

Carburetor Class at Drag Racer Magazine

By Saarinen

Edited by Randy Fish

September 2006 issue

Q: What's required of a fuel system to run alcohol?



Use a diaphragm bypass or a pill-and-poppet style of regulator with a belt-driven fuel pump. Having an adjustable fuel log simplifies connections, accommodates a fuel pressure gauge and the NHRA-mandatory fuel safety shut-off valve, and provides an additional fuel reservoir. A separate mounting kit is required to install the belt-driven pump.

A: Since the volume of alcohol consumed is almost twice that of gasoline, the carburetor will operate at it's most consistent when it's receiving variable fuel pressures and volumes. This is best accomplished by using a belt-driven fuel pump and a diaphragm bypass. The belt-drive pump facilitates lower fuel pressures (2 to 4 PSI) and volume at idle and higher pressures (9 to 11 PSI) and volume at fully open throttle.

Q: With methanol prices being so much less than racing gasoline, what are the pros & cons of switching to alcohol?

A: There are pros and cons to each type of fuel. Alcohol absorbs moisture from the atmosphere, which can be to the detriment of the cylinder walls, combustion chambers, valve gear, as well as the lubricating oil if regular maintenance is not performed. In addition, not only will oil changes be required on a more frequent basis but

also engine rebuilds will become more regular. However, alcohol will produce more torque than its gasoline counterpart. It will also perform more consistently and the engine will run cooler due to the greater consumption of fuel, which is an advantage at this time of year (summer).

Q: What is the best way to tune an engine that is running on alcohol?



Two valuable test meters: exhaust gas temperatures and air-fuel ratios (Innovate)

A: There are many ways of tuning an engine. But jetting and tuning for your highest speed (mph) is still the most effective. Gasoline engines produce more power when tuned slightly toward leanness; however, alcohol engines generally produce more power when tuned slightly toward richness. Once you determine where your car runs best, for further tuning, check your exhaust gas temperatures with an EGT Pyrometer and, more importantly, your air-fuel ratios with an Innovate Lambda meter (a wide-band oxygen sensor).

Q: Why do racers using alcohol seem to run more consistent times than those using race fuel?

A: Because the air-fuel ratio of an engine running on alcohol is about half (approximately 6:1) of that of an engine running on race gas (approximately 12:1), some racers feel the alcohol engine is not so

affected by weather changes. However, it's more likely that the consistency of the alcohol engine is derived from the cooling effects of its fuel, especially when tuned slightly toward richness.

Q: What type of maintenance is required with alcohol fuel?

A: Alcohol, as previously mentioned, absorbs moisture from the air and is, therefore, corrosive. Use a good cylinder lubricant in the alcohol to help combat corrosion. Also, drain and thoroughly clean the fuel system if your car is not in regular use. Finally, get the engine hot and the oil temperature as high as possible to evaporate any moisture in the oil.



Converting from gasoline to alcohol or vice versa is simple with the appropriate conversion kit.

Q: How practical is it to convert to Alcohol?

A: If your racecar already uses a belt-driven fuel pump, it can be pretty simple. Most carburetors need to be converted by a carburetor specialty shop. However, if you're using a Drag Race calibrated Demon® carburetor, simple gasoline-to-alcohol conversion kits are readily available. These kits usually consist of metering blocks, jets, needle-and-seat assemblies, boosters, accelerator-pump nozzles (squirters), and gaskets. In most cases, the carburetor can be converted in an hour or so. **DR**

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Q: My carburetor was running fine, but suddenly began running rich. Is this an easy fault to correct?



High-speed air bleeds (inner) and idle air bleeds (outer) are vital parts of the idle and main fuel metering circuits, and must be clean to operate correctly

A: The air bleeds control the carburetor's fuel curve, and it is crucial they are kept clean. Keep air bleeds clean by spraying them with WD-40 or carburetor cleaner.

Q: Occasionally, I've encountered an off-idle hesitation and cured the problem by tightening the fuel bowls. Is this a common fault or just particular to my car?

