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# service in ACTION

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## Proper installation, operation and maintenance of a wood stove<sup>1</sup>

Lloyd Walker<sup>2</sup>

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### Quick Facts

Adding a wood stove to a house must be undertaken properly to ensure a safe installation.

Install a stove with adequate clearance from any combustible surfaces, including floors, walls or furniture.

Any chimney must have adequate capacity, the correct height, proper location, proper clearance from combustibles and proper mechanical support to be safe.

When an efficient airtight stove is selected and installed with a proper chimney, the efficiency and safety of the stove operation is largely dependent on the skill of the operator.

The type of wood also can affect stove operation. A wood stove requires regular maintenance: proper cleaning of the chimney to remove creosote deposits, regular inspection of the installation, and handling of ashes.

400 degrees F. The interior stove temperatures are over 1,000 degrees F, and if a chimney fire occurs, temperatures over 2,000 degrees F are possible. Obviously, a device that can achieve such high temperatures must be treated with respect, and installed, operated and maintained properly to ensure the device does not pose any hazard in the home.

### Installation

Once a location for a stove is established, prepare the area properly to ensure there is adequate clearance from any combustible surfaces. Combustible surfaces include floors, furniture, and walls of plaster, drywall or paneling. The proper distance from these combustible surfaces is determined by consulting three sources. If the stove is "listed," which means it was safety tested by an independent testing lab, there will be manufacturer's recommendations for clearance from combustibles.

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### Introduction

Many homeowners concerned about rising home heating costs purchase wood stoves to reduce heating bills. Adding a wood stove to a house must be undertaken properly to ensure a safe installation. A wood stove is unlike any other device presently in a modern home.

A wood stove regularly has surface temperatures over

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  2. Colorado State University Cooperative Extension specialist and research associate, agricultural and chemical engineering.
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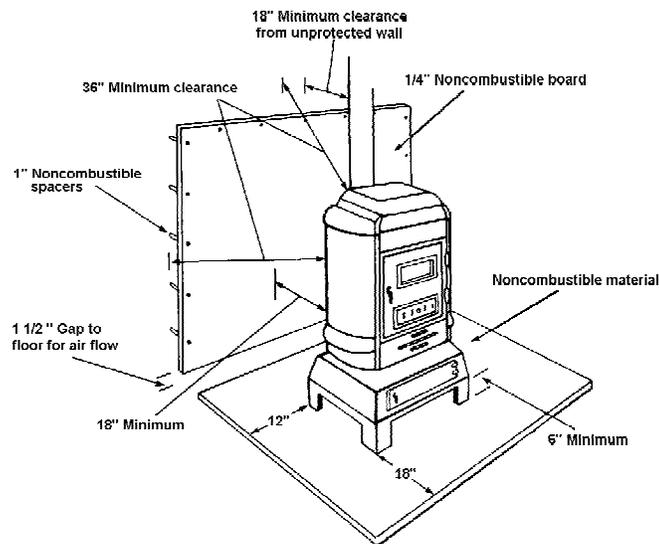
**Table 1. Minimum clearances from combustible walls and ceilings.**

Type of protection	Stove type		
	Radiant	Circulating	Stovepipe
None	36"	12"	18"
1/4" Noncombustible board spaced out 1"	18"	6"	12"
28 gauge sheet metal, spaced out 1"	12"	4"	9"
28 gauge sheet metal on 1/8" noncombustible board, spaced out 1"	12"	4"	9"

**Table 2. Floor protection for stove installations.**

Height of stove bottom from floor	Protection needed
18 inches or more	24 gauge layer of sheet metal
6 to 18 inches	24 gauge layer of sheet metal over 1/4-inch layer of non-combustible board
6 inches or less	4 inches of hollow masonry laid to provide air circulation through the masonry layer covered by a sheet of 24-gauge sheet metal

Extent of protection is:  
 18 inches beyond any side with a firebox opening (door)  
 12 inches beyond all sides with no openings



**Figure 1. Reduced clearance installation (use wall and floor protection).**

If a stove is not listed, follow the National Fire Protection Association recommendations (see Table 1) for clearance from combustibles. However, either of these recommendations are superseded by local building codes. Check with the local building inspector to find out what clearance standards are enforced in your area.

