

Fitting, Engines – Setting up – 2

TECH ENGINE SETTING UP PART 2

JETTING IN AND SETTING UP CARBURETOR INSTRUCTIONS

This follows on from PART 1 where I have explained how to prepare your engine ready to set up the jetting in procedure. We will cover as many popular carbs that MB have used over the years. If there's a carb not mentioned then the chances are we have not used one so we are not experts to give advice. But ALL carbs work in the same way so a lot of information is relevant and given enough jets you should be able to set up a carb whatever it is.

Jetting is easy if the motor is already run in – you set your main jet by riding flat out, you set your tick over and you adjust in between.....

BUT if you've got a new rebuilt motor or your fitting a new kit – run it in and follow this bloody procedure or be it on your head.....

As previously explained, fuel flow is very important from the petrol tank through to the float bowl so the engine can take what fuel it needs at any part of the rev range.

Always make sure a petrol cap has a breather hole in it, otherwise fuel does not flow from atmospheric pressure.

FLOAT AND FLOAT BOWLS

These are important as they control the amount of fuel which the carb can hold and supply into the engine. Most engines standard or mildly tuned do not need every thing to be fast flow. BUT it is always better to make sure the head of fuel from the tank can flow straight into a carb to prevent fuel starvation which can and does happen from engine to engine.

AMAL

Amal offer 3 float bowls; each has its own needle valve

- 1.6mm needle valve hole is for engines fitted with a fuel pump
- 3.2mm needle valve hole is standard with fuel fed by a petrol tank
- 4.0mm needle valve hole is for alcohol fed engines

Amal offer two floats

- Standard (large) fitted to all 28 – 34mm carbs
- Shallow (small) fitted to all 22 – 26mm carbs. Use the small float in all high revving engines

DELLORTO our preferred carbs

Dellorto offer a number of float needle valves

- 2.00
- 2.25
- 2.50
- 2.75
- 3.00
- 3.50
- 4.00

The smaller is fitted to low revving motors, the larger to higher revving engines, changing them controls fuel starvation

- PHBL 22- 26mm use 2.50 – 3.00mm
- PHBH 28 – 30mm use 3.00 – 3.5mm
- VHSA/B should use 3.00 – 3.50mm

Dellorto offer a number of float sizes, shapes and weights, usually standard works fine. Dellorto offer a various types of float bowls

- PHBL/PHBH are usually standard, plastic or alloy (there is no difference)
- VHSA/VHSB have varying sizes use the larger type to hold the most fuel

A word of warning! We have found that all flat slide Dellortos have a fault from the factory and require what we call a blue print modification. None converted carbs will get fuel starvation below 3/4 of a tank, (mainly on fast high revving engines).

A word of warning! Using an Amal power-jetted carb on a TS1 engine could result in fuel starvation at high rpm as the carb is at an angle and where the Power Jet is would suck air! Convert the carb to a none power jet type.

PWK Type carbs, Keihin, BGM, Stage6, OKO, Koso

The down side of the PWK type of carbs is – the fuel flow is slow, these are excellent on mild or low revving engines and usually work fine. But on a TS1 or high revving or powerful engine the engine can need more fuel than the carb can give! PWK's don't have removable float needle valves or smaller floats or larger float bowls as does the other carbs mentioned. Fuel flow can be adjusted by bending the float arm, we see this tip on forum threads but only helps the problem. Some recommend drilling out the float needle valve, we don't recommend this as they never let the float valve seal and when the fuel tap is turned on fuel leaks everywhere.

So many manufacturers now make a copy of the PWK type carb. We've found even if you do manage to drill out the float valve or the holes either side of it fuel flow doesn't increase! The internal hole feeding it is far too small, when the carb is modified then the fuel flow is good enough for a TS1. Genuine carbs are not bad at supplying fuel but the pattern carbs are not so good – because of this – MBS do not use Keihin carbs any more!

MIKUNI TMX 35mm

We have always found these carbs as they come from the factory that they flow

plenty of fuel for any tuned engine. We haven't found the need for different floats, needle valves or needed to alter the floats. It has been known for the push in needle valve to come loose and petrol will come out of the overflow pipes so check this if fuel leaks. Also if cables run against the float bowl fuel will leak.

Tuned engines tend to use up more fuel per gallon (especially TS1-RB type engines) a good way to help this problem, would be to have a Twin Tank Conversion by having your petrol tank and tool box modified, this will increase full capacity to approximately 13 litres. Today there are a number of aftermarket Twin Tank conversions and long range tanks available, these tanks holding extra fuel helps with head of fuel so some engines may flow fuel well these days – BUT always check these tanks fit with our MB inlet manifolds and carbs used.

