Measuring Backdraft for Health and Safety

While pressure balance within a house is important to maintain healthy conditions, most houses are subject to pressure imbalances. Depressurization can actually be fatal if there are older, naturally aspirating (open vented) combustion appliances that may backdraft flue gases including carbon monoxide.

Older houses may be especially vulnerable, since rising energy costs prompt homeowners to caulk and seal and replace some naturally vented appliances with sealed combustion units to reduce energy use. Large exhaust appliances such as down-draft cooktops may add to depressurization.

It is important to recognize that pressure distribution in a house can be uneven. A small closed basement furnace room with inadequate return or combustion air can sustain significant pressure imbalances. The carpet staining found around outside walls in many houses is a visible sign of pressure imbalances between the basement or crawl space and main floor.

Combustion gases are meant to be vented through a chimney. The draw up a flue is created by the "chimney effect" or buoyancy of warm air that creates a low air pressure in the venting system of a combustion appliance. In a properly operating combustion appliance, air is drawn into the draft hood and up the chimney. A quick check for backdrafting at the draft hood can be done with a match test. In a properly operating combustion appliance, the flame and smoke from a match held near the opening of the draft hood should be drawn into the hood. Remember that combustion appliances may take up to one minute to establish a draft.

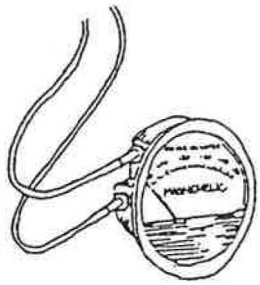
Backdrafting can be caused by a blocked chimney or a pressure drop inside the house. If the air pressure in the room where the combustion appliance is found is lower than the pressure in the chimney, combustion gases will spill into the room. That is why it is important to measure the air pressure difference between the room with the combustion appliance and the outdoorst.

To reduce the potential for backdrafting, the building code sets limits for allowable depressurization in new houses. If natural draft appliances are present, the depressurization should not be more than 5 Pascals (0.02" water gauge). Most gas-fired domestic hot water heaters used today are naturally drafted.

Testing for backdrafting

Paul Tschida, an energy education specialist with the Montana Department of Environmental Quality, has developed a kit that is loaned to homeowners who want to check on the safety of their home. The kit's components are readily available: a Dwyer magnahelic gauge and two plastic tubes.

We've reproduced the instructions here, because this is a simple test that anyone can do if there is any doubt at all about pressure balance. Renovators especially should keep the following instructions as part of their toolkit when assessing the condition of houses, before and after a renovation, to ensure safety is maintained.



1. Get the house ready for testing.

All exterior windows and doors should be closed.

Combustion air sources should be left open. Make sure the inlets are not blocked by snow, leaves or debris.

Turn off all exhaust appliances (bath and kitchen fans, clothes dryer, etc.).

Heating systems such as furnace, wood stove and fireplaces should not be operating. Turn down the thermostat if necessary so that the heating system will not start during the test. Fireplace dampers should be closed.

2. Prepare the gauge

The gauge only reads accurately when level and in a vertical position.

Adjust the indicator dial to zero by turning the small screw on the front of the gauge. The dial may require a little adjusting. If necessary, gently tap the side of the gauge and readjust to zero.

An accurate reading cannot be taken if the wind is blowing more than 10 miles per hour because of fluctuating pressures on the building.

3. Set up the tubes

Insert one end of the first tube into the upper connection (high-pressure tap) and run the other end to the outside, going under an exterior door or through a window. Be careful not to pinch the tube. If the tube goes through a window, you may need to use masking tape to cover any gap. The best location is usually the corner of a door.

Put one end of the second tube onto the lower connection (low-pressure tap) and run the other end into the room with the combustion appliance; or put the gauge in the space with the combustion appliance and leave the lower tap open.

If the dial on the gauge is not stable, it is too windy for an accurate reading. If the dial moves to the left, it shows a positive pressure, which is not a backdrafting concern. As the needle moves to the right, it indicates the amount of depressurization. (Every 0.02" is the same as 5 pascals. A reading of 0.1" means a 25-pascal negative pressure).

