VM34/VM36 AFTERMARKET CARBURETORS

Post 1. Introduction, Selection, Mounting, Cables

Post 2. Baseline Jetting, Startup Adjustments (Mixture and Sync)

Post 3. Tuning
....General
....Midrange
....Main jet selection
Post 4. Slides and Air Jets: Some Additions
Introduction

Fitting VM-series round slide carburetors is a popular modification. Unfortunately, many inexperienced owners buy the carbs with unrealistic expectations. Mounting VM's is a custom modification, and there is no such thing as a bolt-on pretuned custom carburetor. The most any vendor can do is to supply a close baseline from which the carbs can be tuned to the individual engine and environment. There are no shortcuts.

If you expect, as one vendor's site claims, that new VM's will correct problems you are unable to resolve with your OEM carburetors, you will almost certainly be disappointed, and might be better off having your carbs remanufactured to spec. (check www.motorcyclecarbs.com). If you have experience tuning motorcycle carbs or are patient and enjoy detail work, problem solving, and learning as you go, VM's are a relatively economical option that can deliver enhanced performance and tunability.

Bear in mind that OEM CV carbs compensate to a significant degree for atmospheric changes (elevation, humidity, and ambient temperature) and the VM's do not, and are higher maintenance systems. Also, unless you're moving the battery and fabricating a custom airbox, you'll be committed to using pod filters, fabric or foam, which block up when wet (and no, stock frame covers won't prevent this). Finally, bear this in mind. The number of shops able and willing to work on vintage systems is dwindling rapidly. If you're not confident in your ability to complete the project, case your area for professional help. Bear in mind that while dyno tuning is costly, tuning and diagnostics from the saddle is extremely time consuming and even more costly.

These are the only downsides. Properly tuned, the VM carbs will deliver fine performance and mileage--my current engine, cammed, ported and bored (700cc), delivers 48 mpg in hard running with VM36's--except when the pods get wet!

It isn't my intention to rewrite the Sudco Mikuni Tuning Manual. Anyone who buys these carbs and is unwilling to spend $10 for that book gets no sympathy from me. The OEM carb threads were written for beginners, and included quite a few details that are not in print elsewhere. But for the VM's there's a detailed manual available and much of the material on carburetor anatomy in the OEM section applies, so I will not address float level settings, location of components, etc. in detail. If you buy the carbs, buy the book.

If it doesn't make sense to you, study till it does.

Selection

Every now and then I come across a thread (not at 650 Garage, I'm happy to say!) full of vehement argument on VM34 vs. VM36 carbs.

The experts are divided in their views, so we can dismiss the notion that amateurs have the last word to say on the issue in spite of the frequent ranting. In theory, the larger venturi of the VM36 should cost you a bit of low end power in exchange for a little more in the high rpm range; but master tuner Michael Morse reminds us that many successful 750 cc. race engines use the 34's, and claims that any gain in power achieved with the 36's would theoretically occur well past redline and would thus contribute nothing in actual use. At the same time, master tuner Bob Bertaut appears to favor the VM36 even on otherwise stock engines.

I've used both carbs successfully on both stock and performance engines, and in my experience performance differences between them are strictly marginal. Significant differences in performance and fuel consumption will be due more to engine condition, maintenance or tuning issues than to venturi diameter.

Mounting

The VM34 can be mounted either in aftermarket rubber boots from Mikuni or on billet aluminum mounts from Shell Racing, which set the carburetors back a bit for some performance gain in the lower rpm range. The VM36 can be mounted in either OEM boots for the BS34 (yes, you read that right; the OD of the VM36 spigot is only slightly larger than the OD of the BS34, and while it's a tight fit, it works well) or on Shell Racing mounts.

There's a bit more involved than simply bolting up the mounts and popping the carbs on. As a first step, fit the carbs to the mounts on the bench, remove the slides, and check for any up-steps where the spigot meets the mount. If you find a step, smooth it away by working the mount with a dremel or similar tool. Then hang the mounts and check for any upsteps where the mounts meet the ports after you've positioned the mounts for best fit. Work the ports slightly to match.

Cables

The usual setup consists of a primary cable from the twistgrip running to a junction tube in which the primary pulls a plate which joins it to secondary cables which pull the slides. It's also possible to use the two-cable throttle from early XS650's, eliminating the junction tube.

Some builders let the junction tube hang loose under the top tube of the frame. I prefer to secure it to the top of the tube under the tank with crossed pull ties.

Length is always an issue; even from the best and most experienced sources, a pre-made cable can only be an approximation. Bear in mind that the carb-top cable adjustors are used to set lift synch; if they must be turned out to eliminate cable slack, the cable assembly is too long. If the cable is overlength, there are two solutions.

