Generator Repair Saga

There has been a lot of discussion about generator problems and how to solve them and I thought I would relate my experiences so far. I'm far from an expert, but I like a challenge.

Hopefully his narrative will help others facing generator problems.

I have the Onan 2.8KW MicroLite Spec K which runs on gasoline. Newer Roadtreks have an entirely different unit. This one was made about 2002. The vehicle is a 2002 190V on the Chevy Chassis.

The first problem I had was one which I've heard many times before and that is the unit will start, but then stops when you let go of the button. Initially it was a bit intermittent, but then would do this consistently. I was able to locate a shop manual and a troubleshooting guide from Flight Systems. it's quite useful, but does cover a number of Onan generators and they do vary.

With some effort I removed the unit from the vehicle and put it on the bench for testing. Of course it worked perfectly and did so for more than a week's worth of testing. I wiggled wires and tried everything I could to make it fail but it would not cooperate!

A number of things have this exact symptom, so I chose not to just replace parts at random. I put it back into the Trek and it continued to work for about a year before the problem returned. This time I got it on the bench and was able to catch it in the act and trouble shot the problem down to a bad voltage regulator. There was no field excitation so no output from the generator. I used a clamp-on DC ammeter to check for field excitation since it's is difficult to access the wiring while running without a test harness which I don't have. You can measure the field resistance by disconnecting the regulator. When starting, the field is "flashed" or excited via a circuit from the battery and the generator will start producing power. When you release the button, the power to run the controls and excitation shift to the generator. If the generator is not producing power, it will then immediately die. It turns out that when starting the unit you need to hold the *start button* down long enough for the generator to start producing electricity. This takes about a second longer than you might expect. Fight Systems http://www.flightsystems.com/ sold me a new regulator and all was well for several years.

There has also been discussion about the oil level sensor. On my unit this is connected to the ignition coil and when the oil is low it shorts out the coil, so no ignition. These units don't have an oil pump and use "splash" lubrication which is just a paddle bolted to the piston connecting rod.

The oil sensor is a float switch rather than a pressure sensor. I suppose that if the level were very low when the engine begins to crank, it might cause the switch to close. If one suspects that the sensor is bad, it's quite easy to just disconnect the wire which will bypass the sensor. I was told by an Onan rep in Branson a few years ago that the newer units don't have this sensor because they were so unreliable.

The next problem I had was my own fault because I failed to run the unit monthly. The unit developed the dreaded hunting condition. This is presumably due to varnish build up in the tiny passages in the carburetor. I connected the unit to an external fuel tank and main-lined Seafoam, but was not able to resolve the problem. It would take a lot of Seafoam added to the gas tank to get a high concentration. I'm not convinced this is a viable repair option. I asked a carburetor expert about this and his judgement was that once the deposits form, it's difficult to get them out of the tiny passages.

Onan says that the spec K carburetor is not repairable and the only option is replacement. I removed the unit again and replaced the carburetor. This solved the hunting problem. The carburetor is wedged in between the intake manifold and the body of the blower and it's a little tough to get out. The trick it to loosen the bolts holding the manifold and it can be slid out. Be careful not to wreck the gasket between the input air horn and the blower housing. Don't bend any of the linkages. Remove the governor arm and choke to remove the linkages.

While the unit did run, it was still a bit unstable at the low end. In addition it would rarely start the A/C on the first try without dying.

I talked with an Onan tech in Florida at a rally and he suggested that I should have changed the governor spring when I changed the carburetor. I've also heard reports of poor fuel pump performance and clogged fuel filters.

So what the heck, I decided to pull the unit again and replace the fuel pump, fuel filter, air filter, spark plug and the governor spring. The manual discusses valve lash adjustment, so I thought well I will do that too. The fuel pump was the most expensive part at $36.78 at Amazon. I bought the gaskets on E-bay. The head gasket was about 20 bucks and the valve cover gasket was about $10. Fuel filter was $14 and the air filter was $19. All but the fuel pump were genuine Onan parts. I had more time than money invested by a long shot.

Once I got the unit apart, I decided to clean the carbon from the combustion chamber. This was more involved than it first appeared in that I had to remove the unit from the base to get at the screws holding the shrouds which direct air around the cylinder and cylinder head. This also allowed me to get most of the grime and dirt off the unit.

