



Why burn wood?

Wood is a wonderful way to heat any space that is occupied by people, whether it is a home, an office, a workshop or a store. There is something cozy and friendly about wood heat — the way the wood looks when it is stacked, the way the heat radiates throughout a room, the way the smoke smells as it wafts from the chimney.

Maine people have always had a deep affection for their woodstoves. Today, more than 50 percent of all of Maine's households rely on wood as their primary or secondary source of heat. Since Maine is the nation's most heavily forested state (90 percent of Maine is forested), Maine's reliance on wood heat can be expected to continue.

*There's no doubt about it,
the radiant heat
from a woodstove
or fireplace
is inviting
and friendly.
People love
to gather around
the woodstove to read,
to visit, or even to snooze
in a favorite armchair.*

The MAINE WOODBURNING GUIDE

Here are a few of wood heat's advantages:

AVAILABILITY: Again, in a state that is 90 percent forested, there is little chance that wood burners will run out of fuel. Virtually all parts of Maine provide plenty of fuel for the woodstove.

COST: Like any other fuel, the cost of firewood can fluctuate according to supply and demand. But wood is almost always a good buy, even when wood costs are up and fuel oil prices are down.

"COZINESS": There's no doubt about it, the radiant heat from a woodstove or fireplace is inviting and friendly. People love to gather around the woodstove to read, to visit or even to snooze in a favorite armchair. You can't get that same cozy feeling by gathering around the oil furnace!

Of course, there are some disadvantages to wood heat as well. Here are a few of them:

SAFETY: Every year, houses in Maine are damaged or destroyed by fires that started near a woodstove or chimney. Woodstoves or other woodburning appliances that are properly installed, maintained and operated are no more dangerous than other heating systems, but they still can and do start fires (See "Burning Wood Safely" section on Page 14.)

POLLUTION: All heating devices that combust fuel are sources of pollution. Older woodstoves and other devices are much more polluting than new ones — modern woodburning technology has reduced pollution levels enormously.



CLEANLINESS: Some people complain that carrying wood into the house, cleaning the ashes out of the family woodstove, cleaning out the chimneys, and dealing with the small amounts of smoke that can puff out into the room can make housekeeping a more difficult chore.

No matter how you look at wood heat, the one thing that everyone can agree upon is that heating with wood is not automatic! The efficiency, safety, cleanliness and level of pollution associated with wood heat depends heavily on the person who burns the wood.

*The efficiency,
safety, cleanliness,
and level
of pollution associated
with wood heat
depends heavily
on the person
who burns the wood.*

This publication is designed to help make you a better wood burner. It explains what to look for in a woodstove or other woodburning appliance; it explains the ins and outs of the fuel that goes into the woodstove; and it tells you what you need to do to install and operate your woodstove safely and efficiently.

Even after you read this booklet, you may well have additional questions about woodburning. Here are a few other sources of information:

- Your local fire officials.
- Your local Cooperative Extension Agent.
- The State Fire Marshal.
Telephone 624-8744.
Mailing address: 164 State House Station, Gardiner, ME 04345.
Physical address: 397 Water Street, Gardiner, ME 04345.
- Energy Conservation Division
Department of Economic and Community Development
59 State House Station
Augusta, ME 04333-0059
624-9800

Woodburner's Tip

Whenever you load your stove, make sure that the flue and your stovepipe are open. Open the firebox door slowly to allow the fire to adjust to the airflow. That will help carry the smoke up the chimney instead of out into the room.



THINGS TO KNOW about woodburning equipment

Woodburning equipment has come a very long way from the days when woodstoves were little more than big cast-iron boxes with a door at one end and a stovepipe at the other.

It's still possible to buy simple woodburning stoves, or to construct traditional fireplaces. But the other end of the woodburning spectrum is a high-tech world of new ideas, new hardware and even new fuels that make heating with wood much cleaner and more efficient.

*When it comes
to woodburning,
bigger is
definitely not better.*

An important point in woodburning technology came about in 1988, when new federal regulations for woodburning appliances went into effect. Now, new woodburning appliances must be rated, much as cars are rated for fuel efficiency. Woodburning stoves, fireplace inserts and other appliances are now rated by the federal Environmental Protection Agency (EPA), and their efficiency ratings are printed on labels attached to the appliances before they are sold.

Up until 1988, airtight woodstoves had an average efficiency of around 50 percent. But since that time, efficiency ratings have moved up quickly. New appliances with catalytic combustors now have average efficiency ratings of 72 percent. New devices without catalytic combustors

average 64 percent. The new pellet-burning appliances are even better, averaging 78 percent efficiency.

Before deciding which appliance is best for you, however, you must determine what size appliance will work best in your home. Probably the most common mistake that new wood burners make is selecting an appliance that is too big for the space that it must heat.

When it comes to woodburning, bigger is definitely not better. Here's why: For wood heat to work properly, the appliance should work at or near its maximum efficiency. That means the appliance must contain a good, hot fire. If the appliance is too large for the space it must heat, it will have to be damped down. That means the fire will smoulder rather than burn, and that will increase creosote and pollution. It also means that a fair amount of unburned energy will escape up the chimney.

Remember that stoves and other woodburning appliances are rated according to their maximum heat output, measured in BTUs/hour. That rating should be roughly equal to, or only slightly greater than, the heating load of the space you plan to heat.

Here is an example:

Let's say your 1,200 square foot house has average insulation (R-19 in the ceiling, R-11 in the walls, R-2 rated windows), and that there is a .75 air change (infiltration) rate per hour. This average-sized house will have a maximum hourly heating load of about 54,000 BTU/hour.

You should look for a stove that delivers around 54,000 BTU/hour of heat — perhaps just



a little higher. But don't forget these variables! A very tightly-sealed home will need less heat. So will a home that is more heavily insulated. Drafty homes, or homes with smaller amounts of insulation, will need systems with more heating capacity.

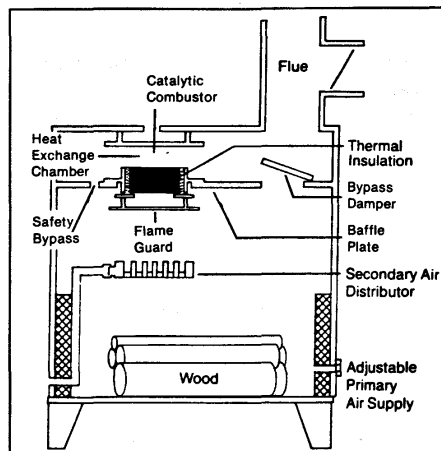
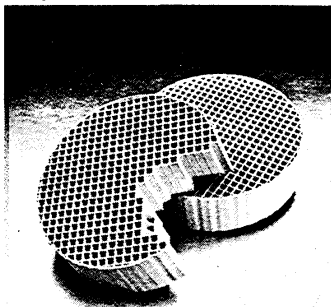
Once you have determined the size of the appliance you need, the next step is to determine the type of appliance that would be best for you. As a first step, let's take a look at some of the new woodburning technology. Later, we'll look over the typical appliances that are available.

(For Additional information on sizing your woodstove, contact your dealer or equipment manufacturer.)

