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Installation & Operation of Wood Heating Systems: Part Three in a Series on Wood as a Fuel Source

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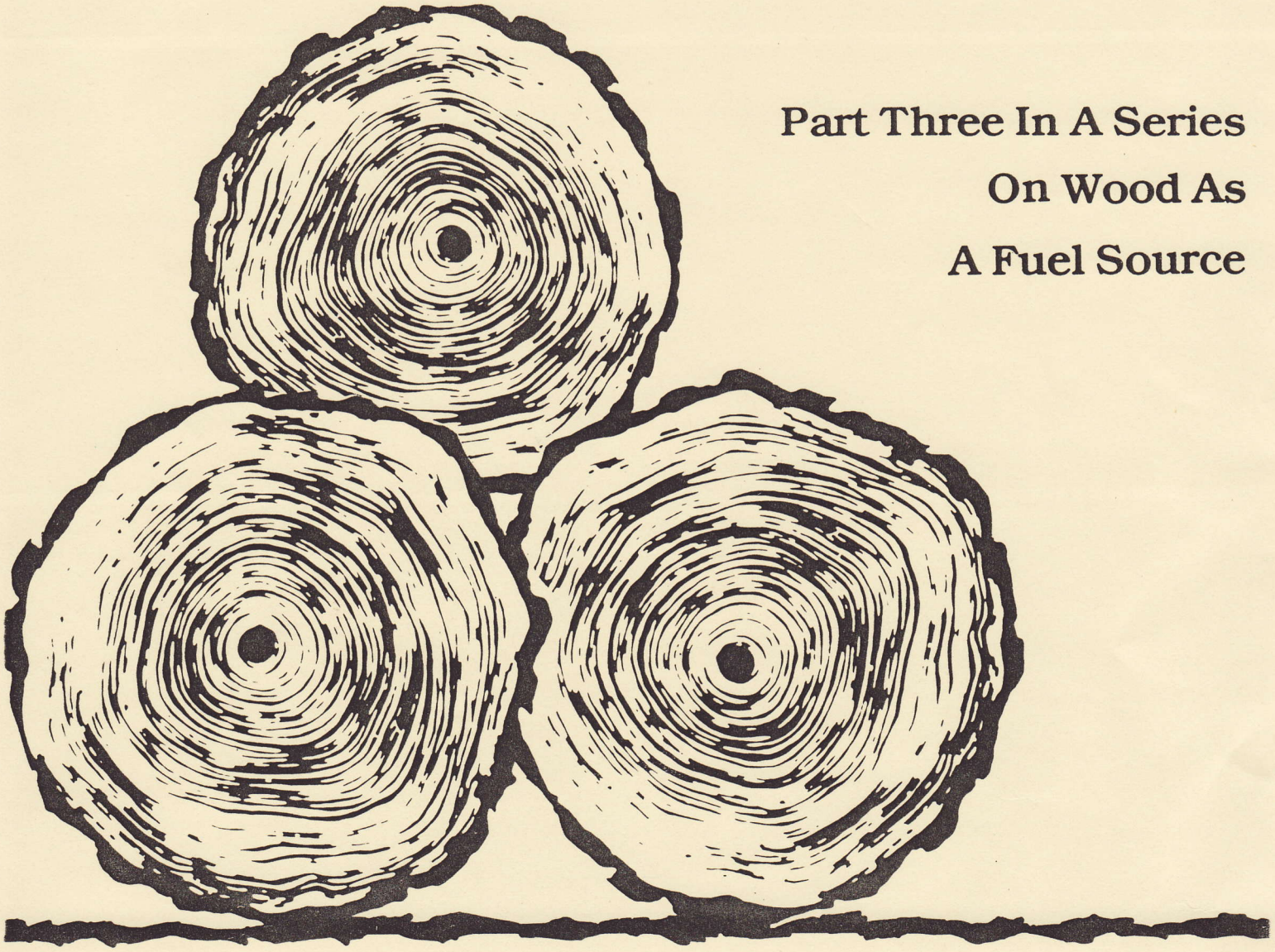
Installation & Operation Of Wood Heating Systems



Part Three In A Series On Wood As A Fuel Source

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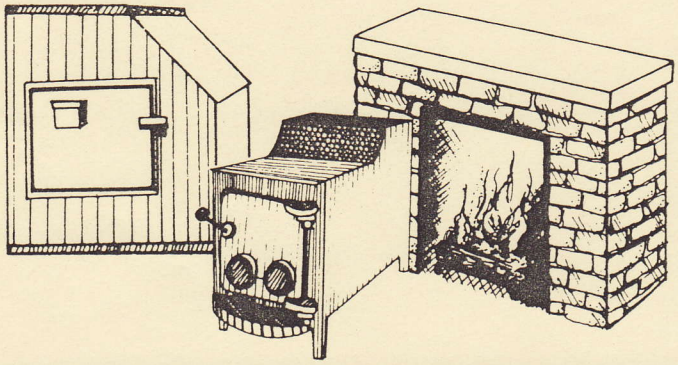