I was able to get it all back together and it does run better. The no load stability is better, but not quite as good as I would like, but it is very smooth with just a little be of load. Was it worth the effort, probably, but it was a learning experience!

Pictorial Review of Service Activity

This is not for the faint of heart, but it was not as difficult as I feared. Of course if I knew then what I know now, it would have been easier. So hopefully you may learn from my mistakes. There are lots of opportunities for injury and property damage so you have to determine if you have the necessary skills to tackle this job. Given the horrific repair prices I've heard, I'm way ahead on the expense problem. I will admit that I am handier than most, but I think it's within the ability of a lot of folks.

Getting the Generator Out of the Vehicle for Service.

Step one is to get the vehicle high enough off of the ground so you can both work and have the generator clear the back bumper when you have it on the ground. Even if you intend to get the unit serviced, removing it yourself and then taking it to a shop will save you a lot of money. You need to have a very secure way of doing this and be very sure of what you have done. Having the vehicle fall while you are under it would likely be fatal. ***Be very careful and sure that you have it secure.*** My platforms are made from two 2-by-12s about 20 inches long with 2 by 4's sandwiched in-between. You want cross members so if the 2-by-12s split, they won't come apart. The overall height is about 4 ½ inches. My driveway is on a bit of a hill, so I just have a bumper in the front of the wheel as a chock. Vehicle in park, parking brake set and chocks in front of the wheels. My ramps are made using three 2-by-6s cut on diagonal and 4 pieces of half inch plywood cut to match. I bolted the parts together with threaded rod. The ramps are about 18 inches long and the end matches the height of the platforms. If I did it again I would probably figure out a way to attach the ramps to the platforms. To be honest I made them out of the scraps I had in the garage.

Step two is to get ready to drop the generator. First of all it's very important to disconnect all of the batteries by disconnecting the ground connections. This includes the vehicle battery ground. It's also important to make sure it's not connected to shore power. Double check and verify that power is off. The generator should not crank when you hit the start button. Since I wanted to test on the bench, I removed one of my 12 volt batteries.

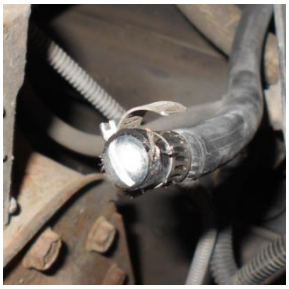
Before you get under the vehicle, get yourself a box of disposable nitrile gloves. I bought mine at Harbor Freight and they really help keep your hands clean. Believe me; it's really dirty under the vehicle and inside the unit.

You will want to remove the exhaust pipe assembly first. Loosen the U-bolt which clamps the pipe to the muffler inside the generator. No need to remove it entirely, just pull it down and out of the way on

the pipe. The pipe will be held by friction. Remove the hanger which is secured by a Torx™ fastener. You might have to buy this tool.

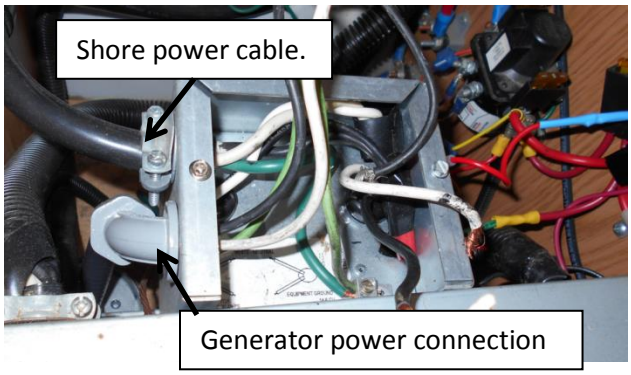
Disconnect the U-bolt holding the pipe on the side of the vehicle and then remove the pipe. A little penetrating oil may help and if they are very old, new U-bolts are inexpensive and readily available.

Disconnect the fuel line. Be prepared with a "plug" to stop up the end of the hose. Fuel could siphon out of the tank. The fuel connection is on the right side looking at the back of the unit and it's a simple ¼ in tube with a nipple on the end secured with a small hose clamp. Once you loosen the clamp the hose will pull off, but they often "glue" themselves to the pipe. If it is stubborn, I use an open end wrench the size of the tubing to push on the hose. A little gentle persuasion will do the trick without breaking something. I used a ¼ 20 bolt as a plug.