From Table 1, the distance to unprotected surfaces, especially for radiant stoves, is quite large--36 inches. Thus, most stove installations have some type of non-combustible wall protection behind the stove to allow for installation closer to the wall without presenting a safety hazard (see Figure 1). Asbestos millboard, while it is an acceptable type of protection, is not recommended because of the health hazard from asbestos fibers. If asbestos is used, paint with a high temperature enamel to lock in the fibers.

A most important item in wall protection is the 1-inch spacing necessary between the protecting material and the wall. The 1-inch spacing is necessary to ensure air circulation between the protection and the wall so that the wall is not subject to high temperatures. The spacers used to attach the sheet metal to the wall also must be non-combustible. (Do not use wood furring strips.)

Another method to achieve the same type of protection is using brick or masonry with a 1-inch air space between the brick or masonry and the wall. However, the weight of such a wall may cause structural problems in the house. Protection on the wall behind the stove must extend far enough on either side of the stove so that the distance measured from the stove body to the combustible part of the wall is at least 36 inches.

Floor protection is the other critical area to considered with stove installation. The National Fire Protection Association's recommendation for extent and type of protection of combustible floors under stoves are given in Table 2. If the stove is listed, install it according to the manufacturer's instructions. Check local building codes for specifics regarding type of floor protection and acceptable clearances. Cover floor protection materials with noncombustible materials such as brick, stone or tile to improve appearance.

With the stove properly installed, connect the stove to the chimney. For this connection, use a heavy gauge stove pipe--generally 24 gauge for most installations--and follow manufacturer's recommendations. The connecting stove pipe must be as short as possible. Secure all joints with sheet metal screws and connect the pipe with the crimped end pointing downward to contain creosote (see Figure 2). It is important to observe the 18-inch clearance from combustible surfaces. To reduce clearances, add wall protection using the same materials and techniques recommended for the stove installation (see Table 1).

Choose the type of chimney with safety in mind. A

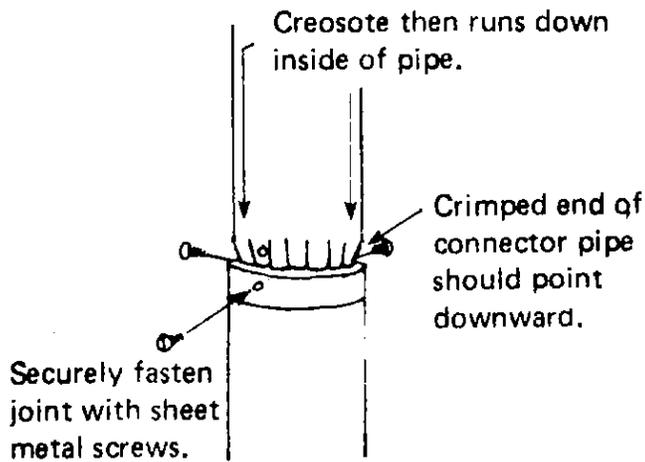


Figure 2. Proper connection of stovepipe.

masonry chimney is acceptable but may be expensive and difficult to build. An existing fireplace chimney can be used for a wood stove. The simplest type of chimney to add to a house is a factory-built metal chimney (see Figure 3). When choosing a factory-built chimney, choose a chimney that is listed (tested by an independent lab).

The innermost lining of the chimney should be stainless steel to withstand high temperatures and corrosive environment. Install only a class A, all-fuel, or solid-fuel chimney for a wood stove installation.

There are three common types of listed factory-built metal chimneys; all are equally safe when installed in accordance with instructions and properly maintained. The three types are: 1) the air cooled thermo-syphon chimney, 2) solid pack insulated chimney and, 3) air insulated chimney.

Wood stoves function more efficiently with less maintenance problems when using a solid pack or air insulated chimney. The thermo-syphon chimney is designed principally for use with fireplaces and can present problems in wood stove operation due to the cool temperatures maintained on the innermost lining, which will accelerate creosote formation and require more frequent cleaning.

Any chimney must have adequate capacity, correct height, proper location, proper clearance from combustibles and proper mechanical support to be a safe installation. The diameter of the chimney must meet manufacturer's recommendations to provide adequate capacity for the stove. The chimney must be high enough to ensure efficient functioning of the stove (see Figure 4).

