

1. **Keep the Portage & Main Optimizer 250 at Peak Performance**

You will want to keep the wood furnace hungry, but not starved for wood. Read on to find out how. Operating a wood gasification furnace efficiently requires that one learns how to successfully manage a down-draft fire, even if one has successfully operated a conventional wood boiler. The key to achieving optimal gasification operation is keeping the refractory hot at all times. Operating a wood gasification furnace is basically operating a down draft fire (an upside-down fire).

2. Experience tells us that it is important, that the same person be fuelling the wood furnace, so that they learn to feed to the heat load, to match the weather. The warmer or colder weather forecast, you will want to adjust the amount of wood accordingly. Adding too much wood for the warmer weather temperatures will result in too many coals. Adding too little wood for the cooler weather temperature will result in water temperature and/or refractory cement/brick temperatures too low to re-ignite.

3. **Air Settings for an Optimizer 250 on the Air Distribution Box**

The top knob is for adjusting the air for the burn chamber. The bottom knob is for air adjustment in the reaction chamber. Both knobs should be approximately 5 turns out – start by turning in a clockwise rotation until it will not turn in any more, then proceed to turn counter-clockwise 5 complete rotations--this will increase air volume. These are good general settings; with experience, do not hesitate to experiment.

4. Disk on primary air intake for blower motor should be open only $\frac{1}{4}$ " or approximately 3 -1/4 turns out from being totally shut. (May have to remove disk and turn around to shut totally off. Jam lock nut will require 9/16 wrench to securely tighten it in place to prevent it from closing due to vibration.) By turning down air on primary air intake, you decrease the furnace output, this will keep it burning longer between on/off cycles, maintaining refractory slab at optimum temperatures resulting in quicker gasification reigniting after a down cycle.
5. The large amount of P&M refractory cement and brick holds the heat during the off cycle. This hot refractory helps the wood gases burn quickly, once the fan introduces new oxygen, after being in an off cycle. These wood gases start to burn at around 700 ° F. The surrounding water is only 180° F. or so (whatever your aquastat is set at). Re-ignition is dependent on hot refractory and a reasonable coal bed usually about 2 inches.
6. The P&M gasification furnaces will gasify very quickly with first fire – “no coals”. Always start fire with smaller kindling and slowly build up. These gases burn quickly, with the over and under air, heating up the refractory to enable a quick start up after a down cycle. Don't be overly concerned, if there is not a strong gasification in the reaction chamber at all times. As long as the horizontal fire tubes are not creosoted up and have only ash and dust in them, the unit is gasifying 99% of the time otherwise they would be coated with creosote from the un-burnt gases.
7. The fan on the Optimizer 250 is of very good quality enclosed ball bearing motor but most importantly, being capacitor run, which means the fan, will provide a constant velocity of air.
- a. It won't blow less air because the nozzle (slot in bottom of fire box) is somewhat restricted. As long as the refractory brick and water temperature has been kept up to operating temperatures, the constant air will eventually cause the nozzle's restriction (usually un-burnt coals) to burn it self clean, allowing for complete gasification again.
 - i. **Do not stir up the coals.**
 - ii. Do not be concerned if there is a loose bed of coals above the nozzle.

