



Excursion Installation Instructions



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GOLDEN FUEL SYSTEMS SVO INSTRUCTIONS

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Chapter One – Overview of Components

1.1 Necessary Tools

To start your installation it will be beneficial to have a few tools and supplies handy:

- A good sharp knife or hose cutter to cut the flexible fuel hose.
- A small tubing cutter for stock steel fuel lines.



Tubing Cutter

- Fuel Line Disconnect Set to disconnect fuel lines and fittings (not necessary on every vehicle so check your fuel line connections and plumbing prior to purchasing a set or keep your receipt.)



Quick Disconnect Sets

- Hand Vacuum Primer Pump for Priming Coolant and Fuel Lines and Troubleshooting (not necessary, but very handy and cuts down on priming frustration and allows for quick diagnosis of restriction or air issues.)



Hand Vacuum Pump available at www.goldenfuelsystems.com

- Some rags or shop towels to keep things wiped up and clean.
- Although you can use screwdrivers for the hose clamps it is highly recommended to purchase some nut drivers to tighten the hose clamps. They don't slip off and will be a great addition to your toolbox. You will need 1/4" and 5/16" nut drivers. They are cheap and easy to find at any hardware or automotive store.
- A screw gun or drill will also be handy. Again, 1/4 and 5/16 driver bits are a real help. The self-drilling screws for mounting the hardware of the kit are easily installed with the screw gun.
- A set of wire pliers (strippers and crimpers.)
- A tube of Teflon Pipe Joint Compound (also known as *pipe thread sealant*). *Special note: We do **not** recommend the use of Teflon tape in place of pipe joint compound. Teflon tape is much more likely to leak (either air in or fluid out.) We like the fool-proof 'smear-n-go' philosophy of the pipe joint compound.*

- 2" or larger hole saw to cut a hole in the trunk of your car (or the bed of your truck) to run the Triple Bypass Hose (3B hose.)
- Stock Fuel Filter. Stock fuel filters remain one of the most neglected areas of a diesel maintenance regime. This will prevent restriction issues and complicated diagnosis
- Supply of coolant for your vehicle, depending on year we recommend getting a **universal formula** to mix with all types of coolant.
- Digital Volt/Ohm meter. These are less than 20 dollars at most auto part stores and far superior to a test light. We do not recommend a test light because of its potential to damage complex computer circuits.

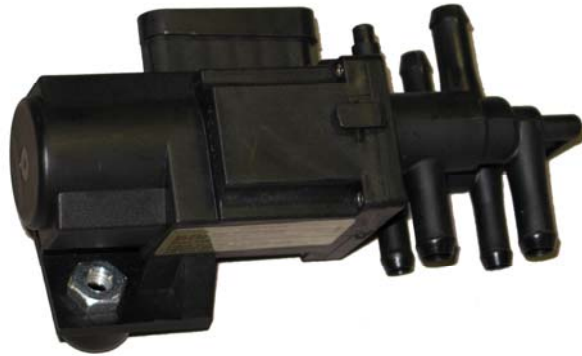
1.2 Preparing the Installation

The first step to ensure your installation will be as clean as possible is to study your stock fuel configuration. Find your diesel fuel filter, your injection pump, your lift pump (determine if your engine has an internal or external lift pump), your return lines, fuel lines, and such. Follow the flow of the stock fuel system as it makes its way from the fuel tank, to the injection system and finally, the return fuel back to the fuel tank. Once you have a solid idea of how the fuel flows on your current system, it will make the installation process much smoother.

There is no right or wrong way to start the installation. Some start with the plumbing, move on to mounting parts and then finishing the electrical while others do portions of the vehicle at the same time. You may also consider placement of the components first, then lay out the plumbing and finally finish with the electrical. Regardless of the installation procedure, properly planning the project will limit mistakes. Chapter One is a brief overview of the components for familiarization.

1.3 Components

1.3a Pollak Selector Valve



Pollak 6-Port Valve

The six port fuel selector valve can be mounted where it is most convenient. The material that the valve is mounted to does not matter because this valve receives its grounding from the wiring harness. Ensure that it is clear of any hot or moving parts. You can secure the valve with two 5/16"-18 x 1" bolts (included with the kit) or just use cable ties to hold it in place. You will generally mount the valve in an area as close to the engine as possible or in the engine, if possible. This allows for a faster purge of the SVO during shutdown. You may need to fabricate a bracket for it to mount securely. This valve must not be mounted after any high-pressure (60+ psi) fuel pumps. For example: on the 1999 and newer Ford Powerstrokes, the lift pump is a 60-70 psi pump and is mounted to the inside of the driver's side frame rail just under the drivers seat. This means that the best place to mount this valve is just to the rear of the lift pump along the same frame rail.



Toggle Switch

The toggle switch (provided with the 6 port fuel selector valve) will be mounted through a 15/32" hole usually on the dash within easy access of the driver. Pick somewhere that you can easily access for drilling and wiring. Be careful not to push too hard on the dash as you are drilling, so that you won't crack the panel. Push the toggle through the hole and secure it with the locator tab and nut provided in the Pollak switch box. Follow the supplied wiring instructions within the Pollak box.

1.3b Racor SVO Filter



6120

Racor 6120

The 600 Series Filters all have mounting holes cast into the filter head. They will need to be bolted to a solid foundation in an upright position. Generally they will be mounted at the beginning of the fuel line run (close to the tank) or at the end of the fuel line run (close to the fuel selector valve). Either one is fine. The pluses and minuses for each have to be weighed by the individual owner and are usually decided by where it is the easiest to install with the least amount of modifications. The filter heads have seven ports. Four of them are inlets and three are outlets. They are designated by arrows that are cast into the head by the ports. Only one of each is to be used while the others will be plugged with the provided 3/8" NPT plugs. This allows multiple configurations for different applications.



1000FH with the Exclusive GFS Thermostatically Controlled Heater 80°-175°



900FH with the Exclusive GFS Thermostatically Controlled Heater 80°-175°

Racor 900FH, 1000FH

All Racor Filters must be mounted 10 degrees from vertical to function properly. The see-thru contaminant collection bowl allows the operator to check for water and solid contamination at a glance. Overhead Clearance

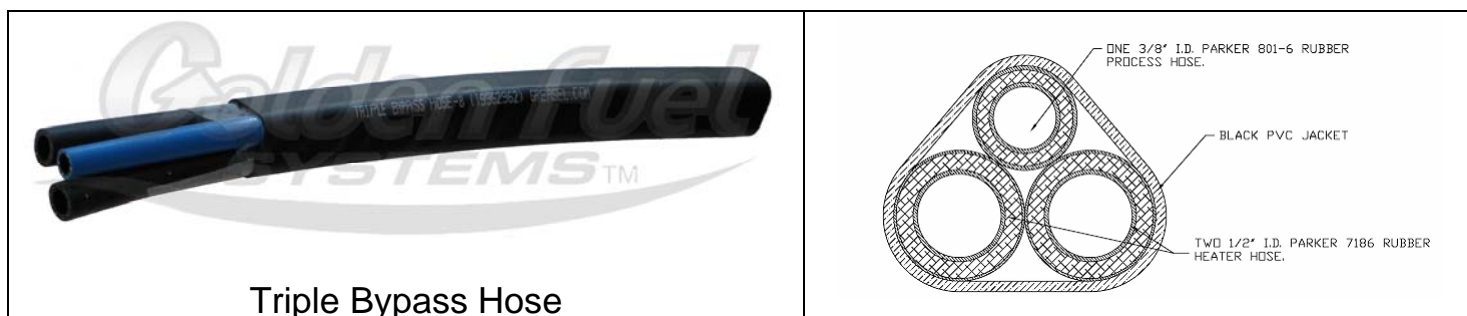
needed for Turbine Series Filters: 5” – 12”. Allow for at least 2” clearance under the unit for draining water from the collection bowl. Turbine series filter assemblies are designed to be installed on the vacuum side of the fuel transfer pump for best efficiency. These filters include an internal 12V, 300 watt Heater with Golden Fuel Systems exclusive thermostat so it turns on at 80° and safely raises the fuel up to 175° degrees.

WARNING! DO NOT ACTIVATE THE HEATER WITHOUT FUEL IN THE FILTER! THIS CAN PERMANENTLY DAMAGE THE HEATER ELEMENT AND/OR FILTER! REMOVE THE FUSE IF THE FILTER IS GOING TO BE EMPTY OR NOT RUNNING FUEL THROUGH IT FOR EXTENDED PERIODS WHILE ACTIVATED (36 hours or more.)

Adjustable one-piece clamp-type mounting brackets, with grade 5 fasteners, are included for ensured durability. One 2-micron Element is installed in the Filter. 2 adapter bushings for 3/8” MPT Fittings are included.

