Seal Fireplace Dampers With Weatherstripping to Conserve Energy

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Introduction

When fireplaces are not being used, they should be sealed with weatherstrip to air seal the damper and prevent wasted energy. The common perception should be that just like doors and windows, fireplaces require weatherstripping to prevent energy loss.

Leaking Fireplace Dampers Waste Energy

Fireplaces are the largest intentional opening in the home, costing U.S. families over $6,100,000,000 (based on figures as of March 2005) each year in wasted energy costs.

Like a door or window, fireplaces are openings to the outdoors and should be weatherstripped to prevent the loss of heated and/or cooled air. By weatherstripping the fireplace, several benefits are achieved including improved comfort, energy conservation, reduced energy costs, reduced noise, and improved indoor air quality.

Fireplace dampers are not effective at sealing the fireplace. When dampers are closed they do not provide an air tight seal and are quite ineffective at controlling undesired air leakage. Most fireplace dampers are left open. A study showed that 80% of fireplace dampers are inadvertently left in the open position[1]. Many fireplaces have broken and/or missing dampers.

In a 1990 study designed to measure the leakage area of fireplace with and without the damper closed, Energy Options Northwest had this impressive finding; the effective leakage area (ELA) of the fireplace dampers averaged about 30 square inches when closed. As a frame of reference, the total ELA of typical houses built to moderately tight standards is between 70 and 120 square inches. These results demonstrate that by weatherstripping the fireplace, the total effective leakage area (ELA) of the house can be reduced by 25 – 43%.

Another research study performed in Europe showed similar results. The study showed that an open damper on an unused fireplace in a well-insulated house can raise overall heating and cooling energy consumption by 30%[2].

The majority of energy loss in the home is due to air leakage. Air leakage, or infiltration, occurs when outside air enters a house uncontrollably through cracks and openings. Properly air sealing such cracks and openings in your home can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Building scientists and other experts agree that a significant amount of energy costs are wasted due to air leakage. Warm air leaking into the home during the summer and out of the home during the winter waste a substantial amount of energy dollars. See the collection of web references at the end of this paper.

According to the U.S. Department of Energy (D.O.E.), the typical U.S. family spends approximately $1,300 a year on home utility bills, of which 44% goes for heating and cooling (as of March 2005). In fact, the average American household's annual utility bill expected to rise to about $2000 by 2015[3].

Inadequately sealed fireplaces are noted as being one of the worst air leakage sources in the home. According to the D.O.E.[4], by weatherstripping the fireplace, the typical U.S. home can reduce air leaks by 14% or more.

According to the D.O.E.[5], there are 111,100,000 family households in the U.S. By multiplying the number of family households by the typical savings possible by weatherstripping the fireplace, the total annual energy cost savings that can be achieved by weatherstripping fireplaces is $8,900,000,000. This incredible amount can be expected to rise to $13,700,000,000 annually by the year 2015.

Of course not every home in the U.S. has a fireplace. However this only serves to increase the energy cost burden for the homes that do have fireplaces.

According to estimates there are 33,000,000 fireplaces in the U.S. By dividing the total annual energy cost savings that can be achieved by weatherstripping fireplaces by the number of homes with fireplaces, the average annual savings that can be achieved by weatherstripping the fireplace would be about $275 per fireplace.

Not Just Heating Losses Occur – Consider Air Conditioning Losses

Energy loss through fireplaces is not just heat loss. Fireplaces can also cost wasted air conditioning.

Consider a typical home that is provided with central air conditioning, and a fireplace. Air leaks in and out of ducts at all the connections within a system (e.g. at plenums and behind registers)[6].

Of course this leakage means that air that occupants have paid to have heated or cooled escapes from the heating or cooling system and does not heat or cool the house. Air leaks into the heating or cooling system increase the amount of outside air that must be heated or cooled. Outside air is usually cooler (for heating) or warmer and more humid (for cooling) than air inside the house and the heating or cooling capacity of the system is then used to heat or cool this outside air instead of the air in the house. These issues are well documented and well understood.

