WOOD HEAT STOVES & SOLAR
12426 N. Bloomfield Road
Nevada City, CA 95959
(530) 265-8618
www.woodheatstoves.com

All about Chimney "Draft"
or
(Why does my stove smoke up the house?)

Draft = The natural tendency of hot air to rise. Your stove pipe must have draft (to pull the exhaust out of your stove) for your stove to operate. A woodstoves' performance varies dramatically depending on the power of the draft in the chimney.

Draft is caused by the warmer air rising out of your home through the chimney pipe penetrating the highest ceiling in your home. The lower the penetration in the "shell" of your living space is the lower the draft will be.

Some chimneys are called "non-self starting" or "backdrafting" due to the pipe penetrating the shell so low. These can only be started by "cracking" open a window or door near the stove or by warming the pipe with small kindling fires or a hair dryer or a propane torch. In some cases only a supplemental draft fan will establish adequate draft. Test your draft before lighting the fire by lighting a match at the partially opened door of the stove and see if air is going up the chimney or down into the room.

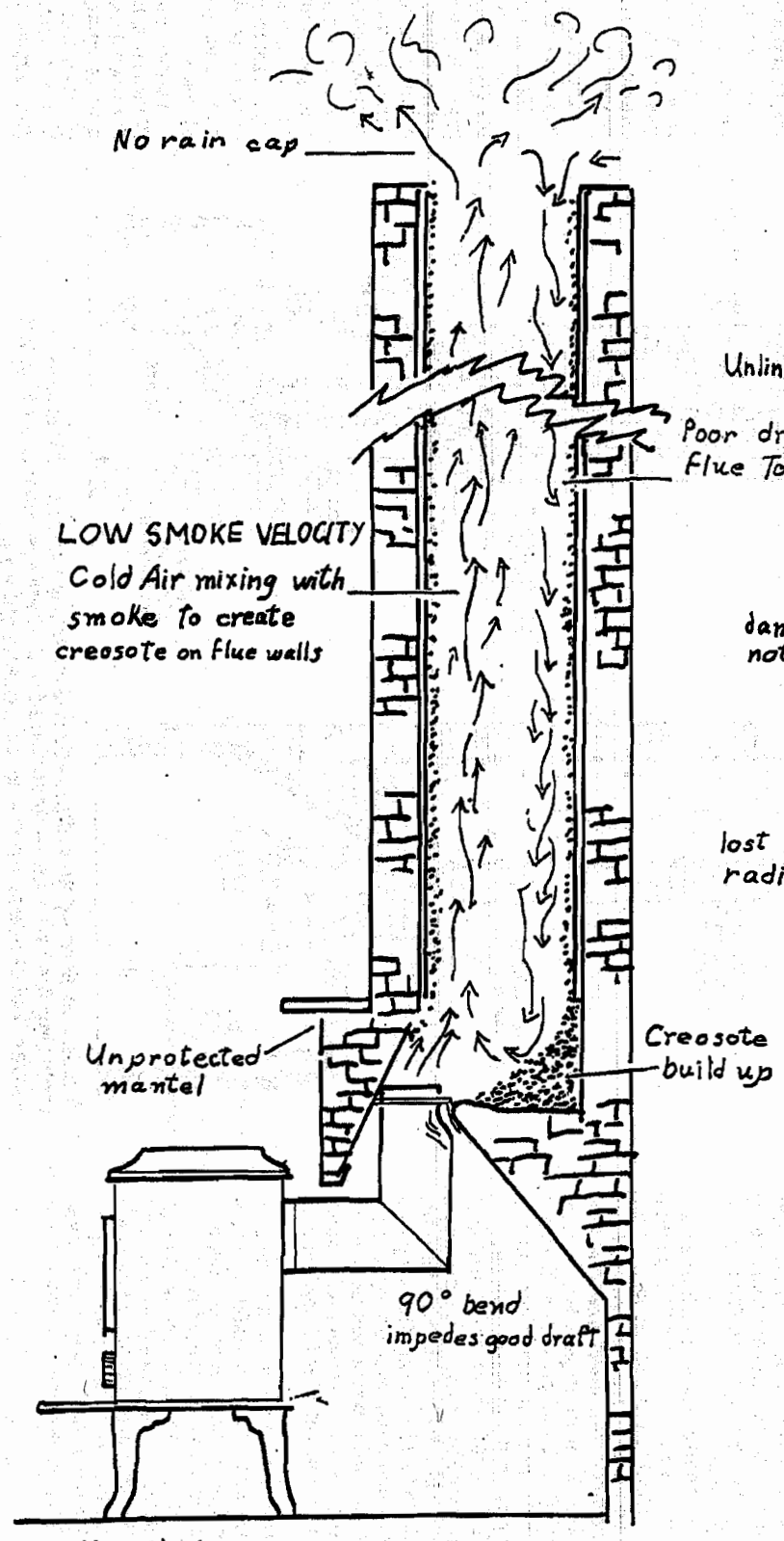
Other things that can cause low draft are open vents or leaky construction in the upstairs such as whole house fans, skylights, recessed lights and fixtures or leaky furnace duct systems. Seal them all and test with a lit cigarette or incense to see if they are leaking air. Some people remove the screens on their chimney caps (although codes require them on a woodstoves)

