

# Fireplace Design

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Fireplaces can take more heat out of homes than they add. When outside air is 30°F colder than indoor temperature, fireplaces may draw more heat from the home for combustion than they replace.

Four elements essential for an efficient fireplace are: (1) a duct to supply air for combustion from the outside rather than from the home, (2) glass doors and dampers to minimize infiltration of outside air into the home, (3) a heat exchanger to get the fireplace heat into the home, and (4) insulation to minimize conduction heat losses.

## Provide an Outside Air Intake

If you supply the draft of air your fireplace needs for combustion with an outside air duct, your fireplace will not have to draw and waste heated room air (Figure 1). A 28 square inch duct from outdoors to inside the fireplace chamber will provide enough draft. An insulated metal duct will minimize heat loss and reduce fire potential.

Provide a 2¼ inch by 14 inch closable floor grille two to four inches off the fireplace floor to prevent ashes and debris from falling into the air intake. A duct in the side of the firebox instead of the floor further reduces this risk. Leave at least 20

inches between the floor grille and the back of the firebox. If this is not possible, install the combustion air duct outside the firebox in front or in the side of the firebox.

Install this duct in new fireplaces during construction. The ash dump in existing fireplaces can be used for an air intake (Figure 2), or a hole could be cut through the brick and a duct installed.

Prefabricated fireboxes often don't have space to put the combustion air inlet on the floor in front and still leave 20 inches between it and the back wall. Two courses of brick in front of the prefabricated firebox will provide the needed space.

## Glass Doors and Dampers

Install glass doors across the front of the firebox and seal the edges with heat resistant caulk or furnace cement. Otherwise, the draft up the chimney will pull air from the house for burning, even if you have an outside air supply.

Glass doors also allow you to control the rate of burning better. Once the fire is going, keep these doors closed and use the combustion air duct to supply the air needed to keep the fire burning.

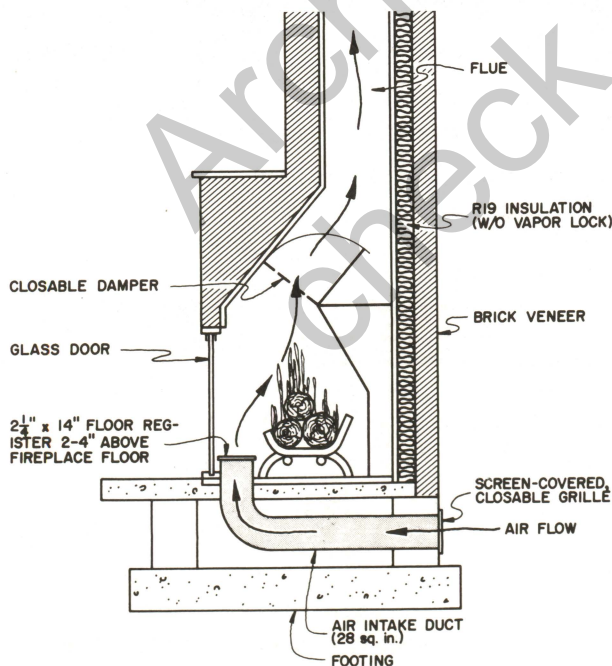


Figure 1. Supply outside air for combustion in new construction.

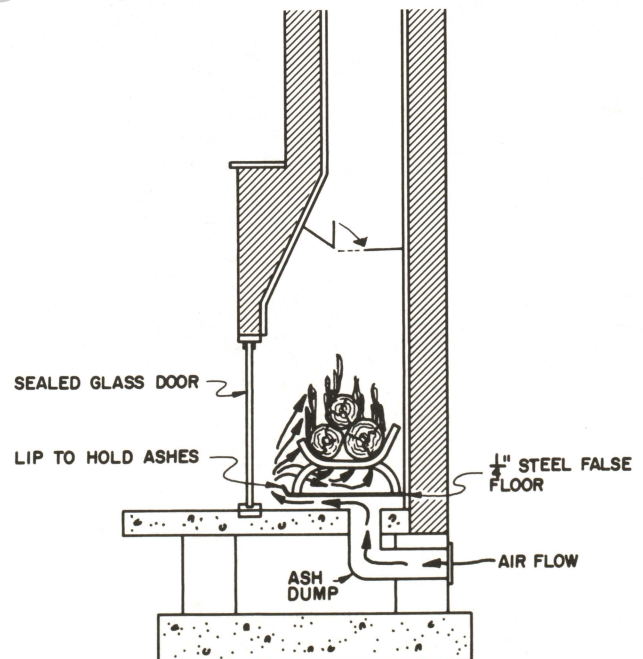


Figure 2. An existing fireplace can be modified to provide combustion air through the ash dump.

Also essential for efficient heating are dampers for the outside air supply and the flue. You should be able to regulate the burning rate by adjusting damper openings. Tight sealing dampers also reduce infiltration of cold air when the fireplace is not in use.

## Heat Exchangers

Your fireplace won't add much heat to your home if you don't have a good way to extract the heat before it goes up the chimney. There are two good ways to do this. Blowing air around, behind, or over the firebox with a small fan behind the firebox is most effective (Figure 3). A 1/12 horsepower fan does a better job than letting the air flow into the home naturally. You can tie this system into your home heating duct system and provide heat for the entire home (Figure 4).

Another way to move air into the room is to use a fan to blow air through a hollow metal grille above the fire and out into the room. You probably won't be able to use a commercially available heat exchanger grille while the glass doors are closed. Your most practical alternative may be to open the glass doors while the heat exchanger is in use.

A heat exchanger is not effective unless part of it is over the fire.

## Insulate Your Fireplace

Brick and concrete are excellent conductors of heat. A brick fireplace exposed to the outdoors loses about 60,000 British thermal units per square foot annually by conduction. Mineral wool insulation 3½ inches thick will cut this to less than 10,000 Btu per square foot annually. Six inches of insulation is even better. Not building your fireplace on an exterior wall eliminates the need for insulation and results in a more efficient system. The only practical way to insulate an existing fireplace is to install the insulation outside of the brick work (Figure 5). *Don't install flammable insulation next to the chimney.*

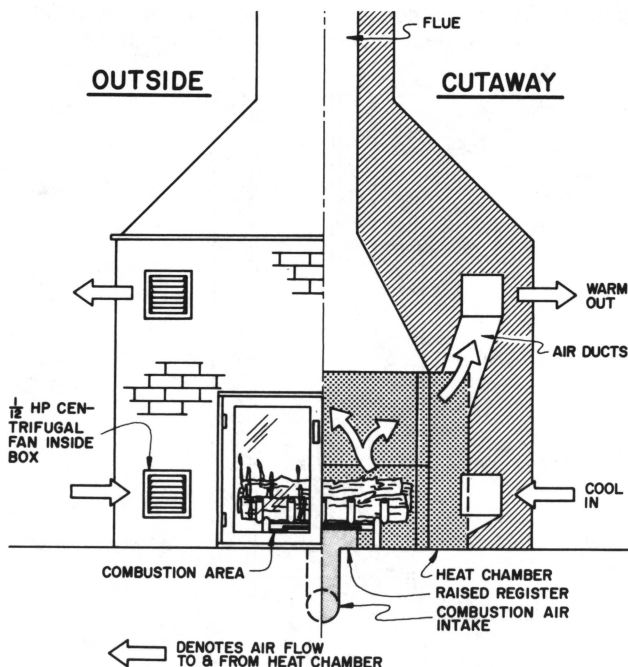


Figure 3. This fireplace is designed for efficient transfer of combustion heat to the living space.

## Operating Your Fireplace

To start the fire, open the chimney flue damper and the outside air damper. You may need to open the vents on the bottom of your glass door to get the fire started well. Close the glass door vents when the fire gets started.

When the fire is going well and you want to slow the burning, close the air intake partially. If you don't have a good seal on your glass doors, this may pull air from your room.

Closing the chimney damper some will also reduce burning but could cause smoke to go into the house.

Do not try to put out the fire when you go to bed or leave. Leave the glass doors shut and close the intake air duct. Leave the chimney damper open slightly unless the fire is completely out.

Refer to guide 5450, *Wood Fuel for Burning*, for detailed information on selecting firewood and managing woodland.

## Prevent Soot Buildup

Soot can accumulate in your chimney if you don't have high enough flue temperature and enough draft or if you burn too much green wood. See guide 1731, *Wood Stove Maintenance and Operation*, for information on controlling soot and cleaning chimneys.

## If a Chimney Fire Develops . . .

- Call the fire department!
- Close down air intake and block off the front of the fireplace to limit the oxygen needed for burning.
- Make sure the fire is completely out and has not spread to the walls or attic around the chimney.

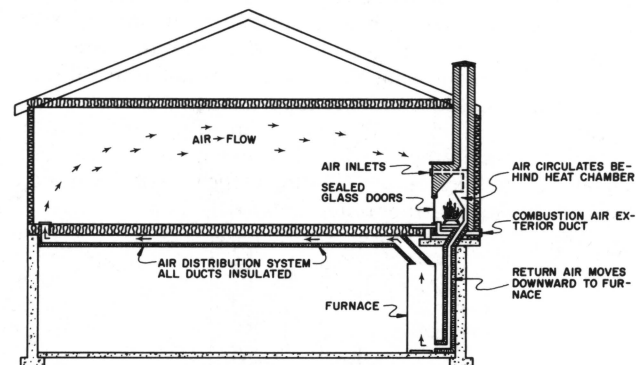


Figure 4. Heated fireplace air can be distributed by the home's central air unit.

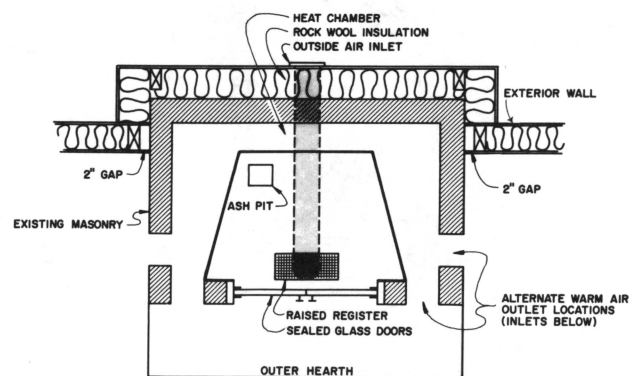


Figure 5. This fireplace is insulated from the outside.



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