Installation & Operation Of Wood Heating Systems

Part Three In A Series On Wood As A Fuel Source

Introduction

The installation and operation of wood heating units are both very important factors in the safe, efficient use of wood as a heating fuel. There are several considerations which should be taken into account when wood is used, that are not involved in common oil, gas, or electric systems. These include obtaining the wood; loading, starting and tending the fire; removing ashes; and inspection and cleaning of the chimney. Placement of the unit is also important in the distribution of heat and safe operation. The following guidelines should be helpful in planning, installing, and operating your wood heating system.

Location of Unit

Here's how to determine the best location for your stove:

- Pick a good central location in an open area. This distributes the heat over the greatest area.
- Spread the heat through the house by using registers near the ceiling or locate the stove to take advantage of staircases, which aid both hot air flow and cold air return.
- Be sure the stove has plenty of ventilating space, provided by safety clearances between the stove and nearby surfaces.
- Keep the stove away from exits so it doesn't block fire escape.
- A location with an interior chimney will keep more heat inside the house than will one with an exterior chimney. Exterior chimneys also wear out sooner and usually condense more of the tar-like, highly flammable substance called creosote.
- An unused chimney, although convenient, may be a hazard, and does not necessarily dictate the best stove location.
- Provide working space in front of the stove for wood loading and ash removal.
- If it is convenient to locate the stove in the same room as the central furnace's thermostat, this will fool the thermostat and save a substantial amount of furnace fuel through less frequent use.

Building Codes and Safety Standards

House fires occur when stoves are improperly installed or carelessly operated. Most fires are caused when combustibles are too close to a hot stove, by escape of hot gases or flames through a crack in a chimney, by conduction of heat from a chimney into combustible materials, or by sparks or coals escaping from a stove.

It is recommended that you consult the local building official and fire marshal and notify your insurance agent before installing a stove. The National Fire Protection Association (NFPA) has developed standards that are the basis for many local building codes. For maximum safety locate a stove or heater at least 36 inches from woodwork, other combustible materials or furniture. A stove pipe should not be closer than 18 inches to the ceiling.

Wall Protection

The recommended clearances can be reduced considerably if combustible walls and ceilings are protected with asbestos millboard or

·28 gauge sheet metal spaced out 1 inch from the combustible wall. The spacers should be constructed from a non-combustible material. Provide a 1 inch air gap at the bottom of the asbestos millboard or metal panel. Air circulating behind the panel will cool the panel and the wall.

Brick or stone provide little or no protection from a combustible wall because they are good conductors of heat.

Asbestos millboard is a different material from asbestos cement board.

Minimum Clearances from Combustible Walls and Ceilings*

Type of Protection	Stove Type		Stove Pipe
	Radiant	Circulating	
None	36"	12"	18"
1/4" Asbestos Millboard, spaced out 1"	18"	6"	12"
28 gage sheet metal, spaced out 1"	12"	4"	9"
28 gage sheet metal on 1/8" asbestos millboard, spaced out 1"	12"	4"	9"

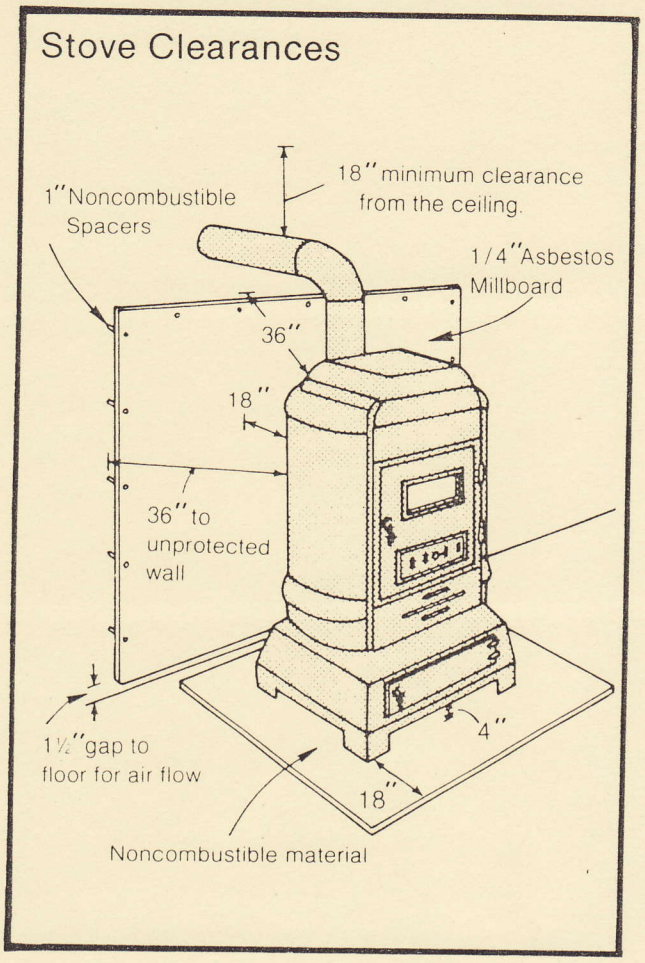
*From National Fire Protection Association No. 89M, 1971.