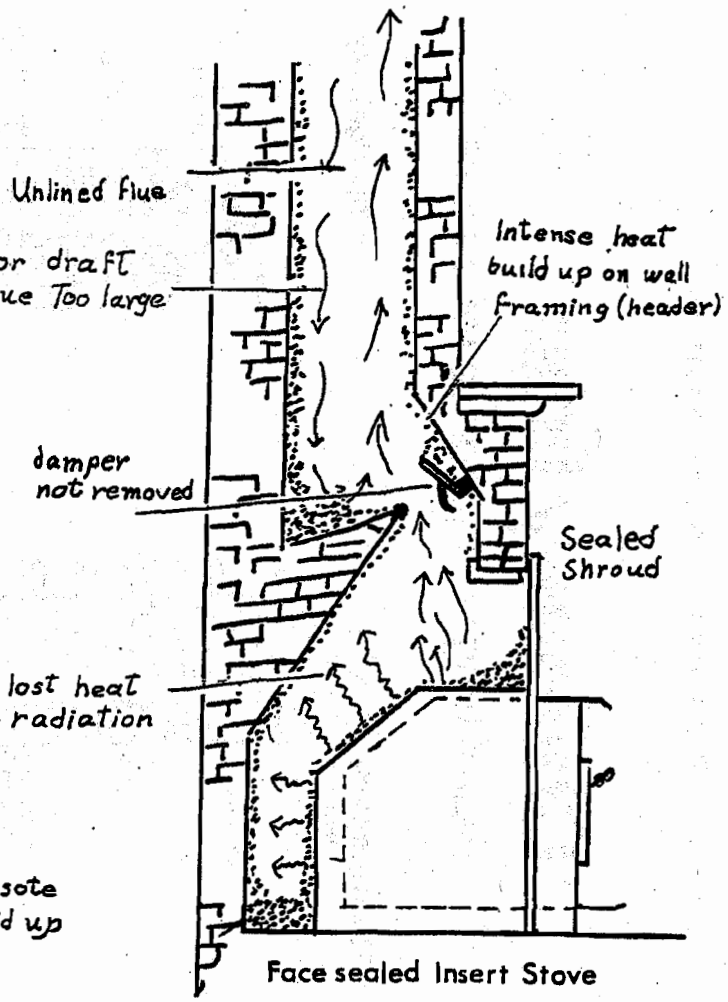
In planning your chimney location, make every effort to penetrate the shell at the highest ceiling for the best draft. Avoid elbows in the flu pipe or at least reduce the angle on them.

Direct vent gas or pellet stoves need no draft and can be used successfully without any vertical vent.

For more information on draft or help in solving your draft problems call us at 265-8618.

THE WRONG WAY





The factors noted on this page violate N.F.P.A. (NATIONAL FIRE PROTECTION ASSOCIATION) rule 211 - pose a significant fire hazard - reduce the effective heat output of the stove - may cause smoke back puffing through the stove door - will reduce the ability of the stove To keep clean glass

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Chimney liner

Retrofitting your fireplace for a stove

Chimney liners. Add them to your vocabulary if you plan to fit a woodburning stove into a fireplace.

A flexible stainless steel pipe that runs from the bottom to the top of the chimney, a liner is "one of the trends coming on strongly in the market," according to Jay Fenton of Richmond, president of the California-Nevada chapter of an industry organization known as the Wood Energy Institute.

