



***2003 and Older VW
Installation Instructions
All diesel applications, including
TDI motors.***



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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

Do pre-conversion maintenance; there is no sense to installing a system on a vehicle that is in poor condition. A vegetable conversion will not improve a tired engine, and is not a miracle fix for all engine problems. The engine will still require regular maintenance. It is highly recommended that you make sure that the engine is in excellent condition beforehand. It is especially important on VW engines to inspect the rubber timing belt condition. These engines, the 1.6, 1.6 turbo, and TDI motors have a good reputation for longevity, but are all interference engines, like most diesels, meaning that the valves and pistons occupy the same space at different times in the 4 stroke cycle. If the belt breaks, the valves and pistons will touch, definitely bending the valves and damaging the head, as well as potentially damaging the pistons. Maintenance will eliminate this risk.

The first step to ensure your installation will be as clean as possible is to study your stock fuel configuration. Most VW engines are transverse mounted with front wheel drive. The front of the engine will be located on the passenger side of the vehicle, where you will find drive belts and in most cases the fuel filter. It is recommended that you go ahead and discard the cover on your TDI motor; its presence will actually limit where you can install components. Familiarize yourself with the layout of the motor; VW has simplified this on the newer motors with handy stenciled fuel lines indicating direction. Generally, you can trace the supply from the filter to the injection pump inlet which is usually on the left hand side of the pump.

Special note: 2004 and up TDI motors may have the fuel input and output on the other side of the motor. These motors will require the installation of a 6 port selector valve and additional fuel pump. This will be described in more depth further on.

Depending on the year of the vehicle, you may also have a temperature controlled valve for your return line on your stock fuel filter. Inspect to see if this is the case, the return line will come back to the top of the fuel filter and attach to what appears to be a plastic clip. Remember to bypass this component by running a short length of hose from one end around to its other side in a loop. Then just connect the return line coming from the motor to the return line going to the tank with a butt connector. The detriments of keeping this valve original are that it may bypass the return to tank and return fuel to the diesel filter depending on temperature. This can create a problem when you are dealing with an air issue, because it might go from a small loop to a large loop instead of draining air.

1.3 Components

1.3a GFS 3-Port Fuel Valves



3-Port Valves (Figure 2)

The GFS 3-Port Fuel Selector Valve will be used as the return valve. It can be mounted where it is most convenient. The fittings used in the valves will be contingent upon how and where the valve is mounted on the vehicle. Ensure that it is clear of any hot or moving parts. You can secure the valve separately with the (2) 5/16"-18 x 2.5" bolts (included with the system.) 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 the valve to mount securely. These valves are suitable for vehicles with a fuel economy above 10 mpg and may be used on pressurized system up to **50 psi**.

1.3b Fuel Selector Valve



Three port fuel selector valve

The FSV1 will be used as the Supply Valve. It needs to be mounted on a metal part of the engine or body, as that is how it is grounded. Ensure that it is clear of any hot or moving parts. You can secure it with either two of the self drilling screws (provided in the kit) or a bolt of proper size (not included in the kit). Be careful of what you are drilling into. Ensure that there are no wires or other components behind the holes that you will drill. You will generally mount the valve in an area close to both fuel filters (which will be close to the injection pump). For example; on a Mercedes the diesel fuel filter is on the driver's side of the vehicle and we also mount the SVO filter on the driver's side of the engine bay, so it would make sense that we mount the fuel selector valve on the driver's side inner fender well. Remember, the distance between this valve and the injection pump represents your clear out time at the end of the day. Every inch of line adds time the engine needs to burn the fuel held there.



Rocker Switch with Quick Purge Option

The GFS Rocker Switch is most commonly mounted 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. The functioning of the rocker is as follows: Push up to switch to SVO. The middle position is diesel (start and stop vehicle on diesel.) Switch to diesel within 5 miles of your final destination to evacuate stock components of vegetable oil. For a "quick purge," hold down on the momentary-on

(bottom) for 45 seconds to “quick purge” the system of vegetable oil and return the vegetable oil to the SVO tank. A “quick purge” can be performed while at idle or running the vehicle.

