

# WARRANTY, SETUP, USE, MAINTENANCE



## WARNING

Do not use acetone, or any solvent containing acetone (such as brake parts cleaner) for cleaning any part of your fuel system. Acetone will destroy regulator diaphragms, seals, o-rings, and rapidly degrade most fuel hose. All Fore Innovations products require professional installation and shall be used for off-road motorsports application only.

## WARRANTY AND INTRODUCTION

Thank you for choosing Fore Innovations for your vehicle's fuel system. Your Original Equipment (OE) fuel system probably needs little (or zero) maintenance over the time you own the vehicle. By contrast, your high performance fuel system is more complex, draws more electrical current, creates more heat, moves more fluid under high pressures, and is often used with aggressive or corrosive fuels which possibly have additives that cause additional problems.

Additional variables such as operating environment, fuel system configuration and setup, driving habits, operating frequency and duration, fuel type(s), and fuel sources may have substantial influence on the service needs of your upgraded fuel system.

**Expectations:** High performance fuel pumps are a *low cost wear item* used in a very demanding environment... do not expect them to last as long as a typical Original Equipment (OE) pump. With proper setup, use, and maintenance, your high performance pumps may last for years, but in most cases we recommend high performance fuel pumps (and prefilters) be replaced on a regular basis. Alternatively, certain conditions can quickly destroy your fuel pumps.

**Liability:** These pumps have been tested before you receive them. Fore Innovations guarantees fuel pumps purchased from us operate according to published specification when new. After the pumps are placed into service, many variables beyond our control will dictate the lifespan and continued performance level of your fuel pumps. If you suspect your fuel pump(s) have failed or are damaged, contact us immediately. Fore Innovations can help facilitate replacement pump(s), but only the original manufacturer of the fuel pump (such as TI Automotive, Walbro, etc.) will be able to evaluate whether or not you are eligible for a warranty claim due to a quality issue. Generally speaking, there is no warranty on fuel pumps once they are placed into service.

**Application Guidelines:** OE fuel tanks are designed with consideration to engine performance, vehicle use, and potential lateral acceleration rates. A vehicle that is a candidate for our fuel system typically has a performance potential well beyond the original design of the vehicle. As experienced enthusiasts are aware, increased performance of a component or system creates a compromise elsewhere. In the case of our fuel systems, the next weakest link is often the OE fuel tank shape, especially with low aspect ratio fuel tanks. Low aspect ratio tanks (wide and short) will require higher fuel levels at all times. High aspect ratio tanks (tall and narrow fuel tanks) may not need any additional consideration other than minimum levels for fuel heat.

## SETUP THE FUEL SYSTEM PROPERLY

1. Higher performing fuel pumps generally have a shorter lifespan than lower performing fuel pumps. If possible, choose a more reliable, lower performance fuel pump to run full time, with higher performing secondary pump(s) to operate only under load.
2. Stage the fuel pumps: Large fuel pumps generate large amounts of heat. We recommend that you operate only one pump during idle and cruise, then activate secondary pump(s) under load. We suggest an appropriate logic source that activates the secondary pump(s) only when necessary. Some examples of a secondary pump logic sources: pressure (Hobbs) switch, RPM switch, auxiliary outputs from nitrous/boost controllers or aftermarket ECU. Properly sized fuel pressure regulators (such as those supplied in our fuel systems) will minimize the pressure spike when secondary pump(s) are activated.
3. Ensure your fuel pumps are compatible for the fuels you operate. Certain high MTBE (ether) fuels or high ethanol content (such as E85) fuels require compatible fuel pumps.
4. Ensure your fuel filters are compatible for the fuels you operate. Excessively fine inline filtration requires more frequent maintenance and a clogged filter immediately puts the fuel pumps and your motor at risk. A looser filter may require more frequent injector cleaning, but requires less maintenance and monitoring.

