

Inject Your Horse PART 3, FUEL SYSTEM

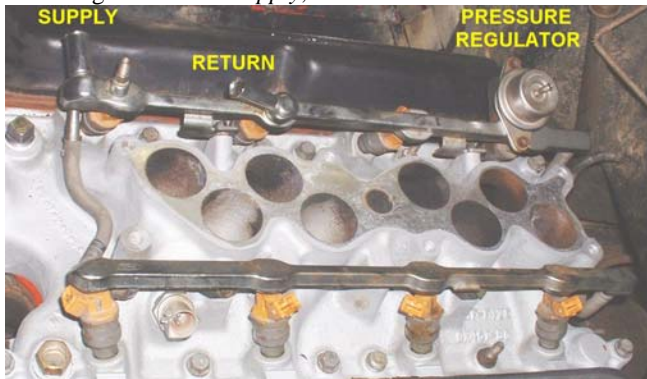
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Mar 2004

Last time I wrote too much, sorry if you fell asleep before finishing it, but all that information needed to be documented in one place. I'm still a little burned out from the last article and other projects in my basement. So this fuel system article will be at the kindergarten picture-book reading level. There is no bolt in kit you can buy, so pay attention. I've seen too many stainless steel jacketed rubber hose with AN fitting fuel systems in magazines and on TV to remember. None of those fuel systems had any prices listed. In the last article I wrote "\$40 Fuel Line and Fittings" in the price lists, let's see how close to that goal we can get.

As always we need some kind of safety warning, I think? It's only 50+ PSI of a flammable liquid, mixed with an electrical system that might spark when wiring pumps. I can't perceive every possibly injury you might incur, so if you are scared, clumsy, or lack common sense, you shouldn't retro-fitting fuel injection into classic vehicles. So please wear as much protective gear as possible, I don't want to get sued because you spilled coffee in your lap.

We will start with the fuel rail; you do remember it from part 1 right? We need to supply as much fuel (volume and pressure) as we can into the fuel rail. The pressure regulator will return any excess fuel back to the gas tank. Because of this the fuel line from the tank to the engine is called *Supply*,



and the fuel line returning fuel is called *Return*. Ford used a special fitting to connect fuel lines to the fuel rail, called *Springlock Fittings*. Springlock fittings take a special tool to disconnect them; I won't get into that this time. For instructions and pictures on how they work www.fordfuelinjection.com. The details are on the "Tools" page.

To get as much fuel as we can to the fuel rail, we can't use the carbureted fuel system, it does not supply enough volume or pressure. High-pressure fuel pumps are not that good at pulling fuel out of gas tanks. That's why new vehicles sold today have fuel pumps inside the tank. It takes a lot of work or money to put a fuel pump *inside* a tank for these swaps. A better option, and arguably the best setup, uses 2 fuel pumps. A low-pressure fuel pump, to draw fuel out of the tank, and a high-pressure fuel pump, to crank up the pressure.

Carter low-pressure fuel pump #P4070, rated at 72 GPH @ 6 PSI, which sells for about \$60 at Summit.



Carter high-pressure fuel pump #P74028, rated at 50 GPH (190 LPH) @ 90-100 PSI, sells for about \$105 at Summit.



These pumps working together can feed 700 horsepower!

Dual fuel pump systems must have a fuel accumulator between them. The model from BC Broncos is a multi-tasking wonder. Fuel accumulators store fuel from the low-pressure pump for the high-pressure pump. Storing fuel is a great idea for rock crawlers, as the accumulator holds a reserve of fuel, just in case gravity temporarily affects the gas tank. Accumulators also equalize fuel flow between the pumps. If one pump is pushing 72GPH and the other is only flowing 50GPH, something has to give. Once the accumulator is full, excess fuel flows out to the return fuel line, and back to the tank. This keeps the low-pressure pump from stressing the high-pressure pump. Normal accumulators stop there, but not the model from BC Broncos. They built one starting with a fuel filter. You get the accumulator and the filter all in one \$70 package.



Setting up the fuel line has been over-complicated way too long. Modern thinking typically suggests using 3/8" line for the fuel pumps and filter. Then a smaller 5/16" line to return fuel from the fuel rail. But purchasing 2 different sizes only wastes money unless you building a multitude of vehicles. 5/16" fuel line can adequately feed an engine up to 350 horsepower. Here is my proposal, if you don't like it, send hate mail to the editor; and I'll try to ignore it. If your engine is never going to produce more than 350HP, plumb your entire fuel system with 5/16" line. If you plan on building an import crusher, plumb everything with 3/8" line.



