

# Wood Stove Primer

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## Finding the Right Size and Model Wood Stove

A wood stove that not only provides heat, but can also be used as a cooking surface do double duty. From a survival standpoint, consider a free standing wood stove that has a flat top that can be used as a cooking surface.

Wood stoves come in different sizes and can be sized to heat a single room or an entire home.

- Small stoves are suitable for heating a family room or a seasonal cottage. In larger homes with older central furnaces, you can use a small stove for "zone heating" a specific area of your home (family or living room). This can reduce fuel consumption, conserve energy and save you money while maintaining comfort.
- Medium stoves are suitable for heating small houses, medium-sized energy-efficient houses, and cottages used in winter.
- Large stoves are suitable for larger, open plan houses or older, leakier houses in colder climate zones.

Talk with experienced hearth product retailers who know the performance characteristics of the products they sell. When visiting local retailers, take along a floor plan of your home; knowledgeable retailers can help you find a wood stove, fireplace insert, or other hearth product that is well suited to the space you want to heat and your climate.

## Emission Limits for Wood Stoves

The internal design of wood stoves has changed entirely since the EPA issued standards of performance for new wood stoves in 1988. EPA's mandatory smoke emission limit for wood stoves is 7.5 grams of smoke per hour (g/h) for non-catalytic stoves and 4.1 g/h for catalytic stoves. (Wood stoves offered for sale in the state of Washington must meet a limit of 4.5 g/h for non-catalytic stoves and 2.5 g/h for catalytic stoves.)

Stove manufacturers have improved their combustion technologies over the years, and now some newer stoves have certified emissions in the 1 to 4 g/h range. When comparing models, look for the EPA white label on the stove - a lower g/h rating means a cleaner, more efficient wood stove.

## Best Burn Practices

### Dry Seasoned Wood

Burn only dry, well-seasoned wood that has been split properly. Properly seasoned wood is darker, has cracks in the end grain, and sounds hollow when smacked against another piece of wood.

A properly installed, correctly used wood-burning appliance should be smoke free. If you see or smell smoke that means you may have a problem. Practice the following guidelines to Burn Wise in your appliance and reduce smoke inside and outside your home.

### Practical Tips for Building a Fire

Once your wood-burning appliance is properly installed, building an effective fire requires good firewood (using the right wood in the right amount) and good fire building practices. The following practical steps will help you obtain the best efficiency from your wood stove.

- Season wood outdoors through the summer for at least 6 months before burning it. Properly seasoned wood is darker, has cracks in the end grain, and sounds hollow when smacked against another piece of wood.
- Wood burns best when the moisture content is less than 20 percent. You can purchase a wood moisture meter to test the moisture content of your wood before you burn it.
- Store wood outdoors, stacked neatly off the ground with the top covered.
- Burn only dry, well-seasoned wood that has been split properly.
- Start fires with newspaper and dry kindling.
- Burn hot fires.
- To maintain proper airflow, regularly remove ashes from your wood-burning appliance into a metal container with a cover and store outdoors.

### Items You Should Never Burn in Your Wood Stove

- **Never** burn household garbage or cardboard. Plastics, foam and the colored ink on magazines, boxes, and wrappers produce harmful chemicals when burned. They may also damage your wood-burning appliance.
- **Never** burn coated, painted, or pressure-treated wood because it releases toxic chemicals when burned.
- **Never** burn ocean driftwood, plywood, particle board, or any wood with glue on or in it. They all release toxic chemicals when burned.
- **Never** burn wet, rotted, diseased, or moldy wood.