One of our members (I think it was Slide) threaded a clutch cable adjustor into his throttle housing to take up the slack. The other solution is to shorten the cable. Open the junction tube and free the primary cable. Make sure that the primary cable end is brass (cast cable ends are not removable). Wrap several turns of copper wire above the cable end for a heat shield and heat the cable end with a mini torch, pulling gently as you heat it. Cut the cable and sheath to the length required and refit the cable end, fraying the cable slightly behind it; a probe stuck into the end of the cable works well for this. Melt 60/40 solder in a small vessel (your stovetop will work fine for a heat source). Step the heat up slowly till you find the point where the solder flows. Flux the cable and end with Ruby Fluid and dip into the solder until the end is covered. Hold 20 seconds or so, remove, rinse thoroughly with water, clean up with a file, and test.

For those who want to try making their own cables, all the materials (and some really trick tools as well) are available from www.flandersco.com. The site's well worth a visit.

Clearance between secondary cables and petcocks is often a problem. Replacing vacuum petcocks with the more compact manual units from Mike's XS helps, but even so it's usually necessary to lift the back of the tank. 45 degree carb top adjustors help; they're available from 650 Central, 650 Motorcycles.com, motorcyclecarbs.com, and Sudco.

Post 2. Initial Setup.

Baseline Jetting

Carburetors are delivered from Mikuni with generic jetting in place. These are available at a very low price; components required to jet for specific applications must be purchased separately, and account for much of the price differences among vendors. Sporting for Less, for example, claims to sell carbs prejetted for the XS650, and sells them very cheaply; but they send out only a few viably baselined carbs (a handful of happy campers is kept around to cast doubt on those who complain), and many that have received no modifications except changes of main and pilot jets. The generic needle jets and needles in particular work very poorly in the XS650.

The first step in setup is to strip the carbs, wash them with gasoline to remove any debris (metal shavings, etc.) left by the manufacturer, check float level, and inventory jets. Note that the float pin is a snap-in type; follow removal procedure given above for BS34's. The tiny brass air jet in the back of the intake bell should be removed if present; it's not used in our application. The generic slides usually work very well. The following baseline has provided excellent results; but remember, it's a baseline, not a recipe, and your individual build may call for mains outside this range.

Needle jet: 159 series, P5 or P6

Needle: 6F9

Pilot Jet: VM22/210 series, sizes 20-25

Main Jet: 4/042 series, sizes 180-200

Start with 3 pilot sizes: 20, 22.5, and 25; if most of your riding is done at high altitude (over 2500 ft.), reduce the range 1 step to 17.5, 20, and 22.5 and for mains, 170-190. Start out with jets in the middle of the ranges and the clip in the middle groove of the needle. These are baseline guides, not a recipe; your engine and situation may call for jetting outside these ranges.

Startup Adjustments: Pilot Mixture and Synchronizing

Before attempting carb adjustments, be sure that cam chain, valve lash, and ignition adjustments are correct, and that ignition components are in good condition. Prep. work on these systems will eliminate a lot of guesswork later.

Start with the mixture screws turned out 3/4 turn (note that the screws function in reverse from BS-series carbs; turning clockwise reduces air and richens, turning CCW adds air and leans). The large adjustment screws on the carb bodies control idle sync, blocking the slides from dropping to full closure. Bob Bertaut recommends setting idle sync by using the smooth ends of drill bits as gauges, inserting them from the air intake

end of the carb to the slide cutaway and increasing or decreasing size to achieve the desired idle speed (go to 650 motorcycles.com, then click on performance parts and then VM36 carbs). Try a 5/32" bit for an initial setting, move the screws equal amounts until idle speed is around 1100, then equalize settings with the drill bit method or attach a manometer.

The slides must also lift off the stops at the same time. To set the lift sync, loosen the locknuts on the carb to adjustors. With air filters removed, open the throttle and feel for the point at which one of the slides clears the venturi, then feel for the slide in the other carb. Set the adjustors so that both clear at the same time. Then fine-adjust by setting a thumb against one slide and a finger against the other and turning the throttle until the slack is taken up. You should feel slight movement in the slides as the cables tension. Turn the adjustors until both slides respond at exactly the same time. Once the engine is running, I prefer to follow up with a manometer.

Do rough adjustments on the mixture screws as the engine warms--whatever it takes to keep it running. Once a stable idle is achieved, set mixture screws by the dead cylinder method described for OEM carbs. Use the adjustor on the primary cable to control rpm's and conserve synchronization. If mix screws must be backed out 2 turns or more, decrease pilot jet size 1 step and reset. If they must be screwed in less than 1/2 turn, increase 1 size and reset. This is strictly a temporary selection--don't ditch the other pilots!