But these air leaks also force air through the fireplace. How? By the pressure differential created by the duct leakage. Depending on where the duct leak is, it can cause a slight reduction or increase in the pressure inside of the home. Because the fireplace is a wide open hole to the outdoors, this will cause your air conditioning to either push air out of the fireplace, or worse, suck air in through the fireplace bringing odors and toxins in with it.

Other Benefits of Sealing the Fireplace

By weatherstripping the fireplace, several benefits are achieved, including improved comfort, energy conservation, reduced energy costs, reduced noise, and improved indoor air quality.

Un-weatherstripped fireplaces allow annoying and uncomfortable downdrafts. Back drafting brings cold air in winter that must be heated, and warm air in summer that must be cooled. Smoke particles and soot from a fireplace can enter into the living space, contributing to odors, poor indoor air quality, asthma, and other undesired problems.

When the fireplace is not weatherstripped, windows and doors can seem to have a cold breeze coming through them. This is caused by a condition known as the stack effect. Between the higher and lower pressure zones of the home lies a neutral pressure zone. The neutral pressure zone tends to move toward the largest air leak. The chimney's neutral pressure zone is above the neutral pressure zone of the house. This creates a flow of air out the chimney even when no fire is burning. As the large volume of air is drawn up the chimney, warm air from other areas of your house goes up the chimney, too. This robs heat from the other rooms and pulls cold air into the home through cracks around windows and doors that have not been completely sealed. Sealing the fireplace helps stop the 'breeze' coming from your doors and windows.

Energy Codes Require All Openings Be Sealed

Energy Codes in force across North America require that all openings in the building envelope (doors, windows, attic access, etc) be caulked, gasketed, weatherstripped, or otherwise sealed to limit air infiltration and exfiltration. This is because air leakage through cracks can result in higher energy use for home heating and cooling than necessary.

The 2000 International Energy Conservation Code (IECC™) - is the latest version of the Model Energy Codes. It has been adopted either state-wide or in municipalities in 26 states, and specifies that all penetrations in the building envelope between conditioned and unconditioned space that are sources of air leakage must be sealed with durable caulking materials, closed with gasketing systems, weatherstripping or otherwise sealed to limit uncontrolled air movement (see IECC Sections 502.1.4.2 and 602.1.10).

Nearly all of the 50 states (as well as our territories) have adopted an Energy Code either the same as or based on a Model Energy Code. Model Energy Codes commonly used are the 2000 and 1998 IECC, or the 1992, 1993 and/or 1995 Model Energy Codes (MEC).

According to the "Plan Check & Field Inspection Guide for 1992 MEC, 1993 MEC, and 1995 MEC", as well as the "Plan Check & Field Inspection Guide for 1998 IECC and 2000 IECC", inspectors are instructed to verify that all doors between conditioned and unconditioned spaces have door boots and weatherstripping.

When inspecting for the Residential Provisions of the IECC/MEC, Building Inspectors are taught that proper air sealing will not only decrease the energy use of the building, but it will also increase the comfort of the homeowner and the durability of the home.

Building Inspectors are also taught that all penetrations in the building envelope between conditioned and unconditioned space must be sealed with durable caulking materials or closed with gasketing materials.

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Mechanical Codes Require Dampers to Be Permanently Blocked Open With Gas Log Sets

In an apparent violation of the Model Energy Codes, there currently exists a requirement in the 2003 International Residential Code (IRC) that the fireplace damper must be permanently blocked open when a vented gas log set is installed. This is intended to sufficiently prevent the spillage of combustion products into the room when the fireplace is used, and to prevent build up of gas should the pilot flame be inadvertently extinguished.

The unintended consequence of blocking the damper open is, of course, significant energy loss when the fireplace is not being used. This requirement is not in agreement with the Model Energy Codes that require all openings to be caulked, gasketed, weatherstripped, or otherwise sealed to limit air infiltration and exfiltration.

An alternative would be to simply instruct the homeowner to open the damper when using the fireplace. Instead of the IRC requirement that encourages energy loss, a reasonable solution would be to require a CO detector to notify the occupants of a build-up of combustion products into the room if the fireplace is used when the damper is accidentally left closed. At least one state (Massachusetts) currently requires homes to be provided with CO detectors[7].

