

Using Carbtune II

After some of the enthusiastic JHPS Message Board messages concerning use of a four column manometer to synchronize and tune Dellortos, I decided to do a little web searching to determine whether or not they were worth the bother. The search for information and the testimonials of others finally convinced me to buy a Carbtune II, four-column, mercury-free manometer kit from John Morgan in Ireland. When the Carbtune II arrived, what I found with the kit were instructions for tuning **motorcycles** - because that is where their biggest market is. Sooooo, next, I set about studying and writing instructions on how to use the Carbtune II on a Jensen Healey with Dellorto carbs. The instructions below are a combination of information (many thanks and credits) gathered from:

- Carbtune Instructions
- Kurt Housh
- John Dymond
- A Lotus website

Instructions

Carbtune II Description:

The Carbtune II is a four column mechanical (mercury-free) manometer. It gives four simultaneous vacuum readings so you can balance the fuel/air flow through each of the carburetor throats simultaneously. It uses stainless steel rods in close-fitting guides to indicate vacuum in cmHg (centimeters of mercury) on the scale.

The indicator tubes are made from high impact plastic. Damping is accomplished by a small airflow restrictor in the rubber connecting tubes. The manometer must be used vertically for a scale starting at 8 cmHg and going to 42 cmHg.

When Carbtune II arrives (I received mine within 5 days of ordering), inside the box you should find the gauge body, rubber tubes, a reusable plastic tie which is used to hang the gauges (release the tie by pushing the two tabs to open the jaws), and inside the small plastic bag there are four 5 mm plastic adapters, four 6 mm plastic adapters and one fine bore, thick wall, clear plastic tube about 8 cm long by 5 mm diameter which is used to make the restrictors (for damping)



Carbtune Set-up

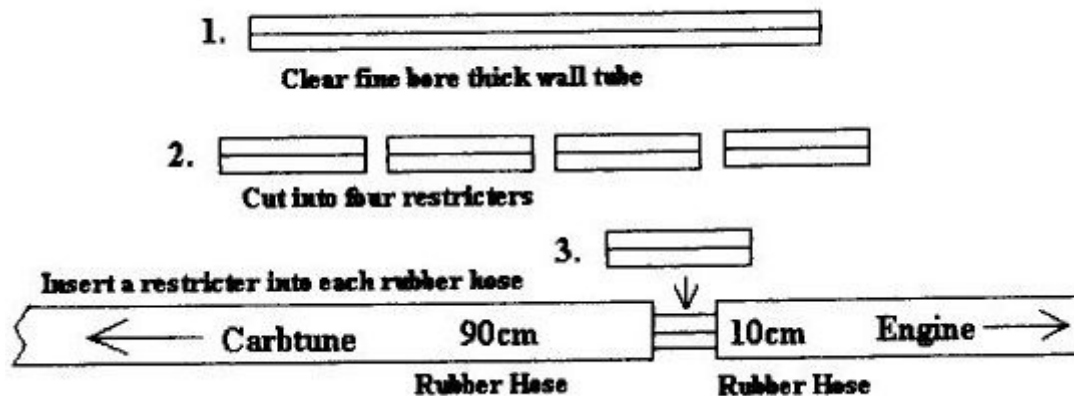
Damping. The restrictors must always be used. Without restrictors, the rods will fluctuate wildly. There are two components to the damping

1. The small amount of friction between the rods and guides which is overcome as soon as the pulsating vacuum of the engine is connected. This friction can vary from tube to tube in the Carbtune and is not a fault.
2. The air-flow restrictors that fit inside the rubber tubes and damp the fluctuations. There will always be a small amount of fluctuation and this is necessary for the gauges to work properly. Do not oil the rods.

How to Make the Carbtune Dampers.

Refer to the drawing. In the small plastic bag with the adapters, you will have received a fine bore, thick wall, clear plastic tube (No. 1). It is about 8 cm long x 5 mm diameter. With a craft knife cut the thick wall tube into four roughly equal pieces (No 2). These are the four restrictors.

Cut about 10 cm off the end of each 1 meter black rubber hose. Push a restrictor into the 10 cm rubber hose (No 3). Now push the remaining 90 cm rubber hose onto the other side of the restrictor. Do this for each hose.



The overall length of rubber hose is not critical. You can make them longer by adding more hose. The restrictors need to be at least 90 cm from the Carbtune for proper operation. The longer the tube between the restrictors and the Carbtune, the more damping. The shorter, the less the damping.