They are of particular interest in the Sacramento area, where dealers report heavy sales in recent years of fireplace inserts and hearth stoves.

Both are woodburning appliances designed to duct smoke out an existing chimney. An insert fits flush with the front of the fireplace and has a face that seals off the opening between the insert and the fireplace. A hearth stove projects into a room and is partially in and out of the fireplace opening. With both, a stove pipe runs at least part way up the masonry chimney.

"The state of the art of woodburning is changing dramatically," Fenton says. "We're now able to provide woodburning stoves with up to 80 percent efficiency — a marked improvement over an open fireplace, for example, which has zero to 10 percent efficiency or a conventional woodburning stove that has 30 to 50 percent efficiency."

Many who already have a fireplace in their homes are opting to install a woodburning appliance that uses an existing fireplace chimney to exhaust the smoke.

"A lot of people don't understand the difference between a fireplace and a stove," says Paul Biondi, partner in Solar Syndicate in Old Sacramento. "They say they have had their fireplace for 20 years and never had it cleaned, so why do they have to clean a stove chimney every year?

"The difference is that the open fireplace is sucking all that air into the opening and burning very hot and therefore burning up all the gases in the fire. All the heat is going up the chimney so the chimney if very hot. The fire is so hot you're getting complete combustion of the gases. You are not getting much heat (in the house), but you are burning everything up."

The result: little creosote buildup in the chimney.

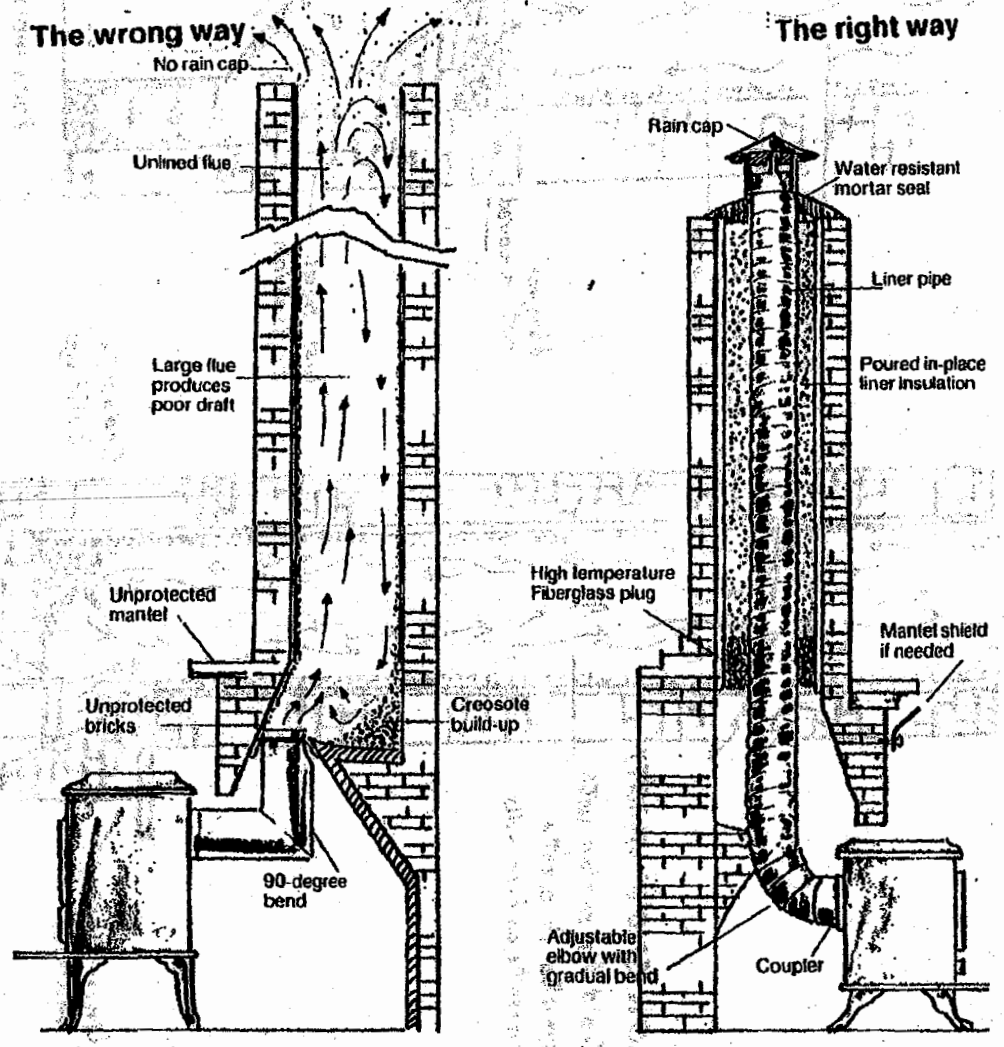
By contrast, Biondi says, a stove produces great heat transfer to warm a room, "but you are not burning up the gases in the smoke and fire the way you are in the fireplace."