Elements other than genuine Racor cartridges will NOT open the shut--off valve and are not recommended for use with the new FH Turbine Series. The new element design will fit ALL older versions of Racor’s Turbine Series, however, old element stock (those with full colored end--caps and the single center bail handle) will not fit or open the shut--off valve in the new FH models.

1.3c Triple Bypass (3B) Hose



3B Hose

This hose was designed exclusively by Golden Fuel Systems and produced by Parker for SVO use. The two 1/2" coolant hoses supply and return hot engine coolant to your hot SVO tank while simultaneously keeping the 3/8" fuel line hot from the tank to the engine compartment. These are 3 separate hoses encased in a rubberized PVC sheath. In addition, the bundled wires can be used for the Racor internal Heater (12 gauge), fuel level sender, accessory pump, etc.

This is the safest and most efficient way to run a heated fuel line. The hoses are extremely durable and can be run under the car without fear of rupture or failure. Plumbing of the Triple Bypass hose is a painless process as long as you’ve planned ahead. Plumbing diagrams are in the next Chapter.

1.3d Vacuum/Pressure Gauge



Vacuum gauge – Color may vary

The vacuum gauge allows one to monitor and diagnose the SVO system. The gauge registers resistance of the fuel moving through the fuel system. The normal operating vacuum the gauge will register depends on the vehicle, but should be around 1-2 inches of vacuum with a clean filter and good oil. When the vacuum reaches 10-15 inches of vacuum, this usually indicates a clogging fuel filter or another source of restriction. Make note of where on the gauge the vehicle starts to hesitate and “bogs” down and this is when the filter needs to be changed in the future. An air issue may be indicated with a “0” reading of vacuum or pressure.

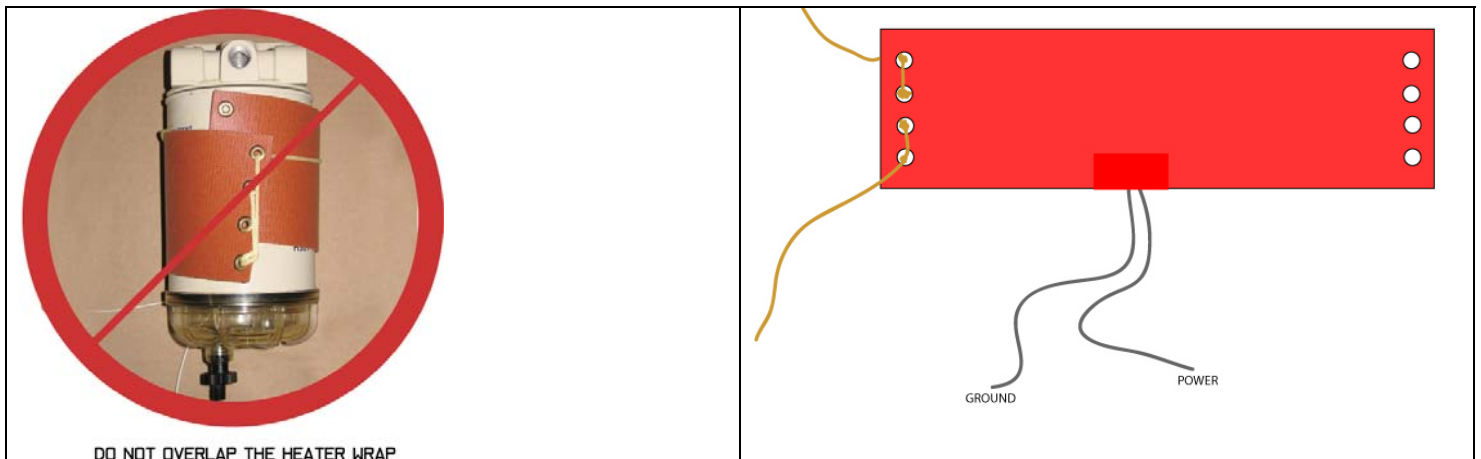
1.3e Fuel Level Sending Unit and Gauge



Fuel Gauge- Color may vary

The Fuel level sending unit and external gauge allows one to monitor the fuel level in the SVO tank.

1.3f External Heater Wrap (Racor 600 Series)



The external heater wrap is secured by a shoelace style system. It should be tight but not overlapped. If it is overlapped then it is not the proper size for the filter element. It is better to have some exposed filter element so that the wrap will not overheat. The Golden Fuel Systems electric heater wrap is a 12 volt electric resistive wrap that we use to heat our vegetable oil filters. We recommend the wrap to be secured as tightly as possible on the lowest point of the filter housing but not overlapping itself. Ensure that the wrap is not pinched under any mounting brackets or between anything that could damage the internal wires. The wrap has two white wires. One wire is to be 12 volt key on fused power and the other wire is to be a ground. It does *not* matter which one you choose for which operation. The wrap is a resistance type heater element, so power and ground are interchangeable. We wire this through a relay that is controlled by the ignition key, but it may also be wired to a separate switch for added control. We recommend that the customer wraps the entire filter and heater wrap with the supplied bubble wrap insulation to prevent the heat from being wicked away.

1.3g Racor Internal Heater



900FH/1000FH Heater



6120 Heater



690/660 Heater

Racor's internal heaters add an extra shot of heat in the cold weather when it is needed. They are thermostatically controlled and offer between 200- 300 Watts of additional heat. This will assist SVO users during the winter by adding immediate heat to cold Veggie in the Filter. This reduces switch over time and issues of cold SVO causing restriction. It is designed to be used in conjunction with the GFS External Heater Wrap and is a genuine Racor product. It has a safety thermostat that turns the unit on at 50 degrees and raises the fluid temperature to 80 degrees. This thermostat allows the powerful 200-300 Watt heater to operate at safe temperatures inside the Racor filter housing. This will be wired through a relay and fused properly.

1.3h Hot Fox Heated Fuel Pick-up



Hot Fox

This coolant-heated fuel pick-up accelerates switch-over times by essentially “heating on demand.” This steel tube is heating the oil as your vehicle is requiring it for the engine. You don't have to wait for the whole tank to warm up. The Hot Fox is constructed of stainless steel, so there is no chance of contamination between fuel and coolant. It can be rotated in the tank for easy hose alignment. It fits in a 1-5/8” hole and has a low-profile, less than 1-1/4” above tank. Three 1/2” FPT Ports allow for multiple set-ups. This will be installed in the Excursion Stock tank to allow it to heat the SVO.

Chapter Two – Step-by-step

The Ford Excursion can be a complicated installation for the do it yourselfer; with this in mind, what follows is a step by step vehicle specific process to ensure a smooth and problem free installation. These directions are geared toward installation without a lift, so you will need to make the necessary adjustments if you are using a lift. Please read through fully so you can make sure you have all the necessary tools and have made preparations beforehand. Also, fully read through each step before beginning that step; these directions are designed so that you can progress through the installation in a linear fashion, without having to undue anything you already did, but each individual step may include preemptive information for that particular step, so full comprehension is essential. Plumbing and wiring diagrams are in the following chapters.

1. Raise the vehicle. On many full size trucks, it is possible to install a Golden Fuel System without raising the vehicle at all, but with the Excursion, the height of the stock tank requires you to raise the vehicle a minimum of 6 inches to clear the hitch. You can easily accomplish this with a pair of ramps or jack stands, and it is only necessary to raise the rear of the vehicle.
2. Try to empty the tank. The stock Excursion tank is 42 gallons with a skid plate permanently attached to it. Empty, it is a handful, so you want to get most of the diesel out of it. It is also a good idea to keep 10 or 15 gallons on hand to prime the new diesel tank later in the installation.
3. Remove the fill port. Disconnect the tank hoses (fill and vent) from the metal fill port tube, then remove the three mounting screws and completely remove this metal tubing. At this point you should also remove the fill port door. This is a very fragile component, and it can be damaged easily.



Fill-port Removed

4. Disconnect the fuel sender. Where the fill port hoses lay over the top of the frame, you can feel a wiring harness that connects to the stock fuel sender, it is attached with a plastic connector to the frame, and if you pull this out, it will simplify disconnecting the factory connector at this location. You may choose to also do step 10 at this point.
5. Drop the maintank. The Excursion maintank is mounted with only 4 bolts, remember to support the tank and try not to let the tank hang from any one bolt, this can damage the threads and require repair later in the installation. With all 4 bolts out you can let the tank come down in essentially a controlled fall. The fuel lines have about 15 inches of rubber before they connect to the tank, so they will allow this much play with no problem.

