Aeromotive, Inc. Technical Bulletin #201

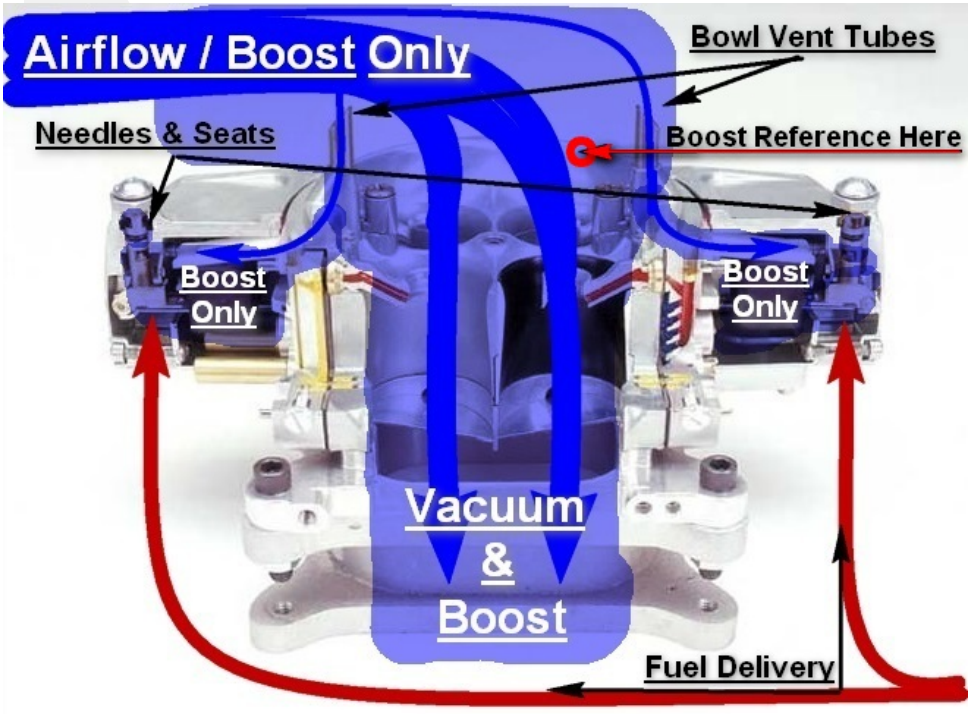
From: Aeromotive Technical Department

Date: **12/8/14**

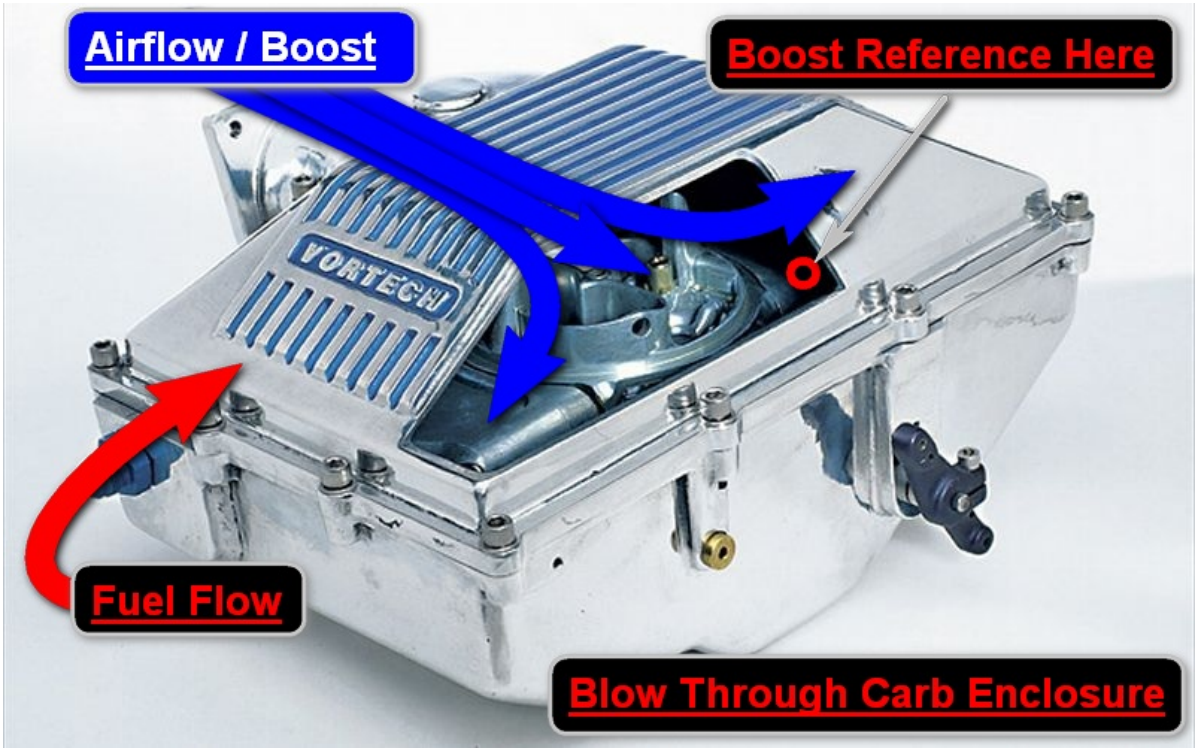
Re: **Carbureted Fuel Pressure Regulators, Vacuum and Boost Reference:**

