# A Farmer's Guide to the SF-20 Steam Generator (AKA: Soil Steamer)

**Note:** This document has been created to assist new users in the Cheshire County Conservation District Equipment Rental Program.

#### This guide includes:

- (1) Overview of the generator's function and setup
- (2) Quick Guide to Use
- (3) More Details
- (4) Troubleshooting
- (5) Video Resources.



#### **Overview:**

When you look at the generator, standing on the right side with the gray control box in front of you, you will see:

1. The Soil Steamer:



#### 2. The control box:



3.



- The garden hose connection: Just to the right of the control box at about the same height.
   From the connection, water flows first through what looks like a filter housing, inside of which is not a screen, but actually a canister of white scale-inhibitor. Next, water flows into...
- The water feeder: a black housing that automatically delivers the right amount of makeup water into the tank, when steam is in use. There's a sight glass on the right side of the feeder. During steam generation, the water level should stay at the same level in the sight glass.
- Two steam pressure switches are located on top of the tank, in the middle. The one on the left
  has adjustable set points that control cut-in and cut-out pressures for the burner control (Don't
  <u>adjust them!</u>). The one on the right has a maximum pressure set point, which will shut off the
  burner if the pressure starts to climb too high for some reason (Don't adjust this, either!)



- Next to the pressure switches, to their right, is a pressure gauge that shows what the actual steam pressure is.
- Next to the pressure switches, to their left, is a pressure relief valve like you see on standard hot water heaters.
- 5. The drain valve for the tank is down low to the right.



- 6. The burner is down to the left, at the back of the tank.
  - It's a "Beckett" brand burner very similar to ones that are used in home heating furnaces, but with a bigger nozzle.



7. The two steam discharge valves are down low, to the left and in back.



- 8. The diesel fuel tank is on the left side of the trailer.
  - $\circ$  Fuel from the tank passes through a filter on its way to the burner.



#### To make steam in the generator, you will need:

 A level place to park the trailer, with no nearby fire hazards. There is a bubble level mounted on the front right side of the tank, near the top. Front to back levelling can be adjusted with the parking stand for the trailer. You'll have to disconnect your towing vehicle to do that. Side to side levelling is up to your own tools and creativity. If the tank isn't level enough, the interior water level won't be right for the boiler.



- 2. **Diesel fuel**, to supply the burner. The red fuel tank can be filled with on-road or off-road diesel. The tank holds 65 gallons of diesel and the burner uses around 4 gallons per hour of runtime.
- 3. **Electricity**, to serve the control switches and the burner ignitor. The required electricity is regular 120Volt AC, like you'd use for a home computer or household appliance on a 15-amp circuit and connects to the generator via a 35' plug-in power cord.
- 4. **A full tank of water**. The silver water tank holds about 135 gallons and your water supply connects via a regular garden hose fitting that's located on the right side of the unit, in front of the gray control box.
  - To fill: Connect your supply; ensure that the drain valve for the tank, that's below and forward of the fill connection, is closed; ensure that one or both of the discharge valves, located at the bottom and back of the unit, are open so that pressure doesn't build up inside; shift the two red ball valve levers, located between your hose hookup and the black water feeder, up to a 12 o'clock position that bypasses the water feeder (the levers can move 90 degrees, from "9 o'clock" to "12 o'clock); fill the tank until water appears within the first inch or two at the bottom of the sight glass that's just in front of the water feeder.



- If you overfill, the space for steam to accumulate inside will become too small. At maximum overfill, water will pour out of the discharge valve.
- 5. A good pair of work gloves to protect your hands from hot surfaces, steam, or water.

Once the setup is complete, and the generator is switched to "*on*" at the gray control box, it takes about 15 minutes of burner running to initiate steam production. Then, an automatic control switch will cause the burner to run only enough to keep the steam pressure between the setpoints of 4 and 12 psi. When the pressure falls to around 6, the burner will kick on and stay on 'til the pressure climbs up to the cut-out point of 12 psi. The amount of steam you call for, by adjusting one or both discharge valves, will affect this control. 10-12 psi is a good amount of pressure to keep the steam sock evenly full. Meanwhile, the water feeder valve will be using a level sensor to automatically keep makeup water supplied to the tank.

During operation, 5 safety switches, all routed through the gray control box, will automatically shut down the generator if parameters for safe operation are unsatisfactory. The parameters include: not enough water, too much steam pressure, and overly hot exhaust gases. At the end of the steaming run (or runs), all there is to do is shut off the main switch. If you're completely finished and ready to break down the generator for return, purge whatever steam is left by opening the discharge valves, let the generator cool for about 10 minutes, and then drain out the water from both the bottom drain valve and the water feeder valve.