6. Disconnect the fuel lines. You will not need the stock fuel lines, so you can either cut the rubber portion, or disconnect the factory connectors. Drag the tank out from under the vehicle and set aside for the moment.
7. Remove the stock fuel lines. CAREFUL. This can be done easily, but the fuel lines run down the vehicle in company with your rear brake line. Take care not to damage this line. At this point, you will need to move up the frame rail under the driver seat where you will see your fuel high pressure pump. Disconnect the supply line from the input side of the fuel pump; once again, Ford has made this simple by using a short length of rubber line here. Trace the return line forward past the high pressure pump (the return is easy to identify because it is hooked to the side of the high pressure pump) to a factory connection that is adjacent your exhaust manifold. You will disconnect it here with a fuel line disconnect tool sold at any auto parts store. Now, with a screw driver, you need to pop open all the plastic retainers for the fuel lines, front to rear. You will notice that the fuel lines are on the inside of the retainer, and the brake line is on the outside, so it is not necessary to play with the brake line aside from removing some plastic clips midpoint on the vehicle. Now, the lines should be loose from the retainers, and you can slide the entire assembly to the rear of the vehicle and pull the ends toward the front of the vehicle down so they clear the front suspension. Then slide the entire assembly forward, and pull the end towards the rear of the vehicle down and out to clear the rear axle. Then pull the entire assembly out via the rear of the vehicle.
8. Modify the stock fuel lines. The installation of a Golden Fuel Systems kit requires that you run the stock supply and return line to the Pollak 6-Port Valve. Since you have the fuel lines out of the vehicle, you can easily cut the return line at around where it was attached to the side of the high pressure fuel pump. Now reinstall this short section in the vehicle. It should run from around the fuel pump up to the factory connection near the exhaust manifold. You should now have a supply port on the fuel pump, and a trimmed return line in the same area that you will be attaching hose to later, so don't anchor anything yet.
9. Modify the stock tank. Now you will install the Hot Fox HFG 14-16 unit according to the photographs. You will need the following for installation of the Hot Fox:
 1. High-speed Drill with a 7/32" drill bit.
 2. 400 RPM Drill with 1/2" Chuck.
 3. Needle Nose Pliers
 4. 5/32" Hex Wrench (3/8" drive Preferred)
 5. 1-5/8" Hole Saw
 6. Oil-Resistant RTV High-temp Silicone
 7. Large magnet (like one off the back of an old speaker).
 8. Some shop rags.
 9. Various wrenches and sockets (for removing and re-installing your tank).
 10. Bucket or drain pan or something to drain your diesel into.
 11. Floor jack (if the tank is mounted underneath the vehicle)
 12. 4 jack stands (if the tank is mounted underneath the vehicle)
 13. Hot Fox Heat Exchanger with Self Drilling Screws



Hot Fox



Try to find a good flat spot big enough for your mounting plate or Hot Fox to seat comfortably on. When installing the Hot Fox, please follow the instructions included with the unit. You will not be installing a Backing Plate for most installations. Please use a bead of silicone in addition to the provided gasket to seal the unit and use the self-drilling screws to secure the unit.

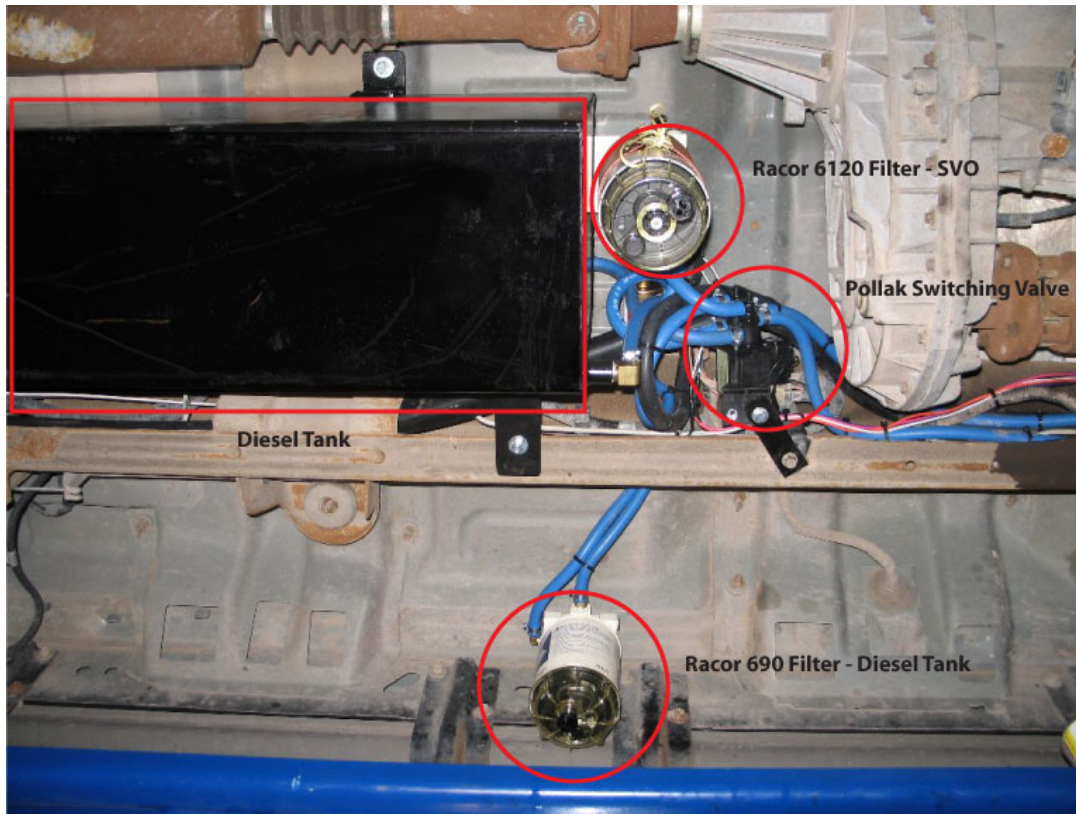
10. Cap off the return and supply line. Due to the unique setup of a Golden Fuel Systems kit, you will require no return line to your maintank. The return line is the smaller of the two metal lines coming out of the sender, attach some hose and plug the hose with a provided bolt.
11. Partially run the triple bypass hose. At this point, you are ready to put the stock tank back up, but before, you need to get the 3B in a position to meet it. Run the 3B along the frame rail over the rear axle, the only crucial thing at this point is that the 3B travels through both holes in the frame cross members that the fuel line formerly passed through. Push enough through that you have enough to meet the tank when it is sitting on the ground under the vehicle. Do not anchor any of the 3B fuel hose; you will need to adjust it.
12. Attach the 3B to the stock tank. Trim back the fire retardant wrapping and connect the heater and fuel hoses. Make sure that it will lie in such a way that it will not inhibit fuel flow, remember, this will be flat on top of the tank.
13. Raise the tank. Get some help for this, while the tank is being raised, you will need to stop periodically and adjust the 3B by reaching over the frame rail and above the tank when it is lower. Your object here is to prevent any kind of kinking. The hose will make a fairly tight turn from the tank through the frame holes, but if done properly, will not create any kind of restriction issue. Because the hose is not anchored, you can pull it back to adjust it to perfection. Also, the fill, and fill vent hoses may become folded, direct these to their proper places above the frame rail during the lifting procedure. Bolt the tank back up properly after lining it up.
14. Verify diesel fuel sender. You are now ready to deal with the new diesel tank. Before you start, make sure that your new sender corresponds to what setup you have requested. If you are reading off of an auxiliary gauge, the sender will have ISS printed on its side at the end of a manufacturer code. If you are reading off of the stock gauge, the sender will have ohm readings printed instead.
15. Plumb the new diesel tank. Note: Fittings may vary from Pictures. You need to attach all your brass fittings to your diesel tank according to the photographs. You will see that the tank has two threaded bolts for the vegetable filter, a cut hole on that end for your fuel sender, diesel return on the top of that end, and supply on the bottom, and your fill and fill vent holes on the other end. All fittings should be oriented and tightened according to the photographs except the fuel fill port. This you can adjust later, so you can leave it loose to facilitate hose routing.







16. Mount the new diesel tank. The diesel tank is designed to hang inside of the frame rail between the single remaining brake line and the drive shaft. It will sit approximately 15-18 inches behind the transfer case, and when near its position, it will become clear how it mounts. It bolts to cross members and to the frame, you will need to drill holes. Before putting it up, attach some wires to your fuel sender and tie it up so it is manageable. This will be impossible to easily do later, so make sure that the wiring is fully attached and tightened down. Also, you can run the 3B behind the frame member that the brake line jumps out and around.



