

Gord Cooke is a professional engineer who has spent 20 years helping builders and HVAC contractors implement innovative technologies into high-performance homes. He has particular expertise in IAQ and air flow management in houses, and can be contacted at gcooke@airsolutions.ca.

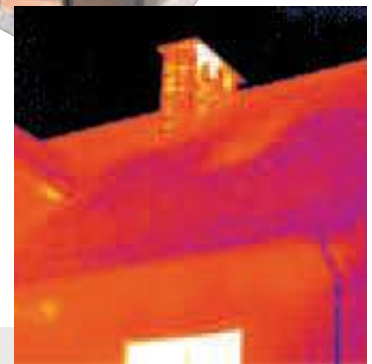
Redefining CAPACITY requirements

For more than 20 years I have been wondering and asking why, when doing a heat loss or heat gain calculation for a house, designers have been directed not to consider or include the performance of a heat recovery ventilation system.

Similarly it always seemed a bit inadequate to try and describe the likely air tightness of a house with some simple subjective characteristics such as “average” or “very tight”, especially when the air leakage component of the final result might be as much as 30 or 40 per cent of the total. The answer is, of course, it was the best we could do with the information available at the time.

Well, I am pleased to report that the new *CAN/CSA F280 Standard Determining the Required Capacity of Residential Space Heating and Cooling Appliances* is now here. It will replace the 1990 edition, and I think all readers will appreciate that there have been a lot of changes in housing technology over the past 22 years that can now be more accurately reflected in this new standard.

Let's have a look at some of the important features of the new standard, and the impact it will have on the sizing of heating and cooling equipment for Canadian homes.



Sizing limit REMOVED

One interesting and hotly debated aspect of the new standard is the removal of the clause in the existing standard stating, “Heating system capacity shall not exceed the total building heat loss by more than 40 per cent.”

Notwithstanding the concern that inexperienced designers and contractors may feel compelled to add unneeded capacity without this restriction in place, it was felt that greater flexibility in system design was needed to respond to the reality of new homes and the expectations of homeowners.

For example, consider a very efficient new home with large areas of glazing on the east and west orientation of the building. A designer may wish to install two HVAC systems – one serving the east side, one serving the west side – to react to the intermittent losses and gains from those windows.

Combined, the capacity of the two systems might exceed the 140 per cent over-sizing limit. And yet, at any point in time, only one system may be operating to ensure the proper comfort levels in all parts of the home.

It is expected that the new HRAI Digest will provide direction to designers and contractors to ensure appropriate sizing decisions are made.



ACCURATE AND REPEATABLE

The bottom line of the new standard is that it will provide HVAC designers and contractors with a more accurate and repeatable equipment sizing guide. It will take some getting used to, of course, as contractors recalibrate their long-standing rules of thumb for sizing.

For example, consider the results for a typical new two-storey, 2,450 sq. ft. home with a winter design temperature of -20°C and a summer design temperature of 31°C. Assuming that this new house is an Energy Star qualified home (with a specific air tightness target) and employing a heat recovery ventilator, here's how the numbers stack up:

	Total Heat Loss (BTUH)	Air leakage component of Heat Loss (BTUH)	Total Heat Gain (BTUH)
Current CSA F280	57,646	13,685	32,450
New CSA F280	34,665	5,049	26,750

Of course, this is just a quick example, without listing all the parameters of the house, but are you ready to consider a 40,000 BTUH furnace for a 2,450 sq. ft. home?

The air leakage component has been shown specifically to show that the single biggest change (at least for a new home) in the new standard is the way natural air leakage is handled.

Incorporating LEAKAGE and VENTILATION

Undoubtedly, the biggest change in the new heat loss/gain calculation is the way air leakage and ventilation is handled. There are four important features to the new standard in this regard:

1. The calculation method can now accept objective air tightness indicators such as blower door air tightness tests. This will be important in both new and existing homes where energy audits or specific air tightness targets have been verified by site testing.
2. The interaction between different types of ventilation systems and air leakage is accounted for. For example, a home with an exhaust-only ventilation system creates a slight negative pressure that changes the leakage patterns in a home. The new standard makes allowance for this.
3. In the old standard, the total heat loss for the building was assigned to individual rooms as a function of the heat loss of that room. In the new standard, recognition of the stack effect (warm air rising) in a home will mean that the assignment of air leakage heat loss will be a function of the floor level of specific rooms. In other words, rooms on the first floor of a home will be assigned a greater portion of the air leakage component.
4. Finally, the new standard will allow designers to take credit for the impact of heat recovery ventilation devices employed in a home.

These features will be incorporated into a spreadsheet embedded in the new standard. The algorithms in the spreadsheet are based on the Alberta Infiltration Model (AIM-2), which was first used in the HOT2000 program.

A second similar embedded spreadsheet approach will be used to update the calculations of heat loss from the foundation of a home. This new foundation approach accepts a much greater range of basement configurations and insulation methods now commonly used in new and existing homes.

Designers will also now have a much wider choice of window types to select from to reflect the significant change in window technologies now available. Specifically, the U factors and solar heat gain coefficients reported by manufacturers in their CSA A440 compliant labeling can be directly input into the calculations.

More changes to come

With the standard being published this month, there is still work to do. The Heating Refrigeration Air Conditioning Institute of Canada (HRAI) initiated the development of the new standard and now will be revising the HRAI Digest to incorporate the features of the standard.

Housing authorities and building code officials will have to formally adopt the new standard to enable designers and contractors to use it in new housing applications.

Software programs, such as Right-Suite HVAC Automated Design software, will have to be updated.

Despite the challenge of all of these pending adjustments, this is a very positive change for our industry. For many years, it has been generally accepted that systems have been oversized, and the old F280 Standard facilitated this over sizing with its conservative approach to air leakage and ventilation.

The new standard employs more objective measures of air tightness, window performance and basement configurations and will empower contractors to rationalize both the size of equipment and distribution systems in both new and existing homes.