### Safe Wood-burning Practices

Once your EPA certified or qualified wood-burning appliance is properly installed, follow these guidelines for safe operation:

- Keep all flammable household items—drapes, furniture, newspapers, and books—far away from the appliance.
- Start fires only with newspaper and dry kindling. Never start a fire with gasoline, kerosene, charcoal starter, or a propane torch.
- Do not burn wet or green (unseasoned) logs.
- Do not use logs made from wax and sawdust in your wood stove or fireplace insert – they are made for open hearth fireplaces. If you use manufactured logs, choose those made from 100 percent compressed sawdust.
- Build hot fires. For most appliances, a smoldering fire is not a safe or efficient fire.
- Keep the doors of your wood-burning appliance closed unless loading or stoking the live fire. Harmful chemicals, like carbon monoxide, can be released into your home.
- Regularly remove ashes from your wood-burning appliance into a metal container with a cover. Store the container of ashes outdoors on a cement or brick slab (not on a wood deck or near wood).
- Keep a fire extinguisher handy.

### **Money Saving Tip**

Look into getting your name on a list with local tree cutters who will deliver wood to your home. This saves them from traveling to the landfill and paying dumping fees. It also reduces landfill dumping. Plus, you may end up with discounted firewood.

### **Install and Maintain a Smoke Alarm**

Each year in the United States, about 3,000 people lose their lives in residential fires – and mostly from inhalation of smoke and toxic gases, not as a result of burns. Properly installed and maintained smoke alarms in the home are considered one of the best and least expensive means of providing an early warning of a potentially deadly fire.

If you burn wood in your home, even occasionally, you install a smoke alarm to alert you and your family in the event of a fire. To be effective, smoke alarms must be in the proper location and tested regularly. Batteries should be replaced regularly, too.

### **Install and Maintain a Carbon Monoxide Detector**

When wood is not burned completely, the resulting smoke contains a number of chemicals, one of which is carbon monoxide (CO).

According to the U.S. Consumer Product Safety Commission, more than 150 people die on average per year from CO poisoning, related to the use of combustion appliances, including wood stoves, in the home.

CO is odorless and colorless. Exposure to CO reduces your blood's ability to carry oxygen. EPA recommends installing a digital CO detector if you use a wood stove or fireplace in your home. A digital detector displays the concentration of CO parts per million (ppm) and makes a warning sound that gets louder as the concentration increases.

## **Installation and Maintenance**

### **Do you smell smoke in your home?**

Shut down your wood-burning appliance, open a window, be sure the flue is open, carefully check the venting (chimney) system, and call a professional wood stove installer or chimney sweep.

The safety of your home and family depends on fully understanding and carrying out the critical manufacturer and building code requirements that include:

- Proper clearances between the wood-burning appliance and venting system and combustible materials.
- Proper protection of combustible floors.
- Proper assembly of appliance and venting components.
- Errors in installation (by a non-professional) may not be visible, and problems may not be apparent for a considerable length of time—and then only by a resulting home fire.

Experienced professionals can properly size and place equipment for best heat distribution. The venting system (or chimney), in particular, is a critical area that requires professional involvement. This is the “engine” that drives the whole burning process—or causes it to perform poorly or fail. Professional decisions about the venting system to ensure adequate draft include:

- Proper sizing (particularly avoiding oversized flues).
- Proper height (often taller than minimum code requirements).
- Proper location (interior of the house when possible) or protection from extreme cold.
- Proper configuration (avoiding excessive horizontal runs and system turns in direction).
- A wood-burning appliance that is sized and placed properly with a venting system that delivers adequate draft will reduce wood consumption, produce more usable heat, and reduce maintenance from inefficient fires.

### **Wood Stoves Installation**

Literally dozens of kinds of wood burning stoves are available. Most can be described by one of the following general categories.

- **Circulating stoves**

These are double walled with an inner combustion chamber usually constructed of cast iron or firebrick-lined welded steel. An outer shell of lightweight sheet metal promotes the flow of air over the inner shell. The room is heated primarily by warm air. Some units have an optional fan, which provides a more positive air flow. You obtain draft control and heat output with a damper operated by a thermostat. Burning efficiencies of 60 to 70 percent are possible with well-built units. The major advantage of the circulating unit is that during operation, the outer shell stays relatively cool.

