Duct Leakage in Commercial Buildings

In large commercial and institutional buildings, the leading cause of energy waste is duct leakage based on studies done by the Center for Energy and Environment (CEE). Buildings use 49% of the total energy consumed in the United States, and of that 49%, HVAC systems are responsible for 32% of the energy. Knowing this, it’s easy to imagine that much of the energy used is simply wasted since commercial ductwork can be made up of tremendous amounts of cubic footage. In fact, in a medium-sized city, only a 5% rate of duct leakage will result in about 380 GWh of wasted fan power over the course of a year in commercial and institutional buildings alone. To put it another way, a typical supply system in a commercial building with 10% of duct leakage can increase fan energy required by as much as 27%.

Not only is duct air leakage needlessly harmful to the environment, as it increases the amount of greenhouse gases into the air at an exponentially higher rate than that of a duct system that is operating properly, but it also weighs very heavy on the wallet! In fact, the DuctSense cost estimate of duct leakage in a commercial building in

Building Enclosure Testing for NEBB CP’s

By: Sam Myers, Retrotec

As building codes and owner expectations evolve, more commercial buildings across the United States are being designed to meet standards that reduce air leakage through the building enclosure. NEBB has test standards written specifically for building enclosure testing, providing NEBB certified professionals the ability to perform blower door tests. The presence of a tighter building enclosure allows for lower utility bills, provides the ability to size mechanicals correctly, improves indoor air quality and reduces issues due to moisture. According to the Building Envelope Technology Access Centre in Canada, most warranty callbacks for commercial new construction are due to moisture. These issues include shrinkage (nail pops and cracked concrete), water intrusion from poor grading, cracks and bad flashing details, interior finish damage from stains and joint movement, condensation within wall assemblies, squeaky flooring and wet framing and exterior finish damage. Much of this can be prevented by designing a proper building enclosure and testing it to ensure it is working as designed.

Building Science Basics

When conducting a leakage test on a building enclosure, it is important to know some basic building science concepts. Building science is the study of how heat, air and moisture move through buildings. Air leakage can affect these items by allowing air of an undesired temperature into the enclosure. This can cause drafts in certain rooms and bring in moisture which can increase the relative humidity of the conditioned space. When relative humidity gets too high, it can cause condensation, mold and comfort issues.
Are you prepared for a data disaster?

It’s Monday Morning, and your office staff and field technicians are coming into the office to start their week. As the staff begins to log in they notice they are not able to get to certain applications or folders or worse yet, they log in and a cryptovirus ransom message appears – pay up, or your data is forever encrypted. I wish I could say that this scenario does not play out, but it does.

The impacts of a network attached storage, server failure or a cryptovirus can be devastating to a test and balance (TAB) firm. Thousands of electronics records, financial statements, and customer reports can be permanently lost without the proper backup processes and solutions in place to protect your TAB firm and your customers from such a loss. In this article, we discuss several best practices you should consider implementing to ensure your data is properly protected and backed up.

Store your data in a central location for ease of backup

To ensure your data is safely protected and backed up, you need to ensure you have the proper information technology (IT) policies in place. Utilize devices such as a network attached storage (NAS) device or better yet a server with a server operating system on it. These devices provide a reliable and supportable means to have your office staff store all of their internal documents as well as customer-facing documents and reports in one location. This way you know where all of your critical data is housed and can implement a proper backup and recovery process in the event of a loss.

NAS devices and a properly built server are inexpensive when compared to the costs involved with a data disaster. Lost revenue, downtime and lost productivity are all real costs to a TAB firm not to mention the collateral costs of loss of customer trust in your TAB firm. Downtime and lost productivity costs can quickly add up as minutes becomes hours and hours become days. In some cases, the impact can reach in the tens of thousands of dollars per day and for larger firms into the hundreds of thousands of dollars. Think of the cost of these devices as an investment in your business and a key component of a sound data loss prevention plan.

How do I back up all this data?