Floor Protection

The material used to protect the floor should extend 6 to 12 inches beyond the stove on three sides and 18 inches beyond the side where the wood is added.

All floors on which stoves are set, except concrete, must be protected from both heat of the fire and hot coals falling out when fuel is added. Metal with asbestos backing and asbestos millboard are non-combustible materials used for floor protection. Slate, brick, marble chips and colored pebbles can also be used; but, unless they are mortared in place with no gaps, metal or asbestos millboard must be installed between them and a wood floor. A two inch layer of sand or ashes, or bricks laid in the bottom of the stove help prevent overheating of combustible flooring.

The air space between the bottom of the stove and the floor covering is important; stoves should be on legs at least 4 inches high. Eight to ten inch legs provide more air space and less heat will be



transferred from the stove to the floor. Be certain that both floor and wall protection extend far enough for adequate protection when a stove or Franklin type fireplace is set on a hearth or inside a stone or brick fireplace.

Stove Pipe

The stove or smoke pipe used to connect the outlet of the firebox to the chimney is sold in 24 inch lengths. Building codes require stove pipe to be 24 gauge or thicker; lower gauge numbers indicate thicker metal. The diameter of the stove pipe used should be the same diameter as the firebox outlet. Most wood stoves use either a 6 or 8 inch smoke pipe. Using stove pipe that is smaller in diameter than the firebox outlet will reduce combustion efficiency and possibly cause improper draft.

Some stove installations should have a damper either built into the stove or in the pipe near the stove to control draft and loss of volatile gases.

Check the recommendation of the stove manufacturer.

Stove pipes should be as short and as straight as possible and enter the chimney higher than the outlet of the stove's firebox. The maximum length of the pipe should be less than ten feet.

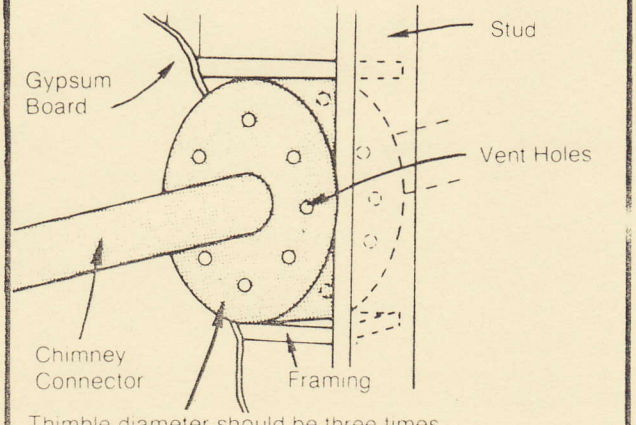
Avoid horizontal runs. Instead, use 45 degree angles to create an upward slope in the flue connector pipe. Try to have no more than one right angle turn between the stove and chimney.

Running a stove pipe out a window and up the outside wall of the house is a dangerous practice. Wood burners sometimes recommend long spans of single thickness stove pipe as a heating device. This idea had some merit when used with inefficient stoves where much of the heat went up the pipe. Airtight stoves, however, are more efficient and this practice may cause rapid creosote builduip.

Long stove pipes and those with restrictions should be cleaned frequently to prevent creosote buildup and possible chimney fires.

Where a smoke pipe must pass through a wall, provide an opening with at least 6 inches of clearance from all wood framing and protect it with a double wall ventilated thimble. This type of thimble is not readily available, but can be fabricated by a sheet metal shop. A thimble about two inches larger than the pipe is used for the installation of a flue for gas furnace and is not adequate for a wood stove installation. The entire length of the smoke pipe must be easily inspected, firmly fastened at the joints and kept free of all combustible materials.

