

Fresh Air Ventilation

Overview

Fresh air can do wonders for a home and there are a number of ways to provide an appropriate supply of outside air. By installing design features such as operable windows, skylights and through-wall vents, as well as mechanical equipment such as exhaust fans and ventilators, you can ensure adequate fresh air will be brought into a home to dilute and remove contaminants, such as emissions from furniture and cleaning products. These measures can also help mitigate and avoid the effects of excessive moisture inadvertently introduced through daily activities such as cooking and showering.

When is This Applicable?

A mechanical ventilation system is required to meet code in all new construction projects, and highly recommended in all projects where you are adding additional insulation and air-sealing, as well as when you are doing kitchen and bathroom renovations. Even if a home has mechanical ventilation, it is worth testing its efficiency and effectiveness if you are planning a remodel, so an upgrade can be included in the scope if needed.

Improving insulation and air sealing of your home (which sometimes includes window replacement) reduces the amount of heat that escapes during the winter, reducing your energy bills. However, since it also reduces the amount of air moving in and out of your house, it is important to improve your ventilation system at the same time to maintain adequate fresh air supply.

What Makes it Green?

One solution to indoor pollution is dilution! Indoor air quality is affected by emissions from paints, glues, furnishings and cleaning products, pesticides, engine oil and gasoline (brought in on clothing and shoe soles), as well as pet hair and other allergens. Moisture from cooking, cleaning, bathing and breathing may also raise the relative humidity of indoor air to the point where the house feels uncomfortable and mold may grow on cool surfaces, introducing more contaminants. Points to consider when selecting home ventilation equipment:

- Code ventilation requirements reflect a nationally-approved standard for what is an adequate supply of fresh air to ensure good indoor air quality in normal occupancy conditions.
- By choosing ENERGY STAR fans to meet the code requirements and completing the necessary King County permit forms, you are meeting the prerequisite requirements related to ventilation for LEED for Homes, Built Green and Northwest ENERGY STAR Homes.
- If you choose energy- or heat-recovery ventilation and/or get your fan flows tested by an independent energy rater/verifier you could earn additional points under LEED for Homes and Built Green and save money over time.

Best Practices

Operable windows are a great source of fresh air ventilation. A mechanical ventilation system helps to ensure you have sufficient fresh air, even during the heating season when windows tend to stay closed for extended periods. There are three typical approaches to mechanical ventilation in homes:



Exhaust ventilation – This is the most common approach in King County in recent years. This approach uses an exhaust fan (choose ENERGY STAR labeled fans only), running continuously to pull air out of the house. Fresh “make-up” air is pulled in through leaks in the building shell or through small “trickle” air vents in window frames. The code requires that make-up air is provided directly to living spaces, kitchen, sleeping rooms and other regularly occupied spaces. This approach typically has the lowest installation cost and is moderately effective.



Window trickle vents are used in conjunction with whole house exhaust fans to provide fresh air ventilation. With proper planning and controls, the bathroom exhaust fan can double as the whole house exhaust fan. Source: O'Brien & Company.

Supply ventilation – In homes with a ducted forced air system, a fresh air duct from outside the house is connected to the return plenum of the duct system, with a mechanical damper which opens and closes to control the fresh air flow. The damper is controlled by a “smart cyclor” which monitors heating system runtime to make sure you get sufficient ventilation and opens and closes the fresh air damper to make sure you don’t get too much. Ducts provide make-up air to all regularly occupied spaces. This option is moderate in cost, and moderately effective, though it may increase your heating and electricity bills if your furnace has a single speed fan.

Going Further - Energy and Heat Recovery Ventilators (ERV/HRV)

If you have a very airtight home (significantly below the code minimum), balanced ventilation with energy recovery will provide the most effective ventilation and make sure you get the best from your energy efficient home. An energy recovery ventilator uses heat from stale exhaust air to pre-warm the incoming fresh air, without mixing the two streams. ERVs capture the latent energy of the humidity in the air in addition to the heat exchange only (as in an HRV).

If you or your family have allergies or chemical sensitivities, an ERV with a high-efficiency filter will allow you to increase ventilation rates to improve your indoor air quality without spending a lot more on heating. ERVs are not certified by ENERGY STAR; look for a Home Ventilation Institute (HVI) rating with a Sensible Recovery Efficiency of 75% or higher and fan efficacy of 0.8CFM/Watt or higher.



