BY TIM MAKER

WOODBURNING TECHNOLOGY UPDATE

VERMONT CASTINGS

This wood stove uses a catalytic combustor to meet EPA emission standards. Combustion air drawn across the inside face of the stove doors helps to keep the glass clean — a common feature in the new generation of wood stoves.

If you haven't checked out wood stoves and manufactured fireplace inserts in the last five years, you may be surprised. Not only has there been a drastic reduction in smoke and emissions, but there has been a corresponding improvement in efficiency. In this article I'll describe some technological advances you may not be aware of, and review the types of woodburning equipment now available. If your clients ask your advice when shopping for a stove or insert, you may be able to help them avoid a costly mistake.

Back in the 1970s, the best stoves were called "airtight." While these had gasketed doors that helped hold a fire overnight, they were relatively inefficient, and when turned down for the night they smoldered and produced smoke and carbon monoxide. By contrast, most new wood stoves meet the Environmental Protection Agency's "Phase II" emission standards. Phase II stoves, recognized by their EPA labels, consume one-fourth to one-third less wood for the same amount of heat, and burn 80% to 90% cleaner. Not surprisingly, the new high-performance designs make these stoves more expensive than their predecessors. The days when you could get a new sheet-metal wood stove for less than $100 are gone. Today's models range from $500 to $2,000, with most selling for around $1,200.

Not all residential woodburning equipment falls under the Phase II testing and labeling requirements. For instance, non-airtight stoves (such as wood cook stoves), zero-clearance fireplace units with loose doors, and all wood furnaces and boilers are exempt. Some pellet stoves are also exempt because they are inherently clean-burning.

Wood Stove Choices

Phase II wood stoves come in two basic types: catalytic and noncatalytic. Catalytic stoves have a honeycomb-shaped combustor in the smoke path, just downstream from the primary combustion chamber (see photo, above). The combustor has a catalytic coating that lowers the temperature at which gases burn completely from 1,100°F to 500°F. During a long overnight burn, complete combustion is achieved by adding air to the smoke in the vicinity of the combustor.

Catalytic stoves demand more attention than noncatalytic stoves. The user has to wait until the fire reaches about 500°F before opening the bypass damper that redirects the gases through the catalyst. The user must also take care not to overfire the combustor and damage the catalyst. The combustor must be inspected and cleaned regularly, and its catalytic coating wears out over time. A typical

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Figure 1. *This noncatalytic wood stove uses ceramic insulation and a lining of firebrick to help maintain high combustion temperatures. Air is channeled to several parts of the firebox to ensure complete burning of gases.*

HEAT-N-GLO

Figure 2. *Unlike ordinary zero-clearance fireplaces, this fireplace insert passes EPA Phase II standards for clean combustion. Built-in blowers on fireplace inserts boost the heat output to equal or exceed that of freestanding stoves.*

combustor must be replaced every two to three years.

Noncatalytic stoves achieve a similar result by maintaining the combustion chamber at high temperatures (a refractory lining of firebrick acts as a heat sink) and adding turbulent secondary air at the top of the chamber just before the hot gases exit the stove (Figure 1). The secondary air provides oxygen so that the combustible gases produced in the primary zone can burn completely.

The choice between catalytic and noncatalytic models depends on how the stove will be used. If your clients are serious wood heat users, then either type would be acceptable. But if your clients are casual wood burners, using the stove occasionally in the evenings and on weekends, it's probably best to steer them toward noncatalytic units, which require less attention. Not surprisingly, noncatalytic stoves accounted for 65% of new stove sales in 1993.

Stove Construction

Stoves can be made from cast iron, steel, or soapstone. If I wanted to quickly heat a house up in the morning or when I got home from work, I would probably choose a steel stove. If I liked traditional styling and wanted to pull the easy chair up to a toasty fire on cold nights, I would lean toward cast iron. If I wanted a gentle, long-lasting heat without having a really hot object in the living room, soapstone would be perfect.

Regardless of construction, most EPA-certified stoves have clear glass doors. To keep the glass clean, primary combustion air is preheated in channels built into the walls of the stove, then released above the doors. The air drops along the glass to feed the fire at its base. This air wash keeps the glass from sooting up. To help boost stove output, some models use fans to blow heated air into the room, while others have built-in convectors. Convectors are passageways in the stove's shell that trap stove heat. The heat is transferred to a moving air stream, then released into the room. Convection stoves are good for heating large spaces, but the advantage may be lost in small, tightly built homes.

Fireplace Inserts

Most people know that conventional open fireplaces are terrible energy wasters. What they don't realize is that the standard manufactured fireplace isn't much better. The glass doors on an EPA-exempt "zero clearance" fireplace are too loose-fitting to hold an overnight fire, so they lose a significant amount of heat up the chimney when the fire dies down. And the tempered glass used in most zero-clearance fireplaces also prevents the fire's infrared radiation from getting out into the room.

Fortunately, there's now an alternative. The EPA-certified Phase II advanced combustion fireplace — known as a fireplace insert — looks and installs like a zero-clearance fireplace (Figure 2). The difference is that it's airtight and has the emissions and efficiency characteristics of an EPA Phase II wood stove. Fireplace inserts have pyro-ceramic glass doors that let firebox radiation easily pass to the room. These high-performance fireplaces can be inserted into an existing masonry chimney, or can be installed in a brick or wood surround and vented with a rated metal chimney system. Some inserts look like a wood stove stuck into the fireplace, while others resemble a fireplace with glass doors. Most have squirrel-cage blowers that help distribute heat to the living space. Look carefully at the wattage of the blower (the lower the wattage the less electricity it will use). And because blowers can be loud, advise your clients to listen to it in operation before laying down their cash.