5. Datalog fuel pressure. For basic diagnostics, make sure you can record fuel pressure at the injectors. Some vehicles have an OE sensor, but other vehicles require an aftermarket sensor. (check with your tuner)
6. Set proper base fuel pressure. (the original fuel pressure is not relevant for a built fuel system) Most fuel injectors require a 40-43 psi differential (base pressure) to provide an adequate spray pattern for proper combustion; however, some tuners may recommend a higher base pressure. While higher base fuel pressure will make injectors behave larger, the higher pressure (load) will reduce the performance and life expectancy of the fuel pump(s).
7. Heat kills: Be aware of fuel heat. Fuel heat exponentially accelerates any chemical affects from fuel additives and softens brushes/commutators, which greatly decreases the life of the fuel pump(s). When running large fuel pumps, operate only one pump full time and activate the secondary pump(s) only when necessary. During low load conditions, operate as little pump possible to minimize fuel heat. Unless the vehicle is a drag race car that runs for very short periods, keep the total pump heat below 250 watts. (Even less is better.)
8. Consider the voltage limits of your particular fuel pumps. In addition to voltage boosters, some vehicles have ECU controlled alternators that elevate voltage in certain conditions. Some fuel pumps can be damaged with momentary exposure above a certain voltage.
9. Failsafe mechanism(s) should be installed that monitor the combustion process such as wideband O<sub>2</sub> or EGT. (fuel pressure or pump current are not adequate failsafe triggers alone)
10. Be realistic about using E85. E85 is best on vehicles that are driven frequently enough to constantly keep fresh E85. Cars driven every 2-3 weeks (or less frequent) are not good candidates for E85 unless you're willing to manually empty and dispose of the fuel in the tank, and replenish with fresh fuel. Consider a flex tune or race gas so the car can sit with mostly gasoline in the tank. Running fuel levels low with the intent to empty the tank often exposes the fuel pumps to unsafe heat levels.

## ***USE OF VEHICLE WITH A HIGH PERFORMANCE FUEL SYSTEM***

1. If you have purchased our fuel system, most likely your vehicle has been modified well beyond the original power level. Your vehicle is now less reliable, requires a higher skill level to operate, more frequent maintenance, and operators need a better understanding of mechanical function and limitations.
2. Operating habits can minimize fuel heat. Follow these guidelines to minimize fuel heat:
  - Keep fuel levels as high as possible at all times.
  - Avoid long periods of idling or cruising.
  - Refilling the tank is a good way to reduce fuel heat
  - On long trips (where the vehicle is operated for long periods of time) keep the fuel above 1/2 tank.
  - Consider the ambient temperatures and use your best judgment to keep your fuel heat minimized.
  - Configure the fuel system so that only one pump is operated full time.
3. E85 is a low quality fuel that will increase the demands of operation habits and maintenance. Follow these additional guidelines with E85:
  - Never store a car with E85 in the tank.
  - Consider a dual/modulated tune so that gasoline may be substituted when possible.
  - Drive the vehicle regularly to keep fresh E85 in the tank.
  - Never park a hot E85 car below 1/2 tank.
  - Use service stations that sell high volumes of E85.
  - Be diligent with filter health, especially when using microglass filtration

## ***MAINTENANCE***

1. **Regular Maintenance:** The following service items should be addressed annually:

1. Inspect all electrical connections and look for signs of corrosion or excessive heat. Tighten, clean, and/or re-connect as necessary.
2. Send injectors out for flow testing and clean/replace if necessary.
3. Replace or clean inline (fine) fuel filter
4. Inspect prefilter (sock) on primary pump. If it is dark gray, replace primary pump and filter.

**2. Fuel Pump Replacement:** We recommend that all high performance electric fuel pumps and prefilters (socks) be replaced every two years. (1-1.5 years in E85) If the prefilter sock(s) are black or dark gray, this indicates excessive brush and commutator wear in the fuel pumps. Pump performance is normally degraded when the prefilter sock is dark colored. These brush and commutator particles also restrict the inline (external, fine) filter as well. The fuel should be drained and properly disposed before installing new fuel pump(s).