Regular rubber fuel hose costs under a dollar a foot, but can not handle the extreme pressures of a fuel injection system. High-pressure EFI rubber hose costs over \$5 a foot. Using it for the entire system will push us extremely over budget. A 25 foot coil of solid steel tubing only costs \$18. Upgrading to a 20 foot roll of stainless steel tubing is about \$30 at Summit.



Steel fuel line

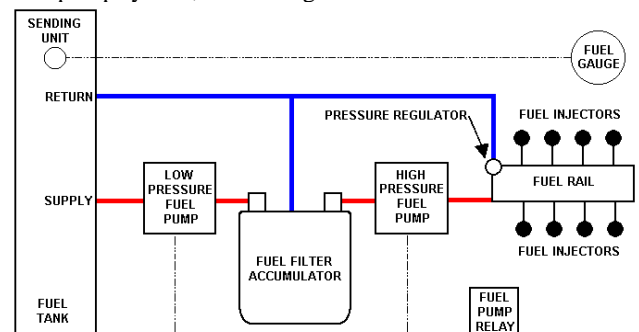
Nylon fuel line

Next time you are at the junkyard, find a Ford EFI vehicle from the 1980's. You are looking for a vehicle with Nylon fuel line, not steel fuel line, both are shown above. You can cut off the Nylon fuel line, and have barbed Springlock Fittings for your fuel rail. Most times if you are buying something else at the junkyard, they'll give them to you for free. Say it out loud, "FREE," your spouse will love you forever.

Interestingly enough, both supply and return Nylon Springlock Fittings are 5/16", even on the 5.8L trucks. This only reaffirms my previous statements about using 5/16" fuel line.



Now that we have most of the parts, let's plan out the system, mount it, and hook it up. This diagram plots out a dual pump system, with a single tank.



It is possible to utilize the dual tanks using a 6 port selector. We were blessed with a custom gas tank, it's easier to plumb single tank systems, and easier to explain. You can purchase a 24 gallon tank ready for fuel injection from most aftermarket vendors for around \$300. Like I mentioned earlier a few places sell a tank with an internal pump, expect to pay over \$500. What ever fuel tank you use, it must have a return port, and be clean. I'm not a welder, so I won't even attempt explaining how to modify an existing tank. Cleanliness is extremely important, always check the tank (no matter how new), and have it cleaned. This EFI fuel system will flow 3-4 times more fuel through the tank than mechanical pumps. Forget to clean the tank, and all that sludge in the bottom will get mixed up with the fuel, end results are not good.

Mount the low-pressure pump as close to the fuel tank as possible. We mounted ours near the pick up tube on the drivers frame rail. The cross member above the rear differential is also a great place to mount the fuel pump. Wiring for the fuel pumps is an important task. Keep the ground as close to the pump as possible. Adhesive-lined heat shrink tubing and dielectric gel are musts for this. Faulty wiring won't last long on our trucks. Hook the fuel pump positive to the EFI harnesses fuel pump relay.



The fuel accumulator is 10" tall, and mounting it on a 4-6" frame rail is extremely dangerous and asking for trouble in the rocks. The low-pressure pump can handle pumping fuel to the engine compartment, which is its job. We had a nice spot behind the driver's headlight for the accumulator / filter combo.



