

## #7 Operating your appliance...safely

Do you know what a firing cycle is? Do you know how to manage your wood stove's firing cycle for maximum safety and efficiency? Has your appliance retailer explained how recent changes in wood appliance design affect the way you should build a fire? If your answer to any of these questions is "no", then this fact sheet is for you. It explains how to operate a wood-fired heating appliance to produce maximum heat and minimum creosote. Combining common sense with an understanding of basic scientific principles, you can make the most of your hard-earned firewood and ensure safe, trouble-free operation of your appliance.

Proper woodburning techniques will create high temperatures in and around your appliance, its flue pipe and the chimney. Check with a WETT certified professional to ensure that your woodburning system is properly installed and in good condition before using these methods. As long as it's in good shape, these techniques will not damage your appliance, but will keep it burning cleaner and operating better.

*Wood is a "hydrocarbon" fuel, made up of carbon, hydrogen and Oxygen. When it is heated in the presence of oxygen, it decomposes, and its chemical constituents are rearranged. In the process, heat and light are given off.*

### UNDERSTANDING COMBUSTION

The first step in getting your appliance to work properly is to understand how and why wood burns. As wood burns, it goes through three phases:

➤ boiling off water in the wood. "Green" firewood is between 35% and 50% water. Properly seasoned wood is about 20% water. The more water in the wood, the more energy the fire will use boiling it instead of producing heat.

➤ the smoke or flame stage. As the wood heats up above the boiling point of water, it starts to smoke. The hydrocarbon gases and tars that make up the smoke are combustible if the temperature is high enough and oxygen is present. When the smoke burns, it produces bright flames. If it doesn't burn in the firebox, it may condense in the chimney, forming creosote. Your goal should be to achieve complete combustion of the smoke, which accounts for about half the total energy in firewood.

➤ the charcoal stage. Charcoal accounts for the other half of the energy in firewood. It is what is left after most of the hydrocarbons have burned off. Charcoal is almost 100% carbon, and burns with very little flame or smoke as long as there is enough oxygen.

## THE THREE "T"s

There are three requirements for complete combustion: Time, Temperature and Turbulence.

### Time

The conditions for combustion must last long enough for the smoke to burn. Efficient modern wood stoves are specially designed to keep the smoke in the firebox long enough to burn it.

### Temperature

The smoke will only burn if the temperature in the firebox is above 540°C (1000°F). The fireboxes of efficient wood stoves are specially designed and insulated to create and maintain these high temperatures.

### Turbulence

To burn, the smoke must be mixed thoroughly with oxygen. Efficient modern wood stoves are designed to provide plenty of combustion air, and many include devices to increase turbulence.

But combustion efficiency is not just affected by the design of your stove. The way you operate it is very important.

*A mistake most people make when preparing firewood is to make the pieces too large. While this means less splitting, it also means a great deal of fussing and frustration with reluctant fires. Smaller pieces will ignite faster and burn more reliably. See WISE fact sheet #11 ("Purchasing, Processing and Seasoning Wood") for more helpful hints.*

## THE FIRING CYCLE

Wood burns best in cycles. A firing cycle is the time between the ignition of a fresh load of wood and its consumption to a coal bed. Each firing cycle should provide between four and eight hours of heating.

Don't expect perfectly steady heat output from your appliance. Once the fire is established, ignore it until the room or house starts to cool off. Try to plan your firing cycles ahead: you'll find you use less wood and that the house won't overheat as often.

Plan the firing cycles to match your household routine. If someone is home all day, there is no real need to build long-lasting fires, and you can use at least four cycles - starting in the morning, at noon, in



the evening and before bed. If the house is empty all day, use three cycles - morning, later afternoon and before bed.

The operating suggestions provided below are of a general nature. Specific operating techniques for certain types of appliances, such as downdraft or catalytic stoves, may vary, and you should consult the operating manual for detailed instructions. If you do not have an operating manual, write to the manufacturer to request one. (The manufacturer's name will be on the label of a certified appliance.)

However, the general principles outlined here, planning your firing cycles, using small flash fires when you don't need much heat, and avoiding slow, smoldering fires, can be applied to all woodburning appliances, as long as they are properly installed. If you have any questions about how to operate your woodburning appliance, ask a WETT certified professional for advice.

