Troubleshooting the FSM

By Had Robinson
Updated April 20, 2026

The tests on the FSM system are different than on un-modified (OEM) fuel system. On the OEM system there are no check valves until the fuel reaches the inside of the carburetor. In the FSM, there are many check valves. The OEM system has a negative pressure on the fuel but the FSM has a low positive pressure. In the OEM system, a leak will allow air to enter the fuel system and is one of the causes of the headaches and engine failures pilots experience, usually at the worst possible time. On the other hand, if there is a leak in the FSM system, it will be evident by the presence of fuel or, if the leak is slight, the presence of fresh oil.

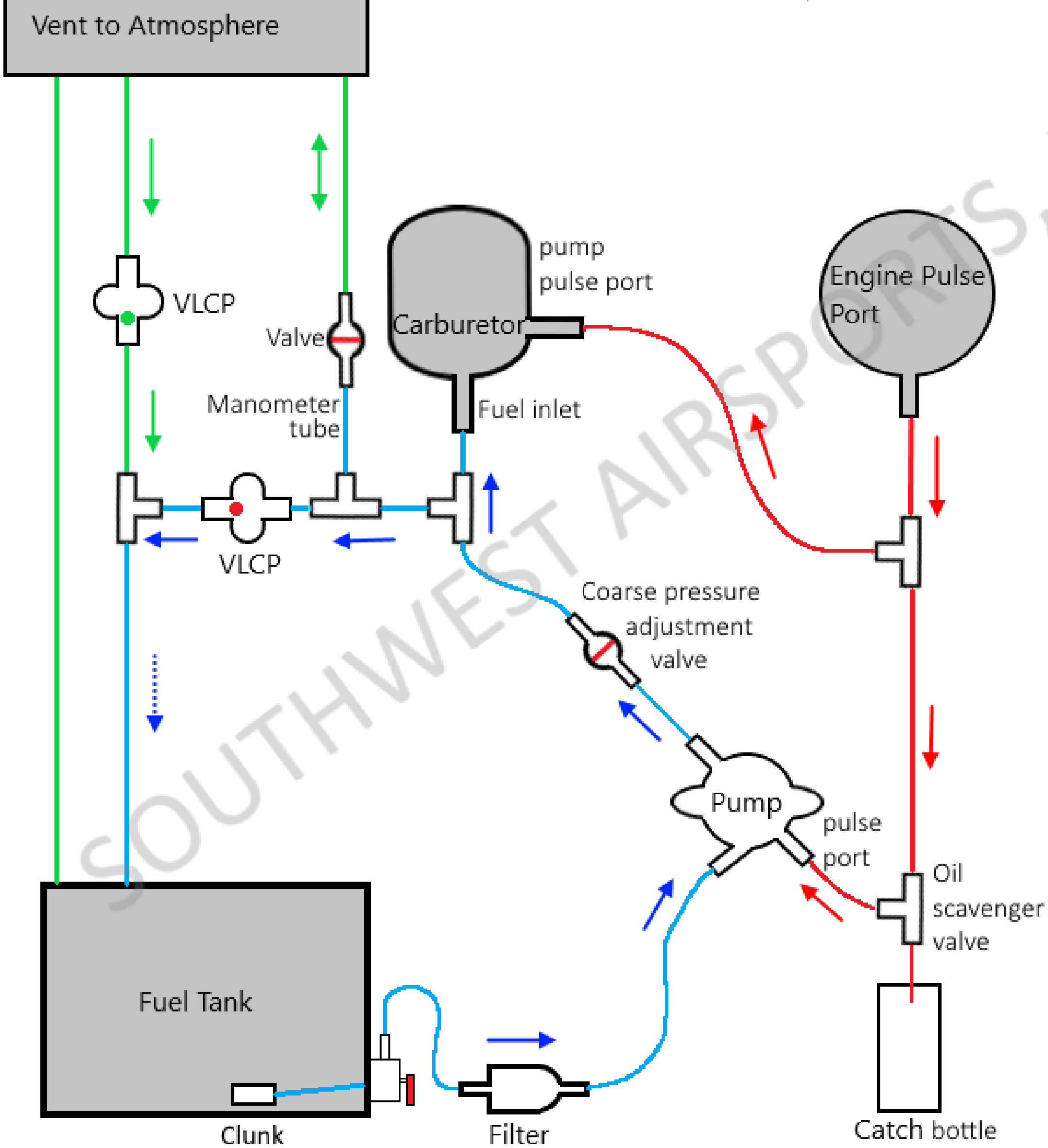
Before troubleshooting: An incorrectly installed FSM can experience vapor lock and why particular attention must be given to the installation instructions. Air or vapor bubbles in the lines up to the coarse pressure adjustment valve may block the movement of fuel if any of the lines are sloped down relative to the direction of fuel through the line. The only fuel line that is not subject to this is the fuel overflow line. The reason this line is immune is that the buoyancy of the bubbles and weight of the fuel offset each other.