The Uniform Mechanical Code (UMC) requires all gas logs be equipped with a safety pilot control. The safety pilot maintains a pilot light and prevents gas flow to the main burner if the pilot is not lit.

Solutions Exist Today To Weatherstrip Fireplaces

There are several devices available today that are used to seal the fireplace. For example, top mounted chimney dampers. These are relatively expensive and have a poor return on investment (ROI). In addition they do not seal the fireplace at the bottom damper, leaving the chimney with all of its odors, toxins, and pollutants exposed to the home. In addition they do not address the wasted energy required to condition the chimney space.

It is often assumed that glass doors are a solution for sealing leaking dampers. This is not true, as glass doors do not air seal the fireplace opening. They do have decorative benefits, however.

There are other products available at hardware stores, etc. to temporarily seal off the flue and stop air from escaping up the chimney. One type of weatherstripping product is an inflatable plug that you insert into the fireplace beneath the damper. This type of weatherstripping is made of heavy plastic with an attached tube for inflating the device. The tube hangs down into the fireplace to remind you that the stopper is there. It can be removed to use the fireplace, and reinstalled again after. These devices have a very high return on investment (ROI), and can pay for themselves in one mid-winter heating bill.

Conclusions

There are 33,000,000 fireplaces in the U.S. As of March 2005, the total energy cost savings that can be achieved by weatherstripping fireplaces in the U.S. is $8,900,000,000, or about $275 per fireplace, ***annually***. This incredible amount can be expected to rise to $13,700,000,000 annually by the year 2015, or over $400 per fireplace, ***annually***.

There are devices available today to weatherstrip the fireplace that can provide a very high return on investment (ROI), and can pay for themselves in as little as one mid-winter heating bill.

Public awareness through education, training, and other methods are required to alert consumers of the amount of wasted energy from fireplaces, and to provide solutions.

The following action items are urged:

1. Educate the general public about the enormous cost of energy loss through fireplaces, and of the various ways to seal these openings between uses of the fireplace.

2. Add the requirement to weatherstrip fireplace dampers to the Model Energy Codes.

3. Allow an alternative to the energy wasteful requirement in the Codes that require the fireplace damper to be blocked open when vented gas logs are installed. As an alternative, the Code should allow the option to not block the fireplace damper in the open position when homes are provided with CO detectors and a safety pilot control.

4. Conduct further study of energy loss through the fireplace in both heating and cooling climates.

References:

[1] Study documented by Joe Pate, Enviro Energy International Inc.

[2] Ventilation perturbations due to an open fireplace in a house - P. Dalicieux and C. Nicolas.

[3] http://www.ded.mo.gov/researchandplanning/newsletter/electricity.htm

[4] http://www.census.gov/population/www/socdemo/hh-fam/cps2004.html

[5] http://www.eia.doe.gov/emeu/recs/recs2005/c&e/detailed_tables2005c&e.html

[6] http://www.mass.gov/legis/bills/senate/st02/st02037.htm

[7] http://www.energy.gov/news/1939.htm

About the author:

Mark D. Tyrol is a Professional Engineer specializing in cause and origin of construction defects. He developed several residential energy conservation products including an attic stair cover, and is the U.S. Distributor of the Fireplace Plug. To learn more visit **www.batticdoor.com**

Attached: Fireplace Energy Loss Web References

Fireplace Energy Loss Web References

Flue Sealers

Even brand-new dampers may not close tightly. Dampers can become warped after the first hot fire. They may even be installed incorrectly to begin with. There are products commercially available to temporarily seal off the flue and stop air from escaping up the chimney. One product is an inflatable stopper that you insert into the flue. Most models are made of heavy plastic with an attached tube for inflating the device. The tube hangs down into the fireplace to remind you that the stopper is there. The flue must be totally cool before installing the stopper. Most manufacturers recommend cleaning the flue before inserting the stopper to ensure a tight and effective seal. This also minimizes the amount of soot that will fall out of the flue when you remove the stopper. Stoppers cost $50. Depending on how often you use them and your climate, they may pay for themselves within a few years.