17. Mounting Pollak 6-Port Switching Valve. The Pollak 6-Port Valves will be able to mount directly to the framerail.
18. Mount the Vegetable Oil filter and Diesel Filter. Examine the vegetable filter; you will see that the filter head has 7 holes in it, each with a corresponding arrow for flow. The filter will come with 5 plugs. You will only be using the two holes on the drivers' side of the filter if the filter is held in its final orientation. You will point the input hose barb down, and the outlet hose barb off of the outlet side of the pump will also point down. Make sure to plug all the holes and completely tighten all pipe threads with thread paste before bolting the filter to the new diesel tank.
19. Strip and Attach the 3B. Cut back about 6 inches of your free end of the 3B. There is a Teflon line within that will allow you to easily strip the rubber sheath. The object here is to cut the 3/8 blue fuel line and attach it to the input side of the filter without kinking it, but also without leaving too much exposed. You will have a number of feet of spare hose left over for later. Remember to save the black sheathing, as you will need this later to wrap exposed lines.
20. Pollak 6-Port Plumbing. Plumb the Pollak 6-Port valves as shown in the plumbing diagram.



21. Connecting the heater hoses. The last part of the plumbing is the connection of the heater hoses. From where you split the 3B, run the heater hoses along the vegetable fuel supply line, wrapping wherever possible with the spare 3B wrap. The heater hoses will run along the fuel lines until about the location of the orange oil heater wire, then you will run them under the steering column and up the firewall coming up on the driver side of the brake master cylinder. There is usually an electrical conduit running along the top of the firewall that the hoses can run along until you bring them to essentially the center of the engine, as shown in the pictures. Connect them to the heater hoses using the white, barbed Tees supplied with the kit in the fashion shown.





22. Attaching the fill port. Now you need to address the fill port fitting. First, without attaching any plumbing to the steel modified dual port, you need to cut out a portion of the stock inner fill port panel towards the front of the vehicle. This can be accomplished with a drill and relatively small bit. The goal here is to remove just enough metal that the modified port will slide or can be pushed into a flat position. The fuel port is oriented so that the pointed end will point towards the front of the vehicle. Once in position, mark or drill three screw holes using the modified port as a template. After everything is fitted properly and screws down tight and immobile, remove the fill port and paint the raw metal to either body color, or a color of choice. Make sure to touch up any raw metal from the modification on the truck as well. After drying, screw in the one inch hose barbs on the downward side and attach hose. With the supplied one inch hose, cut off about 2 and ½ feet and attach it to the hose barb that would be closest to the rear of the vehicle. Attach the remaining hose to the forward hose barb. Position the hose clamps in such a way that they will not interfere with installation; for example, try not to tighten them down on the outside of the barbs, it will not feed through the hole well. Slide the hoses through the hole and tighten down the dual port.





23. Final Fill Port Plumbing. The stock excursion fill port hoses that you dealt with initially now need to interface with the new plumbing. Take the leftover brass or steel reducer and screw in the 1 inch hose barb. The threaded end of the reducer will fit snugly into the stock excursion rubber fill hose left over. Use the original hose clamp and tighten it down over the reducer. This will work effectively and will not leak if tightened down properly. Now take the 5/8 to 5/8 butt connector and mate that with the stock excursion rubber vent hose. You now should have a 1 inch hose barb for fill and a 5/8 hose barb for vent. Take your 2 and ½ feet of 1 inch hose and attach it to the 1 inch hose barb leading to the stock tank. Trim this length of hose so that it does not interfere with either the rear suspension or chafe anywhere as well as providing a decent downward slope for fuel flow. Take your much longer 1 inch fuel line and run it up and over the frame rail leading to the new diesel tank. Position this in such a way that it does not kink, or include an unreasonable uphill for fuel flow. At this point you can tighten down the fill port on the new diesel tank after verifying an acceptable angle. This hose will have a fairly shallow slope, so how you route it will affect how fast you can fill that tank at the pump. Trim this hose to fit and tighten down all hose clamps, zip tying where necessary.





24. Final Vent hose plumbing. The last components of the fill port are the vent hoses. Attach hose to the barb on top of the new diesel tank and follow approximately the same path as the fill hose. This is on top of the tank, but you can reach it, and it is fairly accessible. Do the same at the 5/8 hose barb coming off of the stock tank. Run both of these hoses to up above the fill port hoses and loop them over to prevent debris finding their way inside. You need to get the vents as close to the same level or above the fill ports to facilitate filling and prevent problems. Zip tie in place where necessary, trying to prevent excessive chafing or potential damage.

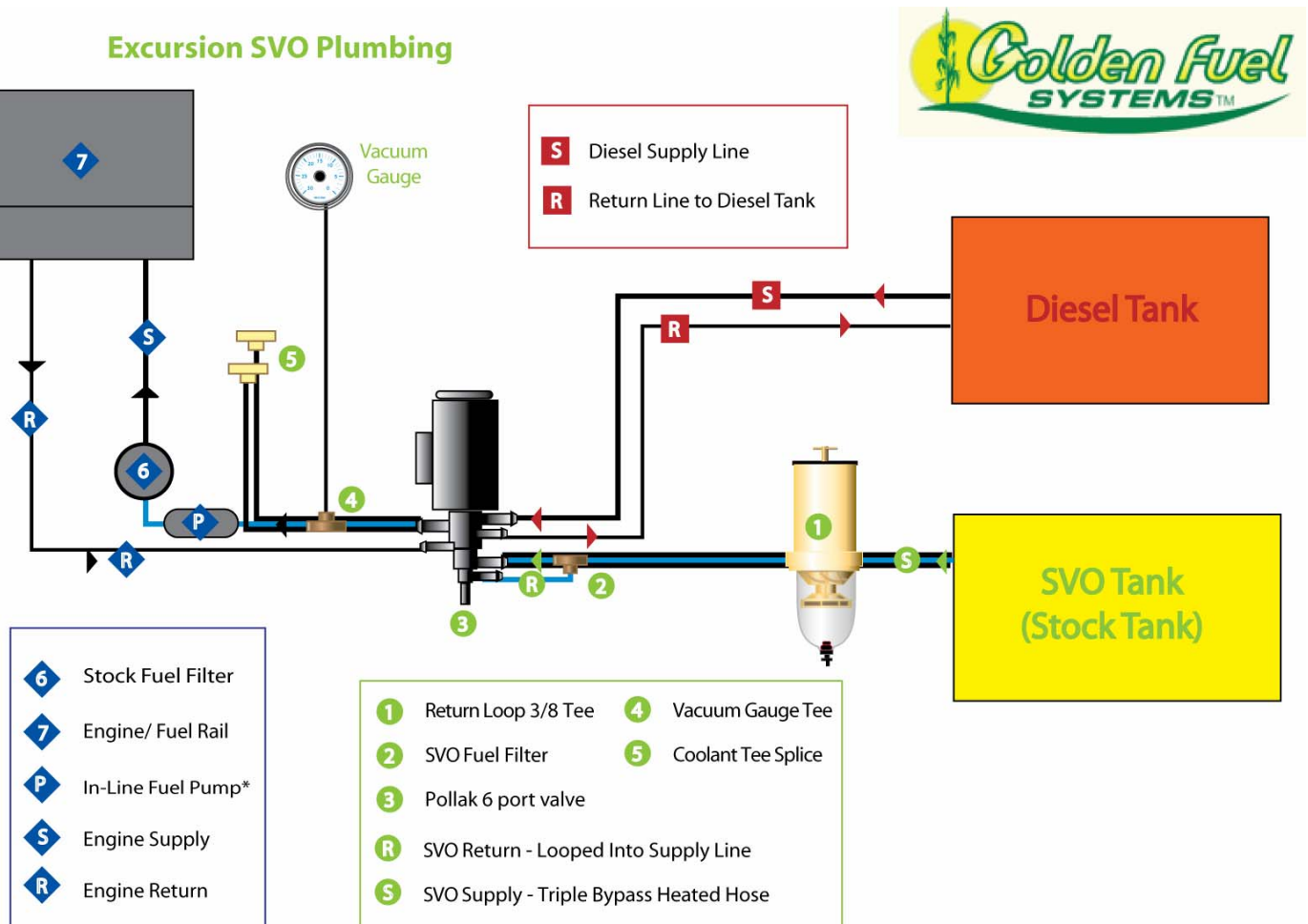


You have now completed the plumbing of the vehicle. From here on you need to follow the wiring instructions in the later Chapters. After wiring, verify that the pump and heaters are working properly. Verify that the valve is working by putting the key on and flipping the switch back and forth while you or someone else feels for movement in the valve.

Chapter Three – Plumbing

Most diesel engines employ two types of fuel pumps to ensure proper fuel supply. The lift pump is responsible for supplying the injection pump with all the fuel it needs. The injection pump is responsible for delivering fuel to the injectors in a precisely measured and timed sequence. The stock lift pump may be mounted in the engine, on the frame of the vehicle or in the tank. Please confirm the location before beginning installation. The original lift pump might have been replaced and relocated during the lifetime of the vehicle.

