Under Pressure

By Bruce Smith

Delivering fluid to fuel parts when they're out of the car.

If you're doing work on carburetors or fuel pumps, at some point you'll find that a regulated low pressure source could be useful. Float level setting, flow rate testing, or leak checking are usually easier on a bench than in the car. A low voltage electric fuel pump could be a solution but the output is usually fixed or, if not, setting a particular pressure isn't easy. In this article, some simple approaches are described that can deliver fluid at the low pressure levels needed when testing fuel parts.

A Syringe Rig for Plunging

Here's a basic fluid delivery setup that uses a 30 ml polypropylene lab syringe, a fluid gauge, and a few other hardware parts. One application for such a rig is float setting a carburetor, as seen in the picture with a Zenith carb below. Fuel is simply poured into the open syringe barrel and then plunged into the carburetor. The fuel level is viewed through a piece of 5/16" ID clear tubing clamped over a main jet (from the carb's mate) and screwed into the fuel port at the left-back base of the carburetor. Two fillings of a 30 ml syringe are needed for the float bowl so syringes smaller than this aren't practical. As the float rises with the fuel level to close the needle valve, the pressure at the gauge increases until no more fuel can pass. You could do without a gauge since the flow will cease regardless of whether you're watching the pressure rise. The level of the meniscus can be read through the clear tubing, which should be 18.5 +/- 1mm from the top of the carburetor base. Once the float level is set, adjusting the accelerator pump injection volume can follow with 0.2-0.3 ml per two strokes per tube. You can measure the volume using a small vial (e.g. a 0.5ml centrifuge tube, usually available on eBay. Although the system is mostly sealed, avoiding spills when emptying the bowl is tough. I've tried using ethanol and methanol in this setup instead of gasoline, since densities would be similar enough to set the float, but the alcohol softens the polypropylene making it difficult for the syringe plunger to move freely in the barrel. Analogies about the effects of ethanol in other places are yours to make.

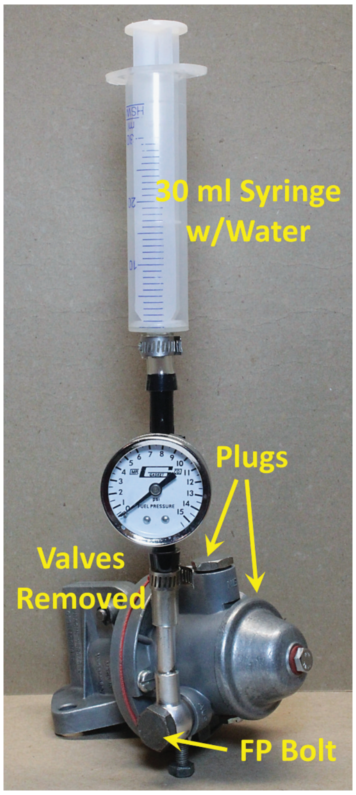
Another application suitable for this syringe rig is leak testing the top end of a DVG A/B fuel pump. This is becoming increasingly important when rebuilding these old style pumps. They've always been prone to leaking when over-tightened but replacements for crushed cone tops are now NLA. Rescuing a caved-in top is sometimes necessary and it takes some finesse to eliminate leaking. Pump testing is done without the valves installed and all but one port plugged (it doesn't matter which one as it is an open system without the valves). The plugs should be tightened once the pump is full. Pressure testing at 10+ psi or so should ensure that it won't leak at lower operating pressures. Leak checking with water is easier than with fuel and the pump can be dried prior to final assembly. Beware that the same banjo fitting is used as for the carburetor but the bolt for the fuel pump has a coarser thread pitch than for a Zenith. You could wrench one into the other but you would soon regret it.

