FSM Operating instructions – general

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updated April 20, 2026

GASOLINE – Premium ethanol free gasoline is best, should be fresh, and have fuel stabilizer added. Use premium (2) stroke 100% synthetic oil e.g., Amsoil Dominator (U.S.), Motul 800 2T or 710 2T Synthetic 2-Stroke (worldwide). These racing oils will better withstand the higher temperatures in engines fitted with the FSM. Please see our fuel & oil specification page for a complete discussion of recommended fuels & oils for paramotors.

https://www.southwestairsports.com/ppgtechinfo/top80/hrservicenotes/fueloilspecs/fuelOil.htm

ALWAYS ADD A FUEL PRESERVATIVE (E.G., STABIL OR SEA FOAM) TO YOUR GASOLINE!

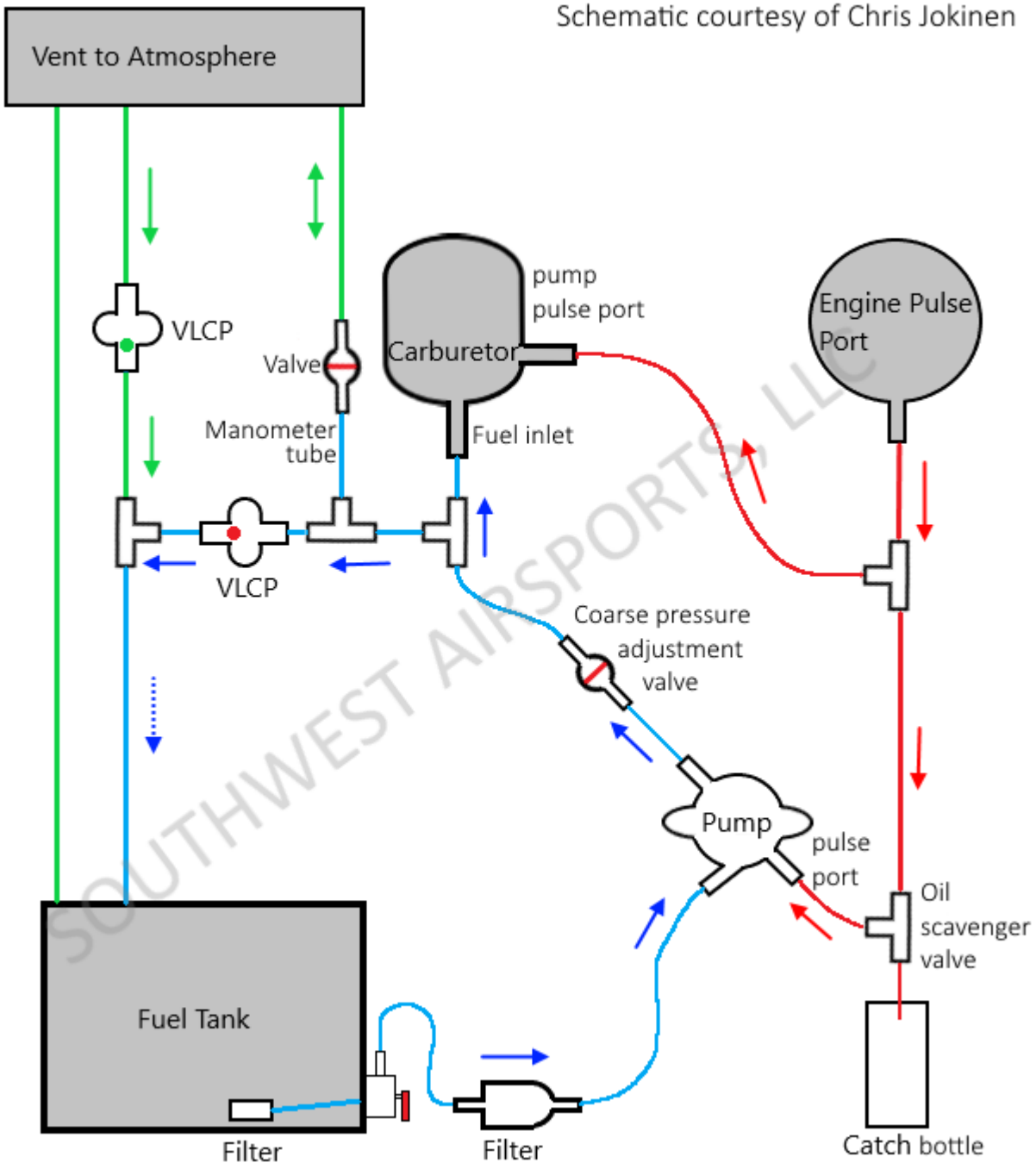
Note: use of AVGAS with the FSM may cause fouling of the piston lands and rings(s) in some engines because of higher operating temperatures. Pilots who operate at high altitudes will have fewer problems with lead fouling. Use of ethanol fuels will drastically increase maintenance of both the FSM and OEM fuel systems.