1.3b Racor SVO Filter



1000FH with the Exclusive GFS Thermostatically Controlled Heater 80°-140°



900FH with the Exclusive GFS Thermostatically Controlled Heater 80°-140°

Racor 900FH, 1000FH

Racor filters must be mounted as close to vertical as possible. Do not exceed 10° from vertical or the assembly may not 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.

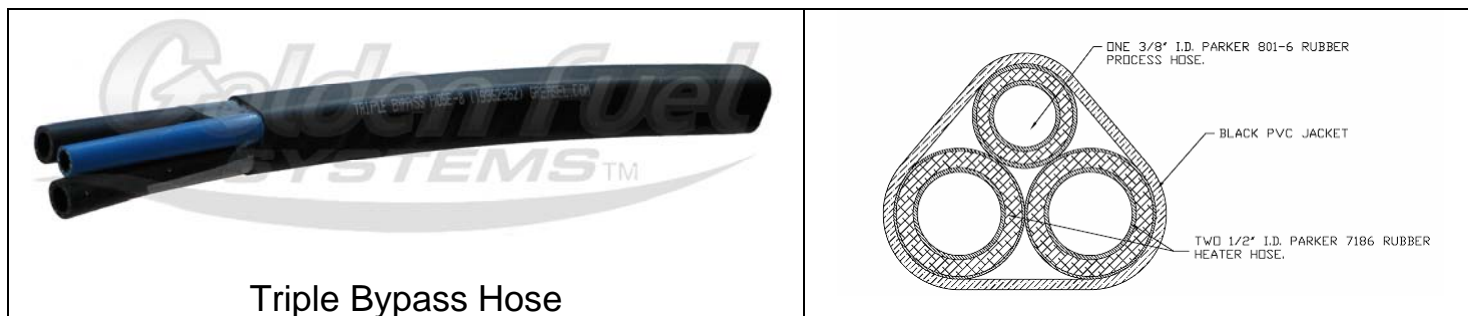
Turbine series filter assemblies are designed to be installed on the vacuum side of the fuel transfer pump for best efficiency. These filters include an internal 12V, 300 watt Heater with Golden Fuel Systems exclusive thermostat so it turns on at 80° and safely raises the fuel up to 140° degrees. You will need to use the supplied 10 or 12 gauge wire for the power wire for the internal heater.

WARNING! DO NOT ACTIVATE THE HEATER WITHOUT FUEL IN THE FILTER! THIS CAN PERMANENTLY DAMAGE THE HEATER ELEMENT AND/OR FLTER! 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.

1.3d 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.

1.3g Vacuum/Pressure Gauge



Vacuum gauge – Color may vary

The Vacuum/pressure gauge is a feature that allows one to monitor both fuel systems. It can indicate when there is restriction in the line and assist in diagnosing issues, should they arise. We recommend mounting this on the engine side of the switching valve. Readings will vary from vehicle to vehicle, when you initially have primed and the system is running properly with a clean stock and vegetable fuel filter, take special note of the readings on your vacuum gauge.

Use idle as you base readings and use those readings to indicate when to change the filters. There will be variations in vacuum during normal driving because of injection pump demands. For example, when at wide open throttle, your vacuum will drop showing the increase of fuel flow. This gauge is invaluable, giving you real time feedback on what is happening in your fuel system.