Next you will need to disconnect AC power wires going through the floor.

Inside the vehicle you will need to disconnect the wires going to the unit below. The wires go to the transfer switch and on my machine the switch is mounted to back of the electrical panel. Roadtrek has used various types of transfer switches over the years. Remove the cover plate to get access. ***<u>You did remember to unplug shore power!</u>***

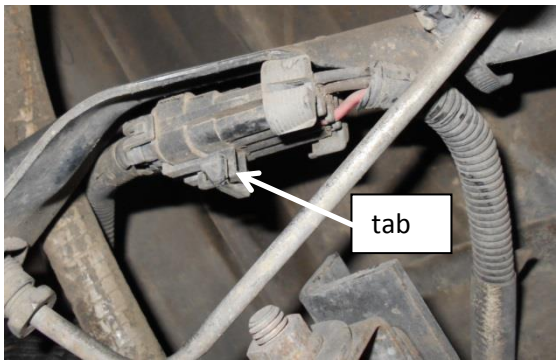


I found it necessary to remove the elbow fitting to pull the wires thru.

Under the vehicle unscrew the clamp so you can pull the wires thru.

When you reassemble, attach a pull cord to the AC wires before you put the unit back on the ground to make easier to pull the wires back into the conduit.

Next disconnect the control connector. This goes to the remote start panel for the generator. There is a release tab you have to depress to disconnect the connector.

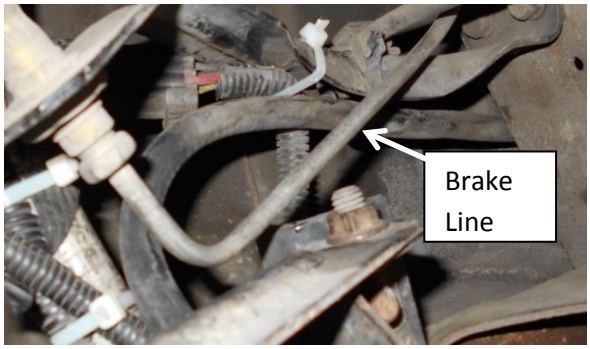


Next disconnect the 12 volt power to the generator. This is a thick cable which is connected directly to the battery, no fuses or protective devices. ***<u>You did remember to disconnect all the batteries and shore power!</u>***

This connection is above the generator and covered with a boot and electrical tape. Remove the tape and pull back the boot. Don't cut the boot unless you intend to replace it. Remove the bolt and nut.

Okay triple check; do you have everything disconnected, fuel, control, AC power out and DC power in?

Next remove the cross braces from the back of the generator. There are two braces which are held by three bolts. Be careful not to damage the brake line which goes right by the bolt on the right looking at the back of the unit.



I found that the top bolts required box wrenches and a socket wrench just won't fit.

Now we are ready to support the generator so we can remove the four remaining bolts.

I used an inexpensive floor jack and a home built wooden cradle. People have asked about my cradle, so I will add some detail. This is the 4th version since I have done this 4 times! The real key is to support the unit at the center to be close to the center of gravity. My lifting point is at the center. The actual center of gravity is probably a bit to the rear. You will notice that there is a stop on the front and back to keep the unit from sliding forward or backwards. It can't slide to the side because of the brackets which hold the unit in place.

The cradle is attached to the jack using the large bolt which held the lifting pad.

The picture shows the cradle raised and holding the generator with 4 bolts removed.

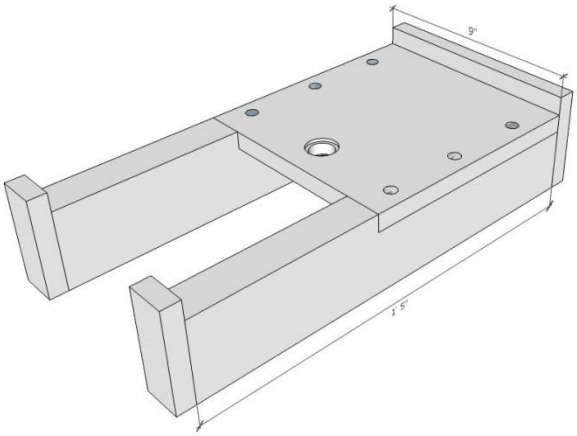
Lowered on to blocks so jack and cradle can be removed.