A: All modular carburetors have metering block gaskets and fuel bowl gaskets that tend to compress over a period of time. In addition, the retaining bolts are subjected to the hot and cold cycles of the engine. To keep the metering circuits fully sealed, it's important to check the tightness of the bowl screws periodically. Incidentally, all Demon carburetors have Helicoil steel inserts fitted to the bowl screw holes for reinforcement.

Q: My drag race car has a fairly old electric fuel pump. How do I know if the fuel delivery is adequate?

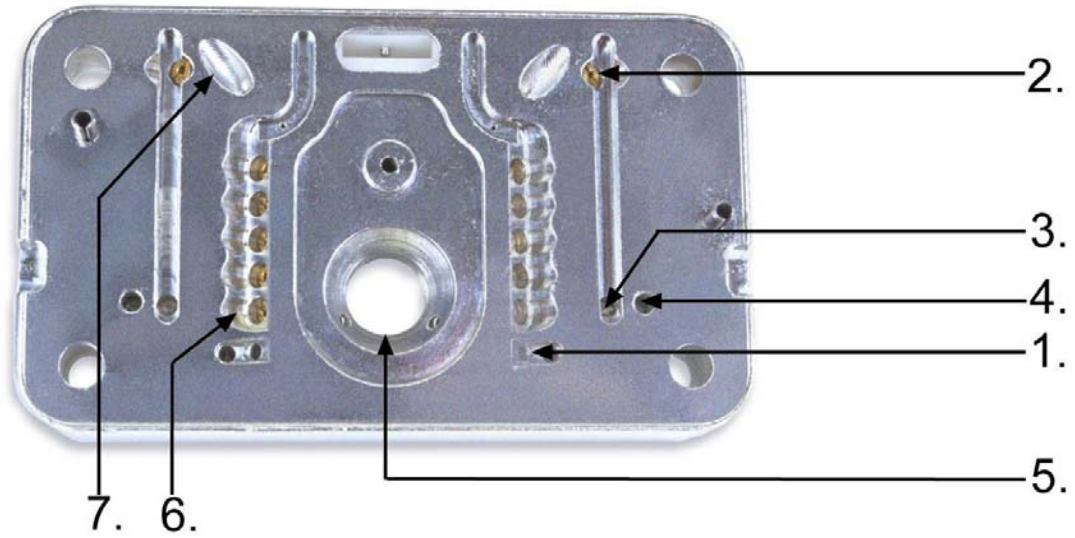
A: Find a clean one-gallon can with a wide opening on top and insert the two or four carburetor fuel lines from the fuel pressure regulator. Then, aided by a friend and with a fire extinguisher nearby, switch on the fuel system and carefully measure the time it takes to fill the container: Eleven-second cars need a gallon of fuel delivered in 30 seconds; high-10-second cars in 25 seconds or less; and nine-second cars in 20 seconds or less.

Q: Fuel is spilling from my vent tubes and from my boosters! What's the remedy?

A: Spillage problems are often related to the needle-and-seat assemblies in the fuel bowls. Remove, clean, and replace them and re-adjust the float levels. Also, it's important to maintain the correct fuel pressure (5.5 to 7.5 lbs/sq. in.) Inadequate fuel pressure causes fuel starvation; excessive fuel pressure leads to needle-and-seat sealing troubles, which result in fuel exiting the vent tubes and boosters. A bowl vent that is blocked or partially blocked can also lead to fuel spilling from the boosters, even when the float levels appear to be correct.

Q: Under rapid acceleration my carburetor stumbles. Can you suggest a remedy?

A: Increase the size of your accelerator-pump nozzles (squirters). The purpose of the accelerator pump is to enrich the mixture—not necessarily at off-idle but under rapid acceleration or rapid throttle openings. **DR**
Scroll down for information on the Demon billet metering block.



Demon billet metering block: This side seals to the carburetor main body; the far side seals to the fuel bowl.

