

Here we will give a brief overview of the different types of Alternative fuel systems on the market and the process behind them. This is not meant to be an in depth explanation of any one system but rather a general explanation of the process behind the most common types of Heated Alternative fuel systems. The two primary categories are Single Tank (Elsbett) and Two tank systems (everyone else). In the Two tank systems there are a handful of variations that utilize two primary approaches- Switching Solenoids, and the pressure differential system (aka check valve setup, valve-less, fn74) But regardless of HOW it's done, the ultimate purpose of ANY system is to get the fuel be it Biodiesel or Straight Vegetable oil (SVO) hot enough to reduce the viscosity enough so that it can be injected, atomized and burned properly. Incomplete combustion of WVO will lead to excessive coking and premature engine wear.

Of the single tank systems Elsbett of Europe is quite possibly the only successful producer of single tank systems and mostly for Mercedes and VW cars. The Elsbett system replaces the injectors and adds multiple heaters including Injection line heaters. The system also keeps the glow plugs on longer to help the combustion process until the engine is warm. This allows the vehicle to start, run and shutdown on oil. However extreme cold weather operation is still questionable, and this system was created for older generations of Diesel that do not see the 20,000+ psi of modern diesels injection systems. There are some modern vehicles whose injection pumps would fail instantly if a startup on cold oil was attempted.

In the two tank category there are two primary approaches. One uses two 3 port switching solenoids, the other uses fuel pressure and check valves. The concept of operation for the switching solenoid type is always the same. One 3 port solenoid switches the fuel SUPPLY between the primary diesel tank and the secondary alternative fuel tank. The other switching solenoid switches the RETURN. The better quality systems will use a dedicated filter(s) and pump for the oil side along with having some level of automation that will monitor the engine coolant temperature and operate the system accordingly.

By using dedicated filters and pump for the oil side this helps alleviate the stress of using OEM parts not designed for the heat and viscosity associated with using oil for fuel. The cheaper systems use the stock fuel pump and or filter for both diesel and oil. While this CAN work, this type of setup is highly prone to failure in anything but ideal situations with ideal oil. But once a filter plugs, or a pump fails the vehicle is left stranded. This type of setup also makes for excessively long purge and shutdown times in some vehicles due to having to completely flush the fuel lines, pump, filter, and injectors of oil. All systems use one or more of the following: filter, pump, heat exchanger, and switching solenoids in varying order. And of course all these components need to be connected with a heated fuel line, of which there are three approaches: Hose On Hose(HOH), Hose In hose(HIH), and electrically heated which will be discussed later.

The second approach to the Two tank heated fuel system is using a pressure differential setup. This design was originally pioneered by Jason Crawford of Dino Fuel Alternatives for use on the Ford/Navistar Powerstroke® engine that turned the normally loathed deadhead fuel system into an asset. The original theory of operation was that by overcoming the pressure of the diesel fuel system the diesel would go into recirculation and the engine would continue running on the alternative fuel so long as it maintained the higher pressure. Anytime the alternative fuel pressure dropped below the threshold, the diesel would take over again. The Valve-less system requires a completely self contained oil system and greatly reduces purge times and increases reliability since none of the OEM Diesel supply system ever sees a drop of oil.

This design led to an ultimately reliable engine with perfectly seamless switchover to oil, and more importantly would seamlessly switch back to diesel by default should anything at all cause the Fuel oil pressure to drop below that of the diesel. Check Valves were installed in the diesel supply side and on the oil supply side to prevent any back-feed and cross contamination. And since this engine uses a deadhead setup that means there does not have to be a return from the engine itself. This new approach has quickly become one of the most emulated Alternative fuel setups on the Powerstroke® engine for its simplicity and reliability. Just like with the switching solenoid type systems, there are several different levels of quality, functionality, automation and convenience features depending on who you buy from and how much you spend.

Both HOH and HIH use engine coolant to help impart heat into the fuel. Hose on hose is exactly that. The fuel lines and the coolant lines are run together as tight as possible to allow a transfer of heat from one to the other. This type of setup is the easiest to install/service and the most reliable, however it is not good for use as a heat exchanger. HOH should only be used for minimal warming and maintaining heat in the fuel line by raising the ambient surrounding temperature. HOH is the least likely to leak or have issues but needs to be used correctly in a system. HIH is the other most popular type of setup. Hose in Hose runs the primary fuel line through the middle of the coolant line. Usually there are two types in internal line used for fuel-Aluminum and Nylon brake line. At each end is a way to separate the coolant and the fuel line.

The most common way to do this is by using a pipe thread Tee where the fuel line is broke out the end through a compression fitting and the coolant is run through the branch on the branch on the Tee. Then a connection needs to be made to the fuel line sticking out the end of the compression fitting. HIH is a great way to heat the fuel quickly and effectively but is prone to coolant leaks, can be very difficult to assemble and one mistake can mean starting all over. As well as any tampering can initiate a leak that con not be fixed. As well as when used with the

aluminum internal line there is no way of knowing whether or not there are any kinks inside the coolant hose, and it is very difficult to work with. However when done correctly using the right type of compression fittings and with great care this can be a very effective heat exchanger AND fuel line at the same time.

BFT is currently finishing up long term testing on a new type of HIH to eliminate a lot of the headaches of traditional HIH. By using DOT certified nylon internal fuel line and specially designed pushlock fittings. We have created an HIH that is terminated in a standard JIC fitting for easy connection, have eliminated the potential for coolant leaks, and is durable in the most demanding environments. The hose can be removed and reinstalled an unlimited number of times without causing a potential for leaks and since nylon line is used internally flexibility is tremendous and the concern for unseen kinks is eliminated. The downside is that meticulous attention to detail is required during assembly and of course the cost is more than the traditional HIH.

The third type of heated line is electrically heated line. This is primarily used on the individual injector lines between the injection pump and the injectors on such vehicles that have individual injector lines. Due to the current draw and expense, electrically heated lines on a large scale or not currently used.