There is a myriad of options on the market today for backup solutions. There are native tools in many operating systems and NAS devices that will back up your data utilizing backup software and then store those files where you tell it to, including the cloud (more on that later). There are solutions that you install, configure, and run. These solutions usually have a front-end interface to them which allows you to pick and choose the files and directories you want to be backed up and then storing those files in a secure cloud location. Many firms provide back and recovery and part of a managed service which includes offsite storage of your data which is almost a must to protect you from physical events such as fire, theft, and acts of mother nature.

How do I know it works?

My last piece of advice after considering the first two points is how do I know my data loss prevention plan works? How do I know if our data can be recovered in a timely fashion and where the recovery location would be? All the investments in technology won’t do you much good if you don’t complete the process and then test your firm’s ability to recover the data in the event of a loss. The way that data is recovered varies greatly depending on the type of loss you and your TAB firm have experienced.
Air can move in, out and through buildings in any of three ways: wind, fans and the building’s natural stack effect. Wind can have the largest impact on buildings that are particularly leaky, causing drafts and pressure changes in various areas of the building. Fans also manipulate air pressure in buildings whether it is a fan from the HVAC system, exhaust fans, etc. Stack effect is the one driver of air pressure that few people consider and has a large impact on energy use and comfort. This is caused by warm, buoyant air moving up and escaping out of the top of the building which draws in outside air at the bottom. This happens without any wind or fans moving air. Not all leaks have the same impact in a building. Leaks at the ceiling and floor have the largest impact, as these are the areas where air is most likely to infiltrate and/or exfiltrate.

Equipment Overview
To accurately test a building enclosure for air leakage and comply with NEBB building enclosure test standards, a blower door system will need to be used. A blower door system consists of a calibrated fan that is installed in an exterior doorway using an adjustable frame and cloth or a rigid hard panel with a hole for the fan to fit into. A digital pressure gauge is connected to the fan and reads the fan pressure with respect to the outside pressure and the pressure inside the building. The gauge works by reading the fan pressure and converting it to flow. The blower door can be set to various hole sizes on the inlet side of the fan which can be changed as needed to maintain pressure. Since the gauge knows each inlet hole size the fan can be set to, it can calculate flow once it reads a pressure. Flow is read as cubic feet per minute at a pressure of 75 Pa induced by the blower door fan (CFM75). The leakage target is typically a percentage of the total envelope area. For example, to comply with the US Army Corps of Engineers air tightness standard, buildings must have a leakage rate of less than 25% of the envelope area at 75 Pa of pressure. Retrotec makes a commercial grade fan that uses a separate variable frequency drive and creates more flow.

In most cases, commercial buildings will need more than one blower door fan to achieve a test pressure of +/-75Pa. To run multiple fans at once, fan controls will need to be linked together so that all fans are running at the same speed. If the commercial model is being used with the VFD, controls are linked there instead of the fan top shown in the diagram to the left. If fans are not linked together and are running independently of one another, the fans do not run efficiently and could “fight” each other instead of working together to achieve a desired pressure. It is also worth noting that each fan will need to be on a separate circuit to keep from tripping breakers.

In a multi-fan test scenario, the digital gauges are connected at an ethernet hub and fed to a router that connects to a laptop where everything is controlled using the blower door manufacturer’s software.

Planning and Site Preparation
As a building tester, it is important to meet with the construction project manager or general contractor multiple times throughout the project to ensure the test will run smoothly at the end. It is best to be involved at the pre-construction meeting to understand to scope of the project. Why is enclosure testing needed? Is it for code or
SAFETY COLUMN

Identifying Yearly Safety Threats

While the construction industry continues to be on an upswing, industry workers such as balancers need to remain vigilant for hazardous risks. Over the last three years, two notable hazards that balancing contractors faced while being on the jobsites were electrical and fall hazards. Avoiding hazards such as electrical and falls should be emphasized in your company frequently, so no employee’s family receives a dreadful call that their spouse will not be coming home.

As we know – electrical hazards are one of the fatal four hazards (falls, struck by, caught in between) that OSHA emphasizes in the construction industry. Balancing firms can best prevent fatal electrical hazards by strongly instituting proper training as well as making it a point for all their employees to complete a hazard analysis where they assess risks on job sites. These two examples go hand-in-hand as new and experienced employees should be trained to know what to look for in a hazard analysis. They not only will work well to identify electrical hazards, but to also identify potential fall hazards.

