TEGLERIZER

The Magical Mystical Weber DCOE

The Numbers	Tuning and Jetting	Do I Run a Single 45 or Dual 40's?	Tuning and Service PDF (2 meg file size)	Weber Resources on the Internet
User Photos and jettings	Adjusting Twin DCOE's	The Fuel Flow Path	Physical Dimensions	Excellent Article by Mickey Luaria
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Tuning your DCOE style Carburetor

So you have a nifty Weber DCOE or S&K Racing sidedraft carb, set up for your vehicle, you're ready to chew gum and kick butt, and you've run out of gum. You bolted on the carb in place of your SUs or Zenith-Stromberg and voila! You have worse gas mileage, and the power gain is slight enough to be psychological. What to do?

First, you must decide your target behavior. Do you want POWER, TORQUE, or MILEAGE? A properly set up system will improve one or two but probably not 3 of those items (you might win the lottery if it is particularly misconfigured now, though).

Next, set your timing! Make sure your ignition system is good from one end to the other. Get rid of those old fouled plugs, check dwell and advance, and make sure nothing is intermittant. Set everything to book values, unless you have a firm grasp of what's better for your car.

One issue with Weber conversions is vacuum advance signal. If your distributor took vacuum from the manifold, you should do the same with the new manifold. You may have to modify it, or use a port intended for a less important function such as pollution control (pollution control mods should be done only for off-road vehicles).

I can not take credit for the bulk of the wisdom presented in this article. If I could remember where I found the original article, there would have simply been a link here and not the full document.

So... since I had to somewhat format and re-write the layout, I will take credit for the page itself and the fact that this information is available to whom ever needs it.

The credit for the original information as presented here, goes to Mike Kimball and John Trindle. I simply added a bit of formatting, inter-article WWW linking, and page layout.

If your distributor took vacuum from the carburetor, you should probably just ignore it. The S&K Racing carb does offer a throttle-plate vacuum port which you can try. A system with no vacuum advance will require more initial mechanical advance than book values for part-throttle tractability. Start with 5 degrees more, you may end up with 10 degrees more.

Finally, set your idle mixture. Maximize RPM with the idle mixture screws, then reduce idle speed to 850-1000 (lowest smooth idle speed) with the idle speed adjustment screw. Tweak the idle mixture screws again at this speed. Repeat until no further idle speed increase is observed.

Your idle adjustment screws should be 1-1/2 to 2-1/2 turns out from full lean. If they are far outside this range, your idle fuel jet is the wrong size. Increase jet size to reduce the number of turns, decrease jet size to increase the number of turns out from full lean (all the way clockwise).

Road tests:

Use timed road testing to set advance. Stop when you are at best time for the runs which reflect your desired driving pattern. To reduce variability, use Wide Open Throttle wherever possible, make your runs on level ground, and do multiple runs in both directions. Please do all this in an open area with good visibility, and slight or no traffic. The road which runs along the river or coastline is a good bet. Consider that you want your average speed over the course to be similar to or slightly below the speed limit. That will attract the least attention and tie up the least traffic. Note: This consideration is why 0-60 testing on open roads is NOT recommended. Pick a narrower speed range.

Use a STOPWATCH, not a regular watch. You'll need to record times to about 0.1 seconds. Use a buddy to time if at all possible while you concentrate on driving in a consistent manner over the same ground, and looking for other traffic! Try to run all your timed runs in the same basic temperature conditions (10F temperature degree change is worth about 2% change in air density, and so mixture). Also, try to maintain a similar weight in the car (with or without a timing partner, full gas tank vs nearly empty, bags of cement or cases of Old Clem's Joy Juice in the trunk, etc).

If you are shooting for best mileage, your tests should consist of sustained runs at the speed and over the terrain you plan to use. Testing with a normal mix of highway and around town can be misleading since your mind-set affects your gas pedal usage. Changes of less than 2 or 3 mpg in a normal mix can be ascribed to psychology as much as physics. So, you should fill the tank, drive at least 1/4 of a tank at sustained speeds, and then check the mileage.

Now you should have a set of benchmark results for further use. Open up the access port in the top of your carb, and remove and inspect the main jet assembly. The part/size numbers are stamped on the side of each component. Record all numbers.

DCOE Thumb rules (use as a starting point):

- **Venturi Size**: If your carb was indeed set up for a similar sized engine, you should be OK on this. Increasing venturi size will result in slower but greater airflow. This will move the power band UP in RPM and reduce torque down low (for a given jetting). Let's assume that your venturi size is appropriate for your engine. (Approprioate venturi size is roughly proportional to the square root of displacement x peak HP RPM. But it varies quite a bit with cam characteristics and so is way beyond the scope of this article).