In some installations, it is possible to isolate the stock fuel filter. By removing it from the supply line, it may allow for faster purging times as there is no fuel filter to purge of SVO. **However, be aware that the stock filter is the last line of defense for the engine, so removing it removes any additional filtration benefits it provided.**



*This is a High-pressure pump (more than 60 psi.) The Pollak 6-Port Switching Valve must be mounted on the suction side of this pump.

*This Stock pump has a life-expectancy of 180,000-220,000 miles.

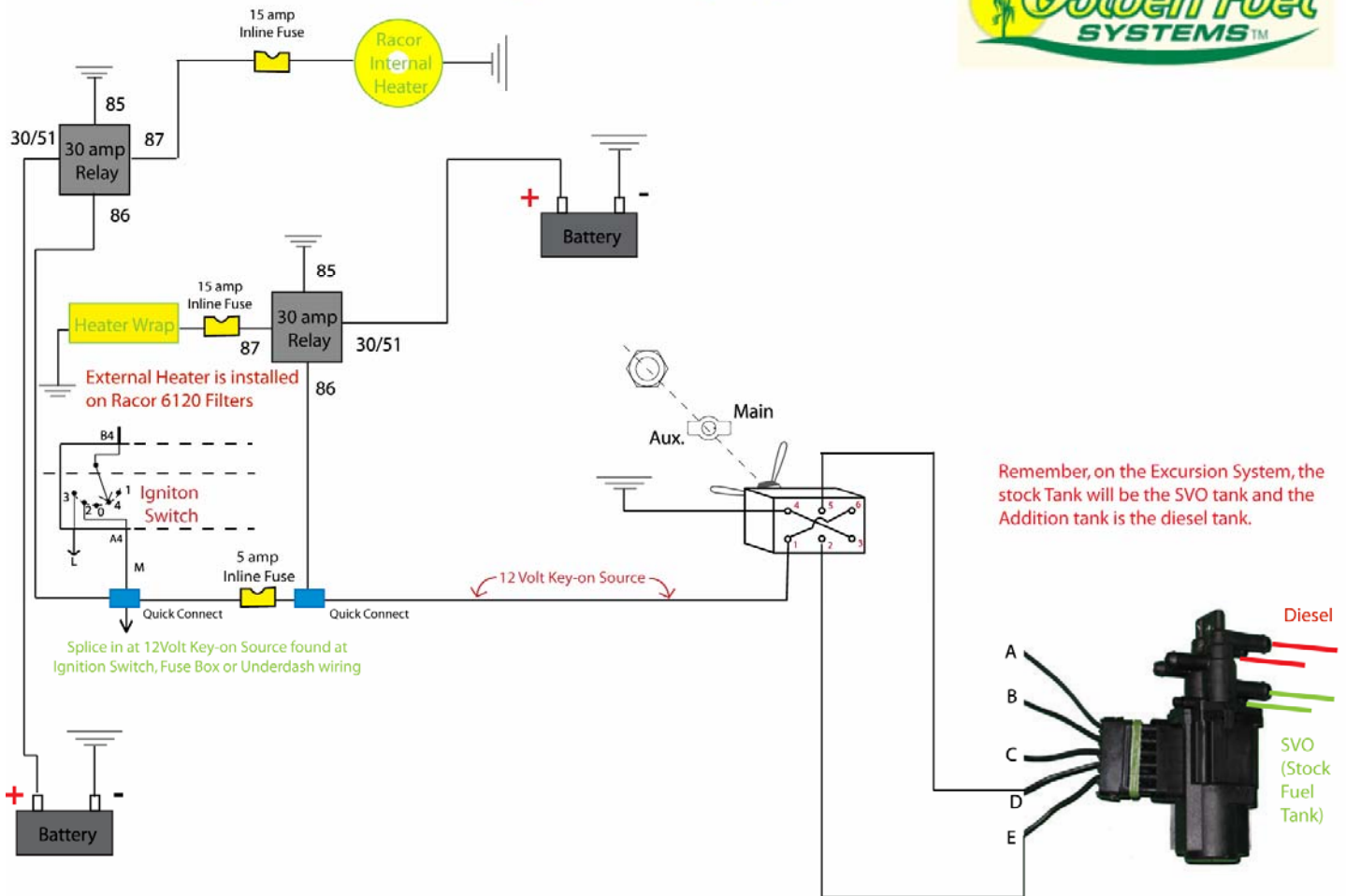
When it fails, please replace it with a FASS SVO HPFP for the best performance on diesel and SVO.

Chapter Four – Wiring

4.0 Pollak 6-port Selector Valve Wiring

When wiring the Pollak Valve, only Terminals D and E will be utilized. Ignore A, B and C.

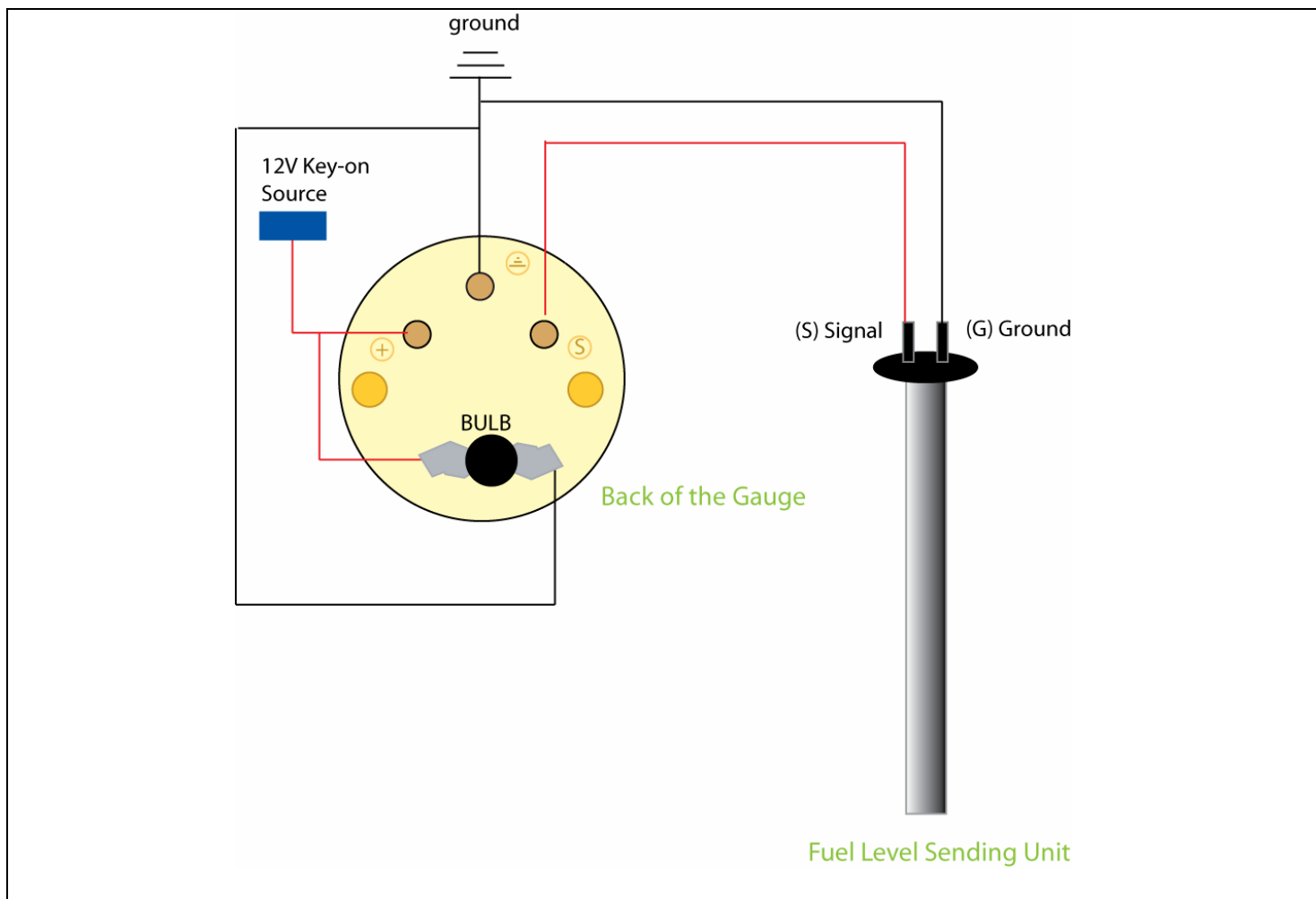
Ford Excursion Pollak Switching Valve Wiring Diagram



4.1 Finding a 12 volt “key on” source

You will need a Digital Volt/Ohm meter (DVOM). You need to find a wire under the dash that only has 12 volts when the key is in the “RUN” position. It will not have power in the “OFF” position or the “ACCESSORY” position. You accomplish this by back-probing the wire with the red lead and then grounding the black lead. It should read 0.0 volts when the key is off but will read approximately 12 volts when you turn the key forward to the “RUN” position. This is two clicks forward, just before you begin operating the starter, when the dash lights and buzzers come on. **Please use a Digital Volt/Ohm meter, NOT a test light.** There have been countless issues of incorrect 12 Volt key-on Sources being found with test lights. Voltmeters are less than 20 dollars at most auto part stores and far superior to a test light. We also do not recommend a test light because of its potential to damage complex computer circuits.