CATALYTIC COMBUSTORS

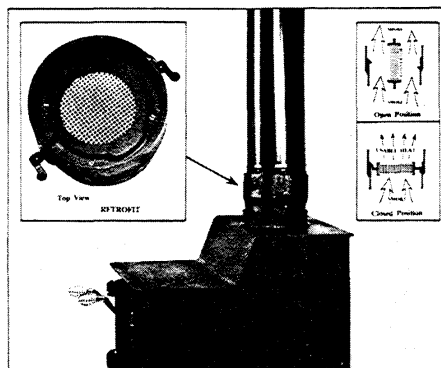
Once a rare "high tech" component found only occasionally, catalytic stoves and inserts have become much more common as manufacturers have searched for ways to make their products comply with government emission standards. Today, more than half of all certified stove and insert models rely on some sort of catalytic technology.

A catalytic combustor is a honeycomb-shaped device that works on the same principle as the catalytic converters that are installed in automobiles to reduce emissions. It burns gasses and carbon material that would otherwise go up the chimney.



Catalytic combustors are designed to reduce emissions, and also offer the side benefit of reducing creosote buildup. This prevents chimney fires, and increases the time between chimney cleanings.

Here is how they work: gasses and carbon material in smoke won't ignite until temperatures reach around 1,100 F, and woodstoves generally operate somewhere below 800 degrees F. The catalytic combustor is coated with platinum, palladium or some other catalyst material which reduces the ignition point of the gasses to around 400 degrees F. The smoke and gasses ignite and burn as they pass over the combustor.



The MAINE WOODBURNING GUIDE



Stoves with catalytic combustors are efficient and clean, and they reduce chimney cleaning costs. But there are a few cautions to keep in mind:

THE RIGHT TEMPERATURE

If stoves with catalytic combustors are operated too hot, the combustor can be damaged. If too cool, particles can stick to the combustor and gum it up. Stoves with catalytic combustors should be equipped with by-passes that allow smoke to move around the combustor until the stove gets up to temperature.

THE RIGHT FUEL

The wrong fuels can cause serious damage to a catalytic combustor. If your stove has a combustor, never burn garbage, plastic, painted wood, driftwood, colored paper or any materials that contain lead or potassium.

COST

Prices for catalytic combustor stoves range from \$750 to \$1,900. The price range for non-catalytic combustor stoves is \$750 to \$1,400. Wood pellet stoves (which we will discuss later) usually range from \$1,500 to \$2,500.

The combustors last anywhere from one to 10 years, but they eventually must be replaced at a cost of around \$150. But before you worry too much about increased costs, consider that federal regulations require manufacturers to guarantee catalytic combustors for three years. Remember, too, that the increased expense will be offset by savings in chimney cleaning and fuel.

Do you like the idea of a catalytic combustor, but already own a perfectly good stove that doesn't have one? There is a way around that problem — just purchase a catalytic damper, a combustor in kit form that installs in the flue pipe. It doesn't work quite as well as an actual catalytic combustor stove, but the cost is reasonable — usually between \$85 and \$140.

“NONCATS”

EPA-certified woodburning appliances that rely on design features other than catalytic combustors are sometimes referred to as “noncats”. About 40 percent of certified woodburning appliances are noncats, and that share is increasing as manufacturers develop ways to make woodburning appliances of all kinds more efficient.

This increased efficiency comes from optimizing the amount of air that mixes with the gasses and flames, often by mixing preheated air in the secondary combustion chamber with exhaust gasses. This allows more of the gas and soot particles to burn rather than escape up the chimney.

Noncats don't require much attention, and they don't need periodic part replacement. When noncat lifetime performance is compared to the lifetime performance of stoves with catalytic combustors, performance levels are about the same.

Still, noncats do have some drawbacks:

1. The newer noncats tend to have smaller fireboxes. That means shorter sticks and more frequent refueling. (Experts believe firebox size for noncats will increase in the coming years, however.)
2. At low burn rates, noncats are more polluting than appliances with catalytic combustors.

PELLET FUEL

Pellet-burning appliances are fueled by wood pellets which are made from compressed wood and such agricultural waste as rice hulls and corn husks. The pellets, which resemble rabbit food, are fed into the appliance's combustion chamber automatically, often controlled by computer. Pellet-fuel appliances may have more than one burn setting, may be equipped with thermostats, and may deliver heat via forced air systems.



Pellet-burning stoves are very efficient, often supplying between 10,000 and 70,000 BTU per hour and operating at 78 percent efficiency. Some burn so cleanly that they do not need chimneys, relying instead on wall vents made from special insulated pipe.

Pellet stoves must be refueled anywhere from once a day to twice a week. Refueling is simple — just pour pellets into a hopper which holds between 35 and 150 pounds of fuel pellets. The pellets are drawn into the firebox as needed by an auger.

Pellet appliances usually cost between \$1,500 and \$2,500. But since the pellet stove may not need a chimney, the total cost of the installed system may be less than that of a conventional woodburning stove.

While these appliances are very efficient and require little tending, there are some disadvantages:

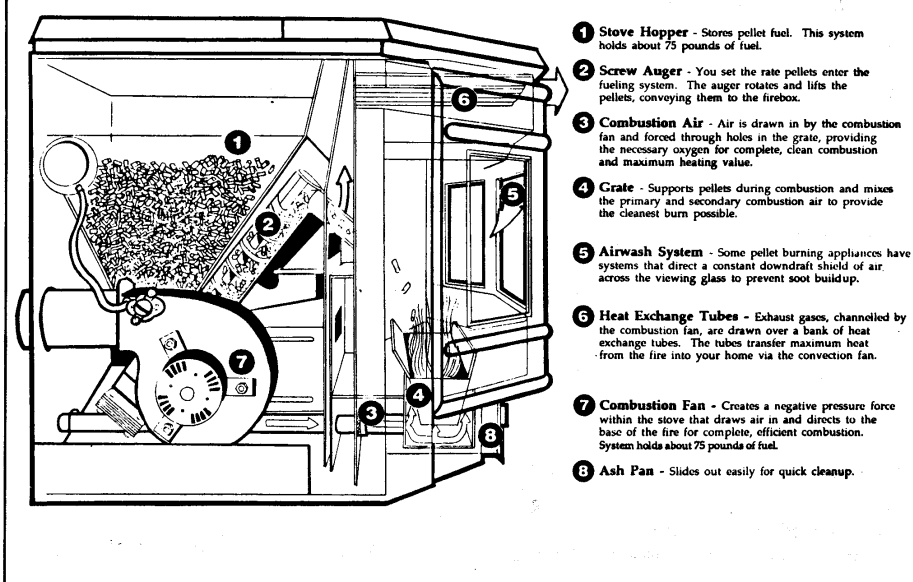
1. Air for combustion and for exhausting of flue gasses must be supplied by an electric fan which uses about 100 kWh each month. This adds some expense to your monthly household budget, and it also prevents the appliance from working during power outages.

2. Fuel pellets may not be available in your area. The pellets are usually sold in 40-60 pound bags, or may be sold by the ton and delivered in bulk. Make sure you purchase “residential” fuel pellets which have an ash content of about 1 percent.

FREE-STANDING STOVES

Free-standing woodstoves have been around for years, and they are available in a variety of shapes and sizes. The major difference between the stoves of today and the stoves of a generation ago is efficiency — modern stoves must be EPA-certified, and have efficiency ratings of 68 to 75 percent.