With balancers using ladders daily, having the wherewithal to stop using a faulty ladder or securing a proper anchor point recommended by OSHA, could easily be forgotten due to the employee wanting to complete the job. Last year, I conducted several fall protection trainings for employees who simply forgot to tie off to an anchor point. The employees did not connect to an anchor point; they simply were deeply involved in completing their job task at the time. However, as safety continues to be the number one priority on construction sites, Safety Managers won’t hesitate to remove non-compliant employees from their site. Simply forgetting this important step in the fall protection standard could be fatal for the employee.

It’s imperative to address hazards that balancers encounter. Some stories I have read about over the last year, regarding employees who were severely injured or died, could have been prevented. Taking the time to go over these hazards as well as others, is a great opportunity to bring awareness to your employees of the importance of ensuring they are safe and compliant to all OSHA standards.

For more information, contact Greg Wharton at (610) 828-4055 or gwharton@smca.org.

Be Prepared for Data Disaster

My advice – test the process, at least once a year. Conduct periodic reviews to ensure you are capturing all of the necessary data, especially if you have implemented a new piece of software or added on staff or new services to your TAB firm which generates either internal or customer facing documentation.

Think about how you would recover your data in the event of a NAS or server crash versus a cryptovirus event, which is typically a very invasive event and can take a protracted amount of time to recover from fully. Many of the managed services provide a way to place your data in a cloud environment and make it available to members of your firm within a matter of minutes to hours, depending on the amount of data. As long as you have electricity or a member of your team has electric and access to the Internet, you can resume business operations fairly quickly with the cloud-based solutions that are available on the market today.

As you begin the new year and execute on your strategic plans, make sure you have given some thought to the concepts mentioned above. How do you protect your data and how much is it going to cost you if that data is suddenly lost due to a disaster or security event? Many of these events can’t be predicted and can come without warning so knowing you have a sound, and tested, data loss prevention plan in place is key to mitigating the risk of data loss. Ben Franklin’s quote was spot on in this case – an ounce of prevention is worth a pound of cure.

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quality control? Is the tester to only test and report findings or locate leaks upon failure? It is also helpful to learn about air barrier and vapor retarder materials. For example, fluid applied air barriers and vapor retarders will, in most cases, be more effective at preventing air leaks.

When the test date is approximately one month away, it is wise to meet with the general contractor and HVAC contractor again to ensure the building will be empty of occupants and workers during the blower door test so that no one opens doors or steps on tubing during the test. Some building preparation is also needed before the test is set up. Some items will need to be taped off such as exhaust vents and make-up air. It will need to be determined who will be doing the building preparation work before the test is conducted.

Another item to consider is the number of fans that will be needed for the test. Retrotec has a calculator available for download that can help determine the number of fans needed for any specific project. Building aspects such as conditioned length, width and height along with the air flow requirements and fan models used can be entered to see how many fans will be needed.

It is also important to become familiar with the plans to define the air barrier location. The air barrier of a building is the exact point in a wall, floor and ceiling/roof that separates inside from outside. This is also a good opportunity to plan how and where the fans, tubing, gauges and laptop will be set up. For larger buildings with multiple stories, reference tubing will need to run from the gauges to various floors or zones to ensure that the entire building is reaching the desired test pressure (i.e. +/-75Pa). Other considerations include pinch points in the building that can restrict air flow such as elevator cars and door ways from stairwells.

**Diagnostics: Locating the Leaks**

Once the test is completed, it will need to be determined if the leakage number meets the standards for code, a third party building standard or the owner’s expectations; whichever standards the building is designed to meet. If the building fails the blower door test, leaks will need to be located and sealed. This can be done in a variety of ways. One of the most effective and popular methods for locating leaks is with thermal imaging by using an infrared (IR) camera. This works especially well when combined with the blower door.

