

## AMAL Concentric Carburetors (updated to include Premiers)

I gratefully accept comments, and criticism. They can be sent to johntioc at aol.com.

### THE BASICS:

Get comfortable, this will take time to read:

### **It's the needle jet stupid: (coined by Don Hutchinson who co-hosted many of my Tech Sessions.)**

If there is one thing you come away with, from the time you spend reading this, is how important the needle jet is to every day performance of your motorcycle. To put this in perspective, a change in size of the needle jet's metering orifice equal to 1/3rd the diameter of the average human hair, (one thousandths of an inch .001"), will make the needle jet too rich or too lean.

In practice the typical 4 stroke needle jet's orifice is .106". A needle jet that has an orifice of .105" will be too lean to a point where it could introduce unwanted detonation. A needle jet that has an orifice of .107" will be too rich where it will significantly reduce fuel mileage and could foul the spark plug. The needle jet is in play in the throttle positions where we ride these bikes the most: closed to half throttle.

Another thing about the needle jet when you are experiencing problems at low throttle openings (below 1/4 throttle) is the size of the cross drilling located on the hex of the jet. The normal size is .035". If it is smaller, or larger than .035" it will change the amount of the fuel delivered significantly.

**Caution: There are about ten odd people manufacturing needle jets around the world. When you see reference to using plug gauges to verify the needle jets size we are referencing checking new needle jets. Not all needle jets on the market have the jet orifice that is marked on the jet. The new .106 could have an orifice of anything but .106". While you can get an idea if a needle jet is worn with an smaller than standard orifice plug gauge, it is better to routinely change them from a know supplier like Burlen.**

**Don't underestimate the importance of the proper grade of the spark plug: You should tune to the manufacturer's recommended brand and grade spark plug.**

The grade of spark plug recommended by the motorcycle manufacturer is an important base-line for carburetor tuning. If you are fouling the recommended spark plug you should **never** change to a hotter grade plug in order to correct the problem. You do this with risk of causing severe damage to the engine.

**The plug is not fouling because you have the wrong grade of spark plug.**

All spark plug cross reference by brands are not always accurate for a particular motorcycle. After extensive testing at MIRA (UK vehical testing grounds) Triumph found that the NGK B8ES was not equivalent to the Champion N3. In the Triumph hemi-combustion chamber the B8ES was equivalent to a Champion N4. The B9ES turned out to be equivalent to a Champion N3.

With Amal, and most Mikuni carburetors, you are dealing with instruments that have multiple tuning stages. Typically it will be only one of these stages that is causing the problem of fouling a plug. This leaves the others to deal with the wrong grade plug. For example let's consider a worn needle jet.

The needle jet's orifice's size will have its most influence below half throttle. Yes, that hotter plug will burn off the unburnt fuel from the plug below half throttle caused by a worn needle jet, but when you take the bike out on the highway, and running above half throttle, the fuel mixture will be too lean for that hotter grade plug. This brings you are one step closer to catastrophic destructive pre-ignition and detonation.

Add a few other factors like an abnormal increase in ambient air temperature, changes in barometric pressure, fill up with a tank of fuel where the octane rating is not up to snuff or you roll the throttle on

without shifting down to drive up even a slight grade (effectively lugging the engine), and you are ever closer to that hotter plug causing expensive problems. You better hope your cell phone's batteries are charged.

**Note: Lugging is when you open the throttle and the engine doesn't respond with an increase in rpm.** A variable venturi carburetor relies on the incoming air's velocity. The faster it passes through the venturi the more lift (vacuum) it develops. The more vacuum (differential in pressure between the venturi and atmospheric pressure) the more fuel will be drawn into the intake manifold. The difference in pressure is the result of the piston drawing in the air/fuel mixture as it descends down the cylinder bore. The actions of the carburetor and piston have a symbiotic relationship.

If the piston doesn't pick up speed (increase rpm) as you open the throttle air velocity decreases. You are letting in more air with less fuel being drawn into the venturi. The air/fuel mixture becomes very lean. This dramatically increases the chance you will suffer detonation, and or, catastrophic pre-ignition. Most of you will have heard about the SU carburetor. This design prevents you from lugging the engine. It is of a constant-depression design (often called Constant Velocity or CV). Another approach used before computers came into use is the vacuum operated shift mechanism. It shifted the transmission into a lower gear when the intake vacuum fell as you depressed the throttle. This was often miss-named a "passing gear." Today the computer does all the thinking and with the transmission having 6, 7 or more gears you hardly feel the transmission shift to a lower gear when the computer senses the engine is being lugged.

When I learned to drive Dad would palm slap the back of my head if I lugged the old Plymouth six. He was a field stone mason with hands the size, and strength of a gorilla, but that's another story. If you open the throttle, and there isn't an immediate increase in engine rpm, that pinging (often un audible) is telling you to shift!

My point here is with a standard engine, tune to the manufacturer's recommended plug. **They were not stupid.** Be sure to mark your throttle so you know where to make your changes. But of course, if you change the compression, cam timing, etc. this must be taken into consideration when selecting the new plug, and jetting, you will be using, and that's another story.

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## Do your home work before you start thinking about tuning a carburetor!

### Be sure of the following:

All of the things will effect manifold vacuum as manifold vacuum directly effects how a carburetor works:

- New points and condensers are installed, and timing set.
- Manufacture's recommended spark plugs are installed
- Valves are adjusted and bike passes a compression test. (Compression is very important when starting the engine. The incoming air/fuel charge must to be able to reach 140° F (temperature varies with the season) for the fuel to vaporize (reach distillation temperature) before the spark plug can ignite it. The ambient air temperature alone is not enough to get the fuel to 140° F. Compressing the incoming air/fuel charge provides the additional heat required to vaporize the fuel.
- If one is installed, the air cleaner is clean.
- Factory recommended jets are installed, and are not worn, corroded or damaged. I confirm their size before I install them.
- The float bowl gasket surface is flat, and not warped from over tightening.

If warped you will have an air leak breaking the fuel pick-up from the bowl for the pilot (idle carburetor) circuit.

- The fuel cap vent is clear, and there are no air leaks in the intake manifold or balance tube.
- The fuel taps, fuel line, fuel filter and fuel connections will flow enough gasoline.
- You know how to operate the choke. Yes, I am serious as this has been a problem in the past.
- You have installed new jets especially the needle jet.
- The fuel tank is free of rust! Very fine rust from the tank can block the fuel filter (causing a lean

condition) and get under the float needle causing it not to seat (causing a very rich condition). There should be absolutely no signs of microscopic rust in the fuel!!

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## When Tuning the Carburetor You Must Mark the Throttle.

While riding you have to be able to **quickly, and safely**, determine which one of the fuel circuits you are using at any specific time.

To tune the carburetor you **MUST** know where the slide is.

Is it?

- closed to 1/4,
- 1/4 to 1/2,
- 1/2 to 3/4 or
- 3/4 to full throttle.

There are specific fuel circuits related to each of these throttle positions. **Engine RPM or motorcycle's speed have NOTHING to do with tuning a carburetor!** For Example: If the problem you are experiencing is under 1/4 throttle it will not be the needle clip position or main jet (as long as the main jet is near, or preferably, a bit richer than the recommended size for the bike you are working on). If the problem is between 1/2 and 3/4 throttle it is not going to be the position of the Pilot Air Screw or Slide Cutaway or Main Jet. Knowing the throttle position, and which fuel circuit services the carburetor at that point, will put you way ahead of someone who is using "Wild Ass" guesses. I cringe when I hear someone say referencing to their Amal or Mikuni VM, "My bike is running lean. I must need a larger main jet." You should always ask yourself at what throttle opening is the bike running lean, then plan your moves accordingly.