Schematic of Wood Pellet Stove





Most modern stoves are made of cast iron, plate steel, sheet metal or some combination of those materials. Cast iron stoves are more susceptible to cracking, and they take a bit longer to heat up. Steel stoves are more prone to warping when exposed to high heat. Sheet metal stoves usually use 16- to 20-gauge steel as an exterior material, and are usually lined with cast iron or heavy plate steel.

Whatever the material, stoves may have doors on the front, the side or on top. Top loaders are usually easiest to load, but they are also most likely to expel smoke into the room. Some modern stoves have glass doors that make the flames visible. Some of these models use airflow systems that keep the glass doors free of soot.

***Whatever stove
you choose, don't neglect
the chimney. Make sure
that any existing chimney
is in good repair
and is capable
of serving your new stove.***

Such modern woodburning technology as catalytic combustors and wood pellet fuel systems are available in modern woodstoves. Other features may include fan-driven heat exchangers, firebox pipe systems or secondary burn chambers, which trap heat from catalytic combustors and radiate it into the room. Stoves are also available in a variety of styles and colors, and may have marble or porcelain exterior panels.

Whatever stove you choose, don't neglect the chimney. Make sure that any existing chimney is in good repair and is capable of serving your new stove. New masonry chimneys

are expensive, but you may be able to use a prefabricated metal chimney. These chimneys are relatively easy to install, but make sure the chimney has been tested and approved for woodburning. For more information on chimneys, be sure to read the "Burning Wood Safely" chapter in this booklet.

FIREPLACES

Masonry fireplaces are cozy, beautiful, and terribly inefficient. They suck up huge amounts of warm indoor air and send it up the chimney, whether the fireplace is in use or not. In fact, fireplaces can actually send more heat up the chimney than they radiate into the room.

But masonry fireplaces don't have to be as inefficient as they used to be:

- The back of the fireplace can be slanted, allowing more heat to radiate into the room.

- Glass doors can be installed so that the amount of air allowed into the fireplace can be regulated. (The problem is that the glass doors also cut the fireplace's radiant heat.)

- The fireplace can be built in such a way that combustion air is drawn from outside, rather than from the room.

- Fan-driven heat exchangers or passive heat vents can be built into the fireplace.

FIREPLACE INSERTS

A fireplace insert is really a woodstove that fits into a fireplace. The EPA certifies inserts in the same way that it certifies woodstoves, so inserts are considerably more efficient than they used to be.

Some inserts fit completely into the fireplace cavity, while other protrude out onto the hearth. The style that protrudes can be more efficient, since the sides and top of the insert can radiate warmth into the room.



The National Fire Protection Association requires that inserts be installed with a positive connection to the chimney.

Some inserts fit completely into the fireplace cavity, while other protrude out onto the hearth. The style that protrudes can be more efficient, since the sides and top of the insert can radiate warmth into the room.

FACTORY-BUILT FIREPLACES

These units are sometimes called "zero-clearance" fireplaces, and they apply modern woodstove technology to fireplace construction. By using tight-fitting glass doors, combustion air control and passive or fan-driven heat vents, some of these fireplaces can reach efficiency levels as high as 67 percent.

A type of manufactured fireplace is the modular masonry fireplace — metal or masonry fireboxes often framed in enameled cast iron. These fireplaces use some of the technology used in masonry stoves (see below) — heat storing thermal mass and efficient combustion.

MASONRY STOVES

Heat-storing masonry stoves, sometimes known as "Russian fireplaces", have been popular for years in Europe, but are finding more acceptance in northern parts of the U.S. Masonry stoves are really huge woodstoves that store and radiate heat.

Masonry stoves have three components — masonry mass, a firebox, and a long smoke/heat channel. Small but intense fires are lit in the fire box once or twice a day. The heat from the fire is stored in the masonry mass, and radiates out into the home over several hours.

Masonry stoves are really huge woodstoves that store and radiate heat.

Masonry stoves are custom built and can include a number of features, including an oven, a cook top, or heated benches.

While masonry stoves are efficient and can heat large areas, they have a number of drawbacks. Because the masonry mass heats and cools so slowly, room temperature cannot be easily regulated. Installation can be expensive — ranging from \$5,000 to \$30,000.

CENTRAL FURNACES AND BOILERS

Central woodburning furnaces and boilers are good choices when a home's layout prevents heating with a single woodstove. They can tie into existing heat distribution systems, and can be controlled by a thermostat, just as an oil or gas furnace can be regulated. Wood-fired furnaces can either stand alone or can be purchased as wood/oil or wood/gas combination units.

Wood furnaces are exempt from EPA emission standards. Their combustion efficiency ratings are usually well below woodstoves — often around 50 percent.



Things to know about wood and other fuel

When it comes to wood heat, what you burn is every bit as important as how you burn it. The very best woodburning appliance won't help you if you burn the wrong kind of wood, or if the wood isn't prepared for burning when it goes into the firebox.

***When it comes
to wood heat,
what you burn
is every bit as important
as how you burn it.***

Whether you plan to cut your own wood or buy it from a dealer, there are a number of things to be aware of. Here are a few questions to keep in mind:

— WHAT KIND OF WOOD IS IT?

Any wood will burn, but some species burn better than others. And if you're splitting your own wood, remember that some woods split easily while others don't. If you plan to buy your wood, remember that wood with low heating value should cost less per cord than wood with high heating value.

Generally, the heavier or denser the wood, the higher the heating value. Different wood species have different heating values. But remember that weight can also be affected by water content. Take a look at the table below to compare the heat values of different wood species.

Characteristics of commonly burned woods

Species	Air-dry Wt. (lb/cord)	BTU/cord (millions of BTU)*	Fuel oil Equivalent (gal)**	Ease of Splitting	Ease of Starting	Coaling Qualities
Sugar Maple	4,600	21.8	155	good	poor	excellent
Red Oak	3,900	21.7	155	good	poor	excellent
Beech	3,900	20.9	149	poor	poor	good
Yellow Birch	4,000	20.9	149	poor	poor	good
White Ash	3,800	20.5	146	excellent	fair	good
White Birch	3,800	18.2	130	excellent	good	fair
Tamarack	3,600	18.7	134	good	good	poor
Red Maple	3,200	19.1	136	good	fair	good
Grey Birch	3,500	17.5	125	good	excellent	fair
Elm	3,100	17.7	126	poor	fair	good
White Pine	2,700	14.2	107	excellent	excellent	poor
Hemlock	2,600	15.0	107	good	good	poor

* Does not take efficiency of woodstove into account

** Assumes 140,000 btu/gallon and does not take efficiency of oil burner into account

— **IS IT SEASONED?** Up to 50 percent of the weight of green wood is water. That water has to be removed for the volatile materials in the wood to burn properly. Green wood will burn, but much of the heat produced will be used to evaporate the water, and that will greatly reduce the amount of heat your stove will generate.

Remember that most of the wood you buy will be delivered green — buy it enough in advance of the burning season to give the wood time to season, or dry. It usually takes at least six months of air drying under cover for wood to be considered dry. "Air dried" wood is wood that contains 20 percent moisture or less.

Sometimes wood dealers will advertise "seasoned" or "dry" wood, and it is usually more expensive than green wood. Make sure the dealer's claims are true — seasoned wood should be cut, split, and then stored under cover for at least six months before it is sold.

