



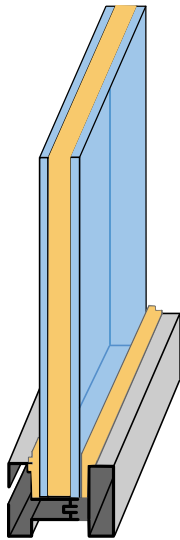
# Throw-away Buildings

## Thermal Window Failure: How it Happens

Virtually all glass condominium towers feature window wall systems (floor-to-ceiling walls of glass) enclosing the entire facade.

Window walls yield spectacular views, but owners who buy a condo unit for the view may not realize that they're relying on a couple of panes of glass separated by less than an inch of insulated space to protect them from the elements.

That insulated barrier will degrade over time, even as energy costs increase. On some buildings, five per cent of the thermal windows may have failed before they're even delivered to the construction site. Another 10 - 15 per cent will fail by the 20-year mark as they're exposed to the physics of heat expansion. By the 25 year-mark, a growing number will fail every year. Here's how it happens:



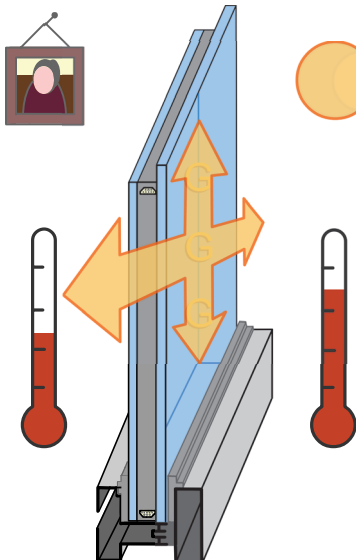
### Insulating gas is sealed between glass panes

Insulated glazing technology, commonly known as double glazing, considerably improves the thermal efficiency of the window units used on older buildings. It consists of two and sometimes three panes of glass separated by a system of spacers and seals. It is that separation - not the glass - that provides the window with its primary insulating value.

The space between the panes is often filled with a heavy gas such as Argon or Krypton. Colourless and odorless, inert gasses don't easily allow air to pass through.

In fact, Argon gas conducts 67% less heat than regular air, thus helping to keep building interiors cool during the day and warm at night.

The seals that trap the gas between the panes of glass are clamped in place by aluminum frames which interlock with the adjacent frames, all of which are attached to the building itself.



### Heat expansion damages seals

During the day, the sun's heat causes the exterior surface of the building to expand and contract while the interior surface remains relatively constant.

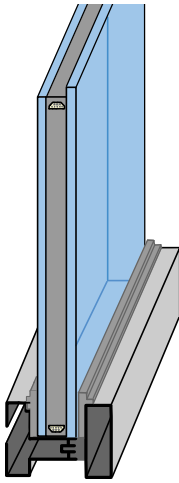
Windows are designed with a certain amount of "give" to help withstand this uneven expansion.

But over time, the continual expansion of the glass panes and aluminum frames puts stress on the window seals.

The seals begin to break down.



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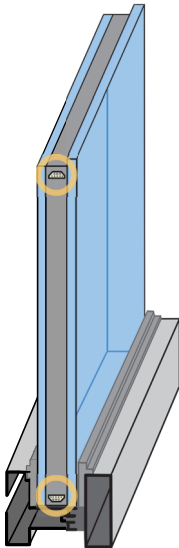
As the window seals deteriorate, the inert gas that is responsible for most of the window's insulating value escapes from the window unit.

Because the gas used in thermal windows is colourless and odourless, you won't be able to see that the window seal has failed.

Building scientists can detect the failure by shining a laser beam through the window, and measuring the changes to the amount of light that emerges on the other side of the glass.

Although the escaping gas will change the window's thermal rating (from R-4 at the centre of the glass for a middle-of-the-road unit, to R-2.5 (R standing for thermal resistance), the more annoying problem will come as the window unit begins to fog up.

Additional methods of analysing the thermal performance of windows are described in Mario D. Gonçalves and Robert Jutras' presentation at the 2007 Symposium on Building Envelope Technology. [View Report](#) [954KB .pdf]



### Failed windows

The problems will be disguised for many years because the window frames are packed with desiccants - moisture-absorbing crystals. You've seen those tiny envelopes in the box for a new pair of shoes? It's the same principle - they help absorb moisture during shipping and storage.

In the case of the window units, the aluminum frames are packed with strips of desiccant (circled left) to absorb water vapour. Desiccant plays a major role in keeping the glazing unit dry for the expected service life of the window unit.

However, moisture entering through the seals will eventually overwhelm the desiccant, creating fog in what was once a dry space.

You may not even realize your unit now requires more energy to heat and cool if the interior temperature is controlled by a thermostat. But you will certainly notice the foggy glass.

For owners who aren't aware that the expected service life of the window unit is a fraction of the life of the building as a whole, this may also be something of a

surprise.

For the first few years, the cost of replacing window units one at a time in individual condos will be annoying but not very expensive.

However, at the 25-year point, as a growing number of window units fail, or if many of them fail earlier than expected, the condominium corporation will want to consider a complete replacement of the facade.

Rising energy costs add pressure to make these changes to reduce the building's energy use.

For further reading on the choices that affect the service life of condominiums, see University of Toronto Professor of Building Science Ted Kesik's paper [The Condo Conundrum](#). [250KB .pdf]