

Insulation plus air leakage control improves comfort and savings.

By Steve Tratt, Sales Manager, Zerodraft

Why insulate a multi-unit building? To keep the occupants warm in winter, cool in summer, and energy costs under control. That much is obvious, says Steve Tratt. But his 21 years' experience in the insulation business has taught him that you can achieve all of these far more effectively if you don't only insulate, but also control air leakage.

So why isn't insulation enough?

Because it is not designed to provide all the benefits that building owners and managers need in terms of thermal comfort and energy efficiency. Insulation simply reduces the transfer of heat and noise. It reduces the amount of energy needed to thermally condition space, but only to a limited degree.

Although they do not expect insulation to achieve much more than these two objectives, management responsible for condominiums would really like to achieve far more from envelope improvement. Items on the wish list might include:

- Fewer occupant complaints about a variety of comfort problems, including thermal, noise, pests, dirt, odours and cigarette smoke
- Greater energy cost savings
- Better quality indoor air
- Less condensation
- Less building deterioration, especially brick spalling and efflorescence
- Fewer safety risks from falling masonry and cladding and ice damming
- A building in which the environment is easier to control, either manually or with a building automation system.

The good news is that with a combined approach to insulation and air leakage control, condominiums can benefit from considerable improvement in all these areas.

How does air leakage control contribute to comfort and savings?

If we accept that insulation is going to reduce heat transfer through large areas of walls, floors and roofs, we have to look at the other ways in which heated or air-conditioned air and expensive energy are wasted.

The building envelope for both high-rise and low-rise condominiums should ideally be a monolithic shell, created with a continuous air barrier system that prevents uncontrolled inflow and outflow of air. In most buildings it doesn't come close. The result is a free passage for expensively conditioned air.

Unfortunately the damage is not only reduced thermal comfort and wasted energy; the air passing through holes, gaps, cracks and leaks in the envelope, carries corrosive contaminants that it deposits on various construction elements. The result is early decay, visual deterioration and even bits falling off buildings.

In low-rise condominiums there are many examples of roof damage caused by ice damming. This costly problem is directly caused by inadequate air leakage control of the vertical pathways between living space and attic. It also presents a danger to people outside the building.

Repairing attics with ice damming problems involves air leakage control and added insulation. The energy-saving benefits are significant. In Ontario, Enbridge Consumers Gas offers cash incentives for ice-damming remedial measures as part of its demand management program.

Other factors contribute to the flow of air. These include: stack or chimney effect – the tendency of warmer air to rise through buildings and out through available holes at the top; wind effect; and the pressure of centralized mechanical HVAC systems.

Air finds any way it can to travel through the building. Vertical pathways in high-rise buildings include elevator shafts, garbage chutes, stairwells, and a variety of electrical, plumbing and communications penetrations between floors. In low-rise condominiums, vertical penetrations are very common, especially between the living space and the attic.

Wherever a roof meets a wall there is likely an entry or exit for air. When operable openings such as doors, windows, fire doors, access hatches, vents and ducts are in the closed position, they are expected to be fully closed, but rarely

are. Ventilation is critical, of course, but it should always be provided in a controlled manner, never by accident!

Air leakage control is about sealing all of these pathways. Done properly, it will contribute significantly to comfort and cost savings.

What materials and techniques are used for air leakage control?

There are many different materials used in air leakage control. Where possible it makes sense to combine insulation and air leakage control at the same time. Fortunately the growing range of insulating air sealants based on rigid polyurethane foam technology has helped us provide an economic way of doing so.

Rigid polyurethane foams provide thermal insulation and control air leakage thanks, among other qualities, to their low air permeability and high 'R' value. In their air leakage control role they act as a high performance component of a building's air barrier system. This requires:

- Continuity throughout the building envelope
- Ability to fasten to supporting structures (self-adhesive)
- Ability to resist peak wind loads, sustained stack effect, and pressurization from ventilation equipment
- Virtual air impermeability
- Durability and long service life.

Polyurethane foams are available in one- or two-component formulations:

One-component polyurethane is an insulating sealant consisting of a single mix of two ingredients in one pressurized can or tank. It is used for sealing smaller cracks and leaks in the building envelope, perhaps under windowsills or around small service penetrations. The material is ejected from the container as a sticky bead. It cures quickly when exposed to the moisture present in air.

Two-component polyurethane contains the same ingredients, but they are kept apart until application. Curing is much faster than with one-component because the process needs no air or moisture. This foam is used for larger holes and gaps, especially roof wall joints.

Other air leakage control, or weatherization materials, include a variety of weatherseals and weatherstripping available in pile and clad foam designs. There is also foam tape for use in certain small applications.

Critical to successful retrofit air leakage control is the process of identifying and measuring air leakage in a building. The first step is to create a pressure difference between the interior of the building and the outside in order to generate abnormal air movement through the leaks. This pressure difference can be created using a centralized mechanical system or with a large depressurization fan installed in the main ground floor entrance. Next, a 'smoke-generating' device is used to identify the location of the leaks.

What is the return on the investment?

Payback on simple insulation has never really measured up to the demands of accountants and controllers. Government grants and improved comfort together added up to some kind of justification. Air leakage control has added enough economic and 'soft' benefits to insulation to make a combined approach extremely rewarding.

In the multi-unit residential sector, occupants in many Canadian buildings have enjoyed improved quality of life at the same time as owners have enjoyed the benefits of reduced energy costs, longer building life, lower maintenance costs and fewer comfort complaints.

In two multi-unit towers in West Toronto, an air leakage control retrofit program consisting of weatherstripping doors and windows, using polyurethane foam behind baseboards, air sealing the doors on the mechanical penthouses and reducing the size of the openings for the elevator cables added up to considerable reduction in both energy usage and energy demand. For electricity users, reduced demand charges are often a major financial reward.

Currently, major retrofit projects are underway in 100-plus-unit low-rise condominiums in both the U.S. and Canada. The reason? To prevent further damage from ice damming.

Insulation plus air leakage control equals better buildings

If condominium management decides to add air leakage control to its insulation requirements, it is likely that the return on investment will be faster, that individual owners will be more content and that the structure will exceed its current life expectancy. Healthy, safe, durable, comfortable and energy-efficient buildings are worth the effort.

Steve Tratt is Sales Manager for the Zerodraft Division of Canam Building Envelope Specialists Inc, Mississauga, Ontario. Zerodraft offers an extensive line-up of materials and equipment for insulation and air leakage control. www.zerodraft.com. 905-890-5866 or 1-877-272-2626.