RUNNING – IN, JETTING AND CARBURATION

Jetting is very important. Jetting is very misunderstood and can take years of experience to set a carb correctly. I will try to pass on my knowledge to help make your job much easier without complicating the issue. Different people and companies suggest different methods of how to run-in. This is MB's way and should set your engine for a long life.

CARB CHOICE FOR TUNES BEING USED

Lambrettas over the years have used various carbs. These carbs have come and gone depending on fashion or availability at the time. These carbs over the years have mainly been Amal and Dellorto carburettors with sizes ranging from 22mm to 39mm in tuned engines. Today newer versions have come along so we have updated this information from the older days of the 80's and 90's. All information given below is presuming the carb is a two-stroke type carb.

To identify a two-stroke carb, look down the main carb hole. Where the needle comes out as the slide is raised, a brass spray tube should stick up protruding into the main carb hole, if the brass spray tube is flat to the carb casting then the carb is a four stroke type. Stay clear of this type of carb, it is possible to jet them in but would require a total different set of jets and won't be listed below. Both carbs work in a similar fashion. 2-stroke carbs USUALLY have a brass spray tube sticking up from between 4 and 10mm. Some 2-stroke carbs do not have this spray tube, Dellorto in recent years have introduced the VHST 26 – 28mm carbs with no spray tube, we have used these to good effect in our racing autos but not so well in the Lambretta engine.

A word of warning! We only recommend rubber mounted carbs, solid mounted carbs can cause varying jetting changes due from internal engine vibrations which cause fuel frothing in the float bowl at various rev ranges, depending on what exhaust is fitted and where the power comes in the rev range. A word of warning! Over the years it was fashion to chrome plate carbs we do not recommend this as it causes jetting problems.

Carb sizes vary for different applications. MB usually set up a tuned

cylinder to suit a carb size and exhaust being used, basically the larger the carb the quicker your top end power, at an expense of losing some low down power! The smaller carb will promote lower down power but will limit a racing engine!

For example we did a Group 4 200 race bike, it did 25bhp at the time, it won loads of races. This engine used a 38mm carb and could do 85+mph with on track gearing! We put the same engine in a road bike and fitted a 30mm carb which then limited it to 75mph but stopped it been a high powered rev monster to an all round road bike that pulled like a train and that was only 8mm on the carb. We have set up a standard cylinder with 22mm carb and it did 10bhp with a 30mm it did 18bhp!

- Stage 3 oval port tune will require from 22mm – 26mm carbs
- Stage 4 oval port tune will require from 26mm – 30mm carbs
- Stage 5 oval port tune will require from 30mm – 34mm carbs
- Stage 6 oval tune will require from 34mm – 38mm carbs
- Stage 1 – 4 Round Port tune will require from 30mm – 38mm carbs

MOUNTING RUBBERS

Presuming that all carbs used are going to be rubber mounted then some care should be taken to use the correct rubber. Details of carb mounting rubbers can be found in our Carburetor information section.

Fit the mount to a clean dry carb and inlet manifold ends.

Always use the wide type jubilee clips!

Don't over tighten it – it will split the rubber!

Normal rubber Mounts tend to split anyway so always carry a spare.

MB now make improved rubbers to stop splitting and to help with modern fuels. A split or worn mount will allow air to be sucked in causing high revs at tick over and possibly worse – a damaged piston. Internal locating ribs and internal holes can be trimmed with a sharp knife if need be to make a rubber fit, like the Dellorto 2 groove mount. If dry and done up correctly carbs stay on. But there are so many manifolds out there, if a carb comes loose, use a bit of loctite to stop the rubber coming off and look to why its coming off.

JETTING IN INSTRUCTIONS AND UNDERSTANDING HOW A CARB WORKS

- From cold, closed to 1/8 throttle = choke, idle jet and air screw
- When started, closed to 1/8 throttle = idle jet and air screw
- 1/8 to 1/4 throttle = slide cutaway
- 1/4 to 3/4 throttle = needle jet (atomiser) needle position and taper of needle
- 3/4 to full throttle = main jet and (power jet if used)

The above explanation doesn't mean each jet only works in the settings shown. Each jet has to overlap to give a smooth throttle response. A main jet

effects most of the jetting through the atomiser/needle at low down speeds.

STARTING

Keep a mental note of this information whilst running and adjust if necessary. Carburetor jetting should be done with the engine at full operating temperature. This is the same if you have your engine set up on a dyno!

