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HEATING THE HOME WITH WOOD

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DOCUMENTS

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Paul B. Stegmeir, vice president, technical operations, The Energy Shed, Inc., Roseville, Minnesota, adapted the Inspection Checklist for Free Standing Woodburning Stoves and Heaters.

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Overview

The energy crisis of 1973-74 renewed interest in burning wood for home heating needs. In some households wood fuel is the dominant means of heating during the cold winter months. However, the return to firewood as a source of fuel for heating the home poses some very important questions: Is it safe? Is it efficient and economical? How is firewood sold and where can it be found? What kind of wood burning units provide the best heat?

This publication is designed to answer some of the most commonly asked questions about wood burning. It combines articles written by staff members at the University of Minnesota and the University of Wisconsin on wood fuel preparation, economics of wood burning, wood burners and chimneys, and safe operation of wood heating systems. In addition, a checklist for proper set-up of wood burning units has been included in the publication. The checklist was prepared by a regional expert on wood burning, Paul B. Stegmeir. Heating with wood can be an enjoyable experience, but it must be done with some consideration of the problems encountered along the way.

Firewood: Procurement and Preparation

Introduction

Woods-related accidents due to chainsaw misuse and tree felling by inexperienced operators have increased with the new enthusiasm for burning wood. Knowing the hazards of preparing firewood should mean seeking guidance to avoid them.

This knowledge used to be passed from generation to generation, but today many people lack necessary firewood preparation skills. However, these skills can be developed.

Purchasing Firewood

Pros And Cons

Firewood can be purchased in several forms. Obviously the more service the seller provides (such as splitting, seasoning, delivering, and stacking), the less labor, time, and equipment will be required of the homeowner. However, the expense will be greater. At present prices of alternative energy sources, many people are paying more for prepared firewood than is economically justified (Economics of Burning Wood, p. 14).

There are several other problems in buying firewood. The species and quantity of wood being bought may not be known and it is difficult to determine how thoroughly the wood has been dried.

Purchasing firewood may be a better choice if only a cord or two per year is needed, or the buyer lacks the time, equipment, and physical ability to prepare firewood and can justify the extra cost.

The following suggestions should be helpful.

Measuring Firewood

Avoid buying firewood by weight unless the moisture content can be determined at the time of sale. Water may be a substantial and unknown part of the total weight.

Even though the weight method is more precise (and used by some forest industries), most firewood dealers sell on a volume basis because it is well understood and readily measured by both buyer and seller.

The unit of volume measurement is the standard cord, which is defined* as an orderly pile of wood,

occupying a space 4 feet by 4 feet by 8 feet or 128 cubic feet (figure 1). By legal definition a cord shall consist of 4 foot long logs. However "pulpwood" cords consisting of 100 inch long logs are generally recognized by forest industry personnel.

How much solid wood (i.e., excluding bark and voids between logs) is in a cord? Solid wood content varies from about 50 to 100 cubic feet per cord depending on the diameter, roughness, and crookedness of the logs. Eighty-five cubic feet per cord is an accepted average value.

When a cord of logs is sawed and split into firewood, the solid wood content remains unchanged but the overall pile volume becomes somewhat less than 128 cubic feet because pieces will then pack together more tightly. Minnesota law states that a cord of logs sawed into firewood lengths and stacked neatly shall occupy 110 cubic feet of space and a cord of logs sawed, *split*, and stacked neatly shall occupy 120 cubic feet of space (figure 2).

Figure 1. A standard cord.

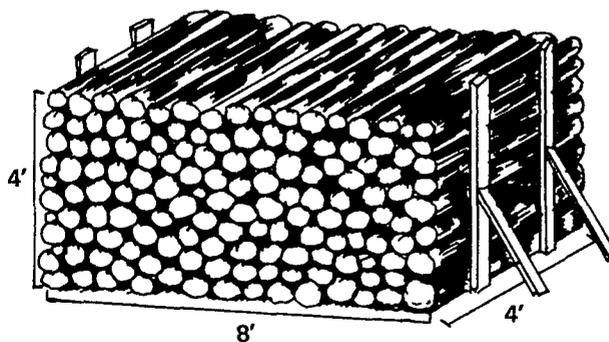
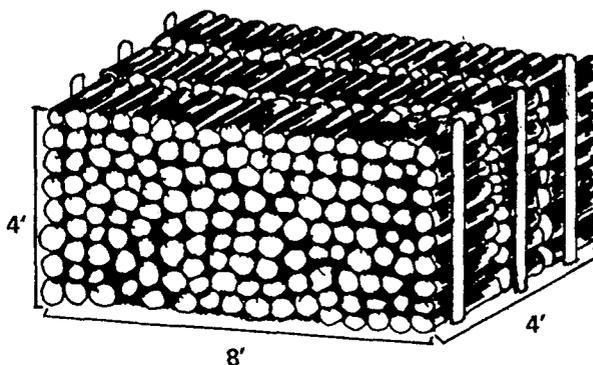


Figure 2. A standard cord cut into firewood can be slightly less than dimensions here.



*Forbes, Reginald D. *Forestry Handbook*. Ronald Press, New York. 1955. Minnesota Statute 239.33 Standard Measurement of Wood.

Firewood is also purchased in units smaller than cord lots. The terms face cord, rick, fireplace cord, stovewood cord, and shortwood cord are frequently used, sometimes interchangeably, to refer to some fractional portion of a cord. In practice, at least two terms, the rick and fireplace cord commonly refer to one-third cords. However because all these terms have varying definitions and are misunderstood, they are not legally recognized. If a portion of a cord is purchased, the volume in cubic feet should be determined by multiplying the stack measurements. When, for example, one-third of a cord of sawed firewood is purchased, the stack volume should be 37 cubic feet ($1/3 \times 110$ cubic feet). The stack volume of one-third of a cord of sawed and split firewood should be 40 cubic feet ($1/3 \times 120$ cubic feet).

Sometimes firewood is sold by the pickup truck load. Pickups will usually hold one-third of a cord if the springs don't give out. (See table 2 for cord weights at 20 percent moisture content.) Since green hardwood firewood can be very heavy, the springs could be overloaded before the box is full of wood. After the wood is home and stacked, measure the stack dimensions to translate the pickup load into cord volume.

What Species Of Wood To Buy

Table 2 lists the heating value of various hardwood and softwood species. Higher density hardwoods will burn for a longer period and produce more heat per unit volume than lower density hardwoods or softwoods. So, for most heating requirements buy the densest hardwood readily available and most favorably priced. Aside from its general suitability some softwood and low density hardwood firewood should be on hand at least for kindling and for quick, hot fires.

If unsure of the wood species purchased obtain a tree or wood identification guide such as Extension Bulletin 363, "Minnesota Forest Trees" available by writing to the Bulletin Room, 3 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, Minnesota 55108.

Burn Seasoned Wood

Seasoning, or drying, takes place until the wood equalizes with the surrounding air environment. Stacked outdoors in a sunny open area, wood eventually dries to about 15-25 percent moisture content; indoors to about 6-10 percent.

Most woodburners are satisfied with the combustion achieved when wood is dried to 15-25 percent moisture content though drier wood will produce even more heat and less creosote. At least 6 months of favorable drying weather is required to reach a moisture content of 15-25 percent. Proper seasoning can be determined by periodically weighing several representative firewood pieces until there is no further reduction in weight. End checks or splits may not indicate interior dryness.

Purchase firewood well in advance of the heating season to allow ample time for drying if it is purchased green or its dryness is questionable.

Processing Your Own Firewood

Pros And Cons

Preparing firewood is hard work, takes time, requires an investment in equipment and a knowledge of its use. However it is good exercise, can be a family activity, and results in custom cutting and seasoning to individual requirements. Also if equipment can be depreciated for an extended period and firewood sources are relatively close to home, preparing firewood is the most economical.

As an alternative to purchasing prepared firewood or preparing firewood from start to finish, woodburning enthusiasts are encouraged to consider purchasing whole logs delivered to the house by an experienced and well-equipped logger. This avoids the problems and hazards of locating, felling, and transporting logs out of the woods. And mutual savings can be realized when firewood is prepared during loggers' slack periods.

Firewood Sources

Land managing agencies and individuals have more reasons than generosity and public relations promotion for allowing firewood cutting on their land. By removing poorly formed, diseased, dead, competing trees and logging residues, firewood cutters aid the forest by "cleaning" it up and by promoting the growth and worth of the remaining trees.

To prevent misunderstandings between landowner and firewood cutter a written permit is usually required. A firewood permit generally specifies: a location description; the kinds of wood to be removed (logging residue, dead trees, or only marked trees); the amount and time of cutting allowed; and a liability waiver to any accidents.

Occasionally, locating a firewood source can be very discouraging to a prospective wood heater. If not so fortunate as to own wooded property, the following list will at least give ideas of where to look for firewood and the proper authorities for issuing firewood permits.

Important Note:

It is unlawful to cut firewood on what appears to be "wild land." Permission must be gained from the owner(s). If it is not apparent who owns the land, i.e., if it is not posted, the owner(s) can be determined through land records in county courthouse offices.

County Lands

Contact the county land commissioner or forestry department in that respective county. Due to the lack of forested lands, some counties may not offer any firewood cutting privileges.

State Lands

Contact the Department of Natural Resources (DNR) district forester in the cutting area. Some districts,

particularly those near large cities, may be able to issue only a limited number of permits depending on firewood availability (see map of DNR offices on p. 6).

Federal Lands

Firewood cutting on federal lands is generally limited to logged areas or areas which can be clearcut. Federally owned forested land in Minnesota is primarily in the Superior and Chippewa National Forest. Cutting permits are issued by the appropriate district ranger.

Superior National Forest Districts (area code 218) Chippewa National Forest Districts (area code 218)

Isabella	293-4255	Blackduck	835-4291
Gun Flint	387-1750	Cass Lake	335-2283
Ely (Kawishiwi)	365-3158	Deer River	246-2123
La Croix	666-5421	Marcell	832-3161
Aurora	229-3371	Walker	547-1044
Tofte	663-7280		
Two Harbors	834-5106		
Virginia	741-5736		

Private Industrial Lands

Pulp, paper, timber, railroad, and mining companies are possible sources of firewood. These companies may allow firewood cutting, because it promotes public relations. Usually permits are issued only for salvage of logging residues and are often limited to people familiar with the area. Illegal cutting and accident lawsuits may threaten this source in the future.

Company foresters will often recommend or insist that an individual contact a local logger cutting on company lands to buy logs directly. This prevents cutting in the wrong area, reduces the number of accidents and lawsuits, and saves the individual the work and expense of felling, skidding, and transporting logs to a selected site.

Permission to cut firewood on these lands is obtained from the company forester or woodland's manager.

Private Woodlots

Landowners with substantial woodlots will occasionally allow firewood cutting. Whether permission is secured depends on whether firewood cutters in the past have demonstrated respect for the property.

Landowners who would like to make woodlots available to the public can contact the local DNR district forester for further information. A Timber Stand Improvement Plan can be determined and the appropriate trees marked for firewood cutting to benefit both the woodlot owner and firewood cutter.

Land Clearing Operations

In preparation for rights-of-way and commercial developments, tree removal may be necessary. When an easement is involved (between a private landowner

and a pipeline company, for example) the landowner usually retains the rights to any timber removed, but this depends on the agreement between the landowner and clearing contractor. Permission to salvage firewood may be obtained from the landowner and/or land clearing contractor. Land clearing contractors are listed in the telephone book yellow pages. Also, power companies, pipeline contractors, and highway departments may be able to provide some guidance.

Residential Tree Removals

Sometimes trees must be removed from residential areas because they are obstructing something or causing a hazard. Tree removal companies too, are listed in the yellow pages.

Dutch elm disease and oak wilt disease are killing an alarming number of trees in Minnesota which could provide a potential source of firewood. Communities not using this resource may be just burning or burying it. Check with tree inspectors for permission to use such wood.

SPECIAL NOTE: Storing Elm and Red Oak Firewood

Red oak and elm make good firewood, but several important steps are necessary to prevent infection of nearby healthy trees. State regulations† require that elm and red oak firewood be burned by April 1. Storing red oak and elm firewood between April 1 and September 15 requires that the bark be removed.

There is another alternative for storing red oak (not elm). If a red oak has wilted after July 1, and was cut into firewood during the winter, it may be kept that following summer if it is wrapped securely in four mil plastic from April 15 to July 1.

Because the summer months are needed for drying, it is usually imperative that elm and red oak firewood be debarked to conform with regulations. Bark removal can be accomplished with a drawknife or spud and hard work.

Sawmills And Wood Using Industries

Slabs, edgings, trim, and scraps are often burned as waste by wood-using companies. Check with such companies on the availability of this resource.