- **Radiant heaters**

These single walled units may be constructed of sheet metal, cast iron or welded steel. They may or may not be lined with firebrick, which improves the stove's efficiency and prolongs its life. Heat is transferred to the room directly by radiant energy and indirectly by convection currents set up by air flow over the surface of the stove unit. The early American "pot bellied stove" falls into this general category as do many of today's imported and domestic units. Draft and heat control may be automatic but are more often obtained by manually operated dampers. Radiant type heaters generally are lower in cost than the circulating units. This is not true of some of the higher-priced cast-iron units with extensive decorative features. Combustion efficiency for these units can be as high as for the circulating units. Lower efficiencies are associated with poor management of manual draft controls.

- **Combustion stoves**

These units combine the look and feel of an open fired "Franklin Type" stove with the efficiency of a closed unit. These radiant type heaters have a door that can be opened to provide a view of the fire without adversely affecting stove operation. When the door is closed, these units operate the same as other stoves. Overall efficiencies are in the 50 to 60 percent range, depending on the amount of time units are operated in the "fireplace" mode. This compares to efficiencies of 10 to 20 percent for the usual home fireplace.

## **Construction**

The Underwriters' Laboratories (UL) listed stove you buy will have a sheet metal, welded steel or cast iron fire box. It may also be lined with firebrick.

Sheet metal stoves are the lowest in cost and should be considered only for occasional use. Since they are light in weight, they warm up rapidly. However, extensive use leads to early burn out. Their life can be prolonged by limiting the size of fires or by lining the fire area with heavier material or firebrick. Sheet metal stoves should be examined frequently for weak, burned out spots.

Welded steel stoves are constructed of 1/4-inch thick or thicker steel plate. They warm up more slowly than sheet metal stoves, but the thicker wall section lasts longer. These units are suitable for continuous use. High quality models will have firebrick lining in the combustion area.

Cast iron has long been considered "top of the line" in wood burning stoves. It provides a stove that warms up slowly, retains heat well, does not warp and lasts for many years. However, a cast-iron stove is not more efficient than well-constructed stoves of other types. Cast iron is relatively brittle and is subject to cracking if handled roughly. For this reason, you should carefully inspect new and used cast-iron units for breaks before using them.

Firebrick or ceramic liners may be used in any of the three stove types. Liners add mass to the stove and tend to spread heat away from hot spots in the fire. This promotes more uniform heating and prolongs the useful life of the stove. Liners also lengthen the time between the starting of the fire and the heating of the room.

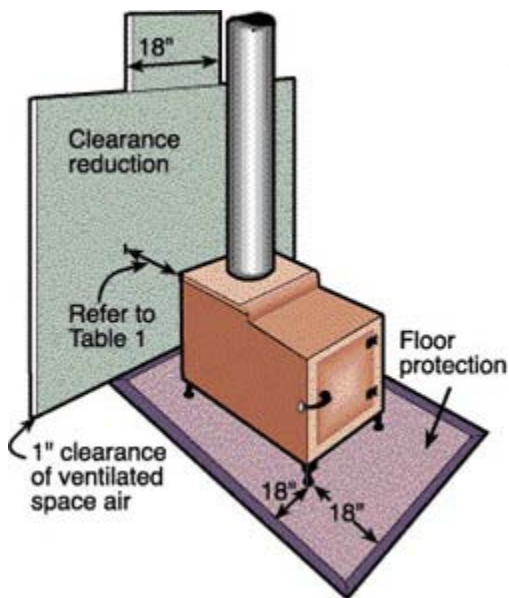
## Sizing

Some manufacturers rate their stoves in terms of cubic feet they will heat; others use number of rooms; a few use Btu (British thermal units). Unless you know the conditions the stove was tested under and how these compare to your own situation, most ratings are of little value. At best, ratings should be used only as general guides. Selecting a size based on space available and required clearances around the stove or on capacity to handle the size fuel you have may be more important than rating.