MAINTENANCE – If ethanol free fuels are used, carburetor rebuilds and replacement of the VLCP's should be done at (50) hour intervals.

The VLCP Green is particularly sensitive to aging due to the presence of gasoline and any additives.

If the bubbles in the overflow line are difficult to control, it is time to replace it regardless of how many hours. Generally, a carburetor rebuild and spark plug replacement are indicated by erratic idle, difficulty starting the engine, or roughness in the midrange.

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

BASIC QUICK TEST OF THE FSM

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

A failure of the 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: 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.

ADJUSTING THE FSM FOR FLIGHT

1. Prepare the engine for flight according to the owner's manual. Steps 2 and 3 may be omitted if done earlier.

2. **Open the fuel tank valve** #4 (figure 1), if your fitting has a valve.

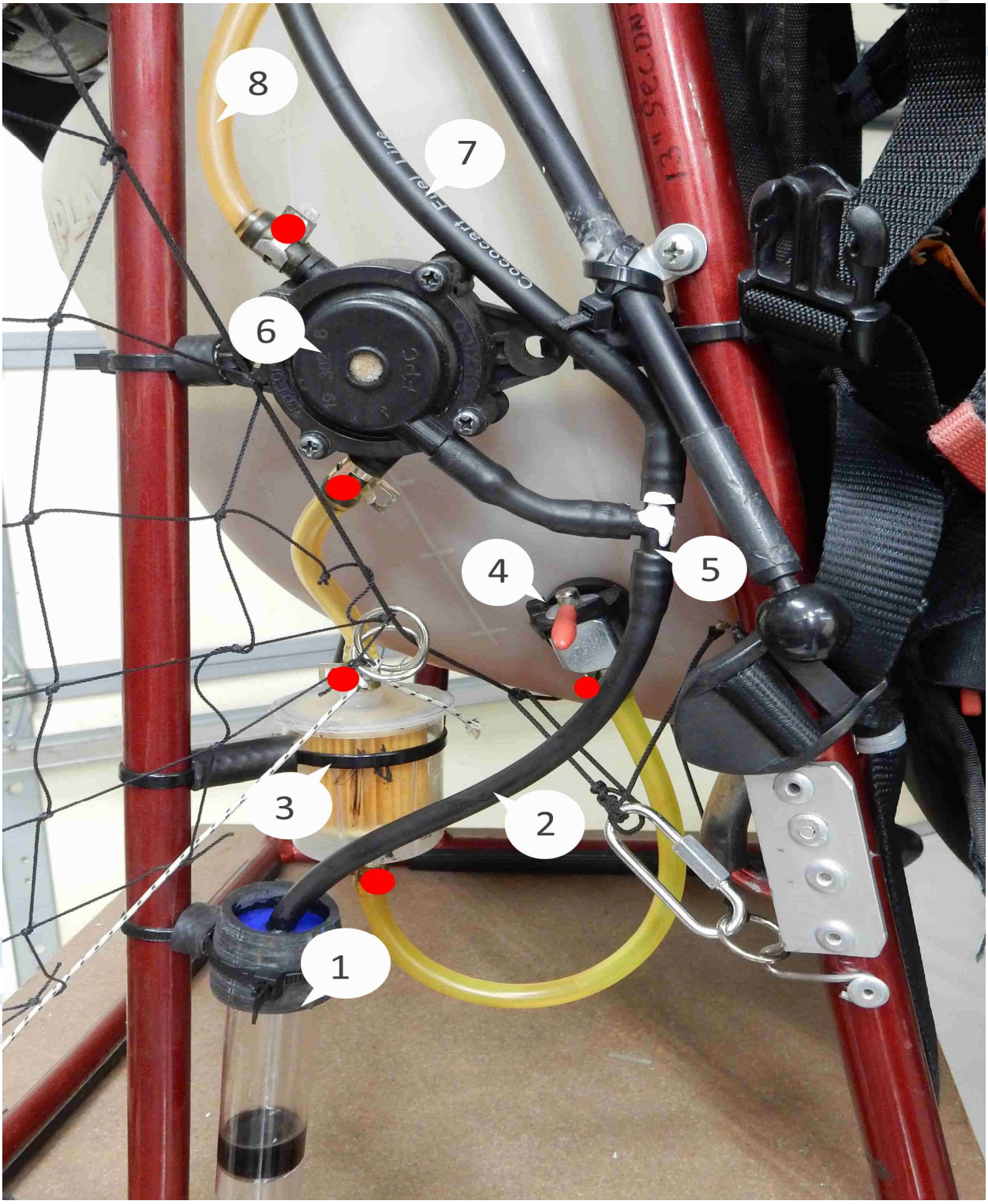


Figure 1

3. **Temporarily adjust the coarse pressure adjustment valve** #9 (figure 2) if it has not been done earlier. 45° off vertical is a good position to start with. Depending on how the valve is installed, it will open CW or CCW.

   Close the manometer valve #17 (figure 2).