Wisconsin Sources

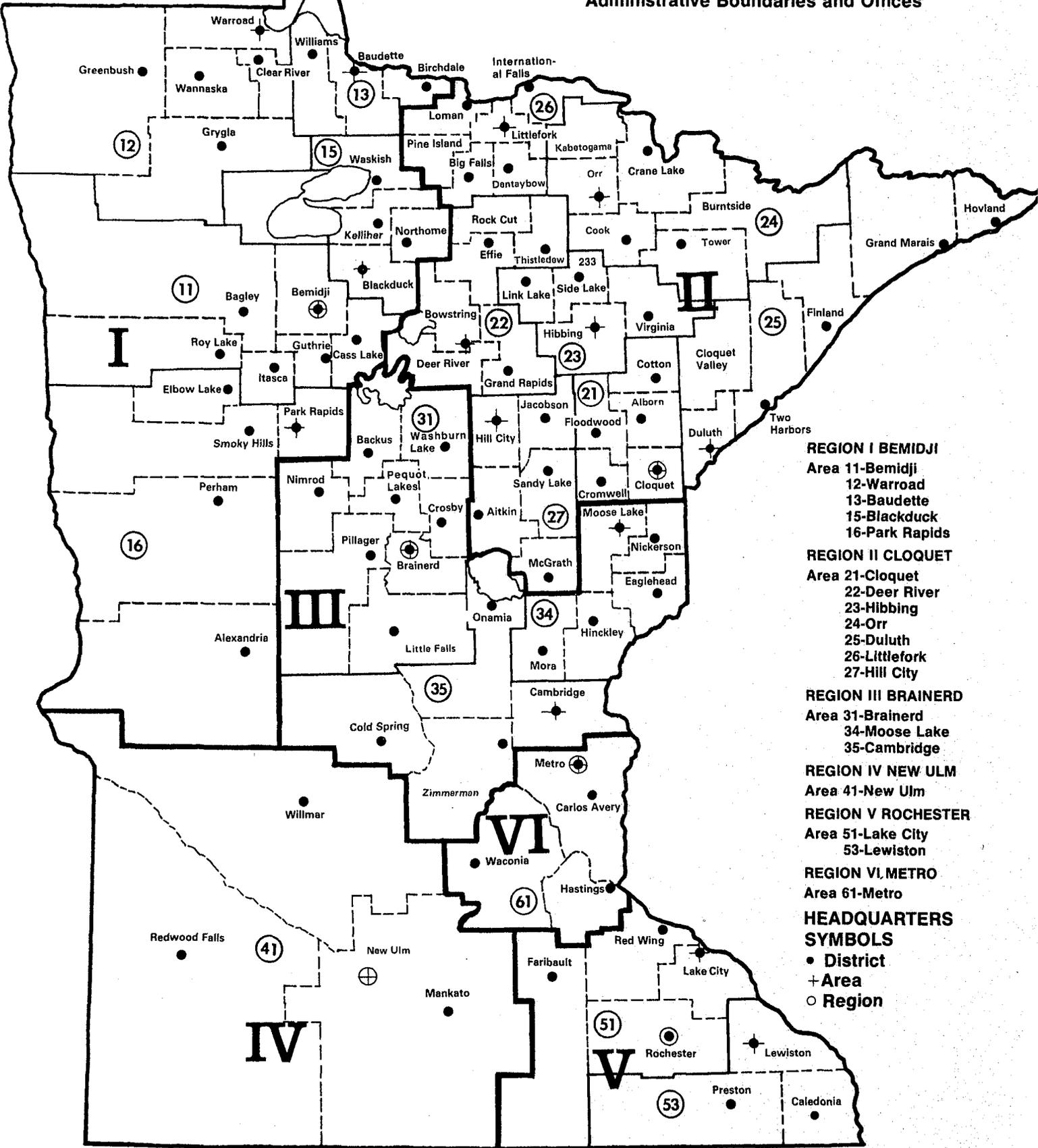
A list of Wisconsin firewood sources is available from:

Agricultural Bulletin Building, 1535 Observatory Drive, Madison, Wisconsin 53706.

Ask for publication G2873, Wood for Home Heating: Locating, Cutting and Gathering Wood. Enclose 15¢ plus postage.

†The Minnesota Department of Agriculture regulates disposal and storage of elm and oak for the state. Check with municipal authorities regarding further restrictions.

State of Minnesota
 Minnesota Department of Natural Resources
 Division of Forestry
 Administrative Boundaries and Offices



REGION I BEMIDJI
 Area 11-Bemidji
 12-Warroad
 13-Baudette
 15-Blackduck
 16-Park Rapids

REGION II CLOQUET
 Area 21-Cloquet
 22-Deer River
 23-Hibbing
 24-Orr
 25-Duluth
 26-Littlefork
 27-Hill City

REGION III BRAINERD
 Area 31-Brainerd
 34-Moose Lake
 35-Cambridge

REGION IV NEW ULM
 Area 41-New Ulm

REGION V ROCHESTER
 Area 51-Lake City
 53-Lewiston

REGION VI METRO
 Area 61-Metro

HEADQUARTERS SYMBOLS
 • District
 + Area
 ○ Region

When cutting on another person's land, follow the landowner's directions. Know exactly where to cut, what to cut, how much to take, and whether to pile any remaining slash. Being extra careful with other people's property, whether it be private or public, will ensure continuing use. In-field guidance and advice on thinning, forest management, and timber stand improvement (TSI) is available from DNR district foresters. A pamphlet, *Improve Your Woodlot by Cutting Firewood*, outlines the major considerations involved when thinning and may be obtained from: USDA Forest Service, Northeastern Area, State and Private Forestry, 1992 Folwell Avenue, St. Paul, Minnesota 55108.

Cutting Season

Timing of firewood gathering is important. The best time of year to "put the wood up" varies depending on the accessibility of the cutting area, and intended burning date. Cutting should definitely be planned to take advantage of the favorable summer drying months.

It is nearly impossible to haul wood during breakup in the spring since the soil is soft and in late winter because of deep snow. Fall is a pleasant time to be in the woods and hardwoods generally have lower moisture contents then. However, wood cut in the fall will not burn satisfactorily the following winter because it will not have dried long enough.

Several sources have indicated that by felling trees (without bucking them into logs immediately) in the late spring or early summer, a substantial amount of moisture may be drawn out of the tree trunk and branches by the emerging leaves. Further processing during the summer may allow enough time for drying before the immediate heating season.

Transportation

Transporting wood is generally the most expensive step in preparing firewood. Before cutting, consider how to get the wood home (figure 3). It might be more economical to rent a large truck than to make many trips with a pickup.

If it is impossible to drive right to the trees, consider how the trees or logs can be moved to a landing. Will it take horses, a crawler tractor or a skidder? If haul roads or skid trails are lacking will new ones have to be built?

Chain Saw Use

When handled improperly chain saws are a major source of accidents in the woods. Novices should seek instruction from a knowledgeable friend or chain saw dealer who can demonstrate safe use.

If the chain saw manual fails to give adequate safety instructions, the following guidelines will provide some background.

Protective Equipment

Always wear protective equipment to reduce injuries when operating a chainsaw or working in the woods. Being properly dressed includes wearing the following items.

- Hard hats are very important in preventing head injuries from falling limbs and trees and are available with eye shields and ear muffs.
- Heavy duty boots with steel toes, and non-slip soles protect lower legs and toes and prevent falls.
- Chain saw (timber) chaps with ballistic nylon inserts prevent cuts to the legs.

Figure 3. If wood is not located nearby, a truck larger than this tractor-trailer unit may be more economical for hauling firewood out of the woods.



- Eye protectors will prevent sight loss from flying wood chips. Goggles or shields made of wire screen or plastic lenses are available.
- Ear protectors such as molded plugs or muffs prevent hearing loss from chain saw noise.
- Properly fitted clothing should neither snag nor hamper freedom of movement.
- Leather gloves protect hands from cuts and abrasions.

Chain Saw Safety Precautions

- Handle fuel with respect. Always mix and store fuel in approved safety containers properly labeled. Stay clear of heat producing sources, such as running engines and never smoke while refueling. Fill over bare ground, not near flammable materials. Wipe off the saw and move away from the filling area before starting. A fire extinguisher should be nearby whenever refueling.
- Hold the saw firmly on the ground to start it.
- When moving short distances with the engine running carry the saw with both hands to maintain control. When carrying the saw from one job to another, always stop the engine and place the chain guard over the bar. Always stop the engine when checking the chain tension.
- Physical fatigue can lead to accidents. Fatigue can be avoided by physical conditioning, planning ahead to avoid problems, working slowly, resting frequently, and keeping the chain sharp.
- Obey the following handling techniques to maintain control of the saw at all times.
 - Keep body balanced by standing with feet well apart and one ahead of the other.
 - Keep body away from the saw's cutting path.
 - Keep arms slightly flexed and the saw close to body.
 - Don't overreach with a chain saw.
 - Prevent kickback injuries by:
 - holding the saw firmly with both hands
 - gripping the top handle with the thumb around it
 - using a saw equipped with a chain-brake or kickback guard
 - watching for twigs that can snag
 - not pinching the bar
 - sawing with the lower part of the bar, close to the bumper, not on the top near the nose
 - maintaining adequate saw speed when entering or leaving a cut in the wood

Felling

Accurate tree felling is an art and takes practice to master. The following guidelines outline the procedures and potential hazards.

- **Never work in the woods alone!** Assistance or help in emergencies should always be readily available.
- The direction you **want** the tree to fall and the direction it does fall are often different (figure 4). The following factors must be considered to determine the direction of fall:

The tree's natural lean. Trees leaning less than 5° can often be felled in any direction.

The presence of large branches on one side.

The wind direction and velocity. Don't cut on windy days.

The presence and position of rot. If rot is discovered in the tree's center, the tree's fall may be unpredictable since there is little "hinge" wood. Be extra careful.

The presence and position of other trees near the one being cut.

The presence of ground obstacles. Avoid felling across objects or gullies which could break the stem.

The topography of the land. Trees on hillsides should be felled diagonally across the hill.

The skidding direction. If skidding the logs or trees to a landing, fell the trees so that the base of the tree is pointing in the skidding direction toward the landing.

The use of wedges or a push from a tractor can also help direct the fall.

- Drop all dead trees in the surrounding area before felling any live trees. This will prevent them from falling on someone unexpectedly. Be extra careful with dead trees because of falling branches and broken tops.
- Maintain a distance of at least two tree lengths between others felling trees.
- After determining the felling direction, clear an escape path and the area immediately around the tree of all obstructing brush and timber. The escape path should be to the rear and at an angle away from the felling direction.
- Before cutting a tree down, be sure the chain saw has enough gas and chain oil to finish the felling cuts.
- Be sure the felling path is clear of people and animals before and during felling.

The Felling Cuts

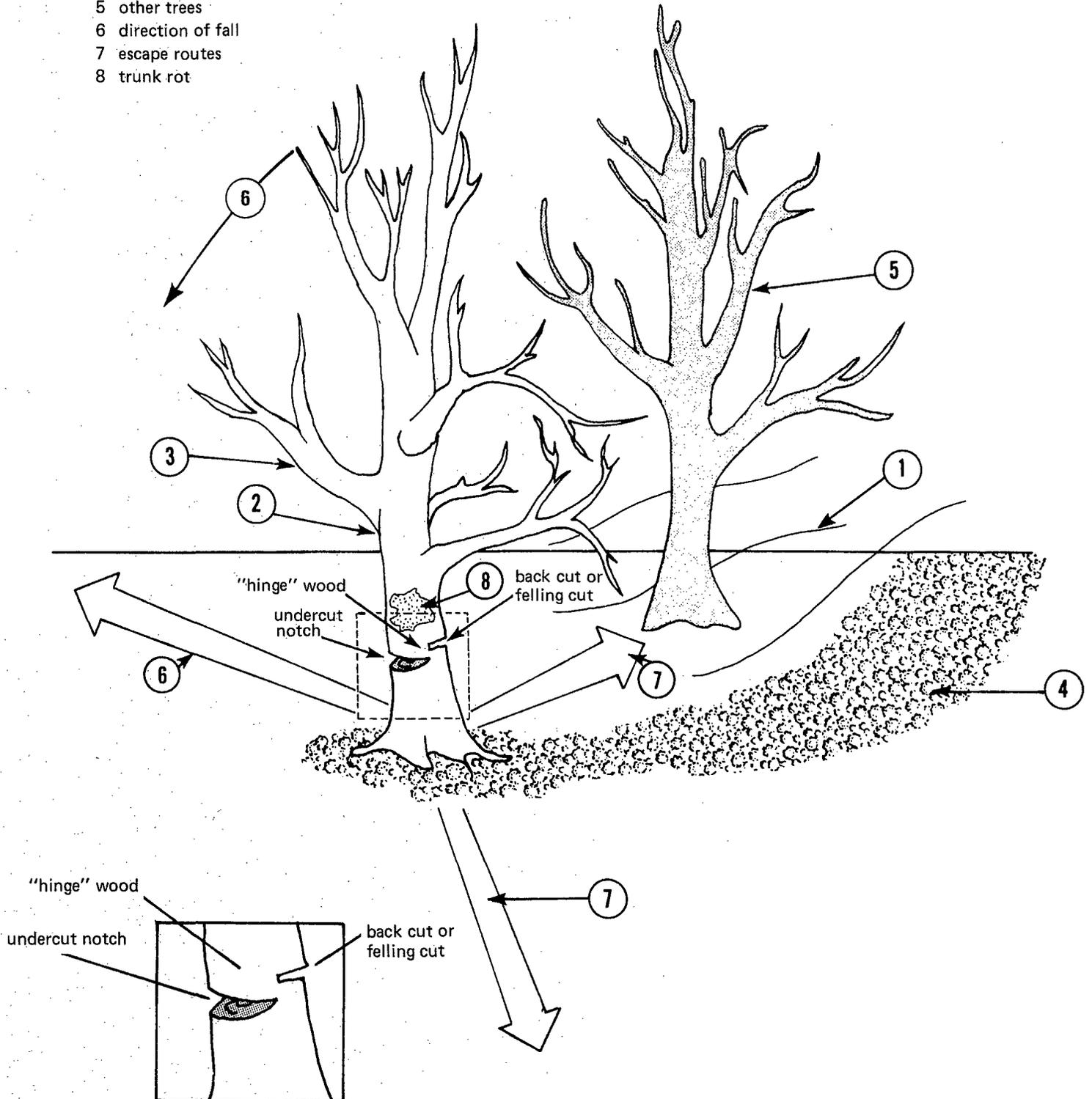
The felling cuts involve making an undercut notch and a backcut (figure 4 inset). The undercut notch is made on the tree's side toward the direction of fall. It should extend from 1/4 to 1/3 of the diameter into the tree. Cut the lower horizontal cut first to prevent pinching the bar.

The backcut is made opposite to the undercut notch. It should be about 1 to 2 inches above and parallel to the horizontal cut of the undercut notch. Stop the

Figure 4. Accurate tree felling is possible if these factors are observed and the felling cuts are made correctly.

Factors to consider when felling a tree

- 1 direction of wind
- 2 natural lean of tree
- 3 large branches
- 4 skidding direction
- 5 other trees
- 6 direction of fall
- 7 escape routes
- 8 trunk rot



backcut about 1 to 2 inches before cutting through to the undercut notch. The wood left uncut in the tree's interior is called holding wood. It acts as a hinge to control the direction of fall and prevents the tree from kicking back as it falls. If the tree is larger in diameter than the bar's length, cuts on each side of the tree may be required. Keep an eye on the top of the tree and the backcut for indications of movement. If the tree begins to fall in the intended direction, immediately stop the saw and place it in a location safe from the falling tree. Then quickly retreat on an escape path. If the tree falls back closing the backcut and pinches the saw before it can be removed, stop the saw and drive a non-steel wedge or two into the backcut or get some help to push it over.