Using a pry bar it is not too difficult to lower the unit the rest of the way to the ground by removing one block at a time.

The plywood makes it easy to drag the unit out and I added a backstop to the end to keep the unit from sliding backwards. Not seen is a brace to hold the backstop vertical.

Safely on the ground! Putting it back are the same steps in reverse.

Before I do this again I will likely make a new cradle which is narrower. This would make it easier to get the unit on and off the blocks. I would make it out of two 2-by-4s 17 inches long. I would make the plate out of 3/4 plywood and notch the 2-by-4s to accept it. Add 1.5 by 4 inch ¾ inch blocks to the ends of the 2-by-4's as stops. I might make it a bit wider, but this should be fine. My jack has a carrying handle which gets in the way so I just removed it. I would put the thing together with dry wall screws. The hole in the plate matches the bolt that holds it to the jack. I had to countersink it both on the top and the bottom.

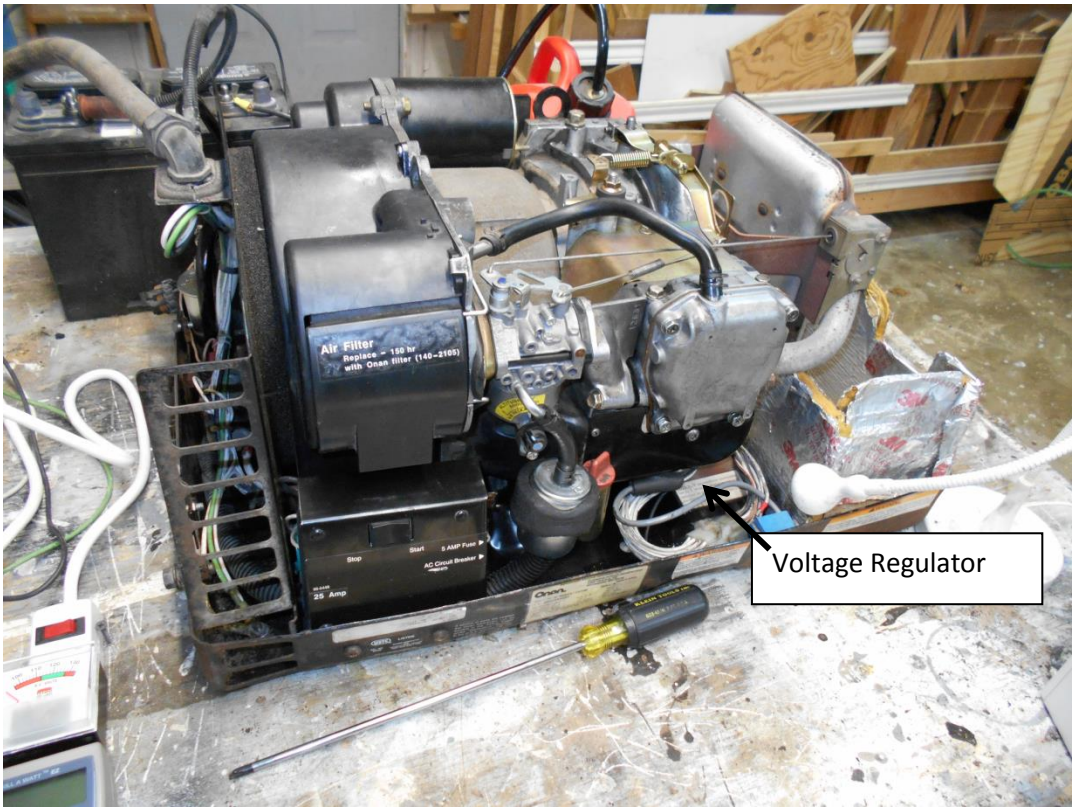


Next step is to get it onto a work bench so we can dive into the guts.

I used a Harbor Freight ¼ ton (500 pound) chain hoist to lift it onto the work bench. Two people can lift this unit, but it was very convenient to be able to lift it easily. ***Be sure the sky hook is strong enough!*** (You need **more** than an eye bolt attached to a single rafter!)