1.3h Fuel Level Sending Unit and Gauge

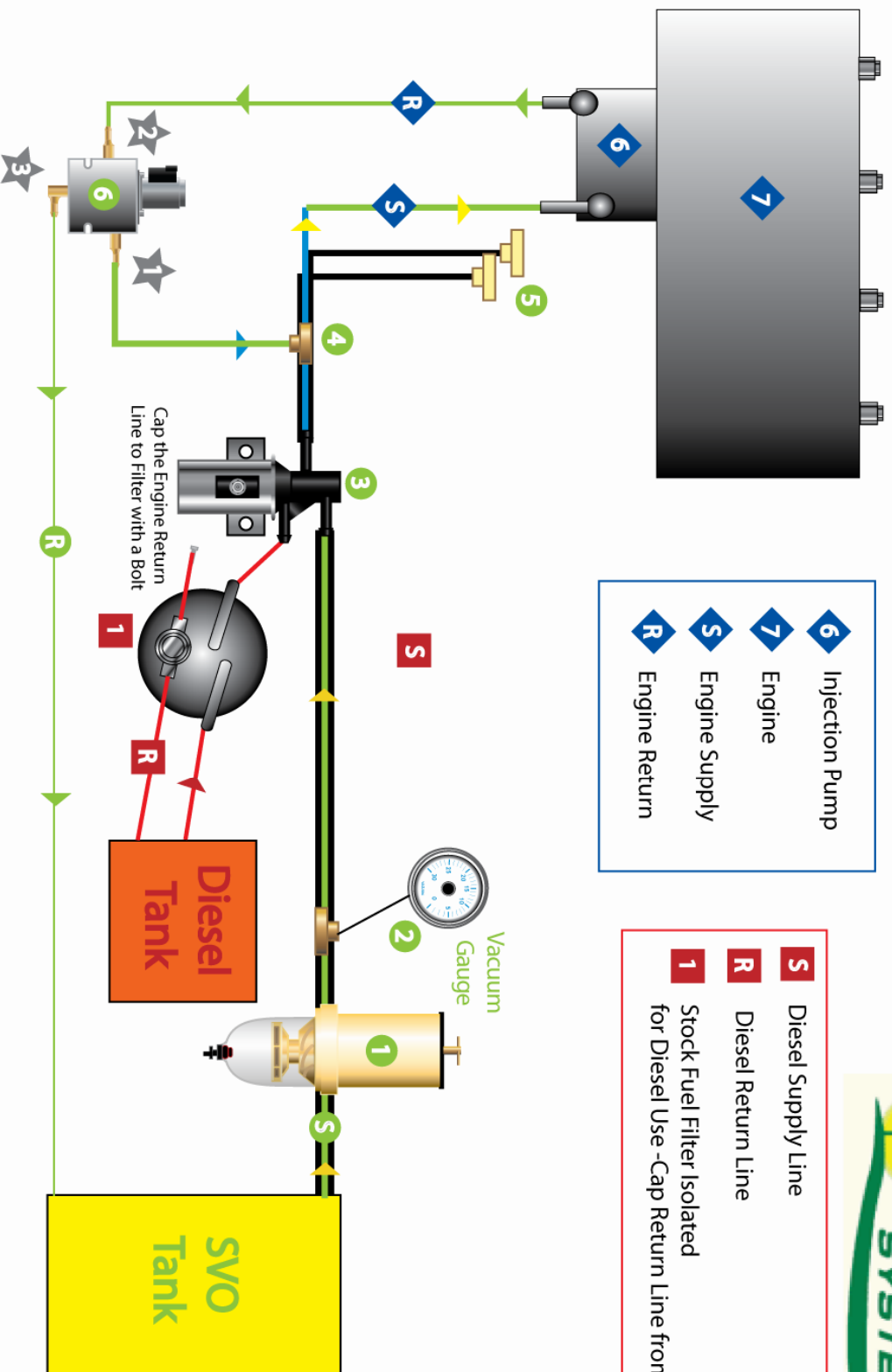


Fuel Gauge- Color may vary

The Fuel level sending unit and external gauge allows one to monitor the fuel level in the SVO tank. This gauge will also move slightly from time to time based on the position of the fuel sender. For example, if the sender is mounted in the front of the tank, and you stop short, the gauge will rise and fall slightly. This is normal and no cause for concern.