### Two Carburetors in One:

To better understand the Amal carburetor it is best to look at it as two carburetors ;

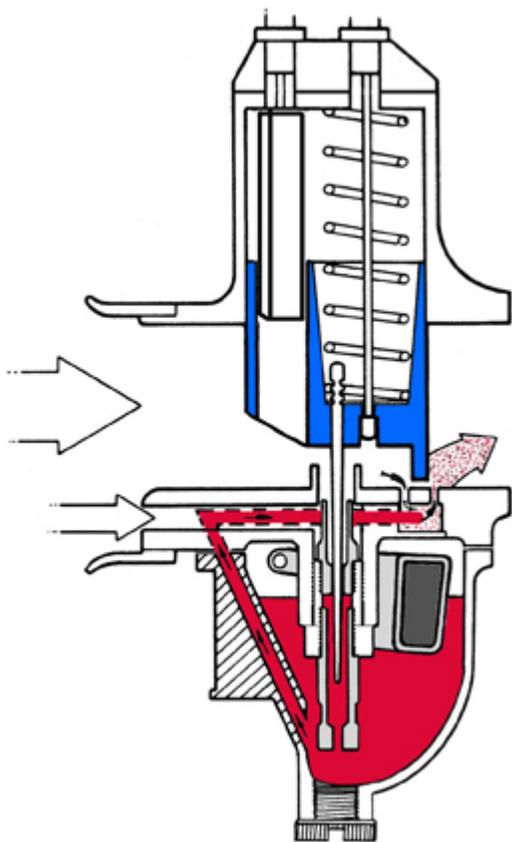
**Idle and Main.** The idle carburetor handles STARTING, idle and very low throttle opening. It is made up of the Pilot Jet (equivalent to the Main Jet in the main carb.) and Idle Air Mixture screw (equivalent to the slide in main carb.).

It is the **Main carburetor** that takes you from very low throttle openings right up through wide open throttle (WOT). The two carburetors each have a main jet and variable air supply while they share a common fuel supply.

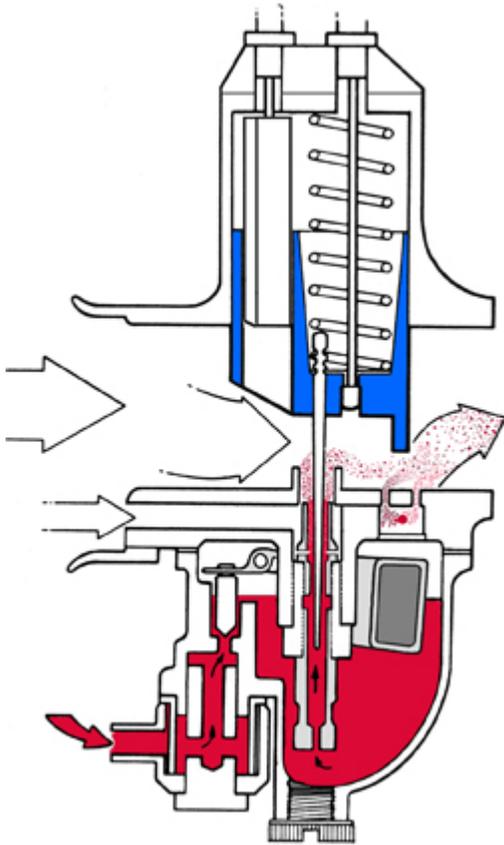
The Idle Carburetor's Pilot Jet is its "main" jet. The Pilot air Screw controls air flow drawing fuel from a shared float bowl. The fuel air mixture is delivered into a small mixing chamber under two Transfer Ports. The Transfer Ports are located each side of the back edge of the slide. They are the Primary, the smaller of the two (0.027"), located just behind the back edge of the slide and the Secondary, larger than the primary (0.040"), and located under the back of the slide.

- The typical Pilot jet in a 4 stroke version of the Concentric is pressed into the body. It is located behind the Pilot Air Screw and has a diameter of 0.016" i.d.. A lot of people with Amal Premiers used on the **Norton MKIII 850**, with removable pilot jets are finding a .019" pilot jet (622/502-19) works best.
- The pilot jet's orifice is not a hole! It is a jet. A jet has a specific size. Poking something through it, or relying on ultra sonic or carburetor cleaner, will not work. If it is not cleaned to a specific size the bike will be hard, if not impossible to start.
- The Pilot Jet in a 2 stroke version is screwed into a threaded hole at the base of the main body. When the pressed in Pilot Jet has been enlarged by accident or on purpose, on some 4 stroke motorcycles (not triumph 500 Daytona), you can use the 124/026 two stroke jet screwed into the body.
- There are two small idle circuit transfer ports adjacent to the back edge of the slide. The smaller, Primary, transfer hole is 0.027" while the Secondary is 0.040".
- It is the Primary transfer port (smaller) that supports idle and transition between idle and main carburetors.

- The Secondary (larger) has two functions. At idle it feeds additional air into the mixing chamber. The change in vacuum as slide just lifts from idle reverses the flow through the Secondary port. It now instead of passing air into the mixing chamber it draws additional fuel into the venturi. This additional fuel helps to make the transfer from the idle carburetor to the main carburetor smoother. It is equivalent of the accelerator pump.
- The Slide Cutaway is an important adjunct to the Idle Carburetor and helps make the transfer from the Idle Carburetor to the Main Carburetor possible. If the carburetor will not take throttle from idle, and the engine stops running only to start again as you close the throttle, as you rotate the twist grip the slide is too lean. If it runs lumpy for a short time only to clean out as the slide is lifted it is too rich. The larger the cutaway the leaner the mixture will be.
- If the bike is hard, or will not start, or won't idle it is quite possible there is something wrong with the Idle Carburetor. A blocked pilot jet is typical, but don't overlook a blockage of the fuel passages or an air leak at the float bowl gasket because of a warped float bowl. Even very fine rust from a fuel tank can fill the fuel filter and block the flow of fuel. That fine rust can actually keep the float needle from seating.
- It is important that all jets and their orifices are clean and on size. These are jets, not holes.



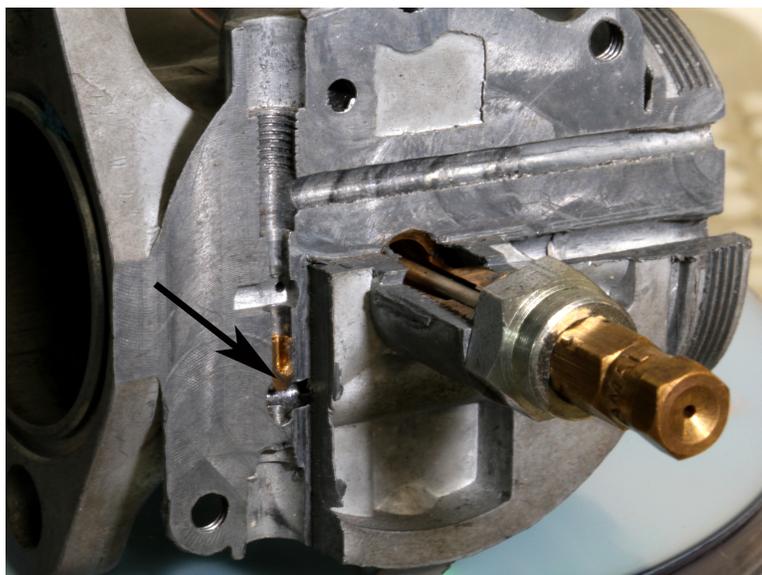
The slide is in the idle position. The secondary transfer port under the back edge of the slide is taking in air into the small mixing chamber just under the two transfer ports. The fuel/air mixture that supports idle is ONLY coming out the small primary port just behind the back edge of the slide.



