CE 64

How to Get the Ventilation That You Need in Your House

Canadian houses are relatively airtight, and have been for years. The old farmhouses where people lived several generations ago had little resistance to air. They were drafty, uncomfortable and very dry in winter due to high air-change rates. Modern housing restricts air entry through good air barriers and sheet materials, such as plywood, oriented strand board (OSB) and drywall. In fact, new Canadian houses and many retrofitted existing houses are so airtight that you cannot count on incidental leakage for good indoor air quality. You must induce or augment the house air-change rate using mechanical ventilation, a requirement in the National Building Code for new houses since 1990.

WHAT DOES THIS MEAN TO YOU?

If your house is stuffy, odours linger, or humidity is high in fall and winter, it is likely that your house does not have adequate fresh air. If you or your children have respiratory conditions, such as asthma, bronchitis or chronic colds, getting the proper amount of fresh air is even more important. Opening windows can be part of the solution, but open windows can be a security risk (in some neighbourhoods), can cause comfort problems and can increase heating and cooling costs. Furthermore, opening windows may not improve indoor conditions under all circumstances. Using a mechanical ventilation system, such as an exhaust fan or a heat recovery ventilator (HRV), can be more effective.

VENTILATION

Ventilation is often defined as a means of providing fresh air. However, the word "ventilation" can describe several different types of air movement.

Infiltration

We get some fresh air from natural infiltration. This is the amount of fresh air that comes into your house through leaks, and is sometimes shown as house air changes per hour (ACPH). An air-change rate of 0.5 ACPH means that half the house air is changed every hour, or that the amount of fresh air that enters the house every two hours equals the volume of the house. Exfiltration, or the amount of air that exits the house, always equals infiltration—if it didn't, the house would either implode or explode.

