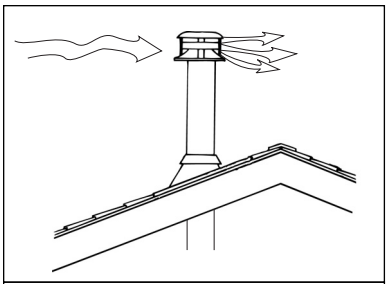
- The greater the temperature difference between the heated gases in the flue and the cooler air outside the chimney, the more draft (more force) is created.

Since natural draft is a function of the temperature differences between flue gases and outdoor air, the following variables can produce and affect that difference:

1. *The amount of heat available from the fire*. A smoldering fire produces little heat and therefore low flue gas temperatures. The lack of temperature difference can mean that the upward flow is weak and unstable. Or a very hot fire can create a huge difference in temperature (so much that excess draft is created and energy is wasted).
2. *Outdoor temperatures*. Colder weather is better for draft because it produces a bigger temperature (and thus pressure) differential. The same fire that produces adequate heat and draft in cold weather could have draft problems in mild or warm weather because not enough force is created from the more similar temperatures inside and outside the flue.
3. *Ability of the chimney to hold heat*. A chimney with poor insulating qualities or that is exposed to extremely cold weather can absorb or lose the heat of the flue gases. The result is a loss of temperature difference (the cooling of flue gases brings them closer to outdoor temperatures).
4. *Height of the chimney*. Since draft is the difference between pressures, the taller the column of heated gases, the greater the total difference between its pressure and that of the surrounding air.

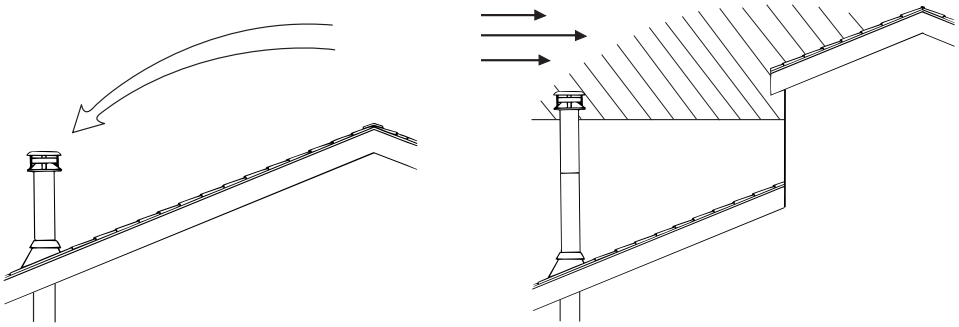
You also need to be aware that natural draft is a relatively weak force. Natural draft is therefore sensitive to a number of factors:

1. *Resistance*. the more turns and the sharper the turns in the venting system layout, the greater the resistance to the flow and the weaker the force of the draft.
2. *Chimney/vent size*. The outlet of the appliance is carefully designed to allow the proper flow of combustion gases and air through the air inlets. The cross sectional area of the chimney must be at least that optimum size and should not be reduced. Conversely, the chimney/vent size can be too large. The warm gases flow more slowly in a large area (think of the rate of flow of a river, faster in narrow areas and slower in wide areas), come in contact with more flue surface area, and lose more heat.
3. *Wind*. Wind blowing horizontally over the top of a chimney can actually assist draft in a fashion similar to that of air flowing over an airplane wing. Wind blowing down into the chimney or blowing against a nearby structure taller than the chimney can adversely affect draft.



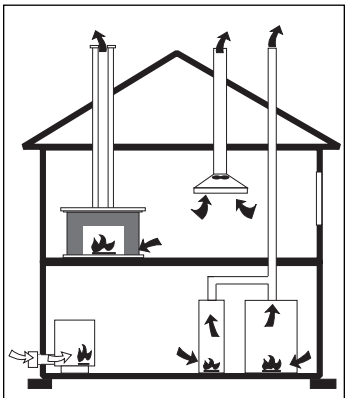
Driving Pressure: *Wind flowing over a chimney creates low pressure that produces increased draft.*

4. *Pressure conditions in the house*. As we discussed, natural draft pulls air into the combustion appliance. The air goes into the appliance because the pressure is negative at the air inlets, that is, lower than normal atmospheric pressure. If another force within the house creates a stronger negative pressure, air flows to that source and can even be reversed and drawn out of the hearth appliance and venting system. For example, exhaust devices such as bathroom and kitchen range exhaust fans (particularly downdraft kitchen range exhausts), clothes dryers, and central vacuum systems can create enough negative pressure to overcome the weaker pressure of natural draft. This is most often a consideration in tightly constructed houses where the hearth appliance and exhaust devices compete for limited outside air sources. Additionally, an upstairs fireplace can create negative pressure problems for a downstairs appliance or fireplace.



Adverse pressure: *Wind flowing over object and down towards chimney creates positive pressure that inhibits draft.*

Adverse pressure: *Wind against building can cause positive pressure that restricts draft at top of chimney.*

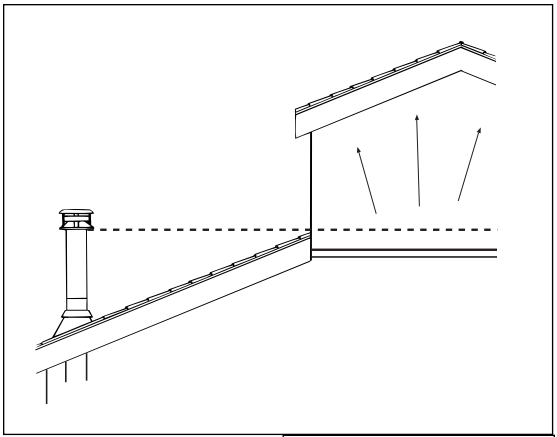


Sources of negative house pressure.

5. *Height of the heated portion of the house above the top of the chimney*. Heated air also rises inside a house, not only just in a chimney. This movement of rising air, or house stack effect, can be greater than the force of draft within a shorter or cooler chimney. The result is weakened draft in competition with the stack effect, or even spillage of smoke into the house through the appliance inlets.

6. *Appliance operation*. The operator can take a number of actions that reduce or increase available heat for the chimney (amount of fuel, air, startup technique) or that play into the hands of external forces (operation during warm weather, operating powerful exhaust devices, opening windows that affect house pressure).

7. *Altitude*. Appliances may need stronger draft to deliver a greater volume of air at higher altitudes to make up for the lower concentration of oxygen. Recommended sea level chimney height may need to be increased by 2-3% per 1000 feet of elevation.



House Stack Effect