

Large Building Testing with Retrotec High Power Door-Fans

- the story of High Rise Energy and Air Quality Diagnostics

Large High Rise Buildings in cold climates suffer the serious consequences of some basic physics. In cold weather, warm interior air wants to rise. Warm air from the first floor will apply a tiny pressure against the ceiling and will flow up to the next floor through whatever holes or cracks that may be there. The larger the area of these holes, the larger the airflow. The designer and builder hope that there are no holes but they magically appear through vertical pipe chases, elevator shafts, stairwells, wiring penetrations, pipe penetrations and the like. Measurements of these holes indicates they are often several square feet in total area?

As the air rises from floor to floor it gathers momentum until it reaches the top of the building where it begins to escape. To make this work there must also be holes in the exterior shell which will allow cold air in at the bottom, freezing the occupants and even the pipes sometimes. This causes those occupants to turn up the heat which makes the “chimney” effect in any high rise run even faster.

This hot air rising causes the occupants of the upper floors to become very hot, forcing them to open windows to cool down which makes the chimney even faster, forcing bottom floor dwellers to turn up the heat even more. As so it goes until the “chimney” is blasting so strongly that it may even become difficult to open the ground floor door.

In cold climates, huge amounts of cold air are drawn in at lower levels. When heated this air is very dry, even when it is raining outside! This causes health problems such as cracked lips and sinuses and forces occupants to evaporate water into the “chimney” to keep it moist. Some of this moisture may push its way through walls as it leaves on the upper floors where it condenses against the cold surfaces on the way out causing familiar moisture problems; mold mildew and the like.

Chimneys, exhaust fans ducts all become players. As pressures in the individual apartments increase, they become candidates for cold air entry or warm air removal: adding to the chimney. Since underground garages are at the bottom of buildings the exhaust from cars gets sucked in through the bottom part of the building, creating increased indoor pollution. Along with this polluted stream, cooking and smoking odors in subsequent apartments adds to the brew.

Building Science Engineering Version

Large High Rise Buildings in cold climates suffer the serious consequences of some basic physics. Stack drives air vertically through the building, being slowed by slab to slab tightness. A new automated high power door fan diagnostic process to accurately measure slab-to-slab leakage will go a long way pinpoint problem areas so they can be fixed before occupancy. Similarly, leakage to the outdoors from individual floors can be measured as the building is being constructed, allowing for remediation and learning about construction defects as the building rises. Party walls between adjacent apartments can be isolated and measured to reduce noise and cooking odor complaints. Installed kitchen and bathroom fan performance can be tested for adequate flow with the same equipment. Add rain penetration, pressurized hallway & stairwell and infrared testing amplification and you have a powerful diagnostic package that should catch most of the air quality and energy consumption problems in high rise buildings. Not to mention mechanical system

longevity and maintenance issues that can be tested in advance of installation. (stairwell and hallway pressurization capacity, smoke containment systems).

	Building component	Energy	Air quality	Longevity	safety
1	ETS testing of one hotel room's envelope. All 6 sides at once.		yes		
2	Measuring the leakage of each side of an apartment separately	yes	yes	Yes. Uncover moisture flow pathways	Yes, fireplace back-drafting, exhaust fan effectiveness
3	Garage ceiling leakage allows exhaust gases to invade all buildings		Yes, car exhaust a huge complaint		Yes, car exhaust a huge complaint
4	Horizontal slabs	Yes. Slab leakage promotes stack driven flows	Yes. Stack drives indoor pollutants		Yes. Stack drives smoke in fires
5	Party Walls		Yes, Cooking odors and noise		
6	Stairwells				Yes. They all leak badly making them poor exit routes.
7	Elevator Shafts	Yes, piston flow with leakage to adjacent apartments drives energy losses	Yes, piston flow drives IAQ problems		
8	Exterior Shell. 90% of all UK commercial buildings are tested using Retrotec high power fans that were purpose built for that job.	Yes. Measuring one floor at a time allows leaky floors to be located and fixed.		yes	
9	Rain Penetration testing at -75 Pa to -300			Yes. Uncover moisture entry	

	Pa is common			points	
10	Infra-red testing of exterior shells	yes	yes	yes	yes
11	Stairwell Pressurization systems can be sized correctly prior to installation often saving \$1000s.				yes
12	Hallway Pressurization systems can be sized correctly				yes
13	Exhaust Fan installed performance can be quickly measured directly.		Yes, seldom do exhaust fans perform well		
14	Exhaust Ducts leakage can be quickly measured directly.	Yes, back-draft dampers can be checked			yes

The Retrotec High Power Fans can go down to 4 cfm, be controlled to zero pressure to measure the exact flow of a bathroom fan. Or be combined, using one fan per floor, to measure the leakage of an entire high rise with 3 fans. A complete picture of the building can be made, taking about one hour per floor that will tell you the leakage of every component: each floor slab and exterior wall sections of each floor. With a bit more time, each apartment or vertical component (stairwell, chase, and shaft) can be measure separately. Additionally, the same equipment can be used with Infra-red equipment to magnify the effectiveness of any camera.

These are a few ideas I have come up with for applications for the one piece of equipment.

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