GUIDELINES FOR ENERGY

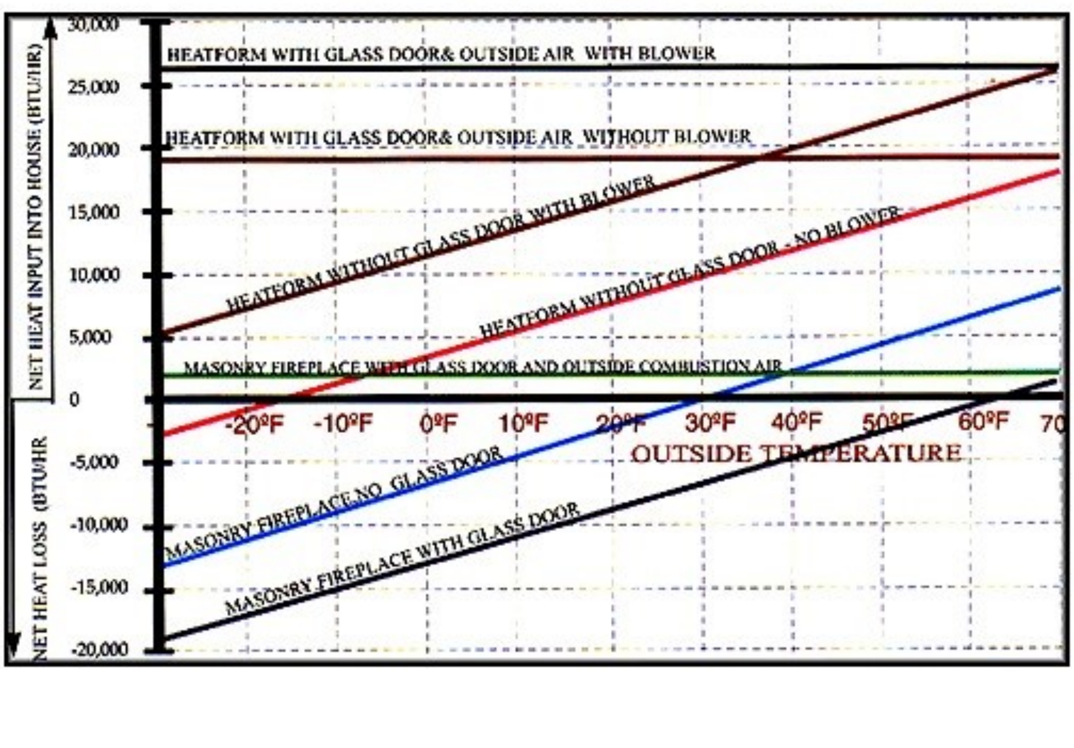
EFFICIENT FIREPLACE DESIGN -

The majority of homes built in the United States this century are built with some sort of wood burning fireplace. As we become more aware of efficient use of energy, it is necessary to examine current fireplace design practices to determine how we can get the most out of our fireplaces. This article will summarize ways of increasing the heating potential of masonry fireplaces. The three fundamental questions addressed will be:

- Where does the air that feeds the fire come from? inside or outside?
- How can we reduce the amount of heat lost up the chimney? (stack loss)
- How can we maximize the amount of heat that actually enters the room?

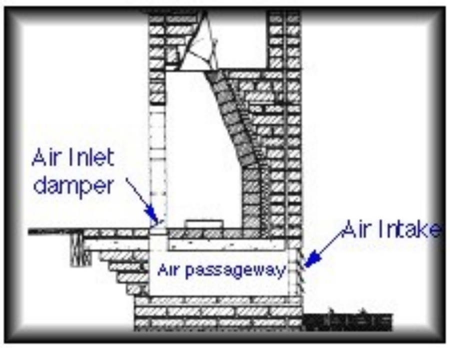
Provide a make-up air supply

The air that fuels a fire has to come from somewhere. With modern airtight construction, the home is a controlled environment where air enters at prescribed locations. This air is heated and distributed throughout the home. The fireplace draws air into the firebox to be consumed in the fire, and then expels the air up the flue and out of the house.In a cold environment, the air drawn into the firebox comes from the house and has already been heated to a comfortable temperature by the central heating system. As the air is expelled up the flue, it has to be replaced by more air. Where does this air come from? It must infiltrate the house from the outside, be heated up by the central heating, and then fuel the fire. The chart below illustrates the energy drain incurred from this process. The net energy shown on the vertical axis is the absolute level of energy available to for use in the house after the combustion air lost up the clay flue tile is deducted. A conventional fireplace with no glass doors or outside make-up air provides no heat gain below 35ºF, in fact it is an energy drain. The energy gain for a conventional fireplace with outside air for combustion and glass doors is constant across all temperatures and results in net heat gain. A source of outside air must be provided. In houses with a forced air heating system, the make-up air can be provided through a fresh air duct connected to the cold air return.

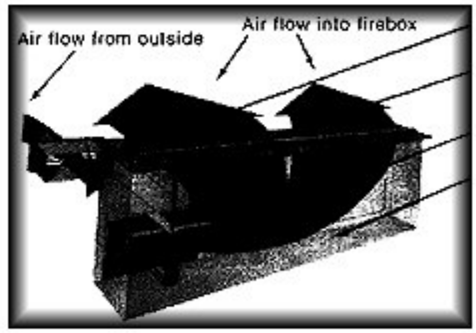


Lacking such a system, an outside air supply should be built into the fireplace itself.. A fresh air supply system is made up of three parts, the intake, the air passageway, and the inlet.

The intake should be located on an exterior wall or on the back of the fireplace. It should have a screen backed, closeable louver that can be operated from the inside. The intake should be high enough above grade to avoid snow blockage. The construction of an outside air system is described in depth in BIA Technical note #19. Below is an illustration from that document.



Another way to introduce outside air into the firebox for combustion is through the use of a proprietary outside air combustion kit as shown below.



The other figures on the chart show the increased efficiency of using an air circulation insert. These are steel boxes that are inserted into the masonry fireplace which allow air to be heated and then use a fan to circulate heated air back into the room. There are many manufacturers of these products available on the market which can enhance the efficiency of a fireplace.

Use Heat efficiently

The heat created by a fire can be used in several ways. One is to provide a masonry mass that absorbs, stores, and slowly re-radiates heat energy back into the room. This method provides a slow, low intensity heat source long after the fire is out. By the positioning fireplace wholly within the building envelope the thermal mass effect can be made more effective than if it was placed on the outside wall where heat would be lost. Another method is to provide high intensity radiant heat while the fire is burning. Rumford and Rosin type fireplaces are designed to maximize the amount of radiant heat emitted by the fireplace. They have tall, wide openings, very shallow fireboxes, and widely splayed coves or jambs to reflect as much high intensity radiant heat as possible. For more information on these types of fireplaces consult BIA Technical note #19C or visit http://www.rumford.com on the internet. Traditional fireplaces emit a good amount of radiant heat as well and will perform best if one complies with the industry standard details provided by the BIA. The third way that fireplace heat can be used is to let the fire heat the air, and then circulate the heated air into the room using a fan. Several steel inserts are widely available that provide this air circulation effect.

Minimize Stack Loss

It is important to reduce the amount of heated room air lost up the chimney. The most common way to control stack loss is the damper, open when the fire is burning, and closed immediately after the fire is out. A damper alone is not usually enough to keep air from exiting. The damper closes but most dampers will not be completely airtight. The warm air in the room will rise due to convection and find it's way through the damper.

Another similar problem is a reverse convection current. This is common when fireplaces are located on the outside of the home. When there is no fire burning, and the air in the chimney gets cold. A reverse convection current can cause cold air outside to fall down the chimney and into the room. Unwanted odors can be drawn into the room with the air as well. Glass doors on the fireplace opening can reduce this problem. Dampers placed at the top of the chimney can reduce this problem further, although the air in the flue is still cold and will still "fall" into the space. Doors and dampers are not completely airtight, but can reduce this affect.

In Conclusion, by maximizing the use of heat, using outside make-up air for combustion, minimize stack loss and adhering to established industry standards for dimensions and details, one can create an energy efficient fireplace that is more than just decoration.