The Importance of Ventilation, Part II

By Steve Bliss

Last month, we discussed why energy-efficient homes need some form of controlled ventilation, and we looked at the pros and cons of the major system types. In this column, we'll examine the specific design issues that can make or break a residential ventilation system.

Supplies and returns

According to Gautam Dutt, of Princeton University's Center for Energy and Environmental Studies, natural infiltration probably doesn't ventilate houses very well. The basement may get the freshest air, drawn in via the stack effect, while other rooms may get next to nothing. A distribution system is needed, he thinks, to guarantee good ventilation throughout the house.

The most efficient distribution system removes pollutants at their sources and delivers fresh air to the prime living areas. In practice, this means putting exhaust pickups in rooms that produce moisture and odors, and supplies in bedrooms and living rooms. Rooms with intermittent use—such as a den used for entertaining—might have an exhaust pickup that can be opened when needed.

Keep supplies away from returns to avoid short-circuiting of air streams. Also, it's important to locate supply diffusers where they won't blow cool air on the occupants—in Europe, many window-mounted air inlets are taped over by disgruntled tenants. Good locations are near ceilings, in hallways, and in closets (with louver doors). Closet supplies offer fresh smelling clothes as an added plus. Open plans that promote good flow of heat will also promote good flow of fresh air. But interior doors to ventilated rooms should still be undercut at the bottoms.

In central systems, the kitchen will need an exhaust pickup, plus a recirculating-type range hood. Keep the central exhaust pickup several feet from the range so that it doesn't get greased up.

Pressure drop

We don't want positive pressures in our homes in winter, because they may push moisture into the walls. Some Montana homeowners, for example, have reported frozen door locks from unbalanced heat exchangers. But we don't want large negative pressures either. There is evidence that negative pressures draw more radon from the soil. Large negative pressures will also increase spillage of combustion products from atmospherically vented flues (which you should not have in a tight house anyway). As for balanced flows, no one's been very successful at maintaining them. So which is best?

My guess is that slight negative pressure is preferable—except where radon is a problem. It's not going to force moisture into door locks and walls, and it may actually dry them out. In practical terms, this means to err on the side of negative pressurization when balancing an air-to-air heat exchanger. Also, it means that small exhaust-only systems are probably fine. But with a tight, negatively pressurized house, you simply can't have combustion appliances without outside combustion air.

To keep negative pressures minimal, exhaust-only systems should have intentional openings (a central duct or through-the-wall diffusers) to supply makeup air. Whatever your approach, make sure you look at the whole house as a system. And make sure that the path of least resistance for makeup air is not down a flue.

Noise

Low-energy houses tend to shield out street noise better than standard houses do, which can be a strong selling point. But in a quiet house, noisy fans sound noisier. Many an exhaust system has had its plug pulled to silence the hum.

First off, look for quiet fans. Many manufacturers rate their fans' noise levels in "sones." A sone, according to industry sources, is roughly equal to the sound of a quiet refrigerator in a quiet kitchen. Unlike decibels, sones are additive, so 2 sones is twice as loud as 1, and so on. The average (noisy) 100-cfm bathroom fan rates 3 to 5 sones. Look for something in the 1.5-to-3 range.

In central systems, do not locate the fan unit directly above or below bedrooms. If possible, create a break between the main fan unit and the duct runs with a length of flexible duct. Also, special "muffler" sections can be added to dampen the sound as your car's muffler does. Finally, hang the unit in such a way that it will not transmit vibrations to the frame of the house. This is usually done by sitting the fan unit on foam-covered slats that are hung from the joists.

Furnace tie-ins

How about providing makeup air through the return side of your furnace in an exhaust-only ventilation system? This seems fine if the exhaust fan runs constantly, or if the fresh-air damper is power-actuated and wired to open only when the exhaust fan is running—as in the van EE system. But running the furnace fan with the vent open and the exhaust fan off would tend to pressurize the house.

How about plugging your air-to-air heat exchanger into your furnace? This,

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