### Starting a Fire

- Clear the firebox of excess ashes.
- Fill the firebox completely with loosely crumpled newspaper held down with at least ten (10) pieces of finely-split dry kindling. Softwoods make the best kindling. Never use flammable liquids to start or "freshen up" a fire.
- Determine where the combustion air enters the firebox and light the fire there so that it gets plenty of air. Open the air inlets fully.
- When the kindling fire is well established, add 2 to 5 small (2 in. to 4 in.) pieces of wood on and behind the kindling. Be sure not to smother the flames.
- Once these pieces are flaming brightly and charred, add as much wood as necessary. Always place the new wood behind the burning wood to avoid smothering it.

### Rekindling from Coals

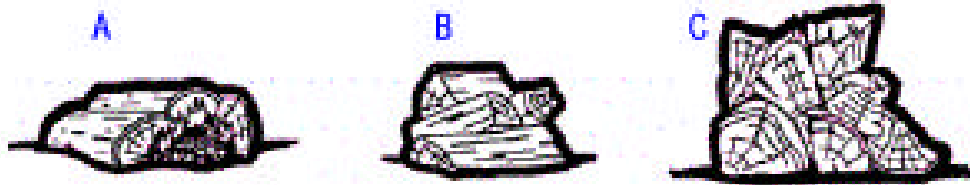
- Rake the live coals towards the combustion air inlet.
- Make a compact pile of charcoal and place small pieces of wood on and behind it. Open the air inlets fully.
- Once the fire is burning well, add more wood as needed, behind the burning wood.

*It's a good idea to use a flue pipe thermometer to monitor the temperature of gases in the flue pipe. The range of acceptable temperatures varies widely with appliance type, but generally the flue gases should not be hotter than 540°C (1000°F). Check with a WETT certified professional for more information.*

## Fuel Load Placement

The way you arrange the wood in the firebox has a big impact on how well the fire will burn. When loading wood onto a coal bed, use a minimum of three (3) pieces of wood to be sure that heat is produced faster than it's lost to the walls of the firebox. If you don't want much heat, use smaller pieces.

loosely stacked load of wood in a criss-cross arrangement burns quickly. A tightly packed load will burn more slowly. You can use different arrangements depending on the firing cycle you want.



A) Use at least 3 pieces of wood when rekindling from coals. Place them so that they make a pocket for the coals.

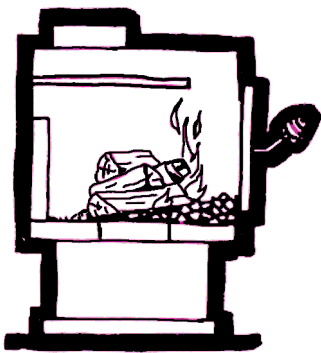
B) Stack wood loosely for a flash fire.

C) Stack wood tightly for an extended fire.

## The Flash Fire Technique

A flash fire is a small amount of wood burned quickly. It is useful when you don't need much heat, or when someone is home to tend the fire.

Many people who use "airtight" stoves try to reduce heat output by shutting down the combustion air supply. The result is a smoldering fire which wastes fuel and coats the chimney with creosote. It's much better to use the flash fire technique instead.



- Rake the charcoal towards the air inlets and load at least three (3) small pieces of wood on and behind it. The pieces should be stacked loosely in a criss-cross arrangement.
- Open the air inlet to produce a bright, hot fire. The air supply can be reduced slightly as the fire progresses, but never enough to extinguish the flames.
- When only charcoal remains, you can reduce the air supply further to avoid cooling the coal bed.

## The Extended Fire

In most properly sized appliances, a well-built extended fire will provide steady heat overnight and leave enough coals to rekindle the fire in the morning.

Extended fire. Remove excess ashes and rake the live coals forward before rekindling a fire.