The most desirable location for a chimney is in the center of the house where most of the chimney is inside of the building. By exposing a minimum amount of chimney to the outside, creosote problems are minimized. A chimney located primarily on the outside of the house operates with cooler surface temperatures and tends to

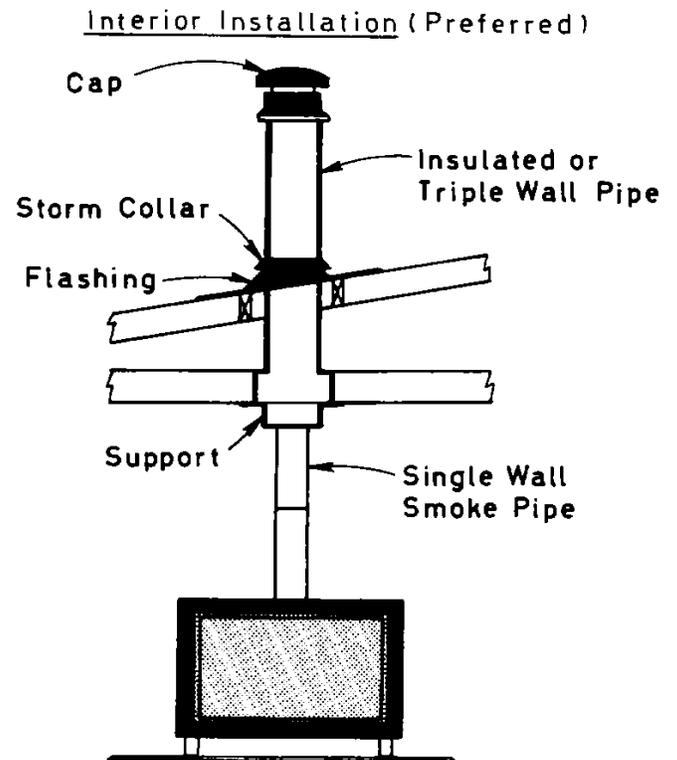


Figure 3. Metal chimney installation.

have creosote deposits more frequently and requires more periodic maintenance. A safe chimney installation requires at least a 2-inch minimum clearance from combustibles. A chimney that projects more than 4 feet above the roof should have some kind of mechanical support by wires, brackets, etc., to ensure that it will not be damaged by high winds.

If an old and long-unused masonry chimney is brought back into service for use with a wood stove, carefully inspect it to ensure that it is still safe to operate. If it does not have a tile lining, add stainless steel stovepipe the entire length of the chimney. Check with the building inspector or fire department for inspection of such an installation.

Once the stove is installed but before it is used, a local building inspector or fire department representative should inspect the installation. It is important to notify your insurance company about the installation to be sure your homeowner's policy will cover a wood stove installation.

There are several safety recommendations to follow after installing a wood stove:

1. install a 10-pound ABC fire extinguisher, and a smoke detector in the home.
2. familiarize house occupants with fire evacuation procedures. Adding a wood stove to a home will change the fire evacuation routes and these must be well understood by all occupants.

3. Regularly inspect the entire installation. Inspect it carefully and frequently during the first few months of operation to be sure that everything operates properly and familiarize yourself with its operating and maintenance characteristics.
4. Clean the chimney at least once a year.

It is extremely important to follow all of the installation procedures outlined in this fact sheet when installing a wood stove. The most efficient wood stove is not going to save any money if the end result is a house fire. Since the wood stove is a potentially dangerous device, treat it with respect and show proper adherence to installation procedures.

## Operation

When an efficient, airtight stove is selected and installed with a proper chimney, the efficiency and safety of the stove operation largely depends on the skill of the operator. The first consideration in operating a stove efficiently is properly preparing the wood for use in the stove. Thoroughly air dry the wood to ensure a moisture content of about 20 percent so that the maximum amount of energy is extracted from the wood.

Green wood does not burn well and the amount of energy available in green wood is 60 percent less than the amount of energy available in dry wood. Season green wood at least six months. Protect the wood from rain or snow with a cover so it does not absorb moisture.

The type of wood used also affects stove operation. Regulate stove operation by the size and type of wood used. Use hardwood (which is not in abundance in Colorado, the only exception being gambel oak), if available, for overnight burns since its higher density provides a longer duration burn. Use small split wood for fire starting and quick heating, often needed in the morning. Use larger round or split pieces when the stove is regularly attended.