If you have enough temperature difference between inside and outside of the building (18°F or more is recommended), the blower door can be run to create a small pressure differential to amplify leaks that can be easily seen on the IR camera display.

Smoke testing with a blower door can also help locate leaks in the building envelope. Vapor emitters such as the Tiny-S handheld fog machine can make air leakage visible in vulnerable leakage areas such as floor to wall connections, around windows and doors, ceiling penetrations or anywhere two dissimilar materials meet that create a gap or crack in the air barrier.

**Adding Building Enclosure Testing to Increase Service Offerings**

To conclude, building envelope testing can be an additional source of revenue for NEBB certified professionals. This type of work is needed to determine if a new building has passed inspection for code or other standards as well as locating issues within existing buildings to determine causes of high energy bills, comfort issues or moisture problems. Learning how building enclosures behave regarding air leakage, heat and moisture transfer can also be useful when diagnosing issues with mechanical systems. Not all comfort issues are directly tied to the mechanical system, sometimes it has to do with how the enclosure is performing whether it is air leakage or a lack of insulation. The combined knowledge of how a building enclosure and its mechanicals work as a system can set some NEBB professionals apart from others.

*For more information contact Sam Myers at Retrotec, Marketing & Training Consultant, sam@retrotec.com, www$retrotec.com, 919-922-3987.*
Duct Leakage

Trenton NJ, with a total square footage of 100,000 sq. ft and a 30% duct leakage rate estimates a cost of $637,291.00 over 20 years. The calculations are based on local energy costs and the specific AHRAE requirements of that area.

Many facility owners or managers may believe that their duct system is not at risk of leakage because it is either new or state-of-the-art, but the State Energy Advisory Board reported that a military barracks built only last year and outfitted by certified HVAC professionals with high quality, modern systems throughout, showed a leakage rate of about 20% when tested by the Lawrence Berkeley National Laboratory.

Of course, there are several reliable and relatively inexpensive ways to seal these leaky ducts from mastic to foams, etc., but the first step in fixing the problem is finding out how much the duct is leaking and where it leaking from. Kanomax is among the companies offering product solutions specifically designed for testing for duct leakage in commercial or institutional buildings.

To learn more email sales@kanomax-usa.com or go to www.kanomax-usa.com.

NEBB Young Professionals Network

The MAEBA Board of Directors would like to thank Dane Gresko, NEBB Certified Technician from Fisher Balancing Company, for agreeing to be the new MAEBA YPN Chapter Liaison. Dane is looking to make an impact with the NEBB Young Professionals Network at the chapter level and becoming more involved with NEBB. Fisher Balancing Company has several employees involved nationally and locally.

NEBB Cleanroom Performance Testing

Effective on January 1, 2020, all Cleanroom Performance Testing (CPT) projects are required to have a Certified Technician performing testing. Is your firm ready to meet this requirement?

For information on NEBB’s CPT program, please contact certification@nebb.org.

Please note: You must first complete the certification process for CPT CT certification before applying for the CPT CP certification.

NEBB Practical Exam

*If you are in need of taking a NEBB Practical Exam, please contact Trish Casey, MAEBA Chapter Coordinator at tcasey@maebanet.org to schedule an exam.*
MAEBA would like to thank the vendors that have joined so far this year!

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Calendar of Events

April 25, 2019
MAEBA Semi-Annual Meeting
Radisson Hotel, Trevose, PA

September 22-23, 2019
MAEBA Recertification Seminar
Harrah’s Resort Atlantic City

April 4-6, 2019
NEBB 2019 Annual Conference
San Antonio, Texas

March 18-22, 2019
Sound & Vibration Measurement Seminar
NEBB TEC in Gaithersburg, MD

April 1-2, 2019
Testing Adjusting and Balancing Seminar
Hyatt Regency San Antonio Riverwalk Hotel San Antonio, TX

April 1-2, 2019
Building Enclosure Testing Seminar
Hyatt Regency San Antonio Riverwalk Hotel San Antonio, TX

June 7-9, 2019
Testing Adjusting and Balancing Seminar
NEBB TEC in Gaithersburg, MD

For more NEBB Seminars Go to www.NEBB.org