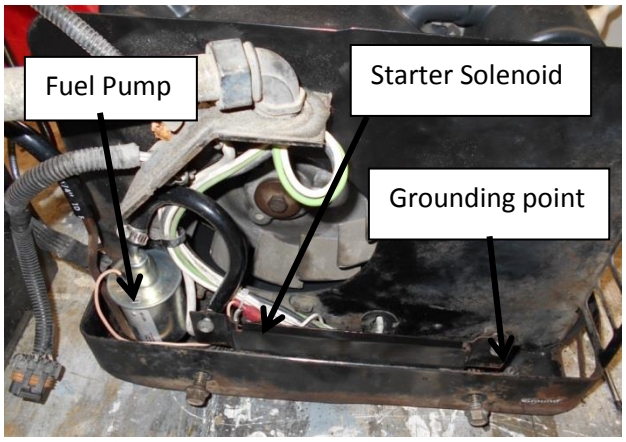
I used chain and lifted the unit using the 4 bolts which secured it to the vehicle.

Here it is with the cover removed and all cleaned up. This picture was taken during reassembly.



I wound up removing the head so I could clean out the carbon and I wanted to remove the layers of oil and dirt.

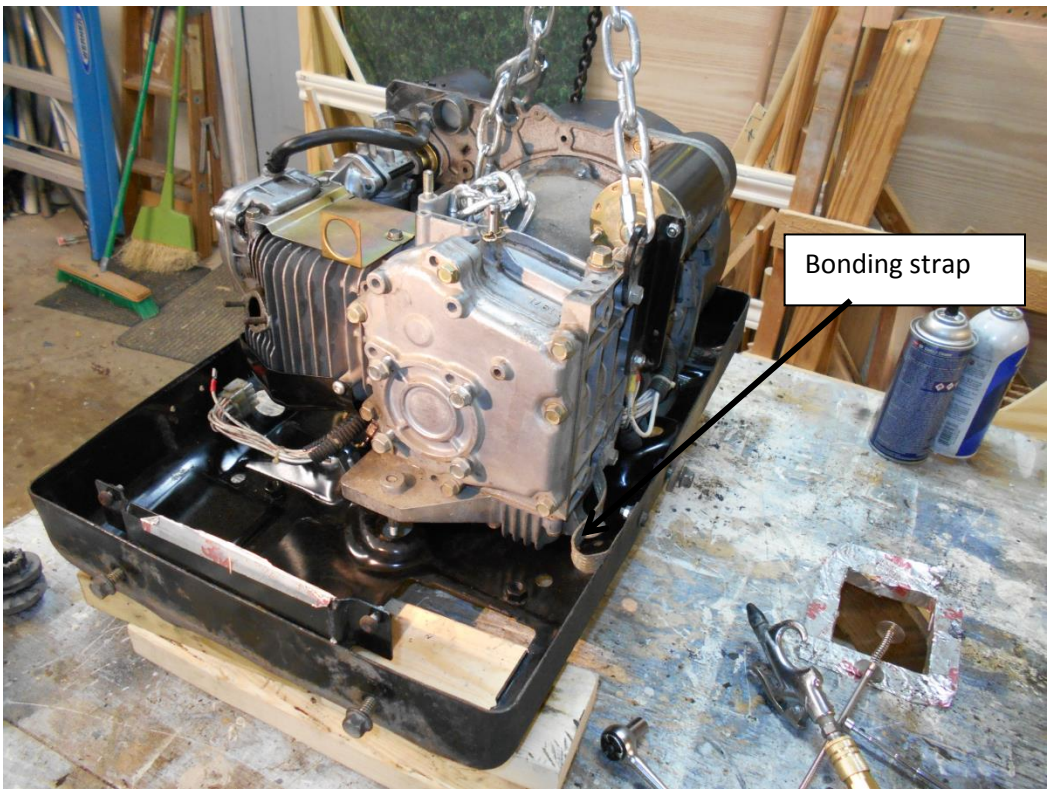
On the left side of the picture is a baffle which directs cooling air into the blower. It's held by two nuts on the bottom side of the unit. Not shown in this picture is a ground point and there are several wires bonded to the bottom plate with a bolt. It's on the lower right. The fuel pump is on the left. This picture shows the new pump installed. It's a little different than the old one in that the exit pipe comes out at an angle. The specs are the same and it's the same physical size. It was about ½ the cost of the OEM part. I think it was made by the same vendor. Also not seen is the starter solenoid which looks similar to an automotive



type. It is just to the right of the fuel pump. While I was in I replaced the fuel line from the pump to the fuel filter and from the fuel filter to the carburetor.