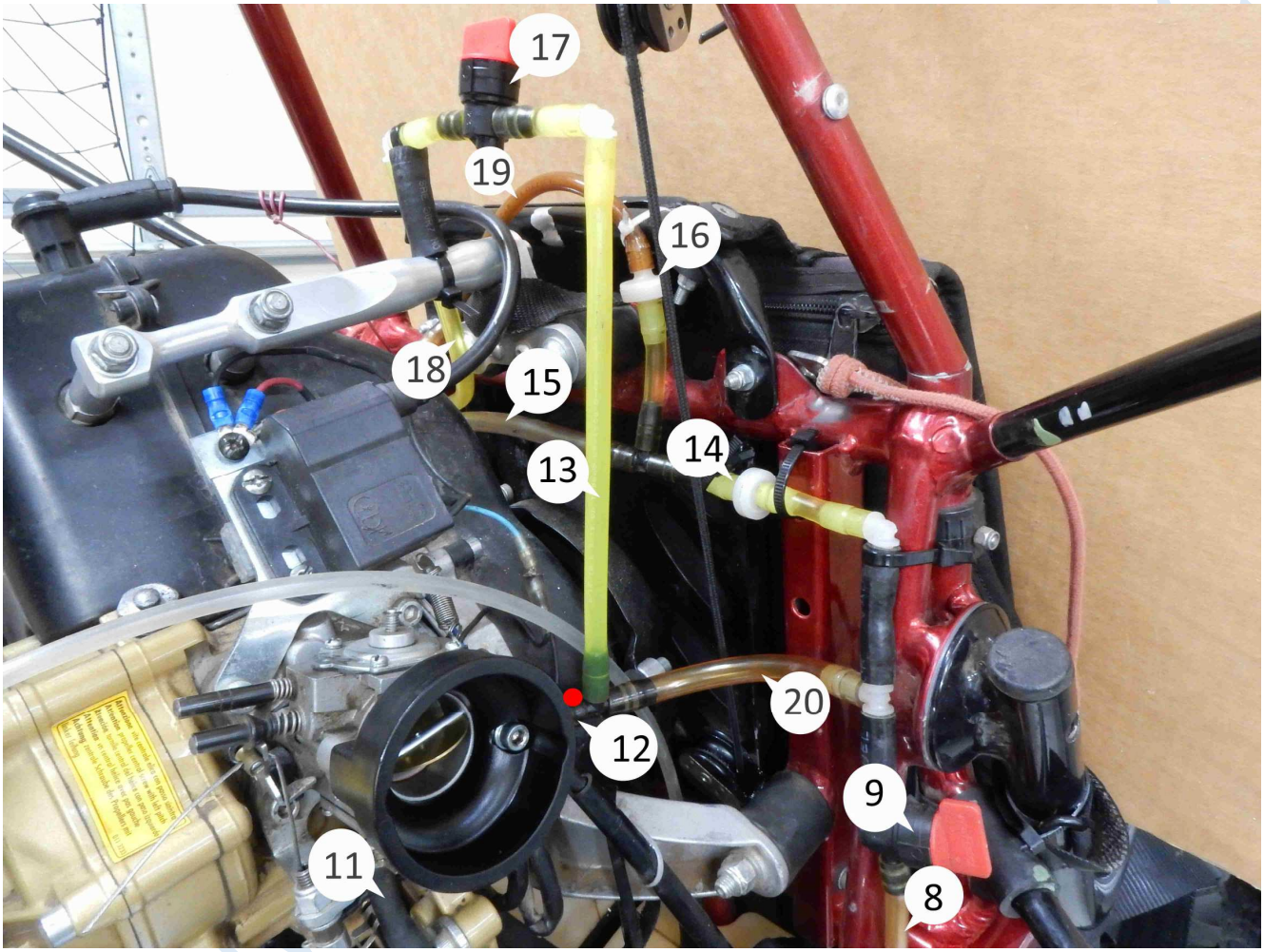


Figure 2

4. **Prime the fuel system** in the usual way. If needed, reference this URL on priming:

   https://www.southwestairsports.com/ppgtechinfo/top80/hrservicenotes/Starting/starting.htm

5. **Start the engine** – While at idle, observe the fuel overflow line #15 (figure 2,3) and make sure there is a good bubble stream. The URL below has a video of what you should see.

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

Open the manometer valve #17 (figure 2). Adjust the Coarse Pressure Adjustment valve so that the fuel level is at the mark on manometer tube or be between 4 & 5 inches high. This is the pressure (height of the fuel) that is needed to open VLCP Red #14 (figure 1) and create the bubble stream in the overflow line.

The healthy stream of bubbles ensures that the fuel pressure in the systems is static – this is our goal rather than some exact pressure. Note: if the pressure must be high enough to spill over into the manometer tube extension, there is something amiss, probably a worn out VLCP Red that requires excessive pressure to open.

The VLCP system is self-regulating when the coarse pressure adjustment valve #9 (figure 2) is set correctly. Before every flight it is a good idea to check that the fuel level in the manometer tube and whether there is a strong stream of bubbles in the fuel overflow line (#15).

If a siphon is accidentally started in the manometer tube, it is easy to stop: a.) close the coarse pressure adjustment valve (CPAV) completely, b.) close the manometer valve, c.) wait for the fuel in the siphon to drain into the tank, d.) reopen the manometer valve, e.) properly adjust the coarse pressure adjustment valve so that the fuel pressure is at the mark on the manometer tube.

Note: if you close the CPAV completely, the engine will stall from lack of fuel. If you do so, perform the above step as quickly as possible.

