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The Magical Mystical Weber DCOE

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Virtual Tour	Rasors Fuel Flow Pathes	The Jetting Calculator	---	An email from a Racer

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In this article, Mickey present a very concise description (loaded with tips) of the inner workings of the Weber carburetor. A MUST read to help dispel many of the myths surrounding the DCOE.

Inglése INDUCTIONS SYSTEMS

WEBER CARBURETORS

A Technical Primer By:

Mickey Lauria

"If you have always wanted to know what makes these carburetors so

special, here's a basic, easy-to-understand introduction to the world of Weber exotica."

Weber carburetors have been seen as standard equipment on the finest racing and street machinery to come out of Europe for over three decades. Maybe you've been lucky enough to get a ride in a Ferrari or a Weber carburetor 289 Cobra; if you have, chances are, it's a ride you've never forgotten! Weber-carburetor engines all have one thing in common: they assault the senses with a rush of torque and a brutal sense of urgency that is generally unmatched among carbureted engines (and they have a sound all their own...go to a Shelby American convention on Open Track day and you can pick out the Weber-carbureted Cobras just by their sound; there is no mistaking it!). The world's most beautiful, exotic and most powerful engines have traditionally been fed through Weber carburetors. But why Weber?

For starters, it's a modular carburetor design. It is produced in a wide variety of styles which incorporate different features, enabling the user to select exactly the right design and size for the intended use. You can even change its CFM to suit your needs, which should begin to explain the Weber's superior adaptability for all kinds of applications.

Now, if you're one of those people who has always had trouble accepting the idea that the Weber is a terrific street carburetor, consider it this way: Weber carburetion is like an expensive musical instrument. If it is not tuned properly, that instrument will never make beautiful music for you-no matter what! And therein, lies the secret of making beautiful music with Weber carburetors-initial preparation..... It's what "tuned induction" is all about!

THE CONCEPT

The Weber carburetor was designed to be totally adaptable to any size engine, for any purpose, at any altitude. There is no such thing as taking four of these out of their boxes and bolting them on to an intake manifold...it simply isn't done that way. This carburetor was intended for serious tuners and performance enthusiasts who want the most that their engine can give them. **Welcome to the Big Time!**

TERMINOLOGY

All Weber carburetors carry a basic model number which is stamped at the base of the carburetor on its mounting flange. The most well-known is the good-old "48 IDA", a masterpiece of design and a marvel of precision machining that has been around since the early 60's with only minor revisions. In this case, the number 48 indicates the carburetor's size. It tells us the carburetor has a bore diameter and throttle plate size of 48 millimeters (about 1 15/16"), while the IDA suffix tells us that it is a high performance downdraft carburetor. There is also a 40 & 46 IDA/3C. Again, a high performance downdraft, available in 40 and 46 mm sizes. The 3C means this one's a "3-choke" (the in-line three barrel). The 40, 42 and 44 DCNF's are compact twin-throats which feature a cold-start. As the prefix numbers indicate, they are available with bore diameters of 40, 42 and 44 mm. Then there are the sidedrafts - all Weber sidedraft carburetors carry the suffix DCOE, their prefix numbers (sizes) ranging from 38 mm all the way to 55 mm (that's close to 2 1/4"). So you see, all those numbers and letters really mean

something. It's all pretty simple.....So, the next time someone mentions he's running Weber's, ask him whether he's running DCOE's or IDA's and pick up a few bench-racing pointers.

THE VARIABLE CFM FEATURE

Some where along the line, you can probably recall seeing four 48 IDA's on a big, nasty rat motor. You've also probably noticed that the same four 48 IDA setup is used on 289 Ford engines, as on the Cobras, for instance, You may have wondered how the same carburetor setup could work on two such vastly different engines. It seems that one engine would have to be either over or under carbureted, if we assume that the carburetion is "right" on one engine. Actually, this isn't true at all, because either engine is running the same set of carburetors as the other. Assuming the Webers are set up properly, the only thing the two systems will have in common is their outward appearance. The Weber's most interesting design feature is it's removable "choke" or venturi, allowing it to be instantly converted from a large-CFM carburetor to one of small CFM, or vice-versa.