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| <p>1. Idle-circuit fuel enters here from a main jet. The vacuum (depression) generated below the closed throttle plates at the idle discharge orifices and transfer slots has the power to defy gravity; it draws the fuel vertically upwards through internal idle circuits to the idle-feed restrictors. The idle-feed restrictors regulate the amount of fuel in the idle circuits.</p> <p>2. At the idle-feed restrictors, the fuel is introduced to the air that is traveling down from the idle air bleeds (also drawn by the depression below the closed throttle plates). Emulsification (mixing) of air and fuel occurs in this vertical channel as the air-fuel mixture for the idle circuit travels downwards on its way to both the idle discharge orifices and transfer slots, located in the base plate.</p> <p>3. Passageway that leads to a transfer slot. The function of the transfer slots is to provide sufficient air-fuel mixture during the transition between the supply of idle circuit fuel and main circuit fuel.</p> | <p>4. Passageway that leads to an idle Discharge orifice. The function of the idle discharge orifices is, unsurprisingly, to provide sufficient air-fuel mixture during idle. Adjustment of the idle mixture is performed by the adjacent screws, which penetrate these particular passageways.</p> <p>5. Power valve aperture. Usually, power valves are considered unnecessary in drag racing applications. They are more suited to cruising and generally work in conjunction with smaller main jets, providing additional fuel when required.</p> <p>6. Emulsion bleeds are set in the main fuel circuits. Air is drawn in from the high-speed air bleeds above and mixes with the fuel in adjacent internal passageways behind the emulsion bleeds. The vacuum (depression) generated by the boost venturii (boosters) also has the power to defy gravity; it draws the emulsifying main circuit fuel vertically upwards, out through the main well exit holes at the top of the metering blocks (7), and discharges through the boosters.</p> |
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May 2006 issue

In this month's Carburetor Class, I asked my technical department for the most commonly asked questions concerning the tuning and servicing of a modular carburetor. Here are six of the twelve and the corresponding answers. The remainder will follow next issue. --- Barry

Q: How can I check my accelerator-pump adjustment?



At fully open throttle, ensure there's a little free-play to avoid damaging the accelerator pump mechanism.

A: With the throttle plates closed, ensure there is no free-play in the accelerator-pump mechanism. At fully open throttle, there should be approximately 0.015" - 0.020" of additional travel available between the spring-loaded pump arm and the lever that attaches to the float bowl. Correct adjustment of the accelerator pump ensures that the vehicle moves cleanly from idle and remains stumble-free.

Q: My street car has a hesitation. I'm told that the spring adjustment on my vacuum-secondary carburetor is at fault. Is this true?

A: When the secondary throttle plates open, the car should not stumble nor should it feel as though the secondaries have opened rapidly. A smooth transition will always give the quickest elapsed time. If you can feel the secondaries slam open, the secondary shaft may be sticking. If you feel the engine bog, then the secondaries may be opening prematurely because the spring is too weak.

Q: My needle-and-seat assemblies are being affected by small particles of dirt, which come through the fuel line and cause flooding. Do I have a filtration problem?

A: Always keep the fuel



This filter is light, has no loss of flow volume, is easily serviced, and can be used with gasoline, alcohol, or nitro

system clean by using an in-line fuel filter installed ahead of the fuel pump. The filter prevents dirt from entering both the pump and carburetor and prolongs the life of both.

Q: How can I select the right carburetor for my application?

A: On a powerful engine that's equipped with large cylinder heads and a radical camshaft and producing 450 hp or more, use a carburetor that's capable of supplying sufficient fuel. High-power engines designed to run at high rpm usually don't have the capacity to draw fuel at low revs. In this case, use a Mighty Demon or a Race Demon carburetor with the appropriate calibration to suit the engine. Lower horsepower engines can benefit from the fuel curve calibrations of a Speed Demon carburetor.

Q: My drag race car stumbles after it leaves the starting line. What's wrong?

A: If the car has traction and it moves forward but then hesitates, there's no amount of accelerator-pump tuning that will correct the stumble.

Instead, it needs a notched float and jet extensions in the rear fuel bowl to cure the problem. Also, fuel surging from the vent tubes can cause a stumble after leaving the line. The best cure for this condition



Use a notched float and jet extensions in the secondary fuel bowl to keep the jets immersed in fuel and prevent starvation.

is to connect both vent tubes together by linking them with a piece of fuel hose. On top of the looped hose, cut a half-inch hole to vent the fuel bowls.

Q: What is the function of a power valve?

