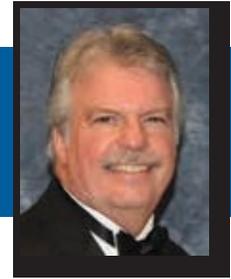


# Building Enclosure Testing: An Essential Aid in Sustainable Building

Frank Spevak | The Energy Conservatory



Building enclosure test using two Minneapolis Blower Doors.

Commercial building tenants and owners spend millions of dollars every year conditioning air to provide a comfortable living and work environment. Because this is a costly necessity, we want to make sure buildings are as energy efficient as possible. One way to improve efficiency is by testing the building for air tightness to determine where and how much air regularly leaks through the building's envelope and then sealing the various cracks or vents in the wall and roof structure. Building enclosure tests also ensure a building complies with increasingly strict standards for sustainability, such as those set by the International Energy Conservation Code (IECC).

## What Is Building Enclosure Testing?

Building enclosure testing, also referred to as air tightness testing, is a quantifiable value that determines the ability of a building to retain air. This testing process serves several purposes:

1. To design a pressure management solution or resolve a problem caused by unplanned airflows in a building,
2. To find air leaks in existing buildings or during the installation of air barriers in buildings under construction, and

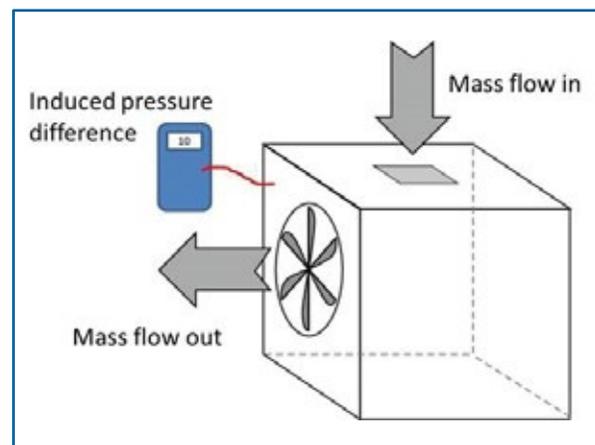
3. To check for compliance with state regulations.

Think of a building as a box that is placed outside. When a box is sealed on all edges, no air goes in or out. The desire is to keep the air inside the box perfectly conditioned at 72 °F, even though the temperature outside the box varies from below zero to more than 100 °F. To keep the box at 72 °F, it needs a cooling or heating mechanism and a fan to distribute the conditioned air. (Remember, this is a really large box.) If we have a small box with small holes or no holes and a large fan, then it is inefficient to condition the air because the fan and conditioning costs more money than is required to maintain proper conditions. Likewise, if we have a small box with a lot of holes, we have

to use a large fan to condition the air because it constantly leaks.

The ideal situation is to have a large box with minimal holes and a small fan. This makes conditioning air efficient because we are using the smallest fan required to maintain air temperature inside the box.

The goal of building enclosure testing is to provide information on the leakiness of the enclosure to contractors, archi-



A simple example of a blower door test. A fan exhausts air from an otherwise airtight box with a single hole in the box.

itects and designers so they can appropriately determine if the HVAC systems can meet the building demand. This also aids in determining building code compliance. The result from a building enclosure test is a number, usually expressed as the amount of airflow at a specific building induced pressure value, e.g. 6,000 cubic feet per minute (CFM) at 75 Pascals (0.3 inches of water column). But this number by itself is of little value until we compare that to the building. When taking into consideration its size, volume and surface area, we can calculate a leakage value in CFM per square foot of floor space, air changes per hour, or the amount of leakage per square foot of the surface envelope or enclosure of the building.

### Planning for Air Sealing during Construction is the Most Effective

When a building is being constructed, it is easier to incorporate air sealing and other energy efficient measures into the building's architecture, instead of adding the measures once construction is complete and hoping that the building will pass when it is tested. During the construction phase, the team has access to areas within a building structure that often become inaccessible once it is finished. During this phase, energy efficient measures can be implemented that will be impossible or far too expensive to include after the fact -- such as sealing a crack within the building envelope, or gasketing between joints in the wall, wall intersection or floor. The tradeoff is the building may initially be a little more expensive to construct, but the life cycle cost of the building will be much less than a conventionally-constructed building.

During commercial construction, the burden of responsibility for an energy efficient building falls on the builders, not the management team or tenants. Once a building is complete and turned over, the process of applying energy efficient measures can be difficult because of conflicting interests between the building owner, management team and tenants. Building owners can avoid this issue by invoking the resources of quality, certified professionals for building enclosure testing during the planning stage of construction.

### What's on the Horizon for Building Enclosure Testing?

Over time, standards for a building's energy efficiency have become stricter because of regulations set by the IECC. This code mandates improvements in energy efficiency to allow home and building performance contractors to adapt to more sustainable practices.

Presently the 2015 IECC for commercial buildings is 0.4 CFM of leakage per square foot of building envelope at 75 Pa or represented as 0.4 CFM/ft<sup>2</sup>@75 Pa. This is similar to the requirements of ASHRAE Standard 90.1 and 189. A non-

commercial standard used by the Army Corps of Engineers for all federal buildings requires 0.25 CFM/ft<sup>2</sup>@75 Pa.

The IECC is constantly upgrading to keep up with the current energy efficiency needs of buildings in each state. The latest IECC marks a high, but achievable, standard for energy efficiency, and most states are choosing to update the energy related portions of their building code. Each state has a different energy standard that contractors are required to meet.

By the end of 2016, 8 states have or will have adopted the 2015 IECC and have chosen to incorporate the updates into their statewide building codes. Along with those 8 states, 13 states operate under the 2012 IECC; 19 operate under the 2009 IECC; and 10 states either operate under the 2006 IECC or older, or have not adopted an IECC at all.

These energy goals start with a realistic recommendation before they progress to a mandated code. The recommendation for energy efficiency is set with a manageable number so nearly any builder can achieve each state's goal.

As contractors continue to achieve these energy recommendations, the easily achievable code value of a previous standard starts to tighten with the new standard. Eventually the building code for each state will move to the values that are established in the IECC. As contractors continue to achieve these energy goals, we will see a higher standard for building enclosure tests become the new normal. For this reason, it's important that energy raters strive to meet higher standards, even if it is not yet mandated in their states.

Another commercial trend we're seeing is a carryover from residential buildings, where building enclosure testing is moving from recommended to mandatory. Many large cities have placed ordinances requiring commercial buildings to have an energy audit. Standards are moving slower on the commercial side, but we predict this trend will continue in coming years.

Building enclosure tests help determine how much air regularly escapes from buildings and how sustainable buildings are. To ensure adding energy efficient measures is cost effective, it is best to plan for this during the construction phase. As we see the energy standard for buildings become higher, energy raters will rely on building enclosure tests as an essential part of achieving the overall integrity and efficiency of a building ■

### About the Author

*Frank Spevak has more than 30 years of experience in the HVACR industry, with expertise in air and pressure measurement equipment. He is the marketing and sales manager at The Energy Conservatory, a Minneapolis-based company known for manufacturing the Minneapolis Blower Door, the Minneapolis Duct Blaster, and digital pressure gauges.*