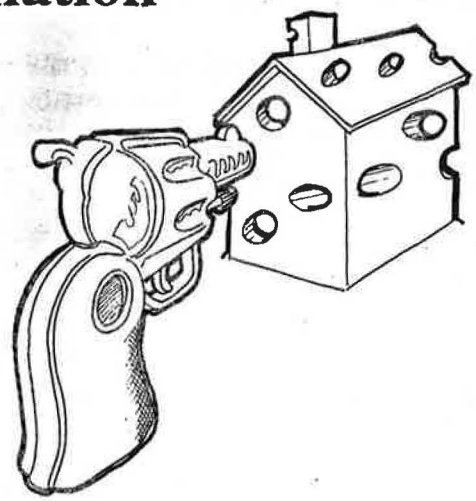
# Residential Ventilation

*Richard Kadulski*

We have become aware of the importance for good quality indoor air to maintain healthy conditions under all weather conditions. This is why ventilation for homes has received a higher profile recently. Codes now mandate mechanical ventilation.



We've been writing about equipment and concerns on an ongoing basis since we started publishing SOLPLAN REVIEW in 1985. Unfortunately there's still lots of confusion about what good indoor air quality means and how to achieve it. There's a lot of poor equipment and too few qualified installers who understand how systems should be installed.

This is an issue of interest to the building industry not just because of new codes but because the consumer is now becoming more aware. Consumer publications are writing about it and educating the homeowner. The January-February 1991 issue of *Harrowsmith* magazine has a feature story on mechanical ventilation as have recent issues of *Popular Science* magazine. Other stories have appeared in the real estate pages of major papers.

Our metabolism consumes energy. We need oxygen that our bodies burn with the food we eat to produce carbon dioxide, water and other byproducts. If we don't replenish the oxygen, then dangerous concentrations of carbon dioxide and other compounds will build up. If you've ever woken up (especially on a cold winter day when the house has been shuttered) feeling hung over, even when you didn't have a drink the night before, you could have had a mild case of carbon dioxide poisoning due to inadequate supply of fresh air.

Despite the evidence that we are dealing with a fundamental principle many are still sceptical. Questions we still hear are: why do we need to add fans? Is it really necessary? We've been building for generations without it and there's been no problems. Isn't this just adding unnecessary cost to the homeowner? Maybe we shouldn't be building such tight houses? The list of questions goes on. We've all heard many variations on this theme.

The fundamental reason for mechanical ventilation is to provide good indoor air quality to ensure healthy indoor conditions. Remember that a house is a system, more than the sum of the components.

We don't build houses the way we used to in the past, as we use new products and materials to make our houses tighter and draftfree. This means the house operates differently than in the "old days" when houses were leaky. Older houses didn't use much insulation, they may not have been kept as warm and comfortable as they are today, the houses were drafty and uncomfortable, and often had naturally aspirating combustion appliances.

The early sod huts on the prairies, the old log cabins, even city homes were full of smoke and soot and chilly rooms, ice on the windows. Today's homes use panel materials (plywood, waferboard, drywall, etc), new caulking materials, tighter doors and windows, and more efficient heating systems. This has meant that the average home today is built tighter with less natural air exchange so pollutants generated inside are being trapped indoors.

Even older leaky houses often have poor indoor air quality, even though it may not have been obvious enough to create major problems. As long as we didn't know any better, we put up with it. It was just the natural state of affairs, just as we put up with big city pollution until it got bad enough to be noticed. The R-2000 program helped to identify just how bad the situation was. The stress on airtight construction practices for new energy efficient homes were monitored in great detail for indoor air quality (as well as energy consumption). For comparison standard housing was also monitored. It was discovered that conditions in existing housing weren't that good.

Today's homes are not just energy efficient, but also more comfortable as well. Home owners who bought the early R-2000 homes were buying them mainly for their low energy consumption. On moving in they discovered the pleasures of a quiet, draft free environment that maintained fresh air without having to keep windows open.

The challenge is how to develop, market and install simple, least costly ventilation systems that work.

## Code changes

The latest edition of the Ontario Building Code has adopted the mechanical ventilation requirement of the National Building Code. For many builders the question now is how to satisfy the code requirements. The Code merely states that every dwelling unit shall be provided with a mechanical ventilation system having a capacity to exhaust inside air or to introduce it at a rate of not less than 0.3 air changes per hour, averaged over a 24 hour period.