**As the Slide is lifted: The Secondary transfer port reverses flow and is now drawing fuel from the mixing chamber adding to what is coming out of the main carburetor's spray tube. It sort of acts like an accelerator pump in an automobile carburetor.**



**• A warped float bowl from over tightening the float bowl screws. The fuel supply passage for the pilot jet passes fuel from the float bowl to the main carburetor body through the float bowl gasket. If the bowl is warped the gasket will leak air into the pilot fuel passage. Fuel will not be delivered to the pilot circuit. If the bowl is warped it must be flattened, or replaced.**



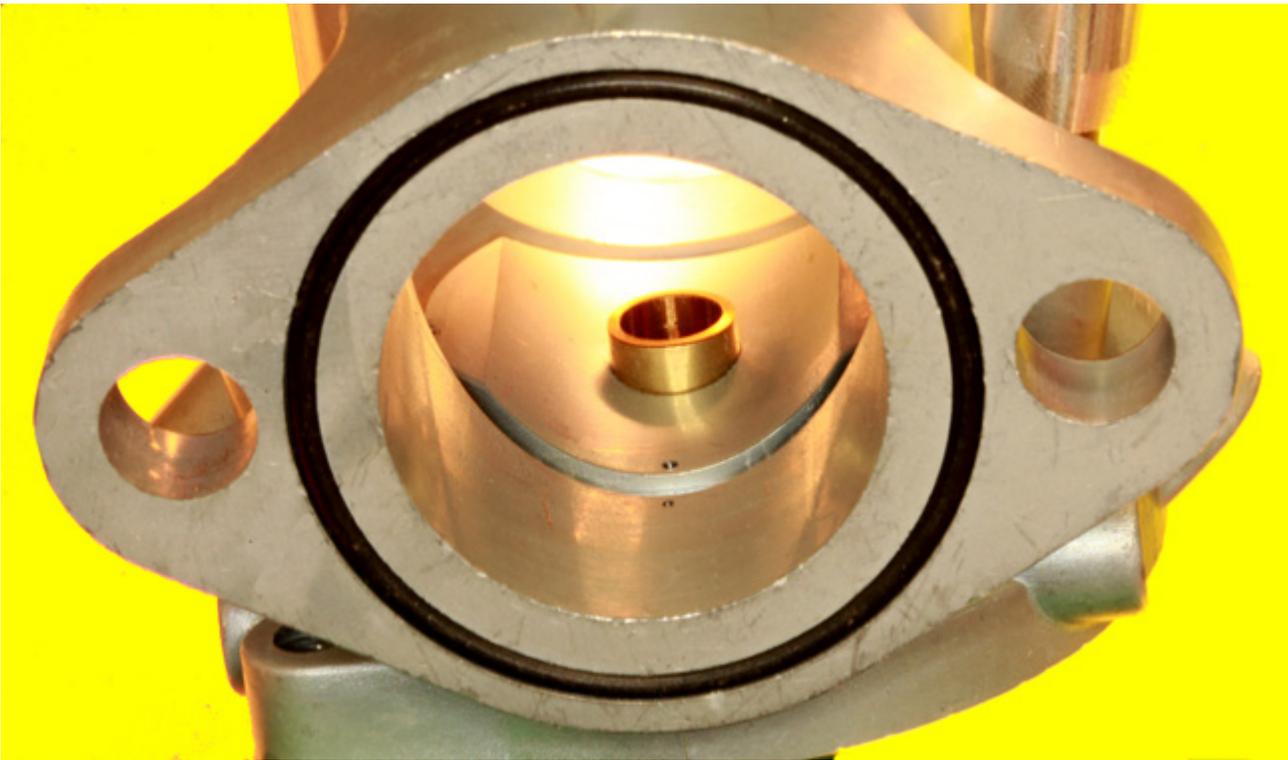
The pilot jet is pressed into the body. The arrow is pointing to the location of the .016" pilot jet's orifice. You can see the two air passages. One is in the center and leads to the needle jet. The other is at the top and leads to the pilot air screw and the fuel supplied by the pilot jet. The two transfer orifices, primary and secondary, are located the slot between the pilot jet and the tip of the pilot air screw.

**NOTE: If the pilot jet is blocked the bike will not start. If it is not on size because of a partial blockage the carburetor will not respond to changes to the pilot air screw and idle will be erratic.**

The pilot jet can be cleaned using a #78 drill (.016" diameter). It will have to be securely mounted in in a brass tube or equivalent. It is a confounded nuisance when the drill gets stuck in the pilot jet and comes out of the brass tube! Twirl it between your fingers in a clockwise rotation and it will draw any "swarf" down stream of the fuel flow and help prevent the drill from becoming stuck.

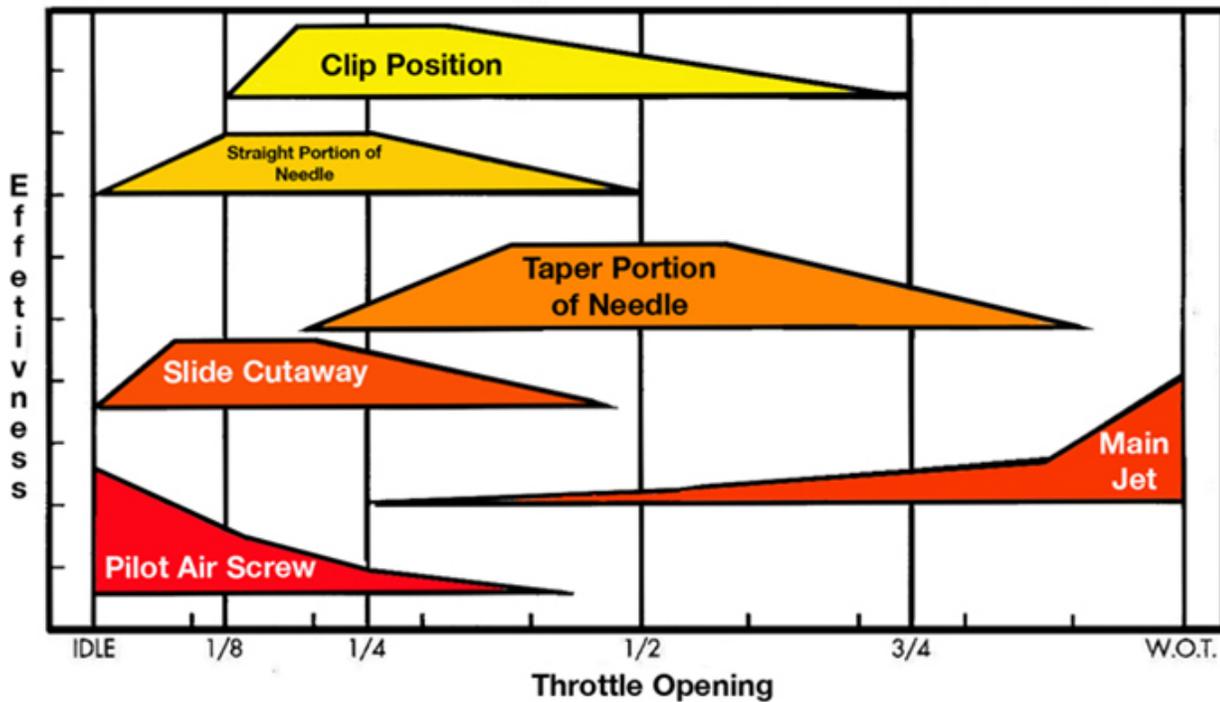
Yes, a guitar string can remove "swarf" from the pilot jet orifice. It doesn't insure the jet orifice is returned to its proper size. Also the "swarf" in the jet is pushed up stream of the flow of fuel. This allows the "swarf" to flow back into the jet and potentially partially block the orifice. The guitar string technique works only if you modify the carburetor where the body is drilled and tapped to accept a modified pilot air screw opposite the working air screw. This way you can push the "swarf" down stream of the orifice. See Amal's web site to see this modification.