- **Main Jet**: Starting point Venturi size number x 4. In the case of the MGB, this should be 36x4 = 144 or a 145 main jet.

- **Air correction jet**: Main Jet plus 60, or in the case of the MGB, about 200 or 205.

- **Emulsion tube**: We won't cover the emulsion tube itself, as effects are too subtle for road testing (emissions control test equipment would be more appropriate).

Idle jet: 50 for MGB (Mike, I need a thumb rule for this?

Altitude compensation: Reduce main jet size 0.05 for every 5000 feet of DENSITY altitude. Density altitude is dependent both on temperature and air pressure. Although calculating actual density altitude is a fairly complex operation, you can approximate it with actual altitude with this forumla:

> Density Altitude = 75 feet * (Outside Air Temperature F - (59F-Altitude/300)) + Actual Altitude
>
> This is a crude measure and you may wish to stick with Actual Altitude to avoid overleaning in warm weather.

To change behavior over the mid to high range of RPMs (more than 1/6 throttle), change main and air correction as follows:

> For a given **air correction jet**, a larger **main jet** will flow more fuel across the RPM range.
>
> For a given **main jet**, a larger **air correction jet** will reduce fuel flow in the higher RPM range.

In general, for racing, the **air correction jet** will be smaller than the thumb rule above, and the **main jet** larger. This allows for more fuel flow over the whole range, and further enrichment at high RPM.

For economy, the thumb rules are close but may require small adjustment. *The question is, why are you looking for economy instead of power at Wide Open Throttle?*

Optimizing for power:

So, out we go to our test road. Warm up the engine completely (I drive for 6 miles to get to my test road) and make sure the air pressure in the tires is right, and fill the tank.

First, run another benchmark series to get a baseline for current weather conditions. You should have enough practice by now to evaluate your runs for consistency.

The **main jets** are the easiest to work with, so we'll try them first. They are in the tip of the jet assembly, and have a pointed "nose". Increase the size one step at a time, and run a benchmark series. If you were running too lean, you will notice a decrease in time spent above 3000 RPM. If you go too rich, the sound of the engine will change dramatically, and times increase. Go back to the next leaner size, and do another run to confirm the problem and clear the plugs.

The **air correction jets** are in the TOP of the **jet assembly**, and require that you separate the threaded portion from the emulsion tube. Be gentle... grasp the components to separate in PADDED pliers and wiggle them apart. Twisting doesn't help much as these are press-fit and not threaded joins. You >will REDUCE the **air correction jet** (it has a flat nose) one step at a time. This makes the mixture richer in the upper (4500+) RPM ranges. If you go too far it will increase the times, and make the engine sound odd in the upper part of its range... I got terrible gargling and hesitation reducing from 190 to 180 (I didn't have a 185). Switch back to the previous size and re-test to confirm.

Now we get into aspects of carburetor performance which are transient or harder to quantify. We move away from the known setting of Wide Open Throttle to **gas mileage and throttle response.**

In highway cruising at legal speeds in most of our vehicles, the throttle is mostly closed. This is because the gear is high, the RPMs are relatively low, and the horsepower requirement is 10% or so of maximum. This causes the **main jet** to be shrouded and so most of the gas being used is coming through the **idle jet** and **progression holes.**

Overall flow to idle port and progression is controlled by the **idle jet/emulsion** assembly. Flow out the **idle port** itself is further restricted by the **idle adjustment screw**. Fuel is pulled from this port by airflow through the **main throat**. It will be a somewhat trivial portion of the fuel flow above idle.

Fuel flow through the **progression holes** is significant above closed throttle but becomes less so after the edge of the **throttle plate** clears the **progression holes**. This is because fuel is drawn from the **progression holes** by high-speed air flow past **throttle plate**. As the **throttle plate** moves away from the **progression holes**, less fuel is drawn from them. At this point the **main venturi** is becoming unshrouded and more fuel is flowing through the **main jet**.

During highway cruise the **throttle plate** is near the **progression holes**. Changing flow through the **idle fuel jet** and **idle air holes** will thus most significantly change cruise mileage.

Modification would involve:

1) Increasing the size of the **idle fuel jet** may allow more power at a given throttle opening, increasing the load at which the transition to the **main jet** occurs. If you have large **main fuel jets** for good power at higher RPMs, you will find more fuel economy at lower RPMs by staying off the mains, and on the **progression holes.**

2) If indeed you have enough fuel to stay off the mains, but still have low economy at cruise, you have either too large an **idle fuel jet**, or too small an **idle air jet**. Increase the size of the **idle speed air jet** hole.

