

## **About Pellet Stoves**

### **Pellet Fuel Appliances and Pellet Fuels**

Pellet fuel appliances burn small, 3/8-1 inch (100-254 millimeter [mm])-long pellets that look like rabbit feed. Pellets are made from compacted sawdust, wood chips, bark, agricultural crop waste, waste paper, and other organic materials. Some models can also burn nutshells, corn kernels, and small wood chips. They are more convenient to operate and have much higher combustion and heating efficiencies than ordinary wood stoves or fireplaces. As a consequence of this, they produce very little air pollution. In fact, pellet stoves are the cleanest of solid fuel-burning residential heating appliances. With combustion efficiencies of 78-85%, they are also exempt from United States Environmental Protection Agency (EPA) smoke-emission testing requirements. Pellet stoves have heating capacities that range between 8,000 and 90,000 Btu per hour. They are suitable for homes as well as apartments or condominiums.

### **Types of Pellet Fuel Appliances**

Pellet fuel appliances are available as freestanding stoves or fireplace inserts. Freestanding units resemble conventional cordwood heaters in that they generally heat a single room well, but not adjacent rooms unless you use a fan to force the warm air into those other spaces. There are also fireplace inserts that fit into existing fireplaces. Several companies now make pellet-fired furnaces and boilers for replacement of, or a supplement to, gas or oil fired furnaces and boilers in residential space heating systems.

All pellet fuel appliances have a fuel hopper to store the pellets until they are needed for burning. Most hoppers hold 35 and 130 pounds (16 and 60 kilograms [kg]) of fuel, which will last a day or more under normal operating conditions. A feeder device, like a large screw, drops a few pellets at a time into the combustion chamber for burning. How quickly pellets are fed to the burner determines the heat output. The exhaust gases are vented by way of a small flue pipe that can be directed out a side wall or upwards through the roof. More advanced models have a small computer and thermostat to govern the pellet feed rate.

### **Bottom and Top Fed Stoves**

Pellet stoves use two types of automatic pellet-feeding systems: top-fed and bottom-fed. In top-fed systems, the auger is inclined at an angle and feeds the pellets into the top or side of the combustion chamber. The auger reduces the possibility of fire "burn back" into the hopper. Top-fed systems, however, may not force ash away from the firebox grate. If this occurs, clinkers (deposits created by repeatedly heating and cooling ash) tend to form there. Clinkers may impede combustion air flow and cause the fire to die. To prevent clinkers from forming in top-fed systems manufacturers recommend burning premium grade, low-ash pellets.

Bottom-fed designs generally have a horizontal auger. Since this system moves the fuel horizontally into the fire chamber, incoming pellets shove aside ashes and clinkers, which then fall into the ash pan. It is not necessary to use higher quality, low-ash pellets in bottom-fed systems.

### **Combustion Air Controls**

To get the maximum of heat from each pellet, and a clean burn, pellet fuel appliances use a draft-inducing fan to supply combustion air and vent combustion gases. The fan either draws air out of the firebox or blows air into it. Either method may cause some problems. For example, air being blown into the combustion chamber causes a positive pressure in the stove. If you open the door some ash and smoke may blow out of the firebox. Also, as the stove ages it may develop small air leaks. If it does, combustion gases may enter the room.

For models where combustion air is drawn out of the stove, opening the door often causes the fire to go out. This type of draft control also requires much more maintenance to keep the fan clean of ash and operating correctly.

Following all operation and maintenance instructions and using premium grade, low-ash pellets, reduces these problems. Also, all stove manufacturers, no matter the type of system, advise against opening the firebox door while the appliance is operating.

## **Installation**

The type of pellet appliance determines how and where it should be installed. Freestanding pellet stoves should be located in a large, open area so that the heat can more evenly cover the space. Fireplace inserts go into existing fireplaces, but there are also models that can be installed into the corner of a room or on a blank wall. All of the manufacturers have specific installation guidelines that must be carefully followed to ensure safe and efficient operation.

Since all pellet stoves have a draft inducing fan to supply air to the fire and vent the exhaust gases, manufacturers and local building codes require vent pipe that is specifically listed by Underwriters Laboratory (UL) for use with the appliance. Normally this is PL (double wall) vent pipe, tested to UL 641. Using anything else (i.e., dryer vent pipe, gas appliance vent pipe, PVC plastic pipe, single wall stove pipe), unless it is approved by the manufacturer and local building codes, may be unlawful and void your stove warranty. Special venting may be required when they are installed in elevations over 2,500 feet (700 meters) above sea level, due to the thinner air at such high elevations.

Most models give you the choice of direct venting (the vent can go straight through a wall) or venting straight up through the roof. If you direct vent the unit, install a vertical section on the outside of the building that clears roof overhangs to reduce damage to the building exterior. Be aware that if you lose electric power, direct vented stoves may force some smoke into the room until the fuel in the firebox burns out.

The vent or flue for pellet inserts can be installed into an existing masonry chimney, if allowed by local mechanical codes. Usually, such installations must use an approved chimney liner or PL vent to keep the old chimney liner from degrading and possibly falling in and blocking the exiting exhaust gases.