Ventilated Thimble



Thimble diameter should be three times the diameter of the stove pipe

Chimneys

The chimney has two main purposes: to create a draft and to evacuate the gases of combustion. It also discharges some of the heat generated by the fire. The higher the chimney or the larger its cross sectional area, the greater the flow capacity. However, chimney area is more important in effecting capacity than chimney height.

Prefabricated Chimneys

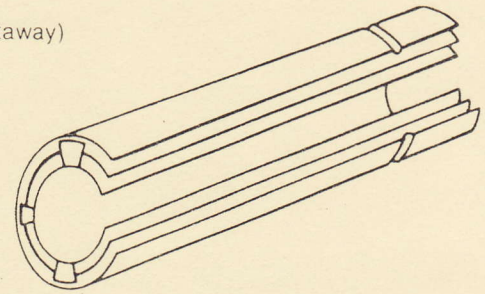
Prefabricated chimneys are easier to erect than masonry ones. Tests at the National Bureau of Standards have shown that metal and masonry chimneys differ little with respect to draft when used under similar conditions. A key point is that metal prefabricated chimneys must be UL listed as ALL FUEL chimneys. Do not use the UL listed "Vent" as it is not insulated or ventilated enough for wood or coal burning. The standard sections are 18 inches and 30 inches long and are available in a variety of inside diameter sizes. The sections lock together and no screws or special tools are needed for assembly.

There are two types of metal prefabricated chimneys, an insulated chimney and a triple wall chimney. Insulated prefabricated chimneys are made of a stainless steel outer casing, one inch of insulation and a stainless steel inner liner.

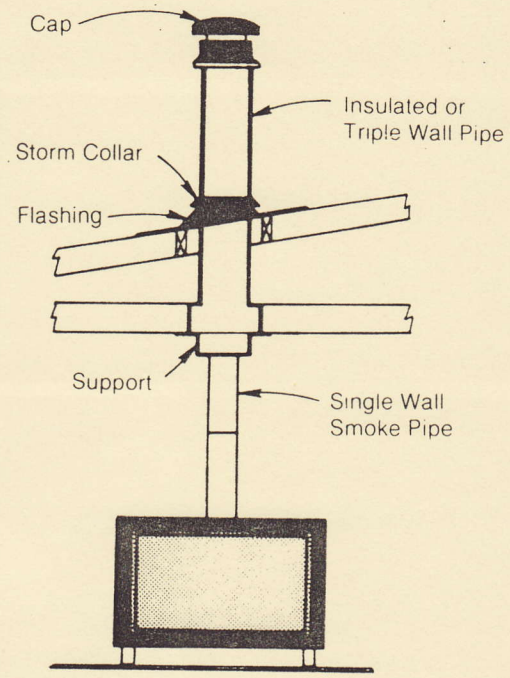
Triple wall chimneys are constructed so that outside air passes down between the outer walls of the triple wall chimney and up along the interior wall. This movement of air cools the chimney.

Triple Wall Chimney

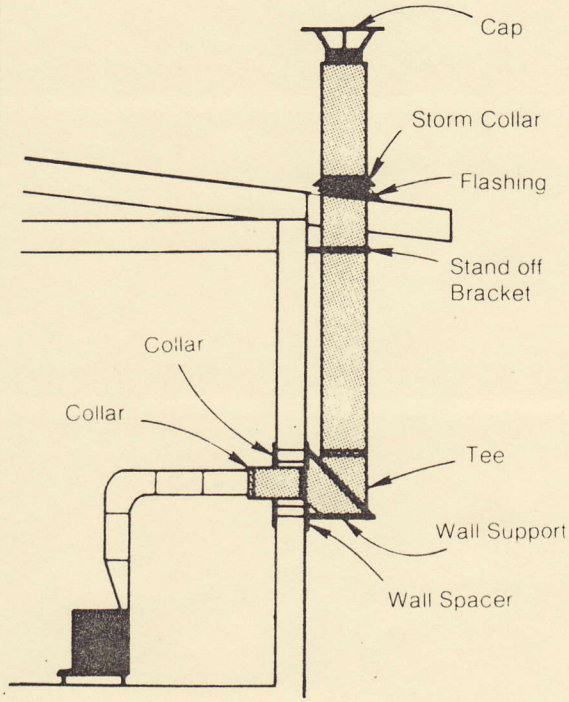
(Cutaway)



Prefabricated Chimney—Interior (Preferred) Installation



Prefabricated Chimney—Outside Installation



Masonry Chimneys

The material cost for masonry chimneys is much less per foot of length than the steel prefabricated chimneys, but much more labor is required for construction.

Masonry chimneys act as large heat sinks to radiate warmth into the room after the stove cools—if it is inside the house and not on an outside wall. An inside chimney absorbs heat from the fire or stove and radiates it back into the living space.