Aeromotive Carbureted Bypass Regulators: Why and how to use vacuum and boost reference.
All Aeromotive, Carburetor Bypass are designed to allow the regulated fuel pressure to be vacuum or boost referenced on a 1:1 ratio with PSI. The purpose of the boost reference feature is to ensure fuel pressure at the inlet of the needle-and-seat rises with boost, offsetting any air pressure opposing fuel flow at the outlet of the needle and seat, in the float bowl itself.

For "blow through" carbureted engines, where air is pushed or "blown" through the carburetor from a turbo or centrifugal supercharger, the carburetor ***and*** float bowls are pressurized, along with the intake. Pressure enters the float bowls via the vent tubes. As boost pressure builds in the intake, it also builds in the bowls, offsetting the pressure working to push fuel in through the needle and seat. Rising boost can act to slow or even stop fuel from entering the bowl, allowing it to run empty. By connecting the boost reference port on the regulator to the hat or carburetor box, the regulator will raise fuel pressure 1:1 with boost pressure, offsetting the rising air pressure and ensuring fuel continues to fill the bowl and feed the engine.

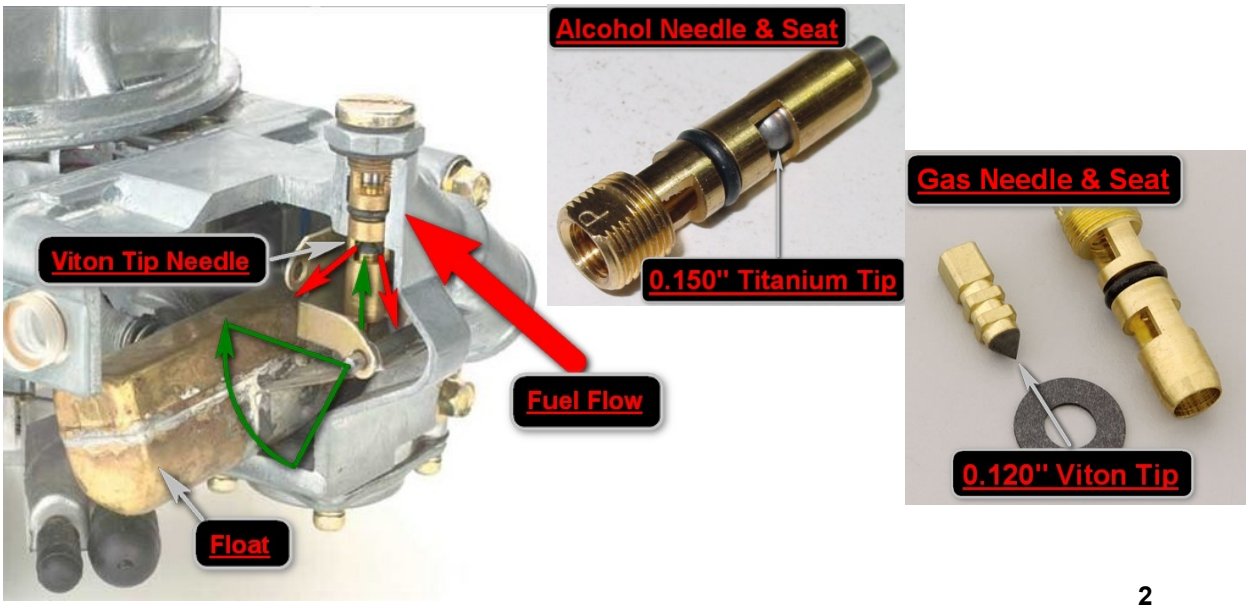


The boost reference line on a blow through engine should reference positive pressure only (that is boost), not vacuum, and be connected to the carburetor box or hat rather than the intake manifold. Does a blow through carburetor in a "box" or enclosure require boost reference? The benefits of enclosing a blow through carburetor do not include avoiding use of a boost referenced fuel system. Always boost reference blow through carbureted engines, regardless of using a box or hat.