## Placing the stove

Stove placement is usually determined by location of an existing chimney flue or by the potential chimney location. The stove should be located as close as possible to the chimney inlet. Maximum length of stovepipe connecting the stove to the chimney should not exceed 8 to 10 feet, and the pipe should have no more than two 90-degree elbows.

Since wood stoves are seldom designed with positive circulation systems, locate them near the center of the area to be heated if you have a choice. Another option is to place the stove so that heat will be picked up by an existing central-heating cold-air-return system and circulated throughout the house.



**Figure 1**  
Clearances for wood stoves.

**Table 1**

Reducing clearances from the wood burning appliance to combustible surfaces.

Combustible surface covering	As wall protector	As ceiling protector
3-1/2-inch thick masonry wall without ventilated air space	24 inches	
1/2-inch thick non-combustible insulation board over 1-inch glass fiber or mineral wool batts without ventilated air space	18 inches	24 inches
24-gauge sheet metal over 1-inch glass fiber or mineral wool batts reinforced with wire or equivalent, on rear face with 1 inch ventilated air space	12 inches	18 inches
3-1/2-inch thick masonry wall with 1 inch ventilated air space	12 inches	
24-gauge sheet metal with 1 inch ventilated air space	12 inches	18 inches
1/2-inch thick non-combustible insulation board with 1 inch ventilated air space	12 inches	18 inches
1-inch glass fiber or mineral wool batts sandwiched between two sheets of 24-gauge sheet metal with 1 inch ventilated air space	12 inches	18 inches

### Clearances

Most home fires involving wood stoves are the result of improper installation or operation. To reduce the possibility of fire, the National Fire Protection Association (NFPA) has recommended certain minimum clearances between wood stoves and combustible materials or furniture. Your local building code or homeowner's insurance company may have more stringent requirements. Table 1 shows NFPA-recommended clearance between wood stoves and protected and unprotected combustible walls and ceilings. Figure 1 illustrates these clearances and shows how protection is installed.

All floors under wood stoves (except concrete, masonry and approved non-combustible construction) must be protected from heat and coals that may fall out. This protection should extend under the stove and outward for 18 inches on all sides.

Manufacturers of listed heaters usually specify the type of material required for floor protection. The type of floor protection required for unlisted heaters depends on heater leg length. Heaters with legs less than 2 inches in height can only rest on a non-combustible floor. Heaters with legs 2 to 6 inches tall must have floor protection consisting of 4-inch hollow masonry laid to provide air circulation through the layer and covered with 24-gauge sheet metal. Heaters with legs higher than 6 inches must have floor protection consisting of closely spaced masonry that

provides a thickness of not less than 2 inches. Such masonry must be covered by 24-gauge sheet metal. Instead of the requirements for floor protection specified here, a floor protector listed by a recognized testing laboratory and installed in accordance with the installation may be employed.

Legs installed by the manufacturer should not be shortened or removed, nor should any item be placed where it will interfere with circulation of air under the stove.

### **Connecting pipe**

Stoves are connected to chimney inlets with uncovered sheet metal pipe known generally as stove pipe. This pipe is usually 6 or 8 inches in diameter and should be constructed of 24-gauge or heavier metal. (The lower the gauge number, the heavier the metal.) Select pipe size to match the outlet size of the stove.

Maximum efficiency is obtained when stovepipes are as short and as straight as possible. In no case should pipes be longer than 8 to 10 feet or contain more than two 90-degree bends.

Avoid horizontal runs. Minimum slope should be 1/4 inch per foot toward the stove. Assemble joints in the pipe so that they will funnel any liquid creosote accumulating in the pipe back to the stove where it will burn. Joints should fit tightly to eliminate entry of room air directly into the chimney system. Use furnace cement to ensure tightness. Use rivets or screws at pipe joints for added strength. A minimum of three rivets or screws is recommended at each joint.

