Reassembly

For each carb

1. Screw the main jet into the needle jet. Screw the needle jet (with a new o-ring) into the carb.
2. Screw in the bleeder (pilot) jet.
3. Screw in pilot fuel jet (with new o-ring) until it gently bottoms, then back it out the number of turns you recorded earlier, set to 1 turn out if you're not sure of the original setting. Final adjustments must be made with plug readings. See below.
4. Screw in the float needle valve seat with washer, then place the needle valve into the seat, position the float, and put the float hinge pin in place.
5. Adjust the float height to 24mm by measuring between the bottom of the float to the carb body at the gasket-mating surface (without the gasket) when the tab on the float just touches the needle. To adjust, bend the tab that rests on the needle valve. Measure both sides to be sure the two floats are even.
6. Screw the bowl drain plug (with new o-ring) into the bowl bottom.
7. Screw in the side pilot air screw (with new o-ring) until it bottoms, then back it out the number of turns you recorded earlier. Set to 1¼ if you're not sure of the original setting. Final adjustments must be made while running at idle. See below.
8. Screw in the choke plunger assembly (with new o-ring).
9. Attach the bowl (with gasket) to bottom of the carb body.
10. Reposition the rubber seals for the throttle shaft—leaving off the end caps for now.
11. Place the fuel lines into the holes on the sides of carbs with the tee in the middle. At the same time place the short sections of rubber hose between the vacuum ports on the carb bodies.
12. Attach the carb bodies to the mounting plate—use “blue” threadlock on the screws.

Final assembly

13. Install the slider assemblies—the slot on slider lines up with the raised guide in carb body. Gently lower the slide being careful that the jet needle goes into the needle jet.
14. Lightly grease the throttle shaft. Put the throttle pulley in position and install the throttle shaft. You can determine which direction the shaft should go by looking for the 5th threaded hole for the throttle pulley and the groove for the stopper plate. Put some extra grease in the 3 grooves on the shaft just before you slide them into the bearings. Use ‘blue’ thread lock on the bolts. Torque to 3.5 ft lbs (42 in lbs). Over tightening can cause binding and add to sync problems.
15. Install the choke shaft and lifters. Make sure each choke lifter goes on right-side up. They have a "bump" that contacts the plunger shaft and if you put some of them back in upside down, your plungers may be out of sync. There may be a little divot next to the screw. That faces down.

16. Perform a manual sync. If you already installed the idle screw, be sure there is clearance between it and the throttle pulley.

Fully closed position

Hold the carbs with the engine side of the carbs facing you. On top of the throttle valve arm is a slotted screw held by a nut. Loosen all 4 nuts, then all 4 screws. Start with the #3 carb. While watching the bottom of the carb slide, turn the slotted screw to fully close the valve (or as much as the slide will drop down). DO NOT turn it any more than necessary. When the slide stops dropping, stop turning. Do the other 3 the same way. Now carefully hold the slotted screws so they can't move and tighten the holding nuts. 3 ft/lb is good—don't over-tighten. If you think the screws moved when you tightened the nuts, re-sync. When done, the bottoms of the slides should look uniform to the eye.

Fully open position

On the carb bracket, by the throttle pulley, there is a slotted screw under spring tension—the throttle stop screw. When you fully open the throttle, the pulley will stop when it hits this screw. Turn the carbs so the airbox side is facing you. Raise the slides fully by pushing up the pulley until it hits the screw. Hold it there. Look up inside the rear of the carbs and note the bottom of the slides. The bottom of the slides should be 0.5 to 1 mm above the top of the intake chamber. If an adjustment is needed, turn the screw in to decrease this gap and out to increase the gap.