**IMHO acetylene torch cleaning tips should NEVER EVER be used to clean the pilot jet.** In an exercise to look into this I measured several that I had in house, and bought several new ones from "reliable" torch makers. Not one of them would clean a jet orifice and leave it anywhere near the original size. Most cut the orifice several thousandths oversize. Being such a small orifice small changes are significant to fuel flow.



You can clearly see the two pilot transfer holes. The Primary is the smallest at .027", and closest to the reader. The Secondary is larger (.040"), and just behind the groove in the body for the slide. You can also see the brass "Straight Cut" spray tube.

## Jetting Chart



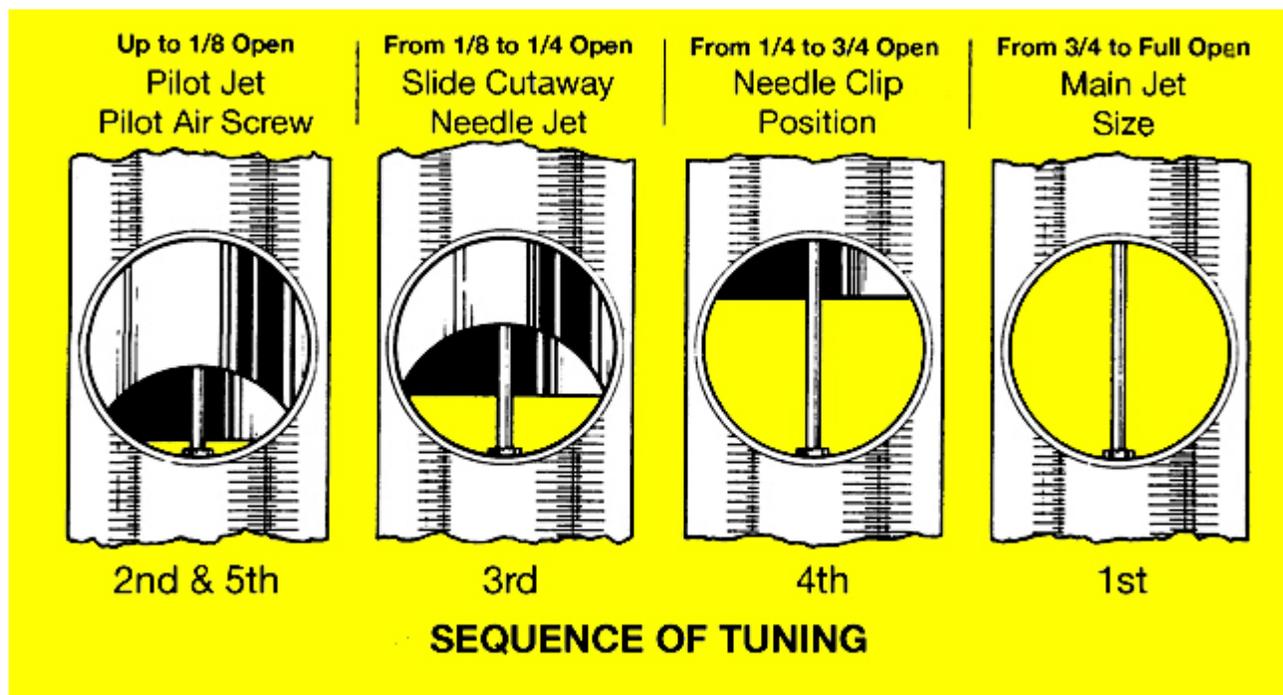
**There is an Important Difference Between Tuning the Mikuni VM and Amal Carburetors**

- With Mikuni the tip of the needle never leaves the main jet orifice all the way through wide open throttle. Thus with the VM the needle is in play through wide open throttle.

• With the Amal, depending upon which groove the needle clip is in, the needle leaves the needle jet at approx. 3/4 throttle. It is no in play when tuning the main jet.

This chart is not drawn in stone. It is a representation of the different Amal fuel circuits, and at which throttle opening they are working. A version of this chart is often found on web sites. The usual problem with them is they have been copied directly out of the Mikuni VM manual and don't represent Amal tuning.

Starting and ending throttle positions for each fuel circuit represented in this drawing are general representations and the actual ones can, and will, vary.



You will never understand how to tune an Amal, or a Mikuni for that matter, until you understand the different fuel and air circuits and at what throttle opening they are in play. We often hear someone say, "My Amal (or Mikuni) is lean. I need a bigger main jet." If you remove the main jet from the carburetor, the bike will still run normally until it gets above 1/2 throttle. As you see from the chart above the main jet doesn't start to really come into any meaningful play until well above 1/2 throttle.

### There are five individual steps to tuning:

• **1st** in sequence- Full Throttle:

At full throttle you are working with the main jet.

If it is a stock bike use the main jet recommended by the manufacturer. If you have raised the compression start about three jet sizes larger than stock and work back down.

• **2nd** in sequence- Idle:

At idle you are working with the pilot jet, pilot air screw. With most Amal's you start with the screw out 1 1/2 turns from lightly seated.

• **3rd** in sequence- 0 to 1/4 throttle:

At 0 to 1/4 throttle you are working with the slide cutaway, **needle jet i.d.** and pilot air screw. Typically a dual carburetor bike I will start with a # 3 and a single carburetor with a # 3 1/2 slide.

• **4th** in sequence – 1/4 to 3/4 throttle:

At 1/4 to 3/4 throttle you are working with the needle jet just as the taper starts on the needle, taper itself and needle clip position. Without any information to work with start in the middle notch.

• **5th** in sequence – Slide Cutaway:

Adjust the slide cutaway for a smooth transition from the idle to the main carburetor. IT It is not required to ride

the motorcycle to adjust the slide. You should be able to turn the throttle briskly from closed and have the engine respond in kind.

### **Recommended starting main jets based upon Concentric 4 stroke by venturi:**

622	22mm	120
626	26mm	140
627	27mm	170
928	28mm	180
930	30mm	200
932	32mm	220
1034*	34mm	360
1036*	36mm	370
1038*	38mm	380

\* Out of production

**NOTE:** These are starting points and changes to the motorcycle will require attention to the main jet size. The wrong main jet can cause serious damage to the motorcycle and you! Check the manual that comes with the bike.

### **Tuning The Carburetor:**

#### **Too Rich Condition**

- White Plastic Float Level Too High — Raise float needle **seat** in bowl.
- Stay-up Float Level Too High — **Carefully** bend the float tang.
- Old style white plastic float “Sunk” full of gas — Replace Float.
- Main Jet Too Large— Install lower number main jet.
- Slide Cutaway Too Low— Install slide with higher cutaway (# 2 is Rich while a # 4 is Lean).
- Needle Jet Too Large— Measure needle jet replace if worn, or if not worn, install needle jet with lower number.
- Wrong Needle Jet Type— Install correct needle jet.
- Needle jet cross drilled hole too small.
- Needle Clip Too Low— Raise Needle Clip to higher groove.
- Wrong Needle— Check motorcycle specifications.
- Wrong Spray Tube— Replace spray tube with leaner type – straight cut.
- Pilot Jet Too Large or Missing— Install smaller number jet.
- Pilot Air Screw too far In— Turn pilot air screw out.
- Choke On— Turn choke off.
- Fuel Leaking Past Float Needle— Fine rust in fuel – Clean fuel tank, filter and/or replace float needle.

