

Fuel Injection Service, Not Just Cleaning

Posted 6/8/1998

By Jim Linder

After many years of fuel injection "service," I think that some service technicians still misunderstand the process of proper fuel system handling. Much has been said over the years in regard to when and how to perform injector cleaning. Some manufacturers have suggested methods of cleaning while others have issued bulletins to disregard any cleaning at all.

For this reason, I offer the following suggestions on the proper process for injector service on today's vehicles.

To begin, all engines using fuel injection do in fact require some slightly different fuel system maintenance! The normal wear and tear with today's underhood temperatures and changes in gasoline quality suggests some buildup of olefin wax, dirt, water and many other additives. Unique to each engine is an air control design that also may suggest different levels of carbon deposits, such as oil control or just the location of the component or control device itself.

To simplify the approach, I will use the word "service" since the phrase "injector cleaning" is misleading as to the real function needed to maintain the vehicles of today!

Fuel Injector System Service

(Note the words "system" and "service" in the subtitle, and not "cleaning!")

The proper steps in fuel injector system service are:

- 1) Check fuel pump operating pressure and volume.
- 2) Test pressure regulator for operation and leakage.
- 3) Flush entire fuel rail and upper fuel injector screens to include pressure regulator.
- 4) Clean fuel injectors.
- 5) De-carbon engine assembly.
- 6) Clean throttle plate and idle air control (IAC) passages.
- 7) Check minimum air flow rate and adjust if needed.
- 8) Relearn onboard computer.

All eight steps may be performed using one of the "two-line" fuel injector service units. (Carbon Clean, Injector Test, DeCarbon and Motor-Vac, to name a few.)

Check fuel pump operating pressure and volume.

The missing link here is volume, as most working technicians assume that if the pressure is correct, the volume is OK also! By hooking up a fuel pressure tester to the fuel rail inlet and return, and using the pressure side feed t-Ed into the fuel unit, we can quickly test the fuel pressure with engine running but also at the same

time test the volume of the pump by stealing fuel into our holding tank (one pint in 30 seconds is the usual specification). When proper volume is flowed into the tank, we would shut down the engine and change hose connections to allow the machine to be put in control of the fuel supply system. The two line system would be attached to inlet and return on the fuel rail, with the vehicle's onboard system being "looped" and returning fuel to the tank. This prevents disabling of the factory unit.

Test pressure regulator for operation and leakage:

At this time, the regulator would be tested for operational pressure and proper regulation including leakage. (This works well as the operator has total control of rail pressure with the unit control valve.)

Points to Ponder:

Good pressure doesn't mean proper volume! Example: A clogged filter may test OK on pressure, but restriction may not allow proper volume under load!

There is some logic to using the vehicle's gasoline to service the system as opposed to a can of shop gasoline that has been around for some time!

Pressure regulators do fail and a lot more of them don't properly shut off the fuel, causing higher-than-normal pump wear and shorter life!

Flush entire fuel rail and upper fuel injector screens to include pressure regulator. At this time, I would suggest raising the input pressure to a point above the regulator setting to allow a constant flow of fuel through the inlet pressure side of the system - through the fuel rail and out the open fuel pressure regulator. In most cases, the apply pressure is 75 psi to 90 psi but will be maintained by the presence of a regulator. At this point, a cleaning chemical is added to the fuel mixture at a 5-1 mixture and allowed to flow through the system for 15 minutes to 30 minutes. (I have some GM dealers that use one hour per vehicle with great results!) Results are best on a hot engine, and fuel supply is looped with the vehicle's engine not running.

More Points to Ponder:

This flush is the "fix" that most vehicles needed to begin. The difference is that you are effectively removing the deposits to a remote tank and filter vs. attempting to soften and blow through the upper screens.

Most injectors use a 10 micron final screen.

A 25 percent restriction in the upper screen would increase the injector on-time approximately 25 percent!

Injectors have a working "duty cycle" like a welder. Extending the duty cycle equals a shortened life of the coil or bobbin.

Each engine has a "pattern failure" in the system. Example: Buick V-6 engines have problem injectors on the rail curves and the injector next to the exhaust gas recirculation (EGR) valve. Those three injectors will always show a restriction to flow first! Cylinder No. 5 is the pattern failure on 4.9L Ford in-line 6s. (Study the rail design and look for the problem areas.)

Clean fuel injectors:

At this point in the "service," we start the engine and adjust the output pressure somewhat closer to regulator pressure or somewhat lower. Adjusting lower will cause the pulse width to open up somewhat longer and allow the injectors to be cleaned. Slow speed (idle) position will take a longer time frame and operating temperature will be reached. This is one place where time is required. Did you ever wonder how a can of injector cleaner could clean the entire injectors in nine minutes? (It can't!) Remember, not only do we want clean injectors, but we also want the chemical to de-carbon the engine valves, pistons and O2 sensor.

Points to Ponder:

Time is required to perform this service.

Internal pintle cleaning is performed during this cycle.

Fuel control is always in direct response to O2 response.

Example: Slow O2 = slow fuel control = poor performance.

De-carbon engine assembly:

On most vehicles, the injector spray is going to help the de-carboning process. On others, we may need to enhance the operation with an external addition of mixture through PCV hoses, throttle plates or idle air controls.

Points to Ponder:

Most technicians (especially very young ones) think carbon is a 1990s problem. The older guys (especially the very old ones) remember throwing rice through a flathead at 2500 rpm and watching the black specs fly out of the exhaust. This is still a problem in the '90s (although rice is not suggested). We have lower fuel volatility, and in some cases too high of a compression may cause a no-start situation.

Proper compression = 14.6 x compression ratio.

Clean throttle plate and idle air control passages

Just this "service" alone on most late model engines will show a manifold vacuum increase of up to two. You may stop the engine and clean the areas as needed, but my suggestion is to use an extra hand-held fuel injector hooked in parallel with the pressure hose along with a pulser to allow a cleaning of throttle plates with the same chemical as the injectors are running on. This has proven to work very well as air drawn into IAC passages on a running engine will clean the passages without IAC removal. Neat trick!

Points to Ponder:

A manifold vacuum increase tells the technician that the engine "liked" the service. Using the hand-held injector usually will lower a General Motors IAC count from 40 to 15 without touching a thing! (Think about this.) Check minimum air flow rate and adjust if needed.

Most vehicles' "stall" problems are due to a misadjusted throttle plate or incorrect minimum air rate. Check service manuals for specs.

Points to Ponder

AC Delco makes a set of small "tune-up" booklets that do an excellent job of covering minimum air rate adjustment procedures.

Relearn the vehicle's onboard computer

Some vehicles may have been running in such a poor state of operation that the onboard computer may need to be relearned! Consult the OEM-suggested relearn procedures per make.

Fuel injection system service is complete! This "service" usually takes approximately one hour for the vehicle to run out of fuel and the entire service to be performed. The good thing is that the technician may do other services while this is being performed! Some of my customers put in a set of plugs while the engine is flushing or change the fuel filter or do the brakes. Charges are up to the individual shop, but the performance gained is absolutely amazing.

In reality, all you are doing is exactly what should be done with mileage, and that is restoring the system to original operations.

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From <http://www.asashop.org/autoinc/june98/techtotech.htm>