U.S. Dep't. of Energy Recommends a Fireplace Draftstopper!

U.S. Department of Energy - Energy Efficiency and Renewable Energy - Energy Savers

http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12570

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The Chimney

Chimneys harness the heat of the fire to create what's called a stack effect. As the warm air from the fire rises, cooler house air rushes into the wood-burning appliance through vents, providing the oxygen the fire needs to burn. Starting a fire with a good hot burn will encourage this healthy draft to flow. Also, between the higher and lower pressure zones of the home lies a neutral pressure zone. The neutral pressure zone tends to move toward the largest air leak. When the top of the chimney is located above the home ceiling (as it should be), the chimney's neutral pressure zone is above the neutral pressure zone of the house. This creates a flow of air into the appliance and out the chimney even when no fire burns.

Fireplace Accessories and Inserts

Although wood-burning fireplaces have aesthetic appeal, they may actually remove more heat from a house than they produce. A typical, vertical-back fireplace with an open front is at best ten percent efficient in converting wood to energy and delivering it to a room. The rest of your wood dollars escape up the chimney. They also pull cold air into the house from small gaps around windows and doors. At the beginning and end of the burn, these convective heat losses are larger than the radiant heat provided by the fire. Also, most fireplaces are inappropriately situated on exterior walls. The large mass of masonry that makes up most fireplaces are poor thermal insulators and readily conduct room heat to the outdoors in cold weather.

Federal Citizen Information Center Recommends a Fireplace Draftstopper!

Federal Citizen Information Center Pueblo, Colorado

Other ways to save energy and money

Keep your fireplace damper closed. Since heat rises, an open damper allows heat to escape from your home.

An open fireplace draws much more air than needed for combustion. As the large volume of air is drawn up the chimney, warm air from other areas of your house goes up the chimney, too. This steals heat from the other rooms and pulls cold air into the home through cracks around windows and doors and other leaky places that cannot be completely sealed off.

An open or poorly sealed damper can draw air up the chimney even when the fireplace is not in use. This can occur during both heating and cooling seasons, creating a net energy loss on an annual basis.

Hydro Energy System Energy Efficiency Tips

When your fireplace is not in use, keep the flue damper tightly closed. A chimney is designed specifically for smoke to escape, so until you close it, warm air escapes - 24 hours a day. If you never use your fireplace, plug and seal the chimney flue to prevent warm air from escaping. Keep your fireplace damper closed unless a fireplace is going. Keeping the damper open is like keeping a 48-inch window wide open during the winter; it allows warm air to go right up the chimney.

Louisiana Department of Natural Resources Recommends a Fireplace Draftstopper!

Fireplaces: Energy Dollars Up In Smoke

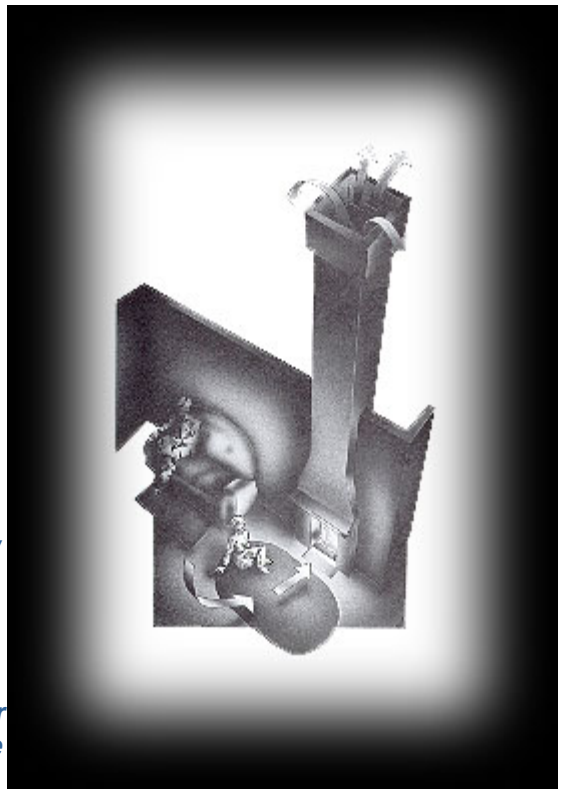
Are your Energy Dollars Going Up in Smoke?