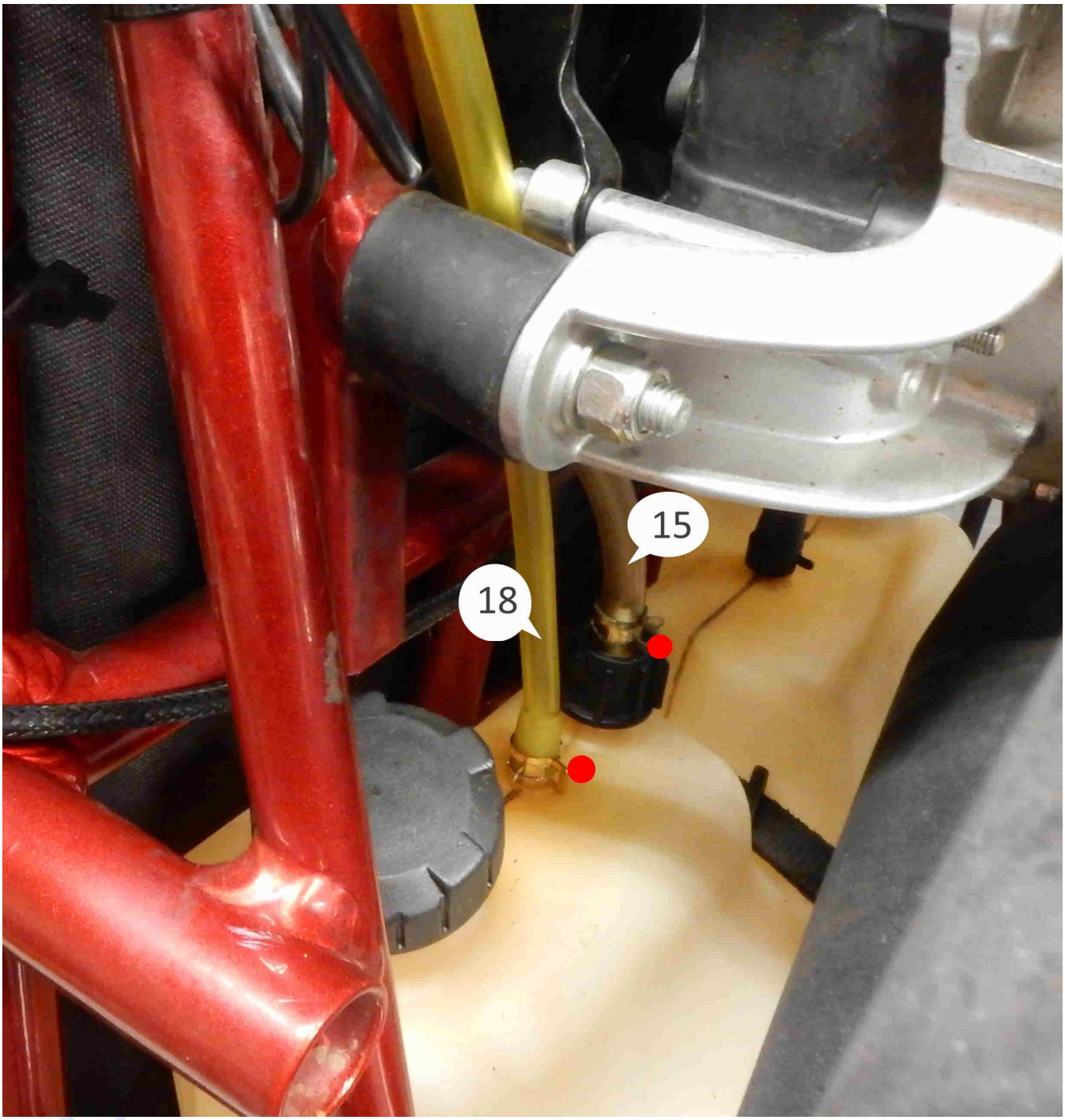


Figure 3

6. **THROTTLE** – *ALWAYS HAVE YOUR HAND ON THE THROTTLE AND THUMB ON THE KILL SWITCH BEFORE PICKING UP AN IDLING ENGINE.*

   Engine manufacturers recommend that the engine be warmed up before launching. If your engine manual does not specify the minimum launch temperature, wait until it has reached 70°C. Briefly run up the engine on your back before launching. Never operate a cold engine at WOT! Test the kill switch. A large vapor or air bubble in the system could cause a stall. Always assume that these non-certified engines could fail at any time.

Note: Throttle response with the FSM is fast which creates an additional hazard both in the air and on the ground.

7. **CHT** – Monitor the CHT to prevent engine overheating. Make a mental note of the typical operating temperature of your engine. See paragraph #20 in *FSM Operating instructions – first time use* for eliminating 4 cycling. All sorts of things can cause overheating such as changes in weather, altitude, fuel/oil ratio, ambient temperature, or humidity.