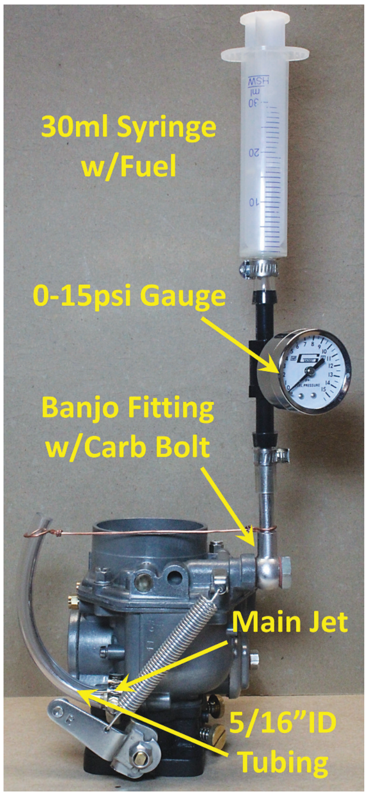
A Water Column for Regulated Pressure

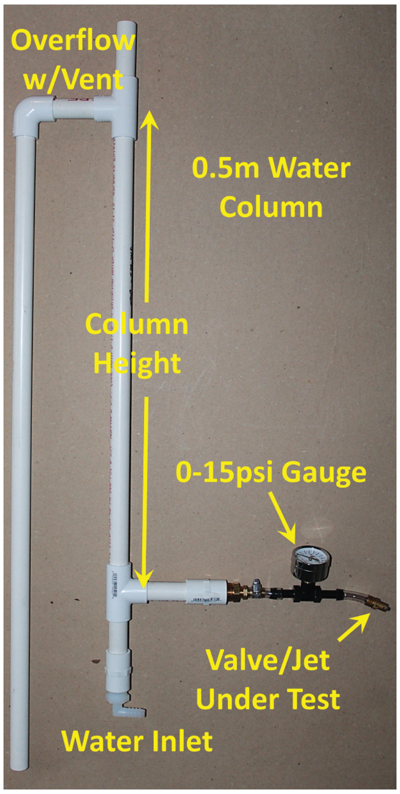
The syringe approach is limited to small volume applications where there is no need to regulate the pressure. It isn't sufficient for testing the fluid flow of carburetor parts, which require a more continuous and controlled source. Back in the days of the Model A, carburetor jet and valve settings were (and still are) based on their flow rates at a standard fluid pressure. Idle, main, cap, and compensating jets are calibrated at the head pressure from a 37¼" water column (WC), corresponding to about 1.35 psi (at 0.434 lb/ft). This value was likely chosen to represent the range of fuel pressures going into the float bowl and drawn out through the jets. A similar standard pressure could be chosen for Zenith and other carburetors, based on the operating pressures of the float needle valve and fuel jets.

The water column described briefly in last issue's article is shown in more detail here. Water is fed into the bottom of the column and overflows at the top, producing a constant pressure at the head resulting from the main column height. The head pressure is changed by modifying the length of the main tube. The open overflow section at the top of the column allows the system to be fed by pressures far exceeding those at the head.

A Pressure Standard for



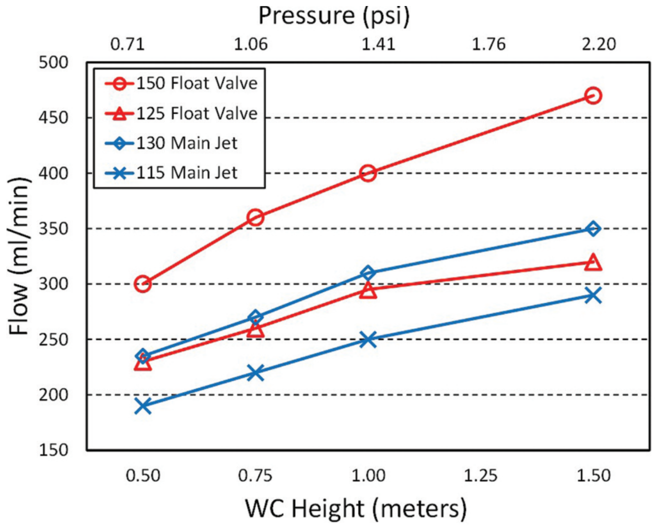




Zeniths

A water column was put to use to measure the flow rates through some Zenith float valves and main jets. Column heights ranging from 0.5 to 1.5 meters were selected, which correspond to 0.71 to 2.20 psi of fluid pressure. Float valves for PO19 Zeniths had a 125 orifice (1.25mm diameter) while older carbs used 150s. Most rebuild kits today come with 125 valves, though many gauge closer to 130. Standard main jets are 115 for normal Zeniths (PO3) and 130 for supers (PO2 and PO19). The plot at right shows the results. From this, a few first-order generalizations can be made about fluid flow rates. When float valves receive fuel from the pump at the spec'd 1.9 to 2.6 psi range, the bowl is filled at corresponding flow rates. For example, at 2.2 psi, the flow to the bowl is 470 ml/min for a 150 float valve and 330 ml/min for a 125 float valve. The two main jets drawing fuel out of the bowl shouldn't do so at flow rates high enough to empty it. For PO3 carbs with a 150 float valve and a pair of 115 main jets, the maximum allowable flow through the each jet is 235 ml/min (half of 470 ml/min), achieved somewhere around 1.2 psi (which is the negative pressure drawn at their exit orifice). The minimum of course is zero. For a PO19s with a 125 float valve and 130 main jets, about 165 ml/min is the maximum flow at a pressure value below the 0.71 psi tested here. This condition may be borderline so fuel pump pressures closer to 3 psi are desirable. So with pressure values ranging from nearly 3 psi to below 0.5 psi, a standard could be chosen somewhere in the middle. A value of 1.41 psi seems like a fair compromise, which happens to correspond to a water column height of one meter. And not too different from the 37¼" WC used with old Ford Model A carburetors.

Flow at 1m WC	
Float Valve	(ml/min)
125	295
150	400
175	560
Main Jet	
115	250
130	310
135	335
140	370
150	410
Idle Jet	
50	45
55	60
60	70



With testing pressure standardized to a 1 meter WC, data for jets and needle valves can be compiled for comparison and calibration. Together with the data already presented, at left is a table of results for a few common ones. Each was cleaned and gauged to their marked diameter. As seen, changing the size of a main jet by 0.05mm can change the flow and resulting volume by 10% or more. And there are significant flow differences between the float valves measured. This list can be added to as more parts are measured.

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