#### **Too Lean Condition**

- Float Level too Low— Lower float needle **seat** in bowl.
- Stay-up float used with brass needle (use aluminum).
- Float Bowl Gasket Surface Warped— Replace or flatten surface.
- Main Jet Too Small— Install higher number main jet.
- Slide Cutaway Too High— Install slide with lower number.
- Needle Jet Too Small— Install needle jet with larger number.
- Needle Jet Cross Drilled Hole too Large— It should measure .035" if larger replace needle jet.
- Wrong Needle jet type— Replace needle jet check spec's.
- Needle Clip Too High— Lower needle clip to lower groove.
- Wrong Spray Tube— Replace spray tube with richer type: Stepped or slanted.
- Pilot Jet Too Small or Blocked— Clean or replace jet.
- Idle Fuel Circuit Blocked— Clean.
- Idle Transfer Ports Blocked— Clean.
- Pilot Air Screw Too Far Out— Turn screw in.
- Fuel Tank Cap Vent Blocked— Clean.
- Fuel Petcocks Too Small or Blocked— Clean or replace as necessary.

- Float Bowl Vent Blocked or Restricted— Open vent.
- Orifice In Float Needle Brass Seat Too Small— Replace with larger orifice.

**TIP:** If you have a stock 4 stroke bike kitted with Concentric carburetor of the proper size with a:

- 0.016" (standard) pilot jet,
- 622/122 0.106" needle jet,
- standard 622/124 2 ring needle in the #2 (middle) position,
- 3 1/2 slide if a single carburetor model,
- or 3 slide if a dual carburetor model,
- and main jet from the workshop manual.

You will be very close to perfect fuel air mixture in all 4 fuel air circuits. All you should have to do is some fine tuning like raising or lowering the needle or a slightly leaner or richer main jet.

### The new Amal Premier Carburetor.

Tuning the Premier Concentric follows the same procedures as the earlier Concentric. There are a couple of things that are different. There is a new anodized aluminum slide. The cutaways match the earlier pot metal slide. The pressed in pilot jet is replaced with a new screw in jet. This jet allows easy changing, or cleaning. The standard Premier pilot jet is .017" (2 annular lines). In spite of information on the internet, it is **mostly Norton 850's** that work better with a .019" (3 annular lines). The new carb comes with a new Stay-up float. **Because of some dimensional changes from the original white plastic float they should be used with an aluminum float needle.** Also these dimension changes require the top of the float be aligned with the top edge of the bowl.

### Odd Stuff:



The tapered needle seldom wears to a point where it needs replacing. It can be easily measured on the part that will wear the most, the major diameter. You will find the diameter to be .0985" (2.5mm). The needle grooves are numbered from the top down, with #1 being nearest the top. If the needle is bent it is a candidate to be replaced.

#### o NEEDLE PART NUMBERS

##### Monobloc—

- 375 models 375/063 stamped "B" on top 5 circlip grooves
- 376 models 376/063 stamped "C" on top 5 circlip grooves
- 376 BSA A10 376/096 stamped "C1" on top 5 circlip grooves • 376 models
- RK6/116 stamped "C2" on to 5 circlip grooves
- 389 models 389/063 stamped "D" on top 5 circlip grooves • 389 models

RK9/088 stamped “D2” on top 5 circlip grooves

- 689 models as 389/063

### Concentric—

#### 600 Series:

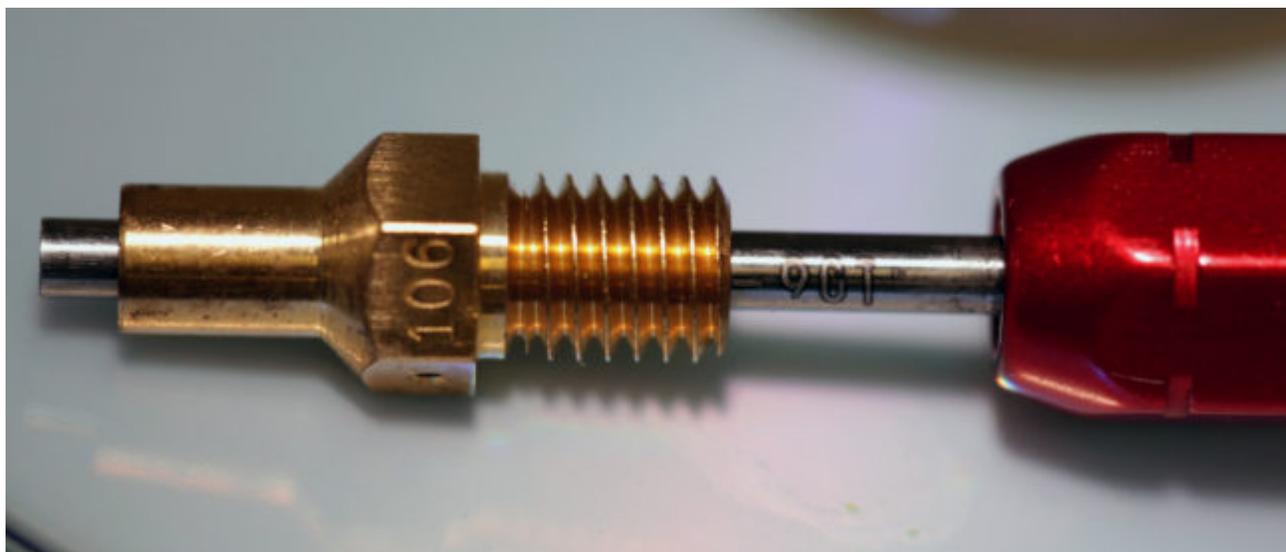
- 622/063 One id groove- 2 stroke used with 622/079 needle jet, and 622/080 jet holder (600 series)
- 622/099 “Y” stamped at top – Alcohol needle
- 622/124 Two id grooves- 4 stroke use with 622/122 needle jet, 622/128 jet holder

#### 900 Series:

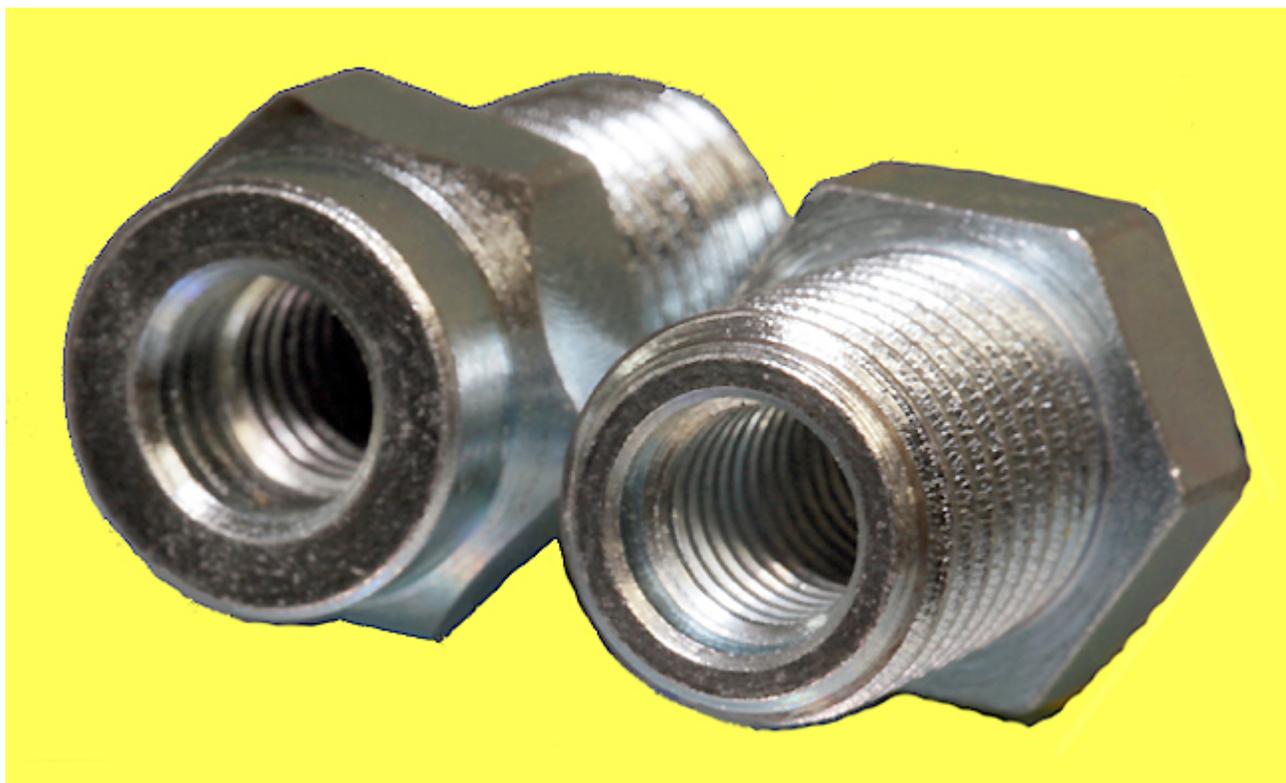
- 928/063 Three id grooves- 2 stroke use with 622/079 needle jet, 622/080 jet holder (900 series)
- 928/099 “Z” stamped at top – Alcohol needle
- 928/104 Four id grooves- 4 stroke Developed for the 850 Norton
- 622/278 Five id grooves- T160 part of Trident lean kit