INITIAL STARTING

Providing your engine is built and set up correctly then it should be this easy to start an engine. Turn on your petrol, choke lever and ignition switch. Within reason, regardless of carb jetting, an engine should start after only a few kicks. Including full race spec motors. Firm kicks are required on or off the stand, as you kick slowly open the throttle up to 1/4 throttle. This is when the choke works correctly and the engine should fire..... or start up immediately. Don't worry if it doesn't, some new engines take a little longer until bedded in. If it doesn't fire after a number of kicks, check your spark, fuel and operating procedure.

Once the engine starts, turn off the choke after a few seconds, the engine should rev and run something like, then adjust the tick-over screw to get a fast tick over for approximately 30 minutes to bed in a new engine. It takes a bit of time to clear oil/grease from an engine rebuild this period allows normal assembly tolerances to bed in a little. Once the initial start up procedure is done slow down your tick-over to even beats, if all's fine, then you can start the running in procedure.

CHOKE JET (see choke jet table)

The choke jet works best from closed to 1/4 throttle. When starting your motor, it should start as previously mentioned with the choke mechanism this can be a manual choke on the carb if panels are not used (these are easy to set up, they work if the right assembly is fitted) or with the Lambretta choke assembly some of which can be temperamental with old or plastic versions. If your engine does not start ALWAYS check you have adjusted the choke cable so the the choke plunger lifts out of the carb, this is one of the most complaints that engines don't start because people do not set up the choke cable! Some adjust the choke so it is always ON, this will make setting up a carb very difficult! Spend time setting up the cable by trimming or adding adjuster screws to get the choke to work correctly. Or buy perfect fitting cables from MB Scooters.

If the motor fires and fires with each kick but doesn't bite, then the choke jet may be too small, but also, if the motor fires a couple of times then stops firing regardless of throttle position, then the choke jet could be too large. This is indicated by a wet spark plug. If you over do it and flood your engine, then it needs clearing. One way is to bump it off, easy when you know how, but get it wrong and the bike could start, shoot down the road dragging your legs behind you and will end up with you and the bike in a mess! You can clear it by removing the plug, turn off your petrol, ignition

switch and kick over your engine a lot of times at various throttle positions until the engine is cleared of excess fuel. This should blow out this excess fuel. Renew with a new dry plug and start the starting procedure again, usually with the petrol turned off until the motor starts. Once started like this it will smoke a lot! Until excess fuel is burnt out of the exhaust.

AIR SCREW AND IDLE JET (ALSO CALLED THE PILOT JET) ADJUSTMENT (see idle jet chart here)

The air screw varies from carb to carb

- On a Dellorto it's the smallest of the two adjustment screws on the side of the main carb body. The larger screw adjusts the tick over speed
- On Amal's it screws directly horizontally into the carb body, the screw next to it, screws at an angle this adjusts tick over speed
- On PWK's its the small screw at the front on the side
- On Mikuni's it's the smaller screw in the side of the carb

The air screw should be set correctly..... Carefully screw in the air screw until it stops then screw it out approximately

- Amal 1 1/2 turns
- Dellorto's flat slide 1 1/2 to 2 turns
- Dellorto PHBH and PHBL 1 1/2 to 2 turns
- Mikuni TMX 1/2 to 2 turns
- PWK 1/2 to 2 turns

Which way does the air screw work?

Screwing in – richens up the mixture

- Amal
- Dellorto flat slides
- Mikuni TMX
- PWK

Screwing out richens up the mixture

- Dellorto PHBL and PHBH

When finely tuning in, which may take some time or miles a 1/4 of a turn either way can make a massive difference. If you turn either way more than 1/2 to 1 turn, then a larger or smaller idle jet is probably required. (This may not be a hard and fast rule with flat slide Mikuni's and Dellorto's, the air screw is very adjustable!) The air screw (and idle jet which work together) can drastically affect jetting up to 3/4 throttle. This setting can be done on the stand when the engine is warm. This is easy to set. If your motor ticks over nicely, with regular beats, then you are something like. If your motor revs up and down erratically on its own, then the idle/air screw is weak. If your motor beats irregularly and lumpy, it may sometimes stall or flood, or spit out a lot from the carb, then it's too rich – exactly like if the choke is left on.

A nicely set idle/air-screw is when you rev up your engine and shut off, the motor should come down to its tick-over position, quite quickly. If the motor takes a long time to come down, then its weak. If it shuts down instantly, it is too rich! Once you are happy with the idle/air-screw setting, finally adjust your tick-over screw to give an even beat, as slowly as the motor will run without stalling. This could be from 1,000 rpm with a heavy flywheel to 2,000 rpm with a lightened flywheel.