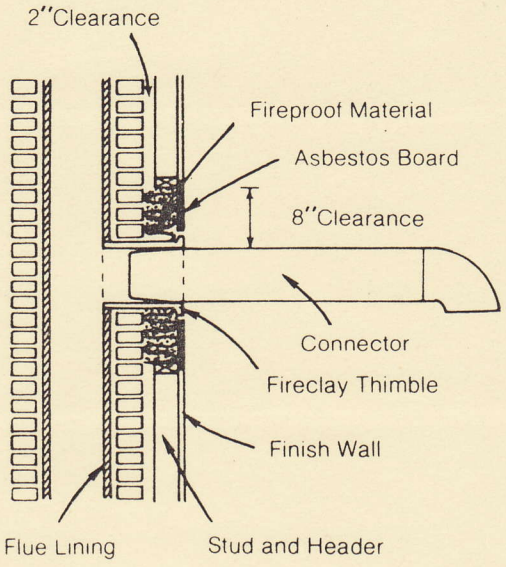
Install the stove pipe so it enters the masonry chimney horizontally. It should be installed flush with and not extended into the flue lining. The wall at the chimney connection must be protected in one of the following ways:

1. If no thimble is used the stove pipe must be securely fastened to the chimney with a high temperature cement. Combustible material within 18 inches of the pipe must be removed. For a 6 inch diameter pipe, this requires a 42 inch diameter hole (6 inches plus two times 18 inches) in a combustible wall. The hole may be closed in or covered with non-combustible materials such as masonry, asbestos millboard, or sheet metal.

2. Use a metal thimble or a burned fire-clay thimble and surround it with at least 8 inches of fireproofing material such as fiberglass insulation or brick. Cover the opening with non-combustible materials such as asbestos millboard or metal. A small gap should be left between the thimble and the covering material to allow either the house or chimney to settle slightly and not crack the thimble. The gap can be covered with a stove pipe flange.

3. Install an insulated ALL FUEL chimney pipe as a thimble. Then only a 2 inch clearance between the chimney and combustible materials is required. Cover the gap between the wall and the stove pipe with a stove pipe flange.

Chimney Connection



Two or More Connections to One Chimney

National Fire Protection Association Standards state that a stove chimney connector is not permitted to be connected to a flue serving a fireplace—a fireplace must have its own individual flue. Franklin stoves have an open front and should be treated as fireplaces in this respect.

Wood stoves should not be connected to the same flue as a gas or oil fueled furnace for two reasons. First, each time the furnace shuts off a small amount of unburned fuel enters the chimney. A spark from the wood stove could ignite the gas and cause a small explosion. Second, the chimney is often not large enough for proper operation of the two heaters.

If two or more stoves, such as a room heater and a cook stove, are connected to the same chimney flue, despite the recommendations against doing so, the connections must enter the chimney at different elevations. A common flue must, of course, be of sufficient size to provide an adequate draft for all the stoves connected to it.

Chimney Caps

A chimney cap is sometimes used to help prevent down drafts where the chimney's top is subject to wind turbulence caused by roof shape, trees, terrain, or other buildings and to keep out rain and snow. Any cap adds resistance to the system and reduces the draft. Mechanical turbines, revolving ventilators and other mechanical devices are subject to failure from creosote buildup and weather. Often the disadvantages outweigh advantages and caps are not used.

If a cap is necessary, a removable flat disk cap is simple and slows gas flow very little.

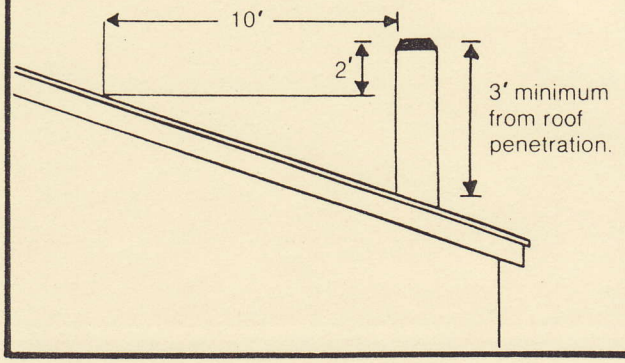
Chimney Height

A chimney should extend at least three feet above flat roofs. On pitched roofs, chimneys should be two feet higher than any point within ten feet, to prevent down drafts caused by wind being deflected from the roof.

The flue lining of a masonry chimney is extended four inches above the top course of brick or stone and the top of the chimney capped with cement mortar. The mortar is two inches thick at the outside edges of the chimney and sloped up to the flue lining to direct air currents upward at the top of the flue and to drain water from the top of the chimney.

Chimney Height

To prevent downdrafts and fire from sparks, chimney height must be at least 2 feet above any roof surface within 10 feet horizontally.