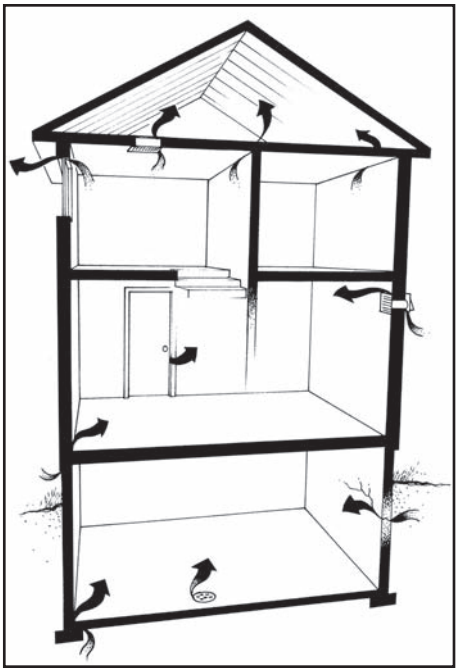

Figure 1 Infiltration and exfiltration of air in a house

Canada

CMHC SCHL
HOME TO CANADIANS

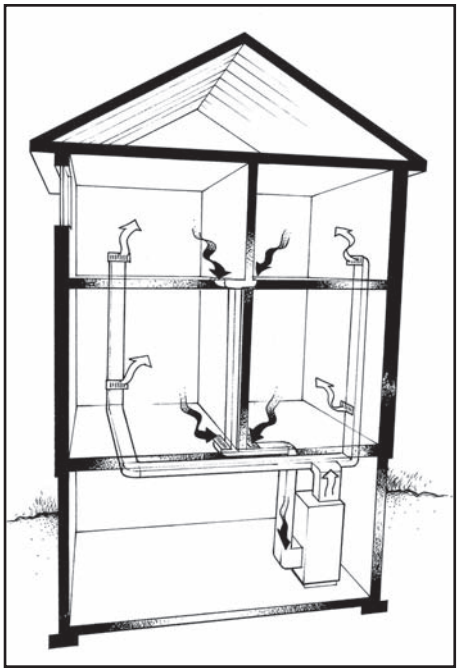

Figure 2 Distribution of air throughout a house

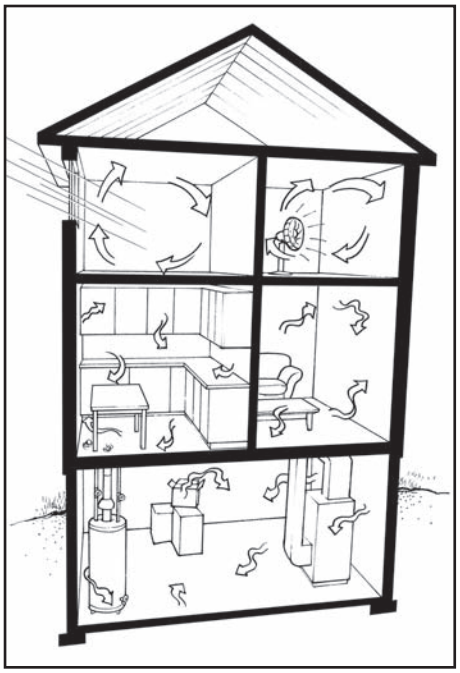

Figure 3 Circulation of air in a house

Distribution

The fresh air needs to be moved around the house, particularly to rooms with closed doors (such as bedrooms). This distribution usually requires fans and ducting systems. Imagine a two-storey house with all the fresh air infiltrating or being delivered into the basement where the clothes dryer is running. Without distribution, the fresh air would be removed from the house by the clothes dryer before it reached the occupants on the floors above. Only the basement would receive fresh air.

Circulation

Even if fresh air is introduced to a room, it will often need some help to be circulated to all parts of the room. Rooms with lots of furniture or stored items are susceptible to having under-ventilation in some parts of the room. Fans can help here, too.

IS VENTILATION NECESSARY?

Ventilation and good air quality are sometimes under-appreciated. If your furnace breaks down in the winter and the house starts getting cold, you will notice that problem within a couple of hours at the most. Insufficient ventilation will generally not be noticed as quickly as it takes time for symptoms, such as stuffy air, to develop.

A good time to check your indoor air quality is when you enter your house, before you get accustomed to the indoor air. Does it have a distinctive odour? Is it fresh and neutral? People moving to a house with good ventilation from a house with bad ventilation will recognize that the indoor air quality in their previous residence was not as good as in their new home.

People need fresh air all the time, but the need for additional ventilation will change. In the middle of winter, when it is very cold or windy outside, the natural air-change rate of the house will be highest and you may not require additional mechanical ventilation.

However, most times in fall, winter and spring, having some mechanical ventilation may make sense. Mechanical ventilation is beneficial for mid-summer if you are using an air conditioner and do not open windows for extended periods of time. In fact, summer is when houses have the lowest natural air change rate. Figure 4 shows the results of recent research that monitored air change rates in an Ottawa home during the summer. Most of the time, the house air change rate was below 0.3 air changes per hour—a recognized threshold for good indoor air quality.

PROVIDING GOOD VENTILATION

All houses can be provided with good ventilation. It is easier to do so when you have ducted air-moving equipment. Here is advice for a variety of houses, starting from the most difficult.