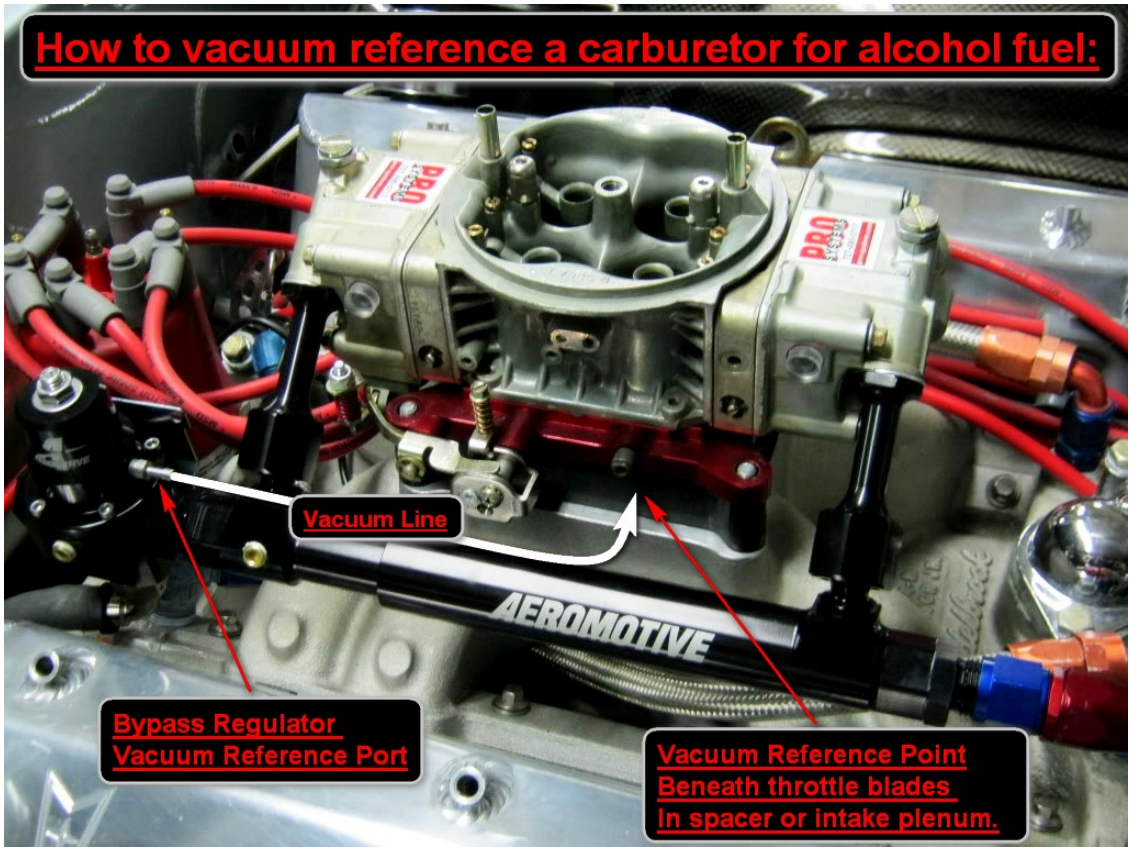


Note: Using a bypass regulator creates a dynamic fuel delivery system that has benefits for all carbureted engines, naturally aspirated, draw through supercharged, nitrous, etc. So do not hesitate to use a bypass regulator for any carbureted engine application, see TB-801 for more info. However, for carbureted engines that do not require a boost reference, like roots blown and nitrous combo's, the regulator's vacuum/boost reference port should be left open to atmosphere, never plugged.

What about vacuum reference? One naturally aspirated engine that can benefit greatly from using vacuum reference are carbureted engines on alcohol. The most restrictive point in a carbureted fuel system is the last thing, the needle and seat. With gasoline needle and seats in the 0.110" - 0.120" range, the largest needle and seat for alcohol carburetors is in the 0.150" range. Although this represents a 54% increase in flow area, methanol engines burn up to 100% more volume than gas engines. It's easy to see where an alcohol carbureted engine requires special attention to the fuel delivery system.



Because alcohol needle and seats are larger, and because they do not incorporate soft rubber tips to enhance sealing (alcohol fuel attacks and damages the tip on gasoline needle and seat assemblies), fuel pressure may need to be reduced to prevent flooding at idle and during staging. On the flip side, due to the large increase in fuel consumption with alcohol, and thanks to the nominal increase in needle and seat size that is possible, fuel pressure must often be increased if we want to keep the float bowl from running dry at WOT (wide open throttle). Short of converting to an Aeromotive mechanical fuel pump and Double Adjustable regulator, the only option is to use the vacuum reference port on our bypass regulator.