To reduce fire potential, maintain the recommended clearances between pipes and combustibles. If the stovepipe must pass through a wall, provide an opening with at least 18 inches of clearance from all framing members. In no case should a stovepipe extend through an unoccupied area of the house. Unless listed for such connection, solid fuel burning appliances should not be connected to a chimney flue serving another appliance. You can convert a masonry fireplace chimney to use by a wood burning stove, but you can't use it as a fireplace after the conversion is made. The chimney connector must extend into the chimney above the lower point of the tile liner.

### **Before you buy**

- Make sure the stove is listed by Underwriters' Laboratories or a similar nationally recognized testing agency that tests in accordance with U.L. Standards.
- Check with your insurance company and local building inspector to make sure you can use a wood stove without large penalties in the form of higher premiums or extensive remodeling.
- Be sure you have an economical source of fuel.
- Make sure you have access to or can install an approved chimney for your stove.
- Look at several different stove types and visit with people who are using them. Are they satisfied with performance? Have they had any problems with the unit? Has the dealer been willing to correct any problems?
- Examine stoves for quality workmanship. Are materials sturdy and parts well put together? Modern stoves gain efficiency from their ability to control combustion air. This requires an air-tight unit with close fitting parts and a tight or gasketed door.



- Shop around. Wood stoves have a "seller's market," and careful shopping may result in substantial savings for similar units.

## **Avoiding Trouble with Wood Stoves**

Creosote builds up in all chimneys attached to operating wood stoves and fireplaces; it is practically inevitable. Creosote is very flammable and easily ignites inside your chimney under the right conditions.

Whether it is attached to a wood stove or fireplace, your chimney should be cleaned and inspected every year. Chimney cleaning is a worthwhile expense and is an important part of heating your home with wood. A trained, professional chimney sweep will clean your stove with the proper equipment and inspect the chimney for cracks, water leaks, misalignment, and deterioration. Have this work done before each burning season.

Burn dry, seasoned hardwood always. A few pieces of unseasoned or softwood firewood greatly contribute to creosote build-up in a chimney.

It takes about two years for firewood to be fully seasoned. The only way you can be sure it is seasoned is to buy it a year or more before you burn it. Stack the firewood in rows under a shelter or tarp and let it dry completely. Loose piles do not promote proper seasoning.

Hardwoods suited for wood stoves include maple, oak, hickory, locust, ash, beech, and walnut. Avoid using pine, willow, cottonwood, aspen, birch, box elder, elm, and silver maple. If you are not sure what kind of wood you have for burning, use a tree identification guide.

When you burn wood, monitor the temperature in the stack with a stovepipe thermometer. For less than \$20, you will be able to tell at a glance whether your wood stove temperature is too cool, too hot, or just right. There are no thermometers for fireplaces, so it is important to keep the fire burning brightly, but not roaring.

Chimney cleaning products like special logs and powders are not a substitute for mechanical brushing. These products may provide a small amount of creosote reduction, but are not reliable for complete chimney cleaning. Keep in mind that any creosote loosened with chemicals must be removed from the chimney, pipe, or stove. Otherwise, it will remain inside as a potential fire hazard.

If you think your chimney is on fire, get out of the house. Call the fire department and explain the situation. If it is possible, close all dampers or glass doors on the stove or fireplace. Monitor for flare-ups for two to three hours after the incident. Call a professional chimney technician to inspect for damage and remedies.

### **Tips that will reduce problems with your firewood and wood stove:**

- Store all firewood outdoors, away from the house. This keeps ants, termites, other insects and mice away from the house. Bring in enough firewood for a day or two.
- Keep firewood dry and off the ground. Avoid storing firewood in the forest where wood-eating insects can infest the logs.