A tree that becomes hung up in another must be handled with extreme caution. **Never get under a hung tree, nor attempt to climb either tree, nor attempt to cut the standing tree!** Either pull the hung tree down, or roll it over with a peavey or cant hook (figure 5).

Limbing And Bucking

Accidents frequently occur when limbing, because footing is poor, and obstructing branches impair vision and can cause kickback injuries. Work slowly and be extra cautious. Begin limbing from the base of the tree and work towards the top. For protection keep the tree trunk between cutter and the limbs being cut. However, if the tree is lying on a hillside, **always** limb

from the uphill side. Maintain footing by clearing away all cut branches. Avoid walking on the tree trunk since it can roll resulting in a nasty fall.

Branches on the underside of the trunk should be left till after bucking. Such branches help keep the trunk off the ground and often prevent pinching the bar.

A springy sapling bent over and trapped under a felled tree should usually be left until the trunk on top can be rolled off. Cutting such springy poles risks getting hit.

Whether wood is cut to firebox length right in the woods or at home makes little difference. If there is access to any log loading equipment it would probably require less handling to cut the trees into 4 or 8 foot lengths, transport them home, and cut the logs to firebox length on a sawbuck or arbor saw. A sawbuck is easy to make and very useful. It keeps the chainsaw from hitting dirt, and situates the log at an easier working height. For safety, keep firewood cleared away from the sawbuck to maintain footing.

Never cut into the ground with a chainsaw. Roll the log over with a peavey or cant hook to finish a cut or raise the log a bit with a sturdy pole. Always watch for rocks on the ground and metal (nails, wire) imbedded in the tree.

Cut wood 4 inches shorter than the firebox. Remember shorter length wood will split easier and dry faster. Generally 16 to 24 inches is standard. A measuring stick is useful to mark the length of each piece.

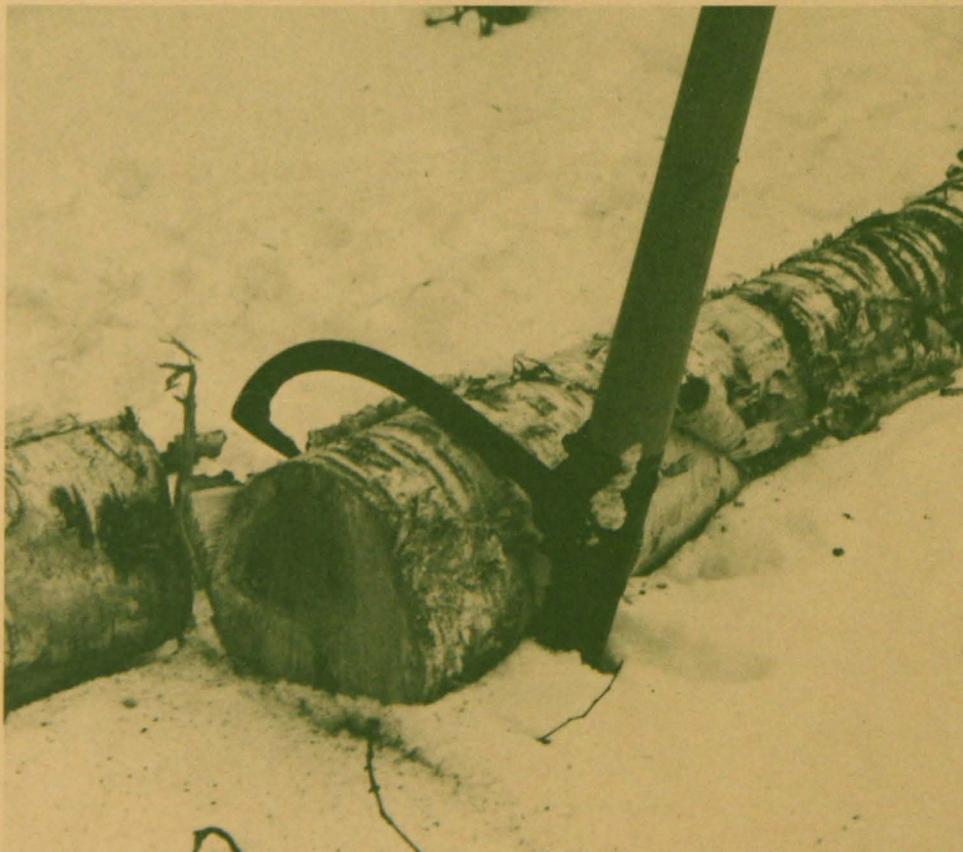


Figure 5. A cant hook is very useful for rolling heavy logs on the ground and can unlodge hung up trees.



Figure 6. Saw pinching can be avoided by determining where tension and compression occur along the stem and making the final cut on the tension or "opening" side.

Pinching the chain saw's paddle is very common and frustrating when limbing and bucking, but it can be eliminated with these guidelines (figure 6).

If the stem is supported on both ends, then the stem is in tension on its lower side. Cut downward from the topside first and then upward from the bottomside last. If the stem is too close to the ground to prevent hitting it with the chain, cut downward from the topside and roll it over. If necessary use a wedge in the cut to prevent pinching.

If a stem is supported on only one end, the wood tension is on the stem's topside. Then, cut upward from the bottomside first and downward from the topside last. Remember, quickly remove the bar at the first indication of a closing cut.

Splitting Firewood

Why Split?

Split firewood, since it has more surface area and edges, dries faster, will ignite more readily and is easier to handle than roundwood. Even though drying time is influenced more by the firewood length, splitting and subsequent drying from split surfaces substantially improves the drying rate. Rapid drying is especially important for tight-bark species like birch to prevent decaying inside the bark.

Firewood Size

The size to split firewood depends on personal preferences and heating habits. Smaller, thinner sticks dry faster than larger bulkier pieces, but burning larger pieces will generally mean fewer trips to the stove to refuel. As a suggested guide: 6-10 inch diameter

pieces should be at least halved; 10-14 inch diameter pieces, at least quartered; and greater than 14 inches in diameter, sectioned appropriately.

Splitting Equipment

Tools for splitting include the splitting maul, axe, sledge and wedges, splitting stands, hydraulic ram splitters and screw type splitters (figure 7). Hand splitting tools generally cost less than \$30 but require more labor and time. Power splitting equipment saves labor and time, and may be economically justified if a considerable amount of wood is burned each year. Screw type splitters cost between \$200 and \$500 and an average size hydraulic ram splitter will cost between \$500 and \$1,000 or can be rented. Due to the mode of operation, screw type splitters can be more hazardous than hydraulic ram splitters. An emergency shut off switch or brake within reach of the operator would be a worthy safety feature if clothing should get caught in the spinning screw.

Splitting Procedures And Precautions

Though splitting by hand is hard work, it is a chore nearly anyone can master. It is good exercise and helps work out frustrations in a useful way.

A single-bit axe will handle easy-to-split wood. Choose an axe with 2¼- to 3-pound head and at least a 30-inch handle. A shorter handle may be the difference between planting the axe in the ground and striking the shin should the firewood block be missed.

Hatchets are easy to wield but due to their size are limited to splitting kindling. When splitting kindling be sure to pull the hand away from the piece before it is struck.

A splitting maul, which is a combination axe and sledge in one, will handle nearly all wood splitting chores. A splitting maul with a 6- to 8-pound head is usually adequate. If the axe end of a maul won't split the piece, the sledge end can be used to drive a wedge which is similar to pounding a nail. Use small blows to start the wedge and be sure it is "set" securely before walloping it. Keep a second wedge nearby if the first one gets buried in the wood. If a piece cannot be split through the center, try slabbing off sections from the circumference.

To prevent any danger from flying wedges, splitting stands have been developed which hold a wedge on a sliding track device.

Whenever splitting firewood observe the following safety precautions:

- Keep bystanders at least 20 feet away.
- Wear goggles or safety glasses whenever striking a steel wedge.
- Wear foot and shin protection.
- Keep split pieces cleared away to maintain footing.
- Regrind wedges that become mushroomed.
- Never use an axe as a wedge or for driving a steel wedge.
- Replace damaged handles.
- Keep handles tight by driving a resin impregnated wedge into the end of the handle. Soaking an axe in water to tighten the handle is only a temporary solution.

Seasoning And Storage

The final and most important step in firewood preparation is proper storage and adequate seasoning. It takes a minimum of 6 favorable drying months for medium to low density firewood to dry to about 20 percent moisture content. The time of year the wood is cut and the size of the firewood segments can have significant influence on the drying rate. However, total drying time and the final moisture are most profoundly affected by properly stacking and storing firewood to improve drying conditions.

Guidelines and Alternatives for Stacking and Storing Firewood Outdoors

Choose a sunny, open, airy, and well-drained location for firewood piles. Shady, damp, enclosed areas are not conducive to evaporating moisture (figure 8).

Provide a supporting base such as cement blocks or old planks for each pile in order to prevent drawing moisture from the ground and to promote air circulation.

While stacking, it may be helpful to segregate firewood by species and size so locating a certain kind will be easier.

Firewood piles are usually stacked in rows 4 to 6 feet high and 8 to 16 feet long. Conventional rows should be situated at least 4 feet apart to allow adequate air movement. Avoid stacking between small trees since swaying may cause the pile to fall. Building the piles' ends up by alternating the direction of the end pieces or stacking between posts set in the ground are two ways to keep a pile neatly stacked.

Figure 7. Mechanical splitters are becoming more popular than hand splitting tools; however, wood requirements and equipment costs should be considered before purchase.

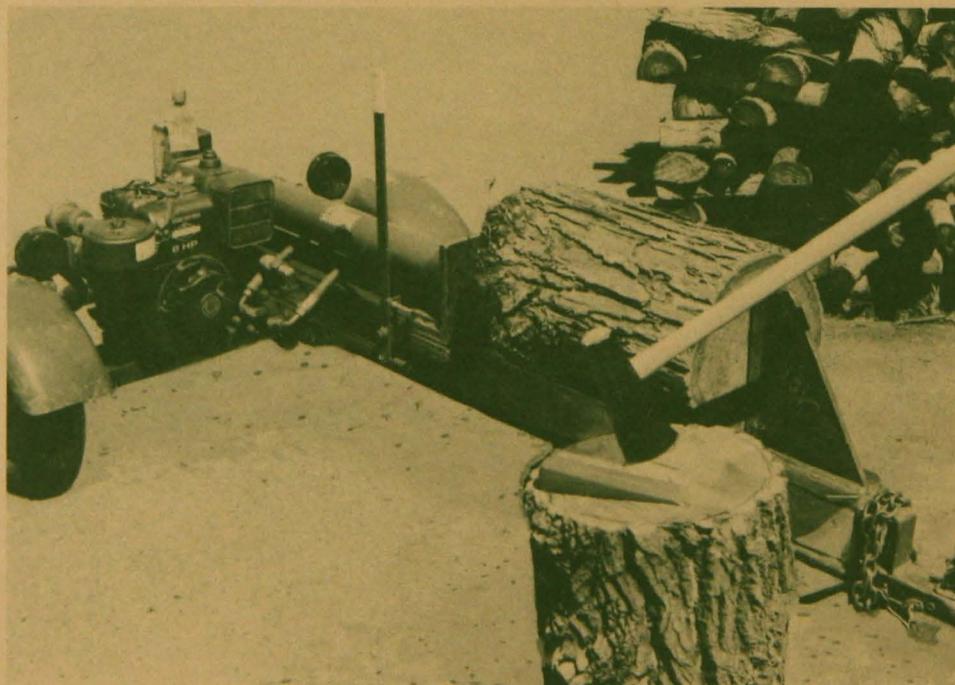




Figure 8. Stacked firewood piles are located in a sunny, open area, piled on old planks and covered with tar paper to keep dry.

An alternative method worth considering is to stack firewood "Lincoln" log fashion in columns. Drying columns increase the drying rate because air can circulate freely about the sticks. These are quite easy to make but take more area than a conventionally stacked pile. A little experience will indicate how high the column should be stacked to avoid toppling.

Cover the top of the pile to shed rain and snow. A roof need not be elaborate, but it should be well secured. A 3 or 4 foot strip of polyethylene with 2 poles fastened along the edges or heavy tar paper secured by ties or weight will cover the top of the pile.

A more permanent shelter can be constructed by building a roof on decay-resistant or treated posts. Build it large enough so piles can be well spaced.

Keep the grass mowed around woodpiles so air movement will not be restricted.

Precautions For Storing Firewood Indoors

Firewood is normally seasoned adequately outdoors. Though it is advantageous to store firewood indoors for additional drying, this practice can lead to problems. Firewood sometimes contains the eggs or larvae of wood-destroying insects, though their presence may not be apparent. Dormant insects can become active if the firewood in which they are hibernating is warmed by indoor storage.

If pin-head size shot holes or honeycomb-like galleries are present, leave this wood outdoors until it is to be burned. Even firewood that does not have these symptoms should not be stored more than 2 weeks indoors.

If an infestation arises, remove any remaining firewood and consult your county extension office.

Economics Of Burning Wood

Energy shortages and high fuel prices are bringing renewed interest in heating with wood. There are several fuel facts to consider in using wood for house heating or fireplace supplement. Not only do heat values, British thermal units (Btu's), vary greatly among wood species, but moisture content, density, and growth rate make a difference.

Fireplace Use Of Wood

Compared to the wood-burning stove or furnace, the ordinary fireplace is a poor heating unit, especially in Minnesota where below zero overnight temperatures are common in January and February. If a fireplace could be operated on a 24-hour basis, a certain amount of heating value could be obtained. This would be especially beneficial in emergency situations where the primary heating system fails. However, most fireplace owners operate units intermittently, during the afternoon or evening. While the unit is in operation, it provides some heat, but the cooling period drains heat from the house. Unless the fireplace has a glass screen, excessive amounts of heated air escape up the flue. On a cold night, such loss would probably be far greater than any fireplace heat gained from its operation. An open fireplace is rarely more than 10 percent efficient.