Plate removed and showing the back side along with the control panel. There is a high voltage capacitor which is part of the generator electronics on the lower left of the plate.

Muffler removed. The bracket which holds the muffler has keyhole slots to make it easier to remove. Note the bonding strap between the engine block and the base.



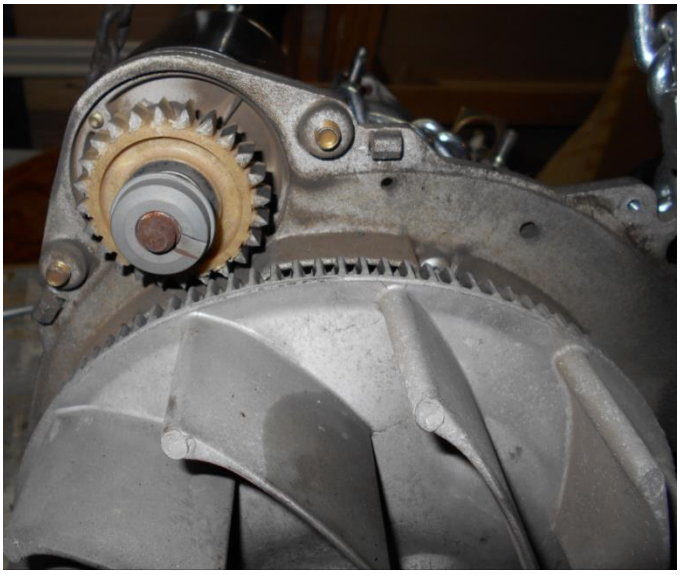
There are lifting rings on the unit to aid and getting the unit off of the base plate. After disconnecting the ground strap, ignition coil and grounding point, the base can be removed. There are 3 pairs of vibration isolators / engine mounts for a total of six fasteners to get the unit free of the base. These are on the bottom of the plate, so it helps to lift it up to remove the bolts.

Head removed. There was a fair amount of carbon on the piston head and the valves. Not terrible, but I cleaned it all off. Did it help, I'm not sure.

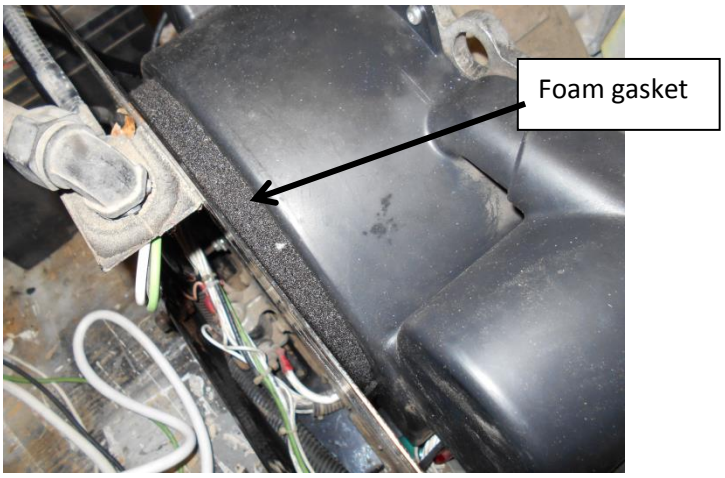
Carburetor and valve cover removed. A new valve cover gasket is a given. The crankcase breather has been removed. These were at about 0.004 inch and the spec is 0.002. Not sure how much real difference that makes.

The shop manual describes the valve lash adjustment. A feeler gauge is inserted between the top of the valve stem and the rocker arm. The piston is set to top dead center with both valves closed. Each rocker arm is held in place by a tall nut with a rounded bottom and a jam nut. The thread pitch is very fine. I was unable to find a torque spec and I was bit concerned about how much I should tighten the nuts. It's difficult to adjust because when you tighten the jam nut, the adjustment changes. It's takes a bit of fiddling to get it to the 0.002 inch gap. One word of caution, it's possible to loosen the stud from the head and you want this to be tight.

Starter Bendix and flywheel. Plastic gear, oh well.



There is a foam gasket between the blower housing and the baffle which had disintegrated. I found material at Lowes which was a good match.



