



Tech Tip

FUEL SYSTEM 121

FUEL SYSTEM MAINTENANCE

Following a Scheduled Service Can Prevent Costly Repairs

Too little consideration is given to basic maintenance and the effect that some of the seemingly insignificant components can have on the system. Fuel filter maintenance is a good example. Many vehicle owners neglect the fuel filter as a service item, and technicians often fail to recommend a fuel filter replacement during normal service intervals. From previous experiences, most just assume a performance condition will be present when the need for a fuel filter replacement occurs. The opposite is the case. With some of the newer fuel injection systems, a failure may occur suddenly with no prior symptoms, accompanied by a repair cost approaching one thousand dollars. When electrical fuel pumps encounter a failure, exploring the integrity of the fuel system should be a top priority to prevent re-occurring failures.

SYSTEM PRESSURE IS CRITICAL

Maintaining the proper system pressure on some of the newer design fuel injection systems is imperative. A minor drop in fuel pressure can result in a perfectly running vehicle stalling out and not re-starting. For example: The Central Sequential Fuel Injection system used by GM incorporates a poppet nozzle attached to each injector via a plastic tube. When the PCM pulses the injector, fuel under pressure is forced through the injector and a plastic tube, which is attached to a poppet valve. The fuel pressure overcomes the spring tension in the poppet valve, forcing the ball

from its seat, injecting the fuel into a selected cylinder. Once the injector coil de-energizes, the poppet valve spring forces the ball seat closed, shutting off all fuel at the poppet nozzle. If the fuel system pressure drops below the minimum, the poppet valves will not receive sufficient pressure to overcome the spring tension. The system pressure is regulated at 60-66PSI. If the pressure drops below 60 PSI, major performance problems will likely occur. The engine may start and idle, but stall out on acceleration. We have encountered engines that would idle on 50 lbs. of fuel pressure when hot, but stall on acceleration. When cold, it is unlikely the engine will start with fuel pressure at 50 PSI. For surging and stalling symptoms, always run a fuel system pressure/volume test.

FUEL PUMP FAILURE

The purpose of the fuel filter is to trap harmful contaminants, contain them, and prevent damage to costly engine and related fuel system components. Obviously, the benefits of the filtration arrangement offer little protection to the fuel pump, as the filter is downstream from the pump. Contaminants that accumulate in the fuel filter have already passed through the fuel pump. And while the filter may offer little protection to the fuel pump, a restricted fuel filter can certainly result in a premature pump failure. And, considering the cost of some of the fuel pump/module assemblies, the repair cost can be an expensive encounter for the vehicle owner. The customer will really get ill

when he determines that adhering to a regular scheduled maintenance of the fuel filter could have possibly prevented the pump failure. And he may really be unhappy with you for not reminding him to change the filter on a scheduled basis.

Let's consider some failures and conditions that can lead to premature fuel pump failure:

Contaminated Fuel... Obviously, clean fuel is imperative in maintaining good engine performance, while preventing corrosion and damage to the fuel system components. Fuel is usually clean when it leaves the refinery. The contamination process starts with the transport and storage facilities (barges, tankers and distributors) where condensation and other contaminants can promote major contamination problems. And there is always the issue of fuel distributors splash-blending the fuel with higher than acceptable chemicals, such as alcohol. This promotes fuel tank corrosion and potentially damages the in-tank electric pump. Fuel injectors and other related components, such as poppet valves, can encounter permanent damage from the chemicals and corrosion.

Low Fuel Levels... The coolant for the fuel pump is the fuel in the fuel tank. Operating a vehicle with the fuel level below $\frac{1}{4}$ tank can result in a fuel pump not remaining completely submerged, thus overheating. When removing a fuel tank for service or cleaning, always check the condition of the baffles. The purpose of the baffles is to prevent fuel slosh, which could promote aeration of the fuel, or overheating of the fuel pump.

Fuel Strainers... Fitted to the end of the fuel tank sending unit/pick-up tube is a strainer. It is constructed of a woven material, often plastic. The strainer's purpose is to prevent debris from entering the fuel pick-up tube. By design, the strainer is supposed to be self cleaning; how-

ever, extreme contamination can result in the strainer collapsing, thus restricting fuel flow. Due to repeated failures, GM revised the strainers for the 2000 N&J body vehicles due to strainer restrictions. The symptoms reported were hesitation, stall and no-start conditions. The new in-tank modular fuel strainer can be purchased from GM under part # 88891094.

Some of the replacement strainers on various applications incorporate a different attachment than the OE version. Some new strainers attach to the pick-up tube at one end of the strainer, instead of the middle. This arrangement reduces the potential for the strainer to collapse and restrict the fuel flow.

Torched Wiring... While examining many defective GM fuel pumps, we have encountered an extremely high failure rate where the wires were shorted just below the connector block. Melted wiring in the fuel tank is not good. In each case, a restricted fuel filter was found or the filter had recently been changed. The filter replacement may have been performed in a last attempt approach to correct a performance symptom. The same contamination that restricted the fuel filter passed through the fuel pump, possibly resulting in a pump seizure. The increased amperage flow necessary to overcome the resistance resulted in the overheated wiring. A restricted fuel filter can promote the same type of electrical failure.

Sudden Pump Failures... Often a customer calls stating that their vehicle had been running perfectly, and then failed to start on the next attempt. Assuming it's a fuel related condition, when a problem like this occurs, it is usually due to the armature in the fuel pump stopping on a bad commutator bar. It is not uncommon for a technician to jar or tap on the fuel tank and the fuel pump start running again. And it will continue to run perfectly until it stops on that same segment or bar. The pump must be re-

placed, as the condition will reoccur. Electric pumps encounter wear on the bushings, brushes and the commutator. This is just normal parts wear. Our job is to prevent premature failure due to contamination, through scheduled service. It can save the customer big bucks in unnecessary repairs.

