

Building Better

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Eagle's Eye on Housing: Chatting with Bill Crist

When I recently Googled start-up procedures for HRVs, downloaded and read several manufacturers' recommendations, I ended up more confused than when I started.

Some Canadian manufacturers include calculating TVC. Several gave instructions to take readings from both sides, intake and exhaust, and balance to the lower reading. If that's the case, why do the TVC calculation? My thought was that you needed to set the exhaust at TVC and then balance the supply to exhaust rates. Seeking an expert opinion, I contacted Bill Crist, who has provided training in ventilation systems for HRAI. Over several weeks, we had the following conversation via e-mail.

FNNBOA : What is the proper use of TVC calculations in balancing HRVs?

BILL: The TVC (Total Ventilation Capacity) is the high-flow rate, or high-speed capacity, of the ventilation system. If the HRV is intended to meet the TVC requirements, high-speed airflows should be at least 90 per cent of this TVC number. The TVC is calculated based on the number of rooms in the house (rooms such as the master bedroom and basement are allocated 20 CFM each. All other rooms are allocated 10 CFM).

For example, a three-bedroom house with an undeveloped basement the TVC would be:

Kitchen	10 CFM
Living room	10 CFM
Dining room	10 CFM
Master bedroom	20 CFM
Two other bedrooms	20 CFM
Bathroom	10 CFM
Basement	20 CFM
Total:	100 CFM

Any additional rooms would be an extra 10 CFM. So, when balancing the HRV, measure 100 cfm (90 CFM min.) on both the supply

and exhaust side of the HRV. BUT – it is very important that the airflows be balanced within 10 per cent. If, say, the exhaust airflow is 100 CFM, but the supply (fresh air) is only 80 CFM, then the exhaust airflow should be reduced to within 10 per cent of the LOWEST airflow. So, in this case, the exhaust airflow should be reduced to 88 CFM.

Ideally, you should look for reasons why the airflow is below 100 CFM and correct this, but regardless, the airflows NEED to be balanced to within 10 per cent.

If they are not balanced, the following problems could arise:

1. The HRV may not operate efficiently.
2. The HRV core(s) may freeze in cold weather (especially if the supply airflow is too high compared to the exhaust airflow).
3. The house may be either pressurized OR depressurized beyond safe limits.

In your example, the HRV would be undersized, 80 CFM, and the unit would have to be replaced with a higher-rated fan so as to fall within 10 per cent of TVC. My understanding of TVC is that the fan would have to oversized and then the supply/exhaust brought down to fall within 10 per cent of TVC. However, contractors using the NBC would use bedroom counts and rate the fans as between 44 and 64 CFM, in accordance with 2005 NBC Table 9.32.3.3. The HRV would be oversized, and the supply/exhaust would be brought down to fall within that range, thus the existing HRV is fine.

Other suppliers use house-volume size and have a formula to size the HRV. In that scenario, we need to know the square footage of the house, and heights of ceilings.

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President's Message

Holmes on Aboriginal Homes

FNNBOA attended the World Indigenous Housing Conference in Vancouver last spring. Attracting indigenous leaders from across the globe, the conference showcased best practices in the areas of Health and Housing, Capacity Building, Disaster Preparedness, Governance and Partnerships. At our tradeshow booth we met and talked with representatives from New Zealand, Australia, and the United States, and re-acquainted with our friends from across Canada.

Perhaps not surprisingly, the barriers to providing adequate housing were familiar to us. Inability to access mortgages, lack of qualified tradespersons, overcrowding and social issues were common themes. Our good friend Deb Taylor was there, promoting the First Nations Market Housing Fund, as were the folks from the Frontiers Foundation, showcasing their *Standing Tree to Standing Home initiative*.

Mike Holmes, "Canada's most trusted contractor," was there as well. Besides presenting at the conference, Mike lent a hand to promote better building systems at a tradeshow booth. I took the initiative to introduce myself to Mike as he was signing promotional materials. He was as advertised: friendly, with a firm handshake and an engaging smile. Mike is working on several aboriginal projects, the most notable being the *Building Homes and Building Skills* joint pilot project in Atikameksheng Anishnawbek, with the AFN, and the Boyle Renaissance project in Edmonton, with the Métis Capital Housing Corporation. Knowing this, I asked Mike what he thought when he discovered that you do not require building permits in First Nation communities.

