General Guarded Blower Door Testing Guidance

Options for blower door testing of multifamily buildings is in a way similar to testing ductwork for air tightness. Those of you that test ductwork know that there are two ways to do a test; total leakage and leakage to the outside. During a total leakage test you pressurize the ductwork and depending on the configuration of the ductwork, some air may be blowing to the outside and some air may be blowing to the inside of the building. With a duct leakage to outside test, a blower door is used along with the Duct Blaster® to bring the building and the ductwork to the same pressure. Because the building and the ductwork are at the same pressure there is little or no leakage between the ducts and the building during the test, so the leakage you are measuring is to the outside. When you are testing multifamily buildings, you also have two options. You can test the total leakage or compartmentalization of an individual unit or you can measure the leakage to outside.

Total Leakage / Compartmentalization

There are a lot of advantages to compartmentalizing a multifamily unit. If a building enclosure is made very airtight and no attention is given to tightness between units, you will be sharing sounds, odors, pollutants like formaldehyde or tobacco smoke with your neighbors. Studies have shown that ventilation systems are much more effective if units are compartmentalized.

If proper attention is paid to air sealing units and sealing chases from floor to floor, you can greatly reduce the wind effect and stack effect. If you think about a strong wind blowing on one side of a building, it has to leak from the unit to a hallway and then from the hallway to the next unit before it can leak outside. Air sealing between units and between floors actually reduces how wind and stack effects air movement through the building.

Leakage to Outside

Sealing between units can result in reducing the wind effect and stack effect, but the largest impact on energy usage is due to air leakage that will occur at the enclosure exposed to the outdoors. There are three basic approaches to testing air leakage to the outside; test the entire building as a single zone, test a single unit with all adjacent spaces at the same pressure or test a single unit with the entire building at the same pressure.

Testing for Total Leakage / Compartmentalization

The Total Leakage test on an individual unit is not much different than testing a single family detached building, but there are some complicating factors. For this to be a repeatable test the building should always be set up the same way. So the question becomes: do you open the adjoining spaces to the outside, close them to the outside or leave them as you found them. The test will not be very repeatable if you leave them as you found them. You are measuring the CFM50 of the unit, so it makes since for all sides to see 50 Pa. This would require you to open adjacent spaces to the outside. If you are following a protocol or a standard, see what it recommends. At a minimum, you should document how the building was set up for the test.

Testing for Leakage to Outside - the entire building as a single zone

Again, testing the entire building as one zone is not much different than testing a single family detached building, but there are some complicating factors. If the building has common interior hallways, you would open the doors between the common hallway and all of the units and open all interior doors inside the units and run the test. You will need to have control of all the mechanical systems in the building. If the units do not have doors to a common interior hallway you would need to set up a blower door on each unit and run all of the blower door fans to the same induced pressure at the same time. This can be done using the TECLOG3 software. There are two strategies to do this in a repeatable way: run exterior reference tubing from each unit to a common location and induce a pressure of 50 Pa above the baseline reading for each unit **or** reference to outdoors on one primary unit and run reference tubing from each unit to the primary unit and bring all units to the same pressure as the primary unit (cruise 0 Pa.). This is similar to doing a duct leakage to outside test.

Testing for Leakage to Outside - test a single unit with all adjacent spaces at the same pressure

This test will be practical for a row house style townhome or garden style units that do not share common hallways. Like was mentioned above, there are two strategies to do this in a repeatable way: run exterior reference tubing from each unit to a common location and induce a pressure of 50 Pa above the baseline reading for each unit **or** reference to outdoors on one primary unit and run reference tubing from each unit to the primary unit and bring all units to the same pressure as the primary unit (cruise 0 Pa.). This is similar to doing a duct leakage to outside test.

Testing for Leakage to Outside - test a single unit with the entire building at the same pressure.

This test will be practical for multiple story buildings with common interior hallways where you need to know leakage to the outside for a HERS rating. For example, if you were testing a common hallway unit with adjoining units on each side and one above and below, you would need to set up at least five blower doors to cover all the adjoining spaces. You would need to move multiple blower door fans with each successive unit tested. It would likely be easier to set up a multi-fan blower door system and depressurize the entire building and run a blower door (or Duct Blaster fan) on the single unit to get it's leakage to the outside. A 36 unit apartment building with 1000 square foot units can be tested to meet 3 air changes per hour with a 3 fan blower door system. Once the 3 fan system is up and running, it would be easy to move from unit to unit with a single fan system to test individual units.

Follow a test standard or protocol

It is always a good idea to follow a recognized test standard or protocol when performing a blower door test. A test standard will give detailed information about what pressure to test at, how many data points are needed, how to calculate accuracy and precision of the results, how to do corrections for air density, accuracy requirements of the equipment, and sometimes it will include information about preparing the building or intentional mechanical openings for the test. Examples of commonly used standards are ASTM E779, ASTM E1827, and CGSB 149. Protocols typically give instructions on how to set up a building and intentional mechanical openings and perform a test and will reference a test standard. Examples of protocols are RESNET, BPI, US Army Corps of Engineers, and ones found in blower door manuals.