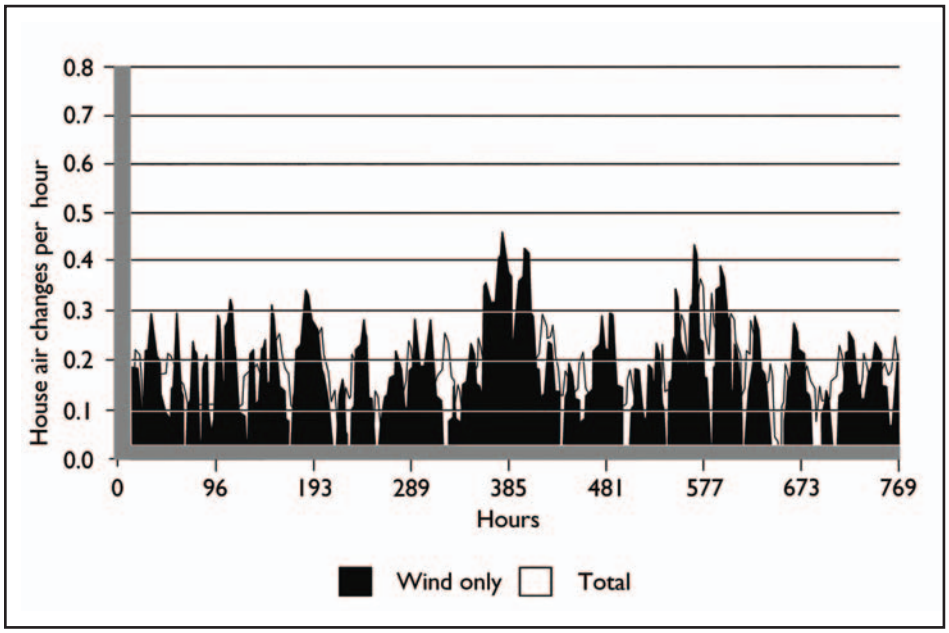

Figure 4 Summer natural air infiltration rates for an Ottawa home not using its mechanical systems and with its windows closed

Older houses with no ducts or fans

Intentional ventilation was a foreign concept to homeowners of houses built 60 or more years ago. Open windows could sometimes induce a breeze in hot summer periods. Open windows were also the standard ventilation for most bathrooms. Houses were so air leaky that the common goal was to reduce ventilation, rather than to promote it.

However, ventilation should be considered if these houses have been tightened as a result of renovations and energy retrofits. While opening windows will still play a part in a ventilation strategy, people are reluctant to leave them open long enough to ensure adequate air quality control. At the very least, bathroom or kitchen fans vented to the outside can be installed to control moisture in these areas. Sometimes, ducting can be retrofitted into chases or installed on the basement ceiling, if the homeowners want the benefits of an air distribution system. Do not install ducting systems in the attic, as the temperatures in Canadian attics are inappropriate for ducting in both the summer and winter. Cross-ventilation, through windows on either side of the house, can contribute to an increased ventilation rate.

Houses with bathroom fans and forced-air furnaces

This is the basic system for older houses. The bathroom fan vents air from the house. Infiltration matches the rate at which the exhaust fan vents air outdoors, and outdoor air enters through various leaks in the house envelope. The furnace fan and ducting system can mix this fresh air with house air and distribute it around the house. In new houses in some parts of the country, the "ventilation" fan switch is located by the thermostat so that the furnace distribution fan can be turned on at the same time as the ventilation fan to ensure ventilation air is distributed and circulated evenly throughout the house.

Is this the best way to run a ventilation system? Probably not, but it can be made to work. First, install a good bathroom fan vented to the outside. Make sure that it is highly energy efficient (less than 50 watts) and quiet (1.5 sones or less), so you can use it without getting annoyed. Make it small (25 L/s or 50 cu. ft./min.), or ensure that you can control the speed. Leave it running all the time, or at least when the house is occupied. That ensures that some fresh air is entering the house. If your furnace or air conditioner is running frequently, then the fresh air is being distributed. You can leave your furnace fan on to ensure distribution, but that will usually cause high electrical consumption. New furnaces can be purchased with DC motor fans that can be controlled to run at under 100 W at low speed. Older furnace fans have power consumption of 400–600 W.

If you have an inefficient furnace fan and need to use the furnace fan for distribution, consider getting a fan-cycling control device. This controller can be used to turn the

furnace fan on for 20 minutes per hour, for instance, to reduce the fan motor electrical consumption. Even 20 minutes an hour should ensure adequate circulation. Having the ventilation fan electrically linked to the furnace fan will ensure that when you turn your ventilation system on the furnace fan comes on too and the fresh air gets to where it is needed.