The result: creosote buildup in the chimney, the cause of flue fires.

"With a chimney lining system, people give their stove a proper sized chimney all the way up with stainless steel pipe," Biondi says. "It gives good draft, the stove performs better, eliminates smoke problems, creates more turbulence in the firebox which mixes air with gases to get a more complete combustion."

A liner system, which includes a stainless steel pipe, poured-in-place insulation, fiberglass plug at the bottom and rain cap at the top, costs from $650 to $1,000 installed, according to Biondi. Hearth stove prices range from $650 upward; inserts from about $1,200.

Another advantage of a chimney liner, Biondi says, is that in the case of an insert the stove doesn't have to be removed for annual cleaning. The homeowner can clean the liner with a brush from the roof, or can hire a chimney sweep for about $40 to do the cleaning, he says.



A chimney liner system, right, eliminates many of the problems — including fire hazards — associated with fireplace inserts and hearth stoves that exhaust smoke up an existing chimney.

DEFINING PERFECTION

Ten Characteristics of Successful Chimney-Vented Combustion Systems

By John Gulland

Very few things in this world are perfect, but it is valuable to define perfection because until we know what it looks like, we'll never know what to strive for. By defining perfection in stove and fireplace systems, we become less accepting of flawed systems because the flaws tend to stand out more.

The following list of design characteristics looks simple enough, but underlying these ten elements is twenty years and millions of dollars in research efforts. I have spent part of my seventeen-year career in the hearth industry with research scientists trying to understand the theoretical basis for successful venting and with chimney sweeps and retailers reaping their insights from thousands of hours of observations in the real world. Only by synthesizing the science and the practical was it possible to devise such a simple ten-point list. Although these points were developed for chimney-vented natural draft systems burning firewood, several of them apply equally to pellet appliances and B-vented gas appliance systems.

When designing or troubleshooting a system, consider the extent to which it strays from perfection. That is, assign a demerit point for each characteristic that does not conform to perfection. Think of each item on the list as a "driving" characteristic that induces the flow of air and gas up the chimney rather than down the chimney into the house. Think of each flaw as an "adverse" characteristic that compromises the system's ability to perform successfully. Tell your customers how their systems stack up to perfection and let them decide how good they want theirs to be.

ONE. The *chimney runs inside* the building envelope (inside the heated space) so air and flue gases stay at least as warm as the air in the house until they are expelled outside.

TWO. The chimney *penetrates the highest part* of the building envelope so the chimney always functions better as a chimney than the house does, even when there is no fire burning.

THREE. The chimney is *tall enough* and its top is *clear of obstacles* to wind flow so it is capable of producing a minimum of draft and is not exposed to adverse pressure caused by wind effects.

FOUR. The chimney *flue is insulated* and is the *correct size* for the appliance so air and exhaust in the flue are kept warm and flow quickly through the system.

FIVE. The flue pipe runs *straight up* from the appliance to the chimney and the chimney has *no offsets* because each change in direction presents resistance to flow.

SIX. The appliance and venting system are reasonably *well sealed* because leaks introduce cool air and big leaks make the system more vulnerable to adverse pressures.

SEVEN. The appliance is EPA certified, or has equivalent characteristics; that is, it is *unlikely to smolder* (a lot of smoke and a very low flue gas temperature) because smoldering appliances are much more likely to spill smoke.

EIGHT. The system is installed in a house that may be fairly "tight" but has a *balanced ventilation* system because exhaust-only ventilation systems cause houses to be constantly depressurized and are disastrous for chimney-vented systems.