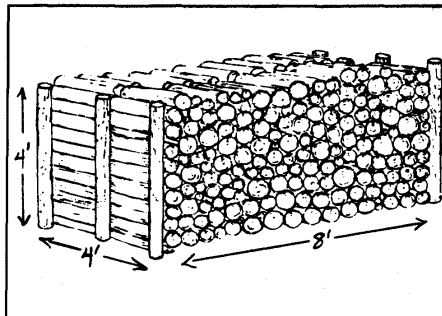
— **IS IT A FULL MEASURE?** Wood is usually sold by the cord, a traditional wood measure that is equal to a stack which is four feet wide, four feet high, and eight feet long. A cord contains 128 cubic feet of wood.

If you are buying your wood and you buy it by the cord, make sure you get your money's worth. And remember a cord of wood will NOT fit in the back of a normal-sized pickup truck.

You may also buy a "loose cord" of wood. A loose cord made up of 12-inch or 16-inch pieces would occupy 180 cubic feet, while a loose cord of 24-inch wood would occupy 195 cubic feet. In both cases, the wood would occupy the standard 128 cubic feet if it were stacked.

There are other terms used sometimes to describe quantities of wood, such as "load," "rick" or "pile." These terms are NOT legal to use when advertising wood in Maine.

Maine has laws which specifically govern the selling of wood. Dealers are required



to provide buyers with delivery slips which must contain all of the following information:

- Name and address of the seller.
- Name and address of the buyer.
- The date the wood was delivered.
- Quantity delivered, and quantity upon which price was based if different from the quantity delivered.
- Species of wood and percentages delivered, such as 35% oak, 25% maple, 25% beech, and 15% other hardwood.

After delivery, it is a good idea to stack the wood so it can be accurately measured. If you feel you have been shortchanged, there are a number of avenues open to you.

The first step should be a direct conversation with the dealer. If that attempt doesn't work out to your satisfaction, you may contact the Bureau of Weights and Measures in Augusta at 287-3841.

Another avenue is to file a complaint with the Consumer Fraud Division of the Attorney General's Office. The address is:

**Attorney General's Office
Consumer Fraud Division
6 State House Station
Augusta, ME 04333-0006
626-8849**

The MAINE WOODBURNING GUIDE



Burning Wood Safely

According to the Consumer Product Safety Commission, woodstoves and other types of fixed heaters cause more than 39,000 residential fires in the United States every year. Anyone who considers wood heat must pay close attention to safety — safety at the time of installation, safety when it comes to operating the woodstove, safety in disposing of the ashes, and safety in maintaining the appliance, the stove-pipe and the chimney.

INSTALLATION

Any solid-fuel appliance that is professionally installed in Maine, and all appliances installed in public buildings, must meet strict standards established by the state Fire Marshal's Office. These same standards should be followed as well by homeowners who install their own appliances, whether they burn wood, wood pellets or coal.

Installation standards apply as well to woodburning central heating equipment, which is defined as systems that carry heat by pipe or ductwork. These standards are established and enforced by the state Oil and Solid Fuel Board. Central heating units sold in Maine must be listed by an approved laboratory such as Underwriters Laboratory or the Energy Testing Laboratory of Maine. These approved devices must be sold with installation instructions.

Woodburning devices which do not have to be listed may or may not be accompanied by installation instructions. If instructions are

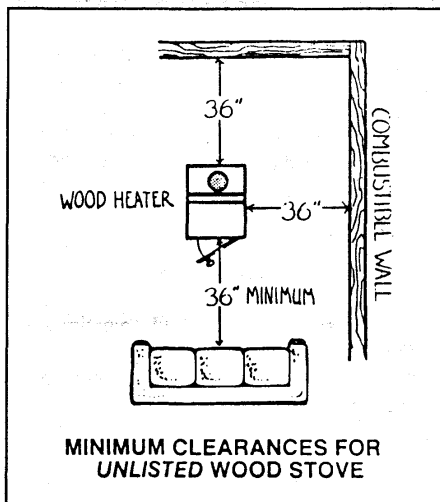
included, you should follow them carefully. If instructions are not included, you may follow the following guidelines.

CLEARANCES

Take particular care to provide enough clearance for your new woodburning device. The amount of clearance needed will depend to some degree on the type of device you are installing — whether it is a radiant device or a circulating device.

Circulating devices have two walls separated by an airspace, with the inner wall surrounding the firebox. Air is heated in the airspace and is then expelled into the room. Because the outer wall of a circulating device is cooler, this type of woodburning appliance requires less clearance.

Radiant heaters have no airspace — the single wall encloses the firebox. Heat radiates into the room via infrared waves directly from the walls of the device. These walls are much hotter than the outer walls of the circulating device. Also, the infrared waves carry heat directly into nearby combustible materials, changing their composition and lowering the





temperature at which they can spontaneously combust. Because of these factors, more clearance is needed.

Extreme care needs to be taken to keep radiant appliances from combustible materials — materials such as magazine racks, furniture, drapes, wood paneling, and even the woodbox. Plaster and sheetrock walls should be considered combustible because of the wooden studs behind the walls.

Heating surfaces on radiant stoves should be at least 36 inches from any combustible material. This minimum clearance should be observed no matter what the stove's exterior material — when considering clearances, there is virtually no difference between appliances of cast iron or heavy steel.

NOTE: There is a way to move your woodburning appliance or stovepipe closer to a

Appliance installation guidelines

1. *DO NOT install your woodburning device in confined spaces, unless the installation is done in accordance with the listing and the manufacturer's instructions. The specified clearance should be maintained REGARDLESS of whether the enclosure is of combustible or non-combustible material.*
2. *DO NOT install your woodburning device where gasoline or flammable vapors or gases may be present. State regulations prohibit installation in any residential garage.*
3. *DO install your woodburning device where the ventilation permits good fuel combustion, proper chimney draft and maintenance of safe temperature for its use.*
4. *DO have an outside air supply in buildings which are so tight that normal infiltration does not provide necessary amounts of air.*
5. *DO design, locate and install the stovepipe and chimney in such a way that they can be easily inspected and cleaned.*
6. *DO use listed factory-built accessories such as heat exchangers, stove mats, floor pads, and protection shields. Use them according to manufacturer's recommendations. If these accessories are not listed, check with your local fire department or with the Fire Marshal's Office for installation advice.*

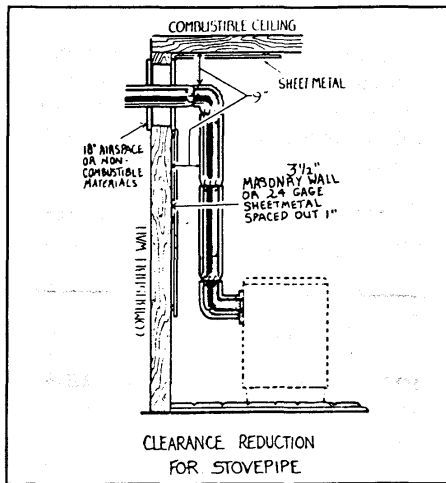
The following woodburning appliances are not covered by the recommended standards that cover woodstoves. For more information on their installation, contact the agency listed.