Mike Holmes has found great success since the first *Holmes on Homes* TV shows. I have to admit I was a fan. Similar to *This Old House*, the shows

featured renovations where problems were found, and demonstrated how the problems were resolved.



How you use fame speaks loads about the character of an individual. Mike has used his fame to speak out about shoddy construction, disreputable contractors and poor inspections. He has given back to the community through initiatives supported by the Mike Holmes Foundation. He continues to improve housing sustainability by promoting green technology with several projects across Canada. His *Holmes Approved Homes* program ensures that regional home builders *Build it Right®*. He was recently listed as the third most trustable celebrity by *Forbes* magazine.

Alas, our community contractors are not so trustworthy. Our news release entitled "*Disposable Housing*" pointed out that homes built on reserve are not lasting as long as off reserve. Many homes require major renovations after five years. Our kids are living in overcrowded, mouldy houses. This is due to many factors, however, our research on life-cycle costing found that non-compliance to codes, poor workmanship and lack of quality-control measures, such as mandatory inspections by certified inspectors, were contributing factors.

Over the years, we have stated that the solutions to these problems are complex, and start with creating a regulatory environment whereby risk-management measures, such as where inspections to community standards are enforceable, and best practices are adopted through specifications that meet community needs.

The advice that Mike gives though *Holmes on Homes* is applicable in our communities:

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- Get a permit.
- Hire a professional: Have the electrical, heating and plumbing work done by a competent tradesman.
- Never do work on a handshake. Sign a contract for all work being done.
- Never pay up front. If the contractor wants money up front, run away from the deal.

Following these simple axioms protects the homeowner's investment, and ensures the work is done to the satisfaction of the homeowner. Better yet, they don't cost a dime. Sadly, failed, disposable housing is often the result of using amateur contractors not under contract. These bad practices are resulting in premature deterioration of our housing stock.

Mike Holmes was surprised to learn that you don't need a permit to work in our communities. I wonder what he would say if I told him you don't need a contract either?

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FNNBOA: Thanks for responding. As a First Nations Building Officer (FNBO), it is important to know how to size HRVs. What I really wanted to know is: What is the industry standard? Worst-case scenario? You would have to follow manufacturers' recommendations, and the FNBO would have to review each installation individually.

Bill: Yes, you are right: If the measured ventilation rate is lower than the TVC, then this SHOULD BE CORRECTED. It can sometimes be corrected by better duct design or better duct installation (larger duct sizes, fewer elbows and restrictions etc.), or it may require a larger HRV or supplemental fans to meet the minimum TVC.

In my opinion, the TVC room count method (CAN/CSA F326) is the most appropriate ventilation standard for your homes. I would recommend that you specify this standard when dealing with HVAC contractors. The house-volume method of calculating the ventilation rates is not commonly used anymore. Where there is high occupancy, the ventilation rate should be increased – so even the room-count method may be result in under-ventilation if there is higher than average occupancy in the house. If there is a likelihood of higher-than-average occupancy, the designed ventilation rate should be increased accordingly.

It is also my view that issues with ventilation cannot be addressed by Minimum Code Compliance. Ventilation rates, whether using the NBC or the CAN/CSA F386, fail to recognize an over-crowded house. If using the NBC table, the determining factor is the bedroom count, which assumes one person per bedroom, except the master bedroom. The F386 uses a room count but again fails to recognize over-crowding. It would be better to use the National Occupancy Standard, which determines the number of bedrooms needed:

- No more than two or fewer than one person per bedroom
- Parents do not share a room with children
- Permanent household members aged 18 or more (except couples) do not share a bedroom
- Permanent household members of opposite sex aged 5 or more do not share a bedroom

FNNBOA: Under this standard, the following family example would require more than three bedrooms, and the ventilation rates would need to be increased.

