Can a fireplace behave itself in a tight house?

Yes, but open fireplaces give all fireplaces a bad name

Talk about a clash of technologies: In a house that is to be tightly-constructed and well-insulated so it will be cozy and easy to heat, the homebuyers want to have a traditional open fireplace, a device whose design was state-of-the-art a couple of centuries ago. Once built, this new house and old fireplace will not coexist without conflict and the owners might regret reaching back in history to select their fireplace.

To perform reliably in a modern house, the unruly traditional fireplace must be tamed by some new technology, but it need not lose the essential qualities that have always compelled us to gather around the hearth.

Declaring my bias, I freely admit my enthusiasm for fireplaces and think that every house needs a hearth to be complete. A fire burns on my hearth all winter and I never tire of watching the flames and being within range of their warmth.

That said, I also think the traditional open fireplace is headed for extinction and I, for one, won't shed a tear at its passing. The end will come because the open fireplace is an antique technology that is incompatible with modern housing. It is wasteful by temperament, and through its gluttonous appetite for fuel and air, it scoffs at the ideas of energy conservation and environmental correctness.

If you build a standard house using the latest in materials and techniques, its tight skin will not leak enough to supply the air demands of an open fireplace. The problem is not with the house, but with the anachronistic fireplace.

Strong opinions, often colored by myth and misinformation, usually surround discussions of fireplaces. So, to avoid any misunderstanding, allow me to propose this basic principle: A fireplace should work well all the time and never screw up in a big way; should not belch acridly during a party, should not set off the smoke detectors at 2:30 in the morning, and should not stink and gush cold air when no fire burns. And further, given the advanced state of construction and fireplace technology, a builder should be able to confidently guarantee to the homebuyer that the fireplace will perform properly.

It is not much to ask, really, that a fireplace work properly, no more than we ask of most other building components. Yet, complaints about nuisance fireplaces are among the most common call-backs in the building industry. Despite the voodoo preached by proponents of certain variations on the theme, there is nothing magical about fireplace design. For example, here is a pretty reliable rule of thumb: the more air the fireplace demands for normal operation, the more susceptible it is to spillage and backdrafting.

If you place the fire on the room side of a flow restriction, like a throat damper, you need strong draft and high flow up the chimney to keep smoke from spilling into the room. An open fireplace consumes between 200 and 600 cubic feet per minute (cfm) of

room air—more if it is a big fireplace with a big, big fire. Tightly built houses cannot tolerate a 200 cfm exhaust flow without getting meaningfully depressurized, so there's a problem right away.

If a home buyer rigidly demanded an open fireplace, it could be made to work if you threw enough money and horsepower at the problem. A chimney top fan could be installed at considerable cost, but it could severely depressurize the house in its attempt to flow enough air to prevent smoke spillage from the fireplace, and would likely backdraft a conventional gas furnace or water heater. Alternatively, a high-volume, fan forced, pre-heated outdoor make-up air system could be designed and installed. Just before lighting the fireplace, the user would turn on the make-up air fan, pressurizing the house and forcing the necessary flow through the fireplace and up the chimney. This large-capacity make-up air system would be complicated because the incoming air would need tempering by a thermostatically-controlled electric duct heater of substantial output. Distributing the air effectively could also be a challenge. Both options—the chimney top fan and large make-up air system—are expensive and both have drawbacks.

There are easier ways to tame the fireplace. When you place the fire behind the main flow restriction, say a glass door assembly, you can get away with lower flow rates and draft levels without smoke spillage. With doors, even a set of leaky bi-fold doors, the flow rate drops by three-quarters to 50 to 150 cfm, depending on flue size, fire size and door leakage. The barrier between the fire and the room formed by the doors makes the fireplace more spillage-resistant by a huge margin. The doors don't make this fire place an efficient heater, just less of a nuisance.

Some people claim that glass doors spoil a fireplace. (Do they mean in the same way electric lights spoiled the pleasure of reading by candle light? Or the way shock absorbers on cars took away the feel of the road?) In reality, at least a spark screen is needed to prevent damage to rugs, floors and furniture when the characteristic crackle of the fire spits glowing bits from the hearth. True, glass doors do block out most of the sound of the fire, which is just fine for those of us who find the crackle only makes them apprehensive about those glowing bits. Given the choice of looking through a wire mesh screen or clear glass, I'll take the glass.

Beyond the open fireplace at 400 cfm average air demand and the fireplace with doors at 100 cfm, there is a third category in this descending order of air demand. Call it a controlled-combustion fireplace. It has doors with gaskets and it manages both the amount and location of combustion air it admits. By limiting the flow of air to an amount closer to that needed for combustion of the wood, the demand falls by three-quarters again to 15 to 30 cfm. Within this category, I would include all the factory-built fireplaces that meet the Environmental Protection Agency (EPA) emission limits for wood heaters, as well as massive heat-storage units like masonry heaters, Russian fireplaces and their ilk. There are also many controlled-combustion fireplaces that are EPA exempt, which, because they are fairly modest consumers of room air, can function well in tight houses.

Not incidentally, a fireplace's consumption of room air directly affects its efficiency, that is, how much of the energy contained in the logs is transferred as cozy warmth to the room. Because they suck up so much room air, open fireplaces deliver between zero and 20 per cent net efficiency. The low efficiency results from the house furnace working so hard to heat up the outside air that must come in to replace air exhausted by the fireplace. The colder the weather, the lower the delivered efficiency from an open

fireplace. A fireplace with doors can deliver between 10 and 30 per cent efficiency, depending on whether it has a heat exchanger that works, but this is still lousy efficiency by modern standards. A fireplace that uses current technology, one that is EPA certified for low emissions, for example, will deliver between 60 and 70 per cent efficiency. This means a modern woodburning fireplace is competitive with any other form of home heating in terms of energy efficiency.

Some housing technologists recommend that builders avoid using any heating or hearth appliance that vents through a chimney and operates on natural draft. This caution would apply to all wood burning fireplaces because, with current technology, they must be vented through a vertical chimney. While I'm sure such advice is well-intentioned, if adopted, it would mean the elimination the natural hearth from every new house. Home buyers could not enjoy the comfort and quality of a well-built modern home while sitting in their favorite chair in front of a real wood burning fireplace. They could not stay cozy and comfortable during an electrical power failure by burning wood in the fireplace. They would be unable to use this renewable energy source as one route to environmental responsibility, but would be forced to heat with fossil fuels and be locked into a one-sided relationship with a large energy utility. If they wanted a hearth, their only option would be a virtual fireplace burning gas or propane with its designer flame and mind-numbing sameness. Of course, gas fireplaces are fine for urban houses and apartments, but one of the great pleasures of living on the urban fringe and beyond is to build a real fire on a beautiful hearth and sit back to enjoy it.

A future of houses without real fireplaces is not particularly appealing. Luckily, it's not necessary either. By matching technologies, it is possible to combine a modern house with a real fireplace. In specifying a spillage-resistant fireplace for a well-built house, the first line of defense is a set of glass doors. These must have panels of ceramic glass, a miracle material that won't shatter, but will allow infrared (heat) radiation into the room.

Better still, select an EPA certified fireplace or a masonry heater from a reputable supplier. These units consume very little room air and can tolerate a modest level of room depressurization without complaint. They can be just as beautiful as a traditional open fireplace, but their manners are so much better.

JG