The area around the carburetor fuel inlet is particularly sensitive to the relative height of the other FSM parts nearby.

Pilots must follow the FSM installation instructions carefully. Dimensions and locations of parts were engineered for various reasons that are beyond the scope of these manuals. The FSM has been thoroughly tested for functionality. There is not a single part, its location, or function that is unnecessary or superfluous, especially in regard to safety. The goal is SIMPLE, RELIABLE, and SAFE.

Contents

Schematic courtesy of Chris Jokinen



- blue lines – contains gasoline
- red lines – pulses that power the carburetor and Walbro fuel pumps (some engines will not have a pulse line going to the carburetor)
- green lines – air
- green, red, or blue dots/arrows indicate flow direction. The dotted arrow is fuel + air

1. Basic health test of the FSM

To test the auxiliary pump: While the engine is idling, fully open the coarse pressure adjustment valve and the manometer extension valve. The manometer extension should immediately be filled with fuel flowing back into the tank. The fuel overflow line should be filled with rapidly moving bubbles and fuel going back into the tank.

A failure of this test is indicated by a falling fuel level or no fuel in the manometer tube. See section 3 "Auxiliary pump failure".

To test VLCP Green: Try to suck on the vent line. It should be impossible. Alternately and a more thorough test: With the engine at idle, clamp shut the fuel overflow line. NO FUEL SHOULD ESCAPE FROM THE VENT PIPE CONNECTED TO THE VLCP! This is a serious failure of the FSM and must be corrected immediately! See section 6 below for more information.

The above tests will confirm that the FSM is working normally.

2. Fuel system leaks and restrictions

The FSM contains pressurized gasoline. Leaks *before* the auxiliary pump will allow air to enter the system. Leaks *after* the auxiliary pump will allow fuel to escape. If air enters the system before the auxiliary pump there will be air bubbles in the fuel and they may find their way to the carburetor and stop the movement of fuel, causing fuel starvation a.k.a. vapor lock. In a properly functioning FSM, any air bubbles in the fuel should move harmlessly through the system to either the fuel overflow line or the manometer tube – but only if the FSM was installed correctly. If there are any bubbles in the fuel line from the manometer to the carburetor inlet, it is likely that FSM was not installed correctly.

Fuel leaks are obvious if they are severe. If the fuel leak is minor, the area of the leak will have a film of fresh oil (not black). Go this page for more information on leaks and how to locate them:

https://www.southwestairsports.com/ppgtechinfo/top80/hrservicenotes/fuelsystemleaks/fuelsystemleaks.htm

Fuel system restrictions *before* the auxiliary pump will cause fuel vaporization in the form of fuel bubbles caused by a vacuum from the pump. These bubbles will also be seen in the fuel coming out of the output side of the pump.

Fuel system restrictions *after* the pump will be evident in low or non-existent fuel pressure at the manometer.

3. Auxiliary pump failure

If the basic test in section 1 fails or the engine shuts down either quickly, slowly, or will not reach full output, the auxiliary pump has failed, either completely or partially. If the manometer tube valve is closed, the internal pump in the carburetor will begin using up the fuel in the manometer tube and the engine will stop. If the manometer tube extension valve is closed, the internal pump in the carburetor may be able to pump enough fuel to keep the engine running.

If it appears that the auxiliary pump is not working at 100%, the best way to test the pump is to remove the fuel overflow line from the fuel tank. In a typical tank, the fitting can be unscrewed from the tank and a line extended to a container. Start the engine in the usual way and measure the fuel output. A correctly installed and functioning FSM should pump about 1 liter/minute. Anything less indicates a partial failure which will require additional troubleshooting.

Note: small pulse ports on the crankcase (<3.5mm ID) will affect pump output.

A partial failure of the auxiliary pump will be apparent by an inability to get pressure in the fuel system (evidenced by a low or zero fuel in the manometer tube) even with the Coarse pressure adjustment valve fully open. Additionally, there will be little or no stream of bubbles or fuel in the fuel overflow line. Also, there may be fuel vapor bubbles in the fuel lines starting at the fuel tank fitting in the tank. These vapor bubbles can be caused by a negative pressure on the fuel due to the operation of the internal fuel pump in the carburetor.