Proper operation of a stove improves efficiency and reduces creosote problems. A small hot fire is the most efficient way to burn wood. Add small amounts of wood at a time to the stove and operate the draft controls in at least a half-open position. However, with overnight burns, load the firebox with wood and restrict the draft for a long duration burn. This type of burn produces more creosote. When loading the firebox for an overnight burn, set the draft controls wide open for the first 20 minutes to establish a hot fire and restrict the draft.

When firing the stove upon awakening in the morning, open the draft wide open with a small hot fire to help dissipate creosote that may have developed from the overnight burn. Make every attempt to operate the stove using a small hot fire whenever it is regularly attended.

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

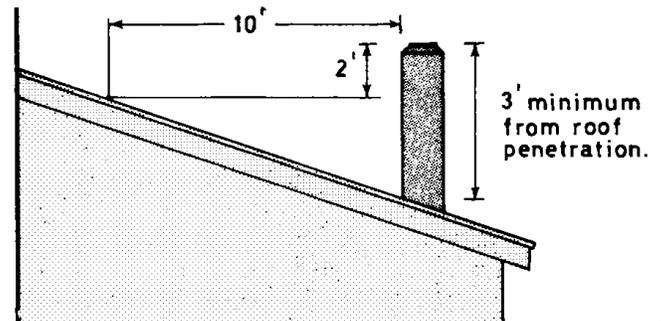


Figure 4. Proper height of a chimney.

The use of a chimney temperature gauge helps assess the operating mode of the stove. This device shows temperature of the burning gases exiting the stove. Install in the chimney connector approximately 3 feet from the exit of the stove. It can be a useful device to help monitor the operation of the stove and retard the production of creosote.

When using a wood stove, be sensitive to the operating characteristics. Regulate the amount of wood and the amount of air provided to the stove to achieve comfort levels in the house. Since a stove does not respond automatically, anticipate its performance in order to have uniform heat production.

An essential part of operational procedures is to know what to do in an emergency situation caused by a chimney fire. A chimney fire occurs when buildup of creosote in the chimney is ignited and burns quickly and hot. A chimney fire is not difficult to detect. It involves flames and sparks shooting out the top of the chimney, a roaring sound similar to a jet engine, the stovepipe glowing red hot and vibration or throbbing of the stovepipe. It generally has a short duration but is intensely hot and has the potential to do serious damage to the chimney and, in some cases, extreme damage to the house.

The best reaction to a chimney fire is to shut off the oxygen to the stove, alert occupants in the house, call the fire department, and make careful observation of the chimney, attic and outside of the house for fire. When a chimney fire is extinguished, carefully inspect the chimney for damage. Inspect the area around the chimney for any smoldering fires that may have started due to the intense heat, and before using the stove again be sure that nothing is damaged that would compromise the safety of the chimney. A chimney fire can be avoided with periodic chimney cleaning and avoiding extremely hot fires (which can occur when burning trash, Christmas wrapping paper, etc.). When a stove begins to glow, it is usually the result of being over-fired. This can damage

the stove and has potential to start a chimney fire.

## **Maintenance**

Use of a wood stove requires regular attention to a few maintenance procedures--proper cleaning of the chimney to remove creosote deposits, and regular inspection of the installation and handling of ashes. Creosote is an inevitable by-product of burning wood. Periodically clean out the deposits formed on the chimney walls to ensure good performance of the stove and reduce any safety hazards created by the creosote deposits. Clean chimneys at least once a year. A more specific rule to follow is to clean the chimney whenever there is a 1/4 inch or more creosote buildup on the chimney walls. Chimneys can be cleaned by a homeowner, using a stiff wire brush designed for the purpose, or by a professional chimney sweep. Cleaning a chimney can be a messy task because of the creosote deposits that are scraped out of the chimney. Take care to prevent dust and creosote from settling in the house. Wear a face mask when cleaning a chimney to avoid inhaling the creosote particles.

Check the stove installation at least once a year to be sure that there is no hazard created by the stove and that clearances from combustible surfaces are maintained. It is important to check the stove pipe used in the chimney connection. Stove pipe is subjected to high temperatures and will corrode in time. It must be checked periodically and replaced when it appears to be corroding beyond safe limits.

Dispose of ash properly. Carry ashes out in a non-combustible container such as a metal bucket, and do not leave them in contact with combustible surfaces. Charcoal buried in ash may smoulder for days. When placed into an improper container such as a cardboard box, it can easily cause a disastrous house fire. Dispose of ash immediately after cleaning the stove by spreading it on flower beds, gardens or compost piles.