Balanced Ventilation – This approach uses both a supply fan and an exhaust fan whose controls are connected to ensure they operate at the same time and flow rate to provide balanced flow. Exhaust and make-up air are ducted from and to occupied spaces, either through a dedicated duct system, or through a central forced air system. Energy recovery ventilation is an upgrade that provides balanced ventilation, improved thermal comfort

and energy efficiency. This approach is more expensive than the other systems, but is the most effective approach. Energy recovery typically offsets the energy cost of added ventilation and fan operation and generally saves money in the long run.

The following table includes considerations applicable when choosing a ventilation strategy and equipment.

VENTILATION STRATEGY AND EQUIPMENT CONSIDERATIONS

| Phase/Component | Considerations | More Information |
|-------------------|---|--|
| Design / Planning | <ul style="list-style-type: none"> • Hire a contractor who is familiar with all the ventilation options. • Ensure that they will perform the necessary calculations and design the system accordingly. • Understand which ventilation approach suits the systems in your home. | <p>Ask the contractors you are talking to about which ventilation system they recommend and confirm that calculations and system sizing are included in their scope.</p> <p>Check the state code ventilation requirements for the size and occupancy of your home.</p> |
| Equipment | <ul style="list-style-type: none"> • Ask for ENERGY STAR fans rated for continuous operation. Variable speed fans with DC motors are the quietest and most energy efficient, and can be adjusted if you need more ventilation. • If installing a supply ventilation system, ensure that your contractor includes a smart cyclor in your system specification. • Ensure the contractor tests the system as part of the installation scope to be sure it is functioning properly. • Request clear instructions for use from the contractor / installer. | <p>A variable speed fan with a DC motor may use as much as 80% less energy than a single speed fan with an AC motor.</p> <p>A supply ventilation system integrated into your central forced air system without a smart cyclor will significantly increase your heating costs in winter and will not give you adequate ventilation in summer.</p> |
| Ducting | <ul style="list-style-type: none"> • Sheet metal duct is preferred. • All ducts should be sealed with appropriate sealant to the fan box, at joints and where they penetrate the building envelope. • The fan box must be sealed to the ceiling. | |



VENTILATION STRATEGY AND EQUIPMENT CONSIDERATIONS *continued*

| Phase/Component | Considerations | More Information |
|-----------------------|---|--|
| Testing / Maintenance | <p>Testing after installation</p> <ul style="list-style-type: none"> Have the fan flow tested once it is installed to ensure it is delivering the required flow – an energy rater can do this, or ask the contractor to provide a testing certificate. | <p>Maintenance</p> <ul style="list-style-type: none"> Clean fans and any filters every 6 months or more frequently according to manufacturer’s guidance. Periodically ensure the exterior duct “flappers” are functioning properly, and air is flowing in or out during operation. If you have a “smart cyclor” (see Supply Ventilation above), hire an energy rater or HVAC contractor to confirm proper operation every few years or as needed. |



This is one example of a heat recovery ventilator located within a conditioned space. Source: O'Brien & Company.

Applicable References/Standards

Energy Compliance Form: This required form includes ventilation rate tables for continuous and intermittent ventilation.

Resources

For the complete King County Green Building Handbook and individual Green Sheet PDF files, please visit our website at: <http://kingcounty.gov/property/permits/publications/greenbuild.aspx>. For additional information, please email dperwebinquiries@kingcounty.gov or call 206-296-6600.

See these related DPER Green Sheets (GS):

- Furnace Replacement, GS Number 18
- Alternative Heating Systems, GS Number 19
- Thermostats, GS Number 16
- Right Sizing Heating/Cooling Systems, GS Number 17
- Duct Sealing, GS Number 11
- Insulation, GS Number 13

Designing a Good Ventilation System -

This article from Green Building Advisor discusses standards, choices, and pros and cons of ventilation system types.



Permit Tips

Mechanical ventilation is required with the permitting of all new, heated spaces > 500s.f. Since there are many options for ventilation, research your options and identify your preferences before filing a permit application. Making an informed decision may provide you with additional energy, comfort, health, and durability benefits.