It is also possible, though rare, that the bubbles in the fuel lines may be air due to a leak somewhere between the auxiliary fuel pump and the tank clunk. This is not a pump failure. Bubbles can block the movement of fuel through the carburetor and shut the engine down, simulating a failure of the auxiliary pump.

https://www.southwestairsports.com/ppgtechinfo/top80/hrservicenotes/fuelsystemmod/pump_failure.mp4

When this happens, the system will revert to the original OEM state except that the cracking pressure created by the VLCP's and various valves in the FSM will increase the negative pressure slightly but only if the manometer tube is closed.

How can you tell the difference between fuel vapor and air bubbles? The fuel vapor bubbles will increase in size as they move up through the system. Air bubbles will not change in size.

Where fuel bubbles appear in the system depends on the vapor pressure of the gasoline, the temperature of the gasoline, and the altitude. The bubbles can be few or many. If many, the carburetor pump may be unable to function and the engine will shut down. In the above video, the fuel starvation was not enough to stop all of the fuel flowing up to the carburetor inlet but enough to create a strong vacuum on the fuel. The negative pressure on the gasoline caused it to “fizz”, usually at some sharp point in the fuel supply line. Typically, this is where the fuel passes by an adapter or some sharp edge in the inline filter. The engine still ran, nonetheless, but it would have likely run in a lean condition had the engine been at WOT for a significant amount of time. Thankfully, the vaporized fuel went into the overflow line rather than into the carburetor where the bubbles would have paralyzed the operation of the pump. This is part of the design of the FSM in case there is some fault in the system.

To confirm pump failure, fill the fuel tank to above the ¾ mark. Start the engine and let it run at idle for a few minutes. Close the Coarse pressure adjustment valve. This will shut off all fuel flow to the carburetor but you will have a minute or two to continue this test. Remove the green cap from the manometer or open its valve. Slowly open the Coarse pressure adjustment valve all the way while watching the level of the fuel in the manometer tube. It should immediately go to 6” (15cm). If the manometer tube is vented to the fuel tank, fuel should be flowing and present all the way to the tank. If the fuel level will not rise in the manometer, there is a problem with the pump. When doing this test, open the valve cautiously as normal auxiliary pump operation can easily push a foot (30cm) of fuel and an uncapped or non-vented manometer will allow it to escape and create a hazard.

Causes of auxiliary pump failure, complete or partial

a.) It has filled or is filling with oil. An easy way to check this is to remove the pulse line from the pump. No oil should drain out of the pulse connector on the pump. If there is any oil present, the pump must be disassembled and the drain tee #5 checked to see if it is clogged.

b.) The tank clunk or some fitting between it and the auxiliary pump input has become clogged with debris. In the case shown in the video on page [4], a small piece of debris had become lodged in an adapter in the fuel line just after the tank clunk. To fix this problem, the tank must be drained and the tank fitting and clunk removed and examined for debris. An easy way to check the clunk is to attach a piece of tubing to it and attempt to suck air through it. There should be no restriction. The same test can be used to check the fuel tank fitting.

When doing these tests on the system, it is handy to use a fuel line clamp that will not damage the line, such as this one from Lisle Corp:

https://www.lislecorp.com/specialty-tools/hose/hose-pinchers

Put a second clamp on the output line above the pump. Using these special clamps is optional but saves time and helps prevent spilled gasoline.