# Quick Guide to Use:

- 1. Complete the set-up requirements for safe location, fuel, electricity, and a full tank of water.
- 2. Turn on your water supply for the makeup water and move the red bypass levers to the left of the water feeder to 9 o'clock. Also ensure that the water feeder drain valve (yellow lever at the bottom of the water feeder) is shifted down to the closed position.



- 3. If the generator has not been run recently, prime the fuel supply by a few strokes of the plunger that's mounted in the fuel filter.
- 4. Switch on the generator at the control box.
- 5. Close the steam discharge valves, if they're not already.
- 6. Wait for steam. You'll know it's there when the steam pressure gauge starts to move up from 0.
- 7. Ensure that your water supply is able to deliver 2-5 gallons per minute at 40-150 psi. There is a pressure gauge right at the water feeder inlet, and that's where you want to see 40 psi. If your pressure is in range, the volume should be as well.
- 8. Use the steam by connecting the hose and sock to one of the discharge valves, adjusting the amount you're calling for to keep the steam pressure around 10-12 psi.
- 9. When you're finished with steam, switch off the generator.
- 10. Let some residual steam flow out through the discharge valve(s) before closing them.
- 11. If you're all done, and not just pausing between runs, disconnect electricity, open the steam discharge valves, and allow the tank water and boiler interior to cool. Then drain out the water tank by opening the lower drain valve. Be cautious about the potentially HOT water before you attempt to drain the water tank. Open the water feeder drain valve as well.

## More details:

- 1. The water feeder does have a screen filter inside of it that serves as an extra safety for keeping water clean in the boiler. The water you put in should be filter-clean already.
- 2. Switches, Indicator Lights, and Reset Buttons:



The following text, about the indicator lights, was adapted from a Sioux Corporation Instruction Manual:

INDICATING LIGHTS: The following lights are located on the gray electrical enclosure box. The instructions below describe their function and aid in troubleshooting what switch may not be functioning.

- 1. Manual Reset Level Switch: This safety switch monitors the water level and if the level switch on the water feeder fails to shut the burner off in a low water condition, this switch will shut power to the burner and must be manually reset.
- 2. Water Feeder Level Switch: Located on the top of the water feeder, the switch will shut off the burner if the water level is below the minimum level.
- 3. Auto Reset Pressure Switch: Located on top of the tank, the pressure is set to the desired pressure and if the pressure is above the setting the burner will remain off until the pressure has dropped below this setting less the "Deadland" setting Ex.10 psi - 4 psi deadland, the burner will shut off at 10 and back on at 6 psi.
- 4. Manual Reset Pressure Switch: If the pressure reaches 15 psi the burner will shut the burner down and the red switch must be pressed to reset the switch and the burner will restart.
- 5. High Exhaust Temp Limit: If the exhaust gases reach a temperature above 700°F this limit will shut the burner of and must be pushed to reset the burner.

INDICATOR LIGHTS ON THE GRAY BOX: WHEN ALL GREEN INDICATORS ARE LIT ALL COMPONENTS ARE OPERATING NORMALLY IF SOME INDICATORS ARE NOT LIT, CHECK THE COMPONENT CORRESPONDING TO THE LEFT MOST UNLIT INDICATOR IF NO INDICATORS ARE LIT CHECK THE HIGH TEMP RED INDICATOR OR MANUAL RESET LEVEL SWITCH.

# **Troubleshooting:**

If you're having trouble, better to seek advice from folks who set up the rental with you before you pull out any tools and dive in. Please feel free to reach to any of the partners on this project:





Cheshire County Conservation District (CCCD) Amanda Littleton: District Manager <u>Amanda@cheshireconservation.org</u>

> Picadilly Farm – Winchester, NH Bruce Wooster: Owner & Farmer bruce@picadillyfarm.com (603) 236-1930



National Center for Appropriate Technology (NCAT) Andy Pressman: Northeast Regional Director <u>Andyp@ncat.org</u> (479) 587-3475

### Video Resources:

- Steam-Flo Startup Video from the Sioux Corp: <u>https://www.youtube.com/watch?v=\_G5FBdN2ayw&t=101s</u>
- Soil Steaming Video from the Sioux Corp: <u>https://www.youtube.com/watch?v=J\_EC-wvtuCc</u>
- Soil Steamer Virtual Workshop from the CCCD: <u>https://youtu.be/M0mbyEOIO70</u>



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