Heat Values

Heat values are not the only basis for selection of fireplace woods. The fragrance of wood and amount of sparks produced in burning are other considerations. Check some of the properties of commonly used fireplace woods in table 1.

Calculating Wood Fuel Values

Using a method outlined by Curtis‡, the number of Btu's in a pound of wood at 20 percent moisture content is calculated. There is little difference between species and the figure is about 6,400 § Btu's per pound of wood. Some woods may be slightly higher, others lower. While fireplaces may burn at 10 percent or less efficiency, a well designed, constructed, and installed stove can achieve 50 percent or more efficiency. This means the total Btu's found in any given cord of wood will be reduced approximately 50 percent because of

‡Curtis, A. B., "How To Calculate Wood Fuel Values," *Forest Industries*. December 1976.

§This figure does not include heat loss associated with flue gases.

the efficiency of the stove. This is an average figure, with some stoves approaching 60 percent or more efficiency.

Table 2 compares the heating values of several different species of wood. Not that woods of higher density weigh more per cord and consequently have greater Btu values. The last column in the table measures the number of cords of any given species required to give 1 million Btu's of available heat. This assumes the wood is at 20 percent moisture content and the stove burns at 50 percent efficiency. These figures are helpful when comparing wood with other fuels.

The importance of moisture in wood cannot be overlooked. In a ton of wood with 60 percent moisture content (common for unseasoned wood), there are approximately 1,250 pounds of wood and 750 pounds of water. The usable heat is $1,250 \times 4,500$ or 5,625,000 Btu's. With a ton of air-dried wood at 20 percent moisture, there are 1,665 pounds of wood and only 335 pounds of water. Then the usable heat value is $1,665 \times 6,400$ or 10,656,000 Btu's. These figures do not consider stove or heating unit efficiency.

Table 1. Characteristics of woods for fireplace use¹

Species	Ease of starting	Coaling qualities	Sparks	Fragrance	Heating class (1 best)
Apple	Poor	Excellent	Few	Excellent	2
Ash	Fair	Good	Few	Slight	2
Beech	Poor	Good	Few	Slight	1
Birch (white)	Good	Good	Moderate	Slight	2
Cherry	Poor	Excellent	Few	Excellent	2
Cedar	Excellent	Poor	Many	Good	3
Elm	Fair	Good	Very few	Fair	2
Hemlock	Good	Low	Many	Good	3
Hickory	Fair	Excellent	Moderate	Slight	1
Locusts (black)	Poor	Excellent	Very few	Slight	1
Maple (sugar)	Poor	Excellent	Few	Good	1
Oak (red)	Poor	Excellent	Few	Fair	1
Pine	Excellent	Poor	Moderate	Good	3

¹Forestry Facts, December 1973. Quarterly publication of the Maine Cooperative Extension Service.

Wood Compared With Other Fuels

How does wood compare with other fuels as a heat source?

Assume heating is with #2 fuel oil and the furnace operates at 65 percent efficiency. It takes 10.9 gallons of #2 fuel oil to produce 1 million usable Btu's (table 3). With fuel oil at 50¢ per gallon, the cost would be \$5.45 per million Btu's.

What is a reasonable price for a standard cord of red oak burned at 50 percent efficiency to remain on a par with the cost of #2 fuel oil at 50¢ per gallon? (Moisture content of wood = 20 percent.)

Checking table 2, it takes .083 cords of red oak burned at 50 percent efficiency to yield 1 million Btu's of usable heat.

$$\frac{\$5.45/\text{million Btu's}}{.083 \text{ cords/million Btu's}} = \$65.66/\text{cord}$$

If a cord of red oak could be bought for less than \$65.66, wood is less expensive for heat than fuel oil. That means it is not economical to pay more than \$65.66 for a cord of red oak when #2 fuel oil sells for 50¢ per gallon.

What about the amount of wood needed to heat a home for the year? Assume 1,000 gallons of #2 fuel oil were burned the past year. There are 91,700 Btu's per gallon of #2 fuel oil when burned at 65 percent efficiency. With 1,000 gallons there are:

$$91,700 \times 1,000 = 91,700,000 \text{ Btu's of heat}$$

A cord of red oak burned at 50 percent efficiency and 20 percent moisture content yields 12 million Btu's. Consequently the equivalent value of the fuel oil is:

$$\frac{91,700,000}{12,000,000} = 7.64 \text{ cords}$$

Table 2. Comparison of heating values for several species of wood

Species	Average specific gravity @ 20% moisture content	Average weight of 85 cu. ft. of wood at 20% moisture (pounds)	Possible recoverable heat units per cord of 85 solid cubic feet and assuming 100% efficiency ² (in millions of Btu's) 20% moisture content	Available heat per cord at 50% heating efficiency (in millions of Btu's)	Units needed to give million Btu's of available heat (cords)
Hickory (average of several types)	.68	4,327	27.7	13.8	.072
Eastern hophornbeam	.67	4,267	27.3	13.7	.073
Apple	.65	4,140	26.5	13.2	.076
White oak	.63	4,012	25.7	12.8	.078
Sugar maple	.59	3,757	24.0	12.0	.083
Red oak	.59	3,757	24.0	12.0	.083
Beech	.59	3,757	24.0	12.0	.083
Yellow birch	.58	3,689	23.6	11.8	.085
White ash	.58	3,689	23.6	11.8	.085
Hackberry	.51	3,247	20.8	10.4	.096
Tamarack	.51	3,247	20.8	10.4	.096
Paper birch	.50	3,179	20.3	10.2	.098
Cherry	.49	3,120	20.0	10.0	.100
Elm (White or American)	.48	3,052	19.5	9.8	.102
Black Ash	.47	2,992	19.1	9.6	.104
Red Maple (soft maple)	.46	2,924	18.7	9.4	.106
Boxelder	.44	2,797	17.9	8.9	.112
Jack pine	.42	2,669	17.1	8.5	.118
Norway pine	.42	2,669	17.1	8.5	.118
Hemlock	.39	2,482	15.9	7.9	.127
Black spruce	.39	2,482	15.9	7.9	.127
Aspen	.36	2,295	14.7	7.3	.137
White pine	.35	2,236	14.3	7.2	.139
Balsam fir	.35	2,236	14.3	7.2	.139
Cottonwood	.33	2,108	13.5	6.7	.149
Basswood	.33	2,108	13.5	6.7	.149
N. white cedar	.30	1,913	12.2	6.1	.164

¹Density-weight and volume at 20 percent moisture content.

²Conversion factors: at 20 percent moisture content, there are approximately 6,400 Btu's per pound of wood.

Table 3. Comparison of energy sources for heating

Fuel	Unit	Heating efficiency (percent)	Heating values		Units needed to give 1 million Btu's of available heat
			1000's of Btu's total	per unit available ⁴	
Natural gas	mcf ¹	70	1,000	700	1.43 ⁴
#1 fuel oil (kerosene)	gallon	65	135	87.8	11.4
#2 fuel oil	gallon	65	141	91.7	10.9
Propane	gallon	70	91	63.7	15.7
Electricity	KWH	100	3,413	3,413	293
Coal					
Anthracite	ton	60	25,400	15,240	0.066
High-volatile bituminous C	ton	60	22,000	13,200	0.076
Low-volatile bituminous	ton	60	28,600	17,160	0.058
Lignite	ton	60	13,800	8,280	0.12
Charcoal	pound	60	13	7.8	128
Wood					
Aspen	cord ²	50	14,700 ³	7,300	0.137
Jack pine	cord	50	17,100	8,500	0.118
Paper birch	cord	50	20,300	10,200	0.098
White oak	cord	50	25,700	12,800	0.078

¹Thousand cubic feet.

²128 cubic feet.

³Assuming 85 cubic feet of solid wood per cord at 20% moisture content.

⁴For other efficiencies: Available heat = total heat × efficiency
Units needed = 1 million ÷ available heat.

Most average size houses (1,500 square feet) will require from 5 to 7 cords of medium density hardwood fuel for a normal Minnesota heating season.

Using the tables, a third comparison can be made. How many equivalent gallons of #2 fuel oil are in a cord of red oak?

The chart shows there are 12 million equivalent Btu's in a cord of red oak. There are 91,700 Btu's in a gallon of #2 fuel oil burned at 65 percent efficiency. So, there are approximately:

$$\frac{12,000,000}{91,700} = 131$$

equivalent gallons of #2 fuel oil in one cord of red oak.

Aspen has only 80 equivalent gallons of #2 fuel oil per cord of wood. Similar comparisons can be made for all of the woods on the chart.

Comparative costs per million Btu's of usable or available heat can also be made. Figures take into

account the efficiencies at which these fuels are normally burned or consumed.

Gas —1.43 cu. ft. × \$2.75/M cu. ft. = \$3.93
 #2 fuel oil—10.9 gal. × \$.50/gal. = \$5.45
 Red oak —.083 cord × \$60/cord = \$4.98
 Electricity—293 kwh × \$.04/kwh = \$11.72

Many firewood buyers are paying up to \$110 per full cord for medium density woods such as oak. If red oak, for example, were burned at 20 percent moisture content and 50 percent efficiency, this would be equal to paying 84¢ per gallon for #2 fuel oil burned at 65 percent efficiency. This means that many consumers of wood as fuel are paying considerably more for wood than they would for some other fuels yielding the same amount of usable heat. As fuel prices change and efficiencies of heating units improve, new cost comparisons will be needed.

Wood Burners and Chimneys

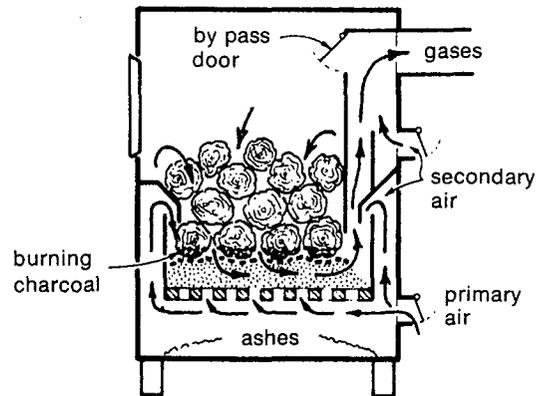
The chunk stove or simple box stove is the most common and least expensive wood heater. It is also the least efficient because it lacks control over the combustion air, and little or no air is available above the wood to burn the gases escaping from the fire. These gases, containing much available heat, escape up the chimney. Not only is considerable heat lost, but the incomplete combustion means creosote could collect in the chimney.

The chunk stove comes in many familiar forms: the pot belly stove, the Franklin stove and many contemporary heaters available at materials dealers. Carefully supervise the stove to control the burning rate. Combustion air enters below the burning coals and must be adjusted manually by opening or closing a small draft door. As air passes through the burning zone, the oxygen is consumed and little is available to burn the gases above the coals. In some stoves, air leaks in around doors and other joints to provide some secondary air. However, this is generally not enough, is not controlled or is in the wrong place. The chunk stove is best suited to periodic use when it can be given the frequent attention needed.

Air tight stoves are more sophisticated and give better control of both the primary and the secondary combustion air, so the burning rate can be controlled. Thermostats can control the flow of air to increase or decrease the heat output. This stove handles combustion air in one of several ways. The drawings show how the combustion air is handled to encourage complete

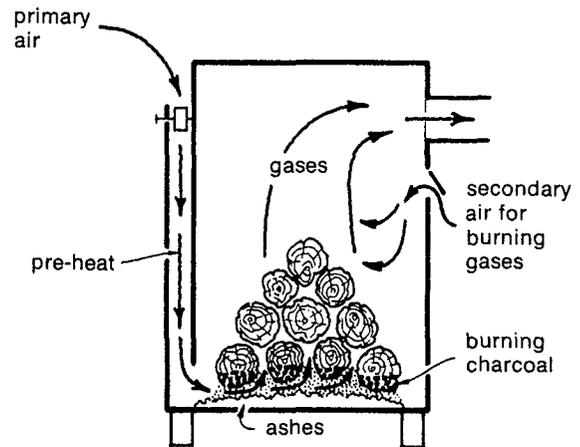
combustion before the gases escape up the chimney. Several manufacturers have stoves that pre-heat the combustion air. Other designs include thermostatically controlled heat exchangers built into the stove to help control combustion chamber temperatures by capturing the heat and using it for space heating.

AIR TIGHT STOVE (CONTROLLED DRAFT)



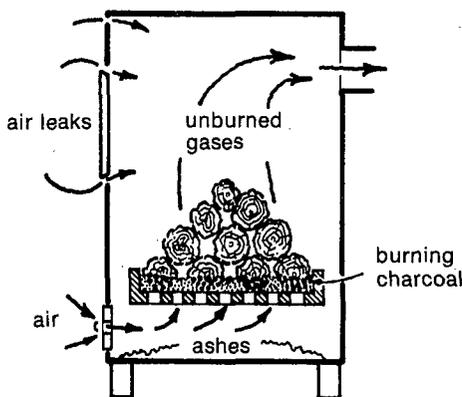
Some controlled draft air tight stoves are designed to preheat the primary air before it reaches the burning fuel bed. The temperature in the burning coals is apt to be near 2000°F, so preheating the combustion air will help to maintain temperatures in the burning fuel. The secondary air will help burn the gases above the wood so long as their temperatures stay above 1100°F.

DOWNDRAFT—BASEBURNING (AIRTIGHT STOVE)



In the downdraft airtight stove, gases are forced through or near the burning fuel bed thus encouraging their burning if oxygen is present. If a slow burn is needed, you may have to add light loads to the stove to avoid cooling gases below their combustion point.

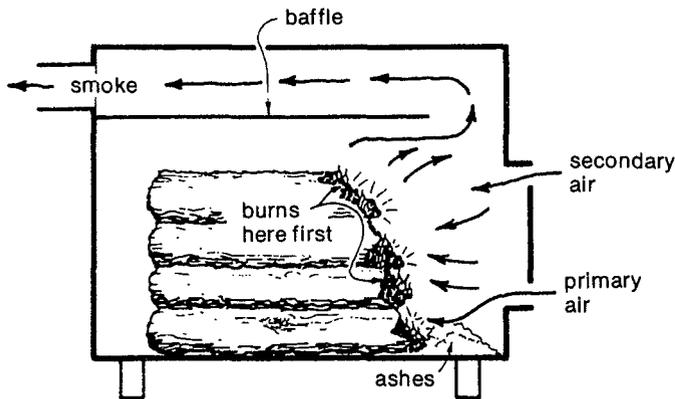
CHUNK STOVE



In many chunk stoves, air enters below the wood to provide oxygen for the burning fuel bed. Air leaks above the wood provide some air for the unburned gases but usually not enough nor in the right place.