Disassembling the auxiliary fuel pump

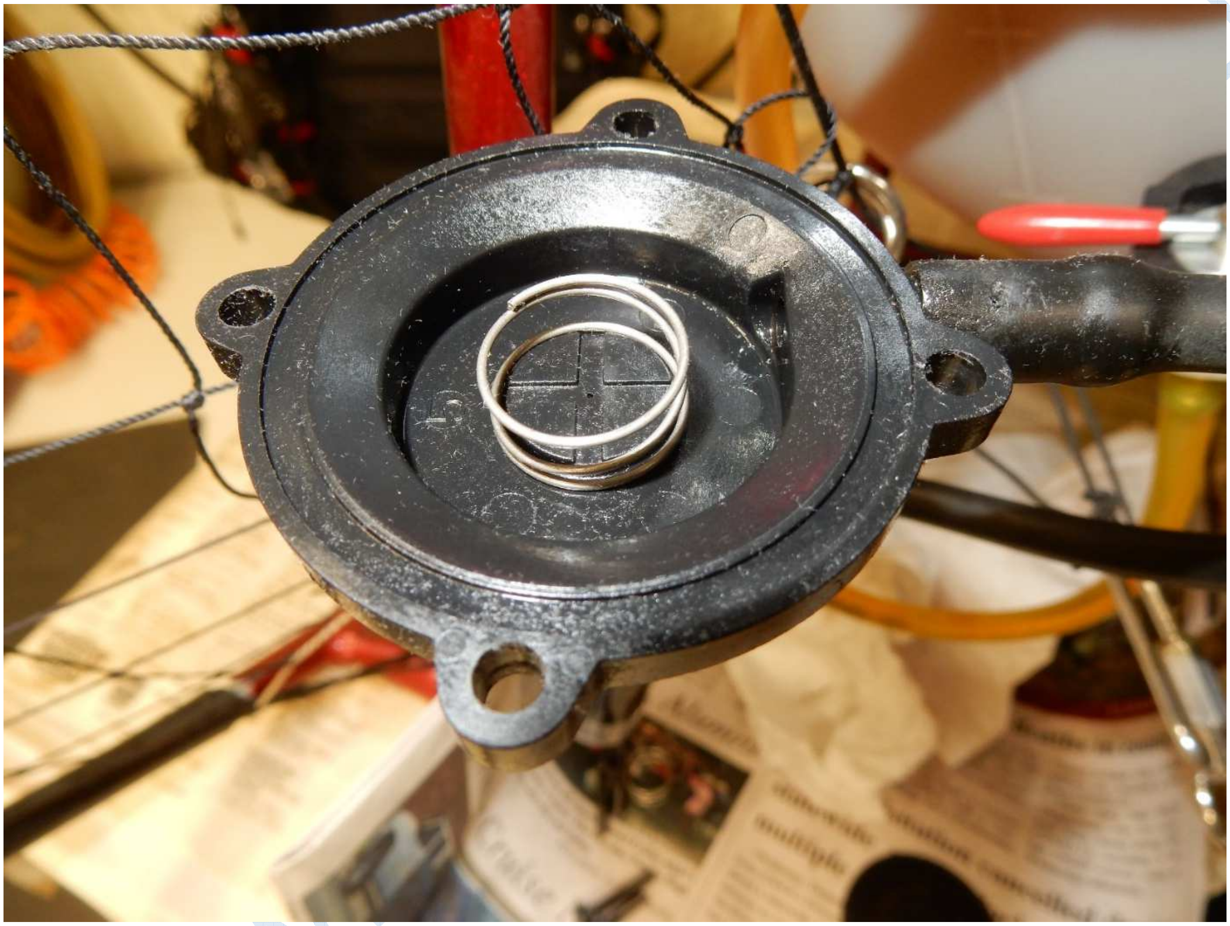
If desired (and to simplify the disassembly), lay the paramotor down on its side so that the auxiliary pump faces up. It is highly recommended that pilots take photographs of each stage of pump disassembly which can assist reassembly later.

The pump has (3) sections, (2) diaphragms, and (5) chambers. The photo below is in disassembly order from RIGHT to LEFT. The 1st chamber (the cavity in the rightmost part in the photo below) is the pulse chamber. The 2nd chamber is on the other side of the 1st diaphragm and pumps fuel. The 3rd chamber in on the top of the 2nd diaphragm and pumps fuel. The 4th and 5th chambers are on the bottom of the 2nd diaphragm and also pump fuel. If the pump is disassembled, it is very important to not separate the 2nd and 3rd sections of the pump (if you do not wish to spend an hour figuring out how to align everything). The diaphragm between these sections has a top and bottom side as well as special ridges that have to be aligned with the 2nd and 3rd sections of the pump. Use a small clamp to hold the (2) sections together while working on the 1st and 2nd chambers of the pump (see the photo on page 10 for details of the clamp).