Flat slide Dellorto's have another jet under the idle jet called an air jet! I find it best to leave it in as standard, some dealers remove it! There is very little information to what or how to adjust this air jet. Removing the air jet effects jetting!

SETTING OFF AND SLIDE ADJUSTMENT (see slide chart here)

It is now time for a road test, providing your clutch works correctly. Knock it into gear to set off, slowly open the throttle as you let out your clutch and your motor should bite, pick up and set off to a smooth even flow. If, however, the motor stalls, (providing you had enough throttle on or your clutch is not dragging), then your slide could be too weak. An over-weak slide would mean you would have to set off with the carb nearly on the main jet. A quick check if you think its weak, is set off with the choke still on, if it doesn't stall and pulls away then the slide is too weak. (This could also happen if an over weak needle, needle jet or idle jet is used, running too far at low speeds with the choke on would cause the motor to cut out!) If, however, when you set off the engine doesn't clean up and splutters, like running if the choke is on (called 4 stroking – sounds like machine gun fire), and you go through each gear and still doesn't clear, then your slide is too rich. If, once run in, you shut off from a high speed and the engine seems woolly and light, or thinly jetted, then it is possible that your slide is too weak. (Dellorto flat slides always seem to run light in this area!) It is very important to get this right for cruising at a later date. A good idle/air screw/slide set up would splutter (4-stroke) a little when setting off from cold, but would soon clear once 3rd and 4th gear is reached.

NEEDLE AND NEEDLE JET ADJUSTMENT WHILST RUNNING IN

At this time, it is advisable to check out your needle jet (atomiser) and needle settings. This could be the most difficult of jets to get perfect. If you open up the carb under normal acceleration and there seems to be a flat spot on the mid range. (Not to be confused with a peaky expansion chamber) ie it doesn't really start to pull until the carb is fully open, then it is likely that the needle/ needle jet is too weak. If, however, you open up and the motor suddenly splutters, then suddenly clears as the main jet comes in then you are too rich. The motor should pick up cleanly through all jets up to the main jet.

Needle adjustment

- RICHEN move the needle clip downwards to raise the needle out of the carb
- WEAKEN raise the clip to lower the needle in to the carb

A basic guide is, if you get to the top clip position you may require a smaller needle jet. If you get to the bottom clip position then a larger needle jet is required. Then further testing is required.

Amal supply a number of needle jets (atomisers) coming in different sizes, (See Amal Atomisers chart) they also offer a short and long type which are inter-changeable between carb bodies. The short version gives a richer mixture and the long version gives a weaker mixture. But Amal only offer one needle per size of carb which makes Amals the easiest to set up! But seems very crude compared to Dellortos.

Dellorto's supply a number of different needle jets (atomisers) coming in various sizes and shapes. (See Dellorto Atomiser chart) Dellorto like Amal offer a long and short type of needle jet. We will consider a long type as a standard fitting, the short type a race fitting (the short type gives an enrichment of fuel under acceleration) With this they offer a large variety of needles which alter in thickness, taper and size, making Dellorto's harder to jet in. For this reason you can finely tune in your carb, given the time and money. There are a number of needle jets (atomisers) / needle combinations that work. This can be a hit and miss affair to start off with. See jetting examples later on.

Mikuni TMX 35mm does not have a needle jet, it is fixed in the carbs body which can and does wear on a Lambretta. Mikuni only offer a fixed number of needles to set up the mid range.

PWK carbs also have a fixed needle jet in the carb body and like the Mikuni the PWK offer a larger number of needle jets to compensate!

DELLORTO NEEDLES AND HOW THE SHAPE WORKS (See the Dellorto needle chart here)

All needles work in the same way as described below, Dellorto over complicate it by offering 3 stage tapers where as most needles have a single taper. Most needles have 3, 4 or 5 notch positions to adjust needle heights, usually carb makes use different E clips to adjust the needle.