By installing a smaller choke, the carburetor is constricted and it flows less CFM, to make it perform in the midrange, or to make it suitable for use on a low-compression small block engine. Pull out those small chokes, drop in some large-diameter ones, which may be nothing more than thin-wall "sleeves", and you've got a set of 48 IDA's that will flow enough CFM to make a big block scream. But don't try putting those "big" carburetors on the small block motor! It will fall flat on it's face, lack throttle response and become a complete nightmare in traffic("....My buddy had a set of those Webers on his engine, and boy! did that car run badly!!!!!"). In order to get drivability, throttle response and lots of torque from the Weber-carbureted engine, the choke size, therefore, is the first consideration. How big is the motor, what's the compression ratio and what do you want to do with it, once the correct size choke has been selected for your application, the jetting for all the rest of the circuits can be established around that choke size.

THREE CIRCUITS

For the sake of simplicity, let's look at the Weber carburetor as having three basic circuits- the idle circuit, the accelerator pump circuit and the main circuit.

The idle circuit is comprised of two components, the idle jet and the idle jet carrier. With these two pieces, the tuner can select exactly how much fuel and how much air he wants to provide the engine at idle and during the low rpm operation, while making very fine adjustments to either, if necessary. The idle mixture is delivered as a proportioned mixture whose total volume can be further regulated with the idle mixture screw, which is located on the lower part of each carburetor barrel. On a correctly-jetted idle circuit, the mixture screw on a 48 IDA is never more than 3/4 of a turn out. This will hold true 100% of the time, no matter what anyone else tells you. If you have to go more than that, you'd better heavy-up the idle jet. Even if you get it to idle, going more than 3/4 turn tells you the jet is lean and you're going to have other drivability problems, which brings us to the next part of the idle jet's function.

The idle circuit in the Weber isn't just an idle circuit - it does more than that. It is actually the circuit which must carry the engine all the way up to about 2,800-3,000 rpm, where

the transition to the main circuit take place. That means if you don't drive over 3,000 rpm, you're only running on the idle jets. After 3,000 rpm or so, the idle circuit is entirely bypassed and no longer has anything to announce. So, if you have a tuning problem that "goes away" after about 3,000 rpm, that tells you to play with the idle circuit. Or maybe the opposite is true. Either way, it's very cut and dried as far as the two circuits are concerned - so isolating the problem is a breeze.

One the most frequently experienced "gremlins" with Weber carburetors is a seemingly incurable and very annoying flat spot which rears its ugly head at about 2,200-2,800 rpm. This condition is generally caused by one of two things - you either have the wrong emulsion tube in the carburetor, which is causing a rich stumble due to an under-emulsified mixture at that particular rpm range or the idle circuit is falling off too early to carry the engine up to the point where the main circuit can take over, leaving a "lean hole". In simple terms, the idle circuit is going lean too early. Either condition is easily rectified. In the case of the emulsion tube, there are really only a few which work really well for V8 applications; and if you aren't using one of them it is certainly a big part of the problem. If the flat spot is still there even with the correct emulsion tube, then you'll need to richen up the idle circuit. This is sometimes a tricky area, because the first thing you want to do is throw in a bigger idle jet, but sometimes playing with air bleeds, mixture screws, or choke sizes can accomplish the same thing while sticking with the original jet size. Seeking a little bit of sound advice here can save a lot of time and hassle. The point here is that these carburetors are designed to come off idle and run smoothly all the way up. Your problems can be solved with a little tuning on your own or by relating the symptoms to someone who is knowledgeable enough to help you. Remember, these carburetors will do just about anything you want them to, except maybe wash your socks.

The accelerator pump circuit, just like on any carburetor, is responsible for eliminating "bog" and making a passing maneuver without a hesitation or stumble. The circuit also has two basic elements. These are the pump exhaust valve and the pump jet. The pump exhaust is nothing more than a bypass valve and this is located in the bottom of the float bowl. This is the piece that regulates how much fuel you want to make available when you need that pump shot. Putting a bigger bypass hole in the valve allows more fuel to bleed back into the float bowl instead of out of the shooters. The smaller the hole, the more fuel you're making available. You can even put in a "closed" bypass for drag racing, when you need all the juice you can get in order to get those slicks turning. Obviously, there is nothing complicated about a simple bypass system. The duration of the pump shot is varied by installing a larger or smaller pump jet (shooter). Larger pump jets give a heavy blast over a short period, while the smaller ones will give a finer, longer-duration shot. As long as you leave the bypass valve alone, you're still getting the same overall volume. In most cases, the stock pump jets can be left alone.