All told I replaced the, fuel pump, fuel line, fuel filter, governor spring, spark plug, air filter, valve cover gasket and head gasket.

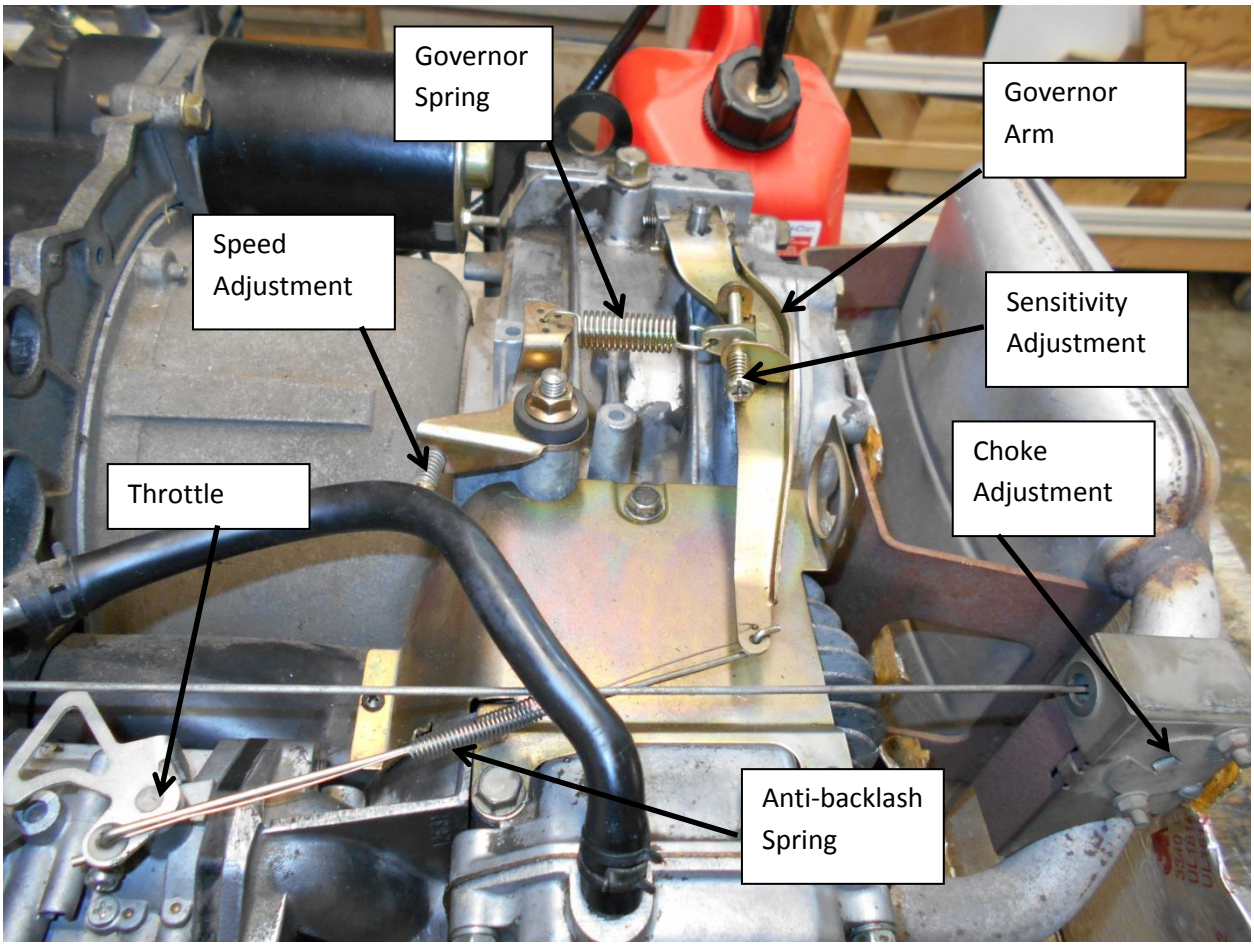
Checkout and Testing

A small plastic gas can was used for a fuel source. I made dip tube and added a vent hole in the cap. Held about a gallon and I ran through all the fuel testing the unit.

One of the 12 volt deep cycle batteries from the RV was used to power the unit. The AC output was connected to a standard duplex outlet to make it convenient to add loads and make measurements.