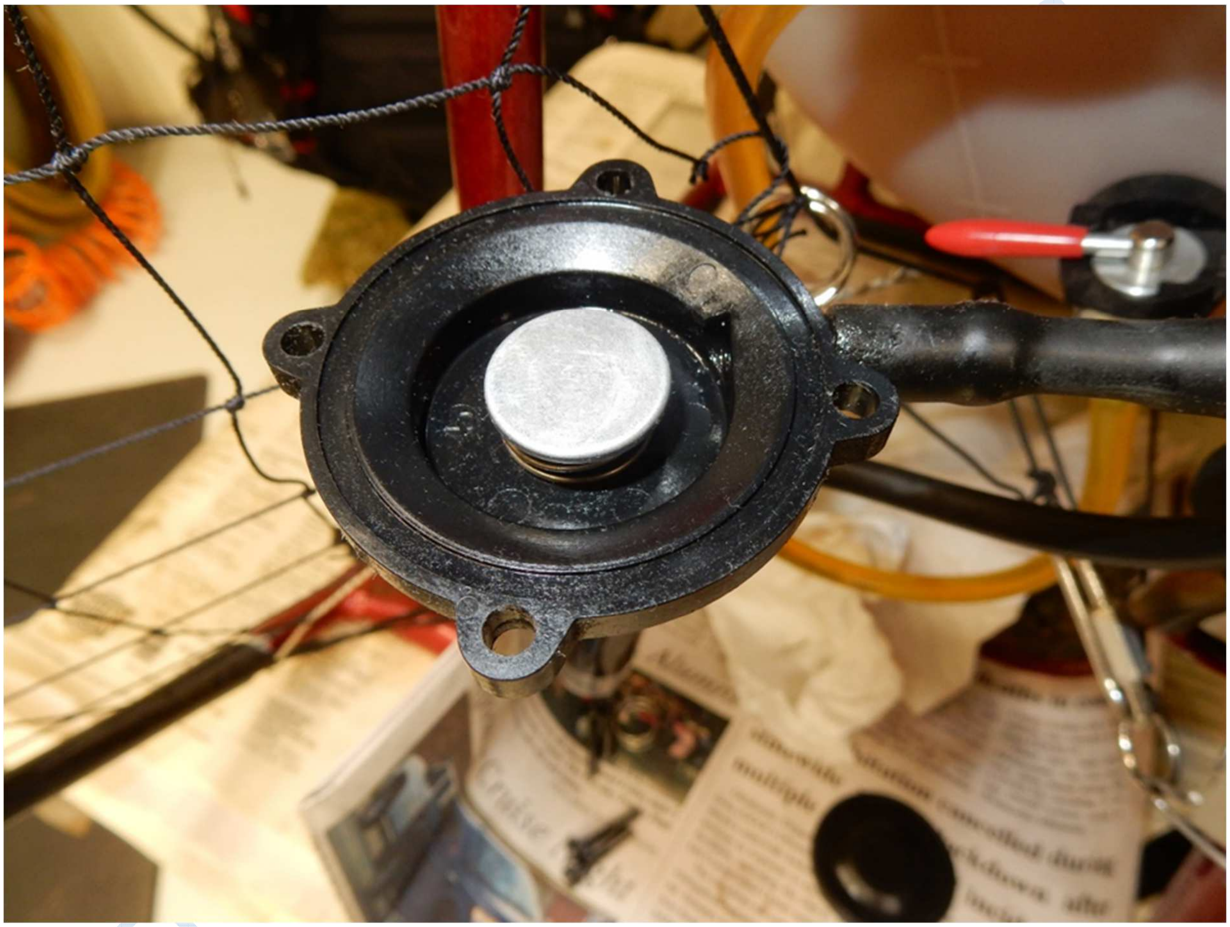
There are (2) identical springs with caps on each of the sides of the 1st diaphragm. The caps prevent the springs from coming in direct contact with the diaphragm (photos below).

The diaphragm has a top and bottom side. The raised center side of the diaphragm faces the pulse chamber.