Post 3. Tuning

Tuning: General

Before you start the tuning process, go to a quiet room, assume the Lotus Asana, stare into a candle till your eyes cross, and chant this mantra: "The Hard Boundary is illusion, everything feeds everything else!" Continue until you achieve Enlightenment--the realization that everything you change in your carbies will alter something else, so that you fully expect the tuning process to lead you in tightening circles instead of straight lines (ain't that why they call 'em "circuits?") Richening the midrange by lifting the needles may force you to go a step leaner on the pilot jets; richening the mains may force you to drop the needles. Anticipate it; you'll be swapping brass quite a few times, and that's as it should be.

As long as the specified slides, needle jets and needles are in place, you should not need to alter them. You'll work with only 4 components in tuning: mix screws, pilot jets, needle position, and main jets. That sounds simple enough; but each component has strong secondary effects outside its area of strongest influence, and balancing these effects is the key to the process.

Three rules of thumb should be followed. First: In working with midrange tuning, pay attention to mix screw position. If best idle's been achieved with the screw fairly tight--.75 turns or less--a fairly lean PJ is in place. If there's richness in the low midrange, try working with the needle position to lean it. If best idle's been achieved at a wide setting--1.5 turns out or more--the PJ is already fairly rich; that makes needle position, again, a good guess for correcting midrange leanness. Second: Setting the needle clips in Position 1 (top groove, needle fully dropped) or Position 5 (bottom groove, needle fully raised) should be avoided. If balance between PJ size and needle position can't be achieved without going to these extremes, try using the secondary effects of MJ changes to bring settings within the range of Positions 2-4. Third: Make one change at a time, resetting mix screws after each change. Changes to neighboring components may be required, but don't assume--test first!

Rich and lean conditions can be detected from the behavior of the engine. I've offered only a few; an extensive list of troubleshooting symptoms is given in Sudco's Mikuni Tuning Manual, and as indicated before I have not attempted to rewrite it or provide a substitute for it. Apart from throttle chop procedures given below, don't rely on spark plug inspection to be very informative except for conditions so rich that plugs become sooted or fuel fouled.

Tuning can be done from the bottom up or the top down. I prefer to work from the bottom up; selecting the mains accurately involves hard running, and when an engine is fresh off the bench from a build it has to be broken in. The pilot and lower main circuits can be tuned decently during break in with the mains approximated, leaving final MJ selection for later.

Tuning: Midrange

Once the engine idles strongly and before attempting to ride, inspect the plugs and ensure that they haven't become sooted or fuel fouled during the initial adjustments (tip: it pays to have several sets of fresh plugs on hand). Also, wipe down the exhaust outlets, so you can check for sooting later. Then start up, let the engine come to operating temperature if cold, and gently roll (don't snap) the throttle to around 1/8 to 1/4 position and quickly back (avoid excessive rpm's). The engine should respond smoothly.

If the engine does not settle back to idle right away, try blipping the throttle; if that causes it to return to idle, a rich condition may be present (check appearance and smell of exhaust and check plugs for soot to confirm). If fuel screws are at wide settings (1.5 turns or greater), reduce PJ size 1 step, reset fuel screws (always by the dead cylinder method), and recheck. If fuel screws are already at close settings (.75 turns or less), raise the needle clips 1 notch and reset mix screws. If the setting is inside .5 turns, increase pilot size 1 step and reset. If the engine won't take throttle without dying or misfiring, ignition and other engine elements are good, and no rich symptoms are obvious, a lean mixture is responsible. If fuel screws are close, try 1 step up on PJ's; if wide, try dropping needle clips 1 step. Work with PJ's, clip position, and mix settings until off-idle transition is smooth.

Next, go for a ride. Pay attention to throttle position. Transitions from 1/8 to 1/4, 1/4 to 1/2, and 1/2 to 3/4 should be smooth and strong. If this can't be accomplished without going to needle clip positions 1 or 5, work with MJ selection, using its secondary effects to keep needle position in the effective range. Half-step needle adjustments can be made by shimming the needle clips with small washers; Radio Shack sells bags of mixed electronics washers that work well.

Remember that every time a change is made, mix screws should be reset. Also, remember that moving the needle by one step is a major adjustment; dropping the clip to lean the needle may force a change to larger pilots, raising the clip often forces a change to smaller ones.

Tuning: Main Jet Selection

The first step in main jet selection is to warm the engine to full operating temperature, run the bike up to around 3500 rpm in a lower gear--2nd or 3rd is a good choice--and open the throttle with a fairly quick roll. Don't snap it--that will make the world's best-tuned engine stumble. Roll it open.

If the engine sputters and responds weakly, mains are probably too large. Go down a step. If there's improvement, move down another step. Look for the strongest pull from the engine.