- iii. Clean slot or nozzle only as absolutely necessary using a non metal tool. Do not touch the slot (nozzle) with steel tools as this will shorten its life.
 - iv. **Do not stir up the coals** as they will break into smaller pieces, which will cause other issues, such as nozzle restrictions (plugging of vertical heat exchanger tube) or more ash build up; which generally causes poor gasification.
 - v. A small amount of ash may get through the nozzle (slot) into the reaction chamber. Clean reaction chamber (bottom door) by reaching to the back pulling ash and coals to the front, into the supplied ash pan. To prevent plugging of vertical tubes, clean weekly or as needed, using the long cleaning tool supplied with furnace.
8. The air is distributed evenly along the top length of the fire-chamber and from under the fire in reaction chamber (bottom door) that gives a better mixture of the wood gases and the oxygen. Check air inlet holes on the top of Optimizer 250 fire chamber and clean if required. Use scraper handle (supplied with furnace) to clean. There are nine holes on each side of air channel.
- a. It is normal to have creosote in the burn chamber(wood burning box)
 - b. It is not normal to have any creosote in the reaction chamber or the fire tubes. .
 - c. It is NOT normal to have excessive moisture in a creosote form in fire chamber.
 - d. It is NOT normal to have moisture dripping—This happens:
 - i. If the temperature drops due to lack of fuel, or trying to add too much fuel without first building up coal bed after loss of temperature. (refractory cement and water)
 - ii. The refractory bed and lack of coals may cause a no relight.
 - iii. Water temperature reaching close to dew point (less than 140°F) will cause condensation to occur.
 - iv. When excessive wood, is not surrounded by temperatures adequate for a relight, the wood sits and smoulders which cause condensate.
9. **If you have determined that there is no air or not enough air into the furnace**
10. Ensure the horizontal or vertical tubes are not restricted.
11. Remove metal plate between the horizontal tubes to allow brush to get in at a better angle.
12. Remove air box cover and check that actuator shaft and dampers is functioning properly. Clean as required.
13. Check blower and fan. Clean if required.
14. Is green light on A419 aquastat indicating signal for fan to come on?

15. **Aquastat Setting (Water Temperature)**

Operate aquastat A419 at (Set Point) of 175 to 195°F with a 5 to 10°F temperature differential. Consult manual for how to adjust aquastat.

16. At this temperature water cannot carry oxygen. Oxygenated water leads to water side corrosion.
17. Always above 150° to 160°F as any lower is getting too close to condensation point which will damage the metal. This is why a diverting valve **must** be installed on each return line with your Optimizer 250. A diverting valve, also helps keeps the water temperature and refractory brick/slab temperature adequate for quick gasification upon refuelling. Ideally, the wood is put in on a regular consistent base, so the temperature

does not drop down. If refuel has been delayed, the diverting valve will protect the furnace from too low of temperatures.

18. Fire Chamber Operation & Maintenance

maintain the fire chamber for optimal temperature by aiming for approximately 1" of ash and ensuring that there is 2" of coals.

- 19. Excessive ash will insulate the refractory brick not allowing it to achieve optimal temperature.
- 20. Use a flat spade to remove ashes by moving coals aside and removing ashes.
- 21. Do not be overly concerned about completely removing all the ashes at each cleaning. Experience will help you establish whether ash removal requires to be done weekly or bi-weekly.

22. Adding Wood to the Optimizer 250

How much wood to put in at a time will be something, only experience can teach:

- 23. **Heating Season:** Putting too much wood in, may result in too deep of coal and ash bed accumulating and insulating the refractory, which results in cooler conditions than optimal.

- a. Putting in too little wood, may allow fire to go out and cool off water and refractory too much.
- b. After adding wood a few times the operator will learn the correct amount to add to make the wood added last to next adding time, usually every 8 to 12 hours. Ideally the same person adds wood each time, to learn the amount to add.
- c. You will notice, we do not use the term "fill the furnace" because the only time you would ever "fill the furnace" to total capacity would be when using it to total heating capacity.

- 24. **Fringe Seasons:** Some Portage & Main Gasification Furnace owners chose to use their furnace year around, heating only their pool & domestic hot water in the fringe seasons. They are mindful of how much wood, they put in the furnace at a time and the dryness of the wood. It is better to burn a soft wood such as poplar, pine or cedar in the fringe seasons. Only put in a small amount of wood – do not let the coal bed get more than 2 inches deep, keep ash to a minimum.

- 25. **Restart:** In the event that the fire does go out, a new fire will need to be started. Start the new fire carefully. Start with kindling and small wood. Stay with the furnace. Add small wood at small intervals (5-10 minutes). Add wood as required to build up sufficient coal bed-sufficient to keep the new charge of wood burning. (Combined ash and coals bed of a total of approximately 2"). The object is to build a sufficient coal bed, which is best done slowly and under constant supervision.



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