Ventilating your home

FACT SHEET

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Build tight and ventilate right is the mantra for builders of energy efficient, high performance homes. In cold climates, minimizing uncontrolled air leakage is a prerequisite for comfort and energy efficiency and controlled ventilation is necessary to ensure healthy indoor air quality and to control humidity.

WHY VENTILATE YOUR HOME

Ventilation supplies fresh air to your home and dilutes indoor air pollutants, removes odors and controls moisture. The way we build houses today, the materials we use and the way we live all contribute to our increased awareness that fresh air is essential to the health of our homes and ourselves. New houses are built more tightly and we use various synthetic materials and cleaning products that pollute our indoor air. We spend more time indoors than previous generations and we generate more indoor moisture with use of hot showers, washing machines and dishwashers.

Older homes rely on natural ventilation—uncontrolled air movement through cracks and small holes in the building structure and through windows and doors. While natural ventilation may seem adequate in supplying the fresh air we need, it can cause drafty, uncomfortable homes that are expensive to heat and cool.

Controlled ventilation allows you to bring in the right amount of fresh air in all seasons and for the level of activity in your house.

HOW TO VENTILATE YOUR HOME

Controlled ventilation strategies include spot ventilation (using localized exhaust fans in kitchens and bathrooms for example) and whole-house or central ventilation systems (one or more fans and duct systems that exhaust stale air and/or supply fresh air).

Spot ventilation

Exhaust fans quickly remove pollutants, odors and/or moisture at their source and as they are generated. Ventilation fans in the bathroom and kitchen are critical because these areas generate the most moisture and odors. To maximize the effectiveness of spot ventilation:

- Fans should be located as close as possible to the source of pollution and moisture. In the kitchen, use range hoods that exhaust to the outside. Avoid ductless, recirculating units because they do not control moisture or other pollutants. In bathrooms, make sure the fan vents directly to the outside, not into attic or crawlspace.
- Locate heating and cooling registers as far away as practical from exhaust vents to minimize the amount of heated or cooled air that is exhausted when the fan is running.
- Use timers or humidity sensors to run fans when needed.

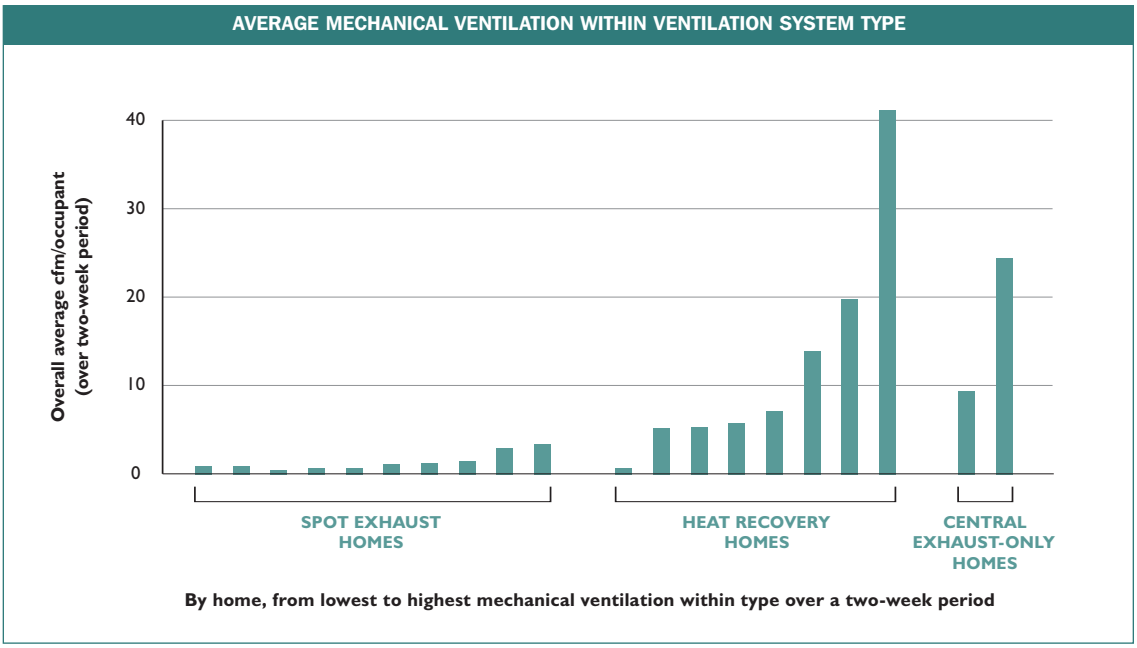
An HVAC contractor conducts an exhaust ventilation test to ensure the system performs effectively.