- Remove loose bark flaps and inspect for holes that have been bored. Do not bring in firewood with insect infestations.
- Do not use insecticides to kill firewood insects. Leave the wood outside, away from the house. Split it into thin segments to remove the insects, and then use the splits for kindling.
- Monitor woodpile gaps and hollow logs for mouse shelters. Hollow logs brought inside can house mice and other unwanted pests.
- Insects accidentally brought indoors in winter should be vacuumed or swept and disposed.

## **Wood Stove Chimneys**

All wood-burning stoves need a tight, well-designed and well-constructed chimney to maximize efficiency and minimize the danger of unwanted fire. Most homeowners who add a wood-burning stove will also have to add a chimney. This publication explains chimney requirements and provides basic information on how to construct the two general types of chimney, masonry and prefabricated metal.

The chimney serves two major functions in stove operation. It provides a draft, or vacuum which draws oxygen needed for combustion into the stove. It also discharges the products of combustion outside the living area. Some of the heat from the stove and occasional sparks are also discharged through the chimney. For this reason, chimneys must be carefully constructed and well maintained to prevent fires.

Draft is caused primarily by the natural rising of warm air (smoke) up the chimney. In general, the taller the chimney, the greater the draft. A warm chimney will provide greater draft than a cool chimney because a warm chimney does not cool the rising smoke. This is why stoves generally perform better after they have run long enough to warm the chimney than they do when they are first started. For the same reason, chimneys that are located within the house have better draft than those located completely outside.

Outside air currents can affect draft if they swirl around obstructions and blow down the chimney rather than across the outlet. Eddy currents of air that affect draft are most often caused by wind blowing across nearby parts of the building roof. For this reason, certain clearances have been established to reduce the problem. A chimney must extend at least 3 feet above a flat roof and at least 2 feet above a roof ridge or any raised part of a roof within 10 feet.

Sometimes getting enough vertical clearance to prevent eddy currents from affecting chimney draft is impossible. This may be because of unusual heights of nearby trees. A hood or chimney cap can sometimes be used to prevent eddies from interfering with draft. Caps and hoods also minimize rain entry into the chimney during periods of non-use.

### **Flue**

The opening in the chimney through which smoke passes is called the flue. To provide adequate room for smoke passage and draft development, flues must be carefully sized in

relation to stove capacity and chimney height. In general, flue size should be 25 percent larger than the size of the stove pipe, which connects the stove to the chimney. This means a stove with a 6-inch diameter pipe would require at least an 8-inch flue; an 8-inch stove pipe requires a 10-inch flue, etc.

Smoke moves up the flue in a swirling pattern. Round flues are more efficient than square or rectangular ones because they offer little obstruction to the natural flow of smoke. For best performance, the inner surface of flues should be as smooth as possible.

One frequently asked question about chimneys for wood stoves is "Can a stove be connected to an existing flue that serves another appliance?" National Fire Protection Association (NFPA) requirements prohibit connecting a stove to a chimney flue serving a fireplace. This requirement has been incorporated into most building codes and insurance regulations. The NFPA recommends that each stove be connected to a separate flue. This reduces interference between units and increases the efficiency of each stove.

### **Location**

Maximum burning efficiency is obtained when chimneys are located as close as possible to the stove unit. The usual recommendation is to limit the length of connecting pipe between stove and chimney to 10 feet.

### **Masonry chimneys**

Most chimneys in new and existing homes are constructed of non-combustible masonry material. This may be brick, concrete block or some type of stone. Masonry chimneys are usually the heaviest part of the house and must be constructed on a concrete footing heavy enough to support this weight without settling. Chimney footings must extend below normal front depth and rest on undisturbed or well-compacted soil. Footings should extend at least 6 inches beyond the edge of the chimney on all sides and should be 8 inches thick for single-story houses. Two-story houses require chimney footings 12 inches thick to support the weight of the added height.