8. **CATCH BOTTLE** - Before and after flying, check the catch bottle (#20). There should be oil accumulating in the bottle at about 0.5 teaspoon/hr (2ml/hr). If there are no signs of oil entering the bottle, it is likely that the tiny valve in the white leg of oil drain tee (#15) is clogged. If it is clogged, use air at 7 psi (0.5 Bar) to try to clear the obstruction from the catch bottle (white) side of modified tee. DO NOT USE ANY OBJECT TO CLEAN THE PORT! Test whether the valve is working by putting a hose on the white leg, immerse the tee in water, and blow in the hose. A tiny stream of air bubbles should come out of one of the other legs.

Notes

Fuel Filter – Only use the fuel filter we supply in the kit, the OEM filter, or purchase a 10-micron filter from a chainsaw supply shop. Auto parts stores rarely carry quality inline fuel filters such as the WIX. The oil may be collected and reused or disposed of. It is perfectly clean. However, it does have some harmless contamination from burned fuel that enters the crankcase and darkens the scavenged oil. On average, the amount of oil scavenged in the catch bottle is about 0.5 teaspoon/hr (2ml/hr).

Tank clunk check – If the clunk becomes disconnected from the fuel tank fitting, the fuel inlet line could position itself above a low fuel level in the tank and suck air instead of fuel.