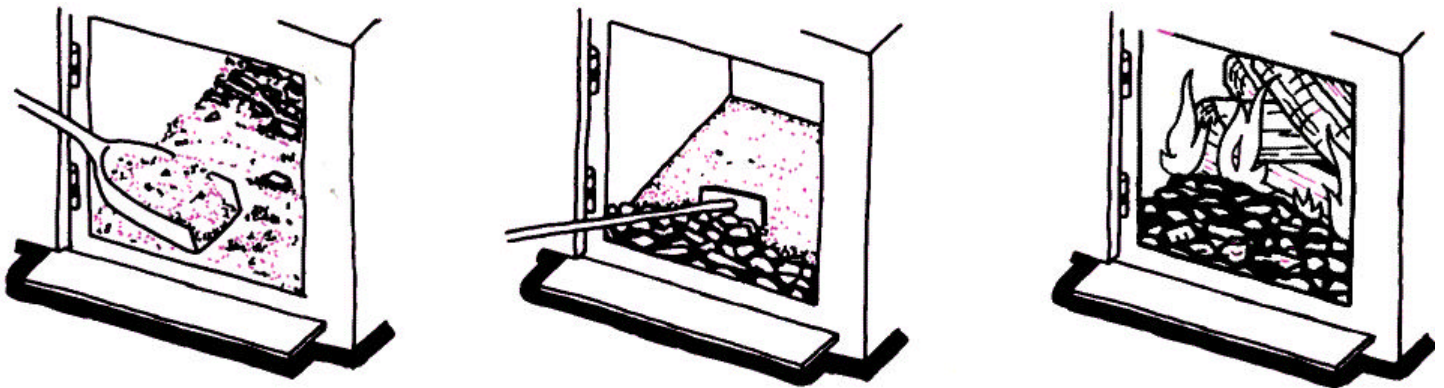
- Rake the coals towards the air inlets and use larger pieces of wood placed compactly in the firebox. Placing the pieces closer together keeps the heat and flame from penetrating the load too quickly and saves the buried pieces for later in the burn cycle so that you get a longer, steadier burn.
- Open the air inlets fully and leave them open for between 20 and 45 minutes, depending on the load size. This creates a hot fire that heats up the firebox.
- When the pieces are covered with a thick layer of charcoal, reduce the air control setting - but not too much! You want to produce a steady, flaming fire.



### Removing Ashes

In most appliances without grates, raking the coal bed will cause ashes to accumulate at the front of the firebox. To provide enough room for the new load of wood, you should remove this ash.

After an overnight fire, the live coals are at the back of the firebox, furthest from the air inlets. The ash at the front of the firebox can be removed without disturbing the coal bed. Each morning, you should remove a small amount of this ash. Scoop the ashes out with a small shovel and place them gently in a covered metal bucket. This simple task will take only a minute and will make stoking the fire easier. Store the bucket carefully - either outside, or on a concrete floor well away from walls or anything that could burn.



Following these simple techniques will help you get the most out of your firewood ...safely. For more information, talk to a WETT certified professional. He or she will be glad to answer any questions you may have.

*This fact sheet is intended only to provide an introduction to the topic of "Operating your appliance...safely" not a "how to" manual! Be sure to consult a WETT certified professional for more detailed information and explanations.*

## The WISE Fact sheet Series

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## Wood Energy Technical Training (WETT)

The Wood Energy Technical Training Inc, is a non-profit, educational institution established in 1988. Provincial affiliates of WETT Inc are dedicated to chimney and venting system safety, and to the elimination of residential chimney fires, carbon monoxide intrusion and other chimney related hazards that result in the loss of lives and property. WETT devotes its resources to educating the public, chimney service professionals, and other fire prevention specialists about the prevention and correction of chimney and venting system hazards.

WETT has developed a training and certification program for wood heat appliance installers, inspectors, chimney sweeps and other professionals called the "Wood Energy Technical Training" (WETT) program. Be sure that any wood heat professional you consult is WETT certified. Look for the WETT logo, it's your best guarantee of reliable advice. For additional information, contact:

*Wood Energy Technical Training Inc* at 1-888-358-9388 or fax at 1-416-968-6818 or email at [info@wettinc.ca](mailto:info@wettinc.ca)

The local British Columbia affiliate is the Wood Energy Technicians of British Columbia, aptly named "*WETBC*". They can be reached at [zigi@shaw.ca](mailto:zigi@shaw.ca) or phone/fax is 1-604-941-4172. Our web site is at [www.wetbc.ca](http://www.wetbc.ca)

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