**Site-built masonry,
flues and fireplaces**
State Fire Marshal's Office
624-8744

**Listed wood fueled
mobile home heaters**
State Manufactured Housing Board
624-8603
State Fire Marshal's Office
624-8744

**Wood fueled units
with water jackets or coils**
Plumbers Examining Board
624-8603

**Wood fueled
furnaces and boilers**
Oil and Solid Fuel Board
624-8603



combustible surface: You may use wall or ceiling protectors. These protectors mount on the wall or ceiling and absorb heat from the appliance or stovepipe. The protectors have mounts, or spacers, that hold them one inch away from the wall or ceiling and allow air to pass between the wall or ceiling surface and the surface of the protector. Besides the spacers that can be purchased, metal washers, thin tubing or electrical insulators may be used. Protectors should be mounted so as to leave a one-inch space between the bottom of the protector and the floor. Wall protectors are made of a variety of materials, and 24-gauge or thicker sheet metal can also be used. *See table 1 below.*

Special note: Always dispose of stove or fireplace ashes in a safe manner. Use a metal safety can with a tight-fitting lid. Ashes may remain hot enough to cause fire if fanned or blown by strong winds. Do not dispose of near structures.

Table 1

Maximum clearance reduction allowed by installing protectors between woodstoves or stovepipes and combustible ceilings or walls

Type of protection	% clearance reduction allowed	
	at ceiling	at wall
1) 3 1/2" masonry wall - no ventilation	NA	33%
2) 1/2" non-combustible insulation board over 1" glass fiber or mineral wool batts - no ventilation	33%	50%
3) Minimum 24-gauge metal, 1" ventilated space	50%	66%
4) 3 1/2" masonry wall, 1" ventilated space	NA	66%
5) Listed prefabricated systems	Per manufacturer's specs	

Notes:

- Clearances are measured from the nearest point on the surface of the appliance to the outer surface of the combustible material.
- When using clearance reduction systems, no clearance is to be less than 12 inches. This applies to listed and unlisted appliances.



Table 2
Floor clearances
(For listed and unlisted appliances)

Length of stove leg	Floor clearance and protection
Less than 2 inches	Fire resistant floor
2-6 inches	Combustible floor protected by 4" of hollow masonry, laid to provide circulation through the masonry layer, covered by 24-gauge sheet metal.
Over 6 inches	Combustible floor protected by 2" thick masonry, placed over a sheet of 24-gauge sheet metal.

Stovepipe installation guidelines

- 1. Use a ventilated metal or fireclay thimble to pass a stovepipe through a non-combustible wall and into the chimney. Attach the thimble to the masonry with refractory cement. The thimble should extend to the inner surface of the chimney liner, but not beyond. The stovepipe should end flush with the inner end of the thimble.*
 - 2. Use stovepipe that has a diameter as large as the flue collar where the pipe joins the stove.*
 - 3. Stovepipe should be as straight as possible. No more than two bends should be used. Additional bends may cause creosote to collect in the stovepipe or chimney, and that may block the flow of flue gas, thereby increasing the risk of fire.*
 - 4. Install the stovepipe with a rise of a quarter-inch for each foot of pipe in a horizontal run. The highest point should be at the thimble or point of entry to the chimney.*
 - 5. Horizontal runs should be no longer than 75 percent of the vertical chimney height above the thimble where the connector pipe enters the chimney.*
 - 6. Overlap at least 2 inches of stovepipe at the joints with the crimped end pointed down to prevent creosote leaks. Secure the joint with three sheet metal screws.*
 - 7. Be sure the stovepipe fits snugly, including connections with the stove and thimble. The pipe must not stick into the chimney flue itself, because this would hamper the draft.*
 - 8. Never pass a stovepipe through a roof, ceiling, closet or concealed area.*
 - 9. There are four methods of passing a stovepipe through a combustible wall.*
- These methods are described and illustrated on page 26 at the end of this booklet.**



FLOOR PROTECTION

All combustible floors must be protected. The amount of protection depends upon the length of the appliance's legs. Stoves with legs shorter than two inches must sit on a non-combustible flooring system in conformance with fire code regulations. Stoves with legs between two and six inches must sit upon four-inch hollow masonry to provide air circulation, and the masonry must be covered with 24-gauge or thicker sheet metal. Stoves with legs longer than six inches must sit upon closely-spaced two-inch thick units of brick, concrete or stone, which in turn must be covered with 24-gauge or thicker sheet metal. The floor protection should extend at least 18 inches in all directions from the stove. See Table 2, page 17.

STOVEPIPES

Of the 39,000 residential wood appliance fires, about 6 percent are started in the vicinity of the stovepipe — the part that connects the appliance with the chimney.

Stovepipes should be made of steel no thinner than 24-gauge. No part of the stovepipe

should be closer than 18 inches to any combustible material. The ceiling should be considered combustible material. That distance may be reduced to nine inches if properly installed protectors are used. See "Stovepipe installation guidelines," page 17.

CHIMNEYS

Chimneys may be built of brick, stone, cinder block, or they may be factory-built of metal. Masonry chimneys must be lined. Metal chimneys sold in Maine must be listed. Make sure they are double-walled or triple-walled, and install them according to the manufacturer's instructions.

Inspect and evaluate chimneys and fireplaces before installing any woodburning device. Fix cracks, deteriorated mortar, and any unsealed openings.

If you build a new chimney, make sure the mason follows the National Fire Protection Association standards adopted by the State Fire Marshal's office. The standard is referred to as NFPA Standard 211.

Chimney installation guidelines

1. Support the chimney on a properly designed foundation.
2. Do not change the size or shape of the chimney within six inches above or below the roof joists or rafters, where the chimney passes through the roof on any other combustible construction.
3. Install ferrous metal frames and doors in cleanout openings. Doors should be able to be shut tightly when not in use.
4. Make sure a two-inch space exists between the chimney and surrounding combustible building materials. Firestops of 24-gauge sheet metal spanning this space must be installed at the ceiling and floor.
5. Line the chimney with fire clay, or with an equivalent flue lining.
6. To ensure a proper draft, make sure the chimney rises at least three feet above the highest point where it passes through the roof, and at least two feet higher than any portion of the building within 10 feet of the chimney.
7. Smoke-test the chimney to discover any leaks.
8. If your home has a fireplace, make sure the hearth is made of non-combustible material. Make sure there is no combustible material beneath the hearth. Make sure there is no combustible material within six inches of a fireplace opening.

When the chimney is completed, the mason must supply the homeowner with a disclosure statement assuring that the chimney meets those standards. If you plan to build the chimney yourself, make sure you obtain a copy of NFPA 211 and follow it carefully.

MULTIPLE CONNECTIONS

In new construction, each combustion appliance must have its own flue. A stovepipe should not be connected to a flue serving a fireplace or oil furnace — each should have its own flue.

If a woodburning appliance is attached to a flue already serving a fireplace, sparks may enter the house through the fireplace opening. In the event of a chimney fire, the fireplace opening may deliver large amounts of air to the fire and hamper attempts to extinguish it. A similar problem may be encountered if the flue services an oil furnace, since air may enter the chimney through the furnace's barometric damper. A woodburning stove may also lessen the efficiency of an oil furnace on the same flue because of changes in the flue's draft characteristics.