If a fuel pump has to be replaced prematurely and has dark gray prefilters, the remaining fuel in the tank is contaminated and should be disposed immediately. Clean the tank if necessary and refill with fresh fuel before installing new fuel pump(s).

Furthermore, if you ever accidentally run the fuel pump(s) dry, we recommend immediate pump replacement.

TI Automotive / Walbro does not list E100, methanol, or fuel containing MTBE as compatible with their fuel pumps; however, in our experience, these fuels can be used for short periods with no apparent damage.

**3: Inline Fuel Filter Maintenance:** The fuel pressure regulator will automatically compensate for restriction in the inline fuel filter, so the fuel pressure before the filter will be higher than observed rail/regulator fuel pressure. This increased fuel pressure is unnecessary load that can severely shorten the lifespan of your fuel pumps.

Cellulose (paper) and microglass filter elements are disposable. Stainless steel filtration may be cleaned and re-used. It is ideal to have the stainless filter cleaned ultrasonically; however, we find that simple backwashing of the filter is usually adequate. DO NOT scrub the mesh of a fine stainless steel filter, as this will distort the mesh and destroy the filter element. Use the following guidelines for service intervals:

- Gasoline fuel with any type filtration: change/clean filter annually (conservative)
- Ethanol blended fuel with stainless filter: clean annually
- Ethanol blended fuel with microglass filter: monitor fuel pressure before and after filter. If difference exceeds 5 psi, replace filter

In case the filters are becoming clogged too quickly, we recommend changing fuel suppliers, switching to stainless filtration, and/or upgrading to 128mm long filter element.

**4. Fuel Hose Maintenance:** PTFE core fuel line has infinite life, so there are no service requirements for PTFE core hose with stainless braid. However, any rubber or elastomer core fuel line (such as Startlite, AQP, FlexLP, Redhorse 235 etc.) should only be expected to have a 5-7 year life expectancy with gasoline. Operating fuel with an ethanol component will accelerate the degradation. Push-Lock type fuel line may only be usable for 1-2 years, depending on the fuel(s) being used.

**5. Ethanol Fuel Maintenance:** Fuel with high ethanol content (such as E75, E85, E98, etc), requires additional maintenance considerations. It is always best to continuously keep your ethanol blended fuel fresh, so we recommend the vehicle be driven often so fuel tank is regularly replenished with new fuel. Do not put your vehicle into storage (or let it sit) with ethanol blended fuel in the tank...this practice will degrade the performance of your fuel system and can easily destroy fuel pumps, level senders, injectors, and clog filters from just sitting a few weeks. We recommend the vehicle be operated frequently so that new fuel has to be added at least every two weeks. Be prepared to do a complete tank drain and fuel swap, and fuel system overhaul if any component of the fuel system is observed to be damaged from sitting in ethanol for extended periods, as other components are likely affected as well.

**6. Fuel Swaps:** Every conceivable safety precaution must be observed when transferring or storing fuel. Carefully examine and follow OSHA fuel and gasoline handling and storage regulations, as well as any other federal, state, or local laws, to include fire codes.

Swapping fuel using the internal pump is a very common way to destroy fuel pumps from running the pump dry. The moment you hear the pump unload, you must stop the pump, as electric fuel pumps have very low tolerance to running dry.

Single Sump Tanks: Disconnect feed or return line and operate fuel pump until pump (audibly) unloads or discharge sputters, then immediately stop the fuel pump.

Dual Sump Tanks: Drain when the fuel level is normally consumed from normal driving to below 1/2 tank. If you start above 1/2 tank, you will leave fuel remnant on the non-pump side of the fuel tank. With engine (and fuel pump off), fuel may "reverse transfer" away from the pumps, so it is best to start the fuel drain immediately after driving car, or let the car idle for five minutes minimum. Disconnect RETURN line (NOT feed line) for discharge to your reservoir. Operate fuel pump until pump (audibly) unloads or discharge line sputters, then immediately stop fuel pump.

***Please contact sales@foreinnovations for questions or clarification!***