

Wood Burning Guide

All wood burning appliances, regardless of their design, work on a very simple principle – introduce combustion into air into the firebox, through either natural or mechanical (blower) means, providing the oxygen necessary to sustain combustion and burn the wood. The resultant hot gases, mostly carbon dioxide and water exit through the flue and chimney system. Sounds easy, right? If it were this easy we would never receive calls about wood burning appliances not working properly. Guess what? It is not the stove! It is your firewood. Poor quality firewood will give you plenty of problems, from low heat to plugged rain caps. Here are the basics of firewood. If your firewood isn't seasoned properly (it is too green (wet) or too old (deteriorating)) you won't have a good fire and your wood burner won't work well. Burning wood in a high efficiency appliance can be VERY rewarding and money saving, when done properly. Done improperly, it can lead to frustration and disappointing results.

For our Wood burners - Wood Burning 101

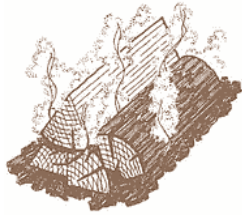

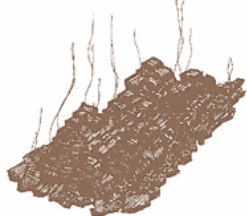
A wood burning appliance owner should NEVER use wet or unseasoned wood as fuel! When you add a piece of wet fuel wood to your fire, the water contained in the wet wood heats up and turns into steam. This mixes with the exhaust gases and extinguishes essential secondary combustion! Secondary combustion is a primary source of heat in all newer stove systems! Regardless of how sophisticated your stove system is, using wet or unseasoned wood will cut down your stove's heat output by at least 50%! Industry data shows beyond a doubt that using wet wood provides MUCH LESS heat, and causes MUCH MORE creosote to form in the chimney, regardless of the draft-control setting or mechanical draft aid!

Here's why:

EPA approved wood stoves and high efficiency wood boilers extract heat from wood in two ways. The first source of heat from wood is the initial or primary combustion of the wood. This is the fire you see first. The second source of heat is the combustion of those gasses which are released unburned from the primary fire, known as secondary combustion. This secondary gas, (which looks like smoke), is loaded with usable fuel. This fuel is vaporized creosote itself. If your stove can ignite and burn this secondary flue gas before it goes up the chimney, you can literally double or triple the heat out put of your stove!

If you burn unseasoned, wood you don't get much heat because the energy stored in the fibers is used to evaporate the moisture within the wood. The amount of water can be considerable -- equal to half or more of the weight of the wood. Plus, the cool-burning fires produced by unseasoned or deteriorating wood create a lot of smoke, which results in air pollution and leaves thick deposits of gummy creosote building up in your chimney. That, in turn, can lead to a chimney fire, which can wreck the chimney or even start a house fire.

The firewood you use for heating should have been cut early the previous spring, or even earlier. If the wood was split and stacked to dry in the sun and wind over the summer and early fall, the moisture content should be below 20 percent. Like unseasoned wood, deteriorating or rotten wood isn't worth burning. Even if it's dry, you won't get much heat because the fungi that cause wood rot will have already removed most of the energy-rich ingredients.

		
<p>1) Boiling off the water - Up to half the weight of a freshly cut log is water. After proper seasoning, the water content is reduced to about 20 percent. As the wood is heated in the firebox, this water boils off, consuming heat energy in the process. The wetter the wood, the more heat energy is used to boil the water. That is why wet firewood hisses and sizzles and is hard to burn, while seasoned wood ignites and burns easily. If you see water coming off the end of you wood IT IS TOO WET and you will lose heat, even enough heat to put the fire out!</p>	<p>2) The emission of smoke and combustion - As the wood heats up and passes the boiling point of water, it starts to smoke. The smoke is the visible result of the solid wood decomposing as it vaporizes into a cloud of combustible gases and tars. If the temperature is high enough and oxygen is present, the smoke will burn. When it does, it produces the bright flames that are characteristic of wood combustion. If the smoke doesn't burn in the firebox, it exits the furnace into the flue pipe and chimney. Here it either condenses - forming creosote deposits - or is expelled as air pollution.</p>	<p>3) The charcoal phase - After the water has boiled off and most of the gases and tars have vaporized out of the wood, charcoal remains. Charcoal is almost 100-percent carbon. It burns with a red glow and some flame or smoke when enough oxygen is present. Charcoal is a good fuel that burns easily. However, burning charcoal often produces carbon monoxide, an extremely deadly colorless, odorless gas.</p>
<p>Primary Combustion: The process by which gases are released from wood. Primary combustion begins at about 540° F, continues toward 900° F and results in the release of a large amount of energy. Primary combustion also releases large amounts of unburned combustible gases, including methane, methanol, water vapor and carbon dioxides.</p>		<p>Secondary Combustion (gasification): The conditions needed to burn secondary gases are sufficient oxygen and temperatures of at least 1100° F. The air supply is critical. Too little air will not support combustion and too much will cool the temperature to a point where secondary combustion cannot occur.</p>

In reality, once a fire is established, all three phases of wood combustion usually occur at the same time. The wood gases can flame and the edges of the pieces can glow red as charcoal burns, while water in the core of the piece is still evaporating. The challenge in burning wood effectively is to boil off the water in the wood quickly, while making sure the smoke burns with bright flames before it leaves the firebox.