You may find two or more appliances attached to older chimneys even though such multiple connections are not recommended. In such cases, it is safer to have the connectors enter the chimney at different levels. The smallest connector should be at the highest level on the chimney. It is especially important to comply with all regulations pertaining to headroom and clearance from all combustible materials.

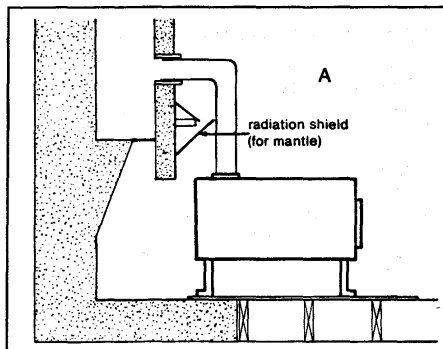
FIREPLACE CONNECTIONS

Woodburning appliances are often connected to existing fireplaces. There are two approved ways of making this type of connection:

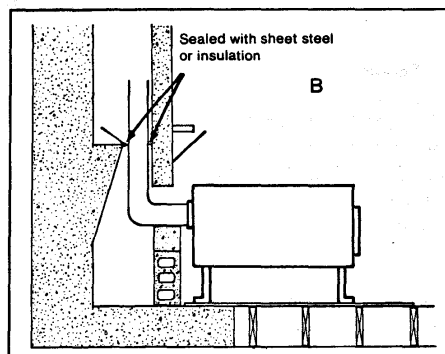
— The first method uses a thimble to connect the stovepipe directly into the chimney above the fireplace (*see illustration A*). When this method is used, the fireplace damper is closed and sealed with a non-combustible material. (*Continued in next column, above.*)

CARBON MONOXIDE DETECTORS

Build-up of carbon monoxide may be a problem if the structure is extremely tight and air leakage is minimal. A CO detector may be a good investment in your safety.



The second method runs the stovepipe up the open damper and into the lined chimney. The fireplace damper is either removed or fastened in the open position, and the fireplace face is covered (*see illustration B*).



SMOKE DETECTORS

All homes should have at least one smoke detector on each living space level, whether the home is heated with wood or not. The detectors should be mounted on the ceiling, or on the wall within 12 inches of the ceiling.

In homes equipped with woodburning appliances, the detectors should be mounted between the woodburning device and the home's bedrooms. Don't forget to test the smoke detectors regularly.

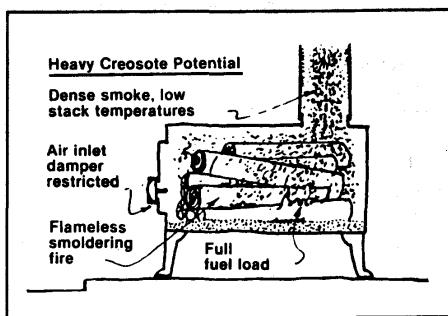
CHIMNEY AND STOVEPIPE CLEANING

If every woodstove worked perfectly, if every stick of firewood was completely seasoned, and if every woodstove owner knew everything there was to know about efficient woodstove operation, we wouldn't hear very much about creosote.

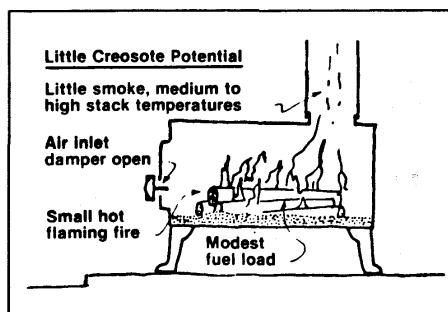
Of course, that isn't the case. Creosote is a fact of life for the wood burner, and knowing how to deal with it is an essential part of the woodburning process.

What is creosote? It is a dark brown or black substance that is formed by the incomplete combustion of wood. It is most likely to form when dense smoke makes contact with a cool chimney surface. It may be a tar-like substance, although at times it is more watery. It can collect in most any part of your woodburning system.

People used to think creosote was more apt to form as a result of using green firewood, or by burning softwoods rather than hardwoods. But research has shown us that creosote is more a result of HOW you burn, rather than WHAT you burn. Good seasoned hardwood will still form large amounts of creosote if it is burned in a damped-down stove. Unseasoned, green firewood will produce large amounts of creosote, but that seems to be more a function of the water that must be driven out of the wood before it can burn at a high enough temperature to prevent creosote production.



The MAINE WOODBURNING GUIDE



The temperature of the chimney also plays an important part in creosote production. That's why outside chimneys and long runs of stovepipe are more apt to host creosote formation — they tend to be colder than inside chimneys or short runs of stovepipe.

All woodburning systems require some form of regular cleaning. Creosote should be removed when it reaches a thickness of a quarter-inch or more. At the very least, chimneys and stovepipes should be cleaned once a year.

Many people do this annual job in the spring, before there is too much rain. Rain can mix with the creosote, forming caustic substances. It can also smooth out the creosote, making it much harder to remove.

Here are some of the things you will need to do:

— You can clean your chimney from inside the house if your chimney has a cleanout or tee, or if the chimney is connected to a fireplace. Otherwise, you will have to clean it from outside the house. If you work on the roof, make sure your ladder and footholds are secure.

— If you clean the chimney from inside the house, close off the bottom of the chimney or the fireplace, and make sure to cover the surrounding area with dust covers — it can be a very messy job!

— If you are working on a chimney that is attached to a fireplace, don't forget to clean the shelf above the damper. This is a very likely spot for the accumulation of creosote.



— There are a number of brushes and other cleaning devices available for chimney cleaning. Buy brushes that fit the shape of your chimney. If you have a masonry chimney, use a steel brush. Flat wire bristles are better at removing hard creosote than round bristles.

— If you have a stainless steel or factory-built chimney, use a plastic brush — metal brushes can scour the metal of the chimney, causing more rapid deterioration of the chimney by the caustic elements in the wood smoke.

***Some components
of creosote
are carcinogenic,
so always wear
protective clothing
and a dust mask.***

— Besides brushes, various types of metal and plastic scrapers are also available for removing stubborn creosote. All of these implements are available at hardware stores or stove shops. Experiment to find the types that work best for you.

— Some brushes are equipped with loops at both ends so ropes can be attached. With this implement, one person on the roof can pull the brush up while another person in the house can pull the brush down. Others have a loop for the attachment of a weight that will pull the brush down the chimney. Still others have connectors for the attachment of extension rods.

— If the creosote buildup is minimal, one pass through the chimney may be enough. If the creosote is heavier or harder, you may have to scrub one area until it is clean before moving on to another section.

— Some components of creosote are carcinogenic, so *always* wear protective clothing and a dust mask. After your cleaning chores are completed, be sure to bathe thoroughly to make sure traces of the creosote do not remain on your skin.

— Disassemble the stovepipe and take it outside to clean. You may have to purchase brushes and other implements that are shaped differently from the ones you purchased for the stove. Scrape and scrub the inside of the stovepipe in the same manner you used on the chimney.

— Don't forget to clean the inside of the stove, too! Creosote can collect in areas of the stove just as it collects in the stovepipe and chimney.

— When your scrubbing and cleaning is completed, check the chimney for leaks. Start a fire and then cover the top and bottom openings of the chimney with wet rags. You should be able to spot leaks by watching for escaping smoke.