Whole-house ventilation

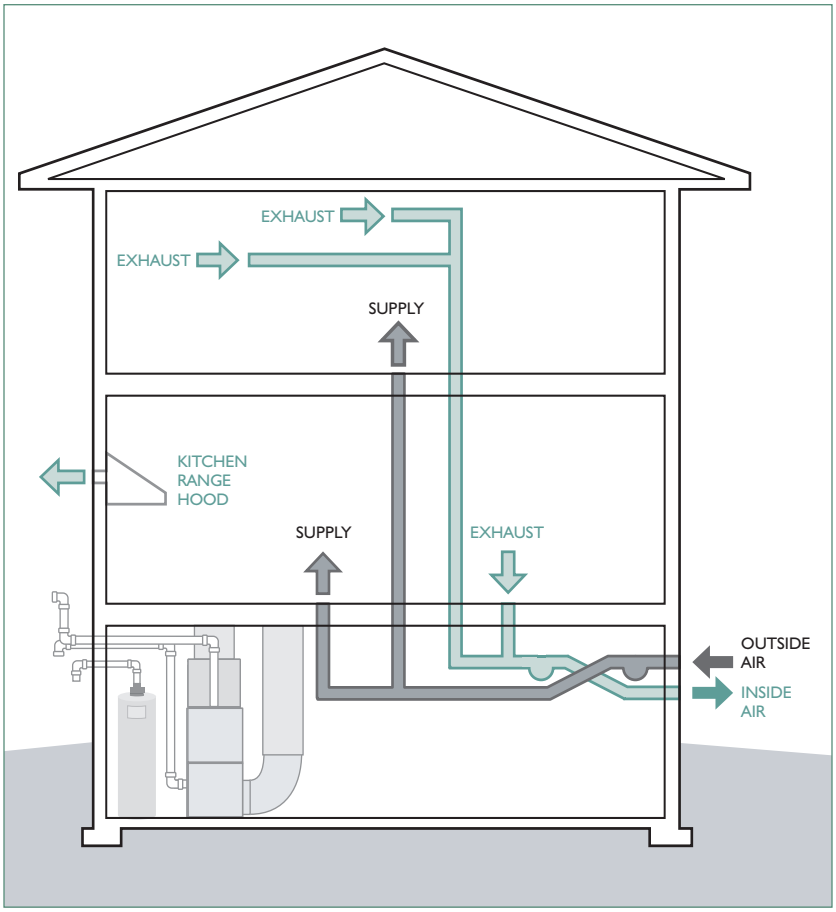
Whole-house or central ventilation systems use one or more fans and duct systems to exhaust stale air and/or supply fresh air. There are several approaches to central ventilation systems:

Balanced. This system usually has two fans and two duct systems—for supplying fresh outside air and exhausting stale indoor air. Fresh outside air is introduced in approximately equal quantity to the amount of stale inside air that is exhausted.

Balanced with heat recovery/energy recovery. This system adds a heat recovery ventilator (HRV) or an energy recovery ventilator (ERV) to a balanced system (described above). The HRV recovers heat from the outgoing exhaust air and uses it to warm the incoming fresh air. An ERV recovers moisture as well as heat from the outgoing air. This system reduces the heating and cooling costs of ventilating your home.



Because they have more capacity and typically have automatic controls, heat recovery ventilators and other central ventilation systems provide more ventilation than spot exhaust fans.



A balanced ventilation systems brings in fresh outside air in approximately equal quantities to the amount of stale inside air that is exhausted. The furnace and water heater in the diagram are vented directly to the outside and do not use indoor air in the combustion process.