What kind of wood should you burn?

It does not matter **what** kind of wood you burn: as long as it is really, truly seasoned. If you're wondering about which wood is really the best, or which wood causes the least creosote to build up, the answer is the same! **Properly seasoned wood produces the most heat, and produces the least creosote!** It's not the *kind* of wood you burn that really makes the critical difference, but whether or not the wood is seasoned. Seasoned wood produces a lot of heat, **and** it burns clean! **Hint: Tap the wood with a key or coin. Seasoned wood gives a sharp, resonant sound, like a baseball bat. Unseasoned wood sounds dull.**

Trees that have the hardest wood have the most energy per cord, while the softest have the least energy per cord. This DOESN'T mean softwoods, such as pine, create creosote – a common misconception. Actually, some softwoods have more BTUs per pound than some hardwoods. What it does mean is that when seasoned, softwoods will weigh less and you probably have to add wood on a more frequent basis than with a hardwood.

It is important to know that many types of wood go bad after 5 or 6 years. After aging for more than 5 years, the creosote - which are the flammable substances in the wood – evaporates and deteriorates. Many types of wood that are allowed to sit for too many years just go dead – they have no heat value left. The heat value of firewood is mostly related to its weight, provided the weight isn't water, and dry rotted wood is very lightweight. Rotten wood can also be like a sponge and absorb tremendous amounts of water. If you use seasoned wood of any kind, you will obtain maximum heat for your stove, furnace or boiler.

What REALLY causes creosote?

Creosote is the condensation of unburned, flammable particulates present in the exhausting flue gas (smoke). Like hot breath on a cold mirror, if the surface temperature of the flue is cool, it will cause the vaporized carbon particles in the flue gas (smoke) to condense. This condensation is creosote build-up. If the wood you are using is rain logged or of poor quality, the fire will tend to smolder. Wet wood causes the whole system to be cool, and inefficient. But, dry wood means a hot fire! A hot fire means a hot flue, and a hot flue means much less creosote. It may be helpful to consider that a given piece of wood, once properly seasoned, will yield approximately 300% (ie. three times) more useful heat into your home compared to when the tree was just felled.

If you have trouble starting your fire, or if you have trouble keeping your fire going, you are probably using unseasoned or rotten wood. If wood is not properly seasoned it will be hard to light. It will keep going out. It will smolder. It won't put out heat. The moisture content in unseasoned wood does not allow the wood to burn well. It just burns poorly and inefficiently. It is also precisely the moisture in wood which **causes** creosote to build up at an accelerated rate. One fresh-cut cord of oak may contain enough water to nearly fill six, 55 gallon drums. The **moisture**

content in the wood determines how much heat the fire puts out, **and** how much creosote will build up in your chimney or flues system.

Back in the early 1980's, tests were conducted to discover which kind of wood created the most creosote in a regular "open" fireplace. The results were surprising. **Contrary to popular opinion, the hardwoods, like oak created MORE creosote than the softwoods, like fir and pine.** The reason for this is that seasoned softwoods create a hotter, more intense fire. The draft created by the hotter fire moves the air up the chimney faster and as a result do not have as much time to cool down and condense as creosote inside the chimney. Denser hardwoods were found to smolder more, so their flue gas temperature is cooler. Thus, more creosote is able to condense on the surface of the flue. **So, saying that "softwood builds up more creosote than oak" just isn't true!** It is a misunderstanding to think that it's the pitch in wood which causes creosote. It's not the pitch that is the problem; it's the water IN the pitch. Once the water in the wood has evaporated, that pitch becomes high octane fuel! When dry, softwoods burn extremely hot!

Preparing Your Firewood Supply



Firewood should be split and stacked in the early spring to be ready for burning in the fall. After drying in the warm summer winds and sun, the wood will have a moisture content of about 20%. When seasoning your firewood; do not cover it with a tarp or you will prohibit evaporation! Use a shed, or buy a prefab wood crib. A piece of dry firewood has

large cracks or checks in the end grain. Look for these when judging the quality of firewood. For best burning move your seasoned firewood to a sheltered location or cover it to keep it dry for heating use.

If you get serious about wood burning, you must always think one full year ahead! When buying or cutting your firewood, remember that first and foremost, it must be properly seasoned. The best way to get seasoned wood is to **buy or cut THIS year's wood for NEXT year!** In the case of hardwood, especially oak, it should be seasoned for at least one full year! Don't believe it when you hear people say *even though this wood was split this year, it will be just fine.*

Look for gray, or darker, brittle wood that has a lot of cracks in the inner rings. Seasoned wood might look gray, or dark or dingy because it has been sitting in the sun, drying, and collecting dust for a while. But, if you split it: it's dry and very **WHITE** inside! Unseasoned wood has the fresh clean look of new lumber at a building supply store. Unseasoned wood has that same fresh look on the **INSIDE** when it's split. Though the older, seasoned wood is darker on the outside, it is bone white on the inside - which means that it really is seasoned.

There you have it. Everything you needed to know about firewood. In short, plan ahead and use properly seasoned firewood and the time spend messing with your heater will be minimal and your heat will be maximal!

Note:

Save this and put it with your owner's manual for future reference.