Negative pressure in a building can be caused by exhaust fans, heating system duct leakage, and in cold weather, by stack effects.

4. Check for negative pressure caused by exhaust fans

Open all interior doors. Turn on exhaust equipment in sequence and note the pressure reading on the gauge each time you turn on a fan. You may want to start with the smaller fans and work up (i.e.: bath fans, kitchen fan, and clothes dryer).

Record the pressure reading as you turn on each fan:

Bath fans _____

Kitchen range hood _____
(recirculating kitchen fans do not vent to the outside so they can be ignored).

Clothes dryer _____

Other venting equipment that draws air out of the building, such as a central vacuum cleaner

_____

One or more exhaust fans or appliances in combination may cause a negative pressure. If the gauge shows 0.02" W.G. or more negative pressure, it is probable that the combustion appliance(s) will backdraft. Under some circumstances backdrafting may occur at less than 0.02 inches of water column negative pressure.

If a problem is found, some means of providing make-up air is needed. Try opening a window located close to the exhaust fans causing the negative pressure, then watch the gauge. Allow enough make-up air to reduce the pressure to less than 0.01 inch of water column negative pressure. For a permanent solution, mechanical make-up air may have to be provided.

Return all exhaust fans to their normal position.

5. Check the effect of a forced air heating system.

Close all interior doors. This restricts airflow to the return side of the furnace, which may increase the negative pressure at the combustion appliances. Repeat the reading.

If a combustion appliance is located in a crawlspace:

- Close crawlspace vents if they are normally closed in winter
- Close the crawlspace access door.
- Turn on the heating system.

Follow the steps in "Prepare the gauge" above.

Negative pressure is often caused by duct leakage on the return side of the heating system. Repairing the return side duct leakage should solve the problem. A missing furnace filter, access cover and furnace cabinet leakage also can contribute to negative pressure.

If the negative pressure is caused by insufficient airflow back to the furnace, try opening interior doors and watch the gauge. Although doors should be undercut, the undercut may not be enough to balance airflows. Relieving the negative pressure requires installing pressure relief grills between rooms with supply registers to allow air flow back to return air registers. An HVAC contractor may be able to supply other solutions.

Do a final test of total negative pressure with all exhaust fans and heating system operating.

Healthy Indoor Environments

We spend most of our lives indoors, inside vehicles, offices, restaurants, shopping malls, skating rinks and houses. Despite the progress being made, evidence suggests that many of these indoor environments are continuing to damage the health of the people working and living in them.

In the United States, indoor pollution causes thousands of cancer deaths and hundreds of thousands of respiratory health problems each year. A recent report on asthma and indoor air quality linked indoor exposures to the development and provocation of asthma.

eading authorities such as the American ung Association, the United States Environmental Protection Agency (EPA), CMHC and others have consistently identified indoor pollution as one of the most serious risks to human health. Unfortunately, pollution in Canadian buildings of all types has received insufficient attention from government agencies, corporations, other organizations and individuals. We have no clear structures or national strategies for addressing indoor air quality problems, and, with few exceptions, no acknowledged government or community leadership on this complex issue.

Sick building syndrome incidents are still common. Many materials, furnishings and commercial products continue to pollute our indoor environments. Buildings are still being built, renovated and maintained without adequate attention to indoor environment issues.

Healthy Indoors is a cross-Canada, consultation, strategy development and alliance building process for achieving healthy indoor environments. A discussion paper has been prepared to provide a common level of information and analysis of the issues involved and options available to achieve the objective of improving the indoor air quality in our indoor environments.

Background papers available for download are at: *www.healthyindoors.com*

Forums have been held in Toronto and Halifax. The next one will be in Vancouver March 1, 2001. The intent is to bring together policy makers from various sectors to develop a strategy. Anyone with a concern for indoor air quality is encouraged to look at the papers, submit their comments and participate in the process.