Rising energy costs are causing more people to look for alternatives and less expensive ways of maintaining comfort in their homes. One of the most logical choices for home heating is wood. It's an easily obtainable renewable resource. If you cut your own wood, it's not as expensive as operating a mechanical heating system run by electricity, natural gas, or coal.

Fireplaces are experiencing a comeback in new home construction and home renovations. A fireplace often adds to the real estate value of a home, making it more attractive. A warm fireplace is so inviting on a cold winter evening, but the benefit of having one stops there.

The truth is, fireplaces are tremendous energy wasters.

Inefficiency of Fireplaces



At best, a traditional masonry fireplace is a poor heater. The energy efficiency level fluctuates during operation. While the fire is maintained at a high temperature, maximum efficiency will range between 20 and 30 percent (with an indoor/outdoor temperature difference of 40 degrees and moderate winds). But once the fire starts to die down, the efficiency drops to 10 percent or less. That means of all the heat produced by a fire during that cool-down time, only about 10 percent actually helps to heat the room. The rest goes up the chimney. That's quite an expensive way to heat your home, considering that a cord of wood may cost $150. Depending on how large a fire you build and how long it burns, it's possible that a substantial part of your investment goes up the chimney in smoke.

A traditional masonry fireplace is an energy loser because of its basic design. It incorporates a flue and a chimney which create a natural draft of air to prevent smoke and toxic gases from entering the house. The draft also pulls air (oxygen) from the room to support combustion.

Existing heat in the house is pulled right up the chimney, too.

You could be losing more heat than you think.

If a mechanical heating unit such as a gas or electric heater is operating, energy loss will be even greater.

In fact, energy loss through a fireplace happens year round if special measures are not taken to prevent it. Even with the damper closed, air infiltration still takes place. Heat loss occurs up the chimney even when the fireplace is not being used. In summer, cooled air escapes through the closed, but not airtight, damper.

Glass doors will not eliminate air being pulled from inside the home.

Heating and Cooling Loss when the Fireplace is not Used.

Fireplaces: Studies in Contrasts by A. C. S. Hayden

A. C. S. (Skip) Hayden is head of Energy Conservation Technology at the Combustion and Carbonization Research Laboratory (CCRL) of CANMET in Ottowa, Canada.

Energy-efficient, environmentally-friendly, and safe alternatives to the outmoded conventional fireplace are here, and they're aesthetically pleasing too.

As a member of the Industry for 17 years, I personally think that inefficient, open fireplaces SHOULD be against building codes. A building Inspector would refuse to approve your house if you cut a one square foot hole in the wall and let your heated air escape, but that's exactly what a fireplace does. We must move on from early "Americana" , and just as we rid ourselves of the gas guzzlers, get rid of OPEN fireplaces that waste our resources.

Leakage when the Fireplace is not Used.

Masonry fireplace chimneys have a large cross-sectional area, using 8"x12", 12"x12" and even 12"x16" tiles. This represents a large leakage area either where heated house air can escape--even when the fireplace is no longer warm, or where downdrafts of cold outside air can enter the house. Dampers nominally serve to close off the chimney, but in most cases they are quite ineffective, if they are even used.

Fireplaces and Woodburning Stoves ... May Raise Energy Costs

Fireplaces were once the source of heat in American homes, so it is understandable that many homeowners believe burning wood in their fireplaces is saving them energy and fuel.

Unfortunately, the opposite is actually true in many cases. Fireplaces are notorious for heat loss. While burning, the average fireplace is operating between 5% and 15% efficiency, drawing almost as much heat up the chimney as it is producing, plus losing a tremendous amount of heat through infiltration and conduction during the 90-95% of time it sits idle in the home.