### Mark II—

- 2622/063 2B1 – 2 stroke
- 2622/124 2A1 – 4 stroke – T140 use with 2928/122 .106” needle jet
- 2622/125 2A2 – alcohol
- • 2928/030 2C3 – 4 stroke- T140 EPA Tuning use with 2928/031 stainless .105” needle jet
- 2928/063 2D1 – 2 stroke
- 2928/124 2D2 – 2 stroke
- 2928/125 2C2 – alcohol
- • 2036/063 2F1 – 2 stroke
- 2036/077 2E3 – alcohol rich
- 2036/125 2E2 – alcohol



Checking new needle jets. Pictured is a minus .106” plug gauge. It measures .1058” and should be a slip fit in the needle jet orifice. A .106” plug gauge would be a light press fit and a plus plug gauge (.1062”) would be a press fit. The small hole on the side of the hex is .035”.



This illustrates that the internal threads of the main/needle jet holder are counter bored.

The counter bore detail is especially important for the needle jet. If you look at the needle jet picture above you will see that the thread does not extend all the way to the shoulder. This a small, but important detail! If jet holder wasn't counter bored the jet's orifice would close up as you tighten the jet. Thus your .106" jet would end up .105" or smaller.

I mention this because a run of jet holders were run without the counter bore. When it was found out, instead of replacing the holders with proper ones, needle jets were supplied where the end of the thread was undercut. The thinking was the undercut would solve the problem. Well it didn't, and as you tightened the jet in place it either broke off, or the orifice just below the undercut closed up as before.

The needle jet is the only jet that **ISN'T** identified by how much fuel it will flow. It's orifice is measured in inches. The most common for four stroke engines is a 0.106". The smallest needle jet is .105". Below that the carburetor will rarely work. A few 4 stroke engines require a .107", but they are few. Two strokes use larger needle jets as does carburetors set up for alcohol. An engine that runs well with a .106" needle jet will run lean with a .105" and rich with a .107". The needle jet is the only jet that gets larger in normal use and can wear to .107", and beyond, in as little as 10,000 miles.

**As the needle jet is the only jet in the carburetor subject to wear it should be at the top of the list for replacement at annual service intervals. A worn needle jet is so common that it led to coining the phrase "It's the needle jet stoopid."**

### **Again a word of caution:**

There are some ten odd people making aftermarket parts for Amal carburetors. Some like Keyster in Japan make some real nice jets. Others, including ones that were made in USA, UK and the Far East are poor copies, at best. Unless you are equipped to measure your new needle jet the most practical way to insure your new needle jet measures 0.106" is to buy one in an Amal package.

### **Needle Jet Part Numbers:**

#### **Monobloc—**

- **376/072** – state size: .105", .106", .107" and up

#### **Concentric—**

- **622/079** 2 stroke – state size: .106", .107", .108" – and up. Not crossed drilled .714" o.a. length counter bored .138" at bottom – jet orifice opposite threaded end.
- **622/100** alcohol state size: .120" and up
- **622/122** 4 stroke state size: .105", .106", .107", .108" cross drilled .035" hole – jet orifice at threaded end – .803" o.a. length – counter bored .158" deep at top

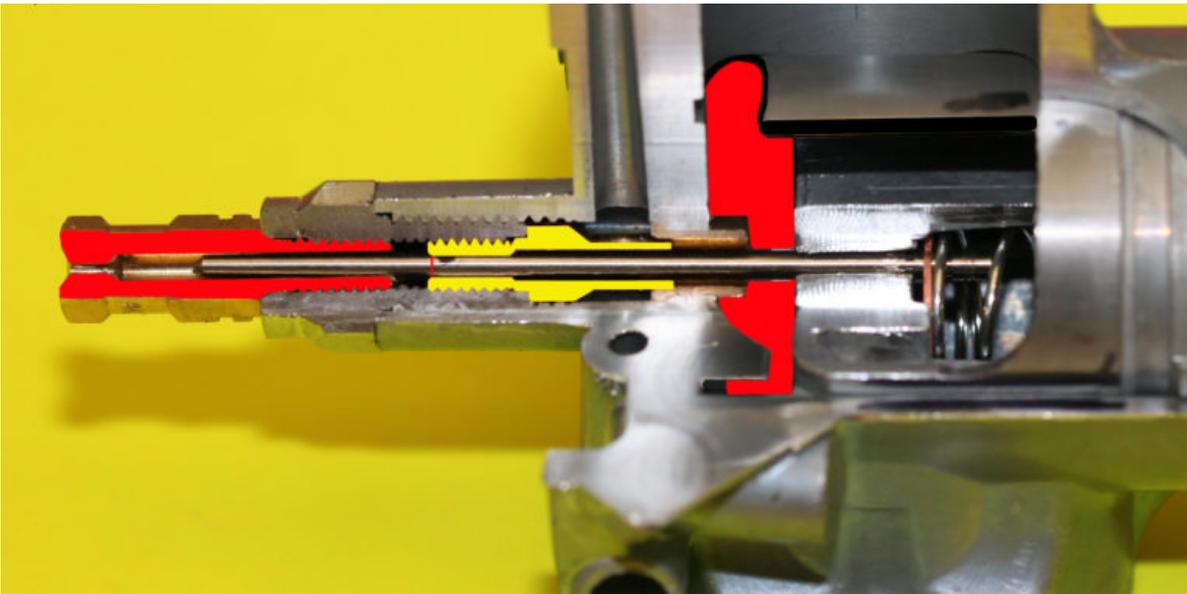
#### **MKII—**

- **2928/031** 4 stroke stainless .105" special T140 EPA bikes
- **2928/079** 2 stroke state size: .105", .106", .108", .109" – up. Not crossed drilled – .770" o.a. length – jet orifice opposite threaded end – counter bored .140" deep at bottom
- **2928/100** alcohol state size: .120" and up
- **2928/122** 4 stroke state size: .105", .106", .107", .108" – up Crossed drilled with .035" hole .860 o.a. length – counter bored .158" deep at top. jet orifice at threaded end. Annular identifying groove at top.