Exhaust only. This system uses fans to exhaust stale indoor air but supplies fresh outdoor air passively though intentional or unintentional openings in the building envelope. Often, a bathroom fan, controlled by a remote timer or de-humidistat, is used to provide continuous ventilation in this system. Because the fan may be running for long periods of time, it is important that it be quiet, with a maximum noise rating of 1.0 sone (equivalent to the sound a newer refrigerator makes when it is running).

Supply only. This system uses fans to draw in fresh outdoor air and push out stale indoor air through openings in the building envelope. This approach generally is not recommended for cold climates.

CONTROLS FOR YOUR VENTILATION SYSTEM

There are several types of manual and automatic controls for ventilating systems. Manual controls require the occupant to activate the system, while automatic controls can be set to operate the system based on time of day, occupancy, humidity or other parameters. All controls should be easily accessible and understandable.

Manual controls

The most basic manual control is an on/off switch. Other controls include:

Delay Off Timer. Switch activated by the occupant that allows a fan to operate 20 minutes or more before turning off automatically. These timers are useful in bathrooms where it is important to continue removing moisture after the occupant has finished showering.

Timer. Allows occupants to set the time duration for operating the ventilating system.

Automatic controls

These controls can be fully or semi automatic (includes an override switch) and fall into the following categories:

Automatic Timers. Programmable timers that can be used much like a setback thermostat to run fans during those times when there is likely to be a greater need for ventilation.

Humidity Sensors (de-humidistat). Turn ventilating systems on and off when relative humidity reaches a certain level.

OPERATING GUIDELINES

Properly operating and maintaining your ventilating system is important for your health and comfort as well as the health of your house. In a new home, it is important to run the ventilating system continuously for the first year or two to remove the moisture and gasses emitted from the construction materials, carpets and furnishings. In general though, you'll want to:

- Use a hygrometer to measure indoor humidity and adjust your ventilating strategy to keep winter humidity levels at 30 percent to 35 percent
- Regularly clean fans
- Regularly clean intake openings
- Change filters at least twice a year

HOW MUCH FRESH AIR DO WE NEED?

HVAC and indoor air quality professionals talk about air changes per hour (ACH) and cubic feet per minute (cfm) when specifying ventilation systems. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommends ventilation rates of 30 cfm to 165 cfm based on the floor area of the house and the number of bedrooms.

Wisconsin's building code requires spot exhaust ventilation in bathrooms and kitchens, but does not stipulate an overall ventilation rate for homes. The Wisconsin ENERGY STAR® Homes program requires its certified new homes to have mechanical ventilation systems capable of providing continuous ventilation of 20 cfm for the first bedroom plus 10 cfm for each additional bedroom. A four-bedroom house would have a mechanical ventilation system capable of providing 50 cfm of continuous ventilation.

Signs of inadequate ventilation

- Do you notice unusual odors, musty smells, stale or stuffy air?
- Do you have mold or mildew in closets, or on ceilings or exterior walls?
- Is there condensation on the inside of your windows or other signs of excessive humidity?

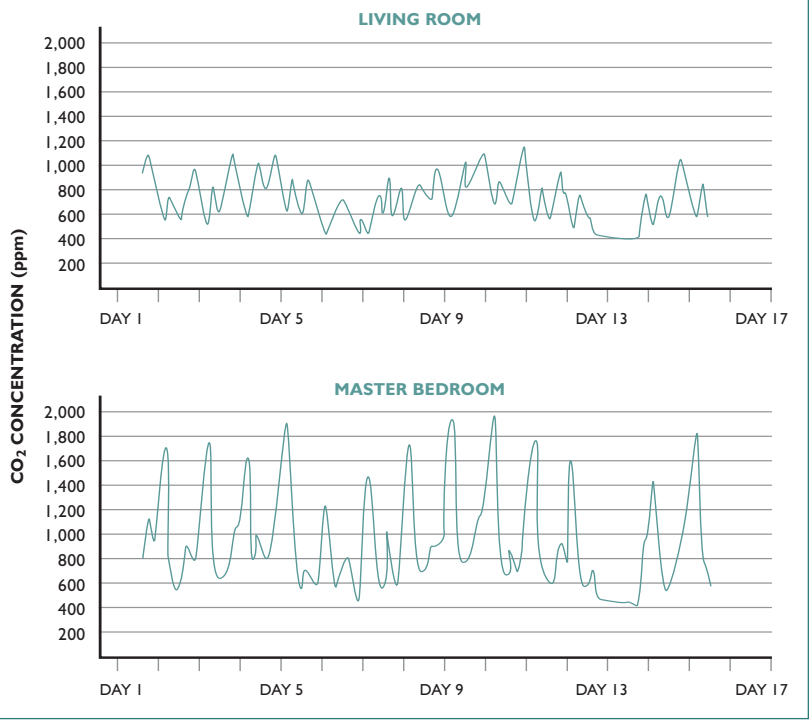
RECOMMENDED VENTILATION RATES*
measured in cubic feet per minute (cfm)