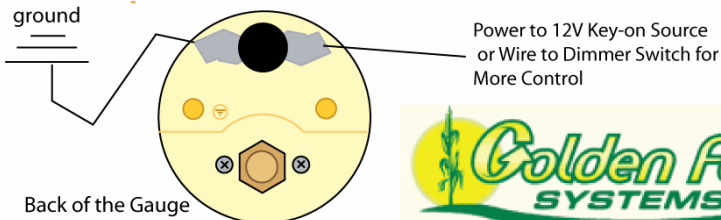
4.2 Wiring of Fuel Level Sending Unit and Gauge



4.3 Vacuum Gauge Set-up

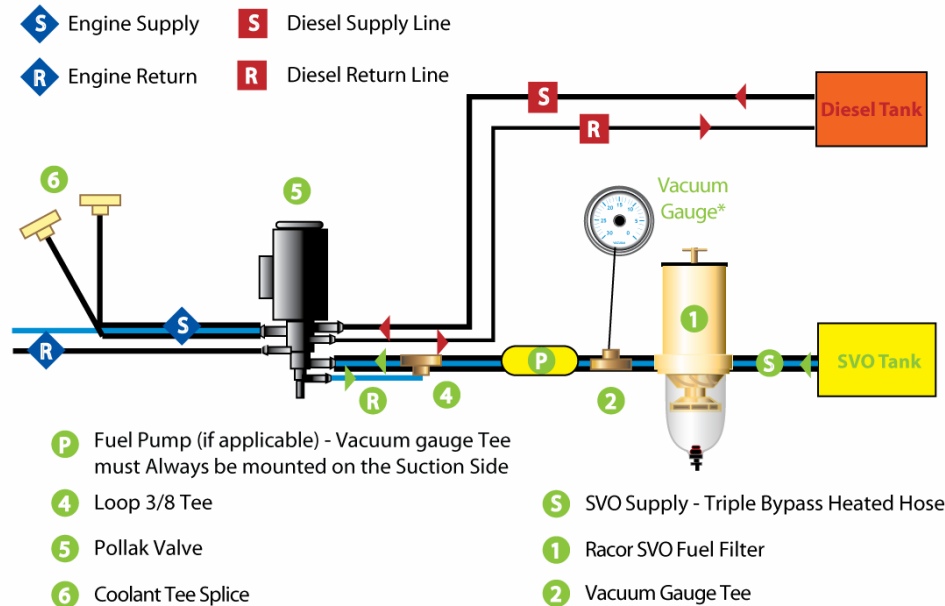
The vacuum/pressure gauge allows one to monitor and diagnose the SVO system. The gauge registers resistance of the fuel moving through the fuel system. When the vacuum reaches 10-15 inches of vacuum, this usually indicates a clogging fuel filter. Make note of where on the gauge the vehicle starts to hesitate and “bogs” down and this is when the filter needs to be changed in the future. Depending on the vehicle, there may be symptoms of restriction at any of these vacuum points mentioned.

Vacuum Gauge Wiring



Vacuum Gauge Plumbing

If a specific Plumbing Diagram was provided for your vehicle, please follow the specific instructions

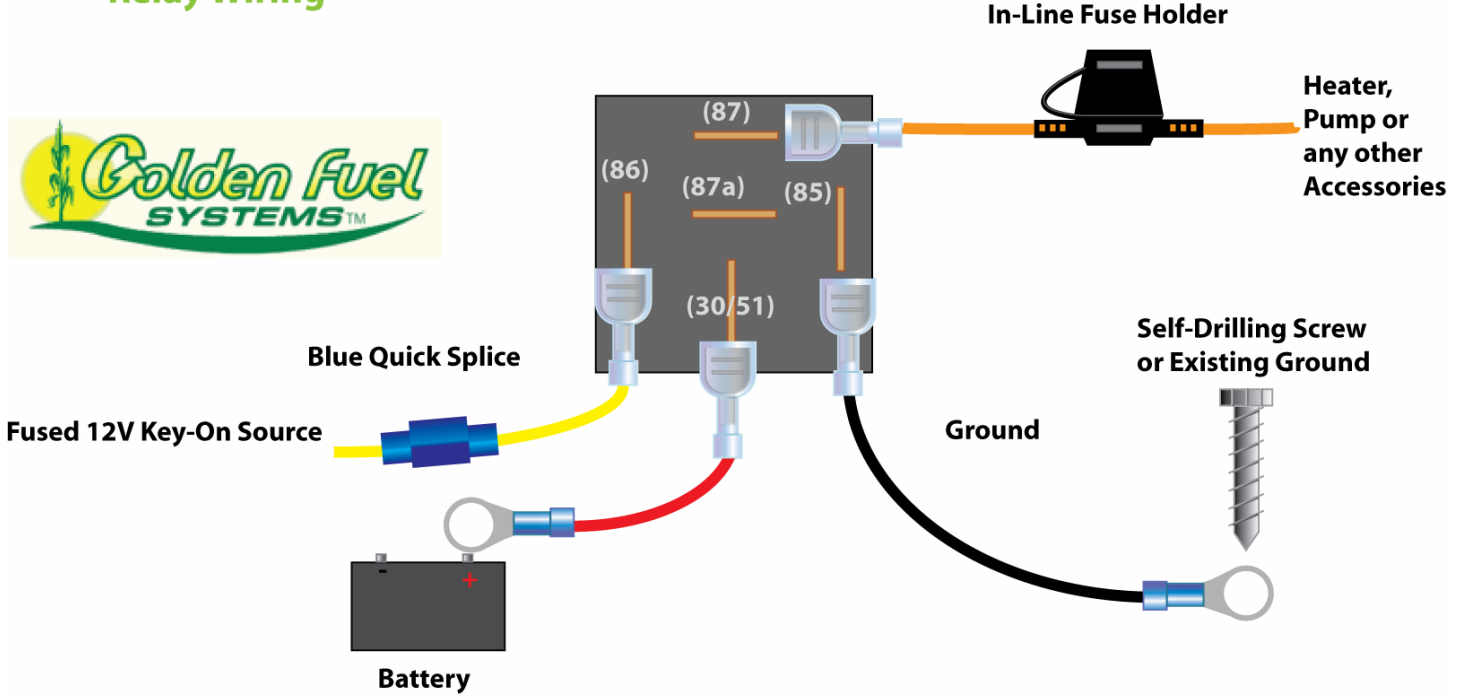


Install vacuum gauge between Filter and SVO Pump or right after the Pollak Valve (if system doesn't have SVO Fuel Pump) - engine side (reads restriction on both diesel and SVO.)



4.4 Wiring Relays

Relay Wiring



When wiring the relay, label the relay with the accessory that it controls. Make a note of the wire colors and their respective functions, as well. Installing the relay on the driver's side fire wall is usually the most convenient location. Note: Relays may have 4 or 5 posts.

Chapter 5 - Finishing the Conversion

5.0 Finishing Checklist

So you think you're all set and ready for a test drive? Let's run through this checklist to highlight the critical points of finishing the conversion.

- Make sure all Hose Clamps are tight.
- Check the grounds from relays, sending units and pumps to ensure metal contact.
- Insert all the fuses at this point.
- Remember to prime Filters with diesel or veggie (we recommend using the Mity-vac Hand Pump to pull fuel through or using the fuel pumps.) You may fill the filter with clean fuel to speed up the priming process, Remember, if using an electric pump to prime, don't let it run dry for too long.
- Remember to prime the lines with diesel or veggie (we recommend using the Mity-vac Hand Pump to Pull fuel through and check for air bubbles or use the fuel pumps to prime.)
- Change your stock filter so you know everything in the fuel line is new.
- Prime your coolant lines by using a pump or the old-fashioned way of driving and filling when the air bubbles work themselves out. Keep a couple of gallons of coolant with you in the vehicle when you go for the test drive and check the coolant level.
- Make sure you have at least half a tank of Diesel, but not full to the brim. You will most likely have to purge air bubbles in the veggie system to the diesel tank and you don't want to overflow a full tank. For more on air purging check section 5.2.