— A mechanic's mirror or other small hand mirror may be used to examine a chimney. When the chimney is cool insert the mirror into a cleanout, insert, or fireplace opening and aim the mirror upward until you see sky light. A flashlight may also be needed. Look for creosote build-up and damage to the lining.

How to detect creosote buildup

1. Watch for creosote dripping from stovepipe joints.
2. Listen for a dull, heavy "thump" when the stovepipe is tapped.
3. Visually inspect the system. Look through the door or cleanout, and use a mirror and flashlight to look up the chimney.
4. Visually inspect the chimney from the roof, using a lightbulb or flashlight.
5. Visually inspect the stovepipe by removing a section.



Comparing heating fuel costs

This section is designed to help you compare the real costs of one fuel against the other. To do this with accuracy, you will need to gather some information:

- The cost per unit of fuel (cost per cord, cost per gallon, etc.)
- The BTU content per unit of fuel
- The efficiency rating of your heating system.

You will want to determine the cost per million BTUs (MBTU) of heat — whether it is derived from firewood, #2 fuel oil, propane, electricity, etc.

The chart entitled “Maine Heating Fuel Costs” (on page 23 of this booklet) gives examples of costs per MBTU for a variety of fuels at fixed costs per unit of fuel and at a fixed range of efficiencies. It also gives an estimated total yearly fuel cost for the different fuels based on an annual heat load of 60 million BTUs.

Page 24 is entitled “Fuel Cost Comparison Chart” and explains how to use the table on page 25. This table allows you to plug in a variety of costs per unit of fuel, but at fixed efficiencies.

You may also derive the cost per MBTU of any fuel at any cost per unit and at any efficiency, and then compare that fuel cost to any other fuel cost by using the following formula:

$$\text{\$MBTU} = \frac{\text{\$ per unit of fuel} \times 1,000,000}{\text{BTUs per unit fuel} \times \text{efficiency}}$$

Example: How do the real fuel costs compare between mixed hardwood bought for \$85 per cord and burned at 70% efficiency, and

#2 fuel oil bought for \$.85 per gallon and burned at 75% efficiency?

$$\begin{aligned} \text{Hardwood} &= \frac{\text{\$85 per cord} \times 1,000,000}{24,000,000 \text{ BTUs per cord} \times 70\%} \\ \text{\$MBTU} &= \$5.06 \text{ MBTU} \end{aligned}$$

$$\begin{aligned} \text{\#2 fuel oil} &= \frac{\text{\$.85 per gallon} \times 1,000,000}{138,000 \text{ BTUs per gallon} \times 75\%} \\ &= \$8.21 \text{ MBTU} \end{aligned}$$

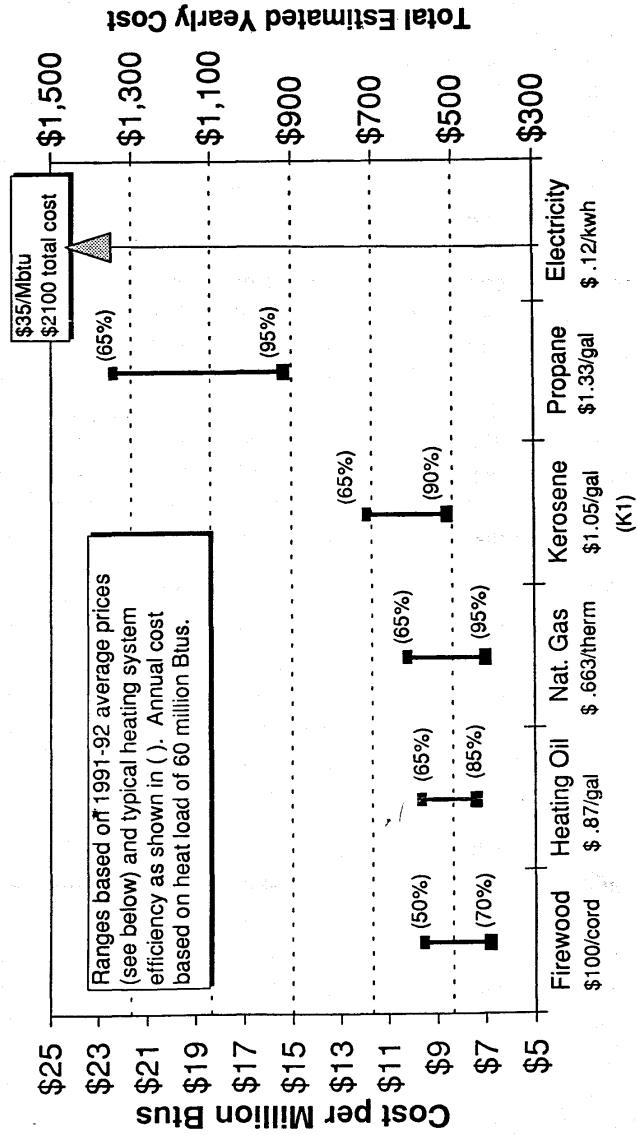
In this example, the real cost per MBTU of mixed hardwood is less expensive than that of #2 fuel oil.

Woodburner's tips

If you want your woodstove to work at peak efficiency, you need to know how hot things are inside. Invest in a stack thermometer and mount it on the stove's flue pipe. The most efficient — and least polluting — temperature range for woodstove gasses is about 250 to 450 degrees F.

Remember that too much ash in your woodstove can restrict the flow of air into the firebox. Your stove will burn much more efficiently if you remember to clean the ashes out on a regular basis.

Maine Heating Fuel Costs Adjusted for Heating System Efficiency



Shows relative cost of fuel, based on heat content and system efficiency, and approximate yearly cost of heating typical home. Prices and efficiencies may vary.



Fuel cost comparison chart

The cost of various sources of energy is expressed in different ways, making comparison difficult. The chart on the facing page enables you to compare the cost of various heating fuels on the basis of their Heating Equivalent Cost as expressed in dollars per million BTU (\$/MBTU).

To use the chart, read across the fuel price row until you come to the current cost per unit of that fuel. Then, read either up or down to the Heating Equivalent Cost row to determine the price per MBTU.

For example, you might want to know how the cost of heating with wood compares with the cost of heating with oil. If mixed hardwood is to be burned in a standard airtight stove at 50% efficiency and is available at \$100/cord, the Heating Equivalent Cost is \$8.33/MBTU. If fuel oil to be burned in a new heating system at 85% efficiency is available at \$.85 per gallon, its Heating Equivalent Cost is \$7.23/MBTU. Therefore, at these prices, oil is cheaper than wood. If, on the other hand, you have an older oil heating system that is only 65 % efficient, its Heating Equivalent Cost would be \$9.78/MBTU, and wood would be less expensive to burn. As you can see, the efficiency of the equipment and fuel cost both affect the Heating Equivalent Cost.

If you are considering switching fuels, remember the cost of the heating equipment. If the difference between the Heating Equivalent Cost is small, it may take many years of fuel savings to pay for installing a new heating system. Also, remember that some fuels have incidental costs associated with them, such as the cutting and splitting of firewood or annual maintenance for oil-fired equipment. Environmental damage caused by the production or use of the fuel is another cost that this chart doesn't address.