NINE. There is *no large exhaust ventilator* (like a downdraft kitchen range exhaust), or if one is present, it is electrically interlocked to a fan-forced make-up air system to prevent the house from becoming excessively depressurized when it operates.

TEN. The appliance is operated by an *informed householder* because the best of designs can be disabled by improper operation and a lack of maintenance.

You may have noticed that an outside air supply does not appear on the list. There is good reason. While there is some anecdotal evidence that providing outdoor air can help in certain situations, there is no solid scientific evidence to suggest that "off-the-shelf," outdoor-aired systems are any less likely to spill smoke than are appliances that take their combustion air from the room. In developing the list, I have only included characteristics that consistently and reliably contribute to successful venting.

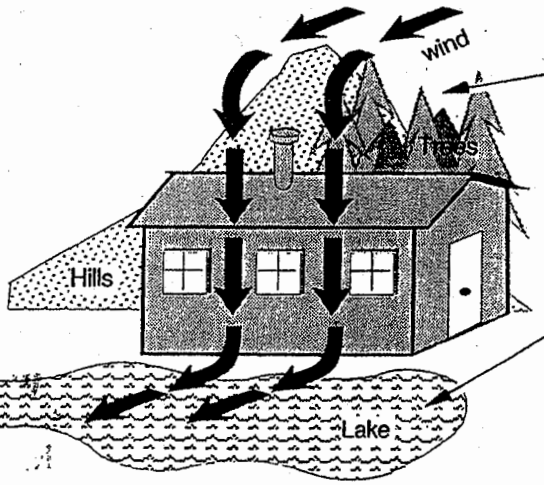
With new houses becoming increasingly "tight," it is more important that ever that the industry designs hearth systems that consistently produce strong draft systems that, even when not operating, will flow air up the chimney rather than down. As you work with customers to locate and configure their appliance and chimney systems, strive to reach perfection by meeting all ten design objectives. Aiming for perfection is a worthy goal because it results in systems that do not spill smoke when operating and do not spill odors when not running. After all, if every system were perfect, people would love their hearths even more than they do now.

John Gulland is the author of the new HEARTH Education Foundation manual, **Reliable Chimney Venting**, *which includes a thorough explanation of each of the ten points of perfection referred to in this article.*

Heater may be encountering negative pressure (cont.)

CAUSE # 2: DOWN DRAFTS

The second cause of negative pressure is down drafts. If the vent termination is located in a position where the wind currents push air downwards, air may be forced into the gas vent. This leads to a down draft situation because the pressure is higher in the vent than in the house. The most common locations for down drafts are homes located directly next to a lake or on the leeward side of tall trees or a hill. Because the strength and direction of the wind varies, this type of problem is sporadic. The heater may start normally, but because there is cold air coming downwards or creating a "cold air blockage" in the gas vent, the heater will not vent correctly and will shut off. In some cases the heater may run normally but when the wind increases or changes direction, a down draft is created and the heater will not vent correctly and shut off.



Down drafts can be created by any tall objects (usually trees or hills) directly upwind of the vent. When the wind blows it curls around the tall objects and turns downwards, forcing air into the vent.

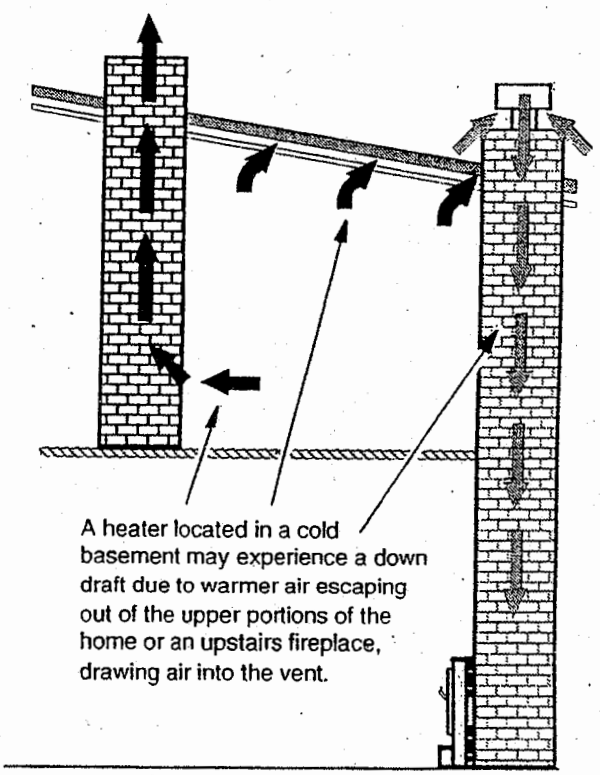
Down drafts can be created by a lake near the home. Because the lake is often cooler than the air near it, the surrounding air cools and sinks, forcing air into the vent.

