

## Efficient, Convenient Wood Heating

### INTRODUCTION

More than one million Canadian families heat their homes at least partly with wood. For these households wood is an important energy source, one that involves their active participation. Having control over the fuel supply offers security from electrical power interruptions and shelter from rising conventional energy costs.

Considering the many advantages for those who live at the urban fringe and beyond, wood heating is worth doing right. “Done right” means making sure the wood heating system is installed exactly to safety codes, preparing good quality firewood and operating the system using techniques that will produce the best efficiency and effectiveness.

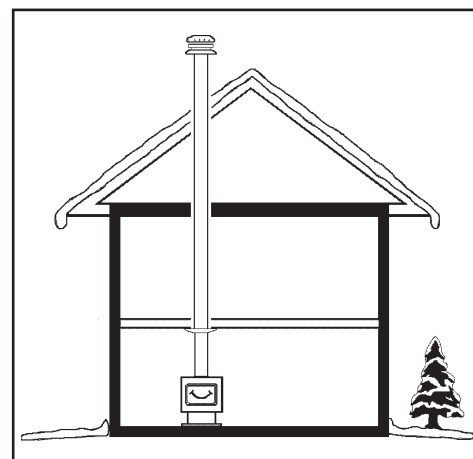
### SYSTEM DESIGN AND SAFETY

The chimney is a critical component of a wood-heating system. It is much more than a simple exhaust pipe. It is the engine that drives the system by producing the pressure difference, or draft, that draws in combustion air and expels exhaust outdoors.

To work properly, a chimney must be installed up through the warm space of a house, rather than through a wall and up the outside.

The venting system—the flue pipe and chimney—should be as straight as possible. The best performing system has the flue pipe running straight up from the flue collar of the wood-burning appliance to the base of a chimney that runs straight up through the roof (see Figure 1).

“Advanced-technology wood-burning appliances,” which have been available since 1990, are about one-third more efficient than older conventional units, such as 1970s and 80s “airtight” stoves. They are identified by their Environmental Protection Agency (EPA) certification or compliance with CSA standard B415 of the Canadian Standards Association (CSA) for low smoke emissions. If you are planning a new wood-heating system or thinking of replacing your older stove, take advantage of the new technologies and save yourself time, money and work.



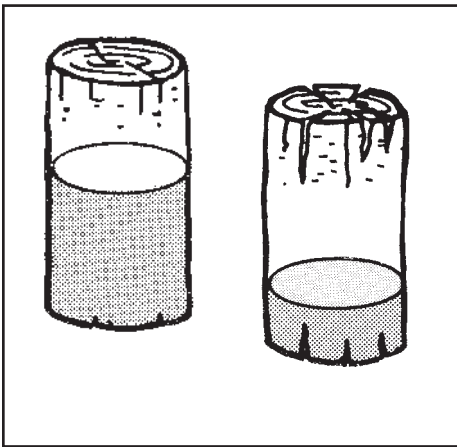
**Figure 1** This chimney and flue pipe arrangement gives the best performance

Your best resource for reliable wood-heating information and service is a WETT-certified retailer, installer or chimney sweep. WETT stands for the Wood Energy Technology Transfer program, Canada’s national training system for wood-heating professionals. You can find the WETT-certified professionals near you by visiting [www.wettinc.ca](http://www.wettinc.ca) or by calling WETT at 1-888-358-9388. In Quebec, visit l’Association des professionnels du chauffage (APC) at [www.poelesfoyers.ca](http://www.poelesfoyers.ca) or call (514) 270-4944.

## BUYING AND PREPARING FIREWOOD

Good quality firewood is essential for efficient and convenient wood heating. Good firewood is the right size for the appliance firebox and is properly seasoned.

While hardwoods like oak and maple are fine for very cold winter weather, softer woods like birch and poplar make better fuel for milder spring and fall weather.