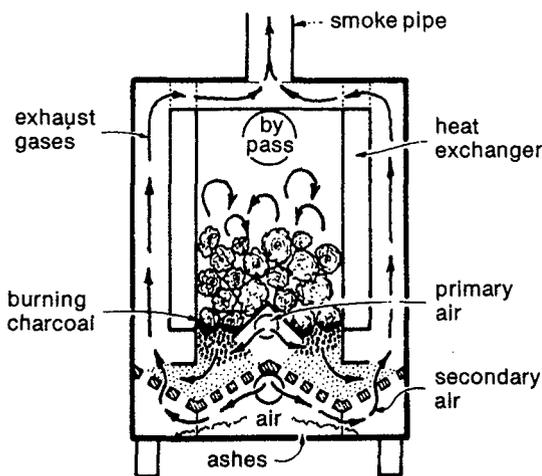
Air tight stoves with proper controls mean much less time is spent operating them. Most are designed so they need be filled only once a day. It is most important to use dry wood since much of the burn is quite slow. Wet or green wood could produce low temperatures in the combustion chamber, allowing unburned gases to escape and condense in the chimney. With any wood burner, the "art" of burning must be learned.

FRONT BURNING (AIRTIGHT STOVE)



The front burning airtight stove is designed with a baffle which forces the gases forward into the burning area. This encourages combustion by keeping the gas temperature high and introducing additional air. Since oxygen is consumed near the front, burning toward the back is delayed.

DIVERTED AIR—BASEBURNING (AIRTIGHT STOVE)



In a diverted air-baseburning airtight stove, combustion air usually moves laterally, and secondary air moves gases through the burning area before they can move up the smoke pipe. Thermostatically controlled fans move room air through heat exchangers to help control stove temperature and to add heat to the room.

Combination Units

Combination units that burn wood along with other fuels are available. Furnace type units are designed to burn wood as the primary source of fuel and another standby such as fuel oil, as the auxiliary fuel. Since most are designed to switch to the auxiliary fuel automatically, they have the advantage of not needing the attention a wood-only unit requires. This permits leaving home without arranging for someone to tend the unit or to have a concern about the state of the fire.

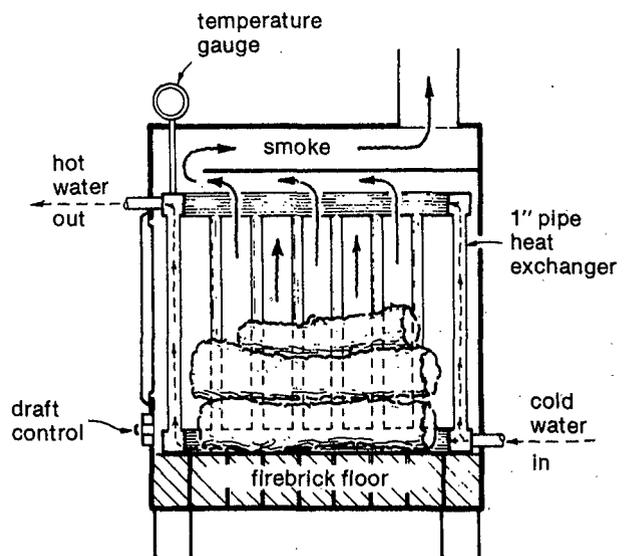
Combination units come in two basic designs: a single combustion chamber for both fuels, or a chamber for each. Each claims certain advantages, such as igniting the wood with the auxiliary burner or better efficiency when using a chamber designed for a specific fuel.

When selecting a combination unit, be sure the chamber for burning wood is large enough for an adequate supply of wood. The door opening must be large enough for chunk-sized wood. Also check whether it is possible for ashes to clog the auxiliary burner, which might prevent ignition of the alternate fuel. (A fire going out in freezing weather could obviously damage a home.)

Modifying The Current System

Existing warm air or hot water furnaces can be modified to accept warm air or hot water from an auxiliary wood burning unit. If the unit is properly installed, and if the chimney is designed to handle a wood fire, there will be substantial savings in fuel costs if wood is available at a reasonable cost.

WATER HEATING WOOD BURNER



Water heating wood burners must be designed with continuous water flow when burning wood.

When attaching the ducts from a wood burning unit to the plenum of a warm air furnace, be sure that hot coals, ashes, gases, or open flame cannot be drawn into the system. That could mean serious fires or asphyxiation by monoxide poisoning.

When attaching to a hot water system, proper installation of a pressure safety valve, expansion tank, and circulating pump is very important. If not done, dangerous pressures could develop within the system and rupture it with explosive force.

When attaching auxiliary wood burners to any system, get the services or counsel of an experienced heating systems installer.

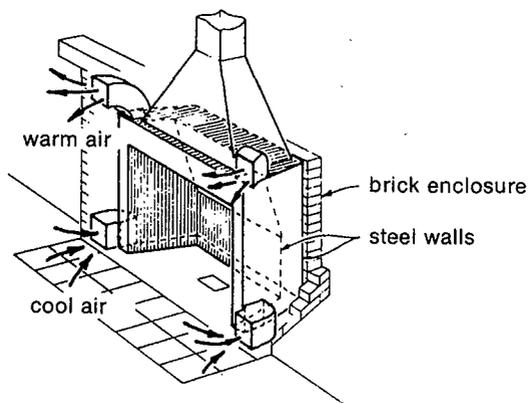
Fireplaces

Fireplaces are not very efficient heating units. However, preformed steel fireplaces are usually designed as heat exchangers so more of the heat can be used for space heating.

The traditional fireplace must be designed with proper openings in relation to the flue size if it is to work properly. In general, the flue should be about $\frac{1}{10}$ of the area of the fireplace opening. There is also a recommended depth in relation to the fireplace opening and in the design of the smoke chamber immediately above the fireplace opening.

With the preformed steel fireplace, be sure the fireplace and chimney are well designed so the fireplace will function properly when burning wood.

DOUBLE WALL STEEL FIREBOX



A conventionally built fireplace should be fitted with a quality cast iron damper which can be closed to reduce heat loss when the fireplace is not being used. Glass doors are useful to close the fireplace opening to reduce heat loss when the coals are slowly burning down.

Chimneys

A masonry chimney with a vitrified fire clay tile flue liner is the most satisfactory chimney for wood burners. A masonry chimney is most often built with 4 inches of brick or chimney block completely surrounding the flueliner. If the chimney is on the outside of the house, then 8 inches of masonry beyond the flue liner

is recommended. The additional thickness of brick insulates the chimney and reduces the possibility of gases cooling as they move up the chimney.

A well-built chimney should rest on a firm footing and be structurally independent of the house structure. There should be a 2-inch clearance between the chimney and the house framing where the chimney passes through the floors, ceiling and roof. Proper flashing at the roof line will insure weatherproofing between the chimney and the roof. The chimney should be built with 8 inches of masonry beyond the flue where it goes through the roof to the outside. Building the chimney out is called corbeling. Extend the chimney so the flue extends at least 2 feet above the peak of the house.

The chimney top is usually capped with reinforced concrete to prevent cracking. The flue liner usually extends 2 to 3 inches above the cap.

If there is more than one heater or fireplace in a home, each should have its own flue. However, both units may be connected to the same flue if the flue is large enough and the connection is properly made. If a water heater or similar unit is vented through a flue designed for a heater, the connection should be made into a common smoke pipe before it enters the flue.

Approved prefabricated vents and chimneys are available that do not require masonry construction. They can be supported on the house framing and will cost less than a masonry chimney. Their life expectancy is generally considered less than a masonry chimney. The class A, all-fuel chimney or vent approved by the Underwriters Laboratories is the only one recommended for wood burners. Install all prefab chimneys in accordance with manufacturers' instructions and building codes. Be sure to provide proper clearances as the manufacturer recommends.

Cleaning Chimneys

A properly designed, well-built chimney used to burn dry wood should require very little attention. If there is complete combustion, gases moving up the chimney should be mostly carbon dioxide and particulate matter. If the gases are warm as they leave the chimney, there should be little condensation.

Loose soot can usually be removed by pulling a weighted burlap bag filled with straw up and down the chimney. Be sure to close the opening into the flue and the cleanout at the bottom when cleaning the chimney.

Creosote may form in chimneys if wet wood is burned or if there is a slow burn and incomplete combustion. This allows condensation usually near the chimney top. Creosote is very difficult to remove—the most satisfactory way is to chip it from the masonry flue liner. Take great care to avoid damaging the flue liner if the creosote is beginning to chip. Some have had success in loosening it with a log chain.

If soot and creosote build up and plug the chimney, the result could be a dangerous chimney fire. Check the chimney at least yearly to assure there is no excessive buildup of creosote or soot.

Items to check when installing wood-burning equipment:

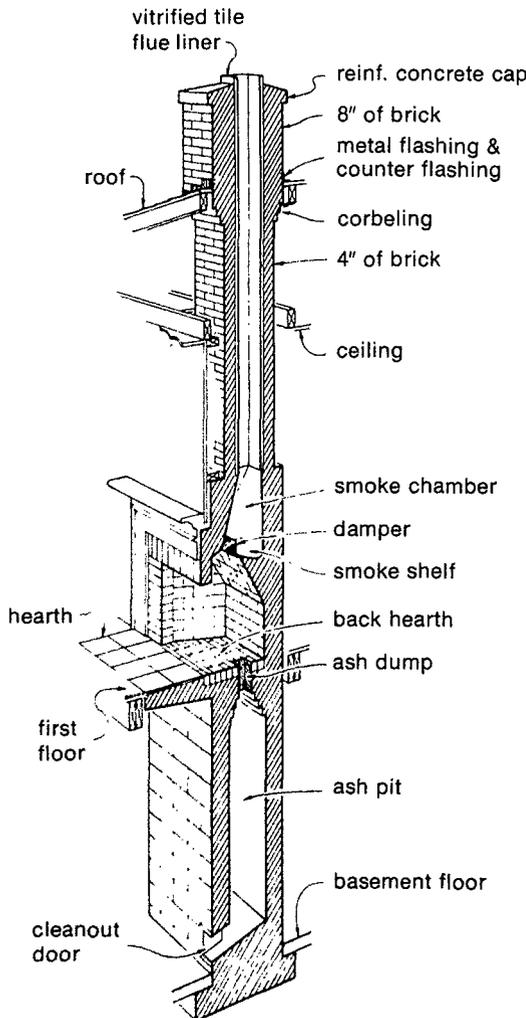
Make sure any equipment bought comes with installation and operating instructions. Install it according to the manufacturer's instructions. The equipment should be installed to meet the minimum requirements of the National Fire Protection Codes or local building inspection department requirements.

Check these potential problems:

Attachment to an existing chimney should be thoroughly investigated for adequate size, proper type (must be an all fuel burning chimney), manifolding into one entrance into the chimney and, of course, the condition of the chimney itself.

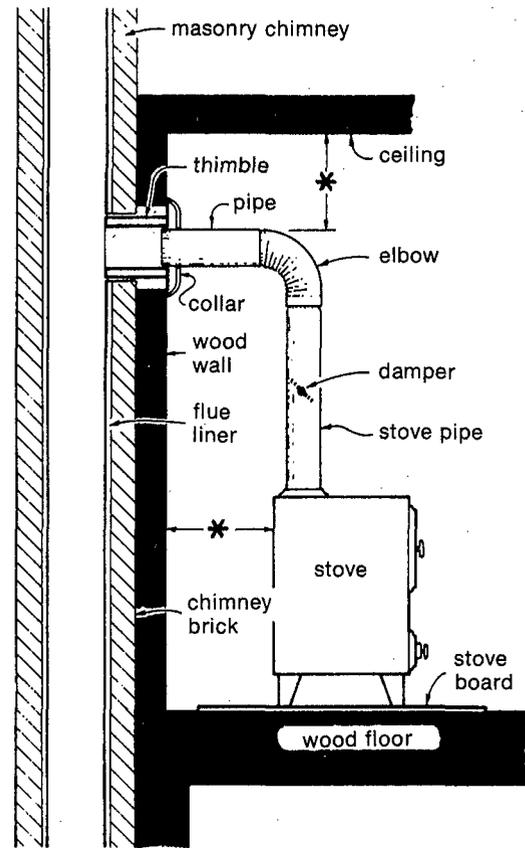
A new chimney must be the proper type and adequate size. Install prefabricated chimneys according to its listing and manufacturer's installation instructions, with proper height above the roof. Install masonry chimneys according to local building inspection department requirements.

MASONRY FIREPLACE CHIMNEY



This is not intended as a detailed drawing for building a fireplace but merely to illustrate the various parts. Check local building codes.

WOOD STOVE INSTALLATION



* Be sure to check manufacturer's recommendations and local building codes for safe installation, especially for space between stove and wall, pipe and ceiling.

As buildings are weatherstripped and tightened up for energy conservation, this leaves less combustion air for the heating equipment. Consult the manufacturer's instructions for the correct air amount. In the absence of manufacturer's instructions, check the local building inspection department.

Air taken from the outside and ducted directly to the space in which the equipment is located should be no less than one (1) square inch (free area) for each 4,000 Btu's of fuel consumed.

Air taken from the surrounding space should be at one (1) square inch (free area) for each 1,000 Btu's of fuel consumed.

Check the space between the heater and any combustibles before starting the installation. Clearances shall be at least those in the manufacturer's instructions. Clearance shall conform to the requirements of National Fire Protection Codes or local building inspection department. Adding a decorative brick veneer or sheet rock to an existing wall does not reduce the clearance requirements. For methods approved for reducing clearances, check with the building inspection department or fire department.

Permits and inspections may be required for all or any part of the installations.

Safety and Wood Heating Systems

Wood heating is not nearly as easy as some accounts make it sound. There's more to it than setting a thermostat and calling the service company when something breaks. If you burn wood, you become the fuel company, and must know what type of wood to burn and where to cut or buy it. Once you have the wood, you must cross the generation gap back to grandma and grandpa's day to learn how to burn wood efficiently and get the most heat out of it.