How do you determine all this rot? You need to see what your mixture is at your normal cruise speeds. The only way outside a dyno is to do plug cuts after sustained operations at those speeds. This means you turn off the engine and take it out gear after a sustained test at speed. Coast to the side of the road and pull the plugs... comparing color. You are looking for a chocolate brown or dark grey for all results. White is too lean, and black is too rich. Light brown/grey is also somewhat lean.

A note on plug cuts. High-performance spark plugs such as Champion Gold and other high temperature, anti-fouling plugs, can make it hard to read plug color. You want to have the standard temperature range plugs installed for thest tests. In addition, oil fouling will mask true mixture color. If you get oil fouling on your spark plugs, fix >that The following test assumes the idle mixture adjustment screw has been properly set. The speeds are representative, and should be altered for your cruise gearing and desired RPM (on the MGB this corresponds to about

2K, 2.5K, 3K, and 3.5K RPM).

One method would be:

5 minutes at 35, check plug color
5 minutes at 45, check plug color
5 minutes at 55, check plug color
5 minutes at 65, check plug color

If the plugs are pale at 35 and 45, and go progressively darker at 55 and 65, your **idle jet** is too small, or your **idle air jet** is "too large", or you are transitioning to the **main jet** too early.

If the plugs are black at 35 and 45, and go towards brown or stay black at 55 and 65, your **idle fuel jet** is too large for your **idle air jet**. Increase the size of the **idle air jet** hole. In extreme cases you might have to reduce the size of the **idle fuel jet** (check the recommended size for your engine).

If your **idle fuel jet** is extremely small, you may be already on the mains at 35 mph. This is unlikely. You would have noticed this in the benchmark step when your **idle adjustment screw** was several turns out from full lean.

When you have a relatively even color across the speed/RPM range, fill the tank with gas and drive normally. With luck you will have increased your part-throttle cruise mileage noticably! Your mixture control will be better across the operating range and your engine will be happier because of it.

----------- end of economy optimization -----------------

Now we get into an even more subjective optimization... **Throttle response.** One complaint folks have about the Weber carb versus twin SUs is a "flat spot" or dead zone, or bog, on throttle. Some tuners advise against the Weber for this reason.

Well, now that you've optimized the mixture curve over normal driving / racing parameters, you have probably virtually The missing piece of the puzzle is the **accelerator pump**. This device should actually give significantly stronger initial throttle response than a constant-depression carb without one.

When the **throttle plate** opens suddenly, airflow slows down suddenly. Bernoulli tells us that suction in the **venturi** is caused by the air in the **venturi** travelling quickly. When the air slows down, the suction decreases, and less fuel is pushed into the **throat** of the carb by ambient pressure.

In order to cope with the lean condition caused by more air and less fuel, the **accelerator pump** squirts additional fuel into the throat of the carb.

When you move the **throttle plate** open, a linkage pulls on a spring. This spring moves a piston which forces fuel into the accelerator jet chamber, and through the **accelerator pump jet**, through a metering hole, and into the throat of a carb. Fuel not used **drains back** into the float chamber through a small drainback hole.

> There are several things to consider about this squirt... Volume, Pressure, and Duration. They are all interrelated but here's how you can think of it:
>
> If you increase the size of the metering hole, Pressure Drops, Volume / unit time increases, and duration decreases.
>
> If you strengthen the spring, Pressure rises, Volume / unit time rises, but duration decreases.
>
> If you decrease the size of the drainback hole, Pressure is slightly increased, volume is increased, and duration is increased.

So what do we do now? The typical symptom on a book-value Weber conversion is a bog unless you baby the throttle. This is because the mixture leans out when you try to suddenly involve the **main jets** with insufficient airflow. When you bring airflow up more gently, the **progression circuit** helps you out, and the air is moving faster when you get to demanding fuel from the **main jets**.

This shows that fuel volume is insufficent for fast throttle movement. We increase **accelerator pump** volume / unit time most easily by enlarging the metering hole (this item is as easily accessible as the main and idle jets). Use a pin vise and a set of drills 61-80 to gradually enlarge the metering hole. On the MGB, I started about 77 and ended up at 69. More may be required as I get used to the difference.

Try to reproduce realistic transitions, from realistic RPMs, in all the gears. You may notice as you enlarge at some point the initial response is good, then a short bog before things kick in. This means the duration is too short.

If you see this problem at extremely low RPMs, you may want to re-evaluate your requirements. Do you need to SLAM the throttle from 1400 RPM? In any case, stop enlarging the metering hole if you run across this problem. Going any further will require modification of the drainback hole to provide a bigger fuel supply.