Building Air Tightness Testing: Why It Is Important And What You Should Know

You may be familiar with the term “Blower Door Testing” and the increased desire on behalf of building owners and managers for essentially air tight buildings, but until recently only a limited understanding of the various ways that this type of testing can be conducted on buildings existed in the building community.

There are (3) three very different yet similar types of tests that involve the use of blower doors. They include:

• Whole Building Air Tightness Testing;
• Indoor Environmental Quality Testing, and;
• Room Integrity Testing

One of the things that make each of these test types different is that they all have specific and unique acceptance criteria, but they all have something in common too…that is the use of blower door testing equipment and the associated computer programming (Photo 1). Additionally, depending on the building size and test type some projects require a single blower door and controller while others require multiple (ganged) blowers and controllers.

Whole Building Air Tightness Testing

Whole Building Air Tightness Testing is not a mandatory test prescribed in building codes, but a performance-based option that many specifiers are referencing. The only requirements for whole building air tightness testing are those mandated by the State of Washington, the United States General Services Administration and many United States Army Corps of Engineers projects.

In 2011, the Air Barrier Association of America (ABAA) Whole Building Air Tightness Testing Standards Committee was asked by the United States Army Corps of Engineers (US ACE) to review and amend the Air Leakage Test Protocol for Building Envelopes. Over the course of a few months, this protocol was amended and a revised document was sent to the US ACE. This new US ACE protocol was recently approved for public release with unlimited distribution. This same committee is now working on an ASTM-style format for whole building testing, which is intended to be taken to ASTM for their review.

The “Whole Building Air Tightness Test” is the most frequently requested blower door test. As the name implies, this is a test that measures the air leakage (infiltration/exfiltration) of the whole building. This testing is typically conducted in accordance with either:
ASTM E 779, *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*; or

While the performance criteria can change from job to job, the typical specification requires the “pressure boundary area” of the building, (this includes the total surface area of the “six sided box” which is the roof/ceiling, walls, and ground/floor) to produce an air leakage rate of less than 0.25 cfm/sq. ft. at 0.3” w.g. (75 Pa.)

Thus a single story building with a flat roof, measuring 200 ft. long by 100 ft. deep by 22 ft. high, is allowed 13,300 cfm of air leakage. In addition to the blower doors, this testing involves fairly sophisticated measuring and data logging equipment (Photo 2). The test result provides the building owner with air leakage (infiltration & exfiltration) through the completed building.

Often, this testing is augmented by diagnostic testing which includes smoke tracer testing and thermography inspection to assist us in representing to the builder where air infiltration points may be occurring within the envelope (Photos 3 & 4).

The diagnostic testing may include:
ASTM C 1060, *Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings*; or

In the end, a report is produced which stipulates whether the results of the Whole Building Air Tightness Test complies with the performance criteria stipulated in the contract documents or specification.

**Indoor Environmental Quality**
Are you involved in the construction of an apartment building or similar project? Some local jurisdictions are requiring testing to show compliance with “USGBC LEED Indoor Environmental Quality (EQ) Prerequisite 2, Environmental Tobacco Smoke Control” criteria. This program allows the contractor to test and subsequently designate some apartments for “smoking” while others are “smoke free” (Photo 5). As with whole building air barrier testing, this test is conducted with a blower door, but in this case it is done on a unit by unit basis.

Testing is conducted in accordance with:
ASTM E 779, *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*
Room Integrity Testing - BSL 3 Level

The third type of air tightness testing that involves a blower door is conducted for the purpose of strictly controlling air flow within a given space. This testing is for what is referred to as Biosafety Level 3 (BSL 3).

Some buildings, especially hospitals, universities, and research facilities will include an isolated room (laboratory) that is pressurized such that air flow is directed inward only (negative pressure within the room). Thus biological agents; those that are known to cause serious disease, are not allowed to escape either to the exterior or to the surrounding rooms. These are sophisticated rooms which require redundant systems to control the interior air space.

This testing can be accomplished by conducting any of the air leakage tests featured in this article, including the diagnostic smoke testing mentioned earlier (Photos 6 & 7).

Diagnostic testing is critical to determining where any undesired openings occur within the envelope, and there are potentially many such openings. Thus, it is not only important to conduct the test in order to determine whether the air leakage is within the acceptable level established by the design criteria, but it’s also critical to conduct the diagnostic testing to find and eliminate as much air transfer as possible.

Periodic Inspections - Good Insurance

Each of the three blower door tests mentioned in this bulletin are valuable tools to evaluate building air leakage. Successful test results are dependent on good construction practices and excellent workmanship. The tie-in of the various construction elements, the sealing of the penetrations, and the materials used are often critical to performance. To provide some assurance of the quality and thoroughness of the work being conducted, and acceptable air leakage performance, periodic inspections are recommended throughout the construction process. There is a significant amount of value added to the construction project as time goes on and these tests are conducted very late in the process. When one considers the cost of removing completed work in order to seal critical intersections where they were missed or incorrectly installed, it becomes evident that periodic controlled inspections go a long way in attaining the desired performance.

Conclusion

Whether you are a contractor, architect, specifier, building owner, or product manufacturer, you may be involved with one of these tests in the near future. This Information Bulletin is intended to provide you with an overview of this type of testing. Architectural Testing, Inc. has the experience and knowledge to conduct both the inspections and testing to the required standards. Should you require any of these services, please do not hesitate to contact us.

About The Author

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Joshua joined Architectural Testing in 2001 and has focused on the performance and field verification testing of the building enclosure throughout his tenure; as part of this he leads our national Whole Building Air Testing program. He is a certified Infrared Thermographer and has completed a Level 3 certification in Air Leakage Testing in Large Buildings.

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