During heating season, you become a "slave" to the stove. All operation is manual—loading, firing, and removing ashes. If you burn wood, you become a chimney sweep, and must learn how to inspect, clean and repair your chimney.

Finally, there's plenty that can go wrong. Even if you install your wood burner properly and operate it carefully, the system is more dangerous than any other heating system. You must always be alert for house and chimney fires. Before investing one penny, consider this responsibility and the potential danger to life and property. If you really want to install a wood stove, make your life easier and do it the safe way.

Unsafe installation is a major cause of serious fires. Safety standards, drawn up to reduce fire loss, must be followed. They have been designed to protect you.

Building Codes And Safety Standards

Before installing any wood burning system, you have to do some homework and learn the local building codes and insurance specifications.

A building permit may be required, and any changes in your home must comply with building codes. Some areas may not have a fully updated code, but the Building Inspection Department or Fire Department can supply the latest information on what you must do.

Check with your insurance company. Some companies do not wish to insure homes heated by wood because of the increased fire hazard. You might have to pay a homeowners insurance rate so high that it would wipe out any savings you hoped to gain on fuel bills. Before you light the first fire, be sure that both a local building inspector and an insurance company representative INSPECT and APPROVE IN WRITING any installed wood burner. Failure to obtain a permit could bring a fine or insurance cancellation.

The National Fire Protection Association (NFPA) has published several manuals on fire prevention and safety. Copies should be available from public libraries, or by writing to the NFPA at the address listed in the bibliography. It would help to look at these manuals, as they are the basis for most building and insurance specifications.

Select The Best Location

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.

Table 4. Clearances for wood burners with no added protection¹

	Radiant ²	Circulating ³	Supplemental ⁴	Cook-stove or range	Pipe
Ceiling	36"	36"	36"	30"	18"
Front	48	48	48	—	18
Side	24-36	18	36	24	18
Rear	36	18	36	24	18

¹Information adapted from NFPA bulletin No. 89M, 1976 edition.

²A radiant stove is one with a single layer of metal enclosing the fire, such as a Franklin stove.

³A circulating stove is one with a second metal jacket enclosing a space for heating and circulating air.

⁴A supplemental heating device is one such as the Add-A-Furnace.

Plan Clearances For Safety

Clearances protect nearby combustibles from the hot stove. The clearances listed in tables 4 and 5 permit

cooling air to flow around the stove and move the heat around the room. The required clearances are based on each stove's type, size, temperature and distance from the closest wall. Figures 10-12 show typical installations with clearances.

There is a simple test that will tell if you've provided enough clearance. Place your hand on the closest surface. If you can keep your hand there comfortably while the stove is operating, the location passes the test. If not, you need added protection.

In installing protection, use *only* asbestos millboard, as it withstands much higher temperatures and provides better insulation than asbestos cementboard, which cannot be used.

However, you can't get protection by nailing a sheet of asbestos millboard directly to the wall or ceiling. You must use non-flammable spacers such as those made of channel iron or porcelain. Or you can use long nails not driven in all the way, so the millboard is held away from the wall or ceiling (figure 11 and 12).

Table 5. Clearances for wood burners adding protective coverings

Type of protection	Radiant stove				Circulating stove				Cook stove or range				Supplemental heating device			
	ceiling	sides	rear	stove pipe	ceiling	sides	rear	stove pipe	ceiling	sides	rear	stove pipe	ceiling	sides	rear	stove pipe
1/4" of asbestos millboard spaced out 1"	30"	18"	18"	12"	30"	9"	9"	12"	25"	18"	18"	12"	30"	18"	18"	12"
28 gauge sheet metal on 1/4" asbestos millboard (no space)	24	18	18	12	24	9	9	12	20	18	18	12	24	18	18	12
28 gauge sheet metal spaced out 1"	18	12	12	9	18	6	6	9	15	12	12	9	18	12	12	9
28 gauge sheet metal on 1/8" asbestos millboard spaced out 1"	18	12	12	9	18	6	6	9	15	12	12	9	18	12	12	9

¹Information adapted from NFPA bulletin 89M, Heat Producing Appliance Clearances, National Fire Protection Association, 470 Atlantic Ave., Boston, MA.

²Front clearances are not listed because the space needed in front for loading and cleaning is usually more than enough to fulfill the safety standards.

³See text for cases where stovepipes pass through walls.

Figure 10. Typical wood stove installation

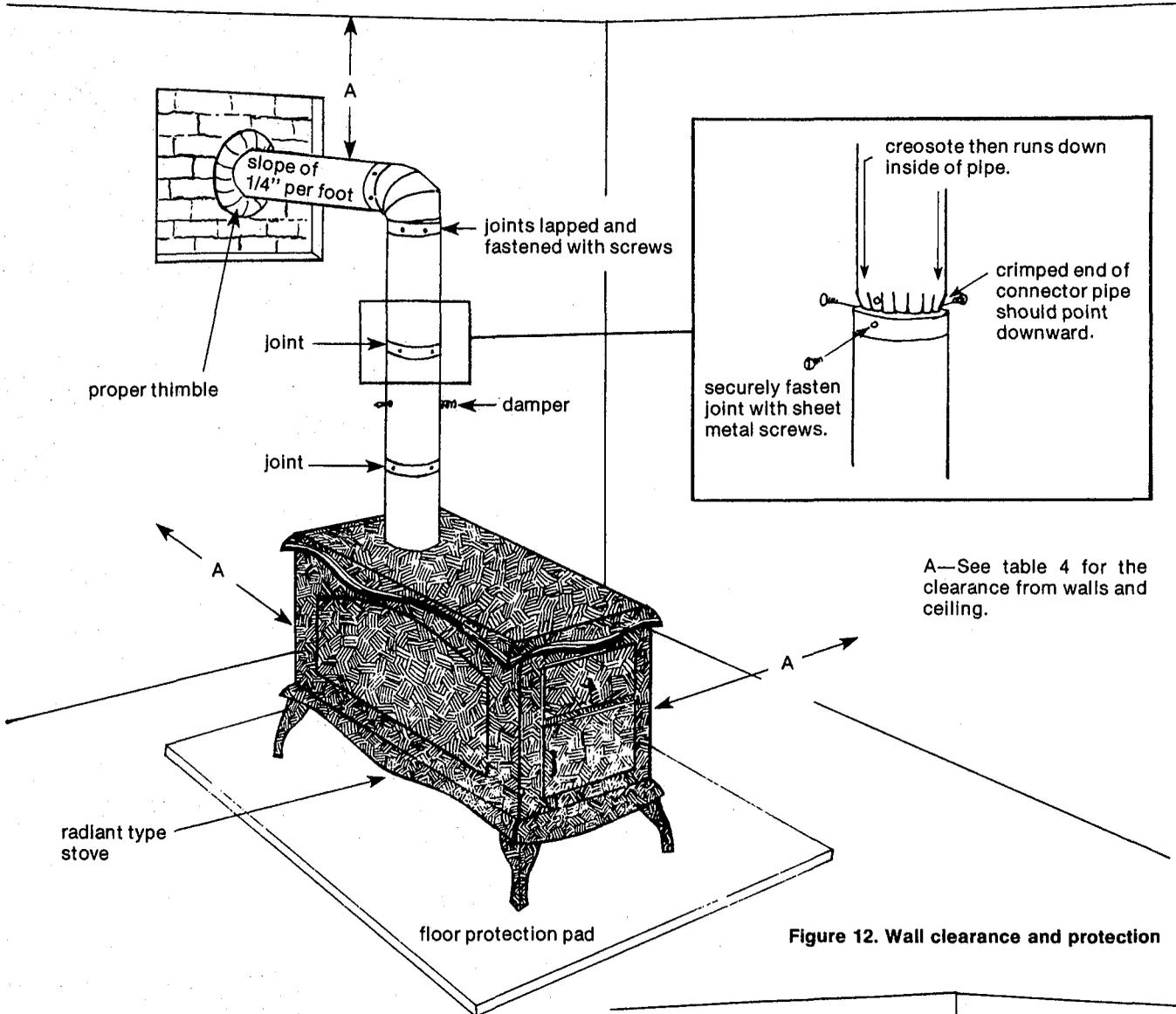
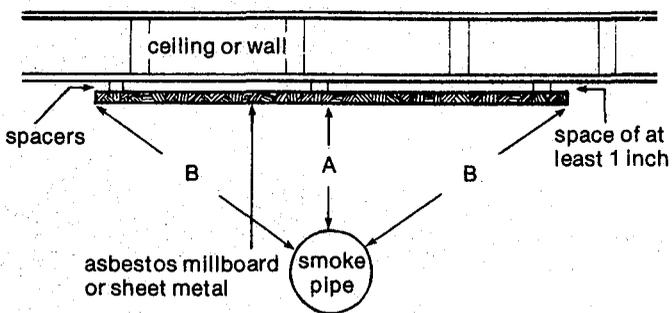


Figure 11. Smoke pipe clearance and protection



A—See table 5 for this clearance

B—Minimum distance here is three times diameter of smoke pipe

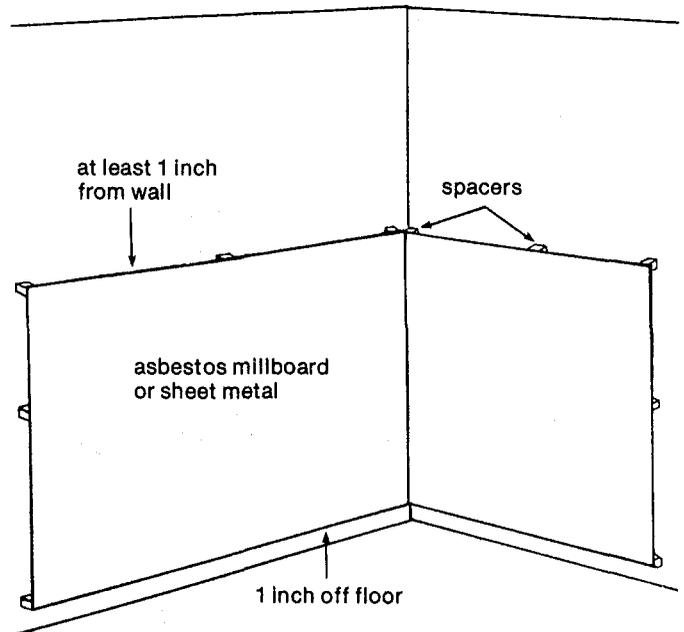
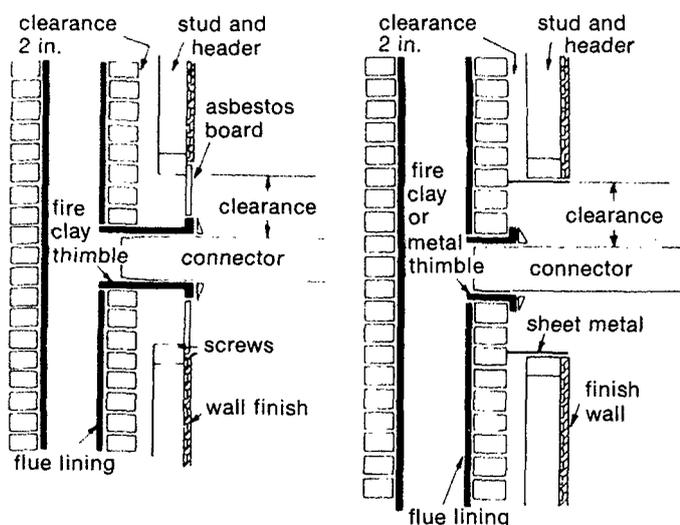


Figure 13. Connecting smokepipe (connector) to chimney through wall



Two methods of connecting a chimney connector to a chimney flue where the connector must pass through a combustible partition wall. Instead of the asbestos board shown, sheet metal may be used, or a metal lath and plaster finish may be applied at that area. Use 24 gauge or heavier metal. Clearance needed is three times the diameter of stovepipe.

Reproduced with permission from NFPA No. HS-8, *Using Coal and Wood Stoves Safely!* 1974, National Fire Protection Association, 470 Atlantic Ave., Boston, MA.

Solid masonry walls can't burn, so are excluded from clearance requirements. But masonry conducts heat, so keep combustibles out of contact with masonry walls. Protective coverings must extend over all areas of wall and ceiling to the minimum clearance allowed for an unprotected wall (36 inches for stove, 18 inches for stovepipe, table 4).

Even though the floor doesn't get as hot as the walls or ceiling, it needs protection. In general, 18 inches is enough clearance to protect the floor if it is covered by non-flammable material, such as a sheet of 24 gauge metal or brick or fireproof clay tile (figure 10). If the stove legs are from 6-18 inches long, 24 gauge sheet metal laid over a ¼ inch sheet of asbestos millboard is needed. Legs of 6 inches or less require 2-4 inches of hollow masonry laid to provide air circulation and covered by a sheet of 24 gauge sheet metal.

The floor protection should extend at least 12 inches beyond the sides and rear of the stove, and at least 18 inches beyond the stove front, to protect against falling embers and for loading wood or removing ashes.

The clearances in tables 4 and 5 are not adequate for other combustible objects such as drapes, furniture, and paper products which ignite at low temperatures. Place these items at least 3 feet away from the stove, and make sure they stay away.

Firewood is a special hazard. It may be convenient to stack firewood next to the stove, but wood will ignite at temperatures lower than a stove's normal operating

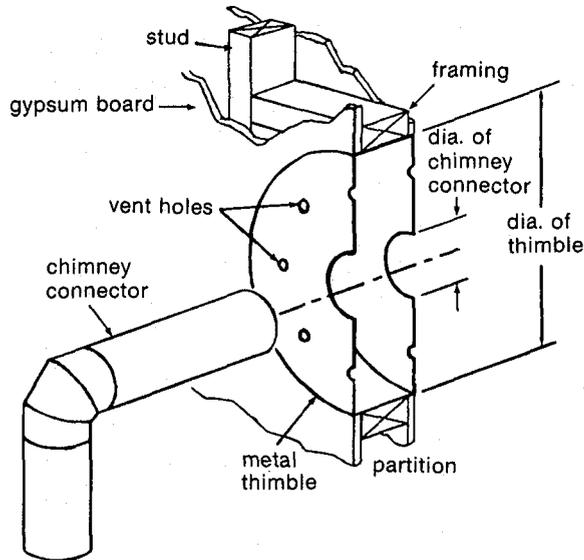
temperature. Stack all wood, including green wood, well away from the stove and chimney, even if you are using a woodbox. Do not try to dry green, wet or frozen wood on or near the stove.