Chapter Two - Plumbing Diagrams

2003-Older VW Plumbing



- 6 Injection Pump
- 7 Engine
- S Engine Supply
- R Engine Return

- S Diesel Supply Line
- R Diesel Return Line
- 1 Stock Fuel Filter Isolated for Diesel Use - Cap Return Line from Engine with Bolt

- 1 SVO Fuel Filter
- 2 Vacuum Gauge Tee
- 3 FSV1
- 4 Loop 3/8 Tee
- 5 Coolant Tee Splice
- 6 Return Valve
- S SVO Supply - Triple Bypass Heated Hose
- R Quick Purge Return Line to SVO Tank

2.0 Engine with Internal Lift Pump

- 1 Valve Input
- 2 Valve Output
- 3 Valve Input

2.1 Routing the Triple Bypass Hose (3B)

3B Hose is relatively easy to manipulate. It is flexible, yet durable, allowing for tight installations. The first step is to plan where to route the hose from the tank, under the vehicle and then into the engine compartment. You will need to take into account where your stock heater hoses are in the engine and where the Racor Filter and GFS 3-Port Valves will mount. This will determine where the 3B hose will need to route, as well as where you will need to splice into the hose.

The 3B hose can follow the stock fuel lines for the length of the vehicle. This is typically on the driver side of the vehicle. You can come up into the engine compartment near the power steering box, taking care not to interfere in any suspension or steering control systems. The hose will have to diverge from the stock fuel lines when you approach the rear end assembly. GFS Recommends starting with plumbing the 3B hose at the tank(s) and then running it under the vehicle, lightly securing it with the zip ties so that there is enough slack to move it if necessary. Please observe the included plumbing photos for tank plumbing, filter plumbing and engine plumbing.

The most important factor in running your 3B is to remember not to kink it while avoiding moving parts. You may experience some trial and error with routing, and in the case where you absolutely require a tight bend, you can remove the sheath from the hoses by carefully cutting, and re wrap after making the bend.

When you reach the trunk area, it is a simple matter of choosing where you want the hose to come up into the trunk. Usually you will need to cross over to the passenger side behind the rear suspension to get up into the trunk, as the exhaust system uses a lot of the space on the driver side. When you drill your hole, remember to treat the raw metal with a little paint to prevent rust, and uses some extra rubber hose to create a grommet for the hole.

Once inside the engine compartment with the 3B hose, you will need to trim back the rubber sheath to expose the individual hoses so they can route to the various points they will need to go to. You will have to split 4 feet or more of the 3B sheath because the fuel hose generally needs to be routed to the driver's side of the engine and the heater hoses generally need to be routed to the passenger's side of the vehicle.

There is a Kevlar string inside the hose that you can pull on to split the sheath length wise. However, a hose knife is recommended to cut the sheath with speed and without finger burn. There is a clear wrapping inside the 3B hose that will be exposed when you split the sheath. This clear wrap is only there to protect the internal hoses from the shrink wrapping process during the 3B manufacturing process. You can discard any clear wrapping that you expose.

Once the 3B is initially routed you need to verify clearance between the hose and other moving parts and that there is enough slack at each end to make all connections before you trim the hose to length. Do not leave any SVO fuel hose exposed outside of the engine compartment. Insulate it with coolant lines and sheathing or bubble wrap, if necessary. Even a couple of inches of exposed SVO fuel hose in cold weather can create a slug of cold SVO that might result in restriction that will immobilize the SVO System. If anything is not satisfactory then you can correct it at this time.

In the engine compartment, decide which heater hoses you are going to splice into and where you will install the splice. You will need one supply hose and one return hose. GFS recommends waiting to perform the coolant splices so that it is the very last step to complete the installation as it will be quite wet once the heater hoses have been cut.

The best place on your VW to attach your heater hoses is in series with your oil cooler coolant lines. This is located on the driver side of the engine running into the base of the oil filter. Remember, you will be cutting one hose, and putting the 3B in series, not parallel with the coolant line. You will splice into the coolant line and install the two 5/8" x 1/2" 90 degree fittings. (Provided with the kit) with the 4 large hose clamps (provided with the kit). Some vehicles will require two 3/4" x 3/4" x 1/2" tees. Please contact us if your installation needs them. Next, trim the coolant lines of the 3B to the correct length, install one medium hose clamp per hose, and push them completely onto the 90 degree that you just installed. Next trim the fuel line of the 3B hose to the correct length, install one small hose clamp, and push it completely onto the 3/8" NPT x 3/8" barb fitting (provided with kit) that is installed in the inlet port of the filter head, or valve. Go back and double check that all hose clamps are tight. Once your conversion is complete, be sure to check your coolant level and add as needed. While some installs lose almost no coolant when you cut into the heater hoses, others wind up with a serious loss, and replacement is mandatory!