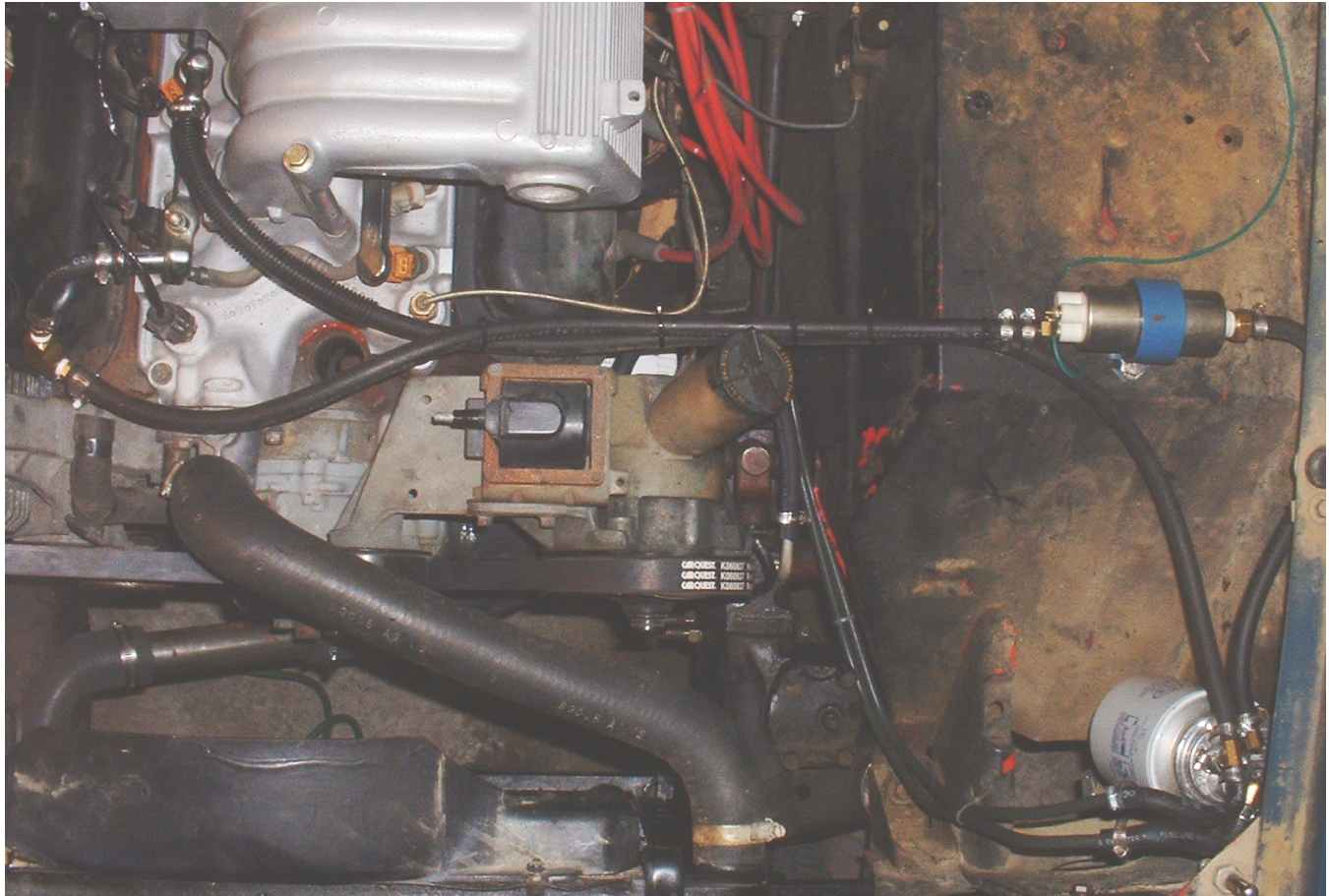
To keep within budget, we mounted the high-pressure filter with the old ignition coil bracket. With the accumulator behind the headlight, mounting the pump on the inner fender seemed natural. Wire the high-pressure pump exactly like the low pressure pump, keeping the ground as close as possible.

We ran most of our system with the standard steel line, and low pressure rubber hose. We only needed the expensive EFI rubber hose was from the high-pressure pump to the fuel rail, 3 feet was enough. The only high-pressure areas of an EFI fuel system are after the high-pressure pump and in the fuel rail. Everything else is filled by the 6 PSI pump and vented back to the tank.



Not all fuel rails locate the connections in the same spot; if you can be picky, shop around. We got stuck with a '95 Mustang fuel rail, with the connections on the passenger side. Not worth complaining about, it's paid for. However, to make the bend for the supply line, we made this 90° elbow.





In the end I'm only one dollar over my budget at \$41 for fuel line and fittings, total would be \$53 if you upgrade to stainless tubing. This was just one of many different ways to set up a high pressure EFI fuel system. If you do this correctly, you'll never suffer from vapor lock. 50 Gallons of fuel flowing through the fuel rail cools the injectors, and flushes out any possible air. One final safety tip; always dial 911 before using the fire extinguisher! You do have a fire extinguisher, right?

Accumulator / filter	70
Low pressure pump	60
High pressure pump	105
25' roll of 3/8" steel tubing	18
20' roll of 3/8" stainless steel tubing	30
3' 3/8" high-pressure EFI rubber hose	15
3' 3/8" rubber fuel hose	3
Box of 20 Hose clamps	5