Taking advantage of vacuum/boost reference capability on a naturally aspirated, alcohol engine, fuel pressure can be set higher for WOT operation but reduced at idle, using the vacuum in the intake. Although we can't completely control idle and WOT fuel pressure with vacuum like we can with an Aeromotive Belt Drive Pump and Double Adjustable Regulator, a real difference in pressure from idle to WOT is possible, and every little bit helps when it comes to alcohol carburetion.

In order to correctly adjust carburetor fuel pressure with a vacuum reference, use the following procedure: 1.) Start the engine cold, with the vacuum line disconnected and plugged to the intake. 2.) Immediately adjust the regulator for the maximum pressure that will keep the engine running without pushing fuel by the needle and seat. 3.) With the engine warm connect the vacuum line to the regulator and note the drop in pressure. 4.) Adjust the regulator back up to the maximum pressure you found was possible with a cold engine in step 2. Now, at idle, fuel pressure will be safe, but at WOT, fuel pressure will rise by the amount it fell when the vacuum line was connected. Usually a gain of 2-4 PSI is possible.

Caution: When starting the engine with a vacuum referenced regulator, tap the momentary side of the fuel pump toggle switch a couple times to fill the bowls, start the engine with the pump off, then turn the pump on.

Note: Vacuum is normally measured in "HG or inches of Mercury. The regulator works by lowering fuel pressure on a 1:1 ratio measured in pounds per square inch or PSI. The key to understanding how much fuel pressure will drop with vacuum is to convert "HG to PSI. The ratio is roughly 2:1, so every 2" vacuum at idle is equal to 1 negative PSI. If you know how much idle vacuum the engine carries, you can divide it by 2, to predict the amount of fuel pressure drop with vacuum.