You should be all set at this point. Start on diesel and let the engine warm up to operating temperature. If you flip over to veggie, it should be a smooth transition. If you feel a hic-up or two, it might be an air bubble you need to work out of the system by using the quick purge option. Air in the system will cause a shuddering and jumping sensation eventually shutting the engine down, while clogged fuel filters will cause a slow restriction, leading to a gradual loss of power.

To operate the SVO system, always start and stop on diesel. This will ensure a clean start on diesel, preventing any hard starts. Once the engine is up to temperature (watch the stock temperature gauge until it reads normal operating temperature) switch over to SVO. At the end of your trip, either switch back to diesel and drive for about 5 minutes or use the "Quick Purge" feature to minimize purging to 1-2 minutes (depends if the stock fuel filter is plumbed in-line with SVO.)

If you have any questions after this point please contact us via e-mail, fax or phone.

Priming- There are two methods to prime the vegetable side. Both methods require that the SVO supply line not be connected at the Pollak 6-Port Valve. The first method allows you to flip the switch for vegetable and utilize the auxiliary pump to fill the filter and prime the entire line with vegetable oil. We recommend at least initially priming the filter by unscrewing the element and filling it with Diesel or SVO so that the pump doesn't run dry for an extended period of time. The second method allows you do the same thing with a hand vacuum pump. For both methods, wait until you have a good solid flow with no air, and then connect the hose to the port on the valve. The advantage of the hand vacuum pump is that you do not need to turn the key on, and the high pressure pump will not force out all the fuel from the engine through the return line. You can also measure restriction with the gauge on the vacuum pump, and verify a decent flow. Now, with the switch on diesel, turn the truck to key on and allow the glow plugs to warm up. The high pressure fuel pump will come on, and since the distance between the new diesel tank and the valve is so short, it should be able to prime itself without help. Make sure there is diesel in the diesel tank before hand; otherwise this might airlock the vehicle. Now, put the gas pedal to the floor and crank the engine. When it starts, keep it between 2000 and 3000 rpms for a few minutes on diesel. This will allow the air pocket to work its way around to the diesel tank and escape. The engine rpm may drop a few times, and it may shoot some white smoke (air) out of the exhaust. Do not let off of

the gas until it seems to be operating normally. Allow it to idle and check the coolant level. The 7.3L is very good at pushing the coolant through the system, so top it off, and then go for a drive. Drive for a few miles, then stop and top off the coolant. When the engine is up to operating temperature, and you are moving, flip the switch from diesel to vegetable a few times, leaving it on vegetable for perhaps 10 or 15 seconds, and eventually leaving it on vegetable completely. This will allow any air to work its way out that may have been on the vegetable side. After a mile or so, you should be running fully on vegetable with positive pressure on the vacuum gauge, so pull over, and check the coolant level again. You should be able to fully purge the coolant system in this first test drive, but keep some coolant on hand, and check it periodically for the next 50 miles to make sure.

Chapter 6 - Troubleshooting

6.0 Recently Installed System

I switched over to SVO and the vehicle sputtered and coughed and the engine cut out. What should I do?

Most likely, the fuel lines weren't primed properly and there was air left in the system that caused the engine to turn off. Prime the fuel line by disconnecting the SVO fuel line to the switching valve and turning the accessory fuel pump on or using a hand vacuum pump until the fuel flows without any air bubbles. Reconnect the fuel line to the switching valve and tighten the hose clamp. Make sure that you are on the un-looped diesel system when you attempt to start the vehicle. If the vehicle is air-locked it might take several attempts to start the vehicle again and to purge out the air from the system.

I've been running the car for 15-20 minutes and the vehicle is up to temperature, but the tank isn't warm. What should I do?

Most likely, the coolant lines weren't primed properly and there is air left in the system that isn't allowing the coolant to flow properly. Prime the coolant line with a water pump or hand primer pump. You might have to cycle the coolant a couple of times to purge the air pockets completely. Make sure to check your coolant level, as well.

6.1 Mature System

I switched over to SVO and am experiencing acceleration issues and lack of Power. What Should I do?

Most likely, there is restriction in the SVO system. This is usually caused by a clogged veggie filter. Change the veggie filter. Don't forget to prime it (fill it up with fuel) and make sure that it is sealed well.

I changed my SVO Fuel Filter and am still experiencing acceleration issues and lack of Power. What should I do?

If you are running a system that utilizes the stock fuel filter for both veggie and diesel, you might need to change the stock fuel filter.

I changed the SVO and Stock fuel filter and am still experiencing acceleration issues and lack of power. What should I do?

Most likely, there is some other source of restriction that will have to be traced down. Restriction can be caused by numerous foreign objects that get pulled up into the system or by cold veggie. If you found that your system was running fine in the warmer weather, but now has had a couple of hic-cups with the onset of cold weather, we would advise checking your system for any sources of heat leaking such as exposed fuel line, unwrap filters or coolant deficiencies. For the extreme cold climates, there are a couple of inline heaters and heated fuel pick-up upgrades available on our website. **Do not leave any blue fuel hose exposed. Insulate it with coolant lines and sheathing or bubble wrap, if necessary. Even a foot of exposed blue fuel line in cold weather can create a slug of cold SVO that might result in restriction that will immobilize the SVO System.**

I switched over to SVO and my vehicle began to sputter and cough and the engine cut out. What should I do?

Most likely, there is air that has been introduced to the system. If you just changed your fuel filter and didn't prime it properly, that could be the source. If you primed the filter properly, check to make sure that there is nothing loose on the filter. If nothing on the system has been changed recently, then the air leak will have to be traced down. A hand vacuum pump is convenient to trace down air leaks. Check all hose clamps and fittings for a secure fit, as well.

6.2 SVO Cold Starting

You forgot to shut down on diesel! This is part of the "SVO Learning Curve." Most folks running SVO have done it and chances are that you will, too. Every once in a while, we act like humans and forget to flip that switch before we shut down for the night. Don't panic, it's an easy fix and it doesn't harm your vehicle. Here are a few recipes that'll get you back on the road.

The first thing to do, before any of the following suggestions, is flip your fuel selector switch to Diesel. If the weather is above 45 or 50 degrees simply cycle your glow plugs twice and start the vehicle. It will likely require more cranking than normal but once it fires up it should clear out. Keeping your accelerator 50% engaged will help matters. If this approach doesn't work, try some of the suggestions below. These suggestions can be used separately or together (in the event of particularly harsh weather). **When cranking, be sure not to run your starter for more than 30 seconds at a time, allowing it a 60 second break between attempts, otherwise there is a risk of burning up your starter.**

1. **Plug in your block heater.** You can plug in your block heater and wait a couple of hours. Then cycle your glow plugs once or twice and she'll likely pop right off with minimal cranking of the starter. Just about every diesel has a block heater and sometimes they're worth their weight in gold.
2. **Place the vehicle in a heated garage.** If you are parked in a garage and it can be heated then by all means turn the furnace on.
3. **Heat via light.** You can place an incandescent or metal halide (fluorescent lights will not get hot enough) shop light shining on your injection pump, wait about an hour, cycle your glow plugs, and she should fire up!
4. **Hair dryer or heat gun.** Blast hot air on your injection pump and injectors until they feel warm. Cycle your glow plugs and crank her up.

Chapter 7 - Gathering SVO

It is highly recommended that you watch the DVD Liquid Gold available from www.goldenfuelsystems.com that deals specifically with collecting and filtering oil. Pictures are worth a thousand words and moving pictures with commentary are priceless.

7.0 Seven Golden Rules of Gathering SVO

Gathering Rule #1: Drive around back and inspect the oil before asking the owner if you can take it. The last thing that you want to do is make contact with a manager and then get permission to take the oil only to find out that the oil is less than desirable.

Gathering Rule #2: When checking for oil quality, note the consistency, color, and clarity of the oil.

Consistency - Open the bin, peer in, and kick the side of the bin to generate a bit of a wave. If it doesn't move at all (provided it's not a concrete grease trap), walk away. Even in 30°F weather, there should be some fluidity to it (for more information on gathering in the cold, see the next section Wintertime Gathering, definitely worth your time).

Color - If, looking down into the bin, you note the color of the oil is creamy, thick and milky looking, decline the oil. While such oil is certainly usable, it usually eats up more time and filter bags than it's worth. The milkiess is more free fatty acids (aka FFA's) and likely more water than you want to mess with. The actual color does not matter. It can look like new Wesson oil straight off the shelf, light ice tea, or maple syrup. The color will vary mattering on the type of oil (canola, peanut, coconut, etc.), what was cooked in it, what temperature they cooked at, and how long it was used.