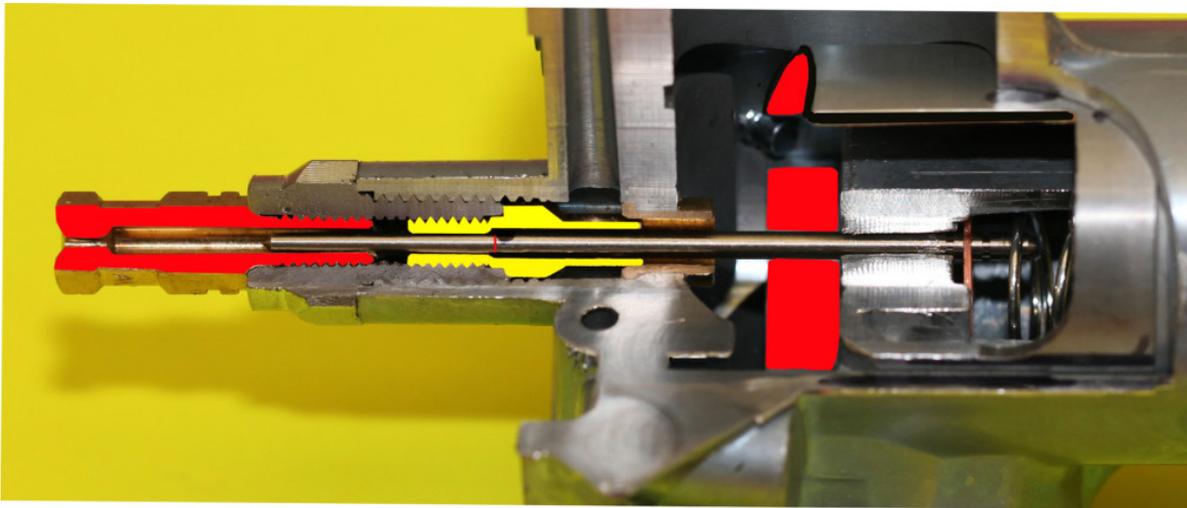
#### • **Needle Jet Notes:**

- Needle jets are the only Amal jet where the number refers to an actual inch dimension. The rest of the jets refer to flow in cc's per minute.
- Gasoline carburetors, both two and four stroke, are commonly fitted with needle jets ranging from .105" to .107". A .106" needle is by far the most common one used. Needle jets measuring .1065" have been made.
- Alcohol carburetors are commonly fitted with needle jets .120" or larger.
- Changing one size either way from the proper needle jet has a strong influence on just off idle to mid range running.
- A slightly worn, or oversize, needle jet will cause the motorcycle to run very rich at throttle openings up to approximately 1/3rd throttle.
- The crossed drilled hole in the 4 stroke needle jets can be made larger to lean out the mixture at low throttle openings. Enlarging this .035" hole has the greatest effect while the straight portion of the needle is in the needle jets metering orifice. As little as .001" increase in the size has a strong effect upon the amount of fuel the needle jet will deliver. The largest I have ever used is increasing the hole to .039". As the hole approaches .050" the carburetor stops working properly. To save embarrassment later, be sure to mark the needle jet as oversize.
- Enlarging the size of the crossed drilled hole can help clear up a bike that has megaphonitis. We found that 0.039" cured megaphonitis on a Triumph 500 twin kitted with Triumph megaphones.
- You can use a reamer to enlarge a needle jet. If a .106" is too small, and a .107" large you can ream the jet .1065".
- If you work on these carburetors as a part of your daily routine a set of Plus and minus .105", .106" and .107" plug gages are handy.

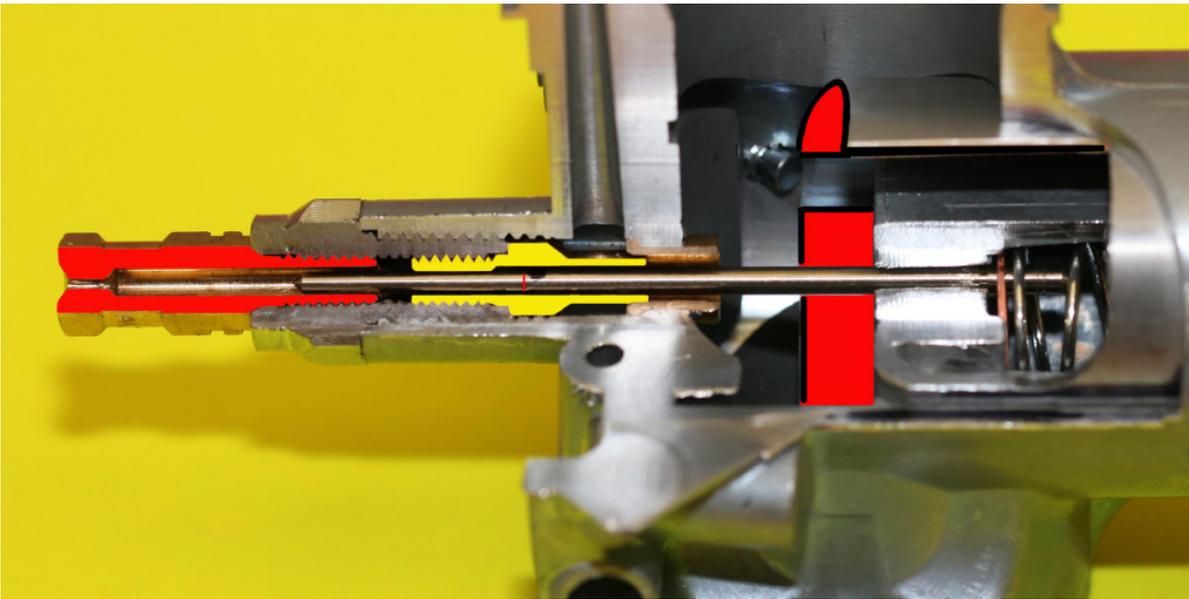
#### **Slide Positions:**



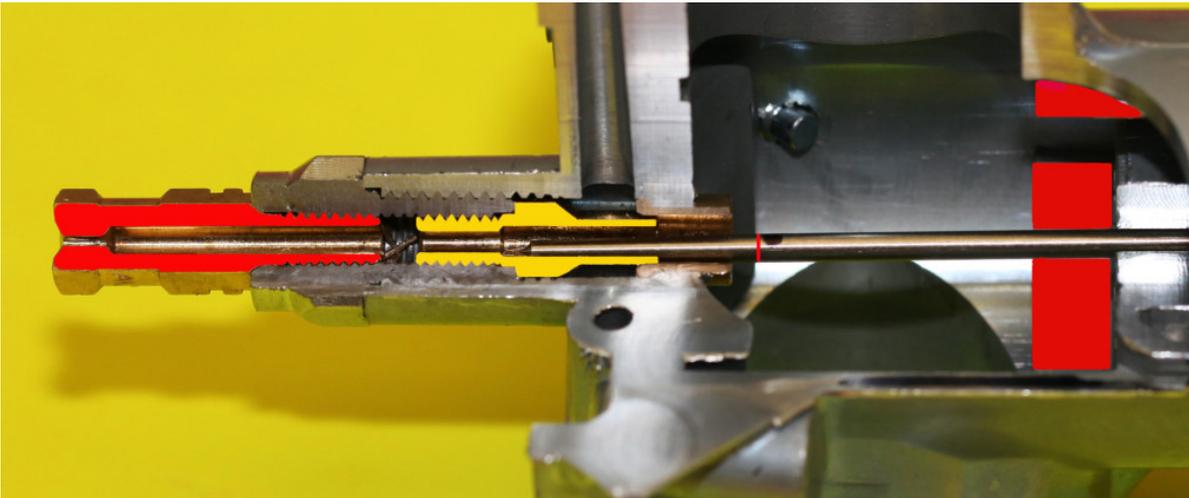
**Slide Closed (idle):** (Red line on needle beginning of taper. From the slide closed up to approx. 1/3rd throttle the fuel metering is controlled by the i.d. of the needle jet and the straight portion of the needle).