A: The function of the Power Valve is to supply extra fuel under high-demand conditions, such



Power valves are rated in inches of mercury, which indicates the amount of vacuum required to open them. They are crucial to carburetor tuning and should be replaced periodically to prevent leakage.

as those at wide-open throttle. It's important to match the power valve to the engine's manifold vacuum to ensure that it's fully closed at idle and not bouncing open. It should be rated at a minimum of 1.5-inches of vacuum under that of the engine at idle (and in gear for cars with automatic transmissions). For example, if the engine is idling at 7.5-inches of vacuum, use a power valve of 5.5 or less. **DR**

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March 2006 issue

Q. How can I benefit by running a “Throttle-Stop” carburetor as opposed to a regular four-barrel?



Throttle-stop carburetors have recalibrated metering circuits for a smooth transition when coming off the “stop”.

A. A throttle-stop introduces an additional set of throttle plates into the intake tract, which operate independently of those of the carburetor. During competition, the throttle plates of the carburetor remain fully open, but those of the Throttle-stop fluctuate from open to partially closed to fully open. As a result, they disrupt the airflow and affect the car’s consistency when coming off the “stop.” Under normal use, the carburetor would progress from one fuel-metering circuit to the next: idle, transfer slot, intermediate, main circuit. But when in Throttle-stop mode, the carburetor is denied circuit transition—instead, it continues to operate on the main circuit only, which can cause inconsistency. Consequently, for Throttle-stop racing in the Super Classes, it’s more reliable to use a carburetor that is specifically designed for the purpose.

Q. I know some guys are running EFI in the Super classes, but I’ve heard they’re difficult to dial-in. With your fuel system experience, would you agree that I’m better off running a carburetor on my bracket car (in terms of drivability and tuning ease)? I’m not exactly an electrical genius.

A. Fuel system experience teaches that the fewer electronics on a racecar the better as any change in voltage affects consistency. Of course, EFI racecars rely on more electronics than their carbureted counterparts. Moreover, if there were a

competitive advantage to running EFI, we’d see everyone doing it. Carburetors are simpler for most people to tune and more adaptable to the changes in the combinations that so many of us make.

Q. I’m planning a cam change in the off-season. How do I match my cam, carburetor and torque converter for the best possible combination?



Belt-driven fuel pumps are electronic-free; therefore, unaffected by voltage losses. The ultimate solution for fuel starvation in drag racing engines, their fuel-delivery capacity increases with engine revs and they’re especially useful in methanol applications.

A. The first step in this process is to discuss the cam change with your camshaft manufacturer. Tell them what you’re trying to accomplish: more HP, TQ, RPM, etc. From those discussions, you’ll be able to determine if the camshaft change affects your torque and power curves. Take this information to your torque converter manufacturer who can determine if your converter needs recalibrating or even replacing. With this information, you can now talk to your carburetor manufacturer to determine if you need to change the size or calibration of your carburetor to suit your new camshaft.

Q. What does Stoichiometric mean?

A. Stoichiometric (pronounced Stoy-kyo-metric) simply means the ideal ratio of air and fuel required for the complete burn. For example, the Stoichiometric ratio of unleaded fuel at sea level is 14.7: 1 (14.7 lbs of air to 1 lb of fuel). On the other hand, the Stoichiometric ratio of 100-octane race fuel is 15.1:1 and for methanol the ratio is a

much richer 6.45:1. As a racer, your air/fuel ratio will be richer than the Stoichiometric ratio. However, it’s important that it’s not too rich and, consequently, inconsistent: in poor weather conditions, the car will be slower than normal; in better weather it will be faster than normal.

Q. My buddy tells me I should run a double pumper on my street/strip car, but my other friends are telling me that I should get a vacuum secondary. What do I need?



Four barrels with mechanically operated secondary throttle plates are ideally suited to higher stall speed torque converters or manual transmissions.