The 1985 edition of the National Building Code had the same requirements but Ontario did not adopt the ventilation section. In B.C., it was adopted. Within a year the confusion led to requests for changes. Many said it wasn't needed and the ventilation passage should be deleted. On reflection after input from many groups, including HRAI and the Technical Advisory Committee of the CHBA-BC, it was decided that it was more important to make it workable and a bridge to CSA F326. The CSA F326 standard, then in a draft version, was used as a reference so that the code would not contradict its intent. As a result, the mechanical ventilation section was expanded.

The B.C. Code still has short comings, but is easier for builders to use, and inspec-

› verify compliance. The results mean onditions due to inadequate ventilare less likely to encountered in new ng.

## o's responsible?

e reason for the confusion about ation requirements is uncertainty about s responsible.

the past fans were selected and id by the electrician. Ducts, hoods and gs were handled by someone else. ever, airflows through a duct, fitting in are affected by how the whole is put ner. Every elbow and fitting adds ance that reduces airflows. Some duct s and screens can put so much resison the end of a straight piece of duct ir flows are reduced to almost noth- simple 4" vent cap, on the end of a ht 6 foot duct run (with no elbows or uct) imposes enough resistance that a ted at 85 cfm (at 0.2" water gauge) lly delivers as little as 30 cfm.

he performance of a ventilation system is dependent on all other components of a house as well. The builder must be familiar with what is required and take charge of ensuring it is installed correctly. Trained ventilation specialists are a new specialty trade that is emerging.

Even when a system is installed, home owners must be shown how it works. The New Home Warranty Program of B.C. & Yukon has been receiving many calls complaints about excessive condensation on windows, odours, etc. In most cases a simple phone explanation resolves the problem as homeowners are instructed how to set the controls so the fan is turned on. Even many R-2000 homeowners are not certain how to maintain the equipment and what correct settings should be. If you install something, make sure the homeowner (or relator) is told how to use it.

## Principles of good design

There are several principles that all ventilation systems should meet.

**Proper fan selection:** Installed fans must be able to move required air flows, (taking into account resistance built into the system). Poor duct layout or fans without adequate capacity will not move much air.

**Equipment must be quiet:** a good ventilation system will run for long periods of time at a low velocity. If the equipment is not quiet, residents will find a way to shut off the fan (can you sleep with the noisy range hood fan running?).

The system should have **automatic controls**, so that it is not necessary to rely on someone to turn on the system.

With many different options available how do you know what is going to work? Is one system better than another? System design must not create undue stress on the house (positive or negative).

*To be effective, systems must be technically sound, cost effective, readily available and easy to install and use by home owners.*

# SA F326 Residential Mechanical Ventilation ystems Standard

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standard for residential ventilation inally been finished. It spells out reements for mechanical ventilation ms in single family, semi- detached ow housing (defined by Part 9 of the onal Building Code of Canada). It is a comprehensive document, the result put of a lot of people in the mechanical building industry, based on the best vledge available at the present. While tandard is not intended for apartments, lation air requirements of these should milar.

s with all Canadian Standards Asson (CSA) standards, it was prepared by a technical committee that included persons from all sectors of the residential building industry, including ventilation equipment manufacturers, contractors, R-2000 program administrators, building inspectors, government and utility representatives.

*The underlying thought behind the standard is the principle that a house operates as a system.*

Most houses have a variety of venting equipment that move air in and out of the house. The leakage characteristics of the envelope, weather conditions, exhaust devices not part of the ventilation system and the venting properties of combustion appliances (including fireplaces) will all affect indoor/outdoor pressure differences acting on the house and thus in turn the performance of combustion and ventilation equipment. CSA F326 considers these as they relate to the whole house, so that ventilation solutions do not create other problems.

Uncontrolled air leakage, natural ventilation through open windows, or other openings operated by the residents are not taken into account. They are not considered adequate to provide fresh air even though uncontrolled leakage through the building envelope will affect and may add to the ventilation provided by the mechanical system (but this will be significant only in the most extreme weather conditions).

The standard spells out ventilation system requirements; equipment and installation requirements (the "how to": workmanship, materials, equipment, insulation