#4609

Residential Ventilation:
How to comply with 1990 Building Code Requirements

The revised 1990 Building Code has requirements for mechanical ventilation. How to comply with the Code?

An overview of the requirements and examples of systems that comply are the subject of a new document that tries to provide how-to information. A preliminary draft, to seek feedback from all sides of the housing industry, is now available for review.

The new Code requirements are not to be considered the last word in residential ventilation. Rather, they should be considered to be minimum requirements.

The How-To manual

The manual is divided into several sections. The most important outline the code requirements and provide seven basic example systems which either meet or exceed the code. These have been grouped by heating system type: forced-air systems and systems without air circulation.

As well, some information on ventilation system components and design and installation options which affect the systems are outlined.

System evaluation should be done with regard to both performance and cost. One cheap to install but that results in homeowner complaints or performance problems is false economy. When selecting a system, the builder needs to consider cost, efficiency, marketability and long term performance as well as the technical aspects of the systems.

There is a lot of usefull information provided about system components and layouts. However, after discussing the principles and options available, the manual does not provide any assistance to the reader how to select an appropriate system for a specific application. A flow chart or map to guide the decision making process can be drawn up, and would be helpful.

Code requirements

The 1990 National Building Code calls for a mechanical ventilation system capable of exchanging the air in a dwelling with outdoor air at a rate of 0.3 air changes per hour (ACH) averaged over a 24 hour period. The calculation is based on the entire heated volume of the house, including basement.

The kind of ventilation system is left open. It may be an exhaust-only, a supply-only, or a combination supply-and-exhaust system. A fan for each bathroom is not needed, nor are there any specific criteria for electrically heated houses.

A continuously operating ventilation system is not required; it can be run by either a manual switch, timer, or an automatic switch such as a humidistat.

Fan Selection and Sizing

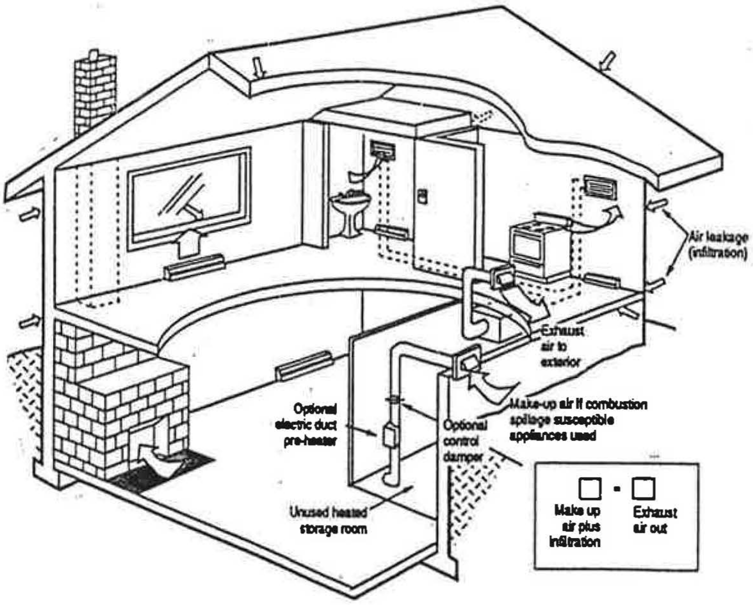
Fans must be rated at least at 25 Pa. to take into account duct resistance, (50 Pa if there are long duct lengths). Quiet fans are recommended (2.0 sones or less). Dryers, central vacuums, cook-top stove exhaust fans are not included when calculating required exhaust capacity.

Make-up Air Ducts

Where exhaust fans are used in houses that have spillage prone combustion appliances (naturally aspirating gas appliances, oil-fired appliances with barometric dampers, all wood burning appliances and fireplaces), a properly sized duct or hole must be included to provide make-up air.

Combustion Air Inlets

Combustion air inlets for fuel-fired appliances are not to supply make-up air requirements unless the inlets have enough capacity to serve both functions simultaneously.



Central exhaust ventilation system for radiant & hydronic heating systems

Complying with the code

Seven ventilation systems which meet or exceed the 1990 Code are described. Each has a schematic diagram, commentary on advantages and disadvantages, installation features, sizing charts and schematic specifications. Four apply to Forced-Air Heating Systems; three to houses heated with electric or hydronic baseboards or Radiant Heating Systems.

1. Point Exhaust Ventilation Systems

This basic system requires the least change from current practice. One or more exhaust fans are required (usually in the kitchen and bathrooms) with a combined capacity to meet the ventilation requirements of the house.

Cost: $300-700. Depends on complexity of ducts and number of fans used.

2. Central Supply with Forced Air Heating

The furnace is used to distribute fresh air through the house. Outside air is ducted to the return air plenum of the furnace where it mixes with indoor air and is distributed to rooms

Airtightness Before:

Before retrofit, the average infiltration rate was 11.4 to 13.5 ACH at a pressure difference of 50 Pascals. (The R-2000 standard is 1.5 ACH at 50 Pascals).