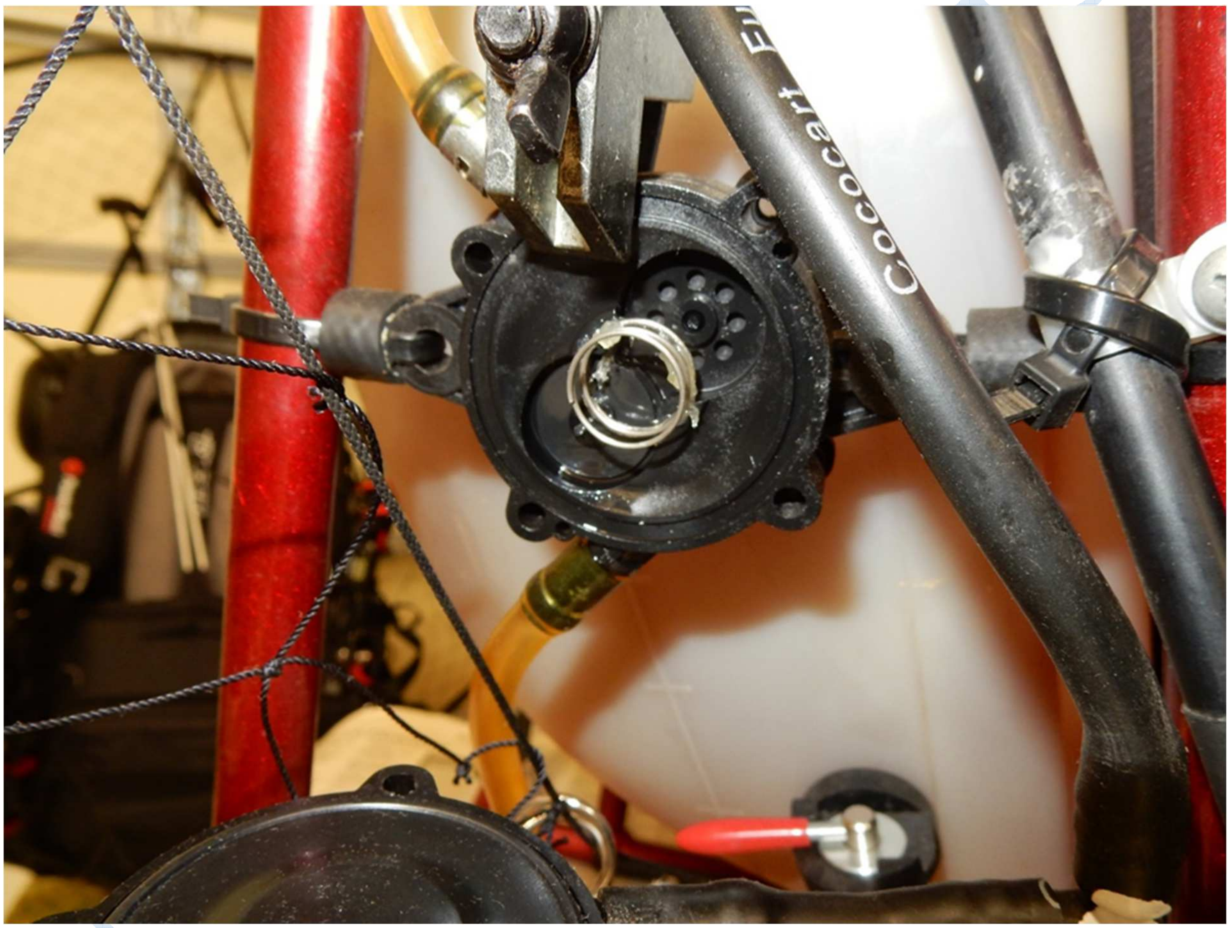
The photo below shows the detail of the 1st chamber (the pulse chamber) that is on the inside of the 1st section of the pump. There is a tiny hole (just visible) in the center which is an air bleed and is connected to a filter on the other side of the cover. This tiny hole must not be obstructed! The nipple with a piece of tubing connected to it that is coming out of the right side of the cover is the pulse line going to the pulse port on the engine crankcase.