The restricted part of the rubber tube must be towards the engine, not the Carbtune. If the restrictors are beside the Carbtune it will not be properly damped. The restrictors will reduce fluctuations to acceptable levels for most applications but some applications may still give readings that pulsate too much even with the dampers in place. Moving the gauges very slightly off vertical will add some extra friction and damping but make sure the rods are still pulsating slightly or the readings may be affected.

The rods need to pulsate to some degree for the gauge to work properly.

Using the Manometer Gauges

The gauges are calibrated in cmHg (centimeters of mercury).

1. Hang the gauges vertically from a convenient place (you may want to use the spring assembly on the hood) above the engine. A reusable clip is supplied for this purpose. The clip fits into the slot at the top of the gauge and you push it into the slot from the back of the gauge. (Release the clip by pushing the two tabs to open the jaws.). For convenience, you may wish to construct a simple stand for the Carbtune. The one shown here sits nicely on the ledge just behind the Jensen Healey radiator and keeps the tubes from getting kinked or otherwise damaged.



[Click for larger picture](#)

2. Some carbs have stubs (extensions) on the vacuum taps which are covered by rubber caps (see picture) or tiny screws which you remove. If you have the stubs, remove/open the caps/screws and skip to step 5
3. If your carbs do not have stubs on the vacuum taps, and need the plastic adapters (supplied with the kit) , remove the blanking screws from the vacuum taps, then screw in the black adapters. Make sure the adapters are seated but do not overtighten - the o-ring washers supplied will assure a sealed fit. Finger tight (using fingers not tools) is enough.
4. For difficult-to-get-to vacuum taps, cut 1 inch of rubber from the end of one of the rubber tubes and push it onto a ballpoint pen. Push the adapter into the other end of the cut-off rubber tube and use the pen as a flexible extension to screw the adapters in and out of the inlets. Alternatively, you can use a screwdriver to screw it in -- there is a slot in the end of the adapter for this purpose.
5. Push the rubber tubes onto the spigots on top of the gauge and then onto the carb stubs (or adapters). Make sure you have the right tube connected to the right carb barrel. You may want to label the tubes so it is easy to tell which tube goes with which barrel.
6. Keep the rubber tubes and the gauge itself away from hot exhaust and make sure the rubber tubes are not kinked or flattened. You may need to rig up some kind of hose support for this purpose.
7. After tuning, it sometimes is easier to remove the adapters if you let the engine cool down.
8. After use, remove the black rubber tubes from the gauge first, then from the carbs. Hang the rubber tubes to drain any fuel from them. When using, if there is any blow-back of fuel into the gauges, hold them high, upside-down, and connect to a running engine until all fuel has disappeared from the gauge scale tubes.

General Hints

1. Read your workshop manual.
2. The engine should be at operating temperature and running at just enough above idle speed (around 950-1000 rpm) so it doesn't falter and stop during adjustments.
3. Don't try to balance at high engine speeds. Keep at about 950-1000 rpm.
4. Manometer readings should be balanced to within 2-3 cmHg (some models up to 4 cmHg) of each other.

5. Make sure that the points, plugs, ignition, valves, air filter, exhaust and oil are all in proper service before balancing. Ideally balance your carbs after you have serviced the rest of your engine.
6. Adjust in small amounts, waiting a few seconds between each adjustment.
7. If lending gauges to a friend please ensure your friend has a copy of the instructions and is familiar with the gauges.