Install Smokepipes (Connectors) Carefully

The smokepipe, or chimney connector, runs from the stove to the chimney. Unsafe smokepipes cause many fires. A safe installation uses proper material and construction, clearances, and provides the proper draft. Figure 13 shows correct installation.

- 24 gauge metal is recommended. It will provide better protection in the event of a chimney fire and will also resist chemical corrosion longer.
- Keep the connector pipe as short as possible. It can be no longer than 75 percent of the vertical chimney height above the flue inlet (where the connector pipe enters the chimney).
- The smokepipe should be straight as well as short. Use no more than two right-angle bends in a connector pipe. Additional bends could cause soot and creosote to collect in the smokepipe or chimney, blocking flue gas flow and increasing the danger of fire.
- The connector pipe diameter should be as large as the flue collar (where the connector pipe joins the stove).
- The pipe's horizontal section must rise ¼ inch for each foot of pipe, with the highest point being at the chimney inlet (figure 10).
- When joining sections of pipe, overlap the joints at least 2 inches, with the crimped (male) end pointing down to prevent creosote drip or leak. Secure each joint with three sheet metal screws. A fireproof sealant may be used in addition (figure 10).
- The fit must be snug, especially at the flue inlet. Use the proper ventilating thimble. The pipe must not stick into the flue itself, as it would hamper the draft (figure 13).
- Connector pipe clearances must be 3 times the pipe diameter (18 inches for 6 inch pipe—the most common household size). Consult tables 4 and 5 for clearance information.
- Avoid passing a smokepipe through an interior wall. If this must be done, use a ventilating thimble (figure 14). The thimble diameter must be at least 12 inches larger than that of the smokepipe, thus giving at least 6 inches of metal-lined, ventilated clearance. If you don't use a thimble, follow the 18 inch-clearance rule. A 6-inch pipe would need a 42 inch square hole cut through a combustible wall.
- Connector pipe cannot pass through an exterior wall.
- Smokepipe cannot pass through ceilings or closets. Holes in the ceiling (including hot air registers) permit fires started near the stove to spread out of control through upper floors. A closet fire could smolder and spread undiscovered.

Figure 14. Thimble for passing smokepipe (connector) thru walls



Reproduced with permission from NFPA No. HS-8, Using Coal and Wood Stoves Safely 1974, National Fire Protection Association, 470 Atlantic Ave., Boston, MA.

Consider Other Wood Heating System Equipment

All wood heaters must have a damper to control the draft and shut down the stove in case of fire. Cast iron dampers are preferred. If the heating device doesn't come with a damper, install one in the connector pipe near the stove, according to manufacturer's directions.

A spark arresting screen on top of the chimney will help prevent roof fires, and a rain cap will prevent birds from nesting in the chimney and will prevent moisture damage.

If you burn wood, you better have a telephone to call the fire department immediately. In case of fire, a good smoke detector will provide enough warning to empty the house and call the fire department before the blaze is out of control. All adults in the household should be instructed in how and when to use a **fire extinguisher** (see section on Chimney Fires).

Other accessories are not recommended unless the manufacturer's instructions and local building codes can be obeyed. It is best to do without "heat reclaimers" or "heat extractors" on a wood stove. By saving heat in the connector pipe, the chimney temperature is lowered, increasing creosote formation in the stack. Manufacturer's claims for these heat savers may be vague or even untrue. These devices also require weekly cleaning, adding another maintenance chore.

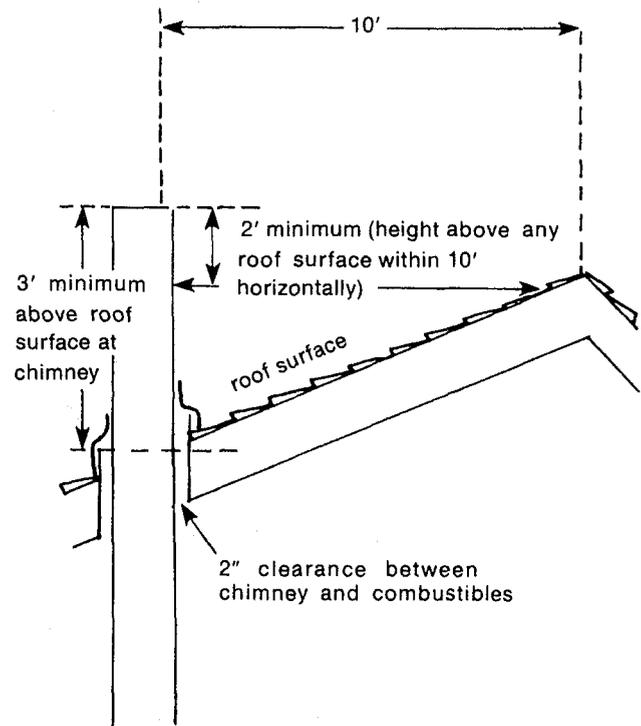
Fans or blowers, if installed on wood space heaters or furnaces according to manufacturer's instructions, may be used. But install only blowers or fans made for your particular wood burner. The wrong fan could blow sparks around the house, setting many fires at once. When installing any device of this type, follow local building codes for electrical wiring. Be sure the insulation on the wiring can withstand the high temperatures near the wood burner.

Make Sure Chimney Can Take The Heat

Chimney fires are common in wood burning systems. Poor construction, careless installation, infrequent maintenance, and creosote and soot buildup can all cause fires. These design features and safety precautions apply to all chimneys:

- A 2 inch clearance should separate the chimney from the combustible materials.
- Each chimney flue must have only one heating device attached and only that single flue inlet open. Seal any other inlets.
- The chimney should be as accessible as possible to ease inspection, cleaning, and repair.
- The chimney flue area must be as large as the area of the flue collar.
- A chimney must extend at least 3 feet above the highest point where it passes through the roof, and at least 2 feet higher than any part of the building within 10 feet of it (figure 15).
- Only two types of chimneys are safe for wood burning use: a lined masonry chimney, or a "Class A", all-fuel chimney. A Class A chimney is manufactured for use with solid fuel and approved by the Underwriters Laboratories, Inc. To meet this standard, Class A chimneys must be able to withstand 1000° on a continuous basis, 1400° for 1 hour, and 1700°F for 10 minutes. (Even higher temperatures—2000 to 3000°—can occur during a chimney fire.)
- Smokepipe cannot be used for chimneys.
- Do not insert water heating coils in a chimney.

Figure 15. Required chimney height above roof (adapted from NFPA Bulletin 211)



If you must add a chimney, you might consider a manufactured metal chimney. The packed type has two metal walls separated by insulation. The triple wall type has three walls with two air circulation spaces. Both (if they are UL-Class A chimneys) are safe for wood heating, but the packed type is preferred because it maintains higher stack temperatures. Follow manufacturer's instructions carefully.

Avoid Double Venting A Chimney

If you plan on using an existing chimney, avoid venting more than one heating device into one flue. Double venting is not recommended by most wood heating experts. Although installation is quicker and costs less, the dangers and disadvantages of double venting are great.

Few chimneys are large enough to handle double venting. You need to increase the flue area by 50 percent for each additional device attached to the flue. Few chimneys have this capacity for double venting.

If two devices are vented to one chimney, the chimney must be rated for the more hazardous of the two. Some chimneys, especially those designed for natural gas furnaces, can't withstand high temperatures and may melt if a solid fuel is burned. Most of today's chimneys won't stand up to the beating they would take from burning wood. Also, double venting increases creosote problems by preventing the high stack temperatures needed to keep creosote from condensing.

With double venting, either or both of the heaters could vent improperly. Flue gases could then back up into the second device and explode, or the poisonous fumes could seep into the house. A venting problem is particularly dangerous when dealing with a natural draft device such as a gas furnace. A backdraft could blow sparks out of the furnace and around the room.

A fire in a double vented system would burn out of control. The flue opening to an oil or gas furnace cannot be closed, and this air supply would make it impossible to suffocate the blaze.

Inspect Masonry Chimneys

An unused masonry chimney in a home must be thoroughly inspected before use. A settled foundation, shifting, cracked mortar or liner, blockage, chemical deterioration, or poor construction are all reasons why a masonry chimney can fail a safety inspection. If you find any damage, repair it immediately.

A masonry chimney should be free-standing, not braced by, or supporting, any part of the building's frame. It must be built on a level, solid footing. An exterior chimney's foundation must extend below frostline.

The chimney should have a cleanout door at the base. Also, a fireproof clay flue liner is mandatory in Class A masonry chimneys. The liner makes the flue airtight and protects the masonry from moisture damage (figure 16).

Older masonry chimneys usually face three problems. The first is lack of a fireproof clay liner. If your

masonry chimney had no liner installed, you must install one for wood burning. It will reduce chance of a chimney fire, protect the masonry from water damage, add years of life to the chimney.

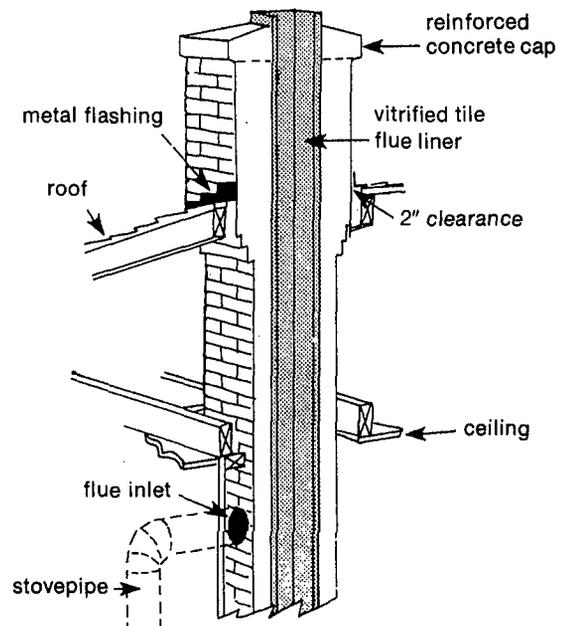
The second problem is the means of support. Many old chimneys were supported by the building's frame, or were hung from the frame and supported by wooden planks at the base. Such braced chimneys should not be trusted, as any settling or shifting of the building will crack the masonry.

Finally, if there are any other flue inlets besides the one in use, they must be completely sealed shut. Insert a piece of clay liner into the hole and fill the inlet with masonry material equal to the chimney thickness. Do not use snap-on metal covers ("pie plates") as they could be blown off during a chimney fire, letting too much air feed the flames and possibly letting fire into the house. Check behind panelling and wallpaper for possible unsealed inlet holes. If a fireplace flue is to be used, the fireplace opening must be sealed shut.

Inspecting a masonry chimney before use is a must. Unless you are familiar with chimney construction, you would be better off to hire a mason skilled in chimney work to make the safety check and do repairs. Anyone can make a few checks, however.

Climb on the roof and inspect the cap and masonry on the top of the chimney. A cracked cap or loose masonry joints can be fixed by carefully repairing the mortar (tuck pointing). If the cap is missing and the joints are rotten, you'll have to replace the top few feet of the chimney. This moisture damage may well extend below the roof line if the chimney has been neglected for a long time. Poke a screwdriver into the masonry joints. Crumbling brick and mortar mean trouble and require repair work. Black streaks on the outside of the masonry show smoke leaks or moisture damage requiring repair.

Figure 16. Masonry chimney with vitrified tile flue liner



From the roof, use a flashlight to look down into the flue. Check for missing masonry or blockage. Use a mirror to check from the bottom up. Better yet, lower a light slowly down the flue. The chimney liner may be coated with soot and creosote, blocking any defects from view. Tie tire chains to a long rope and run the chains up and down the flue until the deposits are worked loose.

If you don't find any damage, light a very small, smoky fire. When the fire is burning, block the flue at the top and search for any escaping smoke, especially in the attic and near the roof line.

If you have only a little damage, you may want to do your own masonry repair. Remove crumbling mortar with a cold chisel until there is a hole or groove about an inch deep, then fill with chimney mortar. You can buy this mortar already mixed, or make your own from one part Portland Cement, one part hydrated lime, and three parts sand. This mix holds up best to the wide range of temperatures in a chimney.

Adding a liner to a chimney is difficult, and a mason should be consulted. Adding a liner may be impossible in some old, odd-shaped or crooked chimneys. Masonry must be sound before adding a liner. A galvanized pipe liner, though easiest to install, will last only about three years, but this is safer than having no liner.

Here's how to add a galvanized pipe liner. Enlarge the chimney inlet to allow an elbow section to pass from the chimney into the stove room. The elbow can be straightened to make it easier. Next, from the roof, lower the elbow section attached to a straight section of pipe down the flue (use sheet metal screws to fasten the sections tightly). Keeping about a foot of pipe above the chimney, add straight sections until the elbow section can be brought inside the stove room opening. The upper end of the pipe should extend above the roofline.

Be Prepared For A Fire

No wood burning system is 100 percent safe and fireproof. A safe installation and extra care help prevent fire, but accept the idea that there could be a fire, and be prepared to handle it.

Make certain everyone in the house is familiar with the warning signs of a chimney fire—sucking sound, a loud roar, and shaking pipes. Instruct everyone on what to do in case of fire. Practice fire drills and instruct all adults on how and when to use a fire extinguisher. Put the fire department phone number in an obvious place near the phone.

If you think you have a chimney fire:

- call the fire department immediately—before doing anything else.
- cut off the fire's air supply by closing any air intake vents to the firebox.
- close the stove damper.
- get everyone out of the house, and put them to work watching for sparks or signs of fire on the roof or nearby.
- Keep a class ABC dry chemical fire extinguisher handy. Discharge it into the stove if there is a danger of the house or surroundings catching on fire.