Remedy

The way to correct this type of negative pressure is to either increase the vent height so that it is above the downward flow of air or install a draft-inducing hood or draft inducer.

CAUSE #3: THERMAL DOWN DRAFT

A rare form of negative pressure is a thermal down draft. This type of down draft is created by the natural convective tendency of a vertical vent. The most common cause of this is a heater located in a cold basement compounded by air exiting through the upper portions of the home. In homes with two fireplaces on different levels, you might notice the downstairs fireplace tends to draw air in while the upstairs fireplace will have adequate natural draft, pulling the warmer air out of the home. The heater may start normally, but because there is cold air coming downwards or creating a "cold air blockage" in the gas vent, the heater will not vent correctly and will shut off.



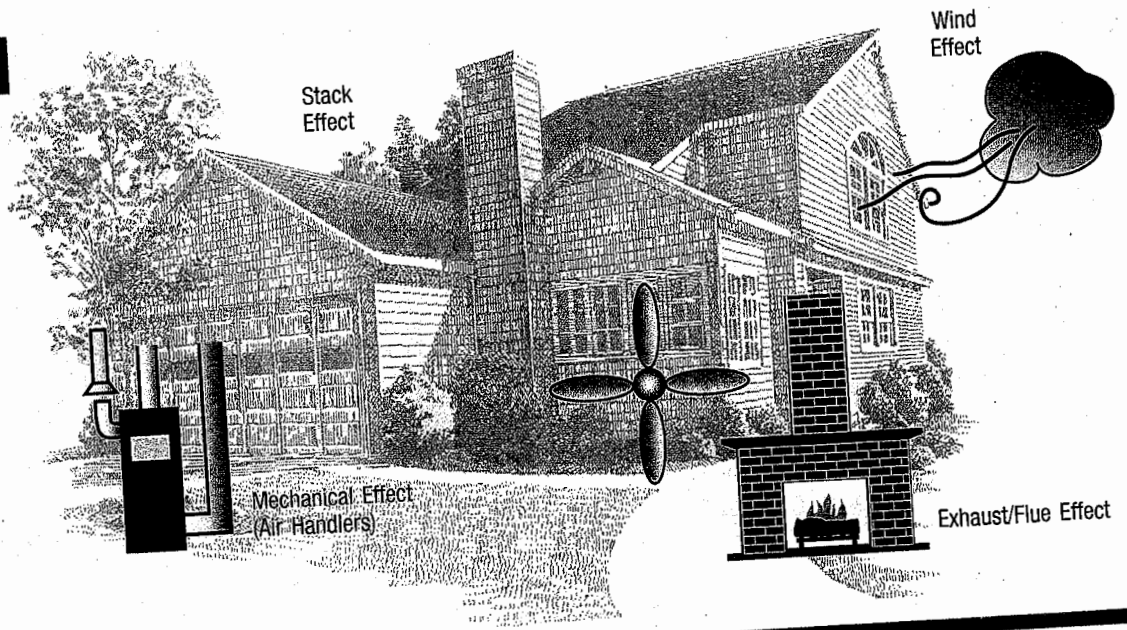
A heater located in a cold basement may experience a down draft due to warmer air escaping out of the upper portions of the home or an upstairs fireplace, drawing air into the vent.

Remedy

Correct this type of negative pressure by installing an air inlet into the basement to help overcome the negative pressure (use a barometric damper) (or use a draft inducer). In severe cases the heater may need to be started a couple of times to generate natural draft.