Operation and Maintenance

The operation and maintenance of a wood heater will influence safety and efficiency almost as much as installation. Although any wood burning system poses a fire risk, this risk can be reduced greatly by following the recommended operating procedures and using preventive maintenance. In addition, these procedures will increase the overall efficiency of burning wood.

Stove Operation

Proper fuel is the key to acceptable stove operation, the best fuel for woodstoves being seasoned hardwood. To start the fire, place a small pile of paper and kindling near the front of the stove. After the kindling is burning well, add several larger pieces of wood and use an open-draft setting. When this wood is burning well, add the desired amount of wood. After about 30 minutes turn down the draft regulator to prevent overfiring. Never use combustible liquids to start a fire, and always keep such liquids—gasoline, kerosene, lighter fluid—away from a stove that is heating.

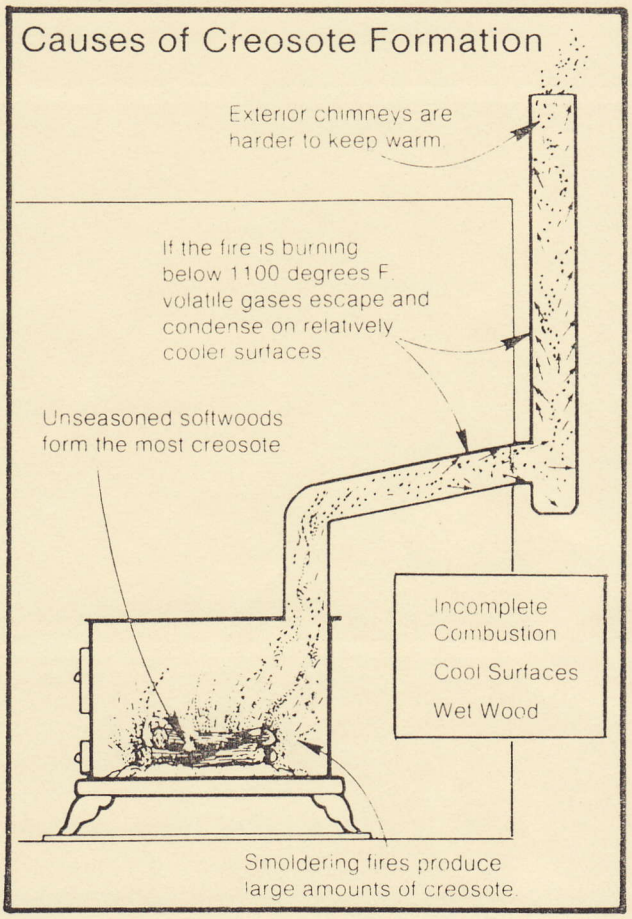
Never use your stove as an incinerator to burn volumes of light materials like paper excelsior, pine needles, etc., which can easily produce a fire hazard. Avoid conditions or actions that cause sudden sharp changes in the temperature of the firebox; for example, applying cold water to a hot stove can warp steel construction or crack cast iron construction.

Learn the stove's operating characteristics across a range of conditions. A stovepipe damper is needed in non-airtight stoves to achieve acceptable draft control. If the stove is an airtight model, you may add a damper to the stovepipe about 6 inches up from the flue collar to get additional draft control beyond that provided by vents.

Periodically inspect your stove and clean, replace, or repair parts; remove and dispose of ashes. Use a metal container with a well-fitted lid for ash removal and dispose of them away from the house after any live coals have cooled.

Creosote Formation

Avoid conditions promoting creosote formation and accumulation; this substance is flammable and is a fire hazard. Creosote results from incomplete combustion. You can reduce creosote formation by avoiding resinous softwoods or green (high moisture) woods; burning the stove hot at least 30 minutes once or twice daily; and avoiding very low draft settings with full loads. Especially avoid low draft settings in the fall and spring when people tend to let their fires smolder because they need less heat than in the winter.



Chimney Fires

Combustion of creosote deposits are likely to occur during a very hot fire. A very intense fire results, creating a roaring noise and producing flames and sparks from the top of the chimney. Chimney fires weaken the masonry in the chimney, can create fires on the roof and are not a safe way to remove creosote from a system.

Follow these steps if you have a chimney fire.