Purging bubbles from the system – Bubbles in the fuel pose a potential problem for the carburetor. They can cause vapor lock in the tiny passages and valves and prevent the internal pump from operating. In new systems or when the FSM is disassembled, bubbles are certain to get introduced into the fuel stream. This can cause temporary fuel starvation which is more an annoyance than a hazard. First of all, it is uncommon for these bubbles to find their way to fuel line #9 (see figure 2). Normally, any bubbles pass quickly through the Coarse pressure adjustment valve (#5 in figure 2), through VLCP Red (#3 in figure 2) and then into the fuel tank. If they take a detour to the fuel line #9 (see figure 2) there could be problems. To help prevent this, the manometer provides a trap for these bubbles so they do not get to the carburetor inlet. With the engine at idle, the pilot can look for any bubbles that might be in line #9. If they seem excessive, open the manometer valve for a moment. The bubbles should quickly enter the tube.

VLCP check – It is important to periodically check VLCP Green (#1 in figure 2) for functionality. An open VLCP Green could result in a fuel leak and/or poor performance of the FSM. A quick test of the valve is to suck on the vent line. It should not be possible to suck air/fuel from the vent line. A more thorough test of the regulator: While the engine is at idle, close the fuel overflow line (#11 in figure 3) with a fuel line clamp or equivalent. The type of clamp pictured below will not damage the fuel line.

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

Fuel should not pass through VLCP into the vent line.

If it does, the VLCP has been installed backwards or has failed and must be replaced.

This test is CRITICAL for the safe operation of the FSM and should be done often to ensure that fuel will not leak from the system. NOTE: NEVER FLY WITH THE VENT LINE DISCONNECTED FROM VLCP GREEN! It will not function correctly with the vent line removed.

Pump air bleed filter check – The auxiliary pump will not function correctly if it the air bleed filter at the center front of the pump becomes filled with oil. The saturated filter will not allow air to move through the tiny hole behind it. The white filter will go off-white in the presence of oil. Use brake cleaner and a cotton swab to thoroughly clean it. Wet the filter with brake cleaner then daub the oil away with a cotton swab. If the pump ceases to operate, see the Troubleshooting Manual which includes instructions on how to disassemble the pump. Note: the back of the fuel pump has a 2nd vent hole which must not be obstructed.

Long term storage – The FSM should not be left with fuel in the system more than a few months, particularly if ethanol fuels are used. The system is relatively easy to purge of fuel. Fuel preservative should always be used, even with ethanol-free gasoline.

a.) Disconnect the fuel line that goes to the carburetor inlet fitting.

b.) Empty the fuel tank by removing it and turning it upside down OR siphon all of the fuel out of it. The clunk in the tank must not be immersed in fuel while purging the system.

c.) Reinstall the tank, if needed, and blow on the primer tube or pump the primer bulb until no fuel comes out of the fuel line going to the carburetor.

d.) Reconnect the fuel line going to the carburetor, hold down the primer lever on the carburetor (or push on the diaphragm with a toothpick, and prime the system with air. The fuel left in the carburetor will drain into the carburetor throat.

e.) Undo the fuel line that goes from the fuel tank fitting to the fuel pump and lay it aside. This part of the system which also includes the fuel filter should be open to the air for storage.

It is fairly easy to see if there is any fuel left in the system. However, the fuel that damages the internals of the system is not visible and we want to be sure there is little or none in there.

Those who want MAXIMUM life of the FSM can also use compressed air (4 psi/0.25 bar) to thoroughly purge the system. If this is done, the fuel line going to the carburetor *must* be disconnected. NEVER CONNECT COMPRESSED AIR TO A CARBURETOR! YOU WILL DESTROY THE DIAPHRAGMS!

Oil drain catch bottle – The bottle is easily emptied by unscrewing it with the cap remaining attached to the engine frame by a zip tie. Remember that the oil can be returned to the fuel tank or your mixing bottle, if desired.

Changes – Do not make any changes to the FSM without checking with Southwest Airsports first. Pressurized gasoline is not particularly forgiving of incompetence, neglect, or mistakes.

Accidents – If you have an accident that might damage any part of your paramotor, test every fuel line joint by trying to bend it. A crack in one of the tee's or a VLCP's could result in a fuel leak. If in doubt, replace it. The tee's and VLCP's are inexpensive and easy to replace.

END OF OPERATING INSTRUCTIONS