Heat recovery ventilators (HRV) connected to the furnace ducting system

HRVs are efficient devices that provide good ventilation without a big energy cost for heating the outside air. The HRV uses the air being exhausted to preheat incoming air. They are able to recover 60–80% of the heat in the outgoing air which means, in winter, the incoming air will be much warmer than outside air (but still cooler than house air). The balanced ventilation provided by an HRV does not usually create house depressurization that could effect the proper and safe functioning of fuel fired appliances in the home.

Since the HRV in this case uses the furnace ductwork, the furnace fan has to be on, or at least cycling on and off, for the fresh air to get distributed around the house. The same considerations apply about getting a furnace with an efficient fan motor or a furnace-fan cycling controller. Note also that all HRVs need maintenance and cleaning.

See CMHC's *About Your House* fact sheet *Maintaining Your HRV* for advice.

Separately ducted HRVs

This system is the most efficient way to ventilate your house, as the HRV does the air preheat and the HRV fan motor distributes the fresh air and collects the stale air through its own ducting system. This means that the furnace fan motor does not need to run as part of the ventilation distribution system which represents significant energy savings.

The HRV should be used anytime the house is normally closed up. Run it continuously at low or medium speed, and switch to "high" for parties or other times when you want more ventilation. If you are buying an HRV, pick one that has been independently certified (e.g. choose one with a Home Ventilating Institute or HVI certification sticker). Choosing one with a high "sensible recovery efficiency" and a fan motor with low energy consumption will ensure lowest operating costs. There is a listing of all rated HRVs on the HVI website at **www.hvi.org**. Also ensure that the contractor installing the HRV has been certified to do so through an organization such as the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI).

As mentioned in the previous section, make sure that the HRV is regularly maintained.

RUNNING THE VENTILATION SYSTEM

Ventilation is not as critical when the house is unoccupied, although some houses require ongoing mechanical ventilation to keep the windows from fogging up in winter and to prevent the subsequent damage to window frames, trim and walls. It is especially important to have high ventilation rates for:

- The first fall and winter for a new house, to get rid of construction moisture.
- Houses with high numbers of occupants, either temporary or permanent.
- Houses in which renovation activities (drywalling, painting, floor re-finishing and so on) or new furniture may be creating high concentrations of pollutants.
- Houses in which bedroom doors are generally closed during sleeping hours. Open doors help ensure that the bedroom air has the same quality as the air in the rest of the house. Closed-door bedrooms require higher ventilation rates or good distribution systems.
- Houses whose residents have respiratory problems (people allergic to outdoor pollutants require filtered outdoor air).

SUMMARY

Most Canadian houses will benefit from the fresh air supplied by mechanical ventilation. In new houses, that fresh air is most efficiently delivered by a separately ducted HRV. In existing houses, quiet and efficient bathroom and kitchen fans, or HRVs when practical, can improve air quality. Using efficient furnace fan motors or furnace fan cycling controls will help to distribute fresh air to all rooms of the house at a reasonable cost.

To find more About Your House fact sheets plus a wide variety of information products, visit our website at www.cmhc.ca. You can also reach us by telephone at 1-800-668-2642 or by fax at 1-800-245-9274.

Priced Publications

The Clean Air Guide: How to Identify and Correct Indoor Air Problems in Your Home	*Order No. 61082*

Free Publications

Moisture and Air: Householder's Guide—Problems and Remedies	*Order No. 61033*
Breathe Healthier Air in Your Home: A Consumer Guide to Residential Indoor Air Quality Investigations	*Order No. 63083*
About Your House *fact sheets*	
Maintaining Your HRV	*Order No. 62043*
The Importance of Bathroom and Kitchen Fans	*Order No. 62037*
Assessing the Comfort and Safety of Your Home's Mechanical Systems	*Order No. 62266*
Should You Get Your Heating Ducts Cleaned?	*Order No. 62044*
Replacing Your Furnace	*Order No. 63227*
Attached Garages and Indoor Air Quality	*Order No. 66343*

Printed in Canada
Produced by CMHC 10-03-09

66348