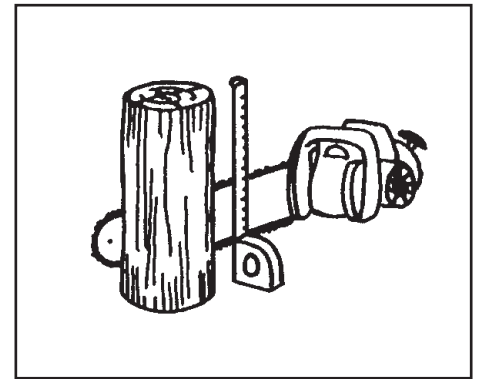


**Figure 2** Wood before seasoning (left) and after seasoning (right)

As much as half the weight of freshly cut logs can be water. This water content must be reduced to 15 to 20 per cent before the wood can burn efficiently. How you process and store the wood is critical to achieving this moisture reduction goal.

Cut the logs into pieces that are at least 7.5 cm (3 in.) shorter than the firebox. For convenient handling and fire management in most wood-burning appliances, firewood pieces should not exceed 40 cm (16 in.) in length. Piece lengths as short as 30 cm (12 in.) can be better for small heaters. Just because your stove's firebox can handle 50 cm (20 in.) logs does not mean that logs that long are needed or even desirable.

Split the wood into a variety of sizes for convenient fire building and maintenance. Large pieces are fine for large fires in cold weather but smaller pieces are needed in mild weather and for fast ignition of new fires or fires rekindled from coals.

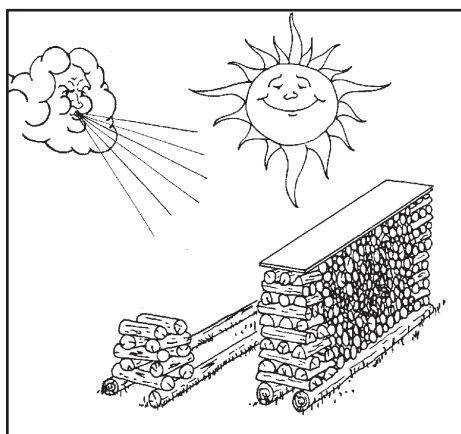


**Figure 3** In general, firewood should be cut 40 cm (16 in.) or less for convenient stoking

Commercial firewood is generally not split small enough. For most appliances, split the wood in a range of 8 to 15 cm (3 to 6 in.) measured at the largest cross-sectional dimension. Although this means more splitting and more pieces to handle, each piece is easier to lift and more importantly, fire management will be much more convenient all winter long.

## Storing wood

In the early spring, wood should be cut to the right length, split to a variety of sizes and stacked off the ground on rails in an open area exposed to sun and wind (see Figure 4). Prepared this way, the firewood will be ready for burning that fall. The tops of the stacks should be covered to prevent rain from soaking down through them. Prime time for firewood seasoning is the very hot days in July and August when the sun beats down, warming each piece of wood while gentle summer breezes rinse away the moisture driven out of the wood. If possible, don't pile wood in a shady area and never stack green wood in



**Figure 4** Stack wood on rails in an open area

a woodshed because it will not dry properly in time for the heating season.

In the fall, ideally after a few sunny days, move the wood to its winter storage location. Winter storage should be close to, but not inside, the house and fully sheltered from rain and snow so the wood stays dry.

## HOW TO START A FIRE WITH LITTLE OR NO SMOKE

A kindling fire that collapses into a smouldering mess is frustrating and also embarrassing if someone is watching. By following the suggestions offered in this *About Your House*, you can avoid future frustration by building kindling fires that ignite quickly and burn reliably.

The kindling fire should quickly heat up the chimney to create strong draft and heat the brick and steel of the firebox to create a good environment for stable combustion. The type and form of kindling materials affect the behaviour of the fire. The edges of split firewood heat up and ignite first, so the more edges there are close together in the kindling fire, the faster it will ignite.

Different wood-burning appliance designs mean that no single set of procedures will work perfectly in all appliance types. The suggestions made in this *About Your House* come from many years of experience and information from scientists, research studies, stove manufacturers, retailers, chimney sweeps and people who rely on wood to heat their homes.

