

Nozzle-Mix (Furnaces)

Overview and Relevant Components



Wet Dog Glass Furnaces most often use a nozzle mix burner in tandem with a variable speed blower and temperature controller. The user assigns a set point temperature, and the controller will ramp the blower up and down to achieve that temperature. The user has four adjustment points to balance the gas and air: FRG (Gas/Air proportionator), the Adjustable Limiting Orifice or Needle Valve, the low fire bypass, and the butterfly air valve Description for this block. Use this space for describing your block. Any text will do. Description for this block. You can use this space for describing your block. Description for this block. Use this space for describing your block. Any text will do. Description for this block. You can use this space for describing your block.

FRG: Primarily changes the amount of gas in the low-fire and mid-fire range. Remove the small black cap and adjust with flathead screwdriver. Clockwise allows more gas through, counter-clockwise allows less.

ALO, Needle Valve: This valve is located just before the burner and limits the maximum amount of gas at high-fire. Remove the cap to find a recessed flathead screw. Clockwise decrease gas, counter-clockwise increases gas (Opposite of FRG)

Low Fire Bypass: Located on the side of the FRG, small flat head under black cover. This allows a small amount of gas through without the influence of the FRG, used for low fire adjustment. Clockwise for less gas, counter-clockwise for more gas.

Butterfly Valve: This valve is located on the cold air line just before the recuperator. While it primarily allows more or less air through, it also affects the amount of gas allowed into the system by the FRG. Small changes here have a very large effect. Closing the valve decreases the air but also increases the gas, and vice-versa.

Turn On



Start with the FRG at about half (Factory setting), and the ALO valve open a half turn. Air will need to be bled from the lines the first time, and the equipment will need to run through its startup sequence several times to do so. Set the Watlow controller to manual and set to 15%

The blower will run for a 30 second purge, then the DSSOV(Dual Safety Shut-off Valves) will click open. KDI Valves have indicators that turn red when the valves open. Kromschroder have blue lights that indicate open. When the valves open, the spark plug will begin sparking inside the nozzle to ignite the burner. If the system does not start within the allotted time the valves close and an error is displayed on the MPA. Press reset to begin the ignition procedure again.

When the Furnace is lit, adjust the ALO clockwise towards less gas until you reach the smallest stable flame possible. This will be just a few degrees from being entirely closed. If you decrease the gas too far and the flame goes out, reset the MPA to begin the ignition process again.

Continue on to the Heat Up schedule and process.

Heat Up Schedule



Round Day Tanks should be heated up at a rate of 15 degrees F an hour. Free standing pots should be heated up at a rate of 25 degrees F an hour Write or print a schedule with the temp goal for each hour. You'll find that it is very hard to maintain this exact rate, try to average out slow hours and faster hours.

When you have the furnace on with the smallest stable flame possible, the temp will rise to around 200-300 and then begin to slow down and stall. When your schedule calls for the temperature to increase, increase the gas slightly by turning the ALO (needle valve) counter clockwise a 1/16 of a turn. This allows more gas into the burner and the temperature will begin to rise again.

The temperature will rise. Track the temp every hour as much as possible. After

several hours the temp rise will slow down, and eventually stall. When your schedule calls for the temperature to increase, increase the gas slightly by turning the ALO (needle valve) counter clockwise a 1/16 of a turn.

Repeat this process over the course of 4-5 days. You will either reach 1900 degrees, or turning the ALO counterclockwise will stop increasing the temperature. Once you're around 1900 degrees, proceed to the Tuning section.

Tuning



Tuning Overview: As the temperature controller varies the speed of the blower, the pressure in the impulse line changes. The impulse line is a small airline from the main air line upstream of the butterfly valve. As the air pressure in this line changes, the proportionator allows more or less gas through to match the air, and maintain the gas/air ratio throughout the range of blower speeds. The butterfly valve is used to set the high fire air pressure as well as to create back pressure in the impulse line. After the butterfly valve the air flows through the recuperator where it is preheated before moving along to the burner inlet. The ALO valve provides high-fire gas adjustment. In tuning the system, the objective is to achieve an efficient air:gas ratio throughout the entire operational range. To do this adjust the blower output to multiple points in the range and adjust the ratio by following the steps below while the furnace is at operating temperature.

Step 1 -On the Watlow controller, press the advance key until you see "CM1" or a percentage and "AUto, MAn, or OFF" and set the control mode to manual . Press the reset key, then set the output percentage in the lower display to 100%. This percentage directly reflects the Blowers speed. 100% is maximum, 0% is the lowest the blower can go without turning off.

Step 2 - Adjust the ALO or AOGC needle valve (located on the gas line just upstream of the burner). Clockwise (CW) rotation decreases gas while counter-clockwise (CCW) increases gas. Increase the gas until you see reduction flames coming out from under and around the door, then decrease the gas until these flames are only about 1" long and fairly difficult to see. The temperature should be rising very quickly at this setting

Step 3 - Adjust the controller output to 20% and again, look for reduction flames around the door. Adjust the proportionator spring stem screw CW for more gas and CCW for less gas. Once you see the reduction flames, decrease the gas until they disappear.

Step 4 - Adjust the controller output to 0% and adjust the low fire bypass on the side of the proportional regulator. Look for the reduction flames to appear, then make them disappear by decreasing gas. At this low output setting, the flames may take 15-20 seconds to build up while the door is closed. When you open the door, you may see a finger of a flame appear then go away. This is because the excess gas in the furnace found oxygen when you opened the door. Decrease gas using the bypass fitting screw until you can open the door after 15 seconds and not see that flame.

Step 5 - If throughout the whole range there is either always too much gas, or too little, adjust the butterfly valve. The default is half open. When the butterfly valve is changed, it has a drastic effect on the tuning. Opening the valve allows more air, but also decrease the impulse line pressure, decreasing the amount of gas the proportionator lets through, and vice versa. A small change to the butterfly valve makes a very large difference. When a setting is found that puts the furnace into a good range for fine tuning with the other adjustments, the butterfly valve should be the last adjustment to be used.

Step 6 - Adjust the proportionator at other output levels such as 30% and 40%. Cycle back through 100%, 20% and 0%, making fine adjustments at the same points you did in steps one through four.

Step 7 - Press the advance key and set the control mode to auto. Press the reset key and set a temperature set point in the lower display. The furnace should now be able to maintain this set point. Once the output percentage stabilizes with a furnace full of glass, you may have more fine tuning to do for charging temps or squeezing temps, and you can use the same steps above, especially steps three through five.