The homes with electric heating were found to have a 38% lower leakage rate than those with gas heating. (Part, but not all, of the difference is likely due to the presence of a flue.) Houses with ductwork had 15% more leakage than those without.

Airtightness After:

After the retrofit work, the air leakage rate was reduced by: 3.9% for the Group 1 houses (owner requested items only); 10% for Group 2 houses (maximum prescriptive items); and 23% for Group 3 houses (the specialists' work).

Cost:

The average WUSU participant in this test requested $25 worth of measures. The effectiveness of the measures varied considerably; some were effective and others did not show any infiltration reduction. Attic ladder covers were ineffective at reducing infiltration (but they appear to be effective as insulation, and could reduce infiltration with some design changes). Sill seal was found not to be effective in the three homes where it was tested.

Installing all possible WUSU measures in a house had a greater effect reducing infiltration. If the homeowner had paid for this work, he would have paid, on average, $230. (costs ranged from $53 to $408 per site).

While the savings achieved by the WUSU work are low (averaging $22/-house), the payback to the homeowner is quick. Spending nine times as much yielded a 3-times increase in leakage reduction. Doing intensive WUSU appears to have a diminishing return. When "maximum WUSU" work is done a lot of it will be ineffective.

The Air-Sealing Specialist's work was, as expected, the most effective method for reducing infiltration (by an average 23%). Significant differences were found in the degree of reduction that could be achieved in gas heated vs. electrically heated houses (the electric houses were tightened more).

As the electric houses in the test were older it was difficult to determine if the Air-Sealing can tighten the typical electrically heated house more than it could the gas heated house.

The Specialist's tools and measurement techniques enabled him to locate many previously unknown leaks in the houses. Many infiltration points were located and sealed, most of which could not be treated using the tools available to WUSU crews.

The cost of the Specialist's work in a full-scale program is ill-defined as standard specifications have not been established. If one assumes that the Specialist's work were to cost about $300 to $400 per house, it would be 12 to 16 times as expensive to the customer as the basic work done in this test. Infiltration is reduced by 7 to 8 times as much as was done with the simpler approach, so the specialists' work is about 7 times as expensive but has the same payback rate.

The Air-Sealing work done in this test was performed by trained crews, much done within the living space, less in attics and basements. (Some firms claim that 90% of their tightening work is done in attics and basements). More training (possibly with other tools such as an infrared camera) might increase the effectiveness, yielding up to a 30 to 40% infiltration reduction as a practical upper limit.

If the lifetime of the sealing work is more than ten years, all approaches tested here were shown to be worthwhile.

Air Quality Measurements

Three pollutants were measured in each home before and after sealing: Radon, formaldehyde and nitrogen dioxide (NO_2). In all houses and for all three pollutants, nearly as many houses showed a decrease in pollutant concentration as showed an increase after sealing.

Air quality measurements indicated that sealing a home does not cause a decrease in its indoor air quality.

"A comparison of Two Weatherization Techniques: NU Seal-up vs The Air Sealing Specialist". Study Conducted by Enercom Inc. Marketing Services Department, North East Utilities, Hartford CT.

No. BS Centre

There are strange things done in the midnight sun
By the men who moil for gold;
The Arctic trails have their secret tales
That would make your blood cold;
The Northern Lights have seen queer sights,
But the queerest they ever did see ......

On September 22, 1990 in Whitehorse, Yukon, far away in the northwestern corner of Canada the Northern Building Science Centre (the No BS Centre) is officially opening.

Guests from other arctic regions in the USSR, USA and Finland, and even Ottawa, are expected for the opening.

The north faces some of the harshest climate conditions in the world. This means that special design and construction practices must be taken into account to deal with northern realities.

Up to now there has been no focal point to deal with northern building issues. Most activity has been coordinated from the South at the NRC in Ottawa and the former Prairie regional station in Saskatoon.

This is about to change as the Northern Building Science Centre located on the campus of the Yukon College opens. It will facilitate building trades training programs, be an information source to the industry and public as well, and help coordinate research and development into northern building issues.

The centre was initiated by northerners themselves. Wayne Sippola, the R-2000 program manager for the Yukon and Yukon Homebuilder's Association executive officer has been a key driving force for the project. It will also house the Yukon Home Builder's Association.

The structure itself is innovative: It uses a rigid monocoque frame developed by the Council of Forest Industries of B.C. The frame is supported on 4 footings rather than a perimeter foundation wall. This allows for foundation movement without damaging the building - an important consideration for buildings built on permafrost.

The structure is "stick built" and uses spruce plywood, spruce dimension lumber, 20 gauge galvanized sheet steel and a large number of power driven nails.