Finally, the best way to lower your heating cost is to make your home more energy efficient. Not only will this reduce the amount of fuel you use each heating season, it will also lessen the impact of annual price fluctuations by reducing the amount of fuel you need to buy during the heating season, when prices are at their peak.



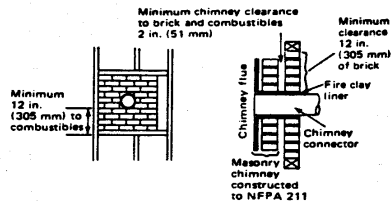
Heating Equivalent Cost in \$/MBTU		6	8	10	12	14	16	18	20	22	24	26	28											
Wood Pellets @ 80% Eff. in \$/Ton		80	100	120	140	160	180	200	220	240	260	280	300	320	340	360								
Natural Gas @ 95% Eff. in \$/Therm		.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	
Kerosene @ 90% Eff. in \$/Gallon		.70	.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.10	3.30									
Fuel Oil @ 65% Eff. in \$/Gallon		.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40				
Fuel Oil @ 85% Eff. in \$/Gallon		.70	.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.10	3.30									
LP Gas @ 75% Eff. in \$/Gallon		.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70
LP Gas @ 95% Eff. in \$/Gallon		.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80
Mixed Hardwood @ 50% Eff. in \$/Cord		70	90	110	130	150	170	190	210	230	250	270	290	310	330	350								
Mixed Hardwood @ 70% Eff. in \$/Cord		90	110	130	150	170	190	210	230	250	270	290	310	330	350	370	390	410	430	450				
Coal @ 60% Eff. in \$/Ton		90	110	130	150	170	190	210	230	250	270	290	310	330	350	370	390	410	430					
Electricity @ 100% Eff. in \$/KWH		.025	.03	.035	.04	.045	.05	.055	.06	.065	.07	.075	.08	.085	.09	.095	.10							
Heating Equivalent Cost in \$/MBTU		6	8	10	12	14	16	18	20	22	24	26	28											
ASSUMPTIONS																								
Wood Pellets (8700 BTU/Pound)																								
Natural Gas (100,000 BTU/Therm)																								
#2 Fuel Oil (18,000 BTU/Gallon)																								
K-1 Kerosene (135,000 BTU/Gallon)																								
LP Gas (93,000 BTU/Gallon)																								
Mixed Hardwood (241,800 BTU/Cord)																								
Coal (12,500 Btu/Pound)																								
Electricity (2412 Btu/KWH)																								
©75% Efficiency \$/MBtu = (\$/Ton)/11.1																								
©75% Efficiency \$/MBtu = 13.3 X \$/Therm ©95% Efficiency \$/MBtu = 10.5 X \$/Therm																								
©65% Efficiency \$/MBtu = 11.1 X \$/Gallon ©85% Efficiency \$/MBtu = 8.3 X \$/Gallon																								
©75% Efficiency \$/MBtu = 8.2 X \$/Gallon																								
©75% Efficiency \$/MBtu = 14.3 X \$/Gallon ©95% Efficiency \$/MBtu = 11.3 X \$/Gallon																								
©50% Efficiency (unsplit woodstove) \$/MBtu = (\$/Cord) / 12 ©70% Efficiency (stove with catalytic converter) \$/MBtu = (\$/Cord) / 16.8																								
©90% Efficiency \$/MBtu = (\$/Ton) / 15																								
©100% Efficiency (electric resistance heat) \$/MBtu = 293 X \$/KWH																								

The material on the following page is reprinted with permission from NFPA 211, *Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances*, Copyright © 1992, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.



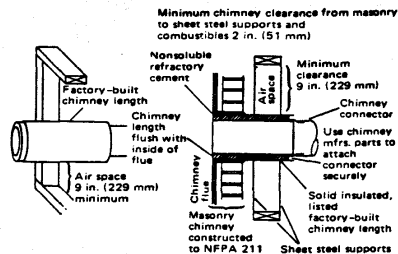
Chimney Connector Systems and Clearances from Combustible Walls for Residential Heating Appliances

System

Clearance
in./mm

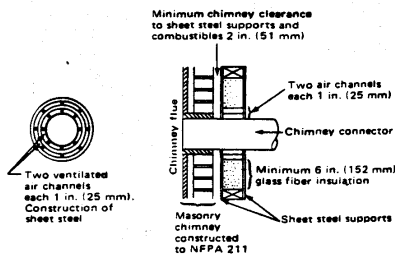
- A** Minimum 3.5-in. (90-mm) thick brick masonry wall framed into combustible wall with a minimum of 12 in. (305 mm) brick separation from clay liner to combustibles. Fireclay liner (ASTM C 315 or equivalent), minimum 7/8-in. (16-mm) wall thickness, shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.

12/305



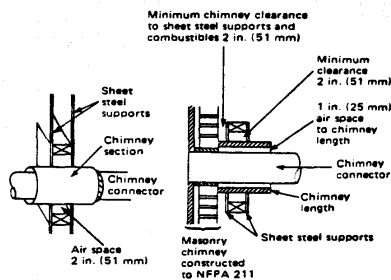
- B** Solid insulated listed factory-built chimney length of the same inside diameter as the chimney connector and having 1 in. (25 mm) or more of insulation with a minimum 9-in. (229-mm) air space between the outer wall of the chimney length and combustibles. The inner end of the chimney length shall be flush with the inside of the masonry chimney flue and shall be sealed to the flue and to the brick masonry penetration with non-water-soluble refractory cement. Supports shall be securely fastened to wall surfaces on all sides. Fasteners between supports and the chimney length shall not penetrate the chimney liner.

9/229



- C** Sheet steel chimney connector, minimum 24 gage (0.024 in. (0.61 mm)) in thickness, with a ventilated thimble, minimum 24 gage (0.024 in. (0.61 mm)) in thickness, having two 1-in. (25-mm) air channels, separated from combustibles by a minimum of 6 in. (152 mm) of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gage (0.024 in. (0.61 mm)) in thickness. Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.

6/152



- D** Solid insulated listed factory-built chimney length with a inside diameter 2 in. (51 mm) larger than the chimney connector and having 1 in. (25 mm) or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24 gage (0.024 in. (0.61 mm)) thickness, with a minimum 2-in. (51-mm) air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12 in. (305 mm). Chimney section concentric with and spaced 1 in. (25 mm) away from connector by means of sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports of minimum 24 gage (0.024 in. (0.61 mm)) thickness. Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney sections shall not penetrate chimney flue liner.

2/51

Additional Requirements:

1. Insulation material used as part of wall pass-through system shall be of noncombustible material and shall have a thermal conductivity of 1.0 Btu-in./hr-ft²·°F (4.88 kcal/hr-m²·°C) or less.
2. All clearances and thicknesses are minimums; larger clearances and thicknesses are acceptable.
3. Any material used to close up an opening for the connector shall be of noncombustible material.
4. A connector to a masonry chimney, except for System B, shall extend in one continuous piece through the wall pass-through system and the chimney wall to the inner face of the flue liner, but not beyond.

1992 Edition

The MAINE WOODBURNING GUIDE

The MAINE WOODBURNING GUIDE
ENERGY CONSERVATION DIVISION
Department of Economic and Community Development

59 State House Station
Augusta, ME 04333-0059
(207) 624-9800

Rev. 10/01