Pellet Stoves

Residential pellets have been around for about ten years now. They're a

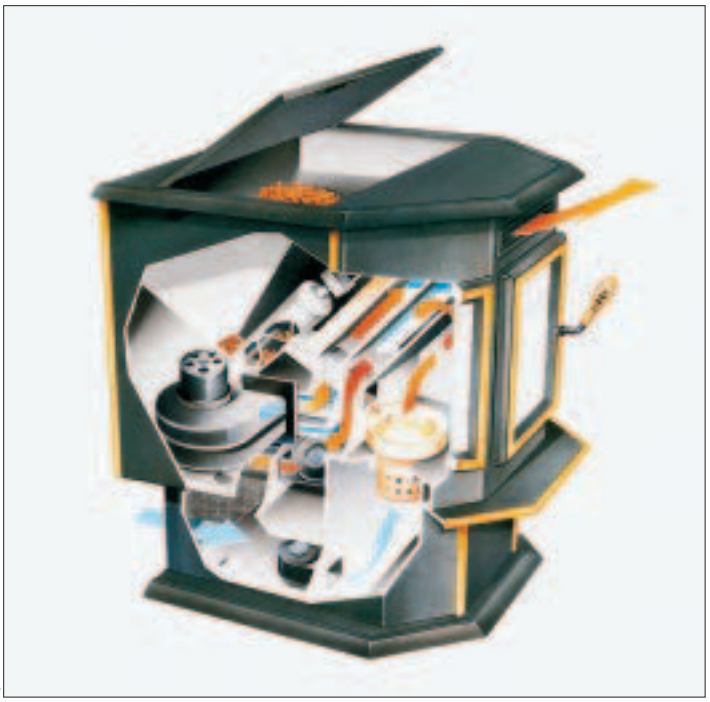

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Figure 3. *Pellet stoves yield very high combustion efficiencies: A screw auger sends a measured amount of pellet fuel to the burn chamber, while fan-forced combustion air ensures nearly complete combustion.*

QUADRA-FIRE

Figure 4. *Because they are inherently clean-burning, most pellet stoves are exempt from EPA regulation. Pellet stoves are the only woodburning appliances available for horizontal, direct-vent installation.*

manufactured product made from wood and wood by-products like cardboard and paper. They look like feed grain and are sold in 40-pound waterproof bags. Pellets are very dry and have much more energy per pound than cordwood. Because pellets burn hot and clean, a pellet stove can be more efficient and have lower emissions than a standard woodburner.

Pellet quality depends largely on ash content, with the range being .5% to 2.5%. Ash content is determined by the species of wood from which the pellets are made, so it varies regionally. Most pellets are in the "premium" class, which contains less than 1% ash. Those with ash contents above 1% are categorized as "standard."

Pellet stoves and fireplace units have a number of attractive features. Pellet burners have integral fuel hoppers that use motor-driven augers to feed the fire at a precisely controlled rate (Figure 3). A pellet stove can operate automatically for as long as two days between fillings. Some units can be controlled with an optional wall thermostat like a central heating system. And the pellets themselves are cleaner and easier to handle than cordwood.

One drawback to pellets is that they generally cost close to twice as much as cordwood for the same heat output. Pellet stoves also require electricity — to run the auger system, the combustion air fan, and (for some models) a convection fan that distributes heated air through the room. During a power outage, a pellet burner can't be used unless it's equipped with battery backup. Because they have mechanical parts, pellet burners also fail more often and require more maintenance than woodburners.

Given all these caveats, is buying a pellet stove a good idea? In my area, I have never recommended a pellet stove because the lack of competition among pellet manufacturers has kept the price of fuel high. In areas like the Pacific Northwest, however, competing producers keep pellet prices lower. Also, air quality concerns are more urgent in areas like the Northwest, giving environmentally-conscious consumers the extra incentive to choose a very clean-burning technology that burns recycled material. Pellets are also considered convenient by consumers who want to burn "wood" but don't want the mess and hard work of cordwood.

Chimney Design

Since most pellet stoves are power-vented, they can be exhausted through a sidewall, much like a high-efficiency furnace (Figure 4). All other woodburners need a chimney.

Exterior chimneys are a bad idea with any high-efficiency woodburning equipment. Such chimneys run cool, which reduces the draft needed to keep the woodburner from backdrafting. This is a particular problem for catalytic stoves, since the placement of the catalyst in the exhaust flow further reduces the draft. To keep resistance to a minimum, chimneys for catalytic stoves should include no more than two 90-degree elbows.

Installation and Maintenance

Sizing and installing a wood stove or manufactured fireplace is best left to a specialty installer. Most wood-heat appliance retailers work with subcontractors who understand the equipment and know the local fire codes. Let them assume the liability.

Properly operated EPA-certified stoves produce very little creosote or chimney deposits and are easy to maintain. The flue and all chimney connectors should be inspected twice a year and the chimney swept annually. ■

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