Masonry chimneys should be lined with vitrified fire clay tile (flue tile). This tile is designed to withstand rapid fluctuations in temperature without cracking and has a smooth surface that is easily cleaned. Flue tile should be at least 5/8-inch thick. It is available in several sizes. The most commonly used sizes in residential construction are 8 by 8 inches, 8 by 13, and 13 by 13 (outside dimensions). Flue tiles are connected together with cement mortar joints, struck smooth on the inside. There should be a 1-inch space between the outside of the flue tile and the surrounding masonry to reduce heat loss through the chimney and thus improve draft.

Masonry walls for chimneys less than 30 feet high must be at least 4 inches thick. If stone is used for the wall, a 12-inch minimum thickness is needed. A chimney that is exposed directly to the elements should have walls at least 8 inches thick to provide added strength for withstanding weathering and wind.

Masonry units should be laid with cement mortar. A recommended mix is one part portland cement, one part hydrated lime and six parts clean sand, measured by volume.

A chimney may contain more than one flue. Two flues may be placed side by side if the adjacent joints in the tile liners are separated vertically by at least 7 inches.

Masonry chimneys must be separated from combustible material by at least 2 inches on all sides. This means that framing and other burnable material in walls, floors, ceilings and roofs must stop at least 2 inches from the chimney. This 2-inch space can be filled with asbestos cement board, sheet metal or other non-combustible material.

Stove pipe connections to masonry chimneys are made through round masonry units called thimbles. These are constructed of fire clay and installed horizontally into the chimney wall. Thimbles must not extend into the chimney beyond the inner surface of the flue liner.

Soot and creosote will accumulate on the inner surface of chimneys. A tight-fitting clean-out door should be installed at the base of the chimney to assist in cleaning.

### **Prefabricated chimney units**

Masonry chimney units cannot be easily added to many existing homes and are not practical in some new home designs. A prefabricated metal chimney unit may be the best choice for wood stoves or fireplaces in these homes.

Prefabricated chimneys are easier to erect than masonry units, and although materials cost more, total unit cost will be nearly the same. These units are relatively lightweight, need no heavy foundation and can often be installed through a closet or unused room corner in an existing home. Tests by the National Bureau of Standards indicate similar performance for prefabricated and masonry chimneys when used under similar circumstances.

Prefabricated chimneys used for wood stoves must bear the Underwriters Laboratory (UL) listed label and be designated as "all fuel" chimney units. UL-listed "vent" type units are not satisfactory for use with wood stoves.

There are two general types of prefabricated chimneys available. They are the insulated unit and the triple-walled unit. The insulated unit is constructed of inner and outer layers of metal (usually stainless steel) with the space between filled with one or more inches of non-combustible insulation. Triple-walled units have three layers of metal and are designed so that air circulates between the layers and removes excess heat. Either type is satisfactory as long as it is UL-listed.

Prefabricated chimneys are available in several sizes and a variety of accessories are available to accommodate different types of installation. There is a required 2-inch clearance between these units and combustible material, just as there is for masonry units.

### **Causes of Smoky fires**

Sometimes even properly constructed and operated stove-chimney combinations result in smoky fires. Each of the following items can cause smoky fires:

#### **Chimney obstructions.**

Bird nests, fallen bricks and a variety of other objects have all been found in chimneys.

Any object that restricts the smooth flow of exhaust gases can cause smoky fires. A good cleaning is the solution to this problem.

**Lack of combustion air.**

Occasionally in a new, tightly constructed home or in a recently remodeled chimney unit, there will not be enough natural openings to supply air for the stove. This restricts the chimney draft and results in smoking. Opening a window slightly or providing some other source of outside air will usually eliminate this problem.

**Occasional smoking can be caused by.**

Unusual wind direction resulting in abnormal eddy currents. If this is a persistent problem, extending chimney height or adding a cap may help.

Burning green or wet wood or too cool a fire. These can prevent the chimney from warming up and developing full draft. If wet or green wood must be burned, wait until the fire is going well and then mix it with dry wood to keep chimney temperature up.