**Slide at 1/4 Throttle:** At 1/4 throttle the needle taper is just beginning to leave the needle jet (as adjusted by the needle clip position).



**Slide at 1/2 Throttle:** At 1/2 throttle the fuel metering is clearly being done by the needle's taper.



**Slide at Full Throttle:** At full throttle the tip of the needle is clear of the Needle Jet orifice. Depending upon which needle groove the clip is in the Needle stops having any effect around 3/4 throttle.

#### **Float Bowls (with needle orifice by size):**

##### **Concentric—**

- 622/052 .062" float needle orifice – fuel pump – 2 stroke
- 622/054 .156" float needle orifice – 2 stroke
- 622/055 .100" 4 stroke – standard – drain plug type
- 622/056 .125" 4 stroke – racing – drain plug type
- 622/057 .062" drain plug type
- 622/058 .052" 4 stroke – used with fuel pump

The float bowl drain was introduced in 1970.

##### **MKII—**

- 2622/055 .100"
- 2622/056 .062" 2 stroke – fuel pump
- 2622/057 .125" 4 stroke – standard

- 2622/058 .156" alcohol
- 2622/059 .052" 4 stroke – fuel pump
- **Pilot Jets:2 stroke Concentric and MKII (also used as choke jets)**• 124/026 in sizes 15-up in increments of 5cc flow (15 would flow 15cc per minute)
  - 622/026-15 .014"
  - 622/026-20 .015"
  - 622/026-25 .016" (standard to 600 and 900)
  - 622/026-30 .018"
  - • 622/026-35 .019"
  - • 622/026-40 .021"**Premier:**  
622/502 in sizes in increments of .002"
    - 622/502-15 .015"
    - 622/502-17 .017" (Standard in 600 and 900 Premiers)
    - 622/502-19 .019" (common to Norton 850 Commando)
    - 622/502-21 .021"
    - 622/502-23 .023"

### Slide Cutaways:

slides are listed from 2 to 4 in 1/16" increments. The #2 cutaway would be 1/8". A #3 cutaway would be 3/16".

#2 = 1/8"

#2.5 = 5/32"

#3 = 3/16"

#3.5 = 7/32"

#4 = 1/4"

### A note about slides:

There is a lot of folklore about the slide clearance in Amal carburetors. To insure the slide will not stick in the bore from the mounting hardware being over tightened the slides are given .0035" to .004" clearance. The typical comment is that Amal couldn't hold a tighter tolerance. This is far from the truth. The early versions of the Amal Concentric had very close clearance and they experienced slides sticking when customers over tightening the mounting hardware. The .0035" – .004" clearance is intentional and the low throttle open jetting was compensated for the extra clearance.

### Triumph 1979 T140 with MKII Carburetors update:

When using a MKII carburetors on a Triumph for off-road, or racing, it is possible to use European jetting. This jetting is for stock pistons and mufflers. Any modifications to compression or exhaust will require different jetting.

The Amal MKII is limited to 15° downdraft with the pilot jet in the bowl. If the downdraft is more than 15° you must move the pilot jet and blank jet. Put the blanking jet in the bowl and the drilled jet in the body. This similar to what you do with a MK1 1/2 when using the carburetor on a two stroke. Switching the pilot jet's location is a tuning trick for both 2 and 4 stroke tuning.

### Original EPA Jetting:      Suggested Non-EPA Jetting:

124/026 #25 Pilot Jet      124/026 #15 Pilot Jet

124/0026 #50 Choke Jet      124/026 #35 Choke Jet

2928/031 .105" Needle Jet      2928/122 .106" Needle Jet

2928/060 #3 Slide      2928/060 # 3 1/2 Slide

2928/030 2C3 Needle      2622/124 2A1 Needle

**Part Numbers that are hard to find:****Welsh plug** in bottom of Concentric body covering the pilot air/fuel mixing chamber **622/085****Pressed in pilot jet 622/107**Replacement float needle **brass seat .100"** seating **622/099****T160 lean Kit:** 622/278 Needle, 622/060 #4 slide**Tips for Racing Carburetors**

There are occasions when you want to check an Amal pilot or main jet's number against a standard.

Use these dimensions **ONLY** as a guide, as the final jet orifice is adjusted by hand during manufacture and checked with a manometer.

Flow in cc's per minute	Jet Diameter in inches
----------------------------	---------------------------

15	—
20	.015"
25	—
30	.018"
35	—
40	.021"
45	—
50	.024"
55	—
60	.026"
65	—
70	.028"
75	—
80	.030"
85	—
90	.032"
95	—
100	.034"
110	.035"
120	.037"
130	.038"
140	.040"
150	.041"
160	.043"
170	.044"
180	.045"
200	.048"
220	.050"
240	.052"
260	.055"
280	.057"
300	.059"

Reference: – Vintage Motorcyclists Workshop by Radco page 129

**Slide Cutaway and Straight vs Megaphone Exhaust Pipes:**

Megaphone exhaust usually requires a main jet 40cc larger.

- Straight pipes typically use Leaner slide (higher #) slide like a #4.

- Megaphones typically use Richer slide (lower #) like a #2.  
reference *Tuning For Speed* by P.E. Irving

### GP Carburetor notes:

- GP limited to 20° down draft.
- GP2 introduced to allow greater down draft angles.
- GP pilot screw turns *out* to richen and *in* to weaken mixture.
- GP2 pilot screw turns *in* to richen and *out* to weaken

To allow greater down draft angles they moved the pilot air screw and pilot jet to the atmospheric side of the mixing chamber.

Tuning is the same as the GP except the pilot adjustment screws *in* to strengthen and *out* to weaken the mixture. This also cures pilot-jet weep at steep down-draft angles.

- Pilot jets are the same as used in the Monobloc (376/076).
- Fuel level in float is set to the bottom of the circle cut in the side of the air jet cover.
- The float bowl should be located in front of the main jet. This prevents fuel starvation on acceleration.
- The GP relies upon an air-jet to correct fuel/air mixture while running on the main jet at a constant throttle opening (typically wide open throttle) subject to varying engine loads. As the engine load changes going over varying terrain, the air velocity through the venturi will change. As the air velocity changes so does the vacuum signal on the main jet. Without the air-jet, while climbing a grade, the air velocity will slow drawing less fuel and you will have a lean mixture. Going down the grade the air velocity will increase and draw more fuel giving you a rich mixture. The air-jet compensates for this change in air velocity at WOT providing a steady fuel/air mixture.
- The air-slide can be helpful when tuning the GP, or TT. If at WOT the speed increases when the lever is closed slightly, the main jet is too small. If the speed falls off, the main jet is either correct or too large. The air-jet can be used to change the mixture to compensate for large changes in elevation or ambient air temperature during a race. This type of carburetor was designed for use in races venues like the Isle of Man.
- The air-slide, which controls the amount of air reaching the air-jet, is located on the side of the carburetor body. The air-slide cavity is easily recognized by the long slot on its side. Many people think the air-slide is a choke. The air-slide is opened and closed to change the amount of air reaching the air-jet.
- The purpose of the air jet is to compensate the mixture strength for varying air speed through the venturi.
- The air-jet for carburetor up to 1 1/16" is .100" over that it is .125". The proper air-jet is installed at the factory and seldom needs to be changed.

Reference above:- *Tuning for Speed* by P.E. Irving

To read more about carburetors used on these motorcycles:

*Tuning for Speed.* by P.E. Irving

*The Vintage Motorcyclist's Workshop* by Radco

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