- A The needles diameter affects the mixture strength up to about 1/4 throttle
- B The needle tip affects the richness of the tapered part
- C The tapered part affects the operating period between a 1/4 and 3/4 throttle
- D Effects throttle position at approximately 1/2 throttle
- E Effects throttle position approximately between 1/2 to 3/4 throttle
- F Effects throttle position approximately between 1/2 to 3/4 throttle

We offer various needle jet sets, the rest are available individually

- Dellorto D needle sets for 22, 24, 25 and 26mm Dellorto PHBL carbs
- Dellorto X needle sets for 26, 28 and 30mm Dellorto PHBH carbs

RUNNING IN PROCEDURE

All engines should require some running in regardless of engine type. A well

run in engine usually lasts a lot longer than a poorly run in engine. Loosely follow this procedure. These running in instructions are mainly for a cast iron cylinder, for alloy cylinders if you set up well then you can run in within 200 – 300 miles. Or if not sure do the fully running in period and get used to your engine.

- For the first 100 miles take it very steady. Only drive around back streets, stop and start using all gears, let the motor cool and start again. A perfect time to adjust cables and brakes and tighten anything after a rebuild
- For 100 – 500 miles drive around town/villages. Avoid motorways and dual carriageways. Vary your speed and alter your idle jet/slide/needle and needle jet as you get used to your motor. Don't stick at constant speeds. Avoid driving two-up or making the motor pull hard into winds, pulling hard up hills and avoid screaming the engine there is no need for it. Occasionally increase your speed, giving it a quick burst. This will clear out the motor, as a tuned motor can tend to choke up a little at low speeds. Still adjust cables, brakes and check tyres and pressures

A correct idle, slide needle and needle jet setting would give a responsive action as you open up the carb and the motor may well start to really pick up as you reach the power band.

Avoid constant speeds for miles because you only use one jet. If that jet is too weak then you could seize or blow a hole in your piston. If you vary your speed at least different jets are being employed and there is less chance of a problem.

MAIN JET ADJUSTMENT WHILST RUNNING IN (see main jet table here)

At around 800 miles it's time to check out your main jet. This is quite easy and most important for setting up a carb.

Increase your speeds so as to use the main jet, ie 3/4 to fully open on your carb. If you hold it flat out in 3rd gear for short distances on a straight, smooth, quiet road and the motor splutters (4 strokes like the choke comes on) then your main jet is too rich. Slowly come down a main jet at a time until the motor just clears – this basically sets the main jet and this allows the rest of the jets to follow suit. Avoid screaming the engine, as there is no need. (This can be done after the engine is fully run in)

An over-rich main jet would mean that as you shut off to change gear, the 4-stroking will disappear until opened up to the same point again. With open carbs a quick look down when riding at that position could confirm this with a jet of petrol coming out. Some times a motor may seem to hold back and cease to rev, if your not sure go up a couple of jets to confirm if it gets worse. When opening fully it may miss a beat slightly (it sounds like an electrical problem) and it may also seem to cut out, this could indicate an over-rich main jet. If, however, you open up and no splutter occurs and seems perfect, it could be best to go up on the main jet until it splutters just to make sure. It is possible that it is perfect but it is better to be safe than sorry. A classic example of a weak main jet is when you are flat out and you

shut off to slow down, or change gear. If your motor speeds up (not to be confused with clutch slip!) then increase the main jet. A weak main jet could be indicated by a backfire, as there is a lack of fuel being delivered. Most people only change the main jet, not understanding the rest of the jets, this becomes a common problem. Because the main fuel system is fed through the main jet hole, then alteration can affect running, right down to the slide, so most people get away with it! With the main jet something like, leave fine tuning until after the running in period.

POWER JETS (See Amal power jet chart)

In the past mainly Amal 28 – 34mm carbs used power jets. A power jet comes in when the carb is fully open and revving flat out. It doesn't give an instant power boost. What it does is allows a smaller main jet to be used therefore cleaning up carburation lower down and in the mid range. The power jet substitutes the main at high speed. If using a power jetted carb the power jet and main jet added together would equal a normal main jet size! A word of warning! Don't use a power-jetted carb on a TS1/RB engine, the power jet is situated in the top of the float bowl and is possible to suck air in at high rpm causing problems!

Some PWK's come with a Power Jet, as standard they come with the same main jet then add on a bigger P/J so the bike is hard to set up.

At present there are some newer bolt on after market Power Jets which have become all the rage based on a Mikuni item. These work in the same way but need fitting professionally. To fit the Power Jet you need to drill the Carbs bellmouth and tap the hole then screw in the Power Jet. From the Power Jet a plastic pipe needs fitting to a pipe which needs screwing or gluing into the bottom of the float bowl. Once fitted the Power Jet has a screw which either lets in more fuel or less fuel at the point where fuel will be sucked out of this new jet. For the Power jet to work the main jet needs decreasing.

To see what jets sizes are available for each carb click here to..... PART 3

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