Chimney fires must be put out from the bottom. The system must be airtight to cut off the air supply that feeds the flames. If the system isn't airtight, or is double vented, it will be impossible to suffocate the fire, and there will be nothing left to do but wait and hope the fire burns itself out without taking the house with it.

It's risky to use water to put out a chimney fire. The extra hot pipes could buckle or shake themselves apart when the water hits them. Salt was once used to stop fires, but it can chemically react with creosote and other products to form a product much like lye, which corrodes pipes quickly.

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2. Heat Producing Appliance Clearances, NFPA No. 89-M, National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts, 02210. Paperback \$2.00.
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4. The Woodburners Encyclopedia, Jay W. Shelton, and Andrew B. Shapiro, Vermont Crossroads Press, Waitsfield, Vermont, 05673. 1976, Paperback \$6.95.
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Inspection Checklist for Free Standing Woodburning Stoves and Heaters#

Type of Stove: Radiant; no jacket or shroud around stove
 Air circulating; metal jacket in place around radiant fire box

YES NO

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. Does this appliance have a listing for this type of installation? (If not, is there any documentation by test lab or professional engineer as to the suitability of this appliance?) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Is there an installation, operations and maintenance manual provided with the appliance? |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Has the homeowner read the manual and is it readily available for reference? |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. Is the stove installed according to the listing requirements, or according to the manufacturer's instructions? |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. Is the stove in sound condition? |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Is the stove located so that it will not block any exits, doors or passageways? |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. Are proper tools readily available for the operation of the appliance? (Tools should include poker, shovel, metal ash bucket, etc.) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. Was there a permit issued for the installation? |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. Are there smoke or ionization detectors properly placed in this dwelling? |

Any "NO" answers to these questions indicate a possible hazard to safe operation of this installation. Each issue should be satisfactorily rectified.

Adapted from the Energy Testing Laboratory, State of Maine suggested installation guidelines

Installation Checklist

RADIANT STOVES—ITEMS 10-13

CIRCULATING STOVES—ITEMS 14-17

ALL STOVES—ITEMS 18-22

CHIMNEY—STOVE PIPE CONNECTIONS—ITEMS 23-36

CHIMNEYS—ITEMS 37-56

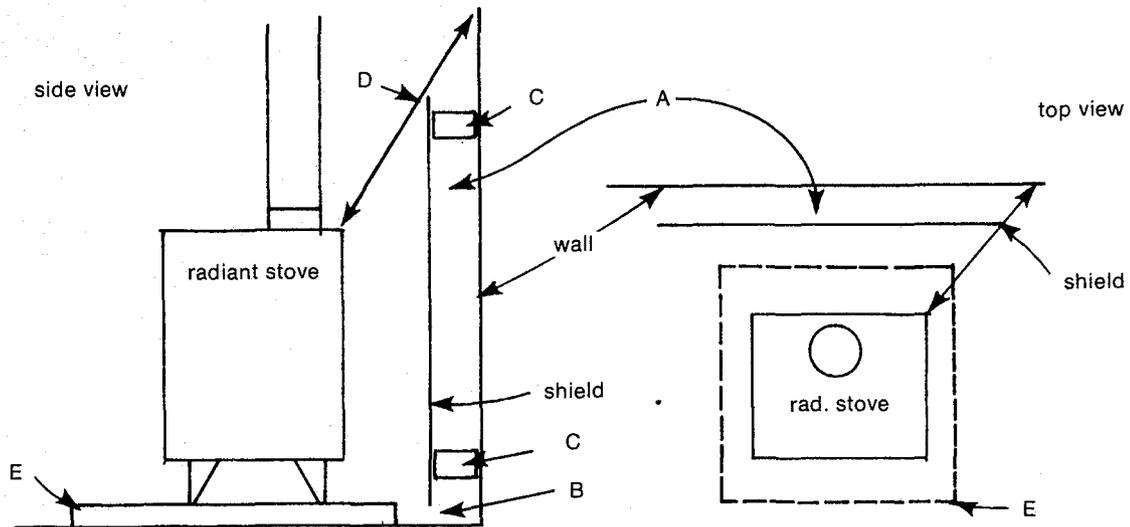
Inspection Checklist

YES NO

Radiant Stoves

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | 10. Are the clearances from combustible materials at least 36 inches from front, sides and rear of stove? |
| <input type="checkbox"/> | <input type="checkbox"/> | 11. If clearance is less than 36 inches but 18 inches or more, are the combustible surfaces protected by 1/4-inch asbestos millboard spaced 1 inch or more from the wall(s), with adequate (1 inch) spacing from the floor to allow air circulation behind the shield? (If answer is yes; proceed to Item 13.) |
| <input type="checkbox"/> | <input type="checkbox"/> | 12. If the clearance is less than 18 inches but 12 inches or more, are the combustible surfaces protected by 1/4-inch asbestos millboard spaced as indicated in Item 11, with a covering of 28 gauge sheetmetal on the asbestos board, between the stove and the wall? |
| <input type="checkbox"/> | <input type="checkbox"/> | 13. If there is wiring on the radiant stove because it uses electrical components, is it wired in accordance with National Electric Code NFPA 70? |

Figure 17.



- A. 1-inch air space
- B. 1-inch space above floor
- C. ceramic spacer (fence post insulator)
- D. 36-inch distance from stove to top and side of shield (for circulating stoves 24 inches or listed distance)
- E. Stove board—6 to 12 inches beyond back and sides, extending 18 inches beyond front or loading side of stove

Inspection Checklist

YES NO

Circulating Stoves

- ___ ___ 14. Are the sides and rear 24 inches from combustible material? (Note: some products have listings for lesser distances, check these listings for permissible clearance distances.)
- ___ ___ 15. If distance to combustibles is 12 to 24 inches or less than the listed distance but half the listed distance or more, is the combustible protected as suggested in Item 11? (figure 17).
- ___ ___ 16. If distance is 8 to 12 inches or 1/3 to 1/2 the listed distance, is the combustible protected as suggested in Item 12? (figure 17)
- ___ ___ 17. If there is electrical wiring on the air circulating type of stove, is it wired in accordance with National Electric Code NFPA 70?

All Stoves

- ___ ___ 18. If the stove has 18 inches or greater open space between the bottom of the stove and the floor, and if the floor or covering is combustible, is there a floor protection of 24 gauge sheet metal extending 18 inches to the hearth opening, and 6 inches on sides and back?

Inspection Checklist

YES NO

- ___ ___ 19. If the legs of the stove are between 6 and 18 inches, and the floor is a combustible floor or covering, is there a stove board of 1/4-inch asbestos millboard with a 24 gauge steel covering (or its equivalent) extending 18 inches beyond the hearth's opening of the stove and a minimum of 6 inches beyond the sides and back? (figure 17)
- ___ ___ 20. If the stove legs are less than 6 inches, is the floor protected by using a stove pad of hollow masonry or its equivalent to allow air circulation beneath the stove board? Is the size of the floor protection area as indicated in item 18? (figure 17)
- ___ ___ 21. If the stove is a listed stove, is the floor protected according to the manufacturer's instructions?
- ___ ___ 22. Are fabrics (drapes, etc.) safe distances from the appliance? Note: many different fabrics ignite at different temperatures and the clearance should be greater than for combustible walls. Drying clothes near the appliance is unsafe as well.

Inspection Checklist

YES NO

Chimney Connection Checklist—All Stoves

- ___ ___ 23. Is the stove pipe the same size or larger than the appliance flue connector?
- ___ ___ 24. Is the stove pipe 24 gauge or heavier?
- ___ ___ 25. Is the stove pipe black pipe, not galvanized?
- ___ ___ 26. Is the stove pipe assembled so that the crimped end points toward the stove so that creosote and moisture will stay inside the pipe and run back to the stove, rather than run outside? Note: it may be necessary to make an adapter of 24 gauge or heavier pipe to allow crimped end toward the stove installation.
- ___ ___ 27. Do all horizontal runs of stove pipe rise from the stove toward the chimney at least 1 inch rise per foot? (NFPA recommends ¼-inch per foot, 1 inch is better.)
- ___ ___ 28. Is the stove pipe run as short as possible (preferably less than 6 to 8 feet)?
- ___ ___ 29. Does the stove pipe *avoid* extending through any floor or ceiling?
- ___ ___ 30. If the stove pipe extends through any wall or partition, is it protected as per NFPA 211 with ventilated thimble or cut away to provide proper clearance of at least 18 inches to combustibles?
- ___ ___ 31. Is stove pipe connection to masonry chimney made through a metal or clay thimble, to allow for easy removal for inspecting and cleaning?
- ___ ___ 32. Are all joints secured with clamps or sheet metal screws?
- ___ ___ 33. Are any leaks between joints sealed with joint compound or joint tape?
- ___ ___ 34. Are all sections of stove pipe 18 inches or more from combustibles?
- ___ ___ 35. If stove pipe is 12 to 18 inches from combustibles is ¼-inch asbestos millboard spaced 1 inch from the wall or ceiling used as a shield? (figure 18)

Inspection Checklist

YES NO

- ___ ___ 36. If stovepipe is 9 to 12 inches from combustible surface, is asbestos millboard with 28 gauge sheet/metal covering and spaced out 1 inch from the wall or ceiling used as a shield? (figure 18)

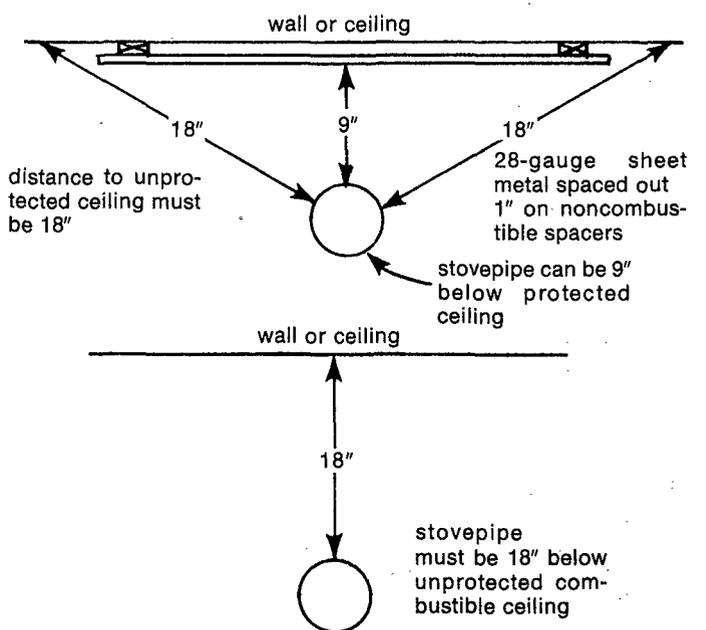
Chimney Checklist—Outside Inspection of the Chimney

- ___ ___ 37. Is the chimney a suitable masonry chimney or listed Class A factory built chimney?
- ___ ___ 38. Does the top of the chimney appear to be in good repair?
- ___ ___ 39. Is the flashing around the chimney in good repair?
- ___ ___ 40. Does the chimney extend at least 3 feet above the roof and at least 2 feet higher than anything within 10 feet?

Inside Inspection of the Chimney

- ___ ___ 41. Is there a cleanout located at the base of a masonry or a cleanout tee located at the bottom of a factory built chimney?
- ___ ___ 42. Is there a lining in the masonry chimney of 5/8-inch fire clay type or a stainless steel liner if no clay liner is present?

Figure 18.



Inspection Checklist

YES NO

- 43. Is there a minimum of 2 inches clearance from the masonry or factory built chimney from combustible materials all the way up through the dwelling?
- 44. Does the chimney appear tight in construction for its entire length? Note: a flashlight and mirror, a flashlight lowered on a string, or an actual smoke test may be required to make this determination.
- 45. Has the homeowner been told to inspect the chimney at least twice during the heating season, but preferably as often as twice monthly?
- 46. Is the chimney on the inside of the building? Note: outside chimneys produce a lower draft and may result in smoking stoves. Colder temperatures in outside chimney systems also cause more rapid creosote build up.
- 47. Does the chimney produce the proper draft required by the appliance? Note: a draft gauge is helpful. However, question the homeowner as to conditions relating to smoking, smoky smells, eye irritations and headaches. Any of these may indicate improper draft.
- 48. Has the homeowner been told that long duration, slow burning of wood, especially with improperly seasoned wood, creates serious soot and creosote problems?
- 49. If a chimney fire occurs, has the homeowner been told to shut off all air supplies to the stove and chimney?
- 50. Is there a metal or clay thimble at the chimney opening for the connector to fit into?
- 51. Is only one natural draft burner on the flue? Note: a wood or coal stove is a natural draft burner as is a pot or wick burner oil stove.
- 52. Is the stove pipe and chimney flue of equal or greater size than the stove's flue collar all the way throughout the vent system? Note: The flue collar on the stove is the

Inspection Checklist

YES NO

- minimum size for smoke pipe connectors and chimney flues. Optimum size is that size and up to 25 percent larger.
- 53. Is the chimney cleanout fixture tight against leaks?
- 54. Are all openings where connector holes have been sealed, sealed with brick and mortar the same thickness as the existing walls of the chimney? Note: old fashioned metal flue caps should be discarded and the openings closed permanently.
- 55. Is the chimney at least 4 inches thick if made of brick and 12 inches thick if made of rough stone masonry? Note: double brick and tile chimneys are safer, warmer running chimneys.
- 56. Is the chimney separate from the one used for venting conventional oil or gas furnaces? Note: while many codes and standards still allow some flue connection, assuming the chimney is sound and large enough, such installations can cause problems. Gas hoods and barometric dampers allow excess air into the chimney causing cooling of flue gases and a greater creosote build up potential. If some flue connections are used, the homeowner must be told to inspect more frequently and clean the chimney at any time creosote deposits exceed 1/4-inch thickness.

A creosote fire in such a chimney can burn without control because of the air leak through the barometric damper or gas hood. By keeping the chimney clean and by burning well-seasoned wood, this type of installation can be safe, but it does require more frequent inspection and maintenance. In this type of installation, most codes require the wood burner to be installed below the conventional system on the chimney.

Note: any *no* answers should serve as indication of less than safe or desirable situations. They should be satisfactorily dealt with and explained to the homeowner before approval is given.

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