The fireplace damper does not completely stop air movement up or down the flue. A seal is not formed even when the damper is closed. Infiltration around the perimeter of the damper is considerable in most cases, since oxidation, residues, and head warpage have contributed to the size of gaps.

A single layer of metal is all that separates treated inside air from the elements outside -- a loose fitting layer at that. If any other opening in the building envelope were to be covered only by a loose fitting sheet of metal, the homeowner would be alarmed and give immediate consideration to the problem. But since the fireplace damper is hidden from view, it usually goes unnoticed.

ACE Hardware Recommends the Fireplace Plug

Conventional masonry fireplaces and older prefabricated fireplaces are about 10 percent energy efficient. They can also cause a net heat loss in the home if not operated properly. According to experts, the greatest heat loss comes when the fire burns down and the firebox cools. Unless the damper is closed, the chimney will continue to draw warm air out of the room.

Researchers have studied fireplaces to determine the amount of heat loss through a fireplace. A recent study showed that for many consumers, their heating bills may be more than $500 higher per winter due to the air leakage and wasted energy caused by fireplaces. The reason is because hot air rises. An easy solution is to add a fireplace draftstopper, which is an inflatable pillow that seals the damper, eliminating any air leaks. Remember to remove the pillow when using the fireplace, and then reinsert after.

Council of Governments Recommends a Fireplace Draftstopper!

Metropolitan Washington Council of Government

Serving the National Capital Region

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Fireplace Tips

Fireplaces

When you cozy up next to a crackling fire on a cold winter day, you probably don't realize that your fireplace is one of the most inefficient heat sources you can possibly use. It literally sends your energy dollars right up the chimney along with volumes of warm air. A roaring fire can exhaust as much as 24,000 cubic feet of air per hour to the outside, which must be replaced by cold air coming into the house from the outside. Your heating system must warm up this air, which is then exhausted through your chimney. If you use your conventional fireplace while your central heating system is on, these tips can help reduce energy losses.

Fireplace Tips

- If you never use your fireplace, put a plug in the chimney flue.
- Keep your fireplace damper closed unless a fire is going. Keeping the damper open is like keeping a 48-inch window wide open during the winter; it allows warm air to go right up the chimney.
- When you use the fireplace, reduce heat loss by opening dampers in the bottom of the firebox (if provided) or open the nearest window slightly-approximately 1 inch-and close doors leading into the room. Lower the thermostat setting to between 50 F and 55 F.
- Install tempered glass doors and a heat-air exchange system that blows warmed air back into the room.
- Check the seal on the flue damper and make it as snug as possible.
- Add caulking around the fireplace hearth.
- Use grates made of C-shaped metal tubes to draw cool room air into the fireplace and circulate warm air back into the room.

For more information on heating and cooling, contact:

The Department of Energy's Energy Efficiency and Renewable Energy Clearinghouse (EREC), (800) DOE-EREC (363-3732), www.eren.doe.gov

The Department of Energy's ENERGY STAR web site: www.energystar.gov

The U.S. Environmental Protection Agency at (888) STAR-YES, www.epa.gov/energystar.html

Owens Corning Customer Service Hotline, (800) GET-PINK, www.owens-corning.com/owens

The Air Conditioning and Refrigeration Institute, Fax (703) 528-3816, E-mail ari@dgsys.com www.ari.org

20% of energy loss is due to poorly fitted fireplace flue dampers.

20% of energy loss is due to poorly fitted fireplace flue dampers. The air rushing up the chimney must be replaced by outside air which must be heated up to room temperature, at a considerable energy loss.

Stop the energy thief...your fireplace damper Traditional fireplace dampers leak. They leak a lot. That costs you big money in lost utility dollars going out your chimney.

Your current throat damper was designed for the days when energy was cheap. Back then if you lost some energy here and there, it was no big deal. Today it is a big deal. Energy prices have skyrocketed and are predicted to go even higher. Be sure the damper locks into place solidly, can be raised an lowered easily and is not stained or covered with dust or chimney debris. When the fireplace is not in use, the damper should always be closed to avoid energy loss. Left open, it will let in cold air.