Proper vent size (diameter) is very important for safe and efficient operation. Be sure to seal the joints and seams of the vent with a sealant recommended by the vent manufacturer or supplier.

## **Maintenance**

According to a survey by *Hearth and Home* magazine, operator error—including poor or improper maintenance—accounts for more service calls than equipment failure. It is very important to follow the manufacturer's instructions for operation and maintenance. Inspect fans and motors regularly, and maintain them properly. Manufacturers advise removing unused pellets from the stove hopper and feed system at the end of the heating season. This reduces the chance of rusting, which can cause expensive damage to the appliance. It also minimizes difficulties in lighting the appliance at the start of the next heating season. Clean the flue vent on a regular basis to prevent soot building up.

## **Pellet Fuel Quality, Standards, and Availability**

Most pellet fuels have a 5-10% moisture content. Well-seasoned firewood is usually around 20%. Some pellets contain either petroleum or non-petroleum lignin used as a lubricant in the pellet production process, though most contain no additives. Pellets made from agricultural waste contain more ash, but they may produce more heat than pellets made from wood.

The Pellet Fuels Institute (PFI) and the Association of Pellet Fuels Industries (which merged into the PFI) established National Residential Pellet Fuel Standards in 1991. Fuel quality certification is the responsibility of the pellet manufacturer.

These standards established two pellet fuel grades: premium and standard. The only difference between grades is in the inorganic ash content: premium should be less than 1%, and standard less than 3%. Premium is usually made of core wood (not bark). There are five fuel characteristics prescribed for both grades:

1. Bulk density per cubic foot (0.028 cubic meters) shall not be less than 40 pounds (18 kg)
2. The diameter shall be 1/4 to 5/16 inch (635-794 mm)
3. Maximum length shall be 1 and 1/2 inches (254-127 mm)
4. Fines (dust) of not more than 0.5% by weight shall pass through a 1/8 inch (317.5 mm) screen
5. Sodium content shall be less than 300 parts per million (ppm).

Manufacturers are encouraged to label their product as meeting PFI Standard or Premium Grade. They are also encouraged to disclose the type of material used, and to print a guaranteed analysis on the pellet fuel bag that includes the following information: grade, type of material, percentage of ash, percentage of fines, and concentration of sodium (in ppm). Manufacturers should have samples of their fuel tested at least twice a year by an independent testing laboratory that uses American Society for Testing and Materials (ASTM) procedures.

You can check pellet fuel quality by inspecting the bag for excessive dirt and dust. (Dirt can form clinkers in the stove.) There should be less than one half of a cup of dust at the bottom of a 40 pound (18 kg) bag.

Pellet stoves designed for low-ash (less than 0.5% or premium grade) tend to operate poorly when used with pellets of a higher ash content. Also, some pellet fuel producers may have trouble obtaining high-quality, low-ash materials for making pellets. Many pellet appliance manufacturers have designed or are redesigning their products to burn pellets with varying ash contents.

Pellet fuel availability has increased over the past decade. There are currently about 30 pellet stove and insert manufacturers, 45 pellet fuel producers, and thousands of wood and pellet fuel appliance dealers across the United States. Before you purchase a pellet fuel appliance, be sure there is a reliable pellet fuel supplier in your area. It is also important to know the type of pellet fuel available before you shop for an appliance. Most pellet fuel appliance dealers either maintain a supply of pellets or recommend a supplier. You may also check the local telephone listings under "Fuel" or "Pellet Fuel," or inquire at a local tree nursery, or at home and garden supply stores.

### **Pellet Stove Pros and Cons**

Pellet appliances are often more convenient, cleaner, and safer than most wood burning appliances. They produce less air pollution than conventional wood stoves. Also, they usually require refueling only once a day. Since the fuel is compressed and bagged, the operator does not have to lift heavy, dirty logs. Most pellet appliance exteriors (except glass doors) stay relatively cool while operating, reducing the risk of accidental burns. Since pellet stoves burn fuel so completely, very little creosote builds up in the flue. Because of this, pellet appliances pose less of a fire hazard and do not require cleaning as frequently as conventional wood-burning appliances.

Unfortunately, pellet appliances are also more complex and have expensive components that can break down. They also require electricity to run fans, controls, and pellet feeders. Under normal usage, they consume about 100 kilowatt-hours (kWh) or about \$9 worth of electricity per month. The loss of electric power, unless the stove has a back-up power supply, results in no heat and possibly some smoke in the house.

### **Stove and Fuel Costs**

Most pellet stoves cost between \$1,700 and \$3,000. However, a pellet stove is often cheaper to install than a cordwood-burning heater. Many can be direct-vented and do not need an expensive chimney or flue. As a result, the installed cost of the entire system may be less than that of a conventional wood stove.

Pellet fuel is normally sold in 40 pound (18 kg) bags at about \$3.00 to \$4.00 each, or about \$120.00 to \$200.00 a ton. You can estimate how much fuel you will need for a heating season by noting that one ton of pellets is equivalent to approximately 1.5 cords of firewood. Most homeowners who use a pellet appliance as a main source of heat use two to three tons of pellet fuel per year. Pellet fuel appliances are often less expensive to operate than electric resistance heating and propane-fueled appliances.

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