A Guide to Carburetor Synchronizing

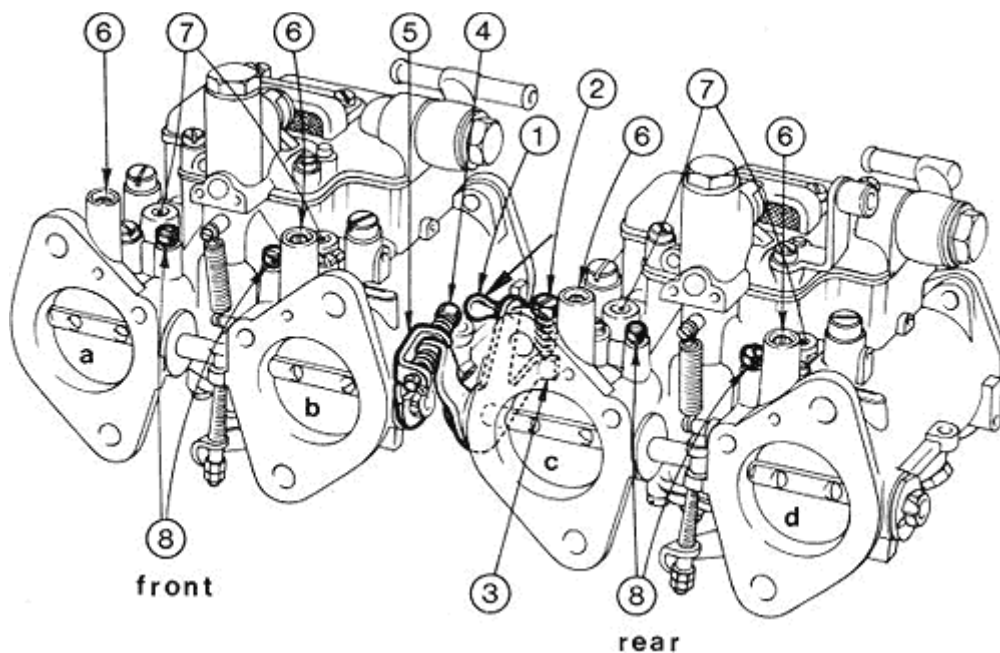
Carb balance will affect the response, smoothness, mileage, performance and running temperature of your engine. Carb synchronization consist of adjusting each throttle valve for carburetors so that they pass as much air fuel-air mixture as all the others. This balances the load carried by each piston.

If one carb is opened further than the others, the other carbs will also supply a richer mixture and mileage will suffer.

If you're running Dellorto carbs, it is strongly suggest that you accurately balance the carbs -- barrel to barrel and carb to carb -- before trying to optimize jetting. You may just find that a lot of "problems" go away when the carbs are balanced.

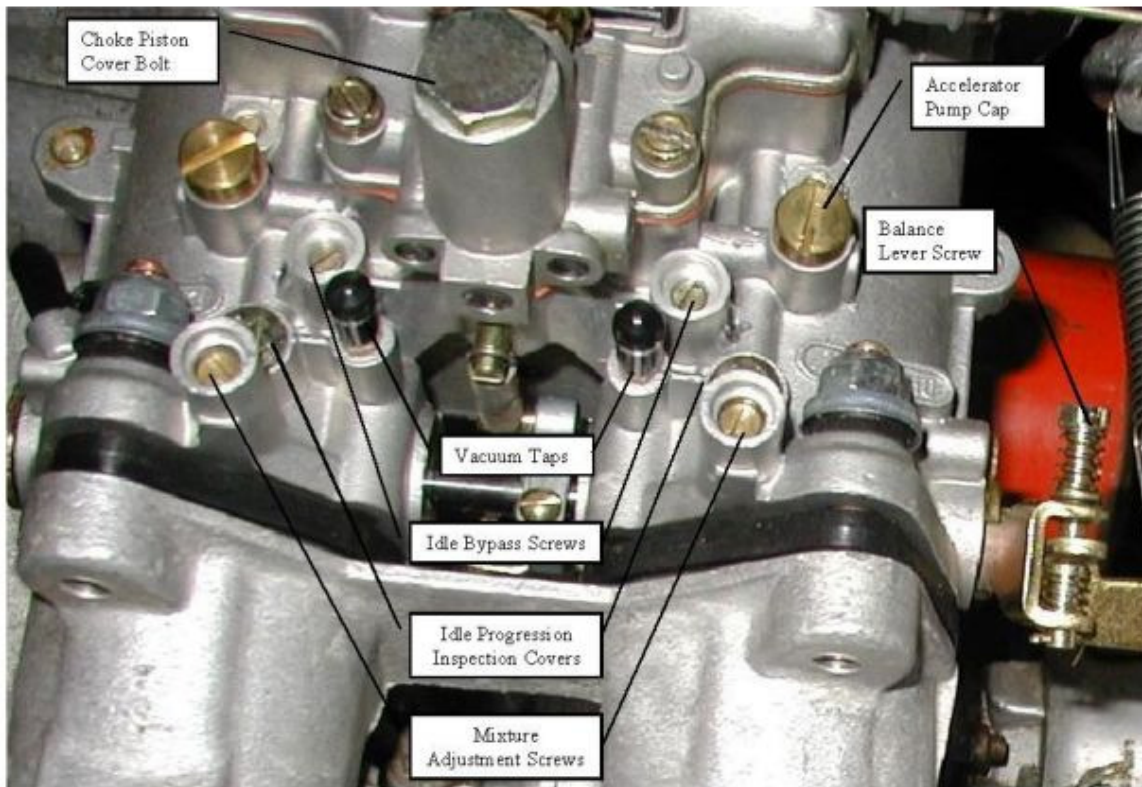
The following balancing procedure assumes the carbs are in generally good condition, the floats are set to the correct heights (hi and low limits) and the ignition is in good condition and properly timed.