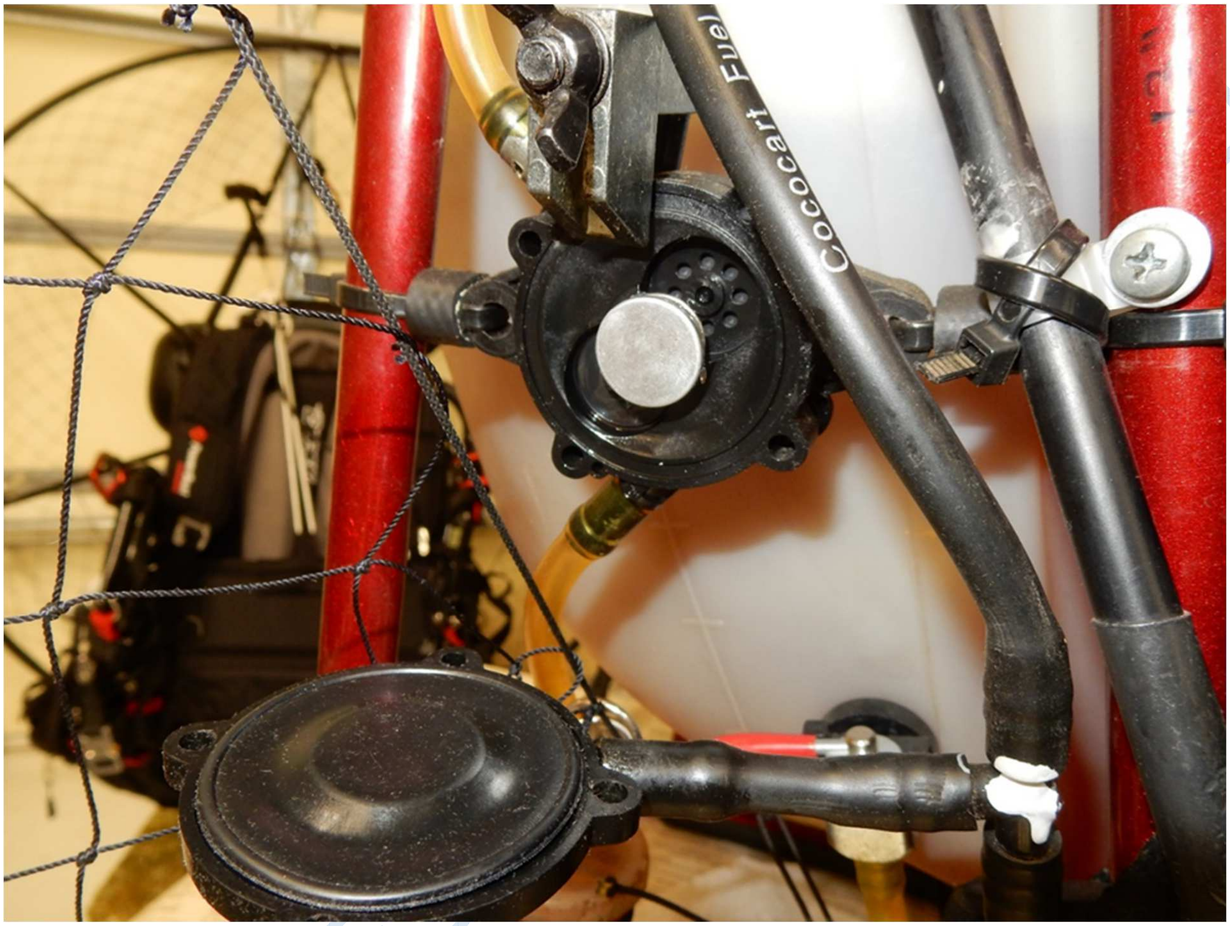
This photo shows the cap that goes on top of the spring that sits on the inside of the 1st section of the pump.



On the other side of the 1st diaphragm is a cap and spring. This side of the 1st diaphragm is the 2nd chamber and has fuel in it. The cap and spring can be set into the 2nd section of the pump using petroleum jelly e.g., Vaseline, to hold them in place while the 1st section is attached. The Vaseline can be safely used inside the fuel pump chamber because it will be quickly dissolved by the gasoline moving through the pump. The petroleum jelly must *not* be allowed to get into the pulse chamber because it will slow down or stop the pump from operating. A fuel line clamp (in the photo below) may be used to hold the 2nd and 3rd layers of the pump together. It can be attached after removing the (4) screws and the 1st section of the pump while holding the 2nd and 3rd sections of the pump together with a hand.



In the photo below, the 1st section of the pump is ready to attach to the 2nd section. Note: when I took the photo below, I put the 1st diaphragm on the 1st section of the pump upside down by mistake. I corrected this during the assembly.



It is vitally important that the 1st chamber and the equalizing port (covered by the white filter on the outside of the 1st section be 100% free of oil. If the port has a trace of oil in it, air will have difficulty moving through the tiny hole. If there is oil on the filter, use brake cleaner and a cotton swab to wash the filter so it is white = free of oil. Touch the filter that is soaked with brake cleaner with a swab. It will quickly absorb the brake cleaner. Repeat the process until the filter is white.

If the pump is assembled incorrectly, it will not pump fuel. To test the pump, completely disconnect it from the frame and put a short hose on the pulse port nipple and another short hose on the pump output nipple. Submerge the end of the hose from the pump output a few inches below the surface of a cup of water. Quickly blow and suck on the pulse port hose. Bubbles should come out of the pump output hose as you blow and suck on the hose. If there are not bubbles, the pump has not been assembled correctly! If all is well, reinstall the pump.

Start the engine. On the "FSM Operating Instructions – first time use", follow steps #6- #9 to verify the pump is working properly.

The FSM is sensitive to dirt in the fuel and it is wise to be cautious about getting dirt into the fuel tank. Typically, debris in the fuel gets settled in the lower loop of the fuel line that enters the inline fuel filter.

4. VLCP Test

The VLCP Green is easy to test. It should be easy to blow into the VLCP Green vent line but impossible to suck on it.

The VLCP Red is not as easy. Remove the overflow line connection at the fuel tank and attempt to blow into the line while pressing down on the primer lever on the carburetor. It should be impossible. Sucking on the line should be easy as air travels in the VLCP Green vent line. Now, cover the vent line opening with a finger. It will be more difficult and check to see if fuel begins moving through the system.

