MOISTURE AND MASONRY HEATERS

As you have heard and read many times to date, dealing with moisture build up is a very important detail, in the easy and efficient operation of your masonry heater. Burning only very dry wood in your masonry heater is of upmost importance. You should have a two-year rotation of wood that is split, stacked and protected from moisture for a period of two years before burning. You should aim for 15% or less moisture content before your wood is burned. Do NOT burn logs that are not split. If you see any evidence of creosote anywhere in your masonry heater or flue pipe, STOP using your heater until you have identified and corrected the source of the problem.

The second item that you must understand to minimize moisture build up in your masonry heater is the possible condensation of moisture from the air and the wood you are burning. Evaporation and condensation are occurring around you simultaneously all the time, but you often don't see the results because they're happening on the molecular level. The same is true inside of your masonry heater. As you fire your heater, the moisture in the wood is heated rapidly, causing complete evaporation. The majority of this evaporation happens during the first third of the burn cycle. Upon start up and when your slide damper is open, this water vapor is usually pulled up and out the flue pipe, without any significant condensation happening. Once the slide damper is closed, it is possible for the water vapor to be cooled to the point of condensation back into the liquid form, especially if the soapstone that forms the exchange chambers is cold. Firing your heater every day throughout the burn season, is the best way to eliminate this moisture staying inside your masonry heater. When you burn full firebox loads on a daily basis, the side exchange chambers are kept warm around the clock, and are thus very unlikely to cool the water vapor back into its liquid form. When the water stays in the vapor form, it is removed from the heater along with the other flue gases through the pipe.

The following will help you better understand what is happening on a molecular level inside your masonry heater. As your heater is fired, phase changes occur when there's either "net" condensation or "net" evaporation... as the air and your cord wood will always have some moisture content. "Net" condensation means that the condensation rate exceeds the evaporation rate causing liquid water droplets to form. On the other hand, "net" evaporation, which means that the evaporation rate exceeds the condensation rate, causes liquid water droplets to shrink and disappear. The moisture in your chord wood starts out in liquid form. A hot burning fire will easily convert this liquid water into vapor. The goal is to make ensure that the flue gases are not cooled to the point that the vapor converted back to liquid for through condensation. This is more likely to happen a the beginning of a burn season when your masonry heater is very cool and the potential exists for the thermal mass of your masonry heater to be cooler than the surrounding air.

The states of net evaporation and net condensation are important to understand the performance of your masonry heater. To better understand how net evaporation and net condensation are achieved, we need to understand a bit more about what controls the evaporation rate (the number of water molecules evaporating in a given area over a given time period) and the condensation rate (the number of water vapor molecules condensing into liquid water in a given area over a given time period).

The vibration of molecules depends on temperature: the higher the temperature, the faster the molecular vibrations, and the more likely a liquid water molecule will break free from its neighbors and evaporate into water vapor. Your fire temperature is a major controller of the evaporation rate. Lower fire and thus moisture temperatures yield lower evaporation rates, while higher burn temperature yield higher evaporation rates. Therefore, a full firebox of properly dried wood and sufficient air supply, burned at least daily, is your best defense against condensation. Never damper down your fire. Do not be afraid of over filling your firebox as it is sized to function most efficiently with a full firebox load. Half or partial firebox loads are a bad idea as lower combustion temperatures can lead to condensation as the flue gases reach the end and coolest part of the exchange chamber path. Your skill in stacking and lighting your firewood is extremely important in maintaining the cleanest, most efficient burns while minimizing moisture. Watch the Top-Down Burn videos at our website to sharpen your skills. www.GreenstoneHeat.com

If you live in a humid climate, it is even more important that you pay close attention to the moisture content of your wood before burning. This link will take you to a chart of recommended drying times for different wood species. https://firewoodhoardersclub.com If you only have softer wood or wood with higher sap, pitch and resin content, you will need to dry out your chord wood even longer, after it has been split, stacked and protected from moisture. You may also need to burn a couple more fires over a given week to ensure the entire thermal mass of your masonry heater is kept warm.

If liquid water drops form and grow -- net condensation is occurring because the condensation rate is greater than the evaporation rate. But, at higher temperatures, evaporation rates increase, and with increased evaporation rates, even *higher* condensation rates are required for net condensation to occur. Higher condensation rates occur when the number of water vapor molecules increases, so when the air is warm, the high evaporation rates give the potential for a higher number of water molecules to remain in the vapor state without *net* condensation occurring. In other words, when the flue gases stay hot during their journey through the masonry heater, more water vapor molecules are needed in order for liquid water drops to form and grow. When the flue gases are cooled, evaporation rates are decreased, fewer water vapor molecules are required for net condensation to occur. So wood burned with the same moisture content can result in very different outcomes in the efficiency of your masonry heater and the water trapped inside.