John Cardinal—Father
Suzanne Cardinal—Mother
Tracy—19
Ken—15
Jim—12
Bob—5
Mary—3

John and Suzanne share a room. Tracy gets her own room. The boys can share a room. Bob and Mary can't share a room, thus Mary gets her own room and Bob shares a room with either Jim or Ken.

Thus the ventilation rates should be based on a five-bedroom house, which is above the minimum standards assumed by both the NBC and F326.

Your thoughts?

BILL: In my experience, a "typical" home may have three bedrooms on the main level and the equivalent of three bedrooms in the basement. Based on this, Section 9.32 of the NBC basically states that if the dwelling unit has more than five bedrooms, the ventilation system should comply with CAN/CSA-F326. So, I would recommend that the system be designed to meet F326 AND be sized based on the MAXIMUM number of bedrooms that may be devel-

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oped in the basement area – not just the typical three bedrooms on the main floor.

This would usually result in the following:

Three bedrooms on main floor = 40 CFM
Kitchen, living room, dining = 30 CFM
Minimum of one bath on main = 10 CFM
Three bedrooms on lower level = 30 CFM
One bath on lower level = 10 CFM
Recreation/undeveloped remainder = 10 to 10 CFM
Total Ventilation Capacity (F326) = 130 to 140 CFM

This TVC is considered the "minimum amount of outdoor air the ventilation system shall be capable of providing." On a typical 1000 to 1200 ft² bungalow, this would translate to 1/3 to 1/2 air change per hour IF THE SYSTEM IS OPERATED AT THE TVC. The bigger issue is making sure that the ventilation system is used properly. This means that it needs to be designed and installed so that the occupants will use it. Often I see these systems shut off when I do a site visit. If the system is designed (with proper controls) so that it is not noisy or uncomfortable AND does not use excessive energy, people will use it – AND the above rates (CAN/CSA F326) will be adequate. The house should also have a quiet, outside-venting range hood.

In summary:

HRVs should be sized using:

- CAN/CSA-F326-M, "Residential Mechanical Ventilation Systems,"
- NOS to a maximum of three additional bedrooms in basement

Improperly sized HRVs can result in:

- poor air exchanges
- high humidity levels resulting in mould
- uncomfortable homes

HRVs should be balanced:

- using F326 to determine exhaust rates
- exhaust air must be within 10 per cent of incoming air

In cold climates, the following considerations should be taken into account:

- Incoming air may need to be tempered to prevent frost build-up

In coastal climates the following consideration should be taken into account:

- An Energy Recovery Ventilator may be better
- Consideration should be given to installing de-humidifiers
- Interior surface temperatures should be kept above 15 C

To be effective, HRVs must:

- be subject to a maintenance regime that includes regular cleaning of filters, ducts and insect screens
- be re-balanced every second year, or when there is a change in occupant loads or renovations that add rooms
- not be disabled
- not be used as the primary fan for removing moist air from bathrooms, kitchens or high moisture areas

You have itemized some good points. I won't attempt to address them all here, but just a few comments:

1. I would suggest including a MINIMUM (not maximum) of three bedrooms in the basement. There could be more depending on the size of the basement.
2. The HRV exhaust CAN be considered as the PRIMARY exhaust for bathroom; you do not need additional bathroom fans if the exhaust grille and duct from the bathroom to the HRV are sized properly, the HRV is sized properly, AND the controls include a timer or switch in the bathroom that operates the HRV on high speed when needed. The HRV exhaust can also be considered the primary exhaust from the kitchen, but I would recommend ALSO installing an outside-venting range hood, as I mentioned previously. The HRV exhaust grille in the kitchen must have a grease filter, and should be at least four feet away from the range. The range hood will handle "extreme" situations (eg. burnt food, frying-pan smoke), and also times when say canning is being done and excessive humidity is being produced. Otherwise, the HRV exhaust will be the primary exhaust system for the kitchen and will operate continuously. Most occupants will not run the range hood for very long because of the noise.