The procedures discussed in this fact sheet are suitable for most current and older models where the fire is built on a solid hearth (not a grate); the combustion air reaches the fire at the front, nearest the loading door; and, there are no catalysts.

However, householders can adapt most of these suggestions to other designs, including catalytic stoves.

You may not be able to use all of the tips that follow exactly as presented, but you can adapt most of them to your circumstances. The result will be more consistent, efficient fires that produce the heating results you want.

Kindling pieces need to be finely split to produce many edges where the fire will first catch. The lower density and usually higher oil content of softwoods like cedar, pine and spruce make them better for kindling because they ignite more readily than hardwoods. The drier and more finely split the kindling, the faster and more reliably will the fire ignite and burn.

In preparing to build a wood fire, remove excess ash from the firebox. Ash should never be allowed to build up to more than 5 cm (2 in.) in thickness. Next, locate where the main supply of combustion air enters the firebox—that's where you want the fire to first ignite. Open the air control fully.

There are two popular strategies for building kindling fires that don't collapse and smother themselves: the two parallel logs technique and the top-down fire technique.

### Two parallel logs

Place two split logs parallel to each other in the firebox with a space between. Fill the space with crumpled newspaper and fine kindling and place several larger pieces of kindling crosswise on top. Light the paper.

### Top-down fire

First, place two or three standard-sized pieces of wood in the firebox. Then add a few pieces of heavy kindling. Finally, add some fine kindling. Roll up single sheets of newspaper, tie a knot in each and place four or five on top of, or in front of, the kindling (see Figure 5). Light the paper.

This type of kindling fire can provide two or more hours of effective heating without having to open the door to add wood or adjust the fire.

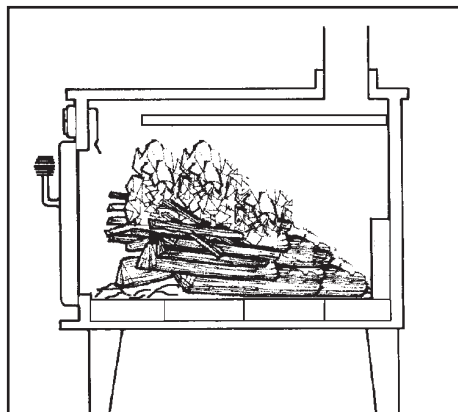


Figure 5 A top-down fire

Owners of small stoves oriented east-west (see Figure 8 on page 6) may have some trouble using either of these methods. One way to make lighting fires easier in small, east-

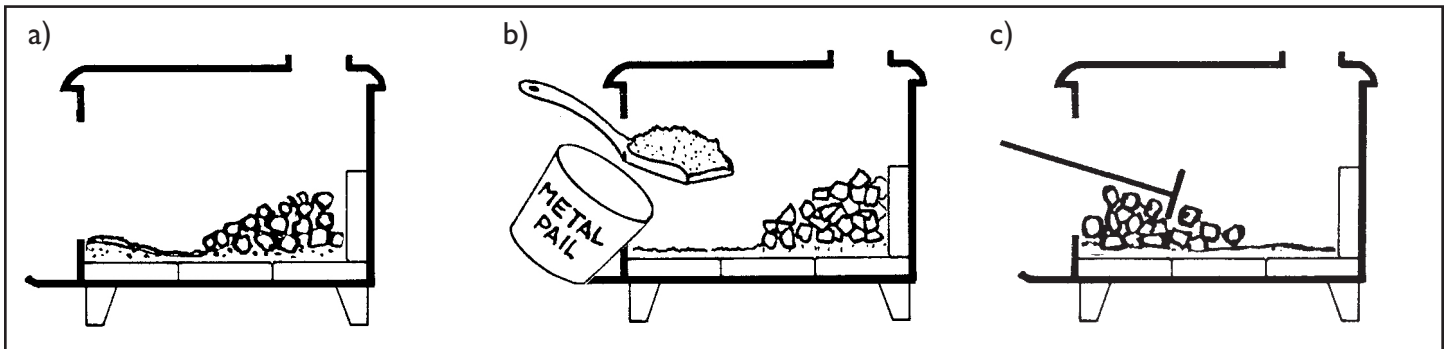
west stoves is to cut some of your firewood in half, especially logs intended for kindling, so that each piece is only about 20 cm (8 in.) long. A kindling fire of small, criss-crossed pieces should light easily if the wood is dry enough.