FUEL LINES/HOSES AND RETAINING CLIPS

Selecting the correct fuel line/hose for installation on today's systems is imperative to maintain the integrity of the system and for safety reasons, especially considering some of the high pressure fuel systems involved. Special attention should be given when making a fuel filter installation or servicing any fuel system where plastic fuel lines are part of the system. Damage incurred due to improper procedures can be a costly endeavor, as the fuel lines can cost in the hundreds of dollars. When installing a fuel filter, be conscious that the filter tubes often slide into connectors containing O-rings. Examine the condition of the O-rings to be certain they are properly fitted into their cavity. Some filters require special release tools to unlock the connectors that secure the filter to the fuel lines. Trying to improvise is almost certain to result in a damaged fuel line or connector, often requiring a complete fuel line replacement. Some filters come packaged with retaining clips and in some cases the clips on the vehicle may differ. The clips supplied may fit 95% of the applications and the other 5% may be a different size or style clip, available only as a dealer purchase item. Technically, the clip is a part of the fuel line, and is not usually supplied by the vehicle manufacturer with their replacement filter. That same filter may fit an application where the connector is of a spring lock type that requires the purchase of a new fuel line to acquire the connector. So, handle the installation with care and use the

necessary tools to make the proper installation. Once the installation is complete, the job should not be considered finished until the system is leak-checked.

ELECTROSTATIC DISCHARGE

The condition of electrostatic charge is one issue and the discharge of the current is another issue. We have all felt the effects of an electrostatic discharge (ESD), such as when sliding across a seat and touching a metallic object. Sparks are certain to fly. When this condition occurs you just experienced the effect of 25,000 volts. It takes 4,000 volts of energy for you to encounter an electrical shock. For years we have cautioned the importance of proper handling of electronics to prevent damaging the sensitive components due to ESD. Now we are faced with a different problem, and that is to protect the fuel system from the same effect. Sparks in the vicinity of fuel system components can be an unpleasant experience. It can ruin your day and make you smell funny, too.

Plastic fuel tanks, fuel lines and filters are becoming commonplace in new vehicles. Some claim the change in component construction is to reduce weight, protect against corrosion, or to simplify manufacturing or installation during vehicle assembly. For whatever reason, the design has certainly led to a different set of problems. Fuel flowing through the ungrounded plastic components, especially in extreme cold conditions, can produce a static charge. We have seen filters and lines with holes punched through them, due to ESD. Some filter manufacturers have impregnated metallic filings in the filter body to prevent the condition from occurring, and some manufacturers have actually discontinued the plastic design and reverted back to metal components. Others have continued with the plastic OE design, but added ground straps to discharge the static charge.



Chrysler encountered some similar problems with their 1996 Dodge Caravan/Grand Caravan, Plymouth Voyager/Grand Voyager and the Town and Country minivans. The problem was an ungrounded fuel tank filler tube. A static charge would build up during the fuel filling process, promoting the potential for an arc and a possible explosion. The fix involved an auxiliary ground strap for the fuel tank filler tube. Some of these ground straps will be lost or purposely left off during fuel pump or fuel tank servicing, reintroducing the potential for the condition. Be conscious of the fuel filter and filler tube ground straps, and make certain they are properly attached.

RELIEVING THE SYSTEM PRESSURE

Fourteen years ago, *Mighty's* "On the Line" column won a readership award in *Motor Age* for an article titled "Surviving a Fuel Filter Change." The article addressed residual fuel system pressure and precautions to take when servicing the fuel system. Fuel pressure must be relieved prior to breaking into the system. The system's residual pressure can be extremely high and the fuel can shoot like a bullet if the system is opened prior to relieving the pressure. Each vehicle manufacturer illustrates a procedure for relieving system pressure. Failure to follow the recommended procedure can result in damage to the vehicle and the person servicing the system. Overhead gas heaters in the shop do not perform well when subjected to fuel vapor or liquid fuel. Think safety!

DIESEL FUEL FILTERS

With diesel applications, maintaining a clean fuel system is imperative. This would include trapping any debris or water that could affect the performance of the engine or cause dam-

age to an expensive injector pump assembly. Often diesel fuel filters are blamed for a performance or no-run condition, when the reason is actually due to fuel related conditions such as waxing or gelling. When the ambient temperature reaches the freeze point, diesel fuel can gel, thus creating a restriction and preventing fuel flow through the filter. The media of the filter becomes coated with a wax or gel substance and only allows minimal fuel flow. When this condition occurs, the symptoms often involve an engine that will idle, but will not respond to a throttle-up demand. These conditions can be circumvented with the use of fuel additives or a fuel heater that is usually positioned in the bottom of the fuel filter reservoir. The heater's objective is to warm the fuel above its cloud point, eliminating the potential for gelling.

In addition to sediments, water contamination through condensation is a major problem for diesel fuel systems. Water can restrict fuel flow through the filter and result in fuel injector failure. Filters and water separators must be drained periodically. While servicing diesel fuel filters, examine the filters for the presence of a black or green slimy deposit. Fungi and bacteria can actually live and grow in the system, feeding off the hydrocarbons, promoting fuel restrictions. If this condition is present, changing the filter is not enough. The system must be treated with a biocide to kill the fungus. It's the only way to prevent a re-occurrence.

Following a scheduled filter service can save the customer a lot of expense in unnecessary repairs and it makes good business sense for the shop, too.

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