By Gord Cooke

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Putting the V back in HVAC

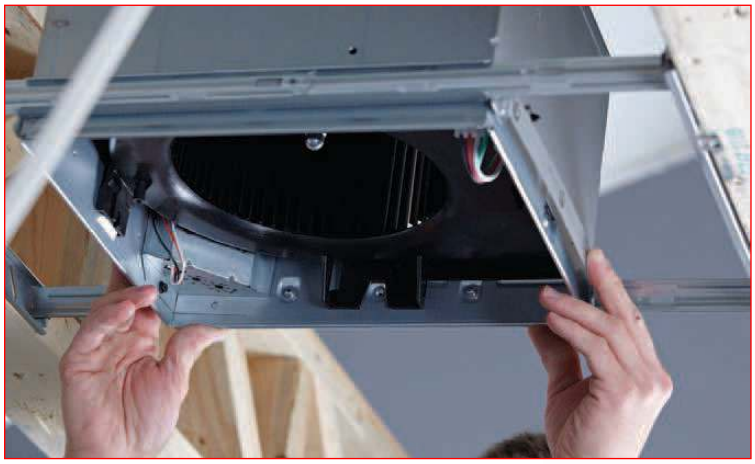
For most homeowners, friends and family, the word ventilation is most easily associated with attics and bathrooms, so as contractors, an understanding of the basic needs for each area is useful in maintaining healthy, durable buildings for the people who count on us to see to their HVAC needs.

Not the same-old fan

What should be of interest to professional HVAC contractors is the virtual explosion of new, high performance bathroom fan models that are now available.

This includes fans with extremely low noise levels, under 0.5 sones, and fans with ECM fan motor technology that result in lower power consumption, but more importantly maintain airflow capacities at varying static pressure loads.

Fans are also sporting new control options; occupancy sensors, humidity sensors, two speeds, adjustable low speeds, timed cycles, delayed off cycles, and more.



The history of bathroom ventilation follows a similar timeline to attic ventilation (see Ventilation, the early years). The early 1940s saw an increased prevalence of indoor plumbing, the start of insulation practices, and higher moisture production from baths and, more importantly, showers. No wonder that codes and standards called for operable windows, passive stack vents in bathroom ceilings and, eventually, mechanical exhaust fans in bathrooms.

The 1990 Ontario Building Code was the first residential code in North America to require a mechanical exhaust fan in all bathrooms, regardless of whether the room had a window or not.

Much like attic ventilation, however, there was not a lot of definitive science or research on the issue of exactly how much ventilation is enough in bathrooms to control moisture and odours.

This is of particular relevance to HVAC contractors now, as you respond to the ever increasing expectations of homeowners who in one or two generations have gone from the idea of a simple utilitarian water closet to their own private rain forest spa.

In the past, mechanical contractors could be excused for thinking that promoting simple bath fans wasn't worth it, leave it to the electricians. That should change.

There are nice new opportunities for mechanical contractors in the bathroom ventilation business. The value of fans with definable, saleable benefits is much higher, and the labour content and disruption of surrounding ceiling areas is lower.

So, put the V back in HVAC. Think about creating relationships with specialty bathroom renovation

contractors and full-service renovators. Property managers of apartment and condominiums should also be a target as they look to retrofit thousands of fans to mitigate moisture, odour and noise complaints.

Remember, the responsibility for airflow, air quality, moisture control and pressure control in houses should rest with mechanical contractors. Bathroom ventilation is an ever increasingly important element of each of these and thus warrants the attention of professional mechanical contractors.

SIZING the fans

With respect to sizing of bathroom fans, perhaps the best place to start is the Home Ventilating Institute (HVI) Guide. This calls for bathrooms under 100 sq. ft. to have a ventilation rate of one CFM per square foot of floor area. A comfortably sized bathroom of five by eight feet, with an eight-foot ceiling would need a 40 CFM fan, which would result in an air change rate of 7.5 times per hour (ACH).

For bathrooms larger than 100 sq. ft., HVI recommends using a fixture count; 50 CFM for each toilet, shower and bathtub, and 100 CFM for a jetted tub. This is the common sizing used in most codes for commercial applications. In a typical household "spa" this could easily lead to a ventilation need of 200 to 250 CFM.

Let's take the math a little further to determine how much moisture that 40 CFM of ventilation can be expected to remove.

Using a psychrometric chart, with household air at 21°C and 40% RH, and imagining that during that interminably long teenager's shower or the long soak in the jet tub, the bathroom itself gets up to say 25°C and 95% RH.

At these conditions the 40 CFM of exhaust will remove approximately 1 kg (2.2 lb.) or 1 litre of water per hour from the air in the bathroom.

Compare this with the expected evaporation rate of a very hot jet tub (40°C or 104°F). Assuming a water surface area of 20 sq. ft. with lots of turbulence, as much as four pounds of water can be expected to evaporate each hour.

In fact, that matches up pretty well with the HVI recommendation of 100 CFM capacity for a jetted tub. It also means that local exhaust ventilation from bathrooms provides excellent drying potential.

Keeping balanced

Some thought should be given to air supply when large capacity exhaust is used. Significant undercuts on doors or transfer grilles may be required to provide adequate replacement air to the bathroom. Otherwise the fan capacity may diminish due to increased static pressure and ventilation effectiveness will be reduced.

VENTILATION
THE EARLY YEARS

The earliest official references to ventilation of attics in residential construction in codes or building practices started appearing in the late 1930s. It is not a coincidence that this is around the same time as attic insulation was becoming prevalent in cold climate housing.

The cause and effect of moisture accumulation on the underside of roof sheathing and in wall cavities was being debated by roofers, roofing manufacturers, the wood industry, the new insulation companies and even painters (who in the early days were known to refuse to paint insulated houses).

The first reference to the now hard, codified rule of one square foot of net free area of ventilation for every 300 square feet of ceiling area appeared in 1942 U.S. federal housing standards without reference to any testing, research or documentation. It is an arbitrary number that has been retained by the industry all these years.

This did, however, establish that the prime directive of attic ventilation was to minimize the effects of moisture accumulation on the underside of roof sheathing. The attic air space itself doesn't really need to be ventilated. In fact, air movement over the top of insulation in an attic reduces the effectiveness of the insulation.

Extensive housing research has now clearly identified that the best way to avoid attic moisture problems is to thoroughly air seal between the house and the attic, eliminating pathways for warm, moist air leakage into attic spaces.