Figure 1

House Pressures and Fireplace Relationships



Fireplace FACTS and *Frustrations*

INSTALLATION

— By Paul Stegmeir

Fireplaces are a fundamental part of the American Dream. The picture of romance and warmth in the minds of new home seekers as they contemplate their special home's design inevitably involves a fireplace (or two, or more). Even basic tract homes rarely are built without a fireplace. The fireplace remains in the top five of desired features of prospective home buyers in nearly every study conducted in all parts of the country.

Fireplace installations cannot be considered separately; they are part of the whole house system.

Fireplaces are great – when they work. When they don't, they can become a nightmare for the homeowner, the builder, and, with factory-built systems, the dealer and the manufacturer. Fireplace problems can occur at only two times – when they are operating, or when they are not. Operational problems can range form smoking on start-up and burn down, smoking continuously, causing back-drafting of other appliances, and soot staining of carpets, windows, walls, drapes, etc. During non-operational periods in cold weather, cold air drafts or deluges may enter the home, and fireplace componentry may even frost up in extreme conditions. During warm weather non-use seasons, fireplaces have been blamed for conducting warm, moist air and even sickening odors into the home.

The problems described above have been around for a long time. Every sweep, dealer, builder, manufacturer, etc., who has been around for a while has dealt with these issues. We've all solved some of these problems. It usually takes time and, often, trial and error additions or corrections. But we don't always succeed, and they are becoming more frequent.

dwelling, with the chimney or vent penetrating the highest insulated portion of that dwelling.

While the above fireplace placement issues may be understood quite easily by builder and hearth industry personnel, the "recessed light syndrome" is a bit more obscure to the casual observer. It's reached the point, for me, that the first question I ask when dealing with spillage and odor issues, is, "How many recessed lights are in the home?" And the response from the person with the problem is usually, "What difference does that make?"

New house design and construction techniques make the sidewalls of homes better insulated, air and vapor barriered and windowed than ever before.

The difference is simple. New house design and construction techniques make the sidewalls of homes better insulated, air and vapor barriered and windowed than ever before. Modern sheathing and air barrier techniques make walls essentially hermetically sealed. New window designs are better and tighter, and mounting configurations assure no compromise on wall integrity. The sealing techniques used to assure tightness at slab and foundation junctures is also more refined. All this results in the vertical elements of home construction being tighter and more secure than ever before. This is true from North to South, from East to West.

Now comes the top of the house. Though upper envelope areas are getting better insulation treatment in all parts of the country, the air leak/bypass potential has often not been considered. Recessed lights are a primary leakage source. Whether vapor barriers are installed or not, recessed lights allow significant airflow out of the heated spaces below. Even the so called "airtight" lights have some air flow, especially if not installed correctly. When coupled with extremely tight side wall construction, and the leakage of air, once common in structures through lower portions of the house, is restricted, fireplace problems occur.

The design mania that seems to require that a new home cannot be built without recessed lights in the ceiling in the fireplace great room, or in every room of the house, for that matter, has swept the nation. This is true, too, for remodels. Recessed lights and fireplaces have seemingly coalesced into that American Dream mentioned at the beginning of this article. When combined, they contribute to the nightmare, because these recessed lights are really holes in the upper envelope which allow the house to serve as a chimney, often with better "draw" capability than the fireplace chimney itself. (They also are the prime vector for moisture movement into attic spaces with the corollary damage to insulation, structural timbers and interior finish. Sealing these lights after installation can often be difficult to impossible, and expensive. *(See Figure 2).*

This normal phenomenon, known as stack effect, is exaggerated in taller buildings. Upper level leaks also serve to increase negative pressure effects in extreme fashion when combined with high or unusual wind conditions. Additionally, powered attic vent fans can be coupled directly to the living space through these leaks.

