MASSACHUSETTS
Energy Code Technical Support

Residential Ventilation System Requirements

Mechanical Ventilation

A mechanical ventilation system introduces fresh air inside a home using a fan-powered solution rather than relying on wind or the stack effect. The Massachusetts residential energy code (based on 2015 IECC) requires that such a system be installed in every home to ensure that the air in the house is replaced with outside air on a regular basis. The ventilation system must be properly sized and controlled to provide at least the minimum calculated airflow, and the fans must be certified by either the Air Movement and Control Association (AMCA) or the Home Ventilation Institute (HVI).

There are three types of ventilation systems:

- Exhaust-only systems
- Supply-only systems
- Balanced systems

Exhaust-only systems remove air from the house and rely on air leaks as the source of fresh air. Supply only systems push fresh air into the house and rely on air leaks to get rid of stale air. Balanced systems supply fresh air and exhaust stale air at the same time. Exhaust-only systems, which are generally the least costly to install, often make use of bathroom or kitchen exhaust fans which are already being installed. By simply upgrading the quality of those fans and adding controls, the code requirements are easily met. Supply-only systems are not recommended in our climate because they can force warm, humid air into insulated framing cavities where the moisture can condense on cold sheathing. Balanced systems supply fresh air and exhaust stale air at the same time which allows for better control of fresh air supply.

Minimum Required Airflow

The installed ventilation system must move enough air to meet either the ENERGY STAR Certified Homes Version 3.1 requirements, ASHRAE 62.2-2013 requirements, or a formula provided in the Massachusetts amendments. A HERS rater or mechanical designer can use the equations in these standards to calculate the airflow for the home you are building. Or, you can size your mechanical ventilation system based on the following table, which is based on the ENERGY STAR homes program:

Airflow in CFM based on size of the house and number of bedrooms

Size of House	0-1 bedrooms	2-3 bedrooms	4-5 bedrooms	6-7 bedrooms	>7 bedrooms
<1500 sq ft	30	45	60	75	90
1501-3000 sq ft	45	60	75	90	105
3001-4500 sq ft	60	75	90	105	120
4501-6000 sq ft	75	90	105	120	135
6001-7500 sq ft	90	105	120	135	150
>7500 sq ft	105	120	135	150	165

There are also airflow calculators available for free use which can be found by searching for "ASHRAE 62.2-2013 calculator". Per Massachusetts amendments, ventilation systems must be tested by a HERS rater, a HERS field inspector, or a BPI professional in order to verify that the installed system airflow meets the minimum airflow requirements. Some systems fail to pass this test due to stuck dampers, blocked airflow in the duct, restrictive termination ports, or fan defects

Exhaust Only Ventilation

Exhaust-only ventilation systems remove indoor air to the outdoors with one or more fans. Because indoor air is being removed, the home becomes slightly depressurized, drawing in fresh outdoor air through cracks in the home's exterior. These systems are commonly either bathroom exhaust fans or remote in-line fans.

1. Bathroom Exhaust Fan

Bathroom exhaust fans used for whole-house ventilation must be quiet (sone rating of 1.0 or less) and be energy efficient (minimum of 2.8 CFM/watt if 90 CFM or more, minimum of 1.4 CFM/watt if less than 90 CFM). Bathroom exhaust fans are available that have multiple speeds, with a high speed setting for when the bathroom is in use, and a low speed setting for the rest of the time.

Remote inline fans can be ducted to multiple bathrooms or other locations, thereby reducing the total number of fans needed and improving the distribution of exhaust ventilation. The inline fan must be energy efficient (2.8 CFM/watt) but does not need a sound rating requirement if it is at least four feet away from any indoor termination.

2. Remote Inline Fan

In extremely tight homes, exhaust only ventilation can depressurize the home enough to backdraft combustion appliances, prevent fireplaces from drawing correctly, and reduce the effectiveness of kitchen and dryer exhaust.

Balanced Ventilation

Balanced ventilation systems use two separate fans (usually contained in the same box) to bring fresh outdoor air into the home and to exhaust stale indoor air to the outside. Balanced systems help maintain a neutral pressure in the home and come with the added benefit of being able to choose where the fresh air comes from and where it will be delivered to. When using a balanced ventilation system, the air inlet location must be at least 10 feet from any exhaust (with some exceptions for roof exhaust), have a screen to prevent pest entry, and, if located within 7 feet of grade, must be labeled with a sign warning occupants not to block the inlet.

1. Source: http://business.panasonic.com/FV-05-11VKS1.html
2. Source: http://www.supplyhouse.com/Fantech-FR150-FR-Series-Inline-Exhaust-Fan-6-Duct-263-CFM?gclid=CPKh8PGXmtMCFcSKswodhvQG1w

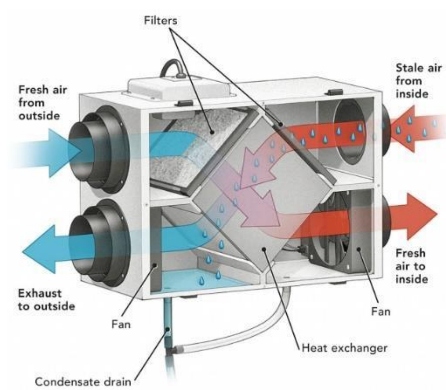
The two most common types of balanced ventilation systems are Heat Recovery Ventilators (HRVs) and Energy Recovery Ventilators (ERVs).