FLOOR AREA (ft^2)	NUMBER OF BEDROOMS				
	0–1	2–3	4–5	6–7	>7
<1,500	30	45	60	75	90
1,501–3,000	45	60	75	90	105
3,001–4,500	60	75	90	105	120
4,501–6,000	75	90	105	120	135
6,001–7,500	90	105	120	135	150
>7,500	105	120	135	150	165

*VENTILIATION RATES BASED ON THE FLOOR AREA OF THE HOUSE AND THE NUMBER OF BEDROOMS.

ASHRAE Standard 62.2-2004, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

OBSERVED CARBON DIOXIDE LEVELS FOR A HOME



Carbon dioxide levels in the home can be a useful indication of the amount of ventilation. The high nighttime CO_2 levels in the master bedroom in this home suggest that it needs more ventilation.

- Are your eyes irritated when you're at home?
- Do you feel noticeably healthier outside your home?

If you are concerned that your home has inadequate ventilation or if you are planning a remodeling project (which could alter the indoor air characteristics in your home) consult a building performance specialist who will conduct tests to determine your home's air leakage, combustion safety and other conditions affecting your home's air quality. Go to focusonenergy.com to find a home performance consultant in Wisconsin.

WHAT ABOUT YOUR ATTACHED GARAGE?

An attached garage can be a significant source of indoor air pollutants, especially carbon monoxide. To minimize exposure to pollutants from an attached garage:

- Seal air leaks between your home and garage to minimize the amount of air from the garage that could seep into your home.
- Never idle cars in the garage (start the car and immediately back out)
- Install carbon monoxide detectors in your home.

You may need additional ventilation in your home to assure that pollutants from the attached garage are exhausted from your living space. A balanced ventilation system is less likely to pull make-up air from the garage into the house.

VENTILATION SYSTEMS AND COMBUSTION EQUIPMENT SAFETY

Exhaust equipment, including spot ventilation fans, whole-house exhaust-only ventilation systems, clothes dryers and other exhaust fans expel indoor air. If enough outside air is not brought in to replace the air that is expelled, the house becomes depressurized (the air pressure inside the house is lower than the air pressure outside the house). In a depressurized house, combustion gases from standard combustion equipment (furnace, water heater, fireplaces) can be pulled back into the house rather than being exhausted up the chimney. This condition is called backdrafting and can cause severe injury or even death.

Avoiding backdrafting

- Replace standard combustion water heaters or furnaces with sealed combustion equipment. Sealed combustion equipment has both the combustion air and the flue gases ducted directly to the outside.
- Have your home checked to be sure there is adequate make-up air for your combustion equipment before installing a ventilation system. Have the system checked after it's been installed or after making major structural changes to your house.
- Install carbon monoxide detectors as an added warning system—see carbon monoxide fact sheet.

LEARN MORE

focusonenergy.com
Contact Focus on Energy to learn more about smart energy choices. Download fact sheets on building a new home or remodeling your existing home, controlling home moisture problems, carbon monoxide in the home and selecting energy efficient appliances and heating and cooling systems.

energystar.gov
The ENERGY STAR® site provides information on improving your home or building a new home, as well as information on energy efficient products meeting ENERGY STAR standards.

epa.gov/iaq/homes/index.html
U.S. Environmental Protection Agency offers information on indoor air quality in homes.

hvi.org
Home Ventilating Institute

nyserda.org/publications/guide.pdf
Homeowner's Guide to Ventilation from the New York State Energy Research and Development Authority.

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