Ask the

INSPECTOR...

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HRV/ERV

I have heard a lot about ventilation and poor indoor air quality in homes recently. What is poor indoor air quality and what is the best type of ventilation system available to me at this time?

Over the past several years, ventilation and indoor air quality in homes has become more of a concern to many people. Traditionally in older houses, fresh air constantly enters the house through gaps around windows, doors, receptacles, unintentional openings, etc while stale indoor air is simultaneously replaced– natural ventilation is constantly occurring. Unfortunately this natural ventilation cannot be controlled and occurs whether it is required or not; creating adverse comfort issues and high energy bills. Conversely, the majority of today's homes have very little natural ventilation due to the more energy-efficient building practices that are used. Low natural ventilation levels may also occur in older homes that have been upgraded (i.e. New windows, doors, and air sealing reduces the amount of air leakage through the building envelope and therefore reduces natural ventilation). Ideally, in order to ensure good indoor air quality is maintained, all of the air in a home should be replaced with fresh, outdoor air approximately once every three hours – this represents an air change rate of 0.3 air changes per hour. When the air in a house is not regularly replaced with fresh air, dust, odours, moisture, and other indoor pollutants may build up with poor indoor air quality being the result. To determine the actual number of air changes per hour in a home, a blower door test is required (For additional information regarding a blower door test, refer to the Ask The Inspector articles on the EnerGuide for Houses Program and Ventilation.). If the test determines that the natural ventilation is inadequate and that additional (mechanical) ventilation is necessary, there are three options available to a homeowner which include exhaust only, supply only, and balanced ventilation. Exhaust only ventilation consists of a fan (or fans) that pushes air out of the house without providing fresh air to replace the exhausted air. During the operation of an exhaust fan, outside fresh air is forced into the home through intentional openings such as windows and unintentional openings such as holes around windows or other openings in the building envelope. Supply only ventilation provides fresh exterior air to the house without mechanically removing the existing stale air from the home. Stale interior air is forced to the exterior of the home through the building envelope through the same intentional and unintentional openings described above. A balanced ventilation system does both; it mechanically provides fresh air to the home and at the same time and rate, mechanically exhausts stale air from the home to the outside. Out of all of the above-noted systems, balanced ventilation systems give the homeowner the most control over ventilation, comfort and energy efficiency in the home.

What type of system provides balanced ventilation and how does it work?

The types of units that will provide balanced ventilation are Heat Recovery Ventilation Systems (HRVS) and Energy Recovery Ventilation Systems (ERVS). These systems are comprised of several key parts, including two fans, ducting, filters, and a heat exchanger core. They are both essentially heat exchangers that provide a balanced supply of fresh air to the home from the exterior while extracting an equal amount of stale indoor air from the home to the exterior. The two air streams pass through a heat exchanger core where the heat from the warm exhausted air is transferred to the cooler incoming air, and vice versa during the summer cooling months. This transfer of heat increases the efficiency of the home's ventilation because the energy used to heat the exhausted air is not completely wasted, and less additional energy is required to warm the fresh incoming air. The main difference between an HRVS and an ERVS is the heat exchanger core. With an HRVS it is heat only that is transferred between the air streams, while the ERVS heat exchanger core allows the transfer of moisture (humidity) between the air streams. This means that in the winter moisture is added to the fresh incoming air so that it is not as dry as the exterior air, improving comfort in the home; while in the summer moisture is removed from the fresh incoming air so that it is not as humid as the outside air inside of the home.

Duct connection configurations

The ducting for the HRVS can be connected in several different configurations, depending on whether ducting already exists in the home and the level of difficulty in installing new ducting. Ideally, the exhaust air is taken from areas that have high moisture levels and therefore poor air quality, such as the bathrooms, laundry room, and kitchen. Fresh air is then returned to the other areas of the home such as the living and dining rooms, and the bedrooms. Where ducting is present in a home for forced air heating, the HRVS may be connected into the existing ductwork. In some cases, new ducting is installed to collect stale air from the above-noted rooms and the fresh air is supplied at the return air duct of the furnace. Where installing new ducting is not possible, the stale air is taken from the return air duct, upstream of the fresh air supply.

Balanced System

The location of the intake and exhaust vents in the home is secondary in importance to the amount of air that is exchanged by the unit. As previously mentioned, the HRVS is a balanced system, meaning that the volume of air that is exhausted from the home should equal the amount of fresh air provided from the exterior. If the system is not balanced, pressure differences may occur between the interior and exterior of the home. An unbalanced system will cause inefficient heat transfer between the airstreams and potential freezing of the heat exchanger core during the colder months of the year. As well, negative pressures in the home could lead to backdrafting of fuel burning appliances, whereas positive pressures may lead to moisture build-up in the building envelope. An unbalanced system can be caused by ineffective or damaged fans, dirty/blocked ducts, registers, or filters, or an inadequate number of intake or exhaust registers in the home.

What type of maintenance is required for an HRVS?

Maintaining your HRVS or ERVS is critical in ensuring its proper and efficient operation. The filters located within the unit should be cleaned or replaced once every one to three months and the heat exchanger core should be cleaned once a year. The manufacturer's instructions should be consulted to determine proper cleaning procedures and the power should always be disconnect to the unit prior to opening the door. The ducting, registers, and exterior vents should also be cleaned regularly to ensure that blockage has not occurred.
To verify that the system is balanced, follow the steps provided in the article "Maintaining Your Heat Recovery Ventilator" on the Canadian Mortgage and Housing Corporation's (CMHC) website at www.cmhc.ca. The system should also be serviced annually by a qualified contractor, similar to the way a furnace is annually serviced, to ensure proper operation.

For further information please contact:

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