17. Install the idle screw knob with spring. After the screw contacts the pulley, give it another two turns. That should be enough to allow the bike to start.
18. Install the rubber manifold boots on the cylinder head. It is very important to replace the o-rings. Give them a good coat of 'hi-temp' bearing grease and torque them to about 6 ft/lbs—don't over-tighten—that flattens the o-rings too much and decreases their service life.
19. Put the fuel line and clamp on the tee between carbs 2 and 3.
20. Install carbs onto manifold boots.
21. Install airbox on to carbs. Be sure the boots are not pinched and the carbs are fully seated.
22. Tighten the screws on manifold boot clamps.
23. Tighten the screws on carb/airbox boot clamps.
24. Install the bolts on the brackets on top of the air box that secure it to the frame.
25. Attach the throttle cables.
26. Attach a bowl vent/overflow hose to the nipple on the bottom of each bowl. Route them to the right frame and through the plastic strap and down in front of the swing arm.
27. Attach the hoses to the nipples on carbs #2, 3 and 4. Route #2 and 4 hoses over the airbox and through the guide that is toward the right on the back of the airbox. They just vent to air. The hose on #3 will go to the petcock.
28. Attach the crankcase breather hose to the airbox.
29. Install the fuel tank—you may want to use an auxiliary fuel tank or set your fuel tank on a table next to the bike and run longer hoses to it. It needs to be off the bike to synchronize the carbs.
30. Attach fuel line from tee, and vacuum hose from #3 carb, to the petcock.
31. Turn the petcock to Prime (Pri) to fill the bowls. If any overflows through the vent hoses, turn the petcock back to Run (On) and tap the offending bowl lightly with a screwdriver handle. That may free up the float. If that doesn't help there may be dirt between the float needle and seat or they are bad and need to be replaced.
32. You can check the float height by attaching a special tool where the bowl drain plug goes and using a clear hose—the fuel level should be even with the top of the bowl.
33. Before doing any other tuning be sure the valves are adjusted and the timing is set.
34. Start the bike and let it warm up.

35. Set the idle to 1100 rpm.
36. Turn each side pilot air screw slowly (both ways) up to one full turn until you hear the engine speed max out. When the engine speed stops rising, stop turning. You may want to go back about $\frac{1}{8}$ turn to allow for listening error. These screws usually end up about $\frac{1}{4}$ to 2 turns out. Now turn the idle down to 1100 rpm using the idle adjuster knob. Go to the next carb and do the same thing until all four are set and the idle is set. Turning them in decreases air flow and richens the mixture. Turning them out increases air flow and leans the mixture.
37. Using a manometer, sync the carbs.
 - a. Remove the fuel tank and the tops of the carbs
 - b. Use the idle adjuster to set the engine speed to 2,500 to 3,500 rpm. Be sure to use several fans to keep good airflow going straight onto the engine from the front. The engine will overheat easily at that speed during the time it takes to do the sync.
 - c. All four carbs should pull the same vacuum. If your manual sync was done carefully, they should be close.
 - d. If they are different, loosen the locknut at the top of the slide of the carb with the highest vacuum and adjust the screw to match the lowest vacuum. Repeat until they are even.
 - e. Replace the carb tops and fuel tank.
38. To fine tune the pilot fuel screws, you'll have to test and take plug readings. Turning the screw out increases fuel flow and richens mixture. Turning it in decreases fuel flow and leans the mixture. Keep record of any adjustments. Even a $\frac{1}{8}$ turn will affect plug color over time. You may find that your final adjustments are not all equal. That is normal. The pilot fuel screws are intended to fine tune the pilot circuit and because of differences in each cylinder, the screws may have to be set differently from each other to get a uniform burn. These screws are sensitive and it can take some patience to get the pilot circuit right. Adjusting the pilot fuel screw will affect the mixture, so you have to re-tune the pilot air screws (for highest idle) after making adjustments to the pilot fuel jets. You may not notice any change in settings, but you should always re-check them.

One way to accurately get pilot circuit plug reads is to ride the bike around at a steady speed of about 30 mph in 4th gear. A few miles should be good and to avoid any color influence by choking the bike when it was cold. It's still better to do a "chop test" at the end of a longer ride though. As you pull into your driveway, quickly pull in the clutch and close the throttle and turn off the ignition. Coast with the clutch in to a stop and check the plug colors. Because the vacuum fluctuates so much at idle with these carbs, if you allow the bike to idle before this plug read, you'll get inaccurate results. Do what the plugs and performance tell you.

Obvious signs such as inability to hold a colder idle or slow warm up indicate the pilot screws are set too lean. A stumble just off idle is usually a lean condition too. Excessive popping on deceleration indicates a lean condition.

If it is very slow to return to idle it usually indicates a lean condition. If the bike is idling correctly and "blipping" the throttle once causes the engine speed to momentarily drop below the set idle, this suggests a rich condition. Don't try to trick the carbs and blip as quickly as you can, just a normal blip. Perfectly operating VM carbs can be "gagged" by blipping quicker than you would during normal riding and stops.

If you have trouble with re-starting and low speed riding at high elevations, try turning the side air screws OUT (leaner) about a $\frac{1}{4}$ turn or so. Set them back when out of the high elevation.