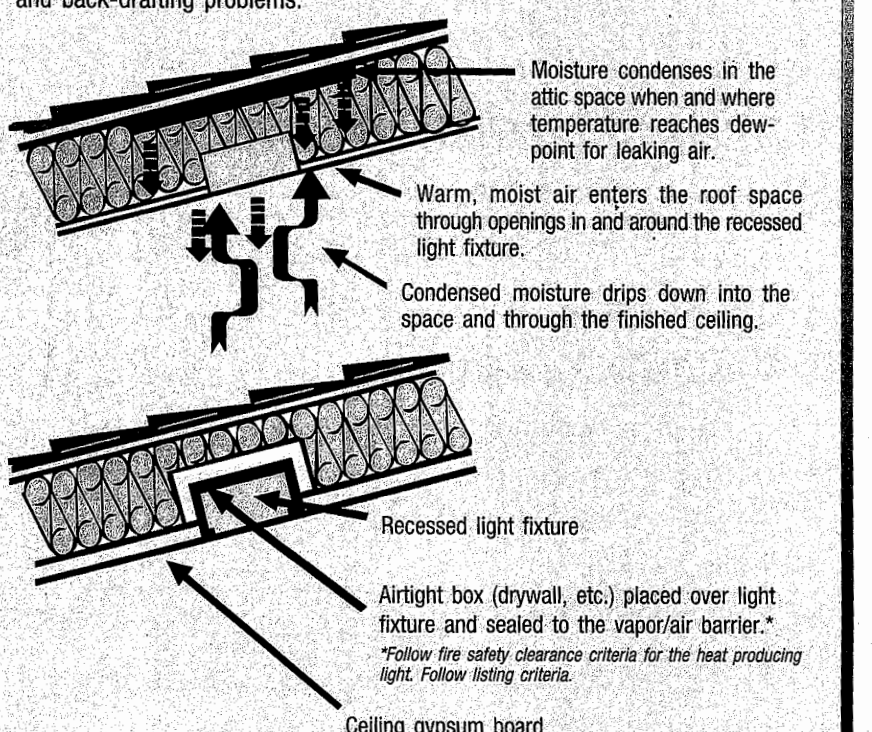
The fireplace acts as the make-up air source for the air lost through the upper envelope. The combustion spillage, odor and cold air inflow problems mentioned earlier are the usual result of this problem.

Another component of the American Dream in new and remodeled homes is the high-power kitchen fan. In tighter new homes, a large capacity fan often cannot be used when the fireplace is in use, and will usually create the inflow problems discussed earlier when the fireplace is idle. I've seen the simple addition of a new, high capacity range hood or down draft ventilator in a remodeled kitchen cause problems, in even older, looser homes. Many a dinner party has been ruined when the new kitchen is being shown off while the fireplace is running. Other fans, such as built-in vacuum systems, bathroom fans, and clothes dryers also need to be considered.

Recessed Light Fixtures

Figure 2

- Major source of upper level air leaks.
- Major contributor to Stack Effect and wind/negative pressure related spillage and back-drafting problems.



wood in high tech systems that require a small portion of the air needed by conventional woodburners (20 to 50 CFM). We can engineer systems to operate properly in tight homes without creating problems, if we choose the right product and the right location within a home. We can design homes without the hindrances to proper fireplace operation. (Chimney through the highest envelope portion of the home, no built-in upper level leaks such as recessed lights, and by providing adequate make-up air, and using sealed combustion conventional heating and domestic hot water systems.)

We can also look to high-tech gas systems. Direct-vent fireplaces are perfectly suited to solve outside wall and low envelope penetration location problems. In addition, they can generally cope with the depressurization problems that result from upper level leaks. They also are the best answer to those situations where excess fan/exhaust capacity can cause intermittent spillage and leakage difficulties. And they have no detrimental effect on house pressures, which can cause the back-drafting of conventional heating systems.

Additionally, we can become more empirical in our approach to dealing with these problems. Using tools such as digital manometers and smoke pencils to diagnose problem situations, or in predicting problem circumstances in proposed retrofits, can help us avoid headaches, or at least explain quantitatively why they exist. Understanding the basics of house pressures, avoiding the installation of spill prone products (B-vent, gas logs, conventional woodburners) in areas of predictable negative pressure (lower levels, basements, etc.), and making sure adequate make-up air exists for both the hearth appliance and the fan capacity of the home are essential.

Fireplace frustrations don't always have convenient or inexpensive solutions. No one said it would be easy. But it's not as difficult as many of us have made it. Some manufacturers are finally aiding us with better technical support. More products that work well are available. Supporting these manufacturers and selling the good products will help solve many of the problems I've described above. HH

The Conventional Fireplace is a Large Exhaust Device

Figure 3

"An operating fireplace with a vigorous fire burning may exhaust 400 CFM or more of combustion and dilution air up the flue."

— Skip Hayden, CCRL

"Tests in Minnesota have shown some fireplaces capable of exhausting in excess of 800 CFM."

— Klossner, Stegmeir