Clarity – This is the most important test of all. This test is for warm weather collecting. Find a clear container and take a sample of the oil. Hold the sample up to the sun or a bright light and check the clarity. You should be able to see through the oil to the other side. If you can see through it then by all means it is great oil and I would collect it for use in my vehicle. If it is just a little hazy then I would take the sample home with me and let it set for a while to see if the oil settles out. If in a couple days the sample that you took settles out and looks clear when held up to a light then it is good oil. I would go back and collect the oil. Then take the oil home and let it settle out for a few days (or a couple weeks if possible).

The longer you let the oil settle then the more sediment will settle out and the longer your pre-filter bags will last! If it is cold outside and the oil in the bin at the restaurant is thick and creamy I wouldn't walk away just yet. Take the oil sample just as you did before (in a clear container) but now you need to warm the oil up. Warming the oil up above the cloud point will melt any FFA's that have changed state. You can warm the oil by simply holding the container in front of the heater vent of your car or you can take the oil home and let it warm up and settle out there. The oil will slowly clear up and hopefully become translucent. Then you can make a decision on whether to collect and process it or not.

As you gain experience and knowledge with the visual and characteristic differences between good oil and bad oil you will be able to dip a stick into the bin and inspect the oil droplets as they fall off the stick. This is usually good enough for a seasoned Golden Fuel Systems burner to determine if it is worth their time in processing.

Gathering Rule #3: When proceeding to ask someone if you can take the oil, knock on the back door. All restaurants have a back door for receiving. Just knock on the door and ask the first person that answers the door if you can have their waste vegetable oil. Most of the time you will either get a 'yes' or a 'let me find out' and then they will find someone who does know. There is no real reason to bother the manager if you don't have to. This usually saves everyone time and hassle.

Gathering Rule #4: Don't bother with the practiced WVO speech about how you're working on this alternative fuel project and how you can run a diesel engine on waste vegetable oil and how you need their oil, etc. Most of

the time, they are busy with work and other customers and are not interested. If they're interested, they'll ask what you are using the oil for, at which point, you can go a little more in depth with your explanation if you want to. Otherwise, keep it short and sweet: "Do you mind if I take a little bit of your used vegetable oil?" usually does the trick.

Gathering Rule #5: Never take the oil without the restaurant's consent! This is the golden rule of oil gathering, and should never be broken. Doing so can spoil it for all WVO burners. Even if restaurant owners have to pay to dispose of their oil (like most of them do), they're still likely to view such unsolicited favors as thievery. There have been reports of people who did not ask permission and had the police called on them.

Gathering Rule #6: Once you start pumping, never pump past the settling line! The settling line is the point of the grease bin where all the solids have piled up, and the oil will be thick and creamy. You do not want to collect the creamy stuff. The creamy stuff will clog your pre-filter bags very quickly. Don't take oil from any lower than at least 2" above the settling line is a good rule of thumb to follow. We are all guilty of getting greedy for that wondrous, free, eco-friendly oil, but it's not worth your time and pre-filters to take the settled junk.

Gathering Rule #7: Never leave a mess at a restaurant grease bin. Try to keep your gathering as clean as possible. We don't want gatherers to be declined by restaurant owners because of the mess someone else made. They're giving us fuel, so let's return the favor by showing them the respect of a clean pull.

Chapter 8 - Processing SVO for Fuel

Most people think that converting a vehicle to run WVO is the hard part, and getting the oil for fuel is the easy part. In reality, it's the opposite. While oil preparation is not overly difficult, there's a definite learning curve to it that's a very slow process, since you have to run it for a while in your vehicle and see how long it takes you to clog a filter before you know how clean it is. It is waste vegetable oil and it does take some work to get clean and the cleaner the better. So, here's our gleaned experience to yield the cleanest oil that time will allow.

Oil preparation actually starts with the gathering process. If you can, gather on a nice, sunny day, taking advantage of the sun's effect on the oil's viscosity. Not only does this aid in the settling process before you even gather the oil, it also prolongs the life of your gathering pump. Choose good, clean oil, pump from the top, and make sure your pump has a good strainer on the intake. If you're not using a gathering pump, use a pitcher (or something of the like), try to take from the highest point possible, and pour it through some panty-hose into your container. While you're pumping, watch the oil and search for the settling line. This is the point of the grease bin where all the solids have piled up, and the oil will turn thick and creamy. Don't take it from at least 2" above the settling line, as the stuff down there will just chew up pre-filter bags later on.

8.0 Letting Oil Settle

There are tons of ways to mass-filter oil out there, and the best rely on multiple stages. Settling is the process of allowing gravity to pull the heavy particles (solids) suspended in the oil to the bottom of its container. Properly applied heat can greatly aid in the settling process by reducing the viscosity of the oil. We accomplish this by painting the container black and setting it out in the sun. DO NOT use any type of open flame heat source under the container to aid in the oil processing. The intense localized heat will cause a convection current within the container which will stir up all of the contaminants that have settled to the bottom. This will negate all the work that gravity has already done for us. Not to mention the fact that propane is a fossil fuel, and using it to prepare our eco-friendly fuel defeats our overall purpose. We cannot say this enough! Settling is your friend! Take the time and let the solids settle out of your oil. Even waiting a mere week can make a huge impact on how clean your oil gets. However, most of us don't want to wait this long. Personally, I recommend at least two weeks, but you have to be the judge. It'll ensure you get the most out of your filter bags and the longest life possible from your Racor filter.

8.1 Pumping Oil

You will pump your oil many times during its preparation, whether it is gathering, filtering, or filling your fuel tank. Always pump from the top of your container. DO NOT put your suction filter at the bottom of the barrel. This will result in pumping up all the settled solids and cause you a lot of frustration, premature clogging of filter bags, and can also damage your gathering pump. Place the suction hose only a couple inches into the oil and start pumping. Continually monitor the suction hose and slowly lower it as the level of the oil drops, keeping it just under the surface. You should be able to see the submerged suction filter screen and will be able to see when you get to the settling line. Stop the pump before you get too deep. Now it is time to clean up and move on to the next gathering spot.

8.2 Filtering

After your oil has had some time to settle, it is then time to filter it. There are a couple of filtering methods. We use a couple of One-shot filtration units at the shop for their convenience, ease of use and unbeatable filtration properties. We filter down to 2 micron, matching or beating most vehicle stock filters. Filter bags are a great low-cost alternative, but don't have any water-filtration capabilities. You can make your own out of multi-layered bed sheets, or buy some Golden Fuel Systems 6-8 micron pre-filter bags. Our pre-filter bags can clean a hundred or more gallons before they clog but it is all relative to the quality of oil that you filter through the bags. If you try to filter really nasty creamy oil then the bag will clog rather quickly. If you use really good oil that has been settling for a couple of weeks then you will be able to get hundreds of gallons

through the bag before it clogs. If it's winter time, it's a good idea to warm the oil a bit before you run it through the bag. A low heat is best and propane burners are not recommended.

Convection is bad and will stir up all the settle deposits and redistribute them throughout the oil. You can use a submersible tank heater in your oil a couple of hours before you run it through the bag. We sell one style on our website that we have used for many years. Do not put it on the bottom of your container as this will also stir up any settled deposits with the thermal currents. Try leaving it suspended just about midway in your container. Do not get the oil too hot! We here at Golden Fuel Systems recommend pre-filtering oil that is between 80°F and 120°F. If the oil exceeds this temperature range then it is possible that it will cause the fibers of the pre-filter bags to stretch and will not work as designed. If you filter the oil at too hot of a temperature it is possible to let enough contaminants through the bag to seriously degrade the lifespan of your Racor filter on the vehicle.

Do not clean and re-use your filter bags for final filtration. We're not saying this to get you to buy more. We've tried our best to find a good way to clean and re-use the bags. We've turned them inside out and gently wrung them out. We've run hot water through them (backwards and forwards). We've washed them in a washing machine on the warm/cold cycle. Unfortunately, all attempts ended in stretched fibers and useless pre-filter bags. You may use them as a pre-pre-filter bag to catch large chunks and save on the new filter bags for final filtration.

After the oil is filtered, store your clean oil in a barrel or jug, preferably in the sun. Even the best of filters will still allow particles in the processed oil, and it never hurts to allow it to continue to settle in the ambient heat until you need it. When you're ready to pump it into your tank, be sure to pump off the top, as mentioned before, to get the cleanest of the crop. And you should still leave the last 4" or so, even of the clean stuff. Pour it into your next batch of unfiltered stuff and let it settle out again.

Don't ever think you can get away with not pre-filtering your oil. Every once in a while, you'll score some oil that's so prime looking that you know you can just run it right into your tank. Fight the temptation. No matter how good that oil looks, skipping the pre-filter stage will land you with clogged Racor filters. We speak from experience (but it was sooo clean! :). We don't want to rain on your pristine discovery of sweet oil; just think of how long your filter bags will last with this great stuff flowing through it!