1. Call the fire department immediately.

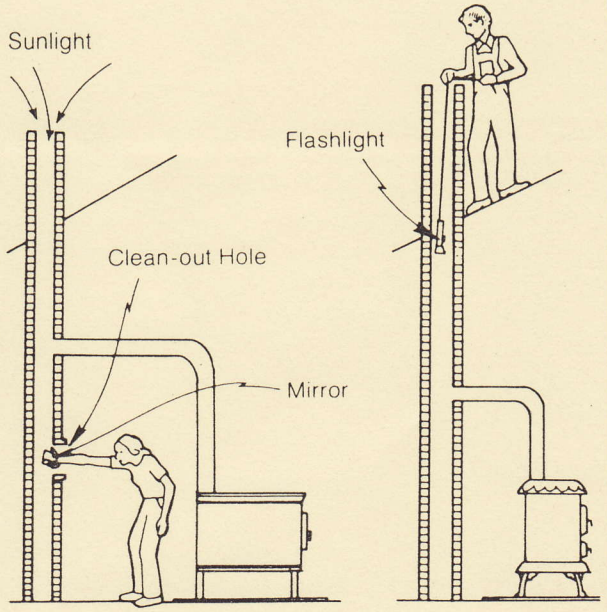
2. Close all openings and draft controls if you have an airtight stove. Close the stove pipe damper in a non-airtight stove.

3. If the fire is still burning, squirt a fire extinguisher or throw baking soda onto the fire in the stove. The chemical travels up the chimney and often extinguishes the flame.

Chimney Inspection

Stove pipes and chimney flues should be inspected frequently for creosote build-up, especially during the first wood burning season. One method for checking stove pipes is to tap on the pipe with a metal object. The sound will change from a metal ping to a dull thud as materials build up inside the pipe. The chimney may be inspected from the roof or, in some cases, a mirror can be used to look up through the chimney flue. If you use an air-tight stove, check the stove pipes once a month.

Inspecting the Chimney



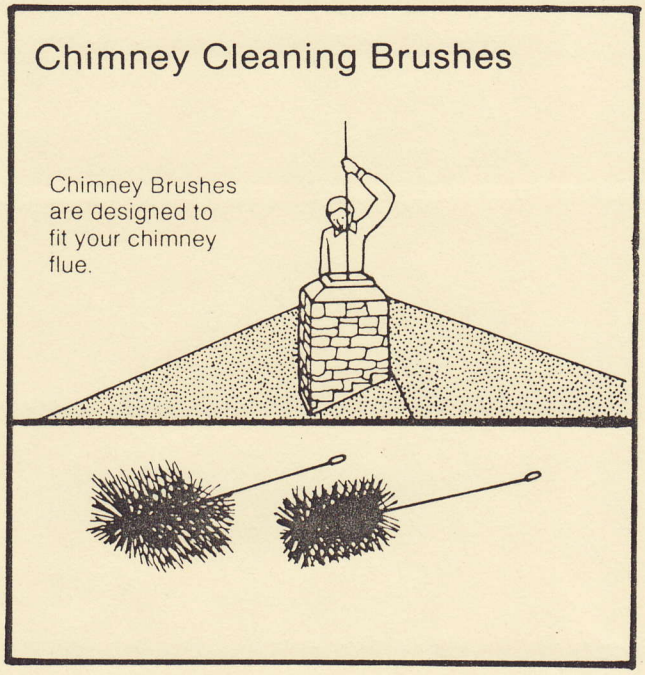
These methods are effective if the chimney is straight.

Chimney Cleaning

The chimney needs cleaning to prevent chimney fires and to improve the draft. How often the chimney is cleaned depends on how frequently the stove is used and how it is operated. Some people recommend cleaning the chimney after every third cord of wood is burned; some recommend once a year. Any time an inspection shows excessive soot and creosote, the chimney should be cleaned.

Chimney Cleaning Brushes

Chimney Brushes are designed to fit your chimney flue.



Chimneys are normally cleaned by mechanical means to scrape off any loose creosote build-up. Clean regularly to prevent plugging or fires. **Stiff wire chimney cleaning brushes** are used by professional chimney sweeps. These brushes are available at reasonable cost. They are constructed to match the size of the chimney flue and can be pushed through the chimney with extension rods or pipe or can be pulled with ropes on either end of the brush. In some cases a weight can be attached to the bottom of the brush which will drag the brush to the bottom of the chimney and it can be pulled up with a rope. People have pulled a bag containing wire neeting weighted with chains or rocks up and down the chimney: others have used tire chains or wire netting without a bag. However, the wire brush would seem to be preferable, as it provides a uniform scrubbing of the entire surface.

Chemicals, such as sodium chloride or table salt, are sometimes used as a chimney cleaner. The chemical combines with water released from a hot fire to form a weak acid that dissolves small amounts of creosote. There is considerable controversy as to how effective such chemicals are.