A more thorough test of the VLCP Redis to remove it and blow in one direction and then the other. One direction should be easy to blow through with almost no resistance and the other direction should be 100% blocked.

The VLCP's will only work in one direction and must be installed with the flow in the direction given in the Installation Manual.

The VLCP's should be replaced when the carburetor is rebuilt because they, like the carburetor diaphragms, harden in the presence of gasoline, especially in the presence of fuels that contain ethanol.

5. VLCP Red failure

This VLCP is not as sensitive to aging as the Green.

If the regulator fails in a closed position (rare) or is installed backwards, the engine can be primed but the fuel system will immediately experience overpressure after the engine is started which may flood the engine or produce an erratic idle. No bubble stream will be seen in the overflow line.

If the regulator fails in the open position, the engine cannot be primed. However, the FSM will function normally, otherwise.

6. VLCP Green failure

The VLCP Green regulator has a number of functions. Its main function is regulating the fuel pressure at the carburetor inlet. A second important function is to allow pressurization of the fuel tank in order to prime the system. A third important function is to prevent the flow of fuel out of the vent line connected to the top of the regulator.

A failure of this VLCP in the open position while the engine is running would be serious if the fuel overflow line should become blocked somehow. Additionally, the tank cannot be pressurized in order to prime the system if the VLCP is open. However, if the engine has a primer bulb, it can still be primed. With a blocked fuel overflow line, pressurized fuel will be forced out of the system through the vent line connected to the top of VLCP Green. This could create a hazard and why adding a long piece of inexpensive tubing from the top of VLCP Green to the bottom of the paramotor frame is an important safety precaution. If this is done, a failure of the VLCP in the open position and a blocked fuel overflow line will allow the gasoline to drain out harmlessly. This sort of cascading event should be rare. Under certain conditions, however, an open VLCP Green could cause the release of fuel through the vent.

If the regulator diaphragm hardens and cannot open easily, the bubble stream in the overflow line will surge from bubbles to a solid stream to bubbles and so on. This indicates that it needs to be replaced. The regulator must open at the slightest pressure in order to break the siphon in the overflow line and why it should be replaced when the carburetor is rebuilt. Typically (and with ethanol free fuels), carburetor rebuilds and VLCP replacement should be done at or before 50 hours.

If the regulator fails in a closed position, the pilot will immediately notice at start up that there is no bubble stream in the overflow line, just a solid stream of fuel. The effect on a running engine will likely be fuel starvation because there will be a high negative pressure at the carburetor fuel inlet.

If the regulator is put in backwards, it will prevent priming if it is done by pressurizing the fuel tank. However, the system can still be primed with a primer-bulb. When the engine is started, the pilot will notice that there is no bubble stream in the overflow line. If a blockage in the overflow line occurs, fuel will come out the vent line.

7. Vapor lock

A correctly installed FSM may still experience vapor lock under certain conditions. This is most often caused by fuel lines being too close to a hot surface or air entering the FSM somewhere between the fuel tank clunk and the auxiliary fuel pump input. Preventing air leaks or fuel leakage is the reason that the particular fuel lines specified in the Installation Manual must have clamps!

8. 4 cycling (roughness) in the midrange

Any 4 cycling indicates that the main jet is set too rich. Do not be afraid of reducing the main jet size with the FSM installed. Note: do this carefully and ONLY with a CHT installed.

If the main jet is adjustable, turn the jet clockwise 1/8 turn and test the engine while flying to be sure that maximum head temperature is not exceeded. If 4 cycling is reduced, close the main jet another 1/8 turn. Continue the process until there is no 4 cycling nor excessive head temperature. or eliminated.

If the main jet is fixed, the most economical method is to temporarily reduce jet size using this method:

https://www.southwestairsports.com/ppgtechinfo/top80/hrservicenotes/walbrowg8/carbmodification/jetmod.htm

Once you a certain of the main jet size needed, you may order that size from Southwest Airsports, if desired.

https://www.southwestairsports.com/shop/paramotors/fuel_system/fuel_system.htm

The goal is to stop 4 cycling while not exceeding maximum engine temperature. If you must operate your paramotor at wide open throttle most of the time, you need a bigger paramotor.

9. Oil catch bottle filling up quickly

Excessive pressure in the crankcase is usually caused by an obstructed exhaust system, typically the muffler. An easy test is to remove the exhaust system and shake it. If anything inside moves or rattles disassemble and examine it.

Vibration from the engine is hard on the internal pipes and baffles inside the muffler and parts may loosen or become disconnected or severed.

END OF TROUBLESHOOTING