The main circuit is the easy one. This is where you make your power. This circuit has three primary elements you should concern yourself with - the main jet itself, the emulsion tube and the air corrector. You're thinking that's a lot of pairs - usually, it's just a main jet. You know how to "read" what your Webers can tell you on a road test, you wouldn't have it any other way. The capability for fine adjustment is what you pay for. Let's take a look at this main circuit.....

The main jet is stuck into the bottom of the emulsion tube and sits in fuel. As the

carburetor begins to work, the main jet meters the amount of fuel allowed to pass through it and up into the "main well" around the emulsion tube. Air enters the top of the emulsion tube through the air corrector which meters the amount of air to be mixed with the fuel. The air blows out of the emulsion tube through a series of holes along its length and aerates the fuel that is rising up the well around the tube. This emulsified mixture is then sucked out of the main delivery nozzle as the "depression" in the carburetor increases to the point where it's strong enough to pull it out. This occurs by 3,000 rpm or so, and you're down the road like a shot.

Tuning the main circuit for maximum power is something that can be done by a series of road tests and a handful of jets. The simple rule of thumb for jetting Weber carburetors is, if you want to implement a change over the entire rpm range, you play with the main jet. If you want to change the way the car feels at the high end, that's where the air corrector comes in. Also, you should keep in mind that the air corrector is a finer adjustment that the main jet. Example: One step upward in the main jet (richer) equals about the same as three steps down on the air (less air: richer). A change of air corrector would be appropriate; for instance, if the engine pulls strong to 5,000 rpm and then goes flat. This would mean she's going lean on you up top; drop the air corrector three sizes or so, and you'll probably be able to buzz that engine right up to 7,000 rpm. If the motor feels sour all the way up, go one or two sizes heavier on the mains only. No magic! So, tell me, what's so hard about jetting these Webers?

STREETABILITY

Most people don't realize that this carburetor, like all highly efficient items, is an extremely simple design with very few moving parts. There are no metering rods, power valves, rubber seals or plastic parts. The accelerator pump on the 48 IDA is a brass piston. The throttle shaft rides in a set of precision roller bearings. Webers use brass floats, which cannot become fuel-logged, and gradually sink with age. It is a superior example of precision machining and "beautifully-fitting" components...it's really very unlikely that one of these carburetors is going to "fail" and cause you to be stranded somewhere. That's another reason why they're well suited to street use and long-distance cruising - they are extremely reliable.

With the infinite tune ability of Weber carburetors, there is no need to compromise the drivability or road manners of your car. If you know someone who suffers from drivability problems with such a nice carburetion system, he is doing so unnecessarily. A Weber unit should be crisp, responsive and smooth. If it is not, something is wrong - let's just say he's not through tuning it yet, that's all!

The first thing most people notice when they go to Webers is an increased flexibility from the motor. There is a natural tendency for a Weber-carbureted engine to idle smoother, have a slicker "feel" to it a low speeds (particularly if a hot camshaft prevented that feeling before), and generally feel much more powerful throughout the entire rpm range. This is largely because they use an independent-runner manifold, which does not incorporate a plenum. In a typical four two-barrel Weber layout, there is one barrel directly feeding each cylinder without any intercommunication between barrels or cylinders. This totally "isolated runner" design ensures that each cylinder is fed exactly the same as the next, without any chance of charge-robbing or over-feeding. What you are doing, in effect, is separately tuning each cylinder. This results in a dramatic increase in horsepower output and torque in midrange, right where street

engines spend 90% of their time, making this an ideal carburetion system for street use, where maximum flexibility creates greater driving enjoyment. The throttle response with an independent runner induction system is also a new experience, it's second to none. A Weber carburetion system will respond like a fuel injection unit, with which it shares some similarities: short runner length, isolated design and essentially a low fuel mass to move when you hit the throttle. (Remember, you're not asking that cylinder to gulp all the mixture from that big plenum area - that's a lot of mass, by comparison. The only mass to move is what's in that one short runner). The main difference between fuel injection and Weber carburetion is that one relies on fuel being injected under very high pressure, while the other responds to the needs of the engine via the depression principle. For street use, the Webers have the edge - it's what they were made for.

