

## Fireplaces and The Modern Home

Nothing evokes the feeling of warm and cozy like an open fire - the experience of fire is hard-wired into an ancient part of our brain. But houses have come a long way from the 1790 colonial with the center chimney and four roaring fireplaces, and the presence of a fireplace must be reconciled with the performance we expect of our homes today.

A fireplace needs air for combustion and a path for the combustion products from the fire to leave the house (the chimney). The force that pulls the combustion air in, and expels the smoke up the chimney, is called the draft, which is generated naturally by the combustion products being hot, so they rise up the chimney (think of starting a fire by first lighting a wad of newspaper to get the draft established). The draft of a fireplace in operation is a very small pressure. If that pressure is overcome by another force, the chimney leaks smoke into the house.

Let's look at the characteristics that have changed between the antique colonial and the modern house:

- In order to make our homes very energy efficient, healthy, comfortable, and durable, we've made them tighter every decade. At South Mountain, we're regularly building houses that meet the most stringent standard for airtightness in the world, that of the German Passivehouse.
- We've added all types of fans to our buildings - bath fans, clothes dryers, and, most importantly, the kitchen exhaust hood.

The result of these changes is that even a small fan can reverse the chimney draft, filling the house up with smoke, making the fireplace (or wood stove) into a nuisance - at best - and a downright hazard at worst. The most challenging case is the combination of a fireplace and a large kitchen exhaust hood, which in a modern house will reverse any fireplace. Air conditioning can further complicate the dynamics.

Are there technical solutions to this problem? Sort of. We can provide a make-up air fan that supplies slightly more air from outdoors than the kitchen hood exhausts, thereby slightly pressurizing the house and ensuring that the chimney draft remains functional. In fact, the building code today requires make-up air for any hood exceeding 400 CFM (cubic feet per minute). The trouble with this solution is that we need to condition that air, heating it or cooling it as the season changes, and the load of that make-up air exceeds the load of the entire house, at least doubling the size of the heating and cooling system, with commensurate cost and complexity effects.

We've tried to solve the draft problem by using a duct to bring outdoor air for combustion to the fireplace directly, and glass doors (now required by code anyway) on the fireplace to isolate the fire from the pressure in the house. But the doors aren't perfect, so they leak some smoke, and when they are opened to add wood a big puff of smoke enters the house.

These days we recommend, whenever possible, that the wood fire lives outdoors, perhaps associated with a porch, or a patio that has a fire pit. Fireplaces and screen porches are a great match! Keep the romance outdoors (along with the smoke and dirt). There are many great design possibilities to consider with this approach.