3. Heat Recovery Ventilator

Heat Recovery Ventilators (HRVs) contain heat exchangers that transfer heat from one air stream to the other. In the winter, heat from the exhaust air is used to warm the incoming fresh air. In the summer, heat from the incoming air is transferred to the exhaust air. HRVs can reduce the heat loss associated with ventilation by 65-95%, depending on the unit.

Energy Recovery Ventilators (ERVs) are similar to HRVs but they transfer both heat and moisture from one airstream to the other. In the winter, heat and humidity in the exhaust air is transferred to the incoming air. In the summer, heat and humidity in the incoming air is transferred to the exhaust air. ERVs usually have a lower heat recovery rate than HRVs, so while they save more energy in the summertime by reducing the need for air conditioning they usually will not save as much energy as HRVs in the wintertime.

HRVs and ERVs are both good choices in our climate. An HRV may be a better choice in small, tight homes with high occupancy where moisture recovery is undesirable in the winter. An ERV may be a better choice in large, leakier homes with low occupancy and air conditioning.



4. Diagram of HRV

Duct Systems for HRVs and ERVs

Most HRVs and ERVs are installed with a duct system to exhaust air from specific rooms in the house and deliver fresh air to others. This duct system could either be its own independent system or can be integrated into the heating and cooling ductwork for homes with ducted heating and cooling. Overall, there are three main methods of ducting HRVs and ERVs:

1. <u>Install a ventilation duct system that is independent of heating and cooling</u>. In this approach, air can be exhausted from bathrooms and fresh air can be supplied to living spaces. This approach is used when there are no ducted heating and cooling systems in the house or when seeking to ensure a specific amount of air is supplied or exhausted to each room of the house independent of what the heating and cooling system is doing. One advantage of this approach is that the HRV/ERV can take the place of the bathroom exhaust fans. Another advantage is that independently ducted ventilation systems do not need to run the furnace fan just to provide fresh air, meaning that less power is used for ventilation. Sometimes exhaust air is also drawn from laundry rooms and kitchens.

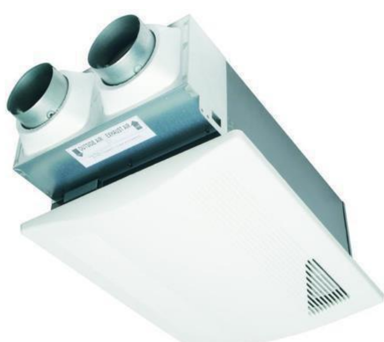
3. Source: https://www.venmar.ca/39-air-exchangers-e15-ecm-hrv.html
4. Source: http://www.greenbuildingadvisor.com/sites/default/files/images/242GR-heat-recovery-ventilator.preview.jpg

2. Install dedicated exhaust air ducts and use the heating and cooling ductwork for fresh air distribution. In this approach, fresh air is ducted to the heating and cooling ductwork, either into a return trunk or a supply trunk. If ducting into a supply trunk, use a scoop to ensure that the airflow isn't blocked by the positive pressure in the trunk. Like option #1, bathrooms are exhausted directly through the HRV/ERV

3. Fully integrate the ventilation ductwork with the heating and cooling system ductwork. In this approach, the HRV/ERV exhaust and fresh air are both connected to the heating and cooling ductwork. While this approach requires the least amount of additional ductwork of the three options, it runs the risk that fresh air provided into the ductwork will be immediately exhausted to the outdoors. To prevent this, fresh air must be provided using a scoop downstream of the exhaust air and either the air handler must run continuously or a damper located in between the supply and exhaust connections must close when the air handler isn't running. If the air handler runs continuously, a large amount of electricity will be consumed that may counteract the energy benefit of using the HRV/ERV.

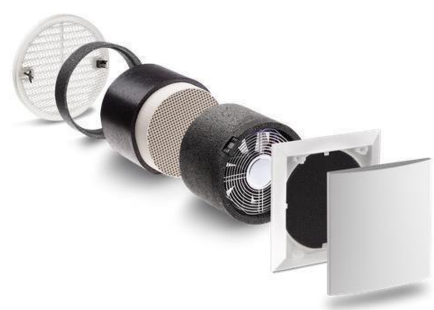
Several HRVs and ERVs are available with minimal ductwork. These systems offer cost-effective alternatives for areas that don't need distribution, especially for small spaces or those with lower ventilation needs. Current options include ceiling mounted units, wall mounted units, and through-the-wall units.

Duct Systems for HRVs and ERVs



5. Ceiling Mounted Unit

6. Wall Mounted Unit



7. Through-the-Wall Unit

Please note that the products pictured in this bulletin have not been endorsed by Mass Save® and are listed only as examples.

5. Source: http://business.panasonic.com/FV-04VE1.html
6. Source: http://zehnderamerica.com/wp-content/uploads/2014/11/TS-CA-70-NWE-2016-08-15.pdf
7. Source: http://www.lunos.de/en/