In the mileage department, it really depends on the rest of the engine and your driving habits, but 16 to 18 mpg is not unusual on the highway. This is pretty respectable, when you stop to consider that the engine is fed by all eight barrels constantly. There is no such thing as a progressive system here. Another thing: Webers will run happily on regular gas. If you can run regular now, you can continue doing so after installing the Webers. This is purely a function of compression ratio and ignition timing, not induction. In fact, if you're running a 10.5:1 engine, you may find it's a little bit fussy about which brand of fuel it wants. giving you detonation at times. Generally speaking, the Weber carburetion will likely change this for the better, suppressing the tendency to "ping". One reason for this phenomenon is that the fuel distribution is now fully controlled, eliminating the "lean spots" which sometimes are present in conventional manifolds which distribute fuel from a central plenum. Lean cylinders run hot - excessive cylinder heat means detonation.

TUNING AND MAINTENANCE

A Weber carburetion system will not be right, unless it's synchronized to ensure that each carburetor is doing exactly the same as the next - the name of the game is perfect cylinder tuning. The synchronization procedure can either be a breeze or a nightmare, depending on whether you have a well-designed linkage system or not. The secret to a good linkage setup is that it must allow independent adjustment of each carburetor without affecting all the rest as you go through the procedure. Here again, if someone tells you they're absolutely impossible to synchronize, you might study his linkage. Chances are, it's incorrect and he's fighting himself. The right components are now available to take this out of the dark ages.

The final idle mixture adjustment on each barrel is a simple adjustment which is performed by ear, but because there are four carburetors, a lot of guys feel intimidated. It's done the same way you do a single four barrel, except in this case, you can listen to each cylinder separately. It may take you four times longer, but it's no more difficult at all. Each mixture screw, as it is turned, will have a noticeable effect on engine rpm, as the wrong setting will cause the cylinder to "go away" - it's just like pulling a plug wire. No matter how hard you try, you can't mess this up if you remember one thing: always start from scratch at 3/4 turn out. From there, you go 1/8 of a turn either way and it's usually in, not out. This will get you out of the woods if you ever get lost.

Once the unit is synchronized and the idle mixtures are dialed in to give you the smoothest possible idle, you can hang up your Unisyn and screwdriver til' next spring, because *now it's set!* And when *it's set, it's set!!* They will not suddenly "go out" on you

and ruin your day at the picnic.

EXPENSE

When it comes to the Price of Admission to "Weberdom", what can one say..... Webers are not for everyone. This type of induction unit represents a sizeable investment. It's still possible to put a unit together on your own with bits and pieces, and if you're a fast-lane spender, you can opt for a ready-to-run unit created especially for your engine. Dollarwise, Webers usually fall into the category of a supercharger with carburetors. The price of opening up a box and pulling out a science-out Weber unit with all the right pieces and associated hardware will run you from $3,000.00-$4,000.00, depending on how much flash you have to have. Sound expensive? Maybe not, if you consider that all things are relative. When you figure the price of a top quality paint job at $5,000.00 to $10,000.00, a completely redone interior at $3,000.00 to $5,000.00, a set of trick wheels and tires at maybe $3,500.00, and your basic "nice street engine" at $3,000.00 to $5,000.00, another two grand for an item that changes the car's whole personality falls right in line.

And as they say, "the fun's in the driving". Weber carburetion is a lot more than something that's exciting to look at. Every time you take that machine of yours down the road, you become more aware of your engine's ability to do everything it should do with a minimum of fuss. Throttle response, quick acceleration and overall flexibility are the constant reminders of what you've spent your money on - the ultimate carburetion system!

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