Refer to the drawing, below during the tuning procechure



1. Throttle Lever - Connected to accelerator pedal, changes engine speed
2. Idle Speed Screw - Sets the carburetor(s) idle speed
3. Throttle Lever Extension - Part of the throttle lever the idle speed screw hits
4. Throttle Balance Lever Screw - Used to synchronize the carburetors
5. Throttle Balance Lever - Spring loaded lever that connects the carbs
6. Idle Mixture Screw - Adjusts the amount of idle fuel-air mixture to the carbs
7. Idle Air Bypass Screw - Used to balance air flow through carb barrels
8. Vacuum Tap Blanking Plug - Used as connection points for manometer

Dell 45 with adjustment points and taps identified.



Step by Step Procedure

1. Remove any anti-tamper seals from the idle mixture screw (6) housing (boss). You might also need to replace the idle mixture screws to ones that are easier to adjust if the stock screws are "tamper proof", have no conventional screwdriver slot, and are recessed in a boss. Replacements are available (from the usual JH and Lotus suppliers) that stick up out of the boss and have a slot for a straight screwdriver blade.
2. Check that the idle air bypass screws (7), to which anti-tamper paint may have been applied are completely closed.
3. Dellorto DHLA's have built-in ports for connecting a manometer. The ports are located right next to the idle mixture screws and may have vacuum tap blanking plugs (8) fitted. The blanking plugs must be replaced with vacuum taps / spigots before the manometer tubing can be installed -- one tube per carb barrel. Some Dells come equipped with brass spigots already in place. During normal operation these are capped to prevent air intake - simply remove the caps for this procedure.
4. Connect the four-column manometer to the carburetor vacuum taps, making sure you know which column goes with which carburetor barrel.
5. Connect a reliable tachometer.
6. Start the engine and leave it running to attain normal operating temperature.
7. Set the idle to about 950-1000 rpm by adjusting the idle speed screw (2).
8. Turn the four Idle air bypass screws (7) fully closed (in). Just seat them, don't crank on them.
9. Adjust all four idle mixture screws (6) to give the strongest vacuum (tallest manometer column reading) for each barrel.
10. Re-set the idle speed to 950-1000 rpm using the idle speed screw (2) if the

- idle speed changes much when the idle mixture screws (6) are adjusted.
11. Adjust the carburetor throttle balance lever screw (4) to match the weakest barrel on the front carb to the weakest barrel on the rear carb.
 12. Open the idle air bypass screw (7) on the strongest barrel of each carb and weaken its vacuum until it matches the weaker barrel on that same carb. Match one barrel on a carb to the other barrel on the same carb. Don't match between carbs with this adjustment. When you are done, there should be only one balance screw open on each carb.
 13. Re-set the idle speed to 950-1000 rpm using the idle speed screw (2).
 14. All adjustments should be made to within 3mm of mercury.
 15. After making the adjustments, your starting point may have been thrown out of whack. Go back and repeat the procedure from the start. Re-set the idle speed, adjust the idle mixture screws for strongest vacuum, balance the weakest barrels on the front and rear carbs, balance the strong barrel to the weak barrel on each carb. If nothing changes, you are done. If you need to make any significant changes during the second trial, you may want to repeat the procedure yet again until it stabilizes.
 16. Remove the manometer (and any adapters) and replace the vacuum tap screws/plugs/blanks.

Notes:

- o This procedure ignores emissions requirements. Adjusting the idle mixture screws for strongest vacuum does not necessarily produce the cleanest running engine -- just the best running engine. For emissions, you would have to connect an exhaust gas analyzer to the tail pipe and set the idle mixture screws to achieve a specified CO level (typically below 5%). The rest of the procedure would be the same.
- o If you are starting the car for the first time since the carbs were re-built, the idle may not be anywhere close to right and you may need to complete a preliminary setup as shown below before you attempt to balance the carbs.
 - a. Disconnect the throttle cable or make sure it is not pressing the throttle open or closed.
 - b. Unscrew the idle speed screw (2) out of contact with the throttle lever extension (3)
 - c. Unscrew the balance lever screw (4) of the balance lever (5) until the throttles of both front and rear carburetors are fully closed. Check that they are with light upward pressure on throttle lever (1). While maintaining pressure on lever (1), tighten the balance lever screw (4) until it contacts the tongue of the throttle balance lever (5), thus fully closing the throttles of both front and rear carburetors.
 - d. Tighten the idle speed screw (2) one more turn after it first contacts the extension (3) of throttle lever (1).
 - e. Remove any anti-tamper seals from the idle mixture screw housing (6) and unscrew each screw 2.5 - 3 turns from the fully-closed position.
 - f. When you start the car, you can always keep the revs up with your foot if you have to. Once the engine is running and settled down, you can adjust the idle speed.
- o On Dellorto 45's and 45E's there's a small throttle stop screw (not shown in drawing). Its only purpose is to keep the butterfly from slamming all the way shut and wedging into the barrel. After a re-build, you should do the same routine of feeling the lever while turning the stop screw in, and then go about 0.5 to 1 turn more. Just enough to keep the butterfly from touching the interior walls of the barrel. This is not a critical setting since the idle speed screw will keep the butterfly open further and the lever will never touch the stop screw. Once the carbs are on the car, it shouldn't be an issue -- unless. If the stop screw is inadvertently screwed in too far, it could hold the butterflies too far

open to allow a slow idle. If you have a problem achieving a slow idle, check out the stop screws.

What do the readings mean?

The absolute manometer readings aren't important as long as they are within the manufacturers specifications. It is the comparative reading that is important, not the absolute value.

If one carb has a significantly different reading than the others there can be several reasons for it.

- It may be at the end of its adjustment so you will have to back off all the adjusters and start again.
- It may be that a rubber tube has been wrongly routed so that you have been adjusting the wrong carb or that the rubber tube is kinked or flattened on its route to the carb or is loose.
- Possibly there is an air leak in the carb to the airbox or carb to head joints. It may be an engine fault and a compression test can help to pinpoint the problem.

As long as the rest of the engine is in good tune and you have some patience you will find it fairly easy and very rewarding to balance the carbs.

Information on the Gauge

Gauges do not need to be zeroed or calibrated. All parts have been matched at assembly.

Damping of the gauges and friction of the rods may be slightly different in each column. This does not affect the final readings, only the time it takes to get there.

If dirt or grease gets into the gauges, and makes the rod movement stick, then they can be cleaned. Lay the gauge flat on its back and remove the two screws from the bottom cap. Slip off the cap and front of the case and the rods will be exposed. (do not lose the soft sponge pad in the cap). Be very careful doing this. Do not lift or move the Carbtune with the bottom cap removed. All the parts will fallout and will be mixed up.

Important - Each rod and spring must go back in its original position and the right way up. The parts are matched at the factory - do not mix. Do not put loose springs together as they will tangle

- For simplicity only remove one rod at time for cleaning. Carefully remove spring from rod and polish rod and inside of rod guide with a cloth. Do not scratch.
- For severe staining use a Brillo pad or the finest steel wool to polish the rods. Wash or clean thoroughly with a cloth afterwards.
- Only assemble when dry.
- Do not remove top cap. Do not remove clear tube assembly from casing as it may affect rod alignment. Do not disassemble tubes from the black seals as they may not reseal.
- But remember, "if it ain't broke, don't fix it."

Spare parts are available from Morgan at the address below. Ring, fax write or email for price details.

Check the FAQ page on www.carbtune.com for common questions and answers. Any instruction updates or amendments will also be featured on the website.

The Carbtune II and previous Carbtunes have been tested and used on many different bike, car, marine and aviation engines. Obviously they have not been tested on every bike, car, boat or plane, so if any problems are encountered with the operation of the gauge or the supplied range of fittings, contact Carbtune with the details. Quite often problems can be quickly sorted out over the phone or by e-mail.

Guarantee

Carbtune is guaranteed against defects in materials and workmanship for a period of 12 months from the date of purchase. Should the Carbtune be damaged through such a defect, please contact the manufacturer. The manufacturer will repair or replace the equipment (at its option) provided you have followed the usage instructions. This does not affect your statutory rights as a consumer.

Manufacturer

John Morgan
Unit 33 Townsend Enterprise Park
Townsend Street
Belfast, BT13 2ES
United Kingdom
Tel: 028-9023-9007
Fax: 028-9024-7294
From outside UK
Tel: +44 28 9023 9007
Fax: +44 28 9024 7294
email: morgan@carbtune.com
<http://www.carbtune.com>