Leave the combustion air inlet open at least until the firebox is full of flames, the surface of the wood is charred black and the edges of the pieces are glowing red.

### OPERATING A WOOD HEATER EFFECTIVELY

The key to maintaining efficient wood fires is to prevent the wood from smouldering because any smoke that passes out of the firebox will condense as creosote in the chimney or be emitted outdoors as air pollution. Smoke is not a normal, unavoidable by-product but is waste resulting from poor combustion. There will be no visible smoke from your chimney if the wood burns with bright, active flames.

After an overnight fire, you will find some coals at the back of the firebox, furthest from the combustion air inlet, and some residual ash at the front of the firebox near the door. This is the



**Figure 6** (a) coals at back, and ash at front; (b) removing ash; and (c) raking coals

best time to remove a small amount of this ash. How you handle the remaining charcoal can have a big effect on how much creosote and air pollution your fire makes. Don't spread the charcoal out evenly and place a new load of wood on top. This can lead to extended smouldering before the wood ignites.

Find where the combustion air enters the firebox. For most stoves, fireplaces and furnaces this is at the front at the loading door. Rake the coals toward the air inlet. To rake the coals properly, you'll need the right tool (see Figure 6).

While many stove and fireplace tool sets include a poker, these are for decorative fireplaces. A properly built

heating fire should not need poking. A rake is the best stoking tool for heating fireplaces, stoves and furnaces. A simple rake can be made by welding a steel rod of suitable length to the centre of a steel rectangle about the size of a business card.

Place the wood on and behind the coals (see Figure 7). Always place the smallest, driest piece of firewood directly on the raked coal bed to act as the igniter. Your igniter should begin flaming almost immediately, and as it burns it will ignite the larger pieces.

Avoid adding a log each hour in an attempt to produce a steady heat output. Wood burns best in cycles. A cycle begins when a new load of

wood is placed on and behind a coal bed and ends when that wood is reduced to a similar-sized coal bed.

The type of fire you build should depend on how much heat you need to produce and how long it will be until the next loading. For

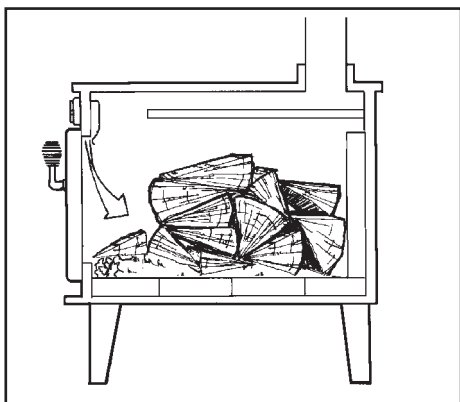


**Figure 7** A small, criss-crossed load for mild weather

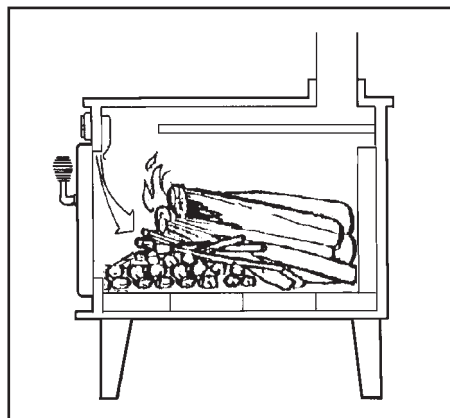


example, to produce a low-heat output fire during relatively mild weather, use small loads of softwood in a criss-cross formation. The softwood will burn quickly and will not leave a large coal bed that can overheat the house. When logs are arranged loosely criss-crossed in the firebox, even a small load ignites quickly and burns reliably.