If the engine dies, then recovers when the throttle is closed a bit, or hesitates and then

takes off, a lean condition is indicated. Increase main jet size until the lag is eliminated.

Check behavior in rolloffs. If the power surges when you roll the throttle from WOT (wide open throttle) to 3/4, it's often a sign of leanness. See if increasing MJ's a step yields better power. If the engine sputters rolling off from WOT to around 7/8, it's often a symptom of richness; see if a step down on MJ's yields better performance.

For final main jet selection, the most accurate DIY procedure is to run a series of full throttle chops. Your first step is to go to www.strappe.com/plugs.html and print out Gordon Jennings' classic article on spark plug reading, and deprogram yourself. In terms of main jet selection, "nice tan color" is irrelevant, meaningless, mythic, BS, the stuff of ancient misinformation whose source has been reliably identified as Og the Cavewrench. The only significant piece of information about the MJ's you can get from a spark plug is from the smoke ring deep at the insulator base where it meets the wall of the plug. As Jennings points out, a ring of soot .040" (1 mm.) thick from the insulator base deposited at full throttle indicates mains rich enough for the safety of the engine. Pay close attention to what Jennings has to say about reading the plugs for evidence of detonation (presence of aluminum) and adjusting ignition timing to prevent it.

Make no mistake about it: the full-throttle chop is a hazardous procedure involving high speed, and if you have a competent shop with a dynamometer in your area they'll do the final tuning for you for a lot less than the price of a 3-digit speeding ticket.

Select your site carefully. A long, steep grade that will let you run at full throttle without gaining too much speed is a plus. A 1-mile run is minimum, 2 is better. Pick your pull-off spot in advance. Gap 3 or so sets of fresh plugs and pack 'em up with a range of mains and your tools. Make sure to include a small, bright LED light, a 10X jeweler's loupe, and a stiff wire you've marked in 1 mm. increments.

Install fresh plugs at roadside. The run starts when you hit WOT in 5th gear. Hold the throttle open. At the end of the run, hit the kill switch and declutch simultaneously, without letting the engine fire off WOT, and coast to a stop.

Don't confuse correct appearance of a new plug fresh off a WOT chop with correct appearance of a plug with some miles on it that's been used throughout the operating range. Off the chop,
the insulator should be white except for the medium-to-dark grey smoke ring, and fuel deposits won't have started to develop on the electrode and ground clip. Use the jeweler's loupe, light and wire to inspect the thickness of the smoke ring from the insulator base. If it's not visible at all or less than 1 mm. thick, reinstall the plugs, step the mains up 1 size, and go again. If it's over 3 mm. or so thick, install fresh plugs, step down a size, and go again. If aluminum flecks are present on the insulator or small balls of aluminum are welded to the electrode tip, go back to the barn and either retard timing 2* or so or install the high octane fuel you should have had in there to start with, before you go again.

Post 4. Slides and Air Jets: Some Additions.

Member panic has clearly tuned a few VM's over the years. He's supplied an important correction: the jet housed in the hole at 6:00 in the intake bell (a 2.0 if it's used at all; most recommend an open hole, and I concur) controls air to the main circuit bypass, which feeds a bit more air over the needle jet when the slide is low, easing transition from pilot circuit to main circuit. He's also posted some very nice material on slide selection. The following is quoted with his permission:

All 30-34mm VM use the same slide, except for:
1. locating pin diameter (2.05, 2.60, 3.05mm)
2. idle screw side (left/right) (most use the VM34/110 slide: 2.60mm, left side)
3. cutaway height (richest is 1.5, then 2.0, 2.5, 3.0, 3.5 leanest; size is arc height in millimeters at center)

36mm and 38mm do not use the same slide....

The slide cutaway is the "accelerator pump" on these, and greatly affects throttle response and low throttle open mixture.
If the slide is too small, response will be great but you'll be trying smaller and smaller needle jets to cure the "black plug 15 mpg" syndrome.
If the slide is too large, response will be poor, and you'll be trying larger pilots etc. to prevent that "pop-stall" problem.

For a 650 either a 2.0 or a 2.5 is a good starting point (there will be exceptions, but never a 1.5).
As engine size goes up (750), slide size should go up as well, typically 1/2 size to 2.5 or 3.0 (there will be exceptions, but never 3.5).
An intermediate 1/4 size leaner can be made (a 2.75 from a 2.5) by simply grinding or filing the center height by .25mm (.010") and blending the cut of the curve.
You may see suggestions that a richer slide can be made from the next leaner size (a 2.5 from a 3.0) by removing .5mm from the bottom seating surface. It's far more complex than that, and I suggest not attempting this unless you're desperate.

Thanks, panic!