A. Choosing a mechanical-secondary or vacuum-secondary carburetor is usually determined by transmission type. Normally, on a vehicle with an automatic transmission with a stall speed torque converter of 2,800 rpm or less, we’d recommend the use of a vacuum-secondary carburetor. This is because the secondaries will only open when there is sufficient engine load and RPM. Conversely, if you’re running a higher stall speed torque converter or a manual transmission, you can usually get better acceleration and throttle control by using a mechanical-secondary carburetor. **DR**

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January 2006 issue

Q. I'm running a carburetor that seems to be big for my application. Can I jet it down to make it smaller?

A. No, not really, unless you're able to reduce the carburetor's size by changing its boost venturii from downleg to annular. An engine needs air and fuel in the proper ratio to be an



Annular boosters are bigger in mass than that of the downleg type; therefore, they reduce the carburetor's capacity and increase airspeed.

efficient power producer. A carburetor can only flow fuel if the engine can create sufficient air speed, which generates low pressure in the venturii of the carburetor and causes fuel to flow through it. If the carburetor is too big, the air speed and, consequently, the fuel flow is reduced. A correctly sized carburetor will always provide better response (fuel flow reaction), yet, still provide enough capacity (total air flow) to achieve top performance.

Another advantage of a properly sized carburetor is the increased emulsification (mixing of air and fuel) and atomization (fuel breakup), which leads to a more homogenous mixture (even distribution) of air and fuel; thus, more power.

Q. What is a dead-head fuel pump and how does it differ from a constant flow style?

A. The dead-head style of fuel pump is ideally suited to drag racing applications. It is simple in form, simple to plumb, and permits increased line pressure from the pump to the regulator, which offsets the severe g-forces acting upon the fuel. G-Forces can drastically reduce the pump's output. However, the dead-head pump is unable to disperse heat easily and

should not be employed for continuous-duty use. Though electrically powered like the dead-head, a constant flow style of fuel pump is better suited for street use. It has fuel flowing through it constantly, which keeps the fuel cool and reduces the amperage draw.

Q. I have a racecar that should run in the "high tens", but it's beginning to lose its enthusiasm: sometimes, I notice it surging under load. Should I increase the size of my main jets or suspect faulty electrics?

A. Your surging and lack of enthusiasm may be caused by a poorly performing fuel system. Before changing carburetor main jets, check your fuel system by conducting the gas can test. A "high tens" car should discharge one gallon of fuel in 25 seconds or less. Have an assistant and a fire extinguisher standing by, then, disconnect the ends of the fuel hoses from the carburetor/s and insert them into the open top of a one-gallon metal container: a clean paint tin. Get your assistant to switch on the fuel system while the event is timed.

Q. What defines a nitrous engine?

A. A nitrous engine is distinguished from its naturally aspirated counterpart by its capacity to consume greater amounts of oxygen and fuel and, therefore, produce more power. However, more power creates additional cylinder pressures and, consequently, greater stresses are imposed on the engine (particularly the bottom end) as well as in the driveline components. For these reasons, a nitrous engine needs stronger internal components. Also, since additional oxygen (nitrous) is being forced into the engine, exhausting the gases must be free of restriction. To accomplish this, a camshaft with a longer exhaust duration cycle, efficient exhaust porting, and a free flowing exhaust system

are used. If you're class of racing permits it, a further boost in power can be found by increasing the compression ratios.

Q. I've heard of the IdleEze on Demon Carburetors, but I don't understand what it does?

A. The carburetor's idle circuit is activated by an area of low pressure beneath the throttle plates (butterflies) drawing fuel from the idle discharge ports and transfer slots. The throttle plates at idle are almost closed and the low pressure is created by a falling piston, which causes vacuum in the cylinder bore, the intake manifold, and under the throttle plates. However, when a performance camshaft is installed, the area of low pressure beneath the throttle plates is diminished and therefore the capacity to draw fuel at idle is impaired. The



On street engines with longer camshaft duration, the object of the IdleEze is to maintain the perfect throttle plate position at idle..

IdleEze, which is fitted to Speed and Mighty Demon carburetors, was designed to provide engines with camshaft durations of up to 260 degrees @ .050" of valve lift (performance street engines) with the correct air/fuel ratio without altering the position of the throttle plates or their vital relationship with the transfer slot. On the other hand, for race engines using camshafts with valve durations in excess of 260 degrees @ .050" (as well as under 260), we recommend the Race Demon which employs an adjustable air bypass valve instead of the IdleEze air valve. **DR**