To produce high heat output in cold weather, use larger loads of harder wood placed compactly in the firebox. If your firebox floor is roughly square, you can load the wood east to west so the combustion air reaches the side of the logs, or north-south so the air approaches the ends of the logs. An east-west load breaks down more slowly, so is a good orientation for



**Figure 8** An east-west load



**Figure 9** A north-south fire

overnight fires in spring and fall when heat demand is low. A north-south load can be larger, but breaks down more quickly, so it is good for high output, long-lasting fires in cold weather. Most small wood stoves are oriented either east-west or north-south and the other dimension is too small for practical loading. Only users of larger wood stoves have the option of load orientation to manage heat output.

Leave the air control fully open until the firebox is full of flames, the new wood is charred black and the edges are glowing red. Turn down the air control in two or three stages to avoid shocking the fire into a smoulder. Long burn times are not an indication of efficiency or

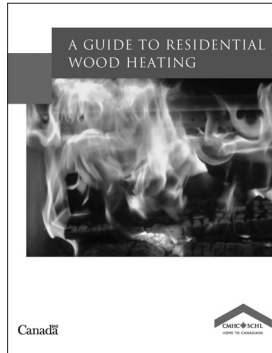
effectiveness. In fact burn cycles of eight hours or less usually achieve peak efficiency and effectiveness.

Because it takes a lot of work to gather firewood, cut it, split it and store it, most people who heat with wood try to conserve fuel. The most obvious efficiency loss is the heat left in the exhaust as it enters the chimney. It is tempting, therefore, to view this heat as waste and to operate the heater so that the flue gas temperature is kept low. This can be counterproductive, because heat released to the chimney is not waste but is the fuel the chimney needs to produce draft and stay clean. Also, burning low to reduce heat loss to the chimney can lead to smouldering, smoky fires, which are extremely inefficient and sometimes dangerous.

About 1/5<sup>th</sup> of the heat from the burning wood should be given to the chimney to produce a strong, stable draft—the pressure difference that drives the system. So, give your chimney the heat it needs to stay healthy. In mild weather, it is usually more efficient to burn a series of short, hot fires throughout the day than to try to burn one load of wood slowly.

## SUMMARY

- You cannot burn efficiently in an unsafe wood-burning system. Have your system inspected and upgraded if necessary before using these techniques.
  - The biggest single efficiency boost you can achieve is by upgrading to an EPA/CSA B415-certified, low-emission, high-efficiency appliance.
  - The length and piece size of your firewood should match the size of your appliance firebox. For efficient and convenient operation, firewood should be cut shorter and split smaller than has been customary.
  - Build kindling fires that do not collapse as they burn. Use finely split, dry softwood as kindling.
  - Wood burns most efficiently in cycles, not by adding one log at a time to produce steady output.
  - When rekindling from hot coals, rake the charcoal towards the air inlet and place the new load of wood on and behind the coals.
- Here are five ways to control heat output:
1. Use softwood, like poplar and spruce, for low heat in mild weather. Use hardwoods, like maple and oak, in colder weather.
  2. Build smaller fires for low output in mild weather and larger fires in cold weather.
  3. Firewood loosely criss-crossed in the firebox burns well in small, hot fires in mild weather. Wood stacked compactly in the firebox is better for longer fires in cold weather.
  4. East-west loads break down more slowly, so they are good for long, low-output fires in mild weather. North-south placement permits larger loads that break down a little faster, making this arrangement better for long fires in cold weather.
  5. Turn down the air control to reduce the firing rate. Turn it down in two or three stages to prevent shocking the fire into a smoulder. Never turn it down so much that the flames go out.



## **A Guide to Residential Wood Heating**

This Guide for homeowners looks at how to heat your home safely and in an environmentally friendly way. Topics include advanced wood heating technologies, chimneys, accessories and installation. You'll learn how to prevent smoke, smell and cold hearths and how to properly maintain your wood heating system. Also included is a guide to calculating your heating costs, to help you choose between alternatives.

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