Even with the most conscientious cleaning habits, the owner of the wood stove still faces some danger of fire. The formation of creosote is a natural process resulting from the burning of wood. A properly installed wood burning stove and properly constructed chimney will withstand an occasional chimney fire. However, the ignition temperature of new house framing is about 500 degrees F. Over a period of years, as this wood is repeatedly heated by chimney fires, the wood will ignite at a much lower temperature. Thus, everything possible should be done to reduce the frequency of such fires.

If you clean the chimney be very careful when climbing on high, steep roofs. You may instead want to hire a chimney sweep who has the proper safety equipment. Many professionals also carry large vacuum cleaners to clean up the soot.

Smoky Fires

One of the most common problems of wood stove installations is smoky fires. Smoke may come into the room through the openings in the stove or the fire may not burn properly because it lacks an adequate draft. Six main causes and cures are:

(1) **Wet wood**. Green or wet firewood causes smoke problems as much of the heat of the fire is used to dry the wood. The cure is to keep a hot fire going and to use seasoned dry wood. If green or wet wood must be burned, split it finer and mix it with dry wood. Soft wood may cause smoky fires because of the resin in the wood.

(2) **Flue too small**. The stove pipe and chimney flue must be large enough to carry the smoke and gases outside. Follow manufacturers' recommendations for stove pipe size. Do not reduce the pipe size between the stove and chimney connection. An 8 inch by 8 inch or 8 inch by 12 inch chimney flue is usually the minimum size for a chimney. If two wood stoves are connected to one chimney, a larger flue may be needed.

(3) **Flue too large**. Many older houses have a large central chimney with several fireplaces and flue openings. If this chimney is used with only one stove or heater there may not be adequate draft to keep the column of smoke rising. By reducing the cross sectional area of the top of the chimney or installing a stove pipe through the center of the flue, the smoke problem should be solved.

(4) **Obstructed flue**. Often stove pipes or flues become partially filled with soot and creosote, especially with small or slow fires. Cure this problem by checking flues and stove pipes once a month during the heating season and clean them when a buildup starts to occur.

(5) **Downdrafts**. Nearby trees, buildings or roof projections often cause downdrafts during windy periods. Raising the height of the chimney, removing the obstruction or placing a cap on the chimney may correct the problem.

(6) **Lack of oxygen**. A fire needs oxygen to burn properly. In a tight, well insulated house, infiltration has been reduced to a minimum. This lack of air can sometimes cause smoke to be pulled back into the house through an adjacent flue. Opening the basement door or a nearby window an inch or installing an air intake to the stove area will generally eliminate this problem.

Stove Installation Checklist

Before starting the first fire in your stove use this checklist to be sure that it is safely installed.

____ 1. The stove does not have broken parts or large cracks that make it unsafe to operate.

____ 2. A layer of sand or brick has been placed in the bottom of the firebox if suggested by the stove manufacturer.

____ 3. The stove is located on a non-combustible floor or an approved floor protection material is placed under the stove.

____ 4. The stove is spaced at least 36 inches away from combustible material. If not, fire-resistant materials are used to protect woodwork and other combustible materials.

____ 5. Floor protection extends out 6 to 12 inches from the sides and back of the stove and 18 inches from the front where the wood is loaded.

____ 6. Stove pipe of 22 or 24 gauge metal is used.

____ 7. The stove pipe diameter is not reduced between the stove and the chimney flue.

____ 8. A damper is installed in the stove pipe near the stove unless one is built into the stove.

____ 9. The total length of stove pipe is less than 10 feet.

____ 10. There is at least 18 inches between the top of the stove pipe and the ceiling or other combustible material.

____ 11. The stove pipe slopes upward toward the chimney and enters the chimney higher than the outlet of the stove firebox.

____ 12. The stove pipe enters the chimney horizontally through a fire clay thimble that is higher than the outlet of the stove firebox.

____ 13. The stove pipe does not extend into the chimney flue lining.

____ 14. The inside thimble diameter is the same size as the stove pipe for a snug fit.

____ 15. A double walled ventilated metal thimble is used where the stove pipes goes through an interior wall.

____ 16. The stove pipe does not pass through a floor, closet, concealed space or enter the chimney in the attic.

____ 17. A UL approved ALL FUEL metal chimney is used where a masonry chimney is not available or practical.

____ 18. The chimney is in good repair.

____ 19. The chimney flue lining is not blocked.

____ 20. The chimney flue lining and the stove pipe are clean.

____ 21. A metal container with tight fitting lid is available for ash disposal.

____ 22. The building official or fire inspector has approved the installation.

____ 23. The company insuring the building has been notified of the installation.

Adapted by Larry W. Turner, Extension Agricultural Engineer, and Kathy Collier, Extension Assistant, University of Kentucky, from the publication, "Burning Wood," by the Northeast Regional Agricultural Engineering Service, Cornell University, Ithaca, New York, 14853.

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