The workbench has a hole which allows connection of the exhaust pipe and directs the exhaust out the open garage door. Make sure the hole is big enough for the cooling air flow out the bottom.

The major adjustment for this unit is the governor. There are two adjustment screws; one controls the speed and the other the sensitivity. There is an anti-backlash spring in the linkage to the carburetor which I did not replace.



This machine uses a purely mechanical governor which is a classic spinning flyweight arrangement. As the speed increases, more force is applied to the arm. Essentially the force is balanced between the

spring and the arm. The sensitivity adjustment moves the point at which the arm spring pulls on the arm so the end of the arm which is attached to the throttle will move more or less. This type of governor will have only one point or load where the speed is exactly 3600 rpm. As the load increases the speed will drop a bit and at no load it will increase a bit. The amount that it changes is a function of the sensitivity adjustment. Adjusting this is a process of getting stable operation and having the no load and full load speed be within the specified limits. The two adjustments interact, so it's a bit of a challenge. I used a pair of Kill-O-Watt meters as a convenient way of measuring the frequency or speed and the power. A pair of electric heaters was used to load the unit to the full 2800 watts.

I suspect when the carburetor gets dirty, the gain or sensitivity goes down and the control loop cannot be adjusted enough to make it stable.

I did not change the choke adjustment. It only took a few minutes for it to warm up enough to disengage the choke. I'm not sure how it behaves in cold weather, but the throttle is designed to open the choke under high throttle even if it's not warmed up. If it's really cold, I'd let it warm up before putting a load on the unit.

My initial plan was to mount a fuel transfer valve so I could more easily attach an external fuel tank with a gas Seaform mixture. After reassembly I thought better of the idea. There was just not a good place to mount this valve and it's a really ugly environment. Instead I found some quick disconnects on Amazon designed for fuel usage. These disconnects have internal valves which close when disconnected. Got them in the mail and they look good. Motion Pro Fuel Line Quick Disconnect Couplings - Single - 1/4in. 12-0029. I've not yet installed them.

Final Thoughts

The little chain hoist made it a lot easier to work on. The unit is not extremely heavy, but just enough to be a problem. Getting the unit on and off the blocks is a bit of hassle. I was working alone, an assistant would have made this easier. Perhaps thinner blocks and a narrower cradle would have worked better. The cradle assembly worked great, it was quite easy to get the unit into position to re-install the bolts.

I took lots of pictures, but I should have taken more!

The shop manual and the parts list are very helpful. The Flight Systems troubleshooting guide give a lot of insight into the how the machine works.

I don't know if the fuel pump was bad, it was working but I suspect it was okay. There was a little evidence of potting compound leaking out of the old pump. Maybe not an issue, but it looked like it got hot at one point. My guess is if the pump were bad, it would be slow to fill the bowl and this would manifest itself with poor performance under load. On the other hand a bad pump might be intermittent and just fail to pump at all sometime. Once I had it out it was not that hard to change and not that expensive.

The valve lash adjustment did make a difference in the sound. Two tight and the valves will not fully close and you can damage the valves. Too loose and the valves won't fully open. Did this make a performance difference? I'm not sure. They were too loose.

The governor spring did not seem any different than the one I took out. I considered trying to compare the two springs, but did not get around to it. I don't think it really made much difference. It's hard to tell. This is mentioned in the shop manual as a cause of poor performance.

The carbon buildup could have made some difference, but not lots. Carbon buildup reduces the volume of the combustion chamber and can cause pre-ignition.

The spark plug that was in the unit had an incorrect gap and I set the gap correctly on the new one. The old plug did not look terrible and probably could have been used.

Bottom line there was no one thing, but probably the aggregate of everything I did combined to improve the performance.

This thing lives under the vehicle and picks up all kinds of dirt and grime. It was filthy inside making it difficult to work on. Complete disassembly made it much easier to clean everything up. Obviously use caution in picking cleaning materials. You don't want to damage electrical components.

Some have added connectors under the vehicle particularly the AC output so make it easier to remove. I've considered this, but have been unable to find a pair of connectors I would trust in this really dirty and wet environment. I would want something water proof and small.

The good news is that it's not that difficult to get it out of the vehicle and the test setup was not difficult. I won't hesitate to pull it out in the future should I need to work on it again.

Hopefully this will help others facing similar problems.

John Slaughter

December 2017