Special note: 2004 and up TDIs can use the same oil cooler line, but on the newer body style. 2006 and up, you may choose to install T fittings on the back of the motor where the heater hoses travel into the firewall. This can only be accessed from underneath the vehicle.

Once your conversion is complete, be sure to check your coolant level and add fluid as needed. GFS recommends priming the coolant lines with a mix of Universal Coolant and water in the recommended ratio. While some installs lose almost no coolant when you cut into the heater hoses, others wind up with a serious loss, and replacement is mandatory! These coolant lines can be primed readily with a hand-held vacuum pump.

Chapter 3 – Installing the Trekker Tank

Install the Trekker Tank(s) in whatever way they fit best in your vehicle. It is recommended to avoid placing the filters in an area where they may be hit with cargo. The tanks are easy to maneuver and bolt down. Three mounting brackets are provided to ensure a secure mount for the tank. There are two 1/2" Coolant ports and one 3/8" fuel pick-up port. There is also an extra port to allow for any extra plumbing necessary.

There is one fuel level sending unit and gauge per tank/chamber to allow one to monitor fuel levels in all tanks. When installing two or more tanks, please decide on the best way to designate each gauge and whether you would like to link the tanks via the barb "T" or "Y" or keep them isolated for filtering purposes. With 2+linked tanks/chambers, you will need to ensure that both tanks have enough fuel so that the pick-up doesn't draw air in if one tank is empty.

If the system has the optional upgrades such as the Integrated One-Shot or Half-shot, the fuel pick-up line on the tank designated as the holding/warming tank/chamber will have the fuel line routed to the Racor filter and then discharge into the "clean" tank/Chamber. The wiring of the pump requires another switch and relay to operate. You will find these instructions included.

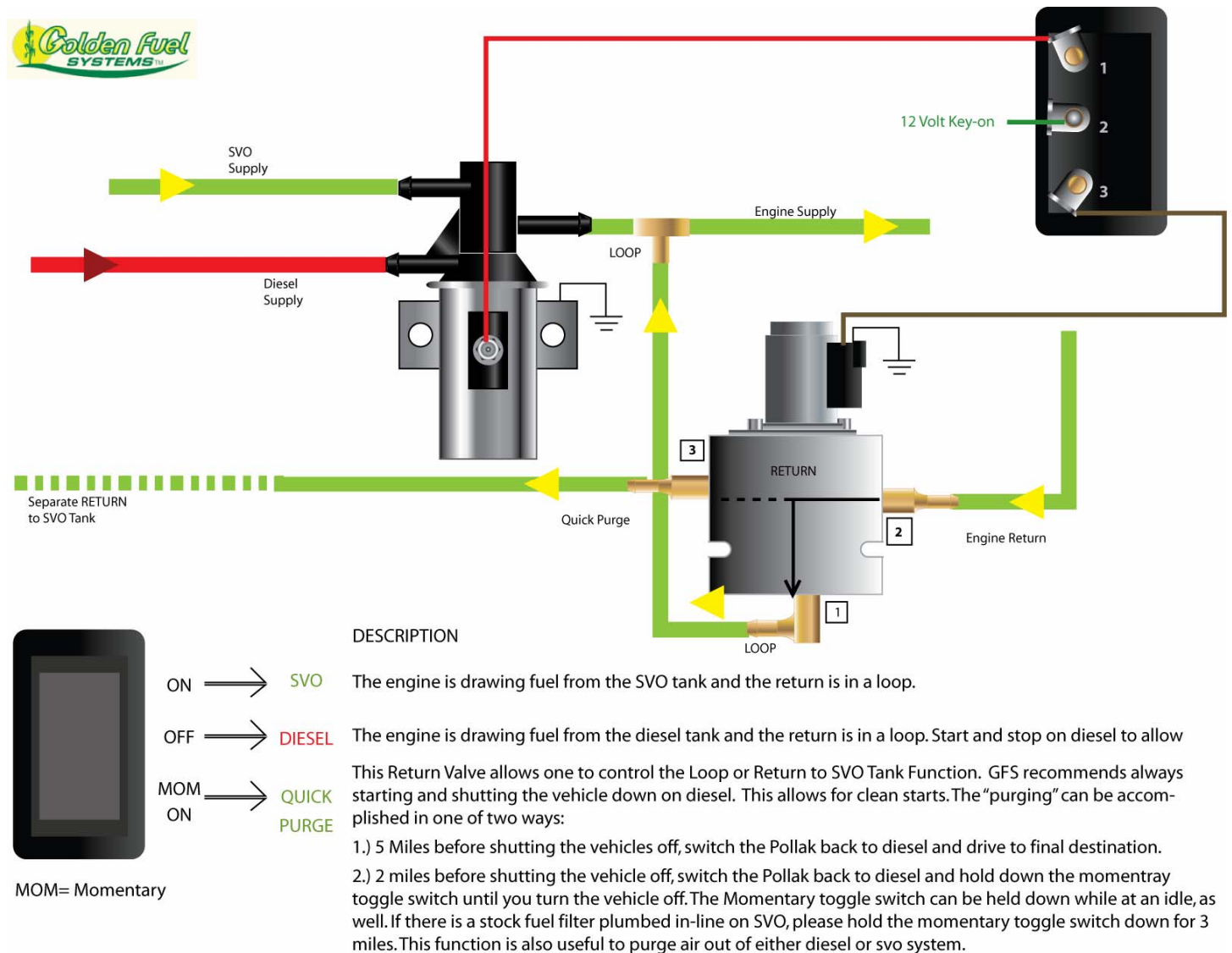




12 Gallon Trekker Tank with Racor 900FH3122 Mounted – Carpet Scored to Allow access to Spare Tire

Chapter Four – Wiring

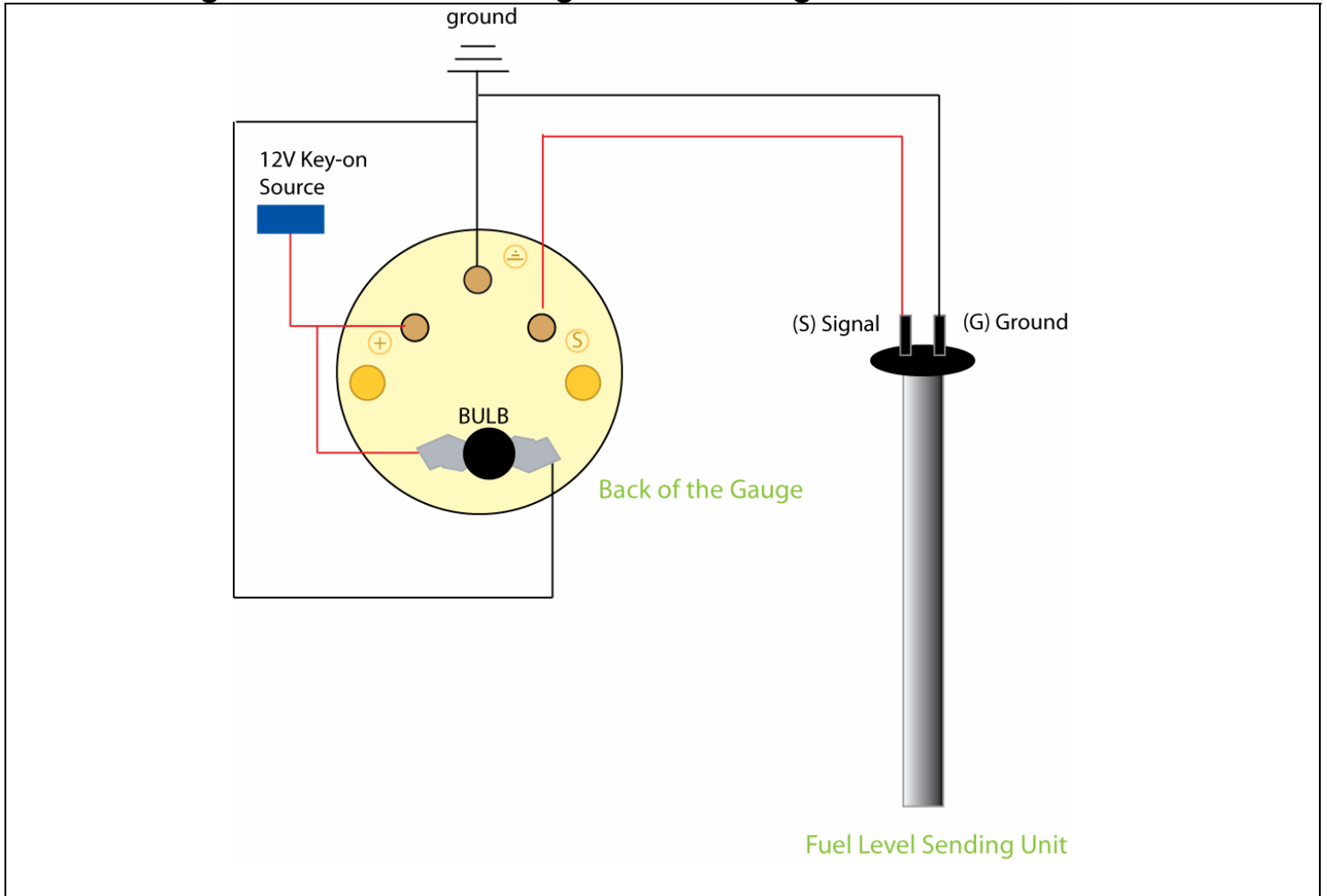
4.0 FSV1 and GFS 3-Port Fuel Selector Valve Wiring



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.

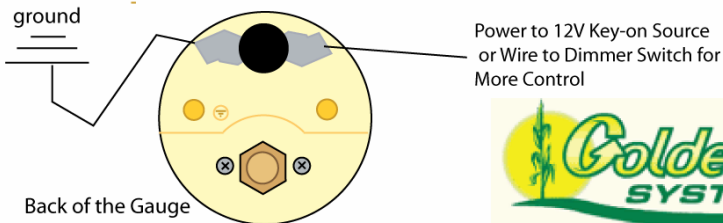
4.2 Wiring of Fuel Level Sending Unit and Gauge



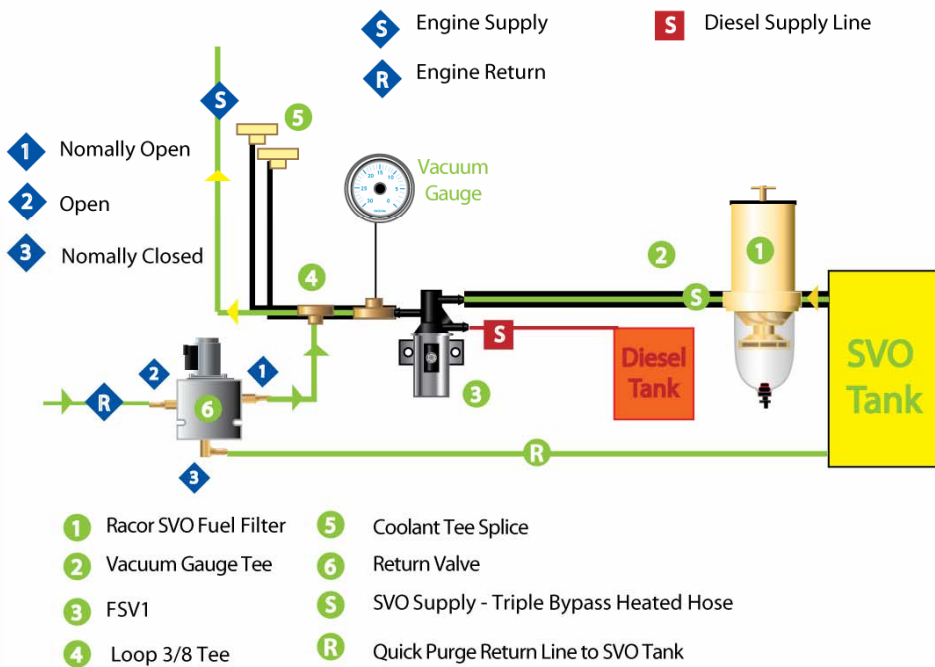
4.3 Vacuum Gauge Set-up

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

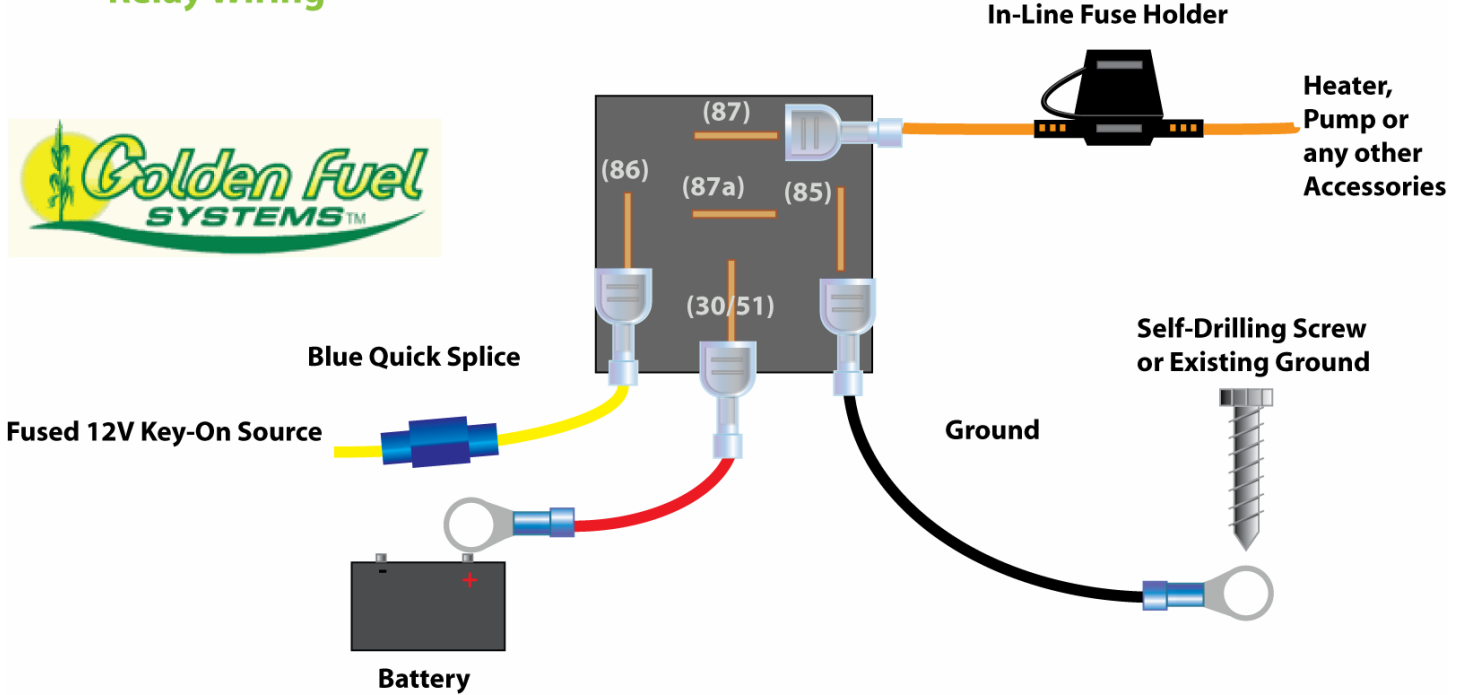


If a specific Plumbing Diagram was provided for your vehicle, please follow the specific instructions



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.

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!