

# Troubleshooting Chimney Draft Problems

We often hear the complaint that someone has a 'bad' stove or fireplace because it smokes into the house. In our experience however, draft problems are almost never caused by the fireplace or appliance, and in fact 75% can usually be attributed to poor insulation and flue installation and termination problems.

The chimney is the engine of every wood-burning system, and in order for the fire to burn properly, the chimney must pull combustion air through the fireplace or stove.

**Here are some common causes of chimney draft problems, and possible solutions ....**

## **Improper flue sizing**

Masonry fireplace flue sizing is determined by the size of the fireplace opening.

Woodstove flue sizing is determined by the stove manufacturer for each model during the testing process. In order for a woodstove flue to do the best possible venting job, the flue opening must have exactly the same cross-sectional area as the vent opening on the appliance. If the chimney is too small, it may not have room for the volume of rising air the stove requires. If it is too big, it may draw too slowly for the appliance, and may never heat up enough to compensate. For this reason, both flue under sizing and flue over sizing should be avoided.

If your chimney is too small, replace the flue. If your chimney is too big, install a masonry or stainless steel flue liner that has the correct diameter.

## **Flue blockage**

If the flue is the proper size and still isn't providing sufficient draft, the first thing to do is check the stovepipe and chimney flue for blockage: bird nests, fallen bricks, Frisbees, leaves, etc. can block or partially block a chimney flue, interfering with proper draft. Make sure the flue is clean: even the thinnest coating of creosote or soot reduces the flue diameter, and can interfere with proper draft.

## **Resistance from below**

Having determined that the flue is clean, make sure sufficient combustion air is being provided to the fire. As the chimney pulls air through a fireplace or woodstove, negative air pressure (a partial vacuum) can be created in the house, which fights against the chimney draft and can actually draw smoke backward down the chimney.

Another problem sometimes occurs in tall houses that leak large amounts of air in the upper stories: heated air rises, so the warm air inside the house wants to flow upstairs and escape through the leaks. In extreme examples, this can result in negative air pressure below that is stronger than the flue updraft.

Negative pressure can be caused by extraction fans and can completely starve the appliance of combustion air as it seeks further air supply to meet its needs. More often than not, it will come from the path of least resistance and availability - which is from the fireplace or woodstove. To eliminate this problem, you will need to vent the stove or fireplace to outside air.

## **Insufficient chimney height**

Chimneys draw a small amount of air, even when there is no fire below: this phenomenon is called ambient updraft. Ambient chimney draft occurs because the top of the flue extends upward several feet, into a thinner atmosphere than exists at the bottom. Thus, air is drawn up the chimney in much the same way as liquid is drawn up a soda straw when you reduce the air density inside your mouth.

Code requires that all woodstove and wood fireplace chimneys must extend at least 600mm above any part of the roof within three metres. Given that topographical and atmospheric conditions can vary considerably from house to house, it is possible for a chimney to comply with this minimum code specification but still fail to extend upward into air of a low-enough density to establish ambient updraft.

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### **Cold flue temperatures**

The ambient updraft created by the air pressure differential from the top to the bottom of a chimney is often not sufficient to exhaust the smoke from a wood fire. This is especially evident in cold weather, when an unused flue can fill with low temperature, high density air, which can completely block the flow of smoke up the chimney.

When this happens, any attempt to light a wood fire will result in a house full of smoke. To 'prime' cold chimney, line the back wall of the stove or fireplace with loose balls of newspaper and light them. Replace the newspaper and relight repeatedly until the hot paper exhaust pushes the cold air plug out of the chimney (you'll see the smoke from the paper fire suddenly disappear up the flue when this happens). Then, build a paper and kindling fire and add progressively larger pieces of fuel as the flue continues to heat up, and establish the thermal updraft needed to exhaust the smoke from the wood fire.

The best venting method for a woodstove, is insulated stainless steel flue. If you are venting into a masonry chimney (for Retrofit fires), install a stainless steel liner.

### **Air inversion**

There is an atmospheric condition, known as air inversion, which causes high-density air to be trapped at flue top altitudes normally occupied by the low-density air that creates ambient updraft. During periods of air inversion, chimneys in the affected area simply don't draw properly. One way to tell if air inversion is causing temporary draft problems is to look at the smoke that exits the flue: if it eddies around the top of the chimney or flows downward onto the roof instead of rising as heated air normally would, an inversion layer is most likely present.

Having established that a draft problem is being caused by air inversion, several solutions present themselves:

- Don't attempt to start a fire during inversion days. These don't happen very often in most areas, and seldom occur during the long periods of winter cold when we use our woodstoves most. Air inversion episodes occur most often when cold weather turns warmer, or when warm weather suddenly turns cooler, as sometimes happens in the Spring or late Autumn. Some areas are more subject to air inversion than others: if your house is totally surrounded by tall trees, hills or buildings, you may experience local "inversion" every time the wind blows across the top of the taller obstruction, pressurizing the air below.
- During air inversion episodes, remove all possible draft resistance at the bottom of the chimney. Today's woodstoves have very small air intakes and very restrictive baffle systems through which air must be drawn by the chimney. Opening a nearby door or window a crack often reduces this resistance considerably, and may allow the stove to be burned even on heavy inversion days.
- Elevate the top of the chimney to a point above the inversion layer. This is a kind of hit-or-miss solution, for three reasons:
  1. Nobody can accurately predict exactly how high the inversion air tends to stack over a given neighbourhood.
  2. The density of an inversion layer can vary from one episode to the next.
  3. There is a limit to how high a chimney can extend before it gets too hop-heavy to support, and it will require support brackets. Never extend your chimney with un-insulated metal pipe, or excessive creosote formation will result.

### **Downdraft or crossdrafting**

Quite often, chimney draft failures are caused by wind, blowing down or across the top of the chimney. If the problem only occurs when the wind blows in a certain direction replace your cowl with an anti-downdraft cowl and in persistent conditions change to the ultimate ADD cowl the "H" top cowl. These cowls are designed to reverse the effects of wind-induced downdraft or cross draft, but will only work when the wind is blowing directly onto them.

Draft inducing cowls will not correct a downdraft caused by increased air density at the top of the chimney due to air inversion, or the type of chimney-top pressurization which can occur